

# SPECIES IDENTITY, GENETIC DIVERSITY & MOLECULAR SYSTEMATIC RELATIONSHIPS AMONG THE ZIPHIIDAE (BEAKED WHALES)

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## ABSTRACT

Beaked whales (family Ziphiidae) are one of the least known of all mammalian groups. The majority of species have been described from only a handful of specimens. Found in deep ocean waters, these species are widespread and often sexually dimorphic. Little is known of intra-specific variation in morphology, and many species are very similar in external appearance. A reference database of mitochondrial DNA sequences was compiled for all 20 recognised ziphiid species to aid in species identification. All reference sequences were derived from validated specimens, which were often represented only by bone or teeth. DNA was obtained from this 'historic' material using 'ancient' DNA methods. For three species, holotypes were sampled. Phylogenetic analyses using this database led to the discovery of a new, previously unrecognised species of beaked whale (*Mesoplodon perrini*), new specimens of Longman's beaked whale (*Indopacetus pacificus*), a species known previously from only two partial skulls and the synonymy of a third (*M. traversii* = *M. bahamondi*).

Phylogenetic reconstructions based on sequence data from three mitochondrial and two nuclear loci (total, 2815 bp) using neighbour-joining, parsimony, and maximum likelihood methods, resolved many of the sister-species relationships in this group. Inferred relationships among *Mesoplodon* beaked whales indicated that cranial and tooth morphology may be far more variable between closely related species than previously assumed. No support was found for a linear-progression of tooth form as suggested by Moore (1968) in his phenetic evaluation of relationships among the Ziphiidae. The geographic distribution of *Mesoplodon* species with similar or divergent tooth morphology is likely due to a combination of sexual selection and selection for species recognition. Both hypotheses predict similar patterns, such as dissimilar tooth morphology among species with sympatric or parapatric distributions. However, only sexual selection appears to offer an explanation for why there are so many *Mesoplodon* beaked whales.

Investigation of mtDNA diversity among a number of beaked whale species indicated that nucleotide diversity was generally lower in this group than in other wide-ranging oceanic cetaceans. The cause of this low diversity was not clear but may be indicative of overall low abundance. Particularly low levels of diversity were found in Baird's beaked whale *Berardius bairdii*, Arnoux's beaked whale *B. arnuxii* and the northern bottlenose whale *Hyperoodon ampullatus*. Strong geographic structure in haplotype frequencies was observed among a worldwide sample of Cuvier's beaked whales *Ziphius cavirostris*.

## Reference:

Dalebout, M. L. 2002 Species identity, genetic diversity and molecular systematic relationships among the Ziphiidae (beaked whales). *PhD thesis, School of Biological Sciences, University of Auckland, Auckland, New Zealand.*