

view, may serve to protect the codfish against the development of the red.\*

We cannot at present dwell any longer on this side of the question, for, as we have already stated, we shall in a future report give the results of our investigations regarding the different methods of salting, the examination of the different kinds of salt used, the packing and storing of the codfish. We shall merely state regarding the nature of the small organism composing the red in the codfish that we have never yet found the slightest trace of a mycelium. We therefore do not believe that it is a fungus, not even one of the family of the *Discomycetes*, like the *Protomyces* for instance. It is doubtless an alga, but it is an open question whether it is a *Beggiatoa* of the family of the *Nostocaceæ*, like the *Clathrocystis*, which Mr. Farlow considers as the cause of the red in the codfish.

BORDEAUX, FRANCE, March 24, 1886.

**32.—REPORT OF OPERATIONS AT THE SHAD-HATCHING STATION ON BATTERY ISLAND, NEAR HAVRE DE GRACE, MD., DURING THE SEASON OF 1887.**

By **W. de C. RAVENEL,**

*Superintendent of Battery Station.*

Active operations in the production of young shad were very much delayed by strong freshets in the Susquehanna River and exceedingly cold weather, but preparations had been completed for the work some time before eggs could be obtained. It was not until April 26 that the first spawn was taken, and this was of inferior quality on account of low temperature, &c. It will be proper to say, therefore, that the season opened on May 1.

The seine operated in previous years was not used this season, as its results were not in proportion to the expenditures connected there-

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\* Our attention has been called to an article published in the *Imparcial*, of Madrid, of the 20th March, in which it is stated that some years ago, in 1878, a red coloring of the green and dry codfish was, during summer, observed at Gloucester and at other places in the United States. The Fish Commission requested Prof. W. G. Farlow to inquire into the causes of this coloring. Professor Farlow found (Fish Commission Report, 1878, page 969) that it is due to the presence of *Clathrocystis roseo-persicina*. "After having observed," the writer of the article in the *Imparcial* goes on to say, "that this hurtful vegetable growth was found on all the walls and boards of the salteries and on all the wooden implements used in them, it was considered safe to assume that only the salt could be the means of its transmission." The Cadiz salts, which have a light rose-color, were examined, and after this examination Professor Farlow arrived at this conclusion: "That the imported Cadiz salt is impregnated with a large quantity of *Clathrocystis*, and that this plant develops on the codfish when the temperature is favorable." The *Imparcial* becomes alarmed at this statement, and fears that the Spanish salts, which in America are all known by the name of Cadiz salts, may lose their reputation.

with and as much dissatisfaction was expressed at its use by the neighboring fishermen.

On account of the limited means at our disposal it was impossible to engage the force adequate for the work. Hence the steamers Fish Hawk and Halcyon were sent to the station to assist in hatching operations. These vessels were utilized in securing spawn from the gill-nets on the eastern side of the Bay.

The Fish Hawk operated in this manner until May 2, when, finding the prospects so favorable, she proceeded to Bull Mountain and anchored, where she continued independent operations until the work ceased. During the season this vessel transferred to Battery Station 1,330,000 shad eggs.

The Halcyon made daily trips to the eastward, leaving the station in the evening and returning early the next morning. There were 8,402,000 eggs transferred to the station by this vessel. The Halcyon was also utilized in the shipment of shad fry to the Chester, Elk, and Sassafras Rivers. An accident to her wheel, which necessitated a trip to Baltimore for repairs, suspended her operations for a few days, but on her return to the station the daily trips for spawn and the shipment of shad fry were resumed and continued until May 21, when the steamer was assigned to other duty. During the season the Halcyon deposited about 3,000,000 young shad in the rivers named.

Marketable shad were very abundant this spring, the run being greater than has been known for many years. One fishing float secured as many as 47,000 shad.

Only four spawn-takers and two men for handling the stationary gill-net for catching ripe male shad had been engaged, and this small force was totally inadequate for the work. The number recommended was forty, but lack of funds prevented their employment. In order to supply the deficiency, a detail of twenty-one men from the steamer Albacross, accompanied by an officer, was sent to the station. This action was made possible by the laying up of that vessel to receive new boilers. The men, however, did not arrive at the station until May 10. Had they reported for duty ten days earlier, the result of the season's work would have been much larger, as they proved apt and soon learned to take spawn successfully.

The abundance of ripe shad is illustrated by the fact that on one night (May 7) five of the station boats secured four millions of eggs, one of them obtaining as many as 1,300,000. All of the fishermen were as successful as the ones whose fish were overhauled, but it was impossible for the few men to attend them in time to get the spawn from the fish while they were alive—and this was the case night after night.

The hatching operations were under the charge of Mr. Wm. P. Sauerhoff, assisted by three trained experts, under whose careful handling the eggs usually hatched successfully. Upon three occasions very se-

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vere losses of eggs were suffered, 1,500,000 being lost on one occasion, and 500,000 on two others. The eggs of the first lot were taken by our most skillful spawn-takers, and appeared sound and healthy when placed in the hatching cones, but soon died. No cause can be ascribed for this loss. The second and third lots were lost from defective arrangements of the water-pipe in the hatching house.

As will be seen by reference to the accompanying tables, the station received during the season 60,569,000 eggs, from which 42,712,000 shad fry were hatched, and 918,000 eggs were transferred to car No. 3. Of those hatched, 11,850,000 were placed in the waters around the station and 29,882,000 were shipped to other points. The table of distribution will give in detail the disposition of the shad fry.

It is evident that the work of the station is limited only by the means at its disposal, and that it would be easy to obtain 125,000,000 eggs. This season's work was accomplished without visiting any of the fishing floats or shores and without covering the ground occupied by the Fish Hawk.

**BATTERY STATION, June 5, 1887.**

TABLE I.—Statement of shipments of shad fry made from Battery Station, Havre de Grace, Md., in May and June, 1887.

State.	Place of deposit.	Stream.	Date.	Number sent.
Delaware	Wilmington	Brandywine River	May 10	2,200,000
	Seaford	Nanticoke River	May 11	2,200,000
	Middletown	Creeks	May 19	150,000
	Clayton and Morton	do	do	150,000
	Dover and Felton	do	do	150,000
	Milford and Ellendale	do	do	150,000
	Millsborough	Indian River	do	400,000
	Wilmington	Brandywine River	May 21	1,924,000
	Seaford	Nanticoke River	May 28	1,400,000
	Georgia	Cartersville	Etowah River	June 5
	Resaca	Oostenaula River	do	1,050,000
Kentucky	Louisville	Ohio River	May 30	1,618,000
Maryland	Elkton	Elk River	do	2,600,000
	Bush River	Bush River	do	960,000
	Gunpowder	Gunpowder River	do	745,000
	Relay Station	Patapsco River	May 25	300,000
	Chestertown	Chester River	May 19	400,000
	Hillsborough	Tuckahoe River	do	3,400,000
	North East	North East River	do	900,000
	Port Deposit	Susquehanna River	do	920,000
	Battery Station	do	do	13,903,000
	Whaleysville	Pocomoke River	May 16	1,800,000
Massachusetts	Dighton	Taunton River	May 24	1,500,000
Pennsylvania	Harrisburg	Susquehanna River	May 20	1,500,000
	Sundry places	do	do	1,820,000
Total				42,650,000

A more detailed account of these shipments, the losses in transit, &c., will be found in the Report of Shad Distribution for 1887, by Marshall McDonald.

TABLE II.—Record of meteorological observations made at Battery Station, Maryland, from April 27 to June 3, 1887, by William P. Sauerhoff.

Date.	Temperature of air.			Temperature of surface water.			Direction of wind.			Intensity of wind.			Condition of sky.			Condition of water.	State of tide.			Weather.		
	6 a. m.	12 m.	6 p. m.	6 a. m.	12 m.	6 p. m.	6 a. m.	12 m.	6 p. m.	6 a. m.	12 m.	6 p. m.	6 a. m.	12 m.	6 p. m.		6 a. m.	12 m.	6 p. m.			
1887.	o	o	o	o	o	o																
Apr. 27	50	58	57	51	53	53	S.	S.	SW.	Light	Light	Light	Cloudy	Hazy	Hazy	Clear	Ebb	Flood	Ebb			
28	54	55	56	53	54	55	NE.	S.	SE.	do	Fresh	Fresh	do	Cloudy	Cloudy	Muddy	do	do	do	Rain. <sup>1</sup>		
29	55	52	51	54	53	52	SW.	NW.	W.	Fresh	Strong	do	do	do	do	do	do	do	do	Do. <sup>2</sup>		
30	50	53	56	51	51	52	NW.	NW.	W.	do	do	do	do	Hazy	Hazy	do	do	do	do			
May 1	50	61	60	50 $\frac{1}{2}$	54	55	W.	S.	SW.	Light	Fresh	Light	Clear	Clear	Cloudy	Clear	do	do	do			
2	58	64	60	53	55	59	NE.	NE.	SW.	do	Light	do	do	Cloudy	Clear	do	do	do	Flood			
3	61	69	70	56	59 $\frac{1}{2}$	61	NE.	S.	SE.	do	do	Calm	do	Clear	do	do	Flood	Ebb	High			
4	65	69	72	60	62	64	SE.	SE.	SE.	Calm	Calm	do	do	do	do	do	do	do	Flood			
5	66	70	68	62	65	65	N.	N.	E.	Light	Light	Light	do	do	do	do	do	do	do			
6	62	80	70	61	64	68	NE.	S.	SE.	do	do	do	Cloudy	do	Cloudy	do	do	do	do	Do. <sup>3</sup>		
7	65	76	68	64	65 $\frac{1}{2}$	65 $\frac{1}{2}$	NE.	SE.	SE.	do	do	do	do	Cloudy	do	do	do	do	do			
8	62	62	64	64	64	62 $\frac{1}{2}$	NE.	E.	E.	Fresh	Fresh	Fresh	do	do	do	Muddy	do	do	do			
9	60	65	65	63 $\frac{1}{2}$	64	64	NE.	NE.	SE.	do	do	Light	do	do	do	do	do	do	do	Do. <sup>4</sup>		
10	61	64 $\frac{1}{2}$	65	64	65	65	NE.	NW.	SE.	Light	Light	Calm	do	Clear	Clear	do	do	Flood	Ebb			
11	64	71	71	64	67	68	SW.	S.	SW.	Calm	do	Light	Clear	do	do	do	Ebb	do	do			
12	70	72	72	65	66	68	S.	S.	SW.	Light	do	do	do	do	do	do	do	do	do			
13	63 $\frac{1}{2}$	65	65	64 $\frac{1}{2}$	65 $\frac{1}{2}$	68	NE.	SE.	S.	Fresh	do	do	Hazy	do	do	do	do	do	do			
14	67	75	69	65	69	70	N.	N.	SE.	Light	Calm	Fresh	Clear	do	Cloudy	do	do	do	do			
15	66	72	73	65 $\frac{1}{2}$	67	70	SE.	SE.	SE.	do	Light	do	do	Cloudy	Clear	do	do	do	do			
16	67	71	71	65	66	70	S.	S.	SE.	do	do	do	Cloudy	do	Cloudy	Clear	do	do	do			
17	67	74	69	65	68	70	S.	S.	SE.	Calm	do	Light	Clear	Clear	Clear	do	do	do	do			
18	65	76	76	68	69	70	SE.	S.	SE.	Light	do	do	Cloudy	do	do	do	Flood	Ebb	Flood	Do. <sup>5</sup>		
19	64	78	74	67	71	72 $\frac{1}{2}$	SE.	SE.	SE.	Calm	do	Calm	Clear	do	do	do	do	do	do			
20	68	79	75	70	72 $\frac{1}{2}$	74	S.	S.	SW.	Light	do	Light	do	do	do	do	do	do	do			
21	69	75	76	73	74	74	SW.	SW.	SW.	do	do	do	Cloudy	do	do	do	do	do	do			
22	70	76	77	72 $\frac{1}{2}$	74	74	SE.	SE.	SW.	do	do	do	Clear	Hazy	do	do	do	do	do			
23	68	75	74	73	74	76	S.	SW.	W.	do	do	Fresh	do	Clear	do	do	do	do	do			
24	73	75	72	72	75	76	S.	S.	S.	do	Fresh	do	Cloudy	Cloudy	do	do	do	do	do	Do. <sup>6</sup>		
25	60	77	68	72	74	75	N.	S.	S.	do	do	do	Clear	Clear	Cloudy	do	Ebb	Flood	Ebb	Do. <sup>7</sup>		
26	66 $\frac{1}{2}$	77	67	73	77	76	NE.	NW.	NW.	do	Light	do	Cloudy	do	do	do	do	do	do	Do. <sup>8</sup>		
27	61	63 $\frac{1}{2}$	63	71	71	71	NW.	NW.	NW.	do	Fresh	do	Clear	do	do	do	do	do	do	Do. <sup>9</sup>		
28	56	63	63	67	67	66	NW.	NW.	N.	Fresh	do	do	Cloudy	Cloudy	do	Muddy	do	do	do	Do. <sup>10</sup>		
29	63	63	64	65	67	67 $\frac{1}{2}$	NE.	NE.	S.	Light	Light	Light	do	Clear	do	do	do	do	do			
30	63	65	62	66	68	68	S.	S.	SE.	do	do	Strong	Hazy	do	Clear	do	do	do	do			
31	64	64	65	65 $\frac{1}{2}$	65	65	SE.	SE.	SE.	Fresh	Fresh	Fresh	Cloudy	Cloudy	Cloudy	do	do	do	do	Do. <sup>11</sup>		

June	1	64	67	73	62	64	66	SE.	SW.	SW.	do	Light	Light	do	Clear	do	do	High	Ebb	do	Do. <sup>12</sup>
	2	68	65	72	66	66	69	S.	SW.	SW.	do	Fresh	Strong	do	do	Clear	do	Flood	do	Flood	
	3	64	69	74	66	67	68	NW.	S.	SW.	Light	Light	Fresh	do	Cloudy	Cloudy	do	do	do	do	

<sup>1</sup> From 3 p. m. to 6 p. m.

<sup>2</sup> Squally all day.

<sup>3</sup> Began at 12 p. m. and stopped at 8 a. m. of 7th.

<sup>4</sup> All day.

<sup>5</sup> From 7 a. m. to 8.30 a. m.

<sup>6</sup> Squall 2.30 p. m.

<sup>7</sup> Squall 5.15 p. m.

<sup>8</sup> Squall 6 p. m.

<sup>9</sup> At 6 p. m.

<sup>10</sup> At 2 p. m.

<sup>11</sup> Storm all day.

<sup>12</sup> From 6.30 a. m. to 9.30 a. m.

100 BULLETIN OF THE UNITED STATES FISH COMMISSION.

TABLE III.—Record of the shad-hatching operations conducted at Battery Station, Maryland, from April 26 to June 3, 1887, by William de C. Ravenel.

Date.		Eggs obtained.	Loss.		Fish hatched.	Fish deposited in local waters.	Fish deposited in other waters.
Day of week.	Day of month.		Eggs.	Fish.			
Tuesday	Apr. 26	241,000					
Wednesday	Apr. 27	336,000	150,000				
Thursday	Apr. 28						
Friday	Apr. 29						
Saturday	Apr. 30	660,000					
Sunday	May 1	792,000					
Monday	May 2	2,453,000					
Tuesday	May 3	1,581,000	150,000				
Wednesday	May 4	2,098,000	500,000				
Thursday	May 5	3,763,000					
Friday	May 6	4,095,000			220,000	220,000	
Saturday	May 7	4,302,000	500,000				
Sunday	May 8	821,000					
Monday	May 9	2,362,000	1,500,000		1,078,000	500,000	
Tuesday	May 10	956,000		50,000	2,568,000		2,500,000
Wednesday	May 11	3,876,000			2,000,000		2,500,000
Thursday	May 12	2,115,000		50,000	2,717,000		2,800,000
Friday	May 13	2,552,000			2,648,000	420,000	2,160,000
Saturday	May 14	2,883,000			2,000,000		2,360,000
Sunday	May 15	2,302,000			927,000		2,160,000
Monday	May 16	1,882,000			1,538,000		500,000
Tuesday	May 17	2,743,000			2,497,000		1,973,000
Wednesday	May 18	3,145,000			1,034,000		300,000
Thursday	May 19	2,278,000		500,000	1,530,000	1,573,000	700,000
Friday	May 20	3,893,000			3,010,000	1,997,000	1,800,000
Saturday	May 21	1,594,000			3,190,000	1,518,000	1,924,000
Sunday	May 22	744,000		150,000	3,481,000	557,000	
Monday	May 23	1,877,000			2,000,000	1,576,000	1,900,000
Tuesday	May 24	502,000			1,700,000	89,000	1,800,000
Wednesday	May 25	840,000			2,857,000	2,292,000	300,000
Thursday	May 26	997,000			1,297,000	997,000	300,000
Friday	May 27	822,000			485,000	70,000	300,000
Saturday	May 28	653,000			1,285,000		1,400,000
Sunday	May 29	272,000			885,000		885,000
Monday	May 30	190,000			500,000		
Tuesday	May 31				24,000		700,000
Wednesday	June 1				176,000		
Thursday	June 2						
Friday	June 3				1,538,000	38,000	1,500,000
Total		60,569,000		778,000	42,712,000	11,850,000	20,882,000

In addition to the fish delivered as reported above, 918,000 eggs were delivered to car No. 3, May 30, for hatching and movement to Kentucky.