

SKETCH OF THE SCHOODIC SALMON-BREEDING ESTABLISHMENT.

By CHARLES G. ATKINS.

[Written by request of Prof. S. F. Baird, for the London Exhibition, 1883.]

The salmon of the Schoodic lakes belongs to the group termed "land-locked" salmon, whose distinguishing trait is the absence of the habit of migrating to the sea. It has been regarded by naturalists until recently as a distinct species from the sea-going salmon (*Salmo salar*), but the most recent researches of American ichthyologists have led to the conclusion that there are no specific differences between the two. But whatever the verdict of systematic ichthyology, the marked difference between them in habits and growth must, from the fish-culturist's point of view, separate them as widely as any two species of the salmon family.

Doubtless the absence of the migratory instinct is at the bottom of most of the variations from the normal type of *Salmo salar* which the land-locked salmon exhibits. The lakes afford a far poorer feeding ground than the sea; hence, perhaps the diminutive size and leaner flesh of the land-locked salmon. Its lower tone of color, less permanent sexual marks, and greater liability to ovarian disease, as well as different habits of feeding, may perhaps be referable to the same general cause. There are some other peculiarities which are not so easily explained. For instance, the eggs of the land-locked salmon are very considerably larger than those of the sea salmon, and the same is true of the very young fry.

My observations on the young of the Sebago land-locked salmon lead me to think that their growth is more rapid than that of the anadromous salmon, for, among other things, I have seen specimens more than a foot long still bearing plainly on their sides dark, transverse bands characteristic of young salmon. But this may be explained in another way. It may be that the land-locked fish simply retain the marks of the immature stages to a later period of life. This view is supported by another fact that I have observed, namely, that the dark bands are never completely obliterated from the sides of the land-locked salmon, being always very distinct, even in adult specimens, on the under side of the skin, a phenomenon which I have sought for in vain among the migratory salmon.

The land-locked salmon, though smaller and leaner than his anadromous brother, is yet not a poor fish. His flesh is fat and rich and of a more delicate flavor. In game qualities he is, for his size, quite the peer of the larger salmon and affords keen sport to the fly fisherman.

He is, therefore, much sought after, taking, perhaps, in public favor the lead of all fresh-water species.

The natural range of the land-locked salmon in the United States is very much restricted. Leaving out of the question the salmon formerly frequenting the rivers tributary to the great lakes, Ontario and Champlain, the extent of whose migration is a matter of doubt, we find them only in four limited districts, all in the state of Maine, namely, the Presumpscot River in Cumberland and Oxford Counties, the Sebec (a tributary of the Penobscot) in Piscataquis County, the Union River, in Hancock County, and the Saint Croix, in Washington County. There are some minor differences between the fish of these several districts, of which, perhaps, that of size is the most notable. The Sebago and Union River fish are much larger on the average than those of the Sebec and Saint Croix. The Sebago salmon average at the spawning season 4 or 5 pounds weight for the males and a pound less for the female, while specimens of 12 and 14 pounds weight are not rare, and there is even on record one of 17½ pounds. The Union River fish are about the same size. The Saint Croix fish vary in the matter of weight in different parts of their range, but the average weight of either sex at Grand Lake Stream is a little less than three pounds. Specimens of over 6 pounds are rare, and none are on record of over 10 pounds.

Attempts have been made to collect eggs of land-locked Salmon in each of the four districts mentioned above, but it is found that in the Saint Croix district alone, and there only in the single locality of Grand Lake Stream, are they sufficiently abundant to yield a large stock of eggs. In 1873 the Commissioners of Fisheries of the United States, and of Massachusetts and Connecticut, founded an establishment at Sebec Lake, but after two years of effort it was found that the supply of fish was too small, and they determined to transfer the work to Grand Lake Stream.

The land-locked salmon of the Saint Croix, though originally well distributed through the lakes tributary to that river and still inhabiting a great many of them, finds in some a much more congenial home than in others, and Grand Lake, on the west branch, or Schoodic River, is of all these waters their favorite abode. This body of water is of irregular shape, about 12 miles in length and 4 in extreme breadth, fed almost wholly by short streams that form the outlets of other lakes, and from this cause as well as from the fact that it drains a gravelly country and is girt with clean, rocky shores, it is one of the purest of the lakes of Maine. Its greatest depth is believed to be a little over 100 feet. Its outlet is Grand Lake Stream, a shallow, rapid, gravelly stream, about 3 miles long, to which the salmon resort in October and November to deposit their eggs. Comparatively few of the salmon of this lake resort to the stream tributary to it.

Of necessity the operations with land-locked salmon are conducted in a very different manner from those with migratory salmon. Being

at home in fresh water and having there their feeding grounds they continue to feed until the close approach of the spawning-time, and hence they could not be penned up in the summer without some provision for an artificial supply of food, which would probably involve a great deal of expense and trouble. Moreover, the necessity of collecting breeding fish early in the summer does not exist, because they are at no time more congregated and easy to catch than at the spawning season.

The capture of the fish is easily effected by stretching a net across the outlet of the lake and leading them through a tunnel-formed passage into an inclosure of netting. There happens to be at this point a wide surface of smooth bottom, with water from 1 to 3 feet deep, affording an excellent site for spacious inclosures not only for entrapping but for assorting and storing the salmon during the spawning season. Nets are generally stretched across the stream (to keep the fish back in the lake) immediately after the beginning of the close season, September 15. The very earliest of them begin to spawn before the end of October, but the actual inclosing of the breeding stock is deferred until the early days of November. The taking of spawn generally begins about November 6, and continues for two or three weeks. Commonly by November 20 or 22 this work is completed, and the breeders are carried a mile or two up the lake and liberated.

The method of manipulation is the same employed at the Penobscot station, and is not supposed to differ materially from that adopted by all American breeders of Salmonidæ. The results in the impregnation of the spawn are not so uniformly satisfactory as at the Penobscot station. There appears to be a greater prevalence of ovarian disease than among the migratory salmon. The occurrence of white eggs among the normally colored and healthy ones, as they are yielded by the fish, is very common, and occasionally the entire litter is found to be defective. It is not improbable that there are some eggs that are incapable of impregnation, though exhibiting no visible symptoms of disease. However, the general result is satisfactory, the ratio of impregnated eggs being from 93 to 95 per centum.

The facilities for developing and hatching the eggs are rather poor. No good site could be found by the side of the stream, no suitable brook could be found near enough to the fishing grounds, and the neighboring springs lacked either volume or facilities for utilization. At present there are three hatcheries in use, two of them using spring water exclusively and one of them lake or stream water exclusively. The lake water would be preferred, but unfortunately it can only be used for the slow development of part of the eggs, circumstances connected with the floating of timber down the stream compelling the evacuation of that hatchery in March. The main hatchery is very favorably located and served, except that the water is all spring water, and this unfavor-

able circumstance is well counterbalanced by the facilities for aëration, which are very good and very fully employed. The eggs are placed upon wire-cloth trays in stacks or tiers, ten deep, and arranged for a free horizontal movement of the water.

Of the eggs here obtained three-quarters are shipped away to the order of the parties supporting the establishment; the remaining quarter is hatched out and the young salmon liberated in the lake, to keep up the stock of fish. The shipments are made in January, February, March, and sometimes April. The eggs hatched are selected from those that have been retarded in development, and they reach the age for liberation in June, when their natural food is believed to be abundant.

The following statement shows the work accomplished each year since the organization of the establishment at Grand Lake Stream:

Year.	Salmon caught.			Eggs obtained.	Eggs distributed.
	Males.	Females.	Total.*		
1875-'76.....	1,055	1,571	2,628	1,077,500	933,000
1876-'77.....	272	749	1,021	543,000	460,000
1877-'78.....	1,776	2,372	4,151	2,159,000	1,070,000
1878-'79.....	1,122	1,785	2,908	1,723,000	1,470,000
1879-'80.....	938	1,084	2,022	1,113,456	992,000
1880-'81.....	698	1,473	2,171	2,326,740	2,068,500
1881-'82.....	370†	652	1,022	947,000	860,000
1882-'83.....	600	1,004	1,604	1,600,000	1,496,000
	6,831	10,600	17,527	11,489,696	10,249,500

*Including some whose sex was unknown. † Estimate.

TRANSPORTING CARP FROM THE UNITED STATES FISH COMMISSION TO BRAZIL.

By J. W. COUCHMAN.

[Letter to Prof. S. F. Baird.]

It is with pleasure I report the safe arrival of thirteen beautiful specimens of the survival of the fittest out of the one hundred carp which were shipped to me from New York by steamer Borghese. They were thirty-nine days at sea. The greater portion of them died before the steamer reached St. Thomas. None died during the last ten days of voyage. Your instructions for keeping them were not carefully observed. The person who had them in charge fed them on hard-boiled eggs. If it would afford you any pleasure I will be glad to give you a report of them from time to time.

RIO DE JANEIRO, BRAZIL, RUA DO OUVIDOR No. 130,

January 6, 1883.