XXVI.—ON THE CULTURE OF THE CARP.

A.—ON CARP-PONDS.*

As the price of fish and of other articles of food is gradually increasing, greater attention is given to fish-culture, in order to have constantly on hand an adequate supply in ponds. These reservoirs are either natural sheets of water or artificial excavations. Those artificially constructed are, of course, preferable, especially when the greatest care has been taken to provide everything that will secure a good supply. Fish can also be reared in marl or peat bogs; yet, as a general rule, these are suitable places of abode only for the crucian carp, the roach, &c.; and fish from such bogs can be used only as food for other fish, such as pike and trout.

The two kinds of fish to which we direct our attention at present, in connection with pond-culture, are the trout and the carp. We shall confine ourselves in this article to carp-ponds, as these seem to be the more popular with us. In former times such ponds were quite common in Denmark, and traces of them may still be seen near many of our old castles and manor-houses.

The chief difficulty in rearing carp is, that a large number of ponds is absolutely necessary in order to meet the expense of culture, and to make the time and labor bestowed upon it remunerative. Wherever carps are raised, a complete system of ponds is arranged, the most important of which are those designed for the young carp, and those provided for the mature fish.

The *pond for young carp* forms, as it were, the basis of the whole establishment, and must be large enough to furnish young carp for the other ponds. If this is not the case, it is best to have several ponds for the young. Ponds having an area of from six to ten acres are considered the best. Such a pond must only be fed from field-ditches, and must by no means be connected with other ponds, brooks, or streams. In this way only is it possible to preserve the pond free from pike, which are the most dangerous enemies of the young carp. Immediately in front of the chief embankment, the pond must have a depth of at least five feet, while in other places two feet is sufficient. At its bottom a main ditch is dug out, into which several smaller ditches lead from the sides, so that in emptying the pond all the water can be drawn into a deeper

* Lidt om Karpedamme. [*anon.* Af A. F.] < Nordisk Tidsskrift for Fiskeri.—Ny Række af Tidsskrift for Fiskeri. Anden Aargang. Kjobenhavn. 1874. (pp. 79–84.)

ditch outside. By this means the young carp can gather in the inner ditches of the pond, from which they are taken. It is necessary to do this as quietly and quickly as possible, as the young fish are very tender, and speedily perish.

The pond for young carp should have flat and even banks, so that the sun may readily warm the water and thus quickly hatch the eggs which are pasted to plants and roots. Hence it is not necessary to introduce much fresh water during the spawning season, as the water in the pond would thus become too cold, and so retard, and even completely frustrate, the spawning and hatching process. During the spawning season (from the end of May till some time in July) the plants which grow in the shallow places should not be removed, and care should be taken that neither cattle, ducks, nor crows, as well as other birds, approach the pond. Nor should perch, tench, or other fish be allowed to enter it.

In those countries where carp are reared on a large scale, any piece of ground which seems suitable is taken as a site for a pond for the young fish, on the principle that the risk in raising any sort of grain is much greater than that of rearing carp. In consequence of the high price of fish, carp-ponds are now generally used year after year continuously, while formerly the piece of ground was used one year as a fish-pond and the next as a corn-field. It seems now to be the general opinion that the keeping of fish year after year continuously in the same pond has no deteriorating influence on their growth. When, however, the grass at the bottom of the pond begins to disappear and gives way to reeds, the pond ought to be drained, and then plowed and sowed with some grain. It is an easy matter, however, to arrange the ponds in such a manner as to be proof against such contingencies. It is of course necessary that the pond should be secure from inundations, and it is always an advantage if no spring flows into it or issues from the bottom. It is likewise important that the embankments should be made so strong as not to be easily broken. A clayey or pulverulent bottom is preferable to any other.

It is best to stock the pond for young fish in the spring, when there is no longer any danger of severe cold or snow. Two male carp, which ought not to be less than four nor more than seven years of age, are taken from the winter pond and placed in the pond for young fish, the number of fish taken, however, being in proportion to the size of the pond. Besides these fish, there are put into the pond about ten strong carp, three years old; from forty to fifty two years old; and about six hundred one year old. Care should be taken that all these fish be placed in the pond in as perfect a condition as possible, and that they be put down carefully in shallow places, so that it may be readily seen whether the fish continue strong and healthy. Fish which have lost some of their scales, or which have been injured in any other manner, grow slowly. The experience of many years has proved that carp which are ready to

spawn, spawn but rarely, if there are no young carp in the same pond. But even if the mother carp, notwithstanding all the care taken, should not spawn, the pond would thus still yield some profit.

We cannot give here, in full, all the different regulations to be observed in transplanting fish; they are, on the whole, the same as those used in shipping any live fish. The main thing to mention is, that in emptying a pond for young fish, it should be done slowly, so as to allow the fish sufficient time to collect in the ditches at the bottom of the pond. While the process of emptying is going on, every other opening should be closed in order to prevent the carp escaping.

The *ponds for grown fish* may cover an area of about sixty acres. Carp two and three years old are kept in these ponds, and even sometimes those only one year old, provided the pond can be preserved free of pike. If, however, fish one year old are not placed in these ponds, no fear need be entertained of pike, especially if a grating has been placed at the openings where the water flows in and out, since this permits the passage of small pike only. Great care must be taken not to allow the fish to slip out. When it rains hard and the flow of water is considerably increased, the young carp will immediately swim against the current even into narrow and shallow ditches; there it becomes an easy prey to various animals, or else, remaining there after the water has flowed off, dies on the dry ground.

Carp ponds are used exclusively for rearing carp that are more than two years old. Two-year-old carp, after having been kept for two full years in these ponds, ought to be fit for sale; and three-year-old carp ought likewise to be ready for sale after having been kept there for one year, or, at any rate during one whole summer. The growth of the fish will be dependent on the nature of the soil and the character of the water. The water will be most suitable if it flows from all the neighboring farms. The bottom of a carp pond should be as even as possible, and not rise in any place above the surface of the water, as such small islands easily become the abodes of the enemies of the fish.

Small pike, perch, and tench may also be kept in these ponds. The pike will find ample food in the perch, which increase very rapidly, and the tench generally keep themselves so well concealed in the mud that they escape the pike. The pike, perch, and tench alone will, as a general rule, repay all the expenses of constructing the reservoir. Carp-ponds are emptied in October.

Winter ponds are used for preventing the fish from perishing in very severe winters, when the other shallow ponds easily freeze to such a depth and for such a length of time as to cause the death of the carp. It is best that these ponds be so arranged that the fish may be supplied with good fresh water during the entire winter. The other ponds can easily be so arranged as to preserve fish in them over winter; but although in this way the difficult labor of emptying the ponds in the spring and autumn is avoided, it will always be best to have separate

winter-ponds, since, at any rate, the tench cannot be left over winter with the carp in the shallow ponds, inasmuch as they constantly stir up the sediment at the bottom and thereby disturb the young carp. In the winter-ponds the different kinds of carp can easily be kept together, as they generally remain very quietly at the bottom as soon as they have found a place to suit them.

Sale-ponds are receptacles only for fish ready to be sold. They should not be too large, since it is desirable that the fish may easily be taken out with a bag-net. It is best to have them near the house, or at any rate well guarded and locked. A constant stream of water should pass through them, and at the place where the water flows in there should be a strong wooden embankment, as the carp are apt to excavate the earth round the opening. The sides of these ponds are sodded, and the channel through which the water flows off should be so arranged as to be proof against every danger of a break. These ponds ought to be examined and cleaned every summer. They should have a depth of 6 feet, so that the bottom may not freeze.

Care should be taken in winter to keep some openings in the ice and maintain the inward and outward flow of the water. This object is most effectually secured by placing bundles of straw or reeds in both the openings. One or more holes, in proportion to the size of the pond, should constantly be kept open in the ice.

It must be understood that there are many rules to be observed, and much work to be done, which, if minutely treated, would require a very lengthy and detailed description, and which, indeed, would be out of place here, as there are so many local differences to be taken into account in deciding what is the best plan to pursue.

In Holstein, where carp-raising on a large scale has been carried on from very early times, almost every farm has its own method of procedure. In one thing, however, all are agreed, viz, that carp-raising can only be carried on regularly and profitably by the most judicious treatment. A careful choice of ponds, the selection of a superior breed of carp, and careful treatment of the fish will always yield the largest profits.

B—CARP-CULTURE IN EAST PRUSSIA.

By R. Strüvy.*

The undulating character of the surface of East Prussia favors the construction of ponds, and led to extensive breeding of fish at an early day, the heavy rains of that northern climate furnishing the necessary water in abundance.

At the time of the Teutonic Order the province is said to have possessed an unusual supply of fish, and traces of that period are even yet to be seen, not only in the numerous ruined dams, but also in some that

* Unsere Karpfenzucht. <Landwirthschaft und Industrie. Herausgegeben von August Wieneke. Berlin: 7. Jahrgang, 1875, Jan., p. 8, 9.

are still well preserved, on account of the practical plan upon which they were constructed. A heavy pine tree, more rarely an oak one, was simply dug out in such a way that it was hollow four feet from the butt, and for the rest of its length was hewn out trough-shaped, and covered with heavy cross-boards. It was supplied with a round hole near the butt from which a tap projected at right angles. This was laid as a discharging-pipe beneath the dam, the latter being formed, on the side toward the pond, of planks or hewn timber, over the middle of the hollow portion of the log, which was four feet long, as before stated. In order to prevent the loss of fish, when the water was drawn off, screens were placed at the tap and tap-hole. The dam was then banked up high enough to cause the water to overflow upon a piece of gently-sloping meadow-land. Flood-gates could therefore be dispensed with, it being only necessary to see that the water never passed over the dam. If this was sodded at first, and the pond did not remain dry too long, it never leaked, since moles and rats only penetrated dams when the ponds were dry. Strong streams should not be led into such dams unless the escape for the water around them is well situated, otherwise it may be washed out, and afford an outlet for the water.

The abandonment of a large number of these works occurred, chiefly, between the years 1830 and 1860, because it seemed more profitable to convert the land into meadows or farming-land. Afterward the dams necessarily disappeared entirely, as the land was drained and leveled. The price of fish consequently advanced so high, on account of their scarcity, that those who had retained their ponds found their business very profitable. In the last few years the larger farmers have turned their attention again, with more earnestness, to this branch of production, but skill and knowledge in regard to it have been lost, and such losses have been suffered that it is absolutely necessary to consider the matter practically and resort to exchanges of experience, since theory alone does not answer.

Three annual courses of spawn, fry, and table-carp mainly require attention. How, then, are good eggs to be obtained? Theory suggests that a shallow pond be constructed which can be kept free from predacious fish, and that about five males and five females, of at least five pounds in weight to the acre, be placed in it in the spring, and that ten to twelve young carp be added for chasing; old carp are said to be too inactive about spawning-time, and the more the water is disturbed the better the eggs will be fertilized. The writer, in spite of having followed these directions closely, obtained no eggs during the past year, but purchased 108,000 from a relative, who, in consequence of inability to finish his spawning-pond in time, had placed his eighteen spawning-carp in a pond of twelve and one-half acres, among the fry, and some table-carp that had been left. The fry also grew finely.

The cause of the failure to obtain any eggs became very apparent. When the pond was drawn off in the spring, before setting out the

spawning-fish, by way of precaution, on account of previous high water, a number of large pike and perch were found, and carefully removed; but in the operation they lost their spawn. The pond was therefore allowed to remain dry for eight days. This, however, was not sufficient, since, instead of the expected carp, six bucketfuls of pike and perch, as long as a hand, were obtained, and the workmen repeated the old absurdity, that in some years carp spawn pike. Predacious fish make their appearance of themselves where carp are bred. They seek the ponds from the nearest streams during high water. The writer had the opportunity, during the past spring, of witnessing the persistent efforts of a pike, of four pounds in weight, in attempting to reach a carp in a ditch so shallow that he was easily killed with a cane. But pike and perch are not alone to be feared on account of their ravages; the green edible frog is also suspected of consuming the spawn. Large bastard-carp are also supposed to injure the eggs by their attempts to fertilize them, thus rendering them unproductive. The writer, however, doubts this, as he has obtained pure carp-eggs among bastard-carp. In order to produce valuable carp-eggs, the milters and spawners should be large and healthy, rather more of the former than of the latter, and, above all, they should receive gentle treatment in the spring, and neither be squeezed nor struck. The pond should be preserved absolutely free from predacious fish, and should have gently-sloping, sunny, grass-covered banks; it is even more beautiful if the grass grows down into the pond. Ducks and geese, like all water-fowl, are injurious. The water must be pure and not too cold, (spring,) nor in any degree fouled, since the formation of mold may injure the whole lot of spawn. Only the strictest attention in this particular can insure success, for one instance of neglect generally injures the whole yield.

At the end of October, or the beginning of November, the ponds are drawn off and the eggs, fry, and spawning-fish are removed to their winter-quarters from all that are not kept up during the winter. From this time to spring carp eat exceedingly little, and can be kept, if necessary, in very small inclosures, which are not liable to freeze, or which are fed by water continually splattering into them. In East Prussia preservation for the winter presents great difficulties, and is attended too frequently with decided losses. If the pond is large enough, and is supplied by a never-failing source of water, no air-holes should be cut in the ice; but if once made, they must be kept open throughout the winter. The appearance of carp at these holes is always a suspicious circumstance, as healthy fish are seldom seen at them. Turbid snow-water, dammed back, also often destroys the whole winter-stock in a short time. Where fish are crowded together light feeding, of soaked peas and chopped bread, is advisable; care, however, is necessary with all easily putrescible matter, as animal offal, &c. Much has been said in regard to the good or bad character of ponds, with reference to the flavor of the fish. This may, however, be regarded as a mat-

ter of secondary importance, for although carp may acquire a moldy flavor in ponds with marshy and turfy bottoms, this unpleasant quality often disappears a few days after they are placed in pure water, so that when carp of very fine flavor are desired by the writer, he places them in the basin of his fountain for two to three weeks. In case there are several ponds, therefore, the worst should contain the fry, and the better ones the marketable fish. With a liberal supply of food, carp, three years old, will have a weight of three to four pounds, and they are then in the best condition for the table, since old carp are tough and fibrous, and those under three pounds are generally too full of small bones. For this reason the ponds should never be overstocked. From 15 to 24 dozen of eggs should be allowed to the acre, because of considerable loss, and 45 young fish, and, only where there is great abundance of food, double this number. In this way a clear return of 10 to 25 pounds per hundred square yards will be obtained, and even more if no accident prevents.

If old carp-culturists are disposed to smile at this brief account, and to find nothing new in it, they are earnestly requested to communicate their experience, as it was admitted in the beginning that skill and experience have both been lost, and everything must be learned anew. The losses experienced, too, have been too great to permit the business to get fairly under way; in fact a large company failed for want of the necessary experience. Since, however, there is no intention of abandoning the enterprise until fine, fat carp, from East Prussia, appear as delicacies on the tables of Berlin, further information is desired.

C—CARP-PONDS.*

The value of a fish-pond depends upon an adequate supply of water, and the amount of food for fish it affords. The latter condition is affected, to a great degree, by the character of the soil and the depth of the pond. Thus a sandy soil yields but little food, but of excellent quality, while loamy and peaty soils are good, and a loamy mold excellent indeed; but those of tenacious meager clay, as well as stony soils, are very inferior. These statements are especially true in regard to ponds for carp. The first consideration in laying out new ponds is the power to regulate perfectly the supply and discharge of the water. A pond is seldom formed by excavating the earth, but generally by constructing an embankment across the lowest part of an uneven piece of ground. By employing the earth adjoining for this purpose the fish-pit is generally formed at the same time. The best material for the dam is loam and clay. When the soil is sandy a foundation of loam must be prepared in order to retain the water, when a supply of the latter is not at command. A new soil yields the largest return, which is diminished by reedy growths and muddy sediment. A pipe for draining the pond, which can be opened or closed on the water-side at pleasure, is laid

* Landwirthschaft und Industrie, Berlin, Dec. 1, 1875, 170. Translated by Prof. C. F. Himes.

through the dam at its lowest point. It usually consists of heavy hollowed logs, imbedded in soft moss. These will last much longer if the bark is uninjured. It may also be constructed of bricks, or of earthenware pipes, with cement. On the water-side it passes through sheet-piling, or a cemented wall, and is closed by a plug, or better, by means of a drop-valve, which can be opened by a rod with a screw attached. A stand-pipe is also often placed vertically upon the horizontal discharge-pipe. It is closed on the front, from the bottom to the water-level, with sluice-boards placed on top of each other. These may be placed in position or removed at will, according as it may be desired to raise or lower the water in the pond. Where small streams flow through the pond, this arrangement affords the additional advantage of keeping the depth of water uniform, since it flows out over the top board through the drain-pipe. A wooden grate is placed at the entrance of the drain-pipe, to prevent the fish from passing into it. It is entirely submerged to preserve it from decay. Iron grates are altogether unsuitable, on account of their rapid destruction by rust. The fish-pit is an excavation in which the fish collect when the pond is emptied. It must be capable of being completely drained, and in loose, soft soil it is well to line it with wooden or stone walls, and give it a firm bottom of sand, stone, or boards. The greatest attention should be given to the fish-pit, and it should be carefully freed from all mud whenever fish are caught. It is also advisable to form a pit, called in Bohemia the sluice-pit, at the outlet of the drain-pipe, in order to catch any fish that may escape through a defective grate; and for this reason it should also be supplied with a grate at its outlet. When the ponds are large, this is lined with wood or stone. It should be kept full of water that the discharge-pipe may be preserved from decay. After some time the flow of water renders the interior of the drain-pipe so rough that the fish are so injured in their passage through it, that it is very undesirable that they should be found in the sluice-pit. The bottom of the pond is traversed with ditches, so that the water may flow off freely and rapidly from all sides, and the fish find their way easily into the fish-pit, and also that the rich, muddy soil may dry off rapidly, and soon permit the passage of draught-animals over it, if the pond is to be put in order. Depressions in the pond, from which the water cannot be completely drained, are very objectionable, since a great number of fish are lost in them, and the removal of the predaceous fish is prevented. No trouble should therefore be spared to drain such depressions. If the supply of water is such that the pond can be filled with certainty in the spring, it is well to allow it to become dry after the fall fishing, in order that the soil may be freshened, and a portion of the enemies of the fish may be destroyed. Ponds which are supplied exclusively by rain or snow water must be filled again in the fall immediately after they have been emptied. The water from villages and cultivated land is very advantageous, on account of the nutriment contained in it, and in Wittingau ponds are

fed from the drainage of the soil rather than from streams, because the former is richer in nutriment. By leading in water from the adjoining water-sheds, from cultivated land, and villages, the ponds are much improved. When creeks or brooks flow through the pond, a brush-weir, formed of layers of untrimmed brush-wood, in such a way that the fish cannot pass over it, must be placed so as to prevent the ascent of the fish in the stream. The water-level should, as a rule, be maintained as constant as possible; and, in summer, a sudden, large influx of water should be prevented, because the fish swim very eagerly toward the current of fresh water, and are thus drawn from their feeding-ground and are liable to be stolen. In a dry season, if the addition of water is unavoidable, it should only be allowed to flow in during the day and be stopped at night. It is important to be able to turn fresh water into the fish-pit, when the pond is fished out, in order to revive the fish when they become languid. If the water falls in dry weather, the borders become dry, fermentation and putrefaction of the marsh-vegetation occur, and the carp leave their feeding-ground for deep water. The spawn laid on the grass in the breeding-ponds also become dry and dead. On the other hand, it is advantageous to allow ponds, prepared the summer before, to dam up gradually, so that the higher portions may be pastured, and breeding-places be afforded to insects. As these portions are in succession rendered accessible to the carp, by the gradual rise of the water, they are eagerly sought out by them. This plan has greatly increased the productiveness of the ponds in Peiz, as well as in Wittingau. Since carp find their food, for the most part, on the flat margins of the pond, it is in general better to lay out several small, shallow ponds than one large, deep one. Floating masses of vegetable matter and marshy growth reduce the productiveness. Repeated mowing in summer, under water, and burning the roots when drained and dried by exposure, are employed to prevent the latter; the former are intersected in different directions by ditches, when the knots of vegetable matter will float to the shore, and may be drawn out; or the marsh may be covered, when drained, if necessary when frozen, to the depth of several inches with sand, which will prevent their floating when the pond is filled. In the winter it is beneficial to allow the water to flow in and out of the pond. If it becomes covered with ice, this is removed, at such a distance from the wintering-place of the fish that they may not be reached with a spear. In Wittingau, such openings in the ice, in the larger ponds, are cut from 40 to 65 feet long and 3 to 4 feet wide, and the ice is removed twice a day by means of hooks. If a decided thaw occurs, when the ice is covered with a considerable depth of snow, and the latter becomes saturated with water, and freezing weather follows, the preservation of the fish through the winter becomes doubtful. The water generally changes color to yellowish, milky-white, or brownish; and sluggish insects appear at the openings in the ice and die, and

also fish that are weak and gasping after air. The craw-fish perish first, next the frogs, then the predaceous fish, and finally the carp, and the openings are surrounded by crows. The remedies for dangers from these sources are increase of the number of openings, flooding, and finally immediate fishing-out of the pond. A general destruction of fish may also occur in summer, if the water becomes so low in hot weather that vegetable and animal matter begins to putrefy and scum becomes prevalent, or also if much manure or ditch-water flows into the pond. The fish, in such cases, swim along the surface, gasping after air, and finally die. A heavy rain is usually the most efficient remedy, in the absence of which nothing remains but copious additions of water, or immediate capturing of the fish. A pond in which the fish have died in this way should be drained dry and put in order. It is very important not to stock the pond too full. This was considered impossible in Bohemia two hundred and fifty years ago, but the evidence in recent times is conclusive that not only smaller fish are obtained, but also less total weight of fish, when the stock exceeds certain limits established by experience. In Schleswig-Holstein it is assumed that, in a good pond, one carp can be fattened per 150 square feet, but that generally 70 to 80 fish to about two-thirds of an acre are plenty. The carp in ponds there are marketable at three years, but generally only after four years. Small ponds may be stocked proportionally heavier than large ones. In general, it is not advisable to stock a pond with carp of different sizes.