



## Molecular phylogenetic analysis of a known and a new hydrothermal vent octopod: their relationships with the genus *Benthoctopus* (Cephalopoda: Octopodidae)

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\* In: Brökeland, W. & George, K.H. (eds) (2009) Deep-sea taxonomy — a contribution to our knowledge of biodiversity. *Zootaxa*, 2096, 1–488.

### Abstract

The resolution of evolutionary relationships among deep-sea incirrate octopuses has been hindered by the paucity of individuals available for morphological studies and by the lack of tissue samples preserved using fixatives compatible with simple DNA extraction techniques. Evolutionary relationships from 11 species of deep-sea incirrate octopuses were investigated using 2392 base pairs (bp) of DNA from four mitochondrial genes (12S rDNA, 16S rDNA, cytochrome c oxidase subunit III, and cytochrome b) and the nuclear gene, *rhodopsin*. Morphological examination of these species was also undertaken. Molecular analyses distinguish a species of octopus from hydrothermal vents at Manus Basin from the vent octopodid *Vulcanoctopus hydrothermalis* known from vents on the East Pacific Rise. Both are herein considered members of the clade currently assigned the name *Benthoctopus*, although taxonomic implications preclude formally naming *Vulcanoctopus* as a junior synonym. Morphological investigations led to the conclusion that *Benthoctopus macrophallus* is a junior synonym of *Benthoctopus yaquinae*. An amended diagnosis of *Benthoctopus* is provided with additional information on male reproductive characteristics.

**Key words:** Octopodiformes, *Vulcanoctopus*, *Enteroctopus*

### Introduction

The family Octopodidae Orbigny comprises the familiar benthic octopuses and contains most genera and species within the suborder Incirrata Grimpe (order Octopoda Leach). Deep-sea octopodids comprise a significant proportion of the family's known diversity. Of the 37 genera currently recognised (Norman & Hochberg 2005), 11 contain at least one species known from depths beyond 1000 m. These octopodids are found in diverse deep-sea habitats and have been recorded from the Arctic to the Antarctic, and from abyssal plains to hydrothermal vents (Voss 1988b; González *et al.* 1998).

Deep-sea octopodids are unsurprisingly characterized by features thought to be adaptations to the deep sea, such as the absence of an ink sac, reduction in gills, radula and crop, large eggs and spermatophores (Robson 1924; Voss 1967; 1988a; Muus 2002). Confusion of the evolutionary relationships of deep-sea octopodid taxa has arisen because many of these features also serve as a basis for traditional systematics.

Voss (1988a,b) split the deep-sea octopodids into two subfamilies, depending on whether sucker seriation