*Aquatic Mammals* 2003, **29.3,** 404–410

# A Gervais' beaked whale (*Mesoplodon europaeus*) washed ashore in southeastern Brazil: extra limital record?

Marcos César de Oliveira Santos[1], Émerson Zampirolli[2], André Ferreira Vicente de Castro[2] and Fernando Siqueira Alvarenga[2]

[1]*Projeto Atlantis/LabMar, Departamento de Ecologia, Instituto de Biociências, Universidade de São Paulo, Brazil, Rua do Matão, 321, Cidade Universitária, São Paulo, SP 05508-900*
[2]*Centro de Estudos de Encalhes de Mamíferos Marinhos de Santos (CEEMAM), Avenida Pinheiro Machado, 1033/13, Santos, SP, 11075–003, Brazil*

## Abstract

On 10 August 2001, a beaked whale was found dead on a rocky shore at São Vicente (23°58′S; 46°24′W), São Paulo state, Brazil. The damaged specimen was approximately 390 cm in length and in an advanced state of decomposition. It was identified as a *Mesoplodon europaeus* based on the following characteristics: (1) the presence of a flattened pair of teeth placed near the posterior half of the short mandible symphysis; (2) when viewed laterally in an upright position with the long axis of the rostrum horizontal, the premaxillary foramina straddle a horizontal plane, transecting the centres of the maxillary formamina; and (3) both the protuberance of the maxillary, which interrupts the antorbital notch, and the ridge that extends back from this protuberance are conspicuous. Cranial measurements are presented. This is the southernmost record of this species in the southern hemisphere, the first one to the southwest Atlantic and the first one along the Brazilian coast. Recent beaked whale records along the Brazilian coast, due to the increasing of cetological research, raises the possibility of ordinary distribution, rather than extra limital observations. Further investigations are needed to draw reliable conclusions on Gervais' beaked whales in the southern hemisphere.

Key words: Gervais' beaked whale, *Mesoplodon europaeus*, *Mesoplodon*, Ziphiidae, Brazil.

## Introduction

Gervais' beaked whales (*Mesoplodon europaeus* Gervais, 1855) occur in warm temperate and tropical waters in the Atlantic Ocean (Mead, 1989; MacLeod, 2000; Norman & Mead, 2001). Although the holotype was found in the English Channel around 1840 (Gervais, 1855), most records come from the northwest Atlantic, mainly from the Gulf coasts of the United States and Caribbean Islands (Raven, 1937; Ulmer, 1947; Rankin, 1953; Moore, 1963; Caldwell, 1964; Varona, 1970; Debrot & Barros, 1992; Mead, 1989; Rosario-Delestre *et al*., 1999; Norman & Mead, 2001). Recent observations close to Europe and West Africa showed that *M. europaeus* may not be as rare in the northeast Atlantic as once thought (see Reiner, 1980; Burton *et al*., 1989; Robineau & Vely, 1993; MacLeod, 2000). In the southern hemisphere, there are only three confirmed records, all from the Ascencion Island at 07°57′S (Mead, 1989; Norman & Mead 2001). These were the previous southernmost records for this species. Almost all records of the Gervais' beaked whale are strandings with few confirmed sightings (Pitman, 2002).

Correspondence to: Marcos César de Oliveira Santos, Rua Professor Artur Ramos, Num. 178/Ap. 162–A, São Paulo, SP, 01454–010, Brasil.



## Materials and Methods

*Specimen description*

On 10 August 2001, a beaked whale was found dead on a rocky shore at São Vicente (23°58′S; 46°24′W), São Paulo state, Brazil. The carcass was in an advanced state of decomposition, suggesting the animal was dead for some time before being washed ashore. Due to damage caused by waves washing the animal against the rocky shore and the inaccessability of the stranding location, it was not possible to take external measurements other than total body length (approximately 390 cm), or to identify the sex of the animal. Only its head was recovered and the skull (Fig. 1) was deposited at the collection of the Museu do Instituto de Pesca de Santos (CEEMAM # 127).

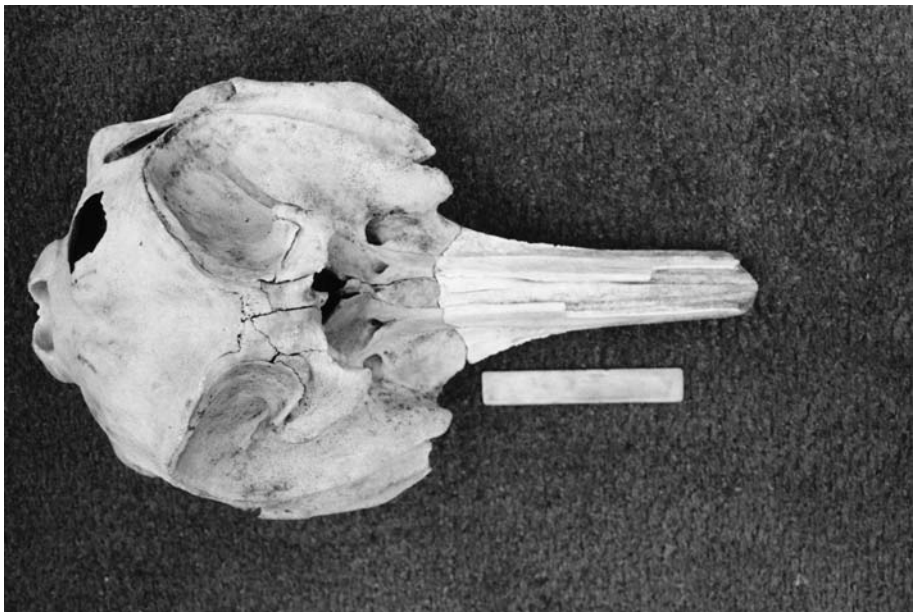

**Figure 1.** Skull dorsal view of the *Mesoplodon europaeus* (CEEMAM # 127) specimen which stranded in August 2001 at São Vicente, Brazil. (Scale = 15 cm).

**Figure 2.** Skull frontal view of the *Mesoplodon europaeus* (CEEMAM # 127) specimen, showing the extreme development of the vertex. (Scale = 15 cm).

The animal was identified as a *Mesoplodon* specimen based on the extreme development of the vertex (Fig. 2), which involves the postero-dorsal extensions of the maxillary, premaxillary, frontal, supra-occipital, and nasal bones (True, 1910). The specimen was identified as a *M. europaeus* based on the following characteristics: (1) the presence of a flattened pair of teeth placed near the posterior half of the short mandible symphysis (Fig. 3) (True, 1910; Harmer, 1924; Raven, 1937; Norman &

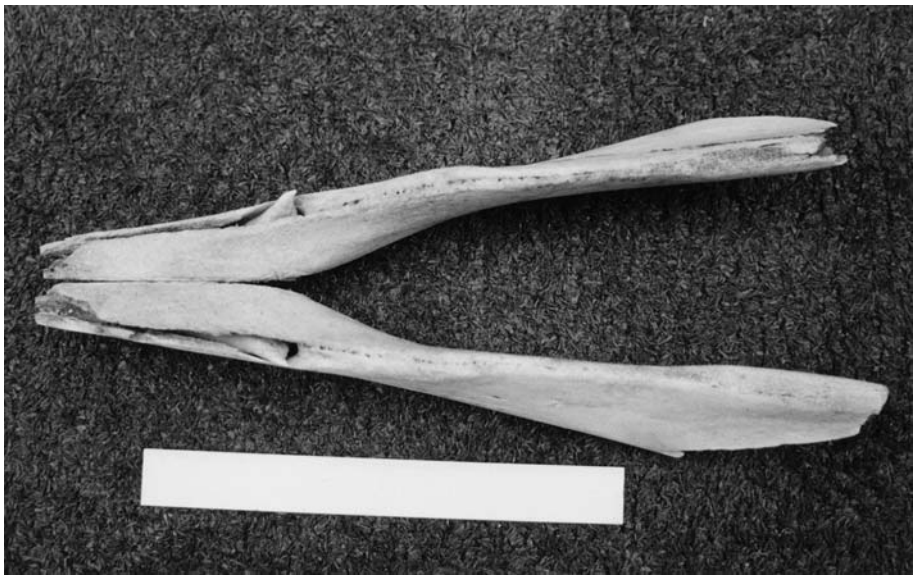

**Figure 3.** Dorsal view of the *Mesoplodon europaeus* (CEEMAM # 127) mandibles showing teeth position in relation to the symphysis (scale = 15 cm).

Mead, 2001); (2) when viewed laterally in an upright position with the long axis of the rostrum horizontal, the premaxillary foramina straddle a horizontal plane transecting the centres of the maxillary formamina (Norman & Mead, 2001); and (3) both the protuberance of the maxillary which interrupts the antorbital notch and the ridge that extends back from this protuberance are conspicuous (Raven, 1937). In addition to those characteristics, the basirostral groove described by Flower (1878) to be common in other *Mesoplodon* species than in *M. europaeus* was absent. The analysed skull resemble the Andrew's beaked whale (*M. bowdoini*) skull. However, the gap between the nasals is too large, the right nasal crest is not big enough and the maxillary foramina are different.

The skull is incompletely ossified and some bones are not completely fused indicating that this specimen was probably a subadult. Raven (1937) described that the relative age of a *M. europaeus* specimen could be judged by the extent of the co-ossification of the presphenoid and vomer, which in adults occupies the entire mesorostral canal. In the studied specimen, the mesorostral canal is formed by the vomer below and bounded on either side above by the medial borders of the premaxillaries, and it does not completely fill the canal, indicating a probable juvenile specimen (as shown in Fig. 3, Raven, 1937). However, it presents fully ossified pulp cavities of both teeth (Fig. 4), showing evidences of being mature. In addition, it was not possible to reach the specimen gender based only on the analysis of the mesorostral canal, as Varona (1985) described that females and juveniles share similar skull characteristics which are different from the ones observed in adult males. Based on the characteristics described above, we concluded that this specimen was probably a subadult female.

## Results

Due to damage sustained either pre- or post-mortem, the tip of the rostrum and some of the cranial bones of the São Vicente specimen, it was not possible to take all the cranial measurements. Those which could be taken are shown in Table 1. Measurements were taken with calipers to the nearest milimeter following Moore (1963) and Ross (1984). The condylobasal length (CBL) without the broken tip of rostrum measured 538 mm. Based on the relative proportions between the CBL and the skull largest width (around 0.47 as presented by Raven, 1937, after analysing three *M. europaeus* skulls), the estimated CBL of the São Vicente specimen was 685 mm. The width of the base of the rostrum relative to the zygomatic width (0.41) was low when compared to other *M. europaeus* specimens (0.55–0.64, n = 9) by Reyes *et al.* (1995). The relative length of the upper surface of the right nasale in the vertex (28.9 mm) was 0.87 times the


**Figure 4.** Shape of both collected teeth of the *Mesoplodon europaeus* (CEEMAM # 127). Pulp cavities were fully ossified (scale = 15 cm).

least distance between the premaxillary foramina (33.0 mm). This index was less than 2.0 in all *Mesoplodon* species, except for *M. traversii* (Reyes *et al*., 1995; van Helden *et al*., 2002).

## Discussion

The reported record is the southernmost for the Gervais' beaked whale in the south Atlantic and the first known from the southwest Atlantic, as well as for the Brazilian coast. A total of 43 cetacean species were reported in Brazil (IBAMA, 2001; Pinedo *et al*., 2002), including seven other ziphiid species: the southern bottlenose whale ($n=2$), *Hyperoodon planifrons* (Gianuca & Castello, 1976; Simões-Lopes & Ximenez, 1993), the Blainville's beaked whale ($n=3$), *Mesoplodon densirostris* (Castello & Pinedo, 1980; Simões-Lopes & Ximenez, 1993; Secchi & Zarzur 1999), the Gray's beaked whale ($n=4$), *M. grayi* (Soto & Vega 1997; Pinedo *et al*., 2001), the Hector's beaked whale ($n=1$), *M. hectori* (Zerbini & Secchi, 2001), the strap-toothed beaked whale ($n=1$), *M. layardii* (Pinedo *et al*., 2002), the Arnoux's beaked whale ($n=1$), *Berardius arnuxii* (Siciliano & Santos, *in press*), and the Cuvier's beaked whale ($n=13$), *Ziphius cavirostris* (see review by Pinedo *et al*., 2001). All records are from stranded individuals. This Gervais' beaked whale record confirms the predicted occurrence of this species in the southwest Atlantic (see Pinedo *et al*., 1992; Hetzel & Lodi, 1993).

The present record is the fifth *Mesoplodon* species observed in Brazil. The four other species were reported in southern Brazil from 27°S to 34°S. At the latitude where the São Vicente specimen was found (~23°S), the large continental shelf is about 200 km wide. This area is influenced by the warm waters of the Brazil's Current (Emílsson, 1961; Stramma, 1989), which has the same characteristics of the Gulf Stream (Stommel, 1960; Signorini, 1976) where *M. europaeus* is known to occur. The Brazil's current flows southward along the north-east coast of South America, where the continental shelf is relatively narrower (25 to 125 km). As noted before, Gervais' beaked whales could have a cross equatorial distribution along warm and temperate deeper waters (Mead, 1989; MacLeod, 2000). If this is the case, strandings would be expected to occur along the Brazilian northeast coast. However, prior to the mid 1990s, there were few cetacean studies in this region and only a few research groups are developing surveys for stranded animals. Dedicated cetacean sighting surveys are rare along the entire Brazilian coast. Records of stranded individuals are important for understanding the distribution of poorly known cetacean species, such as beaked whales (Mead, 1989). However, care must be taken when drawing conclusions from a small number of records, particularly from regions where little is

**Table 1.** Cranial measurements taken from the *Mesoplodon europaeus* specimen (CEEMAM # 127) collected in São Vicente, São Paulo – Brazil, in August 2001. Bilateral measurements were taken from the left side, except for measurements 18, 19, 37 and 38, which were taken for both sides.

| Cranial Measurement Description | | mm |
|---|---|---|
| 1. | Length of temporal fossa | 90.1 |
| 2. | Length of orbit | 78.8 |
| 3. | Length of right nasal on vertex of skull | 54.2 |
| 4. | Length of nasal suture | 48.8 |
| 5. | Breadth of skull across postorbital process of frontals | 325.0 |
| 6. | Breadth of skull across zygomatic processes of squamosals | 321.0 |
| 7. | Breadth of skull across centres of orbits | 309.1 |
| 8. | Least breadth of skull across posterior margins of temporal fossae | 208.7 |
| 9. | Greatest span of occipital condyles | 103.4 |
| 10. | Greatest width of an occipital condyle | 46.5 |
| 11. | Greatest length of an occipital condyle | 37.2 |
| 12. | Breadth of skull across exoccipitals | 265.8 |
| 14. | Breadth of nasals on vertex | 48.3 |
| 15. | Least distance between premaxillary crests | 49.1 |
| 16. | Greatest extension of right premaxillary posterior of right nasal on vertex of skull | 28.9 |
| 17. | Greatest span of premaxillary crests | 158.1 |
| 18. | Least width of premaxillae where they narrow opposite superior nares | 31.4 L/39.7 R |
| 19. | Greatest width of premaxillae anterior to place of measurement # 18 | 44.5 L/67.9 R |
| 20. | Width of rostrum in apices of antorbital notches | 193.3 |
| 21. | Width of rostrum in apices of prominential notches | 132.1 |
| 22. | Greatest transverse width of superior nares | 52.3 |
| 23. | Greatest inside width of inferior nares on the pterygoids | 78.6 |
| 24. | Height of skull | 232.9 |
| 25. | Greatest width of temporal fossa | 63.2 |
| 26. | Least distance between maxillary foramina | 78.1 |
| 27. | Least distance between premaxillary foramina | 33.0 |
| 28. | Distance from posterior margin of left maxillary foramen to most anterior extension of left maxillary prominence | 75.3 |
| 30. | Length of tympanic bulla, left | 45.2 |
| 33. | Outside height of mandible at mid-length of alveolus | 46.9 |
| 34. | Inside height of mandible at mid-length of alveolus | 50.0 |
| 35. | Right/left tooth height | 51.8/51.2 |
| 36. | Right/left tooth length | 56.0/57.0 |

known about cetacean species distribution, such as the southwest Atlantic. Sick whales could stray far beyond their normal range and carcasses could travel unknown distances before reaching the shore. As a result, the distribution of strandings could reflect the local ocean currents, rather than the real species distribution (e.g., MacLeod, 2000). Gervais's beaked whales and other ziphiid species could occur in deeper waters along the Brazilian coast as indicated by strandings. However, little information is available on ziphiid biology and distribution for most of the south Atlantic. Therefore, the São Vicente specimen record is important in raising the possibility that this species could have a similar tropical to warm temperate distribution in the south Atlantic as it has in the north Atlantic. However, more specimens will be required to confirm whether the present specimen corresponds to an extra limital record.

**Acnowledgments**

Colin MacLeod, PhD, provided useful references. Colin MacLeod, PhD, James Mead, PhD and Eduardo R, Secchi MSc. reviewed the first draft and provided important comments to improve this manuscript. Graham Ross, PhD, Jeanette Thomas, PhD, and an anonymous reviewer helped with the final revision of the manuscript and provided excellent suggestions to reach its final format. Alan Baker, PhD and Graham Ross, PhD, were very kind and helpful to discuss and reach the species identification.

**Literature Cited**

Burton, T. D., Cotton, D. & Enright, M. (1989) Gulf stream beaked whale *Mesoplodon europaeus* (Gervais). *Irish Naturalists' Journal* **23,** 156.

Caldwell, D. K. (1964) A new record for the beaked whale, *Mesoplodon europaeus*, from Jamaica. *Caribbean Journal of Science* **4,** 547.

Castello, H. P. & Pinedo, M. C. (1980) *Mesoplodon densirostris* (Cetacea, Ziphiidae)—primeiro registro para o Atlântico Sul Ocidental. *Boletim do Instituto Oceanográfico*, São Paulo **29,** 91–94.

Debrot, A. O. & Barros, N. B. (1992) Notes on Gervais' beaked whale, *Mesoplodon europaeus*, and a dwarf sperm whale, *Kogia simus*, stranded in Curaçao, Netherlands Antilles. *Marine Mammal Science* **8,** 172–178.

Emílsson, I. (1961) The shelf and coastal waters off southern Brazil. *Boletim do Instituto Oceanográfico*, São Paulo. **11,** 101–112.

Flower, W. (1878) A further contribution to the knowledge of the existing ziphioid whales genus *Mesoplodon*. *Transactions of the Zoological Society*, London. **8,** 203–234.

Gervais, P. (1855) *Histoire Naturalle des Mammifères*. L. Curmer, Paris, France. **2,** 1–344.

Gianuca, N. M. & Castello, H. P. (1976) First record of the southern bottlenose whale, *Hyperoodon planifrons* from Brazil. *Scientific Reports of the Whales Research Institute* **28,** 119–126.

Harmer, S. F. (1924) On *Mesoplodon* and other beaked whales. *Proceedings of the Zoological Society of London* **36,** 541–587.

Hetzel, B. & Lodi, L. (1993) *Baleias, Botos e Golfinhos: Guia de Identificação Para o Brasil*. Nova Fronteira, Rio de Janeiro. 279 pp.

IBAMA (2001) *Mamíferos Aquáticos do Brasil: Plano de Ação II.* Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis, 96 pp. Action Plan for Marine Mammals. Available from SAIN, Av. Norte s.n., Brasília, DF, 70800–200.

MacLeod, C. D. (2000) Review of the distribution of *Mesoplodon* species (order Cetacea, family Ziphiidae) in the North Atlantic. *Mammal Review* **30,** 1–8.

Mead, J. G. (1989) Beaked whales of the genus *Mesoplodon.* In: S. H. Ridgway & R. Harisson (eds.) *Handbook of Marine Mammals*, volume **4**: *River Dolphins and Larger Toothed Whales*, pp. 349–430 Academic Press, London.

Moore, J. C. (1963) Recognizing certain species of beaked whales of the Pacific Ocean. *American Midland Naturalist* **70,** 396–428.

Norman, S. A. & Mead, J. G. (2001) *Mesoplodon europaeus. Mammalian Species* **688,** 1–5.

Pinedo, M. C., Rosas, F. C. W. & Marmontel, M. (1992) *Cetáceos e Pinípedes do Brasil. Uma Revisão dos Registros e Guia para a Identificação das Espécies*. UNEP/FUA, Manaus. 213 pp.

Pinedo, M. C., Barreto, A. & Lammardo, M. (2001) Revisão de *Ziphius cavirostris, Mesoplodon grayi e Lagenodelphis hosei* (Cetacea: Ziphiidae e Delphinidae) em águas brasileiras, com novos registros para o sul do Brasil. *Biociências* **23,** 67–76.

Pinedo, M. C., Barreto, A., Lammardo, M., Andrade, A. L. V. & Geracitano, L. (2002) Northernmost records of the spectacled porpoise, Layard's beaked whale, Commerson's dolphin, and Peale's dolphin in the southwestern Atlantic Ocean. *Aquatic Mammals* **28,** 32–37.

Pitman, R. L. (2002) Mesoplodont whales. In: W. F. Perrin, B. Würsig & J. G. M. Thewissen (eds.) *Encyclopedia of Marine Mammals*, pp. 738–742 Academic Press, San Diego.

Rankin, J. J. (1953) First record of the rare beaked whale, *Mesoplodon europaeus*, Gervais, from the West Indies. *Nature* **172,** 873–874.

Raven, H. C. (1937) Notes on the taxonomy and osteology of two species of *Mesoplodon* (*M. europaeus* Gervais, *M. mirus* True). *American Museum Novitates* **905,** 1–30.

Reiner, F. (1980) First record of an Antillean beaked whale, *Mesoplodon europaeus* Gervais, 1855 from the República Popular de Guiné-Bissau. *Memórias do Museu do Mar,* Cascais, Portugal, Série Zoologia. **1,** 1–8.

Reyes, J. C., Waerebeek, K. V., Cárdenas, J. C. & Yáñez, J. L. (1995) *Mesoplodon bahamondi* SP. N. (Cetacea, Ziphiidade), a new living beaked whale from the Juan Fernández Archipelago, Chile. *Boletin del Museo Nacional de Historia Natural*, Chile. **45,** 31–44.

Robineau, D. & Vely, M. (1993) Stranding of a specimen of Gervais beaked whale (*Mesoplodon europaeus*) on the coast of West Africa. *Marine Mammal Science* **9,** 438–440.

Rosario-Delestre, R., Rodríguez-López, M. A., Mignucci-Giannoni, A. A. & Mead, J. G. (1999) New records of beaked whales (*Mesoplodon* spp.) for the Caribbean. *Caribbean Journal of Science* **35,** 144–148.

Ross, G. J. B. (1984) The smaller cetaceans of the south coast of Southern Africa. *Annals of the Cape Province Museum, Natural History* **15,** 173–410.

Secchi, E. R. & Zarzur, S. (1999) Plastic debris ingested by a Blainville's beaked whale, *Mesoplodon densirostris*, washed ashore in Brazil. *Aquatic Mammals* **25,** 21–24.

Siciliano, S. & de O. Santos, M. C. (in press) On the occurrence of the Arnoux's beaked whale (*Berardius arnuxii*) in Brazil. *Journal of the Marine Biological Association*, UK.

Signorini, S. R. (1976) Contrinuição ao estudo da circulação e do transporte de volume da Corrente do Brasil entre o Cabo de São Tomé e a Baía de Guanabara. *Boletim do Instituto Oceanográfico*, São Paulo. **25,** 157–220.

Simões-Lopes, P. C. & Ximenez, A. (1993) Annotated list of cetaceans of Santa Catarina coastal waters, southern Brazil. *Biotemas* **6,** 67–92.

Soto, J. M. R. & Vega, S. S. (1997) Primeiro registro da baleia bicuda de Gray, *Mesoplodon grayi* Haast, 1876 (Cetacea: Ziphiidae) para o Brasil, com referências osteológicas e a revisão das citações de zifídeos em águas brasileiras. *Biociências* **5,** 69–89.

Stommel, H. (1960) *The Gulf Stream: Physical and Dynamical Description*. Berkeley, University of California Press.

Stramma, L. (1989) The Brazil Current transport south of 23°S. *Deep Sea Research* **36,** 639–646.

True, F. W. (1910) An account of the beaked whales of the family Ziphiidae in the collection of the United States National Museum, with remarks on some specimens in other American Museums. *Bulletin of the United States National Museum* **73,** 1–89.

Ulmer, F. A. (1947) A second Florida record of *Mesoplodon europaeus*. *Journal of Mammalogy* **28,** 184–185.

van Helden, A. L., Baker, A. N., Dalebout, M. L., Reyes, J. C., Waerebeek, K. V. & Baker, C. S. (2002) Ressurrection of *Mesoplodon traversii* (Gray, 1874), senior synonym of *M. bahamondi* Reyes, Van Waerebeek, Cárdenas and Yáñez, 1995 (Cetacea: Ziphiidae). *Marine Mammal Science* **18,** 609–621.

Varona, L. S. (1970) Morphologia externa y caracteres craniales de un macho adulto de *Mesoplodon europaeus* (Cetacea, Ziphiidae). *Poyeana A* **69,** 1–17.

Zerbini, A. N. & Secchi, E. R. (2001) Occurrence of Hector's beaked whale, *Mesoplodon hectori*, in southern Brazil. *Aquatic Mammals* **27,** 149–153.