Journal of the American Killifish Assoc 35(5) 133-136 *(2002)*

Culture Parameters of the Annual Fish, *Cynopoecilus melanotaenia* (Regan, 1912) Based on a Temporary Water Body Characteristics

(Cyprinodontiformes, Rivulidae)

Alexandre Arenzon, Alberto Carvalho Peret and
Maria Beatriz Camino Bohrer

Introduction

Annual fish are defined as a group of Cyprinodontiform fish that can be found in temporary ponds, ditches and mudholes occurring in some parts of South America and Africa that dry out seasonally (Myers, 1942). The complete drying out of that aquatic habitat leads to the death of all adult and juvenile fish. The population survives as buried eggs for up to 18 months (Wourms, 1972). When the next rainy season starts, a new reproductive cycle begins, ponds refill and embryos hatch. The larval fish rapidly grow, become sexually mature and spawn repeatedly over a long period (Myers, 1942, 1952; Carvalho, 1957; Walfourd & Liu, 1965; Lacerda, 1969, Costa, 1990; Arenzon, 1999, 2001).

Due to its fast corporal growth, precocious sexual maturity, and long reproductive period, these annual fish seem to present basic characteristics of species that could be used in toxicity tests. Some species can even become sexually mature after 6-8 weeks of life (Vaz-Ferreira et al., 1964; Walfourd & Liu, 1965; Weitzman & Wourms, 1967; Arenzon, 1999). The use of annual fish as test organisms in toxicity tests could help to solve some problems of this kind of biomonitoring, such as continuous culture and/or recruitment of live stocks of test organisms in a healthy condition and in sufficient numbers.

The culture of organisms in the laboratory implies previous knowledge of biological characteristics such as the reproduction and growth of the species, as well as the physical and chemical parameters. Some factors have been put forward as significant stressful at some time in the life of organisms inhabiting temporary waters: desiccation, chemical variation (variation in ionic proportions), high temperature, low oxygen concentration,

high light intensity, habitat isolation (Harland-Rowe, 1972; Belk & Cole, 1975; Wiggins et al., 1980; Louw & Seely, 1982 and Willians, 1985). According to Williams (1985), there is a lack of information on this subject for South America temporary water. The present study aims to present the variation of some physical and chemical parameters found in a temporary water body where *C. melanotaenia* can be found. Based on these information culture parameters were determined.

Material and Methods

The information was collected in a temporary water body, located on the northern Coastal Plain of Rio Grande do Sul State, Brazil (29°58'48" and 29°58'54" S; 50°14'12"and 50°14'20" W).

Monthly superficial samples were carried out for the physical and chemical analyses. All samples were completed at the same period of the day, between 10:00 and 11:00 am. The analyses of pH**,** total alkalinity**,** chloride**,** hardness**,** dissolved oxygen and BOD_5 were done according to APHA, 1985. Depth and bottom water temperature were also analyzed.

Results and Discussion

Williams (1985) considered six main types of temporary water bodies based on a combination of degree of predictability, salinity level, and extent at which these waters occupy discrete basins or are associated with seasonally or unpredictably flooding rivers. This author defines as temporary water bodies those that occupy discrete inland basins containing fresh or saline water and which dry out for some time each year, or that are usually dry, but contain fresh or saline water in some years. According to Williams' classification, the habitat of *C. melanotaenia* is a "Type A temporary water body", which mean fresh, with predictable filled water basins not associated with rivers. This type of water body is typical, but not exclusive, from temperate regions.

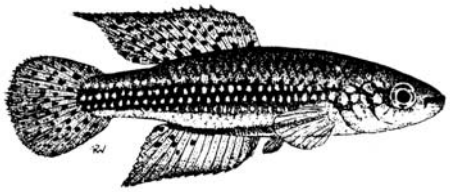
The most variable parameters that we recorded were temperature, oxygen and biochemical oxygen demand (BOD) (Table I). The water temperature in shallow ephemeral ponds was closely similar to the air temperature and strong fluctuations were recorded. At the bottom of our temporary pond, temperature fluctuations ranging from 13.0 to 28.4 °C (average = 20.3 °C) were recorded during the year. The concentration of dissolved oxygen showed a great variation during the study period. The analyses showed the lower concentration (1.5 mg. L^{-1} of O_2) in the autumn, and the higher (11.2 mg. L^{-1} of O_2) in the winter. The variation in the oxygen concentration for the entire study period was 55%. During the dry phases, heterotrophic respiration may cause a serious decrease in the oxygen levels. This could explain the low concentrations found in the autumn. Despite the very low oxygen rate found in the autumn *C. melanotaenia* was normally found in the pond during this period, evidencing the low oxygen needs of this

species. The biochemical oxygen demand (BOD) also showed a high variation during the study period (53%). The annual average of oxygen consumption was 64% of the initial oxygen. The lower oxygen consumption was recorded in the winter (6 %), and the higher during the summer (100%).

The values of pH, alkalinity, chloride and hardness presented a very low variability through the year. The pH values showed a low annual variation (3.1%), evidencing a system without great alteration. The lower value was recorded during the summer (pH = 6.2) and the higher value was recorded in the autumn (pH = 6.8). The annual average for the study period was 6.5. The annual average of alkalinity was 0.308 meq . L^{-1}, with a coefficient of variation of 25%. The maximum value was recorded in the spring (0.424 meq . L^{-1}), and the minimum value during the winter (0.212 meq . L^{-1}). Chloride values showed a variation between 6.3 mg/L and 13.7 mg . L^{-1} of CL^{-}, both extreme values were recorded during the winter period. The annual average was 9.9 mg . L^{-1} of Cl^{-} and the variation was 24%. The low hardness degree characterizes this water body. An annual average of 16.9 mg.L^{-1} of CaCO3 (variation = 28%) was found. The values varied from 10.9 mg.L^{-1} of $CaCO_3$ (winter) to 22.5 mg.L^{-1} of $CaCO_3$ (autumn).

Table I -Monthly, annual average variation, maximum and minimum value, standard deviation (s) and coefficient of variation (CV) of the analyzed chemical variables in the collection site during the study period.

	pH	**Alkalinity** meq/L	**Chloride** mg/L of Cl^{-}	**Hardness** mg/L of $CaCO_3$	**DO** mg/L of O_2	**BOD_5** mg/L of O_2	**BOD_5** %
APR	6.5	0.342	9.9	18.4	1.54	0.96	62
MAY	6.5	0.378	8.5	21.7	4.05	3.62	89
JUN	6.5	0.214	6.3	12.3	5.02	-	-
JUL	6.7	0.214	8.1	10.9	11.21	2.75	25
AUG	6.8	0.212	13.7	10.9	11.21	0.69	6
SET	6.6	0.424	11.6	21.5	6.20	2.71	44
OCT	6.5	0.263	8.4	11.7	6.78	6.78	100
NOV	6.6	0.315	7.9	21.5	4.26	3.48	82
DEC	-	-	-	-	-	-	-
JAN	6.3	0.343	13.3	19.6	3.48	3.48	100
FEB	6.2	0.280	11.2	14.7	10.36	3.94	38
MAR	6.8	0.403	9.9	22.5	3.68	3.48	95
AVERAGE	6.5	0.308	9.9	16.9	6.16	3.19	64
MAX	6.8	0.424	13.7	22.5	11.21	6.78	100
MIM	6.2	0.212	6.3	10.9	1.54	0.69	6
SD	0.2	0.077	2.4	4.8	3.36	1.68	34
AMPLITU.	0.6	0.212	7.4	11.6	9.67	6.09	94
CV (%)	3	25	24	28	55	53	53



Cynopoecylus melanotaenia (Porto Alegre. Rio Grande do Sul, southern Brazil)
Drawing by R. H. Wildekamp

Based on these data we suggest the following conditions to the culture of *C. melanotaenia* in laboratory: Temperature around 20°C, pH = 6.2 – 6.8 and hardness = 20 $mg.L^{-1}$ of CaCO3, no aeration is needed. Arenzon et. al. (in press) showed that embryos of *C. melanotaenia* kept at 25°C may present morphological abnormalities and suggested a constant temperature of 20°C or a variable temperature of 16-25°C.

Centro de Ecologia
Universidade Federal do Rio Grande do Sul (UFRGS)
CP. 15007
Porto Alegre, Brazil, 91501-970
e-mail: alex@ecologia.ufrgs.br

References:

Arenzon, A., Peret, A. C. & Bohrer, M. B. C. 1999. Reproduction of the annual fish *Cynopoecilus maelanotaenia* (Regan 1912) based on a temporary water body population in Rio Grande do Sul state, Brazil. Hydrobiologia, 411:65-70.

Arenzon, A., Peret, A. C. & Bohrer, M. B. C. Growth of the annual fish *Cynopoecilus melanotaenia* (Regan, 1912) in a temporary water body in Rio Grande do Sul, Brazil. Brazilian Journal of Biology, Brazil, v. 61, n. 1, p. 117-123, 2001.

Arenzon, A.; Lemos, C. A. &, Bohrer, M. B. C. The influence of temperature on the embryonic development of the annual fish *Cynopoecilus melanotaenia* (Cyprinodontiformes, Rivulidae) Brazilian Journal of Biology (2003) – in press.

Lacerda, T.P. 1969. Estudos sobre peixes anuais da região de São Leopoldo. São Leopoldo: UNISINOS. Dissertation, Univ. do Vale dos Sinos, São Leopoldo, Brazil: 65pp.

Myers, G.S. 1942. Studies on South American freshwater fishes I. Stanford Icht. Bull. 2: 89-114.

Myers, G.S. 1952. Annual fishes. Aquarium Journal (San Francisco). 23: 125-141.

Wourms, J.P. 1972a. The developmental biology of annual fishes. I. Stages in the normal development of *Astrofundulus myersi* Dahl. J. Exp. Zool. 182: 143-168.