STUDIES ON STARVATION IN LARGEMOUTH BASS

MARIAN F. JAMES

University of Illinois, Urbana, Illinois

It is known that fish can endure for long periods of time without food. Previous quantitative studies on starvation of bass are unknown to the writer. The purpose of this study was to determine the changes in weights and lengths of live largemouth bass, as well as the changes in the weights and composition of various organs of the body during complete starvation. In order to see if all parts of the body are equally affected by inanition, the water content, the organic, and the inorganic substances in the different organs were investigated.

Method.—The eighteen largemouth bass fingerlings (Huro salmoides) used in the experiment were obtained at Fork Lake, near Mount Zion, Illinois, on October 21, 1938. They were placed in separate aquaria at the Experimental Zoological Laboratory of the University of Illinois. These aquaria were kept clean and covered with black cloth to prevent the growth of algae.

The period of starvation—from October 22, 1938 to February 25, 1939—was 126 days. At the beginning of the experiment, the fingerlings varied in standard length from 101 to 119 mm.; in total length from 124 to 147; and in weight from 21.16 to 35.71 grams. Each week the live bass were weighed and measured by a standard technique. Notes were kept concerning the activity, external appearance, and body contours of each fish. The water temperatures remained constant throughout the experiment, averaging 23.86° C.

Each week one fish was chosen by lot, killed, and dissected under water by a uniform method. The excess moisture was removed from each organ immediately after excision. Each organ was placed in a covered weighing bottle and the wet weight determined. The parts were then transferred to platinum crucibles and dried for two days in an oven at 102° C. to reach a constant weight. The ashing was done in a furnace at about 800° C. for two hours. All weights of the organs were obtained on a chainomatic balance accurate to .00001 gram.

An experiment to determine the effect of feeding on growth subsequent to a prolonged period of complete starvation on two of the starved fish was begun February 19. Both fish refused to eat at first and were forcibly fed. The amount of food per day was gradually increased. One fish died after the first week but the other lived and started to grow again.

Results.—During the experiment one fish died from starvation. There was a gradual decline in average live weight during the 19 weeks from 26.945 to 11.842 grams, an average loss of 56 per cent. All fish did not lose at exactly the same rate. The greatest average weekly loss, 1.449 g., in live weight occurred the first week of starvation while the smallest weekly loss, .672 g., was the seventeenth week. Although the losses fluctuated, the early loss was greatest due to the digestion of food present in the alimentary canal and rapid utilization of the stored fat and glycogen.

The average decrease in standard length was from 108.72 mm. to 103.69 mm. Growth in length continued for the first week, but afterwards there was a gradual decrease.

The external appearance of the bass changed strikingly. At first they had a healthy plump appearance; but as starvation continued, extreme thinness and emptiness of the body cavity was evident. The scales examined from the starved fish showed marked erosion on the edges.

The per cent of the original wet weight of the body of the fish was determined for each organ. The organs of the unstarved fish were used as 100 per cent and the others calculated on this basis. A moving average of five weeks was used in smoothing the graph. The following changes in original weight were observed. The eyes increased from 100 to 113 per cent during the 19 weeks of starvation. The head decreased gradually to 79 per cent, the fins to 56 per cent, the gills to 52 per cent, the digestive tube to 22 per cent, the trunk (without viscera) to 38 per cent, the heart to 19 per cent, and

the liver to 16 per cent. The eyes increased in wet weight — their organic and mineral substances were constant, or declined slightly. The greatest losses occurred during the first four weeks. It seems logical that the early loss of weight in the liver would be greatest because of readily available glycogen and fat. Graphs were made for the dry weights and ash weights of the organs. They showed practically the same results as the wet weight curves. The per cent of water in the entire body of the fingerlings during starvation was found to remain nearly constant—77 per cent. The organic substance of the body, that part lost on ignition, gradually decreased from 17.93 per cent and 13.80 per cent while the percentage of inorganic substance or ash doubled. This is because the fish shrunk to half their original weight.

Bass usually die after a prolonged period of starvation. The fish which survived in this experiment was not attracted by food and the digestive system had begun to atrophy. This individual required 8 grams of food to increase its weight one gram whereas normal bass require 3½ to 5 grams.

These studies were carried on under the supervision of Dr. David H. Thompson of the Illinois Natural History Survey whose advice and suggestions have been very helpful in the preparation of this paper.