

129.—TROUT AND TROUT CULTURE.

By R. A. KOSS.

The brook trout belongs to a family of fish the members of which are distinguished for their delicate flavor, and among which the salmon, the king of all food-fish, occupies the most prominent place. The trout is one of our most valuable fresh-water fish, and recommends itself to the pisciculturist by many excellent qualities. The clearer, colder, and more rapid in their flow the waters are in which the trout lives the darker is its peculiar many-colored skin. It seems as if nature took special care not to make its appearance too striking so as to attract the attention of its enemies, of whom man, after all, is not the worst. The trout, which in brooks reaches a weight of about three pounds, seldom more, is a very hardy fish and not very choice in its food. It is not timid, and can even be easily tamed, in which case, on account of its voracity, it can be accustomed to take its food from a man's hand. It is particularly well adapted to pisciculture, because its eggs are very hardy and can easily be transported a considerable distance. Its power of digestion is very extraordinary, and when well fed it grows quicker than most other fish. Its food is exclusively animal, consisting principally of insects, larvæ, snails, and other small animals. All these water animals need aquatic plants for their existence, and these plants are, therefore, necessary indirectly to the trout. It occasionally eats fish, but never shows as much liking for them as for the other articles of food mentioned above. When a number of trout living together have sufficient food there will be among them but very few which eat fish, perhaps only one in a hundred, provided that the difference of size is not too great. The trout which eat fish grow quicker than their comrades; in retired places they lead the life of hermits, and their flesh is less delicate than that of other trout. If one succeeds in catching these destructive individuals no more fish will be eaten, for in the shallow brooks there will rarely be any other fish of prey. Trout do not like the company of other fish; it is well, therefore, to keep them separate from other fish as much as possible.

For spawning places the trout prefers shallow spots with a gravelly bottom, over which the water flows slowly and with broken force; the fecundity of the trout in a certain body of water depends altogether upon the extent of suitable spawning places. Whenever a brook has large stretches of gravelly bottom over which the water flows gently, it may be assumed with a great deal of probability that it contains trout. For supplying trout with food it is well if there are occasionally places where the bottom is muddy or peaty; a slow current is also much to be preferred to a rapid current flowing over a rocky bottom, because

* "*Forellen und Forellenzucht.*"—Translated from the German by HERMANN JACOBSON.

the former favors the development of water plants and small aquatic animals. Trout are very numerous in clear mountain streams, flowing rapidly over their rocky beds, because they like the character of the water; but they remain small, and do not get very fat; while slowly-flowing rivers, having muddy bottoms, but fed by many gravelly brooks, where the fish can retire for spawning, produce the largest, fleshiest, and best-flavored trout, which fetch the highest price in the market. It is a very general, but nevertheless erroneous, notion that trout only live in water which is clear and transparent as crystal; on the contrary, they seem not in the least disturbed by the water being muddy, and, as we have seen, a muddy bottom even favors their growth. In Norway, which is famous for its delicate trout, they flourish most in rivers and brooks with muddy bottoms, provided suitable spawning-brooks are within easy reach. If there are in a body of water many stagnant places where aquatic plants grow in profusion, and hollow banks with entangled roots of trees and similar hiding places, the trout will flourish, even if the water does not flow very freely. Thus the river Leith, in Scotland, for example, is so shallow in many places during the summer that one can almost walk from bank to bank without wetting his feet; but it possesses a series of stagnant puddles extending for miles, which harbor an abundance of very large and delicately-flavored trout.

It is likewise an erroneous idea that trout require very cold mountain water; they are, on the contrary, very well able to stand warm water, such as is found in the plains during the hot season. It has been observed in Germany that trout streams reached a temperature of 21, and even 26, degrees Réaumur, without in the least injuring the fish. A warm temperature of the water is even beneficial to trout, as it increases their food very considerably, which is an important item, considering their voracity. It is well, however, for trout streams flowing through a plain to have here and there along their banks bushes and shade trees, for during the heat of the day trout love to stay in such shady places, as under the overhanging branches and among the roots they find an ample supply of food, principally insects, which generally live on the leaves and are thrown into the water by the wind.

Trout-culture is made comparatively easy by the circumstance that no other fish stays as steadily in one place without ever going far from it as the trout. Any person who lives near a stream, and is in the least observant, will be able to indicate the exact place of sojourn of this or that particularly striking individual trout. Apart from the spawning season the trout live permanently in a body of water extending frequently not more than 50 to 100 feet, which enables the proprietors of small bodies of water to use them advantageously for trout-culture. When trout are well taken care of they prefer to stay within narrowly-confined limits; they learn to know man, approach him without fear, and even jump out of the water to get some food which is held out to them, in which case, however, one has to be careful not to get hurt by their sharp teeth.

If trout are well fed they begin to spawn when two years old, and it has even happened that trout only one year old have been known to discharge mature spawn. Two-year-old trout lay from two hundred to five hundred eggs, three-year-old ones about a thousand, and those from four to five years old even as many as two thousand. To stock a moderately-sized stream with trout requires at least ten thousand young fish per annum. If this has been continued for three years one may, with tolerable certainty, count on good trout-fishing. As a general rule trout flourish better in brooks, where they take care of themselves, than in ponds, where they have to be fed artificially. They need human protection only until they are able to seek their own food. Where there is no running water they can be kept in that which is still, provided that the latter is constantly kept pure by inflowing springs.

If there are no suitable natural spawning places a spawning and hatching establishment may take their place; and it is well known that during the last decades a great deal has been done in the way of artificial trout-culture. It requires a good deal of technical knowledge to start and superintend such establishments, but the expenses are very trifling compared with the great profit. Natural trout-culture is much less profitable, because it has been calculated that, left to themselves, one thousand eggs will produce, on an average, only one fish, whilst in a well-conducted piscicultural establishment eight to nine hundred fish may be raised from the same number of eggs. The very waters in which trout flourish most have frequently no suitable spawning places, and if the supply is limited to the result of natural propagation the trout must soon die out, or, at any rate, become very scarce. Young fry from a piscicultural establishment are best placed at first in small streams or brooks with a gravelly bottom and retained there for some time by means of a wire grating.

As trout find much more food in the brooks and streams above referred to [sluggish, well-shaded waters] than in gravelly mountain streams, and consequently grow faster and acquire a more delicate flavor, a wide and exceedingly profitable field is here opened to the pisciculturist. The prejudice that trout are difficult to raise and that they are very choice in the selection of water cannot be sufficiently combated. As soon as they are able to forage for themselves they will be satisfied with almost any kind of water, provided it contains sufficient food. A brook containing pike and perch, but no spawning places for trout, will have to be stocked with ten times as many young fry, if any good fishing is looked for, as are required for an open mountain stream which is free from those two fish; but by means of artificial pisciculture the necessary quantity of young fry can easily be procured.

Mr. Peard, an Englishman, has made very practical suggestions for improving small trout-brooks. As we have seen, trout flourish best in streams which have not only a gentle current of water flowing over even places, but also a considerable number of large, deep, and calm

pools. These are the favorite hiding places and winter quarters of the fish, as the aquatic plants grow in profusion in quiet water, supplying ample nourishment for insect life, and quantities of food are usually brought together in such places by the currents. Wherever there are no such pools they can easily be made artificially, for which purpose cross-dikes are constructed in the bed of the stream, at a distance of one hundred to one hundred and fifty feet, and strengthened by sod, sand, and stones. Below these dikes holes are dug, three to five feet deep and six to seven feet long, in each of which are placed some large and several small stones, or flagstones. The fish are thus provided with suitable hiding places, and fish thieves are foiled in their endeavors to catch trout with nets. As these dikes produce small waterfalls, the pools are increased by every high water, if proper care is only taken that the floods do not carry the dikes away. They should extend several feet on the bank, so as to prevent the water from flowing past them; and then the soil carried along by the stream will continually make the dikes stronger and stronger.

In our age, when it is often so exceedingly difficult for a man to make a living, it is absolutely necessary for the farmer and landed proprietor to husband his resources, and to derive the greatest possible benefit from his property. A stream or a pond, unless used for purposes of irrigation, was formerly considered almost like dead capital, and attempts were even made to lay it dry, with the view of using the land thus gained to greater advantage. In our days no landed proprietor should be found guilty of such folly. By utilizing such waters for pisciculture, the first expenses of which are, as a general rule, very slight, a tenfold greater profit can be realized than by laying them dry and using them for agricultural purposes. In nearly every part of our country there are thousands of such ponds and streams which at present are entirely useless, but which if stocked with fine food-fish would become a rich source of income to their owners. Of all the various branches of pisciculture, trout culture is certainly the easiest and most profitable, and all persons who are in any way in a condition to carry on this business should give all possible attention to it.

130.—SCARCITY OF SALMON IN THE LITTLE SPOKANE AND OTHER STREAMS ON THE PACIFIC COAST.

By LIVINGSTON STONE.

[From a letter to Prof. S. F. Baird.]

It looks as if this year would prove a poor one for salmon at the Spokane River as well as McCloud River. A letter from Lane C. Gilliam, of Spokane Falls, Wash., dated September 17, 1883, says: "I have just completed my second trip to Little Spokane, and as yet no salmon to speak of are running. The Indians, who are encamped here in great