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A Second Case of Survival by a Teleost without a lower Jaw

C. M. Breder, Jr.

American Museum of Natural History

(Plate I; Text-figure 1)

THE case of a fish, *Anoptichthys jordani* Hubbs & Innes, which had survived without a lower jaw, was described by Breder (1945). While the cause of this loss was not at all clear, it was speculated that it probably was of genetic origin rather than some accidental damage, on a basis of the unlikelihood of recovery from such an injury. Nothing further was found on this subject until a fish showing a similar defect was discovered in a tank of *Astyanax mexicanus* (Filippi). It was first noticed on about October 1, 1952, but it was not until later that it was realized that the fish was beginning to resemble the case noted above. The photographs of the living fish, Plate I, were taken on December 17, 1952. The resemblance to the condition of the cave fish earlier described is unmistakable. The teeth of the upper jaw may be best seen in the front view and the protruding glossohyal and urohyal are evident in the lateral view. The "mouth" was a vertical slit similar to that of the cave fish, *Anoptichthys,* and feeding was seen to be done in a similar manner. The photograph in the lower right of Plate I shows the fish about to pick a piece of dry fish-food from the bottom. It would seem certain that precisely the same osseous elements had disappeared in both cases, which led to the development of identical feeding methods. Although this fish was rather thin it fed readily and managed to engulf what seemed to be the usual amount for this species.

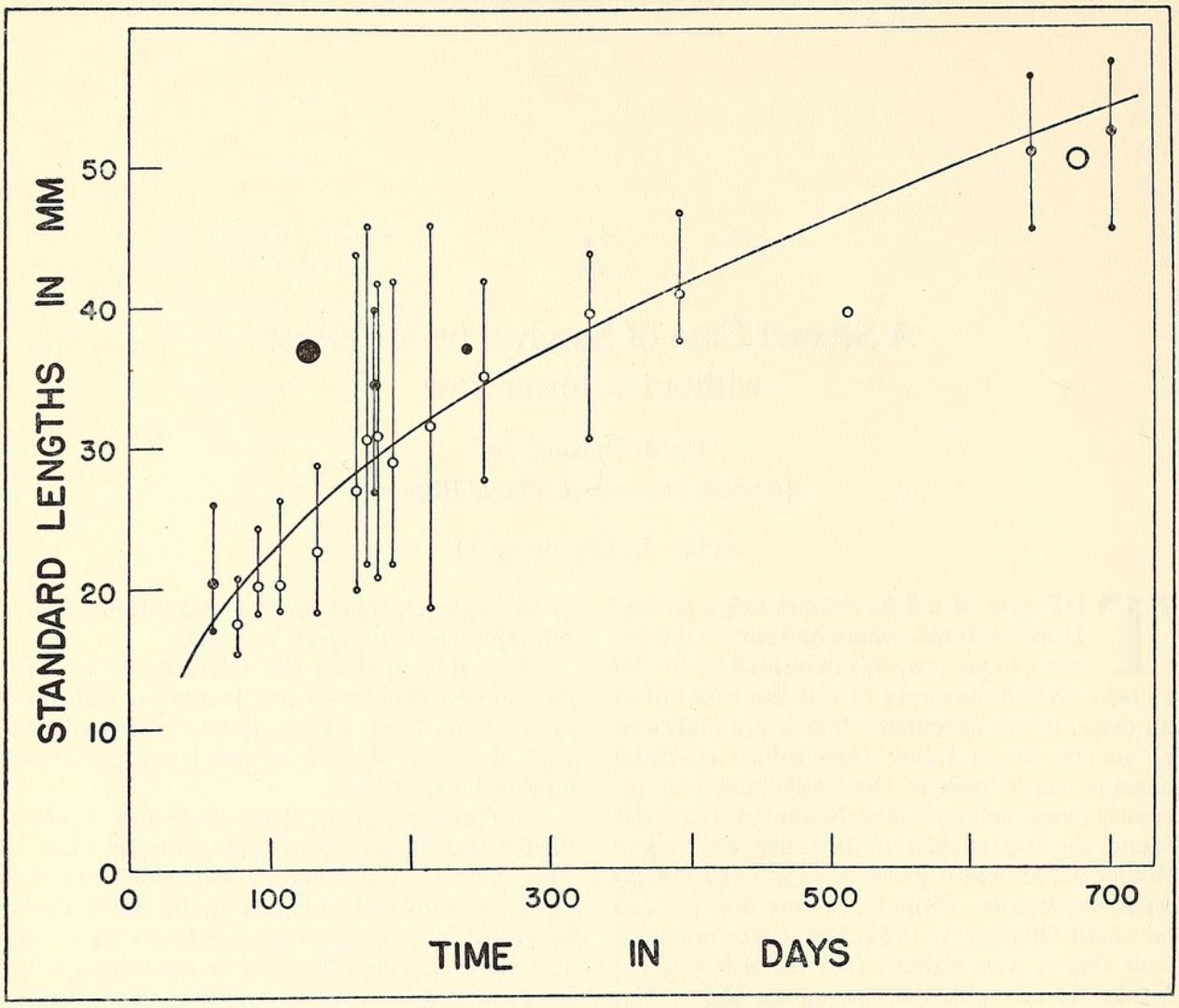
Since the fish showed the secondary sex character of hooks on the anal fin it was established in a well-planted aquarium with a female of its own size which had previously been known to spawn, in the hopes that it might reproduce. Although the two fish remained in each other's company for most of the time, after the manner of this species, there was no indication of any reproductive activity at any time.

From this time on the fish seemed to lose ground and apparently had increasing difficulty in obtaining food. Its emaciation increased and when evidently about to expire, it was preserved on April 13, 1953.

A radiograph of the head made shortly after the fish was fixed in formalin is shown in Plate I. This confirmed the earlier suspicion that the same elements had been lost by the fish as those described in the preceding report on a cave fish. The most notable difference is associated with the orbital series of bones which in this instance did not tend to crowd in about an empty socket, since they were held to their normal positions by the presence of an intact eye.

This fish lived 676 days, having been one of a brood from a spawning on June 7, 1951, at the fish cultural establishment of Mr. Albert Greenberg at Tampa, Florida. The cave fish, on the other hand, survived only about six months, circa 180 days. The behavior of the two was strikingly similar, both assuming a more nearly vertical position to obtain food from the bottom as they grew older, the position in both cases reaching nearly 90° in their later days.

Evidently this defect is carried in the genes of both the cave fish and their river-dwelling ancestors. Its appearance is thus clearly not linked to the depigmented and eyeless condition of the cave forms. Both cases developed from a small group of fishes which had been inbred to a considerable extent, which condition may have been responsible for the phenotypic appearance of this deficiency. The cave fish attained a growth of 37 mm standard length in a Tampa greenhouse while the river fish attained a standard length of 51 mm in the Department labora-



TEXT-FIG. 1. Growth of *Astyanax,* open circles, and of *Anoptichthys,* closed circles, as obtained in the laboratory. The smaller circles above and below connected by vertical lines represent the extreme range, the slightly larger circle between representing the means. The two large circles standing alone represent respectively the two jawless cases. There are represented on this graph 300 measurements of *Anoptichthys* and 535 measurements of *Astyanax.*

tory in New York. On dissection, normal but small and thin testes were found, which looked typical of fishes under conditions of undernourishment. It still remains unknown at this writing whether such fish do survive long enough and in sufficient vigor to reproduce.

In order to determine more accurately, if possible, what effect on the rate of growth this oral malformation exerted, measurements of age and size which had been accumulated in the laboratory for various experiments were draughted, which amounted to 300 cave fish from La Cueva Chica stock and 535 river fish of the stock on which the work in the laboratory has been carried out and which are descendents of the fish taken in Mexico as near to La Cueva Chica as practicable.

A growth curve calculated for the cave fish is represented by the following equation:

$$y = 5.007x.^{0.369}$$

and for the river fish the following:

$$y = 2.143x.^{0.501}$$

This difference is probably expressive of a slightly larger growth rate shown by the cave fish, but it is not great in any case. Because of the varied sources and times from which the data were accumulated, it may have little significance, although there is corollary evidence which indicates that there is a real difference. It would seem to be rooted in the fact that the cave fishes consume more food than the eyed river fish, the latter taking considerable notice of what transpires outside of their aquarium. For present purposes it is adequate and more satisfactory to handle all the data together, in which case the equation becomes

$$y = 2.841x.^{0.451}$$

which is the curve shown in Text-fig. 1. This

graph gives the growth as obtained in the laboratory for both cave fish and river fish and serves as a satisfactory base line to which these anomalies may be referred.

The jawless cave fish is clearly larger for its age than most of the cave fish from the laboratory. This fish spent its entire life in the Florida hatchery. There the temperatures average somewhat higher and the light is brighter and every effort is made to grow fish as fast as possible. This probably accounts for the difference, but nevertheless there is certainly no suggestion of any stunting associated with the abnormality.

The river fish which spent all but the first two months of its life in the laboratory is clearly close to the two mean values for normal fish indicated on either side of it. Here again there is no suggestion of stunting. It would thus appear that whatever condition developed in these two fishes which led to their death took place rather rapidly and was not a long protracted semi-starvation, as might be assumed were it not for the comparative data herewith submitted.

Reference

Breder, C. M., Jr.

1945. Compensating reactions to the loss of the lower jaw in a cave fish. Zoologica, vol. 30, no. 10, pp. 95-99.

EXPLANATION OF THE PLATE

PLATE I

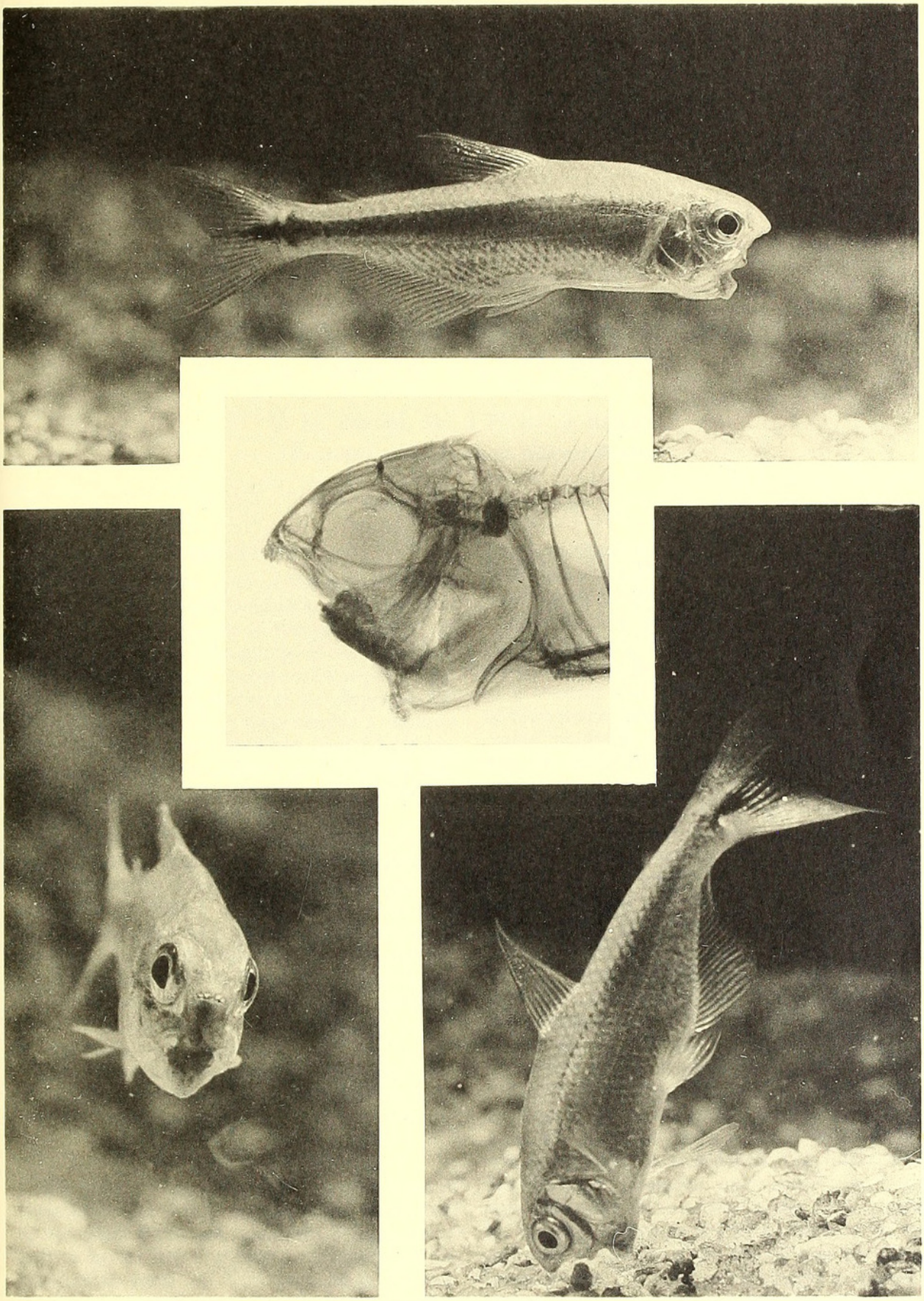
Astyanax mexicanus lacking a lower jaw.

Upper: Lateral view of the living fish in an aquarium.

Lower left: Frontal view of the above fish. The teeth in the upper jaw are clearly visible as is the slit-like "mouth."

Lower right: View of the fish about to pick up a particle of fish-food from the bottom, showing the position assumed by the fish at such times. The particle is directly below the mouth opening. (Photos by W. Chavin).

Middle: Radiograph of the head of the newly-preserved fish. (Radiograph by E. Logan).



A SECOND CASE OF SURVIVAL BY A TELEOST WITHOUT A LOWER JAW