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BIOLOGICAL OBSERVATIONS ON A DWARF MINKE WHALE, *BALAENOPTERA ACUTOROSTRATA*, CAUGHT IN SOUTHERN BRAZILIAN WATERS, WITH A NEW RECORD OF PREY FOR THE SPECIES

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Abstract – In the late austral spring, a 3.43m long immature male dwarf minke whale (*Balaenoptera accutorostrata*) was accidentally caught in a gillnet set in waters 143m deep, close to the continental slope off southern Brazil. A brief description of the specimen, including external measurements, colour patterns, reproductive status and skull measurements, is presented. The stomach was full of the euphausiid, *Euphausia similis*, and was heavily infested by anisakid nematode parasites. *Euphausia similis* is reported for the first time as a prey species for dwarf minke whales.

Resumo – Durante a primavera austral, um macho imaturo de baleia-minke-anã, *Balaenoptera accutorostrata*, medindo 3,43m, foi capturado acidentalmente em uma rede de emalhe armada em águas de 143m de profundidade, nas proximidades do talude continental sul do Brasil. Se descreve, brevemente, aspectos biológicos do exemplar, incluindo medidas externas, padrões de coloração, estágio reprodutivo e medidas cranianas. O estômago estava repleto de eufausiáceos, *Euphausia similis*, e infestado por parasitas nematóides. Este é o primeiro registro de *Euphausia similis* como presa de baleia-minke-anã.

Keywords: Dwarf minke whales, Western South Atlantic, bycatch, euphausiids, parasites, colour pattern.

Until recently, the minke whale was considered to be a single species, *Balaenoptera acutorostrata*, originally described from the northeastern Atlantic Ocean but considered to have a circumglobal distribution in northern and southern hemispheres. In the mid 1980s, two forms were recognised in the Southern Hemisphere based primarily on body and baleen colouration as well as some biological parameters (Best, 1985; Arnold *et al.*, 1987). The first form corresponded to *Balaenoptera bonaerensis*, described from Argentina by Burmeister (1865), and documented from commercial whaling catches in the Antarctic (Williamson, 1959; Kasuya and Ichihara, 1965; Doroshenko, 1979), South Africa (Best, 1982) and Brazil (da Rocha and Braga, 1982). Despite earlier skepticism, *B. bonaerensis* has now generally been recognised as a valid species, referred to as the Antarctic minke whale (Rice, 1998; IWC, 2001). The second form was a previously unrecognised diminutive form, now more popularly called the dwarf minke whale. Based on both morphological (Best, 1985; Arnold *et al.*, 1987; Zerbini and Simões-Lopes, 2000) and molecular (Wada *et al.*, 1991; Pastene *et al.*, 1994) data, the dwarf minke whale has been considered more closely related to the Northern Hemisphere *B. acutorostrata* than to the Antarctic minke whale, but its taxonomic status remains unclear, pending further study (IWC, 2001).

The dwarf minke whale has been reported near all continents of the Southern Hemisphere (see Baker, 1983; Best, 1985; Marsh, 1985; Arnold *et al.*, 1987; Baldas and Castello, 1986; Zerbini *et al.*, 1996; Arnold, 1997), as well as in Antarctic and sub-Antarctic waters (Kato *et al.* 1990, Kasamatsu *et al.*, 1993; Aguayo, 1994). The southernmost record of this species was based on one animal sighted during winter at 69°25'S (Aguayo, 1994). In Brazil, sightings are rare, but dwarf minke whale records represent about 75% of all minke whale strandings (Zerbini *et al.*, 1996).

Although some biological data were collected from individuals caught during commercial (da Rocha and Braga, 1982; Best, 1985) and scientific whaling (Kato *et al.*, 1990), or through accidental capture (Marsh, 1985; Arnold *et al.*, 1987), the biology of the dwarf minke whale remains poorly documented. In this report, we present new information based on a fresh specimen, accidentally caught in fishing gear.

Specimen description and discussion

On 25 November 1992, a 3.43m long young male dwarf minke whale (Fig. 1) was incidentally caught in a gillnet set for sharks at a depth of 143m. The net was 6,000m long and 4m high, with 30cm stretched mesh size. The capture occurred south of Rio Grande (33°35'66"S - 51°29'80"W), Rio Grande do Sul State, southern Brazil. It is not known, however, whether the animal was caught when the net was set at the bottom or during the setting/hauling procedure. The animal was brought by fishermen and landed while still fresh at a fishing facility of Rio Grande. Subsequently, the whale was transported to the *Museu Oceanográfico "Prof. Eliézer C. Rios"*, where it was dissected. External colour patterns were examined, organs were collected and weighed, stomach contents, including parasites, were preserved. After cleaning and preparation, the skeleton was deposited in the marine mammal collection (MORG 0096) of the *Museu Oceanográfico*.

External morphology and colouration: External measurements and some organ weights are presented in Table 1.

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Measurements were comparable to dwarf minke whales from other regions (Best, 1985; Arnold *et al.*, 1987). The more anterior position of the dorsal fin observed in the present specimen support the hypothesis that this feature may have taxonomic value to distinguish the dwarf minke whale from other minke whale types.

Colour patterns were also similar to the ones described for the dwarf minke whale by Best (1985) and Arnold *et al.* (1987). The base of the flippers was white and connected to a nearly rounded white blaze on the shoulder (Fig.1a). The dark pigmentation extended from the back onto the area between the eyes and the anterior insertion of the flipper, continuing as a dark throat patch which covered the ten uppermost ventral grooves just under and behind the angle of the mouth (Fig.1a). However, this specimen presented a striking dark lateral wave-like patch located in the flank of the whale (Fig.1a), extending from just before the anterior insertion of the dorsal fin almost to the ventral grooves (Fig.1b). A similar feature was observed in another young dwarf minke whale collected in Australia (Paterson, 1994).

Not all baleen plates were kept so an accurate count can not be provided. The colour of the preserved plates was similar to the ones reported for dwarf minke whales collected in South Africa and Australia (Best, 1985; Arnold *et al.*, 1987). Most plates were light yellowish and a few presented a narrow external dark border. This border's breadth corresponded to up to 5% of the width of the plate.

Skeleton: Cranial measurements are presented in Table 2, while pictures of the skull were illustrated by Zerbini *et al.* (1996, Fig.3). The following cranial characters were observed in the present specimen: the parietals were incorporated in the vertex and were in contact with the interparietal. The latter was exposed and presented a somewhat rhomboidal shape. The anterior border of the supraoccipital was curved posteriorly in the midline of the skull and the hamular process of the pterigoyds was narrow and elongated. These were previously described as diagnostic for dwarf minke whales (Arnold *et al.*, 1987; Zerbini and Simões-Lopes, 2000). The vertebral formula was C7-T11-L10-Ca18. The vertebral epiphyses were not fused.

Reproductive status: The testes were very small. Both measured 9.3cm of length and were clearly undeveloped. The size of the specimen, *i.e.* 3.43m, and external analysis of the testes indicated its immature status. Information from animals caught in whaling activities suggests that male dwarf minke whales reach sexual maturity at approximately 6m (*e.g.* Best, 1985; Kato, 1991).

Parasite infestation: Despite the small size of this animal, its stomach was heavily infested by at least two nematode species of the genera *Anisakis* (about 3%) and *Pseudoterranova* (about 97%). Further analyses, including molecular methods, may help determine the species identification of these nematodes. No parasites were found either in the intestines or any other organ though no fine search was performed. The genus *Anisakis* has also been found in the stomach of an adult dwarf minke whale stranded in New Zealand (Dawson and Slooten, 1990). Studies on North Pacific minke whales (Araki *et al.*, 1997) and Antarctic minke whales (Dailey and Vogelbein, 1991) indicated only *Anisakis* in the stomachs. There is an early record of *Pseudoterranova decipiens* from Northern Hemisphere minke whales (from Delyamure, in Tomilin, 1967) but the accuracy of this information is uncertain given the complex taxonomy of *Anisakidae* parasites. Nematode parasites of the family *Anisakidae*, including the genera *Anisakis*, *Contracaecum*, *Pseudoterranova* (= *Terranova*, *Phocanema*, *Porrocaecum*) are composed of several complexes of sibling species and are the nematodes most commonly reported from the stomachs of cetaceans (Dailey, 2001). Heavy infections of these parasites rarely cause clinical signs, but can result in gastritis and ulceration (Dailey, 2001).

Diet: The stomach was almost full of *Euphausia similis,* suggesting that dwarf minke whales may wean at much smaller sizes than Antarctic minke whales, given that the latter measure approximately 2.8m at birth. This euphausiid is considered an important prey for balaenopterid whales (Kawamura, 1980). Despite the extensive review on the food of baleen whales around the world (Kawamura, 1980) and specifically in the Southern Ocean (Kawamura, 1994), this euphausiid species has not previously been reported in the diet of dwarf minke whales. Dwarf minke whales taken in the Antarctic fed primarily on myctophid fishes (*e.g.* Kato *et al.*, 1989).

In the western South Atlantic *E. similis* seems to occur from the Abrolhos Bank region (ca 16° to 19°S) northeastern Brazil to the Uruguayan continental shelf (*ca* 34° to 35°S) (Ramirez, 1971; 1973; Tôha, 1981; Freire, 1991; Gorri, 1995; Muxagata, 1999). According to Gorri (1995), this euphausiid has its centre of dispersion in warm waters and is an indicator species of the influence of the warm Brazil Current in the southern Rio Grande do Sul State, southern Brazil (Gorri, 1995). In this area, *E. similis* is abundant, representing 40-60% of the zooplankton captured in sampling nets in the spring and summer (Gorri, 1995). *E. similis* occurs in neritic waters (Tôha, 1981; Muxagata, 1999), where sightings of dwarf minke whales have been reported in recent years (Hassel *et al.*, 2003; Zerbini *et al.*, 1997). The more neritic distribution pattern of dwarf minke whales had previously been well documented off South Africa (Best, 1985) and off eastern Australia (Arnold, 1997).

Since *E. similis* typically inhabits mild and warm waters, its lack in the checklist of prey species in the minke whales' diet probably is because most data come from animals caught in high latitudes. However, the species is not included among the euphausiids found in the stomach of minke whales in medium latitudes from waters off Durban, South Africa (Best, 1982), which were: *E. diomedea*, *E. lucens* and *E. recurva*. The "krill" (certainly not *E. superba*) found in at least 3% of the analysed stomachs of minke whales

caught during whaling activities in northeastern Brazil (Williamson, 1975) is probably not *E. similis* as the whales were killed mostly in oceanic waters and further beyond the northern limit of this eupahusid range. Although it is already known that balaenopterids may feed outside their regular feeding grounds in high latitudes whenever plenty of prey is available (*e.g.* Kawamura, 1975; 1980), this record of *E. similis* is the only data available on food of dwarf minke whales in mid latitudes. No records exist for the South African specimens (P. Arnold, pers. commn) and whales seen at low latitudes in Australia have not been seen feeding (Birtles *et al*., 2002).

Records of juveniles of dwarf minkes throughout much of the year along the Brazilian coast suggest that at least some individuals do not migrate to Antarctic waters (Zerbini *et al*., 1996; 1997) and may explore locally high productive coastal areas off eastern South America (*e.g.* Hassel *et al*., 2003).

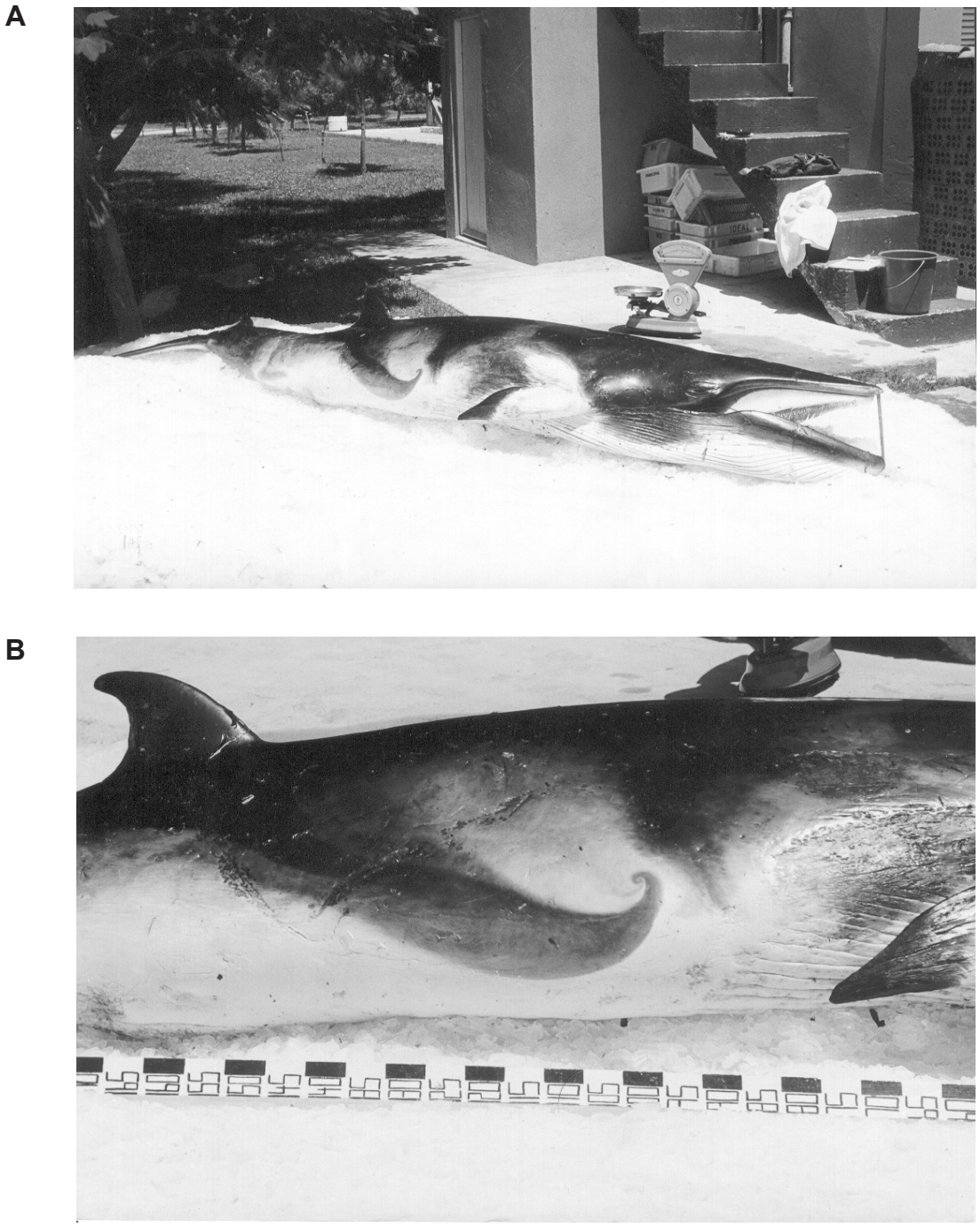

Figure 1. External colour patterns (A) and details of the wave-like flank patch (B) of a dwarf minke whale incidentally captured in southern Brazil.

Table 1. External measurements and some organ weights of a juvenile male dwarf minke whale, *Balaenoptera acutorostrata*, incidentally caught in a gillnet in southern Brazil.

MEASUREMENTS	IN cm	IN kg	NUMBER
Total Length (tip of upper jaw to fluke notch)*	343.0		
Projection of lower jaw	4.5		
Blowhole length	10.5		
Blowhole width (maximum)	5.9		
Snout to angle of mouth*	37.2		
Snout to centre of eye*	66.0		
Snout to ear*	78.0		
Snout to anterior insertion of flipper*	94.2		
Centre of eye to angle of mouth	8.5		
Centre of eye to ear	19.0		
Centre of eye to edge of blowhole (over curve)	32.0		
Flipper length, anterior insertion to tip	55.4		
Flipper length, axilla to tip	38.4		
Flipper maximum width	16.0		
Snout to anterior insertion of dorsal fin*	228.0		
Length of dorsal fin base	25.5		
Height of dorsal fin	19.2		
Snout to centre of umbilicus*	187.0		
Snout to centre of genital slit*	231.0		
Snout to centre of anus*	255.0		
Fluke width	96.5		
Depth of fluke notch	3.4		
Girth at axilla	195.0		
Girth at anus	92.0		
Thickness of blubber (dorsal position)	1.1 to 2.8**		
Thickness of blubber (ventral position)	1.6 to 4.0**		
Number of ventral grooves (between flippers)			55
Heart weight (without blood)		4.09	
Left lung weight		3.47	
Right lung weight		3.90	
Left kidney weight		2.14	
Right kidney weight		2.08	
Liver weight		13.00	
Pancreas weight		0.165	

* Distances taken in straight line parallel to body axis.
** Measurements were taken half way through the length of the animal

Table 2. Skull measurements of a juvenile male dwarf minke whale, *Balaenoptera acutorostrata*, incidentally caught in a gillnet in southern Brazil.

	MEASUREMENTS	(in mm)	%CPL	%ZGW
1	Condylo-premaxillary length	755.0	100.00	174.36
2	Right premaxillary length	512.0	67.81	118.24
3	Left premaxillary length	507.0	67.15	117.09
4	Right maxillary length	484.0	64.11	111.78
5	Left maxillary length	524.0	69.40	121.02
6	Distance from the tip of premaxillary to vertex	528.0	69.93	121.94
7	Distance from the tip of premaxillary to anterior border of nasal bones	413.0	54.70	95.38
8	Distance from the tip of premaxillary to posterior border of nasal bones	480.0	63.58	110.85
9	Median length of nasal bones (straight line)	79.2	10.49	18.29
10	Anterior breadth of nasal bones	48.0	6.36	11.09
11	Rostrum length	408.0	54.04	94.23
12	Rostrum breadth (at one half of the length)	178.0	23.58	41.11
13	Rostrum breadth (at base)	273.0	36.16	63.05
14	Maxillary breadth at the parietals distance	92.2	12.21	21.29
15	Maxillary maximum breadth at the vertex	78.2	10.36	18.06
16	Breadth of frontal across nasals	93.6	12.40	21.62
17	Maximum breadth of maxillary at the nares	100.9	13.36	23.30
18	Skull breadth at the squamosal	433.0	57.35	100.00
19	Skull breadth at the frontal (anterior)	382.0	50.60	88.22
20	Skull breadth at the frontal (posterior)	425.0	56.29	98.15
21	Skull breadth at the descendent process of the maxillary	363.0	48.08	83.83
22	Orbital length at the right frontal	110.7	14.66	25.57
23	Orbital length at the left frontal	104.1	13.79	24.04
24	Breadth of exoccipital	332.0	43.97	76.67
25	Occipital condyle breadth	125.7	16.65	29.03
26	Height of the right occipital condyle	79.7	10.56	18.41
27	Height of the left occipital condyle	82.2	10.89	18.98
28	Foramen magnum breadth	63.0	8.34	14.55
29	Foramen magnum height	48.0	6.36	11.09
30	Distance from the anterior edge of foramen magnum to the vertex (straight)	190.0	25.17	43.88
31	Distance from the tip of premaxillary to the anterior edge of palatine	419.0	55.50	96.77
32	Distance from the tip of premaxillary to the posterior edge of palatine	569.0	75.36	131.41
33	Distance from the tip of premaxillary to the posterior edge of hamular process of the right pterygoid	645.0	85.43	148.96
34	Right mandible length (straight)	754.0	99.87	174.13
35	Left mandible length (straight)	753.0	99.74	173.90
36	Right mandible length (over curve)	807.0	106.89	186.37
37	Left mandible length (over curve)	814.0	107.81	187.99
38	Mandible height at the right coronoid process	112.0	14.83	25.87
39	Mandible height at the left coronoid process	112.4	14.89	25.96
40	Mandible height at the right condyle	73.9	9.79	17.07
41	Mandible height at the left condyle	74.5	9.87	17.21
42	Maximum length of the right tympanic bulla	79.5	10.53	18.36
43	Maximum length of the left tympanic bulla	78.6	10.41	18.15
44	Maximum breadth of the right tympanic bulla	62.4	8.26	14.41
45	Maximum breadth of the left tympanic bulla	61.6	8.16	14.23

Obs.: The measurements are also shown as proportions of the condylo-premaxillary length (CPL) and width of the zygomatic process (ZGW).

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