

**New Insights Into The Biodiversity And Evolution Of
Aspidochirotid Holothurians**

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Understanding and management of coral reefs depend fundamentally on our ability to distinguish and identify species, in conjunction with knowledge on their origin, distribution and biological characteristics. Yet available information on reef biota remains often inadequate and difficult to access. Aspidochirotid sea cucumbers are a case in point: they include the largest and most conspicuous motile invertebrates on reefs, and are often severely overfished because of their economical value. Identification of some harvested species, even though common, is problematic. We are undertaking a revision of these organisms. Here we present results from a molecular phylogeny on 200+ taxa, based on 2 mitochondrial gene regions. Results provide insight into macroevolutionary transitions, diversification, and species limits. Holothurians show substantial niche conservatism in latitudinal distribution, depth range, and feeding mode. Heavy reliance on ossicles has led to a confused taxonomy: in some groups ossicles evolve rapidly, possibly in response to variation in carbonate saturation levels, in others they are conserved and mask substantial cryptic diversity. The latter is exemplified by the circumtropical "species" *Holothuria impatiens*. This species complex revealed to consist of at least a dozen reciprocally monophyletic, well-defined, evolutionary significant units (ESUs). Each major tropical region has at least one endemic ESU, the East Pacific and Indo-West Pacific (IWP) host multiple taxa. The latter include peripheral, archipelagic endemics as well as ESUs that range across the entire IWP. Broad overlap in the range of some in combination with recent divergence indicate the rapid evolution of reproductive isolation barriers among these ESUs. Morphological distinctiveness of ESUs vary: some show differences in ossicle morphology, others in live coloration, yet others show no morphological differences that we have been able to discern to date. These results are leading to a better understanding of the varied diversity and diversification mechanisms of reef organisms.