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Research Note

FISH SPECIES FROM MOSQUITO BREEDING PONDS IN NORTHWESTERN COLOMBIA: EVALUATION OF FEEDING HABITS AND DISTRIBUTION

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During the last 100 years fish have been recognized as potential biological control agents of mosquito larvae (S. S. Ahmed et al., 1988, *Bull. Soc. Vector Ecol., 13:* 1-59). However, the use of fish in biocontrol programs has been restricted to only a few species (E. C. Bay, 1985, *Amer. Mosq. Control Assoc. Bull., 6:* 18-24; M. V. Meish, 1985, *Amer. Mosq. Control Assoc. Bull., 6:* 3-17). These fish species have been transported from their place of origin to many other countries and an evaluation of their potential in vector control programs has not been conclusive (WHO, 1981, TDR/VBC/ICMC/81.3). Search for native species of predatory fish that include mosquito larvae in their diets has been performed in countries of Africa and Asia (E. C. Bay, *loc. cit.*). In Latin America, the search for new predatory fish species has been documented by E. C. Bay (1967 *Proc. Calif. Mosq. Control Assoc., 35:* 34-37) and G. Dahl (1971, *Inderena,* 391 p.). Herein we report the results of a survey of native Colombian mosquito predatory fish species, their feeding habits, and distribution in mosquito breeding ponds.

This study was performed in the Urabá area in the North western corner of Colombia, close to Panama. Two localities, Currulao and Carepa, were separated by 30 km and in each locality three permanent (P) and two semipermanent (S) ponds were chosen. The ponds were selected because mosquito larvae were abundant.

Breeding ponds were sampled monthly during one year from June 1988 to May 1989. Each pond was swept twice with a 2.5 m Beach-Seine net. Collected fish were divided, selected by species, and one part was fixed in formalin 10% and transferred to 70% ethanol; the other part was taken to the laboratory to confirm their feeding habits by analysis of the gut content, feces, and feeding behavior. Literature reports on feeding habits were used in a few specimens when gut content analysis was not conclusive. Confirmation of the taxonomic status of the fixed samples was performed by using the keys described by G. Dahl (1971, *loc. cit.*), and L. R. Parenti (1981, *Bull. Amer. Mus. Nat. His., Vol.* 168).

A rating system similar to the one described by S. S. Ahmed et al., (1988, *loc. cit.*) was devised by combining gut content analysis (0 no mosquito larvae included in diet, 3 a few mosquito larvae in diet and 6, most of the diet composed of mosquito larvae); distribution (1, found in 1 to 3 ponds; 2, found in 4 to 7; and 3, found in 8 to 10 ponds), and mean number of fish captured during the survey (1, between 0.01 and 10, 2 between 11 and 100, and 3 more than 100). The summation score of these values (evaluation index) was used to separate the species in four groups; group 1, fish species with score of 11 and 12, group 2 with score between 8 and 10, group 3 with score between 5 and 7. Those fish species that did not include mosquito larvae in their diets were classified in group 4.

Temperature in the ponds throughout the year ranged from 26 to 34 °C, dissolved oxygen from 0.7 to 11.5 mg/l, pH from 5.7 to 9.3, and perimeter ranged from 10 m to 170 m. Sixteen fish species from 11 families were collected. Species diversity varied from 2 to 12 species per pond. Nine of the species were found exclusively in permanent ponds. No fish species were present in one semipermanent pond.

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TABLE

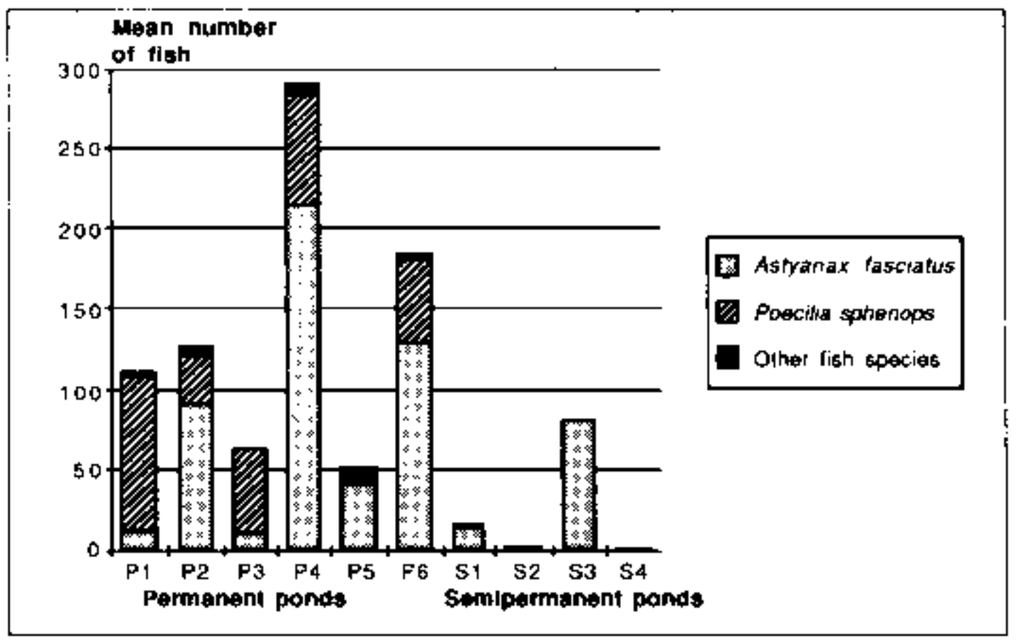
Evaluation of fish species as mosquito larvae predators in Northwestern Colombia

Species	Feeding habits	Distribution[a]	Abundance[b]	Evaluation Index[c]
Group 2				
Aequidens pulcher	(6)	5 (2)	14.2 (2)	10
Roeboides dayi	(6)	4 (2)	6.5 (1)	9
Astyanax fasciatus	(3)	9 (3)	601.0 (3)	9
Poecilia sphenops	(3)	7 (2)	303.2 (3)	8
Cheirodon insignis	(6)	1 (1)	2.3 (1)	8
Hoplosternum thoracatum	(6)	1 (1)	0.1 (1)	8
Lebiasina festae	(6)	1 (1)	0.3 (1)	8
Saccoderma hastatum	(6)	1 (1)	1.8 (1)	8
Gephyrocarax simuensis	(6)	1 (1)	0.8 (1)	8
Group 3				
Astyanax caucanus	(3)	1 (1)	0.5 (1)	5
Pimelodus sp.	(3)	1 (1)	0.1 (1)	5
Group 4				
Hoplias malabaricus	(0)	6 (2)	0.9 (1)	3
Curimata sp.	(0)	3 (1)	2.6 (1)	2
Synbranchus marmoratus	(0)	2 (1)	0.2 (1)	2
Ctenolucius hujeta	(0)	1 (1)	0.2 (1)	2
Loricaria filamentosa	(0)	1 (1)	0.6 (1)	2

Numbers in brackets correspond to arbitrary indexes designed in order to obtain the evaluation index.
a: number of ponds where the fish species was found.
b: mean number of fish captures during the study.
c: the higher the number the best suited the species for mosquito larvae control.

Eleven of the fish species collected included mosquito larvae in their diets; in seven species gut content study showed that mosquito larvae were an important part of their diet; another four species included mosquito larvae occasionally in their diets and the final five species reported in this study did not feed on mosquito larvae (Table). *Astyanax fasciatus* was the most commonly distributed species being found in nine out of ten mosquito breeding ponds, and in six represented the main fish population (72.1 to 99.5% of the total population). *Poecilia sphenops* the second most commonly distributed species as it was found in seven of the ten ponds and was the main species in three ponds (77.7 to 84.7%). In seven mosquito larvae breeding ponds of which *A. fasciatus* and *P. sphenops* occurred together, their combined populations represented between 95.6 and 99.9% of the total fish population (Fig.).

P. sphenops and *A. fasciatus* were present in both permanent and semipermanent mosquito breeding ponds. Although *Roeboides dayi* and *Aequidens pulcher* were found with mosquito larvae as a main component in their diets they were found exclusively in permanent ponds (4 and 5 respectively).



Main fish species and their population structure of six permanent and four semipermanent mosquito larvae breeding ponds in Uraba, Colombia.

From our results it is clear that there are some fish species that eventually could be good candidates for evaluation as mosquito control agents due to their preference for mosquito larvae, wide geographic distribution, and the large populations present in nature. The 16 species were classified in four groups. No fish species was assignated to group 1 because none had an evaluation index between 11 and 12. Nine species were assigned to group 2. The most important species for mosquito larvae control under natural conditions is *A. pulcher*

because of its preference for mosquito larvae, moderately wide distribution and abundance. Perhaps *A. fasciatus* and *P. sphenops* could also be included in the selection because of their wide distribution and abundance. The use of *P. sphenops* for mosquito larvae control has been reported previously (B. Velimirivic & J. L. Clarke, 1975, *Tropenmed u. Parasitol., 26:* 503-506). *R. dayi,* deserves merit not only because of the results of the gut content analysis, distribution and abundance, but also because it is susceptible to be cultured (A. Uran, unpublished observation). Although *Cheirodon insignis, Hoplosternum thoracatum, Lebiasina festae, Saccoderma hastatum,* and *Gephyrocarax sinuensis* were not reported by Ahmed et al., (1988, *loc. cit.*), their feeding habits, indicate that further evaluation should be of interest.

Species ranked in groups 3 and 4, (evaluation index between 2 and 7) are not recommended for further consideration because of their poor feeding habits on mosquito larvae.