

**86.—FISH-CULTURE AS A MEANS OF IMPROVING THE RACE OF FISH.\*****By Baron VON K.**

The principal object of all animal culture is the cheap production of food, but another object should be to produce the greatest possible quantity of meat in proportion to those parts which are either worthless or of little value for food. It should be the aim of the fish-culturist to produce races of fish having superior flesh.

There are two ways of reaching this end: (1) A sufficient supply of suitable food, furnishing enough food even beyond the actual need; and (2) the most careful selection for breeders of such animals as possess all the desired qualities in an especial degree. To provide a sufficient supply of suitable food presupposes an exact knowledge of the quantity of food and of its nutritious qualities needed at every age of the fish for its growth and development; therefore, the laying down of standard rules of feeding, such as, owing to the investigations of learned physiologists, have long since been laid down for our domestic animals. We still know but very little, and opinions are greatly divided, relative to the food which a fish needs for its life and growth.

It is true that endeavors are made by fish-culturists to raise the annual increase in the weight of fish to a certain desired point. But the experimental means are soon exhausted and the increase is but small. The question as to the food of fish should be studied all the more as artificial fish-culture tends to increase very largely the number of fish, which when left to nature are during the early period of their life exposed to a great many dangers. Although, owing to the depopulation of the waters, there is no present danger that they will become overstocked with fish, there is no doubt that sooner or later the fish will suffer from want of food, so that, in spite of all care and trouble, we would only get skeletons instead of plump fish, unless we find ways and means for procuring the necessary food or to increase the food at our disposal. We should not leave to nature and accident to furnish the necessary supply of food for the great mass of our fish. Pond-culturists especially should be prepared to stock their ponds with a larger number of fish than is the case at the present time; and they would by no means be certain of reaching this end by using some food which here and there, under different conditions, has answered the purpose. They must furnish to their fish food which their water does not contain in sufficient quantities and which they require at their different ages.

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By means of long-continued observations of fish kept separate in aquariums, by trying different methods of feeding, and by chemical analyses of the various articles of food, we shall undoubtedly obtain satisfactory results. This is a line of investigation which would repay a physiologist for engaging in, and this is a branch of fish-culture where science can be employed to advantage. An attempt in this direction is the standard carp food prepared by Carl Nicklas in his well-known Manual of Pond-culture. This standard food is based too much on unreliable suppositions and on conclusions as to the correctness of which we entertain the gravest doubts; as, for example, when, in order to determine the necessary quantity of albumen, the hog is taken as a standard, because it is likewise omnivorous, which quality alone does not entitle us to draw a comparison between a mammal living on land and a fish living in the water.

Nicklas, however, deserves credit for having been the first to direct attention to the necessity of a rational system of feeding fish, and to lay down some standard rules therefor. By further and careful experiments his errors will probably be corrected. Although Nicklas states that by using fish-food prepared according to his rules he had obtained results perfectly satisfactory to himself, and although he accompanies his assertions by figures showing these results, he will doubtless agree with us that by using a method of feeding based on scientific investigations the results would have been much greater.

We desire to know what quantities of the different nutritive substances are needed, and what is the limit of food which should be exceeded, if a larger and superior race of fish is to be gradually produced. The proportion of nutritive substances composing fish-food should be very accurate. As is the case with other animals, the needs of fish change with age. During its early stages, when its framework of bones grows very considerably during the course of one year, it needs a different food from that required at a later period. All this can only be determined by means of exact scientific experiments. If we are prepared to give the fish food which is suitable in every respect, there is a reasonable prospect that we shall be successful in employing the second means for reaching the object in view, namely, the careful selection of breeders which are calculated to produce fish of superior flesh. In this respect it should first be determined what shape is most favorable to the development of flesh. In regard to this we prefer that framework of bones which is shortest in proportion to the size of the body, and the limited development of those parts which are worthless, such as the head, since the food can be given in small particles, and the tail and fins, because a well-cared-for pond fish need not be a particularly good swimmer. Care should also be taken not to lose the power of propagation in the endeavors to form flesh and fat. We also desire fish of rapid growth, so as to reach a good weight as soon as possible. The growth of fish varies very much when left to nature, and is furthered by a suf-

ficient supply of food rich in ashes. From among the well-formed fish we will therefore select those as breeders which develop quickest. The experience of stock-raising teaches that thereby we obtain a race of quickly growing animals. This quality is inherited, and is not easily lost, even when the animal for a short period is kept under less favorable conditions. An ample supply of proper food is therefore the first condition for producing better and more flesh, and only by satisfying this condition can artificial fish-culture prove a success in every sense of the word.

It is to be hoped that soon some physiologist may be found who will make earnest endeavors to fix the standard of food, which is still unknown. Surely friends and well-wishers of the fisheries will be found to furnish the necessary means for establishing an experimental station. The German Fishery Association will surely take as much interest in the rational raising of fish as in their numerical increase and in the introduction of foreign fish. The experience of stock-raising shows that it is not necessary to import animals from abroad as long as we adopt the principles followed by foreign raisers. The same applies to fish-culture. If our suggestions should lead to some action in this matter, we are certain that the numberless ponds in Germany which have been drained will again be filled with water and be restored to their original purpose, and that large quantities of fish-flesh will be brought into the market, of a quality which at present is rarely seen on our tables.

#### 57.—A MUD SLOUGH ON THE GRAND BANKS.

By Capt. GEORGE A. JOHNSON.

[Communicated by the Hydrographic Office, U. S. Navy.]

The opening is to the eastward and the trend of the slough is NW. by N. (p. c.). The lower point of the opening is in latitude 44° N., longitude 49° 12' W.; the upper point is 7 miles to the northward of this position. At the lower point is a depth of 128 fathoms and at the northern 45 fathoms. In the center of the slough no bottom was obtained at 300 fathoms, and at one point along the northern edge bottom was obtained at 150 fathoms. From a point about half way the length of the slough, on its southern side, the vessel dragged in a NE. direction between 6 and 7 miles, with anchor down and 150 fathoms of chain out, until it brought up at the point on the northern edge somewhat beyond the point referred to above as having a depth of 150 fathoms. Along the edge of the bank the current runs about SSW., while in this slough the water is nearly dead, what little current there is being in some places just the opposite of what it is along the eastern edge of the bank.