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First stranding record of *Kogia sima* (Owen, 1866) in the Colombian Caribbean

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The dwarf sperm whale *Kogia sima* (Owen, 1866) belongs to the *Kogia* genus, which is currently recognized within the family Kogiidae, along with the pygmy sperm whale *Kogia breviceps* (de Blainville, 1838). Historically the taxonomy regarding these two species has been confusing: they were initially placed within the Physeteridae family until 1966, when Handley confirmed an independent family for the genus (Rice, 1998) and described the differentiation between the two species, solving the identification confusion of previous records. This was supported by Chivers *et al.* (2005), who phylogenetically identified *K. sima* separately from *K. breviceps.*

Kogiids are among the most frequently stranded cetaceans in some parts of the world (Baird *et al.*, 1996; Ortega-Argueta *et al.*, 2005), so most of the information gathered comes from stranded individuals[1] (Jefferson *et al.,* 2015; Muñoz-Hincapié *et al.*, 1998). Both species are considered to be rare and very few observations have been made of free-ranging animals, mostly because they are not prone to form large aggregations (Nagorsen, 1985; Ross, 1979*a, b*) and, due to their offshore habitat preference, long dives, low profile at surface, rare aerial or surface-active behavior, and avoidance of vessels (Plön, 2004; Baird, 2005). Lack of research effort in the distribution mapping has led to limited information on population status[2]; consequently, this species is currently catalogued as DD (Data Deficient) by the International Union for Conservation of Nature (Taylor *et al.*, 2012).

Species identification. Owing to the differences in body length and fin position, the dwarf sperm whale seems to be flatter in the posterior end of the body, compared to the slightly arched rear end of the pygmy sperm whale (Jefferson *et al.*, 2015).

Distribution of the genus. The two *Kogia* species occur in all temperate and tropical waters of the Pacific, Indian and Atlantic oceans[3] (Handley, 1966; Leatherwood *et al.,* 1976; 1982; 1988; Caldwell and Caldwell, 1989; Culik, 2004; Mullin and Fulling, 2004; McAlpine, 2009; Waring *et al.,* 2013; Jefferson *et al.*, 2015), mostly between 24° N to 40° S (Wade and Gerrodette, 1993), but extra-limit records include reports as far as north as the Faroe Islands (Bloch and Mikkelsen, 2009) and Sable Island (Willis and Baird, 1998).

In the Atlantic Ocean the genus has been reported in southwest countries as Brazil (Geise and Borobia, 1987; Pinedo, 1987; Portes and Lodi, 1998; Dos Santos and Haimovici,

[1]Bortolotto, A., Papini, L., Insacco, G., Gili, C., Tumino, G., Mazzariol, S., Pavan, G. and Cozzi, B. (2003) First record of a dwarf sperm whale, *Kogia sima* (Owen, 1866) stranded alive along the coasts of Italy. Work n° 86 *in* Abstracts, *31st Symposium of the European Association for Aquatic Mammals*, 14-17 March 2003, Tenerife, Spain.

[2]Ward, N., Moscrop, A. and Carlson, C. (2001) *Elementos para el desarrollo de un plan de acción para los mamíferos marinos en el Gran Caribe: una revisión de la distribución de los mamíferos marinos*. Programa de las Naciones Unidas para el Medio Ambiente. Primera Reunión de las Partes Contratantes (COP) del Protocolo Relativo a las Áreas y Flora y Fauna Silvestres Especialmente Protegidas (SPAW) en la Región del Gran Caribe, 3-6 de agosto, La Habana, Cuba. 89 pp.

[3]Mullin, K.D. (2007) *Abundance of cetaceans in the oceanic northern Gulf of Mexico from 2003 and 2004 ship surveys*. Southeast Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration. 26 pp. Available from NMFS, Southeast Fisheries Science Center, PO Drawer 1207, Pascagoula, MS 39568.

2001; Barbieri, 2004; Meirelles *et al*., 2009; Carvalho *et al*., 2010; Santos *et al*., 2010; Sampaio and Aroucha, 2000; Di Azevedo *et al*., 2015; Moura *et al*., 2016), Uruguay[4] and Argentina (Barquez *et al*., 2006); in northwest ones as Canada (Nagorsen and Stewart, 1983; Lucas and Hooker, 2000), along the eastern U.S. coast, between Massachusetts and the Florida Keys (Gunter and Overstreet, 1974; Credle, 1988; Waring *et al.,* 2004; 2009; 2011; 2013; Hayes *et al*., 2017), and in the Gulf of Mexico[5] (Gunter *et al*., 1955; Raun *et al*., 1970; Gunter and Overstreet, 1974; Lowery, 1974; Schmidly and Melcher, 1974; Davis *et al*., 1998; Delgado-Estrella *et al*., 1998; Würsig *et al*., 2000; Baumgartner *et al*.; 2001; Mullin and Fulling, 2004; Ortega-Argueta *et al*., 2005; Bossart *et al*., 2007; Vázques-Castán *et al*., 2009).

For the Caribbean, detailed information of this genus distribution is scarce and considered uncommon. Although reports are increasing, most of the available data comes from stranded individuals and fisheries bycatch (Luksenburg, 2011), just some belonging to live sightings (Muñoz-Hincapié *et al*., 1998). Data on *K. sima* in the Caribbean specifically comes from the eastern Caribbean and Antilles, including Mexico, Cuba, Bahamas, Dominican Republic, Puerto Rico, Saint Vincent and the Grenadines, Aruba and Curacao[6, 7] (León and Aguayo, 1945; Caldwell *et al.,* 1973; Van Bree, 1975; Debrot, 1992; 1998; Debrot and Barros, 1994; Debrot *et al*., 1998; 2011; Cardona-Maldonado and Mignucci-Giannoni, 1999; Whitt *et al*., 2001; MacLeod *et al*., 2004; Barros and Debrot, 2006; Dunphy-Daly *et al*., 2008; Vázques-Castán *et al*., 2012; Luksenburg, 2014, Niño-Torres *et al*., 2015), while León and Barrios (2001) and Villapol *et al*. (2008) reported it for the Venezuelan coast. The species was reported for the Caribbean coast of Honduras and Costa Rica by Marineros *et al*. (2013) and Palacios-Alfaro (2009), respectively. In the Colombian Caribbean, the information attributed to the genus *Kogia* is limited and, as most of the reports worldwide, are the outcome of various stranding and entanglements events. This specific stranding event is the first *Kogia sima* reported for the Colombian Caribbean coast.

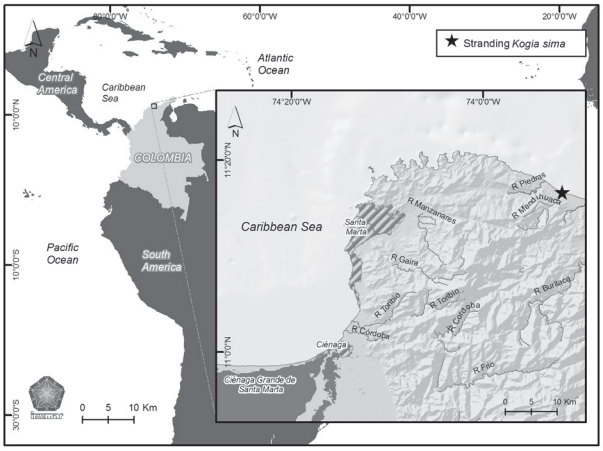

Figure 1. Location of *Kogia sima* stranding report (star icon) at the Mendihuaca River mouth, Magdalena department.

Stranding event. Here we present the first confirmed stranding record of *Kogia sima* in the Colombian Caribbean. On 26 March 2008, local fishermen reported a stranded dead cetacean in the Mendihuaca River mouth (11º16'36.2"N, -73º51'41.9"W) (Figure 1) in the Magdalena Department. A. Polanco (pers. obs.) first responded to the stranding, confirming it as an adult pregnant cetacean (field number INV260308Ks-A) belonging to stranding Level 2 (Geraci and Lounsbury, 1993) (Figure 2A). The specimen showed no evidence of interactions with fishing gear or entanglement, and the overall condition was good; three circular marks on the ventral and lateroventral sides of the body were detected, probably belonging to *Isistius* sp. bites. Morphological measurements were taken, following Norris (1961), Geraci and Lounsbury (1993), and Carrillo and Tejedo (2005)[8].

The initial examination confirmed that fishermen allegedly cut open the ventral region of the specimen and removed a dead fetus (Figure 2B), before the competent authorities reached the place. The fetus (field number INV260308Ks-B), which was kept in a foam cooler, was recovered 5.5 km away from the stranding place at Puerto Nuevo (Magdalena) and voluntarily handed to the researcher (Figure 2C). The adult's body was not preserved, but its measurements and photographs are documented in the Information System for Marine Biodiversity of Colombia (Sistema de Información de Biodiversidad de Colombia - SIBM). The fetus is deposited in the Mammal Collection of the Museum of Marine Natural History of Colombia (MAKURIWA) under catalog number INV MAM004.

Species confirmation. Basic measurements were taken, and the initial identification and confirmation of the specimen was

[4]Vaz Ferreira, R. and Praderi, R. (1973) Un nuevo ejemplar de *Kogia breviceps* (Blainville) (Cetacea, Physeteridae) del Atlántico sudoccidental. Caracteres y notas. Pages 261-277 *in* Libro de Trabajos, *V Congreso Latinoamericano de Zoologia*, 18-23 October 1973, Montevideo, Uruguay.<?>

[5]Davis, R.W. and Fargion G.S. (Eds) (1996) Distribution and abundance of cetaceans in the North-Central and Western Gulf of Mexico: Final Report, vol. II: Technical Report. OCS Study MMS 96-0027. *Prepared by Texas Institute of Oceanography and National Marine Fisheries Service. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region*, New Orleans, LA. 357 pp.

[6]Bonnelly de Calventi, I. (1986) *Informe sobre los recursos marinos de la Republica Dominicana con énfasis en los mamíferos marinos y su protección*. Universidad Autónoma de Santo Domingo, Facultad de Ciencias, Centro de Investigaciones de Biología Marina. Santo Domingo, República Dominicana.

[7]Barros, N.B. and Debrot, A.O. (2006) Status of small cetaceans in the Leeward Dutch Antilles. *Paper SC/58/SM14 presented to the Scientific Committee*, 58th Annual Meeting of the International Whaling Commission, St Kitts & Nevis, May-June.

[8]Carrillo, M. and Tejedo, M. (2005) *Protocolo de Actuación en Cetáceos Varados; Morfometría de Cetáceos*. Red Canaria de Varamientos, Canarias Conservación. 2 pp.

Figure 2. Detailed photographs of dwarf sperm whale (*Kogia sima*) stranded in Mendihuaca river mouth, Colombian Caribbean. A) Full view of adult depicting the position of the dorsal fin midway along the body; B) Ventral region of the pregnant female cut open; small shark bites (probably *Isistius* sp.) can be observed; C) Dead fetus.

made based on the morphological generic features according to Norris (1961; 1966), Handley (1966), Ross (1979*a*), Caldwell and Caldwell (1989), Debrot (1992), Jefferson *et al.* (2015) and Carrillo (2018). Measurements showed that a) the ratio between the total length of the animal and the distance to the center of the blowhole corresponded to 4.05% for the adult and 7.81% for the fetus (<10%); b) the ratio between the total length of the animal and the height of dorsal fin was greater than 5% (11.05% for the adult and 7.56% for the fetus); and c) the ratio between the height of the dorsal fin and the distance from the tip of the upper jaw to the leading edge of the dorsal fin was between 11% and 50% (25.22% for the adult and 11.49% for the fetus); in addition, the number of teeth in each ramus of the lower jaw was between eight and 12 (Table 1). The specimen herein reported is the first voucher specimen of *Kogia sima* for Colombia.

Reports of the genus Kogia *in the Colombian Caribbean*. The presence of the genus *Kogia* in the Colombian Caribbean is represented by the following reports. A stranded specimen in Acandí (Gulf of Urabá, Figure 3) was recorded in September 1973 by Cuervo *et al.* (1986), which was initially misidentified and incorrectly determined as a *K. sima*; later on, an examination of the skull (now housed at the Instituto de Ciencias Naturales, Universidad Nacional de Colombia) completed by Muñoz-Hincapié *et al.* (1998) confirmed that it was, in fact, an adult *K. breviceps*. The second report corresponded to a carcass found in Santa Marta (Magdalena) in June 1986, which was identified as *Kogia* sp. (Vidal, 1990). A third report was of a live stranding in Bocagrande area, in Cartagena (Bolivar) in October 1983, close to the seawalls and identified as a *K. breviceps* (Prieto-Rodríguez, 1989), and a fourth one belonged to an entangled specimen in Berrugas (Gulf of Morrosquillo, Sucre) in November, 1988 (Vidal, 1990) (Figure 3). The fifth report, located in Santa Marta Bay (Magdalena) in February 1990 (Flórez-González and Capella, 1995), corresponded to an entangled adult, identified as *K. breviceps*; this specimen was taken to the INVEMAR facility by local fishermen who caught it incidentally. The animal

Table 1. Morphological measurements and corresponding percentages used for the species identification of *Kogia sima* specimen stranded in the Colombian Caribbean.

Measurement n°	Measurements	Adult (mm)	% of total lenght	Fetus (mm)	% of total lenght
1	Tip of upper jaw to deepest part of the fluke notch	2100	100	483	100
2	Tip of upper jaw to center of anus	–	–	326	67
3	Tip of lower jaw to center of umbilicus	–	–	225	47
4	Tip of upper jaw to top of dorsal fin	–	–	297	61
5	Tip of upper jaw to leading edge of dorsal fin	920	44	242	50
6	Tip of upper jaw to anterior insertion of flipper-Right	450	21	129	27
7	Tip of upper jaw to anterior insertion of flipper-Left		0	128	27
8	Tip of upper jaw to center of blow hole	85	4	38	8
9	Tip of upper jaw to center of eye-Left	–	–	59	12
10	Tip of upper jaw to angle of gape	100	5	38	8
11	Anterior edge of rostrum to tip of upper jaw	140	7	25	5
12	Pectoral fin width-Left	55	3	33	7
13	Pectoral fin lenght-tip to anterior insertion-Left	228	11	83	17
14	Pectoral fin lenght-tip to posterior insertion-Left	331	16	–	–
15	Dorsal fin height	232	11	28	6
16	Dorsal fin base	370	18	55	11
17	Fluke span	610	29	126	26
18	Lobe fluke width-Right	340	16	49	10
19	Blubber thickness-Dorsally	–	–	5	1
20	Blubber thickness-Laterally	–	–	4	1
21	Blubber thickness-Ventrally	–	–	3	1
1 vs. 8 Ratio <10%		**4**		**8**	
1 vs. 15 Ratio >5%		**11**		**6**	
15 vs. 5 Ratio >11%		**25**		**11**	
Teeth on each ramus of lower jaw 7-12		**9**		**8**	

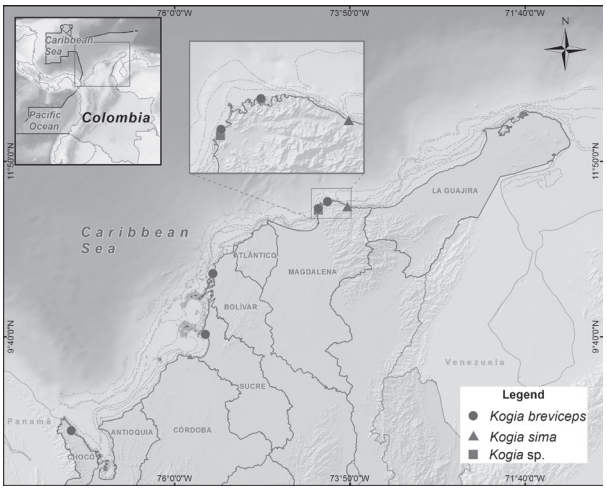

Figure 3. Records of the genus *Kogia* for the Colombian Caribbean, including the present report of *Kogia sima* (triangular icon).

remained uncatalogued and was reported only as N.H. Campos (pers. comm.) (Muñoz-Hincapié *et al*., 1998) until the current study, when related information was gathered and the official record created; thus, the skeletal remains and photographic record are deposited at the Mammal Collection of the Museum of Marine Natural History of Colombia (MAKURIWA) of INVEMAR. The sixth and last record, belonging to an adult male *K. breviceps* specimen, was reported on Gayraca Bay, at Tayrona National Natural Park in September 2007[9] (Figure 3).

According to Odell *et al*.[10], dwarf sperm whales account for about 17% of the *Kogia* sp. strandings worldwide and twice as many female *K. sima* as males, usually a single animal or cow/calf pairs, have been reported (Baird *et al*., 1996). Even though winds, currents, tides, magnetic fields and lunar cycles may differentially influence the probability of *Kogia* strandings, one of the strongest hypotheses suggests that the availability of prey and the forced movement of water due to wind changes may affect where prey is located, causing it to move closer to shore, and therefore, causing these mammals to move ashore as well (O'Brien, 2008). Another hypothesis, although not elucidated in detail yet, is directly related to pregnancy and birth processes, as pregnant females or adult females with newborn calves often strand, as well as females whose reproductive system shows evidence of a recent birth prior to stranding (Delgado-Estrella *et al*., 1998).

[9]Pérez, D., Mojica, D., Polanco, A. and Jáuregui, A. (2007) *Informe de varamiento de mamífero acuático en la Ensenada de Gayraca, Parque Nacional Natural Tayrona (PNNT), Santa Marta, Caribe Colombiano*. Universidad Jorge Tadeo Lozano. Presented to Ministerio del Medio Ambiente, Vivienda y Desarrollo Territorial, Unidad Administrativa Especial del Sistema de Parques Nacionales Naturales, Programa Parque Nacional Natural Tayrona, Santa Marta, Colombia. 11 pp.

[10]Odell, D.K., Barros, N.B. and Stolen, M.K. (2004) Dwarf and pygmy sperm whale (genus *Kogia*) stranding patterns in the southeastern United States. *84th Annual Meeting of the American Society of Mammalogists*, 12-16 June 2004, Arcata, California, USA.

The sightings of the dwarf sperm whale in the Gulf of Mexico and Caribbean region occur over and close to the continental shelf, especially in areas with high zooplankton biomass, which leads to a year-round consistent abundance and distribution of possible prey (Würsig *et al*., 2000; Baumgartner *et al*., 2001; Wang *et al*., 2002).

To conclude, the documented events of the dwarf sperm whale have been considered rare, although these reports indicate that both *K. sima* and *K. breviceps* are present and confirmed in Caribbean Colombian waters, with a year-round occurrence. This implies that the lack of sightings is not related to the biology and ecology of the species or the absence itself, but because of the lack of an inter-institutional stranding network to properly keep record of the events. The enormous gap of information on ecology, life history, and distribution suggests a much-needed increase of species-specific offshore research; therefore, this report enriches the distribution information of this species. Since the data related to the presence and the general biology of this species is scarce, every contribution is of particular relevance. The information presented here on fetal morphology is also of importance.

The stranding-related reports, especially of pregnant females and cow-calf pairs, could suggest either an important, yet unknown effect of pregnancy in the biology and/or life history of the species, or a detrimental anthropogenic impact on these populations.

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