

XXVI.—RAISE CARP!*

By MAX VON DEM BORNE.

It is well known that carp-raising is a very ancient industry and has been brought to a very high degree of perfection. Any one who wishes to start a carp-raising establishment will not hesitate to undertake a journey for the purpose of studying by personal observation the establishments of experienced carp-raisers. Valuable hints will be found in the following works:

WENZEL HORAK. *Die Teichwirthschaft, mit besonderer Rücksicht auf das südliche Böhmen.* Prag, 1869. (Pond Culture, particularly in Southern Bohemia.)

KARL NICKLAS. *Lehrbuch der Teichwirthschaft.* Stettin, 1880. (Manual of Pond Culture.)

ADOLF GASCH. *Die Teichwirthschaft auf dem Gute Kaniow.* Bielitz, 1880. (Pond Culture on the Kaniow estate.)

As also in my own work, *Die Fischzucht* (Pisciculture).

The president of the German Fishery Association, Herr von Behr, of Schmoldow, has requested me to prepare a short article, which would show in a simple manner that, even independent of pond culture, carp-raising may reach a much higher degree of perfection than it possesses at present. I gladly meet this request, and, as the contents of this brief paper have been very carefully examined by von Behr, I feel convinced that he fully agrees with the views expressed by me.

The main points are, to introduce great masses of young carp in our rivers, which by river improvements have been deprived of the old spawning-places of the cyprinoids; to stock with young carp our numerous German lakes, where, owing to the presence of pike and other fish of prey, carp cannot successfully spawn, as a portion, at least, of such young carp will under all circumstances reach maturity; and to make even small ponds and marl-pits sources of revenue by stocking them with young carp. The manner in which I would like to see the Stettiner Haff stocked with 20 million young carp, may be seen in various newspapers articles on the subject, as well as in Circular No. 6, 1881, of the German Fishery Association.

I therefore gladly meet von Behr's request, and will endeavor to describe how young carp, for the purposes indicated above, can be pro-

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cured in the easiest and cheapest manner, instead of obtaining them from a distance at a comparatively great expense.

The *beau ideal* of carp-raising would be the following plan: Every owner of ground should toward the end of May select a dry piece of ground, well warmed through by the sun—say one-half hectare in extent—and fill it with water from a running stream or brook to the height of three-quarters to one meter, and thus form a so-called “sky-pond.” Pike should positively be kept out of such a pond, which is much easier constructed than is generally supposed, especially if one does not mind the small expense of inclosing it with a low dike. Most estates have sufficient running water to keep the water at the same height all the time. The next thing would be to procure from some reliable establishment one spawner and two milters, place them in the pond, and also put in it a quantity of brush-wood of pine, juniper, birch, &c.; and one may with certainty count on seeing this brush-wood, in June, when the sun has warmed the water, and again in August, covered with numberless carp eggs. A female carp is said to contain about one-half million eggs. This figure may be a little exaggerated, but Mr. Gasch, whose pamphlet has been spoken of above, and who, for his carp culture, received the gold medal at the Berlin International Fishery Exposition, calls 60,000 young carp to one-half hectare a *very common result*. He also assures us that 1,000 young fish of this description, in a pond measuring one-half hectare, reach the length of 20 centimeters (in exceptional cases 15 or 25 centimeters) the same summer in which they first saw the light of this world, without giving them any food. As such a carp is worth 20 pfennig (5 cents), the revenue from one-half hectare, from the end of June till October, would be 200 mark (\$47.60). This astonishing development of the young carp was owing to the fact that they always had abundant food. When the 60,000 young fish first left their eggs, they found sufficient food on one-half hectare, but as they grew in weight and size they needed a larger extent of pond, which in four months increased from one-half hectare to 60 hectares. The small spawning-pond cannot supply sufficient food till autumn, and even if the fish escape starvation, they will always be in poor condition. As our ideal “sky-pond” is of course supposed to enjoy the advantage of a most favorable location, we permit the young fish, when they have reached the length of a few centimeters, and need a larger extent of water, to slip through the grating which closes the pond, in order to scatter over the river or lake, or we let the entire contents of the pond flow into the river or lake. If this is not possible, we assign to the fish a larger space from the very beginning. Fifty thousand young fish can live very well till October in one hectare of water, and be successfully used for stocking other waters, although they will not reach that degree of development which Mr. Gasch attains for his fish. The fish may also be fed with boiled potatoes, broken into small pieces, kitchen refuse, linseed cake, manure, &c.

What becomes of our young fish when the cold season approaches, when in October their power of moving decreases, till the period when they commence their long winter sleep? If the spawning-pond is suited for wintering, where there is no danger of its being covered so thickly with ice as to cause the death of the young fish, it will be best not to take them out *till spring*, when the ice has melted, and when it is certain that the pond can again be filled at the right time.

If the young fish cannot winter in the pond, they may get through the winter by being placed in a so-called "chamber-pond" which is free from fish of prey, and can be laid entirely dry; or, if this should be impossible, the 60,000 young fish may safely be set free in October. We know the dangers to which they are exposed in waters containing many fish of prey, but we also know from experience that, in spite of this, successful results may be looked for. While, during winter, the young fish are in a lethargic condition and the fish of prey are particularly voracious, these latter are in spring in a very lazy condition, owing to their having spawned, whilst the carp are lively and have an excellent appetite. From principle, therefore, it is much better to set out young fish in spring, although the setting out of one summer's young fish is by no means as hopeless an undertaking as is thought by many pisciculturists. I will give an example from my own experience. One of my lakes, the *Hamelung Lake*, measures about 5 hectares, and contains numerous pike and perch. In autumn I stocked this pond with 1,200 one-summer's carp, and three years later I caught, during the ice fisheries, 680 table carp, which on an average weighed 3 pounds each. During the two previous winters the pike, caught during the ice fisheries, invariably threw up small carp, which they had evidently swallowed during the fisheries, because they had not yet been digested. I obtained similar favorable results in several other lakes and in the river *Mietzel*, all of which waters are rich in pike and perch. I have, therefore, come to the conclusion that *one hectare of water, which contains many fish of prey, can, even in autumn, be sufficiently stocked with carp, by placing in it 250 one-summer's carp*. The fear, so often expressed, that such small fish would all be devoured by fish of prey, is in my opinion entirely groundless, because all large fish have, at some time during their life, been small, and been exposed to the danger of being devoured by larger fish.

The larger the carp the smaller may be the number of fish placed in one pond. It will also pay to place large carp in open waters, for a very intelligent pisciculturist in Schleswig-Holstein has for a long time been in the habit of buying a large number of carp measuring 20 centimeters or more in length, and stocking, with these fish, lakes where fishing is easy; and has in this way become a wealthy man. Thus he set out, last year, carp weighing $1\frac{1}{2}$ pounds each, and has been able, this winter, to catch fish weighing $2\frac{1}{2}$ pounds each.

Throughout our entire country people begin to take a greater inter-

est in water culture, and there is a very general and growing consciousness of our *duties* with regard to our large and beautiful lakes and rivers. The hope may therefore not be in vain that landed proprietors of liberal views, and more especially the largest landed proprietor, the State, will here and there, in their fields or forests or along their rivers, construct spawning-ponds of $\frac{1}{2}$ hectare, buy 3 spawning carp for 10 mark (\$2.38), and annually let 60,000 young carp loose in the rivers. An example will show what may be accomplished with very small means. When in the autumn of 1881 I visited some of the forests on the shores of the Stettiner Haff, in company with Counsellor von Büнау and the Royal Forester Baron von Dücker, for the purpose of finding suitable places for constructing spawning-ponds for carp, we found that Baron von Dücker had already, by irrigating certain portions of these forests, constructed the necessary ponds by simply closing those ditches through which in former times several of the ponds and one lake had been drained. At an expense of only 71 mark 69 pfennig (\$17.19), four ponds had been constructed with a total area of 101 hectares, and by a further expense of 3,500 marks (\$833) all the other necessary arrangements could be made. With just as small an expense, spawning-ponds with a total area of 700 to 1,000 hectares could easily be constructed in all the forests on the shores of the Stettiner Haff. The 101 hectares already in existence could probably furnish at least 5,000,000 carp per annum, and therefore produce the quantity demanded by me (20,000,000) in four years.

Magnificent carp, both as to size and flavor, are caught here and there in our rivers, and there is hardly a doubt that they have, when young, escaped from some piscicultural establishment, or that, because not needed there, they have been purposely set at liberty.

As not all those persons who would like to raise young carp are able to construct spawning-ponds, I make the following proposition, which I do not consider chimerical, and which is well worth a trial. I must state expressly, however, that I have not personally made the experiment. At the International Fishery Exposition in Berlin, there was exhibited in the Swedish department a spawning-box which had been used in Sweden since 1761 for bleak and other fish, and might also be used for carp. It is very spacious, made of perforated boards, and the inside is covered with pine brush. At the beginning of the spawning season it is stocked with male and female fish, which deposit their eggs on the brush-wood, and are thereupon let out through an opening in the side of the box. The spawning carp have to be removed, for if they remained in the box they would either injure or devour the eggs. The fish may also, when taken from the box, be placed in a small pond, where they will sufficiently recover to be fit for another spawning. The box is secured by an anchor and floats about in the water; by the motion, the water is constantly renewed, and any injury from strong waves is averted. As soon as the young fish can swim the box is opened, so that they can go out into the open water. It would be an advantage

to have portions of the sides of the box made of fine wire grating. Why could not such boxes with brushwood be placed in a lake and stocked with 3 carp (1 spawner and 2 milers)? Would not the brushwood soon be covered with eggs?

Carp may also be transplanted by sending such brushwood covered with eggs to some distance and placing it in floating boxes similar to the one described. It is well known that Mr. R. Eckardt, of Lübbinchen, has frequently shipped carp eggs in this manner to distant places.

There is much talk at the present time of *mirror carp* and *leather carp*; they are generally considered a more delicate article of food than the scale carp, but do not grow as fast as these. Mr. Gasch very justly considers it important to use for purposes of propagation only the finest-shaped carp, which presumably will grow quicker than carp of inferior form.

In the above I have entirely followed Mr. Gasch, as far as the small "sky ponds" are concerned, whilst, with regard to the Swedish spawning-box, I have only urged that experiments be made; but in the following I take the liberty to communicate my own experiences of many years in the Berneuchen piscicultural establishment, as well as those of other pisciculturists.

CONSTRUCTION OF A GOOD SPAWNING-POND.

The first condition is that it can be laid completely dry and be filled again with water at the proper time. No puddles must remain, if any favorable results are to be looked for, and no pains should be spared to remove them. Only in rare cases can a good pond be constructed by digging out of the ground; the best way is to inclose a piece of low ground in the lowest place by a dike. As has already been mentioned, a pond can be constructed at a very trifling expense by closing the drain by means of which swamps, lakes, or ponds have formerly been laid dry.

According to the different sources from which the water for the ponds is drawn, we distinguish—

Brook and river ponds, which are fed by running water;

Spring ponds, which are fed by springs;

Sky ponds, which are fed by rain and snow-water, or by ditches which are dry during the hot season.

The *dike* is made from the material nearest at hand, the fish pit being constructed at the same time. The best material is loam or clay. Wherever the soil is sandy, the dike and pond must have a foundation of clay, if water does not flow into the pond at all times, in order to prevent the pond becoming dry.

Flat spawning-ponds are the best, because in them the water gets warm easier than in deep ponds. The most suitable depth of water is about 1 meter in the deepest places.

In order to let off the water from the pond, a *drain-pipe* is laid through

the dike, which can be closed and opened on the water side; it may be either of wood or burnt clay or cement. In sandy soil the drain-pipe must be perfectly tight, because otherwise the sand enters and is carried along with the water, so that the dike sinks and the water of the pond flows out. In sandy soil wooden drain-pipes ought therefore to be incased in cement.

The so-called *tap-house* is located at the end of the drain-pipe on the water side; it consists of a wooden grating or rake, which prevents fish from entering the drain-pipe, and a *valve* for letting off the water. Iron gratings are not suitable, because rust soon destroys them.

The *fish-pit* is a hole near the tap-house, in which the fish gather when the water of the pond is let off. It should be so constructed that it can be laid entirely dry, must be spacious and have a firm bottom; wherever the bottom is loose, it should, therefore, be made firm by means of sand, gravel, and stones.

Besides the fish-pit there is another pit, into which the water flows after having left the drain-pipe. It is intended to receive the fish when the grating is broken, and for this purpose there is a grating at its mouth. It is not advisable, however, to let too many fish gather in this pit, because they are easily injured in passing through the drain-pipe.

The bottom of the pond is furrowed with small ditches, so that the water can everywhere flow off easily and quickly, and the fish can easily find their way into the fish-pit.

If a brook or stream passes through the pond, a ditch is carried round the edge, so that the water can in this way be let out. In this manner stones, sand, and mud are kept out of the pond, which would otherwise be entirely filled with such matter. High water is also let out in this way, as it might cause a break in the dike.

Small floating *swamp islands* and *reeds* are injurious. The floating is prevented by putting sand on the swampy places when the pond is drained off; and the growth of reeds is checked by laying the pond dry, by using the bottom for agricultural purposes, and by cutting the reeds under the water during summer.

Spawning-ponds for carp should be kept free from fish of prey, because they prevent the increase of the carp. In Bohemia one pike is put in the raising-ponds, to every 10 carp; the increase is thereby so completely prevented that when the pond is laid dry not a single newly-born carp is ever found. When the carp want to spawn, the pike immediately make their appearance and act as if they too wanted to spawn. This probably disturbs the carp to such a degree as to prevent impregnation, for the numerous eggs are always destroyed by a sort of mold. The pike must therefore be carefully kept away from the spawning-ponds; and it will be the safest way to feed such ponds from such rivers, &c., which contain no other fish, but especially no pike. Sky-ponds, which are fed by atmospheric water, are therefore the safest. Water coming from brooks, lakes, and ponds containing pike should therefore be filtered

through a *gravel weir*. Such a weir is made by placing a grating in the feeding-ditch and filling the ditch with coarse gravel of the size of walnuts. Pike of the previous year cannot pass the weir, and the young pike are too small to disturb the carp in their spawning process; they grow so rapidly, however, that they devour many small carp till the autumn fisheries commence. Such pond feeders should, therefore, be avoided as much as possible during the period when the young pike can still pass the gravel—from March till the beginning of the opening season of the carp. Following the example of Bohemian pond-culturists, I have, so far, stocked 2-hectare spawning-ponds, with 10 spawners, 6 milters, and 1 male carp weighing one pound, and obtained during one summer on an average 100,000 young carp (the maximum being 150,000). Spawners weighing 4 to 6 pounds are the best, as larger fish are too indolent.

The *fishing* of the ponds takes place during a cool season, in spring or autumn, when there is no danger of any frost. It will be well to introduce fresh water into the fish-pits during the fisheries, so as to freshen up the fish at all times. As soon as the water has been drawn off, and the water-area has been diminished to about one-fifth or one-tenth of its original size, fishing commences, care being taken that the fish never lack fresh water, by occasionally stopping the draining process or by introducing fresh water. The edge of the fish-pit is covered with boards and reeds, and on the edge of the water large tubs are placed filled with fresh water. From the net the carp are removed to these tubs, cleaned from mud and dirt, counted, put in the transporting vessels and carried as quickly as possible to their destination. As in catching the fish the water is stirred up and becomes muddy, and as the fish more or less inhale this impure water, it has to be removed from the gills. Carp which are to be transported any considerable distance are therefore, some days previous, placed in clear running water, where they are not given any food whatever, so that they may be thoroughly purified, and do not make the water impure by their excrements. The temperature of the water should, at most, be 10° Réaumur; the lower, the better. One of my friends in Pomerania has calculated the necessary quantity of water, in the following manner, from the weight of the fish and the time consumed in transportation.

Excess of weight of water over weight of body during a period of transportation lasting :

Carp.	10 hours.	20 hours.	30 hours.	40 hours.
	9	12	15	18

The result obtained in my spawning-ponds is entirely thrown in the shade by that obtained by Mr. Gasch; but, in order not to make any rash calculations, I will make my result the basis, and assume that a spawning-pond of 1 hectare produces annually 50,000 carp of one summer. Supposing that 1 hectare of water, containing fish of prey, needs

250 carp of one summer, a spawning-pond of 1 hectare would be sufficient to completely stock with carp an open water area of 1,000 hectares in 5 years, and to fill up the gaps occasioned by the fisheries.

In *setting out* the young fish, they should be distributed, as much as possible, over the entire water area, and care should be taken to place them in shallow water where they find plenty of food and where they are protected from fish of prey.

If it is intended to raise large carp, which are not exposed to any danger from fish of prey, a larger pond area is needed. I must here refer once more to Mr. Gasch, whose results are unexcelled by those of any other pisciculturist, and, basing my assertions on his experience, I must say that it requires a pond-area of at least 50 hectares to raise 50,000 carp of 20 centimeters length per annum; therefore, 50 times as many as we supposed before.

The *otter* is an exceedingly dangerous enemy to the fish, and must positively be exterminated, if carp are to be raised; herons, cormorants, and ducks also do great damage to the spawning-ponds. It is, therefore, necessary to combat these enemies in the most energetic and persistent manner. In my book *Fischzucht* I have treated of all these matters at length, and any of my readers who desire further advice on this subject are therefore referred to that work.