

A REMARKABLE GENUS OF FISHES—THE UMBRAS

By THEODORE GILL

I

In 1726 Marsigli, in a volume on fishes in a series entitled *Danubius Pannonico-Mysicus* (tom. iv), for the first time described in a recognizable manner a small fish of lower Austria which was known to watermen as the Hundsfisch (dogfish) and which he called *Gobius caninus*. He likened it to the Cyprinid named gudgeon (with which indeed many watermen confounded it), and hence the name he gave it, *Gobius* being his Latin name for the gudgeon. That name was not applied in the spirit of the modern binomial system of nomenclature and consequently has not been adopted by modern naturalists. He indicated that the little fish lives in stagnant

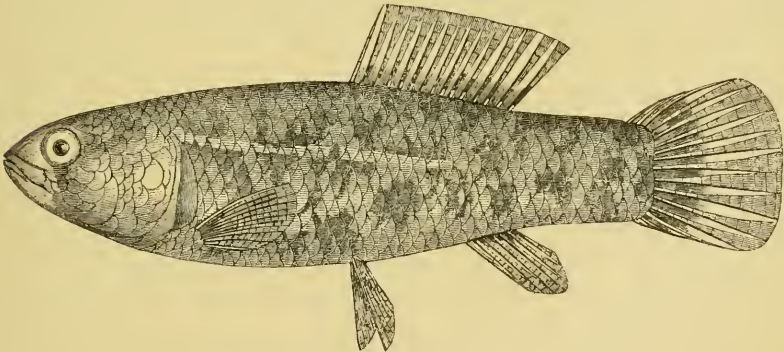


FIG. 34.—European Umbra (*Umbra umbra*). After Heckel and Kner.

waters and in caves, and that it is rarely seen; it is observed mostly in spring when it is carried by freshets into more frequented waters.

In 1756 W. H. Kramer, in an *Elenchus Vegetabilium et Animalium per Austriam inferiorem observatorum*, described the same fish as found in affluents of the Danube and caves in lower Austria, and he named it *Umbra*; the name was given as a generic term after a consideration and comparison of the genera of Artedi. The name was given because the species harbored mostly in grottoes where the light does not penetrate and consequently lived in the shade (*umbra*).

In 1777 J. J. Scopoli accepted the name *Umbra* as a generic designation and referred it to his second order (ordo 2.), distinguished by the subcylindrical body (*corpore tereti aut teretiusculo*). He interposed it between the genera *Esox* and *Albula* on the one hand and *Cobitis* and *Anableps* on the other. His diagnosis was equally applicable to almost all Cyprinodonts and doubtless, if the author had known such, he would have referred them to the same genus.¹ As it was, having adopted the genus from Kramer, the species described by Kramer was evidently the type.

By all later authors the type was overlooked or referred to the genus *Cyprinodon* and not till 1842 was it properly recognized. Then the illustrious Johannes Müller found that it was a very distinct genus and related not to the Cyprinodonts but to the pikes with which he associated it in the same family. A few years afterward (1846) Valenciennes proposed to isolate it as the sole representative of a peculiar family to which he only gave the name "Les Ombres (*Umbra*)" in common with the genus. He thought it was most nearly related to the Amias, from which it differed mainly in the absence of the suborbital cuirass (*cuirasse sous-orbitaire*) and the lingual bone; the simple non-cellular air-bladder further distinguishes it. Consequently he believed it was the type of a distinct family (le type d'une famille distincte) which he proceeded to define.

No representatives were recognized from America until near the close of the first half of the nineteenth century, and then several observers at nearly the same time obtained and described specimens from different localities. Jared Kirtland, in 1840, described one form under the name *Hydrargyra limi* from individuals obtained in northern Ohio; Zadock Thompson, in 1842, found the same species in Lake Champlain, and, failing to recognize it as the same as Kirtland's, gave a new name—*Hydrargyra fusca*—to it; in the same year (1842) James E. Dekay gave a new name (*Hydrargyra atricauda*) to the fish first described by Thompson, and having obtained from Rockland county, New York, small specimens of another species, he gave to the latter the name *Leuciscus pygmæus*. None of these authors recognized the relations of the new forms; they all, however, appreciated the likeness to the Cyprinodonts which actually exists, although the fishes really belong to a different family, while the last (Dekay) committed in one case an incomprehensible blunder, inasmuch as his *Leuciscus pygmæus* had none of the essential char-

¹ 256 *Umbra*, *Kramer*. Maxilla inferior longior. Dentes in maxillis. Caput et Abdomen *Cyprini*. Membrana Branch. oss. (6). Pinnæ inermes (7). *Scopoli* Introd. Hist. Nat., p. 450, 1777.

acters he assigned to the genus *Leuciscus* or that truly define the family of Cyprinids.

It was not till 1855 that the true relations of the American fishes were partially recognized. Two years previously (1853) Louis Agassiz had, indeed, referred to "*Charaxini* [*Characini*]" without adipose fin of I. [J.] Müller, of which a new genus occurs in the fresh waters of our northern and middle as well as western states, with a half a dozen species some of which," he continues, "have been unfortunately described as *Leuciscus*, *Fundulus* and *Hydrargyra*, with which genera they have no affinity, while other new ones have been described by Professor Baird and myself." He concludes: "I shall call this genus *Melanura*, from the singular black mark which all species show on the tail." Such is all the information communicated respecting the new genus, and no one could be certain what species were meant. But in 1855 Agassiz interposed a "Note on *Melanura* Agass." in a "Synopsis of the Ichthyological Fauna of the Pacific Slope of North America," affirmed that *Melanura* is the North American representative of the European *Umbra*, specified the species he would refer to it, and gave a diagnosis of it. The diagnosis contained no characteristic differentiating it from *Umbra*. It was regarded by Günther in 1866 as identical with it, and such is now the opinion of all ichthyologists.

In 1866 A. Günther gave the name *Umbridae* to the family recognized by Valenciennes twenty years before and referred all the American forms, under one specific name (*Umbra limi*), to the same genus as the European fish (*Umbra crameri*). The best idea of their relationship may be conveyed by the statement that they are Pikes in the guise of Killiefishes. They have scales with a peculiar ornamentation or structure, and these extend over the head, leaving only the snout and jaws naked (figures 35, 36).



FIG. 35.—Scale of *Umbra*.



FIG. 36.—Head of *Umbra*, from above.

II

The results of investigations thus summarized may be summed up in a few words.

The Umbrids or mud minnows are a feeble family represented by a single genus whose species are distributed in a notable manner. A single one (*Umbra umbra* or *krameri*) occurs in central and southeastern Europe, Hungary and the neighboring countries, and two others are inhabitants of the eastern slope of the American continent and the Mississippi valley, while all the intervening countries are deprived of them. They are scarcely distinct from the pikes and, as in them, the supramaxillaries form the lateral margins of the mouth, but the jaws are not produced and the teeth are all small and "villiform." In appearance, indeed, they are much more like Cyprinodonts (killiefishes) than pikes. The species chiefly frequent still waters and are most at home in muddy and reedy ponds or in clear ponds with a muddy bottom; they are also prone to resort to sequestered pools or caverns. They hide on or rather in the bottom, and where not one may be seen at first, numbers may be secured by drawing a net over the bottom and stirring up the mud. They are very tenacious of life and individuals have been kept by the writer for many months without change of water in moderate sized jars with water plants. Their behavior and carriage are characteristic and have been especially described by a number of naturalists, especially by Heckel and Kner (1858), C. C. Abbott (1884), and L. Kathariner (1899).

III

From authors already cited and from personal observations a tolerable biography may be obtained and the tale is of considerable interest.

In a clear pool some may be seen, if quietly approached, in mid-water, perfectly motionless, with the pectoral fins closed and stretched out and downward, at right angles to the trunk, and with the tips curved slightly forward, while all the other fins (including the ventral) are widely expanded; so they may remain for minutes at a time or with a slight movement of dorsal rays; then one pectoral may be expanded and its surface displayed forward and backward while the other fin may be appressed to the side. Another attitude often assumed is one of balancing in midwater, when sometimes a vertical position is taken, or even the back is inclined downward; the pectorals are then the principal fins used and are constantly moving in an undulatory manner, the fully expanded ones being for a moment outspread and horizontal to the length. Still another frequently assumed attitude is a "statue-like" one which has been also designated by Abbott as the "salamandrine position," and which is often maintained for several minutes at a time. "The body is frequently

curved when at rest, and remains so, the head being turned to the right or left, and the tail in the opposite direction. No one can fail to see the salamandrine appearance of this fish when it assumes such a position." The use of the pectoral and ventrals in such a state of

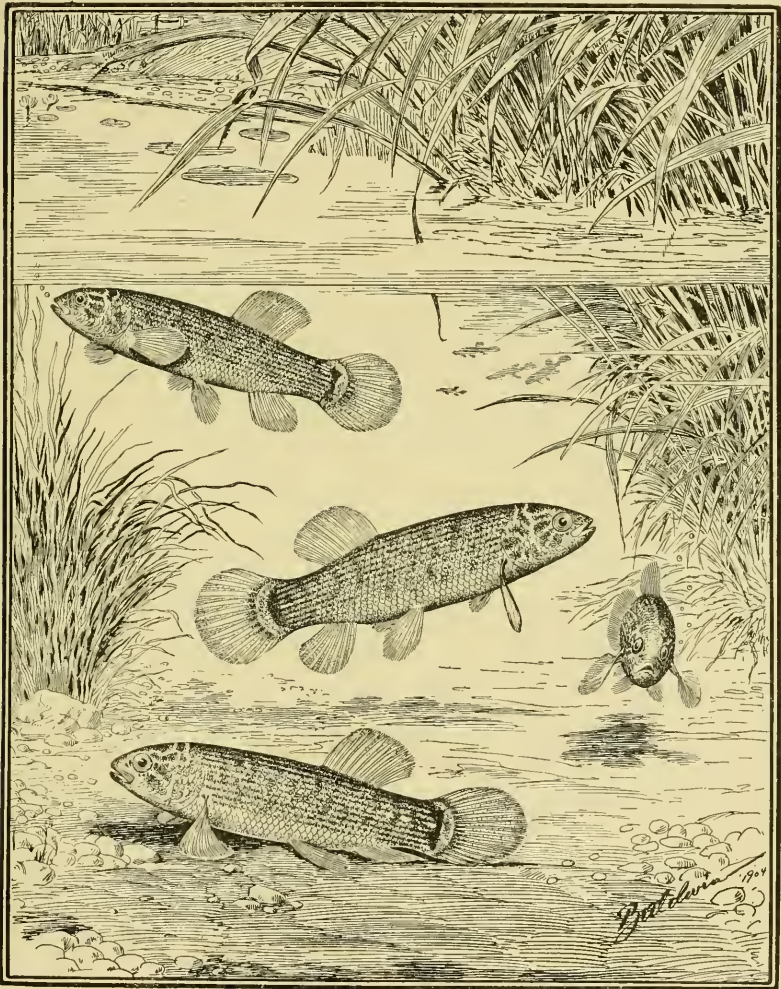


FIG. 37.—Various attitudes of Umbra. After life.

rest has been also likened by Kathariner to that manifested by the "salamandroid" or "sirenoidean" lungfish of Australia named *Neoceratodus*. The pectorals, he declared, are completely turned downward and perpendicular, and their ends, resting on the bottom, in consequence of the weight of the body are twisted outward and

backward; the ventrals are also extended downward and touch the bottom quite lightly. The body rests nearly parallel with the ground, and the caudal is somewhat upraised from the bottom, and the pectorals and ventrals can be used as props for the body. Heckel and Kner have remarked of the European species, that even when the fish remains still or floats, the last three or four rays of the very erect dorsal are alone in a constantly oscillating motion. And, strange to say, they add, the fishes remain thus at rest often for hours at a time, now in a horizontal, now in a vertical position, with the head turned either upward or downward. Then suddenly they all dart from the bottom to the surface with a quick movement of the tail, gasp for air, emit it again in diving as large bubbles through the gill-opening, and for some time afterward breathe very slowly. Heckel and Kner also remarked on their peculiar movements when swimming. The pectorals and ventrals are moved alternately, like the feet of a dog running, and the dorsal makes a quick wavy motion with all its rays, the like of which is seen in seahorses and pipefishes (*Hippocampus* and *Syngnathus*), which is effected by a peculiar disposition of individual muscles for the various rays of the fin.

But most of their life is spent at the bottom, and when a clear pool reveals no evidence of their existence, a little stirring up of the bottom may bring many to view. "On disturbing them, occasionally, instead of swimming, especially if the water is very shallow, they make a forward movement, by giving these fins a leg-like motion, indicated by leaving faint traces, thus: ((((((upon the sand." But it is also "often a voluntary movement on their part," and, in fact, "if suddenly disturbed, they generally dart off by swimming only, and bury themselves, tail-foremost, in the mud." They are perfectly at home there and Abbott claims that they "can pass through soft mud with as much ease [not quite!] as other fishes do through the clear waters." They are mostly carnivorous and do not appear to manifest any special preference for anything that is of the flesh, but their capacity is limited by their own size and that of their mouth. In a state of nature, they feed largely upon the aquatic larvæ of insects as well as crustaceans, and the eggs of fishes as well as young and small fishes. They also make excursions from the water in search of insects. "Unlike any other of our fishes," Abbott asserted, "the mud-minnow will leap twice and thrice its length above the surface of the water to seize a fly or beetle that happens to rest upon some overhanging blade of grass or twig." But, although mostly carnivorous, they are not entirely so, as has been asserted. Forbes (1883), indeed, found that, in the "mud

minnow" (*Umbra limi*) of Illinois, "vegetable food amounted to forty percent, chiefly *Wolffia*" (an aquatic lemnaceous plant), and "a considerable quantity of unicellular algæ was also taken by one; mollusks, eaten by two, were reckoned at five percent, all Physa; insects drop to fourteen percent, chiefly undetermined larvæ. No terrestrial forms were recognized. Corresponding to the greater development of the gill-rakers, we find the Entomostraca assuming greater importance in the food. These were reckoned at ten percent; three percent additional consisting of *Crangonyx gracilis*," a small amphipod crustacean. Five specimens of the *Umbra limi* obtained from a pond, "covered in September with a film of *Wolffia* and other vegetation," yielded to the dissector stomach contents consisting of sixty percent of the *Wolffia*; of the remainder "about one-fourth consisting of Entomostraca" and the rest of "unrecognized insects."

In captivity they will readily take small shreds of meat as well as their natural food. "When kept in aquaria they will devour any reasonable number of flies offered them, and undertake without hesitation to swallow earth-worms as large as themselves. Once they take hold of a worm, they never let go, but at least secure that portion of the animal between their jaws. Not only do they allow themselves to be fed, but they will leap above the water to seize any tempting morsel held above them." Long ago (1842) Zadock Thompson was struck by their power of accommodating themselves to different conditions and declared that they can "live longer than most fishes without water. During droughts, as the waters subside and recede from the caves, they have the power, by a springing motion, of transporting themselves from one little puddle to another. They also have the power of partially burying themselves and living in the mud and among the moist grass-roots, after the other small fishes associated with them are all dead for the want of water. In these situations vast numbers of them are devoured by birds, muskrats, and foxes."

This power of adaptation enables them to find a winter-home with the least waste of energy and loss of life, and to hibernate in the mud. The mud was found by Abbott in midwinter to be of "the consistence of cheese, though, of course, it was less firm when the fish entered it, weeks before." As far as he was "able to determine the fish had burrowed tail-foremost to a depth of from four to nine inches." In every instance "the tail was deeper in the mud than the head, the position varying from nearly horizontal to almost or quite perpendicular."

Abbott thought that when they "had gone into winter-quarters" in water from "three to five feet deep, the hibernating slumber was not as profound; and when they were placed in clear water, at a temperature of 40° Fahr., they almost immediately swam about, slowly at first, but with steadily increasing activity, and in from three to five minutes they were in full possession of all their locomotive powers and assumed the statue-like position common to them in summer."

Soon after the returning warmth of spring has liberated the fishes from their long confinement, or even before spring itself has arrived, they manifest renewed vigor and sexual excitement. They had previously segregated themselves, in large part at least, according to sex—males in one lot, females in another. Abbott found in the middle of one February that, "the weather being mild and spring-like and frogs singing at mid-day," they were in muddy ditches; a week later there were few of the fishes in the ditches, "but a vast number of females, heavy with masses of ova," had invaded "the swift, clear waters of the hill-side brooks," and they continued to ascend in spite of succeeding storms and cold—especially a heavy snow-storm. "Of the specimens taken from the rivulets at this time, none were males." "Certainly the females precede the male fish to the spawning-grounds." Abbott was convinced that "while these fish at the commencement of winter seek shelter from the cold by burrowing deeply in the mud, at the approach of spring they revive synchronously with the maturing of the ova of the female and the milt of the male, and, having thus recovered their wonted activity (during February and March) no severity of the weather appears to deter them from seeking out exceptionally cold waters for their spawning-grounds. This was shown by the snow-storm referred to, after which the female minnows were still found passing up the brooks, forcing their way up miniature cascades with all the agility of salmon, leaping from eddy to eddy, seeking out the most distant points from their muddy summer haunts; and here, where but little water flowed, and with the long grass and twigs projecting from it thickly coated with crystal ice and glistening frost," Abbott "found the plainly colored mud-minnows lying half-hidden among the pebbles and sandy ridges of the brook's bed."

But if Umbras ascend running streams as far as they can go to spawn, it is not because they cannot do otherwise. The fact that they abound in numberless ponds shut off from all running water is sufficient evidence that they can reproduce in still water. They are said to have also spawned in confinement, as has been claimed by Seeley in case of the European species.

In like localities the eggs of the *Umbra* were found by Ryder (1886), "laid singly upon aquatic plants to which they adhere for a time by means of a thin coating of adhesive matter which invests them." The eggs are about a millimeter and a half ('1.6 mm.') in diameter. A peculiarity of the fertilized egg is that, at the time of the formation of the blastodisk, "the vitellus displays a most active amœboid activity of its substance," and Ryder remarked that he knew "of no teleostean egg" in which "such amœboid movements of the vitellus are so pronounced and rapid." On or about "the sixth day" after oviposition, "the young mud-minnow leaves the egg," and "three days after hatching the air-bladder becomes apparent as a fusiform vesicle behind the pectorals and above the foregut, when the young fish is viewed as a transparent object." Then "pigment is rapidly developed upon the upper and lateral aspects of the body, and by the sixteenth day the larvæ have become pretty dark in color, when observed from above."

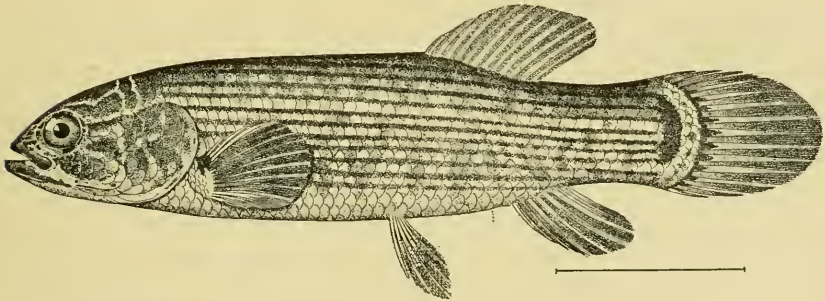


FIG. 38.—Western Umbra (*Umbra limi*). After Jordan and Evermann.

The mud-minnow is an excellent fish for aquaria, as it will live under conditions which other fishes cannot stand. Some kept in a small jar lived for months without change of water save for that supplied only sufficiently to compensate for what was lost by evaporation. The only plants for keeping the water clear were some Oscillariaceous confervæ. The fishes would ascend from time to time to the surface and reject bubbles of air (carbonic acid gas) and take in with a gulping action fresh air. Some were kept for about a year by the present writer in a large glass jar; during an unusually cold period the water froze solid and the jar was broken. The lump of ice was allowed to melt gradually and all the fishes revived and swam about as lively as ever in the new receptacle furnished them. A sudden transfer of frozen fish to "temperate" or summer water was found to be injurious or even fatal.

The European *Umbra* could not be induced by Heckel and Kner to spawn in captivity, and a female which was kept for a year in a small garden basin perished because, although filled to distension with eggs as large as millet seeds, it could not relieve itself of them. When one of a company dies, the rest soon follow it.

The Umbras have no economic value and are even considered by many to be poisonous. For a time at least in bygone years they were frequently to be seen in the markets of Vienna generally mixed up with a loach (*Misgurnus fossilis*), but not sold independently. Of course they were not sought for or caught intentionally, but simply scooped up with other contents of the net. Fishermen indeed, it is said, have a superstitious belief that it brings bad luck to catch Umbras.

IV

Three species of the genus and family are known, distributed and distinguished as follows:

UMBRA UMBRA (*Umbra krameri*): the European Umbra.—South-west Europe, especially Hungary.

The body is light brownish and has lighter longitudinal lines on the rows of scales including and below the lateral line as well as more or less irregular darker spots scattered over the surface. There is no precaudal bar but a trace of one on the caudal fin near its base. An indistinct darker area exists on the scapular arch behind the branchial chamber. The head has a suborbital spot sometimes developed as a transverse bar. The fins are immaculate.

UMBRA LIMI: the Western Umbra or Mud Minnow.—Basins of the Great Lakes and Ohio and Illinois rivers, in weedy streams, ditches, and pools.

The body is very dark brown relieved by about twelve to fifteen vertical narrow lighter bands, some of which often coalesce; the last is bounded by a blackish precaudal bar and there is a lighter bar on the caudal fin near its base. A silvery bar is on the scapular region behind the branchial chamber. The head has a frenal band extending from snout on to operculum, but skipping eyes. The fins are immaculate.

UMBRA PYGMÆA: the Eastern Umbra or Mud Minnow.—Atlantic slope from Connecticut southward to South Carolina in lowland streams, ponds, and pools.

The body is light brown and has about as many longitudinal light lines as rows of scales, that along the lateral line being most vivid. There is a very distinct blackish precaudal bar or vertical spot and a fainter bar at the base of the fin. A silvery band is developed

behind the branchial chamber. The head has a bridle-like band extending from the snout on to the operculum, skipping the eye. The fins are immaculate.

There are slight structural differences in proportions of body, head, and fins between the several species, but they are so unimportant that they need not be specified here. The U. S. National Museum has numerous specimens of all the species. To Dr. Hugh M. Smith, Deputy Commissioner of Fisheries, the writer is also indebted for the opportunity to observe living individuals of the Eastern Umbra which were obtained by digging or dipping deep into the mud at the bottom of a run near the city of Washington.

It is really remarkable that, with such adaptability and such power of endurance as they possess, the range of the genus should now be so restricted. Restricted it undoubtedly is, for the European and American species must be the relics of a once widely dispersed group.

V

Here have been given the essentials of what is known respecting the habits and economy of the Umbrids. Several of the statements, however, require verification, especially such as refer to the segregation of the males from the females and the ascent of both upstream. The entire nature of the oviposition, also, should be especially investigated; and there are the history of the development of the young, the growth from season to season, and the age at which maturity is attained to be inquired into. The present sketch is, therefore, only a preliminary from which to start.