

Diversity of the chaetognath *Pseudosagitta maxima* (Conant, 1896) in the Atlantic Ocean revealed by molecular and morphological approaches

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**Abstract**

Until recently many oceanic pelagic species have been considered as cosmopolitan organisms. At present it became evident that some of these species comprise many distinct molecular operational taxonomic units (MOTUs) that often are regarded as cryptic species. As they can significantly change our perceptions of large-scale biogeographic patterns, it is important to characterize, where possible, the true diversity within common and ecologically important groups. We have analyzed the molecular and morphological diversity of the cosmopolitan mesopelagic chaetognath *Pseudosagitta maxima* throughout the Atlantic Ocean from 60° S to 85° N. Three distinct clades within *P. maxima* were revealed with phylogenetic analyses (Maximum Likelihood, Bayesian Inference) and were geographically separated. Unusually low

COI haplotype diversity was observed within each clade. The subsequent analyses of nuclear markers (H3, ITS1) show that *P. maxima* most likely comprises two distinct MOTUs, tropical and bipolar, that also have some morphological differences. The latter species consists of two genetically slightly divergent populations: the southern and northern. The morphological examination also allowed to determinate a character (type of hook coloration) that accurately distinguishes juveniles of *P. maxima* complex from the other congeneric species. Number of hooks, number of posterior teeth and the arrangement of ova in the ovary were proposed to be the most useful morphological characters to distinguish between tropical and bipolar MOTUs within the *P. maxima* complex. The first two characters should be determined for each maturity stage separately. Our study presents the first molecular evidence for a bipolar distribution in a representative of zooplankton.

**Keywords:** Chaetognatha, *Pseudosagitta maxima*, phylogeography, bipolar species, genetic and morphological diversity

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