

PRELIMINARY INVESTIGATION OF THE DISTRIBUTION, BIOLOGY AND ECONOMIC IMPORTANCE OF A NIGERIAN AQUARIUM FISH, *CTENOPOMA KINGSLEYAE* (GUNTHER, 1896).

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ABSTRACT

A review was carried out to study the distribution, biology and economic importance of a locally sold aquarium fish in Nigeria, the *Ctenopoma kingsleyae*. This was carried out by undertaking a desktop study of previous researchers. The study of the distribution of the fish revealed that it is one of the species, among the six known Anabantid *Ctenopoma* species local to Nigeria. The biology revealed that, the *Ctenopoma kingsleyae* is an active, hardy and omnivorous species, and its oxygen requirement is easily manageable as it possess a labyrinth organ. It is also a peaceful species and can be kept with other species in a community tank. However, there is paucity of information on its reproductive biology and its culture. Also, the sourcing of this fish is from the wild. These are major threats to the sustainability of the utilization of this species, and for its contribution to the growth of the aquarium business in Nigeria at large.

Keywords: Aquarium fish, Biology, *Ctenopoma kingsleyae*, Distribution, Economic importance, Nigeria.

INTRODUCTION

Fishes have been recognized as a source of beauty for almost as long as they were used for food, appearing in cave art, being raised as ornamental fish in ponds and displayed in aquariums in homes, offices or public settings (Froese and Pauly, 2012). Ornamental fishes are often called 'living jewels', this is because of their attractive colors, shapes, behavior, and sometimes peaceful nature (Jayansakar, 1998). Fishkeeping is a popular hobby, practiced by aquarists, concerned with keeping fish in a home aquarium or garden pond (Froese and Pauly, 2012). There are different kinds of ornamental fish species in Nigerian rivers,

Globally, the impact of this sector according to FAO is US \$174 million in export value, and import valued at US \$257 million as at 1998 (Bertley, 2000). The total volume exported in 2006 was 1,292,259, followed by a slight decrease of about 12% to 1,132,286 in 2007 (Ukaonu *et al.*, 2011). The Nigerian ornamental fishes were reported to be in great demand in various countries such as the United States of America, Germany, Belgium, France, Indonesia, Philippines, Sri Lanka and China (Mbawuiki *et al.*, 2012).

However, the aquarium fishes commonly available and sold in Nigeria are mostly exotic species and the

local species are usually minimally available, as they are harvested from the wild just prior to export.

The fish *Ctenopoma kingsleyae*, is a potentially important local aquarium fish in Nigeria. The '*Ctenopoma kingsleyae*' was commonly called Miss Kingsley's climbing perch after Mary Henrietta Kingsley, an English explorer and writer who discovered the species in Gabon (Banerjee, 2013). This species *Ctenopoma kingsleyae*, is one of the six species of *Ctenopoma* species found in Nigeria (Olaosebikan, 2015). Characteristically, the species have elongated, deep and compressed body, with a depth two-three times in standard length (Norris, 1994), and have brownish to olive-brown color with a dark blotch in front of the caudal peduncle, while the border of the dorsal, anal and caudal fins are colorless (Inyang, 1966).

Despite the common use and potentials of this species as a local aquarium fish in Nigeria, the aquarium fishes commonly available and sold in Nigeria are mostly exotic species. The supplies of this species are very low and mostly unavailable, as they are mostly sourced from the wild. Also, the un-checked exploitation from the wild has several consequences including depletion of the wild fish stocks inadvertently. There is therefore the need to breed/culture it, in order to increase its availability, for the development of the Aquarium industry and its value chain. However, there is scarcity of information on its Aquaculture/Breeding. This paper therefore, aims at reviewing and bringing together, the existing knowledge on the biology, distribution and economic importance of *Ctenopoma kingsleyae*, in order to elucidate areas of future research, elicit interest in, the culture/breeding of this species. This will eventually encourage and accelerate the development of breeding/aquaculture techniques of this species, to ensure their sustainable utilization as aquarium fishes.

ECONOMIC IMPORTANCE

The starting point of any prospective business is an overview of economic importance/potentials of the product in question to man in general. In Nigeria, the *Ctenopoma kingsleyae* is popularly known as bush fish, however, globally its common or English name is Tailspot *Ctenopoma* or Tailspot climbing perch (Froese and Pauly, 2012). It belongs to the genera, *Ctenopoma* (the climbing perches), family Anabantidae (Froese and Pauly, 2012).

The fish *Ctenopoma kingsleyae*, is a potentially/economically important local aquarium

fish in Nigeria. Also, its economic potential is rapidly growing in the countries where it is found, especially in and other African countries it is native to (Ibrahim, *et al.*, 2013; Ude and Udoimuk, 2013; Fagbenro and Oluwaola, 2017; Amadiet *al.*, 2019 and Seriously fish, 2019). It is one of the few local species that have been used extensively in aquariums in Nigeria (Areola, 2004; Ukaonu *et al.* 2011). They are omnivorous (Linke, 1980; Ibrahim, *et al.*, 2013; Ude and Udoimuk, 2013; Fagbenro and Oluwaola, 2017; Amadiet *al.*, 2019). The species are known to be very active in tanks (Seriouslyfish, 2019). They are also known to be hardy and have no major threats (Azeroual *et al.*, 2010). These attributes therefore make them easy to manage in aquariums, and endear them to hobbyists, aquarists and aquarium business practitioners alike.

Globally, the impact of this sector according to FAO is US \$174million in export value, and import valued at US \$257million as at 1998 (Bertley, 2000). The total volume exported in 2006 was 1,292,259, followed by a slight decrease of about 12% to 1,132,286 in 2007 (Ukaonu *et al.*, 2011). In Nigeria however, Areola (2004) reported that, although the ornamental fishery sector is in its infancy, ornamental fish export trade has been in existence in Nigeria over forty years. The Nigerian rivers are known to consist of a high diversity of ornamental fish species, and most of them are of freshwater origin. These Nigerian ornamental fishes have been reported to be in great demand in various countries such as the United States of America, Germany, Belgium, France, Indonesia, Philippines, Sri Lanka and China (Mbawuiké *et al.*, 2012). Although most of the Nigerian aquarium fishes are generally not brightly colored, but because they are hardy species, they are in high demand (Areola, 2004). About 100 species of ornamental live fishes have been identified to be regularly exported (Areola, 2004; Mbawuiké *et al.*, 2012). The local species are usually minimally available for stocking in aquarium tanks or for exporting, as they are mostly sourced from the wild, and no information is available on its farming. This un-managed, illegal exploitation from the wild is capable of snowballing into severe challenges for the fish population, the fisheries, and the environment at large in Nigeria.

DISTRIBUTION

The *Ctenopoma kingsleyae* popularly known as bush fish in Nigeria, and globally referred as Tailspot *Ctenopoma* or Tailspot climbing perche is widely distributed and native to Africa (Froese and Pauly, 2012; Banerjee, 2013; Ibrahim, *et al.*, 2013; Ude and Udoimuk, 2013; Fagbenro and Oluwaola, 2017; Amadiet *al.*, 2019 and Seriouslyfish, 2019). It belongs to the genera, *Ctenopoma* (the climbing perches), family Anabantidae (Froese and Pauly, 2012; Banerjee, 2013). Olaosebikan (2015) reported

that, there are nine known species in the genus with six occurring in Nigeria. He added that this species *Ctenopoma kingsleyae*, is one of the six of *Ctenopoma species* found in Nigeria.

The genus *Ctenopoma* are widely distributed in the West and Central Africa (Froese and Pauly, 2012; Olaosebikan, 2015). Froese and Pauly (2012) reported that it has an enormous natural range throughout much of north western Africa. The species *Ctenopoma kingsleyae*, is native to several African countries including Nigeria, Benin, Burkina Faso, and Cameroon (Azeroual *et al.*, 2010; Seriouslyfish, 2019), and specifically in areas such as the Freshwaters of the Lower Guinean forest streams (Amadiet *al.*, 2019), Lake Victoria, Uganda (Witte, 1990).

In Nigeria, *C. kingsleyae* is widely distributed and reported found in Otammiri River, Owerri, Imo State (Ude and Udoimuk, 2013); Upper Reaches of the New Calabar River, Port Harcourt, Rivers state (Ibim and Gogo, 2013) the floodplain of the Oueme River, in Oueme delta, Benin, Edo state (Ibrahim, *et al.*, 2013); the lower Oluwa River and adjacent floodplains of Ondo State Coastal Wetlands (Fagbenro and Oluwaola, 2017), among others.

BIOLOGY

Description: *Ctenopoma kingsleyae* is a deep bodied fish (Fagbenro and Oluwaola, 2017). The genus *Ctenopoma* represents fishes that are generally deep-bodied (body depth 2-3 times into standard length) and share several unique morphological traits (Norris, 1994; Norris and Teugels, 2016). The *Ctenopoma kingsleyae*, is the largest species in the genus growing to 25cm in length. Though aquarium specimens tend to stay a little smaller, but can still attain around 20cm (Seriouslyfish, 2019).

The species was reported to have a round-blunt snout and a large mouth, that is obliquely directed, and extending beyond the anterior border of the eye and opercula notch, and indented above and below (Inyang, 1966). The species is sympatric with the newly discovered *Ctenopoma nebulosum* and are closely related but may be distinguished by the unique black patch at the caudal base and is placed in synonymy with the species *Anabas breviventralis* (Norris and Douglas, 1992). The male is noticeably spinier around the gill covers and under the eyes (Seriouslyfish, 2019).

The dorsal fin (having 10-12 rays) was reported to be narrowly separated from the caudal fin, while the anal fin (having 10-13 rays) was said to originate slightly behind the end of the pectoral fin (Norris, 2003). The *Ctenopoma species* like other species belonging to the family Anabantidae, have suprabranchial respiratory organ (labyrinth organ), although poorly developed. This organ is a complex folded structure, filling a large suprabranchial chamber (Norris, 2003; Seriouslyfish, 2019), formed

as a result of the modification of the first gill was so-named due to its maze-like structure (Seriouslyfish, 2019). This organ enables the fish to breathe atmospheric air to a certain extent (Seriouslyfish, 2019). As a result of this, they are commonly found in oxygen-deficient waters such as marshes, inundated forests or grasslands and river margins (Norris, 1994; Seriouslyfish, 2019).

Environmental requirements: The *Ctenopoma kingsleyae* species were reported to do well in a temperature range of 25-28°C; pH range of 6.0-8.0; hardness range of 5-20°H; (Seriouslyfish, 2019). However, Maithya and Jembe (1998), reported a pH -6.8 to 7.2; temperature range of 28 – 33.2; dissolved oxygen of 0.04mg/l; conductivity of 95µScm; and a total hardness range of 5.8 – 53.7. Norris (2003) reported this species to require temperature range of 22°C-28°C, pH and hardness ranges of 6-8 and 5-20 respectively. Norris (2003) added that the species are demersal, and excel in dimly lit environment, synonymous with their preference for forest areas, as they are naturally found in submerged grassy areas of quiet streams and rivers, with tropical waters.

Food and feeding: This fish species were reported to be omnivorous and highly predacious, preferring live foods such as small fish, earthworm and large insect larvae (Linke, 1980; Fagbenro and Oluwaola, 2017; Seriouslyfish, 2019).

Behavioral Characteristics: The species are known to be very active and so jump about a lot, and one of the more aggressive members of the genus (Seriouslyfish, 2019).

Reproductive Biology: There is paucity of information on the reproductive biology of the *Ctenopoma* species. However from minimal information available, sexual dimorphism in these species revealed that, the male is noticeably spinier around the gill covers and under the eyes (Seriouslyfish, 2019). They further observed that, the species does not become sexually mature until they reach 5-10 years old, and this does not appear to be related to water temperature or other environmental parameters. These hobbyists added reported that, breeding of the Anabantoid species commences with the typical Anabantoid embrace, following a pursuit of the female by her partner, and, this fish species may well be seasonal spawners, with a pair often spawning regularly for several months, and then stop for a while. Norris (2003) reported that the species usually breed or spawn during the wet season when flooding commences, laying up to 20,000 eggs. Olaosebikan (2015) reported the *Ctenopoma* to be egg-scatters, during spawning, and that they fish usually spawn at night, and the eggs float upwards to the surface. It was also stated that, since the species belong to the same group (Anabantids) as the Siamese fighting fish whose reproduction has been better documented,

the *Ctenopoma kingsleyae* are probably bubble nest builders Siamese fighting fish. Generally, most Anabantids build floating bubble nests among water plants in which the eggs are deposited. The bubble nest is made by the male next to a floating leaf, by rising to water surface to gulp atmospheric air and enveloping it with mucus formed in the mouth during spawning to form a bubble (notesonzoology, n.d.).

AQUACULTURE

Captive Breeding: There is paucity of information on the captive breeding of *Ctenopoma kingsleyae*. It was reported that the species are difficult to breed in captivity, although a few successes have been recorded (Linke, 1980; Seriouslyfish.com, 2019).

They reported that, the breeding tank should be large and contain lots of floating plants (Seriouslyfish.com, 2019). However, the general process of captive breeding among Anabantids as seen in the breeding of the Siamese fighting fish (notesonzoology.com), was said to involve the production of several bubbles close to one another to form a raft, after which the male drives the female near the raft and flexes around her in order to stimulate the release of eggs, which the male will then fertilize. The eggs which drift towards the bottom are then picked up by the male fish and blown into the nest. This process is repeated severally until the female is completely devoid of viable eggs. The female is then removed, if not they could be killed by the male, who takes responsibility for guarding the eggs until the fry starts to swim out. The eggs hatch after 24-30 hours and the fry starts swimming after three days, and immediately after, the male is also removed from the receptacle to prevent it from preying on the fry (notesonzoology.com). The fry can be fed infusoria or liquid fry food initially, followed by newly hatched brine shrimp after a few days more (Seriouslyfish.com, 2019).

Grow-Out Process: Globally and in Nigeria particularly, there is paucity of information on attempts towards the culture of the *C. kingsleyae* species. However, few attempts at traditional aquaculture system, termed the Whedos, for several fresh water fishes, including the *C. kingsleyae* was reported in Benin, Edo State, by Ibrahim, *et al.* (2013). The traditional aquaculture system took place in the floodplains of the Oueme River, and depended on the river. Ibrahim, *et al.* (2013), reported that, the physicochemical variables of the water in the Whedos, were in most cases significantly lower than those recorded in the main river channel and this improved the growth of the fish species.

There is scarcity of information about modern aquaculture of this species. However, it was reported that, there is a general belief that the species does not become sexually mature until they reach 5-10 years old, and this does not appear to be related to water

temperature or other parameters (Seriously fish, 2019).

After the spawning, it is advised to remove the parents. The fry can be fed infusoria or liquid fry food initially, followed by newly hatched brine shrimp after a few days (Seriously fish, 2019).

Aquarium Keeping: There is little information about the Aquarium keeping of these species from hobbyists, mainly from their experiences in keeping them. Thus, it was reported that, since the species was reported to be very active, predatory, jumps and is aggressive, it is not a species for community tank. Also, it can be particularly nasty towards conspecifics, and is best kept either as a single specimen or, as a pair. Also as a result of its active nature, it requires a spacious tank for swimming, with a cover with contain no gaps, as the species is a notorious jumper (Seriously fish, 2019). Thus, a single *Ctenopoma kingsleyae* fish could be housed in a standard 48" x 12" x 12" (120cm x 30cm x 30cm) or 108 liter tank. However, in a big tank with plenty of cover, it could be combined with other similarly-sized, robust species, as small fish will be preyed upon.

If there is need to keep them with other species, a tank of minimum 60" x 45cm x 45cm (150cm x 45cm x 45cm) or 303.75 liters in size would be required (Seriouslyfish.com, 2019). They further reported that, since the *Ctenopoma* species does best in a dimly lit and vegetated environments, low lighting, or inclusion of floating plants will be required alongside a dense thicket of plants, chunks of bogwood, or rocky formations as hiding places.

They added that, though the *Ctenopoma kingsleyae* accepts a fleshy diet in in the aquarium such as Prawns, mussels, earthworms and similar foods, they reject dried foods (Seriously fish, 2019).

The accessory respiratory organ, the labyrinth was said to enable the fish to breathe atmospheric air to a certain extent, thus it could be of advantage in aquarium tanks, especially in cases of long power outage, and consequent poor aeration (Seriously fish, 2019).

In cases where the *Ctenopoma kingsleyae* were kept in the aquarium, they were exceptionally long-lived, and there were reports of some surviving for over 30 years (Seriously fish, 2019).

Opportunities and Challenges of Aquaculture of *Ctenopoma kingsleyae*

Opportunities: Several studies reveal that Nigeria has abundance of these Anabantids in its fresh water bodies, however they have not been properly utilized for ornamental or aquarium trade. •the *Ctenopoma kingsleyae* have gained market in Nigeria. •Nigeria is endowed with a suitable climate, water resources and large manpower base in the public sector. • Nigeria has a good freight system that can distribute the

ornamental fishes world-wide to various market destinations. There is a fast growing domestic and international market, several persons are un-employed and can be trained to take up the value-chain for the sustainable production of this species.

Challenges: Lack of well defined policies on ornamental fish trade, Lack of quality research on ornamental fish culture. Poor information on fishes. •Lack of adequate infrastructure and key inputs for the ornamental fish trade. Inadequate research and technology for breeding, grow-out and feeding the fish species in captivity.

CONCLUSION AND RECOMMENDATION

The fish '*Ctenopoma kingsleyae*' is a hardy species native to Nigeria. Thus their management in aquarium tanks and aquaculture systems can be minimal. Also, they have already been well accepted in the Nigerian aquarium market. Thus, they have great prospects/commercial importance as aquarium fishes. However, they are only sourced from the wild and thus are not very available when needed, and there is no known aquaculture of this species to increase their availability.

It is therefore recommended that, more detailed researches on especially, the reproductive biology and culture of the species be carried out, that can elucidate the gray areas in their breeding/culture. This will go a long way to encourage sustainable, mass production of the fish and its seed, to enhance the development of the Ornamental fishery industry, create jobs and increase our foreign exchange earnings (create wealth) in Nigeria, as a whole.

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