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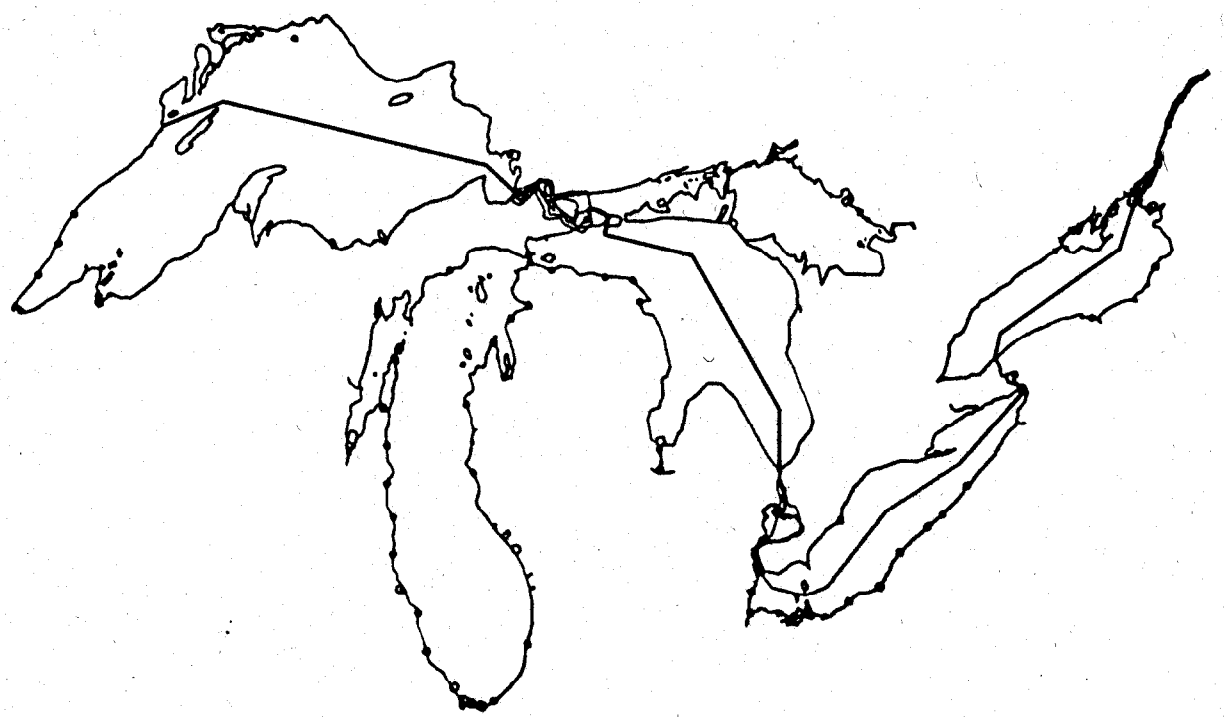
ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES

Volume V--Lake Huron

Great Lakes-St. Lawrence Seaway Navigation Season Extension Program



Fish and Wildlife Service
U.S. Department of the Interior

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The Biological Services Program was established within the U.S. Fish and Wildllfe Service to supply scientific information and methodologies on key environmental issues that Impact fish and wildlife resources and their supporting ecosystems. The mission of the program is as follows:

- To strengthen the Fish and Wildlife Service in its role as a primary source of information on national fish and wildlife resources, particularly in respect to environmental impact assessment.
- To gather, analyze, and present information that will aid decisionmnakers in the identification and resolution of problems associated with major changes in land and water use.
- To provide better ecological information and evaluation for Department of the Interior development programs, such as those relatfng to energy development.

Information developed by the Biological Services Program is intended for use in the planning and decisionmaking process to prevent or minimize the impact of development on fish and wildlife. Research activities and technlcal assistance services are based on an analysis of the issues, a determination of the decisionmakers involved and their informatlon needs, and an evaluation of the state of the art to identify information gaps and to determine priorities. This is a strategy that will ensure that the products produced and disseminated are timely and useful.

Projects have been initiated in the following areas: coal extraction and conversion; power plants; geothermal, mineral and oil shale development; water resource analysis, including stream alterations and western water allocation; coastal ecosystems and Outer Continental Shelf development; and systems, inventory, including National Wetland Inventory, habitat classification and analysis, and information transfer.

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FWS/OBS-82/52
September 1982

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES

VOLUME V
Lake Huron

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PREFACE

The fish resources of the Great Lakes have changed markedly since the settlement of the Great Lakes Basin began in the late 1700s-early 1800s. Local declines in the abundance of some highly valued species that supported early fisheries were reported in the 1800s. By the late 1950s-early 1960s, a number of important native species had disappeared from the catch, most once-productive stocks were depleted, and the fisheries that persisted were supported mainly by species of low value and utility. These undesirable changes have been attributed to the overharvest of desirable species, the invasion and introduction of undesirable exotic species, lowered water quality, and the destruction of portions of the physical habitat, including spawning grounds, vital to the maintenance of the resource base.

Since the 1950s, intensive efforts have been mounted to reestablish stable, self-sustaining fish communities, mainly by reducing sea lamprey abundance, limiting the harvest of remnant native stocks, and stocking desirable native or exotic species to replace or supplement depleted populations. Many of the native species and some of the desirable, introduced species have responded favorably and are now supporting valuable, productive fisheries. These successes suggest that continued judicious exercise of established management strategies will result in further significant improvements in the fish resources and the fisheries. An emerging perspective suggests, however, that enduring, major improvements in the fish resources and the fisheries will require greater emphasis on rehabilitation efforts directed more specifically at safeguarding and improving the quality of the fish habitat in general, and on ensuring fuller utilization of the specialized habitat required by sensitive, embryonic- juvenile life stages of species that are to be included in any future, self-sustaining resource base. We prepared this atlas to provide a comprehensive information base against which past changes in the condition and use of spawning and nursery habitat of Great Lakes fishes could be viewed and evaluated and the needs of the future, self-sustaining resource base could be projected.

The atlas is composed of the following *14* volumes:

I. Spawning and Nursery Areas of Great Lakes Fishes: A Summary by Geographic Area

II. Lake Superior

III. St. Marys River

IV. Lake Michigan

V. Lake Huron

VI. St. Clair River

VII. Lake St. Clair

VIII. Detroit River

IX. Lake Erie

X. Niagara River

XI. Lake Ontario

XII. St. Lawrence River

XIII. Reproductive Characteristics of Great Lakes Fishes

XIV. Literature Cited

Volume I is designed to permit the reader to determine quickly whether a particular geographic area of interest contains fish spawning or nursery areas that are described in volumes II-XII. Volumes II-XII consolidate existing information describing spawning and nursery areas used by stocks of fish, including anadromous stocks, considered to be residents of the Great Lakes and their connecting waters. The information presented for each spawning or nursery area identified in volumes II-XII includes, when known, the area's precise location, history of use, season of use, water temperatures during the season of use, major substrate type, and water depth. Pre- and post-spawning migrations of mature fish and movements of young fish are also described, insofar as this information serves to better delineate spawning or nursery areas. Volume XIII contains concise descriptions of the reproductive characteristics of species included in volumes I-XII.

In the preparation of the atlas we found that considerable information was available for most of the species that support (or supported) major recreational or commercial fishes, or that are or were major components of the forage base; conversely, relatively little information was available for many other species not included in these general categories. For most species, spawning areas were more completely described than were nursery areas. The historical information in particular provided more extensive descriptions of spawning areas than of nursery areas, because much of this information was obtained from records of fisheries that had been conducted for spawning fish. Thus, although the information available to us for compilation was relatively extensive, it was nonetheless incomplete for the reasons given above. Users of the atlas are therefore cautioned not to view the lack of explicit reference to a given area as conclusive evidence that the area is or was not used as a spawning or nursery area by Great Lakes fishes.

Sources of the information incorporated in the atlas are described in volume I. Acknowledgements are also given in volume I.

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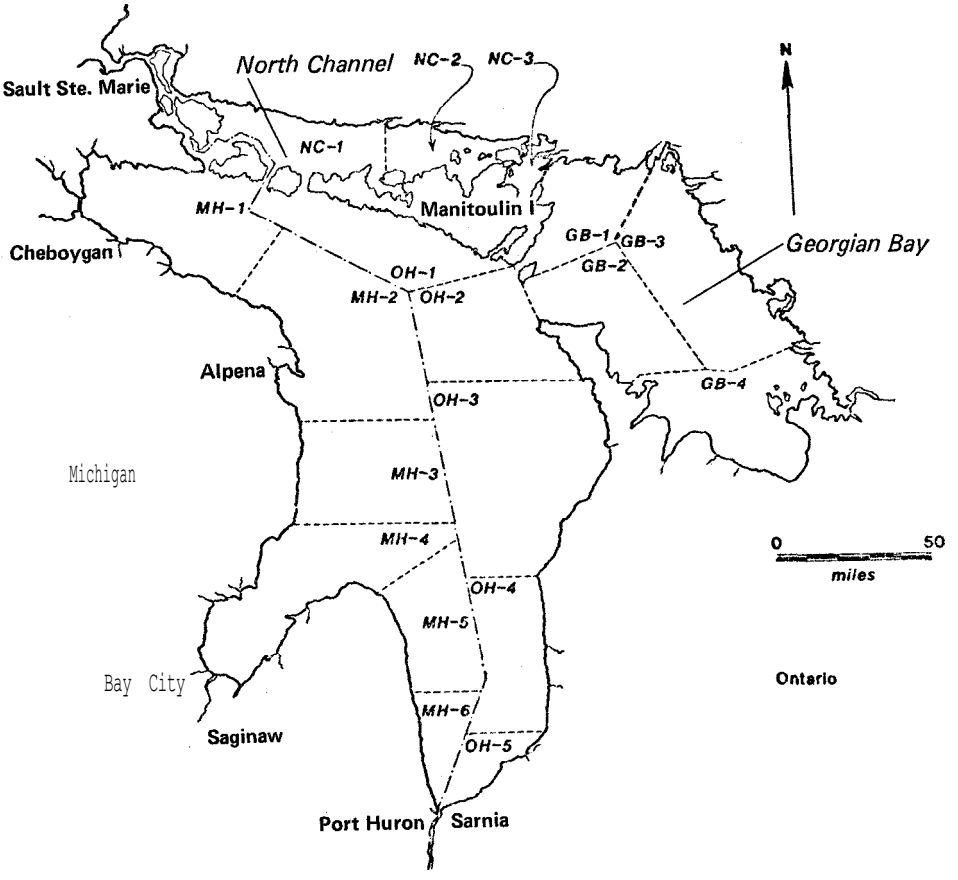
INTRODUCTION



Almost 90 species of fish have been recorded as residents in Lake Huron (Argyle, pers. comm. *1979;* Emery *1976;* MWRC *1975).* This volume describes the reproductive habitat used by the *61* species for which information was available. Forty-seven species treated in this volume were native to the lake. Most of these 47 native species spawned (or spawn) in tributaries or in shallow, protected waters of the lake. Only the lake trout, five species of ciscoes, and the fourhorn sculpin, utilized the deep offshore waters for spawning. Four of these deepwater spawners, the blackfin cisco, shortjaw cisco, deepwater cisco, and kiyi are now believed to be extinct in Lake Huron. Only the lake trout spawned in the shallow nearshore waters and also the deeper offshore waters.

The *14* exotic species treated in this volume were introduced by man or immigrated to the lake during the period of record, from populations established

elsewhere in the Great Lakes drainage. Eight of these are salmonids which spawn in tributaries; the other six exotic species spawn in tributaries and also in protected nearshore waters in some areas. The splake, an artificial hybird created by crossing two native species (brook trout and lake trout), apparently spawns in the nearshore waters.

Information on nursery areas used by the 61 species treated in this volume is fragmentary, but as would be expected, it suggests that tributaries and nearshore waters are important as nursery areas, at least for the earliest life stages. Dispersal from spawning areas is rapid for some species which have small, pelagic larvae, whereas the juveniles of some salmonids that spawn in tributaries may remain in or near spawning areas in those tributaries for as many as three years before entering the lake and dispersing.

The information in this volume is presented in narrative form, by species. A map accompanies each species narrative when there was sufficient information to warrant graphic summarization. Each species narrative presents the available information systematically by statistical fishing district (Smith et al. 1961) beginning with district MH-1 and ending with district GB-4. Within each district the presentation proceeds systematically from one end of the district to the other, by shoreline segment and adjacent littoral and offshore water areas. For each referenced location within a district, the narrative first presents the available information for spawning areas and then for nursery areas. Historical information is presented before the more current information.

The sea lamprey probably entered Lake Huron from Lake Erie via the St. Clair-Detroit River System. A spawning run observed in the Ocqueoc River in 1937 was the first reported occurrence of sea lamprey in the lake; by the early 1940s, major spawning runs had developed in a number of rivers (Shetter 1949).

Many of the tributaries to Lake Huron provide ideal spawning habitat for the sea lamprey (Dees 1980). Ammocoetes have been found in at least 105 tributaries to the lake and also in bays and in the lake off tributary mouths (Braem and Rugen 1976; Dees 1980; GLFC 1975; Wagner and Stauffer 1962; Wagner et al. 1972). Spawning runs occur in April-July and usually peak in May to mid-June (Applegate 1950, 1951a; Applegate and Smith 1950; MacKay and MacGillivray 1949). Sea lamprey populations are small in tributaries south of Saginaw Bay where pollution, unstable stream flow, unsuitable substrate, and water temperatures limit or prevent reproduction (Morman 1979). The tributaries listed below are classified as spawning streams based on the presence of ammocoetes, spawning adults, or both.

Michigan

Spawning runs enter the following streams (Applegate and Smith 1950; Applegate et al. 1952; Bails et al. 1971; Braem and Rugen 1976; GLFC unpubl. data, 1973b, 1975; Morman 1979; Smith and Braem 1976; Torblaa and Westman 1980).

MH-1

Canoe Lake Outlet (45°57, 83°42'), Caribou Creek (45°58', 83°59'), Bear Lake Outlet (45°58', 83°59'), Carr Creek (45°58', 83°59'), Joe Straw Creek (45°57', 84°00'), Albany Creek (45°58', 84°05'), Trout Creek (45°59', 84°06'), Beavertail Creek (45°59', 84°12'), Prentiss Creek (45°59', 84°14'), McKay Creek (46°00', 84°18'), Ceville Creek (46°00', 84°21'), Hessel Creek (46°00', 84°25'), Steeles Creek (46°01', 84°28'), Nunns Creek (46°02', 84°34')‘ Pine River (46°03', 84°39'), McCloud Creek (46°03', 84°40'), Carp River (46°02', 84°41'), Martineau Creek (45°58', 84°43'), unnamed tributary 266-20 (45°46', 84°42'), Beaugrand Creek (45°41', 84°33'), Little Black River (45°40', 84°29'), Cheboygan River (45°39', 84=°28'), Elliot Creek (45°39', 84°25'), Grass Creek (45°39', 84°22'), Greene Creek (45°38', 84°14'), Mulligan Creek (45°37', 84°12'), Grace Creek (45°34', 84008°1, Carp (Black Mallard) Creek (45°32', 84°07'), Seventeen Creek (45°30', 84°06'), Ocqueoc River (45°29', 84°04'), Johnny Creek (45°29', 84°00'), Schmidt Creek (45°29', 83°56'), Trout River (45°26', 83°50'), and Swan River (45°24', 83°44').

MH-2

Middle Lake Outlet (45°10', 83°22'), Squaw Creek (45°00', 83°28'), and Devils River (44°55', 83°25').

MH-3

Black River (44°49', 83°18') and Au Sable River (44°24', 83°19').

MH-4

Tawas River (44°16', 83°31'), East Branch Au Gres River (44°99', 83°34'), Au Gres River (44°02', 83°41), Rifle River (44°00', 83°45'), and Saginaw River (43°39', 83°51').

MH-5

Rock Falls Creek (43°49', 82'38') and Sucker Creek (43°45', 82°37').

MH-6

Cherry Creek (43°31', 82°34') and Mill Creek (43°13', 82°31').

Ontario

Spawning runs enter the following streams (GLFC 1973b, 1975; SLCC 1979a,b; Smith and Tibbles 1980; Tibbles 1959, 1975; Tibbles et al. 1976a,b; Torblaa and Westman 1980).

OH-l

Sand Creek (45°52', 83°21'), Mindemoya River (45°40', 82°16'), Manitou River (45°36', 82°06'), Blue Jay Creek (45°35', 82°05'), and Kaboni Creek (45°42', 81°46').

OH-3

Sauble River (44°40' 81°77'), Saugeen River (44°30', 81°23'), and Penetangore River (44°11', 81°39').

OH-4

Lucknow River (43°53', 81°43'), Maitland River (43°45', 81°44'), and Bayfield River (43°34', 81°43').

NC-l

Kaskawong River (Milford Haven Creek) (46°09', 83°50'), unnamed tributary H-65 (St. Joseph Island, location uncertain), unnamed tributary H-68 (St. Joseph Island, location uncertain), MacBeth Creek (46°17', 83°37'), Thessalon River (46°15', 83°34'), Livingstone Creek (46°15', 83°29'), Mississagi River (46°10', 83°01'), Blind River (46°11" 82°57'), Lauzon Creek (46°11', 82°49'), Spragge River (46°12', 82°40'), Serpent River (46°13', 82°37'), and Silver Creek (45°55', 82°50').

NC-2

Spanish River (46°11', 82°19') and Kagawong River (45°54', 82°15').

GB-1

Chickanishing River (45°59', 81°25').

GB-3

French River (45°56', 80°54'), Key River (45°53', 80°44'), Still River (45°46', 80°34'), Magnetawan River (45°46', 80°38'), Naiscoot River (45°40', 80°34'), Boyne River (45°18', 80°02'), and Squirrel Creek (45°17', 80°04').

GB-4

Sydenham River (44°35', 80°56'), Telfer (Bothwell's) Creek (44°38', 80°52'), Beaver River (44°34', 80°27'), Silver Creek (44°31', 80°17'), Pretty River (44°30', 80°12'), Nottawasaga River (44°33', 80°00'), LaFontaine Creek (44°44', 80°04'), Hog Creek (44°45', 79°47'), Sturgeon River (44°44', 79°44'), and Muskoka River (44°57, 79°53').

LAKE STURGEON

Lake sturgeon spawned over a sandy substrate at the southern end of the lake during June and July; however, sturgeon were found to have "well-developed" eggs throughout the year (Rathbun and Wakeham 1897).

Michigan

MH-3

Au Sable River (44°24', 83°19'). Before dams were built on the river in 1911, sturgeon migrated about 88 mi upstream in the spring to the mouth of the North Branch (Miller 1966, as cited in Schneider and Leach 1979). In the spring of 1935, a sturgeon attempted to spawn at Foote Dam (Mich. Cons. 1935a), about 17 mi upstream from the mouth.

MH-4

Saginaw Bay (44°00', 83°30'). In the early 1900s, spawning occurred over a mud and sand bottom along the east shore of Saginaw Bay between Fish Point (43°43', 83°31') and Sand Point (43°55', 83°24') (Organ et al. 1978).

Ontario

GB-3

Lake sturgeon ascended rivers along the east shore of Georgian Bay in June (Bensley 1915).

GB-4

Musquash River (44°58', 79°53'). Lake sturgeon ascended the river in early June (Ont. Game Fish 1912).

Nottawasaga River (44°33', 80°00'). Lake sturgeon ascended the Nottawasaga River in May (Bensley 1915).

LONGNOSE GAR

Ontario

GB-4

Go Home Bay (44°59', 79°57'). Longnose gar built nests in Go Home Bay on the east shore of Georgian Bay (45°30', 81°00') during mid-June; the nests were constructed in 2 ft of water among the short stems of aquatic plants (Bensley 1915).

GAR spp.

Michigan

MH-4

Saginaw Bay (44°00', 83°30'). An unidentified species of gar spawned in Saginaw Bay from just east of Wigwam Bay (43°59', 83°50') to Saganing Bar (43°55', 83°51') over mud, sand, and vegetation (Organ et al. 1978). Gravid females were collected at the Karn-Weadock Power Plant Complex (43°39', 83°51') from late April through the end of June (Beak Consult. 1976).

BOWFIN

Michigan

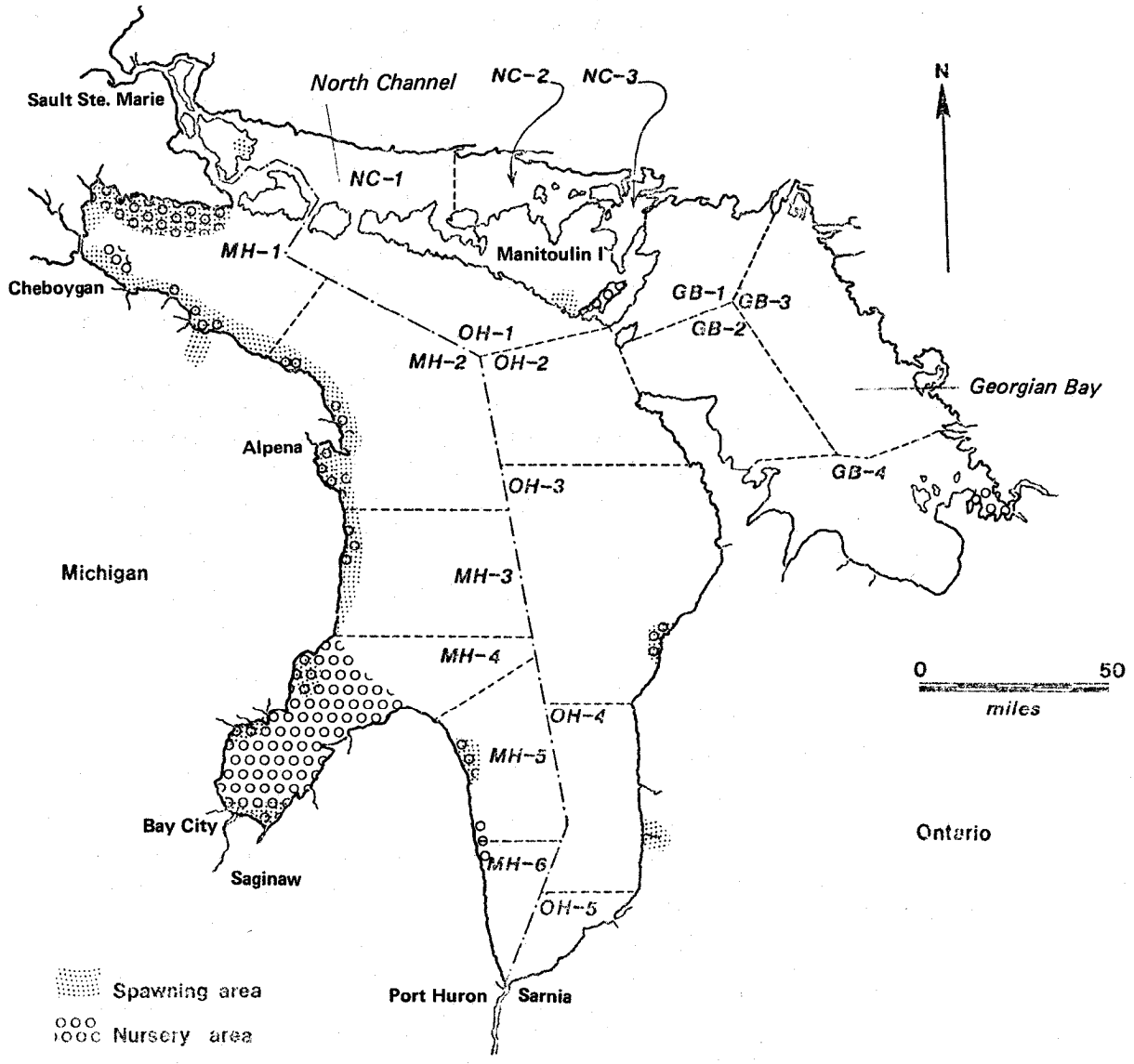
MH-4

Saginaw Bay (44°00', 83°30'). Spawning occurred between Point Au Gres (43°59', 83°41') and Saganing Bar (43°55', 83°51') in late May over mud in 1-2 ft of water, and over sand and muck between Fish Point (43°43', 83°31') and Sebewaing (43°44', 83°27') (Organ et al. 1978).

Ontario

In Georgian Bay (45°30', 81°00') spawning occurs in late May; eggs are deposited in large, open depressions made in mud among plant roots (Bensley 1915).

ALEWIFE



The alewife presumably entered Lake Huron from Lake Erie via the St. Clair-Detroit River System. The first recorded collection of alewives in Lake Huron occurred in *1933* (Miller 1957).

Michigan

MH-1

Point De Tour (45°57', 83°55')--St. Ignace (45°52', 84°43'). Spawning occurs in U.S. waters along the north shore of the lake during

early July, and fry are most abundant in late July. In 1974, however, larvae were collected off St. Vital Point (45°57', 84°00') and Point Fuyards (45°56', 84°23') at depths of about 3-20 ft during June 26-30 (O'Gorman 1976). In 1975, alewife larvae were collected off St. Vital Point on July 23. They were captured at the surface to a depth of 20 ft, but the greatest numbers generally occurred at about the 6 ft depth stratum. The bays and coves of Les Cheneaux Islands (45°58', 84°20') and St. Martin Bay (46°00', 84°37') are believed to be important nursery areas (O'Gorman 1978). In 1955, young-of-the-year (YOY) alewives were collected on September 14 in the Les Cheneaux Island channels (Miller 1957).

Mackinaw City (45°47', 84°44')--Adams Point (45°25', 83°43'). Alewives usually spawn throughout this area during early July (O'Gorman *1976),* and larvae are most abundant during late July (O'Gorman 1978). In *1974,* small numbers of larvae were collected at Zela Point (45°46', *84°31')* on Bois Blanc Island *(45°46',* 84°27'), Nine Mile Point (45°38', *84°13'),* and Hammond Bay (45°30', 84°05') on June 26-30. Larvae were never collected at the surface but were present at depths of about 3-20 ft (O'Gorman *1976).* During *1975,* larvae were most abundant in late July at about the 6 ft depth stratum. Larvae were more abundant in Hammond Bay than off St. Vital Point (45°57', 84°00'); most were collected at about the 6 ft depth stratum over the *18* and 30 ft depth contours (O'Gorman 1978). A spawning run enters the Ocgueoc River (45°29', 84°04') (Hunn, pers. comm. 1979).

MH-2, MH-3

Adams Point (45°25', 83°43')--Oscoda *(44°25', 83°20').* Spawning generally occurs here during the first half of July (O'Gorman *1976).* In 1973, a few alewife larvae were collected off Alpena (45°04', 83°26') and Harrisville (44°40', 83 °18'), over the *18* ft depth contour on June 5 and *19;* spawning runs had just started, and larval abundance probably peaked in early July (O'Gorman *1975).* In *1974,* a few larvae were collected at Thompsons Harbor (45°21', 83°36') on June 26-30 and at Alpena near the surface over the 30 ft depth contour on July 1-2; small to moderate numbers of larvae were also collected at Harrisville at depths of about 3-20 ft on July 10 (O'Gorman 1976). During July 1975, alewife larvae were more abundant off Rockport *(45°12',* 83°23') than off Ossineke (44°55', *83°25').* Alewife larvae were also more abundant than larvae of other species in the littoral zone at Rockport and Ossineke. Alewife larvae were concentrated at about the 10 ft stratum at Rockport and at about the 3 ft stratum near Ossineke, over the 18 ft depth contour; at the 30 ft depth contour, larvae were concentrated near the surface at both Rockport and Ossineke. Alewife larvae were present at Rockport, Alpena, and Ossineke during mid-August. The southern and western shores of Thunder Bay (45°00', 83°20') are important spawning and nursery areas for alewives. The northern shore of the bay is subject to upwellings, and larvae are not abundant there (O'Gorman 1978).

In *1978-79* at Rockport, alewife prolarvae and postlarvae were more abundant than those of most other species. Prolarvae were most abundant in July at mid-depths over the *18* ft depth contour. Most of these larvae

may have drifted into the area from spawning grounds located elsewhere (Tex. Instrum. 1979c).

MH-4

Saginaw Bay (44°00', 83°30'). Massive spawning runs enter Saginaw Bay (O'Gorman *1978).* Spawning starts a few weeks earlier in the bay than in other areas of Lake Huron (O'Gorman 1975). In *1953,* young alewives *(1.5-3.0* in. long) were collected in bottom tows in very shallow water in southwest Saginaw Bay in May-October (Miller 1957). During *1956,* YOY alewives were collected in waters 12-45 ft deep during September. In October, YOY were very abundant in the shallows of the outer bay (Carr *1962).* During *1974,* densities of alewife larvae were higher in Saginaw Bay than elsewhere in the U.S. waters of Lake Huron.

Au Sable Point (44°20', 83°20'). In *1974,* alewife larvae were very abundant here at about the 3 and 6 ft depth strata on July *13* (O'Gorman 1976). In *1975,* alewife larvae were abundant in the surface - 6 ft depth stratum over the 30 ft depth contour in mid-July (O'Gorman *1978).*

Alabaster *(44°11', 83°33').* Alewives spawn here over coarse to medium sand with scattered gravel, rubble, and boulders from shore out to the 25 ft'depth contour. The highest egg densities are found in the beach zone. Gravid adults are found in June; spent fish are found in July. Alewife eggs were collected in the area in June and July. Alewife larvae were more abundant than larvae of other species; *71%* of prolarvae, and 3 *1%* of postlarvae taken were alewives. Young-of-the-year alewives are found here in October (Tex. Instrum. 1979b,d).

Point Au Gres (43°59', 83°41'). In 1973, densities of larvae as high as 2,700 per 1000 m^3 were measured off Point Au Gres; most larvae were collected at about the 3 ft depth stratum during mid-June. In 1974, the density of larvae reached 7,740 per 1000 m3 in the surface - 3 ft depth stratum on July *12* (O'Gorman 1978). The area between Point Au Gres and Point Lookout (44°03', 83°35') is an important nursery area for alewife.

Wigwam Bay (43°59', 83°50'). Spawning occurs here over clay and sand in water as deep as 6 ft (Organ et al. 1978).

Saginaw River (43°39', *83°51').* At the Karn-Weadock Power Plant Complex (43°39', 83°51'), at the river mouth, the heaviest impingement of adults occurred during June to mid-July (Consumers Power 1976c,d). Adult alewives began moving into inner Saginaw Bay in April and reached peak density in May-July; spawning occurred in late June and July, and most adults had left the nearshore zone by late July. Larvae first appeared in large numbers in late July (Beak Consult. *1976).* In *1973,* off

Bay City (43°36', 83°52'), densities of larvae as high as 1,259 per 1000 m^3 were measured at about the 10 ft depth stratum on June 17 (O'Gonnan 1978).

Quanicasse (43°35', 83°40'). Gravid females were present in late June at the Quanicasse Power Plant site (43°35', 83°40'). Spawning occurred throughout the area, but appeared to be concentrated in the shallow beach zone, over a sand bottom. Alewife eggs were collected in June, and alewife larvae were more numerous than those of other species in June and July (Tex. Instrum. 1979b,e).

Port Austin (44°03', 83°00'). In 1974, large numbers of alewife larvae were collected here in the 3-6 ft depth stratum over the 18 and 30 ft depth contours in mid-July. In 1975, larvae were abundant during mid-July, mainly at about the 3 ft depth stratum over the 18 and 30 ft depth contours. By mid-August, very few alewife larvae were collected (O'Gorman 1978).

MH-5

Harbor Beach (43°51′, 82°39')--Richmondville (43°34', 82°36'). In 1974, alewife larvae were abundant off Harbor Beach and Richmondville on July 14. Off Harbor Beach they were concentrated at about the 3 ft depth stratum along the 18 ft depth contour, and off Richmondville at about the 3 ft depth stratum along the 30 ft depth contour (O'Gorman 19761. During mid-July 1975, larvae were more abundant off Harbor Beach than off Richmondville; small numbers were collected during August at both sites (O'Gorman 1978). At Harbor Beach, ripe and running adults, eggs, and larvae were collected from the harbor and north from the harbor for 5 mi at depths out to 45 ft. The substrate in this area is large rocks and boulders (LaJeone, pers. comm. 1979).

Ontario

OH-l

Manitoulin Island (45°50', 82°30'). During 1967-1969 and 1973-1975, alewives were collected at the Canadian Department of Fisheries and Oceans (CDFO) sea lamprey weir in the Manitou River (45°36', 82°06') (FWS 1979c). Young-of-the-year alewives were found in the shallowest and warmest waters of South Bay (45°38', 81°52') during June-August 1964-69 (Faber 1964; Reckahn 1970).

OH-3

Douglas Point (44°19', 81°36′). Alewife eggs are found in the area of the Bruce Generating Plant during late June-early August (Dunstall 1978a). The alewife larvae are more abundant than those of other species at Douglas Point and in Baie du Dore (44°21′, 81°34′) (Dunford 1978b; Dunstall 1978a). Young-of-the-year are found here in late summer (Kelso and Leslie 1979).

OH-4

Bayfield River (43°34', 81°43'). In 1966, a few alewives were collected in the CDFO sea lamprey weir in the Bayfield River (FWS 1966).

NC-1

St. Joseph Island (46°13', 84°00'). During 1973, alewives were collected in the CDFO sea lamprey weir in the Kaskawong River (Milford Haven Creek) (46°09', 83°50) (FWS 1979c).

GB-4

Matchedash Sound (44°50', 79°50'). In 1979, larvae were collected here during June and early July. Most larvae were found in the inner portion of the sound at Bergie Point (44°45', 79°47') on July 4 (Loftus 1977).

GIZZARD SHAD

Gizzard shad were present in Lake Huron in the 1870s and presumably entered the lake via the St. Clair-Detroit River System (Miller 1957).

Michigan

MH-1

Ocqueoc River (45°29', 84°04'). Spawning runs enter the Ocqueoc River (Hunn, pers. comm. 1979).

MH-4

Saginaw Bay (44°00', 83°30'). Gravid females are found near the Karn-Weadock Power Plant Complex (43°39', 83°51') in late June. Fry first appear in late June and are numerous at most stations by July-August (Beak Consult. 1976). Clupeid larvae are found in entrainment samples from mid-May to late August, and prejuveniles are found until late September; these may have been gizzard shad because most juveniles collected later were gizzard shad (Consumers Power 1976c,d). At the Quanicasse Power Plant site (43°35', 83°40'), gizzard shad larvae were collected during May-July and were more abundant than larvae of other species (Tex. Instrum. 1979b,e).

Ontario

OH-3

Baie du Dore (44°21', 81°34'). Larvae were collected here in June (Dunford 1978b).

GB-4

Colpoys Bay (44°47', 81°05'). Spawning runs enter Colpoys Bay and its tributaries (Moccia, pers. comm. 1979).

LONGJAW CISCO

The longjaw cisco is believed to be extinct in the Great Lakes and is now considered to be taxonomically synonymous with the shortjaw cisco (Todd and Smith, unpubl. data). The last capture of longjaw cisco in Lake Huron was recorded in Georgian Bay (45°30', 81°00') on June 12, 1975 (Todd 1978).

Ontario

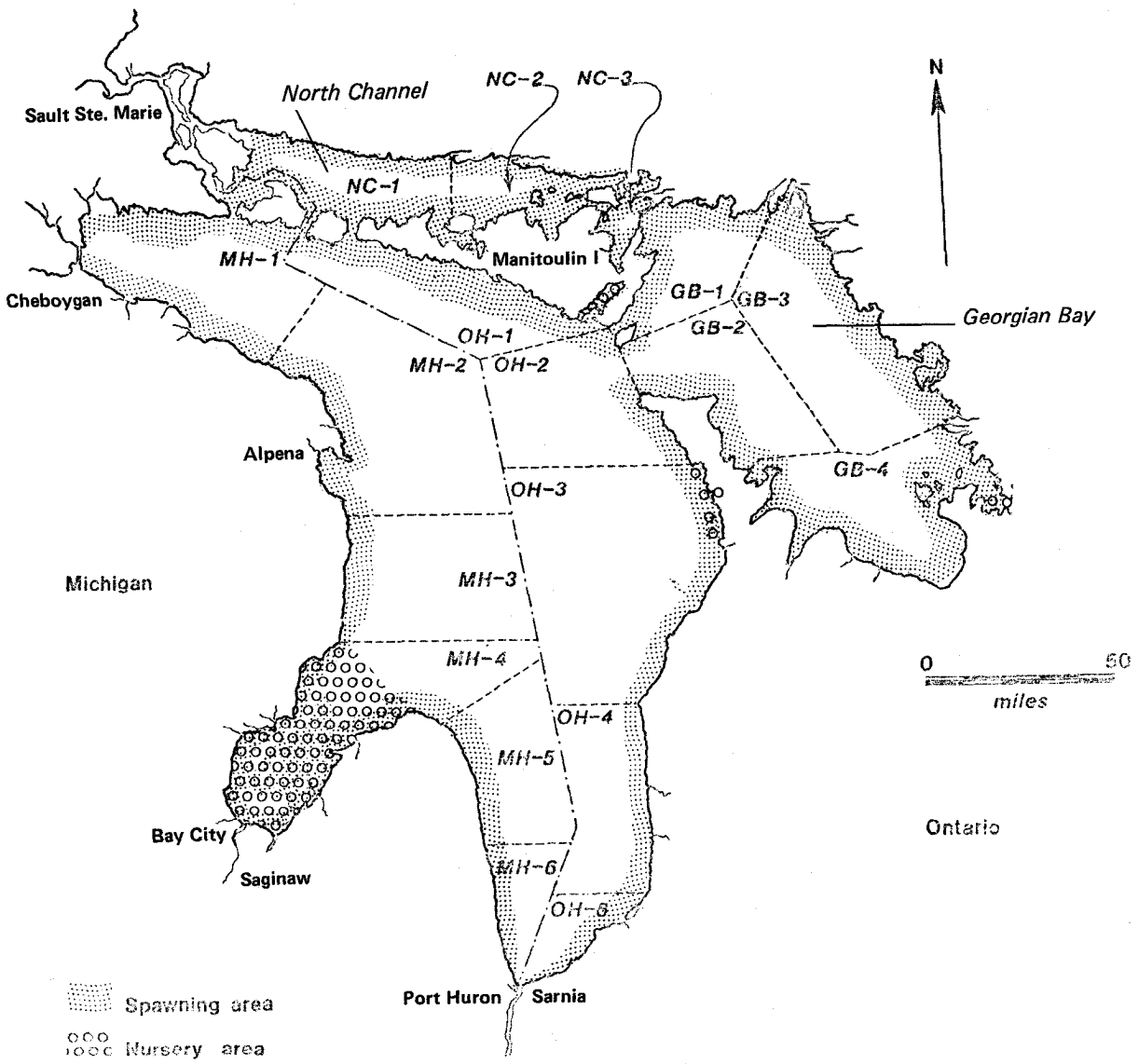
GB-4

Meaford (44°37', 80°35')--Cape Rich (44°43', 80°38'). An inshore spawning run moved into depths of 96-120 ft in this area (Koelz 1929).

Owen Sound (44°40', 80°53'). An inshore spawning run occurred here (Koelz 1929).

Colpoys Bay (44°47', 81°05'). Adults entered the bay in large numbers as early as the first week in November and spawned at depths of 60-144 ft. In 1919, the entire catch in late November and December was composed of spawning fish (Koelz 1929). In 1920, ripe females that had not yet spawned were caught on November 24 at Wiarton (44°45', 81°09) (Clemens 1922).

LAKE HERRING



The lake herring is generally declining in Lake Huron (Todd, pers. comm. *1981).* Lake herring spawn in November and early December (Berst and Spangler 1970a; Carr *1962;* Koelz 1926, *1929;* Rathhun and Wakeham 1897). Runs of lake herring historically came inshore to spawn along the entire shoreline of the lake, usually over gravel and sand (Koelz *1929;* Rathbun and Wakeham 1897).

Michigan

MH-1

Point De Tour (45°57', 83°55')--St. Ignace (45°52', 84°43'). Spawning occurred from 1946 to the 1970s in about 5-25 ft of water over honeycomb, mud, and sand along the shoreline area from St. Vital Bay (45°57', 83°59') to St. Ignace; spawning grounds in this area include Marquette Island (45°57', 84°23'), the St. Martin Islands (45°58', 84°36'), Beaver Tail (45°58', 84°09'), Martin (45°55', 84°09'), Pomeroy (45°55', 84°12'), Tobin (45°56', 84°12'), and Surveyors (45°57', 84°13') reefs, and Goose Island (45°55', 84°25') and Goose Island Shoal (45°54', 84°29') (Organ et al. 1978). The Les Cheneaux Islands (45°58', 84°20') also support reproduction (Odin 1979).

Poe Reef (45°42', 84°22'). An historical spawning ground (FWS 1977).

MH-2

Middle Island (45°11', 83°20'). A large fishery existed for lake herring when they spawned here in November (Koelz 1926). Since the 1930s, spawning occurred off the north and east shores of Middle Island and along the mainland shore opposite the southwest shore of the island on gravel areas in 10 ft of water (Organ et al. 1978).

Thunder Bay (45°00', 83°20'). Spawning occurs along the south shore of North Point (45°01', 83°16') to Whitefish Point (45°03', 83°21') over gravel and rock in about 30 ft of water (O'Gorman, pers. comm. 1979; Organ et al. 1978).

MH-3

Oscoda (44°25', 83°20')--Au Sable Point (44°20', 83°20'). Until 1946, spawning occurred in this area over rock and gravel (Organ et al. 1978).

MH-4

Saginaw Bay (44°00', 83°30'). This was one of the most consistently used and extensive spawning grounds in Lake Huron (Rathbun and Wakeham 1897) and was also a major fishing ground (MSBFC 1899); more than half of the total catch was taken in November (Hile and Buettner 1959). Lake herring disappeared from the bay in the late 1940s and early 1950s (Organ et al. 1978), but some spawning runs occurred in mid-November, at least until 1956 (Carr 1962). During the spawning season, the adults were collected at Point Lookout (44°03', 83°35'), Point Au Gres (43°59', 83°41'), Nayanquing Point (43°46', 83°56'), Tobico Marsh (43°42', 83°56'1, Bay City (43°36', 83°52'), and Sand Point (43°55', 83°24') (Carr 1962; Van Oosten 1929). Spawning depended on temperature and occurred at depths of 25 ft or less anytime from late October to December (Organ et al. 1978). Young fish produced on spawning grounds in the bay probably spent most of their first year of life in the bay (Van Oosten 1927b).

Spawning areas within the bay (from Organ et al. 1978, unless otherwise specified) are as follows:

Au Sable Point (44°20', 83°20')--Point Lookout (44°03', 83°35'). Until 1946, spawning occurred throughout this area, including Tawas Bay (44°16', 83°30'), over a substrate of rock and gravel.

Point Lookout (44°03', 83°35')--Point Au Gres (43°59', 83°41'). Spawning occurred here from 1933-1935 over clay, sand, and rock.

Point Au Gres (43°59', 83°41')--Wigwam Bay (43°59', 83°50'). Spawning occurred until the mid-1950s over mud with clay and rock.

Gilman's Landing (43°48', 83°55')--Saginaw River (43°39', 83°51'). Spawning occurred in this area over sand and gravel (Organ et al. 1978). In 1921-23, fish that were almost ready to spawn were collected between the south end of Tobico Marsh (43°42', 83°56') and the mouth of the Kawkawlin River (43°40', 83°53') in late October to mid-November (Van Oosten 1929).

Saginaw River (43°39', 83°51')--Quanicasse River (43°35', 83°41'). Spawning occurred here over sand, gravel, and rock to a depth of about 12 ft.

Fish Point (43°43', 83°31'). Spawning occurred from the west side of Fish Point south to Sunset Bay Marina (43°40', 83°35') over sand along the 6 ft depth contour and over clay and sand at depths of 12-16 ft. Spawning also occurred directly off the mouth of the Sebewaing River (43°44', 83°28') along the 6 ft depth contour.

Sand Point (43°55', 83°24')--Oak Point (43°58', 83°16). Until 1947, spawning occurred over sand and rock out to a depth of 6 ft and over sand and gravel at depths of 12-24 ft. In 1908, large catches were made along the broad sand flat north of Sand Point in November and December (Leathers 1911).

Oak Point (43°58', 83°16'). Until 1946, spawning occurred around Oak Point and to the east to a point (44°00', 83°05') just past Rat Point (44°00', 83°07'), over rock and gravel to depths of 24 ft.

Point Lookout (44°03', 83°35')--Little Charity Island (44°00', 83°28'). Until 1947, spawning occurred over rock, gravel, and sand in a crescent-shaped area at the 12-24 ft depth contours.

Coreyon Reef (44°00', 83°28'--43°40', 83°50'). In 1938-47, spawning occurred here over rock, sand, and gravel (Organ et al. 1978).

Ontario

OH-1

south Bay (45°38', 81°52'). Spawning may occur here; larvae were collected along shore in April and May (Faber 1970). In 1977, 60% of the larvae caught here were herring larvae (Loftus 1977). Herring and whitefish larvae appear simultaneously immediately after ice breakup. The larvae are distributed throughout the bay in the surface waters (Faber 1970).

OH-3

Stokes Bay (45°00', 81°23') and Pike Bay (44°52', 81°20'). These bays are nursery areas (Loftus 1977).

Fishing Islands (44°50', 81022'--44°43', 81°20'). This area was one of the most extensive and consistently used spawning grounds (Rathbun and Wakeham 1897). In 1977, a few larvae were recovered in the area in late April to mid-May (Loftus 1977).

NC-2

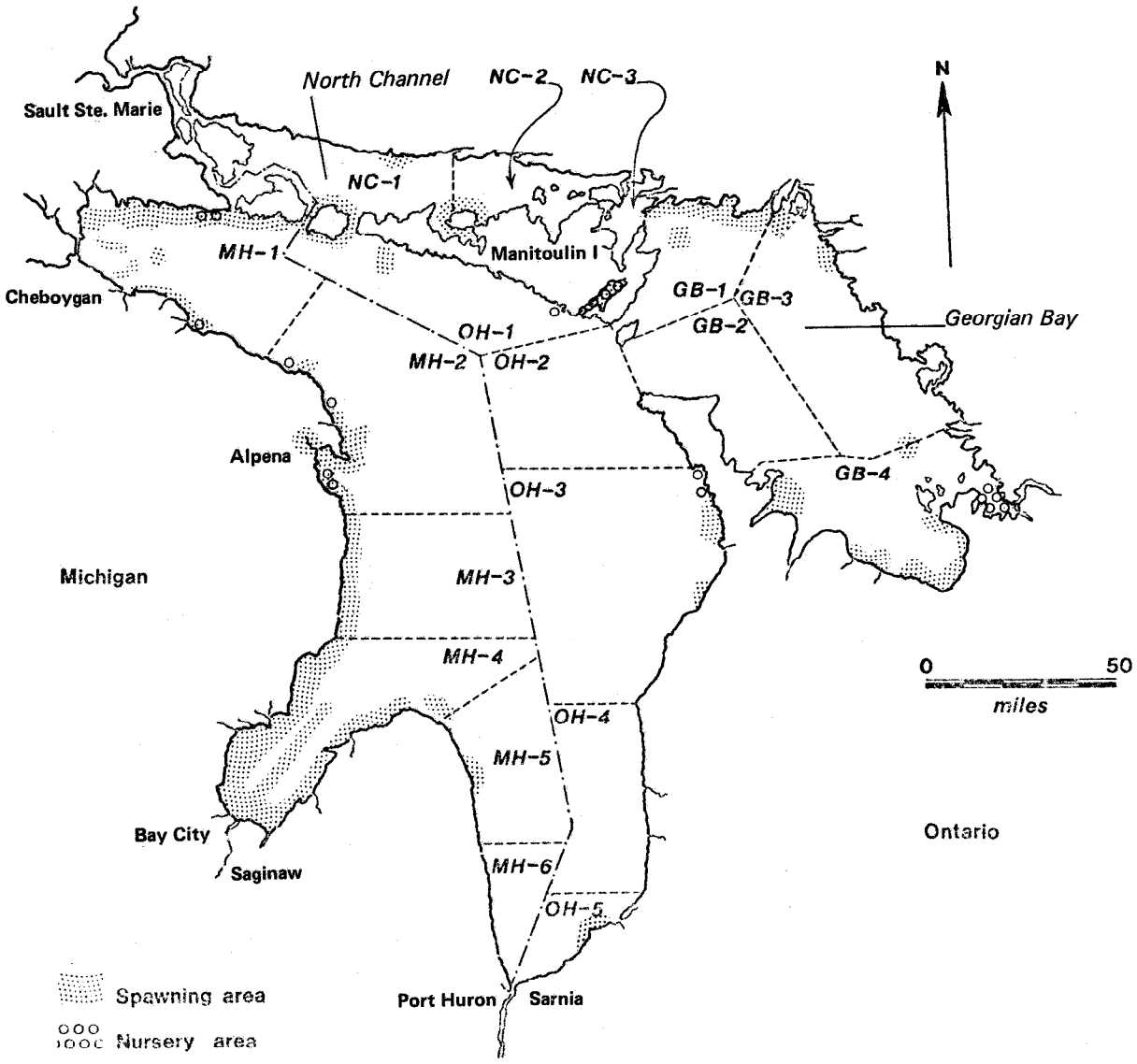
Aird (Cutler) Bay (46°11', 82°28'). Adults appeared in 12 ft of water around the islands in the bay by about November 10, remained for about 3 weeks to spawn, and then left abruptly (Koelz 1929).

GB-4

Bergie Point (44°45', 79°47'). A few larvae were collected from mid-April through May (Loftus 1977).

Colpoys Bay (44°47', 81°05'). The bay was an important "reserve" ground, which was closed to fishing and served as a sanctuary for natural reproduction (Ont. Game Fish 1932). Many "blueback" herring ran inshore during November in southern Georgian Bay (45°00', 80°30') (Bensley 1915).

LAKE WHITEFISH



In Lake Huron, lake whitefish spawn in November and early December (MacKay 1957f; Rathbun and Wakeham *1897).* Lake whitefish prefer a limestone, honeycombed rock, and gravel substrate (Koelz 1929) but will spawn over sand and mud (FWS *1977).* Spawning usually occurs in 36-48 ft of water (Koelz 1929). After hatching in mid-April, fry rise to the surface, remain for a few days, and then are carried or swim inshore where they concentrate in water less than 3 ft deep (Berst and Spangler 1970a, 1973). Larvae are encountered nearshore before or during the spring emergence of smelt fry and as late as early July (Reckahn *1970;* Scott et al. 1978b).

Large spawning populations exist in northern Lake Huron (Eshenroder, pers. comm. *1980).* In *1970,* eggs were taken from spawning adults in northern Lake Huron on November 23, at a water temperature of about 42°F (Edsall and Rottiers *1976).*

Michigan

Spawning occurred at intervals from De Tour (45°59" 83°54') to Port Austin (44°03', 83°00') in nearshore waters on rocky or sandy bottoms during November *1-25* (Rathbun and Wakeham 1897).

MH-1

Point De Tour (45°57', 83°55')--St. Ignace (45°52', 84°43'). Spawning occurred throughout the area between the Straits of Mackinac (45°49', 84°45') and De Tour (Geare *1884).* Spawning grounds near St. Ignace were fished during November (Van Oosten 1927a). Spawning occurred at least since the mid-1960s along the shoreline from the eastern end of Drummond Island (46°00', 83°40') west to Grosse Point (45°58', 84°41') and south to St. Ignace. Specific sites include Beaver Tail Reef (45°58', 84°09'), Martin Reef (45°55', 84°09'), Pomeroy Reef (45°55', 84°12'), Tobin Reef (45°56', 84°12'), Surveyors Reef (45°57', 84°13'), Goose Island *(45°55', 84°25'),* and Goose Island Shoal (45°54', 84°29'), and the St. Martin Islands (45°58', 84°36'). Since *1965,* spawning has occurred over honeycomb, rock, sand, and mud to depths of 24 ft (Organ et al. *1978).* In 1973, larvae were found in small numbers at St. Vital Point (45°57', *84°00')* on May 30-June 1 (O'Gorman 1975).

Bois Blanc Island (45°46', 84°27'). Since 1965, spawning has occurred in areas around the shore of the island (Organ et al. 1978) over a bottom of honeycombed rock, sand, and mud. One area from the east end of Round Island (45°50', 84°36') along the north shore of the island to Lighthouse Point (45°49', 84°25'). Spawning also occurs along the east shore of the island from Lafayette Point *(45°46', 84°21')* to Packard Point (45°43', 84°25'). Lake whitefish also spawned over Poe Reef *(45°42',* 84°22') off the southeast tip of the island (FWS *1977).*

Spectacle Reef (45°46', 84°08'). A few ripe fish were collected here (Rathbun and Wakeham *1897).*

Cheboygan (45°30', 84°28')--Hammond Bay (45°30', 84°05'). Since *1945,* spawning has occurred from Duncan Bay (45°39', 84°26') at Cheboygan Point (45°40', 84°26') to the Hammond Bay Biological Station (45°30', 84'02') at depths to about 50 ft from late October to mid-November. Substrate included aquatic vegetation from Duncan Bay to Nine Mile Point *(45°38',* 84°13') and rock, gravel, and sand in the Hammond Bay area (O'Gorman, pers. comm. 1979; Organ et al. 1978). A spawn collecting station was located at Nine Mile Point (Clark *1886).* Spawning occurred from mid-November to early December in Hammond Bay (Van Oosten 1927a).

Eggs were collected from spawners in Hammond Bay for propagation (Clark 1886). In 1973, a few fry were collected in the bay on May 30-June 1 (O'Gorman 1975).

M H - 2

Thompsons Harbor (45°21', 83°36'). In 1973, a few young were collected in Thompsons Harbor on May 30-June 1 (O'Gorman 1975).

North Bay (45°21', 83°30'). During the 1930s, lake whitefish spawned here over honeycombed rock (Organ et al. 1978). Spawn was collected for propagation at Presque Isle (45°21', 83°29') (Clark 1886).

Middle Island (45°11', 83°20')--Thunder Bay Island (45°03', 83°12'). Spawning occur red in the ares between the islands beginning in late October (Van Oosten 1927a). Spawning occurred at Middle Island during the 1930s-1970s off the east side of the island over gravel and during the 1930s off the north side of the island over unknown substrate (Organ et al. 1978). A few lake whitefish larvae were collected o&f Rockport (45°12', 83°23') in June 1975 (O'Gorman 1978). During the 1970s, whitefish spawned in an area extending 3-8 mi offshore between South Nine Mile Point (45°08, 83°19') and Potter Point (45°05', 83°18') over a gravel shoal at depths of 24-30 ft (Organ et al. 1978). This was one of the best whitefish spawning areas (Koelz 1929), where whitefish appeared in "countless numbers" in November (Smith and Snell 1891). Spawn collecting stations were located at Round Island (45°05', 83°18') and Sugar Island (45°03', 83°14') (Clark 1886). Spawning occurred in 1957-68 around Thunder Bay Island and during the 1920s-1960s towards shore along the south edge of Sugar Island (Organ et al. 1978). Lake whitefish were heavily fished during the spawning season on the shoals north of Thunder Bay Island and Sugar Island (Smith and Snell 1891).

Thunder Bay (45°00', 83°20'). During the 1880s, eggs were collected from ripe lake whitefish in Thunder Ray (Berst and Spangler 1970a; Clark 1886; U.S. Comm. Fish Fish. 1885); spawning occurred during November 5-20 (Van Oosten 1927a) and peaked November 10-15 (Geare 1884). Spawning is especially successful in the North Point area (45°01', 83°16') (FWS 1979d). One gravel and rock area extends from North Point to -Whitefish Point (45°03', 83°21') (O'Gorman, pers. comm. 1979; Organ et al. 1978) and a second extends southeast over the gravel shoal off North Point (Organ et al. 1978). Lake whitefish spawned at Alpena (45°04', 83°26') (MSBFC 1890) and still congregate in large numbers on the reefs near Alpena (Hile, pers. comm. 1979), primarily those already discussed north of North Point. Records from the late 1800s state that the catch was declining and many of the spawning beds had been destroyed by sawdust and mill and rafting refuse (MSBFC 1888, 1890, 1895). A run into the Thunder Hay River (45°04', 83°26') was wiped out by 1925 due to sawmill waste (Schneider and Leach 1979). Historically, few adults were caught during the,spawning season along the west and north shores of the bay (Smith and Snell 1891), but commercial fishermen have recently identified spawning areas along the north shore that have been used since the 1920s (Organ et al. 1978). The gravel shoals off the east side of Sulphur Island (44°59', 83°25') are

currently used (Organ et al. 1978), and the area around Scarecrow Island (44°55', 83°20') was heavily fished during the spawning season (Clark 1886; Ravenel-1898; Smith and Snell 1891). In May 1975, a few whitefish larvae were collected off Alpena (O'Gorman 1978).

MH-3

Thunder Bay (45°00', 83°20')--Saginaw Bay (44°00', 83°30'). Spawning occurred from Alpena (45°04', 83°26') to Saginaw Bay (Van Oosten 1927a). Commercial fishermen have recently identified the entire shoreline from North Point (45°01', 83°16') to Au Sable Point (44°20', 83°20') as a spawning ground. The earliest recorded catch of spawners was in the 1920s over a substrate of gravel, rock, clay, and mud (Organ et al. 1978). In the 1880s, spawning occurred off Alcona (44°45', 83°18'), where spawn was collected, and off Sturgeon Point (44°43', 83°16') (Berst and Spangler 1970a; Clark 1886). Seven Mile Point (44°33', 83°18') was described as a fair spawning ground (MSBFC 1895). Lake whitefish were abundant along the entire shore of Iosco County (44°31', 83°19'--44°10', 83°34') during the spawning season (Smith and Snell 1891). Spawning occurred off Millers Point (44°30', 83°19') about 6 mi north of Oscoda (44°25', 83°20') on November 15-20 (Van Oosten 1927a). By 1895, mill refuse and sawdust had reportedly driven the lake whitefish away from the Oscoda--Au Sable area (MSBFC 1895).

MH-4

Saginaw Bay (44°00', 83°30'). Most of the shoreline, island, and reef areas of Saginaw Bay were used by whitefish for spawning. The entire bay was a fishing ground during the spawning season, usually in November, but sometimes as early as October (Koelz 1929; Van Oosten 1927a); fishermen collected eggs here for hatcheries located at Bay City (43°36', 83°52') and Bay Port (43°51', 83°22') (Westerman 1928, 1930, 1933).

Au Sable Point (44°20', 83°20')--Point Lookout (44°03', 83°35'). From 1915 to the present, spawning occurred along the shoreline between these points over gravel, rock, and sand (Organ et al. 1978). Spawning occurred in Tawas Bay (44°16', 83°30') as early as October and as late as mid-December; at Point Lookout, spawning began on about November 20 (Van Oosten 1927a). Lake whitefish also spawned in large numbers at Gravelly Point (possibly Gravelly Shoal, 44°02', 83°33') (Geare 1884).

Point Au Gres (43°59', 83°41')--Saganing Bar (43°55', 83°51'). This region is an historical spawning area; spawning was last reported in 1952 (Organ et al. 1978). Spawning at Rifle Bar (43=°58', 83°43') began on about November 15 (Van Oosten 1927a).

Pinconning Bar (43°51', 83°52')--Quanicasse (43°35', 83°40'). Pinconning Bar, Ne'Oquam Point (possibly Nayanquing Point, 43°46', 83°56'), and the head of Saginaw Bay were historic

spawning areas (Van Oosten 1927a). Spawning occurred during the 1930s on a sand and gravel area extending from Gilmans Landing (43°48', 83°55') to Quanicasse (Organ et al. 1978).

Fish Point (43°43', 83°31')--Hat Point (44°00', 83°07'). Spawning occurred west of Fish Point at depths of 14-16 ft; in 1915-77 from south of Fish Point to Heisterman Island (43°51', 83°26') over rock and sand at a depth of 6 ft; in 1938-78 in a small area northwest of North Island (43°53', 83°25') at depths of 12-14 f t; in 1938-78 on a small sand area north of the tip of Sand Point (43°55', 83°24'); from 1917-1960s on the reef area northwest of Sand Point (at 43°56', 83°27') at depths of 5-6 ft; in 1915-78 along the shoreline from Sand Point, around Oak Point (43°58', 83°16') over rock, gravel, and sand; and in 1938-79 from Oak Point to about 2 mi E of Hat Point (44°00', 83°05') over rock, sand, and gravel (Organ et al. 1978). In the early 1900s, whitefish spawned on the broad sand flats off Sand Point (Leathers 1911).

Charity (44°02', 83°26') and Little Charity (44°00', 83°28') Islands. Since the late 1800s, the rock and gravel areas around the islands were used extensively for spawning (Geare 1884; Organ et al. 1978). Spawning occurred during November (Van Oosten 1927a).

Coreyon Reef (44°00', 83°28'--43°40', 83°50'). Spawning occurred during November along the reef, from the Charity Islands to Bay City (43°36', 83°52') (Van Oosten 1927a).

Huron City (44°02', 82°50'). Spawning occurs at a small rocky area at depths of 6-30 ft (Organ et al. 1978).

MH-5

Harbor Beach (43°51', 82°39'). Spawning occurred here (Hile, pers. comm. 1979).

MH-6

Forester (43°30', 82°34'). In 1890, Honeycomb Reef, or Rock, 6 mi E of Forester, was a recommended site for lake whitefish planting (MSBFC 1890); it was not stated that this was a spawning area.

Port Huron (43°00', 82°26'). Spawning occurred along shore at depths of 30-50 ft (Organ et al. 1978).

Ontario

Spawning grounds in the Canadian waters of Lake Huron, and especially those in Georgian Bay (45°30, 81°00'), were degraded by discharges of

sawdust and bark from log rafts which formed dense mats on the bottom (Rathbun and Wakeham 1897). Spawning occurs in the lake proper on November 20-December 10 and in Georgian Bay on November 'IO-December 15 (MacKay 1969).

OH-1

Cockburn Island (45°55', 83°20'). Lake whitefish were reported to come onshore to spawn around November 10 (Ont. Game Fish 1913a).

Manitoulin Island (45°50', 82°30'). Lake whitefish spawned in shallow water over honeycombed rock which extended some distance from the south shore of the island (Bell 1895). Lake whitefish spawned around the Duck Islands (45°43', 82°56') (Rathbun and Wakeham 1897). In 1965-1969, young lake whitefish and young round whitefish were caught in Michael Bay (45°35', 82°06') over a sandy bottom at a depth of about 12 ft in mid-July; the water temperature there was about 63°F (Reckahn 1970). Ripe adults were caught on the rocky shoals in South Bay (45°38', 81°52'), primarily at the northeast end of the inner basin in mid-November (Faber 1970; Reckahn 1970). Spawning occurred along shore in the shallows, and hatching occurred in April (Berst and Spangler 1970a; Collins 1975; Faber 1970; Reckahn 1970). In 1977, larvae were collected in the bay (Loftus 1977). Newly hatched larvae were found along shore over rubble and gravel, usually at depths less than about 30 ft for 2-3 weeks in April-May after ice breakup (Faber 1970). Larvae were found in less than 3 ft of water adjacent to areas of emergent vegetation in June and early July (Reckahn 1970). The young moved into the metalimnion at depths of about 47-50 ft in July and August and then into deeper, colder water (Berst and Spangler 1970a; Reckahn 1970). Fry were found in South Bay at Fair's Rock (location uncertain) in April and May (Collins 1975).

OH-3

Fishing Islands (44°50', 81022'--44°43', 81°20'). Spawning occurred among the islands (Rathbun and Wakeham 1897). In 1977, larvae were collected here from late April to mid-May; Stokes Bay (44°59', 81°23') and Pike Bay (44°52', 81°20') were identified as nursery areas (Loftus 1977).

Southampton (44°30', 81°22'). Spawning occurred near Southampton (Rathbun and Wakeham 1897).

OH-5

Cape Ipperwash (43°13', 82°00'). A few fish spawned in the Cape Ipperwash vicinity (Rathbun and Wakeham 1897) and northeast of Kettle Point (43°13', 82°01') (Ont. Game Fish 1909).

NC-1

Thessalon River (46°15', 83°33'). This may be a spawning ground (MacDonald 1978).

Blind River (46°11', 82°57'). In 1917, spawning occurred at Blind River on November 8 (Koelz 1929).

NC-2

There were extensive spawn taking operations in the North Channel (Ont. Game Fish 1913a, 1939) and at Little Current (45°59', 81°56') (Ont. Game Fish 1943).

Barrie Island (45°55', 82°40'). In 1917, spawning occurred on November 10 (Koelz 1929).

GB-1

Spawning occurred in the inshore waters of the north shore of Georgian Bay (Ont. Game Fish 1931).

Squaw Islands (45°50', 81°27'). Spawning occurs among' the Squaw Islands and associated reefs (Rathbun and Wakeham 1897).

GB-3

Bustard Islands (45°53', 80°55'). Spawning occurred among the islands and associated reefs in November (Rathbun and Wakeham 1897).

French River (45°56', 80°54'). Eggs were collected from ripe fish (Rodd 1914, 1917, 1918). Spawning occurred at the river mouth in early November (Kerr and Kerr 1860-1898).

Byng Inlet (45°46', 80°38'). This is a major spawning ground (Budd 1957). Spawning occurred here about November 10 (Kerr and Kerr 1860-1898).

Western Islands (45°04', 80°20'). Spawning occurred among the islands and associated reefs in November (Rathbun and Wakeham 1897).

GB-4

Matchedash Sound (44°50', 79°50'). In 1977, lake whitefish larvae were collected in April (Loftus 1977).

Nottawasaga Bay (44°40', 80°15'). Lake whitefish spawned in many areas of the bay including Gridley (Gidley) Point (44°45', 80°07'), Spratt Point (44°36', 80°01'), the mouth of the Nottawasaga River (44°33', 80°00'), Collingwood (44°30', 80°13'), the Mary Ward Ledges (44°34', 80°19'), Clay Banks (-44°36', 80°33'), and Woodland Beach (location unknown) (Cucin and Regier 1966; Kerr and Kerr 1860-1898). A discrete population spawns near the south end of Wasaga Beach (44°31', 80°02') (GLPC 1961). Whitefish may have spawned at Thornbury (44°34', 80°27') **(Ont. Game** Fish 1911, 1912).

Owen Sound (44°40', 80°53')--Wiarton (44°45', 81°09'). Lake whitefish spawned throughout this area (Ont. Game Fish 1916, 1932). Spawning occurred at Hay (44°53', 80°58'), White Cloud (44°50', 80°58'),

and Griffith (44°50', 80°54') islands, and Cape Commodore (44°48', 80°54') (Cucin and Regier 1966).

Lake whitefish in southern Georgian Bay move from deep water to inshore shoals to spawn (Bensley 1915). Fishermen caught lake whitefish on spawning grounds in this area from late October to early December, at depths as shallow as 6-12 ft (Cucin and Regier 1966).

BLOATER

In Lake Huron, bloaters may spawn throughout the year (Koelz 1929), but spawning usually occurs in February and March (Lagler 1948). Bloaters are generally common but locally declining in some areas of Lake Huron (Todd, pers. comm. 1981). Very few areas have been identified as sites of reproduction.

MH-1

St. Vital Point (45°57', 84°00'), St. Martin Bay (46°00', 84°37'), and Hammond Bay (45°30', 84°05'). During a 1973-1975 survey conducted in the U.S. waters of the lake, bloater larvae were found only in the northern portion of the lake. Larvae usually are found only in the deeper waters, but some were occasionally taken in shallow, nearshore waters in St. Martin Bay at St. Vital Point, and in Hammond Bay; these larvae may have been carried into shallow water by the periodic upwelling of deeper, offshore water along these shorelines (O'Gorman 1975, 1978).

MH-3

Oscoda (44°25', 83°20'). Spawning probably occurred 10 mi E of Oscoda; eggs and sperm stripped from ripe males and females collected there in February 1967 produced fertilized eggs that hatched and yielded viable larvae (Edsall et al. 1970).

MH-5

Harbor Beach (43°51', 82°39'). Spawning may have occurred near Harbor Beach, where spent females and pearled males were taken in mid-March 1919 (Koelz 1929).

DEEPWATER CISCO

The deepwater cisco is probably extinct in Lake Huron. The last capture in Lake Huron was recorded at Wolfsell, Ontario, on August 4, 1952 (Todd 1978).

Michigan

MH-2

Alpena (45°04', 83°26'). In 1919, a few fish that were ready to spawn, running, or spent were caught on August 30 and September 3. In 1920, many females that were nearly ripe were caught on August 7 (Koelz 1929).

Ontario

GB-2

Georgian Bay (45°30', 81°00'). Fish apparently congregated off the Saugeen, or Bruce, Peninsula (45°00', 81°20') at depths of 360 ft over a mud bottom during September; catches at this time near Lion's Head (45°00', 81°13') and Tobermory (45°15', 81°40') nearly doubled, and many of the fish were running ripe (Koelz 1929).

KIYI

The kiyi is probably extinct in all the Great Lakes except Lake Superior, where its numbers are declining and its status is threatened (Todd, pers. comm. 1981). The last capture in Lake Huron was recorded at Griffith Island (44°50', 80°54'1, in Georgian Bay (45°30', 81°00'), on July 10, 1973 (Todd, 1978). Kiyi probably spawned in October or November in Lake Huron (Koelz 1929; Lagler 1948), but the spawning grounds were not described.

BLACKFIN CISCO

The blackfin cisco is believed to be extinct in all the Great Lakes (Todd, pers. comm. 1981). The last capture in Lake Huron was recorded in Colpoys Bay (44°47', 81°05') at Wiarton (44°45', 81°09') on June 26, 1923. In Lake Huron, the blackfin did not spawn before November (Koelz 1929) and possibly not until January. Spawning occurred at depths of about 360 ft (Berst and Spangler 1970a), but no spawning areas were identified.

SHORTNOSE CISCO

Ontario

The shortnose cisco is believed to be extinct in the Great Lakes, with the exception of a small population in Georgian Bay (45°30', 81°00'), Lake Huron. It is an endangered species and may be extinct within the next several years (Todd, pers. comm. 1981). No information was found concerning spawning and nursery grounds.

SHORTJAW CISCO

The shortjaw cisco is believed to be extinct in Lake Huron and is now considered to be taxonomically synonymous with the longjaw cisco (Todd 1978; Todd and Smith, unpubl. data). The last capture of shortjaw cisco in Lake Huron was recorded at Tawas City (44°16', 83°31'), Michigan, on September 16, 1956 (Todd 1978).

Michigan

MH-1

Spectacle Reef (45°46', 84°08')--Forty Mile Point (45°29', 83°55'). Adults congregated in this area over a clay bottom in mid-September, first at depths of about 180 ft and then at depths of 240-300 ft, where they spawned. Males with pearl organs, fully ripe females, and later spent females were caught. Fishing for this species took place during September and October: spawning apparently ended in early October, when catches dropped dramatically (Koelz 1929).

MH-5

The shortjaw cisco also may have spawned in the southern part of Lake Huron because small ones (no age given) were caught at Harbor Beach (43°51', 82°39') in March 1919 (Koelz 1929).

CISCO spp,

Michigan

MH-1

Point De Tour (45°57', 83°55')--Pomeroy Reef (45°55', 84°12'). Since 1962, spawning has occurred in an area (45°53', 83°56'--45°53', 84°12') over mud at depths of 120-300 ft (Organ et al. 1978).

Bois Blanc Island (45°46', 84°27'). Spawning occurs off the northeast corner of the island (45°49', 84°25'--45°48', 84°15') over mud and clay at depths of 120-300 ft (Organ et al. 1978).

Spectacle Reef (45°46', 84°08')--Hammond Bay (45°30', 84°05'). Spawning occurs at an unnamed area (45°45', 84°05'--45°35', 84°00') over mud and clay at depths of about 120-300 ft (Organ et al. 1978). This is the same location cited by Koelz (1929) as a spawning ground for the shortjaw cisco.

MH-2

Black Point (45°21', 83°32'). Spawning occurs in an area northwest (45°22', 83°34') of Black Point over mud at depths of about 60-100 ft during November (Organ et al. 1978).

MH-3

Black River (44°49', 83°18')--Sturgeon Point (44°43', 83°16'). In 1959-64, chubs spawned throughout the area (44°49', 83*13'--44°43', 83°16') at a depth of about 100 ft during November (Organ et al. 1978).

Six Fathom Bank (44°49', 82°30'). Spawning occurs off the north point of the bank (Organ et al. 1978).

MH-4

Port Austin (44°03', 83°00')--Huron City (44°02', 82°50'). Spawning occurred in an area (44°11', 82°57'--44°07', 82°48') over steep banks with mud bottoms at depths greater than 180 ft during November and December (Organ et al. 1978).

MH-5, MH-6

Port Hope (43°57', 82°43')--Lexington (43°16', 82°32'). Spawning occurs in the entire area (43°57', 82°35'--43°18', 82°25') over mud at depths of about 50-200 ft (Organ et al. 1978).

Ontario

OH-3

An unidentified species of chub spawned northwest of Southampton (44°30', 81°22') (Koelz 1926).

PINK SALMON

Since this species was accidentally released in 1956 into Canadian waters of Lake Superior, self-sustaining populations have spread throughout the Great Lakes (Wagner 1979). The first reported capture of pink salmon in Lake Huron occurred in 1969 (Wagner 1974a). Spawning runs enter Lake Huron tributaries in September, and spawning usually occurs over the first suitable gravel near the stream mouth (Wagner 1974a, 1976a,b). Pink salmon have been reported along the U.S. shore as far south as Port Sanilac (43°26', 82°32') (Wagner 1979).

Michigan

MH-1

Albany Creek (45°58', 84°05'). Spawning runs first occurred here in September 1973 and have continued through 1979 (Wagner 1974a, 1976a,b, 1977).

Carp River (46°02', 84°41'). The first record of pink salmon in Lake Huron was established in 1969 when one spent female was observed in this river (Collins 1975b, Wagner 1974a). Runs were recorded here in 1973, 1977, and 1979 (Wagner 1977, 1979). In 1973, the run occurred in late September-early October (Wagner 1974a).

Cheboygan River (45°39', 84°28'). Runs began in 1977 (Wagner 1977) and have continued through 1979 (Wagner 1979). Runs may also occur in many other streams in Cheboygan County (North Woods Call 1979j).

Ocqueoc River (45°29', 84°04'). The first run into a tributary in Michigan's lower peninsula occurred here in 1975 (Wagner 1976a,b), and runs have continued to the present (Hunn, pers. comm. 1979; Wagner 1979). Runs may occur in other streams of Presque Isle County (45°37', 84°12'--45°13', 83°24') (North Woods Call 1979j).

MH-3

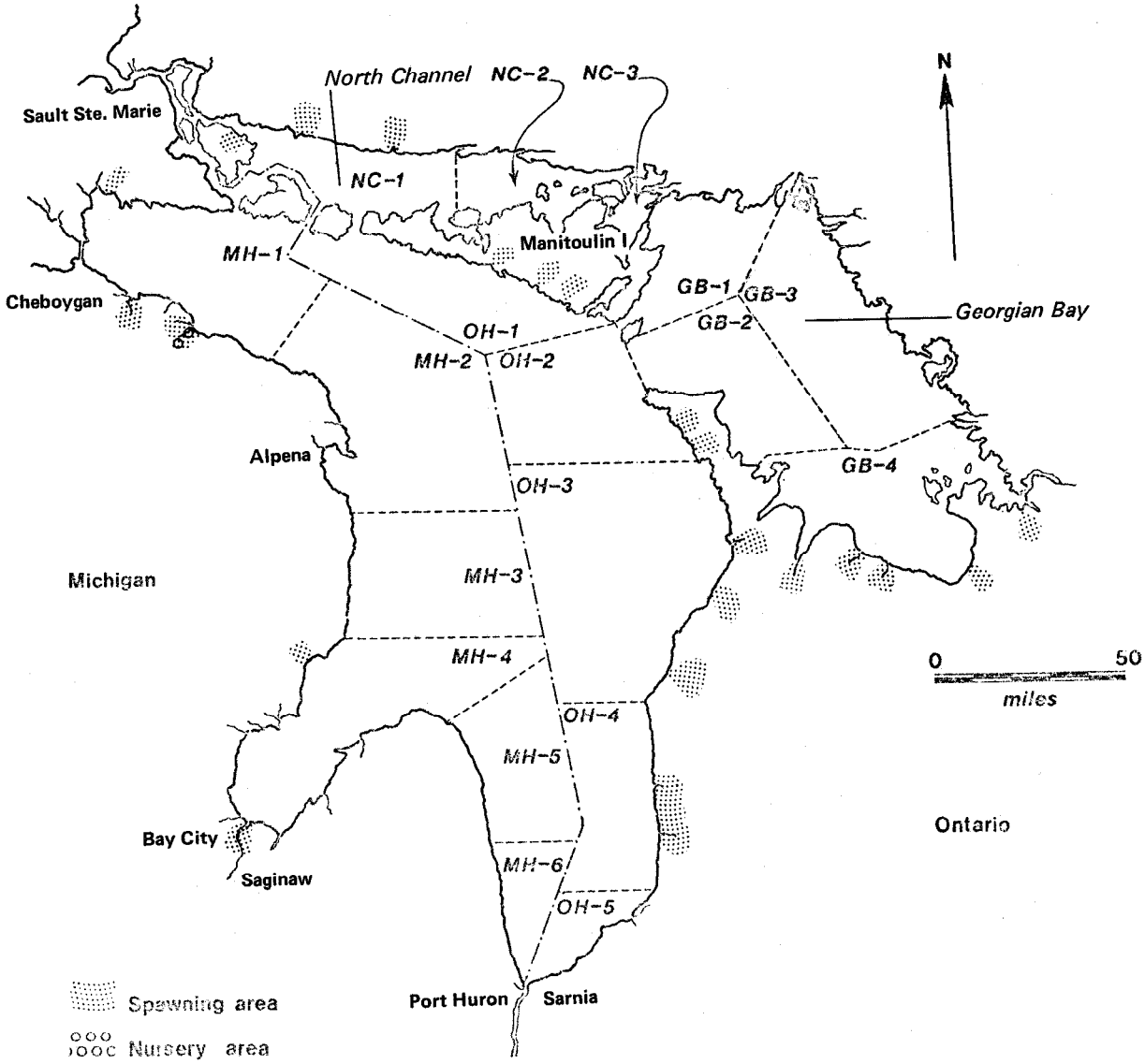
Au Sable River (44°24', 83°19'). One fish was reported here in 1977 (North Woods Call 1979j), and in 1979 pink salmon were listed as common (Wagner 1979).

Ontario

OH-1

Mindemoya River (45°40', 82°16'). In 1973, redds and spawning fish were observed on October 2, spawning ended on about October 9, and eggs in the redds hatched by November 27. Fry subsequently emerged from the gravel during April 8-29, and peak emergence occurred on April 18 (Collins 1975b).

COHO SALMON



In 1967, coho salmon were first stocked in many Lake Huron tributaries (GLFC 1973, 1975, 1976, 1978; MDNR 1970; Parsons 1973), and spawning runs enter tributary streams to spawn in the fall, usually after September (FWS 1979d).

Michigan

The following streams have spawning runs from plantings or straying.

MH-1

Nunns Creek (46°02', 84°34') (MDNR 1970).

Carp River (46°02', 84°41'). A run is expected from plantings in 1979 (North Woods Call 1980a).

Cheboygan River (45°39', 84°28') and Carp (Black Mallard) Creek (45°32', 84°07'). In 1967, a few strays from plantings in 1966 in Lake Michigan tributaries entered to spawn (MDNR 1970).

Ocqueoc River (45°29', 84°04'). In 1969, six coho salmon were seen in the Ocqueoc River between September 13 and November 18 (King and Applegate 1969), and runs currently occur (Hunn, pers. comm. 1979). Natural reproduction apparently occurs in the river because young (4-6 in. long) have been found migrating downstream (Hunn, pers. comm. 1979).

MH-4

Tawas River (44°16', 83°31') (Tody 1970).

Saginaw River (43°39', 83°51'). Large schools of coho salmon enter the river in September. The run peaks in November in the Cass River, a tributary of the Saginaw River, but continues into February (Beak Consult. 1976). In mid-September 1972, adults were found in the thermal plume of the Karn-Weadock Power Plant Complex (43°39', 83°51'); the plant complex withdraws cooling water from the Saginaw River and discharges it directly into Saginaw Bay (MWRC 1974).

Ontario

The following Canadian streams have spawning runs (Environ. Can. 1977c; OMNR 1973):

OH-1

Srigley Creek (45°43', 82°29'), Mindemoya River (45°40', 82°16'), and Manitou River (45°36', 82°06').

OH-2

willow Creek (45°10', 81°34') and Spring Creek (45°02', 81°27').

OH-3

Sauble River (44°40', 81°17'), Saugeen River (44°30', 81°23'), and south and North Penetangore and Kincardine Creek (44°11', 81°39').

OH-4

Lucknow River (43°53', 81°43'), Maitland River (43°45', 81°44'1, and Bayfield River (43°34', 81°43').

NC-1

Jaggers Creek (46°15', 83°53'). Occasional catches may indicate runs (OMNR 1976b).

Livingstone Creek (46°15', 83°29'). A small annual run occurs (OMNR 1976b).

Mississagi River (46°10', 83°01'). Occasional catches may indicate runs (OMNR 1976b).

GB-4

sturgeon River (44°44', 79°44'), Nottawasaga River (44°33', 80°00'), Beaver River (44°34', 80°27'), Bighead River (44°37', 80°35'), and Sydenham River (44°35', 80°56').

AOKANEE

Kokanee have been stocked in Lake Huron and Georgian Bay (45°30', 81°00') since 1964, primarily along Manitoulin Island (45°50', 82°30') and the Bruce Peninsula (45°00', 81°20'), and significant spawning runs have developed since 1966 (Collins 1971; OMNR 1973). Runs generally begin in mid-August, peak the third or fourth week of September, and end by mid-October (Collins 1971). Spawning occurs both in tributaries and on the lake shore (GLFC 1970a).

Ontario

Runs have been reported in the following tributaries of the Bruce Peninsula (45°00', 81°20') and Manitoulin Island (45°50', 82°30'), where spawning occurs in September (OMNR 1973).

OH-1

Mindemoya River (45°40', 82°16') (Environ. Can. 1977c).

Jenkins Creek (45°37', 82°12) (OMNR 1973).

Manitou River (45°36', 82°06') (Environ. Can. 1977c). Major runs began here in 1967 (GLFC 1968).

Bluejay Creek (45°35', 82°05'). Major runs began here in 1967 (GLFC 1968). In 1970-71, the run began in late August-early September, three periods of peak movement occurred during September, and the run ended in early October. Most spawning occurred over fine gravel at the headwaters about 10 mi above the mouth, when water temperatures were about 46-61°F. Alevins and fry emerged from the redds in early January-late May in spring-fed headwater areas, and in late April-late May in other portions of the river. Young migrated out of the stream in late January-late May; 55% of the escapement occurred under ice from late January through mid-March. Peak movement occurred in mid-March and again in early May (Collins 1971; Porter 1972).

South Bay (45°38', 81°52'). A large shoreward movement occurs here prior to spawning (Collins 1971; Reckahn 1970). In 1969, most spawning began in late September, peaked October 2, and ended by October 15. Eggs were found in redds October 14 and November 5 (Collins 1971).

OH-2

willow Creek (45°10', 81°34') (Environ. Can. 1977c).

OH-3

Saugeen River (44°30', 81°23') (Environ. Can. 1977c).

GB-2

Judges Creek (44°58', 81°13') (Environ. Can. 1977c).

GB-4

Sturgeon River (44°44', 79°44'). In 1968, spawning was observed about 2 mi above the river mouth in the fall (Thede 1970).

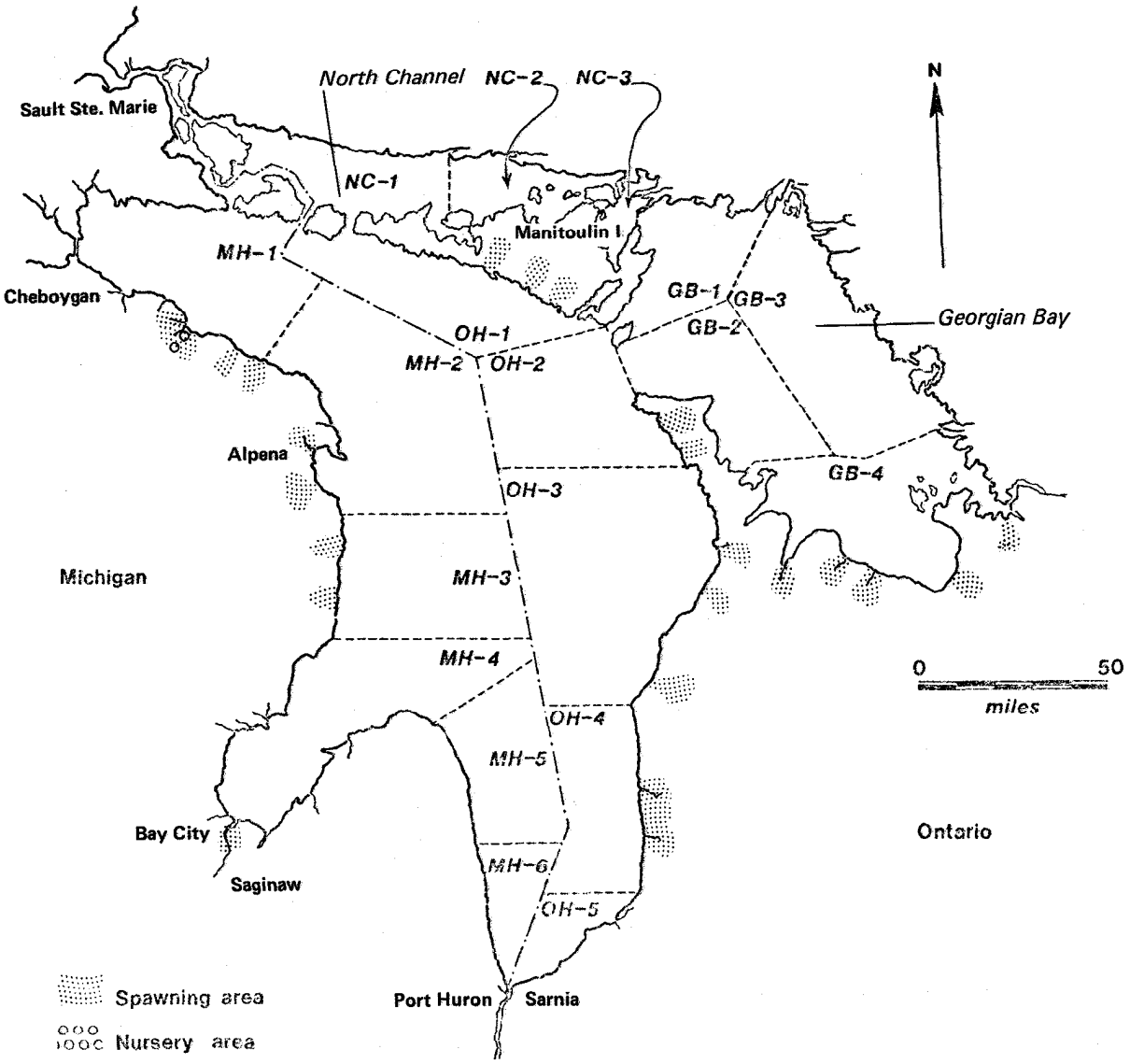
Bighead River (44°37', 80°35') (OMNR 1973).

Telfer Creek (44°38', 80°52'), Sydenham River (44°35', 80°56'), pottawatomi River (44°35', 80°56') (Environ. Can. 1977c).

Gleason Brook (Oxenden Creek) (44°46', 81°06') (Collins 1971; Environ. Can. 1977c). Major runs began in 1967 (GLFC 1968).

Colpoys Creek (44°47', 81°07') (Collins 1971; Environ. Can. 1977c).

CHINOOK SALMON



In 1873, chinook salmon were introduced into U.S. waters of Lake Huron, however, self-sustaining populations were not established (Parsons 1973). In 1967, chinook salmon were reintroduced into U.S. waters of Lake Huron (GLFC 1973, 1975, 1976, 1978; MDNR 1970; Parsons 1973) and produced spawning runs in many of the lake's tributaries in the fall (FWS 1979d); self-sustaining populations are established in some areas.

Michigan

The following streams have spawning runs from plantings or straying.

MH-1

Carp (Black Mallard) Creek (45°32', 84°07'). A run occurs here in the fall (King, pers. comm. 1979).

Ocqueoc River (45°29', 84°04'). Plantings made in 1968 produced good spawning runs in the Ocqueoc River (Rybicki 1973). In 1969, chinook salmon were observed milling about off the mouth of the Ocqueoc River on September 5-7, when the river temperature was 70°F. On September 8, the temperature dropped to 65°F, and the chinook salmon migrated upstream. By November 18, the spawning run was almost over (King and Applegate 1969). in 1970, chinook salmon were concentrated near the mouth of the Ocqueoc River during October; they had been congregating there for several weeks because a barricade at the mouth of the river prevented them from moving upstream (Reynolds 1970). Young salmon (3-4 in. long), tentatively identified as chinook salmon, were found migrating downstream (Hunn, pers. comm. 1979).

Nagels Creek (45°27', 83°52'). Adults attempt to enter the creek.
Swan River (45°24', 83°44'). A run occurs here in the fall (Hunn, pers. comm. 1979).

MH-2

Thunder Bay (45°00', 83°20'). Plantings made in 1968 produced a minor run in the Thunder Bay River (45°04', 83°26') (Rybicki 1973). There is also a run in the Devils River (44°55', 83°25') (Stedman, pers. comm. 1979).

MH-3

Mill Creek (44°40', 83°17'). In 1979, chinook salmon were caught while schooling off Harrisville (44°40', 83°18') in late August. Au Sable River (44°24', 83°19'). During late August 1979, chinook salmon were observed schooling off the mouth of the Au Sable River (Crowe 1979a).

MH-4

Au Gres River (44°02', 83°41'). In 1979, chinook salmon were reported at Au Gres (44°03', 83°42') in mid-November (North Woods Call 1979m).

Saginaw River (43°39', 83°51'). Chinook salmon are present in the river in early November (Beak Consult. 1976).

Ontario

The following Canadian streams have spawning runs, usually in September:

OH-1

Srigley Creek (45°43', 82°29'), Mindemoya River (45°40', 82°16'), and Manitou River (45°36', 82°06') (OMNR 1973).

OH-2

Willow Creek (45°10', 81°34') (environ. Can. 1977c; OMNR 1973).

Spring Creek (45°02', 81°27') (Environ. Can. 1977c).

OH-3

Sauble River (44°40', 81°17') (Environ. Can. 1977c; OMNR 1973).

Saugeen River (44°30', 81°23'). Chinook salmon migrate up the river during September to mid-November (Environ. Can. 1977c; Moccia, pers. comm. 1979; OMNR 1973).

South and North Penetangore Rivers and Kincardine Creek (44°11', 81°39') (Environ. Can. 1977c; OMNR 1973).

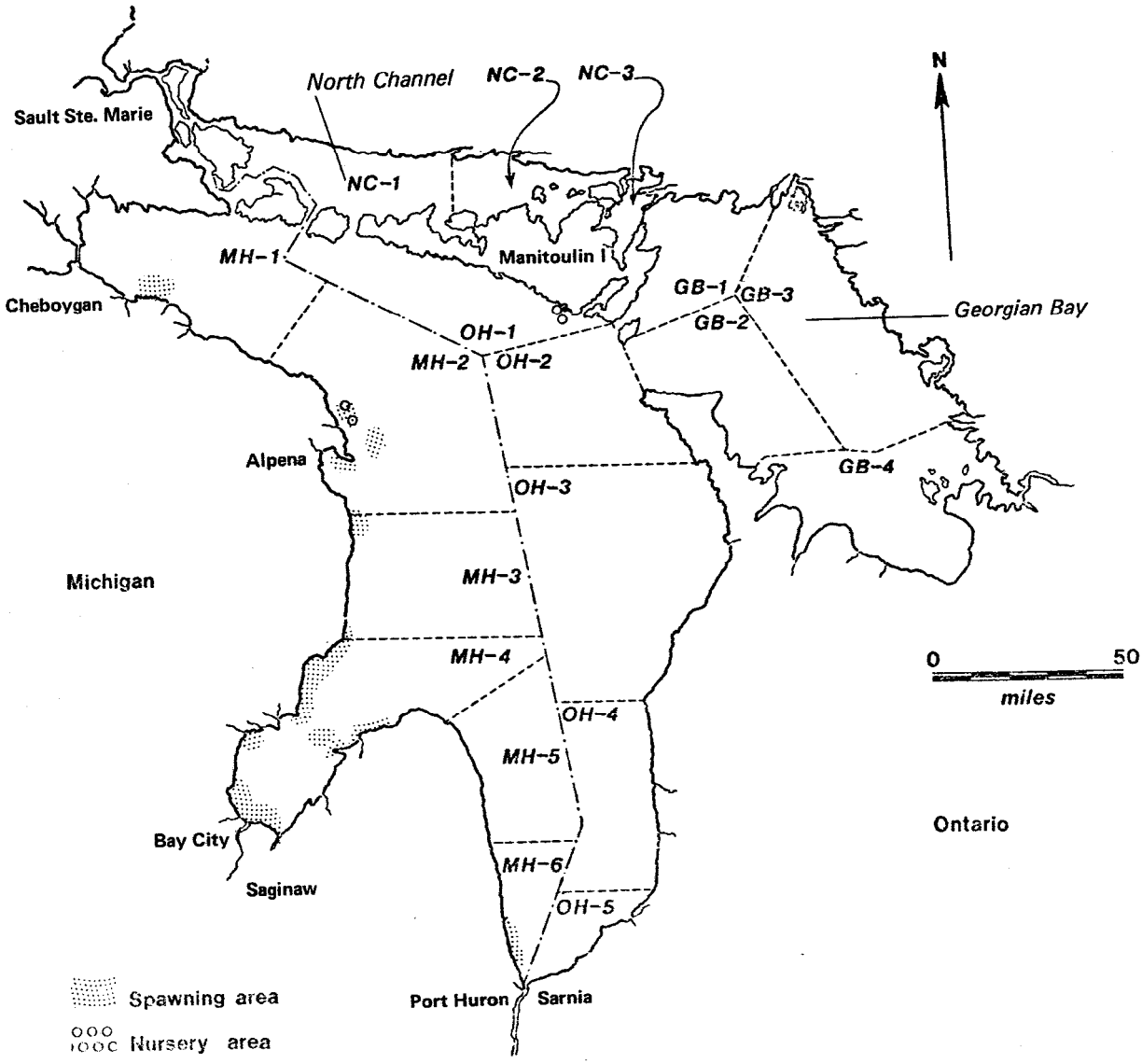
OH-4

Lucknow River (43°53', 81°43'), Maitland River (43°45', 81°44'), and Bayfield River (43°34', 81°43') (Environ. Can. 1977c; OMNR 1973).

GB-4

Sturgeon River (44°44', 79°44'), Nottawasaga River (44°33', 80°00'), Beaver River (44°34' , 80°27'), Bighead River (44°37', 80°35'), and Sydenham River (44°35', 80°56') (Environ. Can. 1977c; OMNR 1973).

ROUND WHITEFISH



In Lake Huron, round whitefish spawn in November and early December (Berst and Spangler 1970a; Koelz 1929). The run to inshore areas begins in mid-October and is heaviest during the last 2 weeks of November (Koelz 1929). Spawning occurs over honeycombed rock and gravel in 24-48 ft of water (Koelz 1929). Round whitefish populations in Lake Huron are stable but rare (Todd 1978).

Michigan

MH-1

Cheboygan (45°39', 84°28'). Fish began moving inshore to honeycombed rock and gravel at depths of 18-30 ft in mid-October, and the run peaked in November (Koelz 1929).

Rogers City (45°25', 83°49'). Many adults enter the city boat harbor in the fall (Hunn, pers. comm. 1979).

Calcite Harbor (45°25', 83°46'). Many adults are caught along shore here, suggesting that the harbor may be a spawning area (FWS 1979d).

MH-2

Middle Island (45°11', 83°20'). Adults began an inshore movement to honeycombed rock and gravel at depths of 18-30 ft in mid-October. The run peaked in November (Koelz 1929). At Rockport (45°12', 83°23') in 1978-79, round whitefish prolarvae were present in April; round whitefish postlarvae were more numerous than those of other species in May (Tex. Instrum. 1979b,c).

Potter Point (45°05', 83°18'). Since the 1930s, spawning has occurred about 8 mi offshore at depths of 20-40 ft (Organ et al. 1978).

Thunder Bay (45°00', 83°20'). Spawning occurs in a rocky area close to shore along the south side of North Point (45°01', 83°16') (O'Gorman, pers. comm. 1979). In 1917, males with pearl organs were taken at Alpena (45°04', 83°26') during the first half of November (Koelz 1929).

MH-3

Black River (44°49', 83°18'). During the 1970s, spawning occurred about 5 mi S of the mouth of the river on gravel substrate at the 10 ft contour in late October and early November (Organ et al. 1978).

MH-4

Saginaw Bay (44°00', 83°30'). Since 1927, round whitefish have spawned from Oscoda (44°25', 83°20') to Point Lookout (44°03', 83°35'), including Tawas Bay (44°16', 83°30'), over rock and gravel out to a depth of about 30 ft and around Charity Island (44°02', 83°26') and Little Charity Island (44°00', 83°28') over rock and gravel out to a depth of 10-12 ft. Spawning also occurred in Wigwam Bay (43°59', 83°50') out to a depth of about 6 ft, in the southern end of the bay from Gilman's Landing (43°48', 83°55') to the mouth of the Quanicasse River (43°35', 83°41'); since 1938 in a small area on the northwest edge of North Island (43°53', 83°25') at depths of 12-14 ft; since 1938 in a small area (43°56', 83°24') north of the tip of Sand Point (43°55', 83°24'), and since 1927 from Oak Point (43°58', 83°16') east to a point (44°00', 83°05') just past Hat Point (44°00', 83°07') (Organ et al. 1978).

MH-6

Port Huron (43°00', 82°26'). In 1913, adults moved inshore to depths of 24 ft 10-12 mi N of Port Huron on November 1. On November 9, large numbers were caught at depths of 42-48 ft; abundance remained high until the fish gradually moved northward again in late November (Koelz 1929).

Ontario

OH-1

Michael Bay (45°35', 82°06'). Young round whitefish were found here in mid-July in about 13 ft of water over a sand bottom with no emergent vegetation (Reckahn 1970).

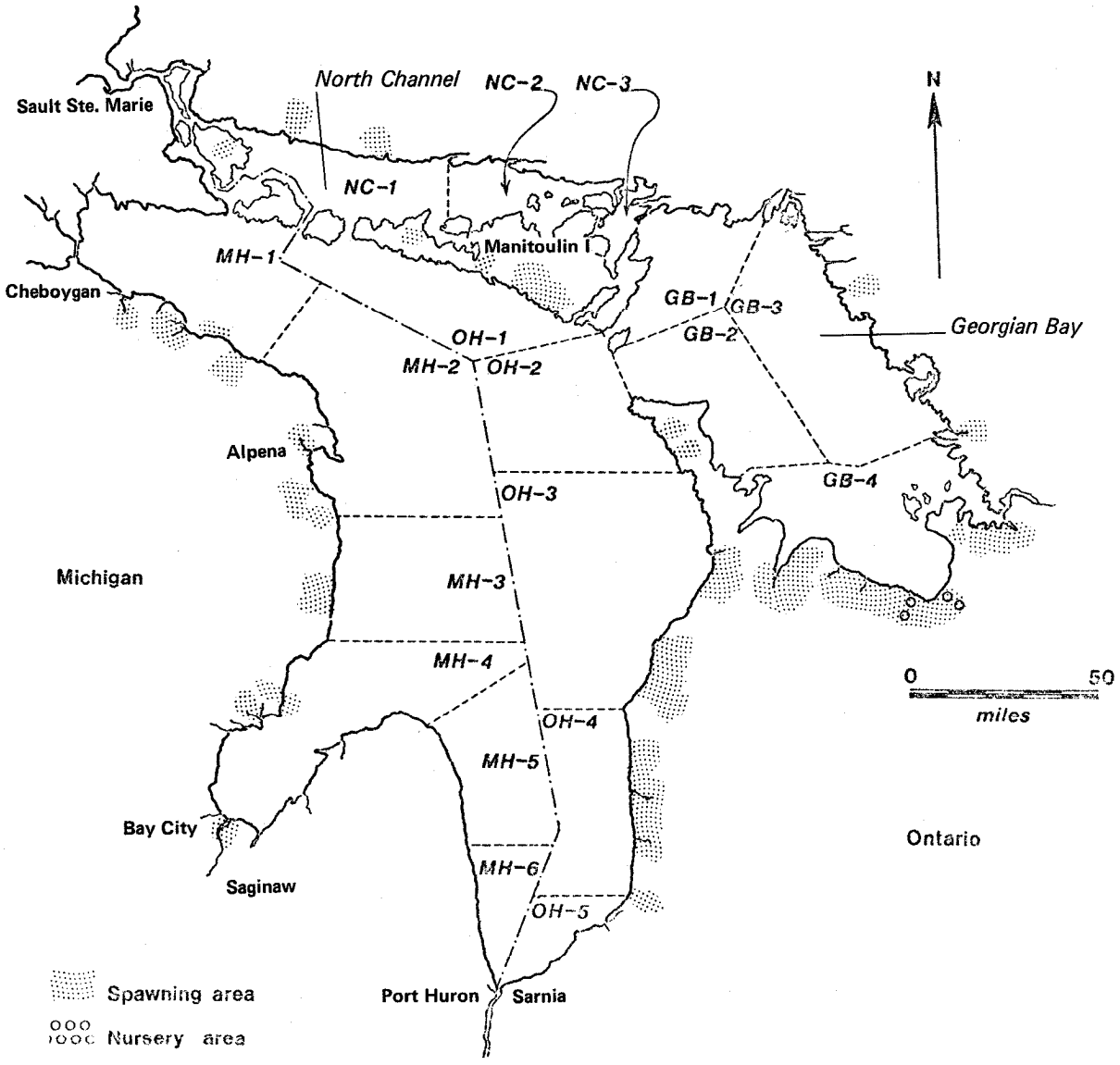
NC-2

Gore Bay (45°56', 82°28') and Kagawong (45°54', 82°15'). In 1917, males with pearl organs were present here during the first half of November (Koelz 1929).

GB-4

Wiarton (44°45', 81°09'). In 1917, males with pearl organs were taken during the first half of November (Koelz 1929).

RAINBOW TROUT



Rainbow trout were first introduced to the Great Lakes in 1876 when the U.S. Fish Commission stocked the Au Sable River (44°24', 83°19′) in Michigan. The first capture of rainbow trout in Lake Huron was recorded near the Les Cheneaux Islands (45°58', 84°20') in 1896. Presumably, rainbow trout entered the Great Lakes from stream plantings because no stocking occurred in the Great Lakes proper (Smedley 1938). Between 1909 and 1913, major spawning runs became established in the Au Sable and Pine (44°30', 83°23′) rivers of Michigan (MacCrimmon and Gots 1972).

By 1930, rainbow trout (steelhead trout) reportedly spawned in most tributaries of Lake Huron except those draining the Precambrian shield (Berst and Spangler 1970a, 1973). Rainbow trout are common throughout most of the lake, running into most tributaries, small streams, and ditches for spawning (USDI 1969a). Stocks are maintained largely by natural reproduction (MacCrimmon and Cots 1972). Both spring and fall runs occur; spawning may occur as early as December (Dodge and MacCrimmon 1970) or as late as June (Dunford 1978b).

Michigan

Runs occur in a few small streams on the north shore of the lake in Michigan and in tributaries from the Straits of Mackinac (45°49', 84°45') south to Saginaw Bay (44°00', 83°30') (MacCrimmon and Cots 1972).

MH-1

Cheboygan River (45°39', 84°28'). This river receives one of the largest runs from Lake Huron (MacCrimmon and Cots 1972). In 1979, spawning runs peaked from mid-April to mid-May (Ann Arbor News 1979a; UPI 1979).

Carp (Black Mallard) Creek (45°32', 84°07'). Lake run spawners were collected at the FWS sea lamprey weir in April-June 1947 and in April and May 1948 and 1949 (Applegate 1950).

Ocqueoc River (45°29', 84°04'). Lake-run spawners were collected at the FWS sea lamprey weir on the Ocqueoc River in April-June 1949 (Applegate 1950). Both fall and spring runs occur (Hunn, pers. comm. 1979), and in 1979 the spring run peaked in mid-April to mid-May (Ann Arbor News 1979a).

Hammond Bay Biological Station (45°30', 84°02'). In 1978, spawning activity was observed in shallow water along shore in May; it is not known if this spawning was successful (Hunn, pers. comm. 1979).

Trout River (45°26', 83°50'). A run occurs here in the spring (Hunn, pers. comm. 1979).

MH-2

Thunder Bay River (45°04', 83°26'). This river receives one of the largest runs from Lake Huron (MacCrimmon and Cots 1972). In 1979, the run peaked in mid-April to mid-May (Ann Arbor News 1979a; UPI 1979).

Devils River (44°55', 83°25'). Runs occur here every spring and fall (Stedman, pers. comm. 1979).

MH-3

Black River (44°49', 83°18'). A spawning run occurs here in the spring (Stedman, pers. comm. 1979).

Au Sable River (44°24', 83°19'). This river receives one of the largest runs from Lake Huron (MacCrimmon and Gots 1972; North Woods Call 1979f; UPI 1979); both spring and fall runs occur (Hansen and Stauffer 1967). In 1979, rainbow trout migrated upstream to the Foote Dam about 17 mi upstream from the mouth (Ann Arbor News 1979a,b).

Pine River (44°30', 83°23'). This river receives one of the largest runs from Lake Huron (MacCrimmon and Gots 1972).

MH-4

Whitney Drain (diverted East Branch of Au Gres River) (44°99', 83°34'). A spring run occurs here (Westerman 1957), and fish also entered the stream in mid-November 1979 (North Woods Call 1979m). Rainbow trout also spawned along the lakeshore between Whitestone Point (44°06', 83°34') and the mouth of the stream (Organ et al. 1978).

Au Gres River (44°02', 83°41'). Spawning runs enter the Au Gres River (Ann Arbor News 1979b, Westennan 1952b). This river receives one of the largest runs from Lake Huron (MacCrimmon and Gots 1972a). In 1979, runs peaked from mid-April to mid-May (Ann Arbor News 1979a). Steelhead trout have also been reported at Au Gres (44°03', 83°42') in mid-November (Ann Arbor News 1979m).

Saginaw River (43°39', 83°51'). Small runs are reported in November-May. Peak runs in the Cass River, a tributary, occur in November-December and in March-April (Beak Consult. 1976).

Ontario

Runs of rainbow trout occur in almost every stream along the east shore of the main basin and the south shore of Georgian Bay (45°30', 81°00'). They are absent from most North Channel (46°00', 83°00') tributaries and in tributaries to the southeast that drain the Precambrian shield (MacCrimmon and Gots 1972).

OH-1

Manitoulin Island (45°50', 82°30'). Significant runs are reported in streams on both the north and south sides of the island (MacCrimmon and Gots 1972).

Mindemoya River (45°40', 82°16') and Srigley Creek (45°43', 82°29'). Spawning runs enter these streams in the spring (OMNR 1973).

Bluejay Creek (45°35', 82°05'). Fall and spring runs enter this stream (OMNR, undated); in 1968, the spring run occurred in Late April-late May (Zimmerman 1968).

Manitou River (45°36', 82°06'). Spring and fall runs enter this river (OMNR 1973, undated); in 1968, the spring run occurred in late April-late May (Zimmerman 1968).

OH-2

Willow Creek (45°10', 81°34') and Spring Creek (45°02', 81°27'). Spring runs enter these streams (Environ, Can. 1977c; OMNR 1973).

OH-3

Sauble River (44°40', 81°17'). The spawning run peaks in May (Environ. Can. 1977c; OMNR 1973, undated).

Stony Creek (44°33', 81°20'). Spring runs enter this stream (Environ. Can. 1977c; OMNR 1973).

Saugeen River (41°30', 81°23'). A fall run enters the river in August-Decembe;r a spring run occurs in April-June and peaks in May (Environ. Can. 1977c; Moccia, pers. comm. 1979; OMNR 1973, 1975a, undated).

Bruce Generating Station (44°19', 81°36'). In 1977, redd building was observed in the discharge canal in late May and early June and viable eggs were recovered. Ripe adults were found in Baie du Dore (44°21)', (81°33') in October (Dunford 1978b).

North and South Penetangore Rivers and Kincardine Creek (44°11', 81°39') and Little Sauble River (44°17', 81°36'). Spring spawning runs enter these streams (Environ. Can. 1977c; OMNR 1973).

OH-4

Eighteen Mile River (44°01', 81°44'). Spring spawning runs enter this river (Environ. Can. 1977c; OMNR 1973).

Lucknow River (43°53', 81°43'). Fall and spring runs enter this river (Environ. Can. 1977c; OMNR 1973, undated).

Maitland River (43°45', 81°44'). Fall and spring runs enter this river; the spring run peaks in May (Environ. Can. 1977c; OMNR 1973, undated). The first spring run was recorded in 1921 (MacCrimmon and Gots 1972).

BayfieLd River (43°34', 81°43'). Spring spawning runs enter this river (Environ. Can. 1977c; OMNR 1973); the first recorded run was in 1935 (MacCrimmon and Gots 1972).

OH-5

Ausable River (43°19', 81°46'). Spring spawning runs enter this river (Environ. Can. 1977c; OMNR 1973).

NC-1

Jaggers Creek (46°15', 83°53'), Thessalon River (46°15', 83°34'1, and Mississagi River (46°10', 83°01'). Minor runs occur in these streams (OMNR 1976b).

Silver Creek (45°55', 82°50'). Spawning runs enter this stream in the spring (OMNR 1973).

GB-3

Naiscoot River (45°40', 80°34'). Spawning runs enter this river in the spring (OMNR 1973).

Moon River (45°08', 79°59'). Spawning runs enter this river in the spring (Environ. Can. 1977c; OMNR 1973).

GB-4

Coldwater River (44°44', 79°39'). Spawning runs enter this river in the spring (Environ. Can. 1977c; OMNR 1973).

Sturgeon River (44°44', 79°44'). A large spring run enters the Sturgeon River (Environ. Can. 1977c; OMNR 1973; Thede 1970). Many gravel areas excellent for spawning occur in the river. A concrete bridge support about 1 mi upstream from the mouth blocks the migration, and most of the fish spawn in the 1/2 mi stretch of river immediately below the bridge. In 1970, spawning occurred from early April to early May when the water temperature was about 37°F (Thede 1970).

Hog Creek (44°45', 79°47') and Copeland Creek (44°46', 79°57'). Spawning runs enter these streams in the spring (Environ. Can. 1977c; OMNR 1973).

Nottawasaga River (44°33', 80°00). This river is used extensively for spawning and as a nursery ground (Berst and Wainio 1967). Spawning takes place in April and May, adults return to Lake Huron after spawning, and the young remain in the stream for 1-3 years before migrating to the lake (Wainio 1962). Runs have occurred recently in the fall and spring, and the spring runs peak in April (Environ. Can. 1977c; OMNR 1973, undated).

Batteaux River (44°29', 80°10'). Spring runs enter this river (Environ. Can. 1977c; OMNR 1973).

Pretty River (44°30', 80°12'). Runs enter this river (Environ. Can. 1977c; OMNR 1973) in the fall and spring, and the spring run peaks in May (OMNR, undated).

Silver Creek (44°31', 80°17'). Spawning runs enter this stream (Environ. Can. 1977c; OMNR 1973) in April, May, or June, and peak spawning occurs in April to mid-May (Lamsa 1963b). In 1958, the spawning run began in early April and peaked at the end of April (Lamsa 1961); the last spawning-run fish were collected on June 27. In 1959, the start of the run coincided with the rise in the weekly mean water temperature from 34°F to 41°F; the first fish was taken on April 10, and the last on May 29. Spent fish migrated to Lake Huron in May, but some remained in the stream throughout the summer. Parr remained in the stream until they reached 1 or 2 years of age and then migrated to Lake Huron; most migration occurred in May and June, but some occurred as early as March and as late as August. A small fall run of mainly 2 and 3 year old adults was observed in late October to mid-November (Lamsa 1963b).

Indian Brook (44°33', 80°26'), Beaver River (44°34', 80°27'), and East Meaford Creek (44°36', 80°33'). Spring runs enter these streams (Environ. Can. 1977c; OMNR 1973).

Bighead River (44°36', 80°35'). Fall and spring runs enter this river; the spring run peaks in May (Environ. Can. 1977c; OMNR 1973, undated).

Johnston Creek (44°43', 80°46'), Waterton Creek (44°42', 80°48'), and Keefer Creek (44°38', 8°°52'). Spring runs enter these streams (Environ. Can. 1977c; OMNR 1973).

Telfer (Bothwell's) Creek (44°38', 80°52'). Runs consistently proceed to the headwaters (MacCrimmon and Gots 1972). The creek generally has two runs, which occur earlier than in neighboring streams (Dodge 1972; Environ. Can. 1977c; OMNR 1973). In 1965-66, the first run occurred October 29-February 15; spawning occurred December 29-February 14, and peaked January 15-February 5. The second run occurred February 16-May 3; spawning occurred February 20-April 30, and peaked March 16-April 16. Fish from the first run returned to the lake before the second run entered the creek (Dodge and MacCrimmon 1970). During 1966-70, fish were seen in the headwaters and spring-fed tributaries of the creek as early as mid-December (Dodge 1972). Spawning was observed and viable eggs were found in redds as early as December 27, and as late as April 26, when water temperatures were about 32.5 and 50°F, respectively (Dodge 1972; Dodge and MacCrimmon 1971). Peak spawning occurred in March-early April at about 43-46°F (Dodge and MacCrimmon 1971).

Sydenham River (44°35', 80°56'). Major runs occur from November to April (Dodge 1972; Environ. Can. 1977c; OMNR 1973), particularly in mid-November to mid-December, late January to early March, and late March to early April. Pre-spawners remain below a fishway about 0.3 mi from the mouth. A few fish spawn in the rapids below the fishway, but most climb the fishway and spawn between the reservoir and the falls about 3 mi from the mouth. In 1966-70, first spawning occurred April 8-17 at about 37-41°F. The lowest temperature at which spawning was observed was about 37°F. Peak spawning occurs in April and May at about 37-44°F (Dodge 1972).

Pottawatomi River (44°35', 80°56'). Runs occur from November to April (Dodge 1972; Environ. Can. 1977c; OMNR 1973), particularly in mid-November to mid-December, late January to early March, and late March to early April. The early migrants remain in deep, ice-covered pools near the mouth until spring. In 1966-70, the first spawning occurred in mid-February to mid-March at about 36-39°F. The lowest temperature at which spawning was observed was about 34°F. Peak spawning occurs in April-May at 37-45°F. Runs are blocked by falls about 2.7 mi from the mouth (Dodge 1972).

Indian Creek (44°37', 80°57'). Spring runs enter this stream (Environ. Can. 1977C; OMNR 1973).

ATLANTIC SALMON

Atlantic salmon were first introduced into the U.S. waters of Lake Huron in 1873. No self-sustaining populations were established from this and subsequent plantings (Parsons 1973). Plantings of Atlantic salmon were made in the Au Sable River (44°24', 83°19') in 1972 and 1973 (GLFC 1973b, 1975, 1976a, 1978; Rybicki 1973), but no spawning runs developed.

BROWN TROUT

Brown trout were introduced into the Great Lakes in the 1880s. No information was found concerning the introduction of brown trout into Lake Huron; presumably brown trout entered the lake from streams that had been stocked (Moffett 1958).

Michigan

MH-1

Carp River (46°02', 84°41'). A fishery was expected to develop in 1980 near the river mouth during late August-early September (North Woods Call 1980a); this suggests that a spawning run may occur here.

MH-2

Thunder Bay (45°00', 83°20'). A commercial fisherman reported spawning in the northwest part of Whitefish Bay (Organ et al. 1978).

MH-4

Whitestone Point (44°06', 83°34'). A commercial fisherman reported spawning along shore in a small area (44°07', 83°34') north of the point (Organ et al. 1978).

Saginaw River (43°39', 83°51'). A few sexually mature fish were taken near the river mouth in late September (Beak Consult. 1976).

Ontario

Brown trout from Lake Huron enter the following streams in October and November to spawn (Environ. Can. 1977c; OMNR 1973, 1975a):

OH-2

Willow Creek (45°10', 81°34').

OH-3

Saugeen River (44°30', 81°23').

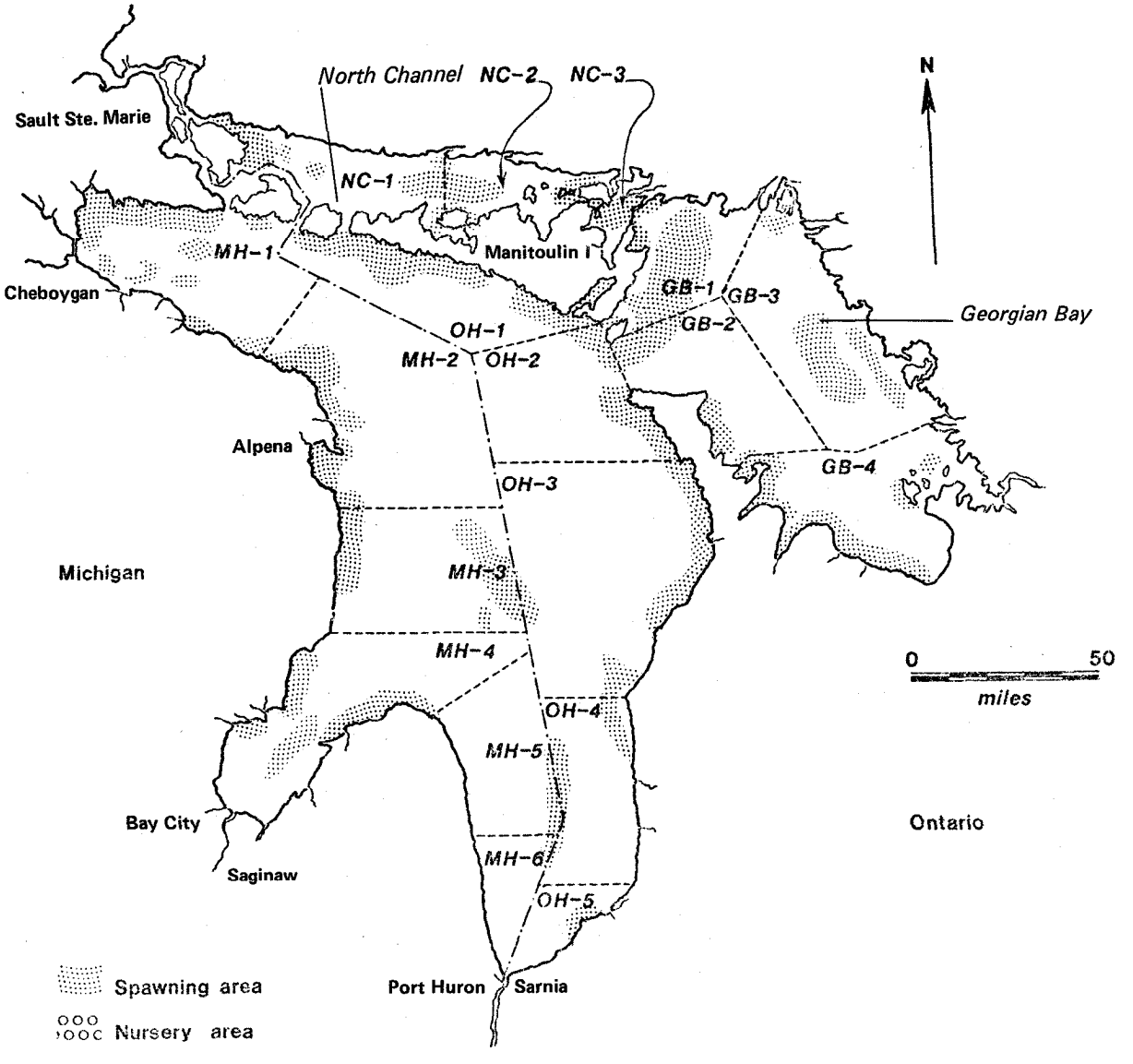
OH-4

Bayfield River (43°34', 81°43').

GB-4

Coldwater River (44°44', 79°39'), Nottawasaga River (44°33', 80°00'), Telfer Creek (44°38', 80°52'), Sydenham River (44°35', 80°56'), and pottawatomi River (44°35', 80°56').

LAKE TROUT



Historically, lake trout were abundant in Lake Huron. Lake trout spawned over reefs of honeycombed rock 10-15 mi from shore at depths ranging from 6-120 ft (Dymond 1928; Goode 1884; Leach 1923; U.S. Comm. Fish Fish. 1900). Spawning also occurred along the shoreline at all suitable locations adjacent to areas inhabited by lake trout (Rathbun and Wakeham 1897). Spawning occurred in the lake during October 15-December 1 (Kerr and Kerr 1860-1898; Lagler 1948; Leach 1923; MacKay 1969; smith 1968; Rathbun and Wakeham 1897; U.S. Comm. Fish Fish. 1900). The various races of trout spawned at different times (KOelz 1926). "Shallow-water" trout began spawning as early as September in water 2-8 ft deep (MSBFC 1890; Rathbun and Wakeham 1897; U.S. Comm. Fish Fish. 1900). Other trout

spawned between mid-October and late November, or even later in the northern part of the lake; these fish spawned further from shore, usually on reefs (Rathbun and Wakeham 1897). By 1959, lake trout in Lake Huron were nearly extinct as a result of intensive commercial fishing and sea lamprey predation (Eschmeyer 1964; Pycha and King 1975). By the 1960s, lake trout were extinct in Lake Huron proper and only a small population of native lake trout existed in Georgian Bay (45°30', 81°00') in 1970 (Lawrie 1970). Today, lake trout are common in Lake Huron as the result of intensive annual plantings of hatchery-reared juveniles which began in 1973 (GLFC 1975, 1979b). Successful reproduction by planted lake trout has not yet been observed in Lake Huron (GLFC 1979b).

Michigan

MH-1

Drummond Island (46°00', 83°40'). Spawning occurred in Huron Bay (45°57', 83°46') during October 23-November 1 (Van Oosten 1927a).

Point De Tour (45°57', 83°55')--St. Ignace (45°52', 84°43'). Spawning occurred in this area from approximately October 15 or 20 to November 1 or IO. Offshore spawning areas were De Tour Reef (45°57', 83°54') on October 4-November 10, Martin Reef (45°55', 84°09'), Pomeroy Reef (45°55', 84°12'), and Tobius (possibly Tobin) Reef (45°56', 84°12') on October 14-25 (Organ et al. 1978; Peck 1979a; Van Oosten 1927a). The De Tour area was identified as the principal lake trout spawning ground (Goode 1884). Nets were set by fishermen very close to shore in shallow water at De Tour to catch fish during the spawning season (Van Oosten 1927a); the water was so shallow here that the tips of the net floats were above the water (Goode 1884). Rock areas on the south side of Goose Island (45°55', 84°25') and on Goose Island Shoal (45°54', 84°29') were also historical spawning areas (Organ et al. 1978; Peck 1979a). During the 1970s, lake trout eggs and yearlings were planted on Pomeroy Reef, but no evidence of egg survival was found (Behmer and Gleason 1975; GLFC 1976a; Wagner 1978b), although the rocky reef was an historical spawning area (Organ et al. 1978). A dredged spoils disposal area south of LaSalle Island (at 45°57', 84°19') was also identified as a spawning ground, but dates of use are not known (Organ et al. 1978).

Mackinac Island (45°52', 84°38')--Bois Blanc Island (45°46', 84°27'). The rocky Graham Shoals (45°50', 84°42') and Majors Shoal (45°49', 84°40') off St. Ignace (45°52', 84°43') are historical spawning areas (Organ et al. 1978; Peck 1979a); yearling lake trout were planted on the Graham Shoals in 1974 (GLFC 1976). Other historical spawning areas included Round Island (45°50', 84°36'), the rock area between Round Island and Mackinac Island, and Lime Kiln Point (45°49', 84°35'), Lighthouse Point (45°49', 84°25'), Lafayette Point (45°46', 84°21'), Poe Reef (45°42', 84°22'), and Zela Shoal (45°46', 84°33') at Bois Blanc Island (Organ et al. 1978; Peck 1979a). Yearlings were planted on Zela Shoal in 1974 (GLFC 1976a). The honeycombed rock of Spectacle Reef (45°46', 84°08'), Raynolds Reef (45°47', 84°13'), and the 36 ft deep bank (45°45', 84°16') southwest

of Raynolds Reef were spawning areas for "native" trout during the 1930s-1940s (Organ et al. 1978; Peck 1979a). Yearlings were planted on Raynolds Reef in 1974 (GLFC 1976a).

Hammond Bay (45°30', 84°05'). Spawn was collected in the bay (Ravenel 1898). Spawning occurred over rock and gravel at the south end of the bay (45°30', 84°03') in 10-20 ft of water off the Hammond Bay Biological Station (Organ et al. 1978).

Rogers City (45°25', 83°49'). Spawn was collected here (Ravenel 1898). Yearling lake trout were stocked here in 1974 (GLFC 1976a), and adults now congregate inside the yacht harbor and along the quarry breakwall at Rogers City during the spawning season, but it is not known if spawning occurs (Hunn, pers. comm. 1979).

Calcite Harbor (45°25', 83°46'). Many mature adults were recently reported in the harbor in October; they were probably attempting to spawn on the shoreline and breakwalls (FWS 1979d).

Adams Point (45°25', 83°43'). Spawning occurred just north of the point on gravel bottom at a depth of about 60 ft (Organ et al. 1978).

MH-2

Adams Point (45°25', 83°43'). Spawning occurred on the shoal along the east side of the point (Organ et al. 1978).

Thompsons Harbor (45°21', 83°36'). Native lake trout spawned at the 6-30 ft depth contours in the harbor and also on honeycombed rock northwest of the harbor at depths of about 40-50 ft (Organ et al. 1978).

Presque Isle Light (45°21', 83°30'). Spawning occurred in the Presque Isle Light District on October 20-November 5 (Van Oosten 1927a). During the 1930s, spawning occurred near Presque Isle Light on honeycombed rock bottom on the east side of North Bay (45°21', 83°30') and in an area about 3 mi NE of the Light (at 45°23', 83°27') at a depth of about 180 ft; "siscowets" or "fat" trout spawned about 12 mi NE of Presque Isle Harbor, (at 45°30', 83°21') at a depth of 300 ft (Organ et al. 1978). Old Presque Isle Lighthouse Reef (45°20', 83°28') is also an historical spawning ground (Peck 1979a).

False Presque Isle (45°16', 83°23'). In the 1930s-1970s, the gravel and honeycombed rock shoal (45°15', 83°22') off the southeast side was used for spawning (Organ et al. 1978). [Authors' note: We believe the statement that lake trout spawned in "...1930s-1970s..." is misleading or incorrect. Although a small population of native lake trout persisted in Georgian Bay at least until 1970 (Lawrie 1970), native lake trout were extinct in Lake Huron proper by the 1960s (Eschmeyer 1964; Pycha and King 1975). Hatchery reared juveniles were not planted in Lake Huron until 1973 (GLFC 1975, 1979b) and these fish probably would not have reached sexual maturity until the late 1970s. Strays from plantings begun in Lake Michigan in 1965 could have spawned in Lake Huron, but probably not before 1970.1

Middle Island (45°11', 83°20'). Spawning occurred here on September 20-October 15 (Van Oosten 1927a). As early as the late 1800s, the rocky, gravel shoals near the island were favorite spawning sites for "shoal-water" trout; spawning began here in late September (Smith and Snell 1891). Middle Island Reef (45°11', 83°18') is an historical spawning ground (Peck 1979a). Commercial fishermen reported that spawning occurred around the east and south sides of the island from the 1920s-1960s (Organ et al. 1978). The Rockport-Stoneport Reef (45°14', 83°23') is an historical spawning ground (Peck 1979a). In 1978-79, many adults were found at Rockport (45°12', 83°23') in October, and most were running-ripe or spent. The rock, boulder, and rubble substrate here is suitable for spawning, but no eggs or young were found in 1979 (Tex. Instrum. 1979b,c).

South Nine Mile Point (45°08', 83°19')--Potter Point (45°05', 83°18'). Commercial fishermen reported that lake trout spawned during the 1970s over a gravel shoal (45°07', 83°13') at depths of 24-30 ft in an area 3-8 mi offshore between these points (Organ et al. 1978).

Thunder Bay Island (45°03', 83°12')--North Point (45°01', 83°16'). Spawning occurred in this area and around the nearby reefs beginning about October 1 (Van Oosten 1927a). The rocky shallows near Thunder Bay Island were a favorite spawning area for the shoal-water trout, as early as the late 1800s. Spawning began here in late September (Clark 1886; Smith and Snell 1891). From the 1920s-1960s, spawning occurred in an area that extends westward from the south shore of Sugar Island (45°03', 83°14'). North Point Reef (45°00', 83°15') is an historical spawning ground, which was used during the 1970s (Organ et al. 1978; Peck 1979a).

Thunder Bay (45°00', 83°20'). In 1977 and 1979, ripe lake trout were found in late September to October off the Huron Cement Company (45°04', 83°24') in about 15-18 ft of water, but spawning was not documented there (Stedman, pers. comm. 1979). Ripe lake trout spawned in the bay from late October to mid-November (Van Oosten 1927a). Spawn was collected in October and November near Alpena (45°04', 83°26') (Ravenel 1898). Smaller "shoal" trout, which spawned in September-October, were also found in the area (Clark 1886; U.S. Comm. Fish Fish. 1900). During the 1970s, spawning occurred on a small gravel area northeast of Scarecrow Island (44°55' 83°20') (Organ et al. 1978).

South Point (44°53', 83°19')--Black River (44°49', 83°18'). Since the 1920s, lake trout have spawned in this area along shore over gravel, rock, and mud (Organ et al. 1978). Black River Island Reef (44°50', 83°17') is an historical ground (Peck 1979a). Spawning occurred until the 1960s throughout the region and until the 1970s on a gravel area that extended about 2 mi N of Black River Island (Organ et al. 1978). In 1974, yearlings were planted in the area north of Black River Island (GLFC 1976a).

MH-3

Black River (44°49', 83°18')--Cedar Lake (44°32', 83°20'). During the 1920s-1960s, lake trout spawned along shore over gravel, rock, clay, and mud (Organ et al. 1978). Sturgeon Point Reef (44°43', 83°15') is an historical ground (Peck 1979a); spawning occurred here from approximately mid-October to early November (Van Oosten 1927a).

Big Reef (Six Fathom Bank) (44°49', 82°30'). This reef, and especially the portion of it about 40 mi out from Alpena (45°04', 83°26'), was the most important historical spawning ground in the lake (Peck 1979a; Rathbun and Wakeham 1897; Smith and Snell 1891). Trout began congregating at the edges of the reef in the summer and moved onto the shallowest portions to spawn (Rathbun and Wakeham 1897); some fish spawned from approximately late October to late November (Smith and Snell 1891), and "black" trout spawned on the reef as late as December (Koelz 1926).

Yankee Reef (44°28', 82°35'). Spawning historically occurred here from mid-October to November 1 (Peck 1979a; Van Oosten 1927a).

MH-4

Tawas Point (44°15', 83°27) --Point Lookout (44°03', 83°35'). During the 1930s-1940s, lake trout spawned along the shoreline over rock and gravel (Organ et al. 1978). Spawning occurred in Tawas Bay (44°16', 83°30') in mid- to late October and at Tawas Point during October 1-20 (Van Oosten 1927a). Running ripe adults are abundant at Alabaster (44°11', 83°33') in October; no evidence of spawning has been found, although the rock bottom provides suitable substrate (Tex. Instrum. 1979b,d).

Point Au Gres (43°59', 83°41')--Wigwam Bay (43°59', 83°50'). Spawning occurred between these points out to a depth of about 24 ft over rock and mud. The substrate is rock, mud, and vegetation just west of the Au Gres Boat Club (44°00', 83°43'), where spawning occurred during the 1940s. In 1978, planted trout spawned over sand in a nearshore area between the mouth of the Rifle River (44°00', 83°45') and Wigwam Bay (Organ et al. 1978).

Charity Islands (44°01', 83°27'). Spawning occurred here during October (Van Oosten 1927a). Since 1915, lake trout spawned on the rock, gravel, and sand shoals around Charity Island (44°02', 83°26') and Little Charity Island (44°00', 83°28'); spawning also occurred there in 1978 (Organ et al. 1978).

Coreyon Reef (44°00', 83°28'--43°40', 83°50'). During 1928-64, lake trout spawned over the gravel and sand reef running southwest from the Charity Islands (44°01', 83°27') (Organ et al. 1978).

Sand Point (43°55', 83°24')--Oak Point (43°58', 83°16'). During the 1930s-1940s, spawning occurred along shore over sand and rock. From 1917 through the 1960s, spawning also occurred on the 4-6 ft deep shoal areas extending from 1-1/2 to 5 mi NW of Sand Point (Organ et al. 1978).

Oak Point (43°58', 83°16')--Hat Point (44°00', 83°07'). During the 1930s-1940s, spawning occurred from Oak Point to an area about 2 mi E of Hat Point (44°00', 83°05') over rock, sand, and gravel to a depth of about 24 ft (Organ et al. 1978).

Fort Austin (44°03', 83°00')--Grindstone City (44°03', 82°54'). Spawning occurred in this area from approximately mid-October to November 1 (Van Oosten 1927a). The Port Austin Reef (44°04', 82°59') is an historical spawning ground (Peck 1979a). In 1974, yearling lake trout were planted at Grindstone City (GLFC 1976a). Spawning was recently reported over rock and gravel just off Grindstone City (Organ et al. 1978).

MH-5, MH-6

Harbor Beach (43°51', 82°39')--Port Sanilac (43°26', 82°32'). During the 1930s-1940s, lake trout spawned along the international border between Harbor Beach and Port Sanilac over a mid-lake, honeycombed rock area at depths of approximately 150-250 ft (Organ et al. 1978).

Ontario

Lake trout in Canadian waters spawned on October 15-December 1 (MacKay 1956b). The following information for Canadian waters is from Smith (1968), unless otherwise specified; the characterization of spawning grounds as "major" or "minor" follows Smith (1968):

OH-1

Cockburn Island (45°55', 83°20'). Lake trout moved onshore here to spawn in early October (Ont. Game Fish 1913a). Spawning occurred at Castilian Rock (45°52', 83°17') over 480 acres of honeycombed rock at depths of 12-72 ft and along the south shore of the island from Ricker (possibly Rickett) Harbour (45°53', 83°17') to Wheeler Rock (possibly Reef) (45°54', 83°31') over 20,480 acres of honeycombed rock at depths of 12-96 ft.

Manitoulin Island (45°50', 82°30'). The south side of the island was one of the most important spawning grounds on the Canadian shore (Rathbun and Wakeham 1897). Major grounds were the shoals, reefs, and banks all along the south shore; spawning occurred from about October 25 to November 15 in areas along the southeast shore of the island (45°41', 82°20'--45°31', 81°50') and November 1-15 in the areas along the southwest shore of the island (45°52', 83°15'--45°41', 82°20'). Spawners were last taken in 1939 in the South Bay area and in 1940 farther west.

Carter Rock (45°51', 83°12'). Spawning occurred over 160 acres of honeycombed rock at depths of 12-66 ft, and over 720 acres of honeycombed rock along the shoreline from the rock to Near Light (45°52', 83°13') at depths of 15-60 ft.

Greene Island (45°49', 83°07'). Spawning occurred over 2,240 acres of honeycombed rock along the south shore and on a bank south and west of the island at depths of 18-66 ft.

Jones Shoal (45°49', 83°04'). Spawning occurred over 640 acres of honeycombed rock at depths of 24-54 ft.

Belonger Bay (45°49', 83°02'). Spawning occurred over 360 acres of honeycombed rock at depths of 18-42 ft.

Stafford Rock (45°48', 82°59'). Spawning occurred over 240 acres of honeycombed rock on the shoal west of the rock at depths of 18-54 ft.

Duck Islands (45°43', 82°56'). Spawning occurred over 560 acres of honeycombed rock on the shoal south of Inner Duck Island (45°45', 82°55') at depths of 12-48 ft; over round stones on the shoals south of Great and Outer Duck Islands (45°37', 82°56') at depths of 12-72 ft; and over 360 acres of honeycombed rock at Western Duck Reef (45°47', 83°02') at depths of 24-42 ft.

Thibault Shoal (45°47', 82°55'). Spawning occurred over 320 acres of gravel at depths of 12-60 ft. Lake trout formerly spawned at depths of about 3-6 ft in Burnt Island Bay (Berst and Spangler 1970b).

Walkhouse Point (45°47', 82°52'). Spawning occurred over 1,200 acres of honeycombed rock on shoals off the point at depths of 12-60 ft.

Hensley Bay (45°46', 82°48'). Spawning occurred over 600 acres of honeycombed rock on a shoal south of the bay at depths of 18-60 ft.

Frenchette Bank (45°45', 82°42'). Spawning occurred over 480 acres of honeycombed rock at depths of 18-48 ft.

Shamrock Bank (45°44', 82°36'). Spawning occurred over 1,400 acres of honeycombed rock south of the bank at depths of 30-72 ft.

Murphy Harbour (45°47', 82°40')--Portage Bay (45°45', 82°32'). Spawning occurred over 2,880 acres of flat, broken, and honeycombed rock along the shoreline at depths of 12-60 ft. Spawning occurred over 720 acres of honeycombed rock on a bank 2 mi S of Murphy Harbour (at 45°44', 82°40') at depths of 54-66 ft.

Thistle Reef (45°44', 82°32'). Spawning occurred over 1,120 acres of gravel and broken rock at depths of 12-42 ft.

Melville Point (45°43', 82°29'). Spawning occurred over 200 acres of honeycombed rock at depths of 12-42 ft.

Dominion Point (45°40', 82°28'). Spawning occurred over 360 acres of honeycombed rock, 2 mi SW of the point at depths of 54-72 ft.

Buckeye Shoal (45°36', 82°12'). Spawning occurred over 960 acres of honeycombed rock at depths of 12-60 ft.

Timber Bay Shoal (45°37', 82°14')--Advance Reef (45°34', 82°10'). Spawning occurred over 4,000 acres of honeycombed rock at depths of 36-96 ft.

Advance Reef (45°34', 82°10'). Spawning occurred over 1,280 acres of honeycombed rock at depths of 12-60 ft.

Michael Point (45°35', 82°07')--Walker Point (45°33', 82°05'). Spawning occurred over 1,760 acres of honeycombed rock at depths of 12-54 ft.

Volunteer Spit (45°33', 82°04')--Red Dan Rock (45°33', 82°03'). Spawning occurred over 560 acres of honeycombed rock at depths of 12-60 ft.

South Bay (45°38', 81°52'). A resident population moved to shallow water in the bay's inner basin in October to spawn on broken rock along shore (Fry 1952).

Wallace Rock (45°32', 82°01'). Spawning occurred over 100 acres of honeycombed rock at depths of 18-36 ft.

McGaw Point (45°32', 82°00'). Spawning occurred over 320 acres of honeycombed rock south of the point at depths of 24-54 ft.

Thomas Point (45°32', 81°58'). Spawning occurred over 320 acres of honeycombed rock at depths of 12-60 ft.

Todman Reef (45°32', 81°56')--Vigilant Rock (45°31', 81°55'). Spawning occurred over 960 acres of honeycombed rock at depths of 12-60 ft.

OH-2

Fitzwilliam Island (45°30', 81°45'). Spawning occurred over honeycombed rock west and southwest of the island at depths of 18-84 ft in October. Major grounds were Little Rock (45°29', 81°51') to Emily Maxwell Reef (45°27', 81°50), the area from Indian Harbour Reef (45°26', 81°49') to McLelan Rock (45°25', 81°49') to Smith Rock (45°25', 81°49'), Manitoba Ledge (45°24', 81°49'), and West and East Sister Patches (45°22', 81°48'). The last reported spawning was in 1945.

Cape Hurd (45°13', 81°44'). Major ground; spawning occurred over honeycombed rock on the 720-acre Southwest Bank at 45°15', 81°46', and on the 200-acre Northwest Bank at 45°17', 81°45'. Spawning occurred here in October and was last reported in 1945.

Cape Hurd (45°13', 81°44')--Scotch Thistle Point (45°00', 81°27') . Shoals off the west shore of the Bruce Peninsula were important spawning areas (Ont. Game Fish 1932). Major ground; spawning occurred on 75,000 acres of honeycombed rock along the shoreline at depths of 12-74 ft. Spawning occurred on October IO-November 10 and was last reported in 1942.

OH-3

scotch Thistle Point (45°00', 81°27')--Main Station Island (44°45', 81°19'). Major ground; spawning occurred at depths of 12-74 ft on October 10-November 10; last reported in 1942.

Chiefs Point (44°42', 81°18'). Major ground; spawning occurred at 44°40', 81°24' on 800 acres of honeycombed rock at depths of 90-108 ft. Minor spawning occurred at 44°40', 81°20' on a honeycombed rock ridge at depths of 36-72 ft. Spawning occurred on October 20-November 1 and was last reported in 1942.

Frenchman Bay (44°35', 81°18'). Major ground; spawning occurred over honeycombed rock ridges (44°35', 81°20') at depths of 42-54 ft on October 20-November 10; last reported spawning was in 1942.

Chantry Island (44°30', 81°24')--MacGregor Point (44°25', 81°29'). Major ground; spawning occurred over honeycombed rock ridges (44°30', 81°30') at depths of 60-120 ft; the last reported spawning was in 1942. Lake trout migrated 60 mi during October from the deep water off Southampton (44°30', 81°22') and behind Big Reef (44°45', 82°32') to smaller reefs along the shore of the Bruce Peninsula (45°00', 81°20') (Kerr and Kerr 1860-1898). In 1908, 30 tons of large females were caught on November 9-10; these fish were assumed to be moving to spawning beds (Ont. Game Fish 1909). The area north of Southampton was one of the spawning grounds for shoal-water trout in late 1890s (Rathbun and Wakeham 1897).

MacGregor Point (44°25', 81°29')--Scott Point (44°21', 81°33'). Major ground; spawning occurred over honeycombed rock ridges (44°24', 81°35') at depths of 48-102 ft on October 20-November 10; the last reported spawning was in 1942.

McPherson Point (44°20', 81°35')--Inverhuron (44°17', 81°35'). Major ground; spawning occurred over honeycombed rock ridges (44°19', 81°38') at depths of 66-102 ft on October 20-November 10; the last reported spawning was in 1942.

Kincardine (44°10', 81°38'). Major ground; spawning occurred 16 mi W-NW of Kincardine over 3,240 acres of honeycombed rock (44°14', 81°59') at depths of 72-108 ft on October 20-November 10; the last reported spawning was in 1942.

OH-4

Point Clark (44°04', 81°45'). The area (44°00', 81°45') south of Point Clark was a major spawning ground. Spawning occurred in

crescent-shaped areas of honeycombed ridges at depths of 24-120 ft on October 20-November 10; the last reported spawning was in 1942.

OH-5

Kettle Point (43°13', 82°01'). Spawning occurred on October 20-November 10; the last reported spawning was in 1940.

In Georgian Bay (45°30', 81°00'), spawning occurred in October (Ont. Game Fish 1909, 1910, 1915) all along the shore, around the islands, and on the offshore reefs and shoals; spawning occurred earlier in offshore waters than in nearshore waters (Bensley 1915; Rathbun and Wakeham 1897). Georgian Bay was an important center for spawn collection (Ont. Game Fish 1933; Redband 1915).

In the North Channel (46°00', 83°00'), lake trout generally spawned about 1 week earlier than in Lake Huron proper (Smith 1968). Large amounts of spawn were taken in the North Channel (Ont. Game Fish 1913a).

NC-1

Colby Island (46°18', 83°53')--southeast end of Portlock Island (46°18', 83°53'). Minor ground; spawning occurred here at depths of 24-30 ft on October 20-30; the last reported spawning was in 1950.

Plummer Bank (46°18', 83°54'). Minor ground; spawning occurred over honeycombed rock at depths of 12-30 ft on October 20-30; the last reported spawning was in 1950.

McKay Island (46°17', 83°47'). Minor ground; spawning occurred on the south side of the island over gravel at depths of 30-42 ft on October 20-30; the last reported spawning was in 1950.

St. Joseph Island (46°13', 84°00'). The stomachs of round whitefish taken here contained lake trout eggs (Ont. Game Fish 1913b). Spawning occurred on October 20-30 off the east and south sides of Big Point (46°13', 83°47') over rock and gravel at depths of 30-36 ft, and off the east side of Gravel Point (46°16', 83°50') over limestone at depths of 30-42 ft; the last reported spawning was in 1950.

Fox Island (46°11', 83°46'). Minor ground; spawning occurred over 300 acres of honeycombed rock at depths of 12-24 ft on October 10-20; the last reported spawning was in 1950.

Beef Island (46°09', 83°48'). Spawning occurred on the east side of the island over 60 acres of small, round rock at depths of 24-30 ft on October 20-30; the last reported spawning was in 1950.

O'Donnell Island (46°08', 83°47')--Perrique Island (46°08', 83°46'). Minor ground; spawning occurred between the islands over 490 acres of

gravel and honeycombed rock at depths of 12-18 ft on October 20-30; the last reported spawning was in 1950.

Birch Island (46°15', 83°41'). Minor ground; spawning occurred on the east side of the island over 210 acres of rock and mud at depths of 12-30 ft on October 20-30; the last reported spawning was in 1950.

Thessalon Island (46°12', 83°38'). Spawning occurred on the south and southwest sides of the island over 400 acres of rock at depths of 6-12 ft on October 20-30; the last reported spawning was in 1950.

Gull Island (46°10', 83°37'). Minor ground; spawning occurred on the west and south sides of the island over 240 acres of rock at depths of 6-12 ft on October 20-30; the last reported spawning was in 1950.

Sulphur Island (46°09', 83°37'). Minor ground; spawning occurred on the north side of the island over 100 acres of gravel, sand, and possibly limestone on October 20-30; the last reported spawning was in 1950.

Bigsby Island (46°10', 83°26'). Minor ground; spawning occurred over patchy honeycombed rock at depths of 30-36 ft on October 20-30; the last reported spawning was in 1950.

McGlashan Patch (46°09', 83°24'). Minor ground; spawning occurred over rock at depths of 12-30 ft on October 20-30; the last reported spawning was in 1950.

Grant Islands (46°08', 83°18'). Minor ground; spawning occurred on October 20-30 on the east side of Fast Grant Island (46°08', 83°17') over mud bottom at depths of 12-48 ft, on the southeast side of Middle Grant Island (46°08', 83°19') over broken rock at depths of 12-30 ft, and on the south side of West Grant Island (46°08', 83°21') over 3,123 acres of rock at depths of 12-30 ft. The last reported spawning was in 1950.

John Island (46°08', 82°35')--Cape Robert (46°00', 82°49'). Minor ground; spawning occurred over round stones at depths of 12-60 ft on October 10-30. Specific locations were Capana Shoal (46°06', 82°54'), Cousins Shoal (46°05', 82°49'), Europa Reef (46°05', 82°46'), Maitland Patch (46°05" 82°44'), Black Rock (46°07', 82°50'), Gunboat Shoal (46°08', 82°44'), Godfrey Island (46°09', 82°42'), and Mills Island-David Island (46°08', 82°41'). The last reported spawning was in 1940.

Portage Point (45°53', 82°46'). Minor ground; spawning occurred over broken rock and round stones at depths of 12-30 ft on October 10-30; the last reported spawning was in 1940.

Barrie Island (45°55', 82°40'). Minor ground; spawning occurred at Creighton Point (45°57', 82°42') and Fishery Point (45°56', 82°44') over **broken rock**, gravel, and round stones at depths of 12-36 ft on October 10-20; the last reported spawning was in 1940. Heron Patch (45°59',

82°42') to Jubilee Shoal (45°58', 82°44') was a major ground, where spawning occurred over 1,040 acres of gravel and round stones at depths of 12-72 ft on October 10-20.

NC-2

Acadia Rock (46°07', 82°40'1, west end of Dewdney Island (46°08', 82°39'), and shoal (46°07', 82°37') southeast of Dewdney Island. Minor spawning grounds.

Restless Bank (46°04', 82°35'). Minor ground; spawning occurred over 640 acres of gravel and round stones at depths of 24-60 ft on October lo-November 10; the last reported spawning was in 1942.

Julia Point (45°58', 82°37'). Minor ground; the last reported spawning was in 1940.

Julia Bay (45°56', 82°33'). Minor ground; spawning occurred at 45°55′, 82°34′ over broken rock, gravel, and round stones at depths of 12-24 ft on October 10-30; the last reported spawning was in 1940.

Rob Roy Patch (46°04', 82°32')--Darch Island (46°04', 82°24'). Spawning occurred over 3,520 acres of gravel and round stones at depths of 12-60 ft on October 10-November 10; the last reported spawning was in 1942.

Innes Island (46°04', 82°20'). Minor ground; spawning occurred at 46°03', 82°22′ over 800 acres of round stones and gravel at depths of 12-60 ft on October 10- November 10; the last reported spawning was in 1942.

Bear's Back Island and Shoal (46°01′, 82°07′). Spawning occurred over 1,600 acres of round stones at depths of 12-60 ft on October lo-November 10; the last reported spawning was in 1942.

Wabos Island (45°57', 82°05'). Minor ground; spawning occurred over 240 acres of honeycombed rock at depths of 12-36 ft on October 18-November 10; the last reported spawning was in 1950.

Bedford (46°02', 82°03') and West Rous (46°01', 82°01') Islands. Spawning occurred south of the islands over 600 acres of round stones at depths of 12-36 ft on October 18-November 10; the last reported spawning was in 1950.

Five Island (46°03', 82°00'). Minor ground; spawning occurred along the north side over 160 acres of round stones at depths of 12-60 ft on October 18-November 10; the last reported spawning was in 1950.

Great La Cloche Island (46°02', 81°53'). Spawning occurred along the northwest shore (46°03', 81°55′ 1 over 720 acres of honeycombed rock and round stones at depths of 12-60 ft on October 18-November 10; the last reported spawning was in 1950.

NC-3

McGregor Bay (46°01', 81°43'). Minor ground; spawning occurred at the small islands at the entrance of the bay over 320 acres of round stones at depths of 12-36 ft on October 19-November 10; last reported spawning was in 1950.

McGregor Point (46°00', 81°42')--Frazer Bay (45°58', 81°38'). Spawning occurred over 960 acres of sand and patches of round stones at depths of 12-60 ft on October 18-November 10; the last reported spawning was in 1950.

Frazer Bay (45°58', 81°38'). Spawning occurred along the south shore over 960 acres of sand and patches of round stones at depths of 18-90 ft on October lo-November 10; the last reported spawning was in 1950.

South Shore of Great La Cloche Island (46°02', 81°53')--Mary Islands (45°58', 81°46'). Spawning occurred over 2,560 acres of honeycombed rock and round stones at depths of 12-48 ft on October 18-November 10; last reported spawning was in 1950.

Heywood Island (45°56', 81°46'). Spawning occurred over 480 acres of round stones at depths of 12-48 ft on October 18-November 10; the last reported spawning was in 1950.

East Point (45°56', 81°50') on Strawberry Island (45°56', 81°52')--Heaver Island Bank (45°54', 81°52'). Spawning occurred over 320 acres of round stones at depths of 12-36 ft on October 18-November 10; the last reported spawning was in 1950. Spawning was completed at Sheguiandah (45°54', 81°55') by November 10 (Ont. Game Fish 1913b).

Boulton Reef (45°54', 81°51')--McGregor Bank (45°54', 81°51'). Spawning occurred over 640 acres of honeycombed rock and round stones at depths of 12-36 ft on October 18-November 10; the last reported spawning was in 1950.

GB-1

Kokanongwi Shingle (45°56', 81°34'). Minor ground; spawning occurred over gravel and round stones at depths of 12-54 ft on October 25-November 12; the last reported spawning was in 1940.

Papoose Island (45°51', 81°21'). Major ground; spawning occurred south and southwest of the island (at 45°50', 81°22') over 960 acres of honeycombed rock at depths of 18-60 ft on October 25-November 12; the last reported spawning was in 1940.

Azov Ledges (45°49', 81°29'). Major ground; spawning occurred south of Squaw Island (45°50', 81°27') over 2,160 acres of honeycombed rock at depths of 18-54 ft on October 25-November 12; the last reported spawning was in 1940.

Smith Bay (45°48', 81°40'). Minor ground; spawning occurred at Goldhunter Rock (45°49', 81°37'), Doyle Rock (45°49', 81°38'), Pelkie Rock

(45°50', 81°37'), West Mound (45°50', 81°39'), and William Island (45°51', 81°38') to Hog Island (45°52', 81°38') over honeycombed rock at depths of 18-54 ft on October 25-November 12. The last reported spawning was in 1940.

Philip Edward Island (45°59', 81°15'). Minor ground; spawning occurred at Green Island (45°54', 81°20'), Scarecrow Island (45°54*, 81°23'), and Harty Patches and the Brothers (45°57', 81°23') over round stones at depths of 18-78 ft on October 25-November 12; the last reported spawning was in 1940.

Collins Inlet (45°59', 81°25')--French River (45°56', 80°54'). Thousands of fish were caught in this area during the spawning season in mid-October (Kerr and Kerr 1860-1898).

Riley Patch (45°42', 81°19'). Major ground; spawning occurred over 1,600 acres of honeycombed rock at depths of 24-96 ft during October to mid-November; the last reported spawning was in 1940.

McNeil Ledge (45°43', 81°15'). Major ground; spawning occurred over 1,920 acres of honeycombed rock at depths of 30-90 ft on October 25-November 12; the last reported spawning was in 1940. Minor spawning grounds existed near the ledge at 45°45', 81 °15'; 45°46', 81°16'; and 45°47', 81°15' on small "lumps" of honeycombed rock. Major grounds existed west and southwest of the ledge at Milligan Rock (45°41', 81°17'), Ben Back Shoal (45°41', 81°18'), and Tranch Rock (45°40', 81°20'); spawning occurred over honeycombed rock at depths of about 24-84 ft in October to mid-November. The last reported spawning was in 1940.

Dawson Rock (45°38', 81°16'). Major ground; spawning occurred in October to mid-November over honeycombed rock on the west side of the rock at 45°38', 81°16' at depths of 12-42 ft, and I mi N-NW of the rock at 45°40', 81°17' at depths of 36-78 ft; the last reported spawning was in 1940.

Northeast Shingle (45°37', 81°24'). The west side was a major ground. Spawning occurred over honeycombed rock at depths of 12-42 ft in October; the last reported spawning was in 1945.

Lonely Island (45°34', 81°28'). The east side was a major ground. Spawning occurred over honeycombed rock at depths of 12-48 ft in October; the last reported spawning was in 1945.

Rabbit Island Bank (45°37', 81°40'). Minor ground; spawning occurred over honeycombed rock at depths of 12-30 ft in October; the last reported spawning was in 1945.

Stewart Rock (45°30', 81°49')--Ship Bank (45°30', 81°50'). Major ground; spawning apparently ended in 1939.

Club Island Ledge (45°33', 81°36'). Minor ground; spawning occurred over honeycombed rock at depths of 12-30 ft in October; the last reported spawning was in 1945.

GB-2

McCarthy Point Ledge (45°27', 81°45'). Minor ground; the last reported spawning was in 1945.

Anderson Ledge (45°24', 81°44')--White Shingle (45°21', 81°40'). Major ground; spawning occurred over 4,800 acres of honeycombed rock at depths of 12-72 ft in October; the last reported spawning was in 1945.

Halfmoon Island (45°26', 81°28'). Major ground; spawning occurred on the south side over honeycombed rock at depths of 18-48 ft in October; the last reported spawning was in 1945.

Darling Reef (45°09', 81°14'). Major ground; spawning occurred over 400 acres of honeycombed rock at depths of 18-48 ft on October IO-November 10; the last reported spawning was in 1950.

Cape Chin (45°07', 81°17')--Smoky Head (45°05', 81°16'). Major ground; spawning occurred over 3,020 acres of honeycombed rock at depths of 18-114 ft on October-November 10; the last reported spawning was in 1950.

Lion's Head (45°00', 81°13')--Jackson Shoal (45°02', 81°11'). Major ground; spawning occurred over 2,000 acres of honeycombed rock at depths of 12-120 ft on October 10-November 31; the last reported spawning was in 1950.

GB-3

Hustard Islands (45°53', 80°55'). Minor ground; spawning occurred over 2,800 acres of round stones and broken rock at depths of 24-66 ft.

Cunningham (north shore of Georgian Bay, location uncertain). In 1910, lake trout first appeared on the shoals on October 17 (Ont. Game Fish 1911).

Kennedy Bank (45°30', 80°41'). Major ground; spawning occurred over 9,600 acres of honeycombed rock at depths of 18-96 ft on October 25-November 10; the last reported spawning was in 1946.

Stalker Bank (45°26', 80°36'). Major ground; spawning occurred over honeycombed rock at depths of 18-60 ft on October 20-November 18; the last reported spawning was in 1946.

Haggart Island (45°25', 80°23'). Minor ground; spawning occurred over round stones at depths of 18-30 ft on October 20-November 18; the last spawning reported by Smith (1968) was in 1946. In the 1970s, stocked lake trout were reported spawning in the same area at 45°26', 80°24' (Environ. Can, 1977c).

Long Bank (45°23', 80°37'). Major ground; spawning occurred over 5,760 acres of honeycombed rock at depths of 36-66 ft on October 20-November 18; spawners were also taken west of Long Bank at 45°25',

80°39' over honeycombed rock at depths of 42-54 ft on October 20-November 18. The last reported spawning at these two locations was in 1946.

Limestone Islands (45°24', 80°32'). Spawning occurred at South Limestone Sank (45°22', 80°34'), at an area south of North Limestone Island (45°25', 80°32'), and from North Limestone Island to Midland Bank (45°26', 80°32'), over broken bottom and honeycombed rock at depths of 12-48 ft on October 20-November 18.

Snake Bank (45°20', 80°22'). Minor ground; spawning occurred here over round stones at depths of 12-72 ft on October 20-November 18; the last reported spawning was in 1946.

Sequin Bank (45°19', 80°31'). Major ground; spawning occurred here over honeycombed rock at depths of 18-54 ft on October 20-November 18; the last reported spawning was in 1946.

Araxes Bank (45°17', 80°20'). Minor ground; spawning occurred here over broken bottom and round stones at depths of 12-30 ft on October 20-November 18; the last reported spawning was in 1946.

Umbrella Ledges (45°12', 80°15'). Minor ground; spawning occurred here over honeycombed rock and broken substrate at depths of 24-114 ft on October 20-November 18; the last reported spawning was in 1940.

GB-4

Lake trout were protected during the spawning season in an area south of a line from Gidley Point (44°45', 80°07:) to Cape Commodore (44°48', 80°54') (Ont. Min. Lands Forests 1950).

Watcher Reef (44°57', 80°05'). Minor ground; spawning occurred here at depths of 18-60 ft.

Christian Island (44°50', 80°12'). Minor ground; spawning occurred on the northwest shore of the island at depths of 6-120 ft.

Collingwood (44°30', 80°13'). Major ground; spawning occurred near Collingwood at 44°35', 80°16'; 44°32', 80°13'; and 44°31', 80°12' over gravel at depths of 18-60 ft.

Collingwood (44°30', 80°13')--Thornbury (44°34', 80°27'). Major ground: spawning occurred at 44°36', 80°23', northwest of Mary Ward Ledges over 2,800 acres of gravel and broken rock at depths of 30-60 ft, and at 44°36', 80°21' and 44°36', 80°20' over gravel at depths of 24-54 ft on October 25-November 15; the last reported spawning was in 1945.

Thornbury (44°34', 80°27'). Spawning occurred near Thornbury (Ont. Game Fish 1911, 1912).

Boucher (44°37', 80°30')--Meaford (44°37', 80°35'). This shoreline supported limited spawning over 768 acres of honeycombed rock at depths of 18-54 ft on October 25-November 15; the last reported spawning was in 1945.

Cape Rich (44°43', 80°38')--Coffin Hill (44°40', 80°50'). Major ground. Spawning occurred near Cape Rich at 44°47', 80°41'; 44°45', 80°36'; 44°45', 80°34'; 44°45', 80°31'; and 44°43', 80°30'. Spawning occurred at these locations, the largest of which covered 4,480 acres, over honeycombed rock at depths of 72-120 ft during October 15-November 15; the last reported spawning was in 1945. Vail Point was historically considered the best place to obtain lake trout spawn in late October (Kerr and Kerr 1860-1898). Spawning occurred over 8,000 acres (44°44', 80°43') of gravel and honeycomb at Vail Point (44°43', 80°45') at depths of 12-96 ft on October 15-November 15; the last reported spawning was in 1945. Considerable spawning also occurred on a 1,400 acre area (44°45', 80°46') of honeycombed rock, 1 -1/2 mi NW of Vail Point, on October 15-November 15.

Pyette Point (44°44', 80°53')--Cape Commodore (44°48', 80°54'). Minor ground; spawning occurred over an area of 1,520 acres of round stones and honeycombed rock at depths of 24-120 ft on October 10-31; the last reported spawning was in 1945.

Islands off Colpoys Bay (44°50', 80°57'). Major spawning grounds were located on the east side of Hay Island (44°53', 80°58'), the east side of White Cloud Island (44°50', 80°58'), the east side of Griffith Island (44°50', 80°54'), and Gunderson Shoal (44°49', 81°01'); spawning occurred over honeycombed rock and round stones at depths of 18-20 ft on October 10-31. Spawning apparently occurred at least until 1950, when ripe, spawning, and spent males and females were captured over clean, honeycombed rock at depths of 42-90 ft around White Cloud Island (Smith 1968); this run peaked on about November IO-II (Tomkins 1951). Spawn was collected at a site about 9 mi from Wiarton in November, this was probably near White Cloud Island (44°50', 80°58') (Can. Dep. Mar. Fish 1905).

Colpoys Hay (44°47', 81°05'). Many lake trout were caught in the bay during November (Kerr and Kerr 1860-1898), and the bay was classified as a "reserve" ground (Ont. Game Fish 1932). There were several spawning areas in the bay. Wiarton Harbor (44°45', 81°09') was a minor spawning ground; spawning occurred until 1950 over I, 120 acres of mud at depths of 30-78 ft in October (Smith 1968).

Town of Cape Croker (44°55', 81°01')--Cape Paulett (44°55', 81°06'). Major ground; spawning occurred over 20,160 acres of honeycombed rock at depths of 18-144 ft on October 10-November 10; the last reported spawning was in 1950.

Cape Dundas (44°58', 81°08'). Major ground; spawning occurred over 1,040 acres of honeycombed rock at depths of 18-104 ft on October 10-November 10; the last reported spawning was in 1950.

Surprise Shoal (45°04', 81°01'). Major ground; spawning occurred over 360 acres of honeycombed rock at depths of 12-66 ft on October 10-November 10 ; the last reported spawning was in 1950.

SPLAKE

Splake (brook trout x lake trout hybrid) have been stocked in Lake Huron since 1954. Splake usually spawn in late fall on rocky shoals (OMNR 1973). Ripe adults have been collected over former lake trout spawning grounds (GLFC 1970a).

Michigan

MH-1

Calcite Harbor (45°25', 83°46'). Many mature splake enter the harbor in October, presumably to attempt to spawn on the shoreline and breakwalls (Fws 1979d).

MH-2

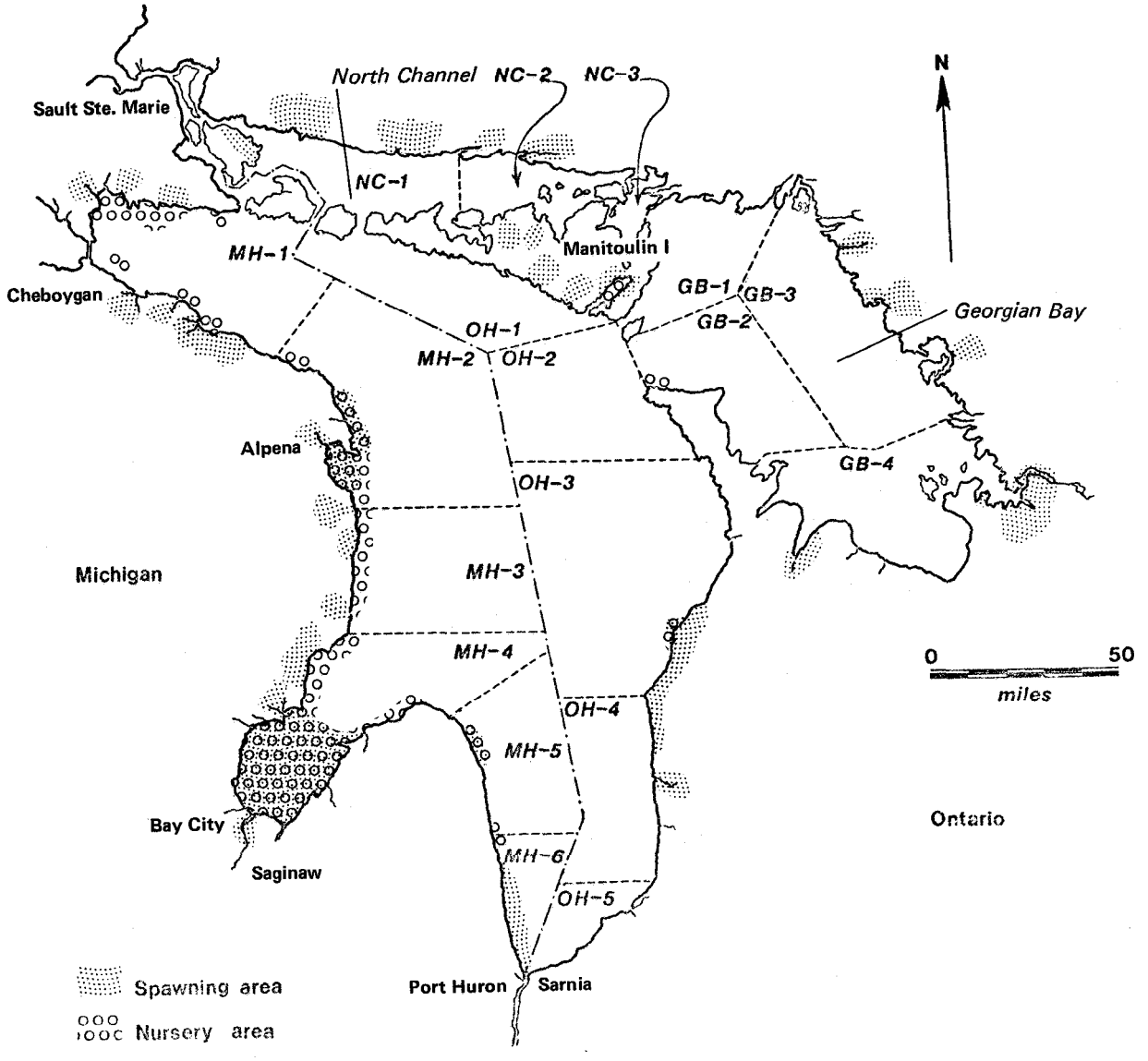
Rockport (45°12', 83°23'). Since about 1974, splake have spawned just off Rockport on a small reef in 6-10 ft of water (Organ et al. 1978).

Ontario

OH-1

Manitoulin Island (45°50', 82°30'). Ripe and running adults have been captured in mid-October over former lake trout spawning grounds in Burnt Island Bay (45°50', 82°57') at depths of about 3-6 ft and temperatures of about 54-57°F (Berst and Spangler 1970b).

RAINBOW SMELT



Rainbow smelt eggs planted in Crystal Lake (44°40', 86°10') (Lake Michigan drainage) in 1912 are believed to be the source of the smelt population found in all the Great Lakes except Lake Ontario. Smelt were first reported in Lake Huron off Rogers City (45°25', 83°49'1, Michigan, in 1925. Records of dispersal suggest that this species entered Lake Huron from Lake Michigan (Van Oosten 1937a).

Spawning runs of rainbow smelt occur in most tributaries to Lake Huron. The runs usually begin around the second week of April, peak in the third or fourth week of April, and continue possibly through the first week of May (Van Oosten 1953). Hatching occurs in mid-May to early June,

and, as they grow, the young disperse from the nearshore areas (O'Gorman 1976). The nearshore areas off irregular coastlines seem to be the most important nursery areas (O'Gorman 1979).

Michigan

In 1973-75, rainbow smelt were the dominant larvae in the U.S. waters of the lake north of Rockport (45°12', 83°23') and were more abundant there than in other parts of the lake (O'Gonnan 1975, 1976, 1978).

MH-1

Point De Tour (45°57', 83°55')--St. Ignace (45°52', 84°43'). The littoral zone from the Les Cheneaux Islands (45°58', 84°20') west to St. Martin Bay (46°00', 84°37') may be an important nursery area for smelt (O'Gorman 1976, 1978). Large numbers of larvae were found in St. Martin Hay, off St. Vital Point (45°57', 84°00'), and off Point Fuyards (45°56', 84°23') in late May to late June; the larvae taken in late May were newly hatched (O'Gorman 1975, 1976, 1978). Lesser numbers of larvae were found off Zela Point (45°46', 84°31') on Bois Blanc Island (45°46', 84°27') (O'Gorman 1976). Spawning runs entered streams near Cedarville (46°00', 84°21') during the latter part of April (UPI 1979), Nunns Creek (46°02', 84°34') (Gleason and Behmer, pers. comm. 1979), and the Carp River (46°02', 84°41') (Warner 1979).

Cheboygan River (45°39', 84°28'). In 1936, a good run started on April 11 (Van Oosten 1937a).

Greene Creek (45°38', 84°74'). Spawning runs occur in this stream (Hunn, pers. comm. 1980).

Nine Mile Point (45°38', 84°13'). Moderate numbers of larvae were found here in 1974 (O'Gorman 1976).

Hammond Bay (45°30', 84°05'). Runs from the bay into Carp (Black Mallard) Creek (45°32', 84°07') and the Ocqueoc River (45°29', 84°04') began in 1936 (Van Oosten 1937a); these have continued through the 1940s (Applegate 1950) to the present (FWS 1979c; Hunn, pers. comm. 1979). Runs in these tributaries usually peaked during the latter part of April (Applegate 1950). Hammond Bay also is a nursery area for smelt. Moderate to large numbers of larvae were found here in mid-June (O'Gorman 1975, 1976, 1978).

Eagle Creek (location unknown), Schmidt Creek (45°29', 83°56'), and Nagels Creek (45°27', 83°52'). Spawning runs occur in these streams and most of the streams north of Rogers City (45°25', 83°49') (Hunn, pers. comm. 1980).

MH-2

Thompsons Harbor (45°21', 83°36'). Fair numbers of larvae were collected here in June (O'Gorman 1975, 1976).

Rockport (45°12', 83°23'). In 1974, larval abundance in the U.S. waters of the lake from Rockport to a location (44°27', 83°19')' just north of Oscoda was highest at Middle Island (45°11', 83°20') (O'Gorman 1976). In 1978-79, smelt larvae were collected at Rockport during May-July; 62% of the prolarvae and 57% of the postlarvae taken were rainbow smelt. Most adults collected in April and May were ripe or running. Shoreline substrate in the area was boulders and rock with patches of sand, gravel, and cobble, and it appeared suitable for spawning; however no eggs were collected and spawning was not observed (Tex. Instrum. 1979c).

Thunder Bay (45°00', 83°20'). This is an important spawning and nursery area. Runs began in the Thunder Bay River (45°03', 83°26') in 1932 (Creaser 1932; Van Oosten 1937a) and have continued to the present (Warner 1979). Spawning also occurs in the bay (O'Gorman 1978). Large numbers of larvae were collected off Alpena (45°04', 83°26') (O'Gorman 1975) and Ossineke (44°55', 83°25') (O'Gorman 1978). Young rainbow smelt may be concentrated in shallow areas of the south and west portions of the bay (O'Gonnan 1978).

MH-3

Black River (44°49', 83°18'). The first run occurred here in 1935 (Van Oosten 1937a).

Harrisville (44°40', 83°18'). In 1936, spawning runs began in Mill Pond Stream (possibly Mill Creek [44°40', 83°17’]) in Alcona County (Van Oosten 1937a). Runs presently occur in the Harrisville area, including the Sturgeon Point (44°43', 83°16') area (Warner 1979). In 1975, large numbers of larvae were found here in early June (O'Gorman 1978).

Au Sable River (44°24', 83°19'). In 1935, runs began in Van Etten Creek (44°26', 83°20'), a tributary of the Au Sable River (Van Oosten 1937a). Runs still occur at the Au Sable River mouth (Warner 1979).

MH-4

Saginaw Bay (44°00', 83°30'). Rainbow smelt spawn in the inner portion of the bay, and larval abundance usually peaks in late May or early June (O'Gorman 1978). In 1956, young-of-the-year (YOY) were numerous from July to October in the inner bay and shallow areas of the outer bay (Carr 1962).

Au Sable Point (44°20', 83°20'). Fair numbers of larvae were found here in June and July 1973-1975 (O'Gorman 1975, 1976, 1978).

Tawas River (44°16', 83°31'). Heavy runs into the Tawas River began in 1935 (Van Oosten 1937) and have continued to the present; these runs usually occur in late April (North Woods Call 1979a; UPI 1979; Warner 1979).

Whitney Drain (diverted East Branch of Au Gres River (44°09', 83°34'). Heavy runs occur usually in mid-to late April (UPI 1979; Warner 1979). Spawning may have occurred along the beaches in the area in 1979 when low temperatures aborted runs into the river (North Woods Call 1979c).

Alabaster (44°11', 83°33'). In 1979, adults were most abundant in April, and in May some were running-ripe. The gravel substrate appeared suitable for spawning, but no eggs were collected and no spawning was observed (Tex. Instrum. 1979d). Rainbow smelt larvae were collected in May and June and were more numerous than those of most other species; 20% of total prolarvae and 52% of total postlarvae collected were rainbow smelt (Tex. Instrum. 1979b,d).

Au Gres River (44°02', 83°41'). Runs began here in 1935 (Van Oosten 1937a). The area from Point Lookout (44°03', 83°35') to Point Au Gres (43°59', 83°41') is an important nursery area for smelt (O'Gorman 1978). In 1973, large numbers of larvae were found off Point Au Gres in mid-June (O'Gorman 1975). In 1956, many YOY were also present in July and August at Point Lookout and Point Au Gres (Gordon 1957, 1961).

Point Au Gres (43°59', 83°41')--Saganing Bar (43°55', 83°51'). Spawning occurred generally throughout this area in shallow water over a bottom of mud and stone just after ice breakup; Wigwam Bay (43°59', 83°50), was identified as a spawning site (Orqan et al. 1978).

Saginaw River (43°39', 83°51'). Runs occur in late April, although in 1976 only a few ripe and spent adults were collected (Beak Consult. 1976). At the Karn-Weadock Power Plant Complex (43°39', 83°51'), at the river mouth, eggs were entrained in mid-late March, and larvae were entrained in mid-May (Consumers Power 1976c,d).

Quanicasse (43°35', 83°40'). Rainbow smelt postlarvae were collected at the site of the Quanicasse Power Plant from May to July; rainbow smelt made up 2.4% of the total catch of postlarvae (Tex. Instrum. 1979b,e).

Port Austin (44°03', 83°00'). In 1975, large numbers of larvae were collected here; greater concentrations of larvae were generally encountered along the south shore of the outer bay than along the north shore (O'Gorman 1978).

MH-5

Runs enter various small tributaries all along the Thumb area (44°03', 82°52'--43°00', 82°25') (Warner 1979).

Harbor Beach (43°51', 82°39'). In the southern part of the lake, the largest numbers of larvae were taken off Harbor Beach in June to July (O'Gorman 1975, 1978). Running ripe adults and eggs were captured from the harbor north for 5 mi to an unnamed location (43°54', 82°41') to depths of about 45 ft; the substrate was boulders and large rocks (LaJeone, pers. comm. 1979).

MH-6

Richmondville (43°34', 82°36'). Larvae were found here in 1973 but were about half as abundant as at Harbor Reach (43°51', 82°39') (O'Gorman 1975).

Port Sanilac (43°26', 82°32')--Port Huron (43°00', 82°26'). Runs occur at Port Sanilac (UPI 1979) and in the entire area from Port Sanilac south to Port Huron (Warner 1979). Commercial fishermen reported that smelt were abundant on the beaches along the southwest shore of the lake in the spring (Organ et al. 1978).

Ontario

In 1934, the first runs were recorded in Georgian Bay tributaries (Dymond 1944), and by 1941, runs were occurring in every stream along the shoreline of the bay and in most of the tributaries of Lake Huron proper (Dymond 1944; Van Oosten 1953).

OH-1

Lonely Bay Creek (45°42', 82°20') and Dean Bay Creek (45°41', 82°19'). Rainbow smelt first appeared in these streams in 1932 (Dymond 1944).

Manitou River (45°36', 82°06'). Some rainbow smelt were collected in the CDFO sea lamprey weir in 1969 (FWS 1979c) and runs may occur.

south Bay (45°38', 81°52'). In 1948, runs from the bay entered Cornell Creek (45°40', 81°53'), McLennan's Creek (45°41', 81°51'), Peltier Freshet (45°42', 81°46'), Trudeau Creek (45°41', 81°45'), Pheasant Creek (45°40', 81°45'), and School Freshet (45°39', 81°48'). The runs usually stopped within 1/4 mi of the bay, at the first falls with a drop of more than 1 ft. Heavy runs began on April 14, the day after ice breakup on the bay, but did not occur in one small stream until late April. The runs were believed to be composed almost entirely of fish from a resident stock in the bay (Baldwin 1950). During 1964-68, larvae were abundant in the bay beginning in early May. Larvae quickly moved away from the shoreline

areas and within several days were dispersed throughout the surface waters of the inner basin (Faber 1964, 1970).

OH-3

Port Elgin (44°26', 81°24')--Port Albert (43°53', 81°43'). Most streams in this region have runs (Dymond 1944). Eggs have been entrained at the Bruce Generating Station at Douglas Point (44°19', 81°36'); rainbow smelt larvae and YOY are more abundant than those of most other species at Douglas Point and Baie du Bore (44°21', 81°34') from mid-May throughout the summer (Dunford 1978b; Dunstall 1978a; Kelso and Leslie 1979).

OH-4

Nine-mile Creek (at Port Albert 43°53', 81°43') and Maitland River (43°45', 81°44'). Runs occur in these streams (Dymond 1944).

NC-1

St. Joseph Island (46°13', 84°00'). In 1934, runs occurred in several small unnamed streams (Dymond 1944; Savage 1935).

MacBeth Creek (46°17', 83°37'). In 1933, runs entered the creek in mid-April to mid-May (Savage 1935).

Thessalon River (46°15', 83°34'). Runs occurred in mid-April to mid-May 1933 (Savage 1935) and in mid to late April 1941 (Dymond 1944).

Livingstone Creek (46°15', 83°29'), Mississagi River (46°10', 83°01'), and Blind River (46°11', 82°57'). In 1933, runs entered these creeks in mid-April to mid-May (Savage 1935).

Algoma Creek (46°11', 82°49'1, One of the first runs on the north shore occurred in this stream in early April 1932 (Savage 1935).

Lawgon Creek (location unknown, possibly Lauzon Creek [46°11', 82°49'1). Runs occurred in mid-April to mid-May 1933 (Savage 1935) and in mid- to late April 1941 (Dymond 1944).

Serpent River (46°13', 82°37'). In 1933, runs entered the river in mid-April to mid-May (Savage 1935).

Shepherd (Sheppard) Creek (46°13', 82°36') One of the first runs on the north shore occurred in this stream in early April 1932 (Savage 1935).

NC-2

Spanish River (46°11', 82°19'). The first run here occurred in 1937 (Dymond 1944).

Gore Bay Creek (45°55', 82°28'). Rainbow smelt first spawned here in 1933 (Dymond 1944).

Kagawong River (45°54', 82°15'). The first run occurred here in 1934 (Dymond 1944); in 1941, the run began in early April (Dymond 1944).

GB-2

Dunks Bay (45°15', 81°38'). Rainbow smelt larvae are common here in spring and summer at depths of 7-13 ft (Emery 1973).

GB-3

Magnetawan River (45°46', 80°38'). Runs here began in 1936 (Dymond 1944).

Pointe au Baril (45°34', 80°30'). In 1936, runs began in many small streams near here, usually in mid-April (Dymond 1941).

Shawanaga River (45°32', 80°23'). The first run here occurred in 1938 (Dymond 1944).

Sequin River (45°20', 80°02'). The first run here occurred in 1938 (Dymond 1944; Environ. Can. 1977c).

GB-4

Port Severn (44°48', 79°43'). In 1938, the first runs near here occurred in a small unnamed stream (Dymond 1944).

North River (44°44', 79°39'). Runs here were first reported in 1938 (Dymond 1944).

Coldwater River (44°44', 79°39'). A run occurred here in 1941, beginning in mid-April (Dymond 1944).

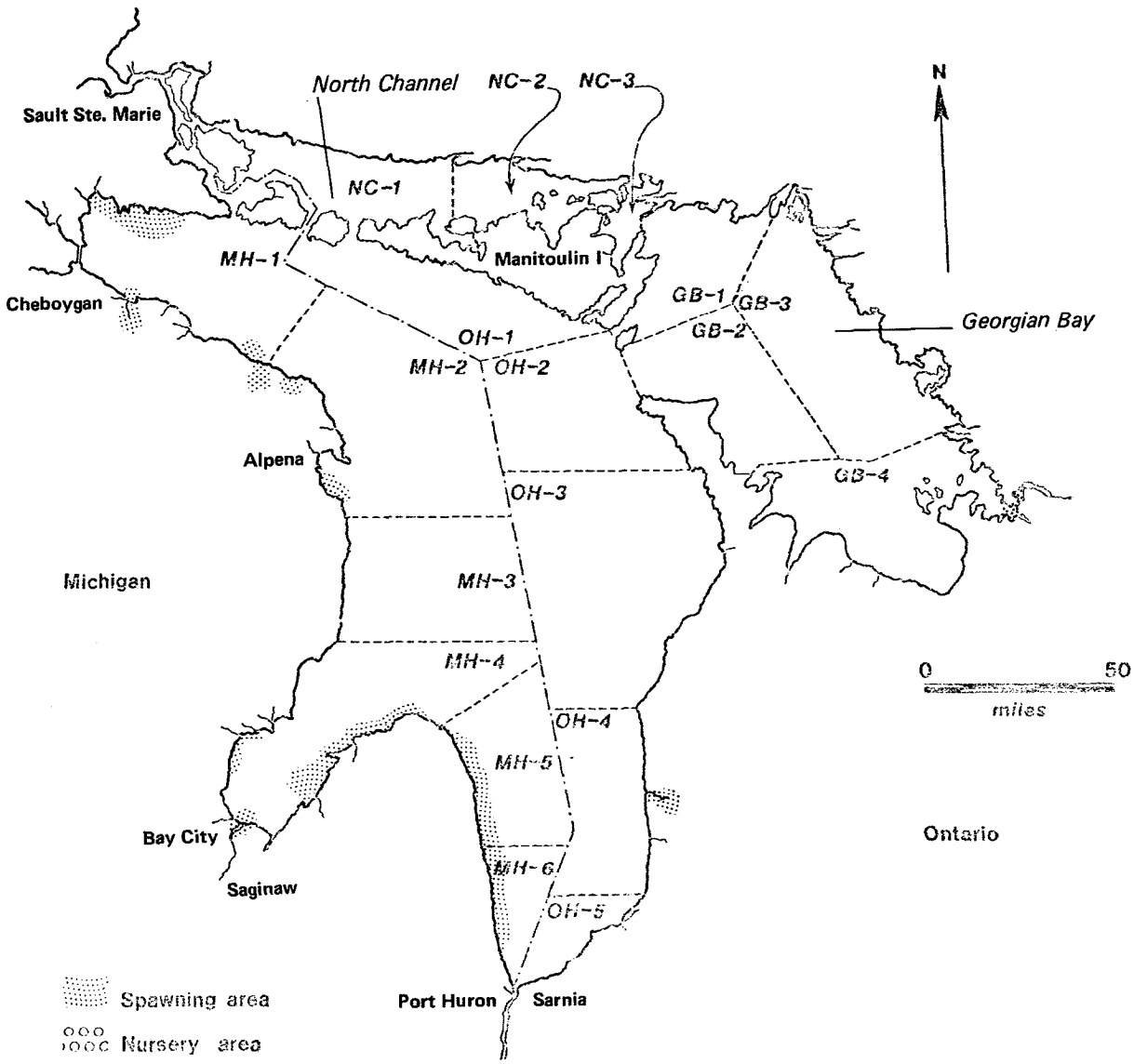
Sturgeon River (44°44', 79°44'). The first run here occurred in 1938. In 1941, the run began in mid-April (Dymond 1944).

Hog River (Creek) (44°45', 79°47'). The first run in Georgian Bay occurred in this stream in 1934 (Dymond 1944) or 1935 (Van Oosten 1937a, 1953). In 1941, the runs began in mid-April (Dymond 1944).

Sucker Creek (44°48', 79°53'). The first runs here occurred in 1936 (Dymond 1944).

Owen Sound area (44°40', 80°53'). Runs occurred here in 1941, beginning in early April (Dymond 1944).

NORTHERN PIKE



Michigan

MH-1

St. Martin Bay (46°00', 84°37')--Les Cheneaux Islands (45°58', 84°20'). Spawning has occurred since the 1950s from the mouth of the Pine River (46°03', 84°39') in St. Martin Bay eastward throughout the Les Cheneaux Islands and Dudley Bay (45°59', 84°09'). Spawning occurs over mud and aquatic vegetation at depths of 6 ft or less in May (Organ et al. *1978).*

Cheboygan River (45°39', 84°28'). In 1929-33, adults were collected at the mouth of the river during the spawning migration, which usually occurred in April; a dam near the river mouth blocked upstream movement (Shetter 1937). Presently, northern pike spawn near the mouth of the Cheboygan River on both sides of the river and also in Duncan Bay (45°39' 84°26') (Stedman, pers. comm. 1979).

Rogers City (45°25', 83°49'). Spawning occurred in "open gaps" in the rock along the harbor (Organ et al. 1978).

Calcite Harbor (45°25', 83°46'). Large spawning runs enter streams southeast of the harbor (FWS 1979d).

MH-2

Grand Lake outlet (45°21', 83°34'). Northern pike migrate to the marshes below Grand Lake (45°18', 83°30') to spawn (Hunn, pers. comm. 1980) .

Thunder Bay (45°00', 83°20'). In the 1920s-1960s, spawning occurred from Sulphur Island (44°59', 83°25') southeast for about 6 mi over mud and rock at depths of 12-24 ft (Organ et al. 1978). Excellent spawning habitat also exists in the Squaw Bay marsh (45°00', 83°27'1, in the reeds along the south shore of Squaw Bay, and along the south shore of Thunder Bay (at 44°54', 83°20'); spawning probably occurs in these areas (Stedman, pers. comm. 1979).

MH-4

Saginaw Bay (44°00', 83°30'). Spawning occurs just after ice breakup in several shallow areas in the bay (Organ et al. 1978).

Wigwam Bay (43°59', 83°50')--Pinconning Bar (43°51', 83°52'). Spawning occurs in this area in very shallow water and also in a small area (44°00', 83°43') about 1 mi E of Wigwam Bay over mud (Organ et al. 1978).

Saginaw River (43°39', 83°51'). In 1975-76, spawning probably occurred in the vicinity of the Karn-Weadock Power Plant Complex (43°39', 83°51') at the river mouth. Ripe fish were caught in the bay on March 9-13, both ripe and spent fish were caught in the bay and river on April 21-30, and spent fish were caught on May 17-23. The river bayous provide excellent potential spawning habitat (Beak Consult. 1976).

Fish Point (43°43', 83°31')--east of Hat Point (44°00', 83°05'). Most of the spawning sites identified in Saginaw Bay were along the east shore in this area. All sites are currently used, and the catch of spawners dates back to 1915. The substrate is mud, sand, clay, and vegetation (Organ et al. 1978).

MH-5, MH-6

Pointe aux Barques Light (44°01', 82°48')--south of Lakeport (43°04', 82°28'). Spawning occurred during 1917-69 along the entire shoreline at depths of about 20 ft. Substrate, where identified, was a combination of clay, mud, sand, and rock (Organ et al. 1978).

Ontario

OH-4

Maitland River (43°45', 81°44'). Spawning occurs in the river (Moccia, pers. comm. 1979).

GB-4

Matchedash Bay (44°46', 79°42'). Spawning occurs in the bay (Environ. Can. 1977c). In 1931, it was recommended that the southeastern portion of Georgian Bay that was closed to commercial fishing be enlarged to provide a "spawning sanctuary" (Ont. Game Fish 1931).

MUSKELLUNGE

Michigan

MH-1

Cheboygan River (45°39', 84°28'). In 1929-33, a few muskellunge were captured in the spring during the spawning run at the mouth of the river; a dam near the river mouth blocked upstream movement (Shetter 1937).

Ontario

GB-4

Matchedash Bay (44°46', 79°42'). Spawning occurs here (Environ. Can. 1977c). Spawning has occurred in the southeastern portion of Georgian Bay for a number of years. In 1931, it was recommended that the southeastern part of the bay that was closed to commercial fishing be enlarged to provide a "spawning sanctuary" (Ont. Game Fish 1931).

GOLDFISH

No information was found concerning the introduction of goldfish into Lake Huron.

Michigan

MH-4

Saginaw Bay (44°00', 83°30'). Commercial fishermen reported that spawning occurs in the area from Wigwam Bay (43°59', 83°50') to Saganing Bar (43°55', 83°51') over sand, clay, and vegetation to a depth of about 10 ft (Organ et al. 1978).

LAKE CHUB

Michigan

MH-1

Carp (Black Mallard) Creek (45°32', 84°07'). Spawning runs were reported here during the late 1940s; the runs consistently peaked in May, usually during and just after those of the white sucker and sea lamprey (Applegate 1950).

Ontario

The lake chub was believed to be common during the spawning season all along the Ontario shore and in the coastal streams (Hubbs and Brown 1929).

CARP

The initial plantings of carp were made in the inland waters of the U.S. in 1831. Carp were first observed in Lake Huron in 1900 at the entrance to the St. Clair River. Presumably these fish originated from St. Clair River and Lake St. Clair populations. Carp were first reported in Georgian Bay (45°30', 81°00') in 1905, near the mouth of the Trent Canal (Trent-Severn Waterway) (44°47', 79°44'). These Georgian Bay fish probably originated from the Lake Simcoe population that migrated through the Trent Canal (McCrimmon 1968). Carp inhabit the littoral zone of the lake and move into marshy areas. in the spring to spawn (Berst and Spangler 1970a).

Michigan

MH-1

Hammond Bay (45°30', 84°05'). Carp spawn off the point at the Hammond Bay Biological Station (45°30', 84°02'); spawning occurs over large rock rubble in shallow water, when the water temperature exceeds 55°F, usually in June. Ocqueoc River (45°29', 84°04'). Carp migrate up the Ocqueoc River to spawn (Hunn, pers. comm. 1979).

MH-2

Stoneport (45°18', 83°26'). Spawning occurs in the Stoneport-Presque Isle (45°21', 83°29') area (Hunn, pers. comm. 1980).

MH-4

Saginaw Bay (44°00', 83°30'). According to commercial fishermen, carp spawn extensively in the bay during May-July; the exact timing depends on water temperature (Organ et al. 1978). Spawning occurs along almost the entire shoreline area from Point Lookout (44°03', 83°35') to past Hat Point (at 44°00', 83°05'), at depths of 6 ft or less. Substrate in this area is varied and consists of sand, mud, clay, gravel, and vegetation. The rock and gravel shallows around Charity (44°02', 83°26') and Little Charity (44°00', 83°28') islands were spawning grounds. Spawning sites identified most frequently were the area from Point Au Gres (43°59', 83°41') to Saganing Bar (43°55', 83°51'), including Wigwam Bay (43°59', 83°50'), and the area from Fish Point (43°43', 83°31') to Sand Point (43°55', 83°24'). The entire bay probably serves as a nursery area. In 1975, larvae in moderate numbers were collected in mid-July off Point Au Gres, mostly at the surface over the 18 ft contour (O'Gorman 1978). Spawning was observed in the Saginaw River (43°39', 83°51') about 1 mi upstream from the mouth in May-June. Gravid females were still present at the end of June, a few were still ripe in late July, and fry were abundant in late July (Beak Consult. 1976).

Ontario

OH-3

Stokes River (45°00', 81°22'). In 1977, spawning was observed at the river mouth in late May (Loftus 1977).

Oliphant (44°44', 81°17'). In 1977, spawning was observed at Oliphant in late May (Loftus 1977).

OH-4

Maitland River (43°45', 81°44'). Carp spawn in the river at Goderich (43°45', 81°43'); these fish are probably moving in from Lake Huron (Moccia, pers. comm. 1979).

GB-4

Twelve Mile Bay (45°06', 80°04'). Shallow, weedy areas at the head of the bay are historical spawning areas (Down, pers. comm. 1979).

Matchedash Sound (44°50', 79°50'). Shallow, weedy areas near Waubashene (44°45', 79°43') are historical spawning areas (Down, pers. comm. 1979). Thousands of carp were present in the rice beds in the North (44°44', 79°39') and Coldwater (44°44', 79°39') rivers in late May (Ont. Game Fish 1912). In late May 1977, spawning was observed in the shallows around Beausoleil Island (44°51', 79°52'), and eggs were collected at Bergie Point (44°45', 79°47'). A few larvae were found at Tanner Point (44°45', 79°44'), Matchedash Bay (44°46', 79°42'), Papoose Bay (44°57', 79°52'), Tiffin Basin (44°45', 79°51'), and Penetang Harbor (44°47', 79°56') beginning on May 24 (Loftus 1977).

EMERALD SHINER

Michigan

MH-4

Saginaw Bay (44°00', 83°30'). Larvae were collected at Quanicasse (43°35', 83°40') in May-July; 25% of these were prolarvae and 6% were postlarvae (Tex. Instrum. 1979b,e).

MH-6

Port Sanilac (43°26', 82°32'). Adults concentrated directly off Port Sanilac during the spawning season, but these concentrations have not occurred in recent years (Organ et al. 1978).

Ontario

GB-4

Matchedash Sound (44°50', 79°50'). In 1977, emerald shiner larvae were collected mainly at Bergie Point (44°45', 79°47'), Tanner Point (44°45', 79°44'), and Matchedash Bay (44°46', 79°42'); the larvae first appeared in early June and were more abundant than larvae of other species (Loftus 1977).

SPOTTAIL SHINER

Michigan

MH-4

Saginaw Bay (44°00', 83°30'). In 1974, a few spottail shiner larvae were collected off Point Au Gres (43°59', 83°41′) on July 12 (O'Gorman 1976). In 1975-76, spawning probably occurred in the vicinity of the Karn-Weadock Power Plant Complex (43°39', 83°51'). Large numbers of mature adults appeared by late April and ripe adults were numerous by mid-May in Saginaw Bay. Fry were first taken in late June and by late July were abundant in the inshore waters of the bay (Beak 1976). At Quanicasse (43°35', 83°40'1, spottail shiner postlarvae were 94% of the catch in June. The extensive shallow areas with sand substrate are conducive to spawning (Tex. Instrum. 1979e).

Ontario

OH-1

South Bay (45°38', 81°52'). During 1965-69, young-of-the-year spottails were found in the shallowest and warmest waters in South Bay. Adults moved out to depths of about 19-46 ft after spawning (Reckahn 1970).

LONGNOSE DACE

Michigan

MH-1

Carp (Black Mallard) Creek (45°32', 84°07') and Ocqueoc River (45°29′, 84°04′). In the late 1940s, spawning runs of longnose dace entered these streams; peak upstream movement occurred from mid-April to mid- or late May, usually prior to the runs of the white sucker and sea lamprey (Applegate 1950).

QUILLBACK

Michigan

MH-4

Saginaw Bay (44°00', 83°30'). Since 1943, quillback have spawned along the east shore of the bay (Organ et al. 1978).

Fish Point (43°43', 83°31′). Spawning occurs along the outer side, south for 2-3 mi over mud and rock.

Fish Point (43°43', 83°31')--Sebewaing (43°44', 83°27'). Spawning occurs over substrate of mud, sand, and clay.

Sebewaing (43°44', 83°27'). Spawning occurs in the marshy area (43°45', 83°28′) just north of the mouth of the Sebewaing River delta over mud and in a larger area (43°46', 83°29') about 2 mi farther north over mud and sand.

LONGNOSE SUCKER

Michigan

MH-1

Hammond Bay (45°30', 84°05'). Spawning activity was observed in May 1978 in the shallows along the seawall at the Hammond Bay Biological Station (45°30', 84°02'). A spawning run enters the Ocqueoc River (45°29', 84°04') between the two parts of a biphasic run of white suckers. Runs also occur in many other small tributaries in the area (Hunn, pers. comm. 1979).

Trout River (45°26', 83°50'). A large spawning run enters this river (Hunn, pers. comm. 1979).

Swan River (45°24', 83°44'). A spawning run enters this river (Hunn, pers. comm. 1980).

MH-2

Devils River (44°55′, 83°25′). A large spawning run enters this river every spring (Stedman, pers. comm. 1979).

MH-4

Rifle River (44°00', 83°45'). There is a commerical fishery for longnose suckers in this river during the spawning run (Stedman, pers. comm. 1979).

Ontario

OH-1

Manitou River (45°36', 82°06') and Blue Jay Creek (45°35', 82°05'). CDFO sea lamprey weirs at the mouths of these tributaries captured a "number of tons" of longnose suckers in late April-early June 1968 (Zimmerman 1968).

OH-4

Bayfieid River (43°34', 81°43'). Longnose suckers were captured at CDFO sea lamprey weirs here (FWS 1979c).

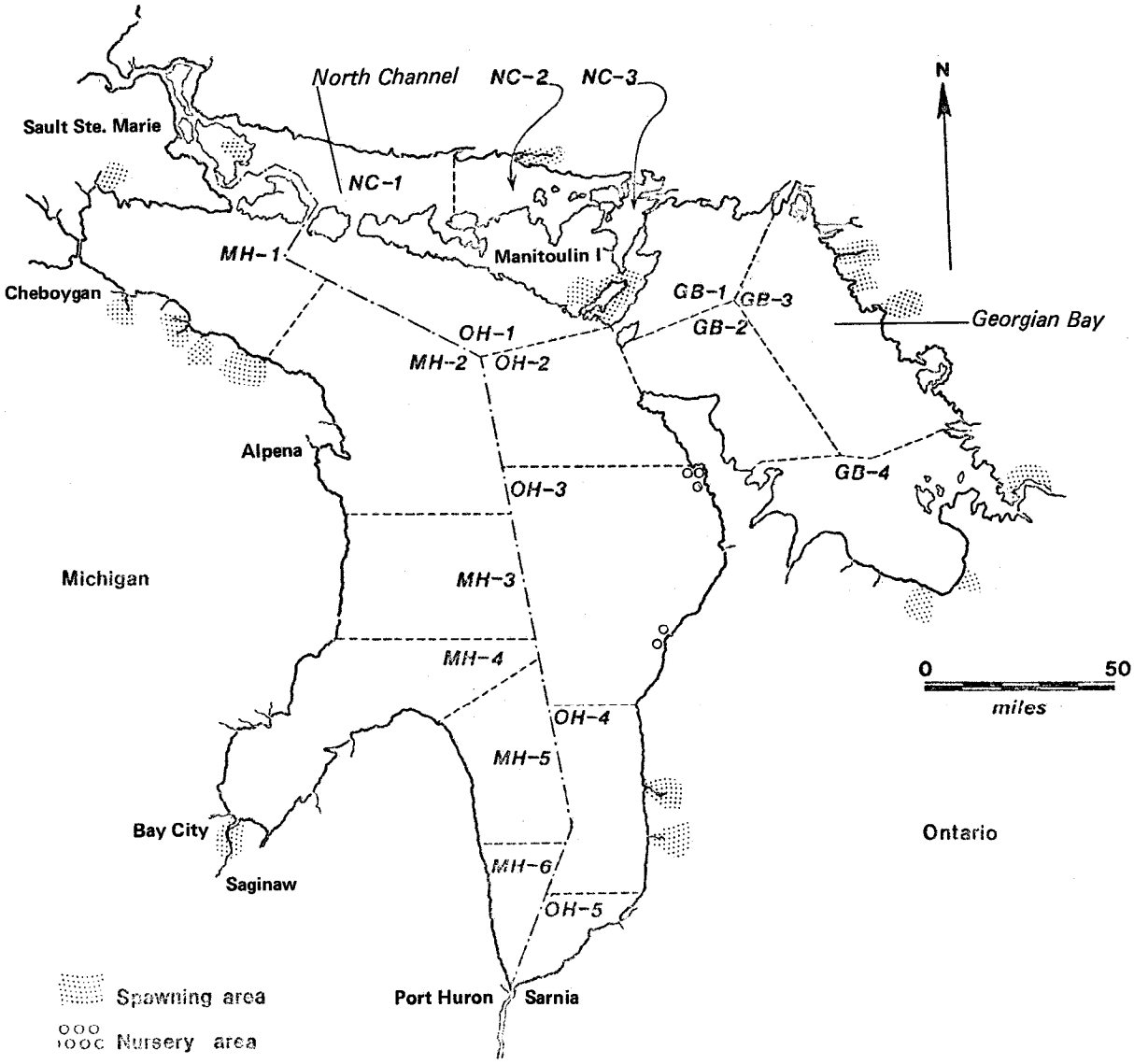
NC-l

St. Joseph Island (46°13', 84°00'). Large numbers of longnose suckers were collected in the sea lamprey weir in the Kaskawong River (Milford Haven Creek) (46°09', 83°50') (FWS 1979c).

GB-4

Nottawasaga River (44°33′, 80°00′). Longnose suckers were captured at CDFO sea lamprey weirs here (FWS 1979c).

WHITE SUCKER



Michigan

MH-1

Nunns Creek (46°02', 84°34'). Many spawning adults were observed here (GLFC *1972)*.

Cheboyqan River (45°39', 84°28'). Adults spawn in the river in late April and early May, and large schools of larvae were observed in early June about 0.4 mi upstream from the mouth (O'Gorman 1979).

Carp (Black Mallard) Creek (45°32', 84°07') and Ocqueoc River (45°29', 84°04'). Large spawning runs enter these streams in May, peaking at water temperatures above 49°F. Spent fish usually return to the lake in late May or in June. The white sucker run usually coincides with the sea lamprey run in these streams (Applegate 1950). The white sucker run in the Ocqueoc River is biphasic and brackets a run of longnose suckers (Hunn, pers. comm. 1979).

Trout River (45°26', 83°50'). A large spawning run occurs here and also in many of the smaller tributaries throughout the area (Hunn, pers. comm. 1979).

Swan River (45°24', 83°44'). A spawning run occurs (Hunn, pers. comm. 1980).

MH-4

Saginaw River (43°39', 83°51'). Large numbers of adults were collected in April and May; ripe fish were present in March, and both ripe and spent fish were taken in late April (Beak Consult. 1976).

Ontario

OH-1

Manitou River (45°36', 82°06') and Blue Jay Creek (45°35', 82°05'). A "number of tons" of white suckers were collected at CDFO sea lamprey weirs in these streams in late April-early June 1968 (Zimmerman 1968).

South Bay (45°38', 81°52'), White suckers ascend tributaries here in the spring (Coble 1967).

OH-3

Stokes Bay (44°59', 81°23'). A few larvae were collected in 1977 (Loftus 1977).

Douglas Point (44°19', 81°36'). In 1975, larvae were found at the Douglas Point Generating Station in late April through early June (Kelso and Leslie 1979).

OH-4

Maitland River (43°45', 81°44'). Runs enter the river in the spring at ice breakup (Moccia, pers. comm. 1979).

Bayfield River (43°34', 81°43'), Large numbers were collected at the CDFO sea lamprey weir in the late 1960s and in the 1970s (Dahl and McDonald 1980; FWS 1979c).

In Georgian Bay (45°30', 81°00'), white suckers ascend rivers, often to the foot of the first waterfall, in early spring (Bensley 1915).

NC-1

St. Joseph Island (46°13', 84°00'). During 1967 to 1977, white suckers were collected in a CDFO sea lamprey weir in the Kaskawong River (Milford Haven Creek) (46°09', 83°50') (FWS 1979c).

NC-2

Spanish River (46°11', 82°19′). Many white suckers were collected in CDFO weirs in April-July (Dahl and McDonald 1980).

GB-3

Still (45°46', 80°34') and Naiscoot (45°40', 80°34') Rivers. Large numbers of adults were captured at the CDFO sea lamprey weirs in these rivers (Dahl and McDonald 1980; FWS 1979c).

Shawanaga River (45°32', 80°23'). The Shawanaga rapids is the major spawning site for white suckers from the river basin and possibly from Shawanaga Bay (45°30', 80°25') (Zimmerman 1967).

GB-4

Severn River (44°53', 79°42'). Dead eggs and egg capsules were found in early May 1977 at about 55°F (Loftus 1977).

Nottawasaga River (44°33', 80°00'). Large numbers of adults were captured at the CDFO sea lamprey weirs here (Dahl and McDonald 1980; FWS 1979c).

Silver Creek (44°31′, 80°17′). In the late 1950s, large spawning runs were observed here in mid-April to mid-June; these fish moved back downstream after spawning (Lamsa 1963b).

SUCKER spp.

Michigan

MH-2

Thunder Bay River (45°04', 83°26'). A spawning run occurs here (Ann Arbor News 1979b).

MH-4

Saginaw Bay (44°00', 83°30'). Commercial fishermen have identified spawning grounds along almost all but the southern shoreline of the bay;

spawning occurs over substrate combinations of sand, clay, gravel, rock, and mud at depths of 3-17 ft (Organ et al. 1978).

Tawas Point (44°15', 83°27')--Point Lookout (44°03', 83°35'). Since 1915, suckers have spawned along shore in this area (Organ et al. 1978).

Point Au Gres (43°59', 83°41')--Pinconning Bar (43°51', 83°52'). Since 1928, suckers have spawned here; the area between Point Au Gres and Saganing Bar (43°55', 83°51') is heavily used (Organ et al. 1978). A massive spawning run enters the Rifle River (44°00', 83°45') in April just as the ice goes out (Ann Arbor News 1979b, 1980b; Griffin 1980; UPI 1979).

Fish Point (43°43', 83°32')--Sand Point (43°55', 83°24'). Since 1915, this area has been heavily used for spawning out to a depth of about 6 ft. Spawninq also occurs west of Fish Point at depths of 12-16 ft.

Sand Point (43°55', 83°24')--east of Hat Point (44°00', 83°05') (Organ et al. 1978).

Ontario

OH-3

Saugeen River (44°30', 81°23'). Large spring runs of suckers and "mullet" entered the river (Kerr and Kerr 1860-1898).

GB-4

Sturgeon River (44°44', 79°44'). In 1970, suckers were abundant on the spawning beds in the river after April 30 (Thede 1970), and these may have been migrants from the lake.

GOLDEN REDHORSE

Michigan

MH-1

Ocqueoc River (45°29', 84°04'). One of the principal golden redhorse spawning runs from Lake Huron enters this stream. In 1949, many spawning run fish were captured at the FWS sea lamprey weir on the Ocqueoc River. Migrations occurred between late April and mid-May, before the peak of the sea lamprey run. Spent fish returned to the lake in May-July (Applegate 1950).

Carp (Black Mallard) Creek (45°32', 84°07'). In 1947 and 1948 spawning runs occurred in this stream in April and May (Applegate 1950).

REDHORSE spp,

Ontario

OH-4

Maitland River (43°35', 81°44'). Runs entered the river in the spring at ice breakup (Moccia, pers. comm. 1979).

CASTOSTORID spp.

Michigan

MH-4

Point Au Gres (43°59', 83°41'). In 1975, catostomid larvae were collected off Point Au Gres in late May and mid-July (O'Gorman 1978).

BLACK BULLHEAD

Michigan

MH-2

Thunder Bay (45°00', 83°20'). Black bullheads are caught in Squaw Bay (45°00', 83°27') and probably spawn there (Stedman, pers. comm. 1979).

YELLOW BULLHEAD

Michigan

MH-4

Saginaw Bay (44°00', 83°30'). Spawning probably occurred in the vicinity of the Earn-Weadock Power Plant Complex (43°39', 83°51') in Saginaw Bay, where gravid females were found until late June and spent females were found in late July-early August (Beak Consult. 1976).

BROWN BULLHEAD

Michigan

MH-4

Saginaw Bay (44°00', 83°30'). Spawning has occurred since 1959 between Fish Point (43°43', 83°31') and Sebewaing (43°44', 83°27') in a marshy area where the substrate is mud, sand, and rock. Another small spawning area exists in the marsh about 1 mi N of Sebewaing (Organ et al. 1978).

Ontario

In Georgian Bay (45°30', 81°00'), brown bullheads spawn from late June to early July; nests are built in shallow water 2-3 ft from shore (Bensley 1915).

CHANNEL CATFISH

Michigan

MH-4

Saginaw Bay (44°00', 83°30'). Channel catfish spawn in a number of areas in the bay (Organ et al. 1978, unless noted).

Charity Island (44°02', 83°26'). Since 1962, spawning has occurred in a sand and gravel, crescent-shaped area around the north side of the island at a depth of about 6 ft.

Point Lookout (44°03', 83°35')--Nayanquing Point (43°46', 83°56'). Spawning occurs in this entire area to depths of 18-24 ft; the substrate here is sand, mud, and clay. The earliest reported catch of spawners was 1928.

Tobico Marsh (43°42', 83°56'). Channel catfish spawn to depths of 6-8 ft from the south end of the marsh to the mouth of the Kawkawlin River (43°40'. 83°53'): the substrate here is mud and clay-

Saginaw River (43°39', 83°51')--Quanicasse (43°35', 83°41'). Spawning occurs in the shallow areas with mud and sand bottom extending for about 6 mi E of the Saginaw River. Large numbers of fry were collected in the discharge of the Karn-Weadock Power Plant Complex (43°39', 83°51') in June-September; they may inhabit crevices in the diking (Beak Consult. 1976).

Squaw Creek (43°37', 83°38')--Fish Point (43°43', 83°31'). A spawning area (43°40', 83°40'--43°45', 83°35') extends from about 3-5 mi N of the mouth of Squaw Creek at depths of 12-14 ft (Organ et al. 1978).

Fish Point (43°43', 83°31')--Sand Point (43°55', 83°24'). Since 1915, spawning has occurred throughout this shallow, mud-bottomed area to a depth of about 6 ft. Spawning also occurs northwest of North Island (43°53', 83°25') at 43°54', 83°27' at depths of 12-14 ft; the substrate here is sand.

Sand Point (43°55', 83°24'). Spawning occurs off the north side of the point over sand and gravel to 12 ft depths.

BULLHEAD spp.

Michigan

MH-4

Point Au Gres (43°59', 83°41')--Nayanquing Point (43°46', 83°56'). Spawning occurs along this shore to a depth of about 24 ft, where the substrate is sand with clay, rock, and mud; earliest reported spawning here was in 1928 (Organ et al. 1978).

Fish Point (43°43', 83°31')--Sand Point (43°55', 83°24'). Since 1927, spawning has occurred along this shore where the substrate is mud (Organ et al. 1978).

TROUT-PERCH

Michigan

MH-2

Rockport (45°12', 83°23'). Trout-perch postlarvae were collected in July; they were less than 1% of the total (Tex. Instrum. 1979c).

MH-4

Alabaster (44°11′, 83°33′). Trout-perch postlarvae were found in June; they were less than 1% of the total larval catch (Tex. Instrum. 1979d).

Saginaw River (43°39', 83°51'). Trout-perch were abundant in the vicinity of the Karn-Weadock Power Plant Complex (43°39*, 83°51') only in late April and May; large numbers of sexually mature adults moved inshore to spawn at that time and larvae were also collected (Beak Consult. 1976).

Ontario

OH-1

South Bay (45°38', 81°52'). Spawning aggregations occurred in shallow water in June and early July; these fish moved into the metalimnion in July and August. Young-of-the-year were found in shallow, warm waters in July and August (Faber 1970).

BURBOT

Michigan

MH-1

St. Vital Point (45°57', 84°00'). In 1975, a few larvae were captured off the point in June (O'Gorman 1978).

MH-2

Rockport (45°12', 83°23'). Postlarvae were collected in June; they were less than 1% of the total postlarvae taken (Tex. Instrum. 1979c).

Thunder Bay (45°00', 83°20'). In 1975, small numbers of larvae were collected off Alpena (45°04', 83°26′) in May (O'Gorman 1978).

MH-4

Saginaw Bay (44°00', 83°30'). Significant spawning has not occurred in the bay since the 1940s, but occasional spawning still occurs along shore in the outer bay and outer portion of the inner bay; spawning occurs to depths of 24-30 ft in February. Areas where spawning has occurred most recently are on the west shore from Tawas Point (44°15', 83°27') to Point Lookout (44°03', 83°35'), Point Au Gres (43°59', 83°41') to Saganing Bar (43°55′, 83°51′), and on the east shore from Sand Point (43°55', 83°24') to east of Hat Point (at 44°00', 83°05') (Organ et al. 1978). On May 30, 1975, one burbot larva was collected near Port Austin (44°03', 83°00') and another was collected near Point Au Gres (O'Gorman 1978). In 1979, burbot

larvae were collected in April and May off Alabaster (44°11', 83°33'), but they were less than 1% of the total prolarvae and less than 1% of the post larvae taken (Tex. Instrum. 1979d).

MH-5

Harbor Beach (43°51', 82°39'). A few larvae were collected over rocks and boulders (LaJeone, pers. comm. 1979).

Ontario

OH-1

south Bay (45°38', 81°52'). Spawning occurs regularly along parts of the South Bay shoreline shortly after ice breakup (Faber 1970). Larvae only a few hours old were found along shore in early June 1964 and in April and May 1965-1968 (Faber 1964, 1970). Larvae were also collected in 1977 (Loftus 1977). Older larvae disperse throughout surface waters over deeper waters (Faber 1970).

BROOK STICKLEBACK

Ontario

OH-3

Douglas Point (44°19', 81°36'). In 1975, larvae were collected here in moderate numbers in mid to late July (Kelso and Leslie 1979).

NINESPINE STICKLEBACK

Michigan

MH-1

Nagels Creek (45°27', 83°52'). Ninespine sticklebacks run upstream in the spring to spawn in Nagel's Creek at Rogers City (45°25', 83°49') (Stedman, pers. comm. 1979).

MH-2

Rockport (45°12', 83°23'). In July 1978-79, prolarvae and postlarvae of this species each made up 5% of the larval catch (Tex. Instrum. 1979c).

Ontario

OH-1

South Bay (45°38', 81°52'). During spawning in June and July, adults were abundant in shallow vegetated areas of the bay (Reckahn 1970). During May-July 1967, when water temperatures were about 49-62°F, nesting activity was observed along the southeast shore of the bay and also along the rocky base of the access road leading to the wharf of the research station, near the northwest side of the mouth of the bay. In the latter area, nests were built under or between rocks, about 1-5 ft from shore at water depths of about 1-3 ft. Successful nests were located in quiet areas on the leeward side. The area supported no rooted vegetation, but the nests contained algae picked off the rocks. Along the southeast shore in less sheltered waters, nests were found along a rocky shelf in sand, under and among rocks. Newly hatched fry were guarded by the male parent. Older fry were scattered and hidden among the rocks (McKenzie and Keenleyside 1969).

WHITE BASS

Michigan

MH-4

Saginaw River (43°39', 83°51'). Mature adults were collected in the river and Saginaw Bay (44°00', 83°30') in the vicinity of the Karn-Weadock Power Plant Complex (43°39', 83°51'1 in late April-late May, spent adults by late June, and fry by late July (Beak Consult. 1976).

Ontario

GB-4

Matchedash Sound (44°50', 79°50'). A few larvae were collected in the inner portions of the sound at Tanner Point (44°45', 79°44') and Matchedash Bay (44°46', 79°42') beginning in late May (Loftus 1977).

ROCK BASS

Michigan

MH-4

Saginaw Bay (44°00', 83°30'). The only recorded rock bass spawning grounds in the U.S. waters are in Saginaw Bay (Organ et al. 1978).

Wigwam Bay (43°59', 83°50')--Pinconning Bar (43°51', 83°52'). Spawning occurred along shore over sand and rock.

Fish Point (43°43', 83°31')--Sebewaing (43°44', 83°27'). Spawning occurred here over mud and clay.

Ontario

OH-1

South Bay (45°38', 81°52'). In the late 1960s, young-of-the-year (YOY) were collected in the warmest and shallowest areas of the bay during July and August (Reckahn 1970).

OH-3

Baie du Dore (44°21', 81°34'). The southeast corner of the bay is an important spawning and nursery area. Nest building was observed over sand, gravel, and plant roots at depths of about 1-5 ft from early June to early July at about 57-71°F. Fry and older YOY remained in the sheltered areas of the bay among dense Myriophyllum through their first summer (Griffiths 1976b, 1978b). Nest building and guarding was also seen in the discharge canal of the Bruce Generating Station (44°19', 81°36') in June and July (Dunford 1978b).

In Georgian Bay, rock bass spawn nearshore in June (Bensley 1915).

GB-3

Pointe au Baril (45°34', 80°30'). Nesting was observed during the 1920s among the small islands (45°29', 80°29') about 5 mi S of the point among rock covered with muck and vegetation at water temperatures of 65-75°F (Hubbs and Brown 1929).

PUMPKINSEED

Michigan

MH-4

Sand Point (43°55', 83°24'). In 1908, spawning was observed in early July in Turtle Bay (43°54', 83°20'), a partially enclosed embayment on the south side of Sand Point. Females with nearly ripe eggs were found as early as June 23, and rips males were seen as late as August 20. The nests were in 0.5-3 ft of water and were cleared of sediment and plant material to expose the plant roots or coarse gravel (Leathers 1911).

Saginaw River (43°39', 83°51'). Spent adults were collected at the Karn-Weadock Power Plant Complex (43°39', 83°51') in late July-early August. Fry'first appeared in late September and were abundant about 1 mi above the river mouth (Beak Consult. 1976).

Ontario

OH-3

Baie du Dore (44°21′, 81°34′). The southeast corner of the bay is an important spawning and nursery area, and the young remain in the sheltered areas of the bay through their first summer of life (Griffiths 1978b).

OH-5

Plympton Conservation Area (43°04', 82°10'). Spawning occurs here (Environ. Can. 1977c).

In Georgian Bay, spawning usually occurs in July (Bensley 1915).

GB-4

Matchedash Sound (44°50', 79°50'). Larvae were collected throughout the sound. Hatching began the last week of May, and a second peak occurred the last week of June (Loftus 1977).

BLUEGILL

Ontario

OH-5

Plympton Conservation Area (43°04', 82°10'). Spawning occurs here (Environ. Can. 1977c).

SUNFISH spp,

Michigan

MH-4

Saginaw Bay (44°00', 83°30'). Commercial fishermen reported spawning by unidentified sunfish in several area of the bay (Organ et al. 1978).

Wigwam Bay (43°59', 83°50')--Saganing Bar (43°55', 83°51'). Spawning occurs here over sand, clay, and vegetation to depths of 10-12 ft.

Gilman's Landing (43°48', 83°55')--Saginaw River (43°39', 83°51'). Since the 1930s, spawning occurred here over sand and gravel to a depth of about 20 ft.

Saginaw River (43°39', 83°51')--Quanicasse River (43°35', 83°41′). Since the 1930s, spawning occurred here over sand and gravel to a depth of about 12 ft.

Fish Point (43°43', 83°31')--Sand Point (43°55', 83°24'). Since 1938, spawning has occurred in this entire area over a mud bottom. Since 1959, spawning has occurred on the outside of Fish Point.

Ontario

OH-1

south Bay (45°38', 81°52'). In 1964, one larva was collected here in mid-August (Faber 1964).

SMALLMOUTH BASS

Michigan

MH-1

Cheboyqan River (45°39', 84°28'). In 1929-33, a few smallmouth bass were collected during spawning migrations from the lake; these runs were blocked by the dam near the mouth of the river (Shetter 1937).

Ocqueoc River (45°29', 84°04'). Larvae and young-of-the-year (YOY) have been found in the lower river; this is a nursery area. A spawning run from the lake probably occurs (King, pers. comm. 1980).

MH-2

Thunder Bay (45°00', 83°20'). The area from Sulphur Island (44°59', 83°25') to South Point (44°53', 83°19') is excellent smallmouth bass habitat; the substrate is rubble with patches of vegetation and is a potential spawning area (Stedman, pers. comm. 1979).

MH-4

Saginaw Bay (44°00', 83°30'). Most spawning areas identified in the U.S. waters of Lake Huron are in Saginaw Bay (Organ et al. 1978).

Charity Islands (44°01′, 83°27′). Since 1927, spawning has occurred around Charity (44°02', 83°26') and Little Charity (44°00', 83°28') islands over rock, gravel, and sand area.

Wigwam Bay (43°59', 83°50')--Pinconning Bar (43°51', 83°52'). Spawning occurs in Wigwam Bay over clay and sand to depths of 6 ft and from Wigwam Bay to Saganing Bar (43°55', 83°51') over sand and vegetation to depths of 10-12 ft. Localized spawning also occurs about 1 mi E of Wigwam Bay (at 44°00', 83°44') over mud.

Fish Point (43°43', 83°31')--Sand Point (43°55', 83°24'). Since 1927, spawning has occurred in this entire area over mud with clay and sand.

Ontario

OH-1

South Bay (45°38', 81°52'). In the late 1960s, YOY were collected here in the warmest and shallowest areas during July and August (Reckahn 1970). The population in the bay is believed to be relatively discrete from those in the main lake. Most of the population is concentrated in the northeast part of South Bay. In South Bay, a spawning migration may occur from Jocko (Roberts) Bay (45°35', 81°54') to the Inner Basin (45°37', 81°54') (Fraser 1955).

OH-3

Baie du Dore (44°21', 81°34'). The southeast corner of the bay is a major smallmouth bass spawning area. Young-of-the-year remain in the sheltered areas of the bay throughout their first summer (Griffiths 1978b). Spawning begins in the bay when water temperature rises above 59°F. Most nests are built at about 51-70°F, and activity decreases in late June (Shuter et al. 1980). Nest building and guarding has also been observed during mid-June to late July in the inner discharge canal of the Bruce Generating Station (44°19', 81°36') (Dunford 1978b).

In Georgian Bay, adults move inshore in late May and usually spawn in June; nesting was observed as late as July 20 (Bensley 1915).

GB-1

Spawning evidently occurred along the north shore of Georgian Bay, because it was recommended that this area be closed to fishing (Ont. Game Fish 1931).

GB-3

Pointe au Baril (45°34', 80°30'). In 1936, nests were observed here on a gravel substrate in 18 in. of water in late June to mid-July. Most of the nests were built on the sheltered sides of islands (Doan 1938b, 1940). Fry were also observed in the nests (Doan 1938b).

GB-4

Go Home Bay (44°59', 79°57'). Nests were built in late June among small stones in 3-4 ft of water, in protected areas near boulders, rock ledges, or fallen trees; the eggs adhered to the stones (Tester 1930).

LARGEMOUTH BASS

Michigan

MH-4

Saginaw Bay (44°00', 83°30'). The only spawning areas identified in the U.S. waters of Lake Huron are in Saginaw Bay (Organ et al. 1978).

Charity Islands (44°01', 83°27'). Since 1927, spawning has occurred around Charity (44°02', 83°26') and Little Charity (44°00', 83°28') islands over rock and gravel.

Wigwam Bay (43°59', 83°50')--Pinconning Bar (43°51', 83°52'). Spawning occurs in Wigwam Bay over clay and sand to depths of 6 ft; from Wigwam Bay to Saganing Bar (43°55', 83°51') over sand and vegetation to depths of 10-12 ft; and from Saganing Bar to Pinconning Bar over sand and rock in the very shallow shore zone. Localized spawning also occurs in an area (44°00', 83°44') about 1 mi E of Wigwam Bay over mud.

Nayanquing Point (43°46', 83°56'). Spawning occurs in the marshy areas over mud and vegetation.

Tobico Marsh (43°42', 83°56'). Spawning may occur from the south end of Tobico Marsh to the mouth of the Kawkawlin River (43°40', 83°53') over mud and sand to depths of 6-8 ft.

Fish Point (43°43', 83°31')--Sand Point (43°55', 83°24'). Since 1927, spawning has occurred over mud, sand and vegetation throughout this entire shallow area. Spawning also occurred in an area (43°41', 83°35') along the outside edge of Fish Point over clay, rock, and mud to depths of 12 ft.

Ontario

In Georgian Bay (45°30', 81°00'), spawning occurred in early June on a bottom of soft detritus (Bensley 1915).

BASS spp.

Ontario

Unidentified species of bass spawned in the following areas in Canadian waters:

OH-5

Plympton Conservation Area (43°04', 82°10'). (Environ. Can. 1977c).

NC-3

Manitoulin Island (45°50', 82°30'). Bass had not finished spawning at Manitowaning (45°45', 81°47') by June 15 (Ont. Game Fish 1913b).

GB-3

Sandy Island (45°16', 80°16'). Spawning occurs west of Sandy Island at 45°16', 80°17' (Environ. Can. 1977c).

GB-4

Honey Harbor (44°52', 79°49'). Black bass were observed spawning along shore, and schools of young were seen along shore (Ont. Game Fish 1908, 1909).

Matchedash Bay (44°46', 79°42') and Victoria Harbor Bay (44°45', 79°47') (Environ. Can. 1977c).

Collingwood (44°30', 80°13'). Historically, bass spawned here and were netted in May as they entered two unidentified bays to spawn (Kerr and Kerr 1860-1898).

BLACK CRAPPIE

Ontario

GB-4

Matchedash Sound (44°50', 79°50'). Black crappie larvae were abundant in collections from mid-May to July; most were newly hatched. One hatching period occurred in May and another in late June (Loftus 1977).

CRAPPIE spp.

Michigan

MH-4

Saginaw Bay (44°00', 83°30'). Commercial fishermen identified spawning areas in Saginaw Bay (Organ et al. 1978).

Wigwam Bay (43°59', 83°50')--Saganing Bar (43°55', 83°51'). Crappies spawn in this area over sand and vegetation. Localized spawning also occurs over mud in an area (44°00', 83°44') about 1 mi E of Wigwam Bay.

Nayanquing Point (43°46', 83°56'). Spawning occurs in the marshy areas over mud and vegetation.

Fish Point (43°43', 83°31 ')--Sand Point (43°55', 83°24'). The earliest reported catch of spawners here was in 1915. Spawning occurs throughout this area; the substrate is primarily mud with sand, clay, or vegetation, Spawning also occurs in this region and in an area extending about 3 mi S from Fish Point over sand and rock at the 6 ft contour. Since 1938, crappies have also spawned off the northwest point of North Island (43°53', 83°25') over a sand area (43°54', 83°27') at depths of 12-14 ft.

Sand Point (43°55', 83°24')--Hat Point (44°00', 83°07'). Since 1915, spawning has occurred in the area from Sand Point to Oak Point (43°38', 83°16') over sand and rock to depths of about 6 ft, around Oak Point over rock and gravel to depths of about 24 ft, and from Oak Point to just east of Hat Point (44°01', 83°05') over rock, sand, and gravel to depths of about 24 ft.

JOHNNY DARTER

Michigan

MH-2

Rockport (45°12'; 83°23'). In 1978-79, prolarvae of this species were collected in April-July; they were 1% of the total catch of prolarvae (Tex. Instrum. 1979c).

MH-4

Alabaster (44°11', 83°33'). In 1979, prolarvae were found in June and July; they were 1% of the total catch of prolarvae (Tex. Instrum. 1979d).

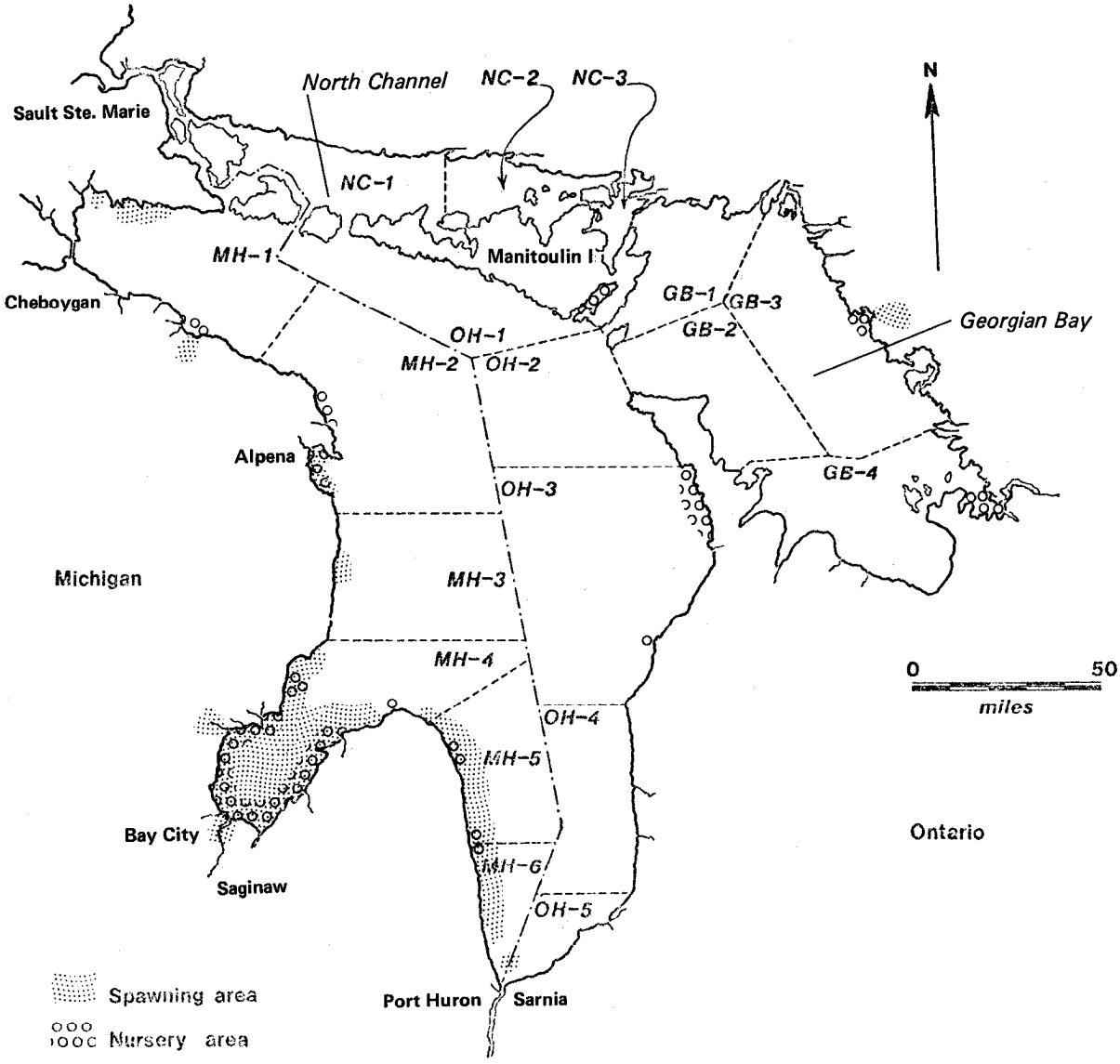
OH-3

Douglas Point (44°19', 81°36'). Larvae of this species were entrained at the Bruce Generating Station; they were 1.5% of the total catch of larvae (Dunstall 1978a).

GB-4

Matchedash Sound (44°50', 79°50'). In 1977, larvae were collected throughout the bay (Loftus 1977).

YELLOW PERCH



The shallow bays of Lake Huron contain preferred spawning grounds for yellow perch. The bays and irregular stretches of the coastline serve as nursery areas. In the northern part of Lake Huron, spawning does not occur until early summer, usually late May or early June (O'Gorman 1975, 1976, 1978, 1979).

MH-1

St. Martin Bay (46°00', 84°37'). Since the 1950s, spawning has occurred in a small area just west of Nunns Creek (46°02', 84°34') over mud and aquatic vegetation to depths of 6 ft (Organ et al. 1978).

Les Cheneaux Islands (45°58', 84°20'). Since the 1950s, spawning has occurred throughout the shallows from Mismer Bay (46°00', 84°27') and Mackinac Bay (46°00', 84°24') to Whitefish Point (45°58', 84°13'), including Voight Bay (45°56', 84°23') on the outside of Marquette Island (45°57', 84°23'). Spawning usually takes place in late April but the timing is dependent on water temperature. The substrate throughout the area is mud, and aquatic vegetation is present (Organ et al. 1978).

Hammond Bay (45°30', 84°05'). Hammond Bay was found to have the highest density of fry in the northern section of the lake (O'Gorman 1978).

Ocqueoc River (45°29', 84°04'). Spawning runs enter the river, and fish return to Lake Huron in May and June (Applegate 1950).

MH-2

Rockport (45°12', 83°23'). Yellow perch postlarvae were more numerous than those of most other species in May and June (Tex. Instrum. 1979b,c).

Thunder Bay (45°00', 83°20). Spawning occurs here in the latter part of May, and larvae were collected off Alpena (45°04', 83°26') and Ossineke (44°55', 83°25') (O'Gorman 1978). Spawning occurs in Squaw Bay (45°00', 83°27') over sand during April and early May (Organ et al. 1978). Spawning occurs in the northern part of Thunder Bay and probably also near the mouth of the Devils River (44°55', 83°25') and the adjacent shoreline (Stedman, pers. comm. 1979).

MH-3

Harrisville (44°40', 83°18'). Spawning occurs off Harrisville over sand to depths of about 19 ft and just south of the Harrisville State Park (44°38', 83° 18') during April and early May (Organ et al. 1978).

MH-4

Saginaw Bay (44°00', 83°30'). Historically, this was an important spawning area. Egg masses were found in the bay in the early 1900s (Reighard 1915), and spawning runs were noted in 1929 and 1930 (Hile and Jobes 1940). Runs into the bay may begin in mid-April (UPI 1979). Commercial fishermen captured spawning yellow perch in April and May in almost all areas of the bay at depths of 30 ft or less; the first reported catch was in 1915 (Organ et al. 1978). Spawning areas include almost all areas of the bay at depths of 30 ft or less; the first reported catch was in 1915 (Organ et al. 1978). Spawning areas include the entire rock and

gravel shoreline of the outer basin (44°10', 83°20'), the waters around Charity Island (44°02', 83°26'), and all parts of the inner basin (43°50', 83°40') except the small central portion, which is deeper than 30 ft. Substrate in the inner basin is sand, clay, mud, and vegetation on the northwest shore; sand and gravel around Bay City (43°36', 83°52'); mud with some clay and sand along the southeast shore; and sand with some gravel and rock toward the middle of the basin (Organ et al. 1978). Saginaw Bay is also an important nursery area. During the mid-1970s, the bay was the only place in Lake Huron where yellow perch fry were more abundant than smelt fry (O'Gorman 1978). More yellow perch fry were found in the inner bay than in any other part of the lake (O'Gorman 1975). Young-of-the-year are generally found in every cut or ditch from Point au Gres (43°59', 83°41') to the Saginaw River (Gulvas, pers. comm. 1980). Fry inhabit the inshore water at depths of 12 ft or less during the summer and move to deeper water in October (Carr 1962; O'Gorman 1975; Wells 1968).

Alabaster (44°11', 83°33'). Ripe, running, and spent adults were gillnetted in April at water temperatures of about 39-45°F (Tex. Instrum. 1979d). Yellow perch was one of the most abundant larvae here in May and June; 7% of the prolarvae and 7% of the postlarvae taken were yellow perch (Tex. Instrum. 1979b,d).

Au Gres (44°03', 83°42')--Wigwam Bay (43°59', 83°50'). This is a good spawning area. Wigwam Bay is a major nursery area (Gulvas, pers. comm. 1980),

Pine River (43°59', 83°51'). A large run entered this river (Martin 1939a), but a run has not occurred since the early 1960s (Gulvas, pers. comm. 19801.

Pinconning (43°52', 83°58'). Ripe adults and eggs were collected here in mid- to late April (MWRC 1974).

Saginaw River (43°39', 83°51'). Spawning runs evidently entered the river, where spawners were reported in February 1907 (MSBFC 1909b). More recently, egg strands were found just east and west of the river mouth in late April-early May (MWRC 1974). No spawning occurs presently in the river, but large numbers of adults move inshore to spawn west and east of the river mouth. Ripe fish are found there as early as mid-March. Spawning begins in late April, when the water temperature is 59-61°F, and is mostly completed by late May, when many spent adults are found. Eggs were found on gillnets and taken in trawls in April (Beak Consult. 1976). At the Karn-Weadock Power Plant Complex (43°39', 83°51'), the impingement of adults was highest from mid-March to mid-May. Unfertilized eggs were entrained from late April to early June; the first larvae were entrained in late May (Consumers Power 1976c,d). The first fry were captured in trawls in late June (Beak Consult. 1976). During the mid-1970s, the greatest densities of fry in the U.S. waters of Lake Huron were found off the Saginaw River mouth in late May and early June (O'Gorman 1975).

Quanicasse (43°35', 83°40'). Yellow perch were 76% of the prolarvae and 50% of the postlarvae taken. Juvenile yellow perch made up 100% of the seine catch in June. The vegetated shoreline and sand bottom here provide good spawning habitat (Tex. Instrum. 1979b,e). Ripe fish and egg strands were found on April 13-18, indicating successful spawning (MWRC 1974).

Fish Point (43°43', 83°31')--Sand Point (43°55', 83°24'). The waters between these points and Charity Island (44°02', 83°26') appear to be heavily used for spawning (El-Zarka 1959; Jaworski and Raphael 1978). Adults were collected in this region April 18-June 7, and peak spawning occurred around mid-May (El-Zarka 1959).

Port Austin (44°03', 83°00'). Moderate numbers of fry were found here (O'Gonnan 1978).

MH-5

Pointe aux Barques Light (44°01', 82°48')--Richmondville (43°34', 82°36'). From 1917-1969, spawning occurred all along the shore over mud, sand, and rock to a depth of about 24 ft (Organ et al. 1978). Running-ripe adults were captured in the area from Harbor Beach (43°51', 82°39') to a location (43°55', 82°40') 5 mi N at depths to 45 ft; larvae were collected in this area in May-July, and peak abundance occurred in June (LaJeone, pers. comm. 1979; O'Gorman 1978). A few fry were collected at Richmondville in May (O'Gorman 1976, 1978).

MH-6

Richmondville (43°34', 82°36')--Burtchville Park (43°08', 82°30'). From 1917-1969, spawning occurred along shore over mud, sand, and rock to a depth of about 24 ft (Organ et al. 1978).

Port Huron (43°00', 82°26'). Yellow perch formerly spawned near the Number 2 buoy north of Port Huron, but the area was ruined by dredging (Dalton, pers. comm. 1979). At Port Huron, yellow perch generally spawned a few days later than the walleye (MSBFC 1909a).

Ontario

OH-1

South Bay (45°38', 81°52'). In 1964, early larvae were abundant in the upper bay; maximum abundance occurred in early June (Faber 1964).

OH-3

Fishing Islands (44°50', 81022'--44°43', 81°20'). In 1977, larvae were found throughout the area. Hatching may have begun around May 5 and continued to early June. The density of larvae peaked during the second week of May. Larvae were most numerous in Pike Bay (44°52', 81°20') (8,224 per 1000 m^3) and were also numerous in Stokes Bay (44°59', 81°23').

Newly hatched larvae were found on May 10 in Howdenvale Bay (44°49', 81°18') when the water temperature was about 42°F (Loftus 1977).

Douglas Point (44°19', 81°36'). Larvae were collected here from early June to early July (Kelso and Leslie 1979).

GB-3

Shawanaga River (45°32', 80°23'). An extremely large catch of adults was made here in the spring (Zimmerman 1966, 1967). Young-of-the-year were found in comparatively high numbers in the summer along shorelines throughout the Groundhog Islands (45°32', 80°30') area (Zimmerman 1966).

GB-4

Matchedash Sound (44°50', 79°50'). In 1977, yellow perch larvae were found at all sites sampled. Hatching began in late April and continued for about one month. The highest density of larvae (35,000 per 1000 m3) occurred at Bergie Point (44°45', 79°47') on June 13 (Loftus 1977).

CHANNEL DARTER

Michigan

MH-1

Cheboygan River (45°39', 84°28'). Channel darters migrate into the river to spawn in July at water temperatures of 69-72'F. The spawning ground, about 1 mi above the river mouth, has a substrate of rock, gravel, and sand, a swift current, and a water depth of 1-1/2 to 5 ft (Winn 1953).

SAUGER

Michigan

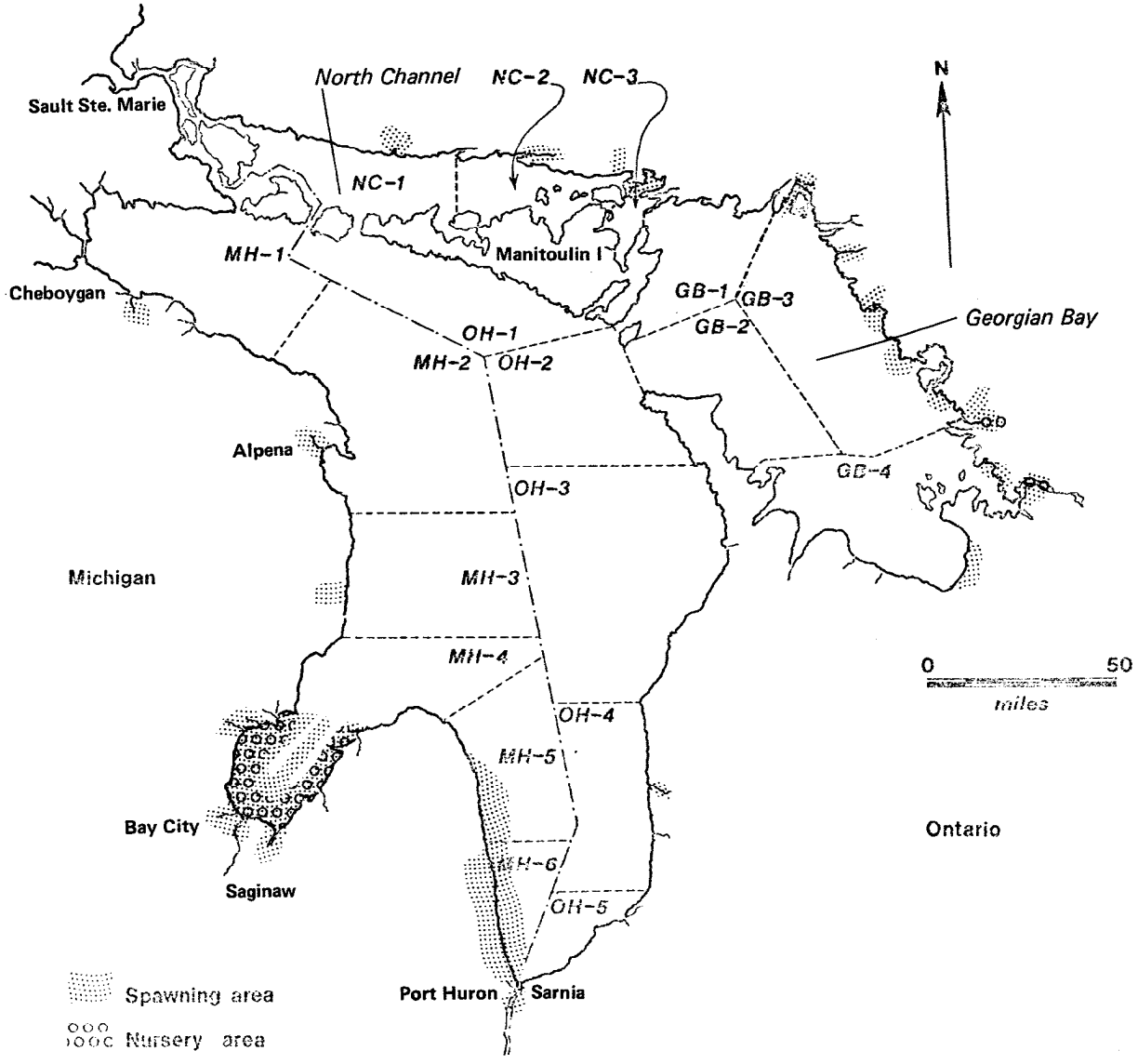
MH-2

Thunder Bay (45°00', 83°20'). In the 1880s, large numbers were caught here in the spring (MSBFC 1887).

MH-4

Saginaw Bay (44°00', 83°30'). In 1933-35, ripe fish were caught between Point Lookout (44°03', 83°35') and Point Au Gres (43°59', 83°41') over clay in 6-30 ft of water (Organ et al. 1978).

WALLEYE



Various distinct walleye stocks exist in Lake Huron. Alteration of spawning habitat was the primary cause for the decline of stocks in the lake (Schneider and Leach 1977).

Michigan

MH-1

Point De Tour (45°57', 83°55'). In the northwest part of Lake Huron, the largest concentration of walleyes occurred in the vicinity of De Tour.

(Schneider and Leach 1979). These fish presumably remained in the area or migrated into the St. Marys River to spawn.

Cheboygan River (45°39', 84°28'). Substantial walleye spawning runs occurred in the river as early as the mid-1800s. The run was adversly affected by the installation of dams, which began in 1847, and by sawmills, papermills, and logging; by 1903 it was negligible (Schneider and Leach 1979). A small spawning run developed in later years. For many years, walleyes were collected at the Cheboygan Dam near the river mouth during March and April and transferred upstream (Eschmeyer 1950; Eschmeyer and Crow 1955; Schneider and Leach 1979; Shetter 1937). On April 28, 1948, viable eggs were collected below the Alverno Dam on the Black River, which is a tributary to the Cheboygan River (Eschmeyer 1950) and a major spawning area (Schneider and Leach 1974). Spawning runs occurred in the Cheboygan River during the 1970s (Schneider and Leach 1979).

Ocqueoc River (45°29', 84°04'). Walleyes in large numbers have been caught in the Ocqueoc River, but it is not known if these are stream residents or migrants from Lake Huron (FWS 1979c). Some were taken in early years in Hammond Bay (45°30', 84°05') (Schneider and Leach 1979).

MH-2

Thunder Bay River (45°04', 83°26'). Industrial and sawmill pollutants and dams are believed to have altered the spawning habitat in the Thunder Bay River, causing declines in the populations in the 1920s (Schneider and Leach 1977, 1979). A spring run of walleyes entered the Thunder Bay River in 1925 but not in the 1930s (Schneider and Leach 1979).

MH-3

Au Sable River (44°24', 83°19'). Alteration of spawning habitat caused declines in the spawning population of walleyes in the river in the late 1800s; few survived the logging and lumbering era (Schneider and Leach 1977, 1979). Before dams were built in 1911, walleyes migrated about 88 mi upstream to the mouth of the North Branch (Miller 1966, as cited in Schneider and Leach 1979).

MH-4

Saginaw Bay (44°00', 83°30'). Saginaw Bay has historically been the primary spawning area for walleyes in Lake Huron. Eggs were taken from spawning populations in the bay as early as the 1800s (Nepszy 1977) and into the early 1900s, when mature fish were taken just after ice breakup at temperatures of 35-39°F (Downing 1905; Martin 1939b; MSBFC 1888, 1895, 1890; Westerman 1928, 1930, 1933, 1934, 1937, 1940, 1942). Spawning migrations historically began in late March or early April and lasted 2-3 weeks (Cook 1940; Goode 1884; Hile 1954; MSBFC 1895; Rathbun and Wakeham 1897; Westerman 1927). Spawning began when the water temperature reached 40°F and continued until the temperature reached 50-55°F (Cook 1940).

Commercial fishermen reported that spawning usually began after ice breakup (Martin 1939b; Organ et al. 1978); others reported that spawning occurred under the ice in Saginaw Bay (Eschmeyer 1950; Westerman 1927). Between 1929 and 1956, more than 50% of the commercial catch was made in April (Hile and Buettner 1959).

The increased turbidity and siltation in Saginaw Bay in the 1940s was suggested as a cause for the decline in spawning populations in the bay and for the deterioration of spawning runs to areas near the mouth of the Saginaw River (43°39', 83°51′) and its tributaries. The deterioration beqan in the last century; the runs persisted until water quality became too severe in the 1940s (Leach et al. 1977; Schneider and Leach 1977). The major decline occurred in 1944 (Schneider and Leach 1979). The installation of dams on the tributaries also adversely affected spawning runs (Leach et al. 1977).

The inner bay and its tributaries served as the major spawning and nursery areas until the 1940s (Schneider 1977; Schneider and Leach 1977, 1979). Spawning occurred all along the shore of the bay and in the shallow areas, including the Charity Islands (44°01', 83°27') and Coreyon Reef (44°00', 83°28'--43°40', 83°50'), over a variety of substrates (Organ et al. 1978). Many of these areas were not used after the 1930s and 1940s, but in some areas along the southeast shore and in the outer portion of the bay, spawners are still being caught (Organ et al. 1978).

Eggs were collected from fish at Caseville (43°57', 83°17') and Point Au Gres (43°59', 83°41′), but the prime spawning areas in the bay were off the mouth of the Saqinaw River; along the shores of the inner bay as far as 19 mi from the river mouth; along the shore between Quanicasse (43°35', 83°40') and Fish Point (43°43', 83°31′); along the outer edges of the islands between Sebewaing (43°44', 83°27') and Bay Port (43°51′, 83°22′); and on Coreyon Reef, a shallow bar extending from the mouth of the Saginaw River to the Charity Islands. Spawning also took place along the west shore of the bay between Rifle Bar (43°58', 83°43') and Nayanquing Point (43°46′ , 83°56′) (MSBFC 1890; Schneider 1977; Schneider and Leach 1979).

The Saginaw River supported larger spawning concentrations than the other tributaries to the bay (Rathbun and Wakeham 1897; Schneider 1977). As early as the 1870s, large numbers of spawners were seined at the mouth of the river as soon as the ice broke up (Milner 1874a). Seine fisheries were also carried out near the Kawkawlin (43°40', 83°53'), Pine (43°59', 83°51'), and Rifle (44°00', 83°45') rivers (MSBFC 1890; Schneider 1977). In 1976, one ripe male was caught near the mouth of the Saginaw River at the end of April, and five juveniles 9-10 in. long were taken at the end of June (Beak Consult. 1976). A few "prejuveniles" were also entrained in late June and early August at the Karn-Weadock Power Plant Complex (43°39', 83°51′) (Consumers Power 1976c). The first run in the Quanicasse River (43°35′, 83°41′) since the 1940s occurred in 1980 (Mainville 1980).

MH-S, MH-6

Harbor Beach (43°51', 82°39')--St. Clair River (43°00', 82°25'). Commercial fishermen reported that spawning occurs along the shore from Harbor Beach south to Burtchville Park (43°08', 82°30') over a substrate of mud, sand, and rock within the 30 ft depth contour (Organ et al. 1978). Spawning runs entered streams along the Lake Huron south shore and the St. Clair River (Rathbun and Wakeham 1897). In 1935, runs occurred in all waters south of Forester (43°30', 82°34') (Hile 1937).

Walleyes are presently believed to migrate from Lake Huron into the St. Clair River to spawn in May (Ferguson and Derkson 1971; Schneider and Leach 1977). Tagged walleyes have also migrated into Lake Huron, after spawning in the Thames River (42°19', 82°27') in Lake St. Clair (Ferguson and Derkson 1971; Int. Great Lakes Level Hoard 1973).

Ontario

OH-4

Maitland River (43°45', 81°44'). A spawning run enters the river in the spring after the sucker run begins (Moccia, pers. comm. 1979).

OH-5

Spawning occurs on shoals along the southeast shore of the main lake basin (Spangler et al. 1977). Spawn was collected in the southern portion of the lake (Ont. Game Fish 1939). In the early part of the century, eggs were obtained from fish on seining grounds at Sarnia (43°00', 82°24') and Point Edward (43°00', 82°25') (Can. Dep. Mar. Fish. 1905; Rodd 1913, 1914).

Healthy stocks of walleyes existed in Georgian Bay in the mid-1970s (Schneider and Leach 1977), and there appear to be several discrete stocks that spawn there (Winterton 1975). Spawning occurs at 38-40°F; the numerous rivers along the east shore of the bay provide extensive areas of rapids which are ideal spawning grounds (MacKay 1958e, 1969). Historically, spawning occurred in late April-early May, just after ice out (Bensley 1915; Rathbun and Wakeham 1897). In 1931, it was suggested that the southeastern portion of the bay, along with inshore areas of the north shore, be closed to'provide a "spawning sanctuary" (Ont. Game Fish 1931). Walleye reproduction has been reported in the following areas of Georgian Bay:

The North Channel was a prime walleye spawn collecting area (Ont. Game Fish 1913a). Spawning declined during the 1930s, but healthy stocks of walleyes existed in portions of the North Channel in the mid-1970s (Schneider and Leach 1977, 1979).

NC-1

Blind River (46°11', 82°57')--Mississagi River (46°10', 83°01'). Spawning occurs in these rivers usually from April 20 to May 15 (Environ. Can. 1977c; Payne 1966; Spangler et al. 1977). Spawning may also occur along shore between the rivers (Payne 1966), where ripe adults have been seen (Spangler et al. 1977). A gradual decline in this stock occurred in the 1930s, possibly due to sedimentation (Schneider and Leach 1979).

NC-2

Spanish River (46°11', 82°19'). Paper mill pollution was thought to have caused the decline of the walleyes spawning in the river in the 1920s (Schneider and Leach 1977, 1979).

Little Current (45°59', 81°56'). This was a prime area for spawn collection (Ont. Game Fish 1913a, 1943, 1948); the streams and rivers here were full of walleyes until at least mid-May (Ont. Game Fish 1945).

Whitefish River (46°07', 81°44'). Spawn was collected at Whitefish Falls (46°07', 81°45') (Ont. Game Fish 1945; Ont. Dep. Lands Forests 1948).

NC-3

McGregor Bay (46°01', 81°43'). Spawning walleyes were observed in the channels between islands in the bay (Zimmerman 1967).

GB-3

French River (45°56', 80°54'). One of the major Georgian Bay stocks spawns here (Schneider and Leach 1979).

Magnetawan River (45°46', 80°38'). Walleyes were plentiful on the rapids on May 8 (Ont. Game Fish 1913a); they began arriving on the spawning grounds in early May, and some were still found there in late May (Ont. Game Fish 1912).

Bayfield-Nares Inlet (45°34', 80°31'). A shoal-spawning stock of walleyes uses this area (Spangler et al. 1977).

Sturgeon Bay (45°36', 80°24'). The "pickerel" left the bay by early May after spawning (Ont. Game Fish 1912).

Shawanaga River (45°32', 80°23'). A relatively discrete population spawns in the river (Zimmerman 1966, 1967). The basin is suspected by sportsmen of being the primary spawning ground for most walleyes in the Pointe au Baril (45°34', 80°30') region (Zimmerman 1967). Spawn collection from ripe fish at Shawanaga (45°31', 80°23') occurred as early as 1915 (Rodd 1917). The spawners apparently come from the nearshore areas, as there is no migration from the offshore fishing grounds. In 1965, spawning was completed by May 15-16 (Zimmerman 1967); in 1966, spawning was still occurring on May 7-9 (Zimmerman 1966); and in 1967 most spawning was completed by May 10 (Zimmerman 1967). The spawning site is 2

mi upstream, just below the first falls, and has a substrate of large boulders and smooth bedrock. The lack of smaller rubble and gravel may be affecting spawning success (Winterton 1970). Most of the spawners remain in the basin until the end of June and then move out into the bay; some then move out to Groundhog Island (45°32', 80°30'). About 95% of the tagged fish were recovered within 5 mi of the basin, and the population is not considered to be migratory (Ont. Dep. Lands Forests 1968; Zimmerman 1967). Another population spawns on the shoals of Groundhog Island, just off the Shawanaga River. Spawning occurs from mid-April to the end of May; peak spawning occurs in the first 2 weeks of May (Spangler et al. 1977; Winterton 1970; Zimmerman 1966, 1967).

Carolyn Island (45°30', 80°29') and Woodland Islands (45°33', 80°30'). Spawning occurs here (Environ. Can. 1977c).

Sequin River (45°20', 80°02') and Spider Lake (45°13', 80°01'). Spawning occurs here (Environ. Can. 1977c), but it is not known if these fish are migrants from Lake Huron.

Blackstone River (45°11', 80°00'). Some walleyes from the Moon River stock also spawn here when there is suitable flow in the river (Winterton 1972, 1975). Spawning occurs in Blackstone Harbour (45°10', 79°59') (Environ. Can. 1977c).

Moon River (45°08', 79°59'). A large stock of walleye enters this river to spawn (Ont. Dep. Lands Forests 1969, 1971; Spangler et al. 1977; Winterton 1972, 1975). Spawning occurs consistently below the first falls, over rubble in a pool on the south side; if the flow there is too great, spawning occurs further downstream. Spawning usually takes place from mid-April to the end of May; peak spawning occurs during the first 2 weeks of May. Ripe and spent females have been found in the river throughout this period, and naturally recruited fry have been found moving downstream (Thurston 1973, 1975). Spent walleyes move to onshore areas throughout the islands during May and June, and in July they migrate to offshore shoals. Over 90% move to the Watchers Islands (44°57', 80°04'), about 21 mi S; the remainder move north to Sandy Island (45°16', 80°16'). In October and November, walleyes return to the Moon River Islands (45°09', 80°01'), where they remain until spawning season (Winterton 1972, 1975).

GB-4

Cognashene Lake (44°57', 79°55'), Longuissa Bay (44°58', 79°53'), and Musquash River (44°58', 79°53'). Spawning occurs here (Environ. Can. 1977c). In 1910, the walleye had not yet arrived in the Musquash River on April 25 (Ont. Game Fish 1911); in 1911, all fish were spent by the second week of May (Ont. Game Fish 1912).

Port Severn (44°48', 79°43'). The Severn River (44°53', 79°42') supports a major walleye stock (Schneider and Leach 1979). Spawning runs occur here, and the spawning grounds lie between the Highway 103 bridge and the dams on the Trent-Severn Waterway. In 1974, walleyes arrived here on April 22 and completed spawning by May 2 (Hogq 1974). In 1977, eggs were first found on April 20 when the water temperature was about 47°F;

some larvae were collected on May 5 (Loftus 1977). Spawning occurs over gravel in the fast, shallow water near the locks (Townes 1976). A major spawning area is in swift current adjacent to the small spillway just north of the locks (Townes, undated).

Waubashene (44°45', 79°43') and Nottawasaga Bay (44°40', 80°15'). Walleyes were fished at the head of the bays, where they moved into rivers even under the ice (Rathbun and Wakeham 1897). Many walleyes have been captured in the Nottawasaga River (44°33', 80°00') in April-July (Dahl and McDonald 1980).

Port Severn (44°48', 79°43'). The Severn River (44°53', 79°42') supports a major walleye stock (Schneider and Leach 1979). Spawning runs occur here, and the spawning grounds lie between the Highway 103 bridge and the dams on the Trent-Severn Waterway. In 1974, walleyes arrived here on April 22 and completed spawning by May 2 (Hogg 1974). In 1977, eggs were first found on April 20 when the water temperature was about 47°F; some larvae were collected on May 5 (Loftus 1977). Spawning occurs over gravel in the fast, shallow water near the locks (Townes 1976). A major spawning area is in swift current adjacent to the small spillway just north of the locks (Townes, undated).

FRESHWATER DRUM

Spawning by freshwater drum is limited in Lake Huron because the water temperature required for spawning (70°F) is reached only for a short time in most areas of the lake (Daiber 1950).

Michigan

MH-4

Saginaw Bay (44°00', 83°30'). The greatest numbers of drum occur in Saginaw Bay. Spawning occurs from Wigwam Bay (43°59', 83°50) to Saganing Bar (43°55', 83°51') over sand and vegetation at depths of about 4-10 ft (Organ et al. 1978). Fry were collected at the discharge of the Karn-Weadock Power Plant Complex (43°39', 83°51') in late June and late September (Beak Consult. 1976).

SLIMY SCULPIN

Ontario

OH-3

Douglas Point (44°19', 81°36'). In 1975, larvae were found here in moderate numbers in mid- to late July (Kelso and Leslie 1979).

FOURHORN SCULPIN

Michigan

In 1975 and 1978, very small numbers of larvae were found in the nearshore waters of St. Martin Bay (46°00', 84°37'), Hammond Bay (45°30', 84°05'), Thompsons Harbor (45°21', 83°36'), Thunder Bay (45°00'; 83°20'), and off Point Au Gres (43°59', 83°41') in late April through May (O'Gorman 1975, 1978). Upwellings may have swept these larvae into the nearshore waters from their normal deepwater habitat (O'Gorman 1975).

MH-2

Rockport (45°12', 83°23'). Postlarvae of this species made up 15% of the total catch of larvae in April and May (Tex. Instrum. 1979b,c).

MH-4

Alabaster (44°11', 83°33'). Postlarvae of this species made up 8% of the total catch of larvae (Tex. Instrum. 1979b,d).

MH-5

Harbor Beach (43°51', 82°39'). A few larvae were collected here over a substrate of boulders and rocks (LaJeone, pers. comm. 1979).

Ontario

OH-1

South Bay (45°38', 81°52'). In the late 1960s, postlarvae were found in small numbers along shore in April and May immediately after ice breakup. Larvae were numerous in certain years just outside the entrance of the bay. Larvae may move into the bay after hatching in the lake or may hatch in the bay before ice breakup (Faber 1970). In 1977, larvae were numerous in the bay (Loftus 1977).

OH-3

Douglas Point (44°19', 81°36'). Fourhorn sculpin larvae were collected here (Dunford 1978b) and were abundant in April through June (Dunstall 1978a; Kelso and Leslie 1979). Larvae were entrained at the Bruce Generating Station in April through June at water temperatures of about 37-54°F; eggs were entrained in April (Dunstall 1978a).

GB-4

Meaford (44°37', 80°35'). In 1977, larvae were captured in late April and early May, and spawning may occur here (Loftus 1977).

50272-101

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15. Supplementary Notes

This document is one of a set of fourteen volumes.

16. Abstract (Limit: 200 words)

This atlas is a compilation of current spawning and nursery information concerning the fishes of the Great Lakes. The complete set consists of fourteen volumes. The information may be used to support permit and project reviews, impact statement reviews, planning of baseline research, and coordination with other agencies, and identification of data gaps. The report locates spawning and nursery areas in the Great Lakes and describes spawning and nursery characteristics, timing, and habitats of major fish species of the Great Lakes area.

The first volume is a summary by geographic area, volumes II through XII contain the specific areas referenced in volume I. Volume XIII contains the species spawning and nursery characteristics for the major species, and Volume XIV cites the references used in compiling this work.

The titles of the volumes addressing the spawning and nursery areas for each fish species site specifically are: II., Lake Superior; III, St. Mary's River; IV, Lake Michigan; V, Lake Huron; VI, St. Clair River; VII, St. Clair Lake: VIII, Detroit River; IX Lake Erie; X, Niagara River; XI, Lake Ontario; XII, St. Lawrence River. The title of Volume XIV is, Species Reproduction Characteristics.

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