

Trophic niches in an Argentine pond as a way to assess functional relationships between fishes and other communities

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Abstract

The goal of this study was the identification of trophic niches of several fish species and, consequently, the differentiation of habitats in terms of diet components, seen as an indirect way of linking predators as a function of prey to the various limnological communities.

Samples of digestive tracts from 11 fish species captured in 1992 at Guemes Pond (Azul, Argentina) were analysed. Fifty-four food items were identified, which were grouped as 18 variables. Multivariate techniques were used to analyse the data.

Four groups of samples were segregated on the basis of their associated communities:

- piscivorous species: *Hoplias maiabaricus* and adults of *Oligosarcus jenynsii*;
- phytoplankton-periphytophagous species: *Bryconamericus iheringhi*, *Cheirodon interruptus* and *Cyphocharax voga*;
- zooplanktophagous species: *Odontesthes bonariensis*; and
- zoobenthophagous species: *Rhamdia sapo*, *Astyanax eigemmanniorum*, juveniles of *O. jenynsii*, *Corydoras paleatus* (with incursions to the zooplankton), and *Loricarichthys anus* (with incursions to the phytoplankton-periphyton). *Cichlusomafacetum* exhibits a general, opportunistic diet.

Introduction

Traditionally, fishes were considered to be part of the nekton (Wetzel, 1975; Schäfer, 1985), even if they did not make up a functional entity. Although their swimming ability allows them to move throughout the environment, many fishes present morphological, physiological and behavioral differences which indicates that their niches are diverse (Ringuet, 1975; Gatz, 1979; Hartney, 1989; Jachner, 1991; Winemiller, 1992).

As a way to decrease the interspecific competition for food, and related to the food supply, the segregation of trophic niches of the nekton species involves a differentiation of habitats based on the preyed-on community (Nilsson and Northcote, 1981; Flecker, 1992; Schiemer and Wieser, 1992; Dörgeloh, 1994). Their members establish stronger relationships with other aquatic communities, which allows building up links in ecological terms.

That would imply the disaggregation of the nekton community when looking at closer links between each species and the food-source community. Such a relationship is much more consistent than that given when comparing fishes in terms of typological similarities. The neotropical ichthyographic region, with its high diversity of species (Eigenmann, 1907; Ringuet, 1975), appears to be a plausible scenario for testing the appropriateness of such a hypothesis.

The trophic niche of each species can be depicted by the identification and quantification of the diet components found in their digestive tracts. Fish diet features are usually studied by describing the food items found (up to the lowest taxonomical level attainable), by calculating the frequency of each item or the volume occupied, etc. (Hynes, 1950; Hellawell and Abel, 1971; Windell and Bowen, 1978; Berg, 1979; Hyslop, 1980; Bowen, 1984). In general, results were presented in a very descriptive manner using a simple statistical treatment, which hindered achieving an integrated view on how the system functions.

Given such shortcomings, multivariate analysis techniques are believed to be able to integrate the information of all variables belonging to the trophic niche (Hughes, 1985). Despite the loss of information embedded in those techniques, they set up an objective basis for the discrimination of the various functional groups of variables-samples clusters. Such techniques, many times used and discussed (Wartenberg et al., 1987; Peet et al., 1988; Jackson and Somers, 1991), have been employed in the analysis of fish diets (Graham and Vrijenhoek, 1988; Rice, 1988; Baltanas and Rincon, 1992, to note a few papers). By making use of multivariate analysis techniques, the sequential objectives of this paper are to identify the trophic niches of the eleven fish species found in a typical pond environment and to relate the predator to the prey community.

Materials and methods

The fish specimens were captured at Guemes Pond (36°50' S, 59°50' W), in Azul City, Argentina, which has a surface area of 2.5 ha with a mean depth of 1.5 m. Different gear was used (seine nets and gill nets) between August and November 1992, subsampling at least 10 specimens for each of the 11 species identified (Table 1). Season-dependent variations were not considered because the data were collected mostly during spring (September 21 to December 21 in the southern hemisphere). The digestive tracts were fixed in 5% formaldehyde. The contents of the tracts were spread over Petri dishes and identified/counted with either magnifying glass and/or microscope. The food items were determined at different taxonomic levels so as to assess the prey's original community (Table 2). The relative abundance was classified into six categories: very abundant, abundant, common, scarce, very scarce, and absent, which were coded from 5 to 0, respectively. The relative abundance is a variable that integrates the number and the volume of food items, thereby giving an idea about their importance with respect to the fishes' diet. Due to the high number of zero values, which hinders the statistical treatment (Baltanas and Rincon, 1992) and the noise that variables with low relative frequency introduce in the data matrix, the 54 originally identified food items were grouped and reduced to 18

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