Vol. IV, No. 18. Washington, D. C. Aug. 12, 1884.

145.—NOTES ON THE CULTIVATION OF FISH—MOSTLY AMERICAN—IN FRANCE.*

BROOK TROUT.—Mr. Després has written from Nauteuil-en-Vallée:

"I have only a small number of fry [of *Salmo fontinalis*] from the eggs which you sent me last year, about 200. These specimens, although kept under circumstances only half satisfactory, are in very good condition, having attained on the average from 10 to 12 centimeters [about 4 inches] in length. I think they would have reached a greater size if they had been furnished with regular food independent of what they found in their basin. I intend to give this to them in the future." [*Bulletin*, March, 1883, p. 165.]

CALIFORNIA SALMON.—In returning thanks for the salmon eggs which had been sent him, Mr. Rathelot has written from Grand-Montrouge:

"The eggs of the *Salmo quinnat* which you sent me in December, 1881, came very well. The first, which I placed in a basin in the open air, are large enough; they have attained a length of 22 centimeters [about 8 inches]. Those which I left in my laboratory and which I placed some months after in the same pond are smaller, not having enjoyed while young the same food as the first, which, in addition to the horse-flesh which I give them, found in that stagnant water little worms and other animalcules which increased their growth. They have endured during the hot weather a temperature of 22° C. [71°.6 F.]. They live for the present on very good terms with the blays, gudgeons, barbels, and crawfish. Towards the last of October a quantity of poplar and other leaves having fallen into the pond, the water became much colored. Seeing that my fish would not eat, and not wishing to pursue the experiment further, I was obliged to proceed to clean out the basin. I give these details in order to show that the *Salmo quinnat* does not require a particular kind of water." [*Bulletin*, March, 1883, p. 165.]

THE CONTROL OF WATERS.—Mr. A. Leroy read from a note on the depopulation and restocking of the rivers of France.

Mr. Raveret-Wattel pointed out, on the occasion of this communication, the considerable damage done in the rivers by the inadequacy of certain provisions of the legislation in regard to fish, by poaching, and,

* Translations of items in the Proceedings of the *Société Nationale d'Acclimatation* published in the Monthly Bulletin of the society. Translated by H. P. Jerrell.

finally, by the pollution of the waters, which are poisoned by waste matter from many manufactories.

The President of the Society said that, apart from these different causes of the destruction of fish, there is another, on which too much could not be known to call the attention; this is the "cleansing to a clean border," prescribed by the administration for all the little watercourses. The banks would become absolutely vertical walls; all the plants on which fish spawn would disappear. Now, it is precisely in the little watercourses tributary to the principal rivers that the fry especially are developed. Thus the cleansing to a clean border, when it is not absolutely necessary in order to facilitate the running of water and to assure the supply of manufactories, ought to be done away with as one of the deeply to be regretted causes of the disappearance of fish. Meanwhile, far from being an exception, this cleansing is really an absolute and obligatory practice. From this results an appalling destruction of fish.

Mr. Millet remembered that the question of the depopulation and restocking of the watercourses has often been the object of particular attention on the part of the Society of Acclimatization, which has seen many of the measures which it has proposed for remedying the evil adopted by the administration. Among these measures stands the creation of reservations for fish, from which excellent results have been obtained. More than 820 kilometers [about 510 miles] of navigable streams are actually made into reservations, in which all trespassing, even that with the floating line, is prohibited for five successive years. While recognizing the good effects of reservations, at least in certain places, Mr. Raveret-Wattel thought that it would be well not to exaggerate the efficacy of this measure. In fact, the reservations protect the carnivorous and destructive species as well as those which are not; and the rapid increase of perch and pike has contributed much of late years to the diminution of the other species.

Mr. Millet did not believe that the pike spawned in the reserves. As to the perch, it is easy to destroy the strings of eggs which it attaches to the water plants. [*Bulletin*, April, 1883, p. 263.]

In making an annual report on the works of the Society in 1882, C. Raveret-Wattel spoke as follows:

WHITEFISH.—"Important shipments of eggs of different foreign salmonoids have been sent you again this year by generous donors, among whom, as always, we have to mention first Prof. Spencer F. Baird, Commissioner of Fisheries of the United States. About 250,000 eggs of the whitefish (*Coregonus albus*), sent from New York by his orders, have reached you in perfect condition, and you have been permitted to undertake a very interesting experiment in the acclimatization of this species, the introduction of which in our fresh waters would be a valuable achievement. Mr. Fred Mather, a member of the Commission of Fisheries, has,

as usual, had the kindness to lend his co-operation in this shipment, for which we cannot show ourselves too grateful.

CALIFORNIA SALMON.—"Several gifts, likewise very precious, have been made to us by the German Fishery Association, which, on the proposition of its eminent president, von Behr, has generously made it possible for you to attempt the stocking of our waters with choice species which are recommended either for the quality of their flesh or the rapidity of their growth. Let us recall, moreover, that it is due to the gifts previously made to our society by von Behr, that you have been able to announce this year the complete acclimatization of the California salmon (*Salmo quinnat*), in regard to which Messrs. Rathelot and Clermont have given you interesting details.

FISH-WAYS.—"Knowing that the Society of Acclimatization interests itself in all questions which relate to the restocking of rivers and to the protection of migratory fish, the Minister of War appealed to your knowledge of the subject, with a view to the construction of a fish-way for salmon on the Dourduf River at the dam belonging to the powder mill of Pont-de-Buis, department of Finistère. The numerous documents which you possess, from the Commission of Fisheries of the United States and from other sources, relating to fish-ways for salmon, have permitted you to inform the administration regarding the different systems in use and the types which are most advantageous, considering the cost of their establishment and maintenance as well as their utility.

CROSS-BREEDING.—"Mr. Seth Green, of Rochester, N. Y., one of the veterans of American fish-culture, has given you an account of his very curious experiments in the cross-breeding of different species of salmon. Such experiments should be attentively observed, both as a matter of scientific interest and for the practical results which may be obtained." [*Bulletin*, May, 1883, p. 71.]

LAKE TROUT.—Mr. des Vallières, of Meaux, gave an account of the results which he had obtained from the fertilized eggs of the great European lake trout, and of the *Salmo namaycush*:

"The first of these shipments, which contained a small lot of impregnated eggs, reached me in very satisfactory condition. These eggs produced fry in the proportion of 95 per cent. The eggs of the *Salmo namaycush*, which were sent to me in great numbers, have been mostly spoiled when they reached me. I estimate that 50 per cent of the eggs were thrown away on their arrival; and during the period of hatching probably 15 per cent more died in the egg or perished at birth. I attribute these numerous losses to the freezing which took place during the passage from America, and which has produced morbid effects more or less active. Immediately after the absorption of their yelk-sacs, the fry of these two species [*S. namaycush* and the great European lake trout] were

put into a little canal, derived from the Brasset, a stream which empties into the Marne some hundreds of meters away. This little canal, well arranged and full of running water, is suited to these fish, which are growing in a normal way and will afterwards be set free in the Brasset, whence they can spread in the Marne and ascend its tributaries. It will not be out of place to remark that the waters of the Marne are suited to the salmon family, for trout weighing 1 or 2 pounds have been taken this winter at Meaux itself.

"In the breeding of which I have the honor of giving you an account, I noticed that the *Salmo namaycush* grew with such rapidity that in two months they were larger than the great European trout hatched three weeks earlier. They also appeared more hardy and more easy of acclimatization." [*Bulletin*, July, 1883, p. 426.]

LANDLOCKED SALMON.—Mr. Rivoiron wrote from Échelles, department of Isère, among other things, as follows:

"In my last letter I told you that two-thirds of the fertilized eggs of your landlocked salmon still remained to be hatched. The hatching took place under the best possible conditions, and I had from the whole lot only a very few spoiled eggs, which became white immediately after the hatching. As a result of leaving one of the troughs exposed a little too much to the sun, we lost about fifty. I put them in the shade, and think that we have now lost only a hundred in all. They are very pretty, quite large, and have been taking food for fifteen days. They are fed on insects and the larvæ of the gnat and the water-flea. We can produce with our six basins about a kilogram [$2\frac{1}{5}$ pounds] of insects daily." [*Bulletin*, July, 1883, p. 427.]

BROOK TROUT AND CALIFORNIA SALMON.—Mr. Noordoek-Hegt, of Apeldoorn, Netherlands, has written:

"My fish-cultural establishment is succeeding. During the past week, under the direction of the commission appointed by the Government, Professors Hubrecht and Hoffman, I have set at liberty in the Yssel River more than 200,000 fry and 5,300 young salmon a year old. I have kept over 100,000 fry, of which it is probable that a part will also be set free, and the rest will remain in my basins until they reach the age of one year. I have a hundred California salmon (*Salmo quinnat*) which were born in my basins and are now four years old. These fish have never been to the sea, and yet they are in excellent health. Their average length is 50 centimeters [about $19\frac{1}{2}$ inches]. In October we succeeded in fertilizing a number of their eggs, and the fry are now doing wonderfully well. This fish [California salmon] is much more hardy than the Rhine salmon.

"My experiments with the *Salmo fontinalis*, an American trout, and a very pretty fish, have also been successful. I had imported eggs from America for two successive seasons. Nearly all of the eggs perished; however, from the two lots, we saved several hundred young fish. In

October last those of the first lot were eighteen or nineteen months old, and we have already been able to impregnate artificially a few hundred of their eggs, which have given us the same number of fry, and all are in the best condition. I am sure that if no disaster occurs we shall produce the *Salmo quinnat* and the *Salmo fontinalis* by thousands.

"I have had this year more than 60,000 fry of common or river trout and of lake trout [probably European], all coming from fish hatched in my establishment. So there is reason to be pleased, and I would be happy if I could show you the results of my work. I have sent to the International Fisheries Exhibition at London a model of my hatching shed, a plan of the establishment, and twenty bottles containing fish, which were all, without a single exception, born in my establishment." [*Bulletin*, July, 1883, p. 428.]

BROOK TROUT.—Mr. Després wrote from Nanteuil-en-Vallée, among other things:

"The preceding parcels of eggs which have been sent me have given good results. I have at the present time a hundred of *Salmo fontinalis* about twenty months old, some of which are more than 20 centimeters [about 8 inches] long. These are the ones which have received as extra food horse-flesh chopped up fine. The others, which have had at their disposal only the natural food which they were able to gather in a basin of considerable size furnished with aquatic plants, show a less development, but their health and vivacity are all that could be desired. This experiment in comparison has convinced me that it is necessary to give them, when they are about seven or eight months old, some artificial food in addition to that which they can find in the water, which is probably insufficient to allow them to attain a good development.

"The specimens of last year are likewise in good condition. They are as yet too small for me to state precisely their number. A rise of water caused me to lose some of them, because of an unfortunate arrangement of the basin which contains them. I have remedied this, and in future will watch with care that a like accident may not happen again. The escaped specimens probably have gone to grow up in the little stream which flows near by the establishment." [*Bulletin*, February, 1884, p. 188.]

SALMO CARPIO.—Mr. Kleiter, director of the fish-cultural establishment at Munich, announced the sending of 2,000 embryonic eggs of *Salmo carpio*, which he was directed to make to the Society of Acclimatization on the part of the German Association of Fish-culture. At this, Mr. Raveret-Wattel recalled to mind that the *Salmo carpio* of Lake Garde is an excellent species of trout, which never becomes very large, but whose flesh is much like salmon and is of an exquisite flavor. One fish-cultural establishment alone, on the shore of Lake Garde, is occupied with multiplying this species, so interesting to propagate, and remarkable, moreover, in this, that the spawning season is continued with certain individuals till June. [*Bulletin*, March, 1884, p. 290.]

LAKE TROUT.—Mr. Dubard, of Vilars-sur-Ouche, likewise requested a shipment of trout eggs. He wrote:

"I am encouraged to make this request of you by a precedent which assures me of almost certain success. Last year I bought from different persons 3,000 impregnated eggs, nearly all of which were afterwards hatched. After keeping them in the hatching apparatus for a fortnight I set these little trout free in a brook of running water 20 meters [22 yards, nearly] long by 1½ meters [5 feet] wide, and there I fed them up to the age of three months on chopped fish without appreciable loss. At this time these young fish had attained on the average 35 millimeters [1.4 inch nearly] in length. Then, thinking that there was nothing further to fear, I set them at liberty in my sheet of water which is fed by many good-sized springs. I ought to say that since then I have seen but little of them, but this is explained because of the depth of the basin, its extent, and the quantity of weeds which cover the bottom. If it is possible, I would prefer to receive some eggs of lake trout, which grows, as I have heard it remarked, much more rapidly than the other species." [*Bulletin*, March, 1884, p. 290.]

LAKE TROUT AND CALIFORNIA SALMON.—Mr. Focet wrote from Bernay:

"In reply to your letter of January 31, 1884, inquiring of me the results which I obtained from some shipments of salmon eggs which your society was pleased to send to me last year, I will state that the result was generally good. In fact, from the incubation of about 12,000 eggs of different kinds of salmon, I obtained about 10,000 fry, which have, on the whole, done well during the four months in which I have fed them on grated cooked meat, frog spawn, and codfish eggs. But I was obliged at the end of this period, being no longer able to feed them or to keep them in my apparatus, to set them free in the streams of Risle and Charentonne. I have taken good care of some specimens in my reservoirs, but only a few, as I have trouble in securing them from two great dangers, 1st, the variation in the depth and condition of the water, and, 2d, the voracity of water-rats and otters.

"In brief, the reports on fish culture, which I have made for ten years have been until now, and will be for the future till further orders, the same, as far as I can put in execution industrial fish culture, that is to say, to so care for the fish that it can be turned over for consumption after three or four years of living in a closed basin. However, my labors have not been without good results. I have restocked two watercourses of a length of at least 24 kilometers [about 11 miles]. Trout there are so abundant that recently, because of an accident which happened to the reservoirs of the gas-works, the ammoniac water killed more than fifteen hundred trout in the course of no more than 2 kilometers [1¼ miles] in the waters of the Charentonne. A fine of more than 1,500 francs [$300] was imposed on the gas company. You see

from this what an abundance of fish there was. Some months afterwards, to my great surprise, the evil was repaired. The fish from below, ascending the watercourse, were sufficient to restock it as before.

"At this time all our natural spawners are numerous and in good condition, and we look for the best results.

"One word with reference to the small number of salmon which we find again in proportion to the young fry set at liberty. On the average each year I set free about eight thousand young trout from my purchases, and about two thousand fry of different kinds of salmon which are presented to me. We ought, then, to find them in the same proportions; but we do not. They report to me each year about fifteen or twenty of these specimens, which is a very slight proportion, as you see, and yet for several years I have set free especially lake trout and California salmon. Do they migrate also like the common salmon?" [*Bulletin*, March, 1884, p. 300.]

BROOK TROUT.—Mr. Després wrote from Nanteuil-en-Vallée:

"Last year I received from the Acclimatization Society some eggs of *Salmo fontinalis*, the hatching of which was conducted under the best conditions, and the loss was almost nothing. After the reabsorption of the yelk-sac, which was also accomplished almost without loss, the fry were let run in a basin of oblong shape with a little continuous current on a bottom of sand and gravel with water-plants. I judged that with larvæ and animalcules their food would be sufficient without having recourse to artificial nourishment.

"At the end of eight months I collected about a third of the fry of a size varying from 8 to 10 centimeters [nearly 4 inches in length]. I believe that their development would be greater if a suitable artificial food should be added to that which the young fish naturally find in the water.

"This year I intend to try two methods with the eggs of the *Salmo carpio*, which have been sent me. I would be glad to try them also with some eggs of the *Salmo fontinalis*, if the Society can spare a few.

"The best food, which causes no loss because of congestion of the gills, would be the living prey; but it is almost impossible to procure this in sufficient quantities to supply laboratory basins. In default of this, I have given them with moderate success raw meat, which was tender, and reduced almost to a paste and then mixed with water; the ground flesh of little fish gives the best result.

"My *Salmo fontinalis* are still in my basins. I would like to know whether they can live long in captivity, as the common salmon of France cannot. I am inclined to believe that they can, because their skin and shape show that they are of a variety of trout, either the common or the salmon-trout."

Mr. Raveret Wattel remarked, on the occasion of this letter, that the *Salmo fontinalis*, which is more generally and properly described to-day

under the name of *Salvelinus fontinalis*, is an American species of grayling (*Omble-Chevalier*), which inhabits the little watercourses rather than the lakes, whence it gets its common name of brook trout in the United States. It is an excellent fish, of sluggish habits, which can be raised easily and advantageously in closed basins. [*Bulletin*, March, 1884, p. 301.]

BROOK TROUT.—Mr. Garnier, president of the Linnæan Society of Northern France, forwarded a report of Mr. Lefebvre, on the results obtained from eggs of different species of salmon forwarded by the Acclimatization Society. Mr. Lefebvre states that he has succeeded in propagating *Salmo fontinalis*, and that by means of artificial impregnation he has obtained hybrids from this species and the common trout. The eggs have been furnished by one species and the milt by the other, and *vice versa*. The crossing of grayling (female) and *Salmo fontinalis* (male) has been less successful, and only a few fry were obtained. [*Bulletin*, March, 1884, p. 306.]

TROUT.—Mr. Leroy wrote from the country seat of Roussainville:

"I have the honor of acknowledging the receipt of some trout eggs. They arrived in good condition except five, which I fear are spoiled, and ten whose existence seems to me doubtful. I have not thrown them away, nevertheless, but have placed them for hatching in the different vessels. My three sets of hatching apparatus are placed each under a tap, from which flows, without cessation, spring-water at the temperature of 8° C. [46°.4 F.], all in a half-darkened room. These eggs appear to me to be in an advanced period of incubation; two or three have hatched already." [*Bulletin*, March, 1884, p. 306.]

SALMON, TROUT, WHITEFISH, &c.—Mr. Wagner, director of bridges and roads, and manager of the fish-cultural establishment of Bouzey, wrote from Epinal:

"During last year (1883) we received from the Acclimatization Society some eggs of *Salmo namaycush*, *S. fontinalis*, *S. salar* subsp. *sebago*, *Coregonus albus*, and *C. marœna*. These eggs were in very good condition and hatched well, in the proportion of 80 to 100, with the exception of the landlocked salmon which gave only 50 to 100. The fry of the two kinds of *Coregonus*, after the sacs were reabsorbed, were distributed in the fish-pond of Bouzey, which is supplied by the brook of Avière as well as by the waters of the Moselle River, and whose maximum depth is 15 meters [49⅕ feet]. Moreover, we succeeded in raising a hundred of each of these two species on the hatching tables by means of little fly larvæ, microscopic insects, and finely strained beef's brains. These fry were kept in a basin 1½ meters deep, and have attained a length of 9 centimeters [3½ inches, about].

"The young of *Salmo namaycush*, *Salmo fontinalis*, and landlocked salmon were raised on the hatching tables by means of insects, fly larvæ, and beef's brains. In June they were placed in breeding-trenches of from 4 to 5 decimeters [about 15 to 20 inches] in depth,

supplied by running water, and their food has been continued with minced horse-flesh. The young of *Salmo namaycush* and *S. fontinalis* have succeeded well and have attained a length of from 10 to 12 centimeters; but the landlocked salmon have not given the same result. All these fry were kept during the winter in the lower trenches of the hatching shop, and in the spring are to be distributed in the outside basins and preserved at the establishment. Last autumn we noticed that the males were full of milt, but that the females had no eggs; besides many females have died. There are still sixty of these fry which weigh from 250 to 300 grams [about $8\frac{4}{5}$ to $10\frac{4}{7}$ ounces avoirdupois], and we will try to keep them for reproduction, if possible.

"In 1882 we distributed some fry from little Fera of the Lake of Constance, in the fish-pond of Bouzey, and we had this winter the satisfaction of catching specimens from 18 to 22 centimeters in length.

"I avail myself of this letter to ask the Society to send us, if it is possible, some eggs of *Salmo quinnat*, *S. namaycush*, and *S. fontinalis*, in order to distribute the fry in the fish-pond of Bouzey and in the reservations of the Moselle, while preserving a few of each species at the establishment." [*Bulletin*, March, 1884, p. 397.]

SALMON.—Mr. Bartet, chief engineer of bridges and roads, gave the following account of results obtained from eggs of the different species of salmon which were distributed by the Society and placed for hatching in the aquarium of Trocadéro:

"Sixty per cent of the eggs were successfully hatched. The food which was given the fry at the beginning was mud-worms chopped fine and afterwards whitefish, also chopped fine. Their growth has not been rapid; and the young fish are yet in the inclosed water, and have not been set free in the river. During the first four months after the hatching we lost many of these fish, and now only a tenth part remains. Before placing them in one of the aquarium troughs and taking them out of the hatching apparatus, we kept them, for about two months, in an intermediate basin 5 decimeters in depth, with a bottom of pebbles. The less mortality was produced in the hatching apparatus.

"That apparatus consists of eight troughs placed in a row one above the other, each trough being 50 centimeters long by 20 centimeters wide and 15 centimeters deep, whose inner walls are sheets of glass hermetically sealed. It is supplied by water from the Vanne, which is previously filtered through a sponge contained in a terra-cotta pot, from which the discharge is about 150 liters an hour. The eggs were placed on screens formed of a framework of wood and a rod of glass.

"The hatching is conducted normally; that is to say, it takes place in about six weeks after impregnation, and the reabsorption of the umbilical sac occupies the same time. The temperature of the water is kept at between 9 and 10° C. [about 50° F.]. The surviving fish, put together in a common trough, are in good health." [*Bulletin*, March, 1884, p. 308.]