

# *P*hylogeography


A guide to the study of the spatial distribution of Seahorses



By Leila Mougouï Bakhtiari



# Contents

- An Introduction to Phylogeography
  - JT Bohem's Resarch
  - Map of Hippocampus erectu's migration
  - Conservation of seahorses
- 

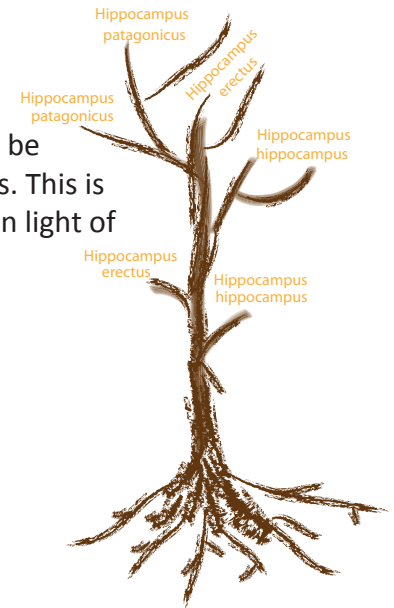
## Phylogeography: The History and Formation of Species

Phylogeography is the study of the historical processes that may be responsible for the contemporary geographic distributions of individuals. This is accomplished by considering the geographic distribution of individuals in light of the patterns associated with a gene genealogy.



The introduction of the polymerase chain reaction (PCR), the process where millions of copies of a DNA segment can be replicated, was crucial in the development of phylogeography. The study of phylogeography grew out of the observation that mitochondrial DNA lineages in natural populations often display distinct geographic orientations.

Phylogeography was heralded as a bridge linking the study of micro and macro evolutionary processes. It is a new and integrative discipline and has become an extremely active area in evolutionary biology. It helps prioritize areas of high value for conservation. Phylogeographic studies of different species have improved our understanding of species responses to environmental changes.



## JT Boehm

J.T. Boehm is currently studying the life history and phylogenetics of several Syngnathid species in the Western Atlantic. He is a graduate student at The Graduate Center, CUNY and also works with The River Project on urban ecology research.



His research on *Hippocampus erectus* speciation started in the Hudson River but branched out to examine the entire distribution of *H. erectus* and its sister species. Specifically he has found that *H. erectus* appears to have more gene flow than expected throughout its population range. This may be due to its ability to raft on floating Sargassum seaweed for long distances primarily driven by the Gulf Stream Currents. This ability for long distance dispersal along with the influence of the Gulf Stream may play an important role in the speciation process of this species and that of its sister species *H. hippocampus* (Europe) and *H. patagonicus* (South America).



Hippocampus erectus  
Americas



Hippocampus hippocampus  
Europe



Hippocampus patagonicus  
South America





Hippocampus  
hippocampus  
lives in  
Europe

Hippocampus erectus and its sister species have been distributed with the West Atlantic current in three very different ecosystems.



Hippocampus  
erectus lives in  
the Hudson river  
estuary

Seahorses can't swim, instead they cling to other moving things or flow with the currents.



Hippocampus  
patagonicus  
lives in  
South America

The phylogeography study of these Syngnathid species show how they have migrated with the Western Atlantic Ocean current which flows from Europe to the north east side of the U.S.A, then down to south America and the mouth of Amazon river.



## Conservation

Phylogeography lies at the interface between the traditional fields of population genetics and systematics and has the potential to provide insights into questions regarding speciation, diversification, and the relative roles of historical versus ongoing processes in determining the present-day distributions of species, populations, and individuals.

Answers to these questions have important implications for conservation planning and implementation.

Studies of intraspecific variation can contribute to the development of conservation strategies, by identifying appropriate units for conservation. Phylogeography has been advocated as useful in estimating present-day gene flow among populations and spatial scales of dispersal.



Phylogeographic patterns in the sea and their causes are still poorly understood, but recent work suggests that the sea is much more heterogeneous than initially thought.

In the case of *Hippocampus erectus*, the study contains three deeply divergent and geographically localized lineages in three different continents. Congruent phylogeographic breaks are seen in three different estuaries, coastal shores and a river going to the Atlantic Ocean.

These findings now raise interesting questions as to how geographic structure is created and maintained in the sea, how speciation occurs, and how many previously unrecognized taxonomically cryptic species exist.

These studies could also help the scientists better understand the kind of marine ecosystems the seahorses are able to live in. On the contrary of their fragile look they are very capable species and they can tolerate many environmental difficulties.



