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Rediscovery of *Sagittalarva inornata* n. gen., n. comb. (Gilbert, 1890) (Perciformes: Labridae), a long-lost deepwater fish from the eastern Pacific Ocean: a case study of a forensic approach to taxonomy using DNA barcoding

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Abstract

Some of the more valuable contributions of a standardized DNA sequence database (the DNA barcode) are matching specimens of different life stages and confirming the species identity of individuals from distant locations. These applications can facilitate the detective work required to solve difficult taxonomic problems. In this case, a match was made between the COI mtDNA sequence of an adult male wrasse recently caught at the tip of Baja California in Mexico in deep water (30–100m) and sequences from a series of unusual larvae collected about 3500 km to the south, in the open ocean over the Galápagos Rift hydrothermal vents in 1985. The Baja adults fit the recent description of *Halichoeres raisneri* Baldwin & McCosker, 2001 from the Galápagos and Cocos Islands. However, another deepwater labrid is known from the same site and depth in Baja; it is the type locality for the century-old holotype and only specimen of the Cape Wrasse *Pseudojulis inornatus* Gilbert, 1890 (later as *Pseudojuloides inornatus*). Deepwater video images from the tip of Baja show wrasses identical to *H. raisneri* photographed in Galápagos but who also fit the description of *Pseudojulis inornatus*. This coincidence led to a closer investigation of the holotype with x-ray, which revealed unanticipated caniniform teeth (vs. incisiform in *Pseudojuloides*) and an error in the fin-ray count in the original description, both of which mistakenly separated *Halichoeres raisneri*. The two species now match in markings, meristics, and morphology as well as overlapping range and are therefore synonymized. Phenetic and phylogenetic trees using mtDNA and nuclear DNA sequences show the species is not close to any other lineage and does not group with the other julidine labrids of the New World or the *Pseudojuloides* or *Halichoeres* of the Indo-Pacific. The distinctive larval morphology, long, thin, and flattened with a sharply pointed black-tipped snout, resembles no other described labrid larvae and, without an available genus, the new genus *Sagittalarva* Victor, n. gen. and the new combination *Sagittalarva inornata* (Gilbert, 1890), n. gen., n. comb. are described.

Key words: phylogenetics, taxonomy, DNA, barcoding, labrid, *Halichoeres*, *Pseudojuloides*, *Sagittalarva*, Galápagos, Eastern Pacific, deep, larvae, wrasses, forensics

Introduction

The advent of highly efficient DNA sequencing and the selection of a standardized mtDNA segment for identifying taxa has resulted in the Barcode of Life database (BOLD) that holds great promise for solving biogeographic and taxonomic questions (Hebert *et al.* 2003; Meier 2008; Ward *et al.* 2009). The convoluted history of the Cape Wrasse provides a clear example of how DNA sequences can help resolve complex taxonomic problems and how a forensic-type approach can reveal unexpected connections and clarify the status of little known taxa. Shared DNA sequences identify and unite different life stages, including larvae and the often different juvenile, immature, female, and male color forms characteristic of many reef fishes. Furthermore, with the addition of other mitochondrial and nuclear genes, DNA sequences can provide a powerful tool for resolving genetic and evolutionary relationships. These phylogenetic analyses are particularly useful in species-rich genera with few distinguishing morphological characters, such as those of the labrid fishes (Bernardi *et al.* 2000; 2004; Rocha 2004; Rocha *et al.* 2005; Barber & Bellwood 2005; Westneat & Alfaro 2005).