

**A REVIEW OF THE GENERAL ASPECTS OF REPRODUCTION OF A  
THREATENED FRESH WATER FISHSPECIES IN BENIN: PARACHANNA  
OBSCURA (GÜNTER, 1861)**

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**ABSTRACT**

*Parachanna obscura* is a fresh water fish belonging to Channidae family that is recognized as snakehead fish. Its first sexual maturity height is 17.5 cm TL in females and 23.4 cm TL in males. Sexual dimorphism based on observation of the genital papilla is difficult to recognize. The fish species is carnivorous with rapid growth rate. For further evaluation of its aquaculture potential in Benin Republic, the current study aims to make a review on the reproductive aspect of *P. obscura*. Its resistance, rapid growth and high economic and nutritional values represent important potential for aquaculture because it is highly appreciated by the West African population in general. The natural stock of *P. obscurais* currently threatened to disappearance in Benin due to fishing pressures that lead to overexploitation. A successful rearing of *P. obscura* in controlled medium could ensure not only the preservation and improvement of natural stocks but also the production of food fish for sustainable aquaculture.

**Keywords:** *Parachanna obscura*, aquaculture, reproduction, sexual dimorphism.

**1. INTRODUCTION**

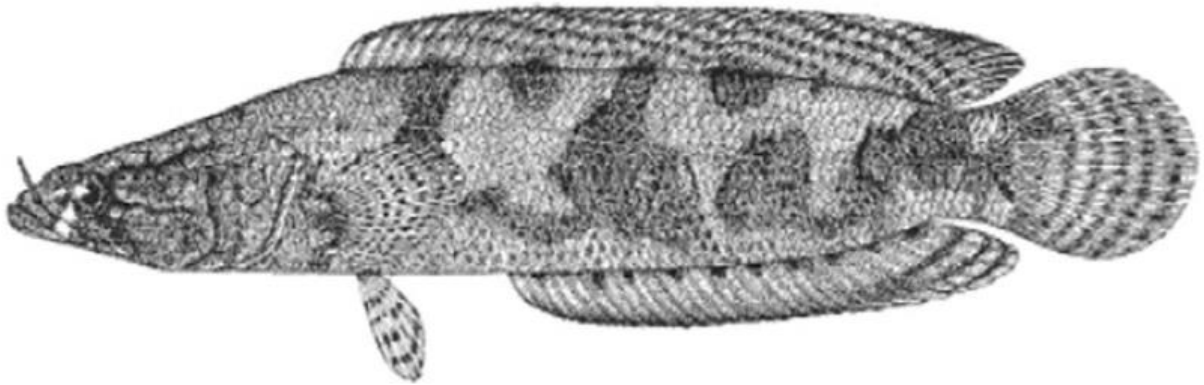
Fishes are generally first choice protein source in most of countries (Daniel Ama-Abasi and Anthony Ogar, 2013).Channidae is a fresh water fish family commonly called snakehead fish which are found in Africa (*Parachanna*) and Asia (*Channa*)(Bonou andTeugels, 1985).*Parachanna obscura* reproduces throughout the year except in February, March and April (IsangedighiandUmoumoh, 2011). The snakehead fish is generally carnivorous, predator, piscivorous, insectivorous and crustaceans consumer (Bonou andTeugels, 1985). It is a resistant species able to survive in stress conditions, with a rapid growth (2 g.d<sup>-1</sup>) and high potential for aquaculture (Olaosebikanet al., 1998). Good growth rates were obtained in specimens fed on commercial pellets (*Coppens*) at 8.25; 3.6 and 2.5% feeding rate with initial body weight respectively 0.9; 4.1 and 9.4 g (Kpogue andFiogbe, 2012). According toKpogueet al. (2013), the

protein requirements of larvae and fries in this species range from 42.5 to 53.5% of feed diet. Larvae collected from the wild and reared at a density of 20 specimens per liter showed good growth and survival rates (Kpogue and Fiogbe, 2012). Moreover, to reduce *Parachanna obscura* production cost, results showed that replacement of fish meal by earth worm meal at 50% rate enabled good growth in specimens (Vodounouet *al.*, 2016). The high protein quality and exceptional fat richness of the filet make this fish a good agent for patient healing and recovery after deliverance and/or surgery and is highly recommended to growing up children (Abassi, 2012).

During the last decades, the scarcity of *P. obscura* specimens in Benin water plans led to a real preoccupation. Overfishing made this high nutritive value fish (21.03 to 22.03% proteins in adults of *P. obscura* according to Daniel Ama-Abasi and Anthony Ogar, 2013) are threatened to disappearance. The production of *P. obscura* in natural continental waters cannot face the local demand due to overexploitation (Kpogue *et al.*, 2013). Bad fishing methods using poison, fire and illegal fishing net affected negatively the fish species and its consumers (Kpogue *et al.*, 2013). A successful rearing of *P. obscura* in semi-intensive and/or intensive production systems could help not only to preserve and improve the natural stocks, but also produce continuously food fish. Thus, supplying a good protein source by producing food fish contributes to food security and improvement of the economic conditions of the increasing African population and consequently ensures the preservation of aquatic biodiversity in Africa. However, the methods used for its exploitation don't guaranty a long term sustainability of this important fish species. That is the reason why its rearing is highly recommended. Many studies were focused on the domestication of *P. obscura* but its artificial reproduction isn't mastered yet. One of the main difficulties encountered in this species is the absence of external sexual dimorphism. The non-mastery of its reproductive conditions in controlled medium makes all the quantity consumed are directly captured from the wild. The current review aims to make a synthesis of the general aspects of reproduction of *P. obscura*.

## 2. DESCRIPTION

*Parachanna obscura* (Figure 1) shows an elongate body, fusiform, subcylindric and covered by cycloid mean size scales. The head is depressed frontally, relatively long and covered by cycloid scales larger than those on the body and symmetric. Eyes are relatively big and lateral enabling the fish to localize rapidly preys. Two nostrils exist at each side of the mouth. The mouth is large and protractile. The inferior jaw is slightly longer than the superior jaw and carries 4 to 6 well developed canines. Adults and juveniles of *P. obscura* are olive-blackish colored on the dorsal side and on the flanks. The ventral side is ochre marbled. Some dark spots tending to connect on the back are present on each side of the dorsal fin (Kpogue *et al.*, 2013).



**Figure 1:** *Parachanna obscura* (Bonou and Teugels, 1985).

### **3. NATURAL HABITAT AND GEOGRAPHICAL DISTRIBUTION**

The snakehead fish (*P. obscura*) is generally found in the inter-tropical convergence zone where the water temperature ranges from 26 °C to 28 °C. This fish lives in flooded plains, swamps, rivers, lakes and ponds. It possesses accessory respiratory organs enabling it to live in hypoxic muddy environments (Olaosebikanet *al.*, 1998). It is both a benthic and fresh water migratory species and the most popular of African Channidae. *P. obscura* is present in African continental water plans and native to countries such as: Benin, Burkina Faso, Cameroon, Central Africa Republic, Chad, Côte d'Ivoire, Ethiopia, Gambia, Ghana, Guinea, Bissau Guinea, equatorial Guinea, Mali, Niger, Nigeria, Senegal, Sierra Leone, Soudan and Togo (Teugels, 2003).

### **4. SEXUAL DIMORPHISM**

No external sexual dimorphism was observed in *P. obscura*. However, bigger and longer specimens were identified males (total length 43.3 cm and 625.6g body weight) (Isangedighi andUmoumoh, 2011). Observations focused on *Parachanna obscura* showed that it's a monomorphic teleost characterized by an absence of visual sexual dimorphism except males have highest body weight (Isangedighi andUmoumoh, 2011). Other methods such as meristic and morphometric parameters measurement, growth, length-weight relationship and condition factor can be used for the determination of sexual dimorphism in *Parachanna obscura*(Vodounnouet *al.*, 2017). Thus, the tail length can help to identify the sex because there is a significant difference between the male and the female regarding this parameter (Vodounnouet *al.*, 2017). By the same way, condition factor in male is the double of those in female (Vodounnouet *al.*, 2017). Concerning the length-weight relationship, an isometric growth was observed in female ( $b=3.01$ ) while in male, this growth was allometric ( $b = 2.74$ ) (Vodounnouet *al.*, 2017).

### **5. SEX RATIO**

Isangedighi and Umoumoh(2011) reported that over a total number of 329 specimens of *Parachanna obscura*, 147 (44.68%) were males while 182 (55.32%) were females showing a general ratio male: female of 1:1.24 that is significantly different from the unit in favor of females in Itu-Cross River (Nigeria). The monthly sex ratio showed a highest proportion of

females from September to January and from March to May with a pick in May while males are dominant in June and July. Equality was also observed in the sex ratio in February and August. Over 103 specimens examined during the dry season, 41 (39.81%) were males and 62 (60.19%) were females showing a male: female sex ratio of 1:1.51 that is significantly based on females. Over a 226 specimens examined during the rainy season, 106 (46.90%) were males and 120 (53.10%) were females with 1:1.13 male: female ratio. Plasticity among males and females proportions in relation to length classes revealed that females dominated in every height classes except 30-31cm TL where males slightly dominated on females. The females' domination pick was obtained in the 32-33cm TL class showing that females also dominated in the biggest heights (Isangedighi and Umoumoh, 2011). The sex ratio is generally based on females (sex ratio male: female = 1:1.24). Similar result was obtained by Udoh and Daniel (2001) who reported 1:1.32 male: female ratio. This trend can be explained by the fact females were more susceptible to capture than males. The sex ratio highly based on females of *Parachanna obscurain* Itu-Cross River is a strategy to ensure exponential production of offspring. In addition, this dominance of females shows that a sufficient number of female is available for the maintenance of good population balance in spite of environmental constraints and anthropic disturbance (King, 1991).

## 6. MATURITY HEIGHT AND SPAWNING CONDITIONS

Maturity height in males and females of *P.obscura* varies. The smallest mature female was 17.5 cm TL (Isangedighi and Umoumoh, 2011) while it is 23.4 cm TL in males. Beyond 50% all sex involved, the maturation height is 24.7 cm TL (Odoet *al.*, 2012). According to Isangedighi and Umoumoh (2011), the gonado-somatic index increases during the rainy season followed by a decrease in the hepato-somatic index. The high value of gonado-somatic index during the rainy season confirms that ovarian development and spawning activities happen in this season. The opposite is recorded in males though gonado-somatic index is higher during the dry season (Isangedighi and Umoumoh, 2011).

## 7. REPRODUCTION

Odoet *al.*, 2012, reported that the monthly mean gonado-somatic index (GSI) in 94 females of *P. obscura* varied from 1.1 – 3.3 % ( $2.05 \pm 0.72\%$  mean). There are some slight variations in the monthly mean GSI showing that the species reproduces throughout the year with three picks respectively in June, September and January (Odoet *al.*, 2012). Oocyte number studied on 15 females varied from 126 to 1580 ( $896 \pm 477$  oocytes in mean) (Odoet *al.*, 2012). Ovary weight is low during stage I (immature) and increases in relation to maturation. Picks appear with fish in advanced maturation stage (stage IV) and decline after spent stage (Odoet *al.*, 2012). Monthly trends of mean gonads weight varied from 0.473 to 2.9833 g. Values higher than 1 g were recorded in May, July and November while lower were obtained in other months. Gonads weight during the dry season (November – Mars) varies from  $0.473 \text{ g} \pm 0.3228 \text{ SD}$  in December to  $1.2847 \pm 2.0093$  in November ( $0.8608 \text{ g} \pm 1.3032$  mean) while during the rainy season (April – October) it varies from  $0.74 \pm 0.71628 \text{ SD}$  in August to  $2.9833 \pm 4.5357 \text{ SD}$  in July ( $1.1163 \pm 1.7205$  mean)(Isangedighi and Umoumoh, 2011). Bonou and Teugels (1985) reported that little information is available on the reproductive behavior of *P. obscura*. According to Gosse (1963), fries are guarded by adults. It is nest builder fish like the other Channids. In monoculture, the

reproductive activity is more intensive in October and November in the southern Nigeria (Victor and Akpocha, 1992). The fecundity in monoculture ponds varies in relation to maturation stages and ovaries contain between 35 and 4010 oocytes (Isangedighi and Umoumoh, 2011).

However, there is not good correlation between fecundity and length or weight but this could be due to poor rearing conditions (Victor and Akpocha, 1992). The plasticity of seasonal reproduction of *Parachanna obscura* in the Itu-Cross River system indicates a higher intensity during the rainy season than the dry season. This increase of eggs number in females during the rainy season is associated to the quality of the flooded plain soil characterized by abundance in nutritive elements. Thus, the offspring will have enough food resources for survival (Isangedighi and Umoumoh, 2011). Flood plain soil also provides protection to fries and creates nest for females spawning (Moses, 1987). Spent females are mostly observed during the first months of dry season (November and December) showing that they spawned during the rainy season. However, some slender gravid females are also recorded during the first months of the dry season (November and December) confirming spawning possibility throughout the year (Isangedighi and Umoumoh, 2011). The low relative fecundity of *P. obscura* is a proof that the species ensures parental care. Relationship among fecundity, weight and total length (TL) of *P. obscura* in the Itu-Cross River system didn't show significant increase in relation to weight (total weight) and somatic weight as reported by Bagenal and Braum (1978) and the female with the highest eggs number was not the longest.

## 8. PROBLEM STATEMENT

Currently, one of the main difficulties to the domestication of *Parachanna obscura* is the absence of external sexual dimorphism. To know about the sex, researchers are obliged to dissect the animal; what doesn't enable the preservation of the specimens for further investigations. In addition, fishing pressures on the natural stock led to the scarcity of the species in Benin water plans. It's also important to mention that the second species of *Parachanna* priority encountered in Benin, *Parachanna africana* has totally disappeared from our water plans. It worth good measures should be taken to preserve the only remaining species *Parachanna obscura* that also becomes scarce in Benin reservoirs.

## 9. POTENTIAL FOR AQUACULTURE

*Parachanna obscura* is considered as a potential species for aquaculture in Africa due to the high quality of its filets and its important nutritive value (Daniel Ama-Abasi and Anthony Ogar, 2013). Its high quality proteins and exceptional fat richness make the fish a good agent for patient healing and recovery after deliverance and/or surgery and is highly recommended to growing children (Abassi, 2012). It is a resistant species able to survive in low oxygen environment. It also tolerates poor water quality with high proliferation and growth rate ( $2 \text{ g.d}^{-1}$ ). Due to its tasty filets with less bone, *P. obscura* is a highly appreciated fish and constitutes an important food base to African people (O'Byrne and Lee, 2007). Beside its nutritive value, this species presents an important commercial and economical potential. However, we cannot trust on wild stock to achieve this potential. A successful rearing of this species in semi-intensive and intensive production systems could help not only to preserve and improve the wild stock but also to produce continuously food fish. *P. obscura* is also efficient to control tilapia production (*O.*

*niloticus*) in polyculture and consequently improve the individual growth rate in both species (Bassey and Ajah, 2010).

## **10. PROSPECTS**

The methods used for *Parachanna obscura* exploitation don't ensure long term sustainability of this important fish species. It's the reason why its rearing is highly recommended. Thus, it would be important to carry out research in order to determine the environmental factors influencing reproduction success, growth and survival in larvae of the species. Concerning the sexual dimorphism identification, our future research works are oriented to genetic sex determination through the method of karyotype. Other analyses such as steroid hormones dosage can also help to distinguish sex in *Parachanna obscura*. Education in preservation and fishing season management techniques could also help to improve the preservation of this species. If appropriate method can be used for a sustainable aquaculture of *Parachanna obscura*, it will contribute efficiently to the preservation of fish diversity in Africa by improving fish farming and reduce significantly fishing pressures on wild stock.

## **11. CONCLUSION**

*Parachanna obscurais* a fresh water fish species highly appreciated by West African population. However, there is no farm or aquaculture station that is specialized in the production of that fish in Benin. Fishing pressures are daily exerted by fishermen. So, the species isn't totally domesticated and is consequently threatened to disappearance. The absence of external sexual dimorphism also constitutes a difficulty to the induction of their reproduction in controlled medium. Our future research works are focused on the sexual dimorphism identification and artificial reproduction of *Parachanna obscura* for sustainable aquaculture and the species preservation.

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