

#### IV.—THE SALMON OF THE DANUBE, OR THE HUCHO, (SALMO HUCHO,) AND ITS INTRODUCTION INTO AMERICAN WATERS.

BY RUDOLPH HESSEL.

[NOTE.—The following communication upon the *Hucho* was prepared by Mr. Rudolph Hessel, at my request, and embodies some facts of much interest in reference to this fish. The propriety of introducing so voracious a species, and one that remains and feeds entirely in fresh waters, where the sea-salmon occurs, or can be introduced, may perhaps be questioned, but whether it might not be planted to advantage in the more southern waters of the United States, or even in the Mississippi River, is well worthy of consideration.

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The Danube salmon differs from the other *Salmonidæ* by its more cylindrical and elongated body. The back is of a dark brownish-green; the belly, silver-white, and on its sides are black, round, and half-moon-shaped spots, which are more crowded along the upper part of the back: in this exhibiting a resemblance in marking to the sea-trout.

With increasing age (fish of 12 to 20 pounds and more) the sides exhibit a reddish tint, which becomes of a beautiful rose-color during the breeding season, and gives rise in some places to the name of "red-fish," not to be mistaken, however, for the "*Röthel*," (*Salmo umbla*, or *salvelinus*.)

The Danube salmon surpasses all other *Salmonidæ* in size, and attains a weight of 40 to 60 and 100 pounds. In rare cases, specimens even of 120 pounds have been caught. Its flesh is almost like that of the salmon of the Rhine in quality, but is white, while that of all the other German *Salmonidæ* is red.

A special peculiarity of this fish is its limited geographical distribution, occurring only in the streams emptying into the Black Sea, especially the Danube and its tributaries. When young (weighing from 12 to 18 pounds) it has its abode in the deep, rapid, mountain branches of the Danube, and afterward descends into the river itself, in the lower portion of which, near Galacz, Semlin, &c., it is found of fully developed size. The rivers Drave, Save, and Theiss, the principal southern tributaries of the Danube, also abound in full-grown fish. It is also frequently caught in the northwesterly tributaries, above Vienna—the Inn, Lech, Isar, Salzach, Altmühl, Regen, Iller, and even the small Brenz; indeed, generally, everywhere in the Upper Danube of Würtemberg. Except as indicated

above it is to be met with nowhere else in Europe. It also occurs in the Black Sea, but only near its shores, and also in the Dnieper, which discharges its water into the Black Sea near Odessa; likewise in the Volga and Ural Rivers of the Caspian Sea.

The Danube salmon has not the peculiar habit of migration from the sea of the true salmon (*Salmo salar*) though it also ascends the rivers to spawn, like most other *Salmonidæ*. Differing from the other European salmon, however, which breed in autumn or winter, it deposits its eggs in March, April, and May, the female making large cavities in the middle of the river for the purpose, called by the fishermen of the Danube 'bruch,' (break.) Accompanied by several males the female fish deposits its eggs at the bottom of these excavations, and while thus engaged are easily caught with the 'trident,' or fish-spear, and even after one of the males has been taken out the others leave the place only for a short while to return and meet the same fate. Many fish are thus captured during the breeding season, greatly to the injury of the fisheries; and although laws prohibiting this mode of fishing during the breeding season have been enacted in all the littoral states of the Danube they are mostly evaded.

The eggs of the Danube salmon have a diameter of about .20 of an inch, and their yolk is not a connected mass, as in the eggs of the other *Salmonidæ*, but is distributed in oily drops upon the entire inner surface. A period of forty to fifty days in cold weather, even more, is necessary for hatching. The eggs are rather sensitive and suffer greatly from the rapacity of the grayling, *Thymallus vexillifer* Agassiz, which exist in great numbers in the tributaries of the Danube. They follow the female *hucho* in shoals, and voraciously consume the eggs. Hence this beautiful fish is never so abundant as is the *Salmo salar* in the Rhine, where the *Thymallus* is far less numerous than in the Danube. In addition to this, the season for depositing their eggs is far more favorable to the *S. salar*, since then the *Thymallus* are full of milt and eggs and less hungry than at spring-time, when they have just done spawning. The young fishes lose their yolk-bag after ten to eighteen days. They have a length of .80 of an inch when hatched, 6 to 6.30 inches when six months old, and 24 to 32 inches after two years. This rate of growth is quite favorable, when compared with that of the European brook-trout, but is less than with the other *Salmonidæ*, which, migrating to the sea, there find richer nourishment than the *hucho*, which generally remains in the river. Since the *hucho* does not enter the sea, for this reason it appears especially adapted to the large lakes of America, as well as to the Mississippi and its tributaries.

In its third year the *Salmo hucho* attains its maturity for propagation. Before that period it prefers to remain in the small rivulets; but when sufficiently grown prefers the most rapid places of the larger tributaries, where rocks, trunks of trees, &c., offer shelter. Like the *S. salar*, it ascends obstructions several feet in height, sometimes six to eight. Like the other large *Salmonidæ* it is a rapacious fish, neither more nor

less so than its congeners of equal size, but is, I believe, decidedly surpassed in voracity by *Silurus glanis*, the sheat-fish, a kind of cat-fish, and the pike, *Esox lucius*. The daily consumption of food of the last-mentioned species, according to my own observations, amounts to one-third of its own weight. The *S. hucho* has a bad name for voracity, because it is not at all dainty; it preys on its own kind, catches frogs and water-fowl, and even does not refuse water-rats. But, after all, it consumes, in proportion to its size, far less than the smallest trout; and the most reliable fishermen of the Danube agree with me in the opinion that it is not as bad as reputed. True, it shows great energy in pursuit of food, but this occurs principally in winter-time when most of the other fishes remain in their hiding-places and the river is covered with ice. In such cases it frequently jumps high up the banks, where it is easily killed.

I have often examined the stomachs of these fish of different sizes, and mostly found white-fish and frogs, sometimes salamanders (*Triton cristatus*,) and once even a ring-snake (*Tropidonotus natrix*).

I believe that in the sluggish southern rivers of North America the numerous salamanders would serve as food, as the *hucho* loves to hunt in bends of the river overgrown with cane, and shows great skill in catching his prey.

Several years ago some ichthyologist maintained that the *hucho* is subject to a peculiar disease of the skin, of which he gave a description. This is, however, a mistake, as I have ascertained by consulting many of the fishermen of the Danube, and to my certain knowledge may occur in any fish very frequently on the carp. It is a spongy excrescence originating where the skin had been injured or the scales rubbed off, and of fungus origin, the same mould, viz, *Leptomitris clavatus*, which sometimes covers the eggs in breeding establishments, especially in winter-time, especially when dead animal matter had been allowed to contaminate the water.

The mode of catching the *hucho* differs greatly along the extended banks of the Danube, and is influenced by the situation, depth, &c., of the river. In summer-time they are taken in nets, and smaller ones, up to 6 pounds, with the fly, which, however, is refused by the older fish. From October to their spawning-time, even during the coldest winter, and under the ice, they are also to be taken with minnow-bait on ground-hooks. No other fish of the Danube besides the pike will take the hook.

No fish of the salmon tribe, the true salmon, *Salmo salar*, not excepted, affords more sport to the angler than the *hucho*, especially before the river becomes covered with ice, or when it breaks up in spring, and whether small or large, from 1 pound up to 60, none takes the hook at this season more readily. In rapids or other places, provided they are free from ice, the fishing is always successful. I have frequently practiced this mode of fishing in the Danube, from Linz to Galacz, and in its tribu-

taries, Lech, Inn, Salzach, Theiss, Drave, Save, Marosz, even in the severe winter of 1852, and always to my satisfaction.

I am entirely satisfied that the *S. hucho* will be admirably adapted for the Mississippi River and its numerous tributaries. The large, deep indentations, overgrown with cane, as well as the numerous rapid mountain affluents, offer favorable abodes. The large lakes of the United States appear also to be equally appropriate for this fish. This, of course, is nothing more than my individual opinion, but that its acclimation is possible is beyond doubt.

For the introduction of this fish two ways seem to be indicated: 1, the direct importation of a number of live fishes, about one year old, to be nursed in a suitable small lake until mature for propagation; or, 2, the importation of a large number of impregnated eggs to be artificially hatched. The former has great difficulties, as the *hucho*, like all salmon, constantly requires fresh water; still I should be willing to try it with about twenty-five to fifty specimens of the age of six to twelve months. It would, however, take almost three years before the fishes would be fit for propagation, and this is a great loss of time. The latter method offers no less difficulties, viz, the collection and transportation of the eggs, which are very sensitive, especially as the temperature of the sea-son is rapidly increasing, when they are spawning. It is scarcely credible that their artificial impregnation is entirely unknown to the fishermen of the Danube, although they believe it possible with the trout.

It would therefore be necessary to engage the most intelligent of the fishermen; to instruct them, and, if they are willing to do the collecting, to assign a centrally-situated place, where the hatching can be carried to the first stage, viz, the development of the eyes. Immediately after the impregnation eggs would not endure transportation for more than two days.

I have consulted several fishermen of the Danube, in person as well as by letter, and believe I could obtain 600,000 to 700,000 eggs in the first year. This is a considerable quantity, under these circumstances. The eggs are very sensitive, and will need to be managed by an expert; as the fishermen are entirely ignorant, and even require to be informed the mode of packing, &c. Hünigen, in 1872, secured 10,000 eggs, for which a man was sent to the Bavarian Danube. Mr. Schuster also received about 2,000, which were hatched. Those at Hünigen perished. It was the first time Messrs. Schuster and Haack had tried the hatching of *hucho*. In Germany preference is given to the salmon of the Rhine over the *hucho*, and even over the salmon of the Elbe, though the latter is the same fish. I believe, however, that the *hucho* will improve in the Rhine, as does every other fish, though it is already a splendid table-fish and desirable not alone on account of size. In reference to the difficulties of transportation, I need not direct your attention to the fact that they become so much greater in a journey to America. But as I reported in one of my last letters to Washington, I hope to meet all

these difficulties by the adoption of a little apparatus, by means of which I may safely carry 400,000 to 500,000 eggs. I think I have overcome the difficulties of construction. Ice for cooling, as you suggested, will be applied without allowing direct contact of the eggs with the melting water. Of this apparatus I hope to exhibit drawings and models in America when I see you. In conclusion, I have to say, that it will be necessary for the fishermen to ask permission for the collection of eggs, which, however, could be readily obtained.

I believe that now I have told you all, the good and bad, of this fish; it is, however, far from my purpose to unconditionally recommend its introduction into your country. I believe the *Salmo salar* ought to be tried in the Mississippi at the same time, as the Gulf of Mexico would afford rich feeding-ground. The Ohio and Missouri, with their many tributaries, may also be found suitable.

P. S.—Of late years there is, everywhere in Europe, manifested the desire to destroy the pike in lakes and ponds. Although our laws are quite stringent and are strictly executed, the catching of *Esox* is allowed even in spawning-time, as rational fish-breeding has proved them injurious. *Salmo hucho* and the other *Salmonidæ* are protected by law during the spawning-season.

I consider the *omul* or *Salmo omul* of Baikal Lake as one of the most excellent of the *Salmonidæ*. It is, however, at present scarcely to be had in Europe. According to my information, it surpasses the Salmon of the Rhine in quality, and is extremely prolific. About 20,000 hundred-weight are said to be caught in the lake, and preserved by smoking, every year. *Salmo omul*, as far as I know, has never been described satisfactorily in any work of natural history.

Very respectfully, yours,

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