

52.—NOTES ON CARP AND FROG CULTURE.**By JOHN H. BRAKELEY.**

Two excellent plants for a spawning pond are the azolla and the water-chestnut.

THE AZOLLA.—This is a small cryptogam, with minutely imbricated leaves, and fibrous roots freely floating in the water. These little plants multiply rapidly, and early in the season will cover closely, as with a beautifully variegated carpet, considerable portions of the pond near its margin. They thus become suitable hiding-places for the different varieties of protozoans, where the latter find partial protection and have a chance to multiply. Later in the season I have frequently noticed the young carp working among the floating roots, evidently in pursuit of food. Besides their furnishing excellent pasture grounds for the young fish, they are decidedly ornamental. When growing in the shade their color is a rich green of various tints, while where they receive the full sunlight they are a beautiful purple.

THE WATER-CHESTNUT (*Trapa natans*).—This is also a floating plant, but with much longer roots than the azolla, so that it does not move about readily in the water. It is a phenogamous plant, but with an inconspicuous flower, its beauty consisting in its foliage. Though a native of India, where it is said to be largely cultivated for the nuts which it produces and which are used for food, it grows well in the ponds of our Middle States. The leaves are of rich deep green, with scalloped edges, floating in the water and forming a compact mass some 10 or 12 inches in diameter. It can be grown among other water-plants with very fine effect. It does well in water from $1\frac{1}{2}$ to 2 feet in depth, sending its fibrous roots nearly or quite to the bottom. The nuts, about the size of an ordinary chestnut, are formed beneath the leaves, and when not gathered fall to the bottom of the pond. There they remain till the following spring, when, in due time, the delicate, graceful leaves make their appearance above the water. The fibrous roots doubtless furnish an abundance of shelter, where water animalcules may hide and multiply, which they do with immense rapidity under favorable circumstances. In a pond warmly located and supplied with only enough water to make up the loss from evaporation the multiplication of these little denizens of the water is simply wonderful. It is said that one female cyclops will be the parent of over 4,000,000,000 in a single year. While many of these small creatures are eaten by the carp, others become the prey of the larger water larvæ, which eventually also become

the food of the carp. It is well then to encourage in our fish ponds the growth of plants with fibrous roots, like those named above, which, as indicated, will greatly increase their capacity for supplying food to the fish.

ARTIFICIAL FEEDING OF CARP.—Carp culture in this country has ceased to be an experiment. While many who received the stock allotted to each by the Fish Commission, through ignorance or neglect, failed to turn them to account, many others have entered upon the care of the fish with enthusiasm, and in their hands the result has been most satisfactory. While much is yet to be learned, sufficient is already known to assure us of the fact that food carp can be raised in private ponds with profit. In regard to them we can speak more confidently than we can of any other fish the cultivation of which has been attempted in modern times. Give them a warmly-located pond with muddy bottom, well supplied with aquatic plants, and free from all other fish, and from the common small reptiles, protecting them from kingfishers, fish-hawks, and bitterns; before they are thirty months old they will furnish you with an ample supply of delicious boiling fish, averaging at least 4 pounds in weight. This they will do with little or no artificial feeding. Then if you will arrange a suitable spawning pond, stocked with a few adult fish; and a growing pond, stocked with young fish, at the rate of 1,000 to the acre; with your market pond twice as large, so that when the growing fish are transferred to it at the beginning of their third summer, there will be 500 fish to the acre; you will have an establishment which will require some care, it is true, but which will make you ample returns in the shape of an annual supply of about 2,000 pounds of fish to the acre.

But results far beyond this may be secured by artificial feeding. Possessing, as they do, excellent digestive organs, few animals respond as readily to an abundant supply of food as do carp. Of this I have abundant proof. Take the following illustration: In a spawning pond, in which I had placed 12 adult fish, at the beginning of their third summer, one of them at least spawned during the season, as in the autumn in drawing the pond I found 15 young fish—all that had escaped the numerous enemies with which the pond abounded. Having ample room and an abundance of food, they had grown rapidly, attaining a length of from 7 to 10½ inches, and an average weight of 10½ ounces. Having so good a start for their second summer, at its close last October their average weight was 2½ pounds. This they did, too, with 2,145 young carp in the three-quarter acre pond with them. This is about 1 pound more than the average weight of their parents at the same age. Doubtless they would have been much larger at the close of their second summer had not the food resources of the pond been drawn upon by the large number of young fish which occupied it with them.

What their growth will be during the third summer is yet to be determined. During the corresponding period in the life of their parents,

they increased from an average weight of $1\frac{7}{16}$ pounds to $4\frac{1}{2}$ pounds—an increase of fully 300 per cent. Should these young fish make a proportionate increase during the next summer, they will attain a weight of 7 pounds. They may fall short of this, but having an extra pound to begin with, they will doubtless be very fine fish next autumn.

Other illustrations could be given, pointing in the same direction. From all which we conclude that if all the food carp will consume be given them their growth will be simply astonishing.

In regard to the economy of feeding carp artificially, the matter has been carefully tested in Germany. It has been determined, as we are assured on the best authority, that 1 pound of food containing a suitable proportion of albumen and the carbo-hydrates, and costing about 4 cents of our money, will produce an increase of 1 pound of fish flesh. As the food used is quite as cheap if not cheaper here than across the water, a similar result can doubtless be produced in this country, and with a very large profit.

FROGS EATING YOUNG CARP.—Frogs have a reputation for possessing a fondness for young carp. The dissection of a considerable number last summer satisfied me that this is no slander, and that small fish, including carp, enter largely into their bill of fare; hence they have no more business in a carp pond than have eels and water-snakes. Not only does the bull-frog (*Rana pipiens*), but also the smaller green frogs (*R. esculenta*) delight in a fish diet. One of the latter I caught in the act of trying to swallow a carp nearly as large as itself. By an expert dodge it escaped a blow of my cane, and left the carp dead, which measured 4 inches in length. On another occasion, while transferring the young carp to the growing pond, another green frog was seen to capture one, and, swimming away to a neighboring tussock, swallow it at its leisure.

Of the 12 bull-frogs dissected, one had in its capacious maw 4 brown mud-fish, the largest being 3 inches long. One only of the 12 had recently made a meal on carp, but had taken 2 to satisfy its appetite. These large frogs had drawn upon every department of animated nature for their supplies of food, including a full-grown meadow mouse, 1 young bird, 1 frog, 2 toads, 2 carp, 6 mud-fish, 1 mud-turtle, 1 potato-beetle, 2 curculios, 7 other land-beetles, 1 dragon-fly larva, 1 other water-larva, 2 bugs, and 2 green caterpillars. They are said also to eat the eggs of the carp. This is probably true of the smaller frogs, but the full-grown bull-frog, as well as the edible frog, seems to prefer larger game.

DO SNAPPING-TURTLES EAT CARP?—Snapping-turtles are said to be very destructive to carp—indeed one of their worst enemies. And this may be true as far as the small carp are concerned. As bottom feeders they would readily come within the reach of these vicious reptiles, who would only have to hide themselves in the mud and wait for the unsuspecting prey to come within the reach of their vise-like jaws.

But I have some evidence—though it is true only of a negative character—which would seem to indicate that they do not feed on carp of any considerable size; and as even this ill-favored, ill-tempered reptile is entitled to its due, I will give it. At the close of the summer of 1882 I placed my carp, then 40 in number, in my ponds, they having attained an average length of 13 inches and an average weight of 1 pound and 7 ounces. Knowing that snappers abounded, I gave special attention to their destruction, and during the summer following captured 40 of them, varying in weight from 3 to 10 pounds; and yet when the water was withdrawn in October, all the carp were there save one, which a fish-hawk was seen to capture. At the close of last summer, though many snappers had escaped the warfare made upon them during the previous season and continued the past summer, not one fish was missing. How many young carp they may have eaten, of course, I have no means of determining—enough doubtless to satisfy their hunger, but they evidently had no taste for large fish.

It is not so difficult to capture snapping-turtles as is generally supposed. Though the muscles which control the movement of the jaws are of great strength, yet since the cutting edges do not exactly correspond, they cannot bite in two an ordinary piece of twine. I have known one weighing 30 pounds to be caught on a piece of twine no larger than a stout fish line. Ordinarily strong twine, with regular snapper hooks attached, will hold them, care being taken not to let the bait (a piece of salted eel being the best) come so near the bottom that they can reach it when hooked with all four feet. If they can do this a large one will be likely to straighten out the hook or to break the line holding it. Besides this method of capturing them there are others quite as effective.

There being a considerable demand for them in market, they might be raised with profit were it not from the fact of their very slow growth. The female lays her eggs in the sand, with only a light covering over them, and as skunks are fond of them and make careful search for them, where this animal abounds snappers are not likely to multiply very rapidly.

RAISING FROGS FOR TABLE USE.—To those who have tried them, frogs' legs, when properly cooked, are a great delicacy; and, judging from our market reports, the demand is quite up to the supply. Can they be successfully cultivated as an article of food as other animals are cultivated, and, if so, will it pay? Some years ago I thought of establishing a froggery, and wrote to persons whom I supposed most likely to be posted on the subject, but could hear of no one who had had experience in this kind of culture. The great difficulty seemed to be to know what to feed them. With the tadpoles there was no trouble, as they are vegetable feeders, and abound in our carp ponds. Last spring I took $2\frac{1}{2}$ bushels from one of my ponds, they having gone safely through the winter; and in the fall took from the same pond five times as many. It seemed a great pity that there was no better use for them

than to turn them into guano. After their transition into froghood, they are no longer satisfied with a vegetable diet. But as they draw their supply of food from all departments of animated nature, it ought not to be difficult to supply their wants. At times their special food is abundant and easily obtained. Potato-beetles enter largely into their bill of fare, as do also caterpillars and curculios. All these are abundant at times, and an ample supply is usually attainable for a considerable portion of the summer. Brown mud-fish, too, is a favorite, which can often be obtained in large quantities in the ditches. True, they do not hesitate, occasionally, to make a meal on a fellow frog, but in the great multitude that could be readily raised, these would scarcely be missed. If they should require their food to be alive when they take it, there might be some difficulty in supplying their wants. But if they feed on the eggs of the carp, as they are said to do, I can see no reason why an artificial food could not be provided for them. Ground dried blood, or ground fish-scrap, mixed with boiled potatoes, might be put in such shape that they would feed upon it. The experiment could easily be tried by any one wishing to test it. An inclosure of a few square yards of water with a small space of dry land, having a base of boards rising 2 or 3 inches above the water, and surmounted by a fence of $\frac{1}{4}$ -inch mesh of galvanized wire 2 feet high, would make a very respectable froggery. If one did not care to raise them for market, a supply for home use would be no mean addition to one's larder.

BORDENTOWN, N. J., *December 26, 1884.*

MARKETING CARP.—Carp will probably make their appearance in the markets of our large Eastern cities next autumn in considerable quantities. The very large number distributed by the Fish Commission, being the hatch of 1881, spawned sparingly in the latitude of the Middle States in 1883. Next autumn these fish will be three summers old, the age at which they may be more advantageously marketed, where raised for profit. In some instances these will doubtless bring fancy prices. According to a newspaper report, a few sold last summer in Fulton Market, New York, at 30 cents per pound—fish said to have been caught in the Potomac River, having got there from the national carp ponds at Washington, D. C., during a heavy freshet. But whatever prices they may bring when they first make their appearance in market, they will ultimately settle down to a price which will be determined by their quality as food. Hence it is an important matter for those who are engaged in their culture that their edible qualities should be such that they will make a favorable impression on the public. As these qualities are to a considerable extent under the control of the culturist, I propose offering a few suggestions in regard to the best mode of preparing them for market.

(1) Always kill your fish as soon as taken from the water. This is much more important and has much greater influence on their edible qualities than is generally supposed. Having always found the pike

and catfish which I get at my country home much superior to those which I purchase in our city market, I have been accustomed to attribute this difference to something peculiar to the water of our antiseptic peat bottoms; but now I conclude that it is due rather to the fact that those in the country are killed as soon as caught, while those of our market are permitted to die a lingering death. In preparing poultry for the table, it would be quite as rational to hold the chicken's head under water till it ceased to breathe as to permit a fish to struggle in the air till dead. And as carp have great vitality this struggle will be kept up for a long time. The killing can readily be done by thrusting the long blade of a pocket knife under the edge of the gill-cover down through the fish, so as to sever the main artery. It will then bleed freely and die speedily, and leave no unsightly wound.

(2) Never take fish directly to market from a pond in which the bottom is strewn with decaying leaves. A market pond should be so situated that the leaves of deciduous trees will not blow into it, since they uniformly impart an unpleasant flavor to fish feeding on or among them. Carp have already suffered in reputation because of a neglect of this precaution. A part, at least, of the very few who have pronounced them an inferior fish have eaten them directly from ponds the bottoms of which were covered with leaves in a state of decomposition. If your market pond is so situated that leaves cannot be kept out it will pay to have large tanks constructed in which to keep them a couple of weeks before offering them for sale, or, better still, have live-boats built, with wire bottoms, and confine them in these, anchored in running water, a week or two before you wish to market them.

(3) Do not market your fish in summer. For the seven months beginning with October they are in season in the latitude of the Middle States. During the months of May, June, and July they are engaged in spawning, and are not fit to be eaten, and, besides, are not in proper condition for the table till some time after the spawning season is over. For home use a supply of those two years old may be kept in a small pond; and if this is supplied with spring water they will be found a fine table fish during any of the summer months; but the disposition of the general crop should be confined to the fall, winter, and early spring months.

Carp start off with a fine reputation as an excellent table fish. Not in Europe alone are they highly esteemed, but of the two hundred and forty persons in this country who gave their estimate to the U. S. Fish Commission of their qualities as a table fish, nearly all spoke of them in the highest terms. With care on the part of the culturists this reputation can be maintained and good prices secured.

ORDINARY GROWTH OF CARP.—Some very remarkable instances of the growth of food carp have been reported. Where a few fish have been placed in a pond warmly located, well stocked with aquatic plants, and where water insects abound as they usually do in such localities, their growth

has seemed wonderful, and yet it is probably not more so than is that of a pig of good breed, supplied with all the food of the best quality that it can digest and assimilate. In this particular of being able to consume large quantities of food and make a corresponding growth, carp seem to resemble this greedy animal more closely than any other with which we are familiar. What they will do at their very best is a question of much interest, yet of much less practical importance than to ascertain what growth they will make under ordinary circumstances; that is, placed in a suitable pond, and left to take care of themselves.

Careful inquiry in regard to a considerable number of the fish distributed by the Commission during the season of 1881 in the latitude of Middle New Jersey has led me to the conclusion that at the close of their third summer, or in the autumn of 1883, they had attained an average weight of $4\frac{1}{2}$ pounds.

In order to determine how nearly the growth of carp under an ordinary system of culture will compare with that of these particular fish, two facts must be taken into consideration. It must be remembered that the young fish distributed by the Commission were very small—much smaller indeed than fish of the same age bred under ordinarily favorable circumstances. Our national breeding ponds at Washington were taxed to their utmost to supply the wants of the thousands of applicants for young carp; and though of comparatively limited capacity, under the skilful management of Dr. Hessel, who has the special care of them, were made to yield 160,000 young fish for distribution; of necessity, therefore, they were small. While under ordinary culture young fish will during their first summer reach a length of from 3 to 4 inches, and frequently much larger, many of those distributed were only 2 inches long. It is obvious, therefore, that at the close of their third summer they would not have attained the size they would have done had they had a better start. No animal stunted while young will ever entirely recover, no matter how favorable the circumstances under which it may be afterwards placed.

And this brings us to the other fact referred to, namely, that many of these young fish were more favorably situated for rapid growth than young fish usually are in a well-established system of carp culture. One thousand fish to an acre of water for their second year, and half as many for their third year, is said to be a suitable number for ordinary ponds. But in providing for the fish received from the Commission in many instances comparatively large ponds had been prepared, so that the 20 little fellows found themselves the sole occupants of acres of water with abundance of food scattered everywhere around them, so they had opportunities for growth such as do not ordinarily fall to the lot of young carp.

The two facts named may be considered as about balancing each other, and the conclusion is reached that $4\frac{1}{2}$ pounds is the normal weight they may be expected to attain in this latitude, at the close of their third

summer, the time when those raised for market will be ready for the table.

If further observation shows that this rate of stocking ponds is the correct one, as I think it will, it is not difficult for the carp culturists to calculate what returns he may reasonably expect from each acre of his market ponds. Five hundred fish, each weighing $4\frac{1}{2}$ pounds, allowing a little over 10 per cent for loss, will make him 2,000 pounds to the acre. The price he will receive for them will depend upon their quality, in connection with his skill in marketing them; and their quality will depend much upon the manner in which they are prepared for market.

BORDENTOWN, N. J., *January 28, 1885.*

53.—TIME OF APPROACH OF FISH TO THE NEW ENGLAND COAST.

By N. E. GOULD.

The following is a statement of the several kinds of fish coming on our coast (the southeastern part of Massachusetts). The first fish that visit our coast are the alewife herring, which usually appear about the 15th of April. The present year the fish were seen on the 20th of that month. The alewife herring never school or appear on top of the water in large numbers in this vicinity, although large numbers of them are taken annually.

The next that come are the shad, which vary but little from the middle of April. The first caught the present season was on the 23d of the month. These, like the alewives, never school or seem to come to the surface of the water, but are caught during the month of May in considerable numbers.

The herring come about the 10th of May. This year the first caught here was on the 11th of the month. These are always seen in large numbers schooling at the surface of the water, and are seldom caught unless they are so seen. The first schools seen the present year were on the 11th of May.

The first mackerel put in an appearance on May 2, and the first schools on May 22.

The first bluefish came on the 27th of May, but no school until June 16, and these very small.

The first menhaden were caught on May 14, but no schools were seen during the season, although these fish were at a former time very numerous on this coast during the month of May. None have been seen schooling in large schools since the spring of 1875. Before that time they were probably the most numerous fish that passed along this coast.

UNITED STATES LIFE-SAVING STATION,

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