

# SEASONAL DIET SHIFT IN A TETRAGONOPTERINAE (OSTEICHTHYES, CHARACIDAE) FROM THE UBATIBA RIVER, RJ, BRAZIL

MAZZONI, R. and REZENDE, C. F.

Universidade do Estado do Rio de Janeiro, Instituto de Biologia Roberto Alcântara Gomes/Setor de Ecologia,  
Rua São Francisco Xavier, 524, Maracanã, CEP 20550-013, Rio de Janeiro, RJ, Brazil

Correspondence to: Rosana Mazzoni, Universidade do Estado do Rio de Janeiro, Instituto de Biologia Roberto  
Alcântara Gomes/Setor de Ecologia, Rua São Francisco Xavier, 524, Maracanã, CEP 20550-013, Rio de Janeiro,  
RJ, Brazil, e-mail: mazzoni@uerj.br

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(With 4 figures)

## ABSTRACT

In the present study, we describe feeding habits of *Deuterodon* sp. from the Ubatiba River and explore if diet changes according to a temporal cycle of dry and wet seasons. We observed that *Deuterodon* sp. fed on an extremely high diversity of items ranging from organic matter, sediment (sand plus quartz parts), algae, seeds and leaves to animal organisms, such as, crustaceans, oligochaets and several life stages of terrestrial and aquatic insects, indicating an omnivorous diet. An important shift in the use of feeding resources was also registered; animal and vegetal items had alternated importance between both seasons. Allochthonous vs. autochthonous items analysis showed predominance of allochthonous items during dry season while no significant differences were registered during wet season.

*Key words:* Osteichthyes, Tetragonopterinae, Brazil, Atlantic Rain Forest, coastal stream, feeding habits.

## RESUMO

### **Hábito alimentar de um Tetragonopterinae (Osteichthyes, Characidae) do rio Ubatiba, RJ, Brasil**

Neste estudo descrevemos o hábito alimentar de *Deuterodon* sp. do rio Ubatiba e exploramos a hipótese de que as variações da dieta são função da alternância das estações seca e chuvosa. Observamos que *Deuterodon* sp. ingere ampla variedade de itens, que variam desde matéria orgânica, sedimento (areia e partículas de quartzo), algas, sementes e folhas até organismos animais, tais como crustáceos, oligoquetas e diversos estágios de vida de insetos terrestres e aquáticos, sugerindo uma dieta onívora. Foi registrada importante alternância no uso dos recursos alimentares; itens animais e vegetais alternaram a importância durante as estações. Quanto aos recursos de origem autóctone e alóctone, registramos maior ocorrência dos últimos na estação seca e ausência de diferenças significativas para os primeiros na estação chuvosa.

*Palavras-chave:* Osteichthyes, Tetragonopterinae, Brasil, Mata Atlântica, riacho costeiro, hábito alimentar.

## INTRODUCTION

The Ubatiba River (22°60'S and 42°48'W), together with its tributaries, Silvado, Caboclo, Fundo, Itapeteiú and Ludigério, composes a small fluvial system of the Brazilian East Basin in the

State of Rio de Janeiro. Twenty-two species make up the Ubatiba River ichthyofauna totalling 14 families and/or subfamilies. The characiforms predominate among these families (Mazzoni, 1998) and, *Deuterodon* sp. (henceforth *Deuterodon*) stands out as one of the most abundant species.

It belongs to the Tetragonopterinae subfamily (Characidae), which is the most abundant and has the wildest distribution in the mentioned river (Mazzoni & Lobón-Cerviá, 2000).

Despite their importance in coastal streams, little information concerning *Deuterodon* biology is available. Sabino & Castro (1990) described *D. iguape* feeding habits in a coastal stream from Mata Atlântica and Mazzoni & Petito (1999) described the reproductive strategy of *Deuterodon* from the Ubatiba River (Maricá, RJ). One of the most important limiting factors for such studies is the taxonomical problem; which is discussed by Gomes (1994).

In this work we present a description of the feeding habits of *Deuterodon* from the Ubatiba River, as well as analyses the diet shift according to seasonal patterns. It concerns a preliminary study to the establishment of the trophic structure of such stream dwelling fish community.

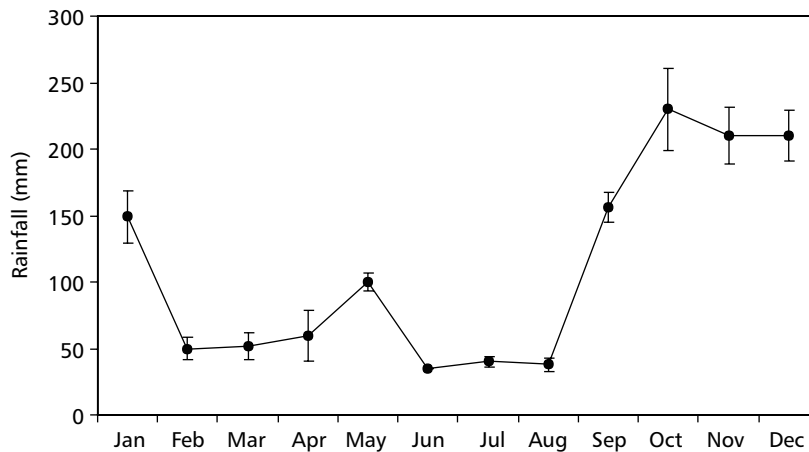
#### MATERIAL AND METHODS

The Ubatiba River is a typical coastal stream 16 km long flowing to the Maricá lagoon. A seasonal rainfall marks the annual hydrological cycle; nonetheless, occasional storms are common all over the year as in other local coastal streams (Fig. 1).

*Deuterodon* specimens were electrofished (AC, 3-4 A, 900W – Mazzoni *et al.*, 2000) during

dry (June, July, August/1995) and wet (September, October, December/1995) months in a 100 m long locality in the medium reaches of the Ubatiba River. Sampled fishes were adult specimens (standard length > 2.8 cm; according to Mazzoni & Petito, 1999) and comprised a wide range of standard lengths, in order to avoid feeding variations related to ontogenetic development. Each collected specimen was conditioned in ice for transportation and dissected to gut removal.

Gut content were then, conditioned in alcohol 70° GL and food items identified under stereomicroscopic, to the lowest feasible taxonomical level. In general, studies on the food of fishes describe numbers or volume of prey items. Owing to the small size of *Deuterodon* guts and, low numbers of items per gut, we considered the Numerical Method (Hyslop, 1980) to better represent the importance of each item in the fish diet. Complementary analyses were done under optical microscopic but, items registered through this method were not quantified. Our results are expressed as the relative abundance of quantified items (stereomicroscopic analyses), i.e., animal vs. vegetal and autochthonous vs. allochthonous items for guts pooled according to wet and dry seasons.  $\chi^2$  tests were applied in order to detect seasonal (dry vs. wet season) differences in food resource use.



**Fig. 1** — Temporal variation of daily mean rainfall values plotted by months, between January and December/1995 (data obtained from INMET).

## RESULTS

A total of 96 specimens were analysed, being 44 from the wet season and 52 from the dry one. All sampled individuals were bigger than 2.8 cm (adult specimens according to Mazzoni & Petito, 1999), this suggests that no difference in feeding habits could be assigned to ontogenetic variation (Table 1).

As a whole, *Deuterodon* ingests many items ranging from organic matter, sediment (sand plus quartz parts), algae, seeds, leaves, crustaceans, oligochaets, nematodes, and several life stages of terrestrial and aquatic insects.

Most specimens (88) had contents in their guts and 13, 24 and 51 had, respectively, only animal, only vegetal and animal plus vegetal as food items indicating omnivory. Considering only quantifiable items *Deuterodon*'s main food resource is animal (Fig. 2).

The animal and vegetal food items differed significantly during dry ( $\chi^2 = 5.3$ ;  $p = 0.05$ ) and wet

( $\chi^2 = 9.3$ ;  $p = 0.05$ ) seasons, animal items were the most abundant during wet season, while vegetal items were the most abundant during dry season (Fig. 3). Autochthonous and allochthonous items did not differ significantly during wet season ( $\chi^2 = 2$ ;  $p = 0.16$ ) but allochthonous items predominated during dry season ( $\chi^2 = 12$ ;  $p < 0.05$ ) [Fig. 4].

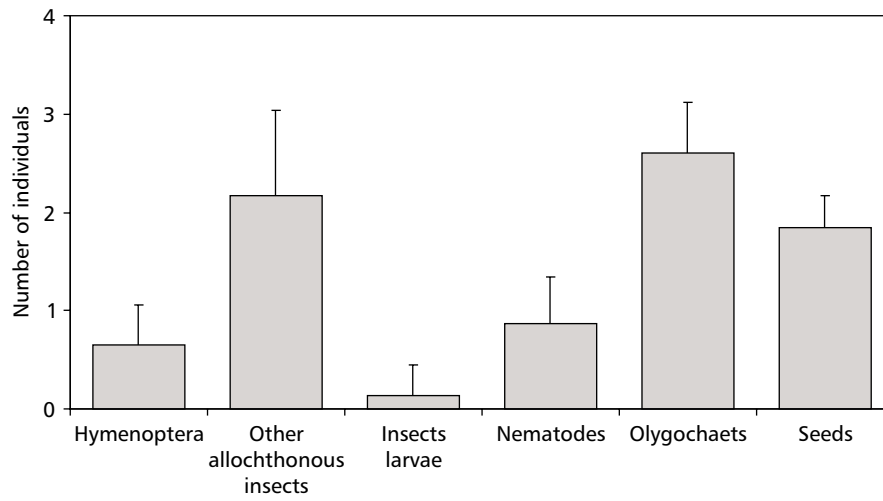
## DISCUSSION

The Ubatiba River, unlike most Neotropical running waters, is essentially a nutrient-rich, high-conductivity river, as a consequence of deforestation and cattle ranching on its surroundings (Mazzoni & Lobón-Cerviá, 2000). *Deuterodon* is one of the most abundant species and widespread distributed in the mentioned river, i.e., it feeds at several trophic levels and exhibits a broad flexibility to ingest practically all organisms available at the site. Nonetheless, its diet is based mainly on autochthonous animal items.

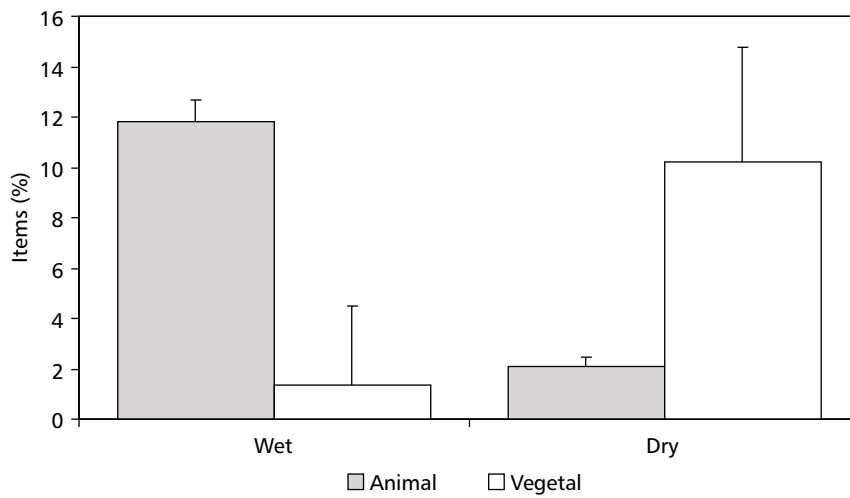
**TABLE 1**

**Absolute frequency (n) of *Deuterodon* sp. specimens, from the Ubatiba River, in each standard length (SL) class; total of sampled specimens (Total), mean (Mean) and standard deviation (SD) of SL.**

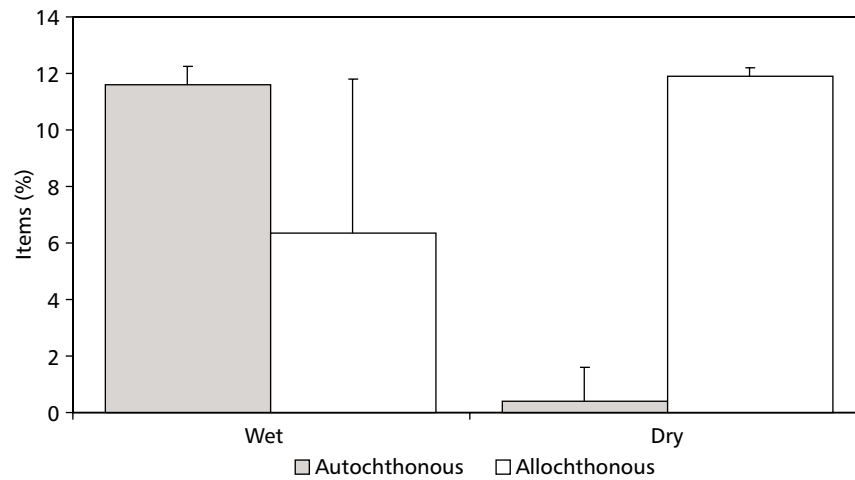
	Wet		Dry	
	SL	n	SL	n
	2.8	10	2.8	5
	2.9	7	2.9	12
	3.0	1	3.0	1
	3.1	3	3.1	6
	3.2	4	3.2	8
	3.3	6	3.3	4
	3.4	3	3.4	3
	3.5	4	3.5	5
	3.6	2	3.6	5
	3.9	1	3.8	1
	4.0	2	3.9	1
	4.1	1	4.0	1
<b>Total</b>	<b>44</b>		<b>52</b>	
<b>Mean</b>	<b>3.2</b>		<b>3.2</b>	
<b>SD</b>	<b>0.37</b>		<b>0.32</b>	



**Fig. 2** — Relative participation of quantifiable food items registered on gut contents of *Deuterodon* sp. from the Ubatiba River.



**Fig. 3** — Relative participation of animal and vegetal food items on the diet of *Deuterodon* sp. from the Ubatiba River, during dry and wet seasons.



**Fig. 4** — Relative participation of autochthonous and allochthonous food items on the diet of *Deuterodon* sp. from the Ubatiba River, during dry and wet seasons.

Arcifa *et al.* (1991) found similar results for *A. bimaculatus* and *A. fasciatus* (Tetragonopterinae related to *Deuterodon*) and detected mainly zooplankton items in their gut content, as also did Ortaz & Infante (1986). Nomura (1975) found exactly the opposite for *Astyanax* spp. from the Mogi-Guaçu River. Sabino & Castro (1990) and Escalante (1987) classified *D. iguape* and *Bryconamericus ihering* (both species related to *Deuterodon*) as carnivorous, finding mainly diptera larvae plus allochthonous insects as food resources.

The predominance of autochthonous items agrees with the way that *Deuterodon* feeds. They often forage near the bottom (RM personal observation). This feeding behaviour facilitates autochthonous items to be ingested in opposition to another stream dwelling fish species, *Mimagoniates microlepis* from the Ubatiba River, that swims and feeds in midwater ingesting large amounts of allochthonous items (Mazzoni & Iglesias-Rios, 2002). Nonetheless, the high occurrence of allochthonous items, registered during dry season, corroborates the hypothesis of various authors (e.g., Winemiller, 1989; Luiz *et al.*, 1998) that allochthonous matter input is the most important

means of food supply in streams, specially during dry seasons.

The main difference, between dry and wet seasons was the relative importance of animal *versus* vegetal items. During dry season we registered predominance of vegetal items (seeds) while in wet season animal items were predominant. Considering the seasonal occurrence of allochthonous vs. autochthonous items, we registered almost total presence of allochthonous items during dry season but high homogeneity in the use of both kinds of resources were registered during wet season. Seasonal shifts in the feeding habits of Tetragonopterinae species were commonly registered in the literature (e.g., Nomura, 1975; Esteves, 1996; Hartz *et al.*, 1996). The trophic spectrum exhibited by *Deuterodon* and the ability to shift prey according to the seasonal cycle has been mentioned for other Neotropical fish species outside the Mata Atlântica coastal streams (Lobón-Cerviá & Bennemann, 2000). In general, such patterns are related to rainy vs. dry seasons (e.g., Goulding, 1980; Winemiller, 1989; Fugi *et al.*, 1996; Almeida *et al.*, 1997; Jepsen *et al.*, 1997; Esteves & Aranha, 1999).

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