

NOTES ON THE LAMPREYS—PETROMYZONTIDÆ.

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In the fresh and brackish waters of the United States occur several species of the lamprey family.

The habits of this group of fishes are not well understood, and in the present discussion we shall be obliged to rely to a considerable degree upon the observations of European zoologists. In the United States these fishes, of whatever species, are generally known as "lampreys" and "lamper-eels," these names being also in use in England, where one of the smaller species, *P. branchialis*, is also known as the "pride," "prid," or "sandpiper." The name "nine-eye" is also common in England, a name which reappears on the continent in the "neun-äuge" and "neun-äugel" of Germany and Austria, and the "nejon ögon" of Scandinavia. This curious name has its origin in the eye-like appearance of the circular branchial openings, of which a considerable number appear on either side of the head. In the common "nine-eye" of England, however, there are really only seven, and, even if the eye be counted, only eight eye-like circles upon each side. In Germany the name most commonly in use is "pricke" or "bricke," while in France "lamproie" is their usual appellation, and in Italy "lampreta."

The lampreys are among the lowest and least specialized of fishes; although in form resembling the eels, they belong to a very different group, which, by Gill and others of our best authorities, has been considered a distinct class, and are not even entitled to be called fishes. So slight has been the progress in the scientific study of the lampreys that but little can be definitely stated about their geographical distribution, excepting that they occur in the fresh waters and along the coasts of the temperate regions of both hemispheres. The largest and best known species, and the only one which has at present any commercial value, is *Petromyzon americanus*, by most authorities believed to be identical with the *P. marinus* of Europe,* which occurs in the streams and estuaries of our eastern coast from Nova Scotia as far south at least as Cape Hatteras.

The key to the habits of the lampreys is found in the peculiar arrangement of their great suctorial mouth. In *P. marinus*, according to Émile Blanchard, this is completely circular, and forms a great sucker enormously capacious, surrounded by a fleshy lip studded with tentacles and supported within by a cartilaginous framework. This mouth is covered over its entire interior surface with strong teeth, arranged in concentric circles—some single, others double—the larger occupying the central portion, and the smaller forming the exterior rows. A large

* Günther's Catalogue Fishes of the British Museum, 8, p. 501.

double tooth, situated above the aperture of the mouth, indicates the situation of the upper jaw; a large cartilage, supporting seven or eight great teeth, represents the lower jaw. The tongue also carries three large teeth, deeply serrated upon their edges.

The structure of the intestine, which, as in the sharks, is provided with an extensive spiral valve, indicates that these animals are chiefly carnivorous in diet. They are said to feed upon worms, insects, and decaying animal matter.

Dr. Benecke, of Königsberg, Germany, and others have found their stomachs full of fish eggs. The structure of the mouth, however, would teach us, even in default of observations upon their customary mode of feeding, that they are semi-parasitic in their habits, attaching themselves to large fish by suctorial action, and, while attached, tearing the flesh of the fish with their marvelous mincing machine, which is composed of the teeth within the circular mouth, while they suck the blood of their victim. They are often found attached to the larger fishes, such as shad, sturgeon, and sharks.

Captain Atwood states that small lampreys of a bluish color are found attached to various species of fish in Massachusetts Bay, such as cod, haddock, and mackerel. They cling to the side of the fish beneath the pectoral and suck their blood until the flesh of their prey seems as white as paper.

There can be but little doubt that to the lampreys may be credited an immense destruction of the various food-fishes which enter estuaries and rivers. It is by no means uncommon for fishermen to find them attached to halibut and other large species caught at sea. Lampreys are found far inland, ascending most of the creeks and rivers of Central Europe and of temperate North America far toward their sources. In fact the distances from the sea, at which the so-called sea-lamprey of Europe is constantly found, are so great, when their feeble powers of locomotion are considered, that Dr. Günther in his essay on the fishes of the Neckar was induced to advance the theory that they are carried from the sea to the river sources by the shad, salmon, and other fish to which the lampreys attach themselves. This view is combated by De La Blanchere, who claims that no one has ever seen lampreys attached to salmon. If I am correctly informed, salmon are largely annoyed by lampreys in the United States, but it seems hardly necessary at present to accept Günther's theory in the fullest extent, since the lamprey is apparently not much inferior to the eel in powers of locomotion, and the eel, it is well known, accomplishes long migrations without apparent inconvenience.

It has been customary among writers upon fishes to class the lampreys among the migratory fishes, and to describe the migrations of the sea-lampreys as beginning in the spring, when they are supposed to ascend the rivers for the purpose of spawning in their headwaters. This theory seems at present hardly tenable; so little, however, is

known of their habits that the theory cannot be pronounced absolutely incorrect. There are, however, certain species of lampreys in Europe which are believed to live entirely in fresh water. A similar statement can most positively be made regarding our species inhabiting the Great Lakes and other inland waters of North America. On the other hand, many of the sea-lampreys remain in salt and brackish water throughout the year. There appears, however, to be excellent evidence that some of the lampreys move from brackish water into fresh for purposes of spawning.

Benecke, speaking of the habits of the river lamprey of Northern Germany, remarks:

"Concerning the habits of 'nine-eyes' in the sea nothing is known. In summer they make their way from the Baltic into the Kurisches Haff and the Frisches Haff, and toward the end of September begin to ascend the rivers, and are caught in great numbers in baskets and pots. The ascent continues until January. In the upper reaches of the rivers they make their appearance in the early spring, and spawn in April and May in small schools in shallow places, where the water flows rapidly over shingly bottom. The act of spawning has been observed by us from year to year in the passage between the bridges at Braunsberg. After the eggs, which are one millimeter in diameter, grayish yellow in color, and entirely opaque, have been deposited in little masses, the lampreys die. The development of the spawn is extremely dependent upon the weather, so that during many years only a very small brood of young fishes makes its appearance. The young of this species have been found by August Müller in the Oder and the Alle, and in the latter (?) the drying up of one of its tributaries near the mill at Pinne gives an opportunity every year to collect hundreds of them in the bottom mud. They are never found partially grown, and we must believe that they go back to the sea, there to attain their full size."

Concerning the breeding habits of the brook lamprey, *P. planeri*, the same authority writes:

"The brook lampreys, like the allied species, feed upon little animals, and are found in almost all the clear brooks in Prussia, seeming never to migrate to the sea, although Yarnell claims that he has found them there. The clear gray, or grayish-yellow, eggs, which are one millimeter in thickness, are deposited in March or April. The adult fish gather themselves together in companies of from ten to fifty individuals to spawn in water of little depth, where the current flows swiftly over rough ground. In close proximity to each other they cling with their mouths to the bottom and their bodies streaming out in the current, squirming like the bodies of snakes. Every once in a while the observer can see a male, easily recognizable by its size and black color, seize upon one of the females with its suckorial mouth, and therewith firmly attaching itself to her close behind the head. The two then extend themselves with a powerful backward squirm, and, while the male with

a half turn of his body, brings his abdominal aperture close to that of the female, a part of her spawn may be seen flowing forth in a clear, semi-opaque flood. This action is repeated until the female has deposited all of her eggs. The young lampreys, when hatched, burrow in the mud. They require a period of four or five years before they reach the size of twenty centimeters."

It is now believed by many of the best European authorities that the parent lampreys die after spawning.

The development of the lamprey is exceedingly remarkable. It was first worked out thoroughly by Prof. August Müller, in 1856.*

The young was formerly considered to be a member of a distinct genus, *Ammocætes*. The young of the brook lamprey, *P. planeri*, which in a general way correspond to those of other species, are thus described by Professor Benecke:

"They are tawny yellow, without any trace of silvery hues, and have half-moon shaped toothless mouths, not intended for suctorial uses. Their small eyes are hidden deeply under their skins, and hardly visible. Their gill-openings lie in a deep furrow. The head is small and pointed, and the fins continuous."

It is a curious fact that as early as 1866 Leonhart Boldner, of Strasbourg, investigated and thoroughly understood the development and metamorphoses of the lamprey, as is indicated in the following paragraph translated from his work upon the water-birds, fishes, and other aquatic animals of Strasbourg:

"From August to December lampreys with eyes are not often seen and are rarely taken, but blind lampreys are found throughout the entire year. The lampreys with eyes and the blind lampreys are all of the same kind, for the young from the very beginning are all blind, and bury themselves at once in the mud as soon as they make their escape from the eggs. The blind lampreys develop no eggs until they develop their eyes."†

Like the eel, the lamprey was formerly believed to be hermaphrodite.‡

So far as I am aware few observations are on record which indicate the date of the spawning of the lampreys in this country. Wittmack, in his excellent work upon the Fishery Statistics of Germany, states that *P. marinus* spawns at Hameln in June, and in the Rhine at Zurich in March and April; *P. fluviatilis* in various parts of Northern Germany, chiefly in March, April, May and June, though in the Kurisches Haff also in November, December, and February. In Bavaria their spawning season is from March to June; in Austria, in April and May; and in Switzerland, in March and April. *P. planeri* is said by the same author to spawn in Pomerania in May, in the Rhine provinces in March and April, in Hanover in May and June, in Gotha in March and April,

* Müller's Archiv für Naturegeschichte, 1856, p. 325.

† See Von Siebold, *Süsswasserfische Mittel-Europas*, p. 378.

‡ Sir Everard Home in Philosophical Transactions, 1815, p. 266.

and in Lower Bavaria in May, June, and July; in the Tyrol in March, April, May, and June, and in Switzerland in March and April. In the rivers of Connecticut, where a lamprey fishery is still carried on, lampreys are reported to be abundant in May and June; and it is probable that these months are included within the period of spawning.

The artificial propagation of the lamprey was first successfully accomplished on the 24th day of May, 1879, when Herr M. Frauen, employed by the German Fishery Union in gathering sturgeon eggs in Schleswig Holstein, fertilized the eggs of the river lamprey and placed them in a breeding box. Between June 3 and June 16 many young were hatched out, and on July 17 the entire contents of the breeding box escaped.*

As has already been stated, it requires four or five years for the larval lamprey to undergo its metamorphoses and become capable of reproducing its kind. The sea lamprey, *P. marinus*, often attain the length of three feet, but those species which are found only in fresh water are usually much smaller.

The name *Petromyzon* signifies a "stone sucker," it being a common habit of these animals to cling to stones and pebbles. In swift currents this habit is of great importance to them, since it enables them to hold their own when their swimming powers would often be severely taxed. It is stated by careful observers that they have some way of transporting stones, and that they build nests, or rather circular fortifications of stone work around the crevices in which they lurk. As may be inferred from what has already been said of the manner in which they prey upon other fishes, lampreys are among the most troublesome enemies of many large species. Günther states that salmon have often been captured in the middle courses of the Rhine with marine lampreys attached to them. Milner, in his report on the Fisheries of the Great Lakes,† remarks:

"A parasite that troubles the sturgeon is the lamprey eel, *Petromyzon argenteus* Kirt., which is found very frequently attached to the skin. The circular scars and raw sores sometimes found upon the sturgeon, and attributed to this cause by the fishermen, are correctly accounted for in this way. It is probable that their natural food is the slime or mucus exuded in abundance from the pores, but they frequently retain their hold upon a spot until they have eaten through to the flesh, and deep ulcerous cavities occasionally result from the sore."

The lamprey was formerly highly esteemed as an article of food, and in early days is said to have constituted an important dish in certain civic feasts of Europe. It was once the custom to drown lampreys in wine and then to stew them. This process was supposed to impart a higher flavor to the flesh. It is stated by Lacépède that King Henry I, of England, came to an untimely end by too full a repast of lampreys. At the present time in Germany and France they are cooked in earthen-

*Circular der Deutscher Fischerei Verein, 1879, pp. 135-136, 159.

† Report of U. S. Fish Commission, Part II, 1874, p. 74.

ware jars with vinegar and spices, and are frequently seen among the relishes and *hors d'œuvres* brought upon the tables as a preliminary course. They are also highly esteemed in many other parts of the continent. At present in this country lampreys are but little prized except in certain portions of New England, particularly along the Connecticut River. Col. Theodore Lyman, in his report as fish commissioner of Massachusetts for 1876, states that the lamprey eel is a fish greatly esteemed by the country people of Massachusetts, and one which was formerly taken in amost incredible numbers in the Merrimac. It was found as far north as Plymouth, N. H., and by the Connecticut River, also, it passes into the same State.

In 1840 Mr. Joseph Ely took 3,800 in one night at Hadley Falls. It was then the custom of the country for each family to salt down several barrels of lampreys for winter use. "Now, in 1866," he continues, "this valuable fish has become nearly extinct in both rivers." This remark should be interpreted as applying simply to the headwaters of the Connecticut, since in the tributaries of its lower stretches there is still a considerable lamprey fishery and a large local consumption.

Mr. George Lyon, of Bridgewater, Conn., writes August 25, 1879:

"Previous to the building of the dam over the Hoosatic, at Birmingham, lampreys were taken in large quantities as far up the river as the falls in the town of New Milford; now none are seen above the dam. Men, standing over the falls on shelving rocks, could hook them, as they clung to the rocks with their suckers, by means of a large sharp hook fastened to a long pole, this hook being imbedded in the holes in the sides of their necks. Many people formerly salted barrels of them for their own consumption. Their use at present has much decreased, owing to the disturbance in the fisheries caused by the building of the dams. Those now used in the vicinity of Bridgewater are taken in the Hoosatic at Birmingham, and during the months of May and June are peddled though the country by the people who catch them."

Mr. N. M. Muckett, of Lakeville, Conn., states that in that vicinity the annual average catch is about 2,000, the implement of capture used being a pole about six feet in length with a hook at its end. The fisheries are located in Salmon River about two miles from the Connecticut, just above tide-water, and the lampreys sell in the markets of the adjoining villages at an average price of five dollars a hundred.

Mr. M. A. Hart, of Riverton, Conn., says that thirty years ago, and before, lampreys were found in the Farmington River in the vicinity of Riverton, but have long ago become exhausted. Quantities are sold in the city markets of Southern Connecticut, chiefly obtained in the Connecticut River in spring and early summer. They are easily caught with the hands, and fishermen in capturing them use mittens.