

# The Dwarf Form of the Minke Whale, *Balaenoptera acutorostrata* Lacépède, 1804, in Brazil

Alexandre N. Zerbini<sup>1</sup> and Eduardo R. Secchi

Museu Oceanográfico 'Prof. Eliézer de Carvalho Rios' C.P. 379 Rio Grande – RS, Brazil 96200–970

Salvatore Siciliano<sup>2</sup>

Fundação Brasileira para a Conservação da Natureza, Rua Miranda Valverde, 103 Botafogo,  
Rio de Janeiro – RJ Brazil 22210–000

Paulo César Simões-Lopes

Universidade Federal de Santa Catarina, Laboratório de Mamíferos Aquáticos, C.P. 5102 Florianópolis –  
SC Brazil 88040–970

## ABSTRACT

In order to verify the available information on the presence of the diminutive or dwarf minke whale in Brazil, a complete review of minke whale records was undertaken. From 1976 to 1993, a total of 24 strandings, sightings and an incidental catch was recorded along the Brazilian South Atlantic coast between June and February. Sexually mature dwarf minke whales were recorded in the minke whale breeding ground off Brazil suggesting an overlapping in the distribution of both ordinary and dwarf minke whales. The latter represented 75% of all confirmed minke whale strandings recorded in Brazil and evidence of spatial segregation by age class was observed. Colour patterns of dwarf minke whales in the southwest Atlantic are similar to those described for other areas but some variable or age dependent differences were verified in qualitative skull characters.

KEYWORDS: MINKE WHALE (DWARF FORM); SOUTH ATLANTIC; TAXONOMY; STRANDINGS; WHALING; DISTRIBUTION; ANATOMY/MORPHOLOGY; SEGREGATION

## INTRODUCTION

The existence of different morphological patterns in Southern Hemisphere minke whales has been reported by several authors (e.g. Kasuya and Ichihara, 1965; Ohsumi *et al.*, 1970; Gaskin, 1976; Doroshenko, 1979; Baker, 1983; Singarajah, 1984).

Best (1985) described two different forms of minke whale in the Southern Hemisphere based on baleen colouration, morphometric characters and colour patterns of whales captured off Durban (South Africa) and near the Antarctic ice edge between 62°W and 105°W. The 'ordinary' Southern Hemisphere minke whale, had asymmetrically coloured baleen series and flippers with one or two tones of grey (type 1 and 2) but never a white patch (Best, 1985). A different form had flippers with a white patch (type 3) connected to a roughly rounded white blaze on the shoulder and dark pigmentation in the neck region that extended onto the ventral grooves (Best, 1985). This latter form was born and attained sexual maturity at a smaller size than the 'ordinary' form, and was named as the diminutive form (Best, 1985) or 'dwarf minke whale' (Arnold *et al.*, 1987).

There is still little information available about the biology and distribution of the dwarf minke whale. This form is known from South Africa (Best, 1985), Australia (Best, 1985; Marsh, 1985; Arnold *et al.*, 1987), New Caledonia (Arnold *et al.*, 1987), New Zealand (Baker, 1983; Arnold *et al.*, 1987), Argentina (Baldas and Castello, 1986; Albareda and Castello, 1990; Albareda, 1991) and Brazil (da Rocha and Braga, 1982; Best, 1985; Baldas and Castello, 1986; Secchi *et al.*, 1993; Zerbini *et al.*, 1993), as well as the

Antarctic (e.g. Kato *et al.*, 1990; Kasamatsu *et al.*, 1993). One probable sighting at 69°25'S (Aguayo, 1994) represents the southernmost record of this form.

The taxonomic status of the dwarf form remains unresolved, although differences in morphometric (Best, 1985; Baldas and Castello, 1986; Arnold *et al.*, 1987) and biological parameters (Best, 1985) clearly distinguish the dwarf from the ordinary form in the Southern Hemisphere. Consequently, the International Whaling Commission (IWC) has suggested that they should be managed separately (IWC, 1991). Genetic studies have linked the dwarf form with the North Atlantic and North Pacific forms and suggested that the ordinary Southern Hemisphere minke whale should be considered a distinct species, *B. bonaerensis* (Wada and Numachi, 1991; Wada *et al.*, 1991; Arnason and Gullberg, 1994; Pastene *et al.*, 1994).

This study presents information on the occurrence, seasonality and skull morphology of the dwarf minke whale along the Brazilian coast.

## MATERIAL AND METHODS

Data were compiled from personal observation, scientific literature, the printed media and unpublished information provided by colleagues. Brazilian museums, research institutions and laboratories were visited in order to obtain unpublished data. All our new records refer to specimens stranded<sup>3</sup> or accidentally caught in nets, with the exception of the two whales sighted off the Espírito Santo State (ES).

<sup>1</sup> Present address: R. Prof. Miguel Calmon 32, São Paulo – SP, 05655–060, Brazil

<sup>2</sup> Present address: UFRRJ-IB, Pós Graduação em Biologia Animal, Seropédica, Itaguaí – RJ, 23851–970 Brazil

<sup>3</sup> In this paper all the whales found ashore will be treated as strandings since it was not possible to verify if most of them stranded alive before they were first observed or if they were washed ashore already dead.

Table 1

Records of the dwarf minke whale along the Brazilian coast. Codes: Colouration: SP - flipper and shoulder white patch; THP - dark pigmentation on ventral grooves. Skull morphology: PIV - parietals and interparietal incorporated in the vertex; CBN - convex border of nasal bones; VGN - antero-ventral groove in the nasal bones.

No.	Locality	Latitude and longitude	Date collected or observed	Evidence	Sex	TL(m)	Criteria used for identification	Source	Specimen no.
1	Cabedelo, PB		13.8.80	Killed in the whaling season	M	6.9	Colouration: SP	da Rocha & Braga, 1982	
2	Cabedelo, PB		15.8.80	Killed in the whaling season	M	7.1	Colouration: SP	da Rocha & Braga, 1982	
3	Cabedelo, PB		27.11.80	Killed in the whaling season	F	7.6	Colouration: SP	da Rocha & Braga, 1982	
4	Praia de Busca Vida, Camaçari, BA	12°43'S, 38°20'W	17.7.92	Stranding		4.50	Colouration: THP	Present study	
5	Ponta de Corumbau, Prado, BA	17°20'S, 39°13'W	8.89	Stranding		4.00 <sup>1</sup>	Skull morphology: PIV, CBN, VGN	Present study	
6		19°28'S, 35°56'W	8.89	Two whales sighted			Colouration: SP	Brito Jr., pers. comm.	
7	Marataizes, ES	21°02'S, 40°50'W	04.8.89	Stranding	F	3.66	Colouration: SP, THP	Present study	
8	Praia do Leme, Rio de Janeiro, RJ	22°56'S, 43°15'W	13.8.68	Stranding	F	5.00 <sup>1</sup>	Colouration: SP, THP	Geise & Borobia, 1988	
9	Praia do Leblon Rio de Janeiro, RJ <sup>2</sup>	22°56'S, 43°15'W	28.6.77	Stranding		6.00 <sup>1</sup>	Colouration: SP, THP	Geise & Borobia, 1988	
10	Praia Vermelha, Rio de Janeiro, RJ	22°56'S, 43°15'W	05.8.77	Stranding	F	5.00 <sup>1</sup>	Colouration: SP, THP	Baldas & Castello, 1986	
11	Ubauba, SP	23°23'S, 45°04'W	12.10.89	Stranding	M	5.00	Skull morphology: PIV, CBN, VGN	Santos, unpublished data	
12	Praia do Centro, Itanhaém, SP	24°11'S, 46°47'W	05.11.92	Stranding	M	5.00	Colouration: THP	Santos, unpublished data	
13	Ilha Comprida, SP	25°01'S, 47°57'W	05.9.86	Stranding	F	3.00	Colouration: SP, THP	Santos, unpublished data	MCEM-MM 070
14	Ponta Oeste Ilha do Mel, PR	25°30'S, 48°23'W	26.6.90	Stranding			Skull morphology: PIV, CBN, VGN	Bittencourt & Zanelatto, 1992	
15	Praia do Rincão Criciúma, SC	28°40'S, 49°22'W	9.80	Stranding		4.50	Colouration: SP	Baldas & Castello, 1986	
16	Praia da Gaivota Sombrio, SC	29°07'S, 49°33'W	6.89	Skull collected			Skull morphology: PIV, CBN, VGN	Simões-Lopes & Ximenez, 1993	UFSC 1084
17	Praia de Mariópolis, Atlântida Sul, RS	29°52'S, 50°03'W	14.12.93	Stranding		7.00	Skull morphology: PIV, CBN, VGN	Ott & Danilewicz, unpubl. data	GEMARS 0130
18	Praia do Cassino Rio Grande, RS	32°07'S, 52°05'W	26.6.76	Stranding	M	2.90	Colouration: SP	Best 1985; Baldas & Castello, 1986	
19	Praia do Cassino Rio Grande, RS	32°07'S, 52°05'W	01.10.84	Stranding	M	2.70	Colouration: SP, THP	Pinedo, unpublished data	LM 639
20	Praia do Cassino - Sarita Rio Grande, RS	32°38'S, 52°26'W	11.1.93	Stranding		<4.00 <sup>1</sup>	Skull morphology: PIV, CBN, VGN	Present study	
21	Praia do Cassino - Albardão Rio Grande, RS	33°13'S, 54°42'W	11.1.93	Stranding		3.00 <sup>1</sup>	Skull morphology: PIV, CBN, VGN	Present study	
22	Praia do Cassino - Albardão Rio Grande, RS	33°13'S, 52°42'W	10.2.93	Stranding		7.00	Skull morphology: PIV, CBN, VGN	Present study	MORG 0097
23	Praia do Cassino - Concheiros Rio Grande, RS	33°27'S, 52°58'W	15.8.92	Stranding		2.60	Colouration: SP, THP	Pinedo, unpublished data	
24	RS	33°35'S, 51°29'W	29.11.92	Incidental catch	M	3.43	Colouration: SP, THP	Secchi <i>et al.</i> , 1993	MORG 0096
							Skull morphology: PIV, CBN, VGN	Zerbini <i>et al.</i> , 1993	

<sup>1</sup> Estimates.

<sup>2</sup> Although Baldas & Castello (1986) reported that this whale was 8.0 m in length, we believe that this value was overestimated.

Whales were identified following the external characters described by Best (1985) and Arnold *et al.* (1987) for the dwarf minke whale. When an advanced state of decomposition did not permit evaluation of external appearance, cranial morphology was examined following the description by Arnold *et al.* (1987). These authors compared the skull morphometry between the dwarf minke whale and the ordinary Southern Hemisphere minke whale (Omura, 1975; Omura and Kasuya, 1976) and observed that in the dwarf form the anterior margins of the nasal bones were convex with an antero-ventral groove; the vertex contained both parietal and interparietal bones; the posterior border of the palatines was angulate and the hamular process of the pterygoid bone was elongated. They noted however, that the observations were from limited material from Australia and that more information was needed from other geographical areas, to determine the consistency of those features for dwarf minke whales. Therefore, the skull morphology of the minke whales with dwarf form colour patterns from this study have been compared with the description of skull morphology provided by Arnold *et al.* (1987). Additional information on dwarf minke whale skull morphology was obtained from Albareda and Castello (1990).

Some skulls were not available for personal examination and were identified based on close photographs of dorsal or dorsal and ventral views. In this case, only specimens that permitted an acceptable evaluation of the skull morphological characters were included in this study.

The codes for the Brazilian states and the name and location of the Brazilian institutions abbreviated in the text are listed in Appendix 1.

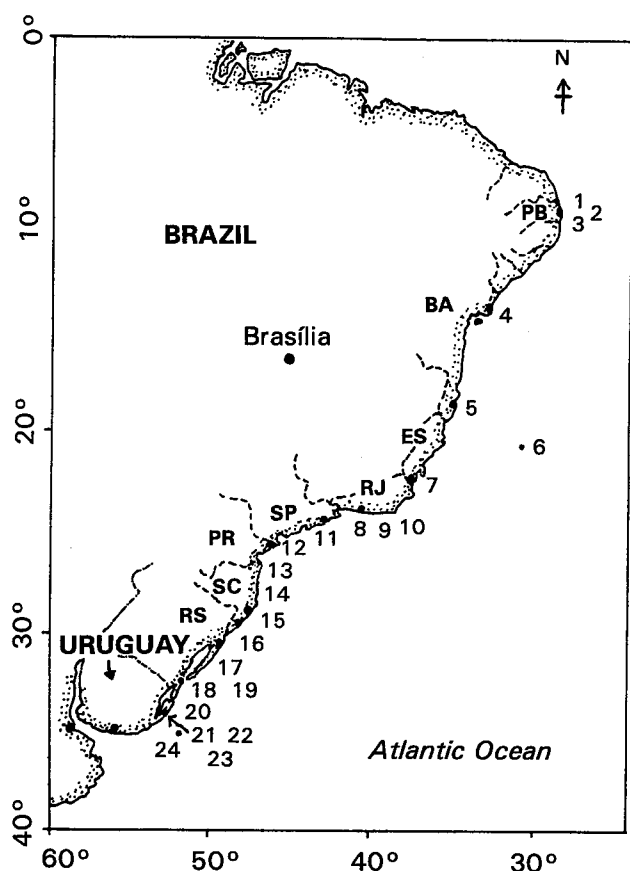


Fig. 1. Records of dwarf minke whales along the Brazilian coast (numbers in the map are associated with data listed in Table 1).

## RESULTS

Table 1 summarises the 24 incidences of the dwarf form along the Brazilian coast. The positions of the animals are given in Fig. 1. From 1976 to 1993, sightings and strandings of the dwarf minke whale recorded in Brazil occurred between June and February. The highest frequency was observed in August ( $n=8$ ).

There are only three confirmed records (nos 1–3, Table 1) of the dwarf form in Brazilian commercial whaling. They were taken off Costinha in 1980 (da Rocha and Braga, 1982). Baldas and Castello (1986) reported strandings of three minke whales with the dwarf form's colour pattern (nos 9, 16 and 18). The only confirmed incidental capture was a young male caught in waters 143m deep (24) and landed in Rio Grande (32°07'S, 52°05'W) (Secchi *et al.*, 1993; Zerbini *et al.*, 1993). The nearly complete skeleton of this specimen was recovered (MORG 0096).

### Review of records of 'unidentified' specimens

Three strandings (8, 9 and 10) reported for RJ by Geise and Borobia (1988) and one for PR (14) by Bittencourt and Zanelatto (1992) were dwarf minke whales (Fig. 2a and b). The RJ animals had the white patch on the flipper and shoulder, and the zone of dark pigmentation in the region of the throat and ventral grooves, as did the animal from PR (H.P. Castello and R.C. Zanellato, pers. comm.; Fig. 2b). The skull (16) collected by Simões-Lopes and Ximenez (1993) was also identified as belonging to a dwarf minke whale.

### Review of unpublished records

Details of previously unpublished strandings (4, 5, 7, 11–13, 17, 19–23) are given in Table 1.

The only sightings of dwarf minke whales were two animals (6) with a white patch on the flippers at 19°28'S, 35°56'W in waters 3,700m deep (J.L. Brito Jr., pers. comm.).

### Skull characteristics

The skulls of three whales (14, 19 and 24) that had been identified as dwarf form based upon colour patterns were examined. Their morphology largely coincided with the description of the dwarf form given by Arnold *et al.* (1987). All of the skulls had a convex anterior border of the nasal bones with an antero-ventral groove and parietal and interparietal bones incorporated in the vertex. Specimen 24 (Fig. 3) also had an elongated hamular process of the pterygoids and a curved posterior border of the palatines. These two characteristics were damaged in the specimens 14 and 19.

Those specimens (5, 11, 13, 16, 17, 20, 21 and 22) in an advanced state of decomposition were classified as dwarf form animals because their skulls presented characters observed for the three specimens described above as well as those described by Arnold *et al.* (1987) and Albareda and Castello (1990). In the three large skulls (16, 17 and 22) possibly of mature whales, the anterior border of the nasal bones was much less convex than in younger specimens. In addition, in 16 and 22 the posterior border of the palatines was straight rather than angulate. The hamular process of the pterygoids was elongated in specimen 22.



(a)



(b)

Fig. 2. Dwarf minke whales stranded in (a) Rio de Janeiro (8) (photo: 'Agência O Globo', courtesy FBCN) and (b) Paraná (14) (photo: M.C.M. Corrêa, courtesy R.C. Zanelatto).

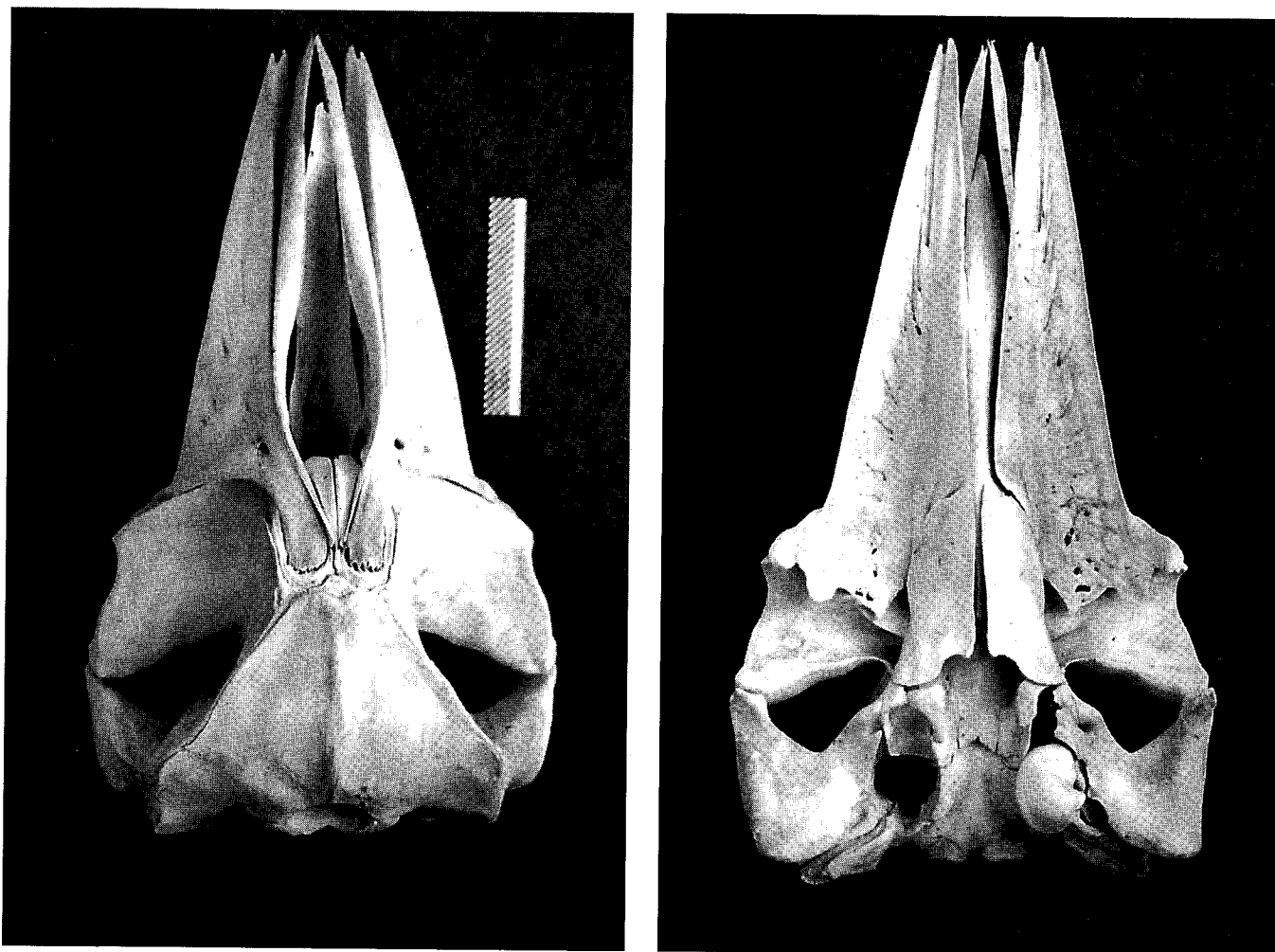


Fig. 3. Dorsal and ventral view of the skull MORG 0096 (scale = 15cm).

## DISCUSSION

The presence of the dwarf minke whale along the Brazilian coast was first suggested by Best (1985) based on the three specimens killed during the whaling season off Paraíba (da Rocha and Braga, 1982), and one specimen stranded in RS. Baldas and Castello (1986) subsequently reported the occurrence of minke whales with a white patch on the flippers from RS, SC and RJ. New records confirm that the dwarf minke whale occurs along the Brazilian coast from RS to the possible ordinary minke whale's breeding ground (Horwood, 1990) off northeast Brazil.

In a review of records of the genus *Balaenoptera* from Brazil (Zerbini *et al.*, unpublished data), the dwarf minke whale represented about 75% ( $n=18$ ) of all minke whale strandings identified to form. Results from the Japanese cruises have shown that the dwarf form is much less abundant than the ordinary form in Antarctic waters (e.g. Kato *et al.*, 1990; Kasamatsu *et al.*, 1993). However, reliable information about the relative abundance of both forms of minke whales in low latitudes is not available (Best, 1985). Singarajah (1984) stated that no minke whale with a white patch on the flippers was found among the 1,745 whales killed between 1979 and 1981 during the Brazilian whaling season. However, he also noted that 'on rare occasions (e.g. 1980 and 1981, about 0.2% of the annual catch) a second type, with a white stripe, was recorded'. Rocha and Braga (1982) reported that three animals with a white patch were

found among 902 whales killed during the 1980 season. Best (1985) suggested that the incidence of the dwarf minke whale off Durban and off northeastern Brazil is low (3–4% and 0.2% of the total catch of minke whales respectively). Since this information was obtained from whaling operations, where the commercial interest may have resulted in selection for the ordinary (larger) form (Best, 1985), the percentage obtained may not reflect the real proportions of the two forms in both regions. Although the sample size was small ( $n=13$ ), Best (1985) observed that almost 80% of the dwarf form animals captured were within 30 n.miles of the coast, suggesting some degree of spatial segregation between the two forms. Given that dwarf minke whales are less abundant, the marked difference observed in the proportion of the strandings of the two forms in Brazil could indicate that, as in South Africa, dwarf minke whales have a more coastal distribution off Brazil and therefore a higher possibility of being found ashore.

The capture of three adult dwarf minke whales among ordinary Southern Hemisphere minke whales in August and November (da Rocha and Braga, 1982) and the statement that dwarf minke whales were regularly sighted during the whaling operations (IWC, 1985) suggest that some overlapping in the distribution of both forms may occur in this region.

It has been accepted that Southern Hemisphere minke whales migrate from low latitude waters southward to the Antarctic Ocean in spring and summer, returning in fall and

winter. Data summarised in this study and provided by Baldas and Castello (1986) suggest that dwarf minke whales are present off the Brazilian coast at least between June and February. This concurs with information from Australia, where dwarf form animals were recorded from July to December (Arnold *et al.*, 1987) suggesting some seasonality in movements and perhaps reflecting latitudinal migration. However, records of dwarf minke whales in Uruguay and Argentina in April and May (Baldas and Castello, 1986), show that they are present in medium latitudes of the southwest Atlantic Ocean throughout the year. They have also been recorded in the Antarctic Ocean both during the austral summer (Kato *et al.*, 1990; Kasamatsu *et al.*, 1993) and winter months (Aguayo, 1994). Thus it is premature to reach firm conclusions about long-range latitudinal movements of dwarf minke whales in the southwest Atlantic.

The small sample size precludes reliable estimation of the length at sexual maturity of the dwarf form. Sexually mature males and females ranged from 6.71–7.10m (da Rocha and Braga, 1982; Best, 1985) and 6.40–7.60m (da Rocha and Braga, 1982; Best, 1985; Marsh, 1985; Arnold *et al.*, 1987; Kato *et al.*, 1990 and Kasamatsu *et al.*, 1993), respectively. Three immature females ranged from 3.83–5.90m (Kato *et al.*, 1990; Kasamatsu *et al.*, 1993).

Northern Hemisphere minke whales, which are genetically closer to dwarf minke whales (Wada *et al.*, 1991), attain sexual maturity at about 80% of their maximum length (Jonsgård, 1951; Omura and Sakiura, 1956). The maximum length obtained for female and male dwarf minke whales are 7.77m and 7.62m respectively (Best, 1985). If the dwarf form exhibits the same pattern as northern forms, sexual maturity would be attained by females and males at around 6.2m and 6.0m in length.

Spatial segregation by length classes has been observed in both Hemispheres on the breeding and feeding grounds (e.g. Sergeant, 1963; Williamson, 1975; Best, 1982; Stewart and Leatherwood, 1985; Wada, 1989; Fujise *et al.*, 1994). There is some evidence to suggest that mature and immature dwarf minke whales are segregated off Brazil. Confirmed mature animals were captured in the breeding grounds off Brazil in August and November (da Rocha and Braga, 1982) and presumed mature (greater than 6m) specimens (nos 17 and 22) stranded south of the breeding grounds at a time when, according to Williamson (1975)<sup>4</sup>, minke whales are moving from the breeding grounds. By contrast, strandings of presumed immature (<6m) dwarf minke whales (nos 4, 5, 7, 8, 10, 12–15, 18–21 and 23) occurred south of the breeding grounds from June to January, suggesting some segregation. In addition, immatures have never been observed, killed or found stranded in the breeding ground area. The dwarf minke whales that stranded in Argentina and Uruguay from June to September were also less than 6m. However, it is important to remember that the sample sizes are small and more data are required to reach any definitive conclusions.

Observations on qualitative characters suggest that the skull of specimens presenting dwarf minke whale's colour pattern collected in Brazil agree with those examined in Australia (Arnold *et al.*, 1987) and Argentina (Albareda and

Castello, 1990). The specimens identified as 'dwarf' on the basis of skull characters alone had the same characters described for whales with the dwarf form colour pattern in both the present and previous studies (Arnold *et al.*, 1987 and Albareda and Castello, 1990). In addition, the qualitative skull features of ordinary minke whales reported by Omura (1975) as well as caught during the whaling activities or stranded in Brazil do not agree with those described for the dwarf minke whale (Zerbini and Simões-Lopes, unpublished data).

The convex border of the nasal bones and an antero-ventral groove were present in the skulls of young specimens (nos 14, 19 and 24) from Brazil. Albareda and Castello (1990) observed the same for skulls from dwarf minke whales ranging from 2.1 to 3.1m collected in Argentina ( $n=4$ ). The anterior border of the nasal bones was more flattened (very lightly convex) in larger skulls (nos 16 and 22), but the antero-ventral groove was still present. Thus, the shape of the nasal bones appears to be age dependent or individually variable. The parietals incorporated in the vertex and the presence of an interparietal were observed in all the skulls analysed.

Although the information on skull morphology presented above confirms previous observations by Arnold *et al.* (1987), the sample size is still small and more material should be analysed in order to verify the consistency of this data.

Precise information on morphometry and colour patterns of dwarf minke whales from the southwest Atlantic is scarce. Baldas and Castello (1986) stated that, in general, no significant morphometric differences could be established between minke whales with or without a white patch on the flippers stranded in Argentina. However, the same authors observed that the dorsal fin appears to be more anterior and the navel more posterior in dwarf minke whales than in ordinary minke whales. A more anterior dorsal fin was also reported by Best (1985) and Arnold *et al.* (1987).

Most of the dwarf minke whale records in the southwest Atlantic were based upon stranded animals but a complete evaluation of the colour pattern was not possible because of decomposition. However, the main characters identified by Best (1985) and Arnold *et al.* (1987) (i.e. a white patch on the flippers and shoulder, and a zone of dark pigmentation extending onto the ventral grooves in the region of the throat) were also seen in all whales where such an analysis was possible.

Although additional morphological and osteological information is necessary to characterise the dwarf minke whale, present data maintain most of the previous differences between both forms of minke whales from the Southern Hemisphere and support the argument that the dwarf minke whale and the ordinary Southern Hemisphere minke whale should be recognised as different taxonomic entities.

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<sup>4</sup> Although Williamson (1975) only examined whales of the ordinary form, his observations on seasonality of minke whales off Brazil were based on animals killed during whaling activities and whales sighted at sea. Since it is very difficult to differentiate both dwarf and ordinary minke whales at sea (Best, 1985; Arnold, pers. comm.) and since the two forms were observed to mix on the whaling grounds (da Rocha and Braga, 1982; IWC, 1985), it is likely that Williamson's observations at sea could include both forms.

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**Appendix 1****Codes for the Brazilian States used in the text**

PB – Paraíba (6°29'S – 7°33'S); BA – Bahia (11°30'S – 18°20'S); ES – Espírito Santo (18°20'S – 21°18'S); RJ – Rio de Janeiro (21°18'S – 23°21'S); SP – São Paulo (23°21'S – 25°14'S); PR – Paraná (25°14'S – 25°57'S); SC – Santa Catarina (25°57'S – 29°20'S); RS – Rio Grande do Sul (29°20'S – 33°45'S).

**Abbreviations, name and location of institutions cited in text**

FBCN – Fundação Brasileira para a Conservação da Natureza. Rio de Janeiro – RJ.

GEMARS – Grupo de Estudos de Mamíferos Aquáticos do Rio Grande do Sul. Porto Alegre – RS.

LMM/DOc. – Laboratório de Mamíferos Marinhos/Departamento de Oceanografia, Fundação Universidade do Rio Grande. Rio Grande – RS.

MCEM-MM – Museu do Centro de Estudos do Mar – Universidade Federal do Paraná. Pontal do Sul – PR.

MORG – Museu Oceanográfico 'Prof. Eliézer de Carvalho Rios', Fundação Universidade do Rio Grande. Rio Grande RS.

UFSC – Universidade Federal de Santa Catarina. Florianópolis – SC.