

AN UPDATE OF THE TAXONOMIC AND DISTRIBUTIONAL STATUS OF FOUR SPECIES OF ZIPHIDS (CETACEA:ZIPHIIDAE) IN THE EEZ OF COSTA RICA

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After Delphinidae (\pm 36 species), the ziphiids (Mammalia:Cetacea) are the second most diverse family of Cetacea in the world, with at least 21 species, both families belonging to the Order Odontoceti. The size of species is variable and ranges between 3.5 m and 13 m according with each species. The members of this family share very particular anatomical and ethological features that clearly differentiate them from the rest of the species of the order. They constitute the group with the lowest number of functional teeth, always in the lower jaw: a maximum of 4 and a minimum of 2 (with the exception of *Tasmacetus shepherdi* in which, besides the two main teeth in the upper jaw there are many smaller functional teeth in both jaws). Usually this teeth are fully grown or present only in adult males (which suggests that secondarily the teeth have become a relevant second sexual character), having a very variable shape and size among species and also occupying different positions in the jaw. As a group of species, this family has a cosmopolitan distribution, although very few individual species are widely distributed, with the exception of Cuvier's (*Ziphius cavirostris*) and Blainville (*Mesoplodon densirostris*) beaked whales, which at least have pantropical distribution. It is also interesting to note that among the species of this family there seems to be a tendency to inhabit cold and polar waters (near 45% of the species), while there are 7 species (33%) recognized in tropical waters (Jefferson *et al.* 1994). A recently described species (*Mesoplodon perrini*) could be an endemic of the subtropical Pacific of the United States (Dalebout *et al.* 2002). Notwithstanding its high diversity, most of the species of Ziphiidae are poorly known and they are undoubtedly the least studied group of Cetaceans. This is due to the great difficulty to study them on the sea which in turn is derived from several intrinsic factors relative to this marine mammals: 1) they are oceanic, high seas species, usually inhabiting far from the coast 2) they feed in very deep waters making very long dives 3) they are very shy, diving away even when a boat or ship is still far 4) adult males are the individuals that can be most surely identified at the species level and they are frequently solitary 5) many species seem to be of naturally low abundance. In fact, there are several species that are known only by stranded animals or skeleton/skull material. This situation is also reflected in the lack of population estimates for many species, particularly in those of the genus *Mesoplodon* (which accounts for 66% of the family species) in many population studies, the population estimations are limited to "beaked whales population" or "ziphiids total population" (e.g. Gerrodette & Palacios 1996), with the management inconveniences implied on this.

In the Eastern Tropical Pacific (ETP), there are at least 7 reported species, some of them widely distributed (e.g. *Ziphius cavirostris*) while others have only marginal distribution (e.g. *Mesoplodon ginkgodens* present only in the northeastern extreme of the region). On the other hand, *Mesoplodon peruvianus* seems to be endemic to the ETP (Jefferson *et al.* 1994, Reyes *et al.* 1991). In this part of the Pacific Ocean, there have been specific identity problems with some beaked whales, for both ones with its overall distribution going beyond the ETP and others more restricted to the region. There has been publications in the 1990's which have used names of some ziphiid species that now have been renamed, re-identified or described as different species (Pitman *et al.* 1987, 1988, 1999, Reyes *et al.* 1991, Jefferson *et al.* 1994, Pitman & Lynn 2001, Dalebout *et al.* 2003). The fact that in the last 15 years three new species of ziphiids have been described, all of them related in one way or another with the Eastern Pacific, has complicated the general panorama (Reyes *et al.* 1991, 1995, Dalebout *et al.* 2002, Van Helden *et al.* 2002). In the wide Exclusive Economic Zone of Costa Rica

in the Pacific (523,000 Km², 89.1% of the total EEZ), Rodríguez-Fonseca (2001) recognized 5 ziphiid species, Rodríguez-H. *et al.* (2002) 3 species and May-Collado *et al.* (2005) only include specifically *Ziphius cavirostris* and *Mesoplodon densirostris*. Of the species considered by Rodríguez-Fonseca (2001), based on the literature published at the moment there are three that of doubtful identity: *Hyperoodon planifrons*, *Mesoplodon grayi* y *Mesoplodon* sp. A. Additionally, of all the species considered by those authors, there are enough sightings, and several strandings, of only *Ziphius cavirostris* (Fundación Keto 2010-2011, Wojtek Bachara, *com. pers.* 2012).

This paper has two objectives 1) to update the taxonomic status of some ziphiids currently recognized in the EEZ-CR, according with the new available information and 2) to specify the known sightings and additional data of the ziphiids recognized in the EEZ-CR except those of *Ziphius cavirostris*, of which there are 11 sightings and four strandings in the last 15 years.

Methodology

The specific literature concerning ziphiids in the ETP of the last 25 years was reviewed to verify the changes in the taxonomic status of the species that had been identified as *Hyperoodon planifrons*, *Mesoplodon grayi* y *Mesoplodon* sp. A in the ETP to update the situation of some ziphiids in the EEZ-CR. Rodríguez-Fonseca (2001) included the sightings of such species whose coordinates were coincident with the EEZ-CR which are considered again here, along with other that this author could not access originally or that are posterior of his publication. *Mesoplodon densirostris* sightings are also included, along with some additional biological data, to afford its accessibility to local researchers and wildlife managers. Most of the overall information comes from the cruises reports of the Southwest Fisheries Science Center (SWFSC), of the National Oceanographic and Atmospheric Administration (NOAA), in the ETP.

Results

In the Table 1 the sightings of four beaked whale species in the EEZ-CR are summarized along with the updated name of the species whose name have changed, and date, position, group size and oceanographic condition (coastal/inshore or oceanico/far offshore) of each sighting. According with the present revision, the species that in Rodríguez-Fonseca (2001) were considered as *Hyperoodon planifrons*, *Mesoplodon grayi* y *Mesoplodon* sp. A, together with its respective antecedents, the actual taxonomic status is the following:

1. *Hyperoodon planifrons* (Rodríguez-Fonseca 2001 based in Pitman *et al.* 1988 and Huertas 1994) has come to be *Indopacetus pacificus* (according to Pitman *et al.* 1999, Dalebout 2003). For decades consider as an *Hyperoodon* (both *H. planifrons* or a tropical undescribed species of this genus) and originally described as a member of *Mesoplodon* genus, all its sightings across the tropical Indo-Pacific waters are now considered to belong to *Indopacetus pacificus*.
2. *Mesoplodon* sp A. (Rodríguez-Fonseca 2001 based in Pitman *et al.* 1988 and Jefferson *et al.* 1994) has come to be *Mesoplodon peruvianus* (according to Pitman & Lynn 2001). *M. peruvianus* was described based on females, juveniles and a calf (Reyes *et al.* 1991). At the time, the unidentified *Mesoplodon* sp A was similar to *M. peruvianus* but with very different coloration and it was thought to be a different species. Some clear sightings and photographs has clearly shown that all sightings of *Mesoplodon* sp A belong to males of *Mesoplodon peruvianus*.
3. *Mesoplodon grayi* (Rodríguez-Fonseca 2001 based in Jefferson *et al.* 1994) has come to be *Mesoplodon* sp. (according to Pitman & Lynn 2001). Two sightings south and southwestern (the first of them into the EEZ-CR at 4°32' N y 89°24' W) of Cocos' Island in 1980 and 1983, were erroneously identified as *M. grayi* (Urbán R. & Aurióles 1992, Jefferson *et al.* 1994). Pitman &

Lynn 2001 considered that though similar to *M. grayi*, the coloration description they made for the individuals sighted was different enough. Thus, they concluded that the identity of these two sightings can be related with: 1) the recently described new species *Mesoplodon traversii* (Van Helden *et al.* 2002, based in partial skulls, jaws and some other bones) due to both coincide in having long beaks 2) a new, undescribed species of the genus *Mesoplodon*.

Table 1. Sightings of uncommon or rare species of Ziphiids in the EEZ-CR

Species	Position (coordinates)	Date	Group size	Oceanographic condition
<i>Indopacetus pacificus</i> ¹	1) 3°50' N 89°57' W 2) 3°12' N 89°04' W	1) 25/10/1986 2) 15/03/1995	1) 15 2) 6	1) Oceanic 1) Oceanic
<i>Mesoplodon densirostris</i> ^{2,7}	1) 3°42' N 85°55' W 2) 3,2 km off Southeast End, Cocos' Island	1) 02/08/1998 2) 20/05/2000	1) 3 2) 1	Coastal (in an oceanic island)
<i>Mesoplodon peruvianus</i> ^{3,4,5,6}	1) 7°32' N 88°07' O 2) 7°32' N 88°07' O 3) 05°31' N 86°31' O 4) 8°29' N 86°10' O 5) 8°25' N 86°24' O 6) 8°29' N 86°10' O	1) 27/09/1987 2) 27/09/1987 3) 17/09/1992 4) 22/11/2003 5) 22/11/2003 6) 22/11/2003	1) 1 2) 2 3) 1 4) 1 5) 2 6) 1	1) Oceanic (CR Dome) 2) Oceanic (CR Dome) 3) Oceanic (near Cocos' Island) 4) Oceanic 5) Oceanic 6) Oceanic (drifting death juvenile female)
<i>Mesoplodon</i> sp. ⁴	4°32' N 89°24' W	22/01/1980	2	Oceanic (~200 Km SW of Cocos' Island). Related with <i>M. traversii</i> and <i>M. grayi</i> , could be an undescribed species.

¹Pitman *et al.* 1999, ²Kinzey *et al.* 1999, ³Mangels & Gerrodette 1994, ⁴Pitman & Lynn 200, ⁵Jackson *et al.* 2004, ⁶Tim Gerrodette (SWFSC), *com. pers.* 2005, ⁷Wojtek Bachara, *com. pers.* 2012

Discussion

The described situations clearly states the difficulties that historically have meant the identification of beaked whales, particularly at sea. When the individual is a female or a subadult, the complications are greater due to the absence of the pair of teeth (in the EEZ-CR there are no records

of *Berardius* spp., the only ziphiid with four teeth while *Tasmacetus* is not expected to be in the whole ETP), and their different coloration in relation to males. In this sense, in the last 15 years, there are no less than 12 sightings of unidentified ziphiids in the ETP-CR (mostly unidentified *Mesoplodon* species), therefore, there is a true limitation to know the real status of some species. However, it is important to point out that for two out of three species, its identity has been clarified: *Indopacetus pacificus* and *Mesoplodon peruvianus*, which is relevant to the conservation and management of this species, both in the ETP in general, as well as in the EEZ's of the region in particular. Towards the future progress of beaked whales research in the ETP, the continuous contributions of the SWFSC/NOAA efforts will be of key importance.

In the case of *Mesoplodon* sp. is of great interest, for scientific and management purposes, to clarify its identity, independently if the two sightings mentioned belong to *Mesoplodon traversii* or to an undescribed new species to science.

In relation to the situation of the EEZ-CR, the available data preliminarilly indicates that *Ziphius cavirostris* and probably *Mesoplodon peruvianus* are common species, widespread in the whole EEZ-CR, while *Indopacetus pacificus* and *Mesoplodon densirostris* seem to be uncommon with a tendency to be more frequent in the southern/southeastern areas of the EEZ-CR. This could represent a more generalist requirements of depth/prey for *Z. cavirostris* and *M. peruvianus*, as well as a more specialized needs of depth/prey for *I. pacificus* and *M. densirostris* since the known sightings of this species seem to avoid waters over the Coco's Range which are less deep than those beyond it. In the case of *Mesoplodon* sp., up to now it should be considered very occasional or rare, probably a more temperate/cold waters inhabitant or a very few sighted species. It is also interesting to mention that in the southern Pacific it seems to be frequent to sight ziphiids relatively close to the shore (30-50 Km). There, the continental shelf is very narrow and less than 50 Km from the coast, depth can descends from 500 to 2000 m, which can be an explanation of such a situation. This means that besides the more offshore-oriented, much wider cruises of the SWFSC/NOAA, it is necessary that each country in the ETP make greater efforts to promote the research of Cetaceans in their particular EEZ's. This would allow a greater sampling effort in each EEZ, considering the seasonal and inshore/offshore variables. Actually, there is a country in the region that have taken important steps in this direction (Palacios *et al.* 2012). Finally, is of prime importance to continuously identify and monitor changes in the climatic and oceanographic marine environment, especially those that can be related with Global Climate Change (GCC), because oceanic species like beaked whales could be exposed to less known effects than those predicted to more coastal species (Dalebout *et al.* 2002, Ferguson *et al.* 2006).

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