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MERISTIC AND MORPHOMETRIC CHARACTERS OF SAURIDA TUMBIL (ACTINOPTERYGII: AULOPIFORMES: SYNODONTIDAE) FROM IRAQ

SUMMARY

Morphometric and meristic characters of the greater lizardfish *Saurida tumbil* were examined from the marine waters of Iraq, Arabian Gulf. Eight morphometric (in the percentage of the total fish length) and six meristic traits have been analyzed. No significant differences were observed between male and female fish specimens, except for length of dorsal fin and predorsal length, which have shown isometric growth; the rest of the morphometric characters showed negative allometry. This study provides data to fishery biologists regarding the morphometric traits of S. *tumbil*, for conservation policies of this fish species of Iraqi waters.

Key words: Arabian Gulf, Basrah, Saurida, meristic traits, body proportions.

INTRODUCTION

The *Saurida* is a genus of the family Synodontidae distributed in the Indo-Pacific region.

The body is elongated and tubular in shape, with head and caudal peduncle slightly depressed. There are several rows of teeth visible in both jaws even when mouth is closed. The longest dorsal fin ray about 4 times as long as last ray. The longest pectoral fin ray is reaching to about pelvic insertion. The pectoral axillary scale is long and pointed. The back and sides of body is brown, belly pale or silvery. There are eight to 10 faint bars occasionally visible along lateral line. The distal parts of dorsal, pectoral and particularly caudal fins are dusky. There are 3-4 dark spots in S. *tumbil* (8 in S. *undosqua-*

mis). *Saurida gracilis* and *S. nebulosa* differ from S. *tumbil* in having the pectoral axillary scale short and broad; spots present on all fins; longest dorsal ray less than 4 times as long as last ray 4 times in S. *tumbil*. In S. *longimanus*, the pectoral fin very long and extending to about middle of dorsal fin base.

During the last decades, the information about the biology of the greater lizardfish S. *tumbil* has increased and covered several aspects on the morphology (Mohanchander *et al*., 2019) and reproduction (Abaszadeh *et al*., 2013) of this commercially important species.

As a living habitat, the greater lizardfish prefers sandy and muddy bottoms or coral reefs located along the coastal zone down to 100 m depth (Soofiani *et al*., 2006). In the Arabian Gulf area, S. *tumbil* has shown high abundance as in number of individuals and biomass as reported from the trawling fisheries (Soofiani *et al*., 2006).

As Jawad *et al*. (2021) suggested that the population of S. *tumbil* located in the marine waters of Iraq at the head of the Arabian Gulf is separated from the other populations of this species on the western coast of the Arabian Gulf. The present study aims to provide useful information on morphometric and meristic traits that allow to discriminate the population of the greater lizardfish from the Iraqi marine waters.

MATERIAL AND METHODS

Fish samples (135) were acquired from commercial fishing trawler operating in Khor Abdullah, marine waters of Iraq, in May 2015 and June 2016 at depth of 12 m (Fig. 1). Fish were examined after to landing while still fresh. Total length (TL), fork length (FL), standard length (SL), predorsal length (PDF), length of the first dorsal fin (LDF), head length (HL), pectoral fin length (PFL), body depth at pectoral fin margin (BDPF); and body depth at anal fin margin (BDAF), were measured to the nearest mm using digital caliper (Fig. 2). Fish weight was recorded to the nearest 0.01 g using Sartorius electronic balance model ENTRIS 60202-1S. Morphometric characters were measured following Lagler *et al*. (1962) and Laevastu (1965); all data are presented in Table 1. All specimens were placed in the fish collection of the Department of Fisheries and Marine Resources, College of Agriculture, University of Basrah, Basrah, Iraq. To minimize the effect of the fish size, body morphometric characters were expressed as percentages. These indices of were calculated using the following formula:

$$I = (C / TL) \times 100$$

where I = morphological trait index, C = morphological trait measurement in

mm, TL = total length of the fish. The relationship between fish total length and different morphometric indices was computed using the following formula:

$$Y = a + b\,X$$

where Y = measurement of the morphological character, X = Fish total length, a and b = constants. According to KARACHLE and STERGIOU (2012), "b" would take an estimate close to 1. To test this estimate, a Student t-test was used. The type of allometry was assessed by checking the significance of the allometric coefficient "b" (b = 1, b > 1 and b < 1 to determine an allometry or isometry (VAN SNIK *et al.*, 1997). Meristic traits like the dorsal fin spines and rays (D), pectoral fin rays (P), pelvic fin rays (V), anal fin rays (A), caudal fin rays (CFR), and scale number on the lateral line (LL), were counted for each fish specimen using a stereo microscope (Tab. 2). Sex was determined by microscopic examination of the gonads. The length-weight-relationship was calculated using the equation, W = aLb , where, W is the total body weight in g, SL is the standard length in mm and 'a' and 'b' are the constants to be determined. The values of Kn were calculated adapting the formula of LE CREN (1951) as, Kn = TW/aLb where TW = observed weight (g), aLb = calculated weight obtained from the length-weight relationship.

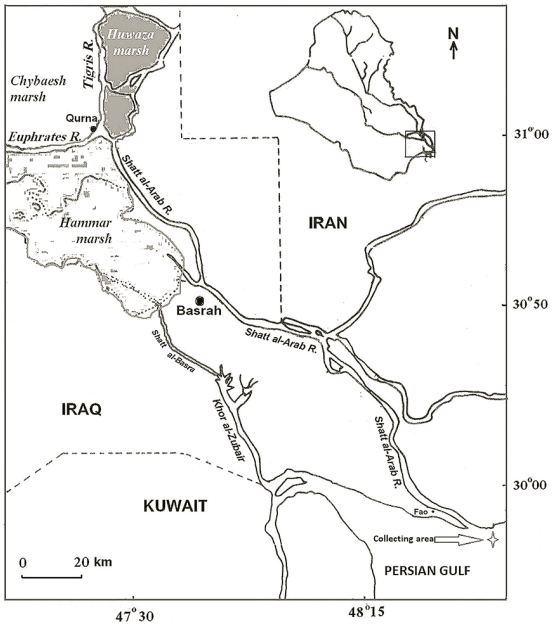

Fig. 1. Map showing the sampling locality at the marine waters of Iraq.

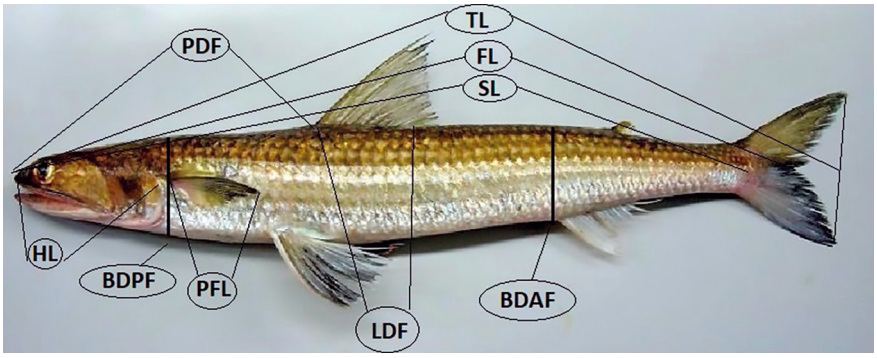

Fig. 2. *Saurida tumbil* (185 mm TL) collected from the marine waters of Iraq showing the morphometric characters studied. Total length, TL; fork length, FL; standard length, SL; predorsal length, PDF; length of dorsal fin, LDF; head length, HL; pectoral fin length, PFL; body depth at pectoral fin, BDPF; body depth at anal fin, BDAF.

Tab. 1. Descriptive statistics of morphometric traits of *Saurida tumbil*. N, number of fish; Min, minimum value; Max, maximum value; SD, standard deviation; R2, correlation coefficient; t, student test; I, isometric allometry; NA, negative allometry.

Morphometric indices	N	Min	Max	Mean	SD	Y=a+bX	R^2	t	Relationship
SL x 100 / TL	135	162	222	193.4	0.71	Y = 0.807x + 0	0.998	81.16	N
FL x 100 / TL	135	172	235	202.4	0.83	Y = 1.424x + 0.242	0.987	11.74	N
HL × 100/TL	135	38.6	54.4	45.3	0.52	Y = 0.210x–	0.973	16.28	N
PFL × 100/TL	135	17.9	27.5	23.4	1.92	Y = 0.012x + 0.114	0.871	29.10	N
BDPF × 100/ TL	135	23.1	39.0	32.2	1.64	Y = 0.077x + 0.051	0.883	18.36	N
BDAF × 100/ TL	135	19.5	28.6	25.1	0.63	Y = 0.745x + 0.112	0.982	54.12	N
LDF × 100/TL	135	20.9	29.6	26.3	0.42	Y = 0.344x + 0	0.972	14.60	I
PDF × 100/TL	135	66.2	91.4	77.8	0.53	Y = 0.523	0.956	15.90	I

RESULTS

The ratios of the morphological characters are shown in Tab. 1. No significant differences were observed in the ratios of male and female specimens (t-test; $p > 0.05$). Therefore, the samples were mixed.

The highest linear function coefficient 'b' was determined for the FL 1.424, and the lowest 0.012 for PFL (Tab. 1). Moreover, the highest correlations with the fish TL total length is $R^2 = 0.998$ and the lowest value was $R^2 = 0.871$ for SL x 100 / TL and PFL × 100/TL respectively (Tab. 1).

Eight morphometric characters relative to TL showed a negative allometry, except for LDF (Y = 0.344x + 0.997) and PDF (Y = 0.523x + 0.995) proportions which had isometric growth. The growth of the remaining morphometric traits exhibited positive allometry (b<1).

The length-weight relationship of the examined specimens is W = 8E – $05^{3.3235}$ L. The r^2 value for normal fish was 0.9898.

Tab. 2. Comparison of meristic characters of *Saurida tumbil* with other studies. 1, minimum – maximum values; 2, mean ± Standard deviation, SD.

Locality	N	Dorsal fin	Anal fin ray count	Pectoral fin	Pelvic fin	Caudal fin ray count	Lateral line	Reference						
		1	2	1	2	1	2	1	2	1	2	1	2	
Indian coastal waters	-	11	-	10-12	-	14-15	-	-	-	-	-	55 - 58	-	Dutt and Sagar (1981)
Iraq	173	12-13	12.6 ± 0.47	1 -13	12.1 ± 0.33	15-16	15.1 ± 0.31	-	-	-	-	55 - 57	55.4 ± 0.62	Jawad et al. (2021)
Kuwait	198	12-14	12.9 ± 0.40	12-13	12.6 ± 0.50	15-16	15.2 ± 0.43	-	-	-	-	55 - 57	55.6 ± 0.76	Jawad et al. (2021)
Saudi Arabia	212	11-12		10-11	10.9 ± 0.34	13-14	13.7 ± 0.44	-	-	-	-	52 - 53	52.8 ± 0.39	Jawad et al. (2021)
Bahrain	128	11-12	11.8 ± 0.43	10-11	10.7 ± 0.46	13-14	13.8 ± 0.39	-	-	-	-	52 - 53	52.7 ± 0.46	Jawad et al. (2021)
Qatar	143	1 -12	11.7 ± 0.44	10-11	0.6 ± 0.50	13-14	13.6 ± 0.49	-	-	-	-	52 - 53	52.7 ± 0.50	Jawad et al. (2021)
United Arab Emirates	173	10-11	10.8 ± 0.37	9-10	9.8 ± 0.42	12-13	12.7 ± 0.46	-	-	-	-	50 - 51	50.8 ± 0.36	Jawad et al. (2021)
Oman	175	9-10	9.9 ± 0.33	9-10	9.8 ± 0.41	11-13	12.3 ± 0.65	-	-	-	-	49 - 51	50.5 ± 0.68	Jawad et al. (2021)
Iraq	135	12	12.5	12	12.2	15-16	15.09	8	-	18-20	18.86	55-60	57.3 ± 0.31	Present study

DISCUSSION

The six meristic characters appeared in Tab. 2 showed values that fall under the expected range for S. *tumbil* from the marine waters of Iraq (Jawad *et al*., 2021).

The results of this study showed that the 8 morphometric traits evaluated on S. *tumbil* does not show significant differences in their disparity (t-test; $p>0.05$). To agree with the account that morphometric can discriminate between diverse species of fish given by Díaz De Astarloa *et al*. (2011) and Zhan and Wagn (2012), such data of a different *Saurida* species need to be obtainable for comparison.

The growth pattern of particular morphometric traits was shown to be species-specific patterns such as the body depth allometry in *S. tumbil*, which has slightly deeper body. The fish body found to be deep so to assist in the manipulation (quick starts and rapid turns) (Webb, 1984). Similar findings were attained for several species of the family Sparidae by Niklioudakis *et al*. (2014), species of the family Carangidae (Sley *et al*., 2016) and cichlid species (Jawad *et al*., 2018). The obvious growth in the abdominal region proposes bigger growth of the intestine (Elbal *et al*., 2004), a result similar to other investigations that have revealed that the middle part of the body increases later during the progress in growth (after head and tail) in bilateral species (Van Snik *et al*., 1997; Gozlan *et al*., 1998), as contrasting to asymmetrical species (*Paralichthys californicus*) (Gisbert *et al*., 2002). The other negative allometric patterns of different morphometric traits obtained in this investigation are linked with changes in body shape required by the carangiform swimming design that this species is used.

The present examination of the morphometric traits showed that all morphometric indices have high correlation value ($r > 0.9$), except for PFL and BDPF, where a correlation value was attained (> 0.8). This indicates that the growth of *S. tumbil* in two areas of the body do not grow as the same growth rate of the total length of the fish maybe due to the inclusion of juvenile specimens (40 specimens) in the account. Comparable results were gained by Oniye *et al*. (2006) and Safi *et al*. (2014) on *Protopterus annectens* and *Pomadasys stridens* respectively and by Sley *et al*. (2016a, b) on carangid species.

The range of the TL of the specimens examined is 155 to 265 mm. Such a range falls into the mid maximum total length reported for *S. tumbil* (600 mm TL) (Shindo, 1972). On the other hand, the maximum total length attained is just over the mid value for the maximum total length reported for *S. tumbil* from the Arabian Gulf (251 - 262) reported by Jawad *et al*. (2021) and the Indian waters (RAO, 1982; Soofiani *et al*., 2006; Abaszadeh *et al*., 2013; Sadawarte *et al*., 2016).

The information on the morphometric and meristic characters of *S. tumbil* is moderate (Rao, 1982; Sadawarte *et al*., 2016; Dutt and Sagar, 1981) and the only studies from the Arabian Gulf area are those of Jawad and Abed (2020) and Jawad *et al*. (2021). In the former study, the asymmetrical variations in six bilateral morphological characters of *S. tumbil* were assessed. The latter work, Jawad *et al*. (2021) investigated the meristic variation among stocks of greater lizardfish *S. tumbil* through the western coasts of the Arabian Gulf and Sea of Oman.

The results of the meristic counts obtained for *S. tumbil* in the present study agree with those of Jawad *et al.* (2021) for Iraqi and Kuwaiti, but differs from those performed in the Arabian Gulf region examined by Jawad *et al*. (2021) from those of the Indian coastal waters studied by Dutt and Sagar (1981). Such differences might support the finding of Jawad *et al.* (2021) in having separate populations located at both Iraqi and Kuwaiti waters at the North West part of the Arabian Gulf. Such differences indicate that different locations and environment have substantial influence on meristic traits where interface between genetics and environment happened (Swain and Foote, 1999).

The higher b value of the calculate L-W relationship equation indicates the fish specimens gain weight in their environment. The Kn value is calculated to understand the general well-being of the fish. The Kn value showed that examined fish has an average of 1.0445, which means fishes are living in a better condition.

The outcome from this study should be related with similar data gained from other populations of S. tumbil inhabiting the western coast of the Arabian Gulf to determine the how the local environmental factors affecting the individuals of each population and assess relative contribution of the different nursery areas to mixed adult stocks (Campana and Thorrold, 2001; Rooker *et al*., 2003).

Even though S. tumbil is an imperative commercial fish, its conservation level has not been assessed. Consequently, the fisheries administrators should take this matter in contemplation to continue its stocks in the Arabian Gulf area.

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