



Notes on the morphometry and biology of the Saddle grunt, *Pomadasys maculatus*, (Bloch, 1793) recorded from the Southeast Arabian Sea

A. T. Sangeetha^{1,2}, Rekha J. Nair^{1*} and K. M. Vishnupriya¹

¹ICAR-Central Marine Fisheries Research Institute, Kochi-682 018, Kerala, India.

²Cochin University of Science and Technology, Kochi-682 022, Kerala, India.

*Correspondence e-mail: rekhacmfri@gmail.com

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Short Communication

Abstract

Studies on *Pomadasys maculatus* collected from the southwest coast of India showed fishes in the length range 130-197 mm with a mean standard length of 139.41 mm and body weight of 79.09 g. The growth pattern observed was isometric. *P. maculatus* shows no sexual dimorphism. Since there is no recent information on the morphometric and meristic characteristics of *P. maculatus* from India, the present study is expected to add more knowledge to the species.

Keywords: Biology, *Pomadasys maculatus*, otolith, Arabian Sea

Introduction

Fishes of the Family Haemulidae commonly called grunters are small to medium-sized fishes, which usually live in shallow coastal waters. The fishes are characterized by small mouths, thick lips and small teeth; most specimens have distinctive patterns, such as stripes or bands (Ahmed and Benzer, 2013) and occur in coral reef areas, as well as in muddy or weedy waters (Fischer *et al.*, 1990). Grunts are distributed in the marine and brackish waters of the Indian, Pacific and Atlantic and are rarely found in freshwater. The Family Haemulidae comprises 133 species in 19 genera distributed throughout the world and the genus *Pomadasys* consists of 35 species (Fricke *et al.*, 2021). They are found in the inshore bays and estuaries of the eastern Atlantic to the Indo-West Pacific (McKay, 2001; Fricke *et al.*, 2021). This genus is differentiated from other genera of this family by the hidden upper jaw when the mouth is closed and the appearance of two pores and a median pit in the chin

(McKay, 2001; Bauchot, 2003). Members of *Pomadasys* genus including *P. kakaan* (Cuvier, 1830) and *P. maculatus* (Bloch, 1793) have economic value since their flesh does not degrade easily and are thus considered as valuable food fish and marketed both fresh and salt-dried (Bianchi, 1985). Eleven species of *Pomadasys* are reported from India (Mishra, 2020), but there is no information on the biology of this fish. *P. maculatus* commonly called Blotched-grunt, saddle grunter locally known as 'Karukaruppan' in Kerala. This paper aims to add information on the morphometric and meristic characteristics of *P. maculatus*.

Material and methods

A total of 74 individuals with total length ranging from 130 to 197 mm were collected for study during the period 30 October 2020 to 15 March 2021 from the fishery harbour of Kalamukku, Ernakulam (9 58' 57.4" N 76 14' 30.2" E) located along the southeastern Arabian Sea, off Kerala, India. Eight meristic and twenty-three morphometric measurements (Fig. 1) were evaluated for the study. Morphometric and meristic characteristics were measured using 0.1 mm digital callipers and a stereomicroscope. The species was identified following McKay (1983) and Randall (1995). The morphometric characters were studied following Kumari *et al.* (2020). The ventral and dorsal view of the otolith of *P. maculatus* and measurements of sagittae were taken using a stereomicroscope (Fig. 2). Swimbladder was examined using Nikon D3500 (Fig. 3). The structure of the swimbladder and otolith was also noted to study its close resemblance in external structure to the sciaenid relative *Nibea maculata*. All measurements were



Fig.1. *P. maculatus*

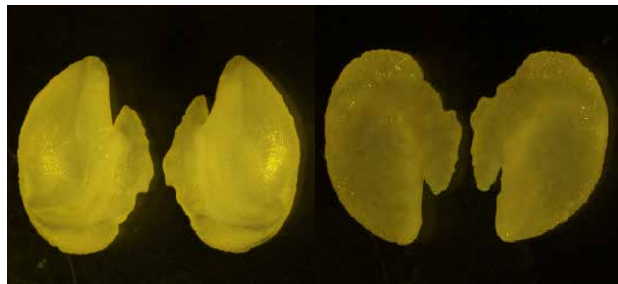


Fig. 2. Ventral and dorsal view of otolith using a stereomicroscope



Fig. 3. Swimbladder of *P. maculatus*

taken using digital callipers (mm) to the nearest 0.1 sensitivity and weighed in grams.

Length-Weight Relationship

The total length (TL) and body weight of all the fishes were measured to the nearest 1.0 mm and 0.1 g. The length-weight relationship was estimated using the formula $W = a(TL)^b$, where W is body weight (g), TL is the total length (mm), a is the coefficient related to body form and b is the regression coefficient. Total length and total weight were also transferred to logarithm values. The linear regression equation relating the two measurements is represented by $\log W = \log a + b \log L$

Results and discussion

Taxonomy

Pomadasys maculatus (Bloch, 1793)

Anthias maculatus Bloch, 1793: 1793: 9 Pl. 326 (fig. 2) (type locality: East Indies)

Pristipoma caripa Cuvier, 1829:176 (type locality: East Indies and India)

Pristipoma pihloo Richardson, 1846: 227 (type locality: Canton, China.)

Pristipoma tharapon Bleeker, 1849: (type locality: Jakarta, Java, Indonesia)

Meristic formula

D1 XII+13-14; P 17; A III+ 7; V I, 5; C 17; LI 48-49; Gr5-6+12-13. Scale rows above the lateral line, 5.

The species is characterized by several dark large elongate patches on the upper back.

Body measurements expressed in SL (with mean in parentheses): Eye diameter 7.27-10.25 (11.27), head length 29.57-36.81(3.08), head depth 17.19-34.51(3.28), pectoral fin length 23.52-34.81(3.19); pelvic fin length 17.86 – 26.67 (4.57); anal fin length 9.14-15.61 (8.93); dorsal fin height 13.22-21.31(6.06) and caudal fin length 17.89-31.82 (3.94).

Body measurements expressed in HL (with mean in parentheses): Eye diameter 22.20-32.21(3.67), head depth 50.46-101.80 (1.07), pectoral fin length 79.54-105.85 (1.04); pelvic fin length 53.57-79.95 (1.49); anal fin length 28.15-48.11 (2.91); dorsal fin height 13.22-21.31 (1.97) and caudal fin length 54.50-99.21(1.28).

Body slightly oval with dorsal and ventral portions equally convex. The suborbital portion is scaly; a narrow isthmus forms

a groove. Chin with a pair of small pores; lips thin; dorsal-fin spines long; dorsal fin notched between spinous and soft portions; caudal fin emarginated.

Length-weight relationship

Pooled data of *P. maculatus* were calculated as $W = 0.008643L^{2.99}$. The corresponding logarithmic equation is written as $\text{Log } W = -4.75 + 2.99 \cdot \text{log } L$ ($R^2 = 0.989$)

Otolith: Otolith is oblong in shape. Dorsal and ventral portions are slightly convex and concave in shape respectively. Well-developed crista superior and crista inferior. The ostium is broad followed by a straight cauda anteriorly which bends sharply at two-thirds of its length. Excisural notch is present. The length and height of the otolith was 7.294 mm and 5.183 mm measured respectively by using a stereomicroscope (Fig. 4). Studies on the otolith of *Pomadasys* are scanty. Lin *et al.* (2013) used the morphology of the sagittae of the genus *Pomadasys* to identify otolith remains from an archaeological site in Nankuanli East (NKLE) in Tainan City in southwestern Taiwan. *P. maculatus* has



Fig. 4. Measurements of otolith taken using stereomicroscope

a characteristic deep notch and also shows a larger otolith height than *P. argenteus* and *P. kaakan* in a similar otolith length.

Swimbladder: The swim bladder is carrot shaped without any appendages; 3 small projections are seen anteriorly (Fig. 3). Sattari *et al.* (2016) conducted a study on the accessory glands of *Pomadasys*; however, no details were depicted.

Table 1. Morphometric and meristic characters of *P. maculatus* in %TL

S. No	Morphometric measurement	Minimum (mm)	Maximum (mm)	Mean (mm)
1	Total length	130	197	165.97
2	Standard length	115	165	139.41
3	Head length	34.4	55.04	45.37
4	Head depth	22.7	51.83	42.80
5	Head width	16.05	45.08	23.62
6	Eye diameter	9.79	15.34	12.38
7	Pre-orbital length	10.69	17.74	13.87
8	Pre-dorsal length	21.78	63.94	53.71
9	Dorsal base length	37.14	84.81	70.43
10	Dorsal fin length	18.6	27.38	23.05
11	Pre-pectoral length	37.51	56.76	47.35
12	Pectoral base length	5.35	9.87	7.95
13	Pectoral fin length	32.72	52.86	43.76
14	Pre-pelvic length	39.74	85.07	50.45
15	Pelvic base length	3.34	6.34	4.92
16	Pelvic fin length	20.66	38.91	30.77
17	Pre-anal length	75.9	116.45	96.91
18	Anal base length	15.11	22.43	18.40
19	Anal fin length	12.65	20.5	15.69
20	Caudal fin length	23.43	45.53	35.60
21	Caudal peduncle length	10.16	19.8	13.96
22	Caudal peduncle depth	10.58	17.68	14.21

Table 2. Comparison of value *b* of *P. maculatus* with previous studies from different areas of the world to present study from Kochi coast, India

Locations	Sex	Slope <i>b</i>	r ²	References
Sofala Bank of Mozambique	Male	2.89	0.98	Brinca <i>et al.</i> , 1984
	Female	2.99	0.99	
Gulf of Aden	Combined	2.620	-	Edwards <i>et al.</i> , 1985
Gulf of Aden	Combined	2.262	-	Edwards and Shafer, 1991
Indian Ocean	Combined	2.569	0.986	Pauly <i>et al.</i> , 1996
Korangi Creek, Pakistan	-	3.7	-	Baset <i>et al.</i> , 2020
MianiHor, Pakistan	-	2.79	-	
Karachi coast, Pakistan	Combined	1.4101	0.961	Ahmed and Benzer, 2013
	Male	2.915		
	Female	2.871		
Central Kerala	Combined	2.901		Mandy, 2015
Karachi coast, Pakistan 2012	Combined	2.532	0.978	Baset <i>et al.</i> , 2020
Karachi coast, Pakistan 2014	Combined	2.56	0.979	
Kochi coast, India	Combined	2.99	0.989	Present study

Colour: Body silvery grey with yellow shade, a series of dark vertical bands dorsolaterally, the band on nape curved and most conspicuous; dorsal fin notched between third and sixth or seventh spines.

Distribution: This species was previously recorded from the Indo-West Pacific and Western Pacific.

Sexual dimorphism: *P. maculatus* shows no sexual dimorphism. Fifty-one samples (16 males and 35 females) were dissected and sex was confirmed by inspecting its gonads. Both morphometric and meristic characteristics of males and females of this species showed consistency with each other, as presented in Tables 3a and 3b. Therefore, this study revealed that only little variations occur between all morphometric and meristic characteristics of male and female fishes of *P. maculatus*. Hence, no sexual dimorphism was reported in this species. Though Mandy and Inasu (1998) stated that sexual dimorphism is exhibited by *P. maculatus*, Safi *et al.* (2014) contradicted this view. The morphometric indices of linear measurements (head length, eye diameter, length of caudal peduncle and caudal peduncle depth) have been expressed as indices (%) concerning total length (Table 3a) and since these show the same values in both sexes, it is very clear that is no sexual dimorphism in both sexes. Thus our studies agree with the view of Safi *et al.* (2014) confirming that no sexual dimorphism was noted. The analysis of meristic and morphometric variations between male and female fishes of a particular species could also be considered a valuable tool in determining sexual dimorphism (Adarsh and James, 2016).

Length-weight relationship: This study presents information related to the length-weight relations, morphometric measurements and meristic counts of *P. maculatus*. The morphometric measurements, the minimum and maximum value of each character and their mean are presented in Table 1. Froese (2006) expressed that parameter *b* should normally range between 2.5 to 3.5. In the present study value of *b* is 2.99, which shows that the linear regressions on data are highly significant with $R^2 = 0.989$ (Fig. 6). The *b* value obtained shows the fishes had allometric or isometric growth pattern which follows the findings of Froese (2006) and Tesch (1971).

The estimated value of slope *b* was compared with the results obtained from the other areas of the world of the same species (Table 2), the *b* values were 2.89 for males, 2.99 for females from the Sofala Bank of Mozambique (Brinca *et al.*, 1984). It was 3.70 from the Korangi Creek, 2.79 from the Miani Hor Pakistan (Ahmed and Abbas, 2000), 1.410 from Karachi coast Pakistan (Ahmed and Benzer, 2013) and 2.569 from the Indian Ocean (Pauly *et al.*, 1996). The *b* values were 2.915 for males, 2.871 for females and 2.901 for combined sexes from central Kerala (Mandy, 2015). Variations in the *b* values for the same fish species are usually attributed to certain factors like the number of specimens examined, length range, habitat, season, sex, diet and gonadal maturity (Froese, 2006; Hossain *et al.*, 2014).

It has been observed that body characters like predorsal fin length and head length against standard length show a high value of correlation coefficient indicating the morphometric

Table 3a. Comparative study on the morphological measurements of *P. maculatus*

S. No.	Total length	Head length	HL in TL %	Caudal peduncle length	CPL in TL %	Caudal depth	CPD in TL %	Eye diameter	ED in TL %
<i>P. maculatus</i>-male (in mm)									
1.	179	49.48	27.64	14.25	7.96	16.88	9.43	13.11	7.32
2.	170	47.97	28.22	16.64	9.79	15.89	9.34	13.03	7.66
3.	173	45.54	26.32	14.57	8.42	15.24	8.81	12.78	7.39
4.	169	47.1	27.87	14.85	8.79	16.79	9.93	12.6	7.46
5.	161	44.99	27.94	10.46	6.49	13.8	8.57	12.03	7.47
6.	162	44.53	27.49	12.28	7.58	15.14	9.34	13.02	8.04
7.	148	41.24	27.86	12.81	8.66	13.83	9.34	11.62	7.85
8.	145	38.6	26.62	11.8	8.14	13.1	9.03	11.14	7.68
9.	172	47.49	27.61	13.05	7.59	13.84	8.05	12.31	7.16
10.	151	40.77	27	11.73	7.77	14.36	9.51	10.82	7.17
11.	157	41.7	26.56	14.11	8.99	14.61	9.31	11.42	7.27
12.	154	42.28	27.45	11.85	7.69	13.17	8.55	11.63	7.55
13.	160	42.49	26.56	13.12	8.2	14.01	8.76	11.34	7.09
14.	155	40.88	26.37	12.15	7.84	14.08	9.08	11.92	7.69
15.	169	45.83	27.12	12.77	7.56	14.68	8.69	12.67	7.49
16.	156	43.21	27.7	12.42	7.96	13.43	8.61	12.16	7.79
Average	161.31	44.01	27.27	13.05	8.09	14.55	9.02	12.1	7.5
<i>P. maculatus</i>-female (in mm)									
1.	190	52.04	27.39	16.85	8.87	16.68	8.78	12.54	6.6
2.	189	51.95	27.49	13.45	7.12	17.04	9.02	13.9	7.35
3.	176	47.55	27.02	16.22	9.22	13.73	7.80	12.54	7.13
4.	185	50.1	27.08	14.73	7.96	13.82	7.47	13.81	7.46
5.	181	49.73	27.48	14.9	8.23	15.72	8.68	12.5	6.91
6.	162	43.28	26.72	12.97	8.01	14.44	8.91	11.71	7.23
7.	184	51.26	27.86	13.76	7.48	16.28	8.85	13.91	7.56
8.	156	44.08	28.26	13.82	8.86	14.06	9.01	11.42	7.32
9.	152	44.02	28.96	12.47	8.20	14.06	9.25	12.16	8
10.	158	43.91	27.79	11.03	6.98	13.87	8.78	11.81	7.47
11.	147	39.19	26.66	11.36	7.73	12.90	8.78	11.06	7.52
12.	150	41.09	27.39	10.16	6.77	13.92	9.28	10.64	7.09
13.	175	46.80	26.74	12.68	7.25	12.71	7.26	10.39	5.94
14.	140	37.85	27.04	11.61	8.29	11.77	8.41	10.17	7.26
15.	166	45.42	27.36	13.07	7.87	15.58	9.39	12.04	7.25
16.	181	48.35	26.71	15.44	8.53	15.68	8.66	13.41	7.41
17.	190	55.04	28.97	17.7	9.31	17.68	9.31	13.43	7.07
18.	179	49.40	27.59	13.84	7.73	16.25	9.08	12.68	7.08
19.	150	41.01	27.34	11.32	7.54	13.64	9.09	10.81	7.21
20.	159	42.99	27.04	14.34	9.02	15.8	9.94	11.47	7.21
21.	170	45.68	26.87	15.83	9.31	16.86	9.92	12.16	7.15
22.	139	37.64	27.07	13.36	9.61	14.04	10.10	9.79	7.04
23.	193	53.06	27.49	14.47	7.49	15.11	7.83	13.7	7.09
24.	161	43.55	27.05	13.02	8.09	14.13	8.78	11.02	6.84

S. No.	Total length	Head length	HL in TL %	Caudal peduncle length	CPL in TL %	Caudal depth	CPD in TL %	Eye diameter	ED in TL %
25.	151	40.26	26.66	14.36	9.51	14.54	9.63	11.71	7.75
26.	174	48.85	28.07	15.34	8.82	16.35	9.39	12.31	7.07
27.	156	43.04	27.59	15.48	9.92	10.90	8.67	10.78	6.91
28.	191	47.9	25.08	11.70	6.13	13.52	7.28	13.10	6.86
29.	168	45.2	26.90	12.72	7.57	13.9	7.90	12.60	7.50
30.	167	44.4	26.59	15.93	9.54	13.28	8.69	11.60	6.95
31.	161	45.4	28.19	12.22	7.59	14.52	8.57	11.60	7.20
32.	185	49.3	26.64	14.36	7.76	13.8	8.6	13.60	7.35
33.	165	53	32.12	12.63	7.65	15.91	9.04	13.60	8.24
34.	190	52.7	27.74	13.01	6.84	14.93	9.12	14.7	7.74
35.	178	48.65	27.33	15.00	8.42	17.32	8.57	12.77	7.17
Average	169.11	46.39	27.44	13.75	8.15	14.71	8.79	12.21	7.23

Table 3b. Sexual dimorphism- *P. maculatus* comparison of morphological and meristic features in males and females (in mm) (Average)

S. No.	Males	Females	
1.	Total length	225.87	201.55
2.	Head length	53.09	50.17
3.	Caudal peduncle length	15.8	15.04
4.	Caudal peduncle depth	17.62	16.11
5.	Eye diameter	14.59	13.26

Meristic features in both males and females of *Pomadasys maculatus*

Dorsal Fin	D1 XII,13-14
Pectoral Fin	17
Anal Spine	III
Anal Rays	7
Caudal Rays	17
Lateral Line	48-49
Pelvic Rays	I,5
Gill Rakers	5-6+12-13

character increase in direct proportion to each other. Linear relationship has been observed between these parameters (Fig. 5). Otolith morphology of *P. maculatus* has not been done from Indian waters earlier. The present work compared with the work done by Lin *et al.* (2013) from Taiwan shows no significant difference. This is the first work from India, which describes the structure of the otolith and swimbladder of *P. maculatus*. Also, is the first report of LWRs parameters for the species *P. maculatus* from the eastern Arabian Sea, thus the data serve as a baseline for further studies. Threats to the habitat of fish, and overexploitation, are some factors which can cause detrimental effects on the fish stock; baseline data of this nature will contribute to areas of management and conservation.

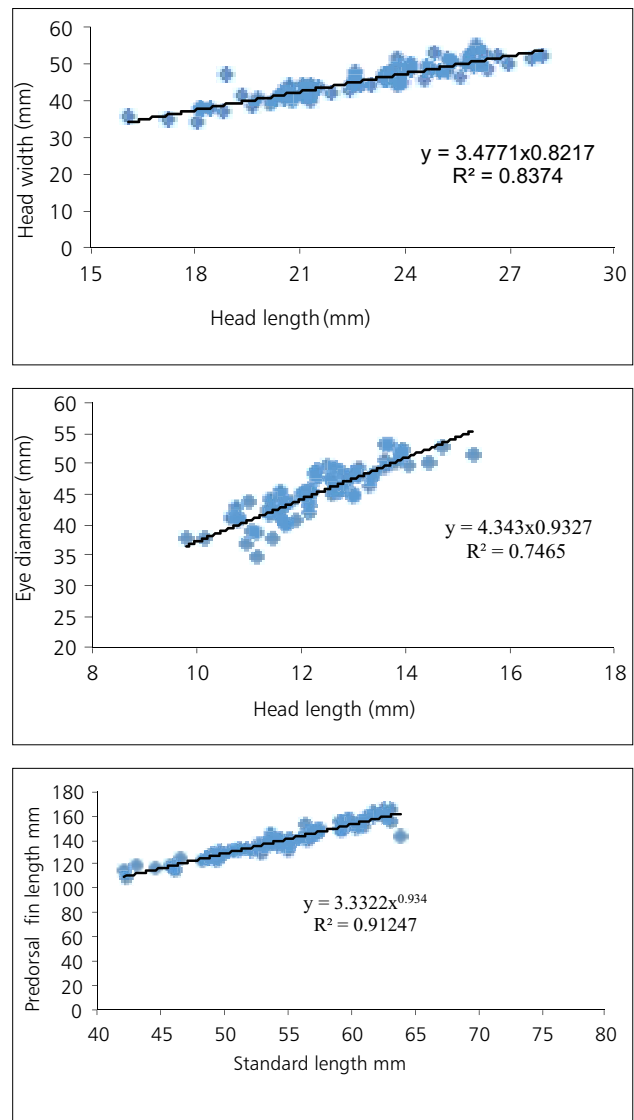


Fig. 5. Morphometric relationships of *P. maculatus* (pooled)

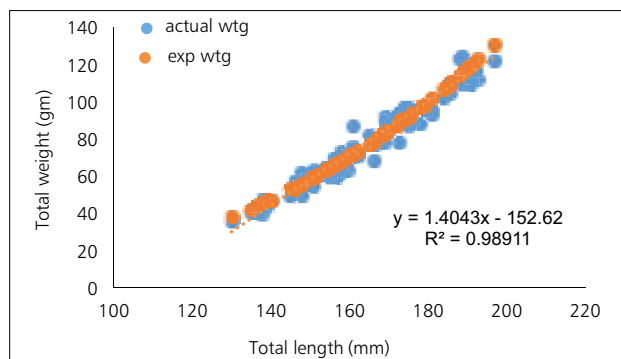


Fig. 6. Length-weight relationships of *P. maculatus* (pooled)

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