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MERISTIC AND MORPHOMETERIC STUDY OF *SPERATA SARWARI* FROM MANGLA LAKE, PAKISTAN

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Abstract: Fifty freshwater fish, *Sperata sarwari* (singhari) 60.8±12.45cm as mean total length and 2445±612g mean wet body weight were collected from Mangla lake, during Nov., 2005, with the help of local fishermen. Meristic count (seven characters) and morphometric characters (thirty-two) from each specimen were studies. Meristic counts are independent of body size and there is no change in meristic counts with increase in body length. While nasal barbel length and maxillary barbel not progressively increases with the increase in total length of fish. Whereas the interspace (between adipose and dorsal fin base) increases in length as compared to adipose fin base and dorsal fin base with the increase in length. The supraoccipital spine length is smaller than the length of interneural shield. It is the only *Sperata* species in which the length of the supraoccipital spine is less than that of the interneural shield. This study will help to recognize the morphometric of different variants in relation to identification.

Key words: Singhari, carnivorous fish, Indus drainage system

INTRODUCTION

Singhari, *Sperata (S) sarwari* is an Indus catfish (family Bagridae) present in Pakistan and Indus drainage system in India. It is a carnivorous fish, feeds mainly on animal food (Nawaz *et al*., 1994). Ahmad (1943) pointed out that there was only one species of the singhari *(Mystus aor)* in the fish market of Lahore. However, subsequent authors have been recording two species *viz.*, *Aorichthys aor* (Hamiliton) and *Aorichthys seenghala* (Sykes) from Pakistan (Ahmad, 1963; Qureshi, 1965).

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and *Aorichthys seenghala* (Sykes) from Pakistan (Ahmad, 1963; Qureshi, 1965). It was further pointed out by Mirza (1990) that there was only one species *Aorichthys aor* present in Pakistan. This necessitated a thorough survey of the singhari in Pakistan. As a result of this survey, it was found that the population of singhari in Pakistan resembles to *Aorichthys aor* in its structure of snout and the number of rays in the caudal fin. It differs from the typical form in the length of maxillary barbels. The maxillary barbels reaching at the most to anal fin and not to the caudal base as in typical form from the Ganges describes by Hamilton (1822). Based on the shape of the snout and the number of caudal fin rays, Mirza *et al.* (1992) concluded that the Indus River specimens were similar to *Aorichthys aor* but differed sufficiently in the length of the maxillary barbels. It also differs from *Aorichthys seenghala* in the structure of snout and the number of caudal fin rays. The Indus population was therefore described as a new subspecies of *Aorichthys aor;* it was names as *Aorichthys aor sarwari (*Mirza *et al.*, 1992).

As pointed out by Ferraris and Runge (1999), the Indus *seenghala* is more closely related to *S. seenghala* than *S. aor*. It can however be differentiated from *S. seenghala* in the relative length of the nasal barbels and the anterior margin of the snout. *S. sarwari* agreed with S. seenghala in most of the characters, but it differs from S. seenghala in the length of the nasal barbels and the shape of the snout. In *S. sarwari* the snout is round as compared to the snout of *S. seenghala*, which is truncated.

The fish was once found in abundance in the Punjab, Sindh, Balochistan, NWFP and Azad Kashmir. Few years back, Punjab fisheries department used to catch singhari from river Ravi, river Sutlej, river Chenab and other related drains. Recently industrial effluents have started entering in the drain water that falling into these rivers. Pollution, over-fishing and depletion of natural breeding grounds have caused irreparable damage to its existence. The status of *S. sarwari* is more or less "endangered" due to poor knowledge of its biology, but also due to the declining stocks of this fish in natural waters due to over fishing and pollution. In Pakistan, limited information is available on the meristic and morphometric characteristics of this important fish. In view of the importance of this fish, there is an urgent need to study its biological performance in natural water bodies of Pakistan. The present work is planned to study the morphometric and meristic characters of Mangla Lake

inhabitant fish specimen of *S. sarwari* for their identification in relation to the species/varieties.

MATERIALS AND METHODS

A sample of fifty fish specimen of *S. sarwari* were collected from Mangla lake, Pakistan during Nov., 2005. The sampling was done with the help of commercial fishermen. The fishes were selected of variable size at random for present study. The length and weight of each specimen were recorded using millimeter scale and electronic digital top-pan balance (Chyo, Japan) sensitive up to 0.1g. The meristic and morphometric measurements of each specimen were done with the help of magnifying glass, measuring tray, scales and vernier caliper.

Morphometric characters were measured by a conventional method described by Hubbs and Lagler (1958) with slight modification mentioned below:

Weight of fish, total length *i.e.,* from maxilla to the longest caudal fin ray, standard length *i.e.,* from head to start of tail, head length *i.e.,* from snout tip to most posterior edge of fleshy operculum, interorbital width, pre orbital length of head, post orbital length of head, eye diameter; interneural shield length *i.e.,* superficial, exposed part of supraneural measured along dorsal midline, interneural shield width; nasal barbel length, maxillary barbel length, inner mandibular barbel length, outer mandibular barbel length, dorsal fin length, dorsal fin base, distance between dorsal fin and adipose fin, adipose fin length, adipose fin base, pectoral fin length *i.e.,* measured from joint to tip of spinous portion, not including filamentous extension, pectoral fin base, pelvic fin length *i.e.,* from pelvic fin origin to tip of longest ray, pelvic fin base, anal fin length, anal fin base *i.e.,* from anal fin origin to posterior base of last anal fin ray, caudal fin length, pre-dorsal distance *i.e.,* from snout margin to base of first dorsal fin spine (spinelet), pre adipose distance *i.e.,* from snout tip to point where adipose fin starts to rise from body, pre-pectoral distance, pre-pelvic distance *i.e.,* snout tip to base of first pelvic fin ray, pre-anal distance *i.e.,* distance from snout tip to anal fin origin, Body depth at dorsal fin *i.e.,* measured perpendicular to long axis of body at dorsal fin base, body depth at anal fin *i.e.,* measured vertically at the end of anal fin base.

In the head region additional characters like occipital process length, occipital process width were also be studied.

For meristic study, following meristic characters were considered: dorsal fin rays, pectoral fin rays, pelvic fin rays, anal fin rays and caudal fin rays. In the head region an additional characters *i.e.*, gill rakers were also be counted. Gill raker counts include all bony elements on the outer face of the first arch, including anterior rudiments. Total gill rakers as well as differential raker counts (upper and lower) are provided as both meristics proved useful in discriminating species. A gill raker situated at the angle of the arch was included in the count of the lower arm. The methods of counting followed according to Hubbs and Lagler (1958). Each fin ray number was derived from principal rays. A magnifying glass was used to count the ray numbers precisely.

RESULTS

Biometric study of S. sarwari

The mean total length of sampled specimen was measured 66.8±12.45cm. While the total wet body weight was recorded 2445±612g. Whereas, the standard length of sampled fish, *S. sarwari* were ranged from 50.1±9.52cm (Table I). Length weight and condition factor relationship for sample specimens have been described previously (Shakir *et al.*, 2008).

Morphometric characters and meristic characters

Head long, somewhat depressed, flat at ventral side, rising from the tip of the snout to its posterior margins. Its mean breadth 15.87% of standard length which was greater than its height. Head mean length 24.52% of standard length greater than its breadth (Table II). Gill raker on lower arm were 11 and 3 on upper arm were observed in thirty six specimens whereas 2 gill raker were observed on upper arm in four specimens. Rakers present only on outer face of first two arches, on both faces of nest two arches (Table II).

A median groove on the head shallow, wide, starting in the line with the anterior margin of eye and reaching the base of occipital process. Mouth inferior, transverse and moderately wide; cleft of mouth shallow, not reaching the anterior margin of eye. Upper jaw slightly longer than the lower jaw. Eye ovoid, supralateral in position with free margins, horizontal

axis longest; located entirely in dorsal half of the head and anterior to middle of head length. Mean pre orbital length of head was smaller than postorbital length of head which were 8.35% and 16.13% respectively. Upper margin of orbit nearly reaching dorsal profile of head (nearer to the snout tip than the posterior margin of the operculum; its diameter smaller than interorbital width and the mean value were 3.34% of standard length and 13.25% of head length. Interorbital width smaller than the head length with mean value 7.15% of standard length. (Table III).

The occipital process length is small than interneural shield length and its mean value was 5.15% of standard length. The occipital process width is smaller than the interneural shield width. An interneural shield between occipital process and basal bone of dorsal fin present. Interneural shield ovoid, longer than wide; posterior end wider and more bluntly rounded than anterior end and its mean length and width was 6.99 and 3.86% of standard length respectively. Body depth maximum at the origin of dorsal fin. Mean body depth at anus was 7.15% of standard length (Table III).

Four pairs of barbels i.e., one each of nasal, maxillary, inner mandibular and outer mandibular. Nasal barbel thin, short and originating just in front of anterior margin of posterior nostrils: its mean length 6.26% of the standard length was recorded. Among forty specimens, nasal barbel just reach anterior of the orbit in twenty nine specimens, anterior half of the orbit in five specimens, not reaching near the orbit in six specimens. Maxillary barbel long originating from dorsolateral just in front of the anterior margin of posterior nostrils and its mean length 49.06% of the standard length. Inner mandibular barbels originating just behind the anterior edges of the lower jaw, its mean length 9.60% of the standard length was recorded (Table III).

Dorsal fin centered above middle of standard length. Dorsal fin base shorter than length of first branched ray. Dorsal fin margin straight; first branched ray longest, more than twice length of last ray. Last dorsal fin ray without posterior membranous connection to body. Dorsal fin with spinlet, spine and seven branched rays. Dorsal fin spine long, straight, slender. Spine margin smooth anteriorly and laterally, with fine serrations on distal half of posterior edge. Spine slightly shorter than first branched ray; adpressed spine tip falls far short of adipose fin origin. Adipose dorsal long, low, originating at some distance behind the rayed dorsal.

The space between adipose and dorsal fin base also variable. Among forty specimens, in twenty eight specimens, inter space (between adipose and dorsal fin base) were greater than the bases of both of dorsal and adipose, in eight specimens, inter space (between adipose and dorsal fin base) were equal to the both dorsal and adipose, in three inter space (between adipose and dorsal fin base) is greater than dorsal fin base but less than adipose dorsal and in one specimen inter space (between adipose and dorsal fin base) is greater than adipose fin base but less than dorsal fin base (Table III). Pectoral fin originating just in front of the angle of operculum at the ventrolateral side, with one spine and nine rays; its spine serrated, sharply pointed at tip, stronger but smaller than the dorsal spine. Anterior spine margin smooth, posterior margin with moderately strong serrations along entire length (Table III).

Anal fin originating just behind the vertical line of origin of adipose fin. Anal fin margin straight; first branched ray longest, about twice length of last ray. Last anal ray without posterior membranous connection to body.

Anal fin with 3 or 4 unbranched, and 8-9 branched rays. Caudal fin deeply forked, lobes pointed and symmetrical; upper lobe longer than the lower; except for filamentous extension of upper lobe. Its first complete ray much longer and bends downward at its posterior end (Table III).

Table I: Biometric parameters of *S. sarwari* from Mangla Lake, Pakistan

Sr No.	Biometric parameters	Mean±SD
1	Weight of fish (g)	2445±612
2	Total length (cm)	60.8±12.45
3	Standard length (cm)	50.1±9.52

Table II: Meristic counts of *S. sarwari* from Mangla Lake

Sr. No.	Parameters	No.
1	Dorsal fin rays	1*- 7**
2	Pelvic fin rays	6
3	Caudal fin rays	17
4	Pectoral fin rays	1* 9-10**
5	Anal fin rays	3-4* - 8-9**
6	Gill rakers	11
7	Gill rakers	3 or 2

* Un- branched fins ** Branched fins

Table III Morphometric characters of *S. sarwari* from Mangla Lake, Pakistan

Sr. No	Parameter	Mean±SD of standard length (%)
1	Head length	24.52±4.22
2	Head breadth	15.87±3.96
3	Pre orbital length of head	8.35±2.12
4	Postorbital length of head	16.13±3.01
5	Eye Diameter	3.34±0.98
6	Inter orbital width	7.15±1.78
7	Occipital process length	5.15±1.43
8	Interneural shield length	6.99±2.33
9	Body depth at dorsal fin	13.78±2.78
10	Occipital process width	1.94±0.56
11	Interneural shield width	3.86±0.87
12	Body depth at anus	7.15±1.23
13	Nasal barbell length	6.26±1.11
14	Inner mandibular barbel length	9.60±1.42
15	Maxillary barbel length	49.06±8.23
16	Outer mandibular barbel length	15.11±3.21
17	Dorsal fin length	18.28±4.78
18	Adipose fin length	11.86±4.32
19	Pelvic fin length	12.62±2.21
20	Pectoral fin length	13.76±1.87
21	Anal fin length	13.08±2.26
22	Caudal fin length	27.90±5.21
23	Dorsal fin base	12.53±2.22
24	Adipose fin base	13.21±1.97
25	Anal fin base	10.29±2.12
26	Distance between dorsal and adipose fin	17.29±3.56
27	Pectoral fin base	4.66±1.67
28	Pelvic fin base	4.14±1.30
29	Pre-pectoral distance	23.37±5.23
30	Pre-pelvic distance	48.57±8.78
31	Pre-dorsal distance	35.96±6.97
32	Pre-anal distance	53.97±8.12

DISCUSSION

In present study, standard length, pelvic fin length, pectoral fin length, dorsal fin length, anal fin length, pelvic fin base, pectoral fin base, dorsal fin base, anal fin base (dependent variables) are highly correlated (increases) with the total length (independent variable), while eye diameter, interorbital width, pre orbital length of head, post orbital length of head (dependent variables) are highly correlated (increases) with the head length (independent variable).

Barbels in four pairs. Maxillary barbel long, slender, without medial membrane (Ferraris and Runge, 1999). During study, it was observed that maxillary barbel of all specimens reaching near or just reaches the anal fin origin. In none of single specimen, maxillary barbels reach at caudal fin. It also pointed out by Mirza, 1990 that the population of singhari present in Pakistan resembles to *Aorichthys aor* in its structure of snout and the number of rays in the caudal fin. It differs from the typical form in the length of maxillary barbels. The maxillary barbels reaching at the most to anal fin and not to the caudal base as in typical form present in the Ganges describes by Hamilton (1822).

Nasal barbel slender, thin, short and originating just in front of anterior margin of posterior nostrils. The length of nasal barbel varies with the length of the specimens. Nasal barbel may reach up to anterior half of the orbit in smaller specimens (2- 32 cm approximately), just reach anterior of the orbit in specimens 33-80 cm approximately in length, not reach near of the orbit in specimens which had 82 cm approximately or above in total length.

As pointed out Ferraris and Runge (1999), the Indus *seenghala* is more closely related to *S. seenghala* than *S. aor*. It can however be differentiated from *S. seenghala* in the relative length of the nasal barbels and the anterior margin of the snout. *S. sarwari* (Mirza *et al*., 1992) agreed with *S. seenghala* in most of the characters. It differs from *S. seenghala* in the length of the nasal barbels and the shape of the snout. In *S. sarwari* the snout is round as compared to the snout of *S. seenghala,* which is truncated. From observation, it may be concluded that in singhari present in Pakistan (Mangla lake) and Indus drainage system in India, length of nasal babel not progressively increases with the increase in total length of fish and nasal

barbel just reach the anterior of the orbit which differentiate it from *S. seenghala.*

The results and observation also revealed that supraoccipital spine length is smaller than the length of interneural shield. It is the only *Sperata* species in which the length of the supraoccipital spine is less than that of the interneural shield. Interneural shield ovoid, longer than wide; posterior end wider and bluntly rounded than anterior end (Ferraris and Runge, 1999).

The interspace (between adipose and dorsal fin base) were greater mostly than the bases of both of adipose and dorsal fin, in some specimens interspace is greater than dorsal fin base but less than adipose dorsal and in some specimen interspace is greater than adipose fin base but less than dorsal fin base and in some specimens, interspace were equal to the both dorsal and adipose were observed. From observation, it may be concluded that with the increase in length the interspace (between adipose and dorsal fin base) increases in length as compared to adipose fin base and dorsal fin base

In the present study, meristic cunts *i.e.*, dorsal fin rays, pectoral fin rays, pelvic fin rays, caudal fin rays in all specimens having different length remained constant. It means that meristic counts are independent of body size and there is no change in meristic counts with increase in body length. Apart from present study, many workers have reported the same results f meristic counts in different fish species.

Conclusions

On the basis of literature review and observation, it may be concluded that *Sperata sarwari (*singhari) present in Pakistan and Indus drainage system, more closely related with *Sperata seenghala* but it differentiate from this species on the basis of some morphological variable characters. It may be singhari found in Pakistan and Indus drainage system are genetic varieties of the genus or may be the same species having slightly changed morphology developed due to changed environmental/physical conditions. The further study at gene or molecular level will be open to decide either singhari present in Pakistan and Indus drainage system is genetic varieties of the genus or may be the same species.

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