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Length-weight Relationships and Fecundity Estimates in Mudskipper, *Periophthalmus papilio* (Bloch and Schneider 1801) Caught from the Mangrove Swamps of Lagos Lagoon, Nigeria

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ABSTRACT

Study was carried out on mudskipper, *Periophthalmus papilio* in Lagos lagoon, Nigeria to provide information on length-weight relationship and fecundity estimates. *Periophthalmus papilio* is of an amphibious fish and a member of the family periophthalmidae. A total of 2,167 individual of the specie were caught from the lagoon using non return valve traps. Biometric data such as Total Length (TL) and Body Weight (BW) measurements were recorded in the laboratory. The specimens ranged from 30.0 to 190.0 mmTL and weighed between 0.5 and 65.3 g BW. The mean TL measurements were 76.0566 ± 1.415 , 115.953 ± 0.999 and 111.361 ± 0.812 mm and weighing 5.908 ± 0.393 , 18.808 ± 0.507 and 16.769 ± 0.367 g for unsex, males and females, respectively. The length weight relationships were: $\text{Log } W = -4.1053 + 2.5522 \text{ Log } \text{TL}$ ($n = 185$, $r = 0.9385$) for unsex; $\text{Log } W = -4.6804 + 2.8606 \text{ Log } \text{TL}$ ($n = 532$, $r = 0.9684$) for males and $\text{Log } W = -4.7916 + 2.915 \text{ Log } \text{TL}$ ($n = 746$, $r = 0.9784$) for females. The growth exponential b values were allometry in this species. The fecundity estimates of the species varied between 508 and 15,700 ripe eggs for fish with size from 91-180 mmTL and 9.1-65.3 gBW. The mean fecundity estimate was $3,482 \pm 102$ eggs for average fish of 116 mmTL. Positive correlation was exhibited by the fish between its fecundity and body weight ($r = 0.4041$) and total length ($r = 0.3810$). The Gonadosomatic Index (GSI) values of the fish varied between 0.01 and 0.48% in males and 0.11-8.40% in females. Higher GSI values indicate a better well being for the fish.

Key words: Length, weight, fecundity, correlation, mudskipper

INTRODUCTION

Mudskipper, *Periophthalmus papilio* is a member of the family Periophthalmidae. It is the only species of the family in the Gulf of Guinea, which include estuaries and lagoons of the West African coast (FAO, 1990). Related species include *Periophthalmus chrysopilos* and *Boleophthalmus boddarti*. *Periophthalmus dipus* and *P. woberi* are fresh water mudskippers. *Periophthalmus papilio* (*P. barbarous*) is a curious fish which has never been reported in both sea and fresh water of rivers and lakes. A new species, *P. takita* was discovered in Australia (Jaafar and Larson, 2008). The kinematics responses of escape of mudskipper, *P. argentilineatus* in both aquatic and terrestrial environments were reported by Swanson and Alice (2004).

Length-Weight Relationship (LWR) as a growth concepts is of attraction to numerous fisheries biologists such as Campana (2001), Ecoutin and Albaret (2003), Ozaydin and Taskavak (2007) and Ozcan and Balik (2009). In Eastern part of Nigeria, studies on LWR were conducted on *P. barbarous* in Imo River estuary by King and Udo (1996), aspects of population dynamics were

investigated by Etim *et al.* (1996) in cross River. Etim *et al.* (2002) also gave reports on the breeding, growth, mortality and yield of *P. barbarous* in Imo River. In Singapore, two congeners, *Periophthalmus walailakae* and *Periophthalmodon schlosseri* were differentiated by their taxonomical and morphological features such as size, body colour and external morphology by Jaafar *et al.* (2006).

Fecundity is the number of ripe eggs produced by a female fish prior to spawning. Total number of eggs laid during the spawning season can be used in estimating fish population. Fecundity may increase with increased body size or differ with species in a population and or between populations of the same species or from year to year or season to season in a population. *Periophthalmus papilio* forms parts of the fisheries in Lagos lagoon and its environs. It is used as bait by artisanal fishermen within Nigerian creeks estuarine and lagoon system. It also contributes to the delicacy of Nigerian people, especially the Ijaw and Ilaje tribesmen and women in Southern Nigeria especially the Niger Delta region and among the Taiwanese and Japanese, selling for as high as US\$20/kg (Khaironizam and Norma-Rashid, 2002). The relevance of this species should be emphasized especially along the West African creeks, mangrove swamps and lagoon systems where its presence in large number was reported by Etim *et al.* (1996), King and Udo (1996), Udo (2002a). On account of this, the author decided to carry out a study on the aspects of its biology with particular emphasis on its length, weight and fecundity. Data obtained from this study can be used as baseline data for carrying out its further study in Nigeria and other parts of the world.

MATERIALS AND METHODS

Collection of specimens: In May 2006 to May 2008, a total of 2,167 individual fish specimens of mudskipper, *P. papilio* were caught from mudflats of the mangrove swamps of Lagos lagoon with non-return valve traps. Services of local fishermen with motorized canoes were employed in setting up traps. Collection of specimens was carried out daily.

Laboratory procedures and data collection: Specimens were tagged after biometric data on sex; total length (TL) and body weight (W) measurements were recorded. TL was in nearest 1 mm and W in near 0.01 g. The relationships between (TL) and (W) were done linearly by logarithms transformation:

$$\text{Log}W = \text{Log}a + b \text{Log}TL$$

where, a and b are constant.

The bellies of the specimens were opened to ascertain sex and stages of their maturity. Specimens classified as unsex were those whose their sex as male or female cannot be ascertained. The maturity stages were determined by naked eye and microscopic examinations of the gonads. Female gonads classified as ripe were used to estimate fecundity. They were preserved in Gilson's fluid for 7 days after which the eggs were washed severally with clean water so as to free them from ovarian tissues.

Fecundity was estimated by volumetric method following that of Bagenal (1973). The estimates were employed to express the relationships between fecundity and total length and body weight of the specimens. The relationships were expressed as:

$$F = a+bX$$

where, F is fecundity estimate, a is regression constant; b is regression coefficient and X is total length (mm) or body weight of fish (g).

RESULTS

Length-weight relationship in *P. papilio*: Specimens were grouped as unsex, males and females.

Unsex: The unsex specimens varied between 32 and 158 mm (mean = 76.566 ± 1.415 mm) TL and W of 0.5-38.1 g (mean = 5.908 ± 0.393 g). The logarithms transformation of the length-weight relationship for the group is presented in Fig. 1 and expressed as:

$$\text{Log W} = -4.1053 + 2.5522 \text{ Log TL} \quad (n = 185, r = 0.9385)$$

Males: The TL measurements of the male ranged from 69 to 180 mm (mean = 115.953 ± 0.999 mm) TL and 3.70-120.70 g (mean = 18.808 ± 0.507 g)W. The length-weight relationship for the group as given in Fig. 2 and expressed as:

$$\text{Log W} = -4.6804 + 2.8606 \text{ Log TL} \quad (n = 532, r = 0.9684)$$

Females: Female specimens varied between 60 and 190 mm and mean value of 111.361 ± 0.812 mm TL. BW measurements were between 2.2 and 65.7 g and mean value of 16.769 ± 0.367 g. The relationship between the TL and W measurements is presented in Fig. 3 and expressed as:

$$\text{Log W} = -4.7916 + 2.915 \text{ Log TL} \quad (n = 746, r = 0.9784)$$

The growth relationship was positively allometry. High correlation values of $b = 2.5522$, 2.8606 and 2.915 obtained respectively for unsex; males and females were allometry accounting for its robustness. The regression coefficient values of $r = 0.9385$, 0.9684 and 0.9784 were observed respectively. Increase in total length of the species gave a corresponding increase in body weight. The b and r values were higher in females than males or unsex. However, their variances were not significantly different ($p < 0.005$) in Lagos lagoon, Nigeria.

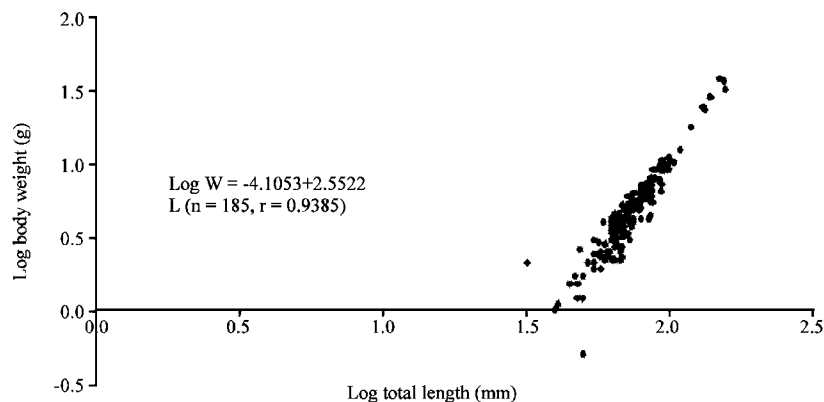


Fig. 1: Length-weight relationship in unsex specimens of *P. papilio* from Lagos, Lagoon

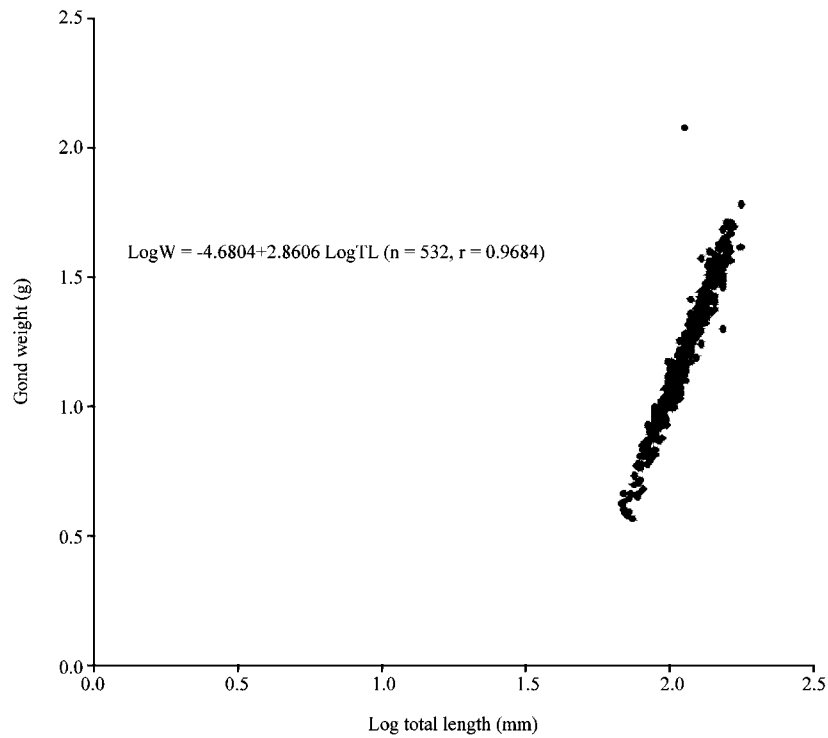


Fig. 2: Length-weight relationship in male specimens of *P. papilio* from Lagos, Lagoon

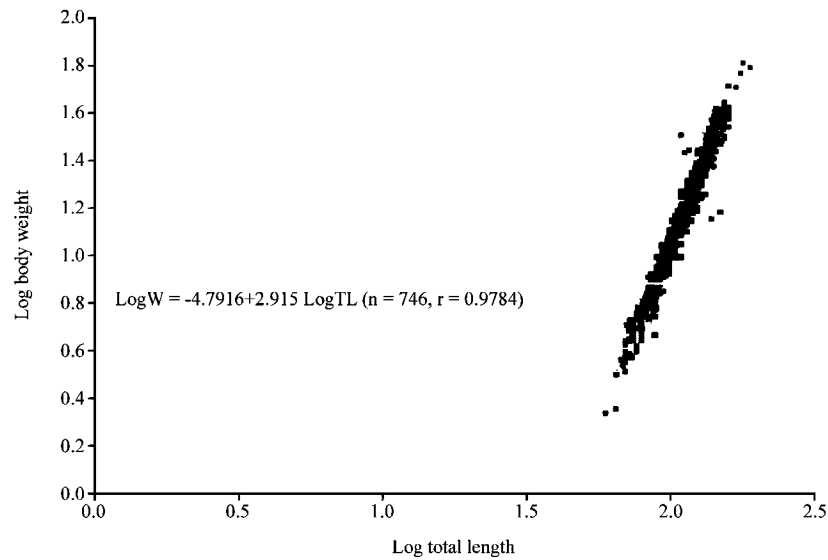


Fig. 3: Log length-log weight relationship of female *P. papilio* in Lagos, Lagoon, Nigeria

Fecundity estimates of *P. papilio*: The 311 female specimens were at their ripe stage and were examined for the fecundity (F). F varied from 508 eggs for fish of 91 mmTL (9.1 g W) to 15,700 eggs for fish of 180 mmTL (weighing 65.3 g). The mean fecundity estimate was 3,482 eggs for average fish of 116 mmTL. Figure 4 and 5 are graphical representations of the relationships between F and W and TL.

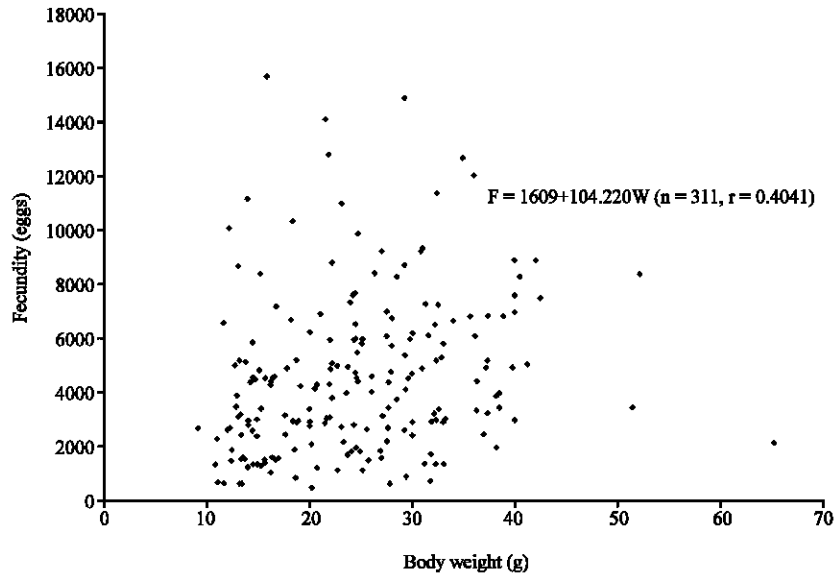


Fig. 4: Fecundity-body weight relationship of *P. papilio* in Lagos, Lagoon, Nigeria

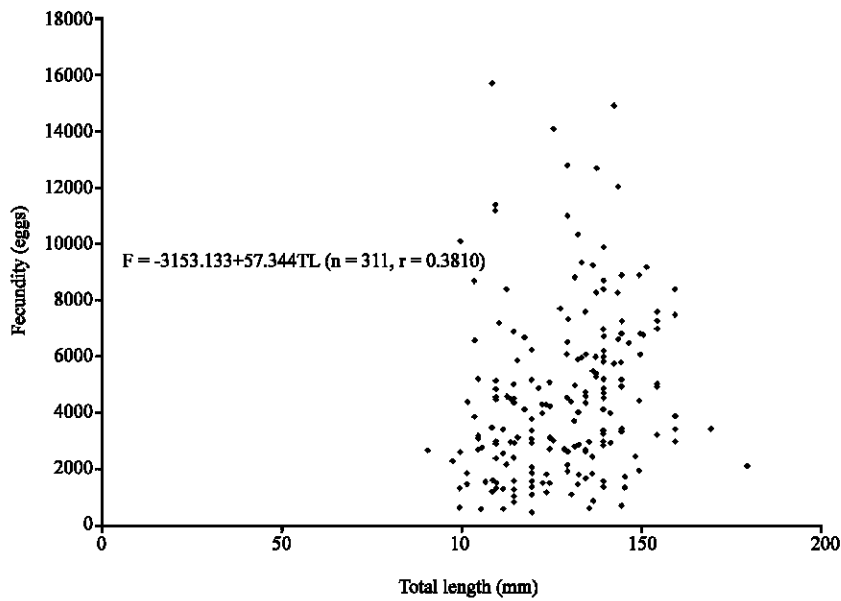


Fig. 5: Fecundity-total length relationship of *P. papilio* in Lagos, Lagoon, Nigeria

- $F = 1609.950 + 104.220W$ ($n = 311, r = 0.4041$) presented in Fig. 4
- $F = -3153.133 + 57.344TL$ ($n = 311, r = 0.3810$) given in Fig. 5

A positive correlation existed between fecundity and the body weight ($r = 0.4041$) and total length ($r = 0.3810$) of the fish.

Gonadosomatic index *P. papilio*: The GSI values ranged between 0.01 and 0.48% for the males, with mean value of $0.104 \pm 0.004\%$. However, the females ranged from 0.11 to 8.40% (mean = $2.69 \pm 0.003\%$). The gonad weight-total length relationships are expressed as:

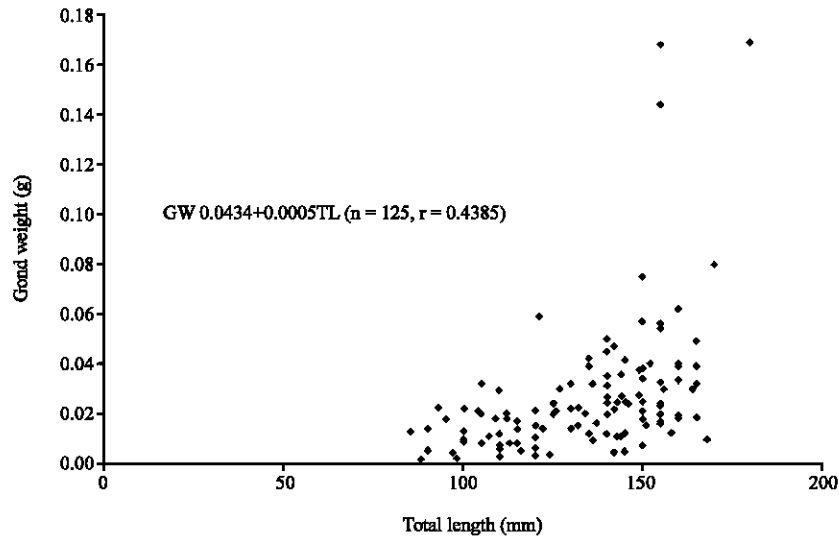


Fig. 6: Gond weight-total length relationship of male *P. papilio* in Lagos, Lagoon, Nigeria

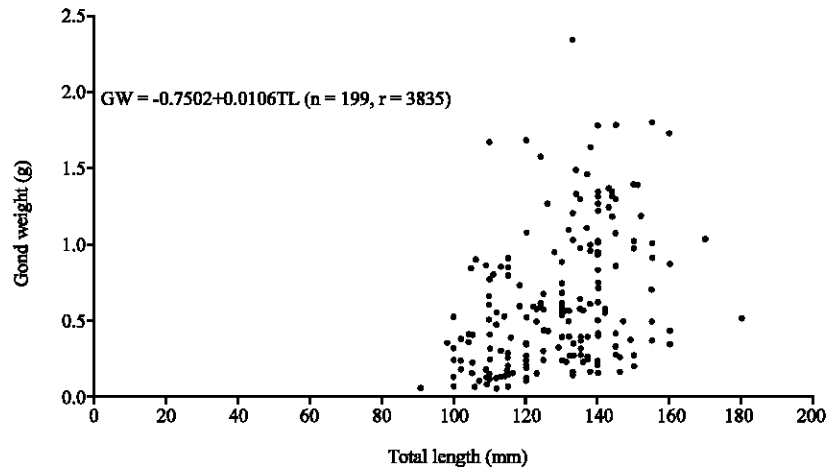


Fig. 7: Gond weight-total length relationship in female *P. papilio* in Lagos, Lagoon, Nigeria

- $GW = -0.0434 + 0.0005TL$ ($n = 126$, $r = 0.4385$) for males (Fig. 6)
- $GW = -0.7502 + 0.0106TL$ ($n = 199$, $r = 0.3835$) for females (Fig. 7)

The regression coefficient, r differed with sex, the higher value was obtained for males. However, the higher the total length measurements of the fish the higher the gonad weights.

DISCUSSION

In Lagos lagoon, Nigeria mudskipper, *Periophthalmus papilio* were grouped into unsex, males and females with size ranging from 30.0-190 mmTL and weighing between 0.5 and 65.3 g BW. There was size variation across the three groups viz: unsex, 32-158 mm; males, 69-180 mm and females, 60-190 mmTL. Females attained higher growth and maturity at 69 mmTL and males at 60 mmTL. In this study, males were significantly heavier in weight but shorter in body length than

the females. This was greatly supported by Udo (2002a) work on this species in Imo River estuary, but contradicted 102 mm and 105 mmTL size at maturity he reported for females and males, respectively. Near isometric growth ($b = 3$) was recorded in this study. b values were 2.5522 for unsex, 2.8606 for males and 2.915 for females. The size of the fish was not too much for its body weight. This might account for its robustness in Lagos lagoon. Udo (2002a, b) reported isometric ($b = 3$) length-weight relationship for both sexes of this species. However, Abdoli *et al.* (2009) estimated b values between 2.10 and 2.86 for both sexes for three species of mudskipper in their study in the coastal areas of the Persia Gulf in Iran. Khaironizam and Norma-Rashid (2002) reported values between 2.56 and 3.50 in the coastal areas of Selangor, Malaysia. A positive correlation values of $r = 0.9385$ (unsex), 0.9684 (males) and 0.9784 (females) showed there was a strong correlation between the total length and body weight measurements of the fish, meaning the fish increase in body weight as it grows in total length. Similar trends were observed in the specie by Khaironizam and Norma-Rashid (2002) and in Calabar, Nigeria by Etim *et al.* (1996). This may be more genetical than being ecological. Strong correlation between fish body size and otolith weight of a related species *Periophthalmodon schlosseri* was reported by Sarimin *et al.* (2009) in Malaysia.

The fecundity of 508-15, 700 eggs (mean = 3, 482±102 eggs) was estimated for the fish with size of 91-180 mmTL and 9.1-65.3 g W, meaning the fish was moderately fecund. Higher fecundity was reported in some non related species in this lagoon. The fecundity of the species increased with fish length and body weight. Higher fecundity between 900 and 23, 933 eggs per spawn was reported in *P. barbarous* (*P. papilio*) by Udo (2002a) from subsistence catches in the mangrove swamps of Imo estuary in Nigeria. These variations although, not significant may be ecological according to this study. Lagos lagoon and Imo River estuary are located in western and eastern parts of Nigeria, respectively. Other contributory factors suggested in this works include food ration, season, environmental conditions, disease and parasite load.

Higher percentages of GSI values were recorded for female. It varied between 0.01 and 0.48 in males and from 0.11 to 8.40% in females. A higher GSI value means a better well being for the fish. In Lagos lagoon a higher percentage of body weight was committed to gonadal development by the females. The GSI had been used to describe the development of gonads in Pike, *Esox lucius* by Danilenko (1983).

In this study, I provide information on the biological data base of *P. papilio* (an economically valued fish in Lagos and its environs). The investigations on its length-weight relationships and fecundity estimates will help in its management and conservation in Lagos lagoon.

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REFERENCES

- Abdoli, L., E. Kamrani, A. Abdoli and B. Kiabi, 2009. Length weight relationships for three species of mudskippers (Gobiidae: Oxudercinae) in the coastal areas of the Persian Gulf, Iran. *J. Applied Ichthyol.*, 52: 236-237.
- Bagenal, T.B., 1973. Fish fecundity and its relations with stock and recruitment. *Rap. P-V. Reun. Cons Int. Explor Mer.*, 164: 186-198.

- Campana, S.E., 2001. Accuracy, precision and quality control in age determination including a review of the use and abuse of age validation methods. *J. Fish Biol.*, 59: 197-242.
- Danilenko, T.P., 1983. The reproductive cycle of the Pike, *Esox lucius* L. in the Kanev Reservoir. *Hydrobiology*, 18: 21-27.
- Ecoutin, J.M. and J.J. Albaret, 2003. Length-weight relationship of 52 fish species from West African estuaries and lagoons. *Cybiurn*, 27: 3-9.
- Etim, L., R.P. King and M.T. Udo, 2002. Breeding, growth, mortality and yield of the mudskipper *Periophthalmus barbarus* (Linnaeus 1766) (Teleostei: Gobiidae) in the Imo River estuary, Nigeria. *Fish. Res.*, 56: 227-238.
- Etim, L., T. Brey and W. Arntz, 1996. A seminal study of the dynamics of a mudskipper (*Periophthalmus papilio*) population in the Cross River, Nigeria. *J. Aquat. Ecol.*, 30: 41-48.
- FAO, 1990. Field Guide to Commercial Marine Resources of the Gulf of Guinea. Food and Agriculture Organization, Rome, Italy, pp: 265.
- Jaafar, Z., K.K.P. Lim and L.M. Chou, 2006. Taxonomical and morphological notes on two species of mudskippers, *Periophthalmus walailakae* and *Periophthalmodon schlosseri* (Teleostei: Gobiidae) from Singapore. *Zool. Sci.*, 23: 1043-1047.
- Jaafar, Z. and H.K. Larson, 2008. A new species of mudskipper, *Periophthalmus takita* (Teleostei: Gobiidae: Oxudercinae), from Australia, with a key to the genus. *Zool. Sci.*, 25: 946-952.
- Khaironizam, M.Z. and Y. Norma-Rashid, 2002. Length-weight relationship of mudskippers (Gobiidae: Oxudercinae) in the coastal areas of Selangor, Malaysia. *NAGA-World Fish Centre Q.*, 25: 20-22.
- King, R.P. and M.T. Udo, 1996. Length weight relationships of the mudskipper, *P. barbarous* in Imo River estuary, Nigeria. *NAGA. Iclarm Q.*, 19: 27-27.
- Ozaydin, O. and E. Taskavah, 2007. Length-weight relationships for 47 fish species from Izmir Bay (Eastern Aegean Sea, Turkey). *Acta Adriatica*, 47: 211-216.
- Ozcan, G. and S. Balik, 2009. Age and growth of Bassan Barbel, *Barbus pectoralis* (Actinopterygii: Cypriniformes: Cyprinidae), under conditions of a dam reservoir. *Acta Ichthyologica Et Piscatoria*, 39: 27-32.
- Sarimin, A.S., M.A. Ghaffar and C.A.R. Mohamed, 2009. Variation of Ca, Sr, Ba and mg in the Otolith of mudskipper in west coast of peninsular Malaysia. *Pak. J. Biol. Sci.*, 12: 231-238.
- Swanson, B.O. and C.G. Alice, 2004. Kinematics of aquatic and terrestrial escape responses in mudskippers. *J. Exp. Biol.*, 207: 4037-4044.
- Udo, M.T., 2002a. Intersexual plasticity in aspects of the biology of the mudskipper *Periophthalmus barbarus* (Gobiidae) in the mangrove swamps of IMO Estuary, Nigeria. *J. Environ. Sci.*, 14: 95-101.
- Udo, M.T., 2002b. Morphometric relationships and reproductive maturation of the mudskipper, *Periophthalmus barbarous* from subsistence catches in the mangrove swamps of IMO estuary, Nigeria. *J. Environ. Sci.*, 14: 221-226.