4.—THE WHITEFISHES OF NORTH AMERICA.

By Barton W. Evermann and Hugh M. Smith.

GENERAL REMARKS.

The whitefishes constitute one of the most interesting and important groups of food-fishes inhabiting the fresh waters of the Northern Hemisphere. In North America they are especially numerous as to species and individuals in the States forming the northern boundary of the United States, in the British possessions, and in Alaska, where there is scarcely a lake or river of importance in which the whitefishes are not represented by one or more species.

The distribution of these fishes, their geographical and individual variations, and their habits are perhaps as little known as are those of any group of fresh-water food-fishes of North America. Only two or three of the numerous whitefishes have been studied with even approximate completeness, and there is much yet to be learned regarding even the best-known species.

The close relationships of many of the whitefishes make a careful study of actual specimens the most essential step toward a fuller knowledge of these fishes. To the scarcity of specimens in collections, and, in the case of most species, the absence of complete series of examples representing different sexes, ages, conditions, seasons, etc., may be largely attributed the general deficiency of recorded information regarding the species of this group.

The United States Fish Commission has recently come into possession of a large amount of new material relating to the whitefishes of the Great Lakes basin and the specimens and data are available for a preliminary study of the group. It is not intended, however, to present a complete account of these fishes, since much more information will be required before such an effort will be warranted. In the present paper we have endeavored to give careful detailed descriptions of all the species of this group found in North America, together with what is now known of the geographic distribution of each. We consider most in detail those species found in the Great Lakes basin, but for purposes of comparison, and that the paper may be as complete as is now possible, we have included all the species of North America.

During 1893 and 1894 Mr. Richard Rathbun, of the United States Fish Commission, as the representative of the United States Government upon the International Fisheries Commission, conducted extensive inquiries and made large collections of the fishes found in the Great Lakes region of the United States. Among these collections were large series of the various species of whitefishes which constitute the principal material upon which this paper is based.

In order to determine the geographical distribution of each species of whitefish in the Great Lakes basin, we have studied not only these collections, but also those contained in the National Museum, and have examined and made notes upon multitudes of specimens in the field and at the various fish markets and fish companies' houses. In this paper are presented the results of these studies and the conclusions reached.

The following persons connected with the Fish Commission collected specimens of whitefishes from the localities named: Mr. Richard Rathbun, Lake of the Woods, Lake Superior, and Lake Huron; Mr. A. J. Woolman and Mr. U. O. Cox, Lake of the Woods and Lake Superior; Dr. J. T. Scovell and Mr. D. C. Ridgley, Lake Huron; Mr. Cloudsley Rutter, Lake Erie; Dr. R. R. Gurley, Lake Ontario; Prof. Barton W. Evermann and Mr. Barton A. Bean, Lakes Ontario, Champlain, and Memphremagog; Mr. Charles H. Stevenson and Mr. Ansley Hall, Lake Michigan; Mr. W. A. Wilcox, Lake Huron.

For other valuable specimens of whitefishes the Commission is indebted to Mr. Charles H. Strowger, of Nine Mile Point, N. Y., who forwarded us many specimens from Lake Ontario. Mr. Strowger has devoted many years to the study of the fishes of Lake Ontario, and has furnished us with a large amount of interesting information regarding the habits and abundance of the species found near Nine Mile Point. Hon. L. D. Miles, of Newport, Vt., has kindly sent us specimens from Lake Memphremagog. Mr. Woolman also forwarded market specimens of whitefishes from Lake Winnipeg and from small lakes in northern Minnesota.

The descriptions given in this paper of Alaskan species are based partly on the hitherto published descriptions and partly upon a reexamination of the specimens now in the National Museum. All the other descriptions have been drawn up from fresh specimens, in most cases numerous individuals of each species having been examined, including large series from the Great Lakes and considerable material from Lakes Champlain and Memphremagog and Lake of the Woods. We have also had a number of fresh specimens of the sisco of Lake Tippecanoe (for which we are indebted to Prof. P. H. Kirsch), and of Williamson's and Coulter's whitefishes.

Desiring to make this paper as useful as possible to the fishermen and others who make no claim to technical knowledge, we have avoided the use of uncommon technical terms whenever it seemed expedient and

have made the descriptions fuller and more explicit than would be otherwise required. To prevent the descriptions from being needlessly long, we have used the usual abbreviations and abridged phrases well understood by students of fishes; and that these may be understood by all, we give on plate 11 an explanation of such terms as may not be at once intelligible to the lay reader.

We present illustrations of all the American whitefishes, in the thought that they will prove of assistance to fishermen and others in identifying the different species. All of these except two have appeared in the publications of the Fish Commission or elsewhere. The drawings of the blackfin and the kieye were made by Mr. A. H. Baldwin for this report. The desirability of bringing together in one publication illustrations of all the species of the group will be at once apparent to everyone.

THE COMMERCIAL IMPORTANCE OF THE WHITEFISHES.

The whitefishes are found in great abundance in the northern parts of North America, Europe, and Asia, and, viewed economically, are the most important fresh-water fishes of the grand divisions named, affording a larger food supply and supporting more extensive fisheries than any other group of fishes of the interior waters.

All of the whitefishes are of sufficient size to have food and commercial value, and in all settled communities they are utilized to a greater or less extent for local consumption or export, or both. The common whitefish and the lake herring are, however, so much more important than all other species combined that they alone are sufficient to give to this group the economic prominence which it has attained. In certain waters the menominee, the blackfin, the longjaw, the tullibee, and other whitefishes are of considerable importance.

In the United States the fishery for the various species of whitefishes is of great extent and importance, the value of the yield ranking among that of such well-known fisheries as the halibut, lobster, menhaden, haddock, bluefish, squeteague, alewife, sponge, fur seal, and lake trout, and, at the present time, exceeding the fisheries named, while the number of persons engaged in the fishery and the capital invested therein are very large. If to the value of the whitefish fisheries of the United States is added that of the fisheries in the Canadian provinces of Ontario, Quebec, Manitoba, and the Northwest Territory, the aggregate is enormous.

While economic fishing of greater or less extent is carried on for whitefishes in the Lake of the Woods, the Great Lakes, and numerous lakes in the more northern parts of the United States and in Canada, the fisheries in the Great Lakes far outrank those in other sections.

For detailed accounts of the whitefish fisheries in the United States waters of the Great Lakes, reference is made to the several reports

issued by the United States Commission of Fish and Fisheries, in which the methods and apparatus are described and full statistical data are given. Detailed statistical and descriptive matter relating to the whitefish fisheries of Canada will be found in the annual reports of the Department of Marine and Fisheries.

The body of water supporting the most extensive whitefish fisheries in the United States is Lake Michigan. Up to a comparatively recent year Lake Erie took precedence, but the serious decline in that lake has brought Lake Michigan to the front. Lake Erie ranks second, followed by lakes Huron, Superior, Ontario, and St. Clair, in the order named.

The aggregate quantity of whitefishes taken for market in the United States and Canada is now more than 76,000,000 pounds annually, with a value of over $2,400,000. These figures are based on the known yield in the Great Lakes and the British North American provinces in 1893 as given in the official reports, and in other parts of the United States in 1894. If to this catch is added the large quantities consumed locally by Indians, Eskimos, and others in Arctic America, Alaska, and the Western States, the total annual output of whitefishes in North America probably amounts to not less than 83,000,000 pounds, having a value of $2,800,000.

THE GENERA AND SPECIES OF AMERICAN WHITEFISHES.

The range of variation among the individuals of each of the species of this group is very much greater than has usually been supposed. An examination of a large series of almost any one of the species shows astonishing differences, even among individuals taken in the same net and at the same time. Aside from the usual variations due to differences in age, sex, and season, there are other variations which manifestly bear no relation to those causes, and which are also independent of geographic influences. Among these are variations in the size of the mouth, the length and relative width of maxillary and mandible, the prominence of the lower jaw, and, most unexpected of all, a very considerable variation in the number and length of the gillrakers. The range in the number of scales in a longitudinal series is also very great. An examination of the tables of comparative measurements, which we give in connection with our discussion of the different species, will make plain the details of these diverse and extensive variations.

The most important characters which are used to separate the different species of whitefishes are the following: Size and shape of the mouth, size of the mandible, maxillary, and eye; relative length of the head and snout; size and position of the different fins; the teeth; the number and length of the gillrakers; the number and character of scales; the color; and the general form of the head and body.

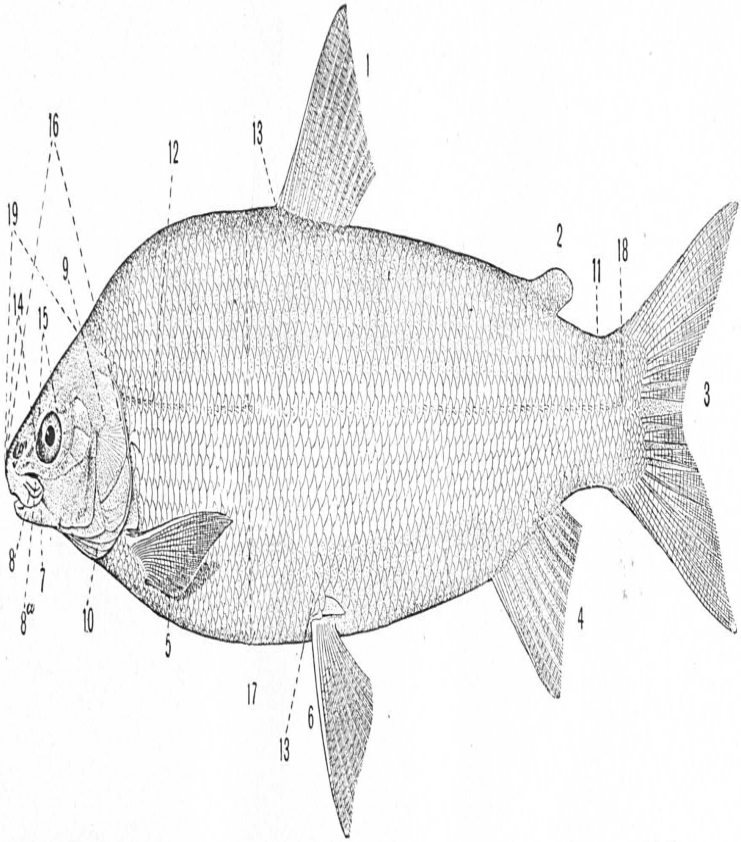
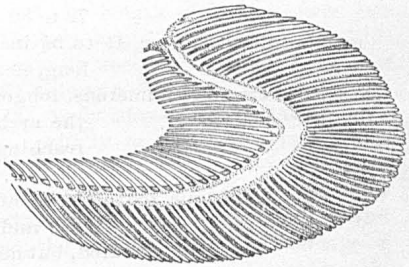


FIGURE OF A WHITEFISH SHOWING THE LOCATION OF PARTS USUALLY REFERRED TO IN DESCRIPTIONS.

1. Dorsal fin.
2. Adipose fin.
3. Caudal fin.
4. Anal fin.
5. Pectoral fin.
6. Ventral fin.
7. Lower jaw, or mandible.
8. Upper jaw, or maxillary,
8a. Supplemental maxillary.
9. Opercle.
10. Branchiostegals.
11. Caudal peduncle.
12. Lateral line.
13. Series of crosswise scales usually counted.
14. Snout.
15. Eye.
16. Head.
17. Depth.
18. Base of caudal.
19. Distance from snout to nape or occiput.

The measurements given in the descriptions in this paper are proportional. "Head 4" means that the length of the head is contained 4 times in the length of the fish, measured from the tip of the snout to the base of the tail or caudal fin. "Depth 5" means the greatest depth of the body is contained 5 times in the same length. The lengths of the eye, snout, maxillary, and mandible are compared with the length of the head; thus "eye 5" means the diameter of the eye (not the orbit) is contained 5 times in the length of the head. The snout is measured from its tip to the anterior rim of the orbit. The maxillary is the long, usually somewhat ovate, bone on side of upper jaw; the mandible is the bone forming the side of the lower jaw. The length of the maxillary and mandible is important.

The gillrakers of the first gill-arch afford one of the best characters for distinguishing the species of this group. The accompanying figure shows the first gill-arch of the bloater or longjaw. From this it may be seen that there are, in this case, 15 gillrakers on the upper or short limb of the arch, and 31 on the long limb; the length of the longest is contained $1\frac{1}{5}$ times in the diameter of the eye. These three facts are ordinarily stated thus: Gillrakers 15+31, the longest $1\frac{1}{5}$ in eye.



Gill-arch of the Longjaw.

The number of scales is also important. "Scales 8–77–7" means that there are 7 rows of scales in a vertical series between the base of the dorsal fin and the lateral line, or 8 including the scale in the lateral line; that there are 77 scales in a longitudinal series counted along the side from the gill-opening to the base of the caudal fin, and that there are 7 scales between the lateral line and the base of the ventral fin. The lateral line is the series of modified scales along the middle of the side.

The total number of species and subspecies of whitefishes recognized by us as at present known from the waters of America is 20, at least 10 of which are known to inhabit the basin of the Great Lakes. The whitefishes and lake herrings are now regarded by most students of American fishes as belonging to one or the other of two rather closely related genera, *Argyrosomus* and *Coregonus*, which may be distinguished as follows:

a. Mouth rather small, maxillary short and broad; mandible short; lower jaw usually included and overhung by the more or less projecting snout; premaxillaries broad, with the cutting edge nearly vertical or directed backward; gillrakers on the first arch few and short, usually fewer than 30...COREGONUS.

aa. Mouth rather large, maxillary long and narrow; mandible long; lower jaw usually more or less projecting beyond the upper; premaxillaries with the cutting edge nearly horizontal and directed forward; gillrakers on the first arch long and numerous, usually more than 35.....ARGYROSOMUS.

The following analytical key will enable one to identify with reasonable certainty the various species of whitefishes of America:

I. **Coregonus**, *the True Whitefishes:*

a. Cleft of mouth short, maxillary and mandible short; lower jaw not projecting beyond the upper; premaxillaries broad, with the cutting edge nearly vertical or directed backward; gillrakers on first gill-arch fewer than 30.

b. Gillrakers very short, thickish, about 12 to 16 on the lower limb of the arch; maxillary short and broad, not reaching eye; mouth very small.

c. Maxillary 3½ to 4 in head; gillrakers short and thick, 5 to 9+11 to 15; body oblong, the back not elevated.

d. Scales 60 to 64 in lateral line; snout blunt and decurved.....*coulterii*, 1.

dd. Scales smaller, 72 to 90 in lateral line.

e. Supplemental maxillary bone rather narrow; scales 83 to 90.

f. Head moderate, blunt, 4 to 5 in body without caudal; tip of snout below level of eye; gillrakers 7 to 9+14 or 15, very short; lower fins pale.....*williamsoni*, 2.

ff. Head very short, blunt, 5⅔ in body; gillrakers short but slender, about 7+14; fins all blackish.....*kennicotti*, 3.

ee. Supplemental maxillary bone very broad, semicircular in shape; scales 72 to 80.....*richardsoni*, 4.

cc. Maxillary shorter, 4⅓ to 5½ in head; gillrakers shorter, about 6+11; body long, slender, not compressed.....*quadrilateralis*, 5.

bb. Gillrakers more numerous, longer and more slender, 17 to 20 on lower limb of the arch; maxillary longer, about 4 in head, about reaching pupil; mouth larger; preorbital long and narrow.

g. Tongue toothless, or nearly so; back decidedly elevated; head very low and short, especially in old examples.

h. Back elevated, but not greatly compressed; supplemental maxillary bone nearly twice as long as deep; head usually 5 to 5½ in length of body.....*clupeiformis*, 6.

hh. Back elevated and greatly compressed; supplemental maxillary bone more than two-thirds as deep as long; head about 5 in length.....*nelsonii*, 7.

gg. Tongue with 3 series of small teeth (not always evident); body elongate, compressed; lower jaw slightly included; head larger; gillrakers 10+15 to 17, about 2 in eye.....*labradoricus*, 8.

II. **Argyrosomus**, *the Lake Herrings:*

aa. Cleft of mouth long, maxillary and mandible long, the former usually extending beyond vertical of pupil; lower jaw long and usually projecting beyond the sharp snout; premaxillaries with the cutting edge nearly horizontal and directed forward; gillrakers on first gill-arch numerous—more than 35.

i. Body elongate, herring-shaped; scales small, uniform in shape and size, the free edges convex.

j. Lower fins pale or merely tipped with dusky; scales punctate with dark specks.

k. Eye large, not much, if any, shorter than snout, its length 3½ to 4½ in that of head.

l. Head long and sharp, 4 in length of body; body very slender, the depth 5 to 6 in the length; maxillary 3 in head.....*osmeriformis*, 9.

ll. Head long, 4½ to 5 in length of body; body deeper and head less pointed; pectorals short, reaching about half way to ventrals.

m. Maxillary 3¼ to 3⅜ in head; lower jaw projecting beyond upper; gillrakers long and numerous, usually about 47 on first gill-arch .....*artedi*, 10.

mm. Maxillary longer, 2⅞ to 3 in head; lower jaw scarcely or not at all projecting; gillrakers fewer, usually not more than 39 or 40 on first gill-arch.....*hoyi*, 11.

lll. Head shorter, about 5 in length of body; pectorals long, reaching more than half way to ventrals; maxillary 3⅛ in head..... *pusillus*, 12.

kk. Eye small, shorter than snout, about 5 times in length of head.

n. Head short, about 5 in length of body.

o. Body rather slender, the depth about equal to length of head.....*lucidus*, 13.

oo. Body deeper, the depth in adult greater than length of head .....*lauretta*, 14.

nn. Head long, 4 to 4½ in length of body; lower jaw strong; maxillary very long, 2½ in head; mandible also very long, usually reaching posterior edge of orbit, at least half as long as head.....*prognathus*, 15.

jj. Lower fins all blue-black; body stout; mouth large; gillrakers numerous, usually at least 50 on the first gill-arch.....*nigripinnis*, 16.

ii. Body short, deep, and compressed, the curve of the back similar to that of the belly; scales large, larger forward and closely imbricated, the free margin often concave or notched.....*tullibee*, 17.

DESCRIPTIVE LIST OF AMERICAN SPECIES OF WHITEFISHES.

In nomenclature and in sequence of species we follow Jordan & Evermann's Fishes of North and Middle America.[1] In the matter of synonymy, preceding the description of each species, we give reference only to the publications in which the various species were described as new. From the synonymy it may be seen that twenty-nine nominal species and subspecies of American whitefishes have been described, but these are now believed to represent only twenty really different forms. The species which have each been described as new more than once are the following: *Coregonus williamsoni*, twice; *C. quadrilateralis*, twice; *C. clupeiformis*, five times; *C. labradoricus*, three times, and *Argyrosomus artedi*, twice.

In connection with each reference we have given the locality from which the type specimens of the supposed new species were obtained. The types of only eight of these nominal species are in the collection of the United States National Museum. We give in parentheses the numbers which they bear on the Museum records.

1. **Coregonus coulterii** Eigenmann & Eigenmann.

COULTER'S WHITEFISH.

Coregonus coulterii Eigenmann & Eigenmann, American Naturalist, November, 1892, 961, Kicking Horse River at Field, British Columbia, one of the head streams of the Columbia River. (Type, No. 44875.)

Description.—Head, $4\frac{1}{2}$ to 5; depth, $4\frac{1}{2}$ to $5\frac{1}{2}$; eye, $3\frac{1}{3}$ to $3\frac{3}{5}$; snout, $4\frac{3}{8}$ to 5; maxillary, $3\frac{3}{8}$ to 4; mandible, $2\frac{3}{5}$ to 3. D. 9 or 10; A. 10 or 11. Scales, 8–60 to 64–6. Gillrakers, 5+11. Body rather slender, compressed, back not much elevated; head short; snout short, bluntly decurved; mouth small, nearly horizontal, the upper lip on a level with the lower line of orbit; maxillary short, broadly ovate behind, barely reaching vertical of pupil; lower jaw short, included, the mandible scarcely reaching vertical of posterior edge of pupil. Distance from tip of snout to occiput $1\frac{3}{8}$ in distance from occiput to origin of dorsal fin. Caudal peduncle long, slender, and compressed. Fins moderate; origin of dorsal much nearer snout than base of caudal, its height $1\frac{2}{3}$ in head and about equal to length of pectoral or longest anal ray. Gillrakers very short, fewer than in *C. williamsoni*. Scales large, firm. Color, pale bluish or lead-color above, becoming silvery on sides and white below; fins all plain. Size small, the specimens examined by us being 5 inches or under in total length.

This species is most closely related to *C. williamsoni*, from which it seems to differ in the larger scales and fewer gillrakers. Specimens of *williamsoni* the size of the types of *coulterii* nearly always show the parr

[1] Fishes of North and Middle America, Bull. 47, United States National Museum, part I, pp. 461–473, 1896.

marks usually seen in the young of most *Salmonidæ*, but our specimens of *coulterii*, all of which are young fish, show no traces of parr marks.

This species was described from the Kicking Horse River at Field, British Columbia, where more than a hundred specimens were obtained by Dr. Eigenmann, in 1892, at an elevation of 4,050 feet. One specimen was also secured by him from Kicking Horse River at Golden, British Columbia. It has not been obtained by any other collector. It does not appear to attain any considerable size or to be of any commercial importance. The largest specimens yet collected do not exceed 8 inches in length. The following table gives comparative measurements of seven individuals examined by us:

Table of comparative measurements of specimens of Coulter's whitefish (C. coulterii).

[The numbers by which specimens are designated in this and all other tables of this paper are those which the specimens bear in the Fish Commission collections.]

No.	Locality.	Length.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.
		Inches.									
189	Kicking Horse River, Field, British Columbia.	$4\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$3\frac{1}{2}$	5	$3\frac{3}{4}$	3	10	11	7-60-6
190	.....do.....	4	$4\frac{1}{2}$	$5\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{3}{4}$	$3\frac{3}{4}$	$2\frac{3}{4}$	9	10	8-60-6
191	.....do.....	$3\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{3}{4}$	4	$2\frac{3}{4}$	9	10	8-62-6
192	.....do.....	$4\frac{5}{16}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$3\frac{1}{2}$	5	$3\frac{1}{4}$	$2\frac{3}{4}$	10	11	8-63-6
193	.....do.....	$3\frac{3}{4}$	$4\frac{3}{8}$	$5\frac{1}{4}$	$3\frac{3}{8}$	$4\frac{3}{8}$	4	$2\frac{3}{4}$	10	11	8-64-6
194	.....do.....	$4\frac{1}{4}$	$4\frac{1}{2}$	$5\frac{1}{2}$	$3\frac{5}{8}$	$4\frac{3}{4}$	$3\frac{3}{8}$	$2\frac{3}{4}$	10	11	8-61-6
195	.....do.....	$3\frac{3}{8}$	$4\frac{1}{2}$	$5\frac{3}{4}$	$3\frac{1}{2}$	$4\frac{3}{8}$	$3\frac{1}{8}$	$2\frac{3}{4}$	10	10	8-60-6

2. Coregonus williamsoni Girard.

ROCKY MOUNTAIN WHITEFISH; MOUNTAIN HERRING.

Coregonus williamsoni Girard, Proc. Ac. Nat. Sci. Phila. 1856, 136, Des Chutes River, Oregon.

Coregonus couesii Milner, Rept. U. S. Fish Comm. 1872-73 (1874), 88, Chief Mountain Lake, Montana. (Type, No. 14146.)

Description.—Head, $4\frac{1}{2}$ to 5; depth, 4 to 5; eye, 4 to 5 (much larger in young); snout, about 4; maxillary, 4; mandible, $2\frac{3}{4}$. D. 11 to 14; A. 11 to 13. Scales, 9 or 10–78 to 87–8; gillrakers, 7 to 9+14 or 15, very short. Body moderately long, back gently elevated, the curve from middle of head to dorsal fin quite evenly convex. Head short, conic; snout gently decurved, pointed; mouth small, maxillary short and broad, scarcely reaching pupil, its direction nearly horizontal in the closed mouth; lower jaw included, the mandible short. Mouth very low; entirely below level of eye. Distance from tip of snout to occiput $1\frac{3}{4}$ in distance from occiput to origin of dorsal fin. Caudal peduncle rather stout; its least depth about $2\frac{3}{4}$ in head. Fins moderate; base of dorsal equal to height of fin, $1\frac{2}{5}$ in head; origin of dorsal usually equally distant between tip of snout and posterior edge of adipose fin; adipose fin unusually large; anal base $1\frac{1}{2}$ in height of fin or about 2 in head; pectoral rather short, $1\frac{1}{6}$ in head; ventral still shorter, $1\frac{3}{5}$ in head; caudal well forked, the lobes about equal to length of head.

Gillrakers few and short, the number usually not exceeding 25 and the length of the longest about 4 times in diameter of eye.

Color bluish above; sides silvery; under parts white; fins all plain, except in breeding males, when they are tipped with black; adipose fin and caudal frequently steel-blue in breeding males. The scales of the male at the breeding season are covered with tubercles, which have been described by Mr. Barton A. Bean as follows:

The tubercles on the scales at this time are very prominent, situated on the middle of the scales, milk-white in color, and forming horizontal lines along the body from head to tail. About 16 of these lines can be counted between the back and the ventral edge of the body. The tubercles show on the abdomen, but the color of that portion of the body and of the tubercles being similar they are indistinct. (Bull. U. S. Fish Comm. 1894, p. 55.)

The following table gives comparative measurements of 37 specimens of *Coregonus williamsoni.*

Table of comparative measurements of specimens of Rocky Mountain whitefish (Coregonus williamsoni).

No.	Locality.	Sex.	Length.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers. Number.	Gillrakers. In eye.
			In.											
186	Shushwap Lake, Sicamous, British Columbia	....	....	4 1/8	4 3/4	4 3/8	4	4	2 1/8	12	11	9-84-8	7+15; 8+14	4
187	.....do	....	3 3/4	4 1/8	5	3 1/8	4 1/2	....	....	12	12	10-87-8	....	....
188	.....do	....	4 1/8	4 1/2	5 1/2	3 1/8	5	....	....	12	12	10-87-8	....	....
31	Little Spokane River	....	14 1/2	4 3/8	4 3/8	5	3 1/2	4	2 3/4	12	12	10-87-8	9+15; 8+15	4
....	.....do	♂	11	5	4	4 1/2	3	....	....	14	13	9-83-8	7+12; 7+12	....
....	.....do	♂	12 1/2	5	4	....	....	....	....	13	13	....	....	....
95	Outlet Alturas Lake, Idaho	♀	....	5	4	5	3 1/8	....	....	10	10	10-85-8	8+14; 8+13	....
96	.....do	♀	....	5	4 1/4	4 1/4	3 1/2	....	....	12	10	10-78-8	7+12; 6+11	....
97	Junction of Salmon River and Alturas Creek, Idaho	♀	....	5 1/2	4 1/2	4 1/8	3 1/2	....	....	12	10	10-86-8	10+15; 8+13	....
98	.....do	....	....	5	4 1/2	4 1/2	3 3/8	....	....	12	11	10-89-8	8+13; 8+12	....
103	Outlet Alturas Lake, Idaho	....	....	4 3/4	5	4 1/2	4	....	....	11	10	10-85-8	6+12; 8+11	....
127	Alturas Lake, Idaho	....	....	4 3/8	5 1/2	4	4	....	....	12	11	10-90-8	9+13; 9+13	....
128	.....do	....	....	4 3/4	5 1/2	4	4	....	....	12	11	10-86-8	8+10; 9+15	....
129	.....do	....	....	5	5	4	3 1/2	....	....	12	11	10-78-8	10+14; 9+13	....
130	.....do	....	....	4 1/2	5	3 1/2	3 3/8	....	....	12	11	10-78-8	8+13; 8+12	....
131	.....do	....	....	4 1/8	5 1/2	4	3 3/4	....	....	13	12	10-84-8	8+10; 8+11	....
132	.....do	....	....	4 1/2	4 1/2	3 1/2	4	....	....	12	11	10-87-8	8+12; 8+11	....
133	.....do	....	....	4 3/4	5	4	4	....	....	11	10	10-92-8	9+12; 7+15	....
134	.....do	....	....	4 1/2	4 1/2	4	4	....	....	12	12	10-85-8	8+14; 10+15	....
135	.....do	....	....	4 3/4	5 1/2	4	3 1/2	....	....	11	10	10-82-8	9+14; 8+14	....
136	.....do	....	....	4 3/4	5	4 1/2	4	....	....	12	10	10-82-8	9+15; 8+15	....
137	.....do	....	....	4 1/4	5	3 1/2	3 1/2	....	....	11	10	9-82-8	7+13; 7+13	....
153	Payette River, a few miles below Payette Lake, Idaho	....	....	5	4 1/4	4	4	....	....	12	11	10-80-8	8+11; 8+12	....
154	.....do	....	....	5	4 1/2	4	4	....	....	11	11	10-79-8	7+12; 8+14	....
155	.....do	....	....	5	4 1/2	4 1/2	4 1/2	....	....	12	11	10-88-8	8+13; 8+12	....
156	.....do	....	....	5 1/4	4 3/8	4	3 3/8	....	....	13	11	10-83-8	9+12; 10+12	....
157	.....do	....	....	4 3/4	4 1/2	4 1/2	3 3/8	....	....	12	12	10-81-8	9+12; 9+12	....
158	.....do	....	....	5 1/4	4 3/4	4 1/2	4	....	....	12	11	9-84-7	8+12; 7+12	....
159	.....do	....	....	5	4 3/8	4 1/4	4	....	....	12	11	9-89-8	8+14; 9+15	....
160	.....do	....	....	5	4 1/2	4 3/8	3 3/8	....	....	10	9	9-83-8	9+12; 8+14	....
161	.....do	♂	....	5	4 3/8	5	3 1/2	....	....	13	12	9-81-7	8+13; 8+14	....
162	.....do	....	....	5	5	4 3/8	3 3/8	....	....	12	11	9-85-7	9+14; 8+13	....
182	.....do	....	....	4 7/8	4 3/8	4 3/8	4 1/4	....	....	11	11	9-84-7	7+14; 6+13	....
183	.....do	....	....	5	4 1/2	4 3/8	4	....	....	12	11	9-85-7	7+12; 7+14	....
184	.....do	....	....	5	4 1/2	4	3 1/8	....	....	12	11	9-82-8	8+12; 8+12	....
....	Snake River at Upper Salmon Falls, Idaho	....	....	4 3/4	5	3 1/2	4	....	....	12	11	9-80-8	7+12; 7+13	....
....	.....do	....	....	4 1/2	4 1/4	3 1/2	4 1/2	....	....	12	11	9-82-7	8+13; 7+12	....

Distribution.—The Rocky Mountain whitefish is of wide distribution. It is found throughout the Rocky Mountain region from central Colorado and Utah northward through Wyoming, Idaho, western Montana, at least as far as the headwaters of the Columbia, and thence westward throughout the Columbia Basin. The most eastern locality from which it has been reported is Chief Mountain Lake, at the head of the Saskatchewan River, on the northern boundary of Montana. It was described from that lake in 1874 by Milner as *Coregonus couesii.* It is found only in the clearer, colder streams and lakes.

One of the authors of this paper has collected or observed this fish at the following places: Provo River, Provo, Utah; Jordan River, near Salt Lake City; Swan River, below Swan Lake, Montana; Jocko River, Ravalli, Mont.; Big Blackfoot River, Bonner, Mont.; Little Blackfoot River, Elliston, Mont.; Cottonwood Creek, Deer Lodge, Mont.; Snake River, President's Camp, Wyoming; Little Spokane River at Dart's Mill, Washington; Snake River at Upper Salmon Falls and Weiser, Idaho; Little Weiser River in Indian Valley, Idaho; and in the upper Salmon River Valley in Idaho in Alturas, Pettit, and Redfish lakes and their outlets. We have also examined specimens collected in 1892 by Messrs. A. J. Woolman and B. A. Bean in Flathead Lake, Montana; Post Creek, St. Ignatius Mission, Montana; Clark Fork, Thompson Falls, Montana, and Spokane and Little Spokane rivers, near Spokane, Wash.; also specimens collected in 1893 by Doctors Gilbert and Jenkins in Payette River, Payette, Idaho; Clearwater River, Lewiston, Idaho; Columbia River, Umatilla, Oreg.; Natches River, North Yakima, Wash., and Newaukum River, Chehalis, Wash.; also many specimens collected by Mr. T. M. Williams at Payette Lake, Idaho. Besides these we have examined specimens in the National Museum from Washington (Major Bendire); Provo, Utah (Dr. Yarrow); Portland, Oreg. (United States Fish Commission); Lake Tahoe (Dr. J. G. Cooper); Mill Creek and Garrison Creek at Walla Walla (Major Bendire); Montana (W. C. Harris); Clark Fork (W. C. Harris); Lake Cœur d'Alene (Bendire); White River, Meeker, Colo. (Jas. L. Foley); Utah Lake (Jordan), and Lake Tahoe (H. W. Henshaw).

This fish attains a length of a foot or more and a weight of 4 pounds, the average weight of adults being about 1 pound. Though not of much commercial importance as yet, it is eagerly sought after by the inhabitants of the region in which it is found and is held in high esteem as a pan-fish. At some seasons it readily takes the hook, especially when baited with salmon or trout spawn.

This whitefish spawns in late fall or early winter, at which time it runs up into the smaller streams. At the mountain lakes in Idaho, where it is an abundant fish, the spawning time appears to be in October or November. Then they ascend the inlets of the lakes in great numbers and spawn upon the same beds which are used by the redfish in August and September. During the summer the young are found in abundance in the lakes.

2a. Coregonus williamsoni cismontanus Jordan.

WHITEFISH OF THE UPPER MISSOURI BASIN.

Coregonus williamsoni cismontanus Jordan, Bull. U. S. Fish Comm., IX, 1889, 49, pl. 9, figs. 8, 9, Horsethief Springs Creek, a tributary of Madison River, Montana.

In the headwaters of the Missouri River is found a scarcely tangible variety of Williamson's whitefish which has received the above name. It is distinguished from *C. williamsoni* by the more slender body and somewhat lower fins. Head, 5; depth, 5 to 5½; pectoral, 1½ in head; ventral, 1⅙; longest dorsal ray, 1½. Scales in lateral line, 80 to 90.

A specimen 9 inches long, from Big Goose Creek, Sheridan, Wyo., gives the following measurements: Head, 4⅔; depth, 4½; eye, 5; snout, 3⅚; maxillary, 4⅓; mandible, 2⅚. Scales, 9–86–8. Length of pectoral, 1¼ in head; ventral, 1½; anal, 1½.

Differences between this and typical *williamsoni* are not marked, and the variety should probably not be recognized as having any real existence.

This whitefish has been collected by us in the following Missouri Basin localities: Red Rock River, Red Rock, Mont.; Beaverhead River, Dillon, Mont.; junction of Gibbon and Firehole rivers, Yellowstone Park; and Big Goose Creek, Sheridan, Wyo. It has been obtained by Dr. Jordan from Madison River below the falls, and from Horsethief Springs Creek, Montana. The National Museum contains specimens from Gallatin River, Montana (W. C. Harris); Gallatin and Madison rivers (J. E. Curtis), and Montana (E. Wernigk).

From these records it would seem that the center of abundance of this variety of whitefish is in the three forks (Jefferson, Madison, and Gallatin) which unite to form the Missouri northwest of the Yellowstone Park. The most eastern locality from which it is yet known is Sheridan, Wyo., where numerous young individuals were collected in July, 1893, by Prof. U. O. Cox, for the United States Fish Commission. These specimens were obtained in Big Goose Creek, which is tributary to Tongue River. Though the streams in the Black Hills to the east of Tongue River are clear and cold and well adapted to the habits of this fish, somewhat extended investigations in that region in 1892 and again in 1893 failed to discover any whitefish there.

3. Coregonus kennicotti Milner.

KENNICOTT'S WHITEFISH; BROAD WHITEFISH; MUKSUN.

Coregonus kennicotti Milner, in Jordan & Gilbert, Synopsis, 298, 1883, Fort Good Hope, British America. (Type, No. 8971.)

Head, 5⅔; depth, 4⅔; eye, 5½; snout about 4; maxillary, 4. D. 11; A. 14. Scales, 10–87 to 90–10. Gillrakers, 6 or 7+14, short and slender, 1¼ in eye. Head very blunt, premaxillaries wide and vertically placed; mouth inferior, the high, blunt snout but little projecting; maxillary

reaching slightly beyond the vertical at front of the eye, broadly ovate; preorbital narrow, its greatest width 5 times in its length and 3⅓ in eye; width of supraorbital bone 2½ in its length. Distance from snout to nape one-third distance from nape to front of dorsal; front of dorsal nearer tip of snout than base of caudal by a distance equal to length of snout and eye. Adipose fin large. Scales small, adherent, very regularly imbricated. Color probably very dark in life; in spirits, fins all blackish, with a bluish tinge (Gilbert). Large, reaching a length of 2 feet.

Dr. Bean says:

This is the *muksun* of the Russians, a name transferred from a Siberian species of similar appearance. The broad whitefish reaches the weight of 30 pounds, ranking next in size to the *inconnu* only. It is a food-fish of great excellence. Dall states that it is abundant in both winter and summer, spawning in September in the small streams falling into the Yukon.

The type of this species came from Fort Good Hope, British America. Murdock reports it from the Meade and Kuahroo rivers, Alaska; Townsend found it in the Kuwuk River, Dall and Turner in the Yukon; and it was recently obtained by Miss Elizabeth Taylor in Great Bear Lake. All the Alaskan references to *C. clupeiformis* probably belong to this species, or to *C. richardsonii*, if the latter be distinct from *C. kennicotti*.

4. Coregonus richardsonii Günther.

RICHARDSON'S WHITEFISH.

Coregonus richardsonii Günther, Cat., VI, 185, 1866, exact locality unknown.

Very similar to the common whitefish, also to the broad whitefish, with which it may prove identical. Scales 10–72 to 80–12; B. 9; D. 13; A. 13. Snout of moderate length, the lower jaw included; eye shorter than snout; maxillary reaching anterior edge of eye, 4 in head; supplemental bone short, broad, and semicircular; mandible shorter than least depth of tail. Pectoral longer than head without snout.

This species was described in 1866, the type locality being unknown, but it was somewhere in British America. It is a species of doubtful validity. Only the types are known. Dr. G. A. Boulenger has kindly sent us the following note regarding the types of this species which are in the British Museum:

I have examined the types (dry) of *Coregonus richardsonii*. There are about 20 gillrakers on the lower part of the anterior arch, the longest half the diameter of the eye. The maxillary extends to below anterior border of eye, and its length is 4 times in length of head, as stated by Günther, therefore a little shorter than in *C. clupeiformis*. Tongue with 4 series of teeth, as in *C. labradoricus*. It seems to agree best with *C. nelsoni* (description), but has fewer scales in lateral line. In short, I can not identify *C. richardsonii* with any of the forms known to me.

5. Coregonus quadrilateralis Richardson.

MENOMINEE WHITEFISH; FROSTFISH; SHADWAITER; PILOTFISH; CHIVEY; ROUND WHITEFISH; CHATEAUGAY SHAD; BLACKBACK.

Coregonus quadrilateralis Richardson, Franklin's Journ., 1823, 714, Fort Enterprise, British America.

Coregonus novæ-angliæ Prescott, Amer. Journ. Sci. Arts, XI, 1851, 342, Lake Winnipiseogee, N. H.

Description.—Head, $5\frac{1}{4}$ to $5\frac{1}{2}$; depth, $4\frac{2}{3}$ to $5\frac{1}{2}$; eye, 5 to $5\frac{3}{5}$; snout, $4\frac{1}{2}$ to 5; maxillary, $4\frac{4}{5}$ to $5\frac{1}{2}$; mandible, 3 to $3\frac{1}{5}$; D. 11 or 12; A. 11 or 12. Scales, 9 or 10–86 to 92–7 or 8. Gillrakers, 5 to 8+9 to 12, usually about 6+11, very long, the longest about 4 in eye.

Body long, slender, and round, not much elevated nor compressed, the back broad, and the body more nearly round than in any other whitefish. Head rather small and pointed; snout short, bluntly decurved, projecting somewhat beyond the included lower jaw; maxillary short and broad, scarcely reaching eye, the supplemental bone very narrow; mandible very short, barely reaching posterior line of pupil; mouth small, entirely below level of orbit. Top of head not arched, cranial ridges prominent. Distance from snout to occiput $2\frac{2}{5}$ in distance from occiput to origin of dorsal fin; origin of dorsal notably in front of insertion of ventrals, equidistant from tip of snout and posterior edge of adipose fin; caudal peduncle long, $1\frac{1}{5}$ in head, somewhat compressed. Base of dorsal fin short, $1\frac{1}{5}$ in longest ray or $1\frac{4}{5}$ in head; anal base short, $1\frac{2}{5}$ in longest anal ray or $2\frac{3}{5}$ in head; pectoral, $1\frac{2}{5}$ in head; ventral, $1\frac{3}{5}$; adipose fin small. Color silvery white, dusky on back and upper part of sides; under parts white; fins all pale except dorsal and caudal, which are more or less dark on tips.

The following table exhibits the variations in proportion of parts in the specimens examined critically by us:

Table of comparative measurements of specimens of the Menominee whitefish (Coregonus quadrilateralis).

Number.	Locality.	Sex and condition.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers.	
														Number.	In eye.
			In.	*Oz.*											
76	Lake Michigan.	♂ nearly ripe.	$14\frac{1}{4}$	12+	$5\frac{1}{4}$	$4\frac{2}{3}$	$5\frac{1}{5}$	$4\frac{1}{2}$	$4\frac{4}{5}$	$3\frac{1}{5}$	11	11	9–86–8	8+12; 8+12	Very short.
77	.....do.....	.....	$14\frac{1}{4}$	14—	$5\frac{1}{4}$	$4\frac{2}{3}$	$5\frac{2}{5}$	$4\frac{2}{3}$	5	$3\frac{1}{5}$	11	11	9–92–7	6+11; 6+11	Very short.
78	.....do.....	.....	$14\frac{1}{4}$	14-	$5\frac{1}{5}$	$4\frac{2}{3}$	$5\frac{1}{5}$	$4\frac{2}{3}$	$5\frac{1}{2}$	$2\frac{4}{5}$	12	11	9–86–7	7+12; 7+10	.....
224	Lake Superior..	.....	.....	.....	$5\frac{1}{5}$	$4\frac{2}{3}$	5	5	5+	3	12	11	10–88–8	5+10; 5+11	4
226	Southampton, Ontario.	.....	.....	.....	$5\frac{2}{5}$	$5\frac{2}{5}$	5	5	.....	.....	.....	.....	10–92–8	7+11; 7+11	4
229	Lake Superior..	.....	.....	.....	$5\frac{2}{5}$	$5\frac{1}{5}$	$4\frac{2}{5}$	$4\frac{2}{5}$	5	3	12	12	10–88–8	5+10; 5+10	4
132	Clear Water Pond, Industry, Maine.	.....	.....	.....	.....	.....	5	$4\frac{2}{3}$	$4\frac{2}{5}$	3+	11	11	9–86–7	5+11; 6+9	$3\frac{1}{2}$
278	Lake Superior..	.....	15	.....	$5\frac{1}{5}$	$5\frac{1}{5}$	$4\frac{4}{5}$	$4\frac{1}{2}$	5	$2\frac{4}{5}$	11	10	9–86–7	.....	.....
286	.....do.....	.....	14	.....	5	5	5	$4\frac{1}{2}$	5	3	11	10	8–81–7	5+12+5+11	4
287	.....do.....	.....	16	.....	$5\frac{1}{4}$	$5\frac{1}{4}$	$5\frac{1}{5}$	$4\frac{1}{2}$	$5\frac{1}{4}$	3	12	11	9–90–8	7+10; 7+10	$4\frac{1}{2}$
288	.....do.....	.....	17	.....	5	5	$5\frac{1}{5}$	$4\frac{1}{2}$	5	3	12	....	9–85–7	6+10; 5+10	$3\frac{2}{3}$

Distribution.—The Menominee is found in the lakes of New England, westward through the Adirondacks and the Great Lakes, thence northward into Alaska. In addition to the localities represented in the foregoing table, we have examined specimens in the National Museum from the following localities: Squattock, New Brunswick (Philip Cox); Farmington, Me. (Frank N. Whittier); Lake Winnipiseogee, New Hampshire (R. Appleton, Dr. W. W. Fletcher); "New Hampshire" (E. B. Hodge); "Adirondacks" (Verplank Colvin); White Lake, Oneida County, N. Y. (W. T. Loomis); Big Moose Lake, New York (Fred Mather); Northville, Mich. (F. N. Clark); Sault Ste. Marie (J. W. Milner), and Madaline Island, Lake Superior (Milner).

It has also been recorded from the following localities: Fort Enterprise, British America (type locality, Richardson); Lake Superior (Agassiz); Saumuss Lake and Fraser River, British Columbia (Günther; probably *C. williamsoni*); Lake Erie (Jordan); Lake Michigan (Jordan; Hoy); island of Kadiak, Alaska (Bean); Mackinaw Straits (Bean); Yukon River, at Fort Yukon (Turner); Nulato, Alaska (Bean); Kuskokwim River, Alaska (Bean); Putnam or Kuwuk River, Alaska (Bean); Slave Lake (Bean); Adirondack lakes, Meacham Lake, Chateaugay Lake, Lake Champlain, Big Moose Lake, the Fulton Chain, and Clear Pond (Fred Mather).

From the above it will be seen that this is one of the most—perhaps the most—widely distributed of the American whitefishes.

The Menominee attains a length of 12 to 15 inches and a weight of 2 pounds; the average weight of the fish taken for market, however, is under 1 pound.

6. **Coregonus clupeiformis** (Mitchill).

COMMON WHITEFISH; OTSEGO BASS; HUMPBACK WHITEFISH; BOWBACK WHITEFISH; HIGHBACK WHITEFISH.

Salmo clupeiformis Mitchill, Amer. Month. Mag., II, 1818, 321, Sault Ste. Marie.
Coregonus albus Le Sueur, Journ. Ac. Nat. Sci. Phila., I, 1818, 231, Lake Erie to Arctic Sea.
Coregonus otsego DeWitt Clinton, Med. and Phil. Register, III, 188, about 1824, Otsego Lake.
Coregonus sapidissimus Agassiz, Lake Superior, 344, 1850, Lake Superior.
Coregonus latior Agassiz, Lake Superior, 348, 1850, Lake Superior.

Description.—Head, $4\frac{3}{5}$ to $5\frac{1}{2}$; depth, $3\frac{5}{6}$ to $4\frac{1}{2}$; eye, about 5; snout, 4 to $4\frac{1}{2}$; maxillary, $3\frac{4}{6}$ to $4\frac{2}{5}$; mandible, $2\frac{1}{3}$ to 3. D. 11, occasionally 10; A. 11, sometimes 12. Scales 11–82 to 92–8. Gillrakers usually about 10 or 11+17 or 18, the longest about 2 in eye. Vertebræ 56. Body rather long and compressed, the back arched in front, especially so in the adult, the outline nearly straight posteriorly; ventral outline somewhat convex in front; bases of dorsal and anal fins not very oblique; back narrow; head small and short; snout short and rather blunt; mouth small, nearly horizontal; maxillary short, broadly ovate, its tip

reaching about to vertical of front edge of pupil, its width about one-half its length; mandible short, reaching about to posterior edge of eye; upper lip on a level with lower line of eye; lower jaw always included and the blunt snout projecting. Distance from tip of snout to nape $3\frac{1}{4}$ to 4 in distance from snout to origin of dorsal fin. Gillrakers not numerous, the number on the short arm of the arch varying from 7 to 11, on the long arm from 17 to 19; the total number, however, is usually 27 to 29; they are short and rather stout, the longest being contained from $1\frac{3}{5}$ to $2\frac{1}{3}$ times in eye. Fins moderate, the longest rays in pectoral, ventral, and dorsal about equaling length of head. Color, satiny-white all over, back with a faint olive-green shade; fins all white, except the caudal, which is usually slightly dark-edged.

The principal variations in the characters of this well-known fish are shown in the following table of detailed measurements:

Table of comparative measurements of specimens of common whitefish (C. clupeiformis).

No.	Lakes where taken.	Sex and condition.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers.		
														Number.		In eye.
			In.													
74	Michigan	♂	$11\frac{5}{8}$	7 oz.	$5\frac{1}{6}$	$4\frac{1}{5}$	$4\frac{1}{3}$	4	4	$2\frac{1}{3}$	11	11	10-80-7	10+19;	9+17	....
121	Erie	♂ spent.	$20\frac{3}{8}$	$3\frac{1}{4}$ lbs.	$5\frac{2}{7}$	$3\frac{2}{7}$	5	4	$4\frac{1}{4}$	3	10	11	10-84-8	10+18;	10+18	$1\frac{2}{5}$
122	.....do....	♀ spent	$20\frac{1}{8}$	$3\frac{3}{8}$ lbs.	$5\frac{1}{6}$	$3\frac{3}{4}$	$5\frac{1}{6}$	4	$3\frac{3}{4}$	$2\frac{1}{2}$	11	11	10-85-8	9+18;	8+17	....
123	.....do	♀ spent.	21	$3\frac{3}{4}$ lbs.	$5\frac{1}{6}$	$3\frac{1}{2}$	$5\frac{1}{2}$	4	4	$2\frac{1}{4}$	11	11	10-83-8	10+18;	10+19	$1\frac{3}{4}$
124	.....do.....	♂ partly spent.	$22\frac{1}{2}$	$4\frac{3}{4}$ lbs.	$5\frac{1}{4}$	$3\frac{2}{3}$	$5\frac{5}{6}$	4	4	3	10	12	10-82-8	11+19	.....	....
225	Superior	.....	.....	.....	5	$4\frac{1}{5}$	5+	4	$3\frac{1}{2}$	3—	10	11	10-92-8	10+18;	10+17	2
227	.....do.....	.....	.....	.....	5	$4\frac{1}{2}$	5	$4\frac{1}{5}$	$4\frac{2}{3}$	$2\frac{1}{2}$	11	11	10-82-9	10+17;	10+18	....
230	.....do.....	.....	.....	.....	$4\frac{2}{5}$	5	$4\frac{2}{3}$	$4\frac{3}{8}$	4+	$2\frac{2}{3}$	11	11	9-85-8	7+18;	7+18	2+
231	.....do.....	.....	.....	.....	$4\frac{2}{3}$	$4\frac{1}{2}$	$4\frac{5}{8}$	$4\frac{3}{4}$	$4\frac{2}{3}$	3—	11	12	11-87-9	10+17;	10+17	2
277	Erie	.....	13	.....	$5\frac{1}{2}$	4	$4\frac{3}{4}$	$4\frac{3}{4}$	4	$2\frac{3}{4}$	11	12	9-75-8	9+18;	10+18	$2\frac{1}{2}$
384	Winnipeg	.....	$15\frac{1}{8}$	.....	5	$3\frac{3}{4}$	$5\frac{1}{8}$	4	4+	3—	11	12	10-81-8	.....		....

Among the numerous specimens of whitefish which we have examined, we have one which is of unusual interest. This is specimen No. 243, obtained by Mr. Cloud. Rutter from the Droziski Fish Company, at Dunkirk, N. Y., September 17, 1894. It is a fine example, 19 inches in total length. In external appearance it might very well pass for a true whitefish, but careful measurements and examination of its gillrakers show it to differ very materially from typical *C. clupeiformis*. It may be described as follows:

Head, 5; depth, $3\frac{1}{2}$; eye, $5\frac{1}{2}$; snout, 5; maxillary, 4; mandible, $2\frac{3}{5}$. D. 10; A. 11. Scales, 10–72–8. Gillrakers, 12+26 on one side and 13+24 on the other, the longest $1\frac{2}{5}$ in diameter of eye. Body stout and deep, compressed; head larger than in the typical whitefish, the mouth larger, maxillary longer and stouter, reaching to front of pupil; mandible longer, reaching posterior edge of eye; snout more pointed, less decurved, the lower jaw slightly projecting. Distance from tip of snout to nape $3\frac{1}{2}$ in distance from snout to origin of dorsal fin. Caudal

peduncle short and deep. From typical *C. clupeiformis* this specimen differs chiefly in the more numerous gillrakers, the somewhat heavier head, the larger mouth, longer maxillary, longer mandible, sharper snout, slightly projecting lower jaw, and the larger scales. In all of these respects the variations from *clupeiformis* are corresponding approximations to the characters possessed by the lake herring.

While we are not at all inclined to admit the occurrence in nature of hybrids among fishes, we are disposed to regard this specimen as a hybrid between the true whitefish (*C. clupeiformis*) and the lake herring (*A. artedi*). We are informed by Dr. Bean, until recently in charge of the Fish-cultural Division of the United States Fish Commission, that it has been a common practice among fish-culturists at the stations about the Great Lakes to fertilize the eggs of the true whitefish (*C. clupeiformis*) with the milt from the lake herring (*A. artedi*), and that this hybridizing has been carried on more or less for several years.[1] Plants of these hybrids have been made in various places, but chiefly in Lake Erie; and it is not at all unlikely that this specimen and all those which the Lake Erie fisherman occasionally get and which they call "mongrel whitefish" are really hybrids between the true whitefish and the lake herring. The number of such hybrids can not be great, however. During the entire season's work of the various Fish Commission parties on the different Great Lakes, only the one specimen which we have described was obtained. Mr. Rutter informs us that the fisherman say they occasionally get a "mongrel whitefish," but this, and possibly one other, are the only ones he saw.

Distribution and abundance.—The common whitefish is one of the most abundant species of whitefishes. It is found throughout the Great Lakes region from Lake Champlain to Lake Superior and Lake Winnipeg. We have examined specimens from Lake Champlain, Otsego Lake, each of the Great Lakes, and from Lake Winnipeg. We have seen no specimens from Lake Memphremagog or elsewhere east of Lake Champlain. Of the three species known to occur in Lake Champlain this is the rarest. The form described from Otsego Lake, N. Y., is a landlocked variety, scarcely worthy of recognition; the National Museum contains three specimens from this lake. In lakes Erie, Huron, Michigan, and Superior the whitefish is abundant, but is now most so in Lake Michigan. It occurs in diminished numbers west and north of Lake Superior, but we have few authentic records to establish the fact. It is reported commercially from Lake of the Woods, Lake Winnipeg, and the northwest Territories, but all the specimens of so-called whitefish which we have seen from the first-named lake belong to a very different species—the Musquaw River whitefish (*C. labra-*

[1] This is done, however, only as a last resort, when eggs of the whitefish can be saved which would otherwise be lost on account of an insufficient number of spawning male whitefish on hand at the collecting station.

doricus). The only specimen of the true whitefish which we have seen from any locality west of Lake Superior is an example obtained by Mr. Woolman in the Duluth market, and which is alleged to have come from Lake Winnipeg. All the records of the occurrence of this species west of Lake Superior need verification.

Names, size, habits, etc.—This fish is generally known as the whitefish throughout the United States and Canada. The landlocked race found in Otsego Lake, N. Y., has been designated by the singularly inappropriate and misleading name of "Otsego bass." Several local names have been applied to the fish in Lake Superior, in allusion to the nuchal hump which characterizes the breeding males. Mr. Woolman found that among the fisherman of the north shore of Lake Superior the names "highback whitefish" and "buffalo-back whitefish" were applied to this fish; the name "bowback" or "bowback whitefish" was heard by Mr. Wilcox in the eastern part of the same lake.

This fish attains a larger size than any other whitefish of North America. Examples weighing as much as 23 pounds, and possibly more, have been taken in the upper lakes. Lake Superior has the reputation of producing the largest fish. In all the lakes, however, fish weighing 10 to 14 pounds are taken. The average size of those obtained in the United States fisheries of the Great Lakes is probably under 4 pounds, the fish taken in gill nets being somewhat larger than those secured in traps.

The habits and movements of this fish are better understood than are those of any other American whitefish. It is chiefly to the late Prof. J. W. Milner that we are indebted for our knowledge concerning this fish in the Great Lakes. The results of his researches were originally published in the Report of the United States Commission of Fish and Fisheries for 1872–73, and have since been extensively copied; we refer to Milner's report for information on this subject.

The whitefish reaches maturity at the age of three or four years, and deposits from 10,000 to 75,000 eggs, the number depending on the size of the fish. The spawning capacity can be approximately gauged by allowing about 10,000 eggs for each pound of body weight. The spawning time is in the late fall, chiefly in the month of November. During the summer they retire to the deeper portions of the lakes, but as the time for spawning approaches they come into shoal water about the islands and in the bays and coves. In Lake Ontario they first appear on their spawning-grounds late in October and the season extends into December. The principal spawning-grounds are in Chaumont Bay, Three-mile Bay, and on the gravelly bars about the head of Fox Island and across to Point Peninsula. The bottom selected seems to be of gravel or of the peculiar rock known as "finger rock" or "honeycomb," at a depth of 20 to 30 feet. In Lake Erie the principal spawning-grounds are among the islands in the western end of the lake.

The whitefish makes regular migrations analogous to the movements of anadromous fishes in the coast rivers. These occur chiefly about the spawning season and are impelled by the reproductive instinct. There are also more or less regular movements at other times, but these are not well understood.

The whitefish rarely takes the hook. Its small mouth necessitates the ingestion of minute food, and examination of the stomach contents has shown that it subsists chiefly on crustaceans, mollusks, and insect larvæ.

Dr. S. A. Forbes, of Illinois University, has made a careful study of the first food of the common whitefish in Lake Michigan, and has reached the following conclusion:

> We are compelled to conclude that the earliest food of the whitefish consists almost wholly of the smallest species of Entomostraca occurring in the lake, since the other elements in their alimentary canals were evidently either taken accidentally, or else appeared in such trivial quantity as to contribute nothing of importance to their support. In fact, two species of Copepoda, *Cyclops thomasi* and *Diaptomus sicilis*, are certainly very much more important to the maintenance of the whitefish in this earliest stage of independent life than all the other organisms in the lake combined. As the fishes increase in size, vigor, and activity they doubtless enlarge their regimen by capturing larger species of Entomostraca, especially *Daphnia* and *Limniaclanus*. (Bull. Ill. State Lab. Nat. Hist., vol. 1, No. 6, p. 108, 1883.)

The common whitefish is generally regarded as one of the best food-fishes of North America. In the regions in which it is taken it is usually held in higher esteem than any other fish. Being a soft fish, it spoils rapidly, and in the condition in which it usually reaches the consumer its edible qualities have greatly deteriorated.

7. **Coregonus nelsonii** Bean.

HUMPBACK WHITEFISH.

Coregonus nelsonii Bean, Proc. U. S. Nat. Mus. 1884, 48, Nulato, Alaska. (Type, No. 29903.)

Head, 5; depth, 4; maxillary, 4; D. 12; A. 12. Scales, 10–88–8 (or 10 counting to middle line of belly). Gillrakers about 26 in number, the longest about 2 in eye. Body heavy forward; back greatly arched and compressed. Head small, snout rather pointed. Mouth small, the maxillary reaching front of eye. Distance from snout to nape about $2\frac{1}{3}$ in distance from nape to origin of dorsal, the latter a little nearer posterior base of adipose fin than tip of snout. Base of dorsal fin, $1\frac{2}{5}$ in longest ray or $1\frac{1}{2}$ in head.

This species is allied to *C. clupeiformis* and *C. labradoricus*, from which it may be distinguished by the greatly arched and compressed back.

It was described by Dr. Bean in 1884 from specimens collected by Mr. E. W. Nelson, at Nulato, Alaska; Mr. Townsend reports it from the Kuwuk River. It is known only from Alaska, from Bristol Bay northward.

Of this species Dr. Bean says:

This whitefish has long been known from Alaska, but it has been confounded with a Siberian species, *C. syrok*, from which it is really very different. The Russian name is *korabati;* the Tinneh tribes of the Yukon call it *kolokuh*. Dr. Dall speaks of it as a common species. He says it is rather bony, and inferior in flavor, and that it is generally used for dog feed except in times of scarcity.

8. Coregonus labradoricus Richardson.

LABRADOR WHITEFISH; MUSQUAW RIVER WHITEFISH; SAULT WHITEFISH; WHITING; LAKE CHAMPLAIN; SHAD OR SHADWAITER; WHITEFISH; GIZZARD-FISH; ATTIHAWMEG; POISSON POINTU.

Coregonus labradoricus Richardson, Fauna Bor.-Amer., III, 206, 1836, Musquaw River, Labrador.

?? *Coregonus angusticeps*, Cuvier & Valenciennes, His. Nat. Poiss., XXI, 534, 1848, Saskatchewan River; description brief and erroneous.

Coregonus neohantoniensis Prescott, Amer. Journ. Sci. Arts, XI, 1851, 342, Lake Winnipiseogee, New Hampshire.

Description.—Head, $4\frac{2}{3}$ to 5; depth, $3\frac{1}{4}$ to $3\frac{3}{4}$; eye, $5\frac{1}{4}$; snout, $4\frac{1}{2}$ to 5. D. 11 or 12; A. 11. Scales, 10–72 to 87–9. Maxillary, $3\frac{3}{4}$ to 4; mandible, $2\frac{3}{5}$. Gillrakers, 9 or 10+15 to 17=25 or 26, the longest about 2 in eye.

Body long ovate, compressed, the dorsal and ventral outlines about equally arched. Head small, slender, and pointed; snout blunt, truncate, jaws subequal; maxillary rather long, reaching to vertical of anterior line of eye; the supplemental bone more than half length of maxillary, its width $2\frac{1}{6}$ in its length; mandible long, reaching vertical of posterior edge of pupil. Eye moderate, shorter than snout, lower edge of pupil in a line with middle of upper jaw. Distance from snout to occiput $3\frac{1}{2}$ in distance from snout to origin of dorsal fin, which is slightly nearer snout than base of caudal. Caudal peduncle short and deep, its least depth $2\frac{1}{6}$ in head. Fins rather large; height of dorsal and length of pectoral about equal to length of head; base of dorsal fin not much oblique, short, $1\frac{1}{2}$ in height of fin; base of anal fin very oblique, about equal to height of fin or $1\frac{1}{2}$ in longest dorsal ray; adipose fin small, over posterior third of anal; ventrals shorter than pectorals, $1\frac{1}{6}$ in head, their insertion under middle of dorsal fin. Tongue with very weak teeth. Gillrakers short and few, usually not more than 25. Scales thin and loosely imbricated; lateral line nearly straight, along axis of body. Color usually quite dark on back and sides, becoming gradually paler below; under parts pale without dark punctulations; fins all more or less black-tipped, caudal darkest. Length about 2 feet.

Specimens from Lake of the Woods are darker and much deeper in body than those from lakes Champlain and Memphremagog. There is also much variation in the length of the maxillary and in the number of scales in the lateral line. In specimen No. 63, from Lake of the Woods, and upon which our general description is chiefly based, the

maxillary scarcely reaches the eye, and is contained $3\frac{3}{8}$ times in the head; the scales are unusually large, there being but 68 in the course of the lateral line; and the body is very deep, the form being much like that of the common whitefish. No. 120, from Lake Memphremagog, has the usual more elongate form of the species, the maxillary is shorter and the scales are much smaller, there being 87 in the course of the lateral line. The examples from Lake Champlain are deeper and paler than those from Lake Memphremagog.

These variations in proportions are exhibited in the following table:

Table of comparative measurements of specimens of Labrador whitefish (C. labradoricus).

No.	Locality.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers.	
													Number.	In eye.
		Ins.	*Lbs.*											
63	Lake of the Woods....	21	$2\frac{1}{8}$	5	3	5+	5	$3\frac{3}{8}$	$2\frac{3}{8}$	12	11	10-68-9	10+15; 10+15	2+
65	.....do	20	.....	$5\frac{1}{8}$	$3\frac{1}{4}$	$5\frac{3}{8}$	5	$3\frac{3}{8}$	$2\frac{3}{8}$	12	11	10-80-9	9+16;	$1\frac{1}{2}$
67	Lake Champlain	15	$1\frac{1}{4}$	$4\frac{5}{8}$	$3\frac{1}{8}$	$4\frac{3}{8}$	$4\frac{3}{8}$	4	.....	11	11	10-72-9	9+17; 9+17	2+
68	.....do	20	$2\frac{1}{4}$	5+	$3\frac{3}{4}$	5	5	$3\frac{3}{8}$	.....	12	11	10-71-8	9+16; 9+16	2+
120	Lake Memphremagog.	18	.....	$4\frac{3}{8}$	4—	5+	$4\frac{1}{8}$	4+	$2\frac{3}{8}$	10	10	10-87-8	9+16; 9+16	2
279	Basswood Lake, Minn	$18\frac{1}{2}$	.....	$4\frac{3}{8}$	$3\frac{1}{2}$	5	5	4	$2\frac{3}{4}$	11	11	9-80-8	.....	....
382	Ely, Minn	$15\frac{1}{2}$	.....	$4\frac{1}{2}$	$3\frac{3}{8}$	$5\frac{1}{8}$	$4\frac{3}{4}$	4	$2\frac{3}{4}$	12	13	10-84-8	.....	....

Distribution and abundance.—This species was originally described from the Musquaw River, Labrador, in 1836. In 1851 it was redescribed as new by Prescott, under the name of *Coregonus neohantoniensis*, from Lake Winnipiseogee, New Hampshire. The specimen described in 1848 from the Saskatchewan River as *Coregonus angusticeps* by Cuvier & Valenciennes is probably identical with the Musquaw River species. It is now known from the Lake of the Woods eastward through the Great Lakes, the Adirondacks, the lakes of Vermont, New Hampshire, and Maine, and northeast through New Brunswick into Labrador. It doubtless inhabits most of the eastern Canadian lakes. We have examined specimens from the following places: Lake of the Woods; Lake Superior; Basswood Lake and Ely, Minn.; Hudson Bay; Ecorse, Mich.; Gross Water and Mississquoi bays, Lake Champlain; Cooperstown, N. Y.; Lake Memphremagog; Lake Winnipiseogee; Moosehead Lake and Grand Lake Stream, Me.; Fredericton and St. Johns River, New Brunswick; Labrador.

This species does not appear to be common in any of the Great Lakes; indeed, we have no authentic record of its ever having been taken in Lake Ontario or Lake Erie, while the few definite records for Lake Huron and Lake Michigan would indicate that it is a rare fish in those two lakes. Lake Superior seems to be the only one of the Great Lakes in which it is at all common. This is no doubt due to the fact that the waters of Lake Superior are colder than those of the other Great Lakes, thus approaching in that regard the character of the more northern lakes of Canada, where this whitefish appears to reach its greatest abundance and largest size.

As early as 1852, Mr. M. H. Perley gave the following very interesting account[1] of this species:

This fish, the celebrated *attihawmeg* of the great northern lakes, so frequently described by Arctic voyagers as the most delicious of all purely fresh-water fishes, is found in considerable numbers in Lake Temiscouata, where many are taken every autumn by the French Canadians, who come over from the St. Lawrence to fish for them, and call them *poisson pointu*. The English lumbermen call them "gizzard fish." They are taken occasionally along the Madawaska River, and the writer has caught them with rod and line below the falls of that river, at its confluence with the St. John, in the early part of summer. At these falls the inhabitants take about 40 barrels every autumn, which are cured in pickle for winter use. The whitefish abounds in all the Eagle lakes, at the head of Fish River, a tributary of the Upper St. John, and in the St. Francis lakes, at the stream's head. In these lakes it is caught abundantly every autumn, by torchlight, with dip nets. It has not been observed in any of the lakes or rivers which discharge into the Gulf of St. Lawrence, nor yet in any of the waters of Nova Scotia.

Some years since this fish was abundant in the Grand Lake, where the writer, in the month of May, saw great numbers taken out of gill nets set for gaspereau, and thrown away by the fishermen as worthless. At the same time the writer caught a number of them with rod and line in one of those small pieces of water connected with the Grand Lake, usually called "keyholes." It is occasionally taken in the Saint John throughout its whole extent. In the harbor of Saint John, in spring, it has been often caught in the seines and weirs with the gaspereau and salted with that fish because its value was not known.

It is probable that the similar fish found in the lower part of the Saint John have strayed from the great lakes at the sources of its upper tributaries and have been swept over the Grand Falls by some extraordinary flood. Once over those falls there is no possibility of return. The whitefish seen by the writer have seldom exceeded 1½ pounds in weight, but they are taken in Lake Temiscouata of the weight of 3 pounds and even more. It is an inhabitant of all the interior lakes of America, from Lake Erie to the Arctic Sea. Several Indian tribes mainly subsist upon it, and it forms the principal food at many of the fur posts for eight or nine months of the year, the supply of other articles of diet being scanty and casual. Its usual weight in the northern regions is from 2 to 3 pounds, but it has been taken in the clear, deep, and cold waters of Lake Huron of the weight of 13 pounds. The largest seen in the vicinity of Hudson Bay weighed between 4 and 5 pounds, and measured 20 inches in length and 4 in depth. One of 7 pounds' weight, caught in Lake Huron, was 27 inches long. Very recently the writer had an opportunity of seeing some fresh specimens of the whitefish of Lake Erie,[2] and was satisfied of their identity with the "gizzard-fish" of the Saint John and Lake Temiscouata.

During the summer the whitefish is not seen in Lake Temiscouata, and it is then supposed to retire to the depths of that unusually deep and cold lake. In October it draws near the shores, and ascends the Tuladi River for the purpose of spawning. It ascends the river during the night, and, having deposited its spawn, returns as quickly as possible to the lake. It is when this fish draws near the shore, prior to spawning, that the fishery is carried on, chiefly at a little bay in Lake Temiscouata,

---

[1] Descriptive Catalogue of the Fishes of New Brunswick and Nova Scotia, by M. H. Perley. Fredericton, 1852. This account of the *attihawmeg*, published in 1852 by Mr. Perley, was appropriated by Charles Lanman and republished verbatim as original matter in the United States Fish Commission Report for 1872–73. In this report Mr. Lanman prints three articles dealing with nine species of fishes, copying the entire amount of his articles from Perley without credit. James F. Knight, in 1866, in a descriptive catalogue of the fishes of Nova Scotia, made a similar use of much of the interesting portions of Mr. Perley's paper.

[2] The "whitefish" which Mr. Perley saw from Lake Erie were probably *C. clupeiformis*, rather than *C. labradoricus*, as he thought.

into which the Tuladi discharges its waters. At the same time the great gray trout (*Salmo ferox*)[1] follows the whitefish to the shore and preys upon it. While the nets are set for whitefish, the fishers, with torch and spear, attack and capture the *Salmo ferox*, frequently of large size; and hence this latter fish has acquired the name of *tuladi*, from the river to which it is attracted by its favorite prey.

The whitefish feeds largely on fresh-water shellfish; its stomach, in consequence, acquires an extraordinary thickness and resembles the gizzard of a fowl, hence its popular name of "gizzard-fish." The stomach, when cleaned and boiled, is a favorite morsel with the Canadian *voyageurs*.

9. **Argyrosomus osmeriformis** (H. M. Smith).

SMELT OF THE NEW YORK LAKES.

Coregonus osmeriformis Hugh M. Smith, Bull. U. S. Fish Comm., XIV, 1894, pl. 1, 2, Seneca Lake and Skaneateles Lake, New York. (Types, Nos. 32162 and 32165.)

Head, 4; depth, 5 to 6; eye, 4. D. 9; A. 13; scales, 9–83–10. Body elongate, slender, back not elevated. Head rather large, its width equal to half its length. Length of top of head $2\frac{1}{4}$ in distance from occiput to dorsal; greatest depth considerably less than length of head. Eye large, equal to snout. Gillrakers very long and slender, as long as eye, 20 + 35. Dorsal fin rather high, its height equal to four-fifths depth of body and $1\frac{1}{2}$ times length of base of fin; its origin nearer base of caudal than snout; its free margin nearly vertical, straight. Longest anal ray, four-fifths length of base of fin. Ventral long, equal to height of dorsal, its length equal to three-fourths of distance from ventral origin to vent; ventral origin midway between base of caudal and pupil. Adipose dorsal long and slender, of same width throughout, its width one-third its length. Mouth large, lower jaw projecting; snout straight; maxillary contained 3 times in length of head; its posterior edge extending to line drawn vertically through anterior margin of pupil; mandible one-half length of head, its angle under pupil. Teeth present on the tongue. Color above, grayish silvery; sides, bright silvery; below, white; tips of dorsal and caudal, dark. Length, 10 inches.

This fish has been recorded from Seneca and Skaneateles lakes, New York, where it is known as smelt. It doubtless inhabits most of the deep-water lakes of the northern part of the State. Nothing is known of its habits, and its small size renders it of little value as food.

10. **Argyrosomus artedi** (Le Sueur).

HERRING; LAKE HERRING; CISCO; MICHIGAN HERRING; BLUEBACK HERRING; GRAYBACK HERRING; GREENBACK HERRING; SHORE HERRING.

Coregonus artedi Le Sueur, Journ. Ac. Nat. Sci. Phila., I, 1818, 231, Lake Erie; Niagara River.

Salmo (*Coregonus*) *harengus*, Richardson, Fauna Bor.-Amer., III, 210, 1836, Lake Huron.

Description.—Head, 4 to 5; depth, 4 to $4\frac{2}{3}$; eye, 4 to 5; snout, 4 to 5. Dorsal 9 to 11, usually 10; anal 10 to 13, usually 11 or 12. Maxillary, 3 to $3\frac{3}{8}$ in head; mandible, 2 to $2\frac{1}{2}$, usually over 2. Scales, 8 to 10–62 to

[1] The fish referred to is the lake trout, *Cristivomer namaycush*.

87–7 or 8, the most frequent number being 9–81–8. Vertebræ, 57. Gillrakers varying from 45 to 58 (15 to 19+30 to 38), long and slender, about $1\frac{1}{5}$ in eye.

Body long, slender, and somewhat compressed; dorsal and ventral outlines but little arched; head pointed; mouth large, jaws subequal or lower jaw somewhat projecting; maxillary long, usually reaching to vertical of pupil, its width $2\frac{1}{2}$ times in its length; supplemental maxillary bone broad, about half length of maxillary; mandible long, but not often reaching vertical of posterior border of orbit; middle of upper jaw on level with lower edge of orbit. Caudal peduncle slender, not much compressed, its least depth equal to distance from tip of snout to middle of eye. Distance from tip of snout to occiput $2\frac{1}{2}$ times in distance from occiput to origin of dorsal fin, which is somewhat nearer snout than base of caudal fin. Dorsal fin small, length of base about $2\frac{1}{5}$ in head, longest ray $1\frac{3}{5}$ in head; base of anal fin about equal to that of dorsal, its longest ray about $2\frac{1}{2}$ in head; pectoral $1\frac{2}{5}$ in head. Color in life: Back dull bluish-green, this color extending down the sides nearly to the lateral line; lower part of sides silvery, under parts white or silvery; dorsal fin usually blackish or bluish-black on distal third, sometimes plain, membrane often punctate with dark; caudal bluish-black at tip; anal and ventrals pure white; pectorals white, edged with dark above. Sometimes the anal has a few black specks at base and on anterior part. The snout is also often more or less dark.

It will be noticed from the numerous comparative measurements and actual counts of fin rays, scales, and gillrakers, as exhibited in the accompanying table, that the amount of variation among individuals of this species is astonishingly great. The greatest range of variation is found in the scales. While the number in the transverse series is pretty constant, the variation being only through 4 (i. e., from 15 to 18), there is no such constancy in the number in the longitudinal series. Omitting from consideration in this connection all specimens in which mutilation of any kind renders the accurate counting of the scales uncertain, we find an extreme variation of 31 in the number of scales in the lateral line. The minimum number found by us is 62 in specimen No. 56, from Lake Ontario. The maximum number is 92 in specimen No. 142, from Lake Erie. These are the extreme variations in the scales, and are exceptional. The number does not usually run lower than 74 nor higher than 83.

The variation in the gillrakers is very great. The least number found was 43 and the greatest 58. The average for 101 examples counted, excluding mutilated ones, was 47. The length of the longest gillraker varies somewhat, from 1 to $1\frac{1}{2}$ times in the diameter of the eye, the average for over 100 examples being about $1\frac{1}{4}$. The gillrakers are, however, always long and slender, and average more in number than in any other species of *Argyrosomus* except *nigripinnis* and *tullibee*.

Table of comparative measurements of specimens of lake herring (Argyrosomus artedi).

Number.	Lakes where taken.	Sex and condition.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers. Number.	Gillrakers. In eye.
			In.	*Oz.*											
10	Ontario	.....	14 1/8	12	4 3/4	3 3/4	4 3/8	4 3/4	3 1/2	2 1/8	10	12	9-75-7	*14+20; 17+30	1 1/8
54	.....do	.....	.....	....	5 1/8	....	4 1/8	4 3/8	3 3/8	2 3/8	10	11	8-71-8	Dressed fish.	....
55	.....do	.....	.....	....	4 3/8	....	4 1/8	4 1/8	3 1/8	2	11	12	9-78-8	.....do	....
56	.....do	.....	.....	....	3 7/8	4 1/8	4 1/4	4 3/8	3+	2—	....	11	9-62-7	16+31; 15+30*	1
69	Michigan	♀ ripe	12 3/4	10—	5 1/8	4 1/8	4	4	3 1/8	2 1/8	10	10	10-83-8	17+30; 16+30	....
70	.....do	...do	13 3/8	12—	4 5/8	4 3/8	4 1/8	4 1/8	3 1/8	2 1/8	10	11	9-82-8	.....	....
80	.....do	...do	13 1/8	11+	4 3/4	4 1/4	4 1/8	4 1/8	3 3/8	2 3/8	10	11	9-82-8	19+30; 18+38	1 1/8
83	.....do	...do	13 3/4	12—	5	4 1/4	4 3/8	5	3 1/8	2 1/8	11	12	9-81-8	16+32; 16+32	1 1/8
85	.....do	♀	14 1/4	13+	5	4 1/8	4 3/8	4 1/8	3 3/8	2+	10	11	9-87-8	17+34; 17+34	1 1/4
90	Huron	♀	11 1/8	....	5	4 1/8	4 1/8	4 3/8	3 3/8	2 1/8	10	12	8-82-8	15+33; 16+33	1 1/8
91	.....do	♀	12 1/8	....	4 1/2	4 3/8	4 1/8	5	3 3/8	2 1/8	10	12	9-83-8	*14+32; 18+33	1 1/8
92	.....do	♀	12	....	4 1/2	4 1/8	4 3/8	5	3 3/8	2 1/8	9	12	8-79-8	17+33; 17+32	1 1/8
93	.....do	♂	12	....	5	4 1/8	4 1/8	4 3/8	3 1/8	2 1/8	10	11	9-76-8	17+30; 16+29	1 3/8
94	.....do	♂	.....	....	4 3/8	....	4 1/8	4 3/8	3 3/8	2 1/8	....	....	.....	17+34; 17+32	1 3/8
125	Erie	♀ spent	13 3/4	12—	5	4 1/8	4 1/8	4 1/8	3 1/4	2 1/4	11	10	9-81-8	16+30; 15+30	....
126	.....do	♂ spent	13 3/8	13	4 1/2	4	4 1/8	4 3/8	3	2 3/8	11	13	9-72-7	17+30; 12+30*	....
127	.....do	♀ spent	13 1/4	11+	4 1/2	4 3/8	4 3/8	4 1/8	3 1/8	2 1/4	10	10	.....	16+31; 13+31*	1 1/8
128	.....do	♂ partly spent	14 1/2	14	5	4 3/8	5	5	3	2 1/8	11	10	9-81-8	16+29; 16+30	1 1/8
129	.....do	♀ spent	14 1/2	13—	5	4	4 3/8	4 1/8	3	2	10	11	9-74-7	17+33; 16+31	1 1/8
133	Huron	.....	.....	....	4 1/8	4	5	5	3 3/8	2+	11	11	9-70-8	*16+30; 15+30	1
134	Erie	.....	.....	....	4 1/8	3 3/8	5	5	3 3/8	2 1/8	11	11	8-76-7	16+32; 16+32	1
140	.....do	.....	.....	....	4 1/8	...	4 3/8	5	3	2+	....	11	9-74-8	*11+30; 10+16*	....
141	.....do	.....	.....	....	4 1/8	4 1/8	4 1/8	5	3+	2+	10	12	9-67-8*	17+27; 17+30	1 1/4
142	.....do	.....	.....	....	4 1/4	4	4 3/8	5	3 3/8	2 1/8	11	13	9-92-8	16+31; 16+31	1
144	.....do	.....	.....	....	.....	....	.....	....	.....	.....	....	....	.....	16+27; 16+29	....
145	.....do	.....	.....	....	.....	....	.....	....	.....	.....	....	....	.....	16+26; 16+28	....
146	.....do	.....	.....	....	.....	....	4 1/8	....	3 1/8	2+	....	....	.....	16+27; 16+30	1 1/4
147	.....do	.....	.....	....	.....	....	4+	....	3 1/8	2+	....	....	.....	18+31; 18+31	1 1/8
148	.....do	.....	.....	....	.....	....	.....	....	.....	.....	....	....	.....	16+30; 16+30*	....
149	.....do	.....	.....	....	.....	....	.....	....	.....	.....	....	....	.....	16+30; 16+28*	....
150	.....do	.....	.....	....	.....	....	5	....	3 3/8	2+	....	....	.....	17+32; 17+31	1 1/8
151	.....do	.....	.....	....	.....	....	4 1/8	....	3 3/8	2 1/4	....	....	.....	15+31; 17+31	1 1/8
152	.....do	.....	.....	....	.....	....	4 1/4	....	3 1/8	2 1/4	....	....	.....	18+32; 16+32	1
153	.....do	.....	.....	....	.....	....	4+	....	3 1/8	2+	....	....	.....	17+30; 17+30	1 1/8
154	.....do	.....	.....	....	.....	....	4 1/8	....	3 1/8	2+	....	....	.....	17+30; 16+31	1 1/8
155	.....do	.....	.....	....	.....	....	4 1/8	....	3 1/8	2 1/8	....	....	.....	17+31; 17+31	1 1/8
156	.....do	.....	.....	....	.....	....	4	....	3 1/8	2 1/4	....	....	.....	18+30; 18+29*	1 1/4
157	.....do	.....	.....	....	.....	....	4	....	3 1/8	2+	....	....	.....	16+30; 16+28*	....
160	.....do	.....	.....	....	.....	....	.....	....	.....	.....	....	....	.....	15+31; 16+30	....
161	.....do	.....	.....	....	.....	....	.....	....	.....	.....	....	....	.....	16+30; 17+30	....
164	.....do	.....	.....	....	.....	....	.....	....	.....	.....	....	....	.....	14+28; 14+29	....
166	.....do	.....	.....	....	.....	....	.....	....	.....	.....	....	....	.....	*15+30; 15+31	....
167	.....do	.....	.....	....	.....	....	.....	....	.....	.....	....	....	.....	16+28; 16+28	....
168	.....do	.....	.....	....	.....	....	.....	....	.....	.....	....	....	.....	17+32; 17+32	....
169	.....do	.....	.....	....	.....	....	5	....	4	2 1/4	....	....	.....	17+31; 17+31	1 1/4
170	.....do	.....	.....	....	.....	....	.....	....	.....	.....	....	....	.....	*14+26; 14+24*	....
171	.....do	.....	.....	....	.....	....	.....	....	.....	.....	....	....	.....	18+30; 17+30	....
172	.....do	.....	.....	....	.....	....	.....	....	.....	.....	....	....	.....	16+28; 16+26*	....
173	.....do	.....	.....	....	.....	....	4 1/8	....	3 1/8	2+	....	....	.....	16+30; 15+31	1 1/8
174	.....do	.....	.....	....	.....	....	.....	....	.....	.....	....	....	.....	*16+30; 13+32*	....
175	.....do	.....	.....	....	.....	....	4	....	3 1/8	2 1/4	....	....	.....	16+32; 16+28	1 1/8
176	.....do	.....	.....	....	.....	....	4 1/4	....	3 3/8	2 1/8	....	....	.....	17+31; 18+32	1 1/8
177	.....do	.....	.....	....	.....	....	.....	....	.....	.....	....	....	.....	16+30; 16+28*	....
178	.....do	.....	.....	....	.....	....	.....	....	.....	.....	....	....	.....	16+28; 17+28	....
179	.....do	.....	.....	....	.....	....	4+	....	3 3/8	2 1/4	....	....	.....	16+30; 17+31	1 1/8
180	.....do	.....	.....	....	.....	....	4 3/8	....	3 3/8	2 1/4	....	....	.....	17+31; 16+31	1 1/4
181	.....do	.....	.....	....	.....	....	4 1/8	....	3 1/8	2 1/8	....	....	.....	17+32; 17+32	1 1/8
182	.....do	.....	.....	....	.....	....	4 1/4	....	3 1/4	2 1/8	....	....	.....	17+29; 16+30	1 1/8
183	.....do	.....	.....	....	.....	....	5	....	3 1/4	2 1/8	....	....	.....	17+31; 16+31	....
184	.....do	.....	.....	....	4 1/8	4+	4 1/8	5	3 3/8	2+	10	12	8-72-7	17+31; 17+31	1+
185	.....do	.....	.....	....	4 3/8	5 1/8	4 3/4	4 3/4	3	2+	10	10	8-80-7	15+28; 15+29	1
280	Superior	.....	15	....	4 3/8	4 3/8	5 1/4	4 1/8	3 3/8	2 1/8	9	11	9-85-8	*13+27; 16+28	1
298	.....do	.....	.....	....	4 1/8	5	4	5	3	2	10	12	.....	.....	....
299	.....do	.....	.....	....	4 3/8	...	4	4 3/8	3	2	10	13	.....	.....	....
303	.....do	.....	7 1/8	....	4 1/8	4 1/8	3 3/8	4+	2 1/4	2	10	11	8-76-7	17+29; 16+32	1 1/8
314	Ontario	♂	10 1/8	....	4 3/4	4	4 1/4	4 3/8	3 1/8	2 1/4	11	11	8-75-7	16+31; 16+31	1 1/8
315	.....do	♂	12 3/8	....	4 3/8	3 3/8	4 3/4	4 1/8	3 3/8	2 1/8	11	11	8-80-7	16+30; 16+30	1 3/8
316	.....do	♀	12 3/8	....	4 3/8	4 3/8	4 1/8	4 1/8	3 1/4	2 1/8	12	12	8-79-7	18+32; 18+33	1
317	.....do	♂	10 1/8	....	4 1/8	4 1/8	4 1/4	4 1/4	3 1/8	2 1/8	11	12	8-76-7	17+33; 17+30	1 1/4
318	.....do	♂	11 1/8	....	4 3/8	3 3/8	4 3/8	4 1/8	3 3/8	2 1/8	11	12	8-70-7	17+32; 17+31	1 1/4

* Gill mutilated; number uncertain.

Abundance, distribution, etc.—In all the Great Lakes the lake herring, or cisco, is more abundant than any other whitefish. It is taken in enormous quantities each year, and in most of the lakes is the object of a special fishery. Considering the entire basin, the quantity of lake herring taken is greater than that of all other whitefishes combined, but in value of catch and in food value it does not equal the common whitefish.

We have critically examined specimens from lakes Ontario, Erie, Huron, Superior, and Michigan. We have also examined all the specimens of this species now in the National Museum, which represent the following localities: Lake Champlain (Professor Baird); Missisquoi Bay, Lake Champlain (R. W. Marfel); Lake Champlain, Vergennes, Vt. (M. E. Hall); Labrador (L. M. Turner); Nelson River, Hudson Bay (Dr. Robert Bell); Hudson Bay (Walter Haydon); Lake Ontario (W. H. Thompson); lakes Erie, Huron, and Michigan; Moose Factory, British America (C. Drexler). The specimens from Labrador and Hudson Bay region may represent a slight variety worthy of recognition.

Mr. John W. Titcomb says this species is quite common in several of the small lakes of Vermont, particularly Bomoseen Lake in Rutland County. In October and November, they appear in large schools close to the rocky shores of the lake for the purpose of spawning.

This species is abundant in Lake Ontario; its most important spawning-grounds are in the east end of the lake, in Chaumont Bay, Three-mile Bay, and about Grenadier, Stony, and Fox islands. Farther west spawning-grounds are found along the shores and bays, more especially in Great Sodus Bay. On the Canadian side important grounds seem to be in the Bay of Quinte. The spawning-beds are usually in shallow water on hard bottom, though mud bottom is frequently used. In the American portions of Lake Ontario the spawning takes place almost entirely in the month of November. The ciscoes of Lake Ontario run from less than a pound to 1½ pounds, though it is said they are sometimes taken weighing 2½ or even 4 pounds.

In Lake Erie this species exists in greater abundance than elsewhere. Its spawning seasons and habits are not known to differ materially from those of the Lake Ontario fish.

Common names.—This species is known by many names. The most widely used are lake herring and cisco, either of which is, in most places, distinctive. In Lake Ontario it is commonly called the cisco. The etymology of the word is in dispute. One assigned derivation is from a fish-peddler named Cisco, who, about 1830, took the fish through the northern part of the State and sold it to farmers as "Cisco's herring." "Sisco" is only a recent variation in the orthography. Other names used by the fishermen of this lake are herring, blueback or greenback, blueback herring or greenback herring, and grayback or grayback herring. The name most widely used, however, is cisco. These different names are the fishermen's way of distinguishing individual variations

in color, sex, age, or time of run. Usually the fishermen claim that the graybacks run in the spring and that the spring or early summer is their spawning time. The greenbacks and bluebacks run in the late fall and they are a better fish than the graybacks. It is not unlikely that all the fish found spawning in early summer are bloaters (*A. prognathus*). In lakes Erie, St. Clair, Huron, and Superior the fish is generally known as herring and lake herring, which are the names in use in Canada. In Lake Michigan the names herring, Michigan herring, blueback herring, and shore herring are in use. The name herring is in places shared by another species (*A. hoyi*). A trade name for large herring in Lake Erie is ciscoette or siscowet.

10a. Argyrosomus artedi sisco Jordan.

SISCO OF LAKE TIPPECANOE.

Argyrosomus sisco Jordan, Amer. Nat., IX, 1875, 136, Lake Tippecanoe, Warsaw, Ind.

Head, $3\frac{3}{4}$ to $4\frac{3}{5}$; depth, 4 to 5; eye, 4 to 5; snout, about 5; maxillary, $3\frac{3}{5}$; mandible, $2\frac{1}{3}$. Scales, 9–74 to 89–8. Gillrakers, 15+28 to 31 (43 to 46), long and slender, 1 to $1\frac{1}{6}$ in eye. This species is not essentially different in form from that of the lake herring, but is smaller and much superior as food. It reaches a length of about 14 inches. It is known only from Geneva, La Belle, and Oconomowoc lakes in Wisconsin, and Tippecanoe, Crooked, Shriner, and Cedar lakes in northeastern Indiana. It lives in deep water except in December, when it comes into shallow water and ascends brooks to spawn. According to Professor Kirsch it spawns from about the 25th of November to the 25th of December in Shriner Lake and the other Indiana lakes.

The following table gives detailed measurements of four specimens from Crooked Lake, Whitley County, Indiana, which were obtained by Prof. P. H. Kirsch, the Indiana State fish commissioner.

Table of comparative measurements of specimens of sisco of Lake Tippecanoe (Argyrosomus artedi sisco).

No.	Locality.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers.	
											Number.	In eye.
136	Crooked Lake, Indiana	$4\frac{1}{8}$	$4\frac{1}{8}$	$4\frac{1}{4}$	6	$3\frac{1}{8}$	$2\frac{1}{4}$	10	11	9–85–8	15+31; 15+30	1+
137	do	$4\frac{3}{8}$	5	4	5	$3\frac{3}{8}$	$2\frac{1}{4}$	10	11	9–89–8	15+29; 14+28	$1\frac{1}{8}$
138	do	$4\frac{2}{3}$	4+	5+	$4\frac{1}{2}$	$3\frac{3}{8}$	$2\frac{1}{4}$	10	11	9–74–8	15+29; 15+30	$1\frac{1}{6}$
139	do	$3\frac{3}{4}$	4—	5—	5+	$3\frac{2}{5}$	$2\frac{1}{5}$	10	11	9–77–8	15+29; 15+30	1

11. Argyrosomus hoyi Gill.

MOON-EYE; MOON-EYE CISCO; CISCO; KIEYE; CHUB.

Argyrosomus hoyi (Gill MS.) Jordan, American Naturalist, IX, March, 1875, 135, Lake Michigan, near Racine, Wis.

Description.—Head, $4\frac{1}{2}$; depth, $4\frac{1}{2}$; eye, $4\frac{1}{6}$ to $4\frac{2}{3}$; snout, $3\frac{2}{5}$ to $3\frac{5}{6}$; maxillary, $2\frac{3}{5}$ to 3 in head, reaching to vertical of middle of pupil. D. 10; A. 11 or 12; scales, 8 or 9–73 to 80–7. Gillrakers, 14+25 or 26, slender, about 2 in eye. Vertebræ, 56; branchiostegals, 8 or 9. Body rather elongate, compressed, the back somewhat elevated. Mouth rather large, subterminal, the lower jaw shorter than upper, even when the mouth is open; tip of muzzle rather bluntly truncate, somewhat as in a true *Coregonus*; mandible nearly reaching posterior edge of eye, $2\frac{1}{6}$ in head. Head rather long, slender, and pointed. Supraorbital and preorbital long and narrow. Distance from tip of snout to occiput, $2\frac{1}{5}$ to $2\frac{2}{5}$ in distance from occiput to origin of dorsal fin; fins low; free margin of dorsal very oblique, the length of the anterior rays $1\frac{3}{5}$ in head, that of the last ray less than half length of the first; longest anal ray, $2\frac{3}{5}$ in head and more than twice as long as the last ray. Pseudobranchiæ very large; tongue with traces of teeth.

Color light iridescent blue on back, scales with a few fine dark punctulations reaching about two scales below lateral line; sides and under parts rich silvery, brighter than in any other of our *Coregoninæ*, much as in *Hiodon* and *Albula;* top of head light olivaceous; cheeks silvery; dorsal, caudal, and pectorals with some dark on their margins; anal and ventrals white, with some dark dustings; the male, perhaps, a little richer, more iridescent blue on back, and with the scales a little thicker and less closely imbricated. Length, 13 inches. Deep waters of Lake Michigan; the smallest and handsomest of our *Coregoninæ*.

The only specimens known until recently were the two sent to Dr. Gill and the one to Dr. Jordan by Dr. Hoy; but during recent investigations by the Fish Commission this species was found to be one of the principal fishes caught in the gill nets in the western part of Lake Michigan. It is a true *Argyrosomus*, though approaching *Coregonus*.

Table of comparative measurements of Hoy's whitefish (Argyrosomus hoyi).

No.	Lake where taken.	When taken.	Sex and condition.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers.	
															Number.	In eye.
				In.	*Oz.*											
57	Michigan	Nov. 6	♀ ripe	$13\frac{1}{2}$	10+	$4\frac{1}{6}$	$4\frac{1}{6}$	$4\frac{1}{6}$	$3\frac{2}{3}$	3	$2\frac{1}{5}$	10	12	8-80-7	14+26; 14+26	2
58	do	Nov. 6	♂ ripe	12	8+	$4\frac{1}{6}$	$4\frac{1}{6}$	$4\frac{1}{6}$	$3\frac{2}{3}$	$2\frac{2}{3}$	$2\frac{1}{6}$	10	11	*8-73-7	14+25; 14+25	$1\frac{1}{2}$
59	do	Nov. 6	♀ ripe	13	9+	$4\frac{5}{6}$	$4\frac{1}{6}$	$4\frac{1}{6}$	$3\frac{2}{3}$	$2\frac{2}{3}$	$2\frac{1}{6}$	10	11	8-78-7	14+25; 14+25	$1\frac{1}{2}$
60	do	Nov. 6	♀ ripe	12	9—	$4\frac{1}{3}$	$4\frac{1}{6}$	$4\frac{1}{6}$	$3\frac{2}{3}$	$2\frac{2}{3}$	$2\frac{1}{6}$	10	12	8-78-7	14+25; 14+25	$1\frac{1}{2}$
61	do	Nov. 6	♂ not ripe	12	8—	$4\frac{1}{6}$	$4\frac{1}{6}$	$4\frac{1}{6}$	$3\frac{2}{3}$	$2\frac{2}{3}$	$2\frac{1}{6}$	9	11	9-76-7	14+26; 14+24	$1\frac{1}{2}$
62	do	Nov. 6	♀ partly spent.	12	8—	$4\frac{1}{6}$	$4\frac{1}{6}$	$4\frac{1}{6}$	$3\frac{5}{6}$	$2\frac{7}{8}$	$2\frac{1}{6}$	10	12	9-73-7	12+25; 12+25	$1\frac{1}{2}$
71	do	Nov. 12	♂ ripe	$12\frac{3}{4}$	8	$4\frac{2}{3}$	$4\frac{2}{3}$	$4\frac{1}{4}$	$3\frac{3}{4}$	$2\frac{5}{6}$	$2\frac{1}{6}$	9	11	9-83-8	14+28; 14+27	$1\frac{1}{2}$
72	do	Nov. 12	♂ ripe	$12\frac{7}{8}$	8+	$4\frac{1}{6}$	$4\frac{1}{6}$	4	$3\frac{1}{6}$	$2\frac{7}{8}$	2	9	9	9-81-8	13+26; 13+26	$1\frac{1}{2}$
75	do	Nov. 12	♂ ripe	$12\frac{1}{4}$	7+	$4\frac{7}{8}$	$4\frac{1}{2}$	4	4	$2\frac{3}{4}$	$2\frac{1}{8}$	9	11	9-83-8	13+26; 13+24	$1\frac{1}{2}$
107	do	Nov. 19	♀ spent	$13\frac{1}{4}$	13—	$4\frac{1}{4}$	...	$4\frac{3}{8}$	4	3	2	10	12	.....	.....	....

* Thicker and less closely imbricated than in No. 57.

Among the collections recently made there are 8 specimens of *Argyrosomus* (5 from Lake Michigan and 3 from Lake Superior) which we refer to *A. hoyi* for the present, though they differ from typical *hoyi* in some respects. The most important of these is the number of gillrakers. In the numerous specimens of *hoyi* examined the average number of gillrakers was found to be 39, while the average for the 8 specimens here considered is but 31½. If we consider only these averages the difference is great, but the range of variation in each is so great as to render this contrast less striking. An examination of the table under *hoyi* shows the range to be from 37 to 42, and the following table shows the range in these 8 specimens to be from 29 to 34. The difference of 3, however, between the minimum for *hoyi* and the maximum for these peculiar specimens is important, and would, under ordinary circumstances, lead us to regard these 8 specimens as belonging to another and apparently undescribed species.

These specimens also resemble *A. prognathus* in general appearance, and a comparison with that species is equally interesting. The chief differences from *A. prognathus*, which can be represented numerically, are the fewer gillrakers, the longer mandible, and shorter maxillary. The average number of gillrakers in *A. prognathus* is, as shown by our material, about 39. These averages are sufficiently wide apart to justify separating the two forms specifically; and we would not hesitate to do so were it not for the fact that the recognized extremes of variation in this particular in *A. prognathus* are very great, the minimum number recognized by us in that species being as low as 32 (in specimens Nos. 23 and 25). But the other characters shown by these two specimens are not appreciably different from typical *prognathus*. They have the projecting lower jaw, the long mandible and maxillary, and the general form of muzzle of that species.

In the 8 specimens under consideration, not only are the gillrakers very few, but the mandible and maxillary are rather shorter, and the general form of the snout is different. The lower jaw projects but slightly or not at all, and the maxillary is narrower. Nos. 108 to 112 were obtained in deep water off Sheboygan, Wis., with Hoy's whitefish, from which they were not distinguished by the fishermen, all being known to them as "kieye" or "chub." While these fish were confounded with *A. hoyi* by the fishermen, they appear more different from that species than they do from *A. prognathus*, the gillrakers in *A. hoyi* being even more numerous than in *prognathus*. Externally they very closely resemble *hoyi*, while in number of gillrakers they seem more closely related to the longjaw. If further investigation should show these differences to be as great and valuable as they now appear, these specimens should be regarded as a distinct species. For the present, however, we suspend judgment and await additional evidence.

The following table shows the comparative measurements of these 8 specimens:

No.	Lake where taken.	When taken.	Sex and condition.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers. Number.	Gillrakers. In eye.
				In.	*Oz.*											
108	Michigan...	Nov. 18	♀ partly spent.	13 5/8	14	4 3/8	4	4 3/4	4 1/8	3+	2—	10	13	9-81-8	11+21;	11+19	1 1/3
109	.....do	Nov. 18	♂	13 3/4	14+	4	3 3/4	5	4 1/8	3 1/4	2	...	...	9-87-8	11+18;	10+19	1 1/8
110	.....do	Nov. 18	♀	13 1/4	13—	4 1/8	4 1/8	4 5/8	4 1/8	3	2+	10	11	9-77-8	12+21;	11+21	1 1/8
111	.....do	Nov. 18	♀ spent.	13	11+	4 1/8	4 1/8	5	4 1/8	3	2+	10	11	9-86-8	10+20;	10+20	1 1/8
112	.....do	Nov. 18	♂ spent.	12 1/4	9+	4 3/8	4 3/8	4 3/8	4 1/8	3 1/4	2 1/8	9	12	8-85-7	10+19;	10+19	1 1/8
282	Superior....	July 28	.....	10 1/8	....	4 1/8	4	4 1/4	4 1/8	3	2 1/4	10	11	8-74-7	13+21;	12+21	1 3/8
283	.....do	July 28	.....	11	....	4 1/8	4 1/8	4 3/4	4 1/8	3	2 1/4	11	10	8-75-7	11+22;	12+21	1 3/8
284	.....do	July 29	.....	11	....	4 1/8	4 1/8	4 1/8	4 1/8	3	2 1/8	10	11	8-74-7	11+22;	13+21	1 1/8

Spawning habits and food value.—Very little is known about the spawning habits of Hoy's whitefish. All the Lake Michigan specimens examined by us were taken between the 5th and 20th of November, and they were all ripe or nearly so, or partially spent. The spawning time is therefore evidently late in the fall, and probably in deeper water than is resorted to by the herring and other species. The probability that the long-jaw spawns much earlier is an interesting and important fact, and is additional evidence of the distinctness of these species.

In the original references to this fish in the writings of Milner and Hoy, it is stated that it has no food value, on account of its small size, but that it constitutes a prominent part of the food of the salmon trout. From the time of its discovery, in 1871, to a comparatively recent date, this fish attracted no attention and was not known to possess economic value. The extension of the operations of the gill-net fishermen of Lake Michigan into the deepest parts of the lake brought the fish into notice, and for fully six years or longer it has had a gradually increasing importance. The relative scarcity of the common whitefish in the fisheries of the western side of the lake has resulted in the utilization of Hoy's whitefish, notwithstanding its small size.

12. **Argyrosomus pusillus** (Bean).

SMALL WHITEFISH; LEAST WHITEFISH.

Coregonus pusillus Bean, Proc. U. S. Nat. Mus. 1888, 526, Kuwuk River, Alaska. (Type, No. 38366.)

Head, 5; depth, 5; eye, 4 3/4; D. 10; A. 12; V. 11; scales, 10–91–9; mandible, 2 1/3; maxillary, 3 1/8; gillrakers very long and slender, numerous, 49 in all. Body rather elongate, compressed. Mouth as in *A. artedi*, the lower jaw projecting; maxillary broad, with rather broad supplemental bone, three times as long as wide, not quite reaching middle of the very large eye; preorbital extremely narrow. Teeth none, or reduced to slight asperities on the tongue. Dorsal much higher than long, its last rays rapidly shortened, the first ray twice length of base of fin; insertion

of dorsal midway between snout and middle of adipose fin. Caudal large, well forked; anal small; ventrals inserted under middle of dorsal, very long, five-sixths length of head and equal to pectorals. Steel blue above, with many dark points; belly white; dorsal and caudal blackish; pectorals and ventrals tipped with black.

This is one of the smallest of the American whitefishes, rarely reaching a foot in length or a half pound in weight. It has the reputation of being more bony than any other whitefish. It is little utilized for food in Alaska, but is used chiefly by native traveling parties and as food for dogs. It extends over a very large portion of Alaska and is very abundant. So far as our information goes, it is found in all parts of Alaska except the southeastern portion. The types were obtained in the Kuwuk River by the well-known collector, Charles H. Townsend.

13. Argyrosomus lucidus (Richardson).

GREAT BEAR LAKE HERRING.

Salmo (*Coregonus*) *lucidus* Richardson, Fauna Boreali-Americana, III, 207, 1836, Great Bear Lake.

Head small, 5 to $5\frac{1}{3}$; depth, $4\frac{1}{3}$ to $4\frac{3}{5}$; eye, 5. D. 11 or 12 developed rays; A. 11 or 12. Scales, 85 to 87, 11 or 12 in an oblique series downward and forward from front of dorsal to lateral line. Eye slightly less than length of snout, $1\frac{1}{2}$ times in interorbital width. Body slender, elongate, the curve of back and belly about equal, the greatest depth exceeding length of head. The snout narrow, almost vertically truncate when mouth is closed, the lower jaw fitting within the upper, but the mouth not inferior. Distance from snout to nape $2\frac{3}{5}$ to 3 in distance between nape and front of dorsal. The head is much smaller in one of our specimens than in the other. Mouth oblique, with rather slender maxillary, which extends to vertical midway between front and middle of pupil, its length from tip to articulation equaling distance from end of snout to front of pupil, and contained $3\frac{2}{3}$ to $3\frac{4}{5}$ in length of head. Supplemental maxillary bone probably broader than in *artedi*, from three-fifths to two-thirds greatest width of maxillary. Suborbital bone large, its width $2\frac{1}{2}$ to $2\frac{2}{3}$ in its length. Gillrakers very long and slender, the longest slightly more than two-thirds length of eye, 16 + 28 in number in each specimen. Front of dorsal slightly nearer tip of snout than base of upper rudimentary dorsal rays. The fins are mutilated, so that their length can not be given. Adipose fin large, inserted vertically above last anal rays, its height from tip to posterior end of base equaling vertical diameter of eye. Color, silvery.

This description is based on 2 specimens recently obtained in Great Bear Lake by Miss Elizabeth Taylor and donated by her to the museum of Leland Stanford Junior University. These specimens are each 16 inches long and are the only ones received by any museum since Richardson's time. These are described in detail by Dr. Gilbert in the Bulletin of the U. S. Fish Commission for 1894.

14. Argyrosomus laurettæ (Bean).

LAURETTA WHITEFISH.

Coregonus laurettæ Bean, Proc. U. S. Nat. Mus. 1881, 156, Point Barrow. (Types Nos. 27695 and 27915.)

Head, 5; depth, 4; eye, 4½ to 5. D. 12; A. 11; V. 12; scales, 10–84 to 95–10, 84 to 87 in specimens examined by us. Body robust, the back elevated; head small and slender, the small eye not longer than snout. Distance from nape to front of snout 2½ times distance of nape from dorsal. Maxillary about reaching middle of eye, 3½ in head, its supplemental bone half its length. Lower jaw very slightly longer than upper; mandible, 2⅓ in head; lingual teeth present. Gillrakers long and numerous, 10+25; ventral scale not half length of fin; pectorals short, not reaching half way to ventrals. Scales smaller than in *A. artedi*, 16 cross series under base of dorsal. Alaska, from Yukon River northward to Point Barrow; generally common. Apparently very close to *A. lucidus*, but differing in longer base of dorsal.

15. Argyrosomus prognathus (H. M. Smith).

BLOAT; BLOATER; BLOATER WHITEFISH; LONGJAW; SILVER WHITEFISH.

Coregonus prognathus Hugh M. Smith, Bull. U. S. Fish Comm., XIV, 1894, 4, pl. 1, fig. 3, Lake Ontario, at Wilson, New York. (Type, No. 45568.)

Description: Head, 4⅓; depth, 3½ to 4; eye, 5. D. 9 or 10; A. 10 to 12. Eye rather small; 1⅓ in snout, 1½ in interorbital space. Scales, 9–75–8. Body oblong, much compressed; back elevated, tapering rather sharply toward the narrow caudal peduncle, the adult fish having a slight nuchal hump, as in *C. clupeiformis*. Mouth large and strong; snout straight, its tip on level with lower edge of pupil. Top of head 2⅕ in distance from occiput to front of dorsal. Maxillary reaching to opposite pupil, 2½ in head; length, 3½ times its greatest width; mandible projecting beyond upper jaw when mouth is closed, very long, reaching to or beyond posterior edge of eye, 1¾ to 1⅞ in head. Head of medium size, rather short and deep, pointed; cranial ridges prominent.

Dorsal rather high, the longest ray one-third longer than base of fin and contained 1⅔ times in greatest body depth and 1½ times in head; free margin slightly concave; origin nearer end of snout than base of caudal. Longest anal ray equal to base of fin or two-thirds height of dorsal. Vertebræ, 55. Gillrakers slender, about 15 + 28, about length of eye. Adipose fin the length of eye, its width half its length. Narrowest part of caudal peduncle contained nearly 4 times in greatest body depth. Ventral as long as dorsal is high, its origin midway between end of snout and fork of tail. Pectoral as long as ventral. Lateral line straight except at origin, where it presents a rather marked curve. Sides of body uniformly bright silvery, with pronounced bluish reflection in life; the back dusky, the under parts pure white without silvery color; above lateral line, the upper and lower edges of scales

finely punctulated, central part unmarked, producing light longitudinal stripes extending whole length of body; fins flesh color or pinkish in life, the dorsal and caudal usually showing dusky edges; postorbital area with a bright golden reflection. Iris golden, pupil black.

The extreme variations in some of the characters of this species are remarkable, their nature and importance being apparent only upon examination of a large series of specimens. We have counted the scales and gillrakers and made comparative measurements of a great many examples, and present in the appended table the figures obtained from such a study of nearly one hundred specimens. Figures obtained from specimens examined in the field and not preserved are not included in this table. A study of the table will show that the relative length of head and depth of body are fairly constant; the same is true of the eye and snout, and the number of fin rays; the maxillary and mandible are a little more variable, while the variations in the scales and the gillrakers are unexpectedly great. Using the averages obtained from the table and putting in parentheses the extremes of variation, this species would be described as follows:

Head, $4\frac{1}{6}$ ($3\frac{1}{2}$ to $4\frac{3}{4}$); depth, $4\frac{1}{5}$ ($3\frac{1}{2}$ to $5\frac{1}{4}$); eye, $4\frac{1}{3}$ ($3\frac{1}{2}$ to 6); snout, $4\frac{1}{3}$ ($3\frac{1}{2}$ to 5); maxillary, 3 ($2\frac{3}{5}$ to $3\frac{1}{5}$); mandible, 2 ($1\frac{4}{5}$ to $2\frac{1}{4}$); dorsal, 10 (9 to 12); anal, 11 (10 to 15); scales, 8 (7 to 9)–75 (65 to 86)–7 (6 to 9); gillrakers, 14 (10 to 17) + 25 (21 to 32).

Table of comparative measurements of specimens of longjaw whitefish (Argyrosomus prognathus).

No.	Lake where taken.	Sex and condition.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers. Number.	Gillrakers. In eye.
			Ins.	*Oz.*											
1	Ontario		$8\frac{1}{4}$	4	$4\frac{1}{8}$	$3\frac{3}{8}$	4	4	$2\frac{3}{4}$	$1\frac{5}{8}$	10	10	9-83-9	*14+28; 15+29	.....
2	do		8	3	4—	$3\frac{1}{8}$	$3\frac{7}{8}$	$3\frac{3}{4}$	$2\frac{23}{32}$	$1\frac{5}{8}$	11	12	9-71-8	*14+24; 15+29	.....
3	do		7	2	$3\frac{3}{4}$	4	$3\frac{3}{4}$	4	$2\frac{5}{8}$	2	10	12	9-79-8	*12+31; 15+31	.....
4	do	♀	11	8	$4\frac{1}{8}$	$3\frac{5}{8}$	$4\frac{1}{8}$	4	3	2	10	11	9-75-8	*13+30; 16+31	$1\frac{1}{8}$
5	do		12	8	4	$3\frac{5}{8}$	5	4	3	2	9	12	9-74-8	*11+24; 14+25	$1\frac{5}{8}$
6	do		13	9	4	4	$5\frac{1}{2}$	$3\frac{5}{8}$	3	$1\frac{7}{8}$	10	12	8-74-8	*12+26; 12+27*	1
7	do		$11\frac{1}{2}$	8	4	$3\frac{1}{2}$	5	$4\frac{1}{4}$	3	$2\frac{1}{8}$	10	10	8-66-7	*13+22; 10+21*	$1\frac{1}{4}$
8	do		14	16	$4\frac{1}{2}$	4	$5\frac{1}{4}$	4	3	2	10	11	8-65-8	*14+26; 14+27	1
9	do		$8\frac{1}{4}$	2	$3\frac{3}{4}$	$4\frac{1}{2}$	4	$4\frac{1}{8}$	3+	2	9	11	9-70-7	*15+26; 16+30	1
10	do		$14\frac{1}{2}$	12	$4\frac{3}{4}$	$3\frac{3}{4}$	$4\frac{3}{4}$	$4\frac{3}{4}$	$3\frac{1}{8}$	$2\frac{1}{8}$	10	12	9-75-7	*14+29; 17+30	$1\frac{1}{2}$
11	Huron		$9\frac{1}{4}$	3	4+	$4\frac{1}{8}$	4	4	3+	2	11	11	9-74-7	*10+18; 12+22	2
12	do		11	5	$4\frac{1}{8}$	4+	$4\frac{1}{8}$	$4\frac{1}{8}$	$3\frac{1}{8}$	$2\frac{1}{8}$	10	12	8-79-7	*14+23; 13+26	.....
13	do		$9\frac{1}{2}$	4	4	4	$4\frac{1}{8}$	$4\frac{1}{8}$	$3\frac{1}{8}$	2	9	12	8-75-8	*10+17; 10+17*	$1\frac{1}{8}$
14	do		7	2—	$4\frac{1}{4}$	4	$3\frac{1}{2}$	$4\frac{5}{8}$	3+	2+	10	11	8-66-8	14+26; 14+27	.....
15	do		7	2—	4	4	$3\frac{5}{8}$	4	3	2	9	12	8-70-7	15+27;	.....
16	do		$8\frac{1}{2}$	2	$4\frac{1}{16}$	$4\frac{1}{8}$	$4\frac{1}{8}$	$4\frac{1}{8}$	3	2	10	12	9-70-7	14+27; 14+27	.....
17	do		$8\frac{1}{2}$	$2\frac{1}{2}$	$4\frac{1}{16}$	$4\frac{1}{8}$	4	$4\frac{1}{8}$	3	2+	11	11	9-75-7	14+23; 13+23	.....
18	do		$8\frac{1}{2}$	2	$4\frac{1}{8}$	$4\frac{1}{8}$	4	$4\frac{1}{8}$	$3\frac{1}{8}$	2	10	11	8-75-7	*12+23; 13+21	$1\frac{3}{8}$
19	do		$8\frac{1}{2}$	....	$4\frac{1}{16}$	$4\frac{1}{4}$	$3\frac{3}{8}$	$4\frac{3}{8}$	$2\frac{3}{4}$	2	9	12	8-77-8	*13+23; 11+23	$1\frac{3}{8}$
20	do		$8\frac{3}{4}$	....	$4\frac{1}{8}$	$4\frac{1}{8}$	4	$4\frac{1}{8}$	$2\frac{5}{8}$	2	10	12	8-73-8	12+23; 13+23	$1\frac{3}{8}$
21	do		$7\frac{3}{4}$	....	$4\frac{1}{8}$	$4\frac{1}{16}$	$3\frac{5}{8}$	4	3	2	9	11	7-73-8	14+27; 14+27	$1\frac{3}{8}$
22	do		7	....	$4\frac{1}{16}$	$4\frac{1}{8}$	4	$4\frac{1}{8}$	3	2	9	12	9-78-8	12+22; 12+23	$1\frac{3}{8}$
23	do		$7\frac{1}{2}$	....	$4\frac{1}{4}$	$4\frac{1}{4}$	4	4	3	2—	10	12	8-79-7	11+21; 11+21	$1\frac{1}{8}$
24	do		8	....	$4\frac{1}{8}$	$4\frac{1}{16}$	$3\frac{3}{4}$	4+	3	2	9	11	9-73-8	11+22; 11+22	2
25	do		$8\frac{1}{2}$	....	$4\frac{1}{8}$	$4\frac{1}{16}$	$3\frac{5}{8}$	$4\frac{1}{16}$	3	2	9	11	8-73-8	12+22; 12+21	$1\frac{1}{8}$
26	do		$6\frac{1}{4}$	....	$4\frac{1}{8}$	$4\frac{1}{4}$	$3\frac{5}{8}$	4	$2\frac{5}{8}$	2	10	11	7-70-6	13+26; 13+19*	$1\frac{1}{8}$
27	do		$5\frac{1}{8}$	....	$4\frac{1}{8}$	$4\frac{1}{8}$	$3\frac{1}{8}$	$4\frac{1}{8}$	3	$1\frac{5}{8}$	10	11	8-71-7	14+26; 15+26	$1\frac{3}{8}$
28	do		$5\frac{1}{8}$	....	$4\frac{1}{4}$	$4\frac{1}{4}$	$3\frac{1}{8}$	$4\frac{1}{8}$	$2\frac{1}{4}$	$1\frac{5}{8}$	10	11	8-70-7	13+25; 12+27	$1\frac{1}{8}$
29	do		$7\frac{1}{8}$	....	$4\frac{1}{4}$	$4\frac{1}{4}$	4	$4\frac{1}{4}$	$2\frac{5}{8}$	2—	10	12	8-70-7	13+27; 14+27	$1\frac{1}{8}$
30	do		$7\frac{1}{8}$	....	$4\frac{1}{8}$	$4\frac{1}{4}$	4—	$4\frac{1}{8}$	3	2	9	12	7-78-8	13+24; 13+24	$1\frac{1}{8}$
31	do		$9\frac{1}{4}$	....	$4\frac{1}{4}$	$4\frac{1}{4}$	4	$4\frac{1}{8}$	$3\frac{1}{8}$	$2\frac{1}{8}$	12	12	7-74-7	*9+30; 6+33*	$1\frac{3}{8}$
32	Michigan		8	....	$4\frac{1}{4}$	$4\frac{3}{8}$	4	$4\frac{1}{4}$	3	2	10	12	7-70-7	12+22; 13+23	2—

* Gill mutilated; number uncertain.

Table of comparative measurements of specimens of longjaw whitefish (Argyrosomus prognathus)—Continued.

No.	Lake where taken.	Sex and condition.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers.	
														Number.	In eye.
			Ins.	*Oz.*											
33	Michigan		7¼		4	4½	4	4½	3	2	10	12	7-72-7	15+20; 16+28	1⅜
34	do		8½		4	3⅝	3⅝	4⅛	3	2½	10	11	7-78-7	12+24; 12+24	1½
35	do		8½		4⅜	4⅜	4	4¼	2½	2—	10	12	7-73-7	*14+26; 14+27*	1½
36	do		8½		4½	4⅜	4	4¼	3	2½	10	12	8-70-7	13+22; 13+22	1½
37	do		8½		4½	4⅜	4—	4¼	3½	2⅜	9	12	8-72-7	12+23; 12+24	1⅜
38	do		8		4½	4¾	4—	4⅜	3	2	10	11	7-70-7	12+22; 12+22	1⅜
39	do		7		4¼	4½	3¾	4	3	2½	9	12	8-70-7	13+24; 13+24	1⅜
40	do		8		4⅛	4½	4	4	3	2+	9	12	7-73-7	12+24; 12+24	1⅜
41	do		7¾		4⅛	4⅛	4	4⅛	2⅝	2	10	11	7-74-7	14+27; 14+26	1⅜
42	do		8		4⅛	4½	3¾	4	3	2½	10	12	8-74-7	13+23; 12+23	1⅜
43	do		8¼		4¼	4½	4	4	3	2	10	12	7-70-7	10+23; 11+23	1½
44	do		8		4¼	4¼	4	4⅛	2⅝	2	9	11	7-71-7	15+29; 15+29	1½
45	do		10		4⅝	4½	4½	4½	3—	1⅝	11	11	8-76-7	11+23; 11+23	1½
46	do		9		4	4½	4⅜	4⅛	3	2—	10	12	8-76-7	12+24; 13+24	2
47	do		7½		4	4½	4	4½	3	2	11	12	8-70-7	13+28; 14+28	1⅜
48	do		7¾		4⅛	5	4—	4+	3	2½	10	11	8-77-7	12+22; 11+23	1½
49	Huron				4½	4½	4⅛	4⅛	3¼	2¼	10	11	9-80-8	13+26; 13+24	1+
50	do				4		5	4	2⅝	2¼	10	11	8-72-8	13+25; 12+24	1
51	Ontario				4¼	4+	5¼	4½	3	2	11	12	9-76-7	14+32; 14+29*	1
52	do				4⅛		5	4	2⅜	1⅞	11	12	8-75-7	15+25; 14+27	1
53	do				4¼		5⅛	4⅛	3	2	10	12	8-71-7	13+25; 13+24	1
79	Michigan	♀ ripe	12⅜	10—	4⅜	4+	5	4⅛	3	2	10	11	9-80-8	13+24; 12+22	1⅜
82	do	♀	15⅜	16+	4½	4½		4	3+	2	10	12	8-77-8	13+23; 13+25	1½
88	do	♂	12¾	11+	4½	4	4½	4	3	2	10	11	8-72-7	13+27; 13+27	1½
113	Superior		16		4⅛	4½	4⅝	4⅜	3+	2—	11	12	9-88-7	Eviscerated	
114	do		16		4	4⅜	5⅛	4	3+	2—	10	11	9-77-7	Eviscerated	
135	Ontario				3⅞	4½	4½	4⅛	2⅛	1⅞	10	11	8-67-8	17+28; 16+30	1
200	Superior				4⅛	4⅜	5⅛	4½	3+	2+	10	12	8-74-7	15+27; 15+27	1⅛
201	do				4	4½	5⅜	4⅜	3	2	11	12	8-82-7	14+27; 14+27	
202	do				4⅛	4½	5⅜	4½	3	2	11	12	9-86-7	13+26; 14+25	
203	do				4⅛	4½	5	4⅜	3	2	11	11	8-86-7	15+24; 14+25	
204	do				4	4¼	5	4½	2¾	2—	11	11	8-76-7	15+25; 14+25	1½
205	do				4+	4⅜	4⅞	4	3⅛	2+	11	11	8-76-7	15+28; 15+29	1½
206	do				4	4½	4⅞	4—	2⅝	2+	11	11	9-73-7	16+27; 14+27	1⅜
207	do				4⅜	4¼	5¼	4½	3	2+	11	13	8-80-7	15+26; 14+27	1¼
208	do				4⅛	4¼	4½	4½	2⅞	2—	10	11	8-77-7	13+26; 13+26	1½
209	do				4	4½	4¼	4¼	3	2	11	11	8-73-7	13+25; 10+23*	
210	do				4⅜	4	3⅞	4⅜	3	2—	10	11	8-74-7	15+28; 15+30	1½
211	do				4⅜	4⅜	4+	4⅜	2⅞	2+	12	15	9-78-8	13+24; 13+24	1½
212	do				4+	4⅜	5—	4+	2⅞	2	12	13	9-79-8	14+27; 14+26	1½
213	do				4⅛	4½	4+	4½	3—	2+	10	11	8-70-7	15+30; 14+29	1+
214	do				4+	4½	4	4⅛	2⅞	2	11	11	8-74-7	13+26; 14+26	1½
215	do				4	4½	3⅞	4⅜	3	2	11	11	8-77-7	*13+27; 15+28	1¼
216	do				4⅛	5⅛	3½	5—	3+	2½	11	11	8-80-7	13+23; 14+23	1⅜
217	do				4⅛	4⅛	4—	4⅜	3	2	11	10	8-70-7	15+28; 15+28	
218	do				4+	4⅜	4	5	3+	2	11	11	8-78-7	14+29; 14+29	1½
219	do				3½	3⅞	3⅞	5—	3+	2	10	10	8-73	14+26; 14+26	1⅜
220	do				4	4¼	4+	4⅝	3+	2—	10	10	9-67-7	15+29; 15+29	1⅜
221	do				3⅞	4⅜	4	4⅛	3	2	11	13	8-78-7	15+25; 15+25	1⅜
222	do				3⅞	4⅛	3⅞	5	3—	2	10	11	8-76-7	15+27; 15+26	1⅜
223	do				3⅝	4⅜	4+	4½	3	2	9	12	9-67-8	15+26; 14+25	2
228	do				4½	5⅛	5—	4+	3—	2+	11	13	8-79-7	12+26; 13+26	
281	do		16		4	3⅞	6	4½	3	1⅝	10	11	8-82-8	*14+21; 14+26	1
285	do		11		4⅛	4⅛	4⅛	4½	3	2	10	11	8-82-7	13+21; 13+21	
275	do		14		4+	4+	5⅜	3¾	2⅝	1⅝	11	11	8-79-8	15+28; 15+28	⅝
276	do		15		4½	4	5⅛	4	3⅛	2¼	11	12	8-75-7	16+27; ..+27	⅝
300	do		8¼		4	4⅜	4	4⅛	3	2	9	10	9-75-8	14+29; 15+29	1⅜
301	do		8⅝		4¼	5	4¼	4½	3	2	10	10	8-79-7	12+24; 12+23	1⅜
302	do		8⅛		4	4½	4	4⅛	2⅜	2	9	12	8-75-7	11+25; 14+26	1½
310	Ontario	♂	12⅛		4	4	5	4	3	2	10	10	8-72-7	14+25; 13+25	1½
311	do	♂	14		4	4	5⅛	4	2¼	2—	10	10	9-77-7	14+28; 14+28	⅝
312	do	♀	13		4	3⅞	5	4	2⅞	2	10	11	8-71-7	13+23; 13+22	1⅜
313	do	♀	11½		4	3⅛	4⅜	3⅛	3	2	9	11	9-66-8	*11+20; 13+21	1⅛

* Gill mutilated; number uncertain.

Food value.—The longjaw is a fish of some commercial importance in lakes Superior, Michigan, Huron, and Ontario. It is most valuable in Lake Michigan, although a few years ago the largest catch was taken in Lake Ontario. Its edible qualities are relatively high. The flesh is firm and of very good flavor, and by many people the difference between the longjaw and the common whitefish in this respect is considered to be

only slight. It is most highly esteemed on Lake Ontario, where it often brings the same price as the common species; elsewhere it yields the fisherman several cents a pound less than *C. clupeiformis*. Mr. Charles H. Strowger, an experienced fisherman and careful observer, residing on the shores of Lake Ontario, gives the following estimate of the food value of this fish:

When properly cared for on being caught, this is a delicious fish. When salted it keeps well, and does not lose its freshness when cooked. A great deal of prejudice against the longjaw is entertained because of the soft and damaged condition in which the fish is usually sold to the consumers. It is a fish that ought to be iced as soon as it is taken from the water and left cold until used, as it easily softens and on cooking becomes too greasy for ordinary human palates to enjoy. When fresh caught it is equal, in my judgment, to any fish for delicacy of flavor. It is a splendid fish for baking when of full size, but small-sized fish are always of less value and should not be caught.

Spawning.—Very little is certainly known regarding the spawning habits of the longjaw. Examples taken by Mr. Charles H. Strowger in Lake Ontario, May 17, 1892, had immature spawn except in one fish, in which the eggs were fully ripe. Specimens sent us from the same lake in April, by Mr. John S. Wilson, contained very immature spawn; while other specimens forwarded by Mr. George M. Schwartz of Rochester, on June 13, 1892, had fully matured spawn. Mr. Strowger's observations lead him to believe that this species has a prolonged spawning period, extending perhaps over the entire year. Specimens examined by us on Grenadier Island June 28, 1894, were ripe, and others examined at various times in June and July were nearly or wholly ripe. From these facts it is certain that many of this species spawn in Lake Ontario in the summer. Some of the specimens obtained by Dr. Scovell in Lake Huron in July were also ripe, while others were not. The probabilities are that Mr. Strowger's view is right, and that while the summer is the principal spawning time, the season is prolonged until late in the fall. Little is known of the location of the spawning-beds, but all the evidence indicates that they are in relatively deep water.

16. **Argyrosomus nigripinnis** Gill.

BLACKFIN; BLACKFIN WHITEFISH; BLUEFIN; BLUEFIN WHITEFISH.

Argyrosomus nigripinnis (Gill MS.) Milner, Rept. U. S. Fish Comm. 1872–73 (1874), 87, Lake Michigan, off Racine, Wis.

Description.—Head, $4\frac{1}{3}$ to $4\frac{3}{5}$; depth, 4 to $4\frac{1}{2}$; eye, $4\frac{1}{3}$ to $4\frac{5}{6}$; snout, 4 to 5; mandible, 2 to $2\frac{1}{8}$; maxillary, 3 to $3\frac{2}{5}$. D. 10 or 11 (rarely 9); A. 11 or 12. Scales, 8 or 9–75 to 81–7 or 8. Vertebræ, 58; gillrakers usually 17+33=50, long and slender, about $1\frac{1}{5}$ in eye.

Body moderately stout, ventral outline more curved than the dorsal. Head large, pointed; mouth large; maxillary long and narrow, reaching middle of pupil, the supplemental maxillary long, narrowed above; mandible very long, usually reaching vertical of posterior rim of orbit; lower jaw usually projecting. Distance from snout to occiput about

2 in distance from occiput to origin of dorsal fin. Caudal peduncle rather slender, its least depth $2\frac{3}{5}$ in head. Fins all long; in No. 100, a female, they measure as follows: Pectoral $1\frac{1}{3}$ in head, reaching just half way to base of ventrals; ventrals a little shorter, $1\frac{1}{2}$ in head; dorsal high, its longest ray equal to length of pectoral; base of dorsal fin short, $1\frac{4}{5}$ in height of fin; base of anal fin about equal to that of dorsal, longest ray 2 in head; caudal fin widely forked, the lobes $2\frac{3}{5}$ times length of middle rays.

The fins of No. 96, a male, measure as follows: Pectoral, $1\frac{1}{3}$ in head, reaching slightly more than half way to base of ventral; ventrals scarcely shorter than the pectorals and just equaling length of longest dorsal ray; length of dorsal base, $1\frac{2}{5}$ in height of fin; anal base shorter than that of dorsal, about $1\frac{1}{5}$ in longest anal ray.

Color in life: Dull bluish-green above; sides silvery, with minute black specks; white below; tip of nose and mandible black; fins all rich blue-black; pale at base. In some specimens, usually females, the fins are less black, the ventrals and anal sometimes showing scarcely any black. The dorsal, caudal, and usually the pectorals, however, are always more or less black.

The specimens of this species which we have examined are from 13 to 16 inches in length and weighed, when fresh, from two-thirds of a pound to $1\frac{1}{2}$ pounds.

Table of comparative measurements of specimens of blackfin whitefish (Argyrosomus nigripinnis).

No.	Lake where taken.	Date when taken.	Sex and condition.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers.	
															Number.	In eye.
				In.	*Oz.*											
81	Michigan	Nov. 12	♂ ripe	$13\frac{1}{8}$	10—	$4\frac{1}{8}$	$4\frac{1}{2}$	$4\frac{1}{3}$	4	$3\frac{1}{8}$	2	10	11	9-81-8	18+33; 18+33	1
84	do	Nov. 12	♂	$12\frac{3}{4}$	10—	$4\frac{3}{8}$	$4\frac{1}{2}$	$4\frac{1}{8}$	5	$3\frac{1}{4}$	2+	10	12	9-76-7	17+32; 16+30	$1\frac{1}{8}$
86	do	Nov. 12	♂	$13\frac{1}{4}$	11—	$4\frac{1}{8}$	$4\frac{1}{3}$	$4\frac{5}{8}$	$4\frac{1}{8}$	$3\frac{1}{8}$	2+	11	12	8-76-7	17+33; 17+32	$1\frac{1}{8}$
87	do	Nov. 12	♂ ripe	13	11+	$4\frac{1}{8}$	4+	$4\frac{1}{3}$	$4\frac{3}{8}$	3+	2+	10	12	8-77-7	17+33; 18+35	$1\frac{1}{8}$
89	do	Nov. 12		$15\frac{1}{8}$	19—	$4\frac{1}{4}$	4	$4\frac{3}{8}$	$4\frac{1}{4}$	3	2	10	11	8-77-7	..... ? +31	$1\frac{1}{8}$
95	do	Nov. 18	♂ ripe	$15\frac{3}{8}$	20—	$4\frac{3}{8}$	$4\frac{1}{2}$	$4\frac{1}{8}$	$4\frac{3}{8}$	$3\frac{1}{8}$	$2\frac{1}{8}$	10	11	9-78-7	16+31; 17+31	$1\frac{1}{8}$
96	do	Nov. 18	♂ spent	$16\frac{1}{8}$	21—	$4\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{5}{8}$	$4\frac{5}{8}$	$3\frac{1}{4}$	$2\frac{1}{8}$	10	11	9-75-8	18+32; 19+34	$1\frac{1}{4}$
97	do	Nov. 18	♂ nearly ripe.	$16\frac{1}{8}$	23—	$4\frac{1}{8}$	$4\frac{1}{2}$	$4\frac{3}{8}$	$4\frac{3}{8}$	$3\frac{1}{8}$	2+	10	11	8-77-8	16+32; 17+32	$1\frac{1}{8}$
98	do	Nov. 18	♀ nearly ripe.	$14\frac{1}{2}$	18—	$4\frac{3}{8}$	4	$4\frac{3}{4}$	5	3+	2+	11	12	9-75-8	17+34; 18+31	1
99	do	Nov. 18	♂ ripe.	$15\frac{1}{8}$	22	$4\frac{1}{8}$	4	$4\frac{1}{4}$	$4\frac{1}{4}$	3	2	10	12	9-80-8	17+31; 17+31	$1\frac{1}{8}$
100	do	Nov. 18	♀ spent.	$14\frac{7}{8}$	21—	$4\frac{1}{8}$	$4\frac{1}{2}$	$4\frac{3}{4}$	$4\frac{3}{4}$	$3\frac{1}{8}$	2	10	11	9-76-7	17+32; 17+33	1
101	do	Nov. 18	♀ spent.	$14\frac{1}{2}$	15	$4\frac{1}{8}$	$4\frac{1}{2}$	$4\frac{1}{8}$	$4\frac{1}{8}$	$3\frac{1}{8}$	2	10	11	9-75-7	19+34; 19+34	$1\frac{1}{8}$
102	do	Nov. 18	♀ spent.	$14\frac{7}{8}$	14—	$4\frac{7}{8}$	$4\frac{3}{8}$	$4\frac{1}{8}$	$4\frac{1}{8}$	3	2	9	11	8-78-7	18+32; 17+32	$1\frac{1}{8}$
103	do	Nov. 18	♀ spent.	$14\frac{7}{8}$	17+	$4\frac{1}{8}$	$4\frac{1}{8}$	$4\frac{3}{8}$	$4\frac{7}{8}$	3	2+	10	12	8-76-7	17+33; 17+33	$1\frac{1}{8}$
104	do	Nov. 18	♂ spent.	$14\frac{1}{2}$	15+	$4\frac{1}{8}$	$4\frac{1}{2}$	$4\frac{3}{8}$	5	$3\frac{1}{8}$	2+	11	11	8-76-7	17+32; 17+32	$1\frac{1}{8}$
105	do	Nov. 18	♂ spent.	$14\frac{1}{2}$	13+	$4\frac{3}{8}$	$4\frac{3}{8}$	$4\frac{1}{8}$	$4\frac{3}{8}$	$3\frac{1}{8}$	2+	10	11	8-75-7	18+33; 18+35	$1\frac{1}{8}$
106	do	Nov. 18	♀ spent.	$14\frac{1}{2}$	15—	$4\frac{3}{8}$	...	$4\frac{3}{8}$	$4\frac{1}{8}$	$3\frac{3}{8}$	$2\frac{1}{8}$	10	12	.....	.....	...
43099	Miltona	.....	.....	$15\frac{1}{2}$	....	4	4	$4\frac{1}{8}$	...	$3\frac{5}{8}$	...	10	...	9-73-7	—— 18+30	$1\frac{1}{8}$
43100	do	.....	.....	16	....	4	4	$4\frac{1}{8}$	...	$3\frac{1}{8}$	...	10	12	9-77-8	—— 17+31	$1\frac{1}{8}$

Range, habits, etc.—The blackfin or bluefin whitefish was first brought to public notice at the same time that *Argyrosomus hoyi* was discovered. It was first collected in Lake Michigan, in deep water off Racine, Wis., and first described by Mr. J. W. Milner in the Report of the Com-

missioner of Fish and Fisheries for 1872–73. It is not known from any of the Great Lakes except Michigan. All of the specimens of the so-called bluefin or blackfin of Lake Superior which we have seen are the longjaw (*A. prognathus*).

The only specimens of the blackfin not from Lake Michigan which we have seen, and, indeed, the only ones existing in collections, are two fine examples (Nos. 43099 and 43100, U. S. Nat. Museum) obtained by James R. B. Van Cleave in Miltona Lake, Minnesota, where the fish is reported to be abundant, and two others (Nos. 22117, U. S. Nat. Museum), secured in one of the lakes at Madison, Wis. The Miltona Lake specimens have been described by Dr. Bean (Forest and Stream, June 2, 1894), and we agree with him in regarding them as not different from the Lake Michigan blackfin. The Madison specimens also agree very well with those from Lake Michigan.

The blackfin is probably the most abundant fish of commercial importance in the deeper waters of Lake Michigan. It is found in schools, like other members of the group, and is, at times, at least, associated with lake trout (*Cristivomer namaycush*), longjaws (*A. prognathus*), chubs (*A. hoyi*), and common whitefish (*C. clupeiformis*).

Up to a comparatively recent date very little was recorded about this fish. Specimens were scarce in collections, and in the National Museum at Washington there were only the four specimens mentioned. The absence of recorded data regarding the fish and its scarcity in collections have certainly been due to no lack of abundance of the fish, but rather to the neglect of collectors. As late as 1886, Dr. Goode, in his standard work on American Game and Food Fishes, stated that "at times it comes in considerable numbers to the Chicago market, but it is in general a rare species."

The first detailed reference to the commercial value of this fish and the most complete account of its habits and distribution in Lake Michigan were contained in a report on the Great Lakes for 1885, issued by the United States Fish Commission, based on inquiries made under the direction of Mr. R. Edward Earll.

Spawning habits.—The spawning season of the blackfin is the same as that of the common whitefish and the lake herring. The somewhat limited observations thus far made, and the specimens available for examination, indicate a spawning period in November and December. At that time the fish are reported to gather on stony bottom for the purpose of depositing their eggs, while at other seasons they are said to prefer clay bottom. The specimens from Lake Michigan examined by us were received fresh November 15 and 21. They were taken in gill nets off Sheboygan on or about November 12 and 18, and examination showed them to be ripe or nearly ripe with spawn; indeed, some were partially spent.

The blackfin is found in the deep water at all seasons, although during part of the year it frequents relatively shallow water. About

the first part of November the fish begins to withdraw from the deepest water of the lake and may be taken at depths of 60 to 80 fathoms. The number of fish in water of that depth increases with the advance of winter, and when fishing is brought to a close by the formation of ice the fish are at the height of their abundance. When the ice breaks up between February and April the fish begin to move into deeper water, and by May fishing is done in water 100 or 110 fathoms deep. During the warmer months this is about the minimum depth at which the blackfins are regularly found.

A favorite resort for the blackfin is Mud Hole, a large depression in the bottom of the lake, located about 20 miles east of Sheboygan; it is 7 or 8 miles square and about 90 fathoms deep. Another ground that is frequented by large bodies of blackfins is Grand Traverse Bay, on the east side of Lake Michigan.

17. **Argyrosomus tullibee** (Richardson).

TULLIBEE; MONGREL WHITEFISH.

Salmo (*Coregonus*) *tullibee* Richardson, Fauna Bor.-Amer., III, 201, 1836, Cumberland House, Pine Island Lake.

Description.—Head, 4 to $4\frac{1}{2}$; depth, 3 to $3\frac{3}{5}$; eye, 4 to 5; snout, about 5. Dorsal fin with about 11 developed rays, the number varying from 10 to 12; anal, 11 or 12. Maxillary, $3\frac{1}{2}$ in head; mandible, 2 to $2\frac{1}{4}$; scales, 9–68 to 71–8; gillrakers, 16 to 18+30 to 34; 1–$1\frac{1}{2}$ in eye.

Body short and deep, compressed, the dorsal and ventral outlines similarly curved. Head small, conic and compressed; mouth large, lower jaw projecting; middle of upper lip on a level with middle of pupil, maxillary long, moderately broad, reaching anterior edge of pupil, the width about one-third its length; supplemental maxillary bone well developed, nearly half length of maxillary, its width $2\frac{3}{4}$ times in its length; mandible long, reaching posterior edge of pupil. Distance from tip of snout to occiput half that from occiput to origin of dorsal fin, which is midway between tip of snout and base of caudal fin. Caudal peduncle short, compressed and deep, its least depth about $2\frac{1}{4}$ in head. Fins rather large; height of dorsal, $1\frac{1}{5}$ in head; base of fin, $1\frac{2}{5}$ in longest ray; anal base very oblique, equal to length of longest ray, which is about equal to base of dorsal fin; pectorals and ventrals long, almost equal to height of dorsal. Scales firm, considerably enlarged anteriorly; free margin of scales less convex than in other species, often emarginate, especially on anterior part of body; lateral line straight and in a line with upper rim of orbit. Tongue with a patch of fine teeth near the tip. Gillrakers numerous, long and slender, the number varying from 47 to 52. Color iridescent bluish above, sides and under parts silvery; older individuals darker above and with more golden reflection on sides; fins all more or less evidently black-tipped; upper edge of pectoral margined with black.

Table of comparative measurements of specimens of tullibee (Argyrosomus tullibee).

Number.	Where taken.	Length.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Scales.	Gillrakers.	
												Number.	In eye.
		In.											
115	Lake of the Woods	12	4¼	3⅛	4	5	3⅜	2¼	11	12	.....	18+33; 18+34	1½
116	.....do	8	4⅓	3⅜	4	5	3½	2⅛	12	13	9-71-8	16+34; 18+33	1⅞
117	.....do	8	4	3⅞	4—	5	3½	2+	12	12	9-70-8	17+30; 17+31	1¼
118	.....do	7¾	4	3+	4	5	3⅛	2+	10	11	9-71-8	16+33; 16+32	1¾
119	.....do	6¾	4	3⅝	4—	5	3¼	2⅛	11	12	9-70-8	17+32; 17+31	1⅝
64	.....do	14	4½	3—	4⅞	4⅞	3⅞	2+	12	12	9-68-8	.....	.....
66	.....do	16½	4⅝	3	5+	5	3¾	2⅛	11	11	9-68-8	16+31; 16+32	1

This species was originally described in 1836 by Richardson, from Pine Island Lake, at Cumberland House, British America. Since then it has been recorded from the following places: Albany River district, Hudson Bay (Richardson, 1836); Lake Superior (Agassiz, 1850); Albany River, Günther, 1866; Lake Superior (Jordan, 1878); Lake Erie (Jordan, 1878 and 1882); Lake Michigan (Jordan & Evermann, 1886); lower end of Lake Erie (Forest and Stream, 1890); Qu'Appelle River (Forest and Stream, 1892); and North Minnesota (Blackford, U. S. N. M.). It is also known from Lake of the Woods, Lake Winnipeg, and Manitoba.

The tullibee attains a length of 18 to 20 inches and a weight of 3½ pounds. Its food value is high, but its commercial importance is as yet very limited. In none of the Great Lakes is the fish at all common, but in the Lake of the Woods it is quite abundant and considerable quantities are taken and shipped to Sandusky. In the provinces of Assiniboia and Manitoba the fish is taken in large numbers for local consumption, with gill nets and in traps made of brush and stones.

But little is definitely known of the spawning habits of the tullibee. Mr. F. C. Gilchrist, of Fort Qu'Appelle, writing in Forest and Stream concerning this fish, as observed by him in the lakes of the Western Territories of Canada, says:

> In September they will again be found gradually nearing the shoal water, feeding heavily, and plump with fat and the now swelling ovaries. Later on they appear to eat little or nothing and devote all their time to playing until about the 25th of October, when they have settled down to the business of propagation, which they have finished by November 10. They prefer shallow water close to shore with clean sand to spawn on, and during the day they may be seen in pairs and small schools, poking along the shores, but at night they come in thousands and keep up a constant loud splashing and fluttering, very strange and weird on a calm night. Two years ago I carefully counted the ova from a ripe fish 2½ pounds in weight, and found there were 23,700, closely resembling whitefish eggs in appearance, but somewhat smaller. After spawning the fish are very thin, lank, dull in color, and quite unfit for human food.

In a recent article entitled "Whitefish culture in New York," published in the New York Fishing Gazette, Dr. Bean records the taking of a specimen of tullibee in Lake Onondaga, New York, where the species is abundant but has apparently not been previously recognized. The fish was a male, 18½ inches long, and was obtained in November by

Mr. James Annin, jr., State superintendent of fish-culture, who furnished the following notes on the tullibee in this lake:

In regard to the spawning habits of the Onondaga Lake whitefish, they are spawning at present at Onondaga Lake. They generally commence running up onto the shoals about November 15, and the season extends into December. They come up to the banks or gravelly shoals and spawn in from 3 to 6 and 7 feet of water. They have never been caught with hook in this lake, and an old fisherman told me that he had tried almost every kind of bait, and had used the very finest gut and the smallest hooks baited with *Gammarus* (fresh-water shrimp) and other kinds of natural food—that is, he supposed the food was natural to them. At the same time he claims he could see them in large schools lying in the water 8 or 10 feet from the surface.

17a. Argyrosomus tullibee bisselli (Bollman).

BISSELL'S TULLIBEE.

Coregonus tullibee bisselli Bollman, Bull. U. S. Fish Comm., VIII, 1888, 223, Rawson and Howard lakes, Michigan. (Type, No. 40619.)

Similar to *A. tullibee*, but with maxillary reaching to middle of eye, and with 80 to 82 scales in lateral line. End of supplemental maxillary bone rounded. Lower jaw projecting when closed. Supraorbital bone elongate pear-shaped. Head, $4\frac{1}{3}$ to $4\frac{1}{2}$; depth, $3\frac{1}{2}$; eye, $4\frac{1}{2}$ to $4\frac{2}{3}$. Scales anteriorly scarcely larger than those on caudal peduncle. This variety of *tullibee* is known from small lakes in southern Michigan and bears the same relation to the typical *tullibee* that *A. artedi sisco* does to the lake herring. Nothing has been recorded concerning its size, abundance, and habits.

COMMON NAMES OF THE WHITEFISHES.

A great deal of misapprehension exists among fishermen, dealers, and others regarding the identity of even the common species of whitefishes, and a large variety of common names is employed to designate the different fishes in the same and different localities. During the recent investigations of the fish and fisheries of the Great Lakes by the United States Fish Commission, a special effort was made to learn the common names by which each of the whitefishes is known to the fishermen about the different lakes. It became apparent very soon, not only that the same species is known by a great variety of names in the different parts of its range, but that in a number of places a single species is known by several common names; and, what is still more confusing, the same common name is, in different localities, applied to two or more entirely different species.

As illustrating the improper use of common names we may take the name "whitefish" or "common whitefish." In Lake Champlain "whitefish" is one of the common names applied to either *Coregonus clupeiformis* or *C. labradoricus*. In all of the Great Lakes it is correctly applied to *C. clupeiformis*, though occasionally about Lake Huron and

Lake Superior it is used for *C. labradoricus*, while in the Lake of the Woods "whitefish" may mean either *Argyrosomus tullibee* or *C. labradoricus*, or possibly *C. clupeiformis*. Again, the "cisco" of Lake Ontario is *A. artedi*, which is the "herring" of Lake Erie, or the "shore herring" or "greenback herring" of Lake Michigan. At Whitefish Bay, Lake Superior, the name "cisco" is sometimes applied to *C. quadrilateralis*. At some places in Lake Superior "cisco" means *A. prognathus*, and in Lake Michigan it may refer to *A. hoyi*. The name "herring" or "lake herring" is generally applied to *A. artedi*, but in Lake Michigan *A. hoyi* is known by the same designation. Such names as "shad," "chub," "pilot-fish," and "shiner," when given to species of whitefish, afford no clue to the identity of the fish and illustrate the confused popular nomenclature.

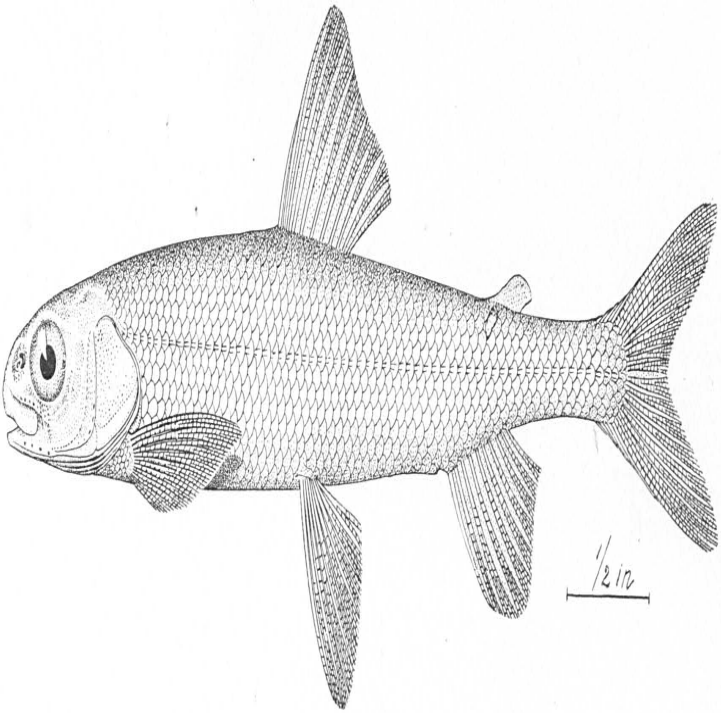
In order to facilitate to some extent the identification of the various whitefishes by persons not conversant with the subject, the common names in use have been brought together in the following list. In the first column we give the common or local name; in the second, the place where used, and in the third the scientific name. The absence of an assigned locality indicates either that the common name is not used among the fishing population (as, for instance, Nelson's whitefish), or that the common name is in more or less general use.

Classified list of the common names applied by fishermen and others to the different species of whitefish.

Common name.	Where used.	Scientific name.
Attihawmeg	Northern lakes	Coregonus labradoricus.
Blackfin, or blackfin whitefish	Lake Michigan	Argyrosomus nigripinnis.
Blackback	do	C. quadrilateralis.
Bloat	Lake Huron; Lake Ontario	A. prognathus.
Bloater, or bloater whitefish	Lake Ontario; Lake Superior	Do.
Blueback, or blueback herring	Lake Ontario; Lake Michigan	A. artedi.
Bluefin, bluefin whitefish	Lake Michigan	A. nigripinnis.
Bowback, or bowback whitefish	Lake Superior	C. clupeiformis.
Broad whitefish		C. kennicotti.
Buffalo-back whitefish	Lake Superior	C. clupeiformis.
Chateaugay shad	Chateaugay Lake	C. quadrilateralis.
Chivey	Maine	Do.
Chub	Lake Michigan	A. hoyi.
Cisco (or Sisco)	Lake Ontario; Lake Erie	A. artedi.
Do	Lake Michigan	A. hoyi.
Do	Lake Superior; Lake Ontario	A. prognathus.
Do	Lake Superior	C. quadrilateralis.
Do	Lake Tippecanoe	A. artedi sisco.
Ciscoette	Lake Erie (trade name for large herring).	A. artedi.
Do	Lake Ontario (trade name)	A. prognathus.
Common whitefish		C. clupeiformis.
Coulter's whitefish		C. coulterii.
Cross whitefish	Lake Ontario	A. prognathus.
Deep-water herring	Lake Michigan	A. hoyi.
Deep-water whitefish	Lake Superior	A. prognathus.
Fresh-water herring	Payette Lake, Idaho	C. williamsoni.
Frostfish	Adirondack Mountains; Lake Champlain.	C. quadrilateralis.
Gizzard-fish	St. John's River, N. B.	C. labradoricus.
Grayback, or grayback herring	Lake Ontario	A. artedi.
Greenback, or greenback herring	Lake Ontario; Lake Michigan	Do.
Herring		Do.
Do	Idaho	C. williamsoni.
Do	Great Bear Lake	A. lucidus.
Do	Lake Michigan	A. hoyi.

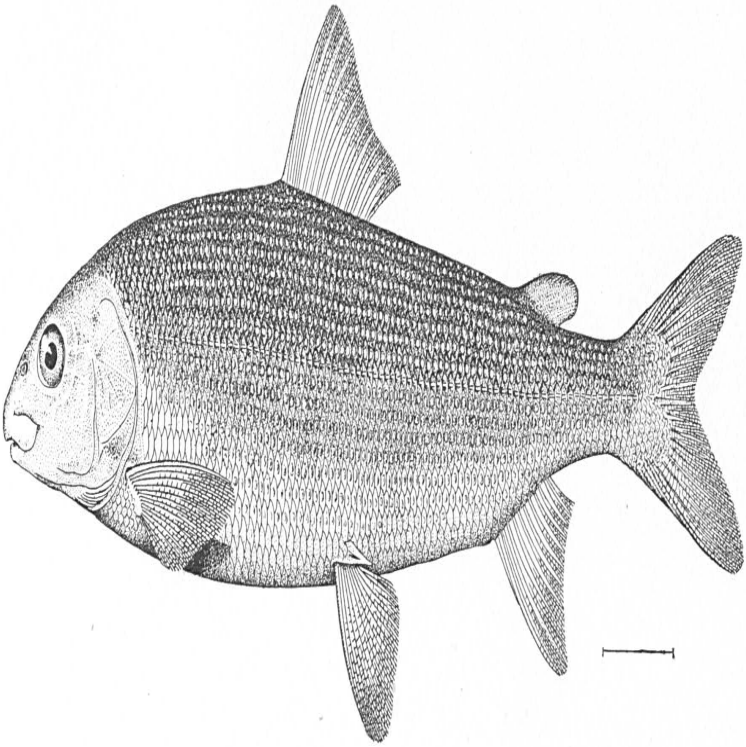
Classified list of the common names applied by fishermen and others to the different species of whitefish—Continued.

Common name.	Where used.	Scientific name.
Highback whitefish	Lake Superior	C. clupeiformis.
Hoy's whitefish		A. hoyi.
Humpback whitefish		C. nelsonii.
Do	Lake Superior	C. clupeiformis.
Hybrid whitefish	Lake Superior; Lake of the Woods	C. labradoricus.
Kiyi or kieye	Lake Michigan	A. hoyi.
Kennicott's whitefish		C. kennicotti.
Labrador whitefish		C. labradoricus.
Lake herring		A. artedi.
Lake whiting		C. labradoricus.
Lauretta whitefish		A. lauretta.
Least whitefish		A. pusillus.
Little whitefish	Lake Superior	A. prognathus.
Longjaw, or longjaw whitefish	Lake Ontario; Lake Huron; Lake Michigan; Lake Superior.	Do.
Longjaw	Lake Superior; Lake of the Woods	C. labradoricus.
Menominee, or Menominee whitefish	Lake Superior; Lake Michigan	C. quadrilateralis.
Michigan herring	Lake Michigan	A. artedi.
Mongrel whitefish		A. tullibee.
Do	Lake Superior; Lake of the Woods	C. labradoricus.
Mooneye	Lake Michigan	A. hoyi.
Mooneye cisco	do	Do.
Mountain herring	Utah; Idaho	C. williamsoni.
Musquaw River whitefish		C. labradoricus.
Nelson's whitefish		C. nelsonii.
Onondaga Lake whitefish	Onondaga Lake, N. Y.	A. tullibee.
Ontario whitefish	Lake Ontario	A. prognathus.
Otsego bass	Otsego Lake; New York	C. clupeiformis.
Pilot-fish	Lake Champlain	C. quadrilateralis.
Poisson pointu	French Canadians	C. labradoricus.
Richardson's whitefish		C. richardsonii.
Rocky Mountain whitefish		C. williamsoni.
Round whitefish		C. quadrilateralis.
Sault whitefish		C. labradoricus.
Shad	Lake Champlain	C. quadrilateralis.
Do	Lake Champlain; Lake Memphremagog.	C. labradoricus.
Shadwaiter	Lake Winnipiseogee	C. quadrilateralis.
Do	Lake Champlain; Lake Memphremagog.	C. labradoricus.
Shiner	Lake Michigan	A. hoyi.
Shore herring	do	A. artedi.
Silver whitefish	Lake Ontario	A. prognathus.
Sisco (see Cisco)	Lake Tippecanoe	A. artedi sisco.
Siscowet	Lake Erie (trade name for large herring).	A. artedi.
Do	Lake Ontario (trade name)	A. prognathus.
Small whitefish		A. pusillus.
Smelt	New York lakes	A. osmeriformis.
Tullibee	Lake Superior; Lake of the Woods; Lake Winnepeg, Assiniboia.	A. tullibee.
Whitefish	Idaho	C. williamsoni.
Do	Lake of the Woods	A. tullibee.
Do		C. clupeiformis.
Do	Lake of the Woods; Grand lakes, Maine; Lake Champlain.	C. labradoricus.
Do	Maine; New Hampshire	Do.



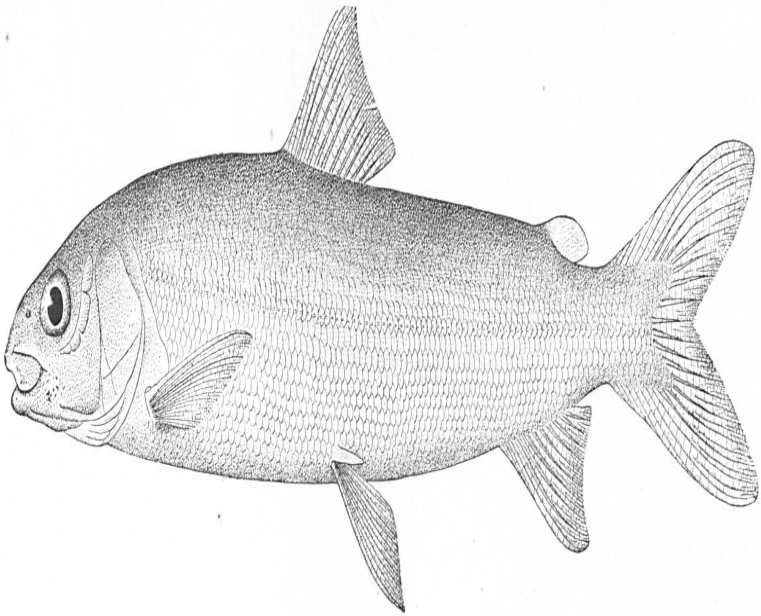
COREGONUS COULTERII Eigenmann & Eigenmann. *Coulter's Whitefish.*

From a specimen, 4½ inches long, one of the types, collected in Kicking Horse River, at Field, British Columbia.



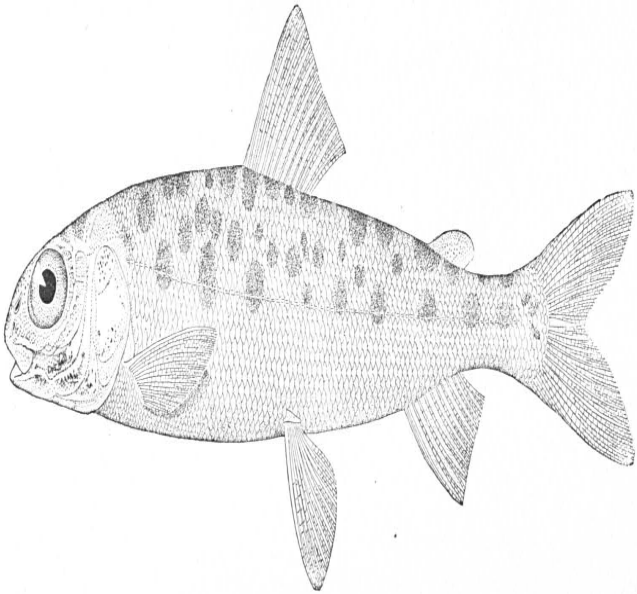
COREGONUS WILLIAMSONI Girard. *Williamson's Whitefish.*

From a breeding male, 11 inches long, collected in Little Spokane River, Washington.



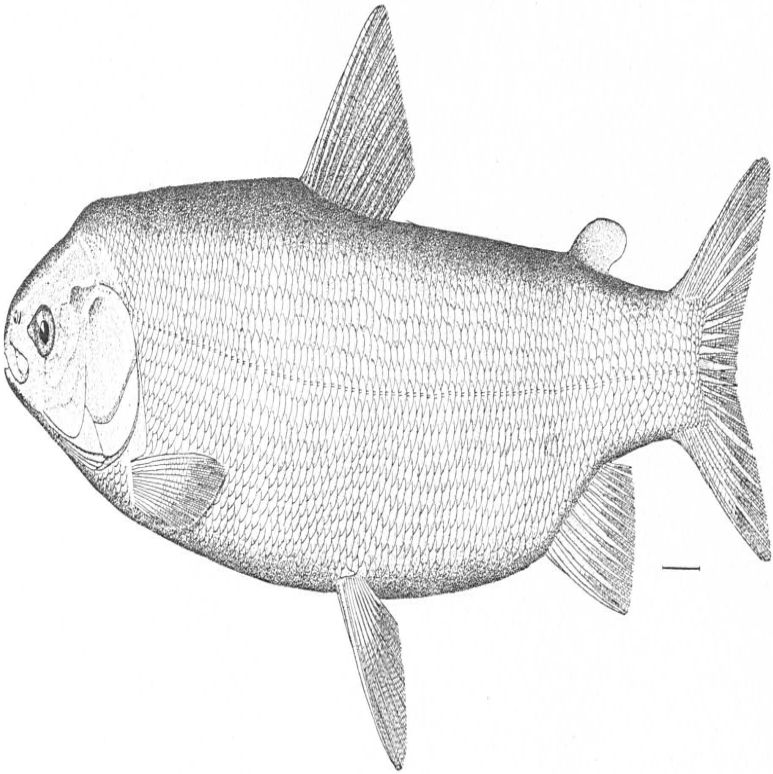
COREGONUS WILLIAMSONI CISMONTANUS Jordan. *Mountain Whitefish.*

From a specimen, about 11 inches long, collected in Horsethief Springs Creek, Montana.



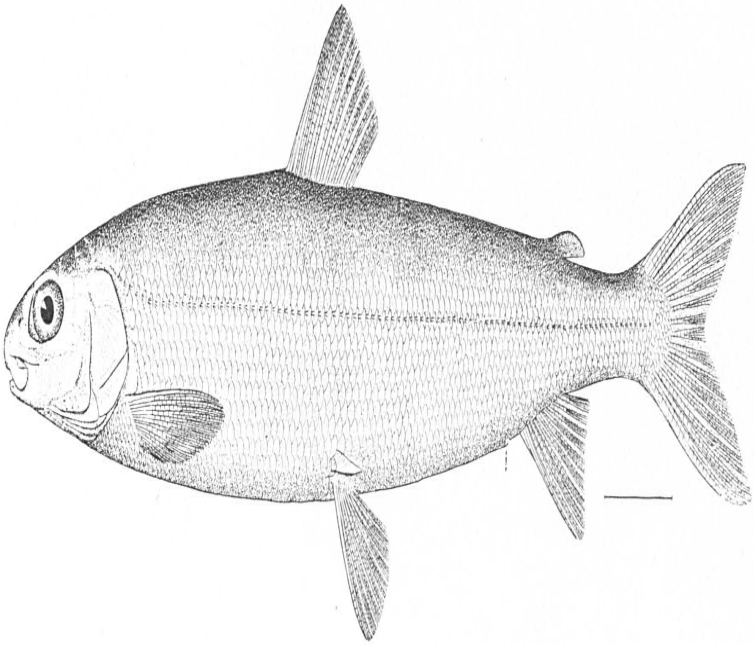
COREGONUS WILLIAMSONI Girard. *Williamson's Whitefish.*

From a young specimen, 3 inches long, showing parr-marks, collected in Little Blackfoot River, Elliston, Montana.



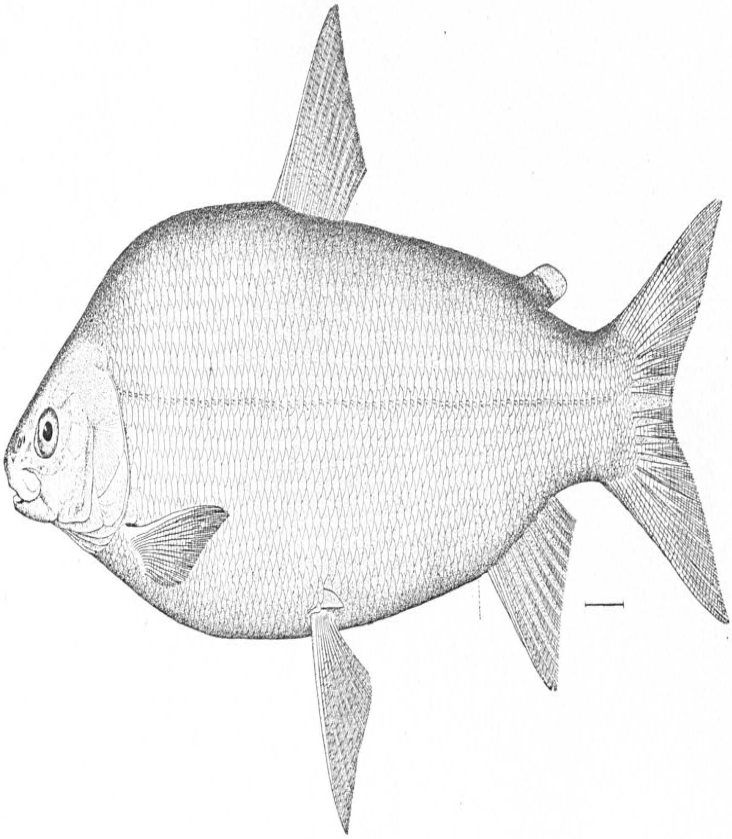
COREGONUS KENNICOTTI Milner. *Kennicott's Whitefish.*

From a specimen, 20 inches long, collected in Meade River, Alaska.



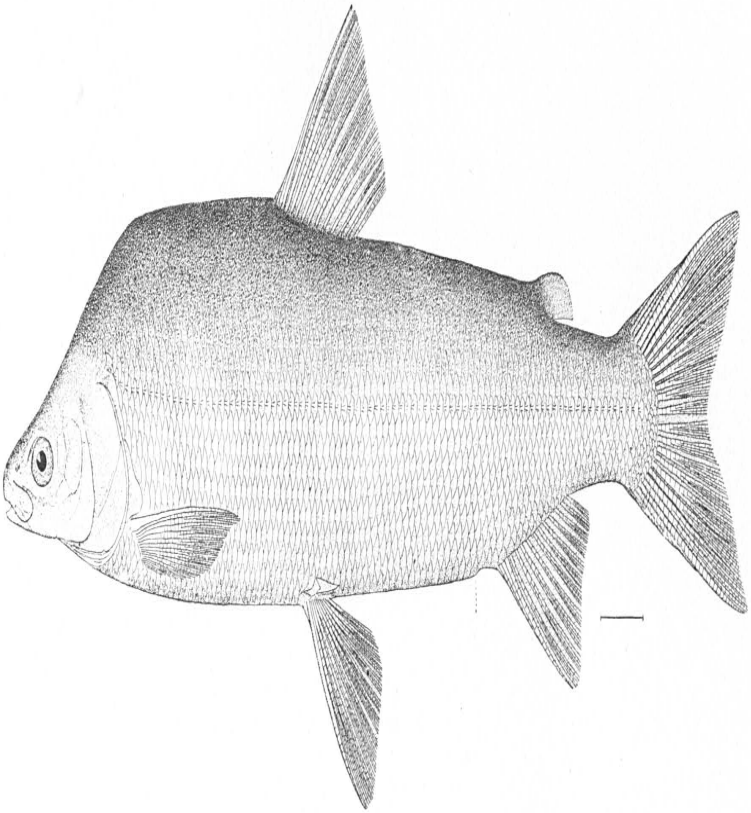
COREGONUS QUADRILATERALIS Richardson. *Round Whitefish.*

From a specimen, 11 inches long, collected in Lake Winnipiseogee, New Hampshire.



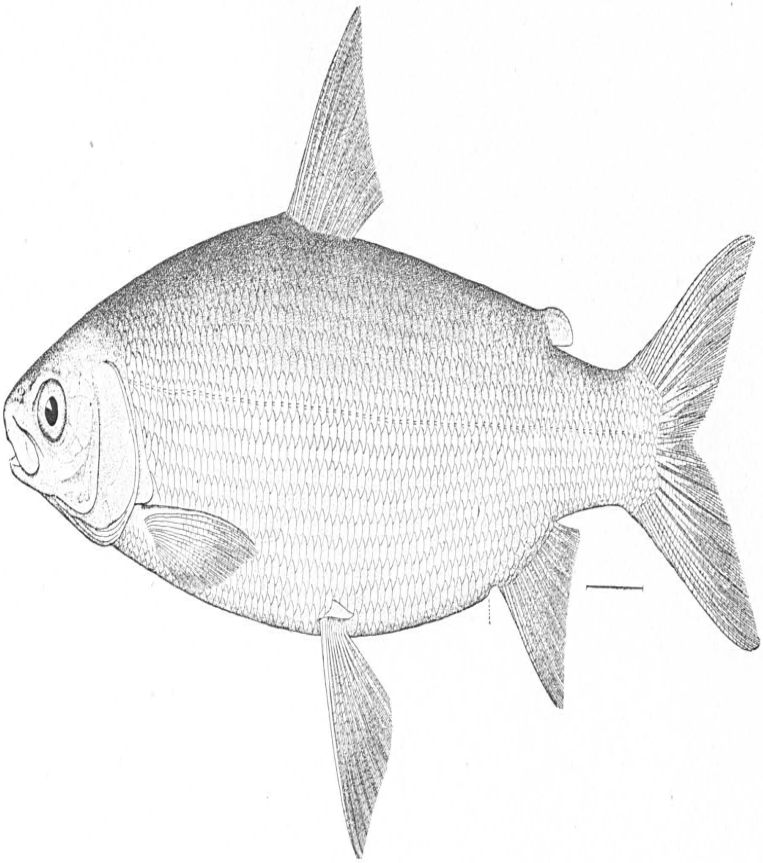
COREGONUS CLUPEIFORMIS (Mitchill). *Common Whitefish.*

From a specimen, 19 inches long, collected in Detroit River, near Ecorse, Michigan.



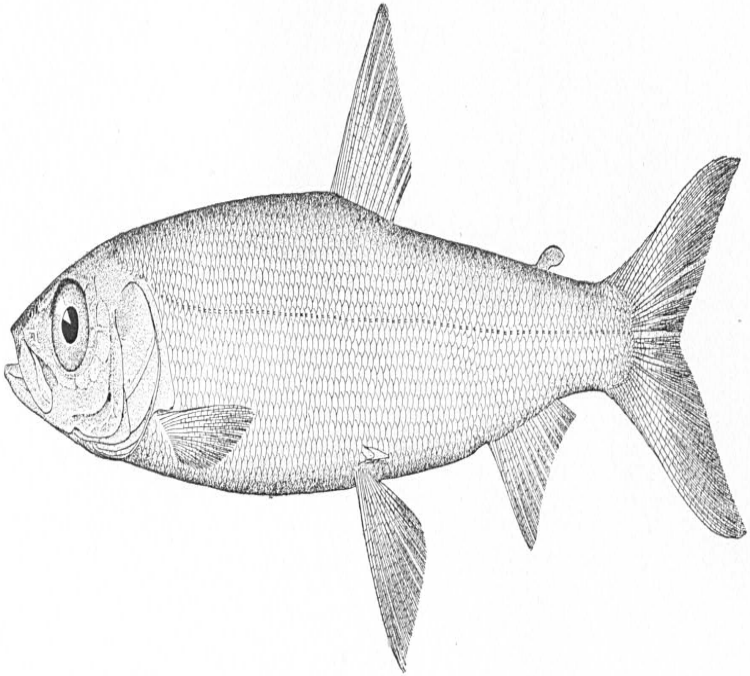
COREGONUS NELSONII Bean. *Nelson's Whitefish.*

From the type, a specimen 18 inches long, collected at Nulato, Alaska.



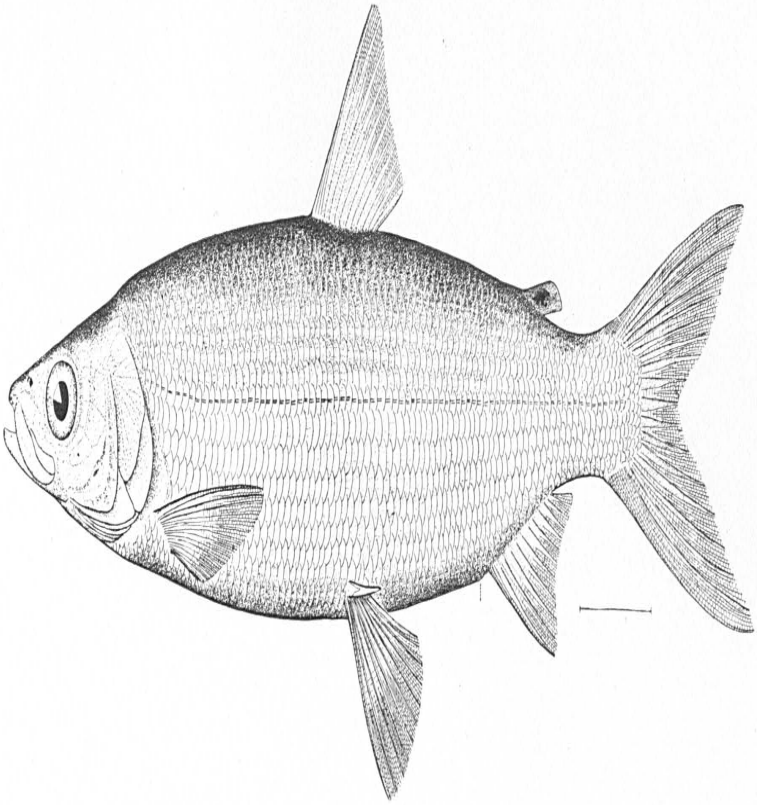
COREGONUS LABRADORICUS Richardson. *Labrador Whitefish.*

From a specimen, 13¼ inches long, collected in Grand Lake Stream, Maine.



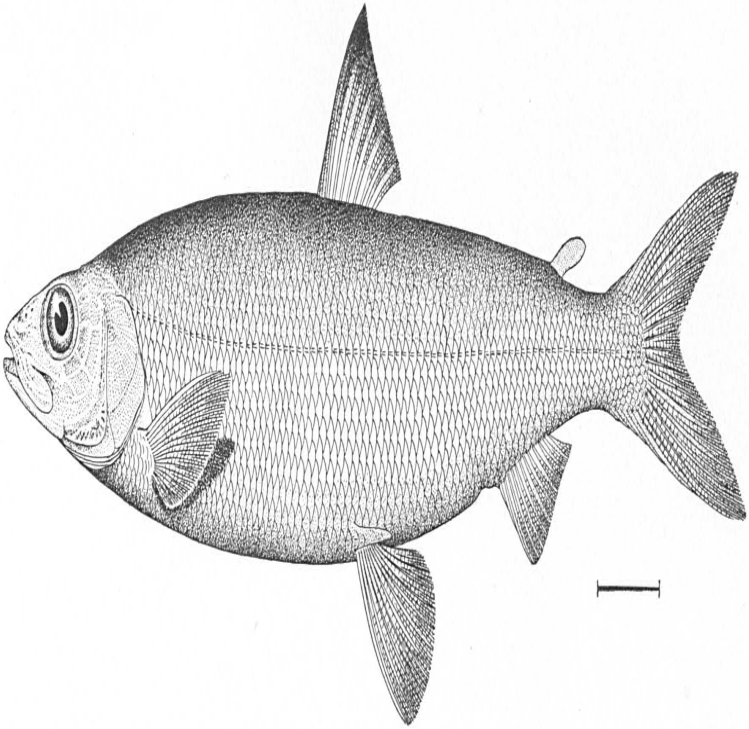
ARGYROSOMUS OSMERIFORMIS (H. M. Smith). *Smelt.*

From the type, a specimen 10 inches long, taken in Seneca Lake, New York.



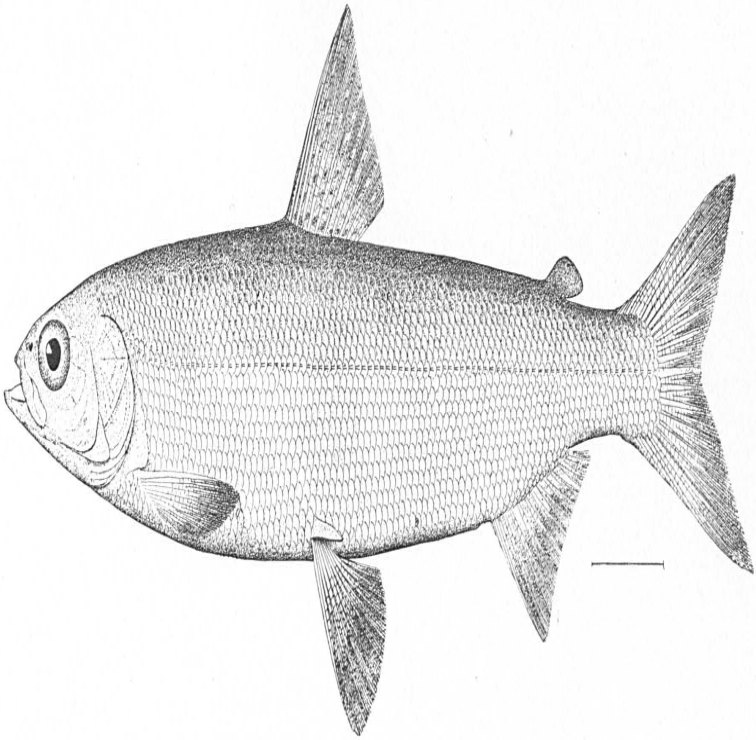
ARGYROSOMUS ARTEDI (Le Sueur). *Lake Herring.*

From a specimen, 11 inches long, collected in Lake Superior, near Bayfield, Wisconsin.



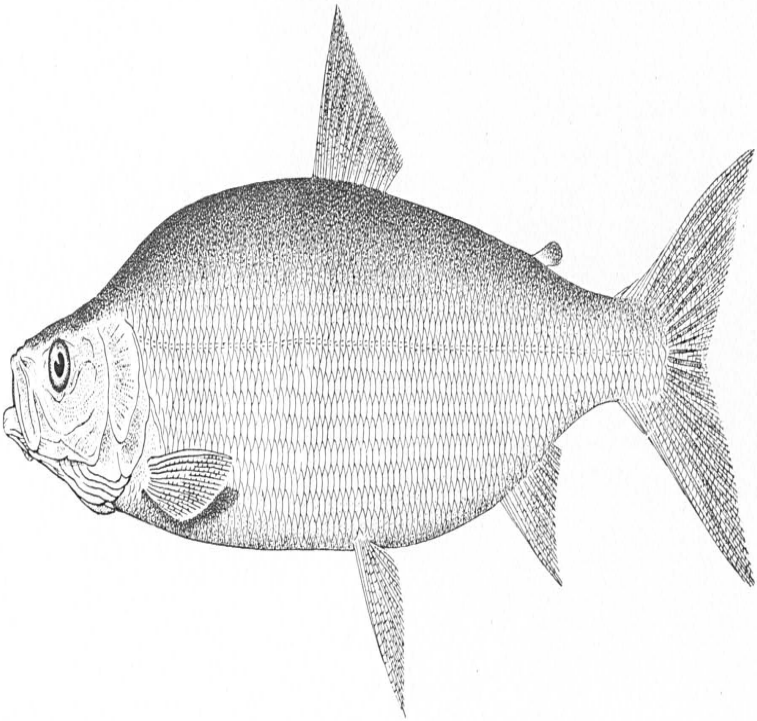
ARGYROSOMUS HOYI Gill. *Hoy's Whitefish; Kiyi.*

From a nearly ripe male, 12 inches long, collected in deep water in Lake Michigan, off Kenosha, Wisconsin.



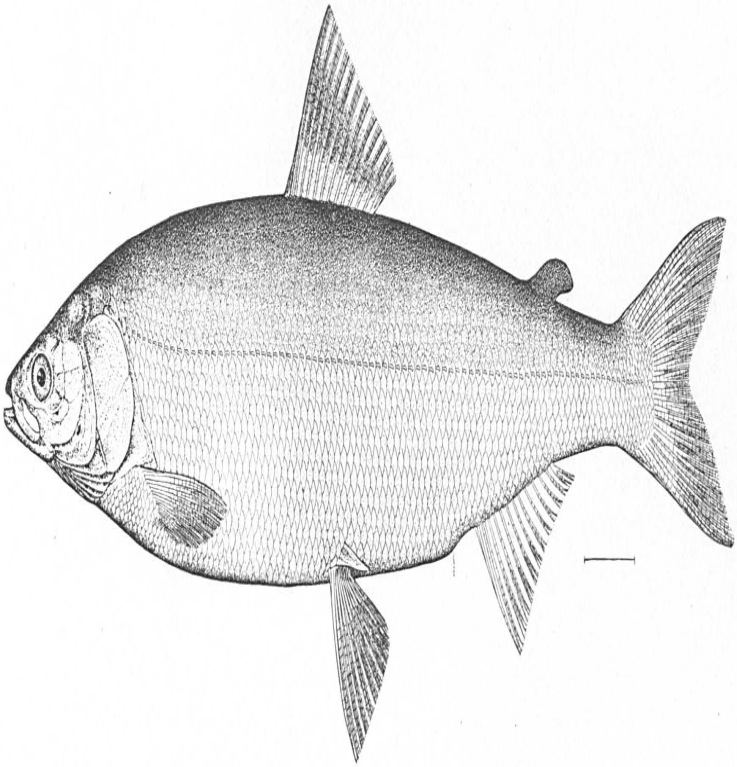
ARGYROSOMUS PUSILLUS (Bean). *Least Whitefish.*

From a specimen, 10 inches long, collected in northern Alaska.



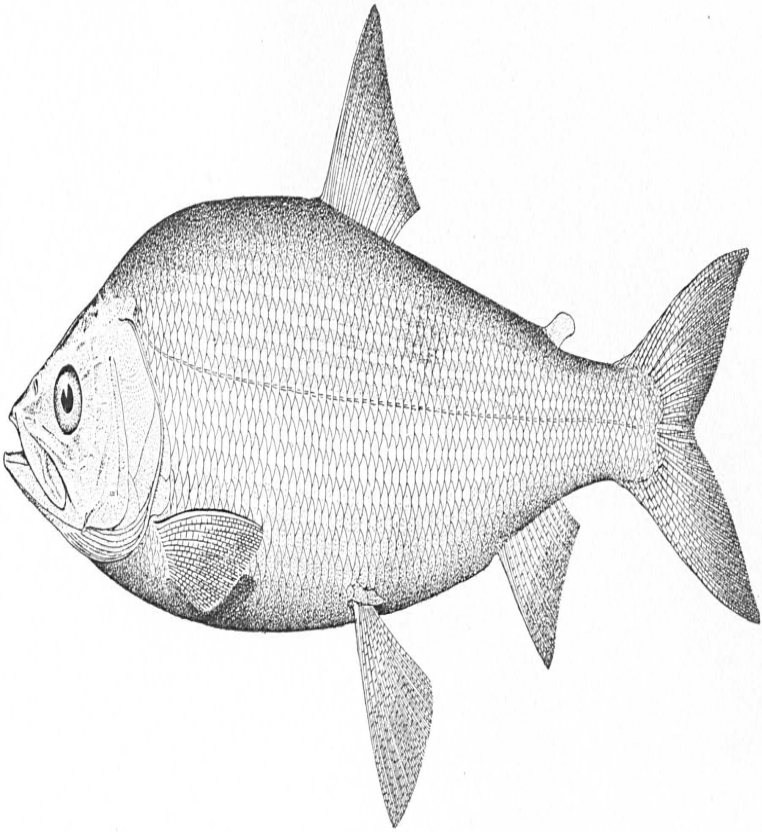
ARGYROSOMUS LUCIDUS (Richardson). *Great Bear Lake Herring.*

Adapted from Richardson's figure of the type, collected in Great Bear Lake.



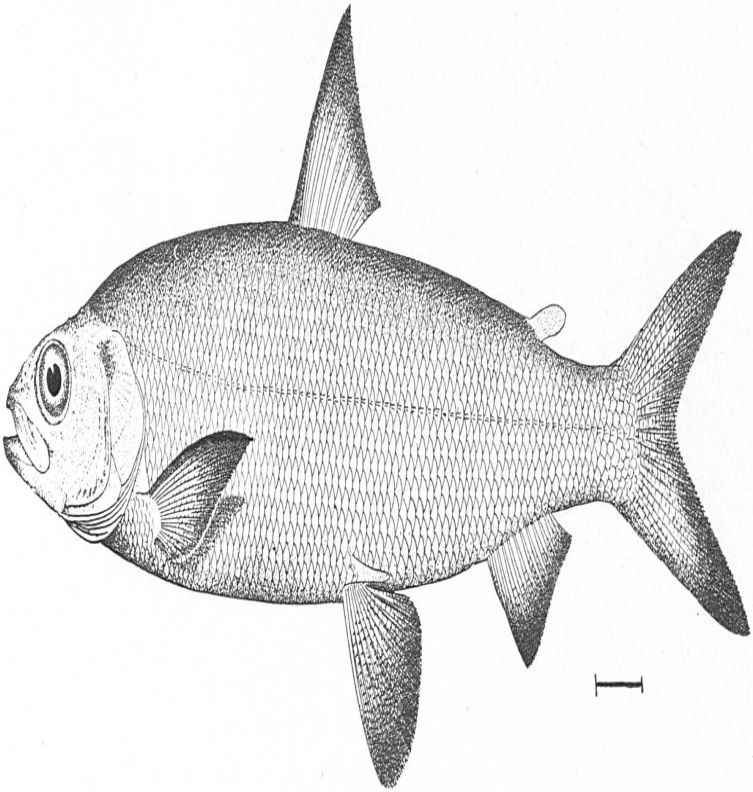
ARGYROSOMUS LAURETTÆ (Bean). *Lauretta Whitefish.*

From the type, a specimen 15 inches long, collected at Point Barrow, Alaska.



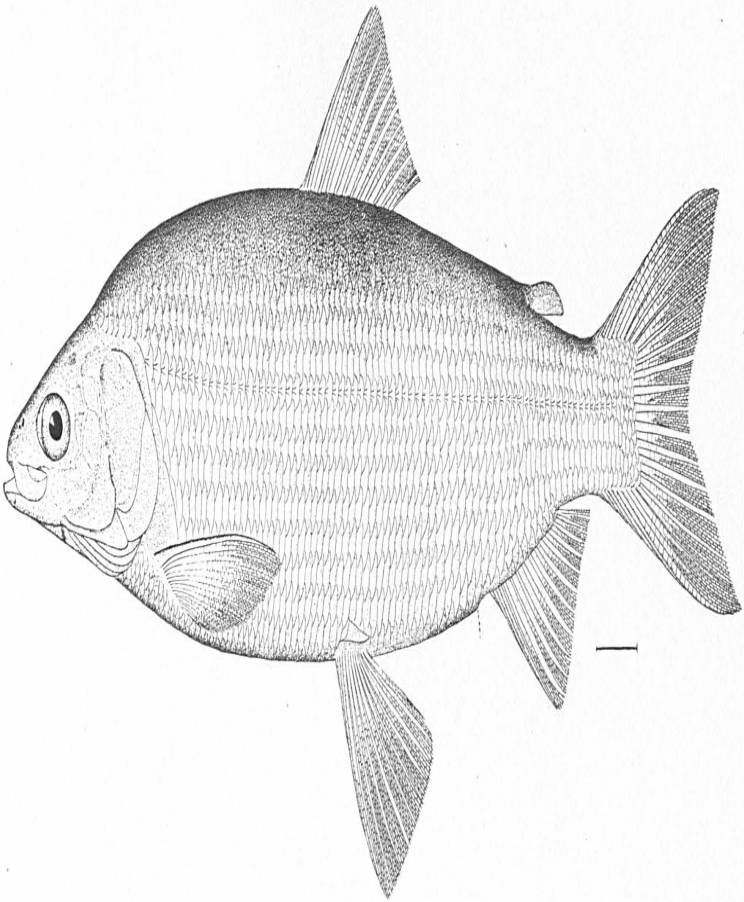
ARGYROSOMUS PROGNATHUS (H. M. Smith). *Longjaw Whitefish.*

From the type, a specimen 15 inches long, taken in Lake Ontario in 40 fathoms of water, off Wilson, New York.



ARGYROSOMUS NIGRIPINNIS Gill. *Blackfin.*

From a nearly ripe male, 16½ inches long, caught in Lake Michigan in 90 fathoms of water, off Sheboygan, Wisconsin.



ARGYROSOMUS TULLIBEE (Richardson). *Tullibee.*

From a specimen 18 inches long, probably from Minnesota.

Report U. S. F. C. 1894. (To face page 324.)