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Comparison of Morphometrics and Meristic Characteristics of two Catfishes *Plotosus limbatus* and *Clarias brachysoma*

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ABSTRACT. *Catfish (Order: Siluriformes) are a very diverse group of bony fish. Eel catfish (Plotosus limbatus) is a demersal, native catfish distributed in the coastal region of Sri Lanka while the Walking Catfish (Clarias brachysoma) is a highly threatened endemic fresh water fish found distributed throughout the country. This study was conducted to compare the morphometric and meristic characteristics of P. limbatus with C. brachysoma so as to ascertain the evolutionary pattern of marine and freshwater catfishes.*

Body shape, colouration, total body length, standard length, head length, eye diameter and mouth gap were recorded as morphometric features. The number of gill rakers present on the first gill arch and number of fin rays and spines were recorded as meristic characteristics. Condition factor and Relative gut length were derived by using morphometric characteristics.

In both cat fishes, deviations from the available literature was not found on body shape and colouration. Condition Factor of C. brachysoma collected from the natural habitat was 0.0088 ± 0.0002. Stomach is comparatively large with presence of spiral valves and highly developed pyloric caeca. Relative gut length was 0.91 ± 0.03. Meristic characteristics of C. brachysoma from the present study is D 70-77 A 55-56 P I 8 V 6 C 10-12.

Condition Factor of the P. limbatus collected from the natural habitat was 0.0040 ± 0.0001. Digestive tract consists of a long alimentary canal. Stomach is not well developed. The relative gut length recorded was 4.91 ± 0.03. Meristic characteristics of present study was found to be D_1 I 5 D_2 procurrent 233 - 240 P I 9 V 13 C 9 - 11 in P. limbatus.

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INTRODUCTION

Catfishes are widely distributed throughout the world. They reach their greatest diversity in the continents spanning the equator, namely South America, Africa and Asia. The majority of the species live only in freshwater, although some have invaded brackish and sea water as well.

Clarias brachysoma is a freshwater, demersal fish species found throughout the wet zone low lands and the central hill region of the Mahaweli river basin of Sri Lanka (Pethiyagoda, 1991). They do not inhabit saline waters. It is an endemic catfish commonly known as Walking catfish or Teysmann's spotted catfish and considered as a popular food fish type throughout the country. The fish is listed as threatened under the IUCN, 1999 Red Data list (IUCN, 2000) and also specified as a restricted fish species for exportation under the Fisheries and Aquatic Resources Act No. 2 of 1996. The fish is classified under the order Siluriformes (catfishes), family Clariidae (air- breathing catfishes) and genus *Clarias* (Pethiyagoda, 1991).

Plotosus limbatus is a demersal catfish distributed in the Southern coast of India and Sri Lanka. It is an amphidromic catfish commonly known as Darkfin eel catfish, considered as a popular food fish type in the coastal region of the country (Talwar *et.al.*, 1991). As sited in Talwar (1991) the fish is classified under the order Siluriformes (catfishes), family Plotosidae (Eel catfishes, stinging catfishes) and genus *Plotosus*. Most of the time this fish is misidentified with similar species occurring in the area such as *Plotosus canius* and *Plotosus lineatus.*

According to available literature, *C. brachysoma* adults are olive green brown or yellow with small irregular dark spots as large as its eye and young are dark brown or copper red in colour (Deraniyagala, 1952). Body is laterally compressed, elongated (ribbon like shape) without scales. Head is depressed; snout rather broad and possesses very small eyes. Mouth is terminal; teeth in villiform bands on jaws; vomerine obtuse, in a crescent band. Barbels are in four pairs.

When considering the morphology of *P.limbatus*, the body is elongated, compressed, tapering to a point posteriorly and the head moderately large, its profile arched from tip of snout to dorsal fin. According to available literature as well, adults are black in colour with a greenish tint. Fins are often blackish brown, usually with a black border. Mouth is transverse and four pairs of barbels present, the nasal barbels extending to middle or posterior borders of eyes, maxillary barbels extending from opercular margin to pectoral spine origin. Anterior nostrils are located above the edge of the upper lip. They possess fairly large eyes, with a diameter of $1/5^{th}$ to $1/9^{th}$ of the head length. Teeth in upper jaw are pointed and in two rectangular patches of 2-4 rows each. Teeth in lower jaw are in two patches of approximately four rows each, the anterior teeth pointed, posterior molar like teeth on the palate in a rectangular patch, pointed or/and molar like. The number of gill rakers on anterior edge of first arch is 20 - 25 (FAO, 1983). Darkfin eel catfish inhabits estuaries and along the open coasts of Sri Lanka and do not enter fresh water habitats. Juveniles form dense aggregations. These fish mainly feed on crustaceans, molluscs and fishes. Dorsal and pelvic fins are venomous.

The objective of this study was to gather background knowledge on morphology and some biological characteristics of these catfishes in order to collect more information on evolutionary biology of catfishes and to find out the interrelationship between marine catfishes and freshwater catfishes in the evolution ladder.

MATERIALS AND METHODS

Fish samples of *P. limbatus* were collected using hook and line from the Chilaw lagoon. *C. brachysoma* were collected from a stream of the Mahaweli river basin near the Kotmale Dam in 2006. Since they are highly threatened endemic species, minimum numbers were collected from natural resources. The laboratory analysis was conducted at the Department of Animal Science, Faculty of Agriculture, University of Peradeniya.

Study of Morphometric and Meristic characteristics

Body shape, colouration, total body length, standard length, head length, eye diameter, and mouth gap were recorded as morphometric features. Length measurements were taken by using a centimetre scale and a vernier caliper. The number of gill rakers present on the first gill arch and number of fin rays and spines were recorded as meristic characteristics. Condition Factor was calculated immediately after capturing the fish from natural habitats. The standard length and live weight of five fish were measured using a centimetre scale and an electronic balance respectively.

$$\text{Condition Factor} = \text{Weight} / (\text{Length})^3$$

To calculate the Relative Gut Length, five adult fish were dissected and the gut lengths were recorded using a centimetre scale.

$$\text{Relative gut length} = \text{Total gut length} / \text{Standard length}$$

Number of fin rays and spines present on each fin was recorded as meristic features by visual counting.

RESULTS AND DISCUSSION

Morphometric characteristics

No deviation from the available literature was observed on body shape and the colouration of both fishes. *P. limbatus* was black in colour with a greenish tint and fins were blackish brown with a black border. Body shape was elongated, laterally compressed with a dorsal procurrent caudal fin (Figure 1). Condition Factor of the fish collected from the natural habitat was 0.0040 ± 0.0001. Digestive tract consisted of a long alimentary canal. Stomach was not well developed. The Relative Gut Length recorded was 4.91 ± 0.03. Gut content analysis indicated that it consumes mostly detritus. These results indicate that *P. limbatus* was a benthic omnivore (grazing fish).

Figure 1. *Plotosus limbatus*.

Figure 2. *Clarias brachysoma.*

When *C. brachysoma* is considered the Condition Factor of the fish collected from the natural habitat was 0.0088 ± 0.0002. The stomach was comparatively large with presence of spiral valves and highly developed pyloric caeca. Relative Gut Length was 0.91 ± 0.03. According to these results *C. brachysoma* is mainly a carnivorous fish. The presence of similar morphological features and the bottom dwelling habit common to both provides for common ancestry.

Meristic characteristics

Gill rakers on the 1st gill arch of *P. limbatus* were 22 – 23 and were short and stumpy with much grown gill filaments (Table 1). Teeth in upper jaw were pointed in two rectangular patches of three rows each and in lower jaw in two patches of approximately four rows each, the anterior teeth pointed, posterior molar like teeth on palate in a rectangular patch and pointed.

Table 1. Various fin ray formulae of *Plotosus limbatus* as reported by different studies.

Reference	Fin ray formulae
FAO species identification sheet (1983)	D_1 I 4-6 D_2 106- 133 procurrent 210-243 A 87-126 P I 13-16 V I 11-15 C 9-11
Talwar and Arun (1991)	D_1 I 4-6 D_2 106 -133 procurrent A 87-126 P I 12-15 V I 12- 26 C 9-11
Present study	D_1 I 5 D_2 223-240 procurrent P I 9 V I 13 C 9-11

Like many fish, *P. limbatus* is a typical suction feeder while in water. It sucks in a mouthful of water and prey. But on land it uses a completely different method. The creature lifts the front part of its body and bends its head down toward the ground (National Geographic.com.2007)

Table 1. Various fin ray formulae of *Clarias brachysoma* as reported by different studies.

Reference	Fin ray formulae
Deraniyagala (1952)	D 70 A 53-60 P I 8 V 6 C 21
Munro (2000)	D 70 A 53-60 P I 8
Talwar and Arun (1991)	D 70-77 A 53-63 P I 9-10 V I 5
Present Study	D 70-77 A 55-56 P I 8 V 6 C 10-12

Mouth of *C. brachysoma* is terminal, teeth in villiform bands on jaws, vomerine teeth obtuse, in a crescentic band. Gill rakers on the 1st gill arch were 18 and were short and stumpy with much grown gill filaments (Table 2). There is an accessory respiratory organ in the form of an arborescent organ at the hind part of their gill cavity. These apparatus arise from 2nd and 4th gill arches, and is responsible for the ability of these fishes to live in oxygen poor waters but also out of water much longer than other catfishes. They sometimes travel out of water over land by wriggling their body to propel themselves forward, using their strong pectoral spines to push on and breathing via their skin and arborescent organs.

These results indicate that there can be some inter-relationship between *Plotosus limbatus* and *C. brachysoma* in the evolutionary pathway. The ability of *P. limbatus* to prey on small terrestrial animals and the development of air breathing apparatus in *C. brachysoma* with walking ability are the main evidences. Though these observations indicate similarities between *P. limbatus* and *C. brachysoma*, further studies should be performed by identifying the other similar fish present (or fish fossils), which may show interrelationships among them.

CONCLUSION

Plotosus limbatus and *C. brachysoma* are demersal catfishes with similar morphological features though they live in two different habitats. There is no deviation

observed from the available literature on body shape and the colouration in both fish. Condition Factor of *Plotosus limbatus* collected from the natural habitat was 0.0040 ± 0.0001. Gill rakers on the 1st gill arch of *P. limbatus* were 22 - 23. The long alimentary cannel, less developed stomach, and the specific teeth pattern showed that *P. limbatus* is a benthic omnivore

Condition Factor of *C. brachysoma* collected from natural habitat was 0.0088 ± 0.0002. Comparatively large stomach presence of spiral valves and highly developed pyloric caeca and relative Gut Length was 0.91 ± 0.03. These results conclude that *C. brachysoma* is a carnivore.

Males and females of both catfishes showed similar morphological characteristics. Therefore either catfishes cannot be sexed by using external characteristics except by observing the genital apparatus. Detailed study of other catfishes (and fossils) is essential to prove the common ancestry of these species, since present study indicates similarities between *P. limbatus* which dwells in saline habitat and *C. brachysoma* which is confined to fresh water habitats.

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