

Seasonal Variation in Food Preference and Feeding Ecology of Two Juvenile Marine Fishes, *Pseudotolithus senegalensis* (Sciaenidae) and *Brachydeuterus auritus* (Haemulidae) off Cape Coast, Ghana

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Abstract

Aspects of the feeding habits and diet of juveniles of the cassava croaker *Pseudotolithus senegalensis* (Valenciennes, 1833) (Sciaenidae) and bigeye grunt *Brachydeuterus auritus* (Valenciennes, 1831) (Haemulidae) in the inshore waters of Cape Coast, Ghana are reported in the study. Both species had a similar diet consisting of larvae of fish, shrimps and cuttlefish. The croaker ingested prey up to 77% of its total length while the bigeye grunt consumed prey up to 70% of its total length. Analysis of the stomach contents, based on the frequency of occurrence, and numerical and gravimetric compositions of these food items indicated that shrimps were the main food of *P. senegalensis* while *B. auritus* fed mainly on fish. While shrimps constituted the predominant food of the croakers all-year-round, the bigeye grunts appeared to shift their preference for fish to shrimps from June to September. The results of the study are compared with those on croakers from other parts of the Gulf of Guinea. The study, however, appears to be the first to give a detailed account of the food preference and feeding ecology of the bigeye grunt.

Introduction

Juveniles of many marine fish species spend some time in shallow coastal waters where they feed and grow to sub-adults before migrating into deeper waters. Successful recruitment of juveniles to the fishable stock, therefore, depends largely on their survival in the shallow coastal waters (Pitcher & Hart, 1982). In Ghana, the inshore beach seine fishery exploits juveniles of many species, and this could have a negative impact on the successful recruitment of sub-adults into the fishery. An understanding of the ecology of these early developmental stages would be of crucial importance for the effective management of the fishery.

Information on the food habits of the different age groups in a fish stock is essential for assessment of the stock (Wallace & Fletcher, 1996) as it defines the trophic requirements of the various developmental stages. It is also an important requirement for the ECOPATH model (Christensen & Pauly, 1992) used in elucidating aquatic ecosystem functioning and generating critical biological information for fisheries management (Mendoza, 1993; Silva *et al.*, 1993). In Ghana, the food and feeding habits of only a few marine species of economic importance have been studied (e.g. Kwei, 1978; Blay & Eyeson, 1982; Yankson & Azumah, 1993; Blay, 1995ab).

The cassava croaker (*Pseudotolithus senegalensis*) (Valenciennes, 1833) and the bigeye grunt (*Brachydeuterus auritus*) (Valenciennes, 1831) are important in the Ghanaian demersal fishery (Koranteng, 2002), and their juveniles constitute a significant proportion of the catches in the nearshore beach seine fishery. Whilst the food and feeding habits of *P. senegalensis* have been reported in the eastern part of the Gulf of Guinea (Anyanwu & Kusemiju, 1990; Tientcheu & Djama, 1994), there is no known record on the food and feeding habits of *B. auritus* in this ecosystem. Aspects of the dynamics of *B. auritus* in Ghana have, however, been reported (Asabere-Ameyaw *et al.*, 2000). This paper reports on the diet and feeding habits of the cassava croaker and bigeye grunt as part of the process of gathering baseline information for a detailed investigation of the trophic structure of fish communities in the Gulf of Guinea ecosystem.

Materials and methods

Monthly samples of *B. auritus* and *P. senegalensis* were obtained from beach seine landings between Cape Coast and Elmina from March 1996 to March 1997. The specimens were immediately preserved in 10% formaldehyde solution in the laboratory and the total length (TL, mm) of individuals was measured and the body weight (W, g) determined.

The stomach contents of the fish specimens were identified and individual food items counted and weighed. The length of the largest prey item (L_{max}) ingested by each fish was measured to establish the relationship between predator and prey. Further analysis of the stomach contents was performed to determine the percentage frequency of occurrence (%F), numerical percentage composition (C_n) and the gravimetric percentage composition (C_w) of the different food items.

The index of relative importance (IRI) of each food item was calculated using the following equation:

$$IRI = (C_n + C_w) \%F \text{ (Pinkas } et al., 1971)$$

Results and discussion

A total of 631 stomachs of juvenile *B. auritus* (43–140 mm TL) were examined and of these 25.4% were empty, while 12.6% of the 435 *P. senegalensis* stomachs examined (76–225 mm TL) were empty. Both species fed entirely on larvae and fingerlings of fish, shrimps (Peneidae) and cuttlefish (*Sepia* spp.), indicating stenophagy in the species because of the narrow spectrum of food items consumed. Analysis of the stomach content data (Fig. 1) shows that the main food items of *B. auritus* were larvae and fingerlings of fish including those of its own kind, which might suggest this species practices cannibalism. Fish larvae and fingerlings occurred in 45.5% of the stomachs, and accounted for 85.8% of the total number of food items while comprising 62.5% of the weight of food consumed. In *P. senegalensis*, peneid shrimps were the main prey items, occurring in 54.5% of the stomachs, with numerical and gravimetric compositions of 79.4% and 74.8%, respectively. Cuttlefish were, however, less significant in the diet of both species.

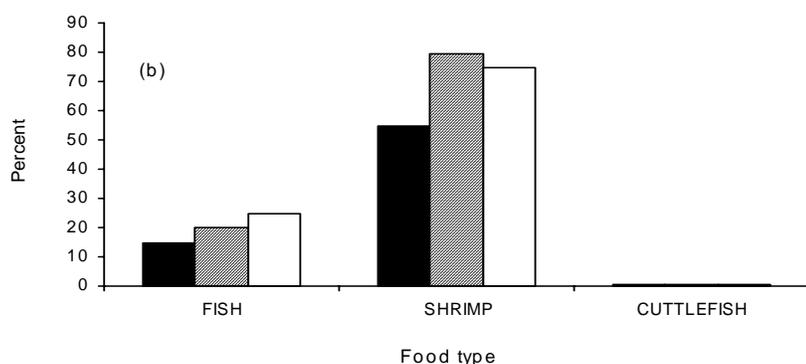


Fig. 1. Percentage frequency and composition of food items in the stomachs of (a) *Brachydeuterus auritus*, and (b) *Pseudotolithus senegalensis*

Studies in Nigeria (Anyanwu & Kusemiju, 1990) showed that *P. senegalensis* fed mainly on shrimps similar to the observation on the Cape Coast fishes, and in Cameroon (Tientcheu & Djama, 1994), shrimps and fish (mainly juvenile clupeids) composed 47% and 45% of the food, respectively. The Nigerian and Cameroonian samples were predominantly adults from trawl catches and, therefore, consisted of specimens from deeper waters. The fish prey of *P. senegalensis* in Cape Coast included *B. auritus* as similarly reported in Nigeria and Cameroon, and this, perhaps, explains the reported higher trophic position of *P. senegalensis* than *B. auritus* (Ménard *et al.*, 2002). It could, therefore, be surmised that adult and juvenile croakers occurring in the Gulf of Guinea have a similar diet.

Monthly variations in the importance of the three food items taken by the two species according to the Index of Relative Importance (IRI) (Pinkas *et al.*, 1971) are illustrated in Fig. 2. Fish larvae and finger-lings were the most important items in the diet of *B. auritus* in May 1996 and January-March 1997 where IRI values > 6,000 were recorded while shrimps assumed a greater importance from June to September 1996 with IRI values ranging from 3,734 to 5,896. Cuttlefish were consumed by this fish in October-December 1996 and March 1997, and were most important in December when the value of the index was 2,000. It is, however, not easy to identify the major factors responsible for the change in the food

preference of *B. auritus* from fish to shrimps in June-September, which incidentally coincided with the upwelling season in Ghanaian waters.

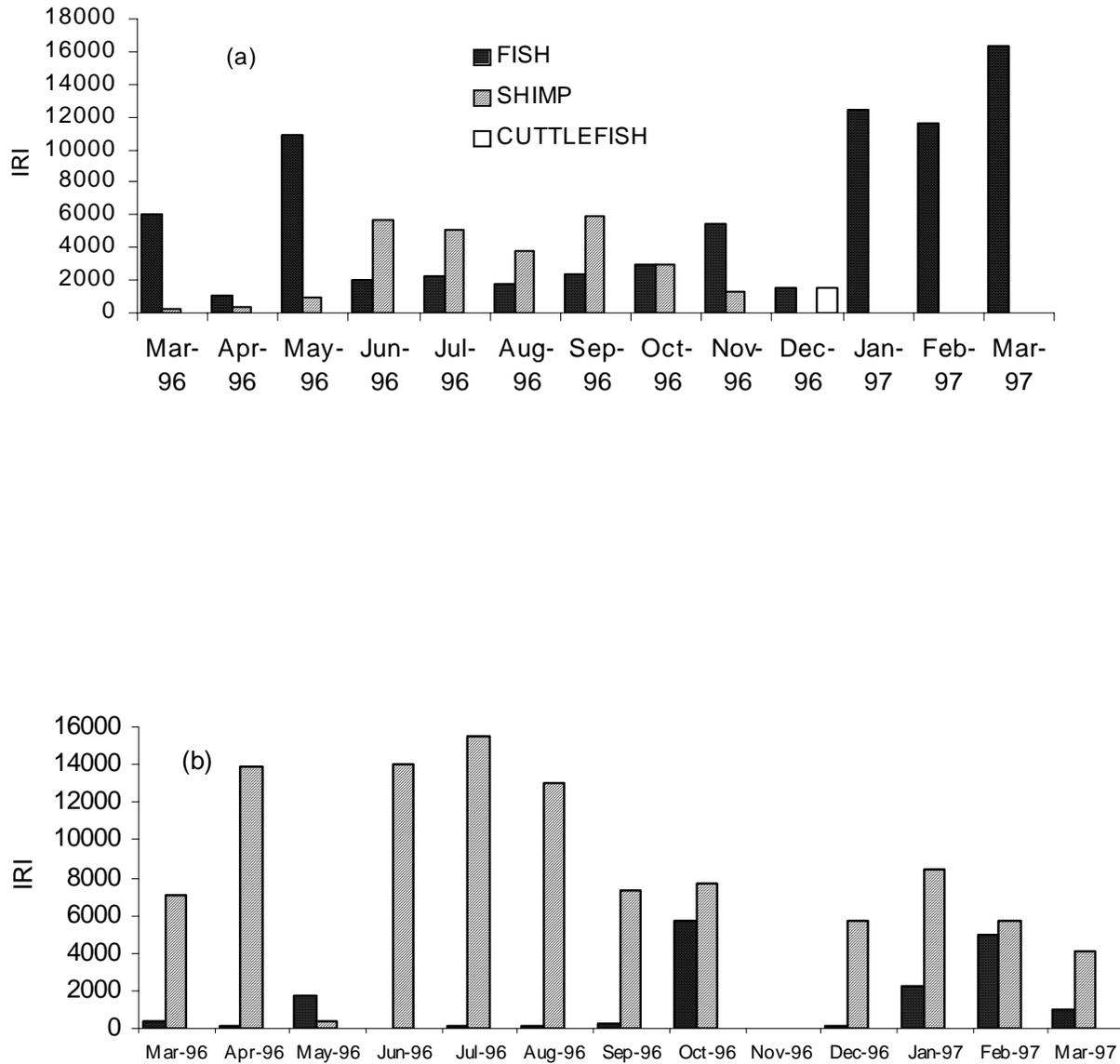


Fig. 2. Monthly index of relative importance (IRI) of food items in the diet of (a) *Brachydeuterus auritus* and (b) *Pseudotolithus senegalensis*

The change in diet of the species could be due to a low availability of its preferred fish food in the benthic habitat as these may have migrated into surface waters to feed on the rich plankton development in the coastal waters during the upwelling season (Mensah, 1966). This assertion is buttressed by the similarly reduced consumption of fish by *P. senegalensis* during the same period (Fig. 2b). In this species, values of the index for shrimps remained higher than for fish throughout the study period, ranging from 7,070 to 15,528 except in May when the value dropped sharply to 433 and prey fish assumed a greater importance with a value of 1,779.

Fig. 3 illustrates the relationship between the size of the two predator species and their prey size. Prey ingested by juvenile *B. auritus* measured 3–70% of its total length. Smaller fishes up to 60 mm fed mainly on fish while larger specimens ate fish, shrimps and cephalopods. In young *P. senegalensis*, prey items measured 2–77% of its length and there was no clear evidence of preference for a particular prey item with size of the predator. There was an apparent exponential increase in prey size with increasing size of *B. auritus*, while in *P. senegalensis* there appeared to be initial rapid increase in prey size as the size of the predator increased but the rate tended to decrease at larger predator sizes (>130 mm).

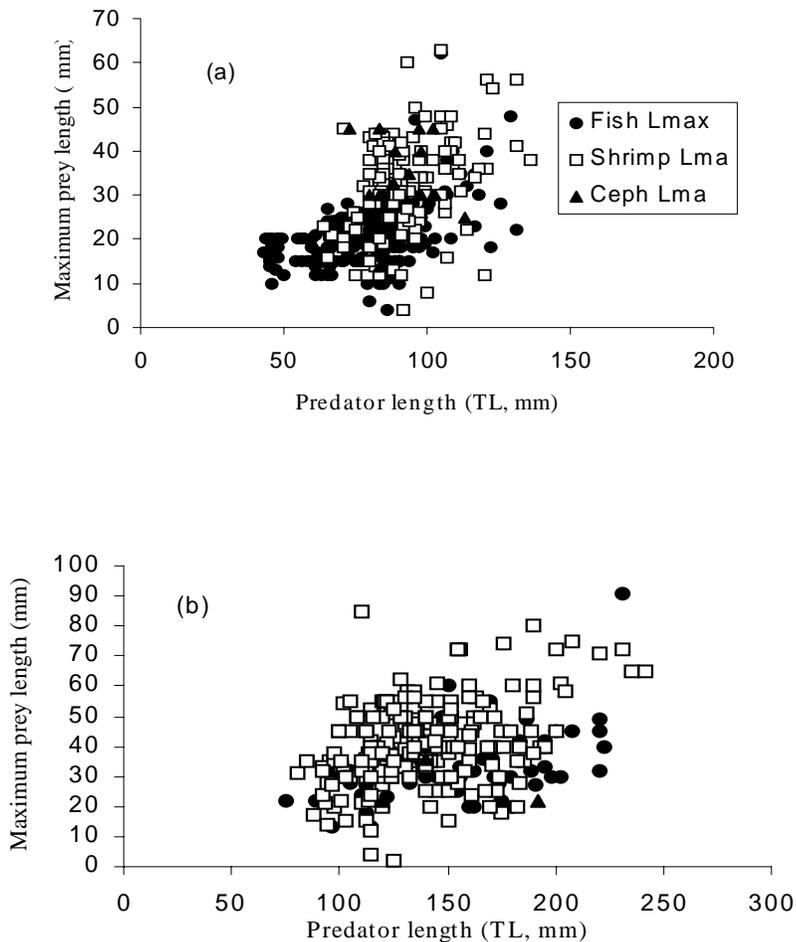


Fig. 3. Scatter diagram of relationship between prey length and length of (a) *B. auritus*, N= 631 and (b) *P. senegalensis*, N = 435

The trend observed in the predator-prey relation for *B. auritus* suggests a possible exponential increase in its gape size with length of the fish, which would allow the ingestion of correspondingly larger prey when they reach sizes 70 mm TL and bigger. In *P. senegalensis* the tendency of the size of prey consumed to approach the asymptote at 120 mm TL may be dictated by the maximum size of their preferred shrimp food in the inshore waters. The largest shrimps consumed measured 65–85 mm in fish ranging in size from 100 mm to 250 mm, and although larger fish prey items were present in this area, the maximum size ingested by this species was 90 mm by a 230 mm specimen. The mathematical equations describing the relationships were, however, not established in view of the large variations in prey size consumed by predators of a given length.

There is no known report on the food habits of *B. auritus* elsewhere in West Africa, except for its listing among carnivorous fishes in Côte d'Ivoire (Ménard *et al.*, 2002). The present study, therefore, appears to be the first to provide a detailed report on the diet of the species in this area.

Conclusion

It may be concluded from the present results that juveniles of the cassava croaker (*P. senegalensis*) and the bigeye grunt (*B. auritus*) are stenophagous, as they fed on a narrow range of food items consisting of larvae and fingerlings of fish, shrimps and cuttlefish. Their preference for a particular food item among this food spectrum suggests possible food resource partitioning between the two species as a means to minimize competition. The food of the Ghanaian croakers is similar to that of the species in other parts of the Gulf of Guinea. Since fingerlings of fish, shrimps and cuttlefish are also caught in beach seining activities in the Cape Coast area, fishing with these gears may be detrimental to the fisheries in general, and the fisheries of these species in particular because of the possible negative effects on the food chains and predator-prey relations in the coastal waters.

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