

17.—CAUSES OF THE DECREASE OF SALMON IN THE SACRAMENTO RIVER.**By JOSEPH D. REDDING.**

The failure in the salmon catch of the Sacramento River during the last four years arises from several causes. First of all, the river has for years been filling up with débris coming down from the hydraulic mining. This has choked up many of the little streams up which salmon formerly went for the purpose of spawning, and has also fouled the river generally. The Sacramento River is a filthy stream. One effect of the débris also has been to cause the Sacramento to overflow its banks and spread over the surrounding plains, thereby causing a heavy growth of tules. The water recedes very quickly, and I have myself seen acres of young fish left high and dry entangled in these weeds. Farmers use the fish thus stranded for manuring purposes.

The second cause is the general violation of the fish law by the Italian and Greek fishermen, and the failure properly to prosecute them under this law. These fishermen catch everything, young and old, and sell the young to the Chinese who ship them to China. It requires a police patrol up and down the river constantly to prevent these marauders from capturing every fish that comes into the harbor. I am glad to say, however, that the strenuous efforts of the State fish commission have succeeded in gaining the respect of these fishermen at last, and they are gradually beginning to obey the law.

A third cause is the presence of great numbers of seals and sea-lions at the mouth of Golden Gate harbor. There are probably 3,000 seals and sea-lions swarming around Golden Gate, each eating from 20 to 40 pounds of fish daily, and mangling a great many. I think they should be exterminated, but many consider that these sea-lions are one of the attractions of the Pacific coast, like the Yosemite and the Geysers; and every suggestion or effort that is made to have them killed off is met by a storm of opposition. Finally the U. S. Fish Commission did a great deal towards stocking the headwaters of the Sacramento with young salmon, and the State commission in past years has done likewise; but within the last five years there has been hardly any deposit of young spawn in the headwaters of these streams.

I do not think that catfish have materially affected the salmon catch in the Sacramento. The salmon spawn at the head of McCloud, Pitt, and Sacramento Rivers, in very shallow water; while catfish prefer sluggish water with a mud bottom. No catfish have been heard of farther up the Sacramento than Tehama, which is at least 60 miles below any of the spawning grounds. Some salmon spawn was found in the stomach of a catfish at one of the salmon canneries on the river a short time ago, and a great hue and cry was raised. The fact is that

the spawn was thrown into the water from the salmon caught by fishermen and sold to the canneries. As to catfish, I believe their importation to this coast was an error; and the board of fish commissioners who authorized their importation, if I remember rightly, came to the same conclusion. The fish which they destroy, however, are perch and dace and their spawn, which at one time were found in vast numbers in the Sacramento.

SAN FRANCISCO, CAL., June 8, 1887.

18.—THE EGGS OF FISHES.*

By Prof. MCINTOSH, LL. D., F. R. S.

[Abstract of an introductory lecture delivered to the class of natural history in the University of St. Andrew's.]

It is but a short time since works devoted to the history of British fishes were devoid of allusion to any other mode of spawning than that by which the eggs of our marine fishes are deposited on the bottom of the sea. Indeed it was believed by most naturalists that the latter was the normal mode of deposition. As a consequence, some of the textbooks at present in use either follow the latter view, or do not specially allude to the question.

The eggs of all fishes are produced in the ovaries, which are symmetrical organs lying beneath the vertebral column, and which at different periods of the year present various appearances according to the degree of development of the eggs. Thus in the quiescent condition of the organs their size is insignificant, while the fully developed ovaries of the codfish occupy a large space and weigh several pounds. At first the eggs are very small, but they gradually increase in size by imbibing nourishment from the ovarian follicles in which they are placed.

A feature not sufficiently insisted on in Great Britain is the fact that only a portion of the ovary in most marine fishes becomes "ripe" at a given time. This provision appears to be admirably suited for the increase of the fishes, a constant succession of the embryos being thus liberated, and time afforded for those of one stage to disappear from the surface of the ocean before those of the succeeding take their places. In America this condition has been clearly described in the report on the cod fisheries of Cape Ann,* by Mr. R. E. Earll; but the account does not seem to have come under the notice of Mr. William Oldham Chambers, who alluded to the subject a year or two afterwards.†

Mr. Earll observes that "the individuals [that is, the cod] do not deposit all their eggs in a single day or week, but probably continue the

* See U. S. Fish Commission Report for 1878, pp. 685, 714, *et seq.*

† "Fish and Fisheries," prize essays, International Fisheries Exhibition, Edinburgh, 1883, p. 187.