Evolutionary Ecology Research, 2013, **15**: 213–239

Spatial learning ability of the threespine stickleback (*Gasterosteus aculeatus*) in relation to inferred ecology and ancestry

Peter J. Park

Department of Biology and Chemistry, Nyack College, Nyack, New York, USA

ABSTRACT

Background: Spatial learning is the ability to learn and use features in space to navigate within an environment. In fishes, it is associated with residence in structurally complex habitat, but very little is known about its ancestral condition in adaptive radiations.

Goal: To investigate the relationship between foraging mode and spatial learning in derived populations of a well-studied evolutionary model fish species, and to test the importance of experience on spatial learning in an ancestral analogue of this species.

Organism: Threespine stickleback (*Gasterosteus aculeatus*) occur as sea-run (ancestral) and divergent freshwater (derived) forms. Freshwater populations occupy an ecological continuum, with benthic stickleback at one extreme, residing and foraging in shallow, structurally complex lakes, and limnetics at the other, living and feeding in the open water of deep lakes that lack structure.

Methods: I used a T-maze to measure spatial learning. In Experiment 1, I compared five benthic and five limnetic field-caught stickleback populations to explore ecological divergence of spatial learning. In Experiment 2, I used a sea-run population to infer the ancestral condition of spatial learning; I studied laboratory-reared sea-run fish raised in spatially complex or simple aquaria because adequate samples of field-caught sea-run adults proved difficult to attain.

Results: In Experiment 1, benthics exhibited better spatial learning than limnetics. These differences were independent of differences in boldness, exploratory behaviour, activity level, or other performance variables that are independent of spatial learning. In Experiment 2, no differences were detected between rearing treatments, but a number of fish from either group still solved the maze, indicating that even fish reared in spatially simple conditions were capable of spatial learning. However, the relative contributions of inheritance and experience remain unclear.

Keywords: cognitive map use, ecotypic variation, forebrain, genetics, hippocampus, phenotypic plasticity, telencephalon.

Correspondence: P.J. Park, Department of Biology and Chemistry, Nyack College, Nyack, NY 10960, USA. e-mail: peter.park@nyack.edu

www.evolutionary-ecology.com

***Evolutionary Ecology Research* is delighted that you wish to consult one of its articles.**

You may if your library or laboratory subscribes.

Did you know that EER invented the idea of posting final drafts of mss as soon as they are accepted?

Ask your librarian or library committee why your place does not already subscribe to the low-cost journal that is publishing splendid science in a socially responsible manner. *EER*'s low prices have helped librarians to rein in the indefensible cost increases that have reduced our access to science all over the world! Just ask our partners at ***SPARC*** — the Scholarly Publishing & Academic Resources Coalition of the Association of Research Libraries.

Or maybe you should just remind the folks who order your journals to contact us and subscribe! You need — and they should support — the journal that:

- Was the first journal in the world to allow e-only subscriptions while maintaining a traditional print edition, too.
- Vests the copyrights of all articles in their authors while preserving the rights of educational and research groups to use its material in classes, seminars, etc. at **no additional cost**.
- Maintains a unified data-base of articles so you can use your web browser to find any article, author, title word or keyword in any article that *EER* has ever published. (Forget about issue numbers, author order, and other such impediments to easy access.)
- Provides *Webglimpse* so that you can search any word, place, species, variable, phrase, keyword or author in any article *EER* has ever published.
- Provides its own **new** search filter that allows you instantly to compile a hot-linked list of articles according to year, issue, author, title word or keyword (as you prefer).

EER is the place to go for great science, responsible publication policies and easy access!

Click here for the Table of Contents of the most recent issue of *Evolutionary Ecology Research*

Click here for full access to a sample issue of *Evolutionary Ecology Research*

Click here for SUBSCRIPTION INFORMATION