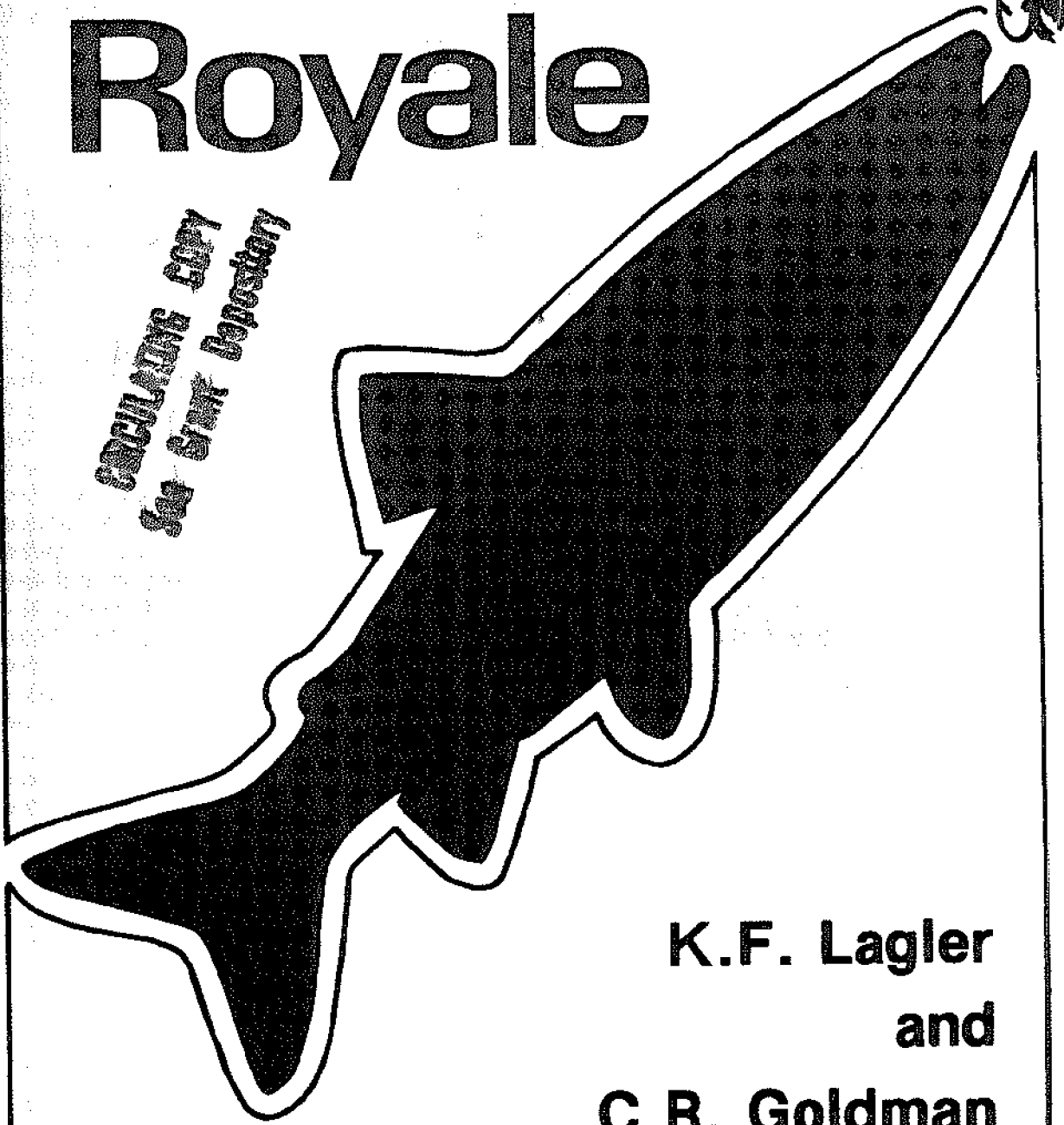


Fishes of Isle Royale

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and
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Fishes of Isle Royale

by

KARL F. LAGLER, PhD
School of Natural Resources
The University of Michigan

and

CHARLES R. GOLDMAN, PhD
University of California, Davis

Revised Second Edition

by

Karl F. Lagler
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About the Authors

Dr. Karl F. Lagler received the degree of Bachelor of Arts in 1934 from the University of Rochester, Master of Science in 1936 from Cornell University, and Doctor of Philosophy in 1940 from The University of Michigan.

The academic and civic activities of Dr. Lagler are very numerous. He has served many state, national, and international fishery and conservation agencies and belongs to, or is associated with, 14 scientific societies. His publications include more than a hundred technical and semi-popular papers and five books including, a monograph (with Carl L. Hubbs) of the fishes of the Great Lakes Region, and a textbook *Freshwater Fishery Biology*. They have won for him international recognition. Over the years Dr. Lagler's graduate students who have earned advanced degrees number more than a hundred at the Master's and Doctoral levels.

At the present Dr. Lagler is Professor of Zoology, College of Literature, Science and the Arts and Distinguished Professor in the School of Natural Resources at The University of Michigan.

Dr. Charles R. Goldman did his undergraduate and master's degree at the University of Illinois and took his doctorate at The University of Michigan. The son of an ardent angler, he developed an early interest in fish, fishing, and conservation. Although most of his fishing has been done in the midwestern and northern United States, Military Service and employment as a research biologist have also taken him to streams and lakes of Japan, Alaska, and many others, worldwide. He is now teaching limnology in the Zoology Department of the College of Letters and Science, University of California at Davis.



Preface to Revised, Second Edition

Since the 1959 first edition of this booklet, there have been many changes in the fish fauna of the Great Lakes, including the waters around Isle Royale. There has also been a substantial increase in knowledge of and experience in the management of the fish and fisheries of Lake Superior and in the fishing of Isle Royale National Park. To prepare this revised edition, I have drawn freely on both published and unpublished information; most regrettably my colleague and former student Dr. Charles Goldman was not able to join me in this effort because of his deep professional involvements elsewhere.

Through the good efforts of James E. Blocker, past president of the Isle Royale Natural History Association, and Donald E. Brown, Superintendent of Isle Royale National Park, members of their respective groups and anglers have contributed observations and experiential notes of great value in amending the first edition. Principal among these contributors have been Ken Vrana, Bruce Weber, Bernard Klugow, and Charles Nottoli. All of these individuals as well as the Natural History Association have my gratitude for helping to improve the presentation, accuracy, and value of the original publication. Drs. Reeve M. Bailey and Gerald Smith have loaned me copies of salmon, trout, pike and walleye illustrations prepared for their book that covers all the fishes of Michigan. These illustrations were made by Karen Payne who was funded by the Michigan Sea Grant Program. Marilyn Eisley, John Judd, and Suzanne Tainter, Michigan Sea Grant also gave support to the preparation of this booklet.

This revision includes a list of references useful for the serious angler or for students of natural history. The authors of these documents are those to whom we owe particular indebtedness for their earlier scholarly work. Outstanding among them is Dr. Walter Koelz. His pioneering field work and fish studies on and about the island enriched understanding of the complex problems in the classification of the whitefishes and their relatives of the coregonine subfamily of the trout and salmon family. The inputs of Dr. Gerald Smith to solving problems of salmon and trout identifications are gratefully acknowledged.

My personal experience with the fish and fishing in Isle Royale National Park was concentrated in the summer of 1945 when for many weeks I circumnavigated and camped around the island to sample the fish along the shores, in the coves, and in all of the permanent lakes and streams. My assistants on that expedition were D. Lundstrom and M. E. Fitzgibbon. Financial obligations were borne by a research grant from The Horace H. Rackham School of Graduate Studies, and logistic support in the field was provided by the state agency that is now the Michigan Department of Natural Resources and by the U.S. National Park Service. Subsequent study visits were made while helping to introduce the unique ecology of the island to summer students from Camp Filibert Roth of the School of Natural Resources of The University of Michigan. Because of the richness of study and esthetic enjoyment opportunities, my days in the park were among the professionally most productive days of my life, and, personally among the most pleasurable! The life of a sportfisher, let alone an outdoor person, is not complete without a period of regeneration in this remarkable insular treasure of the American people.

Karl F. Lagler

Ann Arbor, Michigan

May 5, 1982



Isle Royale National Park

At no time in the history of this country has there been a greater appreciation of its vast natural resources. Of these, the recreational and educational facilities of the National Parks rank among the most important and are used by millions of people each year. One of the wildest and most primitive of such public lands is Isle Royale National Park, Michigan.

Isle Royale, the largest island in Lake Superior, with its numerous adjacent islets was made a National Park by Congressional Act in 1931. The Park's offerings of more than 210 square miles of wilderness area and excellent facilities for boating, swimming, hiking, camping, and fishing are very popular during the summer months. Many visitors return year after year, charmed by the insular solitude that is enhanced by the absence of roads and automobiles. Increasing numbers of anglers visit the island Park annually. This booklet has been prepared to help them and others in the enjoyment, capture, identification, and appreciation of the many fishes found in and about Isle Royale National Park.

Location • Topography • History

The Park is situated at a latitude of 48° North, longitude 89° West, about 20 miles (32 km) northeast of Grand Portage, Minnesota, and about 50 miles (80 km) north of Houghton, Michigan. It is attainable from both these points by boat service. Isle Royale itself is a long, narrow land mass that almost parallels the northwestern shore of Lake Superior, largest of all the world's freshwater bodies. The main island's greatest width is only about a sixth of its 45-mile (72 km) length, and is adjoined by numerous small islands. The general topography of Isle Royale consists of parallel rocky ridges that follow its long axis from northeast to southwest and dip almost 20 degrees to the southeast. The rock strata pass beneath Lake Superior and reappear on the mainland of Michigan about 50 miles to the south.

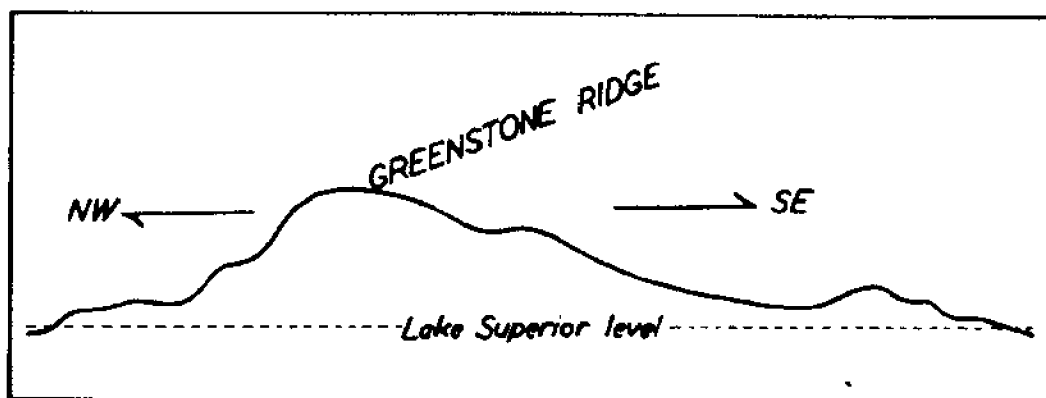


FIGURE 1. Cross section of Isle Royale showing steep northwest-facing and gentle southeast-facing ridge slopes. The highest ridge at the island's center is known as the Greenstone Ridge and is paralleled by many smaller ridges and their intervening valleys. (Diagrammatic)

Following the uplift and tilting of the ancient rocks that compose the mass of the Isle Royale insular group, a series of parallel ridges and valleys developed extending in a northeast-southwest direction. The ridges slope gently to the southeast and steeply to the northwest (see Figure 1). Drainage for the most part follows the narrow valleys between the ridges. Numerous lakes and bogs occupy the valleys. Many good harbors exist along the island shore as a result of the continuation of these valleys beneath the lake level. The longest evident submerged valley is Rock Harbor, 13 miles (about 21 km) long and located near the northeastern end of the island.

Isle Royale was completely covered by glacial ice. After the last major advance of the ice, the water level in the basin now more or less occupied by Lake Superior was much higher than it is today. Drainage to the south and west decreased the lake level leaving wavecut benches as mute evidence of higher lake stages. As the water level fell, the higher lakes on Isle Royale were the first to be isolated from the big precursor of great Lake Superior. Lake Harvey, located near the northern shore at an elevation of 168 feet above Lake Superior was isolated, except for a small outlet several thousands of years ago. The steep narrow outlet has probably served as a successful natural barrier to entry into the lake by many species of fish now present about the island at lower elevations. Only those species present around Isle Royale long ago could have gained access. Siskiwit Lake (the island's largest inland body of water) was similarly "isolated" at a later time, approximately 57 feet above present Lake Superior levels. The highest large lake on the island is Lake Desor, with an elevation of 252 feet. Its size, depth, and the gradient of its outlet may be responsible for the presence of representatives of the ancient postglacial fish population while also permitting relatively recent invasion by several additional species (Hubbs and Lagler, 1949a).



Origin of Fishes

A total of some 52 species and 29 genera in 14 families has been found or is likely to occur in waters on and immediately about Isle Royale. The naturally present component of this total represents less than one third of the kinds found in the Great Lakes (Hubbs and Lagler, 1964). An explanation of this phenomenon may lie in the relatively sterile nature of Lake Superior as compared to the other Great Lakes and in the isolated northern position of the island. It is separated from a limited mainland shore fauna by water which does not now ordinarily reach 50°F (10°C) at the surface even in midsummer. In spite of this formidable coldwater barrier, most of the fishes of Isle Royale are native. Exotic fishes present in the basin around the island include not only the brown and the rainbow trouts but also perhaps four kinds of Pacific salmons, and the immigrant sea lamprey, rainbow smelt, and the alewife (a member of the herring family), and possibly even the Atlantic salmon.

The problem of how mainland fishes, especially "warm-water" ones, reached Isle Royale after the retreat of the last glaciers has been perplexing. Puzzling too is the question of why some fishes made the trip and became established whereas others apparently did not. For example, of the 36 species found in the tributary streams along the nearby northwest shore of Lake Superior by Smith and Moyle (1944), eight have not become established at Isle Royale. Most repopulation of the area following the last retreat of the glacier probably occurred via the meltwater streams that flowed southwest from the ice front to the upper Mississippi Valley. These streams could have afforded access to the Lake Superior basin by fishes inhabiting unglaciated areas to the south in the Mississippi drainage and from other unglaciated areas similarly connected.

No geologic evidence has been found to support theories of an ancient land connection between Isle Royale and the northwest shore of Lake Superior. This would seem to rule out the invasion of fish by small waterways on a land bridge.

It is possible that in time of floods on the mainland, fishes may have been washed into Lake Superior and wandered to Isle Royale. However, a crossing of at least 20 miles of deep, cold water by small fishes does not appear to be very likely. If, however, pond or stream fishes of the mainland found floating

logs or brush in the big lake, they may have, for the food and shelter provided, tagged along with such rafts to the shores of the insular group. Preferred habitats in streams and inland lakes warmer than Lake Superior may have been attained and the first breeding populations established. In addition, the bathymetric (depth) distribution in the Great Lakes proper of fishes most commonly known from shallow-water habitats, as, for example, the Iowa darter, can be surprising.

The presence of fish in isolated bodies of water has sometimes been attributed to accidental transport of eggs or individuals by birds, other animals, or unusual wind conditions such as those which produce water-spouts. Whether or not accidental transport of these kinds or intentional transplants by aboriginals affected fish distribution to Isle Royale is not known. What is perhaps the best solution of the Isle Royale problem in fish geography rests on the theory that a period of much warmer climate followed the last retreat of the glacier — climate perhaps even warmer than that which we now have. This theory is supported by studies of pollen grains from bottom sediments in the Great Lakes showing presence of warm-climate vegetation. Sufficient warming of Lake Superior would have favored the northward dispersal of "southern" fishes to Isle Royale.



Fish Habitats of Isle Royale

Isle Royale offers both fish and fishermen a substantial diversity of water types. Notable by their absence, however, are boatable and overall good fly-fishing streams. Although many fishes are able to adjust rapidly to a wide variety of water conditions, the majority show preference as to depth, current, bottom type, and temperature — quite as individual fishermen select specific environmental combinations for fishing. A knowledge of the existing stream, lake, and shoreline conditions is of great value to the fisherman in locating preferred fishing sites as well as in exploiting them to advantage.

Lake Superior

At Isle Royale the most extensive habitat is, of course, the surrounding water of Lake Superior. Scientific collections have been made along the shore and to great depths. The bottom of Lake Superior slopes more gradually from the island on the southeast than on the northwest. This provides the most extensive area of moderate depth to the southeast. Hubbs and Lagler (1949) reported about 20 species from the margining waters, up to approximately 50 feet (about 15 meters) in depth, to which may now be added the seven non-native recent immigrants or introductions: sea lamprey; alewife, rainbow smelt; and the sockeye, pink, chinook, and coho salmons. In this zone, among the fishes usually sought by anglers are the rainbow, brook and lake trouts (and, expectedly, the brown trout), northern pike, yellow perch, and walleye. The now relatively rare lake sturgeon has not been taken for some time in commercial gill nets in the area. The muskellunge was last reported, perhaps erroneously, on Isle Royale in 1906 for the inshore habitat. The white sucker as well as the longnose sucker are common along the shores. Similarly the lake chub and burbot are quite abundant near the shores and among the islands. Mainstays of the park's historic commercial fisheries in these waters are the lake whitefish (both ordinary and large jumbo varieties), round whitefish (locally called menominee), ciscoes (some locally called lake herring; others, chubs), and lake trout (both the ordinary and the siscowet or fatty kinds).

Open Shore

Along unprotected shorelines in the shallow water that is constantly subjected to wave action, the lake chub, longnose dace, trout-perch, ninespine stickleback, young suckers, and sculpins are found. This habitat is not continuous around the main and other islands since it is interrupted by irregularities in the shoreline that form protected bays and coves. Because of the eroding action of ice and waves on exposed shores, rooted aquatic plants have little opportunity to take hold. The aquatic insects and fishes that dwell here are adapted to life in turbulent water; elsewhere in their ranges many occur in swift streams.

Sheltered Shore

Sheltered coves and the mouths and low, baselevel portions of streams make up another habitat that is transitional between Lake Superior and the inland waters of Isle Royale. Of about 30 species of fishes that occur here, the most typical are the white sucker, lake chub, longnose dace, trout-perch, slimy sculpin, brook stickleback, and the ninespine stickleback. A considerable variety of fishes in such a relatively warm, quiet zone is more the rule than the exception. The most prominently represented sport species is the northern pike.

Rapid Flowing Water

Swift streams or rapid parts of otherwise slow streams on Isle Royale have a fauna similar in many respects to the exposed shorelines. Subjected to the constant force of the stream current, animals must be able to maintain themselves against it or be swept away. Stretches of rapids are to be found in the Little Siskiwit River, Washington Creek, and a number of the streams, both permanent and temporary, that drain the island slopes and lakes (see map, centerfold). Characteristic species, that are also found along exposed shorelines, are the white sucker, longnose sucker, lake chub, longnose dace, and slimy and mottled sculpins. Both the brook trout and rainbow trout are present in swift stretches of streams as well as in associated pools. Despite the introduction of the rainbow trout, collections in 1949 indicated that the brook trout was still the most abundant. The brown trout was not collected on the principal island at that time, nor was it found some years later in Isle Royale streams during examinations of them for evidence of sea lamprey spawning (Moore and Braem, 1965).

Quiet Inland Waters

Lakes, bog ponds, and beaver impoundments are very numerous on Isle Royale itself and constitute an important habitat for fish which varies considerably with depth, elevation, and extent of drainage area. The bog ponds are rather unproductive in comparison to the lakes and will be considered last. A survey of the species composition and lakes makes it possible to divide them into two general classes: (1) those that contain members of the whitefish group and (2) those that do not. By far the largest number of Isle Royale lakes fall into the latter category, although rather certainly all of the lakes originally contained whitefish and their relatives.

Those lakes characterized by the presence of whitefish are, with one exception, the largest and deepest lakes on Isle Royale. Their depth and clear water provide a more suitable habitat — similar in some respects to Lake Superior — for a larger variety of fish than the shallow lakes and bog ponds on the island. Of the 17 different species that are in Siskiwit Lake, 13 are also in the adjacent waters of Lake Superior. Present in one or more of the large, cold inland lakes are whitefish, cisco, brook trout, lake trout, northern pike, yellow perch, northern logperch, spoonhead sculpin, slimy sculpin, brook stickleback, and ninespine stickleback.

A typical and large lake of the group not containing members of the whitefish tribe is Lake Feldtmann which has a maximum depth of only 10 feet (about 3 meters) and a bottom consisting primarily of mud and sand. This lake is located at the southwest end of the island at a low elevation (see centerfold map). The yellow perch, northern pike, and white sucker are the principal fishes found in this environment. Other lakes of similar character to Feldtmann may also contain the blacknose shiner, spottail shiner, golden shiner, and white sucker.

Waters containing the fewest kinds of fishes on the main island are the bog ponds, beaver ponds, pools in sluggish streams, and shallow lakes. Boggy waters are common on Isle Royale. Examples would include Wallace, Sumner, Mud, Stickleback, Lily, Ahmeek, and Sholtz lakes, among others (see centerfold map). Although they differ greatly in size, shape and altitude on the island, these brownish, soft waters have in common a total of six species or less. Partly decomposed vegetation forms a soft ooze on the bottoms, so that a wader is in constant danger of filling his boots with

water. These bog ponds represent a late stage of evolution before the invasion of vegetation along their margins finally fills and extinguishes them.

The fishes found in shallow, quiet inland waters of Isle Royale are those that tolerate an environment of sluggish or nearly stagnant water and include the brook stickleback, northern pike, yellow perch, white sucker, blacknose shiner, and golden shiner. Of the nine species found in this habitat the most typical are the redbelly dace, finescale dace, and fathead minnow.



Fishing at Isle Royale

Historically the fisheries on and around Isle Royale were for food rather than for fun. Since establishment of the area as a National Park and changes in policy by the Michigan Department of Natural Resources (DNR), the commercial fishery, suffering from the declining number of lake trout, has turned in part to members of the whitefish sub-family. Sport fishing at the same time has been increasing and is favored by prevailing policies. The principal recreational species are three trouts (lake, brook, and rainbow), the northern pike, the walleye, and the yellow perch. All of these are good to eat. They are found variously in 32 inland lakes (Table I) and in the surrounding waters of Lake Superior (see centerfold map). However, there are many other species, mostly edible, that may reward the angler with the pleasure of fishing for variety in kinds rather than for maximum size.

One inveterate angler, Bernard Klugow, with more than fifty trips to Isle Royale behind him endorses the use of planned fishing itineraries. One such planned trip would combine boating around the shore from McCargo Cove to Chippewa Harbor, with hiking into Siskiwit Lake, Lake Richie and Lake Whittlesey. Enroute at Brady's Cove the expected catch would be large northern pike. In McCargo Cove, whitefish would be the target, possibly along with good sized brook trout. The hike into Chickenbone Lake is likely to be rewarded with good size ranges of walleye and northern pike, but lakes Livermore, Lesage, and Richie along the way would yield good eating but often small pike. Arrival at Chippewa Harbor should be greeted by consistently fine catches of northern pike varied with lake trout and whitefish at the Harbor's mouth. Modest sized walleye and pike and good perch are most commonly taken after the hike into Lake Whittlesey. The terminal camp at Siskiwit Lake brings one to water that is noted for its lake trout and big northern pike along with delectable brook trout in the tributaries.

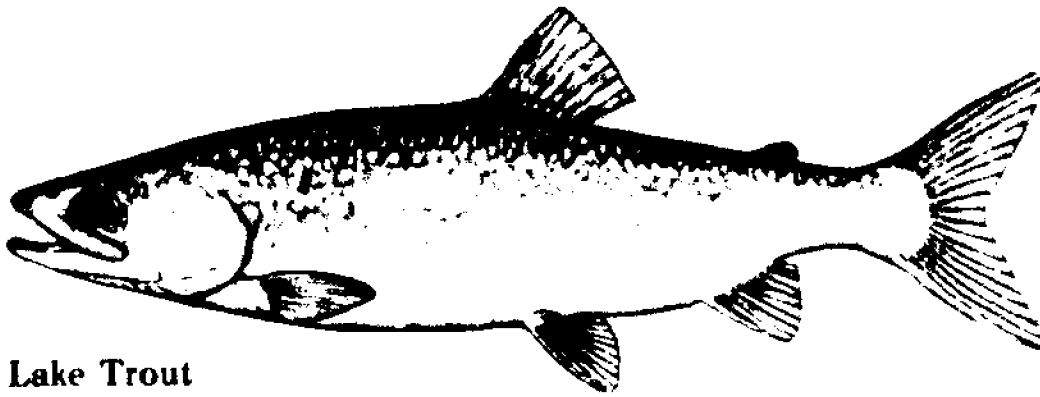
**TABLE I, Fishing Lakes on Isle Royale
Their Depth, Length and Sport Fishes Present****

Lake	Maximum Depth* ft., (m)	Length of Longest Axis* mi., (km)	Brook Trout	Lake Trout	Northern Pike	Yellow Perch	Walleye	Pumpkinseed Sunfish
Ahmeek	10 (3.0)	1/2 (0.8)			X	X		
Angleworm	30 (9.1)	2-1/5 (3.6)			X	X		
Beaver	17 (5.2)	3/4 (1.2)			X	X		
Benson	14 (4.3)	1 (1.6)			X	X	X	
Chickenbone	21 (6.4)	1-7/10 (2.8)			X	X	X	
Desor	55 (16.8)	3 (4.8)	X					
Dustin	22 (6.7)	1/8 (0.2)			X	X	X	
Epidote	5 (1.5)	1/16 (0.1)			X	X		
Eva	24 (7.3)	5/8 (1.0)			X	X		
Feldtmann	10 (3.0)	1-1/2 (2.4)			X	X		
Forbes	21 (6.4)	1/4 (0.4)				X		
George	10 (3.0)	1/2 (0.8)			X	X		
Halloran	10 (3.0)	1 (1.6)			X	X		
Harvey	13 (4.0)	1 (1.6)				X		
Hatchet	18 (5.5)	1-1/4 (2.0)	X					
Intermediate	24 (7.3)	1-1/8 (1.8)			X	X		
John	14 (4.3)	1/2 (0.8)			X	X		
Lesage	30 (9.1)	7/8 (1.4)			X	X		
Lanklater	21 (6.4)	1 (1.6)			X	X		
Lavermore	19 (5.8)	1 (1.6)			X	X		
Mason	26 (7.9)	1 (1.6)			X	X		
McDonald	14 (4.3)	1/2 (0.8)			X	X		X
Mud	3 (0.9)	1/2 (0.8)			X			
Otter	14 (4.3)	3/4 (1.2)			X			
Patterson	13 (4.0)	1/2 (0.8)			X	X		
Richie	39 (11.9)	2 (3.2)			X	X		X
Sargent	45 (13.7)	2-3/4 (4.4)			X	X		
Shoshone	20 (6.1)	1/2 (0.8)			X	X		
Schultz	5 (1.5)	3/16 (0.3)			X	X		
Siskiwit	142 (43.3)	7 (11.3)	X	X	X	X		
Wagejo	10 (3.0)	1/4 (0.4)			X			
Whittlesey	30 (9.1)	2 (3.2)			X	X	X	

* Approximate

** Sport fishes are not known from Suckleback, Newt, Theresa, Wallace, Sumner, and Lily lakes

Based largely on Hubbs and Lagler 1949, with the walleye recently reported for Chickenbone Lake and the yellow perch for Eva Lake as relayed to me by Ken Vrana of the Isle Royale National Park Service staff in 1981.



Lake Trout

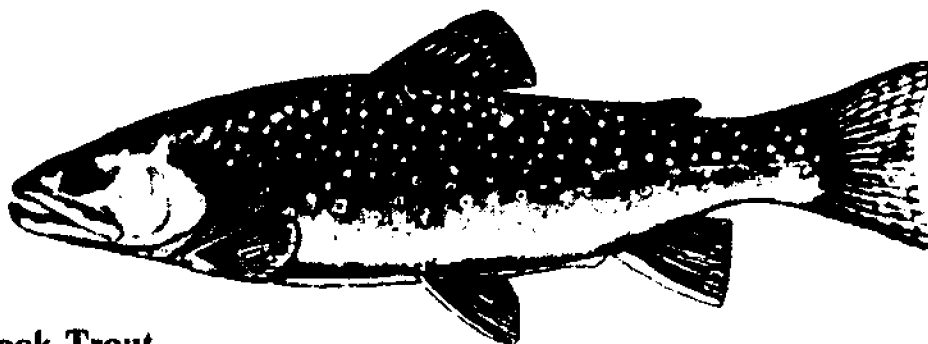
The lake trout or "mackinaw," as it is often locally called, is of great importance to the fishers of the Isle Royale waters of Lake Superior. Island names for the lake trout include "channel salmon" and "redfin." It is easily distinguishable from the other trouts by its characteristically drab coloration mottled with grey. The body of this fish lacks the reds and reddish browns present in the brook, brown and rainbow trouts, although the lower fins may have a rusty-orange tinge. Its moderately but clearly forked tail serves to differentiate it from other trouts of the Park which are all more or less "square-tailed." The lake trout population of Lake Superior was the last of those in the Great Lakes to experience the depredations of the sea lamprey.

Commercially, the lake trout was harvested by gill nets, trap nets, and set lines (baited hooks attached by short lines from long heavy "maitre" cords). It is reported by Hile, Eschmeyer, and Lunger (1951) that formerly set lines have produced about twice the catch of gill nets in the area. However, set lines were abandoned when they produced very poor catches. Sport fishers take the lake trout by trolling or bobbing. Short stiff rods, heavy-duty reels, and strong nylon (up to 40-lb. test), copper or other metal line, to facilitate fishing at depths of 100 or more feet (some 30 meters), is the equipment usually employed. Large copper or silver spoons, feathered lures, and plugs have been successfully used for many years. During very early and late summer, the lake trout may be taken near the surface on light tackle. With this gear it is able to put up a much better fight than when weighted down with heavy line and a clumsy lure.

Many of the lake trout taken weigh about 15 pounds (some 7 kg), but an occasional historic specimen ran over 100 pounds (about 45 kg). The diet consists largely of other fishes including ciscoes, smelt, and chubs. Because of the large size and deepwater habits, adults were relatively safe from the

common predators of fish until the arrival of the sea lamprey. Catastrophic reduction in the numbers of this trout in the Great Lakes by depredations of the sea lamprey presumably has led in turn to an increase in the numbers of their prey. Considerable effort is being made to protect the lake trout in Lake Superior by intensive international lamprey control and by stocking.

The lake trout usually spawns on reefs, sometimes at a considerable distance offshore in waters from 6 to 120 feet (about 2 to 38 meters) deep where the bottom is either rock or gravel. The distribution around Isle Royale includes most of the larger bays and coves and, on the island, Siskiwit Lake (see centerfold map).



Brook Trout

The brook trout is a native of Isle Royale and can be distinguished from its near relative, the lake trout, by its brighter coloration. Reddish spots, each with a light, bluish halo around it are present along the sides. The dorsal fin and the back lack bright coloration but are mottled with dark lines that resemble worm tracings.

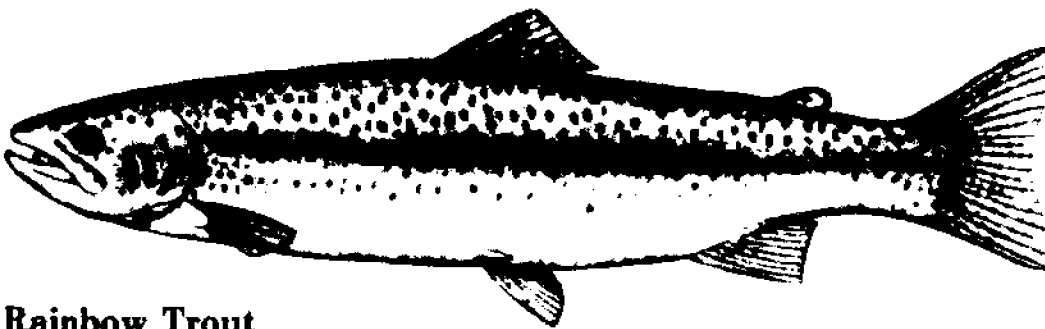
The brook trout is typically a fish of small streams, which, when they are spring-fed and shaded, maintain a fairly cool flow of water over clean rocky and gravelly bottoms. The species is not limited to such situations, however, and can be taken at Isle Royale in Lake Desor, Hatchet Lake, Siskiwit Lake, and Lake Superior, including its bays and harbors (see centerfold map). Three to six-pound lake-run brook trout are not uncommon in Rock Harbor. Streams which support substantial populations are the Little Siskiwit River, with 18-inchers not uncommon below the falls, Washington Creek, and the outlet of Chickenbone Lake.

The brook trout has long been a favorite with anglers for its willingness to seize flies or worms when other trout disdain them. On the end of a light rod even an eight-inch fish puts up

a good fight. Many believe it to be unexcelled as a food fish.

Spawning is in the fall on the gravel bottoms of streams. The female hollows a depression (the redd) and deposits her eggs in it while a male alongside releases milt. Then, moving upstream, the female stirs up the bottom again so that the current deposits a clean layer of gravel over the eggs. After several weeks the young hatch and, as the yolk sac is absorbed, they begin to make their way out of their gravel bed into the free water.

The response of the brook trout to flies, either wet or dry, may in part be attributed to its natural dependence on aquatic and terrestrial insects for a large portion of its diet. Crayfish and worms are also important food items, and as the individual grows larger than nine inches, small fish become an increasing portion of its diet. The large brook trout, including lake-run "coasters", are often important fish eaters, and, as a result, can be taken on small plugs, spoons, and large streamer flies.



Rainbow Trout

The rainbow trout, a native of the Pacific Coast, was first introduced into Michigan about 1880. Stocking has successfully established the rainbow in a number of streams on Isle Royale as well as in the surrounding waters of Lake Superior.

The horizontal rosy band on the side of a stream dwelling rainbow trout is perhaps its most striking characteristic. This band, however, is not very evident in the silver and blue lake-run individuals, called steelheads, so it should not be relied on too heavily for identification purposes. However, tail and the adipose fins are distinctly and profusely spotted, and serve as a more certain means of identification. The rainbow lacks the reddish spots on its side displayed by the brook and the brown trouts.

Rainbows may exceed thirteen pounds (some 6 kg) in weight, but such individuals are unusual. Steelheads grow very rapidly in Lake Superior and usually average somewhat

larger than others of the species that spend their lives in the streams of Isle Royale. Fishing for steelheads during their spring spawning run has steadily increased in popularity in the streams of Michigan and Wisconsin. The time of the maximum migration is dependent upon weather conditions, and generally falls between late January and early May on the Michigan mainland. The fishing of steelhead runs on Isle Royale is usually concentrated in May in the Siskiwit River.

Nest building is accomplished in the same way as the brook trout except that the nests themselves are usually larger to accommodate a female of 15 to 36 inches in length. Two males frequently attend a single female during the actual egg-laying process. The eggs require from 30 to 100 days to hatch according to the temperature of the water. A single female may spawn several times during the spring. The number of eggs laid depends upon the size of the female and therefore may vary from several hundred in small fish to several thousand in large ones.

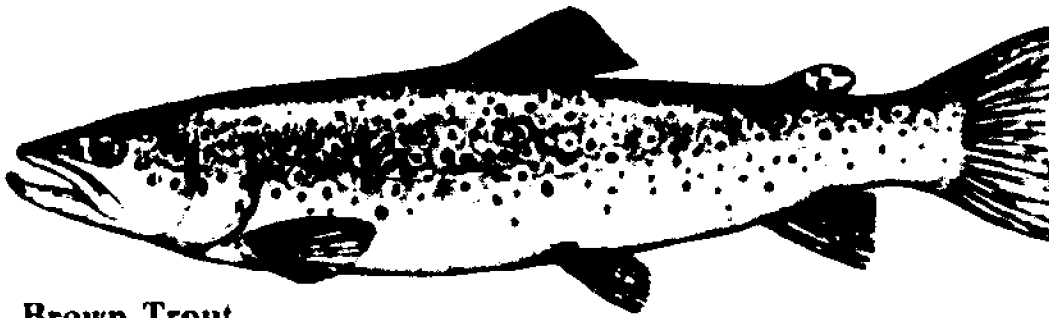
Tagging experiments have indicated that the rainbow is by far the most migratory of the stream trouts. It moves as far as 200 miles from its parent stream and, like the Pacific and the Atlantic salmons, may return to the same stream to spawn. Stocking has long been used to supplement natural reproduction in the management of this and other trout species.

The rainbow trout is very popular with anglers. It often frequents swift stretches of water and, although perhaps not as easily fooled as the brook trout, rises willingly to the fly. Once hooked it is apt to battle spectacularly by repeatedly leaping into the air. It does not require quite as low temperatures as the brook trout and may therefore live well under conditions which are not satisfactory for the native brook trout. The diet of the rainbow is composed of a great variety of aquatic insects, worms, and other organisms including fish. Its willingness to take well-presented flies, worms, or spinners is well known.

One of the best sport fishing localities on the island for rainbow trout is Washington Creek. Schools of them are frequently seen along the shores in Washington Harbor and in Rock Harbor (see centerfold map).

In the 1970's, Minnesota's north shore fishermen were taking between 5,000 and 8,000 rainbow steelheads each year from Lake Superior tributaries not far from Isle Royale

(Hassinger, Hale, and Woods, 1974).



Brown Trout

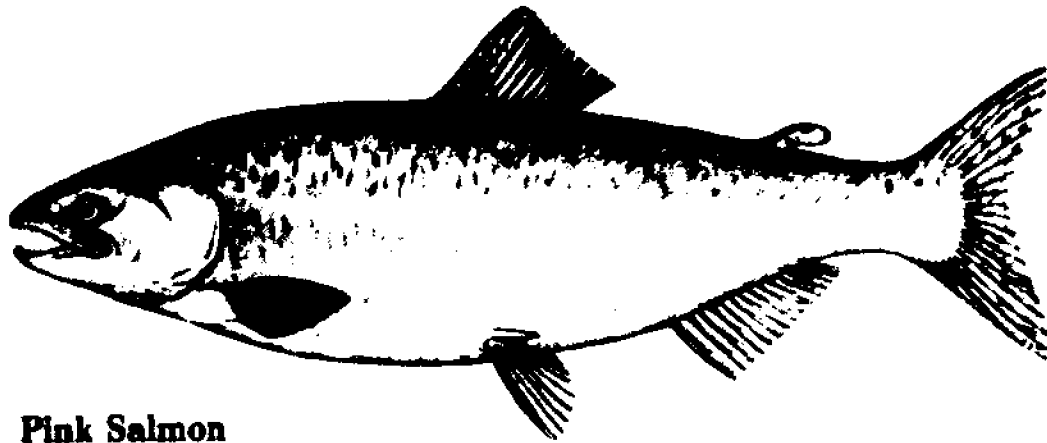
The brown trout, a native of Europe, was introduced successfully into the upper Great Lakes region in the early 1880's. Throughout the Lake Superior basin it has long been common to streams as both resident stream populations and as lake-run populations. The latter reach their greatest abundance in western Lake Superior according to Moore and Braem (1965) who studied fish distribution in streams there that might be used by the sea lamprey for spawning. Thus the brown trout may be encountered in waters of and around Isle Royale National Park. Although without bona-fide records at this writing, the species is included here because of the rather certain probability of its presence.

Populations of the brown trout in streams are readily identifiable from other stream resident trouts by the reddish brown spots on the sides. But in lake-run populations, its appearance tends to merge with the Atlantic salmon (also present in the upper Great Lakes but not known by me from Isle Royale). To a novice it may even be indistinguishable from a steelhead (the blue-green and silvery form of the otherwise rosy-sided and spotted stream resident form of the rainbow trout). Correct identification may involve some scale counts and use of internal characters (Table III, page 32).

A fall spawner like its other relative stream trouts in the Great Lakes region, the brown trout typically prefers gravelly bottoms of cool streams for nesting and burial of the eggs. Some individuals, however, are known to have spawned on rocky reefs in lakes. Although having a wide ranging food habit like the brook and the rainbow trouts, the brown trout is perhaps more of a fish eater. Lake-run individuals grow to larger sizes than stream residents and may get to be 30 pounds (some 14 kg) or more with record lengths elsewhere exceeding 40 inches (about 1 meter) in length.

Stream fishermen have long recognized the cover-loving,

secretive habits of this trout, as well as its capability to feed after dark when it is often most successfully fished with large streamer flies. Lake-run individuals respond very favorably to trolled spoons and jigs.



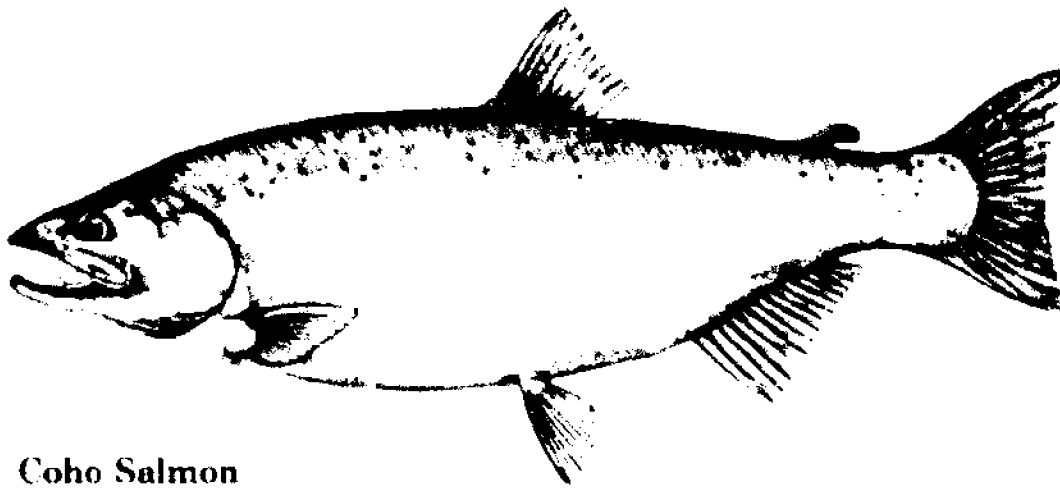
Pink Salmon

The pink salmon is a native of the northern Pacific Ocean and, during spawning season and early growth of the young, in streams of the Pacific Northwest. Sexually mature males develop hooked jaws and a prominent hump on the back which has given the local name "humpback salmon" to the fish. The name "pink" is derived from the color of the fish in its native range. Introduced as fingerlings of the 1955 year class into Canadian waters of Lake Superior in 1956 it appeared in the records of the sport fishery beginning in 1959 and, subsequently, also in the commercial fishery.

The spawning season includes the fall, as for most of its relatives, and the young typically hatch by early spring in the redds in gravelly stream bottoms. A ripe female may contain up to about 2,000 fairly large eggs of about 1/4-inch (6 mm) in diameter. Upon leaving the gravel, the young soon move downstream to the Great Lakes or, in their native range, to the ocean. Here they grow, typically for two years before returning, mostly to their parent streams as sexually mature individuals for spawning.

Lake Superior adults are mostly in the 14 to 16-inch (some 35 to 40 cm) length group and have a weight around 2 pounds (about 0.9 kg). In the big waters where most of life's growth is achieved, the food is dominated by large plankton crustaceans ("mini-shrimp").

In spite of this food habit, the pink salmon is taken in Lake Superior by trolling with flashing spoons, not unlike the practice for kokanee, the lake populations of the sockeye salmon.



Coho Salmon

The coho salmon is also known locally as simply coho, blueback, or silver salmon in various parts of its native range in the northern Pacific Ocean and its tributaries in the Pacific Northwest. The fish was introduced most successfully by the State of Michigan into Lake Michigan beginning in 1966, although other attempts to establish it in the Great Lakes date back to 1873. Within two years it became the backbone of a tremendously vitalized sport fishery. The Government of Ontario planted young coho in Nipigon Bay of Lake Superior in 1969, and it may be encountered now in the waters around Isle Royale National Park.

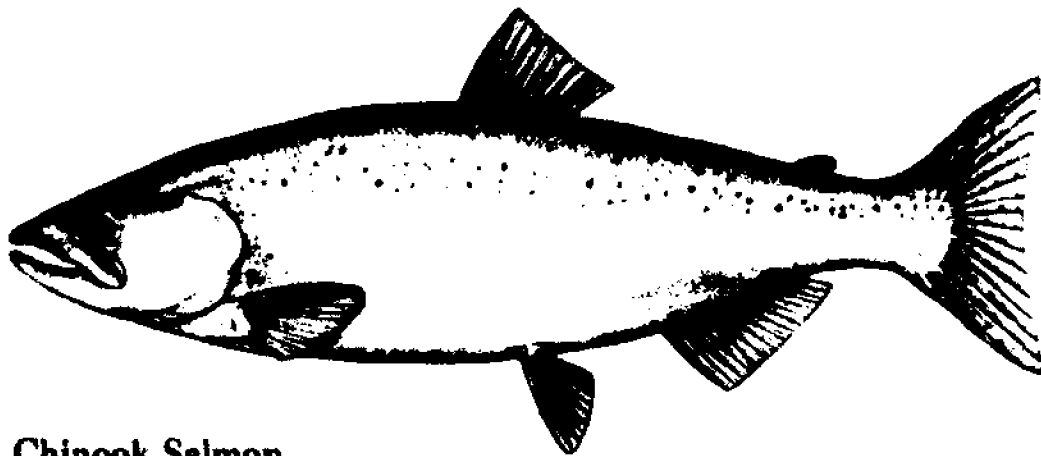
Like the other Pacific salmon and the stream trouts (brook, brown, and rainbow) the coho spawns naturally in a nest (redd) dug in the gravel bottom of the stream which it ascends at sexual maturity. Also, as in the other salmon there is a strong homing tendency. The State of Michigan has taken advantage of this trait to establish its large modern coho hatchery on a Lake Michigan tributary, the Platte River near the town of Honor. Here a weir across the river leads the would-be spawners into the hatchery where they arrive during September and early October. Living to spawn but once and then to die, the adults are taken from the water and stripped of eggs and sperm which are then mixed together. The rather large eggs, mostly 5 to 7 mm in diameter, may number between 1,400 and 5,700 per female in fish between 17 and 28 inches in length (about 440 to 720 mm). After lengthy incubation of up to 100 days depending on the temperature of the cold water in which they are held, the fertilized eggs hatch. The hatchlings are reared to large fingerling size and then stocked by the thousands as silvery smolts in Lake Michigan. The chemistry of the natal and rearing water leads most of those that survive to sexual maturity back to the

Platte, although as in the other salmons there is some straying to other streams.

Growth in the Great Lakes is excellent and during the 1970's was attributed, importantly, to the abundance of the alewife which the piscivorous coho eats most readily.

In the Great Lakes region spawners will have spent at least two years foraging in the big waters and range upward in size to 30 inches (some 760 mm) and more upon entering tributary streams in the autumn.

Sport fishing for the coho salmon in the Great Lakes waters is almost entirely by trolling with large plugs, spoons, or feathered jigs. The preferred temperature range as determined in the laboratory is in the middle 50's°F (12° to 14°C) and depth distribution may be influenced by temperature. In Lake Michigan, most coho are caught within a few miles of shore, coming closer to shore as the early fall spawning season approaches. Some are also taken on light tackle, including spinning gears and large flies (often bucktails) as they enter streams. Also many are reportedly foul-hooked (or snagged), especially when concentrated in streams.



Chinook Salmon

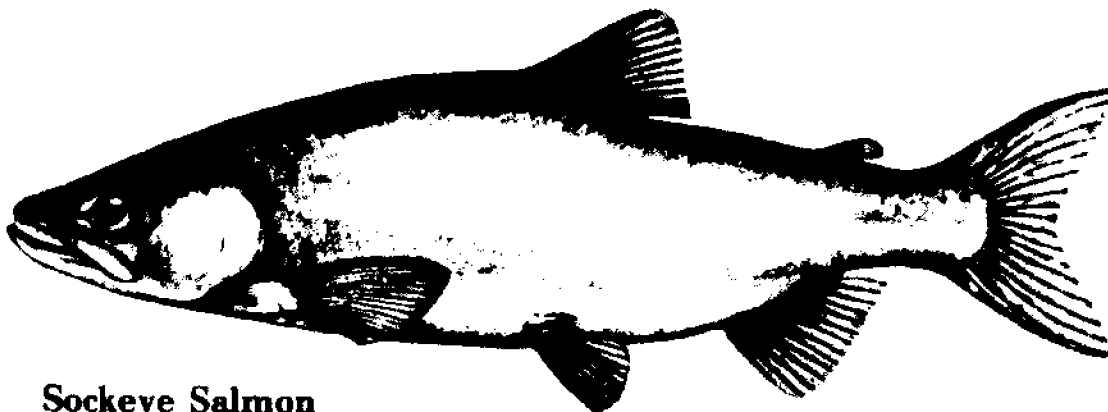
The chinook salmon is a native of the northern Pacific Ocean, southward to California, where it is variously also known as the king, spring, and quinnat salmon or tyee. It was repeatedly introduced into the Great Lakes basin at least since 1873, but apparently became established with spawning runs only after 1970, now reportedly beginning to appear in the sport fishery along the shores of Isle Royale (Charles Nottoli, personal communication 1981). It is acknowledged that the external color characteristics of introduced lake-run salmons (chinook, coho, pink, and Atlantic) are often not sharply distinctive among the species, nor between these salmons and

the lake-run populations of the also-introduced brown trout and rainbow trout (the latter called steelhead because of the coloration of the lake-run individuals, see Table III, page 32).

Basically a spring spawner, with variations extending into summer and fall, the chinook is termed anadromous, because it ascends streams to reach its preferred spawning grounds, usually in gravelly stream beds. Like the stream trouts, spawning takes place in the shallows with females emitting eggs, (some 8,000 for the average individual) and males sperm, both at the same time into a nest, the redd, excavated in the stream bottom. The eggs are then covered with gravel and commence their slow incubation, the length of which is determined by the water temperature (the colder, the longer). The parents die after spawning. Emerging from the gravel, the young may remain in the natal water course or water body for as long as a year or two, when they become silvery smolts and descend to the sea or a Great Lake for growth and the attainment of sexual maturity. In the Pacific Northwest, sea-run individuals then grow for some 2 to 5 years before returning to the natal stream to spawn. There the fish are of 30 to 40 pounds (some 13 to 18 kg), but sometimes exceed 120 pounds (some 54 kg). As they grow, food habits change from predominantly insect larvae to fish.

The largest of the Pacific salmons, chinooks are highly valued as sport fish. Moderately deep trolling with spoons or fish-baited hooks is the principal fishing method.

In time, chinook salmon fishing may become an unusually rewarding activity around Isle Royale.



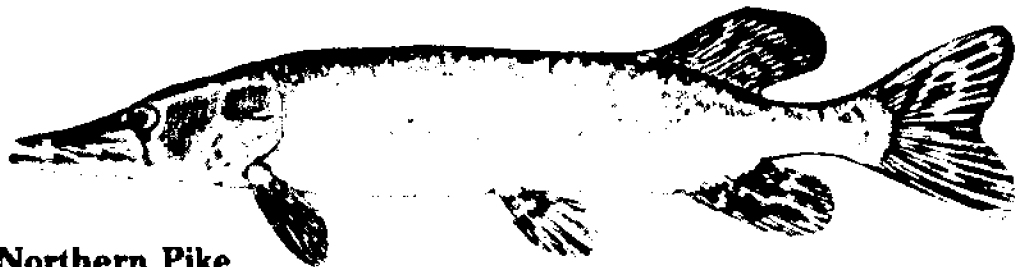
Sockeye Salmon

The sockeye salmon in some parts of its native range which includes the Pacific Northwest and northern Pacific Ocean is also known as the red salmon. Landlocked, freshwater populations, as in Lake Pend Oreille, Idaho, are called

“kokanee.” Establishment of spawning populations has followed from introductions into waters of the upper Great Lakes subsequent to the mid-1960's.

Although breeding individuals ascending streams from the ocean for spawning are prominently red, some freshwater populations are not and offer problems in field identification. The sockeye is typically anadromous and a fall spawner in lakes and streams. In stream or lake, spawning is on gravel beds in a typical trout/salmon nest (redd) excavated in the bottom into which the eggs and sperm are shed and buried. Like the other Pacific salmon (and the sea lamprey, but unlike the Atlantic salmon) the parents live to spawn but once and then die. Inland populations, after descending as silvery smolts from the natal stream or lake in which they spend the first years of their life (2 to 5 years in sea-run populations but often 2 to 8 years in the freshwater run), grow for another 2 to 3 years before homing to spawn. Death follows spawning. In the sea, sizes at maturity range to more than 1.5 meters with an average of less than 0.5 meter (more or less 20 inches). Landlocked races may attain about the same size but are mostly smaller. Great Lakes specimens are mostly between 15 and 17 inches (around 0.4 meter) and up to 2.5 pounds (about 1.1 kg) in weight.

Adapted for feeding upon microscopic life (plankton), the sockeye usually spurns conventional trolling with a hook-bearing spoon. Inland sport fishers favor the use of “cow-bells” or the “willow leaf troll” (a string of flashing metal blades ending in a small hook or hooks, that may or may not carry a small bait such as a salmon egg or a bit of a worm). Why the sockeye responds cooperatively to this lure, even when not baited, remains a peculiar mystery, but perhaps the small, shiny hook in itself is the ultimate lure.



Northern Pike

The northern pike is relatively abundant and widely distributed on and around Isle Royale, occurring in at least 29 of the main island's lakes (see centerfold map). It is easily

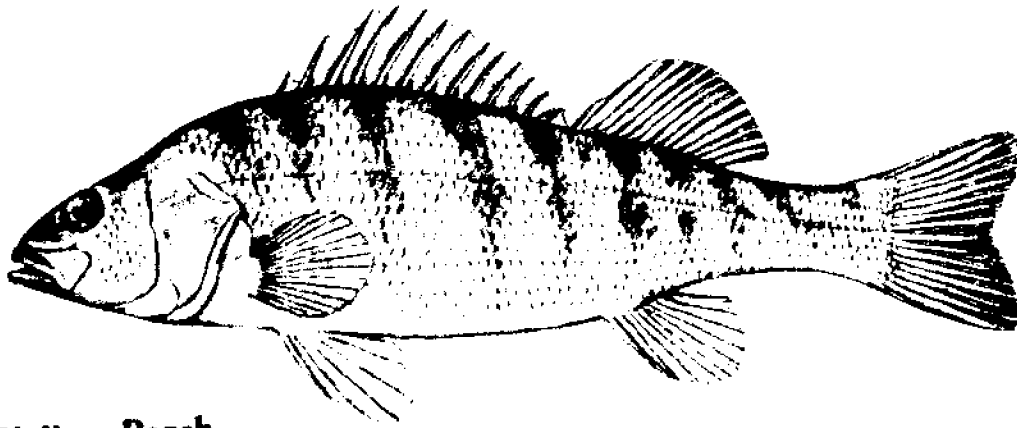
recognizable by its elongated head and snout, which slopes forward from the forehead like a duck's bill. The strong jaws are armed with many sharp teeth. The single, spineless dorsal fin is set well back on the long body, directly above the anal fin. A near relative of the pike, the muskellunge (Figure 36) was reported, perhaps erroneously, from Washington Harbor on the westerly end of Isle Royale in 1906 and allegedly also from Duncan's Bay in the 1930's. None has been recorded since. The northern pike can easily be distinguished from the muskellunge by its fully scaled cheek, and half-scaled gill cover. The muskellunge has such scales only on the upper half of both its cheek and gill cover. The coloration of the pike is a dark greenish with light flecks, whereas a musky has dark markings on a light background, somewhat like a tiger.

The northern pike is found in a wide variety of habitats from shallow marshes to deep lakes and rivers. In the spring it seeks out the shallow water in marshes for spawning, often migrating considerable distances to the proper habitat. Eggs are broadcast on the bottom and are left without parental protection.

The pike is primarily a fish-eater, but includes in its diet almost any animal it can swallow. It is not uncommon to find several small pike in the stomach of a large individual, and even an occasional young waterfowl is not safe from attack.

Casting, spinning, or trolling with spoons or plugs of most any color are favorite methods of catching northern pike. The species reaches as much as 60 pounds in weight and, although according to some anglers not the fighter that the muskellunge is, it usually puts up a great battle. Extreme care should be exercised in removing hooks from the mouth because the teeth are dangerously sharp.

The northern pike is found in most of the coves around Isle Royale and, as already noted, in most of the inland lakes. Since the pike frequently lies in wait for its prey under cover of weeds, rocks, or brush, casting or trolling along the edges of such hiding places frequently brings good results. A common habit of the pike is to follow an underwater spoon right up to the shore or boat before surprising the angler with its smashing strike — so stay ready!



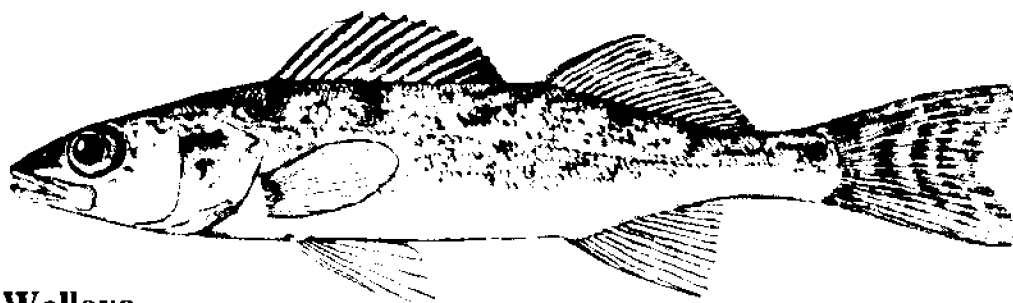
Yellow Perch

The yellow perch is plentiful on Isle Royale as might be expected because it is typically a northern fish, abundant nearly everywhere in the Great Lakes. It is easily recognized by its dark greenish back and bright yellow sides with seven broad, dark vertical bars which nearly ring the body. The first of the two dorsal fins contains stiff spines whereas the second has only one or two feeble spines and about eighteen soft rays. The yellow perch seldom exceeds two pounds (about 1.0 kg) in weight and in cold northern waters is often much smaller. Its great value rests in the fact that it is easily taken and provides sport for a vast number of anglers of all ages who prefer quiet, restful fishing. Because of its abundance and quality as a food fish, it has considerable commercial importance throughout the region.

Although found in all the Great Lakes and a great variety of rivers, the yellow perch does very well in clear, cool, inland lakes which have an abundance of aquatic vegetation. Gregarious by nature, it is often found in schools. Small individuals, a favorite food of the pike, stay close to the cover afforded by vegetation, whereas larger fish frequently move in deep water.

In early spring the gelatinous ropelike strands of eggs of the perch may be seen among the weeds in the shallows. The high reproductive potential of the species often causes overpopulation in lakes, and results in apparently stunted growth. The food includes insects, crustaceans, small fish, snails, clams, and worms.

The yellow perch is most easily caught on small minnows or worms, but takes flies, spinners, spoons, and even plugs on occasion. It is found in at least 29 of the 39 lakes (see centerfold map) on Isle Royale and also along the shores of all the islands in the Park.



Walleye

The walleye is the largest freshwater member of the perch family and reaches a maximum length of about 3 feet (1 meter) and weight of 25 pounds (about 11 kg). It is easily distinguishable from the perch by its large glassy eye and the lack of broad, dark vertical bars on the sides.

Although primarily a lake species in the Park, it is also found elsewhere in large rivers where particular concentrations often occur below dams. It spawns in the spring at night on sand or gravel in 3 to 10 feet of water in lakes and slow streams. The small, numerous eggs are adhesive and stick to bottom materials.

The walleye is primarily a fish-eater and starts on this diet as soon as ten days after hatching. Insects, crayfish, other small crustaceans, and worms are also taken.

This perch-like fish is known on Isle Royale from Chickenbone and Whittlesey lakes and, at least in the past, from Chippewa and Washington Harbors (see centerfold map).

The walleye is very important in both sport and commercial fisheries. As a rule it is not easily caught by sportsmen and usually requires patient, skillful angling. Trolling in the evening or early morning is frequently most productive, especially along the edges of channels. The species is more apt to take a slowly moving bait than one drawn rapidly through the water. Jigging (bouncing a weighted jig or other bait along the bottom — also called “bobbing”) can also be rewarding.

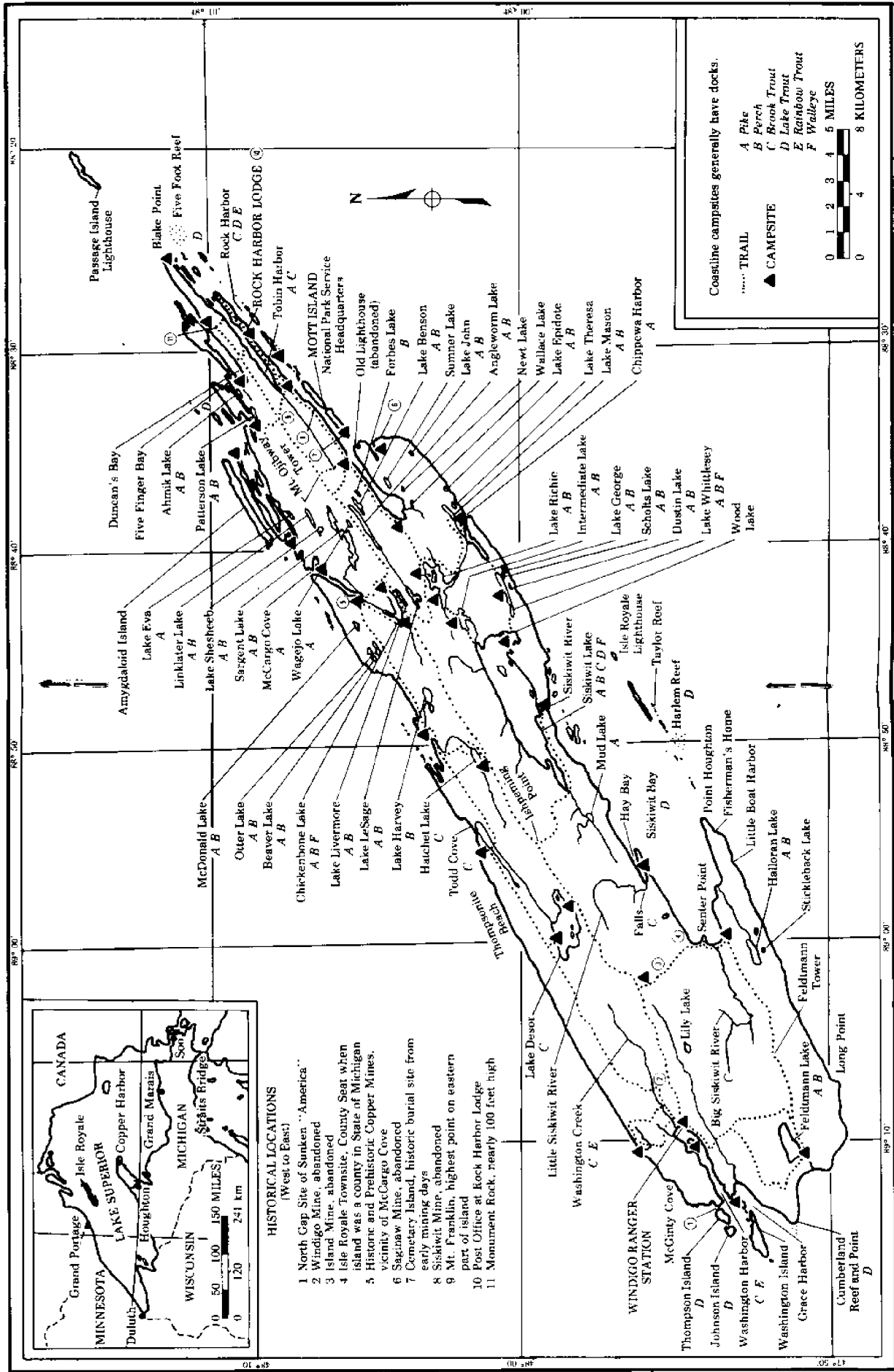
Fishing Isle Royale's Waters

Fishing has been a source of enjoyment and food for Isle Royale residents and visitors. A century ago, miners and loggers relieved their daily toil by tossing a hook into clear, cold Lake Superior waters and grassy inland lakes. No doubt Indians fished before them and stories of the "one that got away" were told just as they are today. Isle Royale's fishing was a valuable selling point during the heyday of the island's private resorts, and fishing is an attraction still for visitors to Isle Royale National Park.

If you wish to fish, a current Michigan fishing license is required. (Trout or salmon fishing requires an appropriate stamp.) Michigan's Department of Natural Resources retains fish management and enforcement authority on Lake Superior and national park rangers assist in this enforcement. The park's inland lakes are administered by the National Park Service and since they are within zoned wilderness there is no biological manipulation of fish stocks.

Isle Royale offers several kinds of fishing opportunities. Whether you hike alone to a wilderness lake or charter a cabin cruiser from a park concessioner you will find your fish. More important, you will also find an opportunity to experience the Isle Royale environment. So bob or troll in Lake Superior waters. Or, indulge yourself in classic brook trout fishing with fly rod or light spinning tackle. Come to Isle Royale and enjoy the park and its fish.

Fishing Waters of Isle Royale National Park



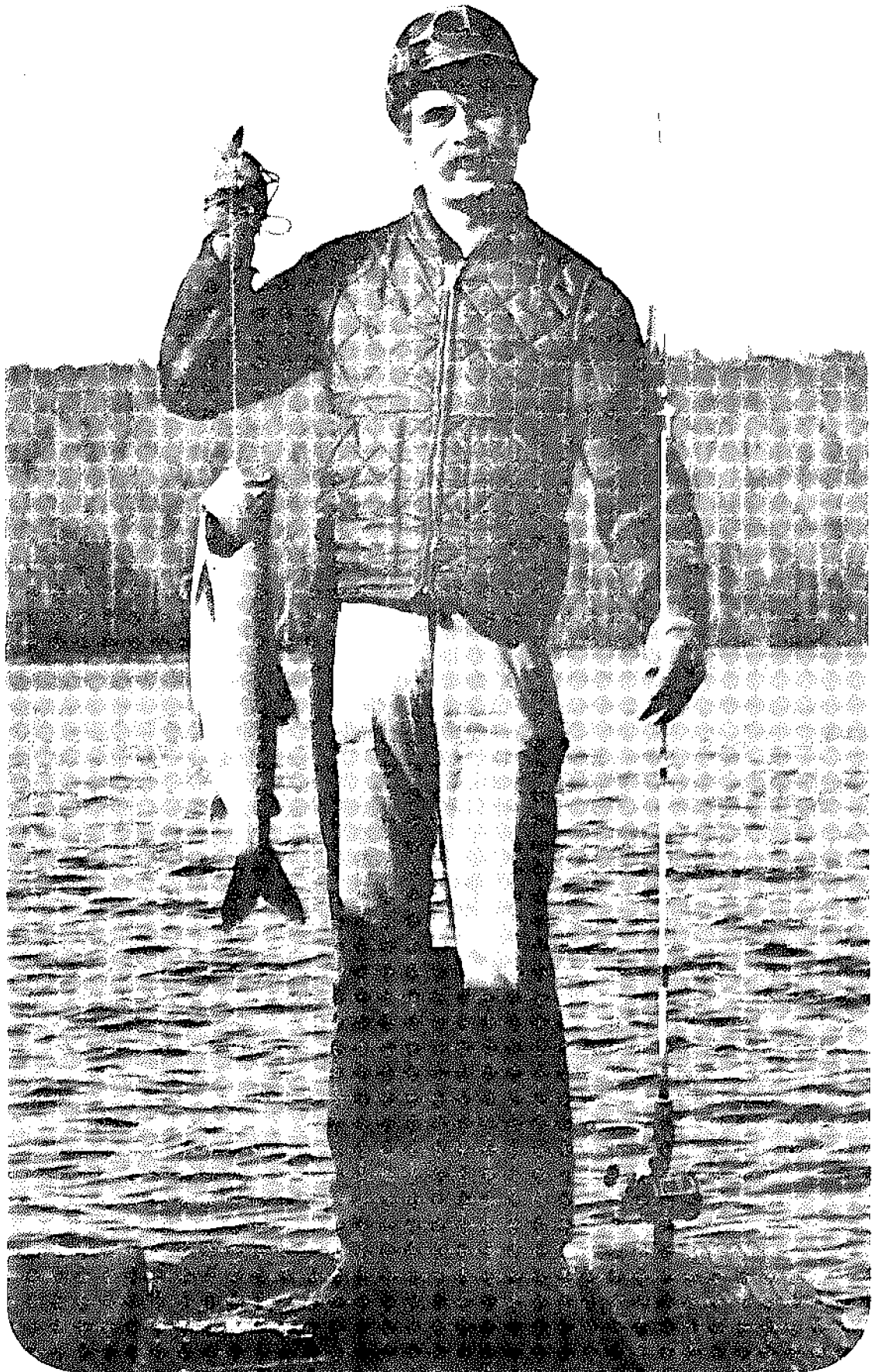


Photo: N.P.S./C. Maass

How to Identify the Fishes of Isle Royale National Park

Almost any fish that comes to hand in Park waters can be identified by comparing it with the figures on the following pages. Should this fail you, try running it through the accompanying simplified pictorial key. If you are still uncertain, or if you wish to have your diagnosis verified, send the specimen or a good photo of it to the Fish Division of the Museum of Zoology at The University of Michigan, Ann Arbor, Michigan 48109, along with information on time and exact place of collection. In order to preserve a fish, place it in full-strength rubbing alcohol (or whiskey), if a 10 per cent solution formaldehyde (available in drugstores) cannot be obtained in time to prevent spoilage. The belly cavity should be slit wide open along the right side of the fish prior to preservation of all specimens more than a few inches long to enable good penetration of the preservative. Preserved specimens can be mailed in a moist condition in a carefully sealed plastic bag (along with date and place of collection and name of person who caught it). The whole can be dispatched in an appropriately wrapped conventional mailing tube.

The Trouble with Fish Names

The names of fishes have forever given problems to sport fishers, outdoor writers, people who like to eat fish, professional students of fishes, and fishery managers. No sooner do they learn to call a fish by a certain common name in one place than they see the same kind of fish in another place, often nearby, and it is called something else. For example, the brook trout that is caught on and around Isle Royale, has more than a dozen other names in its native range in northern North America and in the waters where it has been planted. These include speckled trout, native trout, brookie, squaretail, coaster, etc. The walleye, present in lakes Chickenbone and Whittlesey and also known from Chippewa and Washington harbors of Isle Royale, has more than eighty common and local names throughout its broad range in North America!

For one kind of fish to be called many different names leads to confusion and misunderstanding in communication. Scientists have overcome this by assigning one pair of "official" latin or latinized names to each kind of fish

following a system proposed by Carl von Linné (*Linnaeus*, latinized) more than two hundred years ago. To overcome the confusion of multiple local, colloquial, or common names for one kind of fish, joint committees of the American Fisheries Society and of the American Society of Ichthyologists and Herpetologists have been working hard for some fifty years. The praiseworthy efforts of these committees have now gone a long way toward assigning a single approved common name to each of 2268 species of the United States and Canada. The list, in its latest edition (1980, at the time of this writing) is available from the American Fisheries Society, 5410 Grosvenor Lane, Bethesda, Maryland, USA, 20014.

The scientific or technical name of a fish, or any other animal, is latin or latinized and is the name typically used when fish scientists (ichthyologists) write or talk about it. Each such name is based on a published description made of a specimen or specimens that are then stored in an embalming fluid (most often alcohol) in a museum, such as the University of Michigan Museum of Zoology, Ann Arbor, Michigan, USA, 48109, or the Royal Ontario Museum, Toronto, Ontario, Canada. Questions of identity can be settled by referring to the specimen(s) on which the name was based, as well as by comparing with the original published description.

In actual practice a pair of scientific names is given to each fish, for example, *Esox lucius*, for the northern pike that occurs in several of the lakes on Isle Royale. *Esox* is the genus (generic) name and is begun with a capital letter. The second word of the pair, *lucius*, is the species name assigned by the describer to that specific kind of fish and starts with a small letter. A genus may contain one or more (closely related) species; for example, the genus *Esox* also contains the muskellunge, and the grass, the chain, and the redfin pickerels in North America alone.

The scientific name for any fish is most useful when followed by the name of the person who first described the species. Thus the most useful scientific terminology for the northern pike is *Esox lucius* Linnaeus. The scientific naming of fishes in the foregoing way has gone on for more than two hundred years and the designation and description of a species as new is, of course, a matter of scientific judgement. Thus as museum collections and information have grown, and as communication among scientists has improved over the past couple of centuries, a species is sometimes moved by a

later scholar into a genus different from the one in which the original describer placed it. One of the reasons for doing this is to emphasize closeness of relationship. So that we may know when such a move has been made, the name of the first describer of the species is then placed in parentheses; for example, the scientific name of the lake trout is *Salvelinus namaycush* (Walbaum). In this example, we are clued that the species *namaycush* is no longer in the genus in which it was first described. When trying to gather all that is known about the species from the scientific literature we must also search, we would learn, under the generic name *Salmo* in which the species first was placed by its original describer, Walbaum. Further search, however, would reveal that the species was placed in the genus *Cristivomer* during an intermediate interval of understanding.

Pictorial Key to the Fishes

Compare your specimen with each group of characteristics, in sequence, starting with the first pair, numbered 1A and 1B.

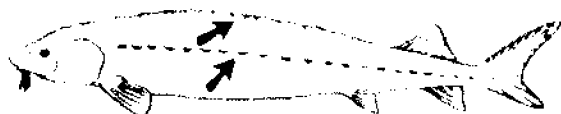
- 1A. If eel-shaped, mouth a sucking disk (without true jaws), and without paired fins, the fish is a SEA LAMPREY (Figure 2).



2. SEA LAMPREY

- 1B. But if not eel-shaped, with true jaws, with paired fins, then go to next split (2A).

- 2A. If armed with bony plates on back and sides, the fish is a LAKE STURGEON (Figure 3).



3. LAKE STURGEON

- 2B. But if not armed with bony scutes, go to next split (3A).

- 3A. If there is no gristly flap in the angle between a pelvic fin and the body, go on from here to (4A).

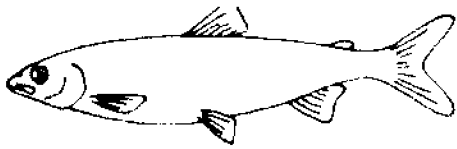
- 3B. But if there is a gristly flap in the angle between each pelvic fin and the body (arrow, Figure 5), the fish is one

of the following three groups of fourteen species, go to (3Ba), (3Bb), and then (3Bc).

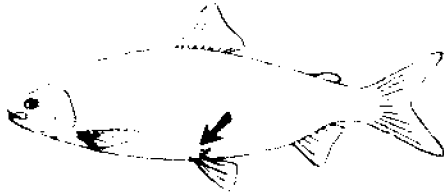
- 3Ba. Jaws toothless but midline of belly with a sharp saw-toothed edge ("sawbelly") the fish is an ALEWIFE (see Annotated List, page 41).
- 3Bb. Jaws without evident teeth (essentially toothless) and midline of belly smoothly rounded, you have a CISCO or WHITEFISH and should compare it with Table II and Figures 4-7 to identify the species.

Character	Cisco (Fig. 4)	Lake Whitefish (Fig. 5)	Round Whitefish (Fig. 6)	Pygmy Whitefish (Fig. 7)
Snout with distinctly angular profile	Yes	No	No	No
Flap between the two nostrils on each side	Double-lobed	Double-lobed	Single-lobed	Single-lobed
Body cigar-shaped, quite round in cross section	No	No	Yes	Yes
Eight to eleven oval spots along sides	No	No	Juveniles only	Juveniles only
Ventral fins orange-hued	No	No	Yes	No
Maximum length about eight inches	No	No	No	Yes

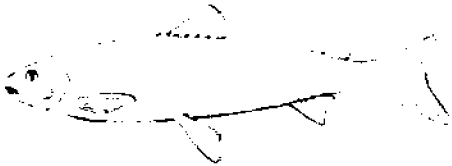
* The "chubs" of deepwaters and certain other relatives of the cisco and the whitefishes are not included here both because they are not likely to be seen by anglers (except in a smoked-fish market) and because of the uncertain state of knowledge regarding them.



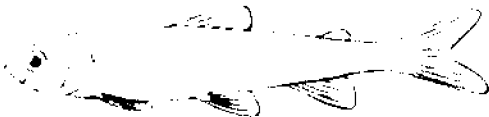
4. **CISCO**
(Locally called "herring")



5. **LAKE WHITEFISH**

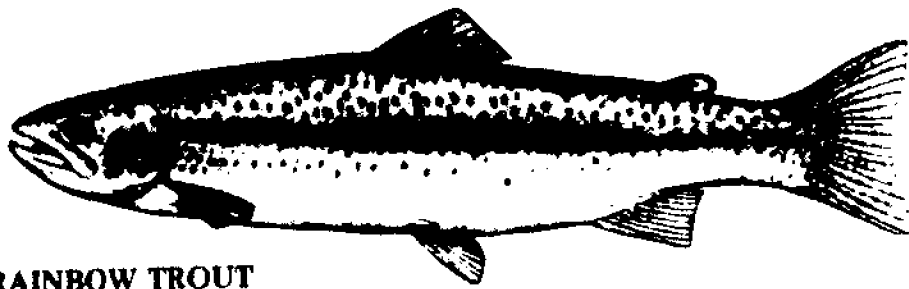


6. **ROUND WHITEFISH**
(Locally called "menominee")

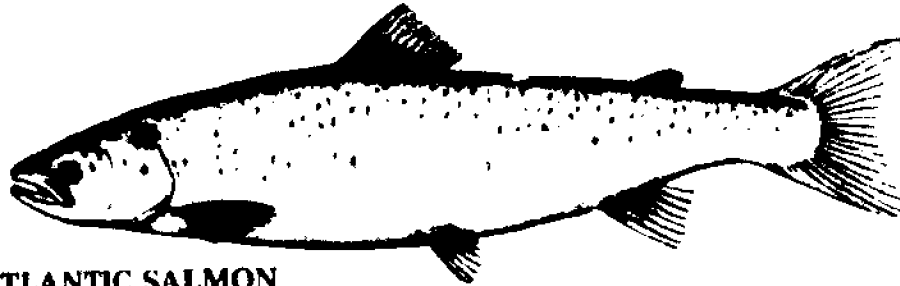


7. **PYGMY WHITEFISH**

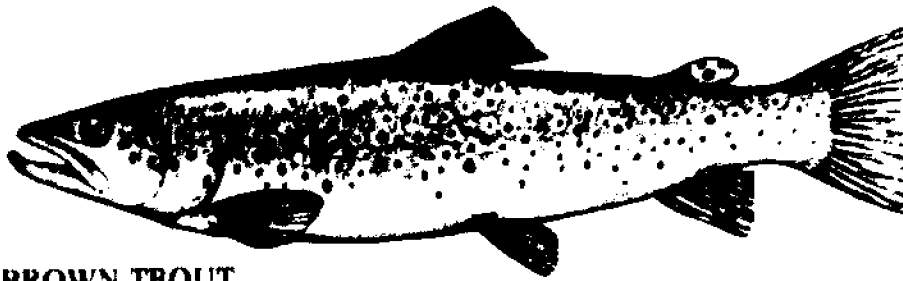
3Bc. Jaws with evident teeth in jaws and with teeth also present in midline of roof of mouth, at least anteriorly, the fish is a **TROUT** or **SALMON**, and you should compare it with Figures 8-16 and the characters in Table III, page 32.



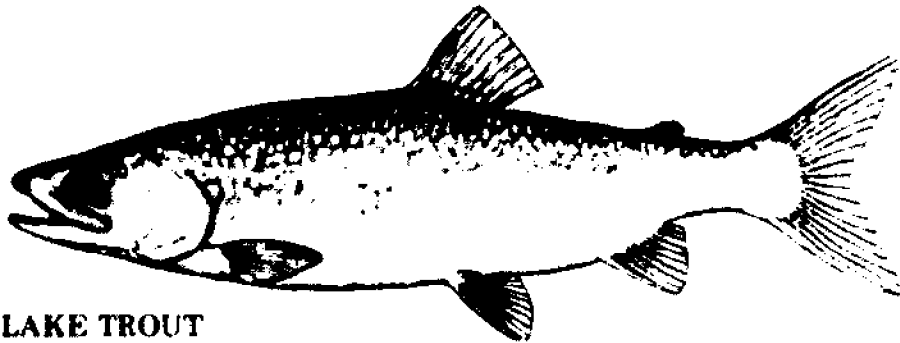
8. RAINBOW TROUT



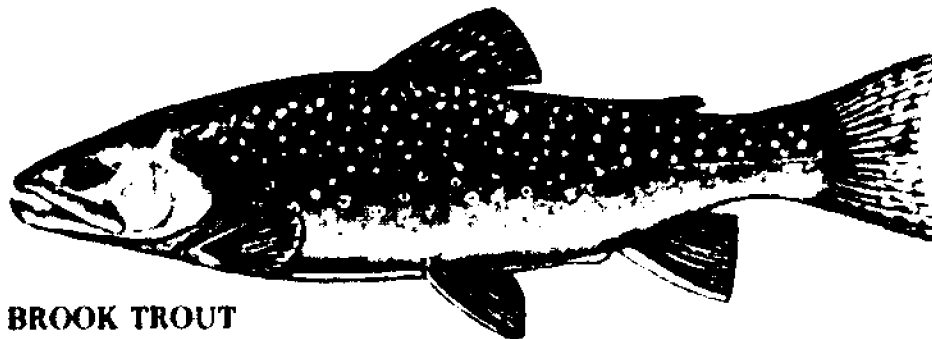
9. ATLANTIC SALMON



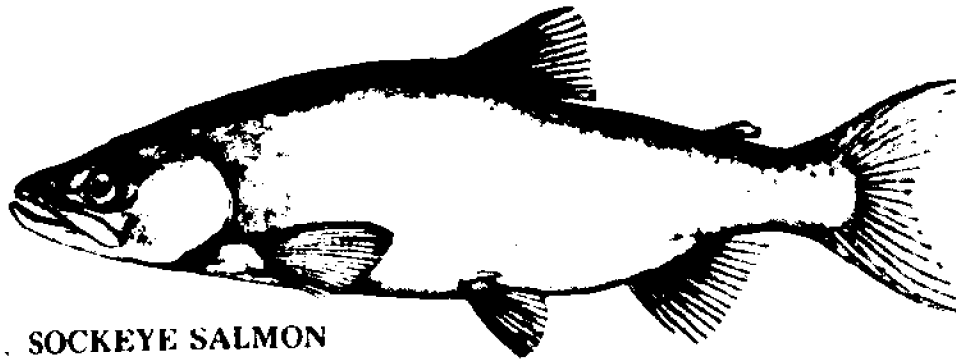
10. BROWN TROUT



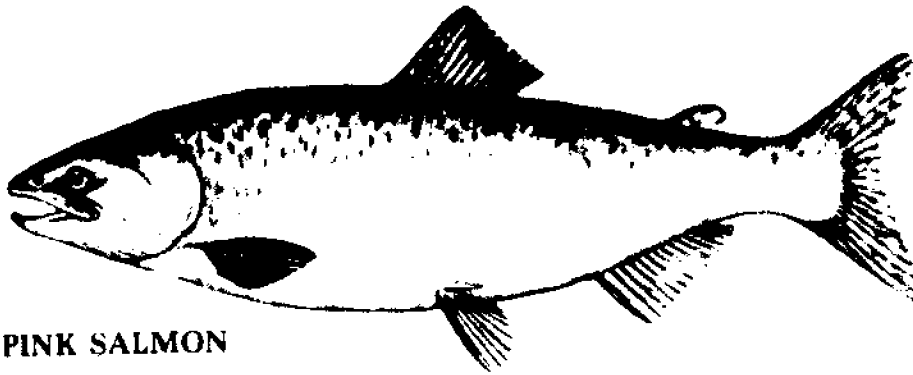
11. LAKE TROUT



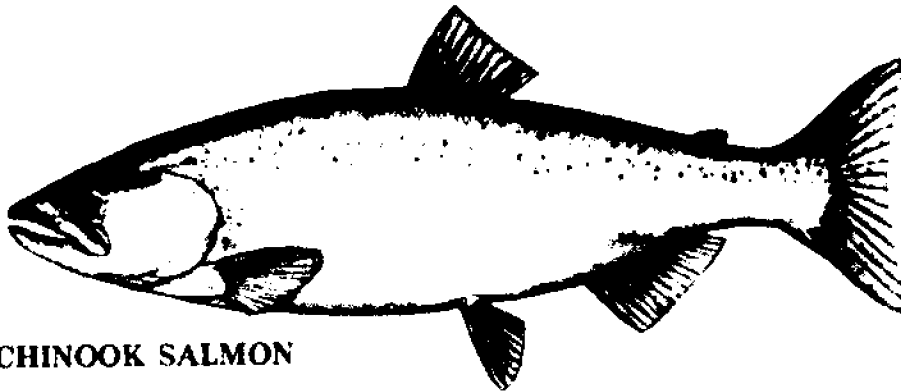
12. BROOK TROUT



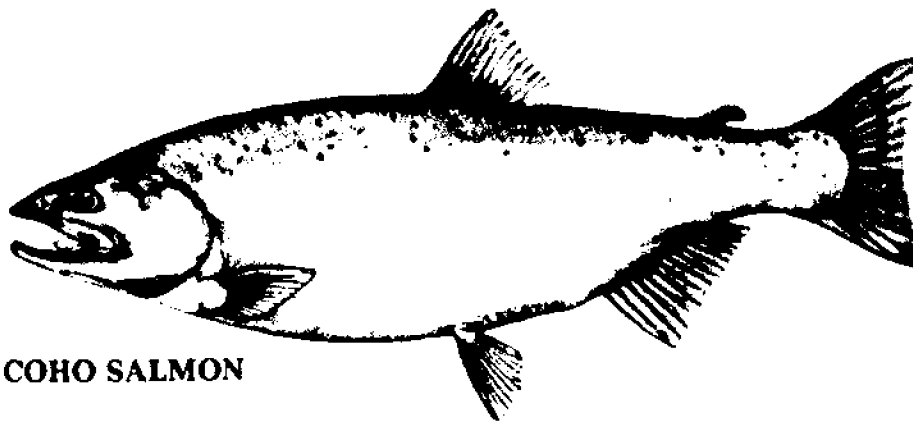
13. SOCKEYE SALMON



14. PINK SALMON

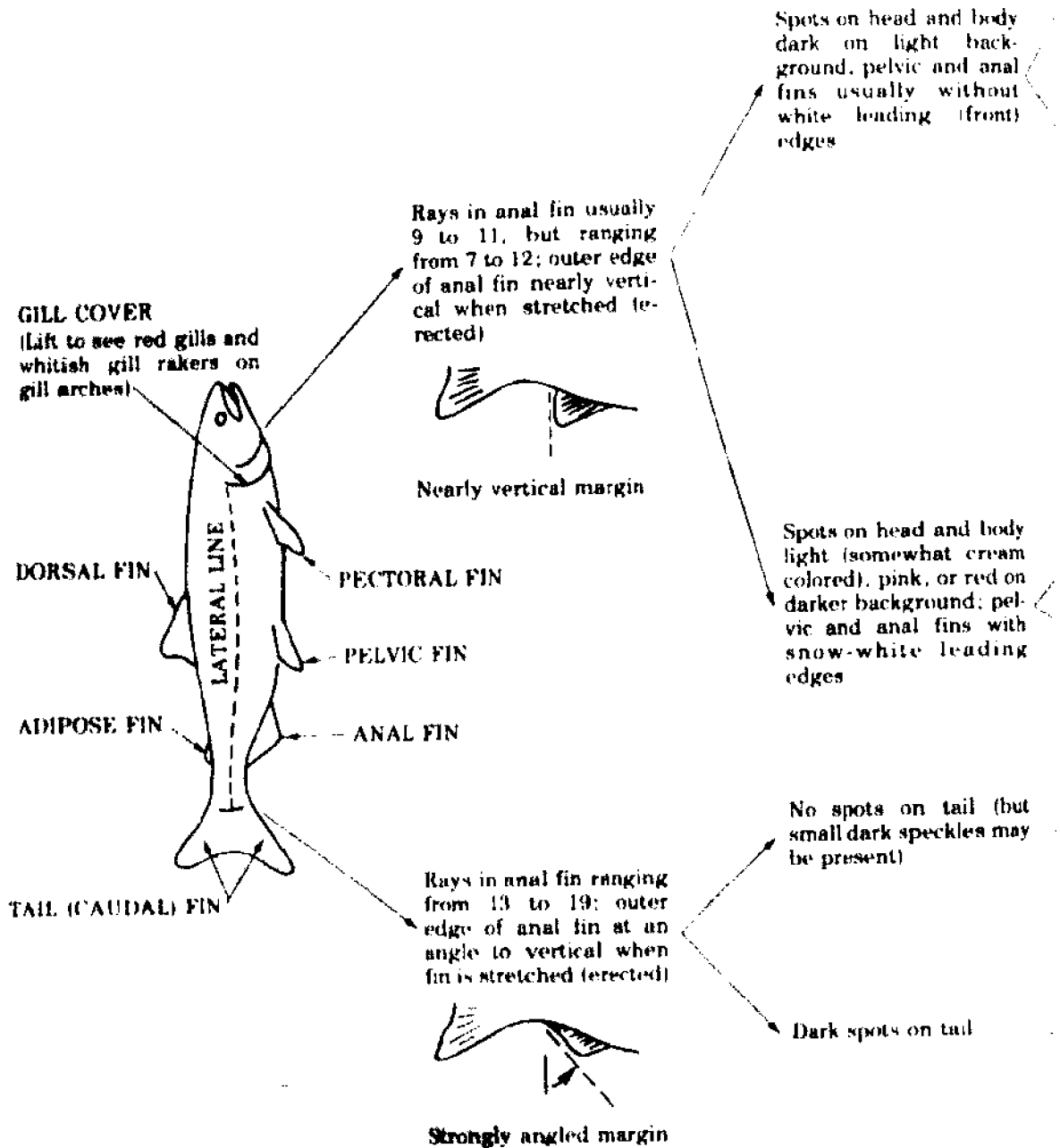


15. CHINOOK SALMON

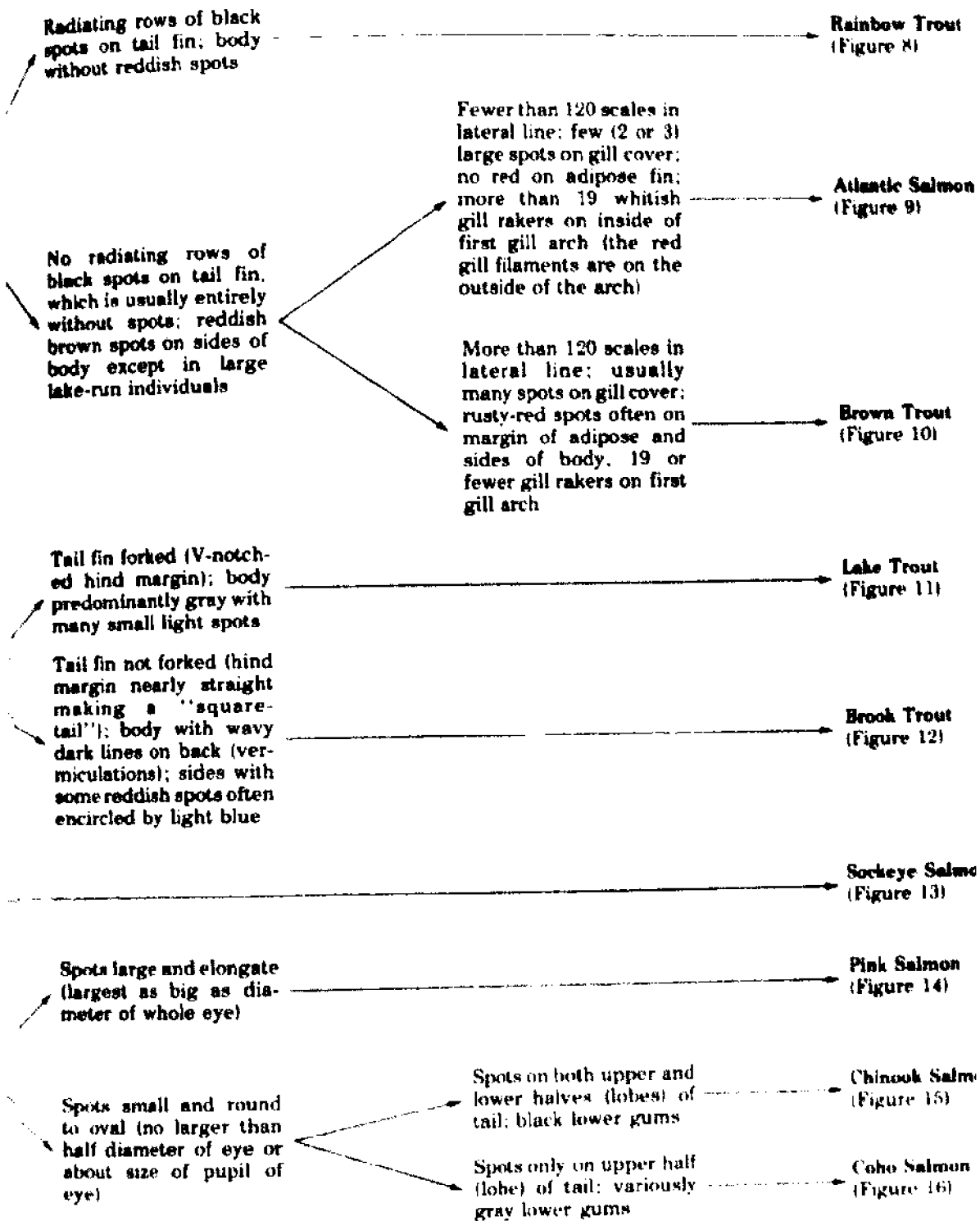


16. COHO SALMON

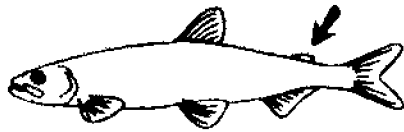
TABLE III, How to Tell Apart Keeper-sized



Trouts and Salmons in the Great Lakes Region



- 4A. If there is a rayless, fleshy (adipose) fin on the back (after eliminating the trouts, salmons, and whitefishes, above and Tables II and III) the fish is one of the following two species of small fishes (Figures 17 and 18).



17. **SMELT**

No dark spots on body.

Pectoral fins not extending backward to level of main back fin.



18. **TROUT-PERCH**

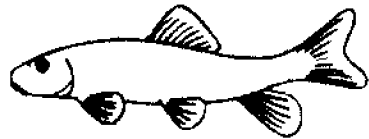
Dark spots prominent on body.

Pectoral fins extending backward to level of main back fin.

- 4B. But if there is no fleshy fin on the back, go to the next split (5A).

- 5A. If the fish has teeth in its jaws (look and feel carefully in small specimens), go to split (6A).

- 5B. But if the fish has toothless jaws it is either a minnow or sucker, and one of 15 species (Figures 19 through 33).



19. **WHITE SUCKER**

Lips thick and fleshy for sucking.

Snout hardly projecting forward beyond upper jaw.

Scales on side of body becoming noticeably larger toward tail; in fewer than 80 rows.



20. **LONGNOSE SUCKER**

Lips thick and fleshy for sucking.

Snout projecting strongly forward beyond upper jaw.

Scales on side of body all nearly the same size from head to tail; in more than 85 rows.

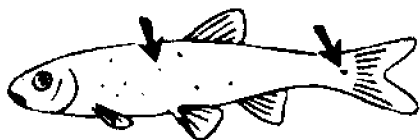


21. **CREEK CHUB**

Dark spot near front of base of fin on back.

Sides usually without scattered individually darkened scales.

Dark spot at middle of base of tail fin.



22. PEARL DACE

No dark spot near front of base of fin on back.

Sides with scattered individually darkened scales.

Dark spot at middle of base of tail fin.

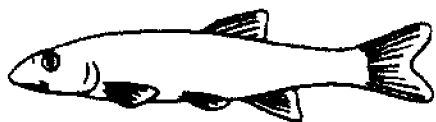


23. LAKE CHUB

No dark spot near front of base of fin on back.

Sides usually without scattered individually darkened scales.

No dark spot at base of tail fin.



24. LONGNOSE DACE

Scales extremely small, hardly visible to naked eye.

Small mouth, overhung by snout.



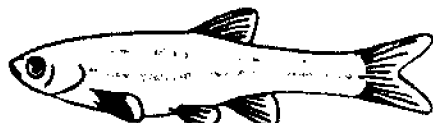
25. FINESCALE DACE

Scales extremely small.

Tiny mouth not overhung by snout.

Belly not flame-red.

One distinct, dark lateral stripe.



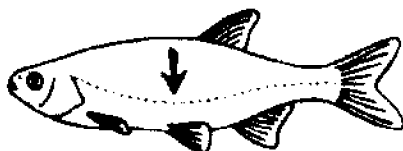
26. REDBELLY DACE

Scales extremely small.

Tiny mouth not overhung by snout.

Belly in some flame-red.

Two distinct, dark lateral stripes.

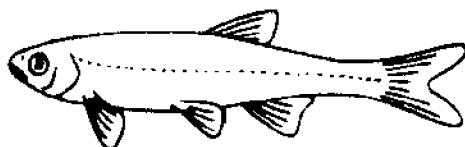


27. GOLDEN SHINER

Body deep and much flattened from side to side.

Lateral line bowed strongly downward.

Often with golden sides and back.



28. EMERALD SHINER

Body streamlined.

Lateral line ordinary.

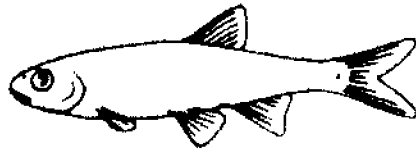
Predominantly silvery with iridescent green along back.



29. SPOTTAIL SHINER

Silvery minnow with prominent dark spot at base of tail fin.

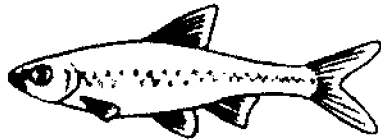
Anus whitish.



30. MIMIC SHINER

Silvery minnow with small dark spot at base of tail fin.

Anus black.



31. BLACKCHIN SHINER

Chin and snout black.

Held at arms length, zig-zag dark line visible along side of body.



32. BLACKNOSE SHINER

Chin white; snout black.

Row of dark crescents along side of body.



33. FATHEAD MINNOW

Head obviously chunky.

Mouth small, chin and snout dusky. Dark spot on front of back fin (in males).

Dusky side stripe, darkening toward tail.

6A. If the fish has a single whisker-like barbel hanging from near the tip of the lower jaw it is a **BURBOT** (Figure 34).

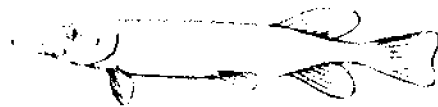


34. BURBOT

6B. But if the fish has no whisker-like barbel, go to next split (7A).

7A. If the fish's face is not like a duck's, go to next split (8A).

7B. But if the fish has a face resembling that of a duck (but with strong teeth), it is a member of the Pike Family (Figures 35 and 36), see Character Summary, Table IV.



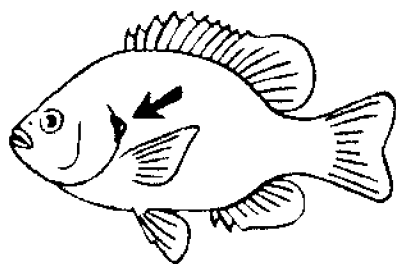
35. NORTHERN PIKE



36. MUSKELLUNGE

TABLE IV, Pike Family Character Summary		
Character	Northern Pike (Fig. 35)	Muskellunge (Fig. 36)
Scales on cheek	All over	On upper half of cheek only
Color pattern on body	Gives impression of light flecks on dark background	Gives impression of dark spots on light background

8A. If the fish has a single fin with supporting rays on its back, is strongly compressed from side to side, and has a red spot at the tip of its gill cover, it is a **PUMPKINSEED** (Sunfish) (Figure 37).



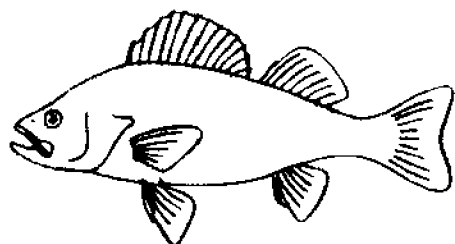
37. PUMPKINSEED

8B. But if the fish has two or more fins with supporting rays on its back, it is one of the three remaining families (a. Perch; b. Sculpin; c. Stickleback) that you can tell apart as follows:

8Ba. Perch Family (Figures 38 to 41), two fins on back with spiny-rays in the first quite stiff.

38. YELLOW PERCH

- Tail margin indented.
- Pectoral fins of ordinary size.
- Commonly longer than 6 inches.
- Vertical dark bars usually regular and prominent.
- Lower lobe of tail fin brassy.
- Anal fin with 2 spines and usually 7 or 8 soft rays.





39. WALLEYE

Tail margin indented.
 Pectoral fins of ordinary size.
 Commonly longer than 6 inches.
 Vertical dark bars obscure or absent.
 Lower lobe of tail fin white.
 Anal fin with 2 spines but usually 12 or 13 soft rays.



40. LOGPERCH

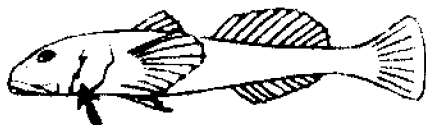
Tail margin indented.
 Pectoral fins enlarged for darting.
 Small, "minnow-sized" fish (less than 6 inches).
 Numerous prominent, dark zebra-like markings on sides of body.
 Dusky "tear-drop" under eye.



41. IOWA DARTER

Tail margin rounded.
 Pectoral fins enlarged for darting.
 Small, "minnow-sized" fish.
 No zebra-like markings.
 Black "tear-drop" under eye.

8Bb. Sculpin Family (Figures 42 to 45), two fins on back but with spiny-rays in first not stiff.



42. DEEPWATER SCULPIN

Three evident cheek spines.
 No evident prickles on skin of body.



43. SPOONHEAD SCULPIN

Single evident cheek spine.
 Prickles often scattered over skin of body.



44. MOTTLED SCULPIN

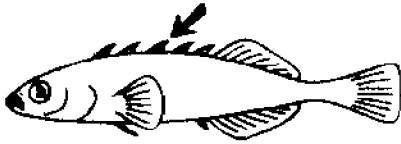
One hidden spine and 4 soft-rays typically in each pelvic fin.



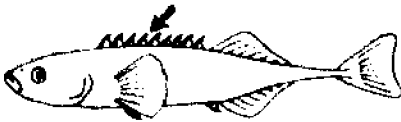
45. SLIMY SCULPIN

One hidden spine and 3 soft-rays typically in each pelvic fin.

8Bc. Stickleback Family (Figures 46 and 47), 5 to 11 separate finlets on back, each with a strong spine.



46. **BROOK STICKLEBACK**
Five or six finlets on back.



47. **NINESPINE STICKLEBACK**
Eight to eleven finlets on back.

Annotated List of Fishes

As previously indicated, the ordinary, common names and the technical names of fishes used in this booklet follow, in so far as practicable, those given in Special Publication Number 12 (1980) of the American Fisheries Society. Technical, latinized names are based on the work of Hubbs and Lagler (1949) excepting where new information or interpretation has called for change; then Hubbs and Lagler (1957 and 1964) were used.

LAMPREY/Family Petromyzontidae

Sea Lamprey, *Petromyzon marinus* Linnaeus (Figure 2)

The sea lamprey, once unable to attain access to the Great Lakes above Niagara Falls, finally overran even Lake Superior. Its damaging effect on stocks of food and game fishes such as lake trout and whitefish is well known. Control of spawning runs by electro-mechanical weirs, and, of larvae in the silt beds of streams by poisons may in time bring this harmful predatory parasite under control. On Isle Royale, this lamprey is known only from Washington Creek. The future of fishing in Isle Royale waters of Lake Superior would seem to depend to some degree on the success of the international sea lamprey control program, spearheaded, beginning in 1956, by the newly formed international Great Lakes Fishery Commission.

STURGEON/Family Acipenseridae

Lake Sturgeon, *Acipenser fulvescens* Rafinesque (Figure 3)

The lake sturgeon is the only member of this ancient family still found in the Great Lakes. It is now rare in Lake Superior, but its range includes Isle Royale where it was taken infrequently by commercial fishermen in the past. Because it requires from ten to twenty years or more for members of this species to reach sexual maturity, its reproductive potential is not great, and there is considerable concern among naturalists that it may be on the path to extinction. Protective legislation has been adopted in some regions to relieve the pressure man exerts on this fish. It would be a great pity if so interesting as well as delicious an example of ancient life should perish.

The sturgeon is easily recognized by the rows of bony scutes

along the top and sides of the body. Its tail is strongly upturned, and its mouth is located below and behind the tip of its snout. Directly in front of the mouth are four curved barbels which aid the fish by taste and touch to feed along the bottom.

Growth, though very slow, extends over a great many years so that weights of several hundred pounds and lengths of seven feet may be attained.

HERRING/Family Clupeidae

Alewife, *Alosa pseudoharengus* (Wilson)

Like the sea lamprey, the alewife is a relatively recent invader of the upper Great Lakes, including Lake Superior from 1945 onward. In this deep, cold lake, however, the invader has never reached the amazing peaks of abundance witnessed in lakes Huron and Michigan. Although no records are in hand for Isle Royale waters, the species is doubtless represented there. Its principal range is along the Atlantic Coast and in tributaries from Newfoundland to North Carolina.

A spring spawner in shallow waters, the alewife also frequents deep water and is good food for predatory fishes there. Common adult size is in the 7-inch (some 15 cm) bracket, which, along with their distribution, makes them particularly vulnerable to the lake trout and the introduced salmons. The noisome, large, spring-time mortalities experienced in the other Great Lakes have not been a bother in Lake Superior.

This species is the only kind of fish in Lake Superior that is obviously a sharply compressed, slab-sided herring, silvery in color with a dark "shoulder spot", and possessing a real saw-tooth edge along the midline of its belly — veritably a "sawbelly." It can hardly be mistaken, and consequently is not illustrated.

TROUT/Family Salmonidae

The salmonids are of great importance as commercial and/or as sport fish. All are characterized by having relatively or quite small scales, a fleshy adipose fin behind the soft dorsal fin, a gristly, finger-like flap in the angle of each pelvic fin, and only soft rays in all of their rayed fins. There are two subfamilies in the Family Salmonidae: the salmons and trouts

(*Salmoninae* Figs. 8-16) and the whitefishes and their relatives (*Coregoninae* Figs. 4-7).

Whitefish/Subfamily Coregoninae (Figs. 4-7)

Cisco (Lake Herring), *Coregonus artedii* Lesueur (Figure 4)

Lake Whitefish, *Coregonus clupeaformis* (Mitchill) (Figure 5)

Round Whitefish, *Prosopium cylindraceum* (Pallas) (Figure 6)

Pygmy Whitefish, *Prosopium coulteri* (Eigenmann and Eigenmann) (Figure 7)

The whitefish subfamily is easily distinguishable from the salmon and trout subfamily by the larger scales and smaller, more delicate mouth, and scarcely evident teeth, if any. Its distribution is confined for the most part to clear, cold, deep lakes. The majority of the species spawn in the fall, broadcasting their eggs.

The whitefish-cisco group includes some of the most important of the Great Lakes food fishes and goodly numbers are still taken annually. The lake whitefish is the largest and most prized, but great numbers of ciscoes are also harvested and used. Most are, or have been, important in the commercial fisheries of Isle Royale.

Efforts to increase the numbers of whitefish by stocking have not shown measurable success and have been abandoned as a wasteful practice.

In addition to the lake whitefish, *Coregonus clupeaformis*, and the cisco ("lake herring"), *Coregonus artedii*, four or five species of deepwater relatives are known from the commercial fisheries of Lake Superior. Collectively these species are less compressed from side to side than the whitefish or the cisco (more like the round whitefish in body form) and are more or less collectively called "chubs" in the region. Like the whitefish and cisco, all are fall spawners. All make excellent eating after being lightly brined and smoked. Individually these deepwater species are difficult even for experts to identify. They are:

1. **Bloater, *Coregonus hoyi* (Gill)**, perhaps named because of its tendency to "bloat" due to pressure release when brought up in gill nets from the great depths that it inhabits.
2. **Kiyi, *Coregonus kiyi* (Koelz).**
3. **Blackfin Cisco, *Coregonus nigripinnis* (Gill)**, marked by having all fins black, especially on their outer halves, but

possibly at or near extinction in Lake Superior if indeed it ever lived there (the species designation remains in question for the Lake Superior population that was called *nigripinnis* by some authorities).

4. **Shortnose Cisco**, *Coregonus reighardi* (Koelz), reportedly becoming sparse in Lake Superior.
5. **Shortjaw Cisco**, *Coregonus zenithicus* (Jordan and Evermann), which is held by some scholars to include fish formerly classified in Lake Superior as the blackfin cisco, *C. nigripinnis*.

SALMON AND TROUT/Subfamily Salmoninae (Figs. 8-16)

Rainbow (Steelhead) Trout, *Salmo gairdneri* Richardson (Figure 8)

Atlantic Salmon, *Salmo salar* Linnaeus (Figure 9)

Brown Trout, *Salmo trutta* Linnaeus (Figure 10)

Lake Trout, *Salvelinus namaycush* (Walbaum) (Figure 11)

Brook Trout, *Salvelinus fontinalis* (Mitchill) (Figure 12)

Sockeye Salmon, *Oncorhynchus nerka* (Walbaum) (Figure 13)

Pink Salmon, *Oncorhynchus gorbuscha* (Walbaum) (Figure 14)

Chinook Salmon, *Oncorhynchus tshawytscha* (Walbaum) (Figure 15)

Coho Salmon, *Oncorhynchus kisutch* (Walbaum) (Figure 16)

All members of this subfamily must spawn in fresh water, although the Atlantic and Pacific salmon typically mature in the sea. In a similar manner some rainbow, brown and brook trout forsake streams and experience increased growth on the expanded food supply in Lake Superior. During the spawning season, these stream trouts and introduced salmon frequently return to the same stream system in which they were hatched if insurmountable dams or pollution do not block their way. The trouts and salmon are discussed in detail in the fishing section of this booklet.

Although at this writing, I do not have bona fide records of the brown trout, Atlantic salmon, or the four Pacific salmon (chinook, pink, coho, and sockeye) from Isle Royale waters, they are known to be present nearby or to have access. Because of the likelihood that all will eventually be caught in the Park environs, they are included in the foregoing keys and in this list for the benefit of anglers.

SMELT/Family Osmeridae

Rainbow Smelt, *Osmerus mordax* (Mitchill) (Figure 17)

The rainbow smelt is not a native of the upper Great Lakes, but was introduced by man from the northeastern United States and Canada in about 1912. It is a highly edible species, abundantly harvested on its spawning runs into streams in the spring. A delicious fish, great quantities of it are sold annually for the American frying pan and deep-fryer.

Part of an essentially marine family, the rainbow smelt is restricted, nevertheless, to fresh waters. Maximum concentrations of spawners in streams usually occur during darkness, when they can be captured in large quantities by dip nets. Smelt eggs are broadcast over the bottom and stick to the weeds, stones, and debris.

The smelt feeds largely upon other small fish and insects. Its elongate slender body is silvery and has, in addition to the rayed dorsal fin, a small adipose fin. Growth is quite rapid. A maximum size of about 14 inches is reached in a few years, but most Great Lakes specimens run about 6 inches. The relationship to other lake fish is not well understood. It may be that consumption of the eggs and fry of other fishes would rank the smelt as an important predator.

SUCKER/Family Catostomidae

White Sucker, *Catostomus commersoni* (Lacépède) (Figure 19)

Longnose Sucker, *Catostomus catostomus* (Forster) (Figure 20)

The sucker family is one of the best known, most widely distributed, and most typically North American freshwater fish groups. It is characterized by an extensible mouth, often with sensitive fleshy lips. Closely related to the minnow family, it has soft-rayed fins and uses pharyngeal (throat) teeth for grinding food organisms. There are no teeth in the jaws or mouth.

Spring spawning runs of suckers provide considerable recreation for a great many anglers, but Isle Royale is not frequented by fishermen early enough in the spring to enjoy the sport there. Suckers are taken by hook-and-line, spears, or nets. As food, though of excellent quality, suckers are not choice because of the many small bones distributed among the muscles. These suckers spawn in the riffles of small streams where the eggs are buried in gravel. In cold northern waters, growth is not very rapid — it may require as many as nine years to attain a foot (some 25 cm) in length.

CARP (MINNOW)/Family Cyprinidae

Creek Chub, *Semotilus atromaculatus* (Mitchill) (Figure 21)

Pearl Dace, *Semotilus margarita* (Cope) (Figure 22)

Lake Chub, *Couesius plumbeus* (Agassiz) (Figure 23)

**Longnose Dace, *Rhinichthys cataractae* (Valenciennes)
(Figure 24)**

Finescale Dace, *Phoxinus neogaeus* Cope (Figure 25)

Northern Redbelly Dace, *Phoxinus eos* (Cope) (Figure 26)

Golden Shiner, *Notemigonus crysoleucas* (Mitchill) (Figure 27)

Emerald Shiner, *Notropis atherinoides* Rafinesque (Figure 28)

Spottail Shiner, *Notropis hudsonius* (Clinton) (Figure 29)

Mimic Shiner, *Notropis volucellus* (Cope) (Figure 30)

Blackchin Shiner, *Notropis heterodon* (Cope) (Figure 31)

**Blacknose Shiner, *Notropis heterolepis* Eigenmann and
Eigenmann (Figure 32)**

**Fathead Minnow, *Pimephales promelas* Rafinesque
(Figure 33)**

All of the foregoing minnows are small fishes whose importance is largely as food for game and commercial fishes. They are spring spawners exhibiting a rich variety of reproductive habits. For example, the creek chub, in streams, constructs a conspicuous nest (redd) 2 to 3 inches deep and from 1 to 18 feet long in line with the current. The eggs are buried in the clean gravel of such a trout-like nest and then deserted by both parents. The fathead minnow, in contrast, attaches its eggs to the underside of rocks or waterlogged pieces of wood; the nest is guarded by the male. The golden shiner scatters its eggs on weedy shoals and promptly leaves them.

All members of the minnow family, like those of the sucker family, have no teeth in their jaws but have throat (pharyngeal) teeth, to puncture, tear, or grind their food. Ichthyologists use differences in these teeth as means for identifying both minnow and sucker species.

PIKE/Family Esocidae

Northern Pike, *Esox lucius* Linnaeus (Figure 35)

Muskellunge, *Esox masquinongy* Mitchill (Figure 36)

The pike family has wide distribution around the world in northern latitudes and is of considerable importance for sport

in the northcentral United States and northward. Its members take both live and artificial baits readily and inhabit a variety of lakes and streams. The large mouth is armed with numerous stout teeth. The bodily coloration blends well with the aquatic vegetation they frequent. The head has a large number of sensory pores which aid in detecting the movements of prey.

COD/Family Gadidae

Burbot, *Lota lota* (Linnaeus) (Figure 34)

The most obvious characteristic of this freshwater member of the cod family is a single prominent barbel on its chin. The burbot (sometimes locally called lawyer or ling) prefers deep lakes or cold streams and is frequently encountered at considerable depths in the Great Lakes. In these waters it feeds largely on small members of the whitefish group and the fourhorned deepwater sculpin. The burbot spawns during the winter; a 15-inch individual would probably be in its fifth or sixth year of life. A large specimen would be about 30 inches long.

TROUT-PERCH/Family Percopsidae

Trout-perch, *Percopsis omiscomaycus* (Walbaum) (Figure 18)

The trout-perch family represents an interesting transitional phase in evolution between the older and more primitive "trout-like" fishes and the more modern "perch-like" ones. It has an irregular double row of spots along the side and an adipose rayless fin reminiscent of the trouts. But it also has scales with a sawtooth (serrated) exposed margin and spiny-rayed fins like the perch.

The trout-perch does not grow much larger than 6 inches, but is of value as a food item for predatory fishes. This family contains only two species in North America, and is probably a remnant of a larger group that was once more successful. Found in at least seven lakes on Isle Royale, the trout-perch also frequents most of the water surrounding the island.

PERCH/Family Percidae

Yellow Perch, *Perca flavescens* (Mitchill) (Figure 38)

Walleye, *Stizostedion vitreum vitreum* (Mitchill) (Figure 39)

Logperch, *Percina caprodes* (Rafinesque) (Figure 40)

Iowa Darter, *Etheostoma exile*(Girard) (Figure 41)

The yellow perch is probably the most typical member of this family. The family as a group is most easily differentiated from other fish in the Great Lakes by the two distinct dorsal fins, both of which have fin rays.

The perch family may be subdivided into three subfamilies: (1) yellow perch, (2) walleye and sauger, and (3) the darter, rich in variety and color. Isle Royale has representatives of all three groups.

The darters, because of their small size, do not enter the fisheries except for the occasional capture of a logperch on a small baited hook. They are eaten by game fishes. Like their larger relatives, the darters are carnivorous, feeding mostly on small insects. The darters of Isle Royale drop their eggs on the bottom of slow stretches of stream or of lake shores and do not afford further protection to them.

SUNFISH/Family Centrarchidae

Pumpkinseed, *Lepomis gibbosus* (Linnaeus) (Figure 37)

The sunfish family is easily distinguishable from the perch family by the union of the soft and spinous dorsal fins into a single fin. There are approximately twenty-five species in this highly successful spiny-rayed group of fishes, although only one, the pumpkinseed with its characteristic red ear-spot, has thus far ventured to Isle Royale. They do best in waters with warmer average annual temperatures than those on Isle Royale.

Eggs of the pumpkinseed are deposited in shallow, quiet areas in hollowed, circular nests swept clean of silt. The male makes the nest and protects the eggs until hatched. The pumpkinseed eats a large variety of insects and other aquatic invertebrates and small fish. They are much sought after by sport fishermen in areas where they are abundant but in the Park are unimportant in the predominantly coldwater fishery.

SCULPIN/Family Cottidae

Deepwater Sculpin, *Myoxocephalus thompsoni* (Girard) (Figure 42)

Spoonhead Sculpin, *Cottus ricei* (Nelson) (Figure 43)

Mottled Sculpin, *Cottus bairdi* Girard (Figure 44)

Slimy Sculpin, *Cottus cognatus* Richardson (Figure 45)

The sculpins may be recognized by the disproportionately large head which tapers back to a small body. The head is

flattened and the eyes bulge, giving a froglike appearance. The large fan-shaped pectoral fins serve to brace them on the bottom where they spend their lives. These pectorals make possible quick, short, darting movements.

Although small fishes, the sculpins, other than the deepwater species, willingly take a baited hook. All are quick to seize other small fish; their value is as food for the trouts and the burbot. They spawn in the spring, with the stream species attaching masses of eggs to the undersides of stones. The deepwater sculpin, as the name implies, is found predominantly in the deepest water surrounding Isle Royale. The others are fairly well distributed over the island in flowing waters and around it in the shore zone.

STICKLEBACK/Family Gasterosteidae

Brook Stickleback, *Culaea inconstans* (Kirtland) (Figure 46)

**Ninespine stickleback, *Pungitius pungitius* (Linnaeus)
(Figure 47)**

The stickleback family has both marine and freshwater members in northern latitudes. Sticklebacks get their name from the separated fin spines along the back. In comparison to other freshwater fishes, the body tapers back to a very small diameter in front of the tail enunciating the streamlined body form. This union of body and tail is known as the caudal peduncle and is particularly slender in the ninespine species.

During the spawning season, the males of the brook stickleback are extremely aggressive and frequently fight over the females. They build a nest of leaves, twigs, and debris which they stick together with "kidney paste." After inducing a female to lay her small number of eggs in it, the male guards the nest until the young hatch. Sizes range upward only to three inches (some 75 mm).

Basic Fish Anatomy

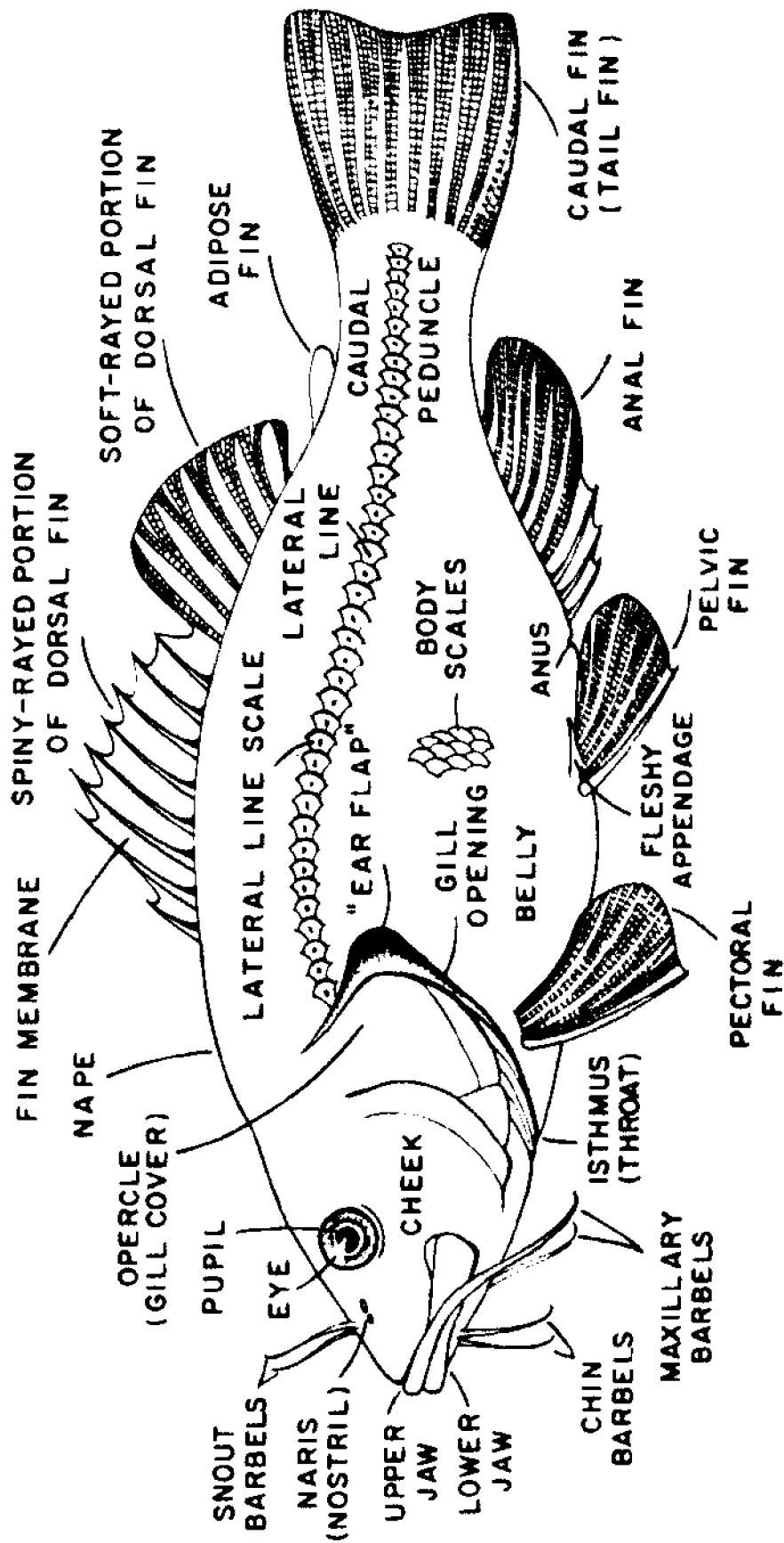
Like an angler, a fish has ten anatomical systems and depends on their integrated functioning:

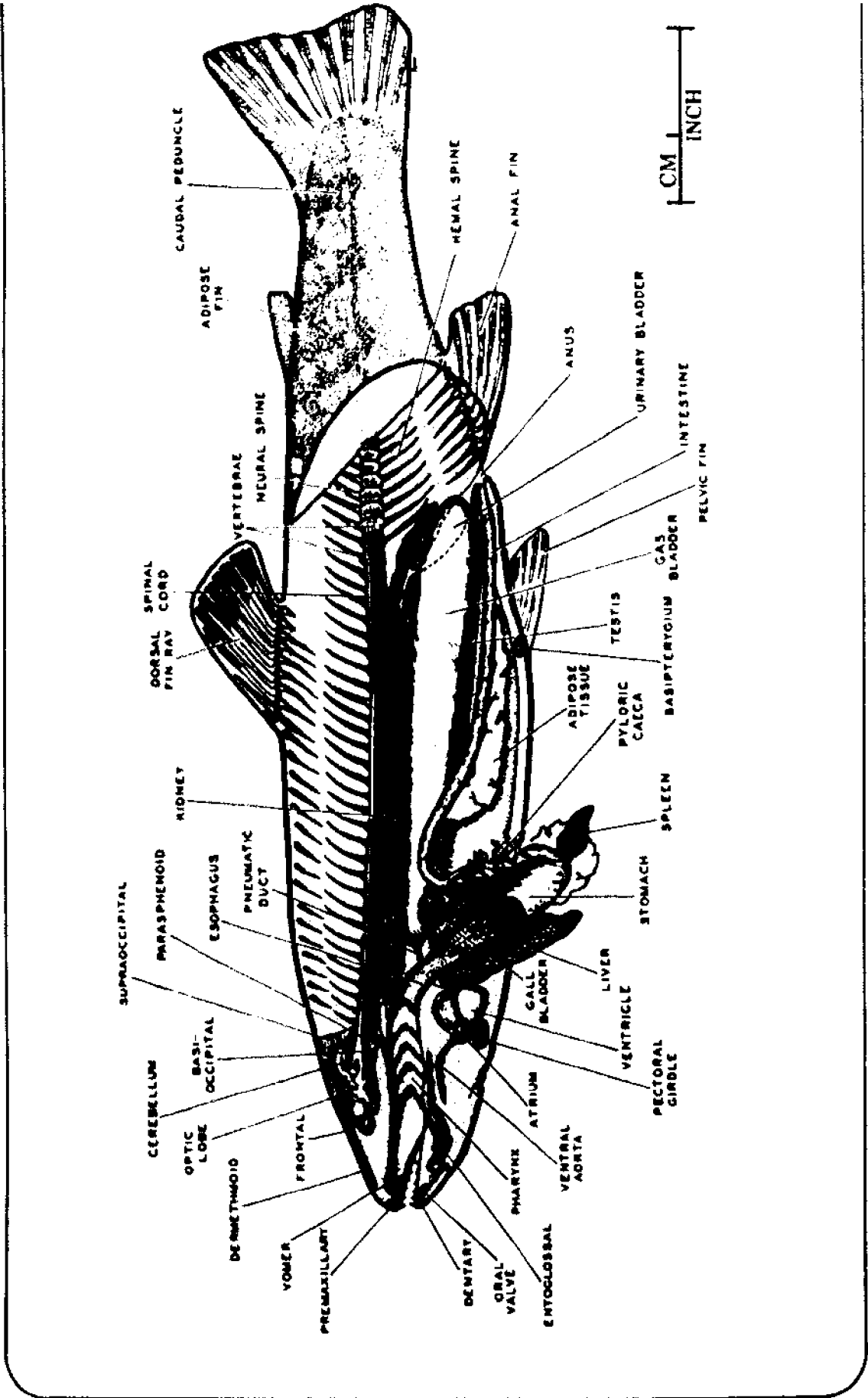
1. **Skin**, which provides a protective envelope to the body along with coloration (so useful in telling one kind of fish from another), mucous glands, skin sensory organs, and in most kinds, scales.
2. **Digestive**, which dissolves foods that are eaten, to make the nutrients in them absorbable for energy and bodily maintenance and growth.
3. **Circulatory**, which by action of the pumping heart and the blood vessels transports dissolved foods and oxygen to the tissues of the body and carries away wastes, like carbon dioxide to the gills and urea to the kidneys, for excretion to the surrounding water.
4. **Respiratory**, which is concentrated in the gills and provides primarily for uptake of oxygen and getting rid of carbon dioxide.
5. **Skeletal**, which supports the body, helping to give it form and also attachments and leverage points for the muscles that account for movement and locomotion.
6. **Muscular**, in three forms which include the heart muscle that pumps the blood, the skeletal muscle that accounts for movements and swimming, and the smooth muscle that involuntarily takes care of moving food through the gut and regulates the size of the internal opening in the eye (the pupil) to control the amount of light that reaches its retinal lining.
7. **Kidney**, which gets rid of wastes, including urea, and helps to maintain the salt and water balance of the fish.
8. **Nervous**, which through brain, nerves, and special sense organs (including touch, taste, smell, hearing, and sensors in the lateral line, etc.) integrates internal functions and the relationships of fish and its surroundings.
9. **Endocrine**, which through glands of internal secretion and their hormones further integrates bodily functions and environmental relationships including growth, reproduction and its critical timing, etc.
10. **Reproductive**, which produces and matures the eggs and sperms for spawning and, thereby, aims at the perpetuation of the species.

To test your understanding, can you assign the name of the system or systems to each of the labeled parts on the anatomical drawings that are included here (Figures 48 and 49)? Knowledge such as this will not only bring you an added measure of satisfaction when you are dressing out a fish to eat, but it will also be helpful to you in identifying problem fish in another section of this booklet. Unfortunately, not all fish are readily identifiable by external anatomy alone, as you already know from your own fishing experiences.

Figure 48 External anatomy of a "dream" fish (there is no
Page 53 fish like this composite), including many terms used in this booklet. (From: Karl F. Lagler, 1962. Atlas of Fish Anatomy. Michigan Fisheries, No. 2)

Figure 49 Internal anatomy of a young adult male brook trout
Page 54 with about half of the fish cut away anteriorly. (From: Karl F. Lagler, 1962. Atlas of Fish Anatomy. Michigan Fisheries No. 2)





Conservation of Park Fishery Resources

The National Park System, to which Isle Royale National Park belongs, is dedicated to conserving our scenic, scientific, and historic heritage. This is accomplished by preserving the native plant and animal life in its natural state. The only exception to this policy at Isle Royale is a law which permits fishing in Park waters. Moderate fishing pressure does not upset the balance of nature, as evidenced by the variety of different animals on Isle Royale that include fish in their diet. The introduction of new species, however, may be very harmful to the native fish. For this reason the Park has wisely prohibited the use of live minnows as fishing bait. In the past, species harmful to many a natural fauna, as well as to fishing, have gained access to waters via the angler's minnow bucket. The outlawing of minnows should not prove a handicap for the angler, since most of the game fishes of Isle Royale take artificial bait or worms just as readily.

Intentional introduction of non-native animal species is also contrary to Park policy. In spite of this, a few exotic fish species have gained access as previously indicated (sea lamprey, smelt, brown and rainbow trouts, alewife, and now the salmons). With the exception of the sea lamprey, these are not regarded as disadvantageous although the brook trout may suffer as a species on the island because of the competitive entry of other stream trouts. Good stocks of stream trouts in Lake Superior and their requirement for flowing water for spawning suggests that no further stocking of the native or introduced species is necessary or desirable. The native species are able to support present angling pressure without danger of over exploitation.

Environmental improvement has not been employed in Isle Royale lakes and streams to enhance their fish production. A change in the environment would alter the natural scene, which is rigidly protected by Park policy.

The seasonal commercial fisheries of Isle Royale have declined over the years. Their presence on the island is not undesirable and is of considerable interest to the visitor. At Isle Royale they conflict little with recreational fishing under current laws, and the presence of long-established fishing families adds to the historical lore of the islands in the Park.

Prior to the advent of the Park, the only real success that man ever experienced on the island was in fishing for food. Fish were the earliest item of trade and barter and, as food, saved the lives of many unsuccessful copper miners who prospected the island years ago. As in most island communities, fish and fishing are an outstanding part of the natural resources, and if wisely used can provide recreation for countless generations.

References

The following selected references are included for those who might wish to extend their knowledge of fishes beyond the brief presentations given in this booklet. The materials are available for reference in college and other libraries or may be purchased either from the publisher or through bookstores.

Fishes of Isle Royale, Lake Superior, Michigan by Carl L. Hubbs and Karl F. Lagler. 1949. Papers of the Michigan Academy of Science, Arts and Letters (located at The University of Michigan in Ann Arbor), Volume 33 (for 1947), pp. 73-133. (The only definitive faunal study of the fishes of the island; calls attention to the presence of a few possibly unique subspecies of minnows in certain of the lakes.)

Fishes of the Great Lakes Region by Carl L. Hubbs and Karl F. Lagler. 1964. The University of Michigan Press, Ann Arbor 213 p. (The classical work on the subject although no longer up to date.)

Distribution of Fishes in U.S. Streams Tributary to Lake Superior by Harry H. Moore and Robert A. Braem. 1965. Special Scientific Report-Fisheries No. 516, published by the U.S. Fish and Wildlife Service, Washington. 59 p. (Gives distribution maps of occurrence of 71 kinds of fishes in the streams studied, including seven streams on Isle Royale.)

Freshwater Fishes of Canada by W.B. Scott and E.J. Crossman. 1973. Bulletin 184, Fisheries Research Board of Canada, Ottawa. 966 p. (Treats all of the fishes of Lake Superior and is currently the most up to date work which does so.)

Commercial Fishing on Isle Royale by Lawrence Rakestraw 1968. Isle Royale Natural History Association, Houghton Michigan. (Popular account of the fishing enterprise on Isle Royale 1800-1967.)

Steelhead of the Minnesota North Shore by R.L. Hassinger J.G. Hale, and D.E. Woods. 1974. Minnesota Department of Natural Resources Technical Bulletin Number 11, 38 p.

Origin and Geography of the Fish Fauna of the Laurentian Great Lakes Basin. R.M. Bailey and G.R. Smith. 1981. Canadian Journal of Fisheries and Aquatic Science. Vol. 38 No. 12 pp 1539-1561. (This journal can be found in most university libraries of the region.)

Fish of Lake Superior. Warren Downs. 1976. University of Wisconsin Sea Grant College Program, Sea Grant Communications Office, 1800 University Avenue, Madison, WI 53706 Doc. No. WIS-SG-76-124, 36 p. (gives an historical perspective on fishing in Lake Superior and relevant natural history information on 23 of the lake's food and game fishes).

The Fishes of Michigan by Reeve M. Bailey and Gerald Smith. 1982? (This study, originally conceived by the late Professor Carl L. Hubbs, was nearing completion at the time the revised edition of this booklet went to press. The salmon, trout and other illustrations included here are from it. Availability of their book may be ascertained from the Fish Division, Museum of Zoology, The University of Michigan, Ann Arbor, MI 48109. This address will also be useful for queries regarding uncertainties that you may have regarding fish identification.)

The following documents, published by the Michigan Sea Grant Program, are available through the Michigan State University Cooperative Extension Service in each Michigan county or from Cooperative Extension Service Bulletin Office, 104 Central Services Building, Michigan State University, East Lansing, Michigan 48824. Please order by title and number.

Freshwater Fish Preparation, E-1179, covers cleaning, handling and several cooking methods. 16 pages; \$.50.

Freshwater Fish Preservation, E-1180, how to preserve fish by freezing, canning, smoking, salting or pickling. 16 pages; \$.65.

Great Lakes Fish Cookery, E-932, handling instructions and recipes for kinds of fish which are often overlooked as food. 16 pages; \$.20.

Salmon Eggs: Bait and Food, E-960, explains how to turn salmon eggs into alluring baits to capture more fish or tasty dishes for yourself. Four pages; single copies free.



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