

A Comparison of Fossils of the Two Whale Families: Physeteridae and Monodontidae (Cetacea)

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Abstract

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Whales are a group of marine creatures that have elicited scientific and layman's curiosity since long. The present paper has a focus on elucidating fossils of two Odontoceti families viz. Physeteridae and Monodontidae. Extant Physeteridae is a monotypic family, while Monodontidae is restricted geographically to cold waters of the Arctic and adjoining seas. Physeteridae fossil data showed a total of 28 species, while Monodontidae had only half a dozen species. Warming of the climate in the past appears to have played a role in northward migration of Monodontids.

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Introduction

Cetaceans are taxonomically most diverse clade of aquatic mammals with fossils being as old as Middle Eocene (52 Ma) (Fordyce & Barnes, 1994). Odontoceti are toothed whales. The present paper has a focus on investigating fossil species of two families of this group viz. Physeteridae and Monodontidae. Physeteridae is a family that has survived the longest in the cetacean lineage (Fordyce & Barnes, 1994). Physeteridae have a cranium with marked left skew asymmetry around the dorsal narial area and a large supracranial basin (Kimura *et al.*, 2006). Hampe (2006) described a new species of hoplocetine physterid from North Germany, while Kimura *et al.* (2006) described the fossil sperm whales from Gunma and Ibaraki prefectures of Japan.

Methods

The paleo-database from www.paleodb.org was used. First, in the analyze section

1. Count taxa was used

2. After this, generate data summary tables was used; in this option a) items to count was chosen as occurrences, and b) fields to tabulate (rows) was selected as 'continent'. The second field (optional) for columns was left blank.

3. Analysis of taxonomic ranges was used. Taxon name was given and then break taxa into species option was selected. It generated confidence interval taxon list. It was submitted to display confidence interval options, wherein options shown by default were used, as a result of which confidence interval output was obtained. Taxa were arranged by first occurrence.

Results and Discussion

The outcome of the above methods has been depicted in Table 1 (Physeteridae) and Table 2 (Monodontidae). Table 1 shows that in case of Physeteridae, two species were earliest in evolution viz. *Ferectotherium kolloggi* and *Preaulophyseter gualichensis*, appearing 28.4

Table 1. Confidence Interval for Physeteridae

	first occurrence (Ma)	last occurrence (Ma)	confidence interval (Ma)	number of horizons	transposition test
<i>Ferecetrotherium kelloggi</i>	28.4	23.03	0	1	1
<i>Preaulophyseter gualichensis</i>	28.4	23.03	0	1	1
<i>Diaphorocetus poucheti</i>	23.03	20.43	0	1	1
<i>Idiorophus bolzanensis</i>	23.03	15.97	0	2	0
<i>Idiorophus patagonicus</i>	20.43	15.97	0	1	1
<i>Orcopsis sp.</i>	20.43	15.97	0	1	1
<i>Physodon leccense</i>	20.43	15.97	15.486	3	0
<i>Ziphioides obliquus</i>	20.43	15.97	0	1	1
<i>Ziphioides triangulus</i>	20.43	15.97	0	1	1
<i>Physeterula dubusi</i>	20.43	2.588	19.889	5	0
<i>Physeterula sp.</i>	20.43	2.588	30.589	4	0
<i>Hoplocetus borgerhoutensis</i>	20.43	0.012	0	2	0
<i>Hoplocetus crassidens</i>	20.43	0.012	35.005	4	0
<i>Aulophyseter morricei</i>	15.97	13.65	0	1	1
<i>Idiophyseter merriami</i>	15.97	13.65	0	1	1
<i>Physeter antiquus</i>	15.97	0.012	0	2	0
<i>Hoplocetus ritzi</i>	13.65	11.608	0	1	1
<i>Paleophoca nysti</i>	13.65	7.246	0	2	0
<i>Kogiopsis floridana</i>	13.65	3.6	0	2	0
<i>Paracetus mediatlanticus</i>	11.608	7.246	0	1	1
<i>Aulophyseter rionegrensis</i>	7.246	5.332	0	1	1
<i>Physetodon baileyi</i>	7.246	5.332	0	1	1
<i>Physeter macrocephalus</i>	5.332	0	0.394	43	0
<i>Physeter sp.</i>	5.332	0	4.375	6	0
<i>Hoplocetus curvidens</i>	2.588	0.012	0	1	1
<i>Hoplocetus obesus</i>	2.588	0.012	0	1	1
<i>Physeter vetus</i>	2.588	0.012	0	1	1
<i>Physeterula neolassicus</i>	2.588	0.012	0	1	1

Table 2. Confidence interval for Monodontidae

	first occurrence (Ma)	last occurrence (Ma)	confidence interval (Ma)	number of horizons	transposition test
<i>Denebola brachycephala</i>	7.246	5.332	0	1	1
<i>Bohaskaia monodontoides</i>	5.332	3.6	0	2	0
<i>Monodon sp.</i>	5.332	3.6	0	1	1
<i>Delphinapterus sp.</i>	5.332	0.012	0	2	0
<i>Delphinapterus leucas</i>	2.588	0	0.191	43	0
<i>Monodon monoceros</i>	2.588	0	0.81	12	0

Ma with zero confidence interval. While, *Physter vetus* and *Physeterula neolassicks* are appeared most recently, 2.588 Ma with zero confidence interval.

In Monodontidae, *Denebola brachycephalia* appeared first 7.246 Ma (Confidence interval = 0), and *Monodon monoceros* evolved the last, 2.588 Ma (confidence interval = 0.81).

Physeteridae showed a total of 28 species, and is thus a large family in comparison to Monodontidae, which showed only half a dozen fossil species. It is also worth mentioning that Monodontidae has only two extant species, *Delphinapterus leucas* (Pallas, 1776) and *Monodon monoceros* Linnaeus, 1758. These species inhabit the cold waters of the Arctic sea and adjoining areas (Brodie, 1989). Subtle warming of the climate, which took place during the early Pliocene, locally and globally (Buchardt, 1978; Zachos *et al.* 2001) might have played a role in facilitating the northward migration of monodontids ; in fact, monodontid material (a fragmented skull and some post-cranial fragments) has also been described from the early Pliocene of Antwerp, North of Belgium by Lamber & Gigasse (2007). It seems that both present and paleo-distribution help for the understanding of species distribution in case of Monodontidae.

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