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Identify Some Morphorogical and Biological Study of Gar or Alligator Fish Atractosteus spatula (Lepisosteiformes : Lepisosteidae) (Lacepede ,1803)

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Abstract
This study attempt to highlight some aspects and the vital characteristics of the Gar or Alligator fish, also known as the Atractosteus spatula. These aspects include some of the behavior characteristics in family and the pattern of nutrition, in addition to some Morphorogical and Biological features that characterize this species such as body shape, and the ear's bone, especially it was recorded for the first time in the Iraqi waters in 2017 within the extraneous fish on the Iraqi water environment.
Keywords: Biological aspects, Morphological aspects, Gar fish, Alligator fish.

Introduction

The Alligator fish, are classified within the Lepisosteiformes The order which Includes Lepisosteidae that consists of seven fish species in both freshwater and marine water distributed in East of North Central America, Caribbean (1&2), Although they are found mainly in the fresh water regions, but many species enter stagnant water, and few can sometimes be found in the sea (1&6).

This fish are characterized by the fact that their air bladder can act as lungs (4). Most of the alligator fish periodically rise to the surface to take a dose of air, and do so much more when they are in stagnant or hot water because it lacks oxygen. As a result, these fish have very strong tolerances and can survive in conditions that can kill most other fish.

Alligator fish are slow-moving fish except the situation when they attack the prey. They prefer shallow, grassy areas in rivers, lakes and tributaries, and often meet in small groups (2). They are glutton predators. They hold the prey with teeth like needles, attacking the side of its head (5). These fish feed heavily on smaller fish and invertebrates such as crabs.

This fish was recorded for the first time in Iraq in Shatt al-Arab waters 2017 by Mutlak *et al*. (8), and is not only the extraneous fish to the Iraqi waters that threaten the Iraqi water environment, especially local species. This fish also threatened to the Iraqi water environment (8). Salnikov V.B. (16) refers to the nearest gatherings of Gar fish from Iraq recorded in the Caspian Sea coast adjacent to Turkmenistan as stated.

Materials and Methodes:

Seven Alligator fish were isolated in a special aquarium, its dimensions were (120 cm for length x 45 cm for width x 50 cm for height). The water volume in this aquarium was 270 liters of water.

The breeding temperature (30°C) and the water values, as shown in Table (1).The Alligator fish were breeding alone at first time and some other species were introduced in the same environment to identify the behavior with the same species and with the other species available in this study were fed with different types of live, dry and alternative food for living to find the preferred food of these fish and the combination of their behavior with the type of food provided to them. The Dino-lite digital microscope pro was used on a magnification force (40x).

Results and Discussion:

The alligator fish body are extended and strongly armored with hard scales and have similar jaws filled with long, sharp teeth. The caudal fin are asymmetrical (the spine extends up to the upper part of the fin, making it larger than the lower part) and dorsal fins are close to the tail (3). All Gar fish are relatively large, but the alligators is the largest whereas fish of these species were recorded up to three meters long (7). Even smaller species such as *Lepisosteus oculatus* are also large, usually up to 60 cm, and sometimes much more (5).

There are two species of alligators known in the world , the long- plain sawmill mouth, *Atractosteus spatula* and *Lepisosteus oculatus*, as in Figs. 1 and 2 (8).

Figure (1) ***Atractosteus spatula***

Figure (2) ***Lepisosteus oculatus***

The difference between the two types can be noticed especially when looking at them from the head side or from the top as shown in Figure 3.

Figure (3) the difference between the two species of Gar fish

Table (1).Water analysis

Water analysis	temperature	PH	KH	GH	NH3	TDS
	30 C	7.2	143.2 Ppm.	322.2 Ppm.	0.25mg/L	348 Ppm.

Table (2) some morphological features of *A. spatula* .

studied morphological and meristic characters	***A. spatula***						
Weight gm	13	10	9	11	7	8	10
Total body length cm	14.6	14.7	13.9	15	13.2	14.2	14.8
Standard body length	12.2	12.5	11.9	12.9	11.3	12.1	12.5
Length of the head cm	4.4	5.2	4.9	5.1	4.6	4.9	5.1
Diameter of the eye mm	7	7	6.5	6	6	7	7
Tail length cm	2.5	2.5	2	2.2	2	2	2.4
Length of fin pelvic cm	1.6	1.2	1.1	1.5	1	1.2	1.5
length of pectoral fin cm	2	1.7	1.3	1.2	1.1	1.1	1.4
Number of teeth in the upper jaw	26	20	32	46	28	34	32
Number of teeth in the lower jaw	17	18	17	23	16	18	18
Body thickness cm	1.5	1.2	1.2	1.3	1.1	1.2	1.2
Head width cm	1.3	1.2	1.2	1.3	1.1	1.2	1.2
The distance from the vent to the beginning of the peduncle cm	1.7	1.5	1.5	1.6	1.2	1.5	1.6
The distance from the beginning of eye to the end of mouth mm	4	4	6	4	4	5	4

Water Analysis:

The water analysis of the fish aquarium concerning breeding the Gar fish, which was prepared in a manner that approximates the requirements of these fish in their real as shown in table (1) , is relatively close to that indicated by Allen *et al*. (17) in America.

Biological measurements:

Table (2) showed the biological measurements and indicators of *A. spatula* breeding in this study notifying of this species which recorded for the first time in Iraq by Mutlak *et al*. (8) and its confirmation of the model measurements that was caught in the Iraqi territorial waters in the Shatt al-Arab.

Behavior of Coexistence and Nutrition:

The behavior of fish in particular and in general is associated with complex structures that affect the movement strategy of the fish and can be attributed to their effect on the survival of fish species, and its body physiology (11). The presence and abundance of food with a quality depend on the type of fish. It can affect the various digestion operation of fish and may be individual differences among fish or a collective of all fish populations in a given area as indicated by Rochfort S. (12) behavior of Gar fish in this experiment. The behavior of Gar in the aquarium was more systematic and coordinated , especially when giving a meal based on the meat, such as parts of the heart which is clean and empty of fat, veins and arteries and the rest of the other tissue. While the fish were alone in the aquarium, its behavior and coordination of movement in an orderly manner were not known when entering other species of fast movement, such as a kind of barb, which belongs to the Carp family and characterized by rapid movement and abduction the food. The fish movement carefully declined under water surface directly.

Since fish movement is associated with general physiological functions of the body, so these functions will certainly derive energy from the existence of food with certain quality, especially high-level food of animal protein origin available in the environment, knowing that the physiological functions generated by various movements of the general animal and fish with energy which can vary by type and by different individuals within the same species in the same environment as illustrated by Gauthey Z. *et al*.(13).

The fear of fish has a clear effect on the behavior of the Gar fish in the breeding aquarium of this study, especially in the first days during the period of acclimatization to the new environment. The fish fear gradually declines when determining the appropriate light intensity to them and began to eat the same food of ornamental fish, but when entering other species such as the Barb that characterizes with its movement speed and agility during swimming, the behavior of the Gar is changed for the first time, but the compatibility of colors between species can be a tranquility factor for the Gar so there was consensus after a period between the two species gar and barbs, but a competition for food exists, when entering the species of bright colors inclined to red such as Oscars and Parrots fish, which belong to the Tilapia family, the fish lived just below the surface of the water and caught food quickly away from these species. This may be due to the difference in the size or the striking colors of these species, which differ in the pattern of coloring and swimming. Cook *et al*.(14) refer it to the effect of hormones, especially steroids, on the behavior of fish during fear, gathering or flight, and their effect on the different body instructions associated with this behavior, which differs in the Gar fish when changing the species mixed with it in the same aquarium.

The aggressive behavior, especially the predation of the fish, is manifested in the entering of small species such as *Gambusia affinis*, which belong to the family of fertile fish. It was observed that the fish of the Gar attacked in a deliberate and planned manner to form a circle that confines the largest number of *Gambusia affinis*, and attacks the prey directly notifying that it bites from the mouth and not directly on head. This type of hunting can be due to the large eye shape especially as it's eye - side head that occupies about a quarter of the head size or more which can bite the prey from the side. These results came in line with what referred to Boschung H.T.& Mayden R.L. (15)) of the fish hostility behavior. It can swallow the prey even if the second is larger than the head of the Gar fish.

(8) indicated that Gar has a negative impact on the water environment because of its predation and rapid growth and can rupture fishing nets because of the shape of its head and its sharp teeth. They are not the desired fish to be a table fish can be consumed by humans only a few people in America especially that the eggs of Gar fish are toxic according to what referred by to Boschung H.T.& Mayden R.L. (15).

Otolith shape: D. L. Buckmeier *et al*.(18) indicated the possibility of determining the age of the Gar fish from the otolith bones and the pectoral fins in addition to the estimated age of scales. The shape of the Gar otolith in this study showed in Fig. 4,. The otolith were extracted for both species following (19) and (20) .

Figure(4) Otolith of *Atractosteus spatula*

As shown in figure (4) I t is clear that there are calcareous growths on the otolith which are due to the development of growth and age in these fish as indicated by J. A. Waessle *et al*. (21) and E. Avigliano *et al*. (22). Also, the Otolith luster which is similar to that of the carnivorous fishes , as in the *Oreochromis zilli* (Fig.5), local *Leuciscus vorax* (Fig.6), and local (Fig. 7), As it provides an important example of the nature of the food of these carnivorous fish as shown by M. Jobling *et al*.(23), which accounts for the luster of the fish's otolith. To the pattern of feeding with high levels of animal proteins and the presence of some mineral elements that reflect the sparkle in these bones.

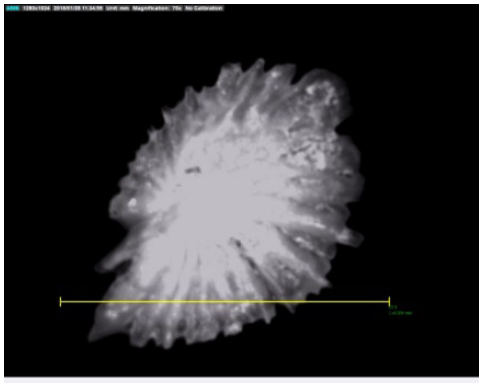

Figure (6) Otolith of *Leuciscus vorax*

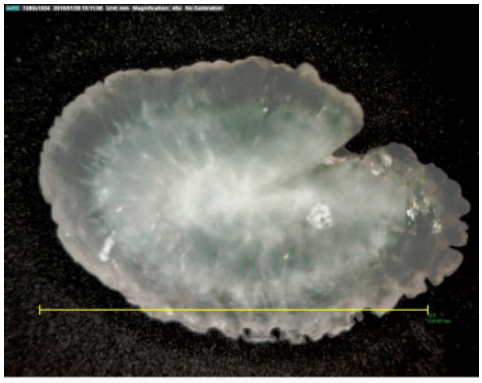

Figure (5) Otolith of *Oreochromis zilli*

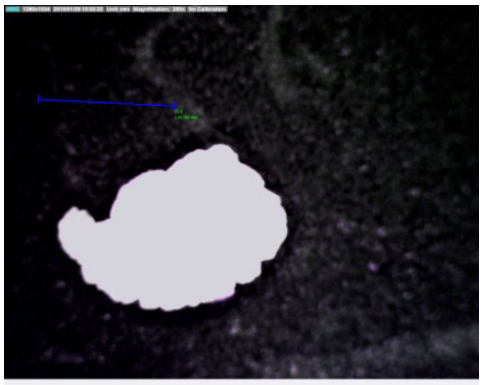

Figure (7) Otolith of *Silurus triostegus*

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