Neotropical Ichthyology, 3(2):312-314, 2005

Scientific note

Feeding of juvenile pirarucu (*Arapaima gigas*, Arapaimidae) in their natural environment, lago Quatro Bocas, Araguaiana-MT, Brazil

Valdézio de Oliveira*, Stephania Luz Poleto** and Paulo Cesar Venere*

The stomach content of samples of juvenile *Arapaima gigas* was analized to obtain information about feeding in natural environments. This species occurs in the Amazonian basin, predominantly in floodplain environment. This is the case of the valley of the middle rio Araguaia, where the lago Quatro Bocas is situated. Juveniles *A. gigas* prefered insects, microcrustaceans and gastropods, most of autochthonous origin. All the stomachs examined contained at least one food item.

Analisou-se no presente estudo, o conteúdo estomacal de juvenis de *Arapaima gigas* com a finalidade de se ampliar informações sobre sua alimentação em ambiente natural. Esta espécie ocorre na bacia Amazônica, com predominância em ambientes de planície. Este é o caso do vale do médio rio Araguaia, onde se situa o lago Quatro Bocas. Juvenis de *A. gigas* apresentaram preferência por insetos, microcrustáceos e gastrópodes, sendo sua maioria de origem autóctone. Todos os estômagos examinados continham pelo menos um item alimentar.

Key-words: food habits, Araguaia, Osteoglossiformes, omnivorous.

The Arapaimidae family (Osteoglossiformes) includes two species, one (*Arapaima gigas* Schinz, 1822) found in the Amazonian basin and rivers of Guianas and another (*Heterotis niloticus*) in Africa (Ferraris *et al*., 2003). *A. gigas*, popularly known as pirarucu, is one of the largest among the South America freshwater fishes. They are commonly found in floodplain environments, where large lakes are formed, and they can also be observed in slow running rivers. The valley of the middle rio Araguaia is characterized by the occurrence of innumerable marginal lakes, which are suitable environments for the development of pirarucu. Among these, is the lago Quatro Bocas (15º23'20''S and 51º42'45''W), a 108 hectares lake, located in the left edge of the rio Araguaia, which it connectes in high water periods (Fig. 1).

According to Borges (1987), this system has a well accentuated dry season that culminates in September/October and a period of high water, between February and April. These environmental fluctuations promote a bigger availability of trophic niches, offering a larger amount and quality of food resources in some periods of the year.

Studies on the diet of *A. gigas* characterize it as piscivorous when adult, in tanks and natural environments (Fontenele, 1948; Menezes, 1951; Santos *et al*., 1984; Carvalho & Nascimento, 1992; Neves, 1995; Alfaro *et al*., 1999; Queiroz & Sardinha, 1999; Imbiriba, 2001). On the other hand, information about the diet of juveniles is not available in the literature.

In December 2002, samplings were initiated in the lago Quatro Bocas, according to four seazonal periods within one year. In March 2003, during high water level, 31 juveniles of *A. gigas* were captured. Juveniles were not captured again until December 2003. The objective of this study was to analyze the stomach contents of these specimens to get up-to-date information about the feeding of juveniles of this species.

In the field, the specimens were fixed in 10% formalin and transferred to the laboratory of ichthyology of the Instituto

*Laboratório de Ictiologia, GEPEMA/CNPq, Depto. de Ciências Biológicas e da Saúde, Universidade Federal de Mato Grosso/ICLMA, Rod. MT 100 Km 3.5, 78698-000 Pontal do Araguaia, MT, Brazil. e-mail: drpaulo@cpd.ufmt.br

**Bolsista CAPES, PPG Ciências Biológicas, Instituto de Biociências, Universidade Federal de Mato Grosso, Avenida Fernando Corrêa da Costa s/nº, 78060-900 Cuiabá, MT, Brazil.

Table 1. Volumetric frequencies (FV%) and occurrence frequencies (FO%) of food items consumed by *Arapaima gigas*.

Food Items	FV%	FO%
Organic Detritus	53	100
Insect Remains	21	100
Order Conchostraca	7	100
Class Gastropoda	7	100
Order Hemiptera	4	74
Order Coleoptera	3	74
Order Perciformes (Cichlidae)	2	3
Vegetable Remains	1	45
Order Prostigmata	1	97
Order Amphipoda	0.4	10
Order Diptera	0.3	51
Class Oligochaeta	0.2	3
Seeds	0.2	35
Inorganic Detritus	0.1	7
Class Bivalvia	0.1	7
Phylum Nematoda	0.01	3

de Ciências e Letras do Médio Araguaia, Universidade Federal de Mato Grosso-Brazil, where they were analyzed. Voucher specimens were deposited in the Museu de Ciências e Tecnologia da Pontífica Universidade Católica do Rio Grande do Sul (MCP35980). The stomach contents were quantified in terms of frequency of occurrence (FO%) and volumetric (FV%), in accordance with Hynes (1950) and Hyslop (1980). The volume of each food item was determined using graduated test tubes. For food items volume less than 0.1 ml a graduated glass plate was used where the value obtained in mm^3 was transformed in ml (Hellawell & Abel, 1971). Identification of the food items was aided by description given by Needham & Needham (1982), McCafferty & Provonsha (1983), and Borror & DeLong (1988).

Analysis of the stomach contents of 31 individuals, ranging in standard length between 22 and 26.5 cm, showed that the diet was composed by 16 food items. Of these, six items stood out in FV and FO, respectively, including: organic detritus, 53% and 100%; insects remains, 21% and 100%; Conchostraca, 7% and 100%; Gastropoda, 7% and 100%; Hemiptera 4% and 74% and Coleoptera 3% and 74%. All individuals included in the sample contained some food item in their stomachs. A single individual, 25 cm long, had ingested small fish of the Cichlidae family in its stomach (Table 1).

Queiroz & Sardinha (1999) reported that in juveniles of pirarucu with the size smaller than 50 cm, the main items found in the stomachs were microcrustaceans. According to these same authors, shrimps have been frequently found in individuals longer than 150 cm; the only items common to all ages are the aquatic insects, mainly, Coleoptera and Hemiptera .

These results demonstrate a high capacity for taking advantage of autochthonous resources available in the environment. Organic detritus, inorganic particles with portions of fine sand and vegetal remaining portions also demonstrated the ability of specimens to pick up food near the bottom. In the stomachs of juveniles of the *A. gigas* studied here small food items were predominant, basically invertebrates from diverse orders.

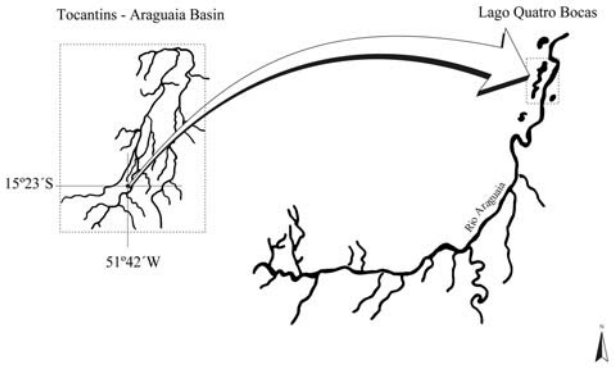

Fig. 1. Partial map showing the Tocantins-Araguaia basin. In prominence, the rio Araguaia. Arrow indicates the lago Quatro Bocas.

Shrimp (*Macrobrachium amazonicum*) and remaining portions of small fishes (*Triportheus elongatus* and *T. angulatus*) have been observed in 50-80 cm long pirarucus (Romero, 1960 *cit in* Neves, 1995). According to this author, in 8-10 cm long individuals, different microcrustaceans, diverse larvae of insects and algae are consumed. Carvalho & Nascimento (1992) indicated that Nile tilapia (*Oreochromis niloticus*), tamuatá (*Hoplosternum littorale*), acari (*Plecostomus* sp.), piabas (common name to some species of the Characidae family) and the cinnamon shrimp (*Macrobrachium amazonicum*) are also used to feed pirarucu in tanks.

Fontenelle (1948) confirms that adult pirarucus are essentially carnivorous, showing a preference for the fish commonly known as cascudo (Loricariidae).

Consumption of insects by juvenile pirarucu observed in this study can be explained by the fact that the environment from which this fish was obtained was a marginal lake with relatively low anthropogenic activity and abundant vegetation on its edges.

Wootton (1990) and Gerking (1994) reported that many fish species have flexible food habits, answering to variations in the availability or exploitation of the potential food. Andrian (1981) confirms that the food regimen of the species is not fixed and immutable, because it is prevailed by biotic and abiotic factors that are constantly changing. Few species are strictly carnivorous or herbivorous (Lagler *et al*., 1962). In the present work, the consumption of vegetal detritus and seeds was small when compared with items of animal origin. The studies carried out by Solar (1943, *cit in* Menezes, 1951) revealed that pirarucu is an omnivore fish which picks up food on benthic organisms and portions of plants that could be carried by water.

About the origin of the food, Lowe Mc-Connell (1999) noticed a linear succession of dominant food sources in streams and rivers and that the allochthonous materials were more important for fish in headwater. The same author com-

ments that, as the environments extend and get deeper, as in lakes, the autochthonous food sources become more important. From the analysis of food items found in the diet of *A. gigas*, it was characterized that the main food resources have autochthonous origin.

The studied species revealed, in this initial phase of life, food preference for aquatic invertebrates; however, an ample trophic plasticity was also noticed. These results are relevant to the preservation and production of this species. The *A. gigas* is a species that can be considered to be in danger of extinction. Protection politics must take into account scientific information about this species obtained in its natural habitats.

Acknowledgements

We thank the team of the Grupo de Estudos em Peixes do Médio Araguaia - GEPEMA/CNPq and the biologist Rosemara Fugi for the review and suggestions to improve this manuscript; the IBAMA - GEREX II, for the logistic support; and to Jazon Leonino de Oliveira and Humberto Pereira Rego, for technical assistance.

Literature Cited

Alfaro, M.R., F.A. Bocanegra & M.V. Garcia. 1999. Manual de Piscicultura Del Paiche (*Arapaima gigas* Cuvier). Tratado de Cooperacion Amazonica–Secretaria pro Tempore. Caracas, Venezuela, 71 p.

Andrian, I.F. 1981. Estrutura da população e alimentação de *Parauchenipterus galeatus* Linaeus, 1766. (Siluriformes, Auchenipteridae), do reservatório de Itaipu e alguns de seus tributários, PR. Unpublished Ph.D. Dissertation. Universidade Federal de São Carlos, SP 244 p.

Borges D.R. 1987. Rio Araguaia, Corpo e Alma. IBRASA: Editora da Universidade de São Paulo-SP, 403 p.

Borror, D.J. & D.N. Delong. 1988. Introdução ao estudo dos insetos. Editora Edgard Blucher Ltda, São Paulo-SP, 653 p.

Carvalho, L.D.M. & C.N.B. Nascimento. 1992. Engorda de pirarucu (*Arapaima gigas*) em associação com búfalos e suínos. Empresa Brasileira de Pesquisa Agropecuária - Centro de Pesquisa Agroflorestal da Amazônia Oriental, Belém-PA, Circular Técnica nº 65, 1-21.

Ferraris, Jr.C.J. 2003. Family Arapaimatidae. *In*: Reis, R.E., Kullander, S.O., Ferraris, Jr, C.J. (Eds.). Check list of the freshwater fishes of South and Central America. Porto Alegre, Brazil: Edipucrs, 729 p.

Fontenele, O. 1948. Contribuição para o conhecimento da biologia do pirarucu *Arapaima gigas* (Cuvier) em cativeiro (Actinopterygi, Osteoglossidae). Revista Brasileira de Biologia, Rio de Janeiro, 8(4): 445-459.

Gerking, S.D. 1994. Feeding ecology of fish. San Diego, California: Academic Press, 416p.

Hellawell, J. M.& R. Abel. 1971. A rapid volumetric method for the analysis of the food of fishes. Journal of Fish Biology, 3: 19-37.

Hynes, H.B.N. 1950. The food of freshwater sticklebacks (*Gasterosteus aculeatus* and *Pigosteus pungitius*), with a review of methods used in studies of the food of fishes. Journal of Animal Ecology, 19 (1): 411-429.

Hyslop, E. J. 1980. Stomach contents analysis: a review of methods and their application. Journal of Fish Biology, 17: 441-429.

Imbiriba, E.P. 2001. Potencial de Criação de Pirarucu, *Arapaima gigas*, em cativeiro. Acta Amazônica, 31(2): 299-316.

Lagler, K.F., J.E. Bardachi & R.R. Miller. 1962. Ichthyology-The study of fishes. John Wiley . New York, 545 p.

Lowe Mc-Connell. R. H. 1999. Estudos ecológicos de comunidades de peixes tropicais. Tradução Anna Emília A. de M. Vazzoler, Ângelo Antonio Agostinho, Patrícia T. M. Cunningham. Editora da Universidade de São Paulo-SP, 534 p.

McCafferty, P.W. & A.V. Provonsha. 1983. Aquatic Entomology. Editora. Jones and Bartlett Publishers 2ª edição Boston, 448 p.

Menezes, R.S. 1951. Notas biológicas e econômicas sobre o pirarucu. Serviço de Informações Agrícolas. Série Estudos Técnicos nº 3. 152 p.

Needham, J.G. & P.R. Needham. 1982. Guia para el estudio de los seres vivos de las aguas dulces. Editorial Reverté S.A. España. 129 p.

Neves, A.M.B. 1995. Conhecimento atual sobre o pirarucu, *Arapaima gigas* (Cuvier 1817). Projeto IARA – Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis. Santarém-PA. 33-56.

Queiroz, H.L. & A.D. Sardinha. 1999. Estratégia para manejo de recursos pesqueiros em Mamirauá. Helder Lima Queiroz e William G.R. Crampton, (Eds). Sociedade Civil Mamirauá, CNPq. Brasília, 108-141.

Santos, G.M., M. Jegu & B. Merona. 1984. Catálogo de Peixes Comerciais do Baixo Rio Tocantins. Projeto Tucuruí. Eletronorte/CNPq/INPA. Manaus, 82 p.

Wootton, R. L. 1990. Ecology of teleost fishes. Chapman & Hall. London, 440 p.

Received November 2004
Accepted June 2005