

Biology of *Gazza achlamys* (Family: Leiognathidae) from Andaman coast

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Abstract

The Family Leiognathidae has 17 species under 4 Genera in Andaman and Nicobar Islands waters. The present study focused on the fishery *Gazza achlamys* from the marine fish landings of South Andaman. *Gazza achlamys* was found to be most dominant fishery resource from this family. The size of the species contributing to the fishery ranged between 110 mm to 165 mm and was dominated by the size group 130-139 mm. Length Weight relationship showed more or less isometric growth. Mature specimens were observed between the lengths of 130-149 mm and it was dominated the fishery. The diet composition of *G. achlamys* mainly consisted of small fishes, worms, shrimps, and crustacean shell pieces. The mature fishes showed low gastro-somatic index. The present study on *G. achlamys* is the basic biology information of this fishery resource from Andaman and Nicobar Islands.

Keywords: *Gazza achlamys*, Fishery, Biology, Andaman, Carangidae

Introduction

Fishes belonging to the family Leiognathidae, are commonly referred to as ponyfishes, slipmouth or silver bellies (James, 1984). There are approximately 53 valid species containing six genera namely *Gazza*, *Leiognathus*, *Secutor*, *Photopectoralis*, *Photoplagios* and *Nuchequula* (Fricke et al., 2020). They are small in size, silver in colour and form large schools, active along open coastlines and in bays where water clarity is low (McFall et al., 1984). They are widely distributed in the coastal waters of subtropical regions (James, 1984). These fishes are generally recognized by their protractible mouth either in direction upward, forward or downward (Woodland et al., 2001; Spark et al., 2005). Ponyfishes are the most commercially important by-catch fishes in most of the fishery industry. They accounted for at least 20.1% of the demersal catch in South East Asia in 1976 (Pauly et al., 1979). Along the Indian coast, the silverbellies are abundant mostly along the south-east coast, especially in the Gulf of Mannar and Palk Bay (Devaraj, 1998, Nair, 2005). Silverbellies typically account around 4% of the total marine fish catch in India (CMFRI, 2019). Silverbellies form major fishery resources in the Indian marine fisheries sector and contribute to an important fishery in the states of Tamil Nadu, Kerala, Andhra

Pradesh and Karnataka as well as in Andaman marine fisheries sector.

Members of the genus *Gazza*, with their canine teeth, feed on small fishes and shrimps. The size of the fish mouth type affect the feeding habit of silver bellies (Acharya and Naik, 2016). *Gazza achlamys* species was first time reported from entire Western coast of India in Cochin and Neendakara (Abraham et al., 2011a). There are few works conducted on the leiognathids from various parts of the country (Balan, 1963; Rao, 1967; James and Badrudeen, 1975, 1981; Jones, 1985; Murty, 1983, 1986 a, b, 1990; Jayabalan, 1986, 1988; Murty et al., 2003).

There are no concerted effort on understanding the fishery and biology of fishes from Leiognathidae from Andaman waters other than species documentation (Rajan et al., 2013). The present study gives an insight on the fishery and biology of this important family from this data deficient region.

Material and Methods

The study was conducted based on the marine fishery landings at Junglighat Fish Landing Center, which is the largest and most active fish landing center in South Andaman during the Pre-Monsoon (Inter-monsoon)

season during 2018-19. Photographs of Leiognathidae species were taken from the landing center and market during each visit. The specimens were brought to laboratory for further identification as described by the authors James (1984) and Abraham et al., (2011a).

A total of 95 individuals of *Gazza achlamys* (Fig. 1) consisting of 38 males and 57 females were analysed during the present study. Length frequency and the Length Weight relationship of *Gazza achlamys* was studied to understand the size group contributing fishery and its growth pattern (Jayabalan and Bhat, 1997; Sivakami et al., 1998). Total length (L) (From tip of snout to the end of the caudal fin) was measured using digital Vernier caliper with 0.1 cm accuracy and total weight to nearest gram was also measured using an electronic weighing balance with 0.1 g accuracy and recorded. The sex wise and combined length weight relationship was calculated using the equation: $W = aL^b$ (Le Cren et al., 1951; Abdallah., 2002; Krishna et al., 2015).



Figure 1: *Gazza achlamys*

Where W= Total weight (gm), L= Total Length (mm), 'a' is an intercept and 'b' is the slope.

The fishes were dissected and stomach was separated and weighed. The dissected stomach was classified visually as empty, trace, ¼ full, ½ full, ¾ full and full (Sivadas and Bhaskaran, 2009) based on the distension to understand the feeding intensity. Contents of the dissected stomach were taken on a watch glass and separated on the basis of size and food items. The same were identified to the lowest taxon possible.

Gastro-somatic index (GaSI) was calculated by using following formula:

GaSI= (Fresh weight of the stomach / Total wet weight of fish) X 100 (Sivadas and Bhaskaran, 2009)

Food items were studied under microscope and identified to record type of food present (Jimmy et al., 2003). The number of food items were counted separately and recorded.

Study the reproductive biology, gonads were examined and sex wise maturity stages and gonado-somatic index were determined (immature, mature, mature, ripe and spent) based on Qasim (1973); Crossland (1977) and Ismen (2003).

Gonado-Somatic Index (GSI) was calculated as follows:

GSI= (Fresh weight of the gonad / Total wet weight of fish) X 100

Results

Length Frequency and Length Weight Relationship

The overall sex ratio observed (females to male) was 1:1.5 for this species, during the study. The size contributed to fishery of *G. achlamys* ranged between 110 mm and 169 mm, and 130-139 mm (32.6%) was observed to be dominant (Fig. 2) with 39.5% in males and 28.1% in females. Length frequency for the male, ranged between 110 mm to 159 mm, comparatively lower than the females (110 to 169 mm). The females were more in the higher length classes. Length-weight relationship of *G. achlamys* was studied for combined and also sex wise (males and females separately). The scatter diagram was plotted following regression value and b value calculated presented in Fig. 3. Results have shown that b value for combined (3.4), males (3.1) and females (3.4) are significantly different from the isometric value 3 and indicated positive allometric growth. Also, there were no significant differences among the sexes (ANCOVA, $P > 0.05$).

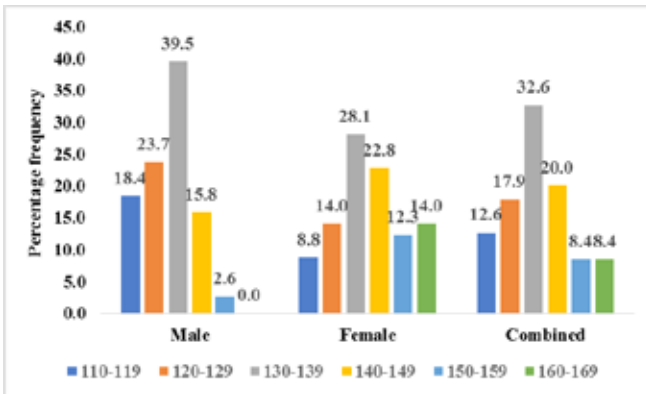


Figure 2. Length frequency of *Gaz*

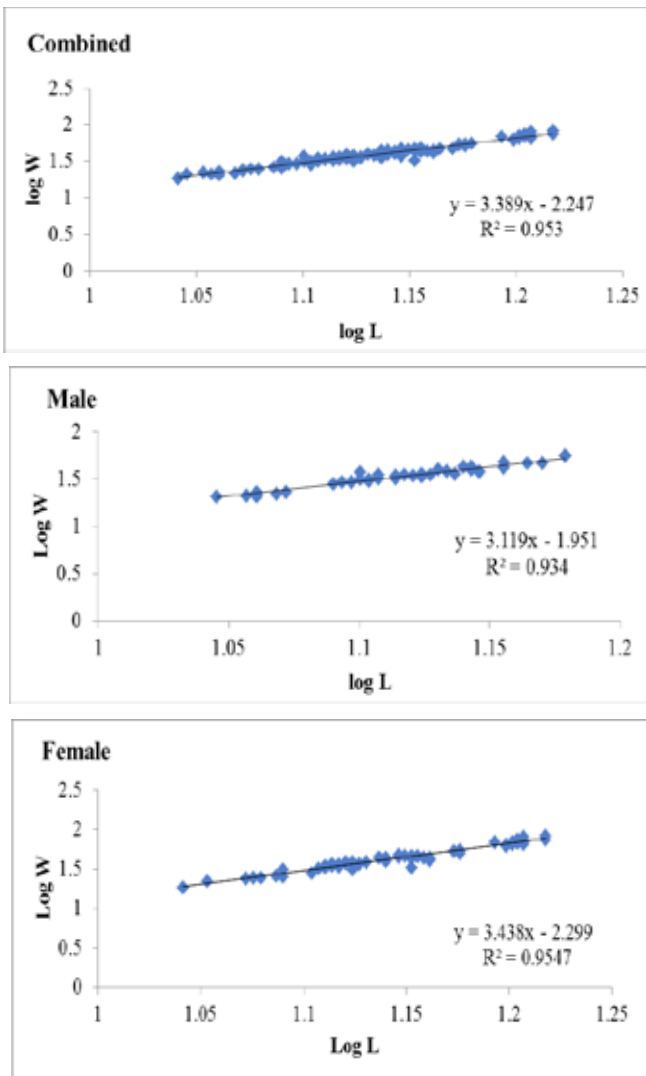


Figure 3: Length weight relationship of *G. achlamys*

The estimated length-weight relationship of *G. achlamys* is given below:

Length-weight relationship (Pooled) $\text{Log } W = 3.4 \text{ Log } L - 2.25$

Length-weight relationship (Males) $\text{Log } W = 3.1 \text{ Log } L - 1.95$

Length-weight relationship (Female) $\text{Log } W = 3.4 \text{ Log } L - 2.29$

Food and Feeding Habits

The dietary observation on *G. achlamys* revealed average feeding intensity during the period of study and was confirmed from the highest percentage of one-fourth (41.1%) and half (28.4%) filled stomachs (Fig. 4). Feeding intensity was found to be higher in females in comparison to males, where full, half full and three-fourth full stomach were recorded more. The length class analysis showed higher feeding rate in the small sized fishes in length class 110-119 mm (Fig. 5), where more fishes were observed with 1/2, 3/4 and Full stomachs. Less feeding intensity was observed in the average sized fishes (120-149 mm) and average feeding intensity was shown by higher sized individuals (15-169 mm). The length class based gastro somatic index analyses have confirmed the trend in feeding intensity (Fig. 6). The average gastro somatic index in the length class 110-119 mm was found to be the highest (2.5485). This was followed by the average GaSI of length class 160-169 mm which had the average GaSI (2.28). Length class 140-149 mm had the lowest average GaSI that is (1.606). The study showed that the prey composition of *G. achlamys* mainly consisted of fish spines (47.6%) and small fishes (22%). The other prominent food item was worms (20.7%), which were found as a whole with minimum digestion. Shrimps and crustacean exoskeletons pieces were found in trace quantities. Sex wise analyses have shown that female fishes prefer small fishes while males showed more or less equal preference to small fishes and worms (Fig. 7).

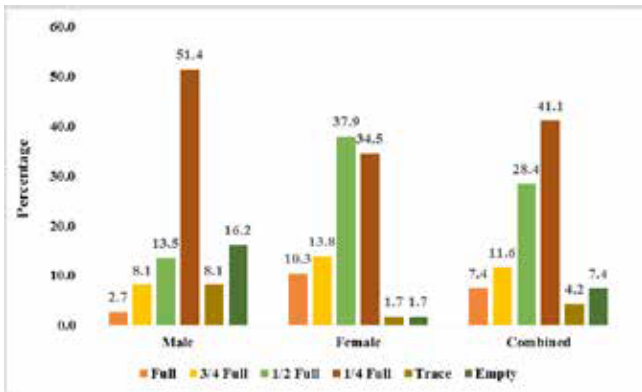


Figure 4: Feeding Intensity of *Gazza achemys*

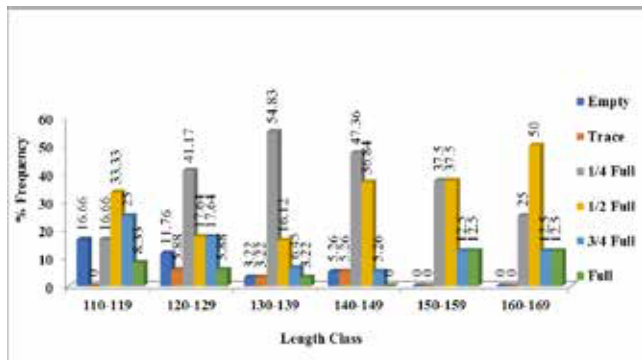


Figure 5: Feeding intensity of *Gazza achemys* according to length class

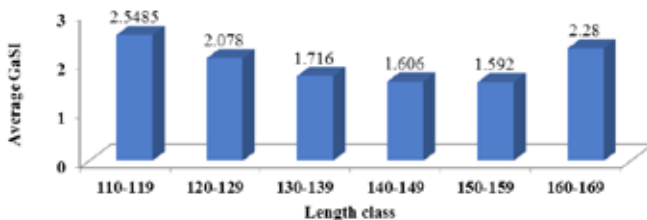


Figure 6: Gastroscopic Index of *Gazza achemys*

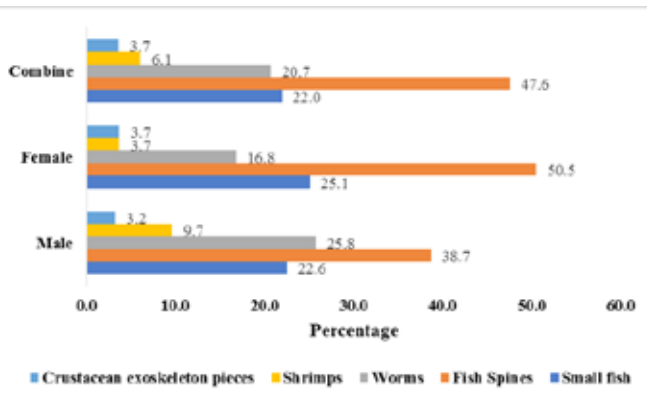


Figure 7: Food composition of *Gazza achemys*

Reproductive Biology of *Gazza achemys*

Gonado-somatic index based on length class (Fig. 8) have shown an increasing trend to the higher length groups. The GSI was highest (4.1) in length class 160-169 mm and 110-119mm had the lowest average GSI (0.7). Analyses of maturity stages of *G. achemys* have shown that the landings is mostly dominated by individuals of maturing stage (Fig. 9) in both males (24.24%) and females (18.94%). Interestingly, the ripe individuals were found only in females and no spent individuals were recorded during the study. This is in accordance with the GSI calculated for the species. Length class based analysis have shown that maturing stage dominated in males with an increase in percentage from the length class 110-119 mm to 13-139mm and decreased (Fig. 10). Mature stages were very less in all length classes and ripe stage absent in males. The females during matured stage dominated in the higher length classes and ripe females were found only in the higher length classes.

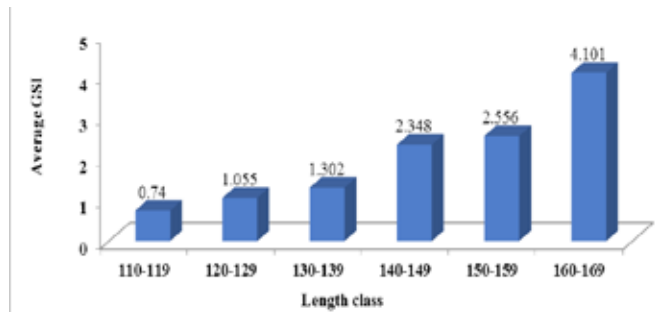


Figure 8: Gonadosomatic Index of *Gazza achemys*

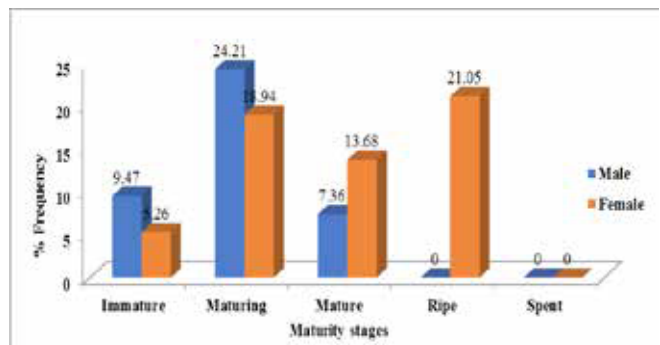


Figure 9: Maturity stages of *Gazza achemys*

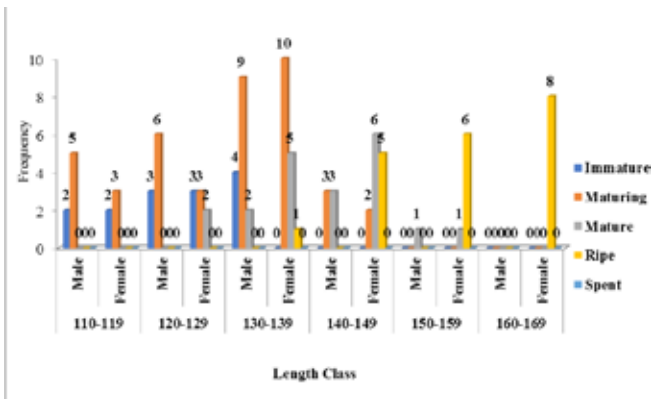


Figure 10: Length class wise maturity stages of *Gazza achlamys*

Discussion

The most dominant length class of *Gazza achlamys* was observed in between 130-139 mm for both the sexes. Length frequency for male ranged between 110-159 mm, which was lower than female 110-169 mm and LWR of this species followed positive allometry growth. Earlier literature (Froese and Pauly, 2019) on biological aspects of *G. achlamys* revealed that maximum length for species were recorded 170 mm and most common length were recorded as 120 mm for males and females. However, the most dominated length from present study showed 130-139 mm which is comparable with earlier recorded data. Studies on other species from the family from south east of Peninsular Malaysia coastal waters (Seah et al., 2009) have shown that the average lengths were comparatively less for *Photoplagios stercorarius* (10.218 cm), *P. bindus* (6.706 cm), *Secutor insidiator* (7.654 cm), *Gazza minuta* (8.802 cm), *Leiognathus fasciatus* (11.127 cm), *L. equilus* (9.385 cm). Jayabalan (1988) recorded 96-105 mm as the most dominating length range of *Gazza minuta* from east coast of India. Previous literature (Froese and Pauly, 2019) also indicated, LWR for *G. achlamys* revealed slightly negative to positive allometry growth with b value was 2.98 (2.80 – 3.16). The results from the present study showed the positive allometry, for which, the b value recorded for pooled (3.39), males (3.11) and females (3.43). Seah et al. (2009) reported 2.211 ± 0.507 for *Gazza minuta*, with a negative allometric growth from southern coast of India.

Leiognathids fed on a variety of food materials, which includes detritus as a major portion with polychaetes, prawns, crabs, fish larvae, copepods, euphausiids, ostracods, gastropods, amphipods, etc. (Tiews et al., 1968; James, 1984; Seah et al., 2009). Earlier available literature on feeding habits for *G. achlamys* reported generally feeds on crustaceans, small fishes and polychaetes. The qualitative analysis of food and feeding habit in *G. achlamys* indicated that, the species is carnivorous and the main food included small fishes and worms. This study showed that the fishes from length class 130-139 mm or maturing fishes had highest percentage of $\frac{1}{4}$ full stomach. Where a lot of stomachs of juveniles and adults were found to be $\frac{1}{2}$ full, $\frac{3}{4}$ full and completely full compared to other fishes. Hence, juvenile, adult male and female had high feeding intensity. Variation occurred in present study of *G. achlamys* had maximum number of $\frac{1}{4}$ full stomachs, followed by $\frac{1}{2}$ full stomachs. The gastro somatic index was found to be highest in length class 110-119 mm and then in length class 160-169 mm which coincides with the fact that juvenile and adults had full stomach.

Studies on reproductive biology of *G. minuta* from Indian coast provided by Jayabalan, (1988) revealed maturity stages to determine length at first maturity where it was indicated that males mature between 81 to 116 mm total length while females mature between 91 to 121 mm total length and gonadosomatic index for the species where females were observed higher indices than males. Comparison to present study on maturity stages of *G. achlamys* were found such as immature, maturing, mature and ripe. The present study supports the previous work for the species *G. minuta*, where the length of mature fishes were slightly more but in case of *G. achlamys*, it was found that most of the mature individuals were observed between 140-149 mm total length. Reproductive biology of the selected species of ponyfishes by Seah et al. (2009) showed that the gonads were mono-lobed with maturing and matured oocytes stages and mean value of GSI for *Gazza minuta* was 0.382 ± 0.070 . From the present study, the gonadosomatic index observed was more in ripening stages followed by mature as reported by Jayabalan (1988) for *G. minuta*. The present study of *Gazza achlamys* showed the ripe females were maximum in number, followed by maturing females in the month of

January. Based on the report of Jayabalan (1986, 1988) *Leiognathus splendens* showed maximum females were immature, whereas maturing and ripe stages were not recorded. This information suggested that the maturation for Leiognathids species were not in the same periods.

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