

Feeding indices of *Planiliza abu* (Heckel, 1843) in Karun River, Southwestern Iran

Miaad Jorfipour¹, Yazdan Keivany^{1*}, Fatemeh Paykan-Heyrati¹, Zaniar Ghafoori²

1. Department of Natural Resources, Isfahan University of Technology, Isfahan, Iran

2. Department of Fisheries, Faculty of Natural Resources, University of Tehran, Karaj Campus, Iran

* Corresponding author's E-mail: keivany@iut.ac.ir

ABSTRACT

The feeding characteristics of *Planiliza abu* in Karun River, Khuzestan Province, southwestern Iran were studied by collecting 460 specimens from November 2016 to September 2017. The specimens were anesthetized in 1% clove oil, fixed in 10% buffered formalin and transferred to the laboratory. The average length and weight of all specimens were 13.18 ± 1.35 cm and 31.05 ± 9.22 g, respectively. The average condition factor for both males and female was 1.34, exhibiting no significant differences in different months in both sexes ($p > 0.05$). The mean relative length of gut in all fish was 2.27 ± 0.36 during the year. The highest gastrostomatic index (GSI) value was in September (12.07), while the lowest in February and March displaying significant differences in different months ($p < 0.05$). A total of 214 empty stomachs were found amongst the 460 fish samples and there were no significant differences in the ratio of empty stomachs in different months ($p > 0.05$). Therefore, based on the visual observations, RLG and GSI, it could be concluded that this species is an omnivorous fish (mainly aquatic insects and plants, algae, diatoms, and detritus) with a modest feeding throughout the year.

Keywords: Condition factor, Gastrostomatic index, Relative length of gut, Vacuity index.

Article type: Research Article.

INTRODUCTION

Feeding habits and ecology are fundamental tools for understanding fish roles within their ecosystems, since they indicate relationships based on feeding resources, and indirectly indicate community energy flux (Ramirez-Luna *et al.* 2008, Dopeikar & Keivany 2015; Ghafoori *et al.* 2018). Understanding fish feeding habits requires extensive field and laboratory studies to infer the main sources of nutrition for a species. Even then, feeding studies can identify the prevalence of food items. However, it is not possible to assess the diet preferences of fish without detailed complementary studies to estimate the range and abundance of potential food items available in their natural environment (Biswass 1993, Aalipour *et al.* 2018). In addition, assessing the diet of fishes is important for aquatic management (Santos *et al.* 2013). It is clear that food habits such as frequency of feeding or size and species of prey, are constrained by the evolutionary history leading to the species body shape and digestive system (Nikolsky 1963). There are many studies about fish diversity and feeding in Iran (Hajiradkouchak *et al.* 2019; Zamani-Faradonbe *et al.* 2021). However, a little documents were found about mugilids. The mugilids consists of nine species in the waters of Iran (Coad 2016). Mulletts are found world-wide in temperate to tropical coastal waters readily entering estuaries and even reside in freshwaters. This family is an important element of the aquatic ecosystem and a number of species are of commercial or other importances (Coad 2021). This family consists of 26 genera with 79 species (Fricke *et al.* 2020). *Planiliza abu* distributed in Asia: Iraq, Syria, Pakistan, Iran and Turkey (Turan *et al.* 2004).

It was described from Iranian tributaries of the Tigris River basin (Keivany *et al.* 2016a), appears in stores as a regular food fish in Ahvaz, Khuzestan, and is an important food in southern Iraq. This study was carried out to provide some information on the feeding characteristics of *P. abu* in Karun River.

MATERIALS AND METHODS

Some 460 specimens of *Planiliza abu* were sampled monthly from November 2016 to September 2017 from lots caught by a fisherman from the Karun River, using a trawl net. Samples were fixed in 10% buffered formalin and transferred to the laboratory. After measuring the total length (cm) and standard length with accuracy of 0.01 and body weight with accuracy of 0.01 g, the specimens were dissected. The age was determined by counting the annuli on the scales. Then the gut weight (g) and length (mm) were measured and recorded. Gastrointestinal components were also examined to evaluate the feeding parameters of stomach fullness and contents. The condition factor was calculated from the equation: $CF = W/L^3 \times 100$, where W = Body weight (g), L = total length (cm; Biswas 1993). The relative length of gut was obtained from the following equation:

$RLG = Li/L$, where Li = length of the gut (cm) and L = total length (cm; Hyslop 1980). The relative length of gut is associated with the type of food eaten. If $RLG = 1$, the fish are omnivores; $RLG < 1$, carnivores; and $RLG > 1$ herbivore. Of course this index is a general one and should be confirmed by examination of the digestive system contents. Gastrointestinal vacuity index was calculated using the equation: $VI = (ES/TS) \times 100$, where ES = number of empty stomach and TS = total number of stomachs examined (Biswas 1993). The index is interpreted as follows:

- If $0 \leq VI < 20$ aquatic medium is rich in nutrition.
- If $20 < VI \leq 40$ aquatic medium is relatively nutritious.
- If $40 < VI \leq 60$ aquatic medium has a moderate nutritional value.
- If $60 < VI \leq 80$ aquatic medium is relatively low in nutrition.
- If $80 < VI \leq 100$ aquatic medium is low in nutrition.

The Gastrosomatic index was calculated using the equation: $GI = Wi/W$ where Wi = weight of the gastrointestinal (g) and W = total body weight (g; Hyslop 1980). Data were analyzed using SPSS 19 statistical software. One-Way ANOVA was used to compare the average of variables in different months. When differences were significant at 95% confidence limit, Duncan's test was used to determine the significance amongst different months. Charts were produced in Excel 2016.

RESULTS

Some 221 female, 207 male and 32 immature specimens were collected. The dominant male and female length class was the 13.1-14 cm (Fig. 1). The males total length ranged from 10 to 17.1 cm (13.16 ± 1.26) and that of females 10.5-17.3 cm (13.44 ± 1.35). The ranges of weight of male and female fish were 12.92-71.28 g ($30.51 \pm 8.64SD$) and 16.23-69.89 g (33.00 ± 9.41), respectively (Table 1). The average condition factor of females and males during different months showed a significant difference ($p < 0.05$; Figs. 2-3), however, there was no significant difference between males and females. The mean condition factor in both males and females was 1.34. The average RLG for all specimens was 2.27 ± 0.36 indicating the fish as a herbivore, however, visual examination of the stomach content revealed the presence of different items (mainly aquatic insects, aquatic plants, algae, diatoms and organic decayed materials) which is characteristics of omnivores. In addition, the comparison of mean of this index in different months exhibited significant differences amongst them ($P < 0.05$; Fig. 4). There was also a significant difference in the RLG of different age groups, the least of which was 1.9 at age 0^+ , which was significantly different from other ages (Fig. 5).

The mean gastrointestinal vacuity index for all specimens was calculated as 46, revealing that the fish have a moderate feeding. Gastrointestinal vacuity index was also calculated in different seasons (Fig. 6) displaying no significant difference in all months (Fig. 7). Amongst the 460 stomachs examined, 214 were empty, 229 full, and 17 semi-full. Comparison of mean values of gastrosomatic index (GI) in males and females and also in all fish in different months showed significant differences ($p < 0.05$). The highest value of GI was recorded in September (12) and the lowest in February (0.03; Fig. 8) in all the fish.

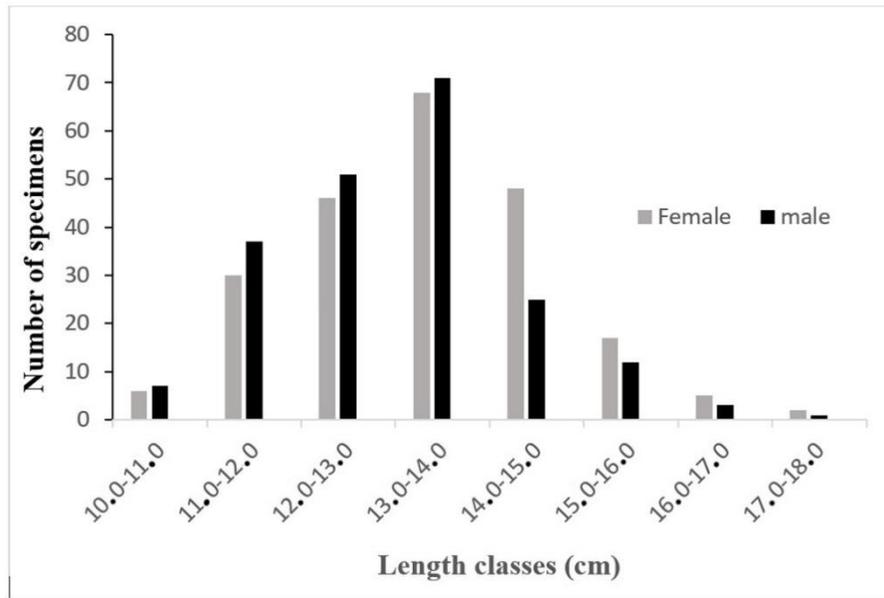


Fig. 1. Length classes of *P. abu* in Karun River (2016-2017).

Table 1. Mean total length and weight of 428 mature specimens of *P. abu* collected monthly in Karun River (2016-2017).

Months	Mean TL ± SD (cm)	Mean TW ± SD (g)
November 2016	14.32 ± 0.96	37.242 ± 8.6232
December	13.53 ± 0.71	29.657 ± 3.8894
January	13.34 ± 0.89	30.837 ± 5.6269
February	15.24 ± 1.04	46.2716 ± 7.9959
March	14.10 ± 0.99	38.112 ± 7.4869
April	12.44 ± 0.83	26.431 ± 5.9189
May	11.95 ± 1.06	22.541 ± 6.0536
June	11.94 ± 0.56	24.756 ± 2.7789
July	11.78 ± 0.89	22.652 ± 5.0896
August	12.55 ± 0.93	27.639 ± 6.7636
September 2017	13.52 ± 0.73	34.601 ± 6.1143
Total	13.18 ± 1.35	31.05 ± 9.22

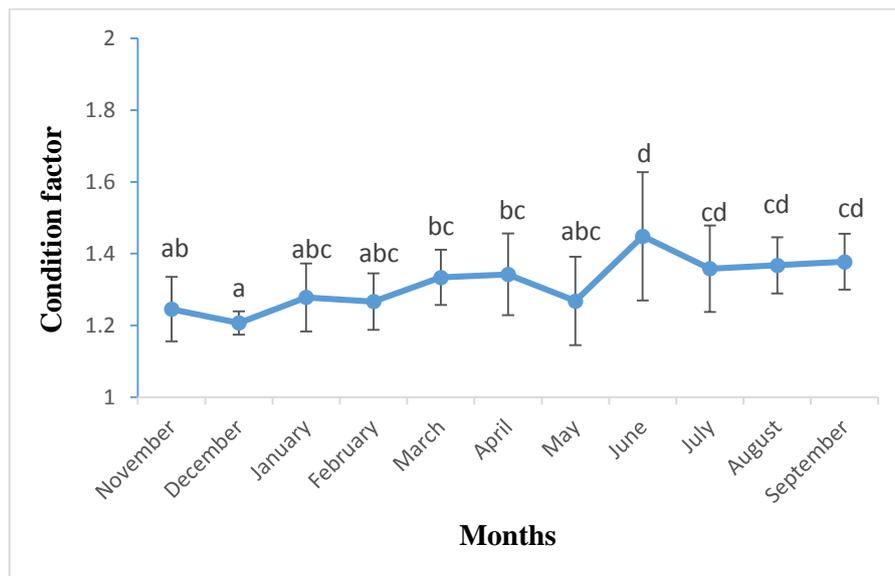


Fig. 2. Mean condition factor of male *P. abu* in different months in Karun River (2016-2017).

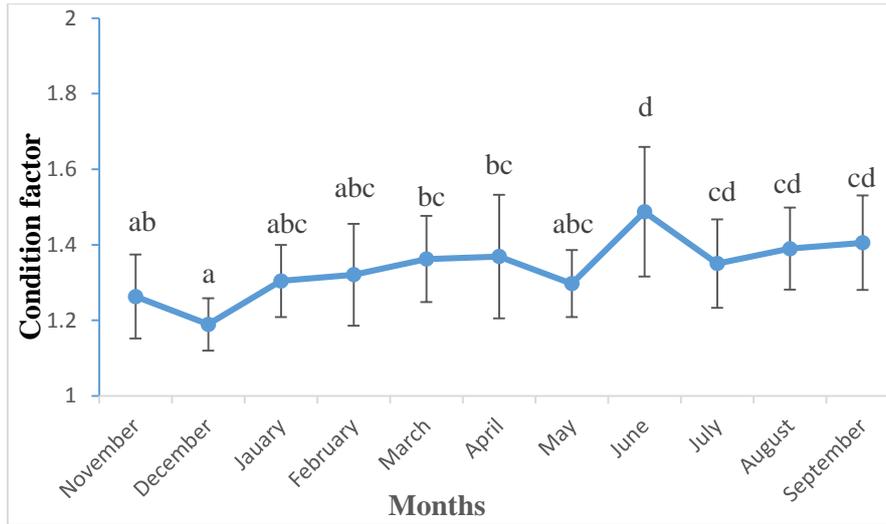


Fig. 3. Mean condition factor of female *P. abu* in different months in Karun River (2016-2017).

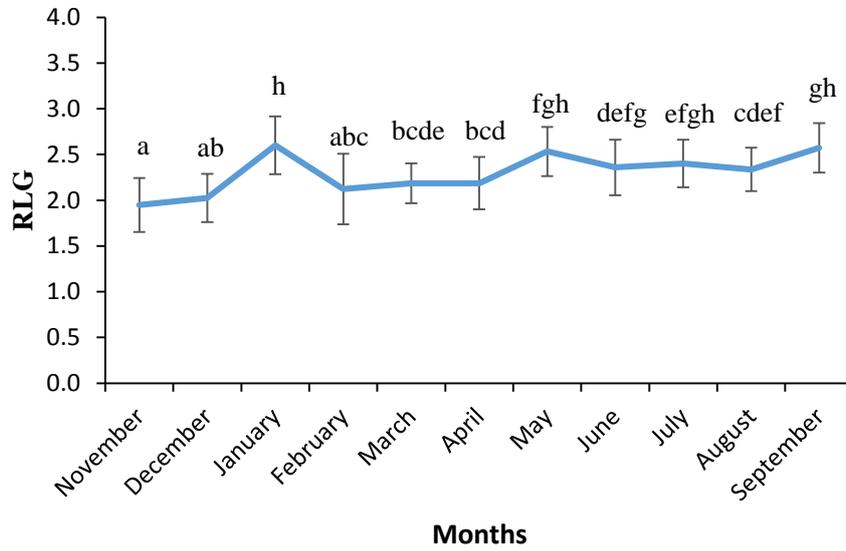


Fig. 4. Monthly variation in relative gut length of *P. abu* in different months in Karun River (2016-2017).

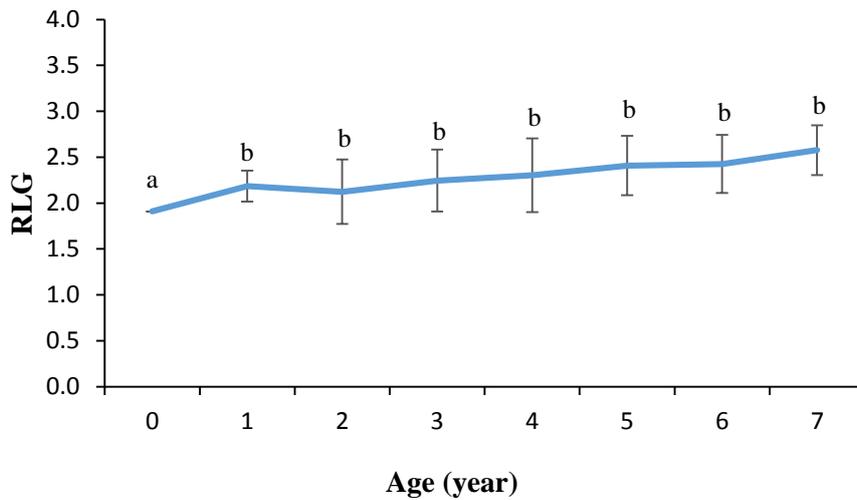


Fig. 5. Relative length of gut at age groups of *P. abu* in Karun River (2016-2017).

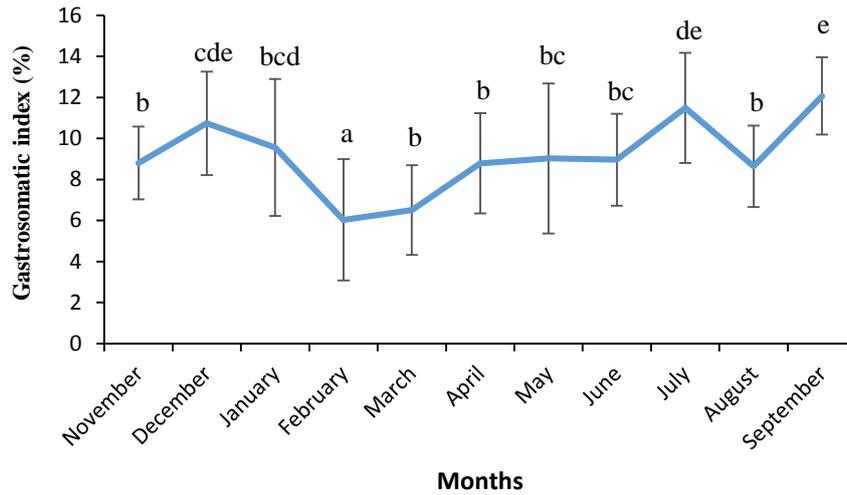


Fig. 6. Monthly variation in the Gastroscopic index of *P. abu* in Karun River (2016-2017).

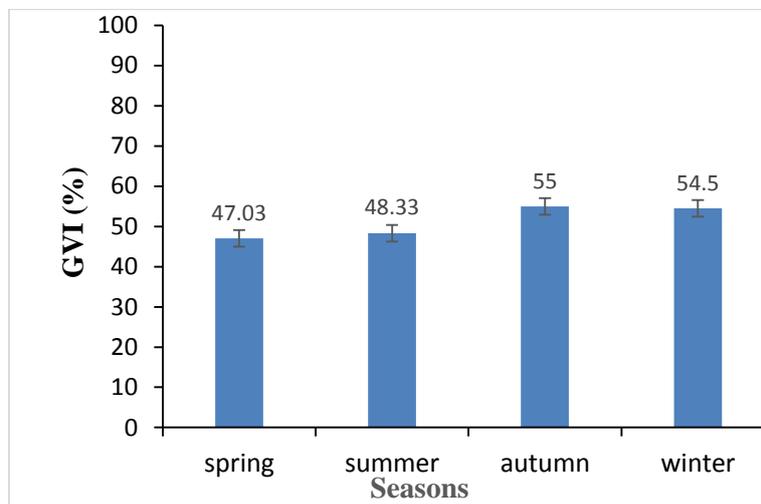


Fig. 7. Seasonal variation in the gastrointestinal vacuity index of *P. abu* in Karun River (2016-2017).

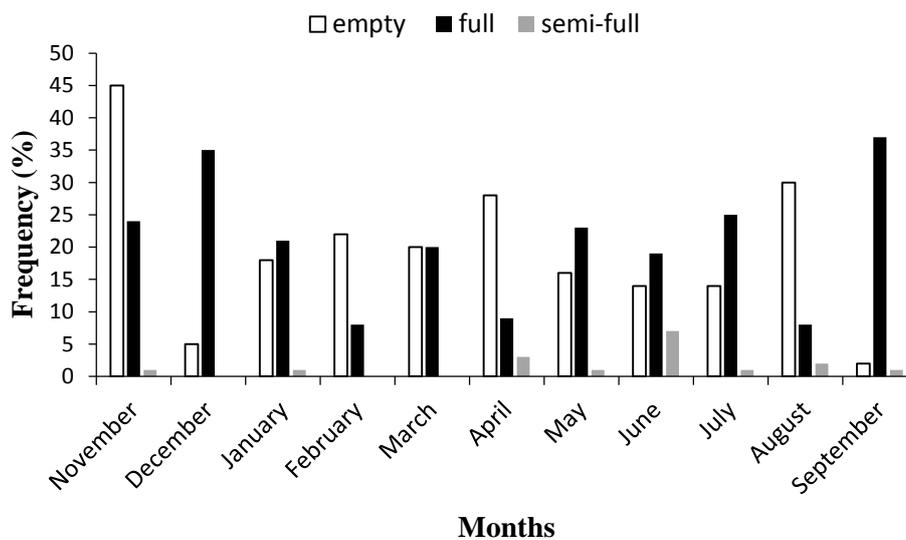


Fig. 8. Percentage of full, empty and semi-full stomachs of *P. abu* in different months in Karun River (2016-2017).

DISCUSSION AND CONCLUSION

It is well known that the food and feeding habits of fishes vary during different stages of their life span. The food preferences depend greatly on the nature of food available in the living habitat, environmental conditions, size or sexual stages of fish as well as inter- and intra-specific competition (Koundal *et al.* 2013, Ghanbarzadeh *et al.* 2014). As Ay and Özcan (2016) reported, the length of the females was higher than that of the males in *Planiliza abu* from Orontes River, Turkey. In the present study, the maximum observed total length and weight of *P. abu* was 17.3 cm and 71.3 g. In general, the differences in the length of fishes could be due to differences in the fishing season, geographic areas, biological and ecological conditions, or inter- and intra-specific differences (Keivany *et al.* 2014, 2015, 2016b, 2017; Keivany & Daneshvar 2016; Keivany & Zamani-Faradonbe 2017). The mean condition factor varied in both males and females showing a significant difference in different months, however, there was no significant difference between males and females, indicating similar feeding habit, growth pattern, fitness and health in both sexes (Fagade 1979). Ay & Özcan (2016) found no significant differences between males and females of *P. abu* ($p > 0.05$), however, they found a significant difference among the months in both sexes. Doğu *et al.* (2013) reported the condition factor values as 1.18 for males and 1.15 for females in Ataturk Dam Lake. Condition factor can contribute to reproductive behaviors and fertility success (Barber 2002). In the present study, the vacuity index of females and males exhibited no significant difference in different seasons ($p > 0.05$), however, it was higher in males.

High values of vacuity index in both sexes can be related to daily feeding cycles, prey availability and reproductive activity of predators (Gancalves *et al.* 1997). Comparison of gastrosomatic index between males and females revealed no significant difference during the year ($p > 0.05$). Maximum index was observed in males during September and in females during July. The mean relative length of gut (RLG) for *P. abu* was 2.27 ± 0.36 , indicating it as a herbivore fish, however, visual examination of the stomach content revealed the presence of different items (Biswas 1993) which is confirmed by gastrointestinal material observed in this study and reported by other authors for *P. abu* (Islam & Khalaf 1983) or related species (Almeida 2003). Gastrosomatic and vacuity indices indicated that *P. abu* in Karun River feeds intensely throughout the year, with a significant increase in November and December. The reason for the high feeding intensity in these two months is probably related to the need for fish to supply more energy spent in developing gonads to complete the reproductive and spawning processes, because these two months precedes the spawning season of the species in Karun River (Jorfipour *et al.* 2021).

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