15(2): 020-023 (2021)

Journal of FisheriesSciences.com

E-ISSN 1307-234X

Review Article

A Review of Sustainable Culture and Conservation of Indigenous Scaly Fish: Case study of Heterotis (*Heterotis niloticus-cuvier* 1829)

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Received: 03.03.2021 / Accepted: 17.03.2021 / Published online: 24.03.2021

Abstract: There has been recent increase in demand for scaly fish. Fish with scale and fins are equipped with digestive system that prevents the absorption of poisons and toxins into their flesh from the waters they come from. Collagen derived from fish scales could be used to heal wounds and for various biomedical applications. If you would like to live a healthy vibrant life, at least consider replacing some of those red meat meals, with some delicious fish. Reduce or eliminate shellfish from your diet and be sure that your fish has scales and fins. Heterotis (*Heterotis niloticus*) is one of the indigenous fishes with fins and scales. Its ability to survive in deoxygenated waters together with its great growth rate makes it a candidate for aquaculture.

Keywords: Scaly fish; Heterotis; Conservation; Aquaculture

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Introduction

The law giver (GOD) knew something that has taken scientists years to discover: "These you may eat of all that are in the water: whatever in the water has fins and scales whether in the sea or in the rivers-that you may eat" (Levi. 11:9, NKJV). Now we know that fish with scales and fins are equipped with a digestive system that prevents the absorption of poisons and toxins into their flesh from the waters they come from). According to Cleo et al. [1] collagen derived from fish scales could be used to heal wounds. Their study included fish scales from fishes that are commonly cooked such as sea bass, snake head, and tilapia. The scales usually removed before cooking contain collagen that can be chemically modified to be water-soluble and used for various biomedical applications. The modified collagen can also incorporate drugs to produce wound dressings with a higher healing potential. This suggests that fish scale-derived collagen has potential to be developed for use in biomedical applications [1]. Fish scales made a perfect ingredient in food therapy which had therapeutic effects in particular for osteoporosis, bone fracture in older people and joint.

Flounder (*Paralichtyes olivaceus*), cod (*Gadus morhua*), haddock (*Melonogrammus aeglefinus*), and salmon (*Salmo salar*) are a few examples of scaly fish. Others are tilapia (*Oreochromis niloticus*), aba aba (*Gymnarcus niloticus*), heterotis (*Heterotis niloticus*) and carp (*Cyprinus carpio*). Bass, mackerel, trout, perch, sardines, are just some of the most popular fish with both fins and scales.

Catfish have fins but do not have scales, these scavengers are primarily bottom feeders and have digestive systems designed to absorb toxins from the water. Clams, lobsters, shrimps, crabs, mussels and squids, do not have scales or fins and are believed to be highly toxic. They naturally absorb all the toxins in the water they live in.

One of the most common indigenous scaly fish is heterotis (*Heterotis niloticus*). Its auxiliary branchial air breathing organ enable it to survive in deoxygenated waters. The fish is able to breathe atmospheric oxygen, and so it can live in swamps where the water is very low in free oxygen. It is a very big heavily built fish which grows to about a meter in length and exceed 6 kg weight. The hardiness of this fish, together with its great growth rate makes it a candidate for aqua culture in Africa and it has been transported to a number of countries for this purpose [2].

Heterotis (*Heterotis niloticus*)

Classification

Kingdom	-	animalia
Phylum	-	chordata
Subphylum	-	vertebrata
Class	-	actinopterygii
Order	-	osteoglossiformes
Family	-	arapaimidae
Genus	-	heterotis
Species	-	*H. niloticus*
Species authority	-	cuvier, 1829.

Nomenclature

Preferred scientific name - *Heterotis niloticus*

Preferred common name - African bony tongue

Other common names - *Heterotis*, African arowana, bony tongue, slap water (Balon, 1975).

Morphology/Morphometric

According to Reed et al. [3] heterotis are easily recognized by their unusual long regular shape, their spineless dorsal and anal fins and their small rounded tail seemingly out of proportion to the size of the body. The head is short and thick and has large sensory pits (**Figure 1**). The lips are thick and there is a dermal flap on the border of the gill cover. The large body scales are patterned in a mosaic fashion which makes the age rings difficult to distinguish. The lateral line extends in almost a straight line from the gill cover to the middle of the caudal peduncle. The color varies from brownish to greenish-olive and is fairly uniform.

Figure 1: Morphology/Morphometric.

According to Paugy [4], young specimens possess external gills, uniform gray brown or bronzed colored often marked with dark longitudinal bands and scales with an oval spot in the posterior zone of the anal and dorsal fin.

Dorsal spines: 0, Dorsal soft rays (total): 32-37, Anal spines: 0, Anal soft rays: 34-39, Vertebrae: 66-69 [5]. The number of gill rakers increases with the length: 33(young) to 98 on the ceratobranchial and 21(young) to 76 on the epibranchial [4]. Lewis, 1974, report that maximum observed length in Lake Kainji was 100 cm with observed weight of 10000 g. Maximum published weight: 10.2 kg [4,6].

Geographical Range

The species current distribution is now far more widespread as a result of man-made introductions

In central Africa, it is widely introduced in the lower Guinea area for aquaculture purposes, from Fort-lamy, Chad, or northern Cameroon to southern Cameroon. It was introduced from Cameroon to the lower Ogowe River basin, in the neighbourhood of Lambarene, Gabon, and from Cameroon to Congo. According to FAO (2005), it was reintroduced to Congo in 1960 with Sudan mention as country of origin. In east Africa, it is present in Lake Turkana. In northern Africa, the species used to be caught from upper Egyptian Nile but is now regionally extinct. In north east Africa, it is found in the Ghazal and Jabel systems, white Nile to Khartoum, Sudan as well as Baro River in Ethiopia. In western Africa, original natural geographical distribution areas include rivers Senegal, Gambia, Volta, Niger, Chad. Areas of successful introduction include artificial reservoirs of Cote d'ivoire and Cross River [7].

Habitat and Ecology

H. niloticus lives in open shallow waters of rivers and lakes where they can be found in the pelagic as well as the littoral zone [3]. The young ones are found in swampy places among aquatic vegetation. It optimum temperature requirement is 25 °c to 30 °c [8]. Its auxiliary branchial air breathing organs enable it to survive in deoxygenated waters. The hardiness of this fish together with it great growth rate make a candidate for aquaculture in Africa and it has been transported to a number of countries for this purpose [2].

Feeding

The African bony tongue is microphagous and a filter feeder which prey on small invertebrates copepods and chironomids [3]. Worms, crustaceans, bivalves, as well as scavenge carcasses. It has a supra-branchial organ which has sensory function as well as a mechanical function in concentrating the little food particles [9]. H. *niloticus* is the only member of the osteoglossid family which is a filter feeder. Bailey (1994) [5] considered this species as a mud feeder [7] reported that in West Africa, it is a phytoplankton feeder [10] experimented the feeding of *H. niloticus* juveniles on intensive fish production venture using artificial diets of varying dietary crude protein levels. 37% crude protein diet produced the best growth.

Breeding

Sexing is unknown as there are no external differences between the sexes; i.e. sexual dimorphism does not exist between the male and the female [4]. *H. niloticus* breed in swamps and flood plains during the wet season into prepared nest [5]. The nest is built from vegetation and is normally about one meter in diameter and 20-60 cm deep. The rim of the nest is a high wall formed out of plant chunks projecting above the water surface. The bottom is a clean platform of clay or mud [11]. in the centre of the nest, they make a depression in which the eggs, some few thousands in number are laid. The gonads are very large and the eggs are about 1-2 mm in diameter. Fertilization is external. After the spawning act, the fish leave by a way of a hole in the wall, through which, 5 days later, the young leave the nest and are guarded by the male alone. It is their habit for the whole brood to swim in a dense school for some time after they leave the nest. The fry are born with external gills which are slowly covered as the fish matures. Captive breeding is unknown [3].

Aquacultural Challenges with *Heterotis*

Several countries report adverse ecological impact after introduction as a pest. They react aggressively to their own kind but will live peacefully with most others of a suitable size [12,13].

The African bony tongue isn't really a species for the average tank. It is a very big heavily built fish which would need a very large indoor pond if it was to thrive.

African bony tongue are nervous fish and are easily startled in captivity, this would lead them to damaging themselves by bumping into pond walls.

Sexual dimorphism does not exist between male and female thereby making artificial propagation and spawning

attempt difficult. Therefore captive breeding in the home is unknown.

Conclusion and Recommendation

There has been recent increase in recommendation by fish scientists and nutritionists for scaly fish. This recommendation has led to a consequent increase in demand for scaly fish. Scaly fish is equipped with a digestive system that prevents the absorption of poisons and toxins into their flesh from the waters they come from. If you would like to live a healthy vibrant life, at least consider replacing some of those red meat meals, with some delicious fish. Reduce or eliminate shellfish from your diet and be sure that your fish has scales and fins.

Heterotis (*Heterotis niloticus*) is one of the indigenous fishes with fins and scales. Its auxiliary branchial air breathing organ enables it to survive in deoxygenated waters. Due to its hardiness together with its great growth rate, it is recommended as a candidate for aquaculture. This is in line with one of Bioresources Development mandate of preservation, protection, and utilization of indigenous bioresources to perform R and D activities for protection of the nation's ecological biodiversity.

Acknowledgement

The authors wish to acknowledge Mr. Josiah Bitrus Habu for his inspiration and encouragement during the time of this review.

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