
HABITS OF SOME OF THE COMMERCIAL CAT-FISHES.

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The fresh-water cat-fishes of the United States of more or less commercial importance may be classified in a popular way as channel cats (*Ictalurus*), mud cats (*Ameiurus*), yellow cats (*Leptops*), and stone cats (*Noturus*). This arrangement is not wholly satisfactory, however, owing to the confusion of the common names, for a mud cat of one locality may be the yellow cat of another, and the yellow cat of some place be the stone cat in another locality, and so on. Then, too, there is no distinct line between channel cats and mud cats. The technical nomenclature and synonymy of these fishes are not in much better shape than the popular classification; therefore the discussion in the following pages will be more or less generic.

The cat-fishes are of such commercial value as food that there have arisen extensive and almost special fisheries for them in the South, the Mississippi Valley, and the Great Lakes region—that is to say, in the centers of their greatest abundance. Of about a dozen species appearing in the markets, probably not more than one-half are very common or merit more than passing notice. The largest are the “great forked-tail cat” of the Mississippi (*Ictalurus furcatus*) and the Great Lakes cat (*Ameiurus lacustris*). The first attains a weight of 150 pounds, the other perhaps 50 or more. Of the smaller cats the more important are the spotted cat (*Ictalurus punctatus*), Potomac channel cat (*Ameiurus catus*), and bullhead (*Ameiurus nebulosus*).

There is very little published information on the habits of any species of cat-fish, and it has been thought that it might be of use to bring together the most important published and otherwise available facts on this subject. Owing to the similarity of habits, for this purpose it is unnecessary to refer to more than those of the most common forms except in a very general way.

The cat-fishes are a hardy race, very prolific, in habits and structure comparatively safe from enemies. For these reasons wherever they occur they are usually very abundant. In late years, however, the demand for these fish has reached such dimensions that in some localities extensive inroads have been made upon their numbers and there has arisen the problem of how to repopulate the depleted waters. It has not, until recently at least, been considered necessary to resort to artificial propagation of cat-fishes, and there have been but few, if any, attempts in that direction. There are a few instances of pond culture, which will be referred to in another place.

Food qualities.—In flavor and other edible qualities the cat-fishes differ somewhat among themselves. As a rule the channel cats, especially the spotted cat (*Ictalurus punctatus* and *I. furcatus*), seem to possess more delectable qualities than the mud cats. This is possibly due to difference in habits and habitat.

Regarding *Ictalurus punctatus*, Jordan says (Bull. U. S. F. C. 1885, p. 34):

As a food-fish the channel cat is certainly better worthy of attention than any other American cat-fish. There is much less waste in the body of the channel cat than in other cat-fishes, as the latter lose more than half their weight by removal of the head, the entrails, and the skin. The flesh of the channel cat, when fresh, is very superior; it is white, crisp, and juicy, of excellent flavor, and not tough. It is much more delicate both in fiber and in flavor than that of the other cat-fishes. When well cooked, I consider it superior to that of the black bass, the wall-eye, the yellow perch, or any other percid fishes. Among other fresh-water fishes, it is inferior only to the white-fish, the trout, and other *Salmonida*.

Speaking of the blue cat (*Ictalurus furcatus*), Jordan & Evermann say (American Food and Game Fishes, p. 19):

In spite of popular prejudice to the contrary, the flesh of this cat-fish is of excellent quality, firm and flaky, of very delicious flavor, nutritious in a high degree, and always commanding a fair price.

Regarding the yellow cat, which they term the mud cat, the same authors state, on page 32:

Its flesh is of fine texture and of excellent flavor, and there is really no good reason for the prejudice against it which obtains in many localities. The fact that it is a large, rather repulsive-looking fish, not too cleanly in its habits, doubtless has something to do with this.

Mr. Charles Hiesler (Bull. U. S. F. C. 1882, 76-79) has written regarding *Ameiurus nebulosus* (?):

It is one of the very best of pan fishes, and has no noticeable bones. It retains its excellence as fresh fish as long as any fish and longer than most of them. It is eaten and relished by all classes of people, and they would eat more if they could get them. It is not salted down because the demand for fresh fish exceeds the supply. Its quality for table food will ever prevent its use for any other purpose.

The great popular demand testifies to the food virtues of the cat-fishes.

Habitat.—Almost any one of the species of cat-fishes seems to be adapted to a wide range of climatic conditions, although somewhat restricted to certain immediate surroundings. *Ameiurus lacustris* is supposed to be distributed from the Saskatchewan River and the Great Lakes to Florida. *Ameiurus nebulosus* is found from Maine to Florida; but in Maine this species occurs, as a rule, only in muddy lakes and streams with plenty of vegetation, and such portions of bodies of water of other character as afford those conditions, and apparently the fish do not stray far from home. Such localities are probably the warmest ones of the region. Regarding the local habitat of the bullhead (*Ameiurus nebulosus*), Dean says (Nineteenth Annual Report State Fish Commission, New York, 1890, 302):

It is one of the hardiest of fishes, will care for itself and even thrive in the muddiest of stagnant waters. It will breed readily and will endure complacently every hardship of drought, extremes of temperature, and lack of food.

Every trait of our cat-fish bespeaks its stagnant mud-loving nature; dusky in color, sluggish, and blundering, furnished with long and tactile barbels, a shallow, slowly drained pond, furnished with an occasional deep mudhole, will suit admirably the needs of the fish. If the water does become warm in the summer, the cat-fish will survive—knowing how to survive is one of its especial virtues. In a 3-foot aquarium at college about a dozen 9-inch cat-fish were kept during very warm weather, the room temperature often in the nineties and the water changed but once a day, with but few fatal results. Should the air supply in the water fail, trust the fish to care for itself. It will come to the surface, leisurely renew the air in its swim-bladder, and even, frog-like or turtle-like, swallow air in bulk, trusting to stomach respiration. Of undoubted respiratory value, moreover, must be the scaleless, highly vascular skin, so important in the breathing economy of the frogs. Should the pond dry,

and the whole pond basin be serried with mud cracks, the cat-fish will lie dormant for days, even for weeks. It has been found in a clod of mud, which served as a cocoon, until softened by the return of the water. In winter the cat-fish, like frogs, and unlike many of its neighbors, appears to hibernate. In November it becomes sluggish and refuses food, and early in December buries itself in the deepest ooze of the pond. It does not reappear till the first sharp thunderstorm in February or March. Then the fish are seen, thin and ravenous, approaching the shore so closely that their heads ripple the surface. So fearless are they in early spring in Central Park that they come in schools in shallow water and will take food almost from the hand.

The channel cats are so called owing to their apparent preference for channels of streams and clearer, cleaner water than that affected by the majority of so-called mud cats, though the native channel cat of the Potomac River, according to our present classification, is generically a mud cat (*Ameiurus*). In some Southern rivers, the St. Johns in particular, several species of cat-fish occur together with precisely the same kind of surroundings, whether muddy or sandy. The description of the method of fishing for cat-fishes in Atchafalaya River, Louisiana, given by Evermann (Report U. S. F. C. 1898, 290) indicates their habits sufficiently to warrant quoting from it under this head:

The Atchafalaya River is in some respects a peculiar stream. It has its sources in Avoyelles and Point Coupee parishes, near where the Red River joins the Mississippi, and is at all seasons more or less connected with both of those rivers by a number of anastomosing channels and bayous. The Atchafalaya River is, in fact as well as historically, one of the mouths of the Mississippi River, and during the floods which come periodically to that region a vast amount of the surplus water of the Mississippi and Red rivers is carried to the Gulf by the Atchafalaya. * * * There are four species of commercial cat-fishes handled by the firms at Morgan City and Melville, viz: The blue cat or poisson bleu (*Ictalurus furcatus*), the yellow cat or goujon (*Leptops olivaris*), the eel cat (*Ictalurus anguilla*), and the spotted cat (*Ictalurus punctatus*). * * * All river fishing during the fall and winter is done on the bottom, while all lake fishing is at the surface. During the spring, when the country is flooded, the fish betake themselves to the woods, and the fishing is then carried on chiefly along the edges of the float roads. The old tackle, which had been previously used in rivers and lakes, is now cut up into short lengths and tied as single lines, called brush lines, to the limbs of trees in such a way as to allow the single hooks to hang about 6 inches under the water. Each fisherman ties his lines to the trees along the edges of the float roads if he can find such territory not already preempted by some one else.

The spotted cat, previously mentioned as one of the most highly esteemed channel cats, thrives equally well in pond or stream. Regarding this species Jordan says:

The channel cat abounds in all flowing streams from western New York westward to Montana and southward to Florida and Texas. It is, perhaps, most common in Tennessee, Arkansas, and Missouri. It seems to prefer running waters, and young and old are most abundant in gravelly shoals and ripples. The other cat-fishes prefer sluggish waters and mud bottoms. I have occasionally taken the channel cat in ponds and bayous, but such localities are apparently not their preference. They rarely enter small brooks unless these are clear and gravelly. Whether they will thrive in artificial ponds we can only know from experiment.

Mr. J. G. Jones, referring to the speckled cat-fish as an artificial-pond fish, speaks of it as follows (Bull. U. S. F. C. 1884, 321):

It is naturally a pond fish, and found only in one locality in the South, at least such is my information and observation. That locality is in Flint River, running south and emptying into the Chattahoochee some distance below Columbus, Ga. Many years ago this fish was plentiful, being found only in still water, lagoons, or ponds. The Flint River runs through the Pine Mountain. Not far south or north of the mountain these fish cease to occupy the waters and inhabit only the tributaries to the rivers,

including a space of about 50 or 75 miles. Some time since I determined to try to domesticate them, and the effort has resulted in success. * * * They love a pond of clean water and a mud bottom. All the floods that come can not wash them from their home, unless the whole of the pond is carried away. They will not go into running water if they can avoid it. Disturb them and, like a carp, they will sink in the mud and hide. They can be caught conveniently in a gill net, but with great difficulty in a seine. My pond covers 5 acres of land, the largest and best pond in western Georgia. It is a perfect mass of fish, and has been constructed only eleven months. The water is from an inch to 5 feet deep and abounds in vegetation.

Food and feeding habits.—The cat-fishes are omnivorous, subsisting upon animal or vegetable food. In a strictly wild state the food is probably to a great extent animal, but they will eat almost any kind of vegetable matter fed to them in artificial inclosures. Mr. Jones further remarked regarding his domesticated cat-fish:

The species is easily tamed or domesticated. They can be trained like pigs; increase and grow fat when well supplied with food. They subsist upon vegetation, but in the absence of it can be fed upon any kind of fruit, such as peaches, apples, persimmons, watermelons, and the like, corn, wheat, and sorghum seed. I put fifty 3 inches long in a basket and set it in my pond. I fed them well on corn shorts and dough. In the short space of six weeks they grew to be 6 and 7 inches long and trebled in weight.

Jordan (l. c.) says *Ictalurus punctatus* is an omnivorous fish, though less greedy than its larger-mouthed relatives, and that it feeds on insects, crayfishes, worms, and small fishes, and readily takes the hook.

In some localities the mud cats swarm about the mouths of sewers and other places, where they obtain refuse and offal. This garbage-eating habit is, however, not confined to the mud cats, and the channel cats occasionally indulge their tastes in that direction. Slops from the galley and refuse from the toilet rooms of the *Fish Hawk* in the St. Johns River, Florida, formed a great attraction for the two principal cat-fishes of that region (*Ameiurus catus*? and *Ictalurus punctatus*). It is doubtful if the food, however foul, taints the flesh in any way, and this allusion to some apparently disgusting feeding habits can not consistently deter anyone who is fond of pork or chicken to forego the cat-fish solely on this account. Besides it is only occasionally and locally that these fish have access to such food.

Hiesler (l. c.) says that cat-fish appear to live on the larvæ of insects and on flies that fall into the water. "They never jump out of the water."

Writing of *Ameiurus nebulosus*, Dean (l. c.) says:

The habits of the cat-fish make it a most objectionable neighbor. * * * The stomach contents show its destructiveness to fish eggs and to young fish. * * * It will eat incessantly day and night, prowling along the bottom with barbels widely spread. It will suddenly pause, sink headforemost in the mud for some unseen prey. Nor is it fastidious in its diet, "from an angleworm to a piece of tin tomato can," it bolts them all. From the contents of miscellaneous cat-fish stomachs, however, there appears to exist a general preference for fish food. Professor Goode has already noted the attractiveness of salt mackerel or herring bait. He has, moreover, hinted incidentally that the fish will not bite when an east wind is blowing. It is in order to procure food in a lazy and strategic way that the cat-fish has been seen to sink in the mud with but barbels and dusky forehead exposed, ready to rush out and swallow the unwary prey.

In their feeding habits all species of cat-fish seem to be more or less nocturnal. They take a hook most readily from about twilight on into the night. Most set-line fishing is carried on at night. Moonlit nights, however, are more favorable than dark ones. On the St. Johns River it was noticed that the fish would begin to rise shortly after sunset, in large numbers, and the sound of their "breaks" could be

heard in all directions, although a lot of garbage thrown overboard would not fail to raise more or less of them during the day. The cat-fish here were wary of a baited hook, and although freely eating of pieces of bread or meat floating at the surface, if a hook and line were attached, it would never be touched. Yet a hook baited with meat or fish and sunk would usually be satisfactorily effective, especially if "bream" (*Lepomis*) began to bite first. The presence of other more readily biting fish seemed to attract the cat-fish and render them bolder. Large cat-fish would take a small baited "bream" hook much more quickly than they would a large hook. The mud cat here bit no more greedily than the channel cat. It might be well to state in this connection that the channel cats (*Ictalurus punctatus* and *Ictalurus furcatus*) are sufficiently game fighters to give an angler not too fastidious a very satisfactory battle. These two species might justly be classed as game fishes.

In northern lakes and streams the bullhead or hornpout does not always seem to be so wily as the southern cat-fishes were usually during the daytime. Although the best time to angle for hornpout is about dusk or after dark, they are not infrequently caught in the daytime, much to the annoyance of the "still fisher" for black bass, pickerel, and other fishes. When hornpouts begin to bite, if other fish are desired, it is necessary to seek another berth. They will take live-fish or dead-fish bait or frogs with equal readiness. If, however, hornpouts are wanted, angleworms are the best bait.

Spawn-eating habits.—Dean has referred to the fish-egg-eating propensity of *Ameiurus nebulosus*, and to show that this species is not alone in this ovivorous habit it may be stated that on the Potomac River a seine haul was estimated to contain about 10,000 cat-fish (*Ameiurus catus* and *Ameiurus nebulosus*). A large number of these fish were opened and their stomach contents examined. They were found to have been feeding almost exclusively upon herring (*Pomolobus*) eggs, to such an extent that their stomachs were distended with the eggs. Mr. Harron, at whose fishery this observation was made, told the writer that although these large hauls were not frequent, occasionally much larger ones were made. In Albemarle Sound, during one shad season, the writer frequently found cat-fish full of shad roe, but cat-fish were not abundant at this time. It is obvious, then, that cat-fishes are very destructive to the eggs of other species.

Under the heading "Salmon not injured by cat-fish," in the Bulletin of the U. S. Fish Commission for 1887, page 56, Mr. Horace Dunn makes the statement:

Word has gone out that cat-fish have been taken in Suisun Bay [California] whose stomachs were full of young fish and salmon spawn. Upon this statement the cry has been made that the cat-fish were destroying both spawn and young salmon. The facts of the case are that the cat-fish were caught in the vicinity of a salmon cannery, and that the spawn was among the fish offal thrown into the bay, and the young fish were "split-tails" and not valuable for food purposes.

The facts of the case as stated do not prove that cat-fish may not be injurious to salmon. The chances are that if they would eat salmon spawn as offal, and living "split-tails," they would eat naturally deposited spawn and young salmon of the "split-tail" size if they had access to them.

Dr. Hugh M. Smith says (Bull. U. S. F. C. 1895, p. 387):

The cat-fish have a reputation among the California fishermen of being large consumers of fry and eggs of salmon, sturgeon, shad, and other fishes. This accords with their known habits in other waters. Mr. Alexander's examination, however, of the contents of several hundred stomachs of cat-

fish in California and Oregon yielded only negative results as to the presence of young fish and ova. Writing of the bullhead in Clear Lake, California, Jordan & Gilbert say that it is extremely abundant and is destructive to the spawn of other species. The scarcity of the valuable Sacramento perch in that lake, which they attribute to the carp, here as in the Sacramento River, may be partly due to the more numerous cat-fish, which feed almost exclusively on animal matter.

Breeding habits.—Probably less is actually known of the breeding habits of most of the species of cat-fishes than of their other habits, yet observations have been made upon two or more species with sufficient detail to warrant the assumption that in the main the habits of most species are essentially alike. Speaking of *Ictalurus punctatus*, Jordan says that it spawns in the spring, but that its breeding habits have not been studied. Mr. Jones says this species spawns when one year old, and twice a year—in May and in September. In the preceding spring he procured eight wild ones. After feeding them well up to this time (October 31), they had spawned in May and September and filled his pond. He says that they take care of their own young and trouble no other fish.

Ryder (Bull. U. S. F. C. 1883, p. 225) thus describes the breeding process of a pair of Potomac channel cats (*Ameiurus catus*) in the aquarium at Washington:

A number of adult individuals of *Ameiurus albidus* were brought from the Potomac River to the Armory building at the instance of Lieut. W. C. Babcock, U. S. N., and Colonel McDonald, and deposited in the large tank aquaria of that institution about the close of the shad-fishing season of 1883. One pair of these have since bred or spawned in confinement, and thus afforded the writer the opportunity of observing and describing some of the more interesting phases of the development of this singular and interesting family of fishes. * * * Its habits of spawning and care of the young are probably common to all the species of the genus, and are quite remarkable, as will appear from the subjoined account.

On the morning of the 13th of July, a little after 10 o'clock, we noticed a mass of whitish eggs in one of our aquaria inhabited by three adult specimens of *Ameiurus albidus*, two of which were unmistakably the parents of the brood, for the reason that they did not permit the third one to approach near the mass of eggs, which one of them was watching vigilantly. One of the individuals remained constantly over the eggs, agitating the water over them with its anal, ventral, and pectoral fins. This one subsequently proved to be the male, not the female, as was at first supposed. The female, after the eggs were laid, seemed to take no further interest in them, the whole duty of renewing and forcing the water through the mass of adherent ova devolving upon the male, who was most assiduous in this duty until the young had escaped from the egg membranes. During all this time, or about a week, the male was never seen to abandon his post, nor did it seem that he much cared even afterwards to leave the scene where he had so faithfully labored to bring forth from the eggs the brood left in his charge by his apparently careless spouse. The male measured 15 inches in length, the female one-fourth inch more.

The mass of ova deposited by the female in a corner and at one end of the slate bottom of the aquarium measured about 8 inches in length and 4 inches in width, and was nowhere much over one-half to three-fourths of an inch in thickness. The ova were covered over with an adhesive, but not gelatinous, outer envelope, so that they were adherent to the bottom of the aquarium and to each other where their spherical surfaces came in contact, and consequently had intervening spaces for the free passage of water, such as would be found in a submerged pile of shot or other spherical bodies. It was evident that the male was forcing fresh water through this mass by hovering over it and vibrating the anal, ventral, and pectoral fins rapidly. There were probably 2,000 ova in the whole mass, as nearly as could be estimated. All of those left in the care of the male came out, while one-half of the mass which he had detached from the bottom of the aquarium on the third day, during some of his vigorous efforts at changing the water, were transferred to another aquarium, supplied with running water, and left to themselves. Those which were hatched by the artificial means just described did not come out as well as those under natural conditions. Nearly one-half failed to hatch, apparently because they were not agitated so as to force fresh water among them and kept clean by the attention of the male parent. * * * When first hatched, on the sixth to eighth day, the young exhibited

a tendency to bank up or school together like young salmon. They also, like young salmon, tended to face or swim against the current in the aquarium, a habit common, in fact, to most young fishes recently hatched. * * *

On the fifteenth day after oviposture it was found that they would feed. While debating what we should provide for them, Mr. J. E. Brown threw some pieces of fresh liver into the aquarium, which they devoured with avidity. It was now evident that they were provided with teeth, as they would pull and tug at the fragments of liver with the most dogged perseverance and apparent ferocity. This experiment showed that the right kind of food had been supplied, and, as they have up to this time (August) been fed upon nothing else, without our losing a single one, nothing more seems to be required with which to feed them.

It is worthy of note that when pieces of liver were thrown into the aquarium the parent fishes would apparently often swallow them, with numbers of young ones eating at and hanging to the fragments. I was soon agreeably surprised to find that the parent fishes seemed to swallow only the meat, and that they invariably ejected the young fish from the mouth quite uninjured, the parent fish seeming to be able to discriminate instinctively, before deglutition occurred, between what were its proper food and what were its own young. As soon as the young began to feed they commenced to disperse through the water and all parts of the aquarium, and to manifest less desire to congregate in schools near the male, who also abated his habit of fanning the young with his fins, as was his wont during the early phases of development.

Regarding the breeding habits of *Ameiurus nebulosus*, Dean (loc. cit.) says:

In breeding habits the cat-fish still maintains its reputation for hardiness. It spawns rapidly, even when transferred to aquaria. The eggs are one-eighth inch in diameter and are adhesive, reminding one somewhat of frog spawn. The mass is deposited in shallows where the bottom is sufficiently hard to support its weight. The danger to the egg occasioned by stagnancy or muddiness of the water is carefully provided for; the male, standing guard, forces the water slowly through them. In some of the southern species, for thorough aeration, the male turns to account the operation of breathing, filling the back of the mouth often so full of eggs that the whole face and throat are distended. In the neighborhood of New York the spawning season is in the early part of April, and appears to last about a fortnight. Toward the latter part of the month the females go into deeper water. At this season (Central Park) of a dozen fish caught, ten proved to be males.

A similarity of breeding habits in *Ameiurus nebulosus* and *Ameiurus catus* is shown by comparing the observations^a presented in a paper by Dr. H. M. Smith to the American Association for the Advancement of Science and a notice^b of which appears in Science (February 13, 1903, 243) with the preceding record of Dr. Ryder. Dr. Smith observed:

A pair of fish from the Potomac River in the Fish Commission aquarium at Washington made a nest on July 3, 1902, by removing in their mouths upwards of a gallon of gravel from one end of the tank, leaving the slate bottom bare. On July 5 about 2,000 eggs, in four separate agglutinated clusters, were deposited between 10 and 11 a. m. on the scrupulously clean bottom. Ninety-nine per cent hatched in five days in a mean water temperature of 77° F. The young remained on the bottom in dense masses until 6 days old, when they began to swim, at first rising vertically a few inches and immediately falling back. By the end of the seventh day they were swimming actively, and most of them collected in a school just beneath the surface, where they remained for two days, afterwards scattering. They first ate finely ground liver on the sixth, and fed ravenously after the eighth day. The fish were 4 mm. long when hatched, and grew rapidly, some being 18 mm. long on the eleventh day, and at the end of two months their average length was 50 mm. Both parents were very zealous in caring for the eggs, keeping them agitated constantly by a gentle fanning motion of the lower fins. The most striking

^a See also Observations on the Breeding Habits of *Ameiurus nebulosus*. Doctor A. C. Eycleshymer. (The American Naturalist, November, 1901, 911.)

^b For the complete account see Breeding Habits of the Yellow Cat-fish. Hugh M. Smith and L. G. Harron. (U. S. F. C. Bull., 1902, 151-154.)

^c Italics by the writer to show close similarity to Ryder's observations.

act in the care of the eggs was the sucking of the egg masses into the mouth and the blowing of them out with some force. The fanning and mouthing operations were continued with the fry until they swam freely, when the care of the young may be said to have ceased. During the first few days after hatching, the fry, banked in the corners of the tank, were at irregular intervals actively stirred by the barbels of the parents, usually the male. The predaceous feeding habits of the old fish gradually overcame the parental instinct; the tendency to suck the fry into their mouths continued, and the inclination to spit them out diminished, so that the number of young dwindled daily, and the 500 that had been left with their parents had completely disappeared in six weeks, although other food was liberally supplied.

In Sebago Lake, Maine, in a shallow, sandy pool, on July 6, the writer observed one cat-fish (*Ameiurus nebulosus*), sex undetermined, with a brood of young thickly clustering under it, in the manner previously described. From Dr. Smith's observations, they might have been 8 or 10 days old; from Dr. Ryder's, about 15 days of age. They were about 12 mm. long. The development doubtless would be somewhat retarded in the cooler waters of this more northern latitude.

Introduction into other waters.—Several species of cat-fish have been successfully introduced into new waters in the United States, and attempts have been made to provide some European waters with American cat fish, with uncertain results, however. A detailed account of the results of the attempts to acclimatize cat-fishes in the Pacific States may be found in the Bulletin of the U. S. Fish Commission for 1895, 379. The cat-fishes handled were *Ameiurus nebulosus*, *Ameiurus catus*, and *Ictalurus punctatus*. In California the cat-fishes have become very abundant and widely distributed. In the lower Columbia and Willamette rivers they are also very numerous. In 1884 ten individuals, presumably *Ameiurus catus* or *nebulosus*, were transferred from the Potomac to the Colorado River in Arizona (Bull. U. S. F. C. 1884, 212). The shipment consisted at first of 100, only 10 of which survived the journey. Their status in those waters at the present time is unknown. Some spotted cats (*Ictalurus punctatus*) have been placed in the Potomac, of which species one or two now and then make their appearance in the catches of the fishermen.

A number of years ago, at different times, small consignments of *Ameiurus nebulosus* were sent to Europe. They survived transportation very well and the last accessible records show that they continued to do well after reaching their destinations. What the ultimate results have been the writer has been unable to ascertain.

Available records of shipments of young cat-fish (*Ameiurus nebulosus*) to Europe give the following data:

Nov. 15, 1884.—One hundred were shipped to Ghent and on the 28th of November 95 were received.

July 7, 1885.—Thirty sent to Amsterdam.

June 16, 1885.—Fifty shipped, and later 49 were received in Germany.

July 18, 1885.—One hundred sent to France, and 81 were received in good condition.

June 20, 1885.—Fifty consigned to England, and 48 were received in good condition at South Kensington.

The latest information possessed by the writer regarding any of these plants is found in early bulletins of the Fish Commission. The following is quoted from the Bulletin for 1886, 197–199:

The first practical attempt in this direction was made in Belgium. Mr. Thomas Wilson, United States consul at Ghent, first suggested placing cat-fish in the Scheldt, a river which, owing to the large number of factories on its banks, does not contain many fish. It was presumed that the cat-fish would be particularly adapted to the river Scheldt, because it had been sufficiently proved in America that

this fish is not much affected by the refuse from factories. After consulting with Prof. Spencer F. Baird, 100 young cat-fish arrived at Antwerp in November, 1884. By the advice of Professor Baird, these young cat-fish were not immediately placed in the river, but first in the large basins of the large aquarium. It is only after these fish have reached maturity in the aquarium and have spawned there that the young generation should be transferred to the river. This was done, and the young cat-fish received from America have provisionally been placed partly in a small pond in the Botanical Garden at Ghent, and partly in the Victoria Regia basin in the same garden. The selection of the last place we do not consider fortunate, as the temperature of the water in this basin is certainly much too high for these fish. At present there are in the Amsterdam aquarium 45 cat-fish, brought direct from New York and placed in a special basin with the hope that they will reach maturity and propagate their species. At present these fish measure from 4 to 6 inches long.

In the same bulletin, on page 138, appears the following, by Dr. Jousset de Bellesme, on the American cat-fish in the Trocadéro Aquarium of Paris:

These fish, which measured 12 cm. (about 4½ inches) in length, were, in the beginning, owing to their small size, placed in one of the tanks for young fish in the aquarium and remained there till November, 1885, when they were put in the large basin, No. 6.

They were first fed with raw meat, but as they did not seem to take very well to this kind of food they were fed on raw fish chopped fine, which they appeared to like. As soon as they were transferred to the large basin they were fed on live fish.

The water at the disposal of the aquarium is that which comes from the Vanne, whose temperature is 15° C. (59° F.) in August and 9° C. (48.2° F.) in December. It is hardly probable that this temperature is sufficiently high for the reproduction of the cat-fish. At any rate, those which we have in our aquarium, no matter to what variety they belong, have never spawned.

When the American cat-fish were transferred to basin No. 6 they were all alive and well, although they had not grown perceptibly. Since that time none of them have died, as far as we have been able to observe, for these fish have a habit of keeping in their holes and never coming out during the day, so that they are hardly ever seen. In basin No. 1 we had some of considerable size, and in order to assure ourselves of their existence it became necessary to empty the basin and carefully search for them at the bottom between the rocks. Even then we did not always succeed in finding them. I have, therefore, reason to believe that seven cat-fish which the Acclimatization Society has given us are still in existence, and the first time the basin is emptied I will search for them again in order to make sure.

Cat-fish are preeminently a poor man's fish. They not only afford him a cheap food-fish, but become so abundant in time and there is so much demand for them that they afford a paying industry, notwithstanding their cheapness. They may be raised in artificial ponds or in ponds unsuited to other fish. They propagate rapidly and prolifically and grow fast. Therefore there can be no objection to the introduction of them into waters unsuited to other fishes or in which other fishes do not occur, provided there is no danger of escape into waters where they would prove an undesirable acquisition owing to the objectionable characters already enumerated. The past attempts to introduce them into European waters, from the records cited, would seem hardly extensive enough to prove their adaptability or unsuitability to those waters