Notes on the confirmation of the Dwarf sperm whale *Kogia sima* Owen, 1866 (Cetacea: Kogiidae) on Venezuelan coasts

Notas sobre la confirmación de la especie cachalote enano *Kogia sima* Owen, 1866 (Cetacea: Kogiidae) en las costas de Venezuela

Luis A. BERMÚDEZ VILLAPOL [1], Alejandro SAYEGH [1] and Tatiana LEÓN [2]

[1]Centro de Investigación de Cetáceos. E/S Los Robles, La Redoma de Los Robles, Isla de Margarita, estado Nueva Esparta, 6313, Venezuela, Telf: 58. 295.262.9752; Fax: 58. 295.262.3934 and [2]La Universidad del Zulia, Facultad Experimental de Ciencias, Departamento de Biología. Maracaibo, estado Zulia. Venezuela.
E-mails: cicvenezuela@yahoo.com, cicvzla@hotmail.com y tleonf@cantv.net ✉ Corresponding author

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ABSTRACT

The dwarf sperm whale, *Kogia sima* (Owen 1866), (Cetacea: Kogiidae) is distributed in tropical pelagic and temperate waters around the world, nevertheless, it is extremely hard to observe on field due to its habits of swimming deep waters, furthermore it can get easily confused with pygmy sperm whale species. *K. breviceps* (De Blainville 1828). Most data obtained from both species comes from stranded animals or incidentally caught ones. In the Caribbean and South America the information on these data is poor and scattered and little is known about the basic aspects of the species biology, life history, behaviour and distribution. *K. sima* had not been considered in the list of cetacean of Venezuelan waters until year 2001. To definitively establish the presence of the species *K. sima* in the country, four records are described here, based on the study of morphometric and/or craniometrical comparison of specimens or collected samples, a definite presence of dwarf sperm whale for territorial waters is proposed and therefore an extension in the distribution range for the southern Caribbean.

Key words: Pygmy sperm whale, *Kogia sima* Owen 1866, craniometry, morphometry, Venezuela.

RESUMEN

La especie cachalote enano *Kogia sima* (Owen, 1866) (Cetacea: Kogiidae), se distribuye en aguas pelágicas tropicales y templadas alrededor del mundo, sin embargo, es sumamente difícil de observar en campo debido a sus hábitos de aguas profundas, además puede ser fácilmente confundible con la especie cachalote pigmeo, *K. breviceps* (De Blainville, 1828). La mayoría de la data obtenida de ambas especies proviene de animales varados, capturados incidentalmente o de restos de ellos. En Suramérica y el Caribe la información acerca de las mismas es muy pobre y dispersa, conociéndose muy poco acerca de aspectos básicos de su biología, historia de vida, comportamiento y distribución. *K. sima* no había sido considerada en la lista de cetáceos de las aguas venezolanas hasta el año 2001. Con el objeto de ser establecida definitivamente la especie en el país, se describen cuatro registros, en base al estudio específico de comparación morfométrica y/o craneométrica de los ejemplares o muestras colectados, por lo que se propone la presencia definitiva del cachalote enano en aguas territoriales y por ende una ampliación del rango de distribución para el Caribe Sur.

Palabras clave: Cachalote enano, *Kogia sima* Owen 1866, craneometría, morfometría, Venezuela

INTRODUCTION

The species of the *Kogia* genus, i.e. pygmy sperm whale *Kogia breviceps (*De Blainville, 1828) and dwarf sperm whale *Kogia sima* (Owens, 1866), have been reported for tropical pelagic and temperate waters around the world (Leatherwood *et al.,* 1983; Hoyt, 1984; Caldwell and Caldwell, 1989, Waring *et al.,* 2004). Initially both species were placed in the Family Physeteridae together with the sperm whale, *Physeter macrocephalus*, actually are recognized to as a distinctive family, Kogiidae (Rice, 1998). Nevertheless, biological works on both species are relatively few, besides that, the observation and differentiation of them, on field, are extremely difficult especially in rough waters (Jefferson *et al.,*

1993; Bortolotto *et al.,* 2003). Some studies of compared hematology and diet analysis speculate that Kogiids species are found almost exclusively in deep-water, but dwarf sperm whales appear to feed in shallower water than does *K. breviceps.* Both species are primarily teuthophagous (Baird, 2005; Bloodworth and Marshall, 2005; Santos *et al*., 2006). Thus, reports on the *Kogia* genus are mostly based on morphometry works from stranded animals. Zoogeography, physiology, life history and behavior of *K. sima* and *K. breviceps* in most regions remain poorly understood (Muñoz-Hincapié *et al.,* 1998; Marino *et al*., 2003; Chivers *et al*., 2005). On studies of the Order Cetacea for the Caribbean, both species are indicated as rare or uncommon, even though some records of specimens of the *Kogia* genus in countries with coasts on the Caribbean sea, as well as in South America are frequently reported (Felix *et al.,* 1995; Muñoz-Hincapié *et al.,* 1998; Debrot *et al.,* 1998; Cardona-Maldonado and Mignucci-Giannoni 1999; Souza *et al.,* 2003). For the Caribbean region, data on *K. sima* is only available for Saint Vincent and the Grenadines, Aruba, Klein Curacao, Puerto Rico and Bahamas (Cardona-Maldonado and Mignucci-Giannoni, 1999; MacLeod, 2004).

Kogiids have a distinctive dark dorsally and light ventrally color-pattern with a pronounced crescent shaped "false gill" like a shark's gill slit on the side of its head (Jefferson *et al.,* 1993). Nevertheless, external morphological characters can be confusing and produced incorrect species identifications, especially among younger animals (Chivers *et al.,* 2005). In spite of a very similar morphology, *K. sima,* in an adult state, reaches maximum sizes of 2.7 m and have 8-13 pairs of teeth in the lower jaw, whereas *K. breviceps* exceeds the 3 m and has from 10-16 pairs of teeth in the lower jaw (Leatherwood *et al.,* 1983; Caldwell and Caldwell, 1989). From the morphometric point of view, the best way to verify specimens of *K. sima* is to refer to the average obtained when comparing the percentages of the dorsal fin's height against the total animal's length; this value should be higher than 5% (Jefferson *et al.,* 1993). Also the average obtained when comparing the total body's length with the distance from the tip of upper jaw to anterior edge of dorsal fin, which in the case of *K. sima,* being located in the middle point of the body, is lower than with *K. breviceps* (Ross, 1979; Debrot and Barros, 1992). Skulls of *Kogia* genus exhibit the greatest degree of asymmetry of all cetacean skulls (Ness, 1967). Compared craniometry of both species is also a valuable instrument for the identification or verification of species, especially if we compare the average between the rostrum length with the condylo-basal length; the range for *K. sima* is 28.5-41.5%, whereas for *K. brecivepsis* is 36.4-50.5% (Roos, 1979).

In Venezuela, the genus has not been considered very important because of the absence of reports and until now; there have been no records of the species *K. breviceps* (Bermúdez-Villapol and Boher, 2003). Nevertheless, the first evidence of the presence of the *K. sima* in territorial waters is based on the identification of a cranium located on the Zulia State coast in 1998 in the west of the country (León and Barrios, 2001).

To definitively establish the presence of *K. sima* in Venezuela, four records of genus *Kogia* were studied and compared. All of them came from stranded specimens or osteological samples, three of them from the west of the country and one from the northwest that constitutes, at the same time, the first record of a live stranding of *K. sima* in Venezuela.

MATERIALS AND METHODS

In this work, four records of the *Kogia* genus were examined in order to confirm or rule out *K. sima* and *K. breviceps* species: two of them coming from data obtained through craniometrical study; samples classified as Nº MBLUZ-M-0225 and CLZV-MC-003 and previously recorded as *K. sima.* Comparative radius obtained by relating value data of face length (FL) with condilo-basal length (CBL) or total skull's length, based on methodology suggested by Ross (1979), was used as a key tool for identification and confirmation. The other two records were based on the comparative morphometry of stranded animals in the western and eastern zones of the country respectively (Figure 1). In order to identify species, the representative percentage for each of the measures relative to the total length of the animals was established, including: the dorsal fin height, the length from tip of the snout to the first insertion point of the dorsal fin (anterior base), and the length from the tip of the snout to the blowhole. In the first specimen, comparison was based on guidelines from Jefferson *et al.* (1993) and Ross (1979). In the second specimen, it was identified following the percentage comparison of morphometric radius of the species *K. sima* and *K. breviceps*, according to guidelines from Ross (1979), Debrot (1992) and Barros *et al*. (1998).

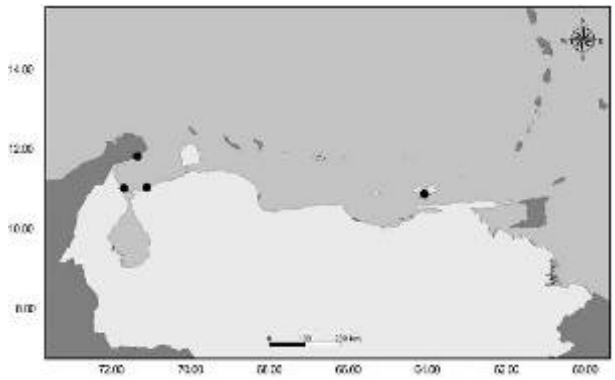

Figure 1. Stranding records for the species *Kogia sima* in Venezuela until 2006.

RESULTS AND DISCUSSION

Specimens studied

First and Second report for the *K. sima* (western region)

By the year 2001, the species *Kogia sima* (Family Kogiidae) was reported for the first time in Venezuela based on the study of a skull found in 1998 in the northwest coast of Zulia State, Páez Municipality, in western Venezuela (11º 50,717' N; 71º 20,633' W) (Figure 2). The specimen was identified, initially by the third author (LT), as an adult specimen of *K. sima*, this was supported by the skull morphology of the sample (Figure 3). Craniometry applied at first was performed following the proposed methodology by Perrin (1975) and Bolaños (1995) and Ross (1979) proposal was not considered (Table 1). The collected material was found deposited in the Mammals Section of the Biology Museum of La Universidad del Zulia (MBLUZ by initials in Spanish) under catalog Nº MBLUZ-M-0225 (León and Barrios, 2001).

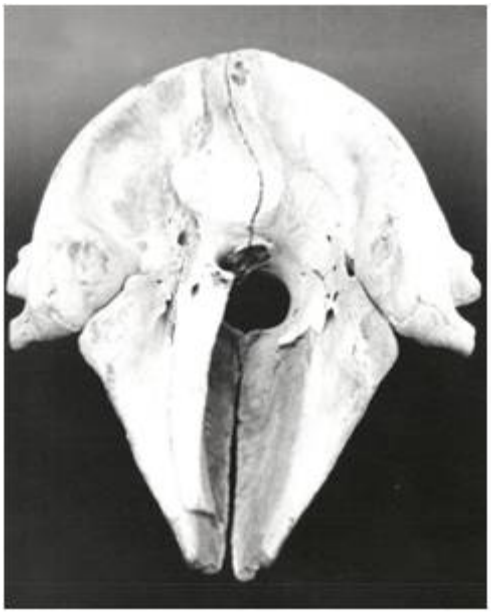

Figure 2. Skull of first specimen of *Kogia sima* recorded for Venezuela (1998). Found dead in Zulia State, Páez Municipality (11º 50,717' N; 71º 20,633' W)

A second case, not published, was reported by the third of the authors (LT) with the finding of an incomplete skull also located in 1998, on the coasts of Falcon State in western Venezuela (11º 03,367' N; 71º 06,193' W). The skull was initially identified as belonging to a young specimen of *Kogia sima* based mainly on morphological features. This osteological material resides in the Collection of the Laboratory of Zoology of Vertebrates (Mammalia Class, Cetacea Order) of the Experimental Faculty of Sciences, Biology Department, of La Universidad del Zulia, under the catalog number CLZV-MC-003.

To confirm or rule out of the species *K. sima* for both samples, the comparative averages obtained when associating the percentages of the value data of the rostrum length (RL) with the condylo-basal length (CBL), based on the methodology employed by Ross (1979) were used as a key instrument for identification.

Figure 3. Partial skull of second specimen of *Kogia sima* recorded for Venezuela (1998). Found on the coasts of Falcon State in western Venezuela (11º03,367'N; 71º06,193'W)

Table 1. Comparisons of skull measures (mm) and RL/CBL averages of MBLUZ-0225 and CLZV-MC-003 samples, placed in La Universidad del Zulia's (LUZ) didactics collections.

Morphometry characteristics (mm)	MBLUZ-0225	Ratio % (RL/CBL)	CLZV-MC-003	Ratio % (RL/CBL)
Condylobasal lenght (CBL)	440	100	255	100
Length of rostrum (RL)	133	30.22	70	27.45
Width of rostrum at base (WRB)	225		125	
Width of zigomatc (WZ)	350		228	
Tip of the rostrum to external nares (TREN)	235		130	
Height of braincase (HB)	190.4		116	
Tip of rostrum to pterigods (TRP)	260		145	
Greatest preorbital width (GPRW)	371		200	
Greatest postorbital width (GPOW)	380		205	
Basioccipital width (BW)	223		142	
Greatest height of right temporal fossa (LMFT)	106.15		49	
Greatest height of left temporal fossa (LMFT)	113.8		-	
Greatest width of right temporal fossa (AMFT)	93.65		67	
Greatest width of left temporal fossa (AMFT)	95.7		-	

In samples MBLUZ-M-0225 and CLZV-MC-003, averages of 30.22 and 27.45% respectively, were obtained. The first is associated with described for *K. sima* (28.5-41.5%) (Ross, 1979), but the second is below this range. The latter result can be explained by the fact that it is a younger and smaller animal than adult specimens (Ross, 1979). These values confirm the species *K. sima* for both skulls, justifying the affirmation that the face of *K. sima* is shorter and smaller than half of the cranium length (León and Barrios, 2001).

Third report (western region)

By 16 June 2000, eight kilometers from Bajo San Bernardo, near San Carlos Island, in Municipality Almirante Padilla of Zulia State, (11º 02,185' N; 71º 41,061' W), a young specimen of the *Kogia* genus was found stranded (Figue 4). The body was later transported to Parque Sur de Maracaibo Fundation, thanks to the collaboration of the Coastguard Service and fishermen of the area, under the guidance of officials from the Ministry of Environment and Natural Resources (MINAMB by initials in Spanish) Zulia Environmental State Region; National Fund for Agricultural Research (FONAIAP by initials in Spanish) of Zulia Region and vets from the Parque Sur de Maracaibo, in order to perform a necropsy of the individual and determine its morphometry (Table 2).

The specimen was first identified, by officials from previously mentioned institutions, as *K. sima* based on the morphologic features of the animal. In this work, confirmation of the species on this specimen were based guidelines by Jefferson *et al.* (1993) and Ross (1979) using the difference in percentage radiuses obtained from the morphometric data submitted.

Results demonstrated that the percentage of dorsal fin's height in comparison with the total body length of the specimen was 7.4%, exceeding the 5% established for *K. sima* (Jefferson *et al.,* 1993).

Figure. 4. Young specimen of *Kogia sima* found four miles from Bajo San Bernardo, near San Carlos Island, in Municipality Almirante Padilla of Zulia State, (11º 02,185' N; 71º 41,061' W).

Table 2. Morphometry (cm) and Comparative averages (%) of *Kogia sima* specimens stranded at Zulia state (16/06/2000) and Nueva Esparta state (16/06/01)

Specimen	16/06/00		16/06/01	
Morphometry characteristics	cm	%	cm	%
Total body length	112	100	106	100
Tip of upper jaw to blowhole	10	8.9	8.5	8.01
Tip of upper jaw to eye	NC	-	15.5	14.62
Tip of upper jaw to anterior edge of flipper	36	32.14	25.5	24.05
Tip of upper jaw to posterior edge of flipper	NC	-	32.5	30.66
Anterior flipper length	20	17.85	20	18.86
Posterior flipper length	NC	-	14.5	13.67
Tip of upper jaw to anterior edge of dorsal fin	53.5	47.76	51	48.11
Tip of upper jaw to posterior edge of dorsal fin	NC	-	68.5	64.62
Dorsal fin heigth	08	7.14	8.5	8.09
Fluke length	25	22.32	31	29.24
Fluke width	17	15.17	12	11.32
Tip of upper jaw to gape	17.5	6.69	NC	-
Tip of upper jaw to anus	88.5	79.01	NC	-
Tip of upper jaw to genital slit	60.5	54.01	NC	-
Tipo f upper jaw to umbilicus	53.4	47.67	NC	-
Lower jaw tooth count	16		16	

Similarly, the percentage obtained by comparing the length from the tip of the upper jaw to the anterior edge of dorsal fin in relation with the total body length of the specimen was 47.76%, under the minimum expected for *K. breviceps* (Ross, 1984). Therefore, the authors conclude that it is effectively a young specimen of *K. sima.*

Fourth report (eastern region)

On 16 June 2001, a specimen stranded live on La Punta Beach was assisted by the CIC staff (10° 53,28'N; 64° 03,616'W), El Guamache sector, to the southeast of Margarita Island (Sayegh *et al.,* 2001) (Figure 5). After external examination of the specimen by the first two authors (BL and SA), six round injuries were found consuming the epithelium and the connective fat tissue, scarcely showing the muscle mass, no injury was bleeding and they looked healed on a general profile, as a light semi-round injury, showing a slit of the epithelium and fibrous exposure of the fat tissue, possibly produced by the cookie cutter shark, *Isistius* spp., reported for the tropical Atlantic (Compagno, 1984). Attacks by *Isistius* spp. has been reported on cetacean species in the Caribbean and northeastern Atlantic (Debrot and Barros, 1994; Perez-Sayas *et al.*, 2002; Alardo *et al.,* 2007). It is also the first reported evidence of wounds inflicted by cookie cutter sharks on any cetacean stranding case documented in the country (Figure 6).

Figure 5. Specimen of *Kogia sima* stranded live on La Punta Beach (10° 53,28'N; 64° 03,616'W), El Guamache sector, to the southeast of Margarita Island (2001)

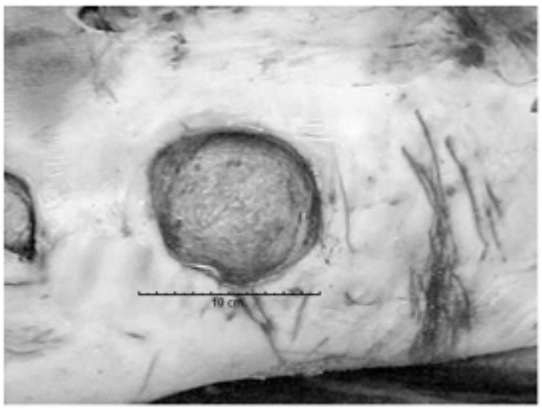

Figure. 6. Round injury possibly produced by the cookie cutter shark, *Isistius* spp., on the specimen of *Kogia sima* found at the southeast of Margarita Island (2001) (10° 53, 28'N; 64° 03,616'W)

The cetacean exhibited a complex start of fatigue, dehydration and metabolic dysfunction. The animal died at 15:30.

This specimen had a black to lead gray coloration on the dorsal region and on the head, with a light decrease in the coloration to the lateral sides, which lightens up on the ventral region until becoming white. The dorsal fin was high and sickled-shaped, located at the beginning of the last third of the body. The presence of a false gill was clearly noticed on the posterior region of both eyes. The specimen had an extended "U" shaped mouth, with no teeth, but eight pairs of bulges on the jaws were noticed. The identification of the species was made by the two first authors (BL and SA), through a percentage comparison of morphometric values of the species *K. sima* and *K. breviceps*, following guidelines from Ross (1979), Debrot (1992) and Barros *et al.* (1998) (Table 2).

Likewise, representative percentages of each of the measures of the total length of the specimen were established, being these considered as key features for the identification of the species: a) dorsal fin's height with regard to the total body length; b) the length from the tip of upper jaw to anterior edge of dorsal fin was 51 cm and represents 48.1% of the total body length, fitting with the comparative percentage for *K. sima* but different from the percentage for *K. breviceps* of 51.7%, that is superior, due to its position in the last third of the body. Also, the dorsal fin's height according to the total body length of the animal was 8.5 cm equivalent to 8.01% of the total length, exceeding the established length for *K. sima* of 6% and exceeding by far the established length for *K. breviceps* of 3,8% in previous works (Debrot, 1992; Barros *et al.*, 1998).

The measure for the distance between the tip of the upper jaw to blowhole was of 8.5 cm which represents 8.01% of the length, completely different than the minimum established for *K. breviceps* of 10% (Ross, 1984). Therefore, the stranded animal is considered an immature specimen of the *K. sima* species.

The presence of *K. sima* is therefore confirmed for Venezuela, and is added to the 24 species for the country (Bermúdez-Villapol and Boher, 2003). Nevertheless, the paucity of records suggests a designation for the species in Venezuelan waters as "Data Deficient".

Three reports from the western side of the country were recorded in the Gulf of Venezuela's axis in coastal areas in which the continental shelf is extensively flat, with a slope fall that abruptly exceeds 3,000 m. This records suggests that *K. sima* might be associated with frontal areas all along continental shelf, as well as over the slope, in those areas with a high biomass of epipelagic zooplankton which makes up the diet of kogiids' potential prey, which is mainly constituted by cephalopods (Baumgartner *et al.*, 2001; Wang *et al*., 2002; Bloodworth and Marshall, 2005).

These data contribute to what little is known about this species in the Caribbean. The four confirmed records presented for Venezuelan waters represent most data for the southern Caribbean suggesting that *K. sima* may not be common in the area. *K. sima* has not been reported in areas close to the Venezuelan coasts or southern Caribbean waters, with the exception of records for Curacao and Klein Curacao (Debrot and Barros, 1992; Debrot *et al.*, 1998), even if its presence can be expected in areas of the Colombian Caribbean (Cuervo-Díaz *et al.*, 1986), Trinidad, Suriname (Muñoz-Hincapié *et al.*, 1998) or Grenada (Romero *et al*., 2002).

CONCLUSION

Comparison methods for differentiation of both species of the *Kogia* genus employed in the analysis in this work based on the relation of craniometric and morphometric radiuses, offered a

solid basis to confirm the dwarf sperm whale species (*Kogia sima* Owen, 1866) for the reports indicated and rule out the pygmy sperm whale (*K. breviceps* De Blainville, 1828. These four records for the dwarf sperm whale on the eastern and western side of Venezuela, confirm the presence of the species in the list of cetaceans for the country's waters; and therefore suggest an extension in the distribution range of it for the southern Caribbean.

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