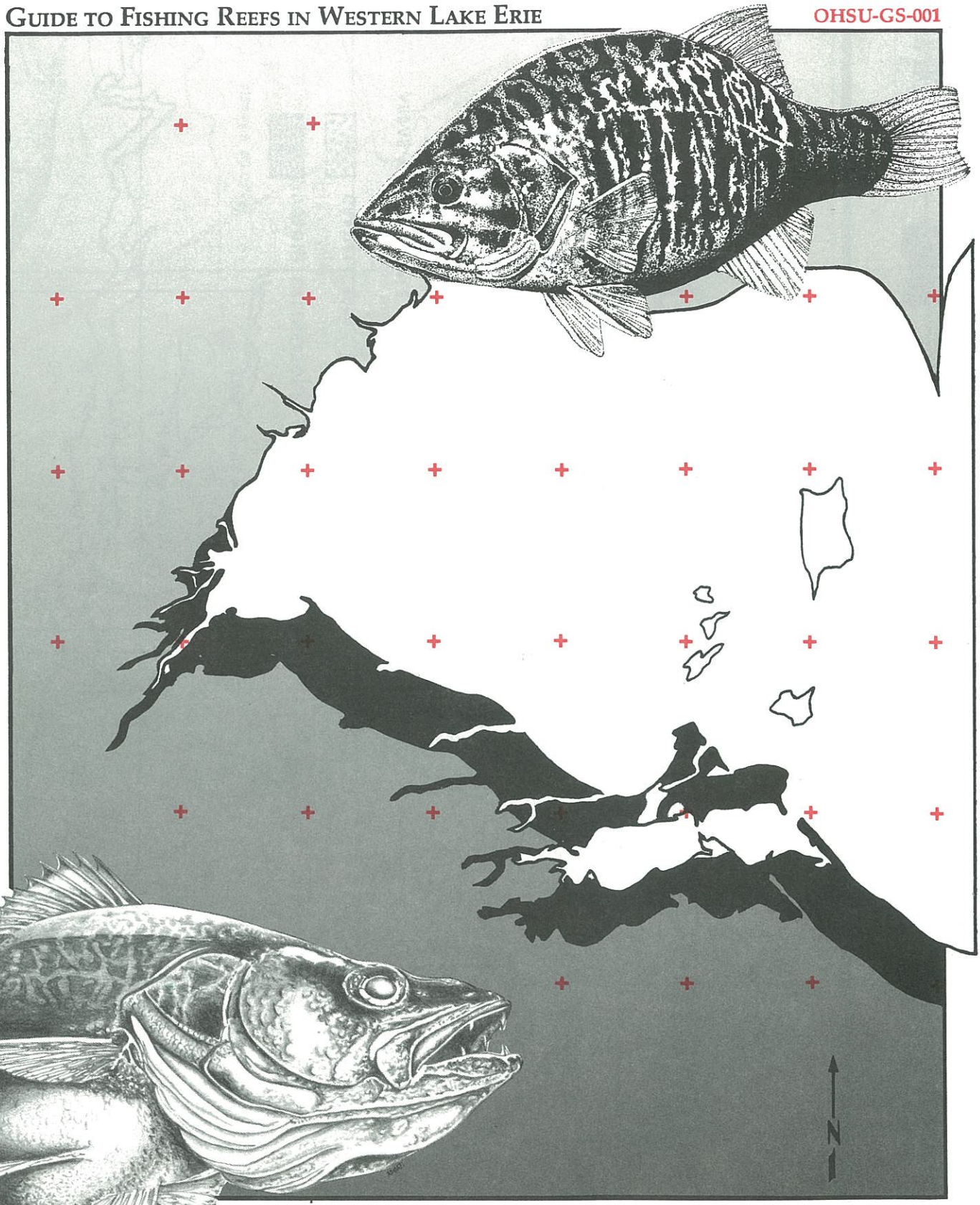
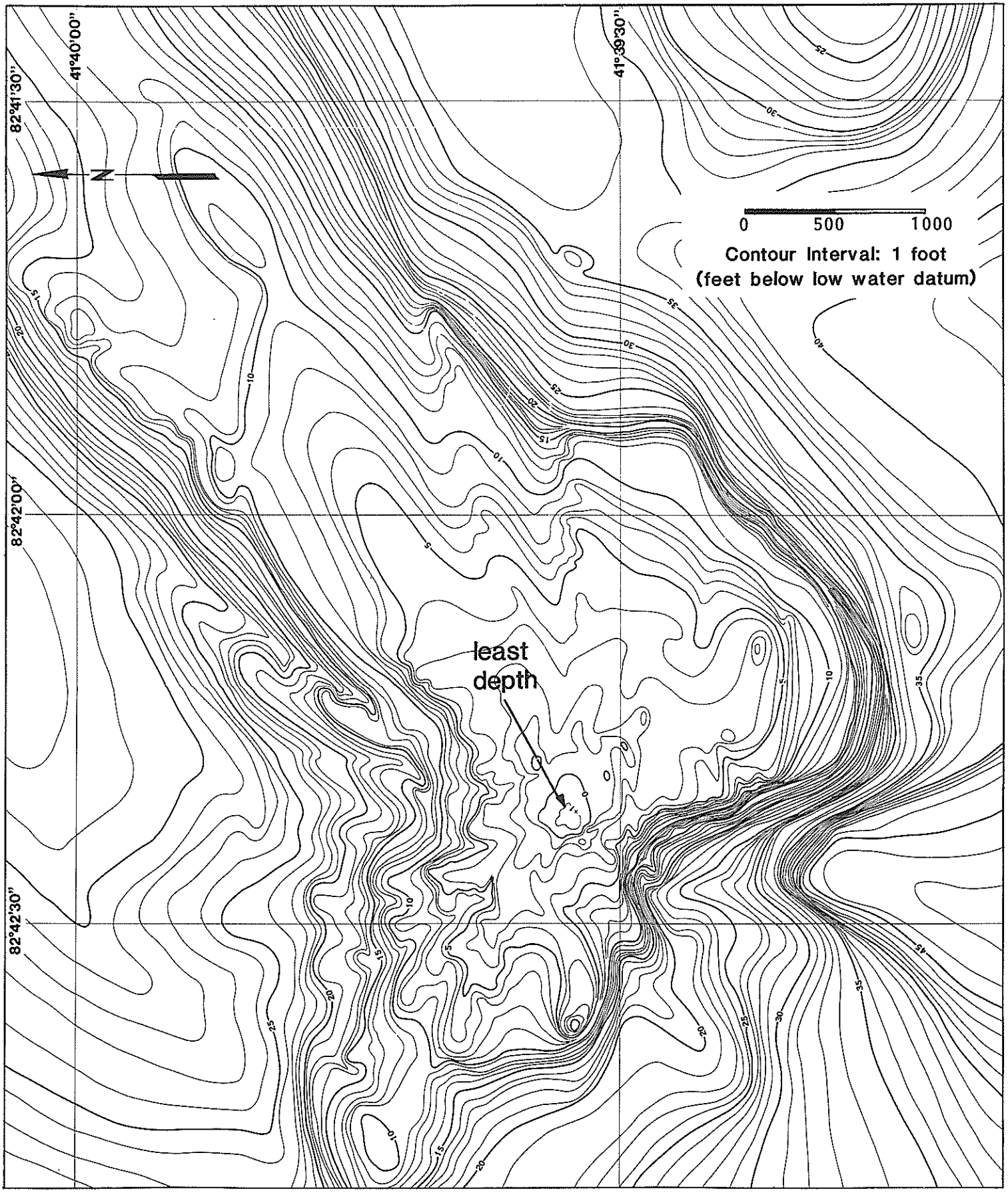
OHSU-GS-001



Guide to Fishing Reefs in Western Lake Erie

Ohio Sea Grant College Program

Bathymetric Map of Gull Island Shoal



made with a recording echo sounder and detailed bathymetric (depth contour) maps were constructed for each reef. The surface acres for each one-foot depth interval for these reefs are given on the table in this guide. A bathymetric map for Gull Island Shoal is also included here.

REEF CHARACTERISTICS

The least depths over the reefs range from 1 foot above Low Water Datum (568.6 feet above mean water level in the Gulf of St. Lawrence at Father Point, Quebec) for Gull Island Shoal to 30 feet below this datum for Northwest Reef. The mean water level for Lake Erie is approximately 1.8 feet above this datum. Most of the reefs are conical in shape and elongated, as are many of the islands, in a northeast-southwest direction. Two factors appear to have influenced this elongation: (1) vertical joint systems in the bedrock are oriented parallel to the elongation (Hartley, 1962) and (2) the major movements of glacial ice, as deduced from grooves found on most of the islands, were from northeast to southwest.

Typically, the reefs consist of bedrock (limestone and dolomite deposited during the Devonian and Silurian Periods, 350-425 million years ago) and associated rock rubble and gravel. The topography of the reef tops ranges from rugged surfaces caused by bedrock pinnacles and large boulders to smooth slabs of horizontally bedded rocks. In places the submerged bedrock has the appearing of low stairs, with the steps dipping slightly to the east from the fringe of the reef to its crest.

Because all of the bedrock formations that form the reefs are carbonate material, abundant solution cavities, many up to 1 or 2 cm (.78 of an inch) in diameter, have formed in the rocks. These cavities are important features in that they are often the site of walleye egg deposition. Eggs held in these depressions are protected from wave attack and strong currents which could wash them onto soft sediment beds where they could be smothered.

The bedrock core of the reef is commonly masked by rubble composed of both local (broken fragments of the bedrock) and glacial origin, ranging from small pebbles to boulders up to 5 feet in diameter. On the upper portions of the reefs, isolated patches of sand and gravel commonly fill vertical joint cracks and small depressions in the bedrock; at the fringes of the reefs sand and gravel or glacial till lap over the rock. Glacial till consists of a random mixture of gravel, sand, silt and clay.

FOR MORE INFORMATION

Additional copies of this publication and other publications of interest for Lake Erie sport anglers can be obtained from the:

Ohio Sea Grant College Program
The Ohio State University
1314 Kinnear Road
Columbus, OH 43212-1194
614/292-8949

Other publications of interest for Lake Erie sport anglers can be obtained from the:

Ohio Department of Natural Resources (Publications)
Fountain Square
Columbus, OH 43224
614/265-6565

Charts and related publications may be ordered from:

Distribution Branch (N/CG33)
National Ocean Service
Riverdale, MD 20737-1199
301/436-6990

Authorized natical chart sales agents in the western basin of Lake Erie include:

IN HURON: Harbor North, Holiday Harbor Marina Inc. and Huron Lagoons Marina Inc.;
IN MARBLEHEAD: Marine City;
IN PORT CLINTON: Brands' HJ Marina, Catawba Island Marina Inc., Fishermans Wharf, Foxhaven Marina Inc., Gem Beach Marina Inc., Portage Entry Marine Inc., Rickards Bait & Tackle, SOS Marine Store and Treasure Cove Marina;
IN PUT-IN-BAY: Wharfside;
IN SANDUSKY: Battery Park Marina, Bob Clemons Boots, Cedar Point Inc. Marina Division, Herb's Sportsmen Supplies;
IN TOLEDO: Brenner Marine Inc., Harrison Marina Ltd., Leo's Book & Wine Shop, Mastercraft's Marineland, North Harbor Marina Inc., The Dock Box Inc., The Tackle Box Inc.;
IN VERMILION: Great Lakes Historical Society and Romp's Water Port Inc.

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LAKE ERIE ISLAND REGION

The Ohio island region encompasses that part of western Lake Erie between longitude 82°37'W to 83°208'W and south from latitude 41°45'N (west of the Bass Islands) or the international boundary (east of the Bass Islands) to the Ohio mainland shore. The region is roughly bounded on the northwest by West Sister Island, on the north by North Bass Island, on the northeast by Middle Island, on the east by Kelleys Island, on the southeast by Cedar Point, on the south by the Ohio mainland and on the southwest by Locust Point. This is an area consisting of approximately 362 square miles, including 9.5 square miles of islands.

In contrast with the other basins of Lake Erie (central and eastern) a number of bedrock islands, reefs and shoals are situated in the western basin. These form a partial divide between the western and central basins. The entire western basin (west of a line from Pelee Point, Ontario to Cedar Point, Ohio) has an area of 1,265 square miles, 13% of Lake Erie. However, its volume, at 5.8 cubic miles, is only 5% of the volume of the entire lake because of its shallowness. The average depth of the western basin is only 24 feet. The lake bottom is quite flat except for the sharply rising islands and reefs.

In the western half of the island region the lake bottom slopes gently lakeward from the mainland shoreline at 3 feet per mile. Between the Bass Islands and Kelleys Island this slope is 6 feet per mile and it increases to 15 feet per mile lakeward of Cedar Point. The steepest bottom slopes are found near the islands and reefs. In South Passage the bottom gradient exceeds 60 feet per mile. The maximum depths in the region are found in the inter-island channels. The deepest sounding, 62 feet, was made in a small depression north of Starve Island Reef. Another depression north of Gull Island Shoal is 54 feet deep. Elsewhere in the region deeps do not exceed 45 feet.

The islands and reefs are arranged in three roughly north-south belts. The most westerly belt lies north of Locust Point and includes at least 12 reefs and West Sister Island. The middle belt extends from Catawba Island (peninsula) through the Bass Islands and consists of at least 14 reefs and 10 islands. The easterly belt encompasses Marblehead peninsula, Kelleys Island and at least 7 reefs. This arrangement of the islands and reefs seems to be controlled mainly by the gentle folding structure of the underlying bedrock and its relative resistance to weathering.

The shores of all the islands are rockbound and rugged, with bluffs along the majority of the island coasts. The highest elevations are normally on the west shore, except for West Sister Island, where the bluffs are highest along the east shore. The west shore of South Bass Island reaches a height of 70 feet above the mean lake level, the highest elevation in the island region. Small beaches composed of sand, cobbles or boulders are found at indentations in the shoreline. The most extensive sand beach lies along the north bay of Kelleys Island.

WHAT IS A LAKE ERIE REEF?

The Ohio Revised Code, Section 1531.01 (DD), defines *reef* as

> *"an elevation of rock, either broken or in place, or gravel shown by the latest United States chart to be above the common level of the surrounding bottom of the lake, other than the rock bottom, either broken or in place, forming the base or foundation rock of an island or mainland and sloping from the shore thereof."*

A *reef* also means,

> *"all elevations shown by such chart to be above the common level of such sloping base or foundation rock of an island or mainland, whether running from the shore of an island or parallel with the contour of the shore of an island or in any other way, whether formed by rock, broken or in place, or from gravel."*

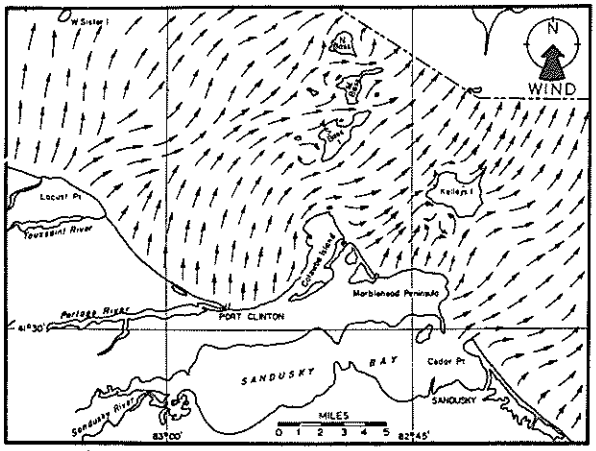
Definition (CC) of the same section of the Ohio Revised Code describes an *island* as "a rock or land elevation above the water of Lake Erie having an area of five or more acres above water."

The Ohio Revised Code does not define the word *shoal*. However, the National Ocean Survey charts use the terms reef and shoal for similar topographic features and they are considered synonymous in this guide.

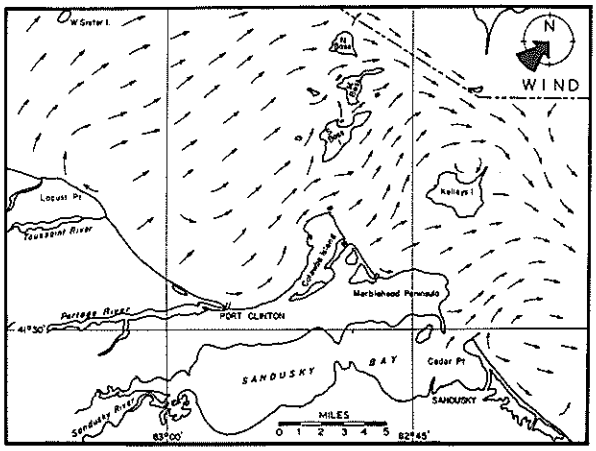
Using the legal definition as a guide, there are over 30 reefs or reef clusters shown on National Ocean Survey charts of the island region, but only 8 of these are officially named. For convenience, the other prominent reefs are labeled in this guide with names used by local fishermen.

Thirteen of these reefs were selected for special study by the Ohio Department of Natural Resources, Division of Geological Survey (Herdendorf and Braidech, 1972). Depth soundings were

for the Island Region



I, Generalized surface currents, moderate south wind



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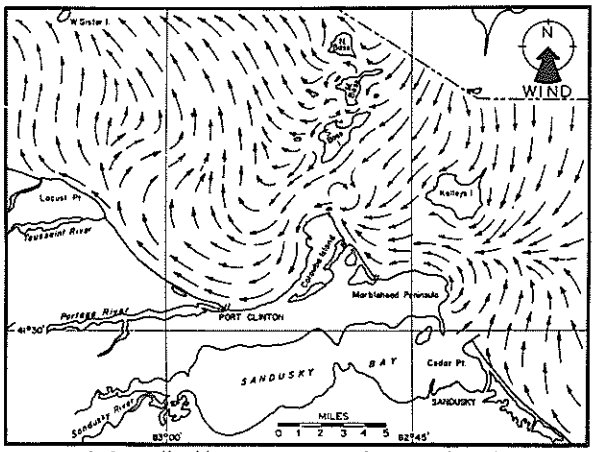
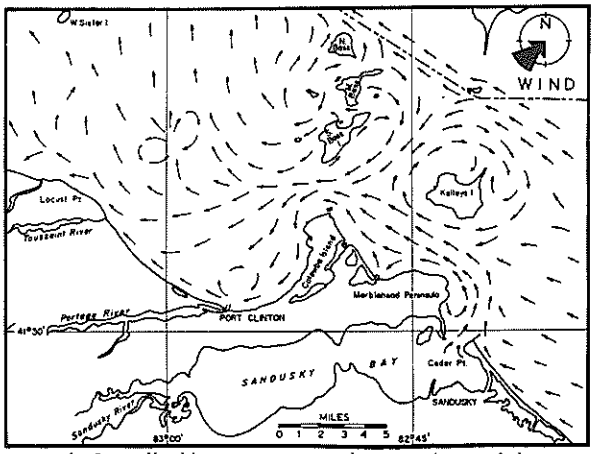


J, Generalized bottom currents, moderate south wind



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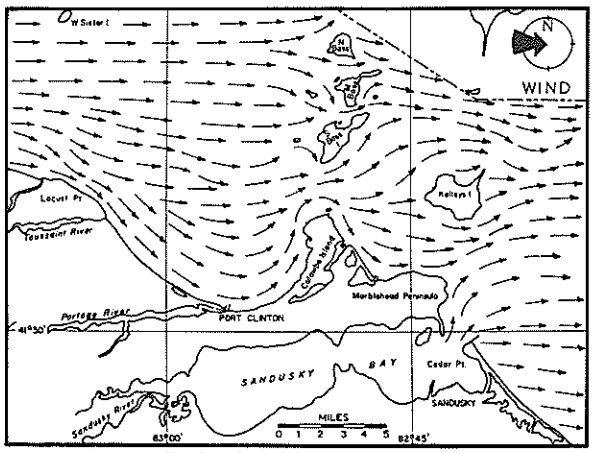

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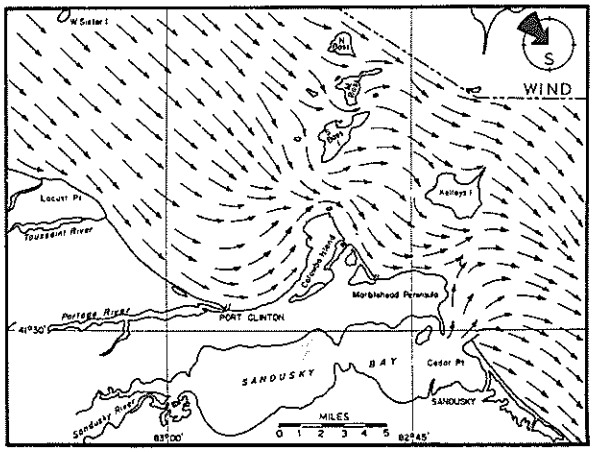
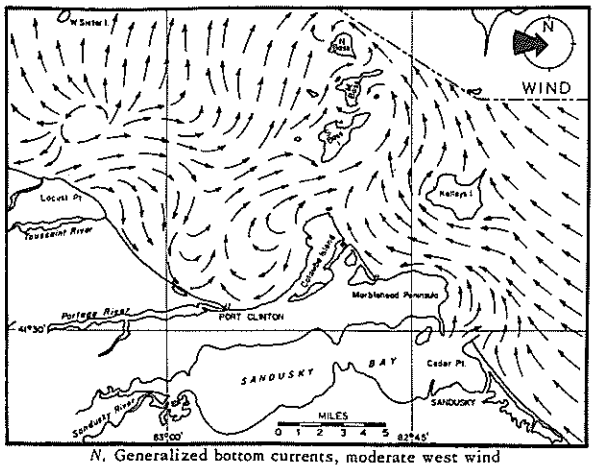
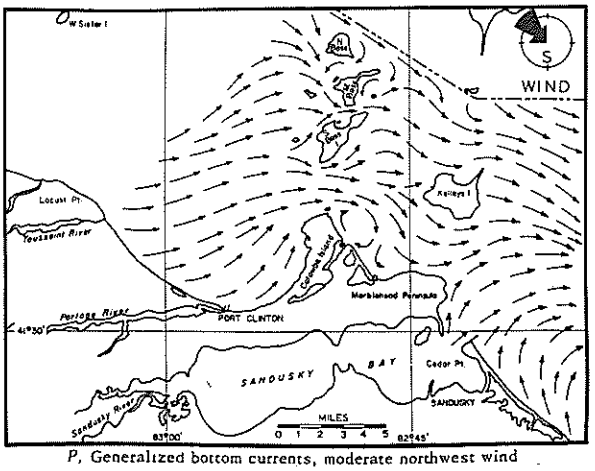


O, Generalized surface currents, moderate northwest wind

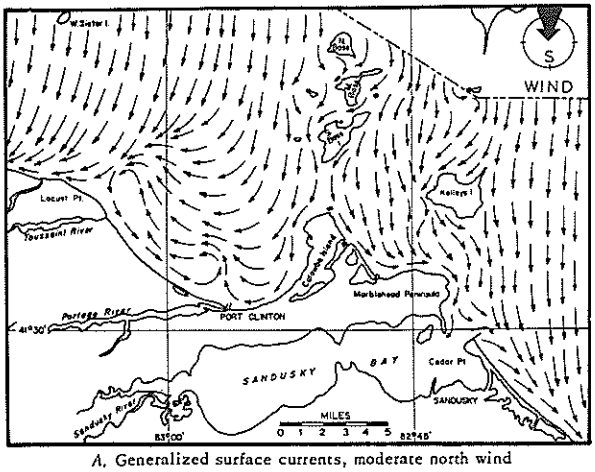


N, Generalized bottom currents, moderate west wind

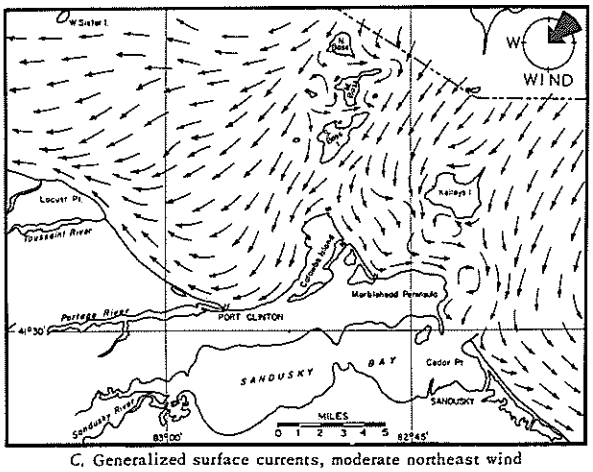


P, Generalized bottom currents, moderate northwest wind

Diagrams of Current



A, Generalized surface currents, moderate north wind



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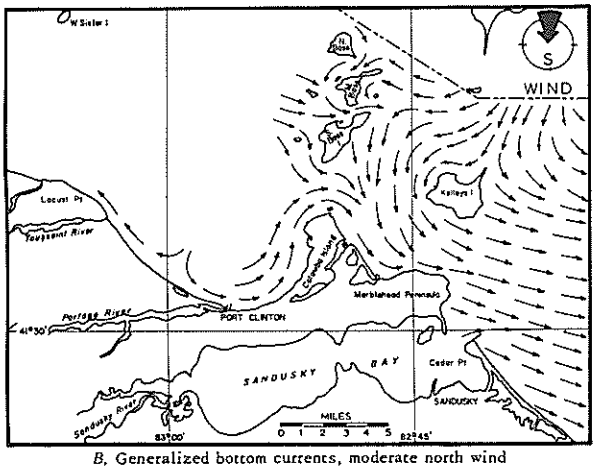
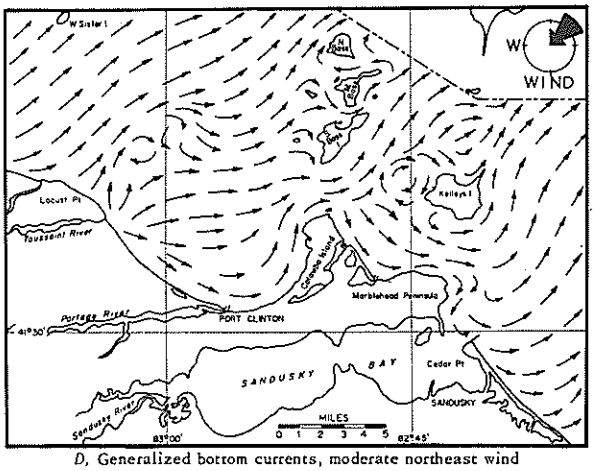
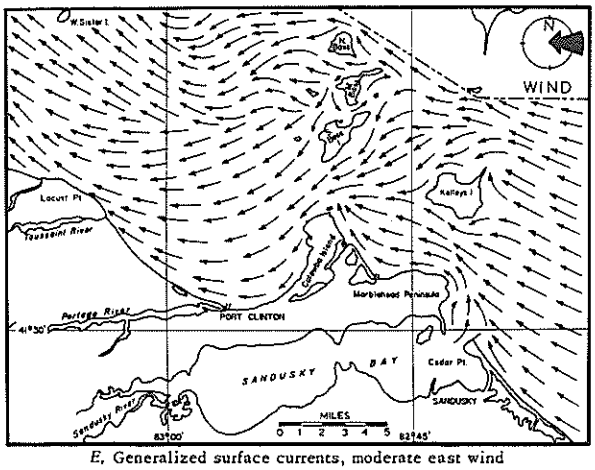


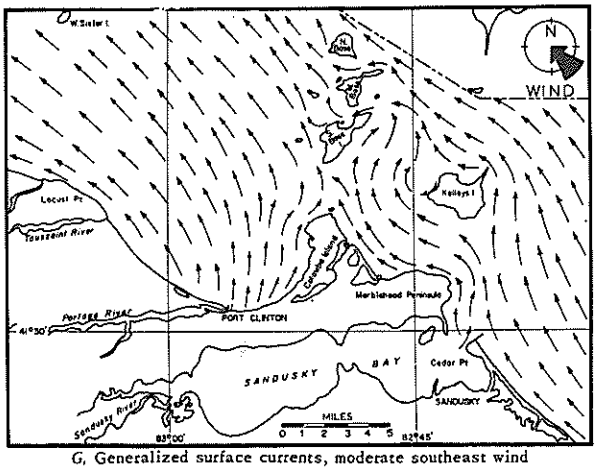
B, Generalized bottom currents, moderate north wind



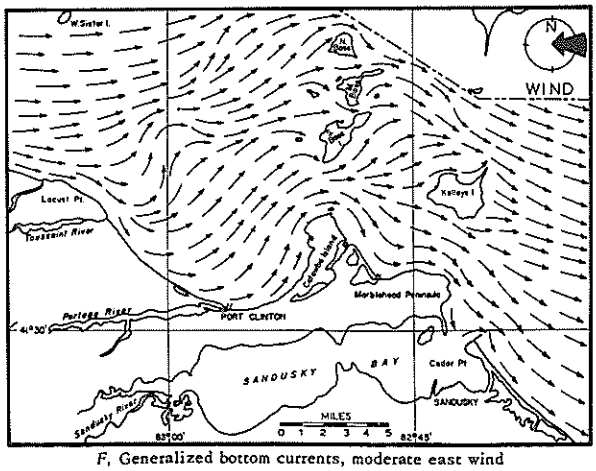
D, Generalized bottom currents, moderate northeast wind



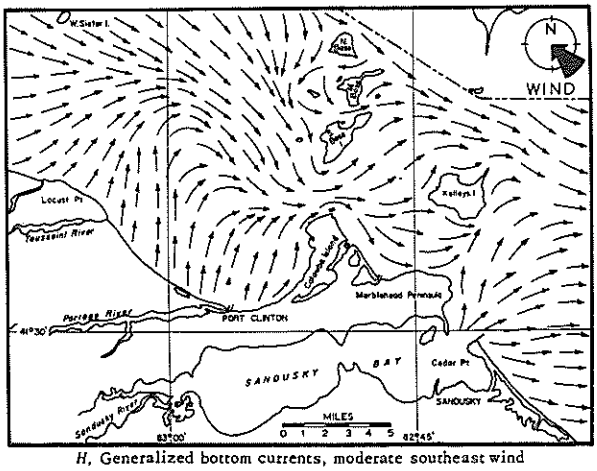
E, Generalized surface currents, moderate east wind



G, Generalized surface currents, moderate southeast wind



F, Generalized bottom currents, moderate east wind



H, Generalized bottom currents, moderate southeast wind

Acres Between Depth Contours for Prominent Reefs

Depth (feet)	Cone Reef	Crib Reef	Gull Island Shoal	Kelleys Island Shoal	Lake-side Reef	Little Pickerel Reef	Locust Pt Reef	Middle Harbor Reef	Mouse Island Reef	Niagara Reef	Round Reef	Scott Point Shoal	Starve Island Reef	Tous-saint Reef	West Reef
above 0			1.8												
0-1			4.0					0.1							
1-2		0.2	5.3					1.3							
2-3		0.9	21.9	0.1				2.4							
3-4		2.2	19.1	0.6				0.8		0.1				0.1	0.8
4-5		2.8	21.6	0.8			0.1	7.3		0.4				0.1	0.1
5-7		5.0	15.9	1.8			0.4	6.8		0.7				2.3	1.6
6-7		2.9	13.8	5.1			3.2	6.3		1.4	0.1			11.9	5.8
7-8		9.0	15.7	11.7			10.2	6.8		2.7	0.6		0.1	11.8	5.8
8-9		10.3	17.9	23.2			16.4	6.9		5.4	5.5		0.4	13.6	9.7
9-10		9.5	25.8	43.1			13.9	6.9	0.1	7.0	8.9		0.5	17.3	12.5
10-11	0.1	14.7	23.9	24.0			15.8	20.8	0.6	6.1	19.1	0.4	0.5	24.0	
11-12	1.4	17.8	22.0	20.4			22.6	30.3	1.2	9.5	16.9	1.1	0.5		
12-13	9.2	20.5	34.3	18.0	0.1		23.9	42.7	4.2	17.2	16.7	5.1	0.6		
13-14	8.5	42.0	32.2	17.3	0.1			90.3	4.7	14.0		11.8	0.7		
14-15	9.2	48.2	28.3	15.5	0.1			116.1	4.3	13.8		14.5	0.8		
15-16	12.1		22.6	17.9	0.5	0.1			5.1	10.9		27.2	0.7		
16-17	12.2		21.4	16.0	1.3	0.3			5.6	10.7		30.1	1.6		
17-18	10.7		21.2	26.4	2.5	2.2			6.0	14.1		46.2	1.8		
18-19	15.0		32.8	26.2	6.2	2.1			7.5	25.4		67.5	3.8		
19-20	19.0		30.4	30.4	4.9	6.8			5.4	37.1		71.2	5.7		
20-21				30.2		12.5						87.3			
21-22				36.6		9.9									
22-23				34.8											
23-24				36.1											
24-25				34.2											
Totals	97.4	186.0	431.9	470.4	15.5	33.8	106.6	345.8	44.2	176.5	67.8	362.4	17.7	81.1	36.3

LAKE SEDIMENTS

The unconsolidated sediments within the island region were deposited by glaciers and prehistoric lakes. During the Pleistocene Epoch, or "ice age", the region was covered by several continental ice sheets and later by a series of glacial lakes, resulting in the deposition of glacial till followed by the deposition of lake sediments. The surface over which the glaciers moved was a stream-cut terrain underlain by Devonian and Silurian bedrock. Glaciation moderately scoured the rock surface during the ice advance, forming features such as the spectacular grooves on Kelleys Island. It also buried much of the preglacial topography under a blanket of till. Lacustrine (lake) sediments, largely fine sand, silt, clay and organic deposits such as peat, now cover most of the till and bedrock. Bedrock comprises only 6% of the bottom surface in the island region. Gravel accounts for another 9%, sand for 26% and silt/clay mud for 59% of the lake bottom. Peat is a minor constituent found locally in nearshore areas at Cedar Point and Locust Point. These deposits consist of organic material which accumulated in marshy areas between the shoreline and offshore barrier beaches. Shoreward migration of the beaches has left the peat deposits in their present, open-water position.

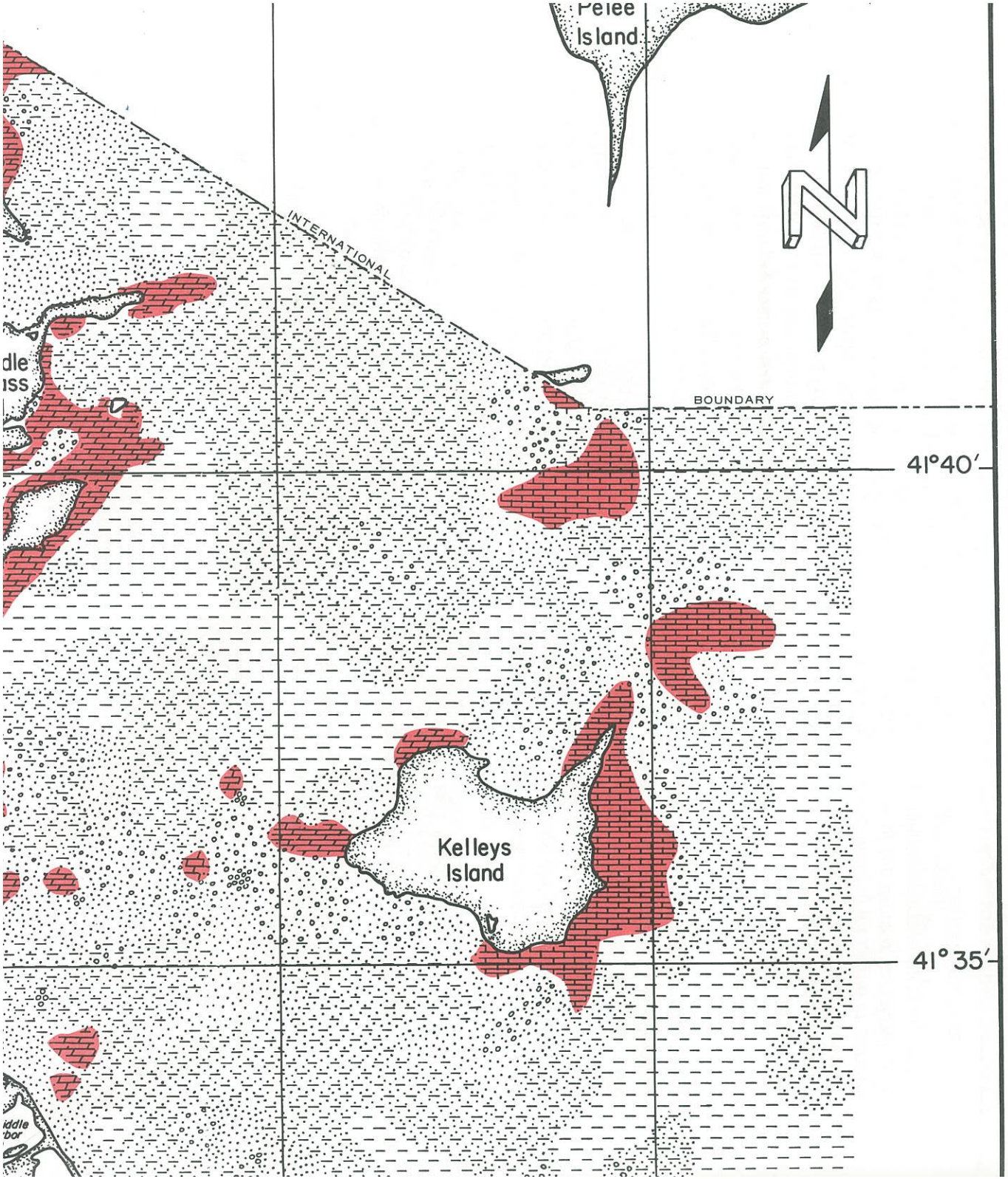
Consequently, it can be seen that a relatively small percentage of the water area of the island region is underlain by bottom types preferred by walleye. Therefore, careful selection of fishing sites should yield the best results.

CURRENTS

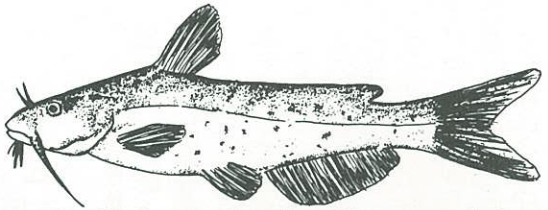
Lake currents were measured at 68 stations in the island region under various wind conditions during a 10-year period (Herdendorf, 1970). The data from these measurements were plotted to create the generalized current maps. One of the most striking features of these plots is that winds from any direction will normally drive surface currents downwind, while subsurface currents are often opposed to the wind. To compensate for the loss of surface water blown downwind, a returning flow of water is created along the bottom. Wind direction, bottom topography and shoreline configuration appear to be the major factors controlling current patterns.

The average recorded velocity for surface and bottom currents was 0.28 knots and 0.15 knots, respectively. (One knot equals 1.15 mph.) The highest velocities were found in restricted areas such as inter-island channels and in the vicinity of reefs. Currents in excess of 0.5 knots were found at 35% of the stations, while currents above 1.0 knots were measured at only one station.

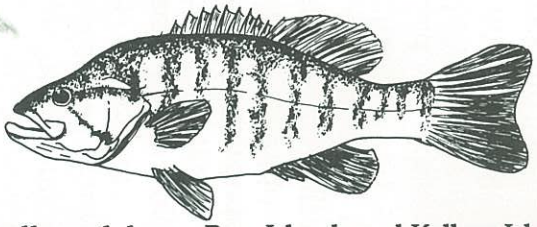
All of the submerged rock exposures within the region project above the surrounding bottom, and are generally swept clean of sediments by the currents. The relatively clean surface indicates that no permanent sedimentation is taking place on the reefs. However, sediment collectors that have been mounted on the reefs indicate that a considerable amount of sediment is being transported over the reefs to be deposited in deeper water. Because the reefs project above the bottom, they are generally areas of higher energy due to the forces of waves and currents. The habitat created closely simulates the environment found in the riffles of streams. Several fish species, particularly the walleye which commonly spawns in steams, appear to have enjoyed success in Lake Erie because of the availability of this type of habitat.



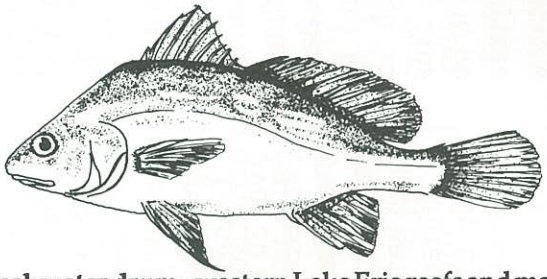
white bass - Maumee and Sandusky Rivers during May; western Lake Erie reefs during June



channel catfish - rocky shoreline areas between Toledo and Marblehead, the island area of western Lake Erie, and in Sandusky Bay during June and July



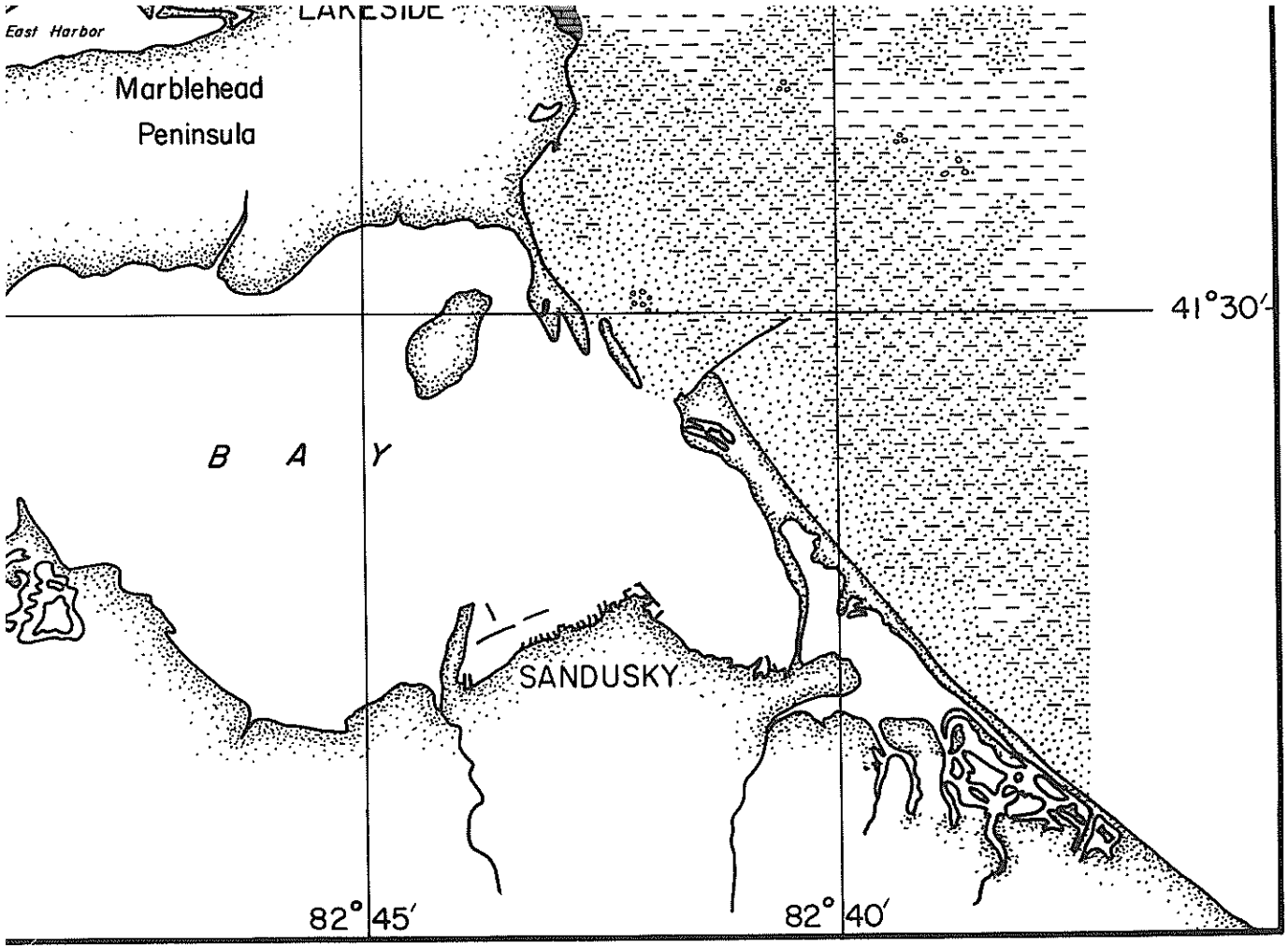
smallmouth bass - Bass Islands and Kelleys Island shore and reef areas during May and June; deep inshore reef areas during September and October



freshwater drum - western Lake Erie reefs and mainland shoreline east of Sandusky during June and July

WHY DO WALLEYE PREFER REEFS?

Walleye apparently rely on sight to find their prey (Regier et al., 1969). Efficient sight feeding, especially for a large fish seeking moving prey, requires sufficiently clear water to discern the prey at some distance. Such relatively clear water is found over the bedrock reefs in the island region. Experienced sport fishermen expect to find walleye concentrated around clean, hard bottoms, such as rocky reefs, gravel or clean



Area of Western Lake Erie

kes and
eceived
, partici-

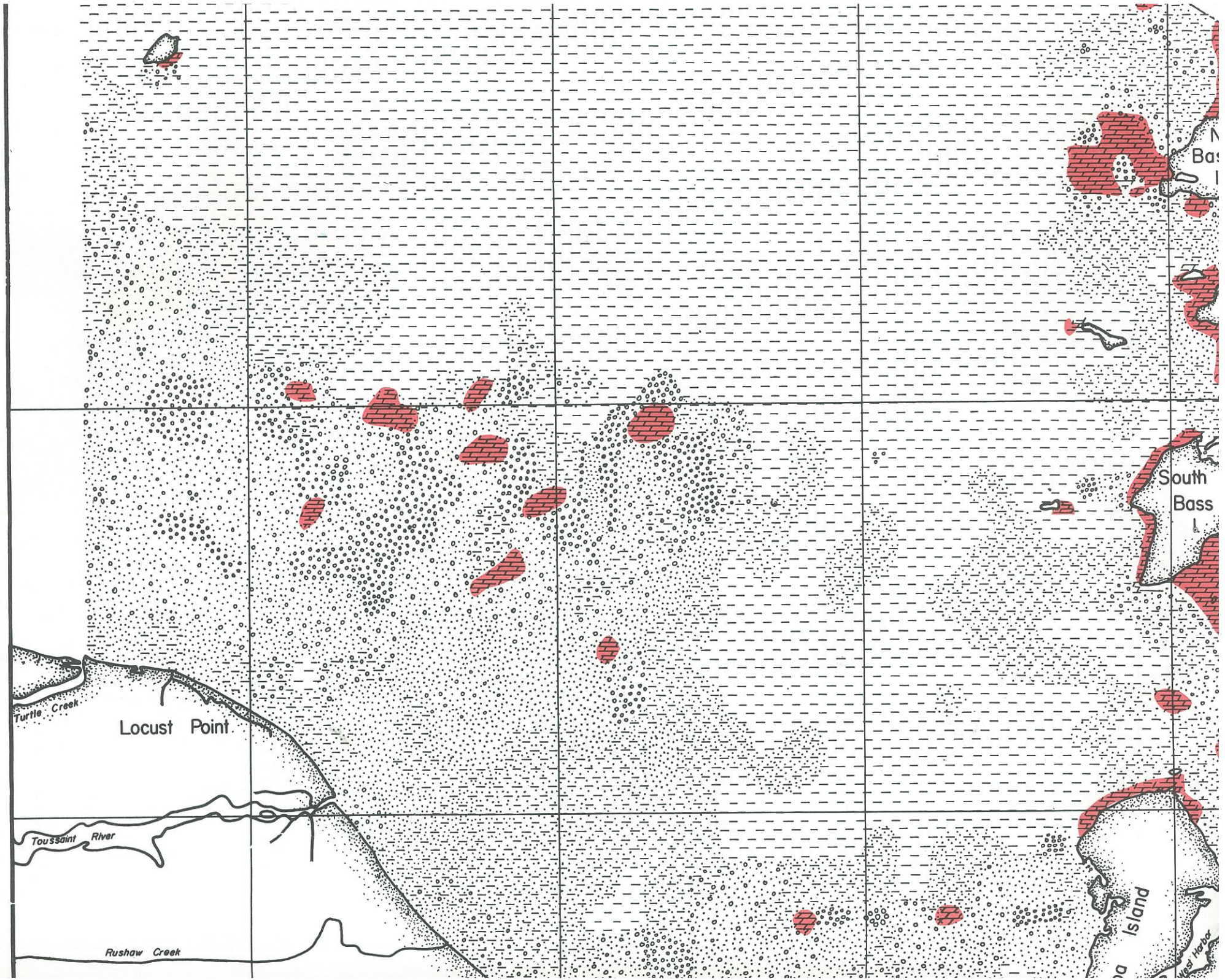
The guide was written by Dr. Charles E. Herdendorf in 1980. Dr, Jeffrey M. Reutter and Ms. Maran Brainard made the 1989 revisions to the guide. Illustrations were drawn by Ms. Suzanne Abbati.

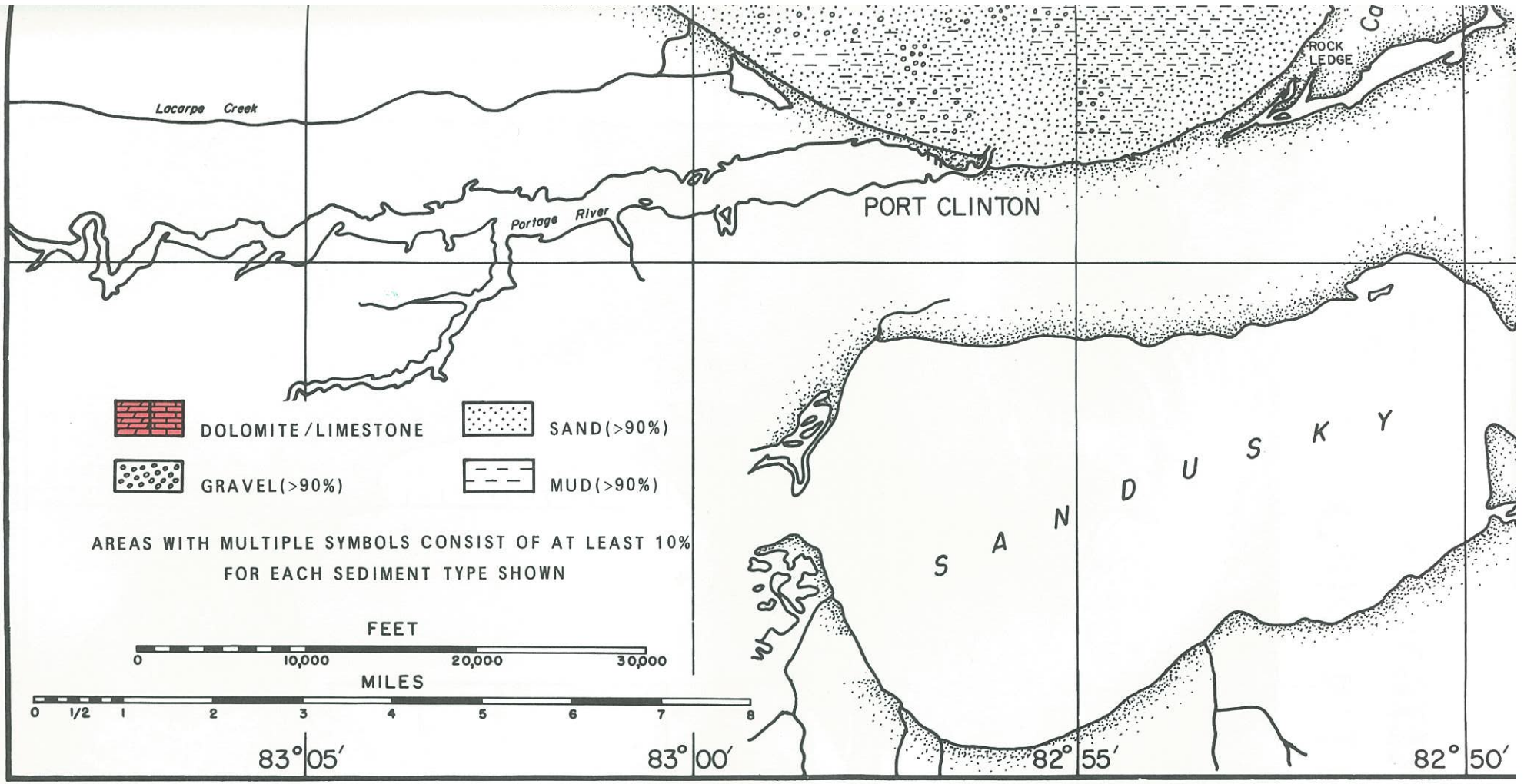
good feeding places for walleye. Cladophora beds (a filamentous green algae) harbor emerging insects and zooplankters. Zooplankton attract small fish, usually shiners, upon which walleye prey.

Scuba divers who have inspected reefs in western Lake Erie have observed walleye lying motionless on the rocky bottom during daylight. This daily "resting requirement" may tend to limit them to reefs and other hard bottoms. Silty or muddy bottoms with high organic concentrations tend to have lower oxygen concentrations. This is especially true during calm periods when currents and water mixing are slight. Walleye prefer not to rest in these areas because of their requirement for high oxygen concentrations.

Walleye commonly spawn over rock, rubble or gravel in streams, shallow offshore reefs or along shorelines of lakes (Eschmeyer, 1950). Spawning runs of walleye persist in only two major Ohio streams, the Sandusky and Maumee Rivers. In the 1800s and the early part of this century many of the lake's other tributaries were productive spawning sites (Langlois, 1954), but the construction of dams, siltation, excessive pollution and irregularity of stream flow due to man's activities have destroyed spawning sites. Today, the major existing spawning grounds in the Erie Basin are found on the reefs of the island region. These reefs are free from oxygen-consuming mud.

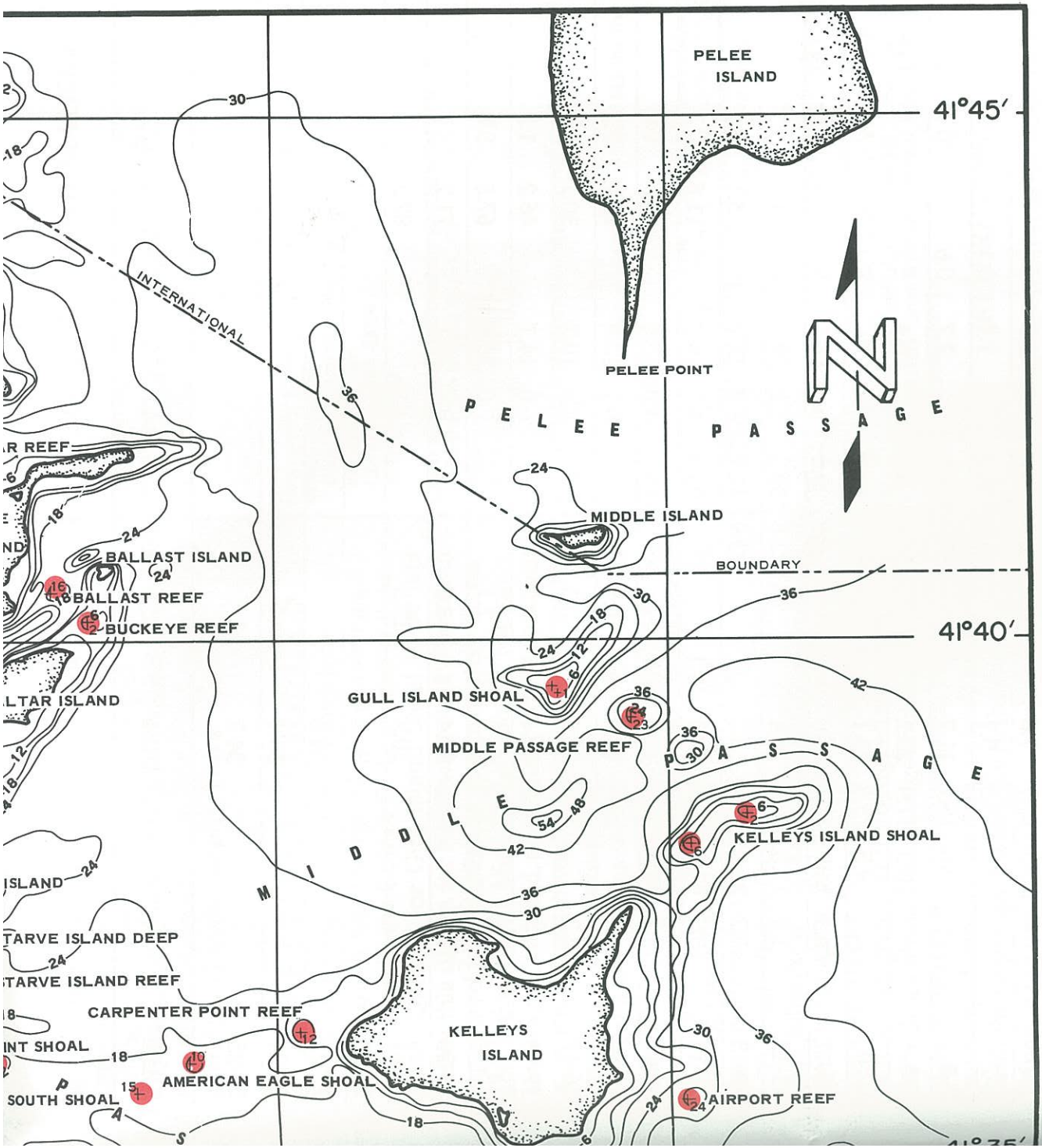
Researchers have postulated that walleye fry imprint some essential characteristics of their birthplace and that most sexually mature adults return to that birthplace to spawn. These factors would also favor the continued utilization of the reefs by future walleye populations.


Locust Point
Turtle Creek
Toussaint River
Rushaw Creek
South
Bass
I.
Island



Distribution of Surface Sediment in the Re

This publication is produced by the Ohio Sea Grant College Program (projects A/EP-1 and M/P-2 under grant NA88AA-D-SG094) of the National Sea Grant College Program, National Oceanic and Atmospheric Administration. Sea Grant's mission is to promote the wise use and development of ocean, Grea coastal resources for the public benefit. Financial suppo from the Ohio Board of Regents, The Ohio State Univer pating colleges and universities, and the private secto



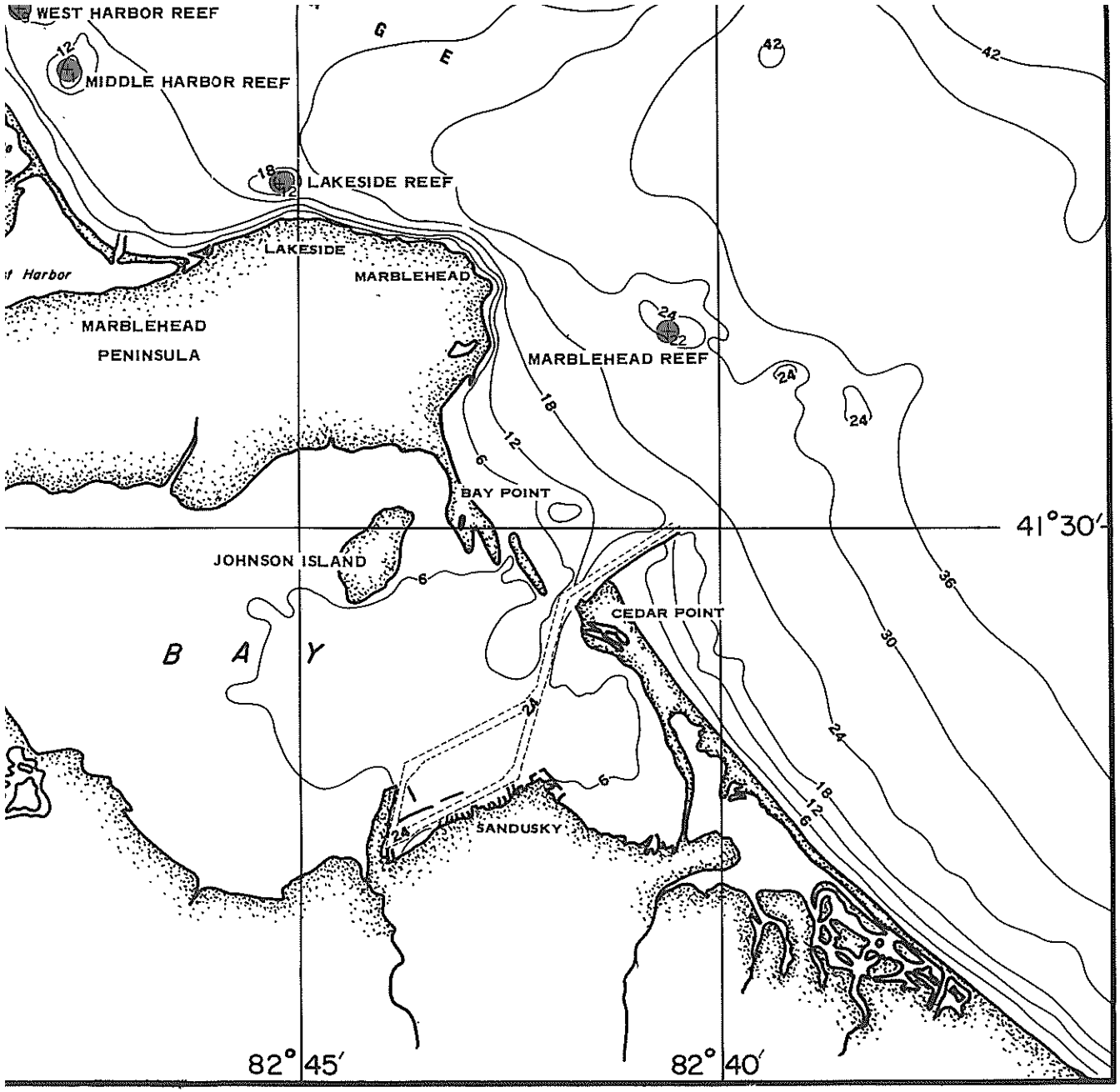
Guide to Fishing Reefs in Western Lake Erie

Ohio Sea Grant Guide (GS-001-89)

The resurgence of the walleye (*Stizostedion vitreum vitreum*) population has rekindled sport fishing interest in western Lake Erie. Each year for the past several years the number of recreational fishermen utilizing Lake Erie has greatly increased. Walleye have long been known for their abundance over gravel, bedrock and other types of firm bottoms, where the water is least turbid. The rock-bottomed reefs and shoals within the western Lake Erie island region are areas of particularly high concentration.

This guide is intended to provide the recreational fisherman with the location of the prominent fishing reefs in the island region as well as information about bottom sediments, current patterns and physical characteristics of the reefs. The maps are not intended for navigational purposes.

The popular Bass Islands and Kelleys Island are located within the western basin just a few miles off Ohio's shore. Major highways leading to this area are U.S. Route



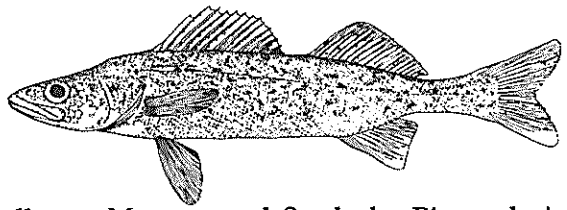
Western Lake Erie

Islands can be reached by ferry service off State Routes 2 and 53 near Port Clinton. Kelleys Island can be reached by ferry service off State Route 163 near Marblehead.

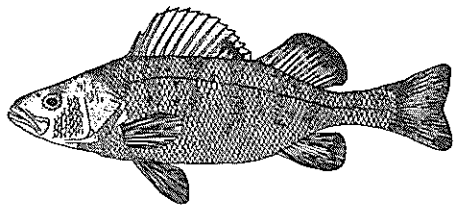
More information about the fish species can be found within this publication.

SPORT FISH OF THE REEF AREA

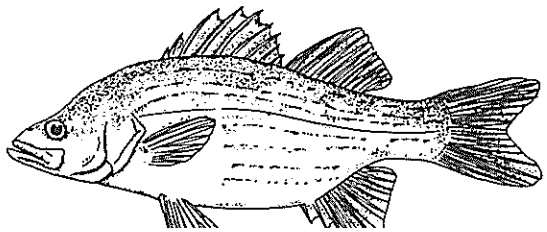
In addition to walleye, at least five other sport fish species are known to be associated with the reefs and rocky shoreline areas of western Lake Erie: yellow perch (*Perca flavescens*), white bass (*Morone chrysops*), channel catfish (*Ictalurus punctatus*), smallmouth bass (*Micropterus dolomieui*) and freshwater drum (*Aplodinotus grunniens*). Baker (1980) lists the best fishing areas and times for these species as follows:

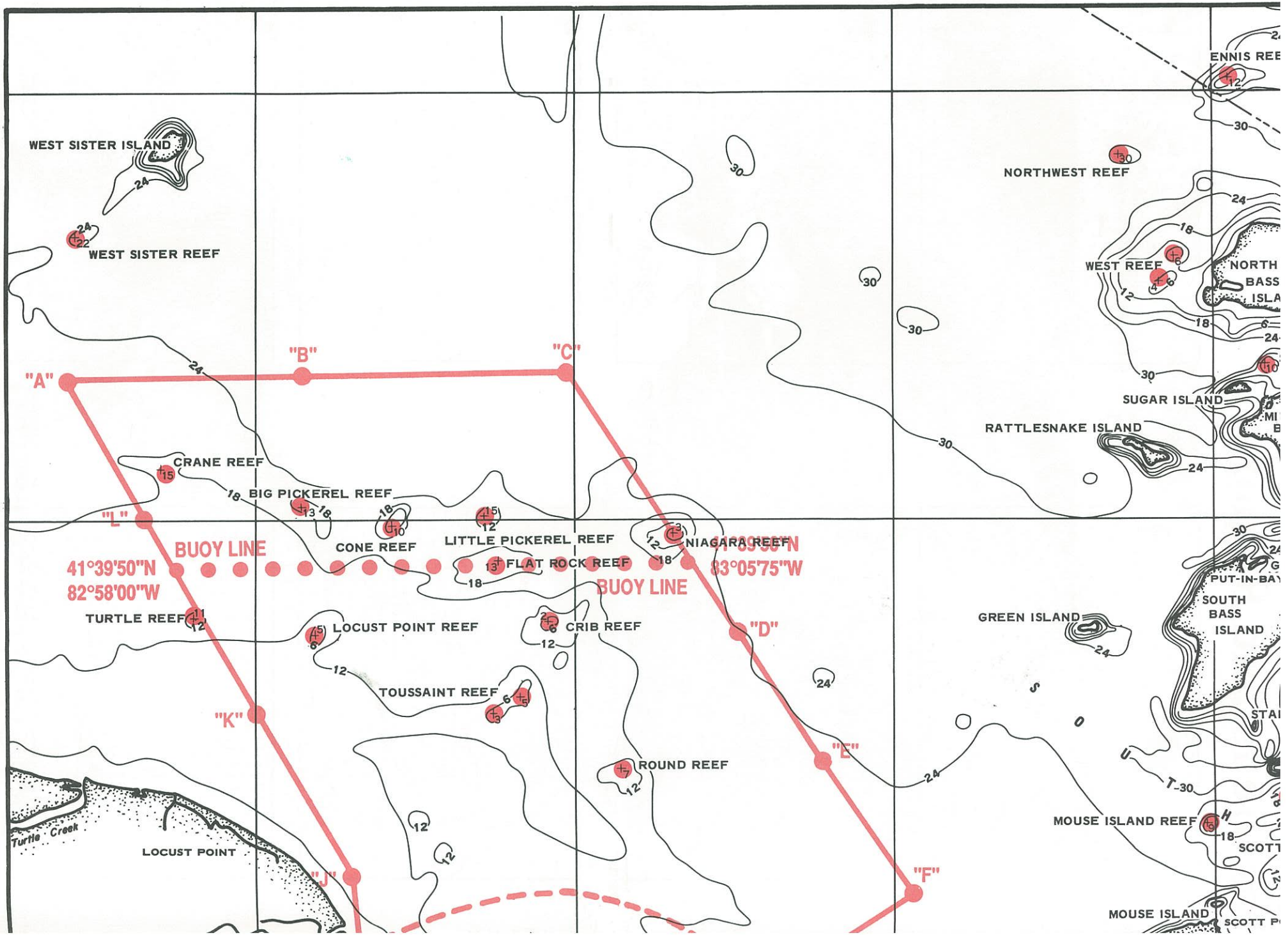


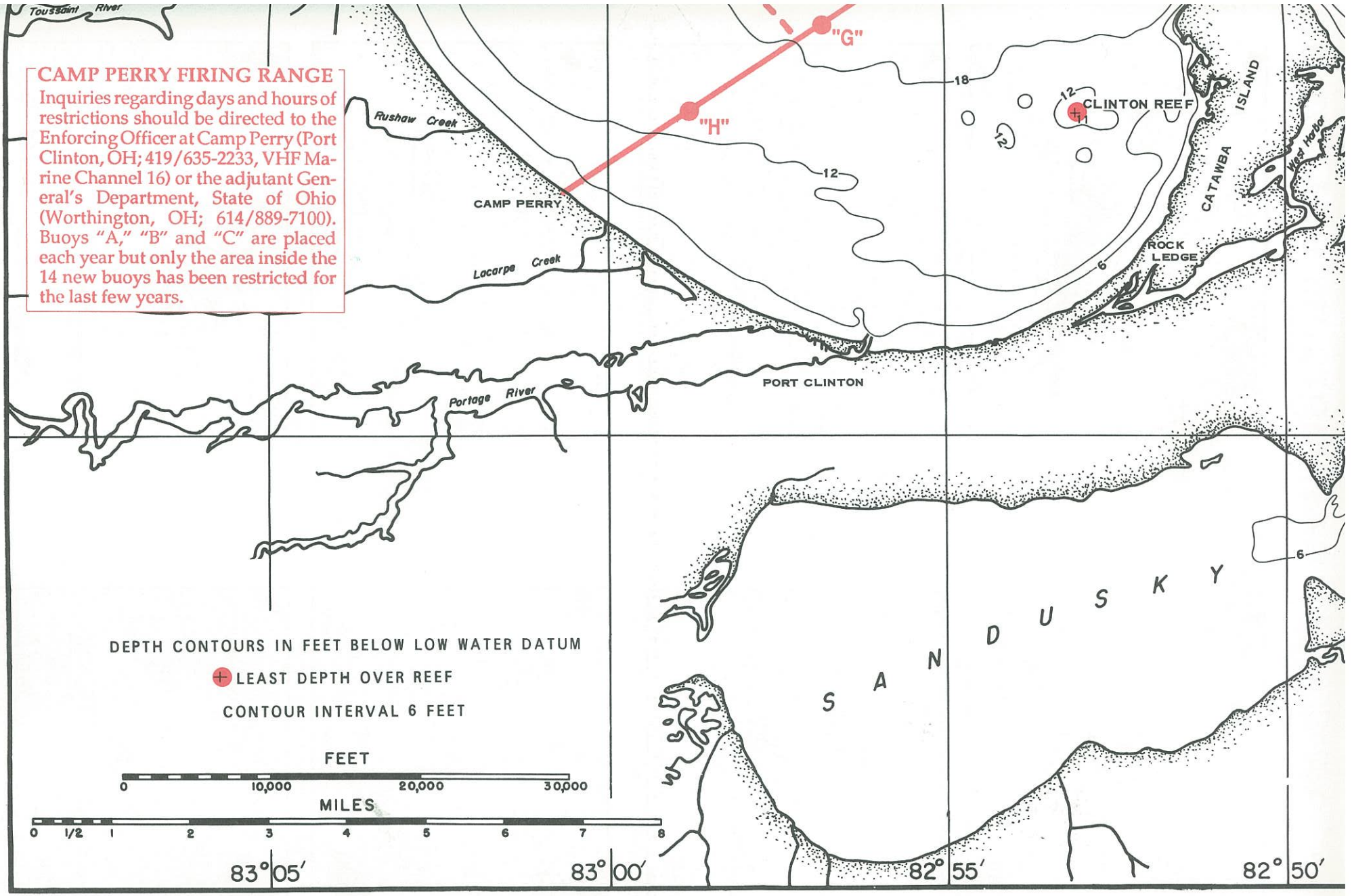
walleye - Maumee and Sandusky Rivers during April; western Lake Erie reefs and West Sister Island vicinity, June through August



yellow perch - nearshore shoal areas in western Lake Erie August, September and October

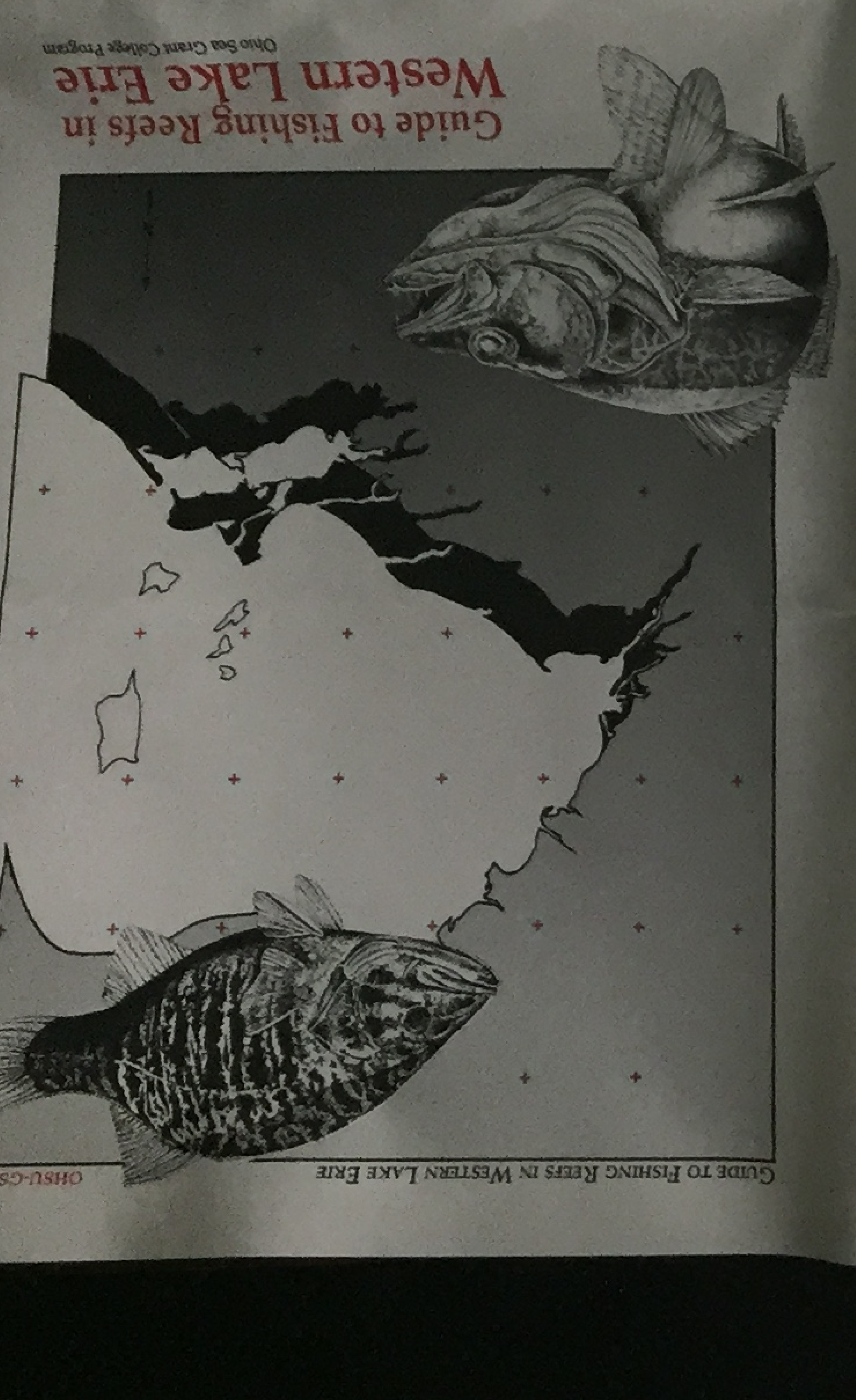



WEST SISTER ISLAND
WEST SISTER REEF
NORTHWEST REEF
WEST REEF
ENNIS REE
NORTH
BASS
ISLA
SUGAR ISLAND
RATTLESNAKE ISLAND
"A"
"B"
"C"
"D"
"E"
"F"
"J"
"K"
"L"
CRANE REEF
BIG PICKEREL REEF
CONE REEF
LITTLE PICKEREL REEF
NIAGARA REEF
FLAT ROCK REEF
BUOY LINE
41°39'50"N
82°58'00"W
BUOY LINE
83°05'75"W
TURTLE REEF
LOCUST POINT REEF
CRIB REEF
TOUSSAINT REEF
ROUND REEF
GREEN ISLAND
PUT-IN-BAY
SOUTH
BASS
ISLAND
MOUSE ISLAND REEF
MOUSE ISLAND
Turtle Creek
LOCUST POINT



Bathymetric Map of the Reef Area o

OHSU-GS-001



Guide to Fishing Reefs in Western Lake Erie

Ohio Sea Grant College Program

LAKE ERIE ISLAND REGION

The Ohio island region encompasses that part of western Lake Erie between longitude 82°37'W to 83°208'W and south from latitude 41°45'N (west of the Bass Islands) or the international boundary (east of the Bass Islands) to the Ohio mainland shore. The region is roughly bounded on the northwest by West Sister Island, on the north by North Bass Island, on the northeast by Middle Island, on the east by Kelleys Island, on the southeast by Cedar Point, on the south by the Ohio mainland and on the southwest by Locust Point. This is an area consisting of approximately 362 square miles, including 9.5 square miles of islands.

In contrast with the other basins of Lake Erie (central and eastern) a number of bedrock islands, reefs and shoals are situated in the western basin. These form a partial divide between the western and central basins. The entire western basin (west of a line from Pelee Point, Ontario to Cedar Point, Ohio) has an area of 1,265 square miles, 13% of Lake Erie. However, its volume, at 5.8 cubic miles, is only 5% of the volume of the entire lake because of its shallowness. The average depth of the western basin is only 24 feet. The lake bottom is quite flat except for the sharply rising islands and reefs.

In the western half of the island region the lake bottom slopes gently lakeward from the mainland shoreline at 3 feet per mile. Between the Bass Islands and Kelleys Island this slope is 6 feet per mile and it increases to 15 feet per mile lakeward of Cedar Point. The steepest bottom slopes are found near the islands and reefs. In South Passage the bottom gradient exceeds 60 feet per mile. The maximum depths in the region are found in the inter-island channels. The deepest sounding, 62 feet, was made in a small depression north of Starve Island Reef. Another depression north of Gull Island Shoal is 54 feet deep. Elsewhere in the region deeps do not exceed 45 feet.

The islands and reefs are arranged in three roughly north-south belts. The most westerly belt lies north of Locust Point and includes at least 12 reefs and West Sister Island. The middle belt extends from Catawba Island (peninsula) through the Bass Islands and consists of at least 14 reefs and 10 islands. The easterly belt encompasses Marblehead peninsula, Kelleys Island and at least 7 reefs. This arrangement of the islands and reefs seems to be controlled mainly by the gentle folding structure of the underlying bedrock and its relative resistance to weathering.

The shores of all the islands are rockbound and rugged, with bluffs along the majority of the island coasts. The highest elevations are normally on the west shore, except for West Sister Island, where the bluffs are highest along the east shore. The west shore of South Bass Island reaches a height of 70 feet above the mean lake level, the highest elevation in the island region. Small beaches composed of sand, cobbles or boulders are found at indentations in the shoreline. The most extensive sand beach lies along the north bay of Kelleys Island.

WHAT IS A LAKE ERIE REEF?

The Ohio Revised Code, Section 1531.01 (DD), defines *reef* as

"an elevation of rock, either broken or in place, or gravel shown by the latest United States chart to be above the common level of the surrounding bottom of the lake, other than the rock bottom, either broken or in place, forming the base or foundation rock of an island or mainland and sloping from the shore thereof."

A *reef* also means,

"all elevations shown by such chart to be above the common level of such sloping base or foundation rock of an island or mainland, whether running from the shore of an island or parallel with the contour of the shore of an island or in any other way, whether formed by rock, broken or in place, or from gravel."

Definition (CC) of the same section of the Ohio Revised Code describes an island as "a rock or land elevation above the water of Lake Erie having an area of five or more acres above water."

The Ohio Revised Code does not define the word *shoal*. However, the National Ocean Survey charts use the terms reef and shoal for similar topographic features and they are considered synonymous in this guide.

Using the legal definition as a guide, there are over 30 reefs or reef clusters shown on National Ocean Survey charts of the island region, but only 8 of these are officially named. For convenience the other prominent reefs are labeled in this guide with names used by local fishermen.

Thirteen of these reefs were selected for special study by the Ohio Department of Natural Resources, Division of Geological Survey (Herdendorf and Braidech, 1972). Depth soundings were made with a recording echo sounder and detailed bathymetric (depth contour) maps were constructed for each reef. The surface acres for each one-foot depth interval for these reefs are given on the table in this guide. A bathymetric map for Gull Island Shoal is also included here.

REEF CHARACTERISTICS

The least depths over the reefs range from 1 foot above Low Water Datum (568.6 feet above mean water level in the Gulf of St. Lawrence at Father Point, Quebec) for Gull Island Shoal to 30 feet below this datum for Northwest Reef. The mean water level for Lake Erie is approximately 1.8 feet above this datum. Most of the reefs are conical in shape and elongated, as are many of the islands, in a northeast-southwest direction. Two factors appear to have influenced this elongation: (1) vertical joint systems in the bedrock are oriented parallel to the elongation (Hartley, 1962) and (2) the major movements of glacial ice, as deduced from grooves found on most of the islands, were from northeast to southwest.

Typically, the reefs consist of bedrock (limestone and dolomite deposited during the Devonian and Silurian Periods, 350-425 million years ago) and associated rock rubble and gravel. The topography of the reef tops ranges from rugged surfaces caused by bedrock pinnacles and large boulders to smooth slabs of horizontally bedded rocks. In places the submerged bedrock has the appearing of low stairs, with the steps dipping slightly to the east from the fringe of the reef to its crest.

Because all of the bedrock formations that form the reefs are carbonate material, abundant solution cavities, many up to 1 or 2 cm (.78 of an inch) in diameter, have formed in the rocks. These cavities are important features in that they are often the site of walleye egg deposition. Eggs held in these depressions are protected from wave attack and strong currents which could wash them onto soft sediment beds where they could be smothered.

The bedrock core of the reefs is commonly masked by rubble composed of both local (broken fragments of the bedrock) and glacial origin, ranging from small pebbles to boulders up to 5 feet in diameter. On the upper portions of the reefs, isolated patches of sand and gravel commonly fill vertical joint cracks and small depressions in the bedrock; at the fringes of the reefs sand and gravel or glacial till lap over the rock. Glacial till consists of a random mixture of gravel, sand, silt and clay.

FOR MORE INFORMATION

Additional copies of this publication and other publications of interest for Lake Erie sport anglers can be obtained from the:
Ohio Sea Grant College Program
The Ohio State University
1314 Kinnear Road
Columbus, OH 43212-1194
614/292-8949

Other publications of interest for Lake Erie sport anglers can be obtained from the:
Ohio Department of Natural Resources (Publications)
Fountain Square
Columbus, OH 43224
614/265-6565

Charts and related publications may be ordered from:
Distribution Branch (N/CG33)
National Ocean Service
Riverdale, MD 20737-1199
301/436-6990

Authorized nautical chart sales agents in the western basin of Lake Erie include:

IN HURON: Harbor North, Holiday Harbor Marina Inc. and Huron Lagoons Marina Inc.
IN MARBLEHEAD: Marine City.
IN PORT CLINTON: Brands' Hi Marina, Catawba Island Marina Inc., Fisherman's Wharf, Foxhaven Marina Inc., Gem Beach Marina Inc., Portage Ferry Marine Inc., Richards Bait & Tackle, SOS Marine Store and Treasure Cove Marina.
IN PUT-IN-BAY: Wharfside.
IN SANDUSKY: Battery Park Marina, Bob Clemons Boats, Cedar Point Inc. Marine Division, Herb's Sportsman Supplies.
IN TOLEDO: Brenner Marine Inc., Harrison Marine Ltd., Leo's Bait & Wine Shop, Mastercraft's Marineland, North Harbor Marina Inc., The Duck Bay Inc., The Tackle Box Inc.
IN VERMILION: Great Lakes Historical Society and Romp's Water Port Inc.

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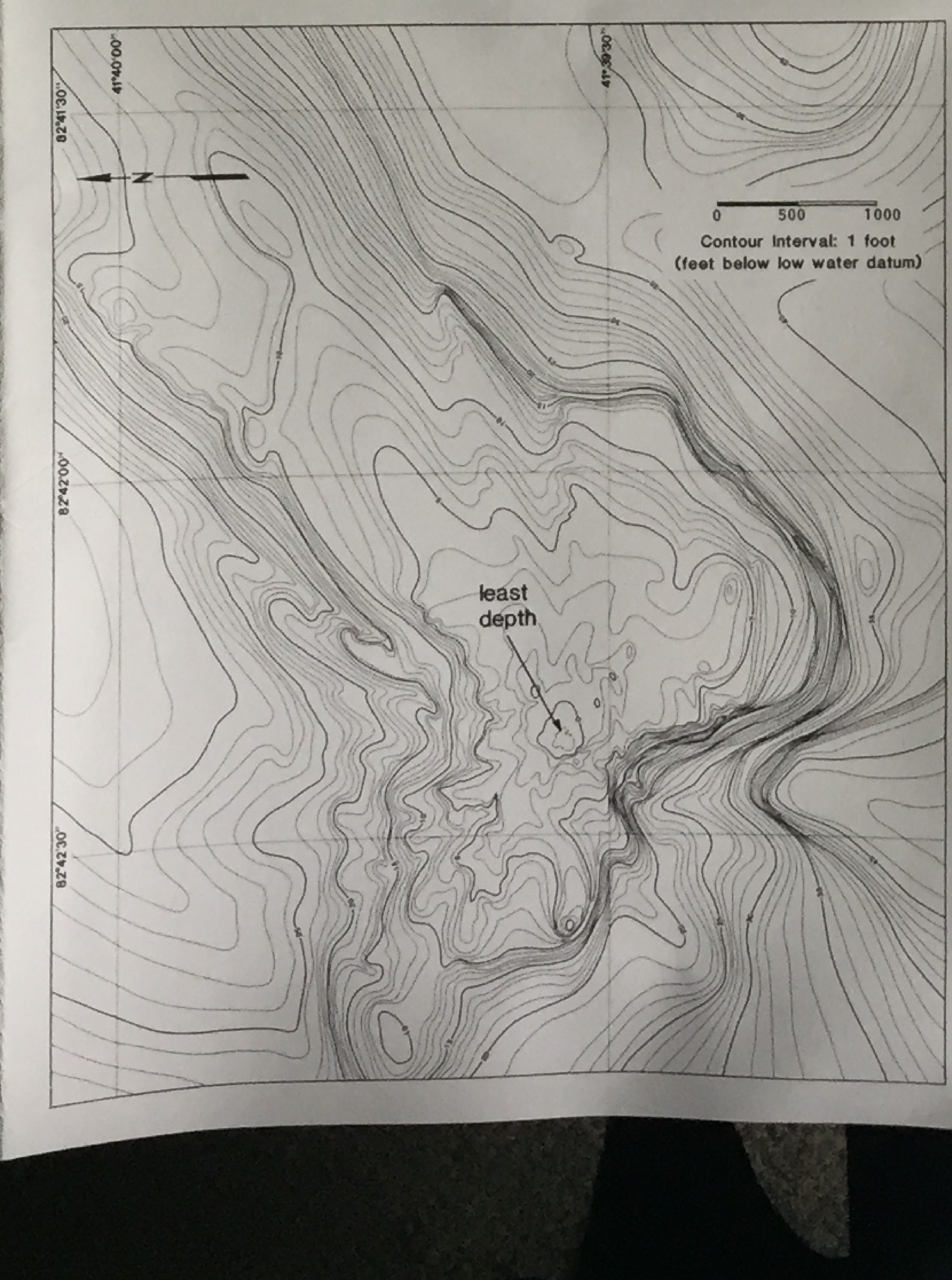
Bathymetric Map of Gull Island Shoal



LAKE SEDIMENTS

The unconsolidated sediments within the island region were deposited by glaciers and prehistoric lakes. During the Pleistocene Epoch, or "ice age", the region was covered by several continental ice sheets and later by a series of glacial lakes, resulting in the deposition of glacial till followed by the deposition of lake sediments. The surface over which the glaciers moved was a stream-cut terrain underlain by Devonian and Silurian bedrock. Glaciation moderately scoured the rock surface during the ice advance, forming features such as the spectacular grooves on Kelleys Island. It also buried much of the preglacial topography under a blanket of till. Lacustrine (lake) sediments, largely fine sand, silt, clay and organic deposits such as peat, now cover most of the till and bedrock. Bedrock comprises only 6% of the bottom surface in the island region. Gravel accounts for another 9%, sand for 26% and silt/clay mud for 59% of the lake bottom. Peat is a minor constituent found locally in nearshore areas at Cedar Point and Locust Point. These deposits consist of organic material which accumulated in marshy areas between the shoreline and offshore barrier beaches. Shoreward migration of the beaches has left the peat deposits in their present, open-water position.

Consequently, it can be seen that a relatively small percentage of the water area of the island region is underlain by bottom types preferred by walleye. Therefore, careful selection of fishing sites should yield the best results.

CURRENTS

Lake currents were measured at 68 stations in the island region under various wind conditions during a 10-year period (Herdendorf, 1970). The data from these measurements were plotted to create the generalized current maps. One of the most striking features of these plots is that winds from any direction will normally drive surface currents downwind, while subsurface currents are often opposed to the wind. To compensate for the loss of surface water blown downwind, a returning flow of water is created along the bottom. Wind direction, bottom topography and shoreline configuration appear to be the major factors controlling current patterns.

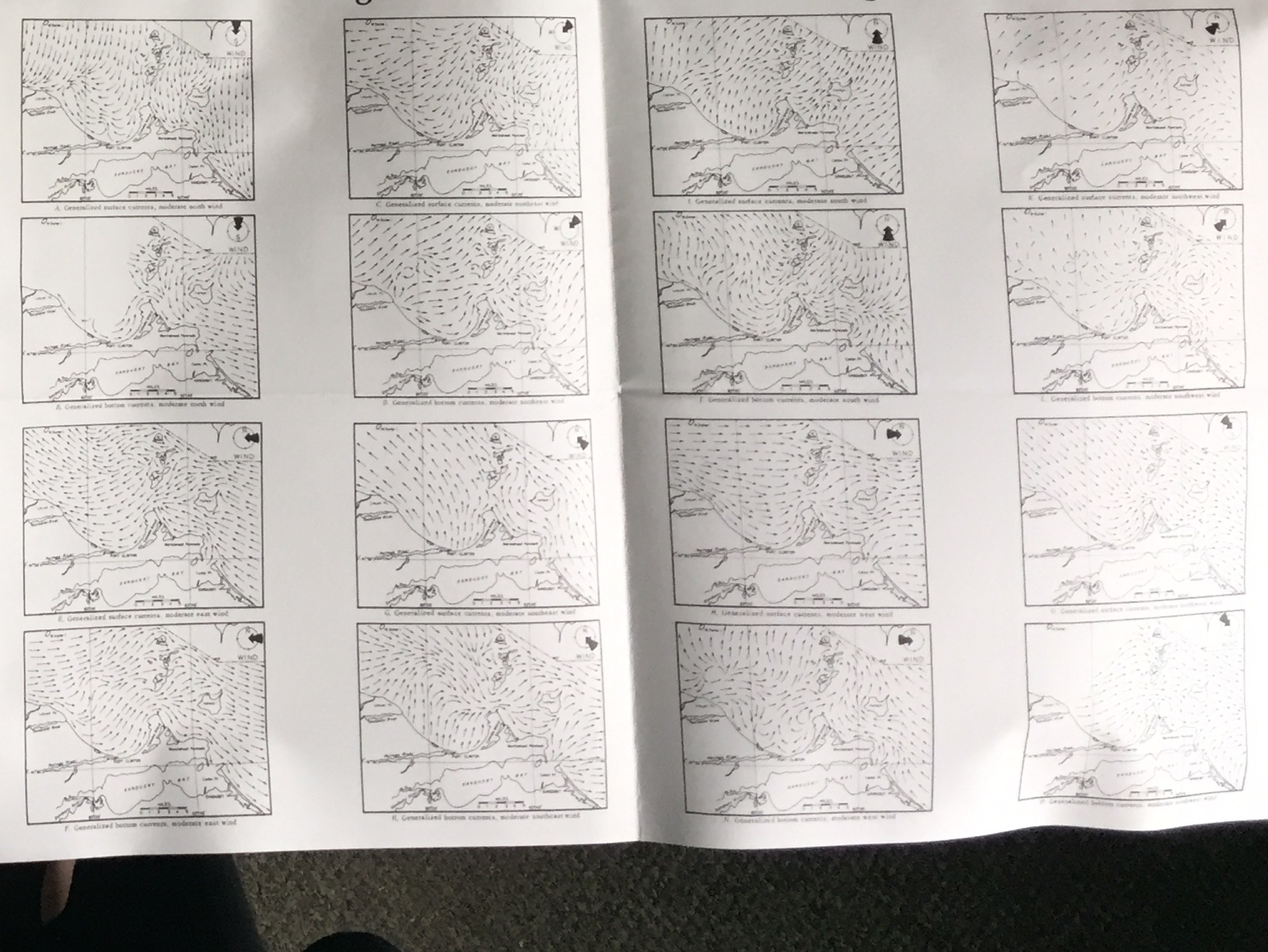
The average recorded velocity for surface and bottom currents was 0.28 knots and 0.15 knots, respectively. (One knot equals 1.15 mph.) The highest velocities were found in restricted areas such as inter-island channels and in the vicinity of reefs. Currents in excess of 0.5 knots were found at 35% of the stations, while currents above 1.0 knots were measured at only one station.

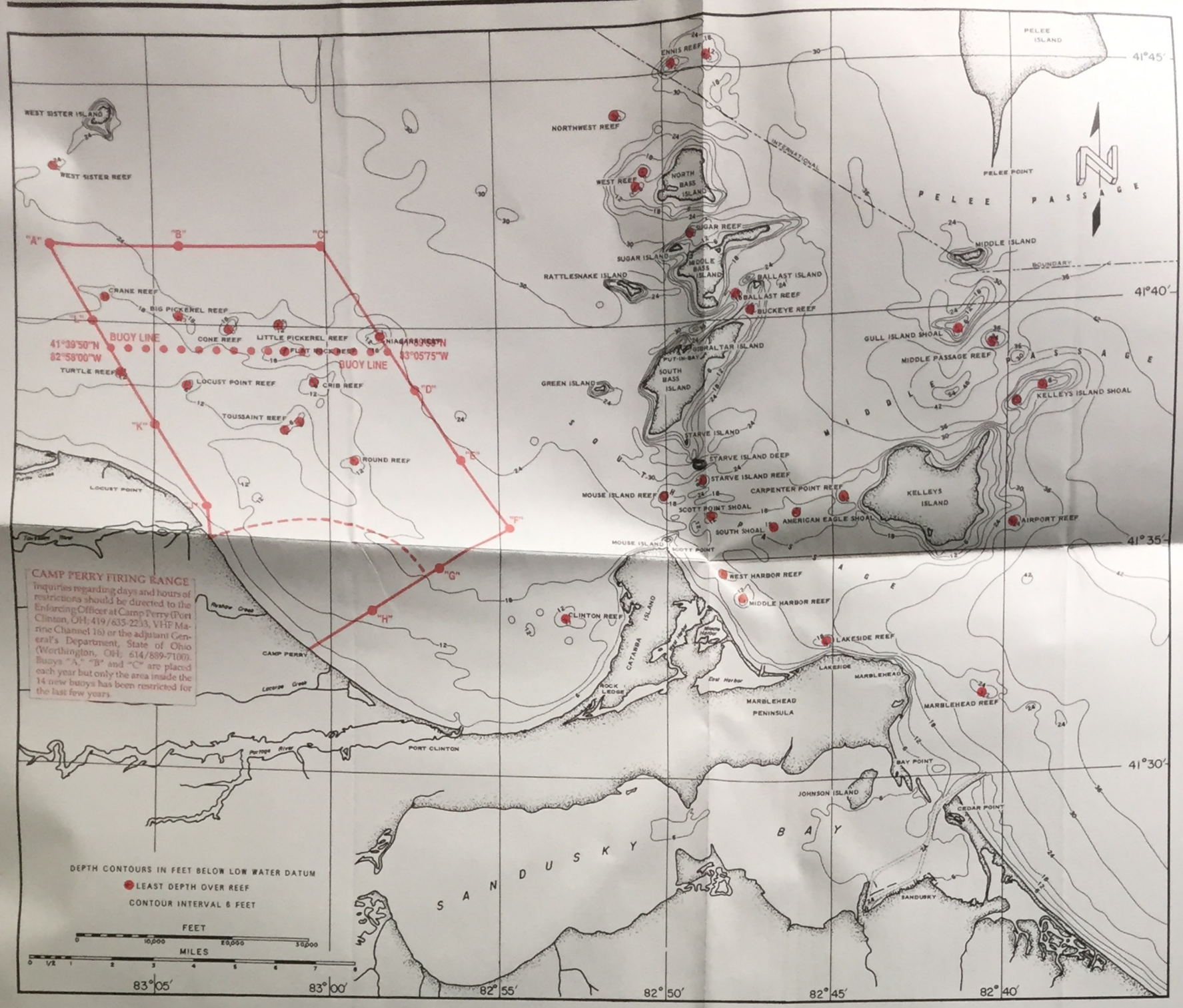
All of the submerged rock exposures within the region project above the surrounding bottom, and are generally swept clean of sediments by the currents. The relatively clean surface indicates that no permanent sedimentation is taking place on the reefs. However, sediment collectors that have been mounted on the reefs indicate that a considerable amount of sediment is being transported over the reefs to be deposited in deeper water. Because the reefs project above the bottom, they are generally areas of higher energy due to the forces of waves and currents. The habitat created closely simulates the environment found in the riffles of streams. Several fish species, particularly the walleye which commonly spawns in steams, appear to have enjoyed success in Lake Erie because of the availability of this type of habitat.

Acres Between Depth Contours for Prominent Reefs

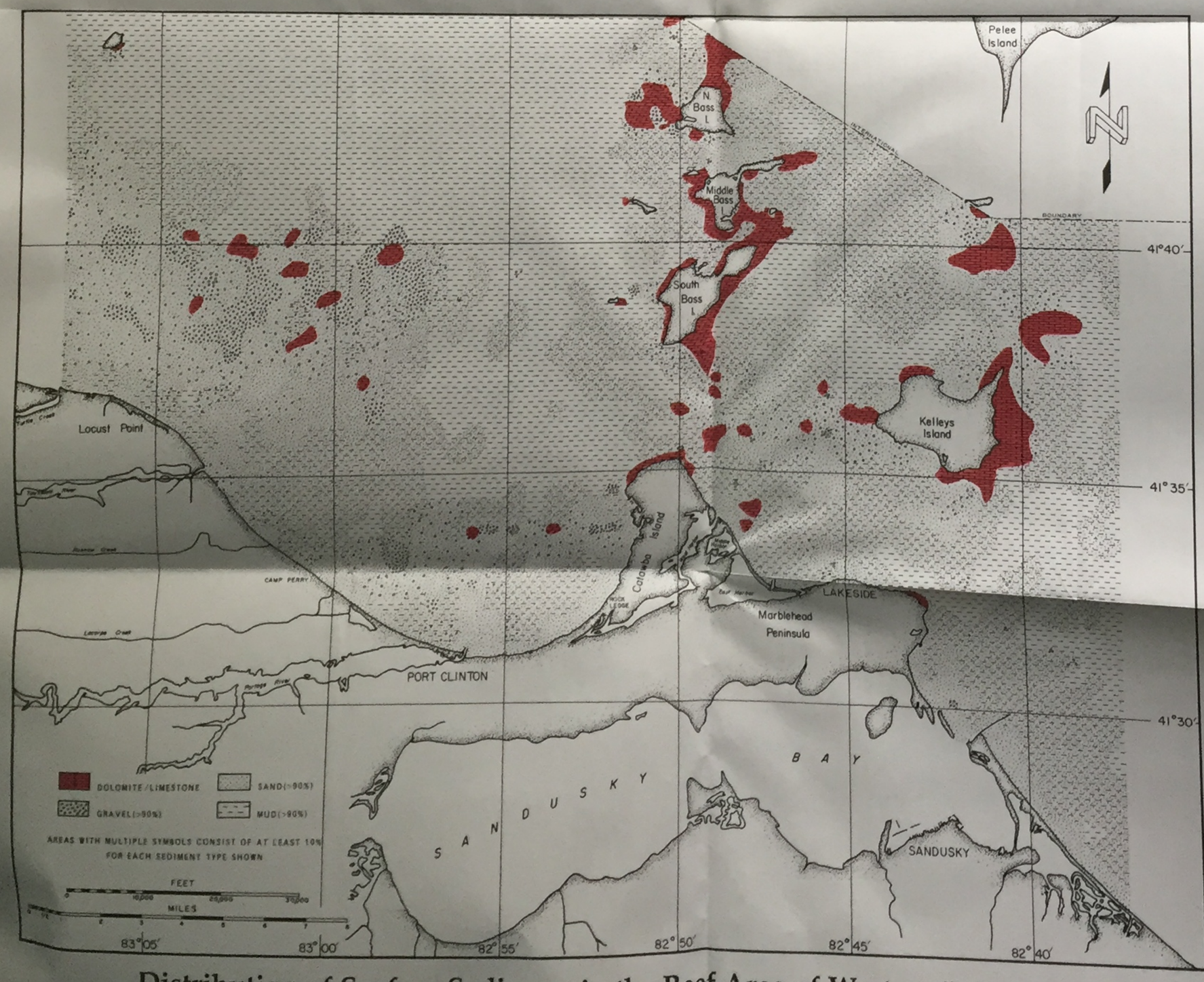
Depth (feet)	Cone Reef	Crib Reef	Gull Island Shoal	Kelleys Island Shoal	Lakeside Reef	Little Pickerel Reef	Locust Pt Reef	Middle Harbor Reef	Mouse Island Reef	Niagara Reef	Round Reef	Scott Point Shoal	Starve Island Reef	Toussaint Reef	West Reef
above 0			1.8												
0-1			4.0					0.1							
1-2		0.2	5.3					1.3							
2-3		0.9	21.9	0.1				2.4							
3-4		2.2	19.1	0.6				0.8		0.1				0.1	0.8
4-5		2.8	21.6	0.8			0.1	7.3		0.4				0.1	0.1
5-7		5.0	15.9	1.8			0.4	6.8		0.7				2.3	1.6
6-7		2.9	13.8	5.1			3.2	6.3		1.4	0.1			11.9	5.8
7-8		9.0	15.7	11.7			10.2	6.8		2.7	0.6		0.1	11.8	5.8
8-9		10.3	17.9	23.2			16.4	6.9		5.4	5.5		0.4	13.6	9.7
9-10		9.5	25.8	43.1			13.9	6.9	0.1	7.0	8.9		0.5	17.3	12.5
10-11	0.1	14.7	23.9	24.0			15.8	20.8	0.6	6.1	19.1	0.4	0.5	24.0	
11-12	1.4	17.8	22.0	20.4			22.6	30.3	1.2	9.5	16.9	1.1	0.5		
12-13	9.2	20.5	34.3	18.0	0.1		23.9	42.7	4.2	17.2	16.7	5.1	0.6		
13-14	8.5	42.0	32.2	17.3	0.1			90.3	4.7	14.0		11.8	0.7		
14-15	9.2	48.2	28.3	15.5	0.1			116.1	4.3	13.8		14.5	0.8		
15-16	12.1		22.6	17.9	0.5	0.1			5.1	10.9		27.2	0.7		
16-17	12.2		21.4	16.0	1.3	0.3			5.6	10.7		30.1	1.6		
17-18	10.7		21.2	26.4	2.5	2.2			6.0	14.1		46.2	1.8		
18-19	15.0		32.8	26.2	6.2	2.1			7.5	25.4		67.5	3.8		
19-20	19.0		30.4	30.4	4.9	6.8			5.4	37.1		71.2	5.7		
20-21				30.2		12.5						87.3			
21-22				36.6		9.9									
22-23				34.8											
23-24				36.1											
24-25				34.2											
Totals	97.4	186.0	431.9	470.4	15.5	33.8	106.6	345.8	44.2	176.5	67.8	362.4	17.7	81.1	36.3

Diagrams of Currents for the Island Region





Bathymetric Map of the Reef Area of Western Lake Erie



Distribution of Surface Sediment in the Reef Area of Western Lake Erie

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The guide was written by Dr. Charles E. Herdendorf in 1980. Dr. Jeffrey M. Reutter and Ms. Maran Brainard made the 1989 revisions to the guide. Illustrations were drawn by Ms. Suzanne Abbati.

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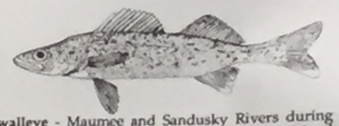
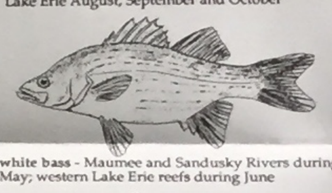
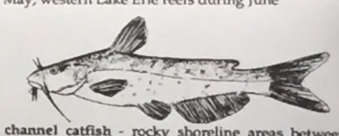


walleye - Maumee and Sandusky Rivers during April; western Lake Erie reefs and West Sister Island vicinity, June through August

yellow perch - nearshore shoal areas in western Lake Erie August, September and October

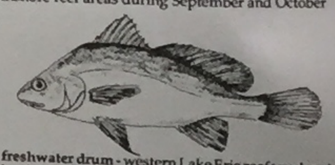


white bass - Maumee and Sandusky Rivers during May; western Lake Erie reefs during June



channel catfish - rocky shoreline areas between Toledo and Marblehead, the island area of western Lake Erie, and in Sandusky Bay during June and July

smallmouth bass - Bass Islands and Kelleys Island shore and reef areas during May and June; deep inshore reef areas during September and October



freshwater drum - western Lake Erie reefs and mainland shoreline east of Sandusky during June and July

WHY DO WALLEYE PREFER REEFS?

Walleye apparently rely on sight to find their prey (Regier et al., 1969). Efficient sight feeding, especially for a large fish seeking moving prey, requires sufficiently clear water to discern the prey at some distance. Such relatively clear water is found over the bedrock reefs in the island region. Experienced sport fishermen expect to find walleye concentrated around clean, hard bottoms, such as rocky reefs, gravel or clean sand, and at the edge of weed beds. Reefs are good feeding places for walleye. Cladophora beds (a filamentous green algae) harbor emerging insects and zooplankters. Zooplankton attract small fish, usually shiners, upon which walleye prey.

Scuba divers who have inspected reefs in western Lake Erie have observed walleye lying motionless on the rocky bottom during daylight. This daily "resting requirement" may tend to limit them to reefs and other hard bottoms. Silty or muddy bottoms with high organic concentrations tend to have lower oxygen concentrations. This is especially true during calm periods when currents and water mixing are slight. Walleye prefer not to rest in these areas because of their requirement for high oxygen concentrations.

Walleye commonly spawn over rock, rubble or gravel in streams, shallow offshore reefs or along shorelines of lakes (Eschmeyer, 1950). Spawning runs of walleye persist in only two major Ohio streams, the Sandusky and Maumee Rivers. In the 1800s and the early part of this century many of the lake's other tributaries were productive spawning sites (Langlois, 1954), but the construction of dams, siltation, excessive pollution and irregularity of stream flow due to man's activities have destroyed spawning sites. Today, the major existing spawning grounds in the Erie Basin are found on the reefs of the island region. These reefs are free from oxygen-consuming mud.

Researchers have postulated that walleye fry imprint some essential characteristics of their birthplace and that most sexually mature adults return to that birthplace to spawn. These factors would also favor the continued utilization of the reefs by future walleye populations.