

**70.—PRODUCTION OF YOUNG FRY OF THE CARP.\*****By CARL NICKLAS.**

For centuries it has been customary, in pond-culture, to place more spawners than milters in the spawning-ponds; and it has been recognized as the most profitable plan to make the proportion two males to three females.

In opposition to this plan, the arch-ducal farmer, Mr. Gasch, at Kaniow, published a pamphlet, on the occasion of the Berlin Fishery Exhibition of 1880 in which he recommends the proportion of one spawner to two milters for spawning-ponds. He says: "According to Dub's method, I invariably make the proportion of the stock in each spawning-pond one spawner to two milters, which is sufficient to produce all the young fry need for the stocking of our own and Prince Pless's ponds, which we rent; in all, 60,000 young fish. To place more spawners in a pond is not only unnecessary, but also injurious, because very easily too much fry is produced, which would not find sufficient food in the pond."

Weighing the pros and cons in this question from a purely theoretical point of view I arrive at the only conclusion which, in my firm opinion, can be in any way defended, that it certainly, is more rational to make the number of milters greater than that of the spawners. This does not, however, force me to the further conclusion that the reason why so many pond-farms cannot raise the necessary quantity of small fry is found in the circumstance that more spawners have been placed in the ponds than milters, much less in the fact that several sets of fish are placed in the spawning-ponds in nearly all cases. In the many pond-farms which I have had occasion to visit, I have not once come across a case where I found a pond, be it ever so small, stocked with only *one* set of fish. In my own practice, although retaining the old method, and placing, in all cases, several sets of fish, each having more spawners than milters, in one spawning-pond, I have always obtained an ample supply of young fish.

In stocking a spawning-pond with several sets of fish, the proportion between the spawners and milters cannot exercise any great influence. In this case the natural desire of the carp finds ample room for play, no matter whether there is a tendency for one male to associate with several females or for one female to associate with several males. If several sets are placed in one pond, for example, nine females and six males,

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either two sets will form, each composed of three milters and two spawners, or *three* sets, each composed of two milters and one spawner, which are sufficient in either case to furnish more young fish than are needed even for a very large pond-farm, even if the eggs of the remaining five or six spawners should not become impregnated. The reason why there are frequently not enough young fish is, in my opinion, to be found in the circumstance that the spawning-ponds are too large or unsuitable in other respects; and if only *one* set of fish were placed in such ponds, no young fry, or at best but a very small quantity, would be obtained.

It must be said in favor of the old method (of composing each set of fish for the spawning-ponds of more spawners than milters), which at present is followed in most pond-farms, that two spawners, supposing them to be entirely equal in every respect, will of course produce twice as many eggs as one; but, on the other hand, though there is nothing to disprove such an assertion, it is very doubtful whether both spawners have become impregnated by one milter.

As no signs of either bigamy or polygamy have as yet been observed among fish, especially among carp, whilst it has often been noticed that several males will engage in mortal combat over one and the same female, I am rather inclined to think that if two females were associated with one male, one of the former would find herself neglected. Moreover, it can hardly be supposed that when the fish are at liberty in a large basin of water, the milt of one male is sufficient to impregnate the eggs of several females, and that the male husbands his milt as much as a pisciculturist, who thereby succeeds in making the milt of one male suffice for the impregnation of the eggs of several females. Experience has taught men to abandon the wet method of impregnation for the dry method. According to this experience, however, it would seem most profitable to have the set composed of more males than females, if a large quantity of fry is aimed at.

On the other hand, I can positively see no reason why one set of fish in a pond should furnish more young fry than several sets, as the very laws of nature seem to forbid it. It is undeniable, however, and well known from olden times, that small ponds are the best for producing young fry. The reason is this, that they are generally flat, and do not contain much vegetation, that consequently their water is much warmer than that of large and deep ponds, and that there is less chance of eggs and fry being injured, especially by the various enemies of fish. There is this additional advantage, that they are easier to superintend, and that the eggs and fry can be better protected from dangers. But no sound reason can be advanced in proof of the assertion that one set of fish in a pond will produce more young fry than several sets.

The following may serve as a contribution towards the practical solution of the problem. A friend of mine, who had so far only engaged in raising salmonoids, wrote me under date of August 9, 1881:

"My young carp have almost rendered me desperate. On the 1st June,

I finished my two spawning ponds, and stocked them immediately. In one of them I placed one spawner and two milters (mirror carp, weighing 7 pounds each). The first pond is about 46 meters long and 7 meters broad (322 square meters = about 3 ares, or  $\frac{3}{100}$  hectares). The depth of water was 40 centimeters at the place where it flowed in the pond, and 90 centimeters where it flowed out. The second pond is just as large, but is stocked with 64 female carp and 36 milters, each weighing 1 pound (this should probably be 1 kilogram). The carp were placed in the pond on the 4th of June; on the 5th they spawned, and on the 11th the young carp left the eggs. One of the female fish has produced so many young fish that I hardly know where to place them; and the same is the case in the second pond. The mirror carp resemble the specimen sent with this letter (on an average 4 centimeters long). I have already taken out 8,000 and put them in other ponds; and still the pond is so full that one fish is almost on another; there are probably 300,000 fish, if not more, left in the pond. They seem lively and in good condition, but I fear that many will die in consequence of overcrowding. These young carp, when placed in a pond 1 meter broad and 6 meters long (6 square meters), and 10 centimeters deep, died at the rate of 500 in a day, although I placed fresh water in the pond twice every day, once in the morning and once in the evening. It is also noticed that in the two large ponds (each having an area of 322 square meters) the carp invariably only stay in the places where the water flows into the ponds; they crowd towards the water at its influx in such enormous numbers that on Monday I caught 2,234 at a single dip of the catcher. Along the edges of the pond the fish gather in very large crowds. I feed them with boiled fish-roe, which I scatter in the water, near the edges, and which the fish devour so eagerly that not a single fish egg is left. Have you ever heard of anything like it? In the second pond there are perhaps several millions of fish, but they are not as large, only about half the size of those in the first pond."

These statements regarding two ponds stocked in different ways show clearly that vast numbers of young fry can be raised in small flat ponds where no dangers threaten the eggs and young fish, and where it is possible to keep a strict surveillance; and that more young fry are obtained from one set of spawners and milters than from another.

The result of the experiment made in the first pond shows more especially that the method to compose a set of more milters than spawners, guarantees the impregnation of *all* the eggs. To judge from the large number of fish hatched in the above-mentioned ponds, it seems that all the eggs of one spawner had been impregnated, and that young fish had been hatched from them.

It may of course be questioned whether the impregnation was caused by one or both milters. It is, however, doubtful whether, with a proportion of one milter to two spawners, all the eggs of each one of the spawners would be impregnated by that one milter.

Instead of simply placing one set of two milters and one spawner in one pond, I would prefer to place two sets, even in very small ponds, as accidents may occur, and it may frequently happen that a spawner cannot discharge her eggs, or that they are not in a healthy condition. And in that case persons having only one pond, containing a single spawner, would not obtain any young fish at all; there is, of course, less chance that two spawners will both meet with an accident, and, on the whole, it will hardly ever hurt to have too many young fish, as there are many ways of diminishing their number.

The result of the experiment made in the second pond, which, according to the former practice, contained more spawners than milters, cannot be adduced in favor either of a preponderance of spawners or a preponderance of milters, as, owing to their small weight (at most 1 kilogram apiece), a large portion of them were not fully matured for spawning, and as consequently it was impossible to ascertain how many females and how many males engaged in producing young fish. But even if this were possible, there would absolutely be no means of ascertaining how many young fish would fall to the share of one set.

Although it is hardly possible that any one but my friend referred to above would conceive the idea of stocking a pond of 322 square meters with 100 spawning fish, the result of the experiment made in the second pond proves this, at least, that it is not necessary only to limit the number of fish in a pond to one set in order to obtain a large quantity of small fry, but that the more spawning fish are placed in a pond the more young fish will be obtained from such a pond.

The experience of Mr. Gasch (the average size of his spawning ponds is 34 ares) and the results of the experiments made in the first pond prove that even in a very diminutive pond enough eggs can be produced to supply a large pond-farm, and that a sufficient quantity of young fish can be hatched from them.

Any pisciculturist can convince himself, by carefully observing the spawning-ponds during the spawning and hatching season, that there is never any lack of eggs and young fish in large ponds. But the dangers to which they are exposed, and against which there is hardly any protection, cause the destruction of by far the larger portion of the eggs and young fish.

Although I think that there are very plausible reasons for composing the set of more milters than spawners, I cannot, so far at least, absolutely reject the opposite plan of our older pond-culturists, which has in many places been retained to the present time. I first want to know what reasons influenced pisciculturists in olden time to follow this method as it seems hardly probable that their following it had been purely accidental. Unfortunately, no light is thrown on this subject either by ancient or modern writers. In *Horak's "Teichwirthschaft"* (Pond-culture) we find in the chapter entitled "*Streichteiche*" (Spawning-ponds) only one reason given why one should associate only three, and not four,

spawners with two milters, and this is that people allege to have observed that if four spawners are associated with two milters, the female fish preponderate too much among the young fry, and that buyers had made complaint at being served with too many females. It is difficult to refrain from a smile when reading of such strange notions. I cannot but state here as my opinion—and probably many of my readers will share my view—that if in the instance referred to the first pond had been stocked in the proportion of two spawners to one milter, the roe of one of the female fish would certainly have been impregnated, and as many young fish would have been produced as in the other case, and that, moreover, we could not exclude the possibility of the one milter also impregnating the eggs of the second spawner, thus producing twice the quantity of young fish. Aside from the fact that two spawners, equal in every respect, will produce more eggs than one, I can only imagine one other reason which could have led our old pond-culturists to adopt their favorite method, viz, that the male carp desires to have his choice of females, and that if he finds none with which he chooses to mate, he will remain aloof. Could our old pond-culturists have been guided by considerations like these? I shall not venture to answer this question.

From all that has been said, it will appear evident that, even if strongly convincing reasons speak in favor of more milters than spawners in each set, reasons which even decide me to declare in favor of this method, there may possibly be some very cogent reasons for the other method so that this part of the problem cannot, without the most exhaustive and thorough experiments, be considered as definitely settled. This is certain, however, as it has been held from time immemorial that small flat ponds are the most profitable for spawning ponds. But, unfortunately, such ponds cannot be found everywhere; and even when there are such they are often so located that they cannot be stocked with spawning fish without great risk of their being stolen. The small ponds are generally in villages or quite near to them. Other ponds there are, which, although small enough, cannot be used as spawning ponds on account of their being too deep or having very steep banks, or because their water is too cold, or the forests surrounding them too dense, &c. I can testify from my own experience that in a large pond-farm which I had to superintend a number of years ago, I had, comparatively speaking, a very large number of small ponds, which, on account of one or the other of the above-mentioned defects, could not be used as spawning ponds, so that I had to use larger ponds. The same experience has been had upon another large pond-farm with which I am well acquainted.

Under these circumstances, it would be profitable, and therefore advisable—considering the greater safety offered by small, flat ponds—to specially construct such ponds in the most favorable locations which can be secured. But as it is not only the object of the pond-culturist to obtain a large number of young fish (at any rate as many as are

needed in his establishment), but also to obtain as large and strong fish as possible, not much is gained for the growing fish by small spawning ponds; for, unless one desires to obtain nothing but miserably small fish, as was the case in the two ponds referred to above, the young fry have to be taken out of the small ponds two to three weeks after they have been hatched and transferred to larger ponds, in which case one can count on only 1,500 fish per hectare. For in spite of the largest possible number of small fish in spring, there would be few, if any, young fish in autumn; for the smaller the fish the tenderer they are, especially with regard to cold winter weather.

It will therefore always remain impossible to obtain annually, in very small ponds, young carp which are strong and healthy in any very considerable numbers.

#### 71.—PRICES OF CARP, TENCH, AND GOLDORFE IN GERMANY.

By F. ZENK.

The proprietor of the Seewiese Fishery, Mr. F. Zenk, of Wurzburg, Germany, has forwarded his price-list to the United States Fish Commission, several items of which, when translated into American money, are as follows :

Mirror carp per hundred .....	\$4 84
Leather carp per hundred .....	7 26
Crucian carp per hundred .....	2 42
Golden carp per hundred .....	9 68
Tench per hundred .....	2 90
Golden tench per hundred .....	9 68
Goldorfe (Golden ide) per hundred .....	12 10

#### 72.—VARIETIES OF CARP IN SAXONY.

By DR. OSCAR HUNGER.

My father, in Saxony, raised both the scale and naked carp. At least I suppose that what you call naked carp is the same which is there called *schleie*. The latter is an inferior fish, the flesh being too soft and slimy. It grows slower and to a less size than the commoner scale carp, *karpfen*. Besides the common blue-scale carp and the naked carp, *schleie*, there is a third kind of carp, which is not cultivated, but infests ponds in Saxony. It is a degenerate kind of carp, *karausche*, or wild carp. It is quite worthless, not growing over one foot in length, full of bones, ugly in appearance, and hardly fit to be eaten at all. That was 40 years ago, before I left Germany. Perhaps they have since exterminated it.

MADISON, IND., October 11, 1883.