

# Strandings of six beaked whales in Santa Cruz province, southern Argentina (1998-2011)

Hevia, Marta<sup>1, 2, \*</sup>; Debora Arcucci<sup>1</sup>; Jimena Belgrano<sup>1,2</sup>; Frank Cipriano<sup>3</sup>; Mauricio Failla<sup>1</sup>; Cecilia Gasparrou<sup>1,2</sup>; Nicola Hodgins<sup>2</sup>; Florencia Kröhling<sup>1</sup>; Vanesa Reyes Reyes<sup>1</sup>; Vanesa Tossenberger<sup>1,2</sup> and Miguel Iñíguez<sup>1,2</sup>

\*corresponding author: marta.hevia@cethus.org

## Abstract

Information on beaked whale strandings in Santa Cruz province, southern Patagonia, Argentina, that occurred between 1998 and 2011 is reported here. During this period, six dead stranded individuals belonging to three different species were recorded: 2 *Mesoplodon layardii* (strap-toothed whale), a 526cm male and a 414cm female; 3 *Ziphius cavirostris* (Cuvier's beaked whale), a 578cm male and two females of 622cm and 287cm respectively and a 657cm male *Tasmacetus shepherdi* (Shepherd's beaked whale), all of which were complete skeletons. Genetic corroboration of sex and species was done for the female strap-toothed whale and the Shepherd's beaked whale. Teeth and skin were collected whenever possible. It was not possible to determine cause of death mainly due to the stage of decomposition of the specimens. Results of a bibliographic survey on strandings of Ziphiidae in Santa Cruz province are also reported here. Similarly to the literature on strandings of beaked whales in this region, data presented here show that *Z. cavirostris* was the species most frequently found stranded.

KEYWORDS: strandings, Ziphiidae, beaked whales, Patagonia, southern Argentina

## INTRODUCTION

Ziphiidae is widely distributed, to the extent that it is one of the cetacean families that can be found in every ocean basin and at all latitudes (MacLeod *et al*, 2006). Notwithstanding this, most of them are rarely seen at sea and only a few have been studied (Reeves, 2002; Mead, 2002a).

Even when some information obtained from stranded individuals may be biased (MacLeod, 2000; MacLeod *et al*, 2006) when dealing with rare species, or species for which available information is scarce, data recovered from strandings are very valuable.

The objective of this paper is to present unpublished information on strandings of beaked whales reported to Fundación Cethus in Santa Cruz province during the period 1998 to 2011. A bibliographic review for the same period is also included.

## MATERIALS AND METHODS

Santa Cruz province is one of the largest provinces of Argentina. It has approximately a 1000km long coastline of pebbled beaches and cliffs, interrupted by five water entrances and only five small cities or towns throughout the province. In Patagonia, south of 39°S, tide regimen is semidiurnal and tide amplitudes are higher than 4m, reaching up to 9.6m. In general the coast is under a process of erosion with active and extensive cliffs. Accretion forms are less frequent and are represented by pebbled and sand beaches (Codignotto *et al*, 1992; Codignotto *et*

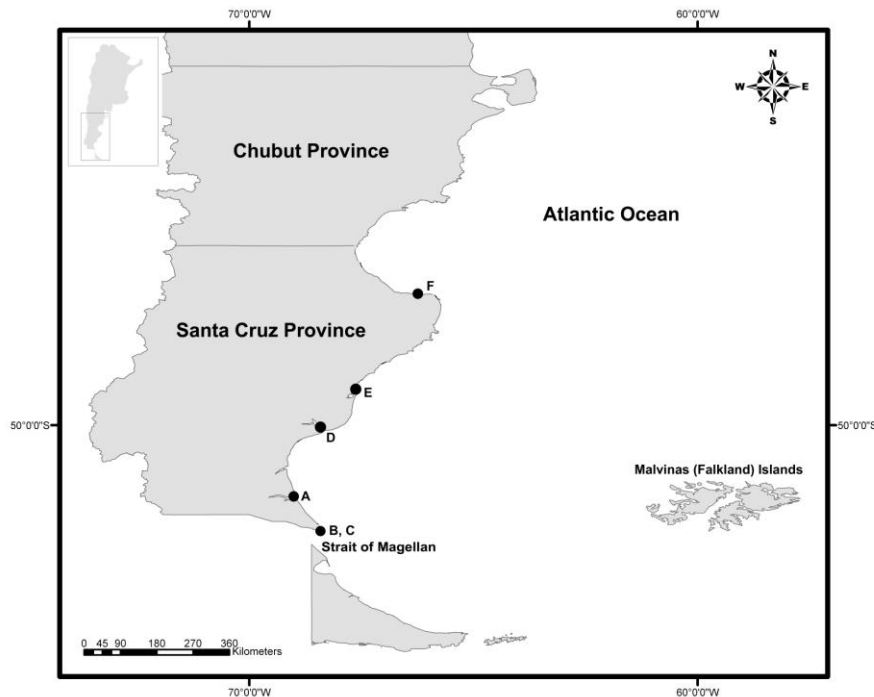
---

<sup>1</sup>Fundación Cethus. Potosí 2087 PA (B1636BUA) Olivos – Buenos Aires – Argentina.

<sup>2</sup>WDCS (Whale and Dolphin Conservation Society). Brookfield House. 38 St Paul Street – Chippenham – Wiltshire, SN15 1 LJ - UK

<sup>3</sup>Genomics Transcriptomics Analysis Core (GTAC), San Francisco State University (SFSU). San Francisco, CA 94132, USA

al, 1993; Codignotto, 1997). These facts make access to the shore difficult around vast areas of the coastline and beach surveys throughout the province are scarce.



**Figure 1.** Location of strandings. A: FCCVZC200210; B: FCPLZC100505; C: FCCVZC100411; D: FCSCML120298; E: FCSJML250107; F: FCBMTS080208

Beaked whale strandings introduced in this paper were reported to Fundación Cethus by local authorities.

Data on each stranding included position, measured using a GPS, date of localization of the stranded individual, date of data collection, species, sex, stage of decomposition according to Geraci & Lounsbury (2005), morphometric measurements following Norris (1961) and photographic records. Age-class was assigned based on total length, according to the average total length for each species described in the literature, and/or presence of diagnostic teeth in males, if cranial morphology was not available.

Skin samples were taken from each individual, depending on the preservation of the carcass, and teeth were collected whenever present.

For rare specimens or for those in which taxonomic classification based on external examination was difficult, genetic determination of species and sex was used. Frozen skin tissue was used to extract total DNA using a DNEasy Kit (Qiagen Corp., Valencia, California, USA). Samples were amplified with standard PCR protocols, using FastStart taq (Roche Diagnostics, Indianapolis, Indiana, USA) and following the manufacturers protocols, and sequenced using BigDye 3.1 chemistry and an AB 3100 Genetic Analyzer (Applied Biosystems, Foster City, California, USA). Genetic species identification used phylogenetic reconstruction analysis with bootstrapping, as provided for cetaceans on the “DNA Surveillance” website [http://www.cebl.auckland.ac.nz:9000/page/whales/cluster\\_advanced](http://www.cebl.auckland.ac.nz:9000/page/whales/cluster_advanced). and sex was determined through the genetic protocol of Baker *et al.* (1996) for amplification of the SRY region. SRY products were separated on an agarosa mini-gel and stained with ethidium bromide to visualize under UV light the SRY product.

A Fundación Cethus’ stranding code was assigned to each specimen and tissue samples collected were archived at Fundación Cethus.

A bibliographic survey on strandings of Ziphiidae in Santa Cruz province during the period considered in this paper was done using peer-reviewed journals, scientific meetings –Reunión de Trabajo de Especialistas en Mamíferos Acuáticos de América del Sur-Congreso SOLAMAC and 16<sup>th</sup> and 17<sup>th</sup> Biennial Conference on the

Biology of Marine Mammals, papers submitted to Small Cetaceans sub-committee of IWC Scientific Committee, IWC Argentina Progress Report and local contacts.

## RESULTS

Between 1998 and 2011 strandings of six beaked whales in the coasts of Santa Cruz province, southern Patagonia, Argentina, were discovered by or reported to Fundación Cethus. These six stranded individuals belong to three different species: *Mesoplodon layardii* (strap-toothed whale), *Ziphius cavirostris* (Cuvier's beaked whale) and *Tasmacetus shepherdii* (Shepherd's beaked whale). It was not possible to determine the exact date of the stranding for any of the specimens presented here except for one of the strap-toothed whales. All of the remaining animals were found dead on the beach and in all cases the skull and most of the skeleton were available.

Species	Specimen Code	Date	Place	Sex	TL (cm)	Age class	DS
<i>Ziphius cavirostris</i>	FCPLZC100505	May 2005	Punta Loyola	F	622	A	3
	FCCVZC200210	Feb 2010	Cabo Vírgenes	M	578	A	4
	FCCVZC100411	Apr 2011	Cabo Vírgenes	F	287	C	3
<i>Mesoplodon layardii</i>	FCSCML120298	Feb 1998	Punta Quilla	M	526	A	3
	FCSJML250107	Jan 2007	Pla. San Julián	F	414	J	5
<i>Tasmacetus shepherdii</i>	FCBMTS080208	Feb 2008	Golfo San Jorge	M	657	A	4

**Table 1.** Ziphiidae specimens stranded in Santa Cruz Province from 1998 to 2011 reported to Fundación Cethus (Date refers to sampling date; TL: Total Length; Age class: A: Adult, C: Calf; J: Juvenile; DS: Decomposition Stage determined according to Geraci and Lounsbury 2005).

Cuvier's beaked whale was the most frequently recorded species with three individuals: a 578cm male found in Reserva Provincial Cabo Vírgenes (52°20'30.5"S, 068°21'52.6"W) in February 2010 (stage of decomposition 4) and two females, a 622cm that stranded in Punta Loyola (51°36'34"S; 69°00'50"W) on May 7<sup>th</sup> 2005 and a 287cm found in Reserva Provincial Cabo Vírgenes (52°19'17.6"S, 68°21'13.6"W) in April 2011, both belonging to a stage of decomposition 3 (Fig. 1; Fig. 2 a, b, and c and Table 1). The male and the 622cm female were considered adults. The smaller specimen was considered to be a calf. Only one tooth from the male specimen was extracted, the one from the left mandible, as it was the only one present at the time of data collection in January 2011. This tooth was highly eroded and the individual was catalogued as FCCVZC200210. Regarding the 622cm female, it was possible to confirm the presence of two throat grooves, with the left one measuring 27cm and the right one 29cm. The separation between them was 3cm at the anterior end and 31cm at the posterior end. Ventral fat thickness was 7cm. This animal was registered as FCPLZC100505. The most recent stranding, FCCVZC100411, the 287cm female, had no visible scars on the body or wounds other than a lesion in the genital area attributed to scavenging birds after the animal had washed ashore on the beach. No external parasites were found and the stomachs and intestines were empty. Skin tissue samples were collected from each specimen for genetic analysis and are stored at Fundación Cethus.

The strap-toothed whales were a 526cm male (stage of decomposition 3) found in Punta Quilla (50°07'47"S; 068°24'08"W) in February 1998 and a 414cm female found in Península San Julián (49°22'10"S; 067°38'38"W) in January 2007 (stage of decomposition 5) (Fig. 1, Fig. 2 d, e and Table 1). The carcass of the 526cm male was found lying on its left side and had no missing parts other than the anterior end of the mandibles. It presented scars on its body and a deep cut of unknown origin on the right side. The dorsal fin had a nick at the tip. The pair of teeth from the lower jaw were absent at the time of field examination as they had been extracted by a local person in order to avoid them being lost. Once recovered, measurements were taken. The left tooth measured 31.5cm and the right tooth 30.5cm; denticle was similar in both teeth: 1cm wide at the base and 0.7cm high. This individual was considered to be an adult and was coded as FCSCML120298. With respect to the 414cm female, as definitive taxonomic classification at species level was not possible in the field due to the advanced stage of decomposition, genetic analysis was used to confirm species and sex. Upper and lower maxillary bones were broken and the bones of the skull were not fused so it has been classified as a juvenile. Two teeth were embedded within the gum; the right tooth was 6.4cm wide at the base, 2.8cm high, its denticle was 1.4cm wide at the base and 0.9cm high; the left tooth was 6.1cm wide at the base, 2.6cm high, its denticle was 1.3cm wide at the base and 0.8cm high. This specimen was catalogued as FCSJML250107.

The Shepherd's beaked whale was a 657cm male found in Golfo San Jorge (47°02'30, 8''S; 066°36'14, 9''W) in August 2007, however due to logistical reasons, measurements were not taken until February 2008 (stage of decomposition 4) (Fig. 1; Fig. 2 f and Table 1). Only one of the larger teeth could be extracted, the one from the lower left jaw, as the other one was absent at the time of on site data collection. Pictures taken at the time the carcass was discovered, and later sent to the authors, clearly shows that the specimen had both of these larger teeth. The tooth that was recovered was 2.4cm wide and 4.4cm high and the pulp cavity was completely filled suggesting that the individual was an adult. Through teeth and dental alveoli counting, it was possible to determine that the specimen had 21 teeth in the upper right jaw. The remaining smaller teeth were also extracted. Tide and weather conditions did not allow for a thorough inspection of the carcass nevertheless, skin tissue was collected and the specimen was catalogued as FCBMTS080208.



**Figure 2.** Specimen found stranded on Santa Cruz province between 1998 and 2011. a: FCCVZC200210; b: FCPLZC100505; c: FCCVZC100411; d: FCSCML120298; e: FCSJML250107; f: FCBMTS080208.

## DISCUSSION

Every specimen of the Ziphiidae family found stranded is highly valuable due to the little information available on these cetaceans. This fact becomes particularly true for individuals found in Santa Cruz province, since the characteristics of its shoreline makes it very difficult to regularly monitor strandings along the length of the coast. This may also be the reason that many of the specimens described in this paper were in an advanced state of decomposition at the time of discovery.

During the 14-year period between 1998 and 2011, Fundación Cethus attended six beaked whales strandings. The bibliographic search revealed only two additional specimens having stranded in the province during that period, one strap-toothed whale (El Patagónico, 02/08/2011) and a Shepherd's beaked whale (Grandi *et al*, 2003).

Adult beaked whales range in size from 3 - 13m (Mead, 2002). One striking feature of these odontocetes is that, with the exception of *Tasmacetus shepherdi*, females and juveniles do not present functional teeth (only vestigial ones) and males of most species have only one pair in the lower jaw (Mead, 2002b).

Among beaked whales, *Ziphius cavirostris* is the species whose distribution is the widest (MacLeod *et al*, 2006). It is also one of the most prolific species in specimens stranded all around the globe (Heyning, 2002; Reeves *et al*, 2002). In southern Patagonia it was also the most frequently documented species. Average adult size is considered to be 610cm and no difference in total length between sexes has been found (Heyning, 2002). According to Reeves *et al* (2002), length at birth for this species is 270cm, value estimated by Mead (1984) based on data recorded from the largest foetus and the smallest calf registered. The 287cm female therefore can be considered to be a calf or a small juvenile, which makes this individual particularly important as most specimens that are washed ashore and found in this area are found to be adults (Goodall *et al*, 2008). Even though the carcass may have been transported by ocean currents (MacLeod *et al*, 2006), the fact that this individual was so small, and the stage of decomposition was 3, this would provide evidence that Cuvier's beaked whale may reproduce off the southernmost tip of the continent, a fact that should be further investigated. The remaining two specimens were both found to be adults.

*Mesoplodon layardii* has a circumpolar distribution in cool temperate waters, restricted to the Southern Hemisphere (MacLeod *et al*, 2006; Reeves, 2002). Maximum size for males is reported to be 590cm and for females 620cm. The male was considered to be an adult, due to its body length and the size of its teeth (Reeves *et al*, 2002; Mead, 2002a). In cases where morphological identification at species level can not be confirmed, genetic identification is highly recommended (MacLeod *et al*, 2006). This was the case with FCSJML250107, for which only bones and dry tissue were available at the time of discovery. In February 2011, a strap-toothed whale of more than 500cm in length stranded on the shores of Caleta Olivia city, in northern Santa Cruz Province, as reported by a local newspaper (El Patagónico, 02/18/2011) and confirmed by the authors through photographs sent by C. Berenguel (*pers. comm.*)

*Tasmacetus shepherdi* is thought to inhabit cold waters of the Southern Hemisphere, and be circumpolar in distribution, though records are considered not to be conclusive as yet (MacLeod *et al*, 2006). It is easily identified, at least when a skull is found ashore, as this is the only species within the Ziphiidae family that has a complete set of functional teeth with males having a larger tooth at the anterior end of each of its mandibles (Mead, 2002). Despite this fact, the species has not been frequently recorded either stranded or alive and is one of the least known of all cetaceans (Mead, 2002), and it is still not clear whether the species is rare or just infrequently found (Pitman *et al*, 2006). Adult sizes that have been reported are between 600cm and 700cm, and there has been documentation of a calf of 340cm (Mead, 2002). The individual found here was classified as an adult male due to its body length and the presence of a large tooth at the end of the left mandible. Within the period discussed in this paper, this was the second specimen found in the Santa Cruz province. Grandi *et al* (2003) reported on a stranded Shepherd's beaked whale in September 2003 near Punta Quilla (50°09'S; 068°21'W). This specimen was a 660cm adult male and, at the time of data collection, was in an advanced state of decomposition. Through Growth Layer Groups (GLGs), the authors determined that this specimen was 23 years old.

On-going further analysis of the six beaked whales described above will continue to provide valuable information.

Frequent shore surveys are very important, especially in areas with low human populations where vast areas are not visited for long periods of time. Surveys may allow the prompt discovery of carcasses, or even live individuals, allowing for more data on the stranded specimen to be collected. This is particularly relevant for species such as beaked whales for which information is not abundant. When and where it is not possible for shore surveys to be conducted frequently, the relevance of responding to the notice of a stranding made by local people is even greater.

## ACKNOWLEDGMENTS

To J. Combina, C. Gutierrez, J. Perancho, C. Torlaschi, B. Quintas, Prefectura Naval Argentina, Consejo Agrario Provincia de Santa Cruz, Regimiento de Caballería 11, Municipalidad de Puerto Santa Cruz, Casa de la Cultura de Puerto Santa Cruz, Municipalidad de Puerto Deseado, Dirección de Vialidad, Pcia. de Santa Cruz and WDSCS (Whale and Dolphin Conservation Society). Research was developed through permits issued by the Subsecretaría de Medio Ambiente and Dirección de Recursos Naturales – Consejo Agrario Provincial –, Provincia de Santa Cruz.

## REFERENCES

- Baker, C. S., F. Cipriano and Palumbi, S.R. 1996. Molecular genetic identification of whale and dolphin products from commercial markets in Korea and Japan. *Molecular Ecology* 5:671-685.
- Codignotto, J.O., Kokot, R. and Marcomini, S. 1992. Neotectonism and Sea-Level changes in Coastal Zone of Argentina. *Journal of Coastal Research*. 125-133.
- Codignotto, J.O., Kokot, R. and Marcomini, S. 1993. Desplazamientos Verticales y horizontales de la costa Argentina en el holoceno. *Revista de la Asociación Geológica Argentina*, 48(2):125-132.
- Codignotto, J.O. 1997. Geomorfología y Dinámica Costera. pp. 89-105. In E.E. Boschi (ed) *El Mar Argentino y sus Recursos Pesqueros. Tomo 1. Antecedentes históricos de las exploraciones en el mar y las características ambientales*. Instituto Nacional de Investigación y Desarrollo Pesquero. Secretaría de Agricultura, Ganadería, Pesca y Alimentación. Mar del Plata. República Argentina. 222pp.
- El Patagónico, February 18th, 2011. <http://www.elpatagonico.net/index.php?item=nota&idn=92193&ref=hoy>
- Geraci, J.R. and Lounsbury, V.J. 2005. *Marine Mammals Ashore: A Field Guide for Strandings*. Second Edition. National Aquarium in Baltimore, Baltimore, MD. 371pp.
- Goodall, R.N.P., Dellabianca, N., Boy, C.C., Benegas, L.G., Pimper, L.E. and Riccialdelli, L. 2008. Review of small cetaceans stranded or incidentally captured on the coasts of Tierra del Fuego, Argentina, over 33 years. Paper SC/60/SM2 presented to the IWC Scientific Committee, June 2008. 13 pp. [Available from IWC Secretariat]
- Grandi, M.F., Buren, A.D., Crespo, E.A., García, N.A., Svendsen, G.M. and Dans, S.L. 2005. Record of a Specimen of Shepherd's Beaked Whale (*Tasmacetus shepherdi*) from the Coast of Santa Cruz, Argentina, with Notes on Age Determination. *Lajam* 4(2): 97-100, July/December.
- Heyning, J., 2002. Cuvier's beaked whale. *Ziphius cavirostris*. pp. 305–307. In E.F. Perrin, B. Würsig and J.G.M. Thewissen (eds). *Encyclopedia of marine mammals*. Academic Press, San Diego, California.
- MacLeod, C.D. 2000. Review of the distribution of Mesoplodon species (order Cetacea, family Ziphiidae) in the North Atlantic. *Mammal Rev.* 30:(1)1-8.
- MacLeod, C.D., Perrin, W.F., Pitman, R., Barlow, J., Ballance, L., D'Amico, A., Gerrodette, T., Joyce, G., Mullin, K.D., Palka, D.L. and Waring, G.T. 2006. Known and inferred distributions of beaked whale species (Cetacea, Ziphiidae). *Journal of Cetacean Research and Management* 7: 271–286.
- Mead, J.G., 1984. Survey of reproductive data for the beaked whales (Ziphiidae). In *Reproduction in whales, dolphins and porpoises* (ed. W.F. Perrin et al.), pp.91-96. Cambridge: International Whaling Commission.
- Mead, J.G. 2002. Beaked Whales, Overview. pp.81-84. In E.F. Perrin, B. Würsig and J.G.M. Thewissen (eds) *Encyclopedia of Marine Mammals*. Academic Press, San Diego, California. 1414pp.
- Mead, J.G. 2002. Shepherd's Beaked Whale. *Tasmacetus shepherdi*. pp. 1078–1081. In E.F. Perrin, B. Würsig and J.G.M. Thewissen (eds) *Encyclopedia of marine mammals*. Academic Press, San Diego, California. 1414pp.
- Norris, K.S. 1961. Standardized methods for measuring and recording data on the smaller cetaceans. *Journal of Mammalogy* 42 (4): 471-476.

Pitman, R.L. 2002. Mesoplodont Whales. pp. 738–742. *In* E.F. Perrin, B. Würsig and J.G.M. Thewissen (eds) *Encyclopedia of marine mammals*. Academic Press, San Diego, California. 1414pp.

Pitman, R.L., van Helden, A.L. Best, P.B. and Pym, A. 2006. Shepherd's beaked whale (*Tasmacetus shepherdi*): information on appearance and biology based on strandings and at-sea observations. *Marine Mammal Science*, 22(3):744–755.

Reeves, R.R., Stewart, B.S., Clapham, P.J. and Powell, J.A. 2002. *Guide to Marine Mammals of the World*. Chanticleer Press, Inc., New York. 527pp.