Effects of Numbers, Sizes, and Previous Exposure of Individuals On Shoaling in Corydoras paleatus (Callichthyidae)

Richard E. Strauss and Tara B. Breeland

Department of Biological Sciences, Texas Tech University, Lubbock TX

Abstract

• The South American armored catfish Corydoras paleatus has been observed to occur in nature in large schools, in smaller shoals, and individually or in pairs. These catfishes are advantageous for laboratory study because they are easily maintained, they spend large time of their activity in groups and are easily quantified in two dimensions. We have shown that:
  1. Swimming aggregations are schools, with regular spacing and parallel orientation;
  2. Resting and foraging aggregations are shoals, with nearest-neighbor distances and individual orientations differing only slightly from random;
  3. Activity levels (swimming and resting) increase with group size, up to a threshold at which groups tend to break apart and re-assemble;
  4. Individual fish tend to shift alliance among groups;
  5. Individuals display a highly significant tendency for size-segregation;
  6. There is a marginally significant tendency to associate with individuals to which they have been indirectly (chemically) exposed, implying some discriminatory ability.

Materials & Methods

• To assess the number of “schools” at any given time, we used k-means clustering, with respect to randomized null distributions, to determine the “best” value of k, based on the stopping rule of Krzanowski and Lai (1988).

Introduction

• Anecdotal observations of shoaling behavior in Corydoras by us in aquaria and by others in nature suggest that, while small (<50) and large (>20) numbers of individuals tend to school cohesively, intermediate numbers of unordered individuals tend to form unordered null distributions. Group segregation into smaller groups that are similar in density-dependent probabilities of prediction and feeding rates. In addition, because Corydoras shoals spend considerable time in inactivity, their group behavior may be more analogous to that of mammals than to that of more active fishes.

• Corydoras populations inhabit slowly moving shallow streams in the La Plata and Paraná drainages of southern Brazil and northern Argentina. It is a species that is amenable to laboratory study because (1) it is commercially accessible; (2) fish are easily maintained, bred and raised in the laboratory; (3) fish are individually identifiable by size and pattern recognition; and (4) being benthic, they stay in two dimensions rather than three.

• The non-reproductive behavior of these fish can be divided into five mutually exclusive and easily recognizable components or states:
  1. Resting on the substrate;
  2. Foraging, by swimming slowly and brushing their barbels against the substrate or other individuals;
  3. Swimming, a rapid movement above the substrate;
  4. Hovering in place above the substrate;
  5. Swimming, while swimming above the water surface to exploit the air in their accessory buccal respiratory cavity.

Body Size & Prior Exposure Assessment

Body sizes were measured from photographs as total length (snout to end of caudal fin). The distance between individuals (cm) was measured as distance between body centroids. Size-affinity was measured at a particular time (photograph) as the rank-correlation between inter-individual distance (and covariance) of pairwise distances between individuals was used to analyze data, categorized as from same aquaria or different aquaria, using mean body size as an anchor. The results showed a marginally significant tendency to assort positively with individuals to which they have been indirectly exposed (P<0.05).

Current and Future Work

• Current work is being focused on factors affecting optimal density of shoals, including: degree of familiarity, chemical & tactile communication, and hunger state.

Acknowledgements

• We thank the following undergraduate students for their participation in this research: Amanda Arnold, René Bravard, Stephanie Casarez, Peter Clark, John Clayton, Catherine Delicato, Sandra Delgado, Christine Evans, Lydia Green, Tiffany Hale, Theresa Jones, Alanly Lym, Christopher McCoy, Amanda Miller, Riley Robinson, and Veronica Villafañe.

REFERENCES


