

## DISTRIBUTION AND ABUNDANCE OF AFRICAN LUNGFISH *Protopterus annectens* (OWEN, 1839) IN THE ORASHI AND SOMBREIRO RIVERS, NIGER DELTA, NIGERIA

<sup>1</sup>FRANCIS, A. and <sup>2</sup>C. N. ONWUKA

1 Department of Fisheries, University of Port Harcourt, Port Harcourt, Rivers State, Nigeria.

2 Department of Fisheries and Marine Technology, Imo State Polytechnic, Imo State, Nigeria Correspondence:

[cnonwuka@yahoo.com](mailto:cnonwuka@yahoo.com), +2348031317343

### ABSTRACT

Studies on the distribution and abundance of the African lungfish *Protopterus annectens* in Orashi River and River Sombreiro were carried out between October 2013 and September 2014. Three hundred and forty-seven (347) specimens were sampled, made-up of one hundred and eighty-four (184) males and one hundred and sixty-three (163) females. The fish had an average length of 46.05 cm and an average weight of 140.75 gm. The fish attained maximum growth both in length and weight 45.55 between April and July with mean length and weight of 45.55 cm and 147.50 gm respectively. The fish was most abundant between April and July which coincided with the rainy season, with values ranging between 10.95% and 11.24%. Monthly Catch per Unit Effort MCPUE ranged between 5.24 kg/man/hour and 7.10 kg/man/hour, with a mean value of MCPUE of 5.64 kg/man/hr. The period April to July is the period of flood, and movement of debris and nutrients into the rivers, and discharge of human waste as food for the fish to support its growth, abundance, and distribution. The research underscores the need for a concerted effort towards conservation strategies to sustain the fish.

**Keywords:** Fish stock, fish species, total biomass, diversity of fisheries, monthly occurrence

### INTRODUCTION

Proper understanding of the abundance and distribution of the fisheries of a water-body is an effective management technique towards a sustainable exploration of the fisheries. Baltz (1990) explained that the distribution of a fish species in space and time may be assessed on a broad zoogeographic basis or within a narrow term of habitat. However, Negi and Mamgin (2013) explained that fish abundance is the totality of the fish stock (total biomass) and recognized that catch per unit effort is an index measurement of fish abundance. Smith and Powell (1975) on the other hand believe that changes in growth and mortality parameters are appropriate measures of fish abundance. Tobor and Ajayi (1978) and Ajayi and Talabi (1984) articulated the abundance, distribution, and diversity of fisheries in Nigeria and explained that there are about 270 species from 78 families in Nigerian waters. Tobor (1992) noted that the fish and fisheries of various aquatic environments are yet to be fully investigated amongst which is the West African Lung-fish *Protopterus annectens* (Owen, 1839), (Plate 1). It is an ancient fish species characterized by the possession of true lungs which it uses for breathing (Reed *et al.*, 1967). Reed *et al.*, (1967), Lewis (1974) observed that the fish falls between the gill-breathing fishes and other animals that breathe with lungs. The lungfish (Dipnoi: Sarcopterygii-*Protopterus*) is found in Africa (*Protopterus*), South America (Lepidosirenidae), and Australia (*Neoceradotus*) (Bond, 1979; Oniye *et al.*, 2006). The animal according to Fishman *et al.*, (1986) survives a variety of environmental conditions, and

the species of African genus *Protopterus* seems to be well adapted to harsh seasonal droughts in which their habitats may dry up completely. In this condition, the African lungfish undergoes aestivation during the dry season; an ecological behavioural pattern of life for survival (Fishman *et al.*, 1986). *Protopterus annectens*, the only surviving species of the family in the Nigerian waters, inhabits the swamps, creek, and flood-plain areas that are prone to drying out during dry season (Reed *et al.*, 1967, Lewis, 1974, Latest classification (Olaosebikan and Raji, 1998) described the species to belong to the family: *Protopteridae* and Order: *Lepidosireniformes*, known to have a pair of true lungs which the fish uses for breathing and enables it to survive out of water for many months. Also, Oniye *et al.*, (2006) described it as demersal with distribution in Nigeria, the Senegal, Niger, Gambia, Volta, and Chad basins. In addition Oniye *et al.*, (2006) and Adeyemi *et al.*, (2009) show that the fish is found in temporary tributaries of Chari River in Bandama, Western Sudan, Comoé basins in Côte d'Ivoire, certain basins of Sierra Leone and Guinea, in North-Western and North-Central part of Nigeria notably in floodplain areas of Jacki Dam near Katsina and Gbedikere Lake in Bassa area, Kogi State, in marginal swamps, flood areas and backwaters of rivers and lakes where the fish is greatly associated with aquatic plants in terms of breeding and feeding ecology. The West African lungfish (Plate 1) has a prominent snout, two small eyes in the head, and long and filamentous paired fins. The study was aimed at explaining the peculiarity of choice of habitat in Orashi and Sombreiro Rivers in Nigeria Delta Region by the

African Lungfish *Protopterus annectens* and showed its biological potential in those Rivers.

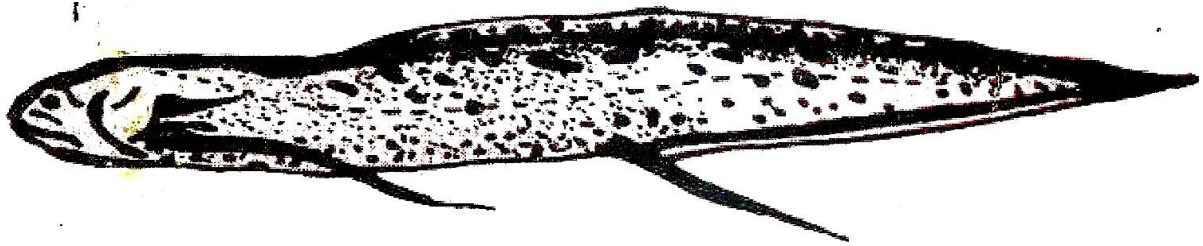


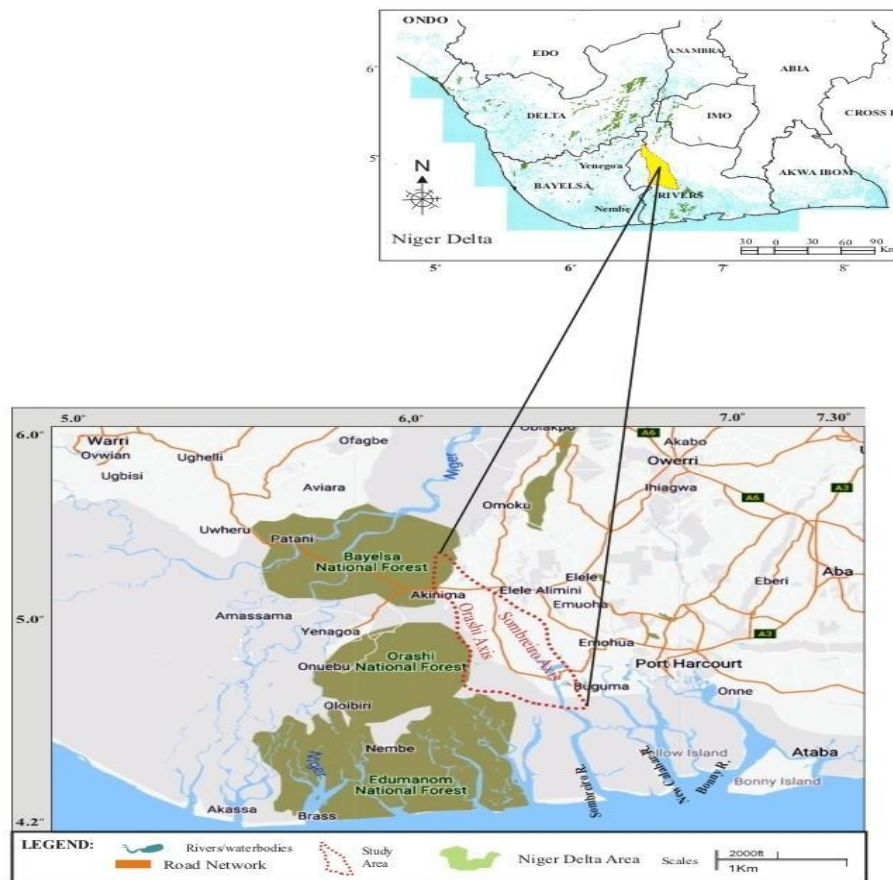
Plate 1. African lung-fish (*Protopterus annectens*) @ Dr. Liz Loeffler, University of Bristol, 1987. The body is covered by ganoid scales embedded in the skin. The dorsal side is olive or brown colored (ventral side lighter) with great blackish or brownish spots on the body and fins except on the belly. **Source:** Specimen Photograph from the field

## MATERIALS AND METHODS

### Sampling Locations

The study was conducted in two water bodies in the Niger Delta: Orashi River and River Sombreiro and their adjoining flood plains all within the rainforest zone of the Niger Delta (Fig. 1). The location of sampling size was documented using a global positioning system which revealed that the area falls within latitude 14" 22' and 27" 50' and longitude 26" 30' and 37" 05', (Osuamkpe, 2014). The area stretches from the Northern part of Bayelsa State, traversing Joinkrama village, Ochebele, and Oruama communities to Ususa in the Southern part of Bayelsa State, to Ahoada in the Eastern part of Rivers State, and the adjoining creek villages in the floodplain areas of Omoku town and Erema.

### Study Area



**Fig. 1: Map of Study Area: The Orashi River and Sombreiro River**

**Source:** Geographic Information Services culled from [www.google.com/search?q=map+of+delta+region+showing](http://www.google.com/search?q=map+of+delta+region+showing)

### Fish Sampling

Fishers from the local fishing communities along the river banks were interviewed through questionnaires to obtain basic information such as:

- Where and how they get the fish species
- The preferred fishing gears and nets
- The preferred habitat of the fish species
- Whether they find the fish in different habitats, and at what specific time and season.
- Under what conditions do the fish breed and spawn.

The fishers explained that the fish is rarely found in shallow waters, but densely flooded zones. At the end of the flood period, the fish burrows into a tunnel-like gully creates a cocoon around itself and remains there till the next flood comes up. They opined that this may take up to a circle of nine (9) months before the fish will come out of the burrow. The information gathered guided the sampling procedure.

Fish samples were caught by the fishers who fish mostly at night using multiple fishing gears that include drag-net, small-mesh seines and dip nets of different mesh sizes, large mesh drift nets of different mesh sizes of 2",3",4", and set gill nets which were mostly used in the flood-plains during flood season. Sampling from multiple fishing gear was deliberate and was done to eliminate bias and selectivity issues that may arise when samples are collected with only one type of fishing gear. Fish sampling was done on a bi-monthly basis i.e. two-week intervals in a month for twelve months, October 2013 to September 2014. The fishers spent between 04-05 hours that is between 07.00 pm to 11.00 pm during each fishing period. The number of fishers varied but in this study five (5) fishers were involved in the fishing. Subsequently, the fish samples were transported in plastic containers to the laboratory. In the laboratory, the morphometric data were taken. The total length (TL), standard length (SL), and body weight were measured. Length measurements were carried out using a fish measuring board measured with accuracy to the nearest centimeter while weight was measured on a top pan salter balance with accuracy to the nearest gramme. The fish samples were also sorted into sexes, having identified the males as having oval-shaped cloaca opening and the females, rounded cloaca opening (Mlewe and Green, 2004). After the measurements, the specimens were preserved in 10% buffered formalin.

### Abundance and Distribution

Catch Per Unit Effort (CPUE) was determined by dividing the total monthly catch by the effort, that is, the number of fishers involved in the fishing (at a time) and finally dividing by the number of hours of fishing (King, 1991).

Thus:  $CPUE = \text{Total Catch}/\text{No of Fishers}/\text{Fishing Hour}$

$CPUE = \text{kg}/\text{man}/\text{hour}$  (King, 1991).

### Monthly Occurrence and Weight Distribution

Monthly occurrence and weight distribution were determined by a comparison of monthly catches within the selected water bodies. This was cumulatively collected to make a percentage relative abundance.

## RESULTS

### Fish Sampling

Fish samples were caught mainly in the floodplain areas, and in the river course of Orashi River and River Sombreiro, traversing many creek towns and villages including Ula-Ahoda, Abarikpo, Ihunajo, Akabuka, Ede, Ogbeide, Okposi, and the floodplain areas of Omoku town and Erema village in Onelga Local Government Area of Rivers State. Fish samples collected ranged between 30cm-69cm total length and 60g-345g weight. A total of three hundred and forty-seven samples were collected for analysis. This included 184 males and 163 females.

### Abundance and Distribution

Table 1 shows the percentage monthly occurrence of the fish sample throughout the twelve-month sampling period. The result shows that the fish was available all year round but mostly during the period between April and July with percentage occurrence between 10.95% and 14.12%. The monthly catch per unit effort (MCPUE) data for the species sampled from Orashi River and River Sombreiro is shown in Table 2. At the peak month of September, the mean MCPUE was 7.08kg/man/hr. The species was least abundant in October with a total catch of eighteen (18) specimens with an average weight of 131kg. This gives an MCPUE of 5.24/kg/man/hour.

## DISCUSSION

The all-year availability of the sampled fish species *P. annectens* is an affirmation of the observation by many researchers (Ezenwa *et al.*, 1987, King, 1996), that most commercial and scientifically important fishes can be landed all year round in fresh and brackish waters in Nigeria. Also, the fish was most abundant between April and July. This agrees with the report of Ezenwa *et al.*, (1987) and King (1996) that the availability of fish species is not a constant phenomenon, in that in some months of the year, the abundance may decrease. In this report, therefore, from October 2013 to February 2014 the relative abundance was at a low ebb. The fish was relatively more abundant during the period April and July. This coincided with the rainy season and as suggested by Oniye *et al.*, (2006) and Adeyemi *et al.*, (2009), this is the period of early heavy rains when aquatic plants thrive along the marginal swamps and flood plain areas and with

heavy human and domestic wastes which support the breeding and feeding ecology of the fish. This observation also aligns with the International Union for Conservation of Nature (IUCN, 2013) Threat Status (On-line Classification of Fish Species) which defines the Conservation Status of the species in the lower Orashi River as "common". The assertion by IUCN (2013) explains the availability of the fish in the lower Orashi River where this present research was carried out. However, IUCN (2013) does not explain the seasonal distribution and abundance of this ancient fish, which is now being explained. According to IUCN (2013), *P. annectens* is common in the lower Orashi River, meaning that it is available, which agrees to the present report, but it is of least concern in Niger Delta, this means that the fish is not available because at a particular time, that is the dry season the fish goes into a burrow and it is difficult to catch them. Therefore this report does not completely agree with IUCN (2013) which categorically states that the fish is "common" in the lower Orashi River. The anatomical abundance and impressive seasonal distribution of the fish species in the Orashi River and River Sombreiro are most probably a result of seasonal floods with the attendant high nutrient debris which make the rivers ecologically conducive for the species to dwell in. Other authors have divergent views on the distribution of fish species within and among habitats. For instance, Percy and Myers (1974) attributed the distribution of fish to be related to early history requirement; Werner *et al.*, (1983a) to predator avoidance and Werner *et al.*, (1983b), to foraging efficiency. On the other hand, Griffith (1981) stated that the distribution of fish species within an aquatic system may be better understood if the system is subdivided into strata such as pools in lotic systems or littoral and pelagic zones in lentic water systems and streams. From the data in Table 1, the fish had the highest relative abundance % value between April and July but can be landed all year round. However, recently, many researchers have faulted the observation that the fish species within the Niger Delta region can be landed all year round. For instance, Davies (2009) and Abowei *et al.*, (2010) noted that the abundance of fish resources had declined in the Niger Delta, Nigeria. The studies explained that oil exploration, commercial and industrial activities are responsible for the fish decline in the region. In the same vein, Otobo (1977) commenting on the general decline and depletion of fish population in the Niger Delta, pointed out that *Nypa* palms (*Nypa fruticans*) which abound all over the region do not provide a good ground for marine fish as mangrove plants do, and that the industrial and effluent discharge within the region had negatively affected the mangrove plants and consequently, the fish fauna.

In the case of *P. annectens*, the preliminary investigation carried out through oral and structured

interview of the local fishers within the Mbiama axis of Orashi River, and the Omoku axis of River Sombreiro indicated that yield had greatly decreased and that it required more effort and more hours to catch the fish. This scenario agrees with IUCN (2013) that the fish is of "least concern" in the Niger Delta. The local fishers attributed the low catches to over-fishing, destruction of the breeding/spawning grounds by sand dredgers, and industrial and commercial activities within and across the river banks. However, the fishers confirmed that the fish can be landed all year round, but were most abundant during the rainy season. They also confirmed that in the dry season the fish go into aestivation, during which time it is more difficult to excavate the soil to catch the fish. This is also the view of Francis (2003); Ezenwa *et al.*, (1987); Tobor (1990), and King (1996) who reported that most commercial and scientifically important fish species like *Tilapia*, *Chrysichthys*, and *Mugil* can be landed all year round in the brackish waters of Niger Delta but there are months when they are more abundant. The presence of *P. annectens* in the lower Orashi River and River Sombreiro, Nigeria (IUCN, 2013) suggests that the water bodies are maintaining Oligo-mesotrophic status, with the availability of food and nutrient conducive for the sustainability of the fish. It is known that the fish thrives in muddy areas which makes Orashi River and River Sombreiro with the collection of debris and nutrients from human and domestic discharge good for the fish to thrive. Against the hydrological and geological nature of the Niger Delta region with series of oil exploration and industrial dredging activities, efforts at sustaining the availability of the fish are recommended by protecting the environment and water bodies. In this regards Government and Fishery Professionals are advised to formulate, develop and aggressively enforce policies and laws to protect the Niger Delta Region against indiscriminate, illegal, and obnoxious activities.

## CONCLUSION

The relatively all-year availability of *P. annectens* and the result of the present research which shows the abundance distribution of the fish in Orashi River and Sombeiro River is a confirmation of the ecological adaptation of the fish to flood plain areas, as a strategy to have access to aquatic vegetation and seasonal deposits of nutrients to feed on. The fish is most abundant during the rainy season and with corresponding distribution within the rainy season. However, IUCN (2013) classified the fish as an important fish species on its Red List and underscores the need for urgent steps to be taken both by the government and fishery professionals not only to protect the environment; water bodies including the floodplains but also the fisheries especially those like *P. annectens* already

adjudged to be at the verge of extinction. To attest to the depletion of the fish resource, the indigenous inhabitants confirmed that the fish has greatly depleted due largely to overfishing as a result of human increasing population and quest for food hence abundance distribution is greatly affected. Defined protected areas as the nursery, breeding, and growth grounds could be mapped out to ensure enhanced reproduction, growth, abundance, and distribution of the fish within the region.

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**Table 1: Analysis of Monthly Catch per Unit Effort (MCPUE) of *P. annectens* from Orashi River And Sombreiro River (October 2013 – September 2014).**

Period	No. of Specimens	Relative Length (cm)	Relative Weight (g)	MCPUE kg/man/hr
Dry Season				
October- 2013	18	47.40	131	5.24
November- 2013	20	48.80	123	4.92
December- 2013	22	49.40	122	4.98
January- 2014	14	45.20	107	4.30
February- 2014	11	47.50	173	6.92
March - 2014	32	45.50	131	5.24
Rainy Season				
April- 2014	38	44.20	134	5.36
May- 2014	41	47.10	166	6.64
June- 2014	49	43.30	137	5.48
July- 2014	39	44.80	153	6.12
August 2014	31	42.70	135	5.40
September - 2014	32	43.50	177	7.10

**Table 2: % of Monthly Occurrence of *P. annectens* from Orashi River and River Sombreiro (October 2013- September 2014).**

Period	No. of Specimens	Relative Abundance %
Dry Season		
October- 2013	18	5.19
November- 2013	20	5.76
December- 2013	22	6.34
January- 2014	14	4.03
February- 2014	11	3.18
March - 2014	32	9.22
Rainy Season		
April- 2014	38	10.95
May- 2014	41	11.82
June- 2014	49	14.12
July- 2014	39	11.24
August- 2014	31	8.93
September - 2014	32	9.22
Total	347	100