

# XXXI.—REPORT ON THE PROPAGATION OF PENOBSCOT SALMON IN 1882-'83.

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## 1. ROUTINE WORK.

At this station the arrangements of former years were continued, Mr. Buck remaining in charge, and the salmon being collected at the south end of Verona by Mr. Whitmore and confined in the inclosure in Dead Brook, whither they were taken in submerged cars.

The season's work opened with the purchase of adult salmon June 3, 1882. There were received in all 586 salmon, of which the last were inclosed June 29. The weight of 473 individuals was estimated singly, and their general average was 13.04 pounds, which is about the ordinary size, but 4 pounds under the average of 1881. They did not appear to be up to the ordinary standard in fatness, but no measurement was made to determine this point. It is quite possible that this was a false impression occasioned by a comparison by memory of the fish with those of the preceding year, which were thought to be remarkable for plumpness as well as for length.

With the hope of lessening the mortality occurring during the term of imprisonment, some changes were made in the cars, and fine minnow nets were used for dipping, but no very decided result followed these efforts. The summer mortality in 1881 was 146 out of 509 deposited in the inclosure. This year out of 560 placed in the inclosure 134 were found dead, and this number should possibly be increased by adding 13 more which were missing at the end of the season. The slight improvement shown by these figures may have been owing less to better handling than to the fact that the salmon this season were of smaller size than in 1881, a circumstance that experience has shown to be favorable.

However, at the spawning season, there were found to be on hand 440 healthy salmon, of which 256 were females and 184 males—58 and 42 per cent., respectively. The most of these were weighed and measured, and the results may be stated thus:

Males, 121 measured.

Length:

Average.....	inches..	32.1
Longest.....	do....	41.5
Shortest.....	do....	28

## Males, 121 measured—Continued.

## Weight:

Average	.....pounds..	10.9
Heaviest	.....do....	22.3
Lightest	.....do....	7

## Females, 246 measured.

## Length:

Average	.....inches..	31.5
Longest	.....do....	39.5
Shortest	.....do....	26

## Weight before spawning:

Average	.....pounds..	12.2
Heaviest	.....do....	28.1
Lightest	.....do....	5.6

## Weight after spawning:

Average	.....pounds..	9.4
Heaviest	.....do....	23.8
Lightest	.....do....	4

The first spawn was taken October 28. The work was nearly completed November 9, but the last eggs were not taken until November 23. Spawn was obtained from 250 females, and the total number of eggs was estimated at 2,000,000. The mean yield was thus 8,360 per fish.

The eggs were kept in the coolest water at command until sufficiently developed for shipment. The losses sustained during the development aggregated 90,000, of which it is estimated that 42,000 were unimpregnated. From these figures we deduce that 98 per cent. of the eggs were impregnated and 95.7 per cent. were shipped.

The eggs available for shipment numbered 2,000,000. Based on the contributions to expenses a pro rata division gave to the United States Commission 1,208,000 eggs; to Connecticut, 132,000; to Maine, 440,000; to Massachusetts, 220,000.

The transfer of the Penobscot eggs is now effected by precisely the same methods employed for years at both the Maine stations, except that the protecting envelope is latterly composed of chopped hay in a somewhat thicker layer than is necessary with moss. The moss is difficult to obtain at Orland, and the hay is found to be a very satisfactory substitute. In all cases, however, wet bog-moss is still the material in which the eggs are first embedded.

As will be seen by reference to Table I, all the packages reached their destination in safety, and with two exceptions the number of eggs found dead on unpacking was insignificant—less than two per thousand. The exceptions were two lots that were sent to Enfield and Norway, Me., March 1, in which the losses were, respectively, 20 and 14 per thousand (= 2 and 1.4 per cent.). The true explanation doubtless is that these

eggs had accidentally escaped the scrutiny by which the unimpregnated were removed in preparation for shipment.

The hatching out and planting also appear to have been attended with a good degree of success and, as the footing of Table II shows, there were 1,716,617 young salmon safely turned out in public waters. The difference between this number and the original 2,000,000 eggs shipped is partly accounted for by the number (75,000) devoted to exhibition and laboratory purposes.

## 2. RECOVERY OF MARKED SALMON.

In the autumn of 1880, after being manipulated, 274 salmon were marked for future identification; 193 of these were females, 81 were males. The method of marking was similar to that employed at Bucksport in 1873. A tag of very thin platinum, about half an inch long and a quarter of an inch wide, stamped with a number, was attached by fine platinum wire to the rear margin of the main dorsal fin, and a record made of the number, with the sex, length, and weight of the fish. These fish were, at the close of the spawning season, dismissed into the open "Narramissic" or Eastern River. Twelve of them were recovered in 1881, in April and May, all in poor condition. Doubtless many others were taken or killed and not reported. Previous experience had taught us to expect the return of these fish in good condition in 1882, and a reward of \$2, in addition to market value, was offered for each salmon bearing a tag. The number brought in was less than had been hoped for, but was perhaps quite all that should be expected when we consider the many chances against a tag remaining in place. For instance, the fine wire is liable to create a sore or to cut its way out through the margin of the fin or of the tag by the inevitable sawing motion created by the swaying of the fish in swimming; or it may be torn off by contact with some foreign object; or possibly the shining bit of platinum may be seized by a neighboring salmon or some other fish. However, from the data afforded by the salmon actually recovered we obtain a substantial corroboration of the conclusions drawn from previous experience. The following statement shows the entire record of each fish recovered:

No.	Sex.	When marked.	Length when marked.	Weight when marked.	When retaken.	Where retaken.	Length.	Weight.	Increase in weight.*
		1880.	<i>Inches.</i>	<i>Pounds.</i>	1882.		<i>Inches.</i>	<i>Pounds.</i>	<i>Per cent.</i>
1135	Female.	Oct. 28	30	7.5	June 20	No. Bucksport	34.5	16.5	127
1136	Female.	Nov. 1	31	8.25	June —	Searsport . . . .	35.5	17.25	112
1239	Female.	Nov. 5	36	14.5	June 22	Sandy Point . .	39.25	21	45
1248	Female.	Nov. 5	32	8	June —	No. Bucksport	39	21	162
1274	Male...	Nov. 12	30	8.5	June 23	Frankfort . . . .	.....	14.75	79

\* See revised estimates below.

It must be borne in mind that when these fish were marked they were in exceedingly poor condition, having just been deprived of their

spawn after a summer's fast. To arrive at a correct estimate of their rate of growth, we should compare their size when retaken with their probable size at the time of their original capture in June, 1880. The record books show the weight of spawn taken from each female. The difference between the average of estimates in June and of ascertained weights in November may be taken to represent the waste of flesh during the period of confinement. This is found to be 10.5 per cent. of the November weights before spawning. Calculating the original weight from these data the following table may be constructed, to exhibit the rate of growth:

No.	Sex.	Weight June, 1880, computed.	Weight November, 1880.		Weight June, 1882, computed.	Increase in two years.			
			Before spawning.	After spawning.		Weight.		Length.	
						Pounds.	Per cent.	Inches.	Per cent.
1135	Female.	10.43	9.44	7.50	16.50	2.07	10.8	4.5	15
1136	Female.	11.53	10.44	8.25	17.25	5.72	49.6	4.5	14.5
1239	Female.	19.01	17.75	14.50	21	1.49	7.6	3.25	9
1248	Female.	11.39	10.31	8	21	8.61	75.0	7	21.9
1274	Male ...	9.49	8.50	8.50	14.75	5.26	54.4	.....	.....

Thus the four females made in two years an average increase of 31.9 per cent. in weight, and of 14.2 per cent. in length. Those varying from 10 to 12 pounds on original appearance range from 16.50 to 21 pounds on recapture.

Taken in connection with previous experience at this station, the results obtained from this experiment warrant us in saying that salmon visit the Penobscot River for the purpose of spawning but once in two years, and that they visit it for no other purpose is well established.

TABLE I.—Statement of the shipment of Penobscot salmon spawn from Orland, Maine, in 1883.

Date of shipment.	Consignee.	Address.	Final destination.	No. of cases.	Number of eggs.			Distance transported.	Hours on route.	Condition on unpacking.	Number dead on unpacking.
					From share of United States.	From share of United States.	Total.				
1883.							Miles.				
Jan. 29	H. J. Fenton	Windsor, Conn.	Poquonock, Conn.	1	50,000	50,000	50,000	391	54	"Good"	92
29	George Jelliffe	Westport, Conn.	Westport, Conn.	1	50,000	50,000	50,000	466	57	"Good"	76
29	United States Fish Commission.	Washington, D. C.	Washington, D. C.	3	220,000	220,000	220,000	739	73	"Excellent"	126
31	do	do	do	2	120,000	120,000	120,000	739	76	"First class"	260
31	E. G. Blackford	Fulton Market, New York.	Cold Spring Harbor, New York.	4	260,000	260,000	260,000	537	79	"Excellent"	196
Feb. 5	E. B. Hodge	Plymouth, N. H.	Plymouth, N. H.	2	160,000	160,000	160,000	404	51	"Good, except a few that were frozen."	60
5	United States Fish Commission.	Washington, D. C.	Washington, D. C.	1	80,000	80,000	80,000	739	73	"Excellent"	18
5	E. G. Blackford	Fulton Market, New York.	Cold Spring Harbor, New York.	1	50,000	50,000	50,000	537	102	"Excellent"	48
6	E. B. Hodge	Plymouth, N. H.	Plymouth, N. H.	1	60,000	20,000	80,000	404	51	"Good"	50
6	George Jelliffe	Westport, Conn.	Westport, Conn.	1	32,000	15,000	50,000	466	55	"Good"	88
14	O. A. Dennen	Moosehead Lake, Maine	Mount Kineo, Maine	2	100,000	100,000	100,000	121	32	"Good"	100
14	D. H. Harmon	Norway, Me.	Norway, Me.	2	120,000	120,000	120,000	210	29	"Good"	91
14	Benjamin Lincoln	Dennysville, Me.	Dennysville, Me.	1	40,000	40,000	40,000	93	73	"Good"	50
14	E. G. Blackford	Fulton Market, New York.	Cold Spring Harbor, New York.	1	40,000	40,000	40,000	537	79	"Good"	50
21	H. J. Fenton	Windsor, Conn.	Poquonock, Conn.	1	60,000	60,000	60,000	391	54	"Good"	23
21	George Jelliffe	Westport, Conn.	Westport, Conn.	1	30,000	30,000	30,000	466	52	"Good"	59
21	United States Fish Commission.	Washington, D. C.	Washington, D. C.	1	80,000	80,000	80,000	739	78	"Good"	97
21	Ellis Hanson	Machias, Me.	Machias, Me.	1	20,000	20,000	20,000	73	104	"Good"	16
1	A. J. Darling	Enfield, Me.	Enfield, Me.	3	105,000	90,000	195,000	60	6	"Good"	3,900
1	D. H. Harmon	Norway, Me.	Norway, Me.	1	55,000	55,000	55,000	210	30	"Good"	742
5	E. B. Hodge	Plymouth, N. H.	Plymouth, N. H.	1	65,000	65,000	65,000	404	48	"Good"	71
5	Prof. S. F. Baird	Washington, D. C.	Washington, D. C.	1	75,000	75,000	75,000	739	739	"Good"	.....
					792,000	1,208,000	2,000,000				

\* The figures here given are intended to cover the time between the start from Orland and the unpacking of the eggs at their final destination. The entire time elapsing between packing and unpacking would be from twelve to twenty-four hours longer, as the eggs were generally packed the day before shipment. † These eggs comprised several series of specimens shipped at sundry times, alive or in alcohol.

TABLE II.—Statement of the planting of Penobscot salmon fry in 1883, reared from eggs collected at Orland in 1882.

State.	Where hatched.	Waters in which the fry were placed.	Tributary to—	Locality of deposit.	Date of transfer.	Number of fish.
Connecticut	Westport	Housatonic River	Long Island Sound	Cornwall Bridge	1883 Apr. 21	37,000
		Do	do	Kent	Apr. 24	38,000
		Do	do	New Milford	Apr. 30	38,000
		Do	do	Southport	May 2	10,000
Maine	Poquonock	Mill River	Connecticut River	Dennysville, Washington County	May 23	20,000
	Dennysville	Farmington River	Connecticut Bay	Near Hancock, Aroostook County	June 5	30,000
	Enfield	Denny's River	Penobscot River	Near Medway, Penobscot County	June 6	30,000
		Matawankeag River	Penobscot Bay	Dover, Piscataquis County	June 7	30,000
		Penobscot River	Penobscot River	Island Falls, Aroostook County	June 8	30,000
		Piscataquis River	do	do	June 9	25,000
		Matawankeag, West Branch	do	Near Medway, Penobscot County		
		East Branch or Matawanon River	do	do		
		Matawankeag River	do	Near Hancock, Aroostook County	June 11	30,000
New Hampshire		Cold Stream and Cold Stream Pond	do	Enfield, Penobscot County	June 12	20,000
		Great Brook	Machias River	Northfield, Washington County	May 21	17,448
		Socasteen River	Mooshead Lake	Tomhegan, Somerset County	June 15	50,000
		Mooshead Lake	Kennebec River	Mount Kineo, Piscataquis County	June 16	30,000
		Hebron Pond	Piscataquis and Penobscot Rivers	Mousson, Piscataquis County	June 29	15,000
		Crooked River	Presumpscot River	Norway, Oxford County	May 20, 25	170,000
		Pemigewasset River	Merrimack River	Sundry places	June	299,000
		Carr's Brook	Hudson River	North Creek, Warren County	May 10	49,800
		Trout ponds of J. D. Jones	South Oyster Bay	Great South Bay, Long Island	May 11	5,000
		Bain or Gilead Brook	Hudson River	North Creek, Warren County	May 15	49,700
		Trout Brook	Salmon River	Albion, Oswego County	May 18	44,200
		Ramont Brook	Hudson River	North Creek, Warren County	May 23	32,000
New York		Beaver Meadow Brook	do	do	May 24	39,900
		Roaring Brook	do	do	May 25	39,500
		Do	do	do	May 29	27,900
		East Branch	Delaware River	Hancock, Delaware County	May 29	112,000
	Washington, D. C.	Do	do	do	Apr. 21	78,750
		West Branch	do	Deposit, Broome County	Apr. 24	112,000
		Do	do	do	Apr. 21	90,000
		Do	do	do	Apr. 24	1,716,617

\*The hatchery at Plymouth is supported jointly by the States of New Hampshire and Massachusetts. In addition to the fry included in above statement were those re-ulting from 85,000 eggs taken from salmon caught in the Pemigewasset, which fry were deposited in the same river.