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Studies on Gonadosomatic Index & Stages of Gonadal Development of Striped piggy fish, *Pomadasys stridens* (Forsskal, 1775) (Family; Pomadasyidae) of Karachi Coast, Pakistan

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ABSTRACT

Gonadosomatic index value in males during September – March were 4.463 to 6.160, while in females the high values during September – February were found to be 3.289 to 9.124, which suggested the spawning period. The highest GSI value in males were 5.792 in stage VI and the lowest GSI value were 1.020 recorded during VII stage. GSI values in male increased slowly reaching to maximum in 5.792 in stage VI and then drastically dropped to 1.020 in stage VII, while in females at high value was 6.363 during stage VI and the lowest GSI values were 1.125 and 1.124 during stages I & II respectively. Seven stages of gonadal development were observed in male and female fish. *Pomadasys stridens* is a benthic-pelagic fish, found at depth of 30-68m. The results will increase our knowledge of reproductive biology of *Pomadasys stridens* which is relevant for fisheries and aquaculture management as well as breeding programmes.

Keywords: Gonadosomatic Index, Gonadal Development, *Pomadasys stridens*.

1. Introduction

Commercial quantities of large numbers of finfish and shellfish are present in the Pakistani coastal waters ^[1]. The Striped piggy grunt, *Pomadasys stridens* is among the fish species of great economic importance in the Pakistani coastal waters. It belongs to the family Haemulidae and can be found at depths between 30-68m of the Western Indian Ocean, Red Sea, East Africa to Mozambique and Persian Gulf. Gonadosomatic index which is an index of gonad size relative to fish size is a good indicator of gonadal development in fish ^[2]. The percentage of body weight of fish that is used for production of eggs is determined by the gonadosomatic index.

Information on the reproductive biology of some economically important fish species which include *Pomadasys kaakan*, *Velamugil cunnesius*, *Drepane longimana*, *Pomadasys hasta*, *Pomadasys maculatum* and *Pomadasys stridens* of the Indo-Pak and Arabian Gulf coasts has been reported by some authors ^[3, 4, 5, 6, 7, 8]. There is paucity of information on the study of reproductive biology of the grunts in the Karachi coast. The reproductive biology of *Pomadasys stridens* has not been widely reported in literature. The aim of this study was to investigate the gonadosomatic index and stages of gonadal development, which are some aspects of the reproductive biology of *Pomadasys stridens* of the Karachi coast, Pakistan. It is hoped that the information obtained from this study will contribute to our knowledge of the reproductive biology of *Pomadasys stridens* and will be useful for fisheries and aquaculture production.

2. Materials and Methods**2.1 Study area**

The Karachi coast was the study area for this research. The Karachi coastline is between latitude 24°53'N and longitude 67°00'E N, and lies in the Northern boundary of Arabian Sea.

2.2 Collection of Specimens and Sampling

Samples of *Pomadasys stridens* were collected fortnightly (A total of 24 collections) from fish harbors of West Wharf and korangi Creek of Karachi coast. The specimens were collected throughout the year from January to December. The fish was identified by using the Manual of Bianchi ^[9]. Simple random sampling technique was used ^[10]. A total of 391 samples collected

during the study period. The samples were transported to the laboratory and preserved in a deep freezer at -20 °C until examination and analysis.

2.3 Body Measurements

The specimens were brought out of the deep freezer and allowed to thaw and the body length and weight were measured. Total and standard lengths were measured using a one-meter measuring board graduated in cm. The fish was wiped with a dry napkin before weighing and body weight and ovary weight were measured using a weighing balance (Sartorius model).

2.4 Gonadosomatic index

The Gonadosomatic index was calculated according to Strum ^[11] as follows:

$$GSI = \frac{\text{Weight of gonad} \times 100}{\text{Weight of fish}}$$

2.5 Stages of Gonadal Development

Gonadal stages were examined macroscopically and classified according to Nikolsky ^[12] as follows:

stage I- immature, stage II- Developing, stage III- Developing, stage IV- Maturing, Stage V- mature, Stage VI- Ripe(Running) and stage VII- spent.

The number of males and females in the different stages of Gonadal development were counted and recorded.

3. Results

The GSI value in males during September – March were 4.463 to 6.160, After which the values decreased slowly reaching to minimum in May (0.964) & August (0.906), while in females the high values during September – February were found to be 3.289 to 9.124. After which the values decreased slowly reaching to minimum in May & June (0.801). This suggests that male and female gonads mature during September – March, the peak value being in October & November (Table 01) & (Figure 01).

The highest gonadosomatic index value in males were 5.792 (Stage VI) and the lowest GSI value 1.020 were recorded during stage VII, GSI values increased slowly reaching to maximum in stage VI (5.792) and then suddenly dropped to 1.020 in stage VII, while in females the high value was 6.363 during stage VI and the lowest GSI value were 1.125 & 1.124 stages I & II respectively (Table 02) & (Figure 02).

In this study, seven stages of gonadal development were observed in male and female *P. stridens*. These were stage are:

3.1 Ovarian stages

Stage I- (Immature virgin): Small, transparent, yellowish white, a bit asymmetrical, somewhat cylindrical, ova transparent and devoid of yolk deposition, Oviduct long and thin. Fish measures 99-180 mm TL.

Stage II- (Developing virgin): Whitish, small, transparent, a bit asymmetrical, Oviduct a little reduced. Fish measure 109-182 mm TL.

Stage III- (Developing): Oviduct much reduced, granular appearance, Ova not opaque, but just visible to the naked eye. Fish measure 164-193 mm TL.

Stage IV- (Maturing): Yellow, oviduct further reduced, occupying nearly 2/3rd of body cavity, ova still in the follicle. Fish measure 136-188 mm TL.

Stage V- (Mature): Yellowish, occupying 2/3rd to 3/4th of the body cavity, blood vessels ramifies over the surface. Fish measure 148-

195 mm TL.

Stage VI- (Ripe, Running): Occupy almost the whole of the body cavity, deep yellow OR Creamy in colour. Asymmetrical, oviduct reduced, ova larger and be extruded after considerable pressure on belly. Fish measure 150-200 mm TL.

Stage VII- (Spent): Ovaries Shrunken, collapsed, spent, bag like with some residual ova. Fish measure 148-210 mm TL.

3.2 Testicular stages

Stage I- (Immature): Small, thin, whitish, Opaque, a bit asymmetrical. Fish measure 56-178 mm TL.

Stage II- (Develoing): Whitish, elongated, about half of the body cavity. Fish measure 127-177 mm TL.

Stage III- (Developing): More elongated, Vas deference widens. Fish measure 145-198 mm TL.

Stage IV- (Maturing): Quite massive, whitish, blood capillaries visible. Fish measure 151-198 mm TL.

Stage V- (Mature): Pale white, with seldom transverse grooves, viscous fluid oozes out from cut surface. Fish measure 145-190 mm TL.

Stage VI- (Running): More elongated, the outer margins slightly wrinkles, milt expression by a moderate pressure. Fish measure 146-195 mm TL.

Stage VII- (Spent): Testes shrunken with wrinkles, flaccid, grayish, no milt expression. Fish measure 155-190 mm TL.

Table 1: Mean GSI of *P. stridens* in different months.

Month	No. of males	♂GSI %	No. of females	♀GSI %
Jan.	26	4.936	25	5.003
Feb.	27	4.463	29	5.078
Mar.	15	5.580	21	2.065
Apr.	09	1.334	32	1.018
May	06	0.964	5	0.801
Jun.	08	1.15	20	0.801
Jul.	06	2.052	13	1.951
Aug.	13	0.906	18	2.162
Sep.	03	5.108	17	5.118
Oct.	11	6.16	10	9.124
Nov.	18	5.919	17	6.513
Dec.	08	3.284	28	3.289
Total	155	-	236	-

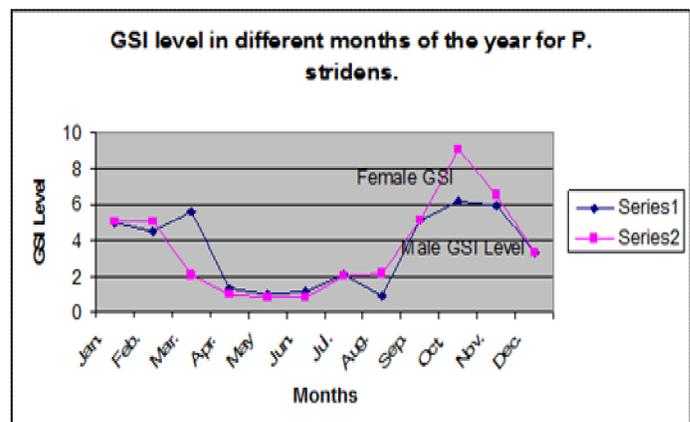
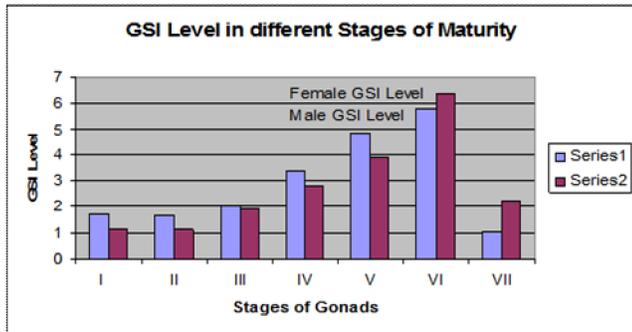


Fig 1: GSI % of Male & Female in different Months

Table 2: Mean GSI values of male and female *P. stridens* in different Gonadal developmental stages.

Testicular Stages	No. of males	♂GSI %	Ovarian Stages	No. of females	♀GSI %
I	30	1.721	I	30	1.125
II	7	1.645	II	28	1.124
III	21	2.039	III	22	1.943
IV	13	3.383	IV	19	2.819
V	27	4.856	V	18	3.909
VI	34	5.792	VI	40	6.363
VII	23	1.020	VII	79	2.261
Total Male	155		Total Female	236	

**Fig 2:** GSI % of Male & Female in different Gonadal developmental stages.

4. Discussion

High gonadosomatic indices were recorded for both male and female *Pomadasys stridens* in this study from September to February, which suggested that the spawning period of *Pomadasys stridens* was September to February, the peak value being in October & November. The gonadosomatic index of *Pomadasys commersonnii* ranged from 0.4 – 5.5 % for both sexes and was high in July to November (Al-Nahdi *et al.*,^[13]). This was in contrast with the results of this study. High gonadosomatic indices were recorded for *P. jubelini* in July to September (Adebiyi,^[14]). Bastard grunt *Pomadasys incisus* had a gonadosomatic index range of 0.159 – 7.880 and high gonadosomatic indices were observed in July to September (Fehri-Bedoui and Gharbi,^[15]). According to Al-Ogaily and Hussain^[16] high GSI were recorded for trout sweet lip grunt, *Plectorhynchus pictus* from March to May. This was in contrast to the results obtained in this study. GSI of silver grunt, *Pomadasys argenteus* was highest in March and an additional small peak was observed in October in the females. High GSI values were observed in February to May in the males. The spawning periods of *Pomadasys argenteus* were February, April and October (Abu-Hakima,^[17]). Spawning occurred throughout the year in bastard grunt, *Pomadasys incisus* (Pajuelo *et al.*,^[18]). This was unlike the spawning period of *Pomadasys stridens* observed in this study which was from September to February, which show a longer spawning period of six months.

The stages of gonadal development observed in both male and female *Pomadasys stridens* in this study were according to Nikolsky^[12] as

stage I- immature, stage II- Developing, stage III- Developing, stage IV- Maturing, Stage V- mature, Stage VI- Ripe(Running) and stage VII- spent. In *Pomadasys jubelini* only three stages (Quiescent, Maturing and Mature stages) were observed (Adebiyi,^[14]). This was unlike the stages of gonadal development observed

in *Pomadasys stridens* in this study. In *Pomadasys commersonnii* all the stages gonadal developments were observed in both male and female fish except the ripe running stage which was not encountered (Al-Nahdi *et al.*,^[13]). Fehri-Bedoui and Gharbi^[15] observed immature, resting, maturing, mature, spawning and spent stages of gonadal development in bastard grunt, *Pomadasys incisus*. Eight stages of gonadal development were observed in silver grunt, *Pomadasys argenteus* (Abu-Hakima^[17]). This study will contribute valuable knowledge needed for fisheries management and aquaculture of *Pomadasys stridens* by increasing the knowledge of reproductive biology of *Pomadasys stridens*.

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