

THE MILLERS-THUMB AND ITS HABITS

By THEODORE GILL

I

A quite common and characteristic denizen of the cold streams of the entire northern hemisphere is a small brownish fish with a wide head, which is mostly found recumbent on the bottom of the stream and generally under a stone or some other object used for partial concealment. The name best known is Millers-thumb. It is one of a large family. The species are numerous and constitute a natural group which may advantageously be recognized as a subfamily (*Cottinae*) closely related to the marine fishes known along the coast of the United States as Sculpins (*Myoxocephalinae*). Although the species are mostly confined to fresh water, a few may occasionally wander into brackish or moderately salt water, as the Baltic Sea, the Gulf of St. Lawrence, and the North Pacific Ocean. Very little is known



FIG. 26.—Skull of Sculpin.
After Girard.



FIG. 27.—Skull of Sculpin. After Girard.

to most persons about these fishes, but considerable has been published in a scattered form, and the principal data are for the first time brought together in the present article; these have been arranged so as to facilitate comparison with the account of "the Sculpin and its habits," published in the Smithsonian Miscellaneous Collections in 1905 (vol. 47, p. 348-359).

II

The Millers-thumbs, or Cottines, are a subfamily of Cottids¹ distinguished from the Sculpins or Myoxocephalines by the restricted

¹The characters of the Cottids are given in the article on "the Sculpin" (p. 349).

lateral branchial apertures and the broad isthmus between them. The skull is differentiated into three regions—a broad, subquadrangular, postocular portion, an abruptly contracted, narrow, interocular region, and a wider preocular or rostral region. The armature of the head is weak, only one pair of conspicuous spines being developed, a single one about the hinder angle of the preopercle; there are, however, rudiments of two or three more below. There are a number of genera, especially in northern Asia, several of which are peculiar to the great lake Baikal and others to Japan.¹



FIG. 28.—Skull of fresh-water Millers-thumb.



FIG. 29.—Skull of Millers-thumb. After Girard.

The name-giving genus, *Cottus*, embraces nearly fifty species, most of which are very much alike and difficult to discriminate. They are most numerous in the northern portions of America and Asia, and less so in Europe; but in the latter continent is to be found the longest and best-known species, *Cottus gobio*.

Millers-thumb is the most generally used name for the species of the genus in England. Yarrell explains how it came into use: "The thumb, by a peculiar movement, spreads the sample over the fingers and, employed with tact, becomes the gauge of the value of the meal produced. Hence the saying, 'Worth a miller's thumb.'" The thumb of the miller of the olden time became thus spread out be-

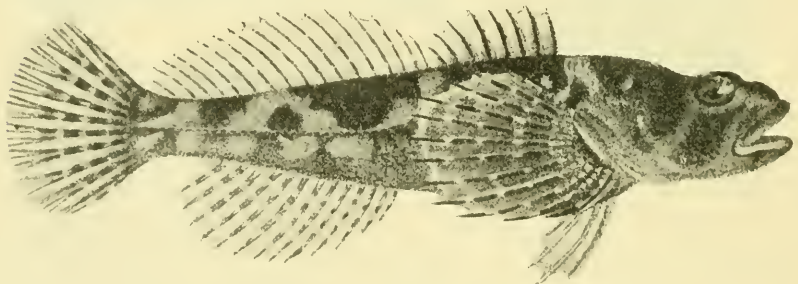


FIG. 30.—*Cottus gobio*. After Smitt (W. v. Wright).

neath the nail, and a likeness was fancied between it and the little fish. The name, however, is not the only one in use in England:

¹The *Trigloopsis thompsoni* of the Great Lakes, often associated with the Cottines or otherwise misplaced, is a typical Myoxocephaline, very closely related to the common *Oncocottus quadricornis* (*Cottus quadricornis* of most authors). The present author indicated this relationship as early as 1862 (Proc. Acad. Nat. Sc. Phila., p. 13).

Bullhead, Bull-knob, Bull-jub, Cob, Cod-pole, Cull, Harbeau, Noggle-head, Tom-cull, and Tommy-logge are applied in various restricted districts. None of these, unless it be Bullhead, was brought over to America by the early settlers, although it is said by Goode (1884, 259) that species are "known in some localities by the English name of Miller's thumb," etc. The name in most general use in the United States appears to be Blob; the primitive use of blob was for a bubble or drop, then for a splotch or blotch, and its transfer to a fish resembling a blotch when seen at the bottom of a stream was not unnatural. Other names applied in various parts of the United States are Bull-head, Muffle-jaws, and Spring-fish. Still more restricted are Stone-fish and Flying-fish, current, according to S. H. Gage, to some extent in central New York, the former being given because "it is found almost exclusively under stones," and the latter "from its rapid movements," which, however, are only manifest as short darts. Another name, Star-gazer, is a book name, originating from Dekay's ignorance of the relations of the fish so named, but adopted by a naturalist (S. H. Gage) of later times (1878). In Maine, according to Kendall (1904), in the Aroostook region, it is known as Rock Cusk, "from a fancied resemblance to the Cusk¹ (*Lota maculosa*); Brook Cusk is also given by Kendall (1908) for the same fish; Goblin is another name recorded by S. A. Forbes (1883) as a term for the *C. meridionalis* in Illinois; Mullhead, according to H. Smith (1907), is used in Virginia.²

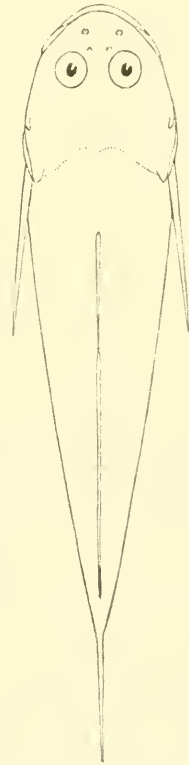


FIG. 31.—*Cottus gracilis*.
After Girard.

¹ The same idea seems to be prevalent in Sweden, where one of the names (*Stenlake* or Stone-burbot) recorded by Smith (p. 172) conveys the same idea as Rock-cusk.

² Numerous popular names given to species of *Cottus* in various countries of Europe are recorded for the Austrian Empire by Heckel and Kner; for Germany by Siebold and others; for Scandinavia by Smitt, and for France by Blanchard, Rolland, and Moreau.

III

The only species whose habits are known are several of the genus *Cottus*.¹ These have been referred by some authors to two genera, *Cottus* and *Uranidea*, but they are so very closely related that what is true of one may be predicated for the other. They agree in all structural details and size as well as appearance and have only been distinguished because *Cottus* has four soft rays to each ventral fin, while *Uranidea* has only three; the former includes all the European and most of the American species, while the latter, so far as known, is confined to America. Inasmuch, however, as individuals from the same pond may differ in the number of ventral rays, and even the same individual may have four rays in one ventral and three in the other, the groups must be reunited under the name *Cottus*.²

The species are so similar in most characters that they can only be distinguished by a close, critical examination. The differences are mainly in the trend and character of the large preopercular spine, the number and condition of the rudimentary spines, the number of rays (especially anal), the relative size of the head and other parts, the presence or absence of palatine teeth (of less significance than in most groups), the spinescence or smoothness of the skin, the size of the mouth, the character of the nostrils, and the color. According to Jordan and Evermann, there are twenty-two species of *Cottus* and nine of *Uranidea* found in the United States and Canada, but no two original investigators, at present at least, would agree as to the exact number. The species are nearly uniform in size, most of them attaining a length of about three to five inches, few less, and few reaching a length of seven inches, or, quite exceptionally, a little more.

There are no such sexual differences in the Cottines as occur among the Myoxocephalines, although the sexes are readily distinguishable by the great development of a genital papilla in the male and its absence in the female; there may also be a difference in the size of the head (it being broader in the mature males than in the females), in the development of teeth on the palatine bones, the

¹ A singular case of nomenclature occurs in Prevost's article "De la Génération chez le Séchot (*Mulus gobio*)."¹ This name occurs only in connection with the title, but is reproduced in the reprint of the article in the *Annales des Sciences Naturelles* (xix) in 1830. *Mulus* may have originated as a printer's mistake for *Cottus*; it could scarcely have been meant for a new generic name.

² For extent of variation in number of rays, see appendix to this article.

spinescence, and the size of some of the rays as well as the size of the body. Males appear to attain a larger size than the females, although the reverse is claimed by some.¹ All such probable differences, however, require confirmation and may vary apparently with the species.

The best observations on habits have been made on the *Cottus gobio* of Europe and the *Cottus gracilis* of the United States. The most notable on the former have been published by Newman, Heckel and Kner, Fatio, and Smitt; for the American species the best have been made known by S. F. Baird and Simon H. Gage; by the latter in "Notes on the Cayuga Lake Star Gazer," in "The Cornell Review" for 1878, pages 91-94, which merit exhumation from the obscurity in which they were buried.

IV

The species, numerous as they are, probably differ very little from each other in habits. All are inhabitants of fresh waters, though not all absolutely confined to such, and most of them of clear, cold

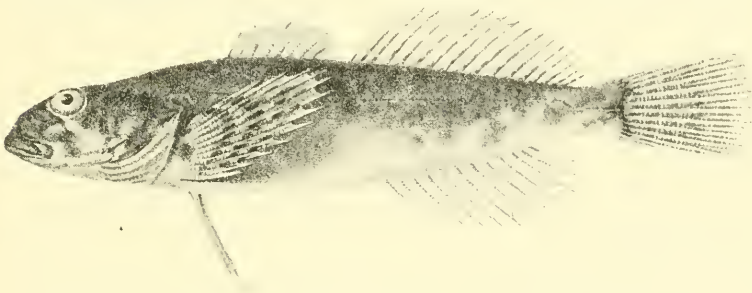


FIG. 32.—*Cottus gracilis* female. After *C. viscosus* Girard (Sonrel).

streams or lakes with a stony or rocky bottom. When in lakes, they affect the mouths of streams discharging into them. They are solitary most of the time, although where one is found, others may be lurking not far away.

S. F. Baird, who explored extensively the fresh waters of the northern United States in the early years of his life, summarized (1851) the results of his investigations of the most common of the

¹ My own observations have led me to believe that the male may attain a larger size than the female. Such was also represented to be the case by J. L. Prevost (1825). Fatio, a most careful observer, however, thought that the female was generally larger; he specified (p. 116): "Mâles présentant une tête plus largement arrondie en avant, avec une taille volontiers un peu moindre que celle des femelles." It is apparently a case of averages.

eastern cottids, *Cottus gracilis*, under the name *C. viscosus*: "These fish usually inhabit clear, spring waters, especially the spring runs which flow through rich meadows, bordered by turf, and having a shallow pebbly bottom. They lie concealed under projecting clods, flat stones, boards, or whatever may serve their purposes of concealment. On being disturbed, they usually hasten off to fresh cover, but sometimes remain motionless. Occasionally they occur in larger bodies of water, of less purity; but we have never seen them in creeks or rivers. Sometimes they are seen lying close to the edge of rivulets formed by leaking embankments, and where the water is far from clear. They always lie close to the bottom, and are never seen poised in the water."

According to Smitt, the common European species (*Cottus gobio*) "frequents shallow beaches and at spots of this nature is seldom

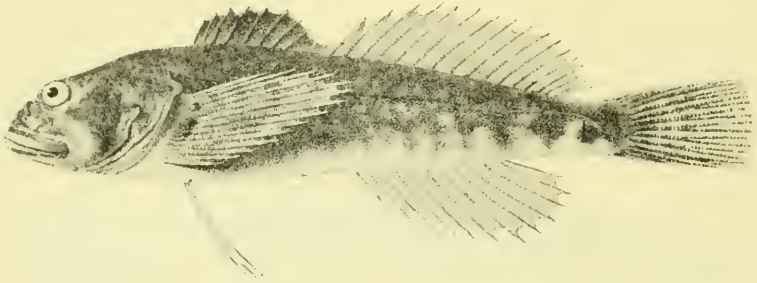


FIG. 33.—*Cottus gracilis* male. After *C. gobioides* Girard (Sonrel).

sought in vain, if one raises the stones. It is under them that it usually passes its time in quiet and inactivity," but watching for prey. Under a stone it may be often seen with its head or pectoral fins just exposed. "Its movements are quick; when driven from shelter, it darts with the speed of an arrow under the nearest stone or other suitable place of refuge." This peculiarity of lurking about stones has given rise to various names by which it is known in different parts of Sweden, as "*Stensugare (stone-sucker)*" and the like.

In dart-like movements the species resembles the little Perches of America known as Darters, and its American relatives indeed, to some extent, have been confounded with them. But, aside from the momentary darting movements, its actions are slow and laborious. It has, according to E. Newman (1856), "no power of sustained swimming, and never suspends itself in water like a true swimming fish; but it will occasionally make a forced march to the surface, working its enormous pectorals with great vigour and great labour. Sometimes such efforts extend even to a tour of the globe or vessel

in which it is kept, but after such extraordinary exertions it sinks down apparently exhausted to the bottom, and there for hours remains motionless."

Newman's observations have been corroborated by the present writer. The attitudes and movements of the Millers-thumb are, indeed, very characteristic. They contrast with those of the perches and minnows by their attachment to the bottom. There they will remain for minutes and perhaps hours, motionless save for the respiratory movements of the gill and mouth—about 40 a minute. Generally they rest on the exerted ventral or anal rays and the body is more or less tilted forwards and backwards. All the fins are erect and motionless, and the pectorals outstretched sideways. The eyes are lateral, but directed somewhat upwards, and they bulge on each side of the interorbital area. The color is partly accommodated to the ground on which the fish rests, and when that ground is grayish sand, the color closely approximates, although the bands are generally distinct. They are quite apathetic and may not be at all disturbed by some other fish approaching and rubbing against them. Sooner or later, however, one is impelled to move, and with a flirt of the tail darts forwards. It rarely goes more than two or three inches away unless very much frightened. If induced to swim, it does so by a wriggling motion and laborious exercise of the pectoral fins.¹

Another characteristic early (1856) insisted on by Newman is a certain change of hues. "There is something very remarkable in the changes of colour," and "these changes do not appear referrible to the ordinary tendency which the colour of certain fishes has to assimilate with the colour of the surface on which they are lying, but extraneous causes produce the effect; the swallowing a worm, the effort of a swimming adventure, and, on one occasion, the extrusion of ova, have produced such changes that the fish could not have been recognized under its altered aspect; the colours are various shades of gray and brown, and these are sometimes homogeneous, sometimes varied with great distinctness and brilliancy." Such changes of color surprised Gage, who experimented "over and over again to make sure there was no mistake." The change "from black to gray takes place in five minutes and sometimes even less." The "cause seemed" to Gage "to be the great fright and the light." Further, "upon studying them more carefully in an aquarium it was found that when the water became deprived of its oxygen they would pant like a suffocating animal, and become very pale, just as they did

¹The observations of the present writer have been chiefly made on fishes in aquariums at close range and repeated very recently (April, 1908).

when frightened. If the water is changed, these pale fish soon regain their natural color and respire slowly and regularly."¹

According to Gage, "If one be carefully watched at a considerable distance, the respirations, indicated by the alternate opening and closing of the mouth and gill fissures, will be seen to take place about forty times per minute. Now if one suddenly moves up very near the fish, not the slightest motion of the body or of the respiratory apparatus can be detected. If, however, one remains perfectly still for about half a minute and watches the gill-covers, he will see them commence to rise and fall very gently, and in two or three minutes the respirations will be as vigorous as ever. This experiment may be tried over any number of times and always with the same result. This is equivalent to holding the breath with the higher animals, and is apparently for the same purpose, viz, to escape detection."

One of the means of defense resorted to by the Millers-thumb is the puffing sideways of the head and the consequent extension of the preopercular spines. This may not only deter an enemy, but may entail serious consequences on one that attempts to swallow the little fish. Birds have been found dead with a Millers-thumb sticking in the throat.

The species are noted for voracity, and they are indiscriminate feeders. They are most active in search of food during the hours of darkness, as has been remarked by Fatio. "Insects, worms, gammaroids and other small crustaceans, or the fry or even the small fishes of no inconsiderable size" have been noted by Smitt and others as subjects of capture. They are even cannibalistic and do "not object to eating smaller brothers and sisters."

L. Lépinay (1907) records an instance of two individuals which had seized on the same victim, and the smaller, refusing to let go, was taken in by the larger one as far as the head, the greed resulting in death to both. When two or more fishes seize the same object there is a regular tussle and pulling to and fro, which reminds the observer of a couple of dogs tugging at a string.

Girard (1851) found only "insects and larvæ" in the stomachs of fishes he dissected. Six specimens, taken in southern Illinois and examined by S. A. Forbes, had eaten only animal food, about one-fourth of which consisted of fishes, one of which was furnished with ctenoid scales. Undetermined aquatic larvæ (thirty-six per cent) and other insects, were estimated at forty-four per cent of the food.

¹ The changes of color have been also especially noticed by Fatio (1882, p. 116, 117).

Crustacea, all belonging to the genus *Asellus*, eaten by two of the fishes, composed the remaining twenty-nine per cent."

But they are interesting to man, more especially on account of their destructiveness to fish-eggs. Inhabitants of the same waters as the Trouts, they are notorious for their ravages on the eggs of the latter fishes. They are consequently objects of detestation to pisciculturists and their numbers have sometimes to be reduced by special efforts. They crush the eggshells as well as the horny coverings of crustaceans and insects and reject them. A kind of mastication is thus manifested.¹

Fatio has well described the manner in which the *Cottus gobio* procures its food. It lays in wait patiently and motionless till a fit victim comes within easy distance, and then springs upon it before the incautious animal is aware of its danger. If the prey is comparatively large—a Minnow, for instance—it will be seized head first, and while it is gradually taken inward, the Cottid looks as if it were chewing with its pharyngeal teeth. At other times, without moving its body, it will blow a current of water against some small body suspended above and in this way make it fall towards itself. Such a feat (which the present writer has never witnessed) was several times observed by Fatio and reminded him of the superior skill of the Archer-fish of Java (*Toxotes jaculator*). The mobility of the eyes upwards is advantageous to the fish for such purpose.²

¹ Quoique doué d'appétits voraces ce petit carnivore paraît, en effet, ne pas goûter beaucoup les proies à enveloppes dures; du moins, je l'ai vu souvent happer par inadvertance et cracher de suite diverses sortes d'articulés. (Fatio, Faune Vert. de la Suisse, iv, 1882, p. 127. See also this article, p. 113.)

² Si la proie est grosse, un petit goujon ou un véron, par exemple, l'animal avalé, la tête la première disparaîtra petit à petit dans le gouffre qui l'attire, sans que le Chabot ait l'air d'opérer la moindre mastication avec les maxillaires, probablement sous l'action et la traction des dents pharyngiennes. D'autres fois, enfin, mieux nourri ou plus paresseux, notre *Cottus* usera de petits subterfuges pour amener jusqu'à lui les miettes qu'il désire; sans prendre la peine de bouger, il projettera ou soufflera, par exemple, un courant d'eau contre tel ou tel petit corps suspendu au-dessus de lui et qu'il veut détacher pour le faire rouler jusqu'à lui. Cette petite manœuvre, que j'ai eu l'occasion de voir exécuter plusieurs fois, rappelle, jusqu'à un certain point, l'adresse du *Toxotes jaculator* de Java qui projette, souvent à une distance de trois à cinq pieds, une goutte d'eau sur les insectes posés au-dessus de la surface, dans le but identique de les faire tomber et de s'en emparer (Fatio, op. cit., pp. 126, 127).

VI

Distinctive sexual characters become manifest during winter or spring, varying in time of development with temperature. The color of the males becomes more intense. "The female, the belly of which is almost monstrously distended during pregnancy, lays its eggs in March" in Sweden—both then as well as earlier or later, according to temperature, in other countries.¹ But first preparation is made for the deposit, and a hiding place is prepared by the male or female (it

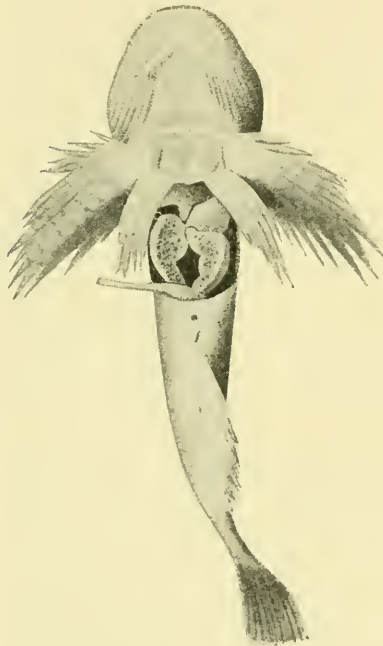


FIG. 34.—*C. gobio* male.
After Prevost.

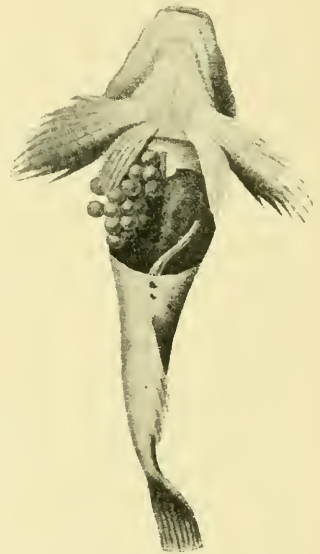


FIG. 35.—*C. gobio* female.
After Prevost.

is uncertain which) scraping a hole with its tail under a stone, or it fastens the deposit of eggs (which is in a mass about the size of a "sparrow's egg") to "stones or bridge-piles driven into the bottom."

¹ According to Baird (1851), the eggs of *Cottus gracilis (viscosus)* "are laid from the middle of April to the end of May, and are deposited in round packets about the size of an ounce bullet, under boards, stones, and in shallow, springy water. It is possible that they are watched by the parent, as we have frequently found individuals under the same cover as the eggs. The ova are of a rose color, and about the size of No. 3 shot, conveying the impression of disproportionate size."

The female then "deserts them, and the male takes" her "place as their protector and guards them for a month, until the young are able to shift for themselves."

Special data on oviposition or parental care have been published by Edward Newman and Simon Gage.

The fish observed by Newman was a female, and soon after its reception (March) it "extruded during the night a mass of ova, collectively equal in size to a sparrow's egg;" the eggs were "nearly transparent and enclosed in a tough envelope; the mass was closely adherent, somewhat reminding one of frog's spawn, but the ova appeared to have no mucilaginous covering. The number of ova must have been about a hundred." "Two mornings after their extrusion, the unnatural parent had torn the mass asunder and devoured the greater part of the ova, and before night the work of demolition was completed by the combined efforts of the Millers-thumb and two minnows." There was no male to assume guardianship. If there had been, doubtless he would have protected and taken charge of the eggs.

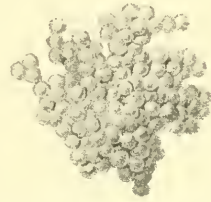


FIG. 36.—Eggs of *Cottus gobio*. After Prevost.

According to Gage, if one goes to the west shore of "Cayuga Lake from April to July, and lifts up flat stones in water twelve to fifteen centimetres deep, there will be found clinging to the under side of many of them an irregular conical mass of beautiful salmon-colored eggs; and under the same stone a Stargazer." Gage thought "the fish seems to have forethought," for the eggs "are never laid above the low-water mark of July; hence in April or May one must look in deeper water for them than in July."

Soland, in a work on the Fishes of Anjou (1869), has affirmed that, after hatching, the male continues his care of the young and remains with them until they are nearly full grown. No other observer has confirmed this claim, which is probably based on some error of observation or deduction.

VII

No detailed observations corresponding to those on the Sculpin have been published about the embryology of the Millers-thumb. J. L. Prevost long ago (1825) noticed the eggs and the newly hatched embryo, 5 millimeters long, but did not carry his observations further. Baird (1851) remarked that he had occasionally "found the eggs with embryos moving freely within the envelope. A

set examined April 22d, 1848, had the eye very distinct, and of large size. The foetal fin extended from the head, by the tail, to the anus. In the course of the day, many became liberated and swam about with the yolk-bag attached. This was sessile, and filled with a transparent, reddish liquid, excepting opposite to the embryo, where was a hard, yellowish cake. All [his] attempts at raising the young, or of development of the egg, failed for want of



FIG. 37.—Embryo of *C. gobio*. After Prevost.

“fresh spring water.” No later investigations have been published. From the figure given by Prevost, it appears that *Cottus* has a larger yolk-sac than *Myoxocephalus*.

Growth appears to be moderately rapid, but exact data are wanting. Specimens in the collection of the National Museum are not in sufficient number nor with exact dates of capture enough to enable

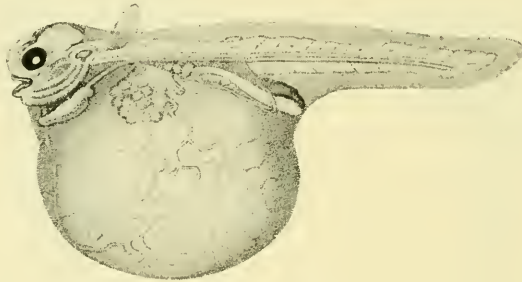


FIG. 38.—Fetus of *C. gobio* 5 mm. long. After Prevost.

one to distribute them according to size at any given period. According to Hartmann and Fatio the common Cottid of Switzerland (*Cottus gobio*) became capable of reproduction at the age of two years—that is, about the beginning of its third year.

VIII

None of the species are utilized for food in the United States, at least by natives. In Europe, however, they are to some extent employed—not in England, but on the continent. Moreau informs us that in France the quality of the flesh is variously appreciated; Smitt remarks that in Scandinavia “it is stated by many to be of extremely good flavour.” The flesh is “white, but is said to turn red when boiled,” in some localities, but, according to Day, “not so in others.” Fatio tells that in Switzerland the fish is much sought for, not only

by fishermen for bait for other fishes, but by lovers of dainties as an agreeable food.

In America, as already noted, the Millers-thumbs, under the name of blobs, are best known as destroyers of the eggs of the trouts as well as salmons, and as such do much damage, and are consequently regarded as pernicious pests.

The published data respecting the injury inflicted on piscicultural interests are scanty. Mr. F. M. Chamberlain, in "Some observations on Salmon and Trout in Alaska," compiled for the "Report of the Commissioner of Fisheries" for 1906 (issued December 18, 1907), simply reported that "the Sculpin or Bullhead would seem to be a more dangerous enemy to the Salmon fry than is the trout; it lurks under the stones in just such places as the fry will seek for shelter (p. 108); on the other hand, it has been asserted that the little fish not infrequently falls a victim to the old trouts (p. 107).

An appeal to the U. S. Fish Commission, and especially Dr. B. W. Evermann, Mr. J. W. Titcomb, Dr. W. C. Kendall, Mr. E. L. Goldsborough, and Mr. H. W. Clark, elicited confirmation of the charge against the Cottids. Mr. Goldsborough communicated data which are noteworthy, not only for their bearing on the matter in question, but also confirmatory of the deliberate manner of feeding previously described by Fatio; his communication is herewith given:

"In the fall of 1903 (September), while at the Salmon hatchery of the Alaska Packers Association, located at Loring, Alaska, I was watching and helping the men spawn the fish. We were wading around in the stream (Naha River) and many eggs were dropped into the water. These were at once gobbled up by the blobs (*C. gulosus*), hundreds of which were lurking around among and under the small stones in the stream. They were so voracious as to at once attract my attention. I got a handful of the fresh, soft eggs and pitched them where I could observe what happened. They were devoured in a few minutes by several blobs and sticklebacks. I kept account of the work of one little blob particularly, which was perhaps three or four inches long; it ate twenty of the eggs and hunted for more. The eggs were all devoured in perhaps two or three minutes. The fish would take a single egg in its mouth, puncture it to get the soft contents, then spit out with some force the soft shell, and immediately take another egg and do the same thing.

"The blob has since been recognized by the superintendent of their hatchery, Mr. Fred Patching, as so destructive to salmon fry that he has made a regular and persistent effort to capture them, and by using traps baited with salmon eggs he has caught thousands."

Cottids have been little used in medicine, but in Russia, according to Pallas, dried fishes were used by peasants as charms or amulets worn round the neck as antidotes against fevers.¹

APPENDIX

While engaged in the examination of Cottids many years ago, I was struck by the fact that there was unusual variation in the number of rays of the ventral fins and was convinced that it had not the systematic value which it might naturally be supposed to have. Recent observations have fully justified the skepticism. Especial observations were made with reference to the value of the number of ventral rays by W. C. Kendall in "Notes on some fresh-water fishes from Maine," published in the Bulletin of the United States Fish Commission for 1902 (XXII, 1904, pp. 361, 362). Dr. Kendall examined a large number of individuals of the *Cottus gracilis*. "Out of 28 specimens otherwise essentially alike from Caribou, 18 had 3 ventral rays in each ventral fin, 6 had 4 rays in each fin, and 4 had 4 rays on one side and 3 on the other. Of 15 specimens from six other localities in northern Maine, 4 had 3 rays in each ventral, 7 had 4 on each side, and 4 had 3 on one side and 4 on the other. Six specimens from Bear River, Newry, in the western part of Maine, had uniformly 3 rays in each fin."

Being desirous to have still fuller statistics respecting the structure of the ventral fins and the development of sexual characters in the genus *Cottus*, I requested Mr. Alfred C. Weed, assistant in the Division of Fishes, to compile certain data. He kindly prepared for me the results of examination of 50 specimens of the *Cottus richardsonii*.

¹ In cibo a nemine adhibetur, sed siccatum, amuleti instar, appendunt collo, ut pectus tangat, creduntque prodesse ad Tertianas abigendas. Pallas Zoögraphia Rosso-Asiatica, 3, 126. No special locality in the Russian empire is mentioned in connection with the superstition.

COTTUS RICHARDSONII¹

Number of specimens, 50.²

Number of males, 32.

Number of females, 18.

Number with ventral rays same on both sides, 45.

Number with ventral rays 3 right and 3 left, 38.

Number with ventral rays 4 right and 4 left, 7.

Number with 3 ventral rays on right side, 42.

Number with 3 ventral rays on left side, 39.

Number with 4 ventral rays on right side, 8.

Number with 4 ventral rays on left side, 11.

Number with more ventral rays on right side than on left, 1.

Number with more ventral rays on left side than on right, 4.

The only asperities found were a small patch of prickles in the axilla of the pectorals, extending caudad as far as the end of the pectoral. In 5 specimens (4 males and 1 female) these were apparently absent.

The sexes showed no noticeable differences in regard to the pectoral and ventral fins.

In the specimens from Labrador the longest dorsal spine was about 1/4 inch in males and about 3/16 inch in females, without regard to the length of the fish.

Males from Labrador were 2 1/8 inches to 3 9/16 inches long.

Females from Labrador were 2 1/4 inches to 3 1/8 inches long.

Males from other localities were 2 11/16 inches to 5 1/2 inches long.

¹The *Cottus richardsonii* has been called *Cottus ictalops* in recent ichthyological works by reason of the assumption that it was the species intended by Rafinesque under the name *Pegedictis ictalops*. Rafinesque's fish with "small scales," "thoracic fins with five rays," and "second [dorsal] with twelve" rays was, however, apparently the same as his *Etheostoma flabellare* and *E. fontinalis*.

²Number of specimens from Labrador, 42.

"	"	"	"	Wytheville, Va., 1.
"	"	"	"	White R., Ind., 1.
"	"	"	"	Vermont, 1.
"	"	"	"	Evanston, Ill., 1.
"	"	"	"	Alabama, 2.
"	"	"	"	Marshfield, Mo., 2.

A female from another locality was $2 \frac{5}{16}$ inches long.

As a whole, the dorsal and anal rays are a little higher in males. Other than this I can see no differences between the sexes except the structure of the post-anal region.

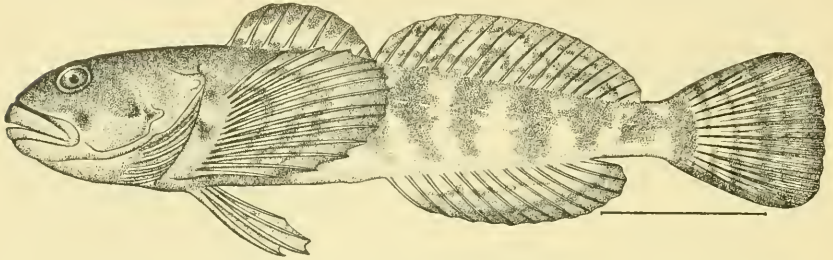


FIG. 39.—*Cottus punctulatus* (Gill).