The Mouth and Gastro-Intestinal Tract of *Pomadasys Jubelini* (Cuvier, 1830) In the New Calabar-Bonny River, Rivers State, Nigeria

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ABSTRACT: The terminal mouth possessed by *P. jubelini* which opens up to 20% of its total body length allows the fish to seize its prey easily. The presence of the multiserial bands of setiform teeth enables the fish to grip its prey firmly in the mouth for suffocation before swallowing. More so, the pharyngeal teeth on the upper and lower surfaces of the mouth are modified in to smooth pebble-like stones that are adapted for crushing soft bones, hard shells and crustaceans before swallowing. The intestine of *P. jubelini* is short (about 50%) of its body length and not coiled. The pyloric caeca were observed in all the species sampled and were between 6 and 7 outgrowths.
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Key words: Terminal mouth, gastro-intestinal tract, *Pomadasys jubelini*

Introduction:

The varieties of dietary items found in the aquatic ecosystem are to a large extent is responsible for the variations in morphological modifications to acquire and utilize the different food item by various species. The functional morphology of the mouth and gastro-intestinal tract of different fish species, revealed to a large extent the type of food and mode of feeding habits of the fish species. The diversity in feeding habits that the fish exhibit is particularly the result of evolution leading to structural adaptation for getting food from the diverse situations that constantly evolve in the environment (Dasgupta, 2000). Adaptation to the mode of feeding could be found in the mouth and jaws, teeth, the shape and size of gill rackers, stomach and intestine (alimentary canal). The intestinal tract of fishes shows a remarkable diversity of morphology and functional characteristics. This is often related to their different feeding habits and to taxonomy as well as body shape, weight, size and sex (Diaz *et al*., 2008 and Banan-Khojasteh *et al*., 2009). Specialised feeding structures are often peculiar feeding habits of some fishes for different dietary items.

The gastro-intestinal of fish have been studied from a few species (Teleost fishes). The knowledge of fish digestive tract is important because of the importance of digestive physiology and improvement and nutrition protocols. Identification of digestive tract structure is also essential for understanding the histo-pathological mechanisms and nutritional functions. This knowledge may help identify differences in microscopic anatomy of intestinal tract among various species. The study of the variation of the structure of the digestive system of fish species is of useful for the nutritional development researches, preparation of diets and handling of the feeding. The interest to approach the histology of these structures resides in the application of the knowledge about the pathology of fishes, as contribution to the development of the fish farming and a rational use of the natural resources (Hernadez *et al*., 2009). *Pomadasys jubelini*, as an important source of fish supply for man has successfully adapted themselves to the estuarine and marine environment which is reflected in their mode of feeding (non piscivorous carnivore). The alimentary canal is also modified for maximum utilization of the food taken (Banan-Khojasteh, 2012).

This study is aimed at investigation the gastrointestinal tract of *Pomadasys jubelini* and the knowledge obtained will be helpful in understanding the biology of the fish (structure and morphology), its functional mechanisms and in formulating suitable feeds.

Materials and methods:

In this study, 10 samples of *Pomadasys jubelini* were collected from three different locations in the New Calabar-Bonny River, Rivers state Nigeria. Immediately after collection the samples were rinsed with water and wiped dry. The total length and weight of each sample were determined using a measuring tape and an electronic scale respectively. The gastro-intestinal tract was removed and tissue samples of oesophagus, stomach and intestines were immediately fixed in 10% formaldehyde. Then the samples were dehydrated through a standard ethanol series to 100%, cleared in xylene and embedded in paraffin wax.5 – 6 µm serial sections were deparaffinized and stained with routine light microscopic study. The sections were examined under the Nikon light microscope and photographs taken with a Nikon photo micrographic attachment. Pictures of the mouth, jaws and pharyngeal

teeth were taken with a Samsung digital still camera, Model No. DSC-W610.

Results:

The structure of the gastro-intestinal of *P. jubelini* fits the description given below. (Fig 1-10)*Pomadasys jubelini* possesses a terminal mouth which is wide and protractile with large cover of scales. The lips are thick and the snout is pointed and elongated (Plate 1). The mouth opens as wide as 20% of its total length (Plate 2). The mouth also has a tongue which arises as a fold from the floor of the Buccal cavity. No teeth are present on the tongue. The presence of multiserial bands of setiform teeth is found on the lower and upper jaws. The teeth of the upper jaw are premaxillary (teeth present in the front margin of the upper jaw) (Figure 5a) while the lower jaw has teeth arranged in a mandibular position (teeth present on the margin of the lower jaw) (Figure 5b). Teeth are present on the pharyngeal bones at the back of the mouth (in the throat) on the ventral and dorsal surfaces. The ventral surface is made up of a pair of pharyngeal teeth. These teeth are in the form of smooth pebbles. The gill bears long, very strong and few gill rakers (13 – 18). The gill arch is very thick and fleshy. Numerous gill filaments are present on the gill of the fish.

Plate 1. The mouth of *Pomadasys jubelini*

Plate 2. The mouth of *Pomadasys jubelini*

Plate 3: The upper jaw of *P. jubelini* exhibiting mandibular teeth

Plate 4: The lower jaw of *P. jubelini* exhibiting mandibular teeth.

Plate 5a: The pharyngeal teeth of *P. jubelini* as situated in the throat.

Plate 5b: The lower pharyngeal teeth are triangular shaped

Plate 6: The upper pharyngeal teeth of *P. jubelini* are oval in shape.

Plate 7: The gill of *Pomadasys jubelini*

The Gastrointestinal Tract (GIT) of *Pomadasys jubelini*

The GIT of *P. jubelini* is made up of a large, long and distensible oesophagus which leads directly into the stomach. The stomach is large, thick–walled, flask-like and elongated with the anterior part lager then the posterior. The pyloric caeca is the anterior part of the intestine which gives rise to a number of finger-like, tubular outgrowths (6-7). The intestine is divided into two parts: the small intestine (duodenum) and the large intestine. The small intestine is just behind the stomach which is short, about 50% of the total length of the fish and straight (not coiled). The rectum is not differentiated externally but is much slimmer then the intestine and ends in the anus of the fish.

Plate 8: The gastrointestinal tract of *Pomadasys jubelini*

Histology of the Gastro-intestinal tract of *Pomadasys jubelini:*

The oesophagus bears longitudinal fold which helps to permit greater distensibility. The mucosa comprises of stratified and columnar epithelium. A

large number of mucus secreting calls are also scattered in the mucosa.

In the stomach, the mucosal folds are thicker (than in the oesophagus) and dense with wavy outline

The duodenum is the small intestine. This segment of the whole intestine possess free striated border and the mucus secreting cells are fewer in number than the large intestine. This segment consists of many branched villi. The epithelium consists of tall and cylindrical columnar cells.

The large intestine is lined by simple columnar epithelium consisting of absorptive cells and mucus secreting cells.

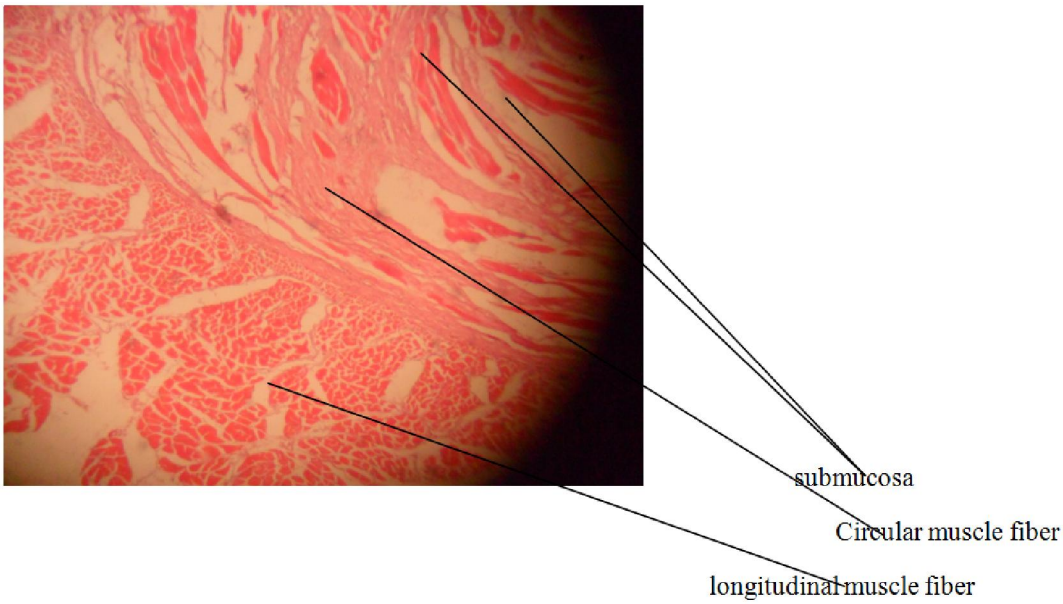

Plate 9; T. S. oesophagus of *Pomadasys jubelini*

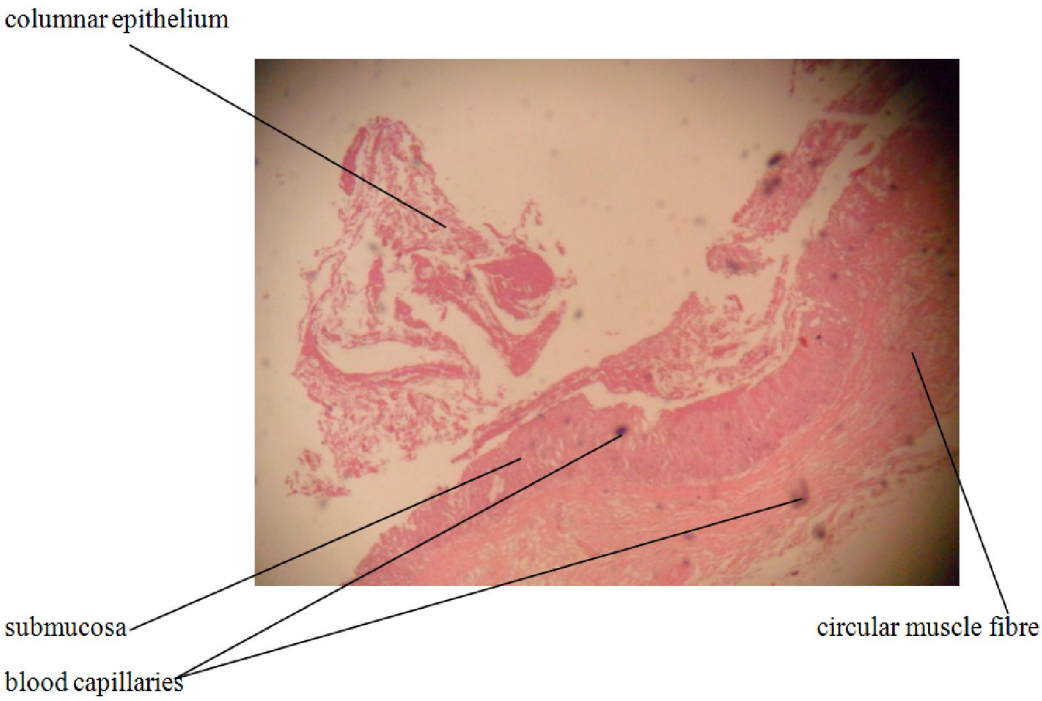

Plate 10. T.S. Stomach of *Pomadasys jubelini*

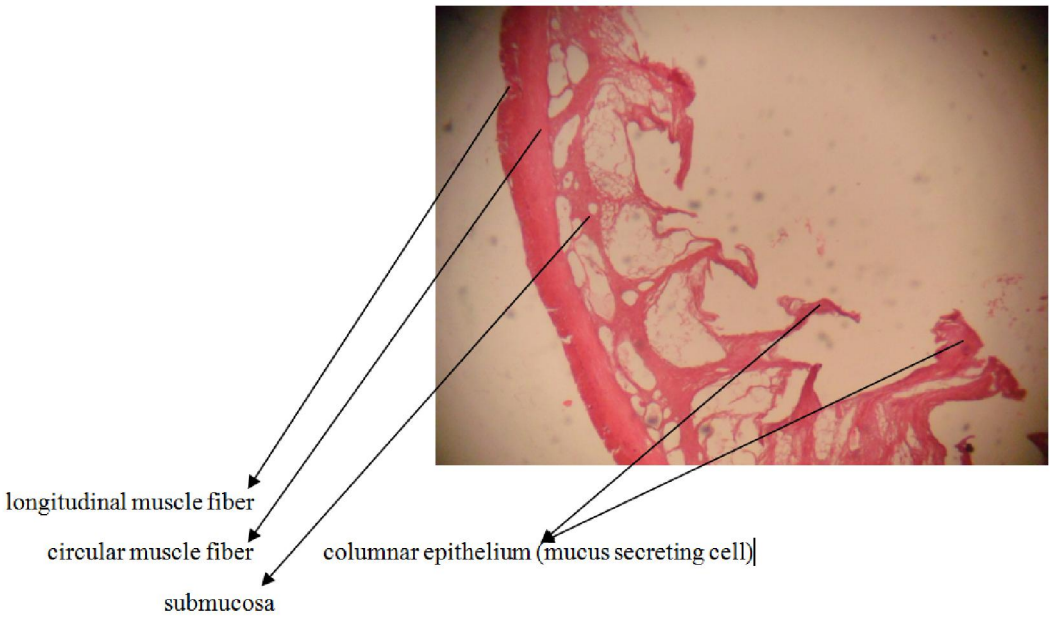

Plate 11. T.S. Duodenum of *Pomadasys jubelini*

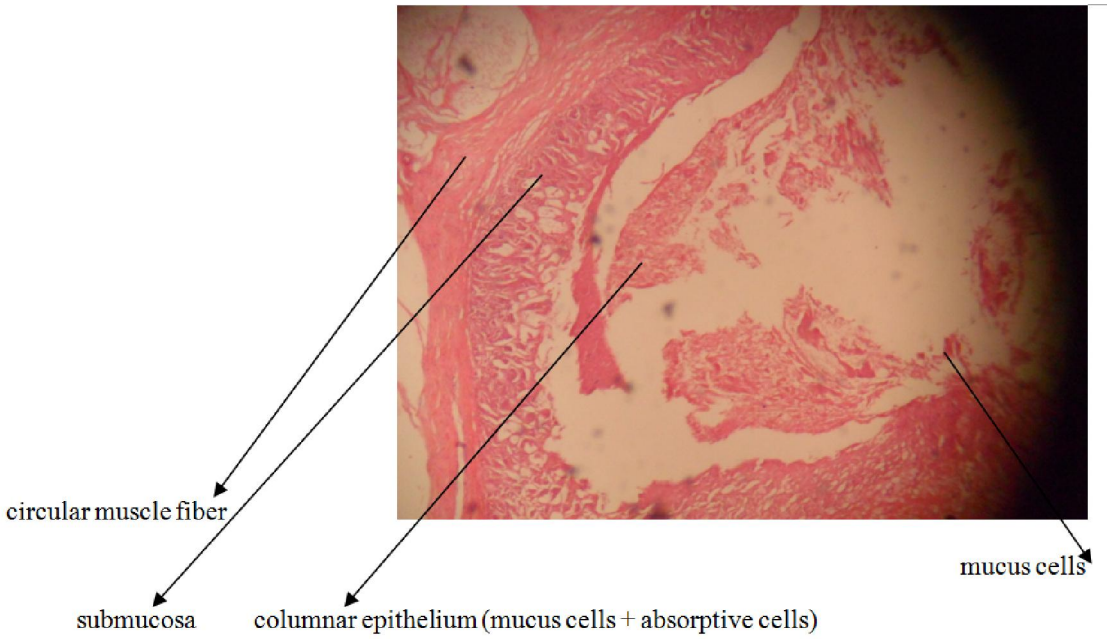

Plate 12. T.S. Intestine of *Pomadasys jubelini*

Discussion:

The terminal mouth possessed by *P. jubelini* which opens up to 20% of its total body length allows the fish to seize its prey easily. The presence of the multiserial bands of setiform teeth enables the fish to grip its prey firmly in the mouth for suffocation before swallowing. More so, the pharyngeal teeth on the upper and lower surfaces of the mouth are modified in to smooth pebble-like stones that are adapted for crushing soft bones, hard shells and crustaceans before swallowing. The Nile Tilapia is mainly herbivorous, feeding on planktons and other higher plants and detritus have specialized structures in the buccal cavity. The jaws and teeth are generally small, soft bicuspid and tricuspid which are lined in rows in the upper and lower jaws (Ugwumba and Ugwumba 2007). These rows of bicuspid and tricuspid teeth are basically for mechanically breaking down plant materials into

smaller particles. Balogun 2000 revealed that the teeth of *Lates Niloticus* The few, long, hard and teeth - like nature of the gill rackers helps to confirm that the fish is carnivorous as to fish species with numerous fine and ling gill rackers which are characteristic to herbivorous species. A highly modified gill racker is seen in *Hemisynodontis membranaceus* where they are not only numerous and fine but each carries lateral processes which over lap to form efficient sieving structure for planktons (Ugwumba and Ugwumba 2007). The gill rackers in piscivorous species are not particularly employed in feeding thus they are reduced in number and size.

The pharynx, oesophagus and stomach were not clearly marked off from each other except histologically as was shown on Figure (1-4). The long and distensible oesophagus possessed by this species is characteristic of carnivorous and predatory species. The flask-like stomach is swollen at the anterior part and reduced at the posterior part. This swollen anterior part (intestinal bulb) is meant for storage. Other fish species possessing this kind of stomach are the *Tor tor, Catla catla* and the *Labeo rohita* (Pandey and Shukla, 2005). Generally the thick walled and flask-like stomach aids in masticating its food components. In the teleost, the mechanical breakdown of food occurs in the stomach (Dasgupta, 2000 and Bana-Khojasteh, 2012). The intestine of *P. jubelini* is short (about 50%) of its body length and straight. Again, this is common to carnivorous species because meaty substances are more readily digested than vegetable ones. In herbivorous species like the *Channa orientalis* the intestine is about 200% of its body length and extensive coiling of the intestine takes place (Dasgupta, 2000). The primary function of the intestine is the completion of digestive processes stated at the stomach and the absorption of nutrients. The pyloric caeca observed in all the species sampled were between 6 and 7 outgrowths. The number and shape of this organ might be particular to only this species and could be one of its identification structures. Srivastava (1988) stated that intestinal caeca serve as accessory food reservoirs and the number varies from species to species. For example, only a single caecum is found in *Polypterus* while up to a hundred are found in mackerel. Eastman and Devries (1997) stated that the caeca contribute significantly to the total post gastric surface area in some species (Perciformes) and experiments indicate that they are capable of enzymatic digestion and nutrient uptake similar to the proximal intestine. According to Das and Moitra (1995) carnivorous and predatory fishes that feed on prey of large size also possess a large Buccal cavity, a long and distensible oesophagus and a more or less straight and short intestine. This can be understood from the variations in the food taken by different species. The carnivorous species have digestive enzymes that are modified to digest fleshy substances at faster rates so the nutrient can easily be absorbed by the fish.

Conclusion:

Knowledge of fish's alimentary canal and morphology is without doubt important which helps to reveal the digestive, physiology and improvement of nutrition protocols. This is essential for understanding the relative histopathological mechanisms, nutritional functions thus contributing to the development of fish faming and diet formulation.

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