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TWO NEW SPECIES OF CISCO FROM THE  
GREAT LAKES<sup>1</sup>

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*Leucichthys alpenae*, new species

*Argyrosomus prognathus* Evermann and Smith, Rept. U. S. Comm. Fish.  
1894 (1896), p. 314-317 (in part).

*Leucichthys johanna*e Jordan and Evermann, Bull. Bur. Fish., 29, 1909  
(1911), p. 24-25 (in part).

This form, currently known as the "longjaw", is one of the largest species of *Leucichthys* found in the Great Lakes. Individuals not infrequently attain a length of 38 cm. (15 inches) and a weight of two pounds. The longjaws are well-flavored and moderately fat and are in demand by fish-smokers. The species occurs most abundantly at depths of less than 60 fathoms and is generally distributed throughout Lake Michigan and Lake Huron, including Georgian Bay, where suitable conditions obtain.

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<sup>1</sup>These descriptions are published with the permission of the U. S. Commissioner of Fisheries.

The type is a female specimen, to be deposited in the United States National Museum, 269 mm. in length to the base of the caudal, collected in Lake Michigan on June 15, 1923, 22 miles NNE of Charlevoix, Michigan, off Ile aux Galets, in 25-47 fathoms of water. Paratypes, deposited in the Museum of Zoology of the University of Michigan, were obtained in Lake Michigan off the Michigan shore on August 11, 1920, 14 mi. SE  $\frac{1}{2}$  E, and on August 12, 1920, 15 mi. SE x S  $\frac{1}{2}$  S of Manistique; on June 29, 1920, 5 mi. N x E, on June 15, 1923, 22 mi. NNE and on August 11, 1923, 3 mi. NW  $\frac{1}{2}$  W of Charlevoix; on August 10, 1923, 8 mi. NNW of Big Rock Point, and on August 21, 1923, from an unknown location off Charlevoix; on June 22, 1920, 5 mi. NNW, and on July 31, 1923, 5 mi. NW of Cat Head Light; on July 30, 1923, off the South Manitou Island; on October 4, 1920, 9 mi. north of Point Betsie; and on March 20, 1919, 12 mi. west of Grand Haven. Other paratypes were taken off the Indiana shore on September 3, 1920, 22 mi. NW x N  $\frac{1}{2}$  N, on October 11, 1920, 20 mi. N x W  $\frac{3}{4}$  W, on November 8, 1920, 18 mi. NNW and on November 19, 1920, 17 mi. NNW and 17 $\frac{1}{2}$  mi. NW x N  $\frac{3}{4}$  N of Michigan City; and off the Wisconsin shore on September 23, 1920, 27 mi. ESE of Milwaukee; on September 25, 1920, 18 mi. and also 5 mi. E  $\frac{1}{2}$  S of Port Washington; on October 1, 1920, 11 mi. SE of Sheyboygan; on August 24, 1920, 10 mi. E x N of Algoma; on August 23, 1920, 12 mi. E x S of the Sturgeon Bay Ship Channel mouth; on August 18, 1920, 4 mi. west of Boyer Bluff; and on August 19, 1920, 20 mi. E  $\frac{1}{2}$  N of Rock Island. Specimens have also been taken in Lake Huron in Michigan waters off Cheyboygan, Rogers City, Alpena and Harbor Beach and in Canadian waters in Georgian Bay, off Lion's Head and Warton; these are not designated as paratypes, and are not involved in the following description.

The body is fusiform, somewhat compressed and elongate. The greatest depth through a point just in front of the dorsal comprises in the type 23% of the total length; in other adult specimens about 23-27%. The width is about 55% of the depth; in other specimens 50-55%. The anterior dorsal profile of the body usually rises gradually from the occiput to the insertion of the dorsal, but it is sometimes somewhat steeper over its anterior half, particularly in the largest specimens. Behind the dorsal the line continues in a very faint curve to the caudal peduncle. The ventral profile is rather strongly and uniformly curved from the tip of the snout to the caudal peduncle. The head, which is relatively short and deep, is contained 4.4 [(3.8) 4.1—4.4 (4.6)]<sup>2</sup> times in the total length. In side view it is broadly triangular. Its dorsal profile is usually more or less faintly convex and forms a smooth arc continuous with that of the first half of the predorsal body contour. The premaxillaries are usually more or less pigmented and are directed forward, ordinarily making an angle of 45°-60° with the horizontal axis of the head. The snout, seen from the side, is broad and rounded. The maxillary is non-pigmented and extends beyond the anterior edge of the pupil but seldom to its center. The eye is moderate in size, contained 4.6 [(3.8) 4.2—4.5 (5.2)] times in the head-length. The mandible is well developed and is usually longer than the upper jaw, though sometimes shorter. The scales in the lateral line number 75 [(71) 74—85 (96)]. The gill-rakers on the first branchial arch number 14+25 [(11) 13—15 (17) + (20) 22—28 (30) = (33) 36—43 (46)]. The dorsal edge of the pectoral is usually nearly straight. The paired fins are relatively

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<sup>2</sup>These and succeeding figures in brackets are based on an examination of 289 paratypes ranging in length from 200 to 386 mm.; the usual as well as the extreme range in variation is given, the latter in parentheses.

short. The pectorals are contained 2.2 [(1.6) 1.9—2.2 (2.5)] times in the distance from their insertion to that of the ventrals; the ventrals are contained 1.8 [(1.2) 1.4—1.7 (1.9)] times in the distance from their origin to that of the anal.

In life the general appearance of the fish is silvery with a faint pink to purplish iridescence suffusing the sides. This reflection is strongest above the lateral line, becoming faint on the back and paling gradually toward the colorless belly. The color lying below the superficial iridescence is on the back a more or less intense pea-green to blue-green which loses its brightness toward the lateral line and becomes bright blue-green below it. On the back the color is obscured by a slaty cast due to fat in the epidermis and to the moderate, rather uniform pigmentation over the scales on the entire dorsal surface. The pigmentation is continued over the top of the head and extends also onto the preorbital area. It is likewise present but in diminished abundance on the sides of the body, chiefly above the lateral line. Four patches of green lie below the surface on each side of the mid-dorsal line of the head—three, the largest of which is rounded triangular, nearly contiguous, are located posterior to the center of the eye and extend backward to the occiput and the other, which is clubshaped, is located on the side of the mid-line, with its narrow end extending backward and inward to meet its companion of the other half of the head. A small patch of green also lies in the cartilage in front of the eye. The maxillaries, premaxillaries and mandible are whitish, all but the first usually showing at least some pigment. The cheeks and iris are silvery with a trace of iridescence on the former and of bronze on the latter. The proximal one-third of the fins is often pale pinkish. The distal two-thirds is whitish except on the dorsal and caudal, on which it is more or less suffused with blackish. The anterior border of the dorsal

and the lateral borders of the caudal are usually lined with black. The dorsal margin of the pectoral is often faintly sprinkled with black. Pigment dots are often present on the membranes connecting the longest rays of the anal and the ventrals occasionally also show pigment, but are usually immaculate.

***Leucichthys reighardi***,<sup>3</sup> new species

*L. reighardi* is one of the smallest species of *Leucichthys* occurring in Lake Michigan, ranking in respect to size with *kiyi* and *hoyi*. No specimens have been collected over 27 cm. in length and most of the specimens seen have been too small to gill in 2¾ inch nets. Like *alpenae* this species frequents depths of less than 60 fathoms and is taken with *alpenae* and the other deep-water species of *Leucichthys* for the smoked fish trade.

The type is a female specimen, to be deposited in the United States National Museum, 210 mm. in length to the base of the caudal, collected in Lake Michigan on April 1, 1921, 18 miles N x W of Michigan City, Indiana, at a depth of 30-35 fathoms. Paratypes, deposited in the Museum of Zoology, were obtained in Lake Michigan off the Michigan shore on March 20, 1919, 12 mi. west of Grand Haven; off the Indiana shore on September 3, 1920, 22 mi. NW x N ½ N, on October 11, 1920, 20 mi. N x W ¾ W, on November 8, 1920, 18 mi. NNW, on November 19, 1920, 17 mi. NNW, on March 2, 1921, 14 mi. NNW, on March 4, 1921, 15 mi. NNW, and on April 1, 1921, 18 mi. N x W of Michigan City. Other paratypes were taken off the Wisconsin shore on March 24, 1919, from an unknown location off Milwaukee, and on September 23, 1920, 27 mi. ESE of Milwaukee; on September 25,

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<sup>3</sup>Named in honor of Professor Jacob Reighard, Department of Zoology, University of Michigan.

1920, 18 mi. E  $\frac{1}{2}$  S and on May 26, 1922, 8 mi. NE of Port Washington; on September 28, 1920, 5 mi. and 40 mi. SE x E and on October 1, 1920, 11 mi. SE of Sheyboygan; on August 24, 1920, 10 mi. E x N of Algoma; on August 23, 1920, 12 mi. E x S of the Sturgeon Bay Ship Channel mouth; on August 18, 1920, 3 to 5 mi. WNW of Boyer Bluff, and on August 19, 1920, 20 mi. E  $\frac{1}{2}$  N of Rock Island. Other specimens, not designated as paratypes, and not involved in the description of the species, were collected in Lake Michigan off the Michigan shore on August 12, 1920, 15 mi. SE x S  $\frac{1}{2}$  S of Manistique; on June 29, 1920, 5 mi. N x E, on June 30, 1920, 3 mi. NW, on June 15, 1923, 22 mi. NNE and on August 11, 1923, 3 mi. NW  $\frac{1}{2}$  W of Charlevoix; on August 10, 1923, 8 mi. NNW of Big Rock Point, and on August 21, 1923, from an unknown location off Charlevoix; on June 22, 1920, 5 mi. NNW and on July 31, 1923, 5 mi. NW of Cat Head Point; on June 23, 1920, off Northport Point; on October 4, 1920, 9 mi. north of Point Betsie; on August 27, 1920, 4 mi. west, and on August 28, 1920, 9 mi. NW of Manistee. Still others were collected in Lake Ontario, in New York waters off Wilson, Sodus Point, Oswego, Selkirk and Sandy Pond, and in Canadian waters off Brighton; in Lake Superior off Grand Marais, Minnesota, and at several locations on the Ontario shore between Fort William and Rosspoint, and also in Lake Nipigon.

The body is little compressed, much less than in any other member of the genus, excepting *artedi*, and as seen from the side, tapers smoothly and regularly to the head and tail from the deepest portion of the body which is through a point at the front of the dorsal. This dimension is in the type 23%, in most of the other adult specimens at hand 22-26%, of the length. Occasionally an individual is taken in which this figure rises to 29% and in such specimens the predorsal body profile is steeper

over its anterior half. The width of the type specimen is 62% of the depth; in other specimens 55-65%. The head is short and is contained 4.4 [(3.9) 4.2—4.4 (4.8)]<sup>4</sup> times in the total length. It is of moderate depth, bluntly triangular in side view; its dorsal contour, not including the premaxillaries, straight or faintly convex. The snout is likewise short, truncated in side view on account of the nearly vertical direction of the premaxillaries, and is contained 3.8 [(3.5) 3.6—4.0 (4.4)] times in the head. The premaxillaries are always heavily pigmented, and usually make an angle of 60°—70° with the horizontal axis of the head, so that their tip is usually at or below the lower edge of the pupil. The maxillary is always more or less pigmented, the cutting edge usually rimmed with black halfway to its distal end; it is short, being contained 2.7 [(2.5) 2.6—2.8 (3.0)] times in the head. The eye is large, is contained 3.8 [(3.6) 3.9—4.2 (4.4)] times in the head and is situated in the second quarter of the head-length, encroaching more or less on the third. The lower jaw is always shorter than the upper and is usually heavily tipped with black. The lateral line scales number 72 [(67) 72—81 (96)]. The gill-rakers on the first branchial arch number 14+23 [(11) 12—14 (16) + (20) 21—24 (27) = (31) 34—38 (43)]. The paired fins are relatively short. The pectoral length divided into the interval between the pectoral and ventral insertions equals 2.1 [(1.8) 2.0—2.5 (2.8)]; the ventral length into the distance from its origin to the anal equals 1.4 [(1.2) 1.4—1.7 (1.8)].

The color of living paratypes has not been recorded but it is probably not different from that of the race of *reighardi* occurring in the northern basin of Lake Michigan. As in other

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<sup>4</sup>These and succeeding figures given in brackets are based on an examination of 145 paratypes ranging in length from 200-257 mm.; the usual as well as the extreme range in variation is given, the latter in parentheses.

species of *Leucichthys* the general tone is silvery and individuals are taken whose color differs in no material way, excepting heavier pigmentation, from specimens of *alpenae* just described. Many examples, however, show very little greenish color on the back. In such individuals the cranial patches are faint pea-green and the cranial cartilages and the fin bases have a sepia tone. The back is of a very pale blue-grey tint with traces of pea-green beneath. The iridescence of the sides is pinkish.