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AGE AND GROWTH OF SOME DELPHINIDS IN THE SOUTHEASTERN BRAZIL

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Abstract

This study provides the first compilation on age and growth of some delphinids in southeastern Brazil (18º25'S-25º45'S). A total of 154 delphinids was reported: 44 *Stenella frontalis*; 36 *Tursiops truncatus*; 26 *Delphinus capensis*; 20 *Steno bredanensis*; 16 *Lagenodelphis hosei*; 3 *Pseudorca crassidens*; 3 *Stenella* sp.; 2 *Stenella attenuata*; 2 *Globicephala macrorhynchus*; 1 *Stenella longirostris* and 1 *Stenella coeruleoalba*. Age was estimated by counting the number of growth layers group present in the dentine in 74.5% of the sample. The growth of 92 individuals of the first five species was determined by Gompertz model to length-at-age data. *S. frontalis* (*n*=27) - the oldest specimen was 23 years and the asymptotic length of 224.4 cm predicted by growth curve occurred at about 20 years. *T. truncatus* (*n*=22) - the oldest specimen was 26 years and the asymptotic length of 301.3 cm predicted by growth curve occurred at about 20 years. *D. capensis* (*n*=17) - the oldest dolphin was 18 years old and the asymptotic length of 215.9 cm predicted by growth

curve occurred at about 5-6 years. *S. bredanensis* (*n*=13) - the oldest specimen was 24 years and the asymptotic length of 258.1 cm predicted by growth curve occurred at about 10 years. *L. hosei* (*n*=13) - the oldest specimen was 19 years and the asymptotic length of 231.2 cm predicted by growth curve occurred at about 7-8 years. Only age was estimated for the other species. The age-at-length data for *S. frontalis, D. capensis, S. bredanensis* and *L. hosei* were consistent, suggesting a good agreement with previous work on these species. For *T. truncatus*, the age at asymptotic length obtained in this study might be confirmed by increasing the sample size. The present study will be helpful to create a new scenario about the biological knowledge of the delphinids in the western south Atlantic coast.

INTRODUCTION

The knowledge on age and growth data is relevant to estimation of parameters used in stock assessment and management (Perrin & Reily, 1984). The age of delphinids has been estimated by counting the growth layer groups in dentine or cementum. Growth layer groups (GLGs) is a generic term and it is used to define groups of incremental growth layers. Increments of tissue are deposited in teeth as a function of time and GLGs may be recognised due to the cyclic repetition (Hohn & Hammond, 1985; Perrin & Myrick, 1980). The accumulation of layers was reported to be annual in specimens of *Tursiops truncatus* Autor, ano? born and died in captivity (Sergeant, 1959; Sergeant et al., 1973). The one-GLG-per-year model has also been suggested for other closely related delphinids, including *Globicephala melas* Autor, ano?, *Stenella coeruleoalba* Autor, ano? and *Stenella attenuata* Autor, ano? (Kasuya, 1972; Kasuya et al., 1974; Perrin et al., 1976 são autores das espécies ou apenas referência bibliográfica? Lia).

For most species of cetaceans direct calibration of teeth used for age estimating is not possible because of the difficulty in obtaining known-age or marked specimens (Pinedo & Hohn, 2000). Hohn et al. (1989) suggest as an alternative approach to helping ensure accurate and precise age estimates is to use information on growth-layer patterns from other species where growth layers have been calibrated. Since at least within taxonomic groups, e.g. the delphinids, growth layers retain many similarities (Hohn, 1990; Perrin & Myrick, 1980).

There have been few studies on age and growth of the delphinids in the western south Atlantic coast. The biological aspects of the tucuxi *Sotalia fluviatilis* Autor, ano? is relatively well known due to its intensive involvement with coastal fisheries (Di Beneditto et al., 1998; Siciliano, 1994). Consequently, analysis on age and growth parameters of these species were conducted for specimens from southeastern and southern Brazil (Ramos et al., 2000a; 2000b; Rosas, 2000; Santos, 1999; Schmiegelow, 1990; Zanellato et al., 1996).

Other delphinids species have been frequently reported along the Brazilian coast, e.g. *T. truncatus, Stenella frontalis* Autor, ano?, *Steno bredanensis* Autor, ano?, *Delphinus capensis* Autor, ano? and *Pseudorca crassidens* Autor, ano? (Alves Jr. et al., 1996; Barreto, 1995; 2000; Lodi & Capistrano, 1990; Pinedo & Rosas, 1989; Pinedo et al., 1992; Santos, 1999; Schmiegelow, 1990; Simões-Lopes & Ximenez, 1993; Ximenez et al., 1987). However, information on age and growth of these species is poorly known.

This study provides the first compilation on age and growth of some delphinids in the southeastern Brazil (18º25'S-25º45'S). The information currently presented will contribute with further life history research of delphinids in Brazilian waters.

MATERIALS AND METHODS

Data on delphinids were obtained from incidental captures in fishery activities, strandings and museums collections in the southeastern Brazil (18º25'S-25º45'S). The study area include the Espírito Santo State, from Itaúnas (18º25'S) to Itapemirim (21º00'S), Rio de Janeiro State, from Barra de Itabapoana (21º18'S) to Parati (23º07'S) and São Paulo State, from Ubatuba (23º30'S) to Baía de Paranaguá in the northern Paraná State (25º45'S) (Fig. 1).

The specimens have been deposited in the following collections: Museu Nacional/Universidade Federal do Rio de Janeiro (MN), Museu de Zoologia from Universidade de São Paulo (MZUSP), Universidade Estadual do Rio de Janeiro/MAQUA (UERJ/MQ), Centro de Estudos sobre Encalhes de Mamíferos Marinhos (CEEMAM), Projeto Atlantis from Universidade de São Paulo (PA/USP), Organização Consciência Ambiental (ORCA), Instituto de Oceanografia from Universidade de São Paulo (IO/USP).

A total of 154 delphinids was reported from 1962 to 1999: 44 *S. frontalis*; 36 *T. truncatus*; 26 *D. capensis*; 20 *S. bredanensis*; 16 *Lagenodelphis hosei* Autor, ano?; 3 *P. crassidens*; 3 *Stenella* sp. Autor, ano?; 2 *S. attenuata*; 2 *Globicephala macrorhynchus* Autor, ano?; 1 *Stenella* (? Lia) *longirostris* Autor, ano? and 1 *Stenella coeruleoalba* Autor, ano?.

Age was estimated by counting the number of growth layers group present in the dentine in 74.5% of the sample. We followed the terminology and layers pattern described previously to delphinids (see Perrin & Myrick, 1980; Hohn et al., 1989) and our experience in dentinal layers pattern of other species, e.g. *S. fluviatilis* (Delphinidae) and *Pontoporia blainvillei* Autor, ano? (Pontoporiidae) (see Ramos et al., 2000a; 2000b). Only the number of complete dentinal layers was considered for age determination. The results were expressed in years old. Fraction of layer was only used for calves with less than one complete layer. In those cases, age was considered to be zero or newborn for tooth with only neonatal line and 0.5 GLG for tooth with postnatal dentinal layer, but not one complete cycle.

The method of decalcified thin and stained sections of the teeth for optical microscope were used following the recommendations of Hohn et al. (1989) and Perrin & Myrick (1980). Large straight teeth were selected, stored in glycerin and ethanol (1:1), fixed in 10% formalin and decalcified in RDO (a commercial bone decalcifier) or formic acid 5%. The teeth were cut on the longitudinal plane on a freezing microtome. Labial-lingual sections were cut to a thickness of 40μm in the teeth. The sections were stained with Mayer's haematoxylin for 40 minutes and mounted in 100% glycerin. Mid-longitudinal sections with well-marked layers were selected and a standard of reading was established. The counts of the growth layers were made using a compound microscope at magnifications of 25x and 50x and a dissecting microscope at 16x and 50x, both with transmitted light. Three series of readings were accomplished. A fourth reading was accomplished using a microphotograph print of the section where all the growth layers were marked. The sets of counts were then compared. When differences occurred between counts, a best age estimate for each specimen was determined re-examining the section and photography together. To avoid tendency in the results, age was estimated without reference to biological data.

The etched half tooth method was used when the decalcification process to thin section was inadequate, mainly to larger teeth. The method of etched half tooth was used following recommendations of Pierce & Kajimura (1980). The teeth were cut in a longitudinal half-section along the using of a carborundum disc. The surface of the longitudinal halves were polished with different grades of whetstone and etched using 5%

formic acid for 2 hours. After rinsing in running water for 24 hours, the sections were air dried at room temperature. The pattern of ridges and grooves observed in the surface of half tooth were accentuated by rubbing the etched surface with soft pencil lead. The GLGs were counted with a binocular dissecting microscope with a magnification of 8x.

Body length was measured by a straight line in axial projections, from the tip of the upper jaw to the notch of the flukes, at 0.5 cm precision. The growth parameters of 92 individuals of *S. frontalis*, *T. truncatus*, *D. capensis*, *S. bredanensis* and *L. hosei* was determined by fitting non linear, Gompertz model to length-at-age data, through the Curve Expert 1.3 for Windows program: $Y = ae\ [-e\ (b\text{-}cx)]$, where Y is a measure size, a is the asymptotic value, b is the correction factor, c is the growth rate constant and x is age (Zullinger *et al*., 1984).

When available, add data about presence of pregnant, lactating, scars of ovulation in the ovary, sperm in the epididymis, foetus length, fusion of vertebral epiphyses were obtained (Perrin & Reily, 1984). Spotting pattern in *S. frontalis* and *S. attenuata* also was observed.

RESULTS AND DISCUSSION

Growth Layer Groups (GLGs)

One GLG in the stained tooth consisted of a pair of adjacent layers, one narrow unstained layer and one broad stained layer (Fig. 2). A fine darkly stained layer demarcated the unstained layer of subsequent GLG. The unstained layer of the first GLG is the neonatal line, a thin layer strongly marked that begin at birth. The GLG in the etched tooth consisted of one prominent ridge and one groove (Fig. 3).

The GLGs pattern was similar among the several species of delphinids analysed in the present study. However, the GLGs of *Delphinus* Autor, ano? and *Stenella* Autor, ano? teeth were more conspicuous (Fig. 2). The *L. hosei* teeth were often curved and, even so the dentinal layers pattern was very similar, it showed GLGs less conspicuous than observed in the *Delphinus* and *Stenella* teeth. The etched half-tooth for *T. truncatus* and *S. bredanensis* presented an easier procedure than the thin section due to the decalcified time, although the two methods were applied. The dentinal GLG followed the same pattern already described in the literature for *T. truncatus* (see Hohn et al., 1989). The first two layers were slightly more distinct in etched half-tooth than stained thin section because of accessory layers (Fig. 3). In stained section the accessory layers might cause difficulty in defining the first layer and often obscure the pattern of layering (see Hohn et al., 1989; Perrin & Myrick, 1980).

The larger teeth belonged to the juvenile individuals of *G*..... *macrorhynchus* Autor, ano? and *P. crassidens* and we did not have problems in applying the thin section method. Only one *P. crassidens* was older and we were able to use etched half-tooth. The dentinal layers in this species follow the long axis of the tooth and the last layers approaching an oblique orientation were less conspicuous.

Stenella frontalis

Age was estimated for 33 *S. frontalis* (Table 1). The oldest specimen was 23 years. No specimens at ages of 17-22 years were observed. The distribution of age frequencies show mode at age of 12 years (15.1%) and the contribution of older individuals was reduced (9.1%). Individuals with ages from zero to 12 years were more represented (90.9%) in the age frequency distribution.

Growth curves fitted to length-at-age data for individuals are presented in the Figure 4. Growth parameters estimated through these curves are presented in the Table 2. Predicted asymptotic length of 224.4 cm occurs at about 20 years. The length at age zero estimated from the Gompertz curve was 128.7 cm. A newborn specimen had the size slightly smaller (123.0 cm) than the predicted length at birth.

Herzing (1990) considered the following age classes for *S. frontalis*: old adults – 15+ years; young adults – 9 to 15 years; juveniles – 4 to 8 years; infants – 2 weeks to 3years; and neonates – 1 day to 2 weeks old.

In the present study, only one specimen was more than 20 years (#36, Table 1) and two were 15 and 16 years (#44 and #38). The specimens with less than 15 years, measuring up to 223 cm long, could be considered immature individuals (78%). However, the specimen #26 of 199 cm had already vertebral epiphyses totally fused, indicating physical maturity.

A wide age range for the spotting phase has been observed for *S. frontalis.* Herzing (1990) suggest that the spotting phase occur at 9-15 years. The specimen #1 (189 cm and 9 years) have already showed the spotting pattern.

Tursiops truncatus

The age range to 29 *T. truncatus* was zero to 26 years old (Table 3). No specimens at ages of 20-25 years were presented in the sample. The distribution of age frequencies was bimodal, with one mode consisting of specimens from 0-1 years (24.1%) and the other from 7-9 years of age (24.1%). The contribution of individuals to other age classes was reduced.

The asymptotic length of 301.3 cm predicted by growth curves occurs at about 20 years (Fig. 4 and Table 2). The specimen #57 of 300 cm had already vertebral epiphyses totally fused, indicating physical maturity. The length at age zero estimated from the Gompertz curve was 176.4 cm. The two younger specimens both with 0.5 years were smaller (162.0 and 166.0 cm) than length at birth predicted. Only one foetus was collected (#51, Table 3). The female data to this foetus are unknown.

Barreto (1995) estimated the age in 66 *T. truncatus* found stranded along the southern Brazilian coast (~31º-34ºS). The oldest animal also was 26 years and individuals up to 2 years represented 49% of the sample. Physical maturity of the skull to functional units was estimated to occur at five years.

The age of attainment of the asymptotic body length in our sample at about 20 years was higher in relation to the physical maturity of the skull estimated by Barreto (1995). This difference might be due to following factor; Barreto (1995) used the physical maturity of the skull in contrast to our use of maturity of the body size. Perrin (1975) suggests that the physical maturity of the skull is highly correlated with sexual maturity, and not physical.

In other areas, the largest animals did not exceed the size of 280.0 cm for males and 260.0 cm for females, approximately. For *T. truncatus* from Texas coastal waters, USA, the Gompertz model gave predicted asymptotic length of 268.0 cm for males and 246.7 cm for females, excluding all specimens less than one year of age. Length at age zero predicted from the Gompertz curve was 128.2 cm for males and 115.1 cm for females (Fernandez & Hohn, 1997). The longest male from the southeastern Africa was 257.0 cm and the oldest was 42 years and the longest female was 249.0 cm and the oldest was 43 years. Both sexes reach their asymptotic size – 243.0 cm for males and 238.0 cm for females – between 12 and 15 years (Cockcroff & Ross, 1989).

Read et al. (1993) related that the Gompertz model provided a good description of

the growth of *T. truncatus* from Sarasota, Florida, USA; males (266.4 cm) had greater asymptotic values than females (249.2 cm). Seargeant et al. (1973) presented age-length scatterplots showing that males from northeastern Florida achieved asymptotic body length of approximately 270.0 cm, compared to about 250.0 cm for females, very similar to the values presented by Read et al. (1993).

Four possible factors could be accepted to explain the considerable difference between the values of asymptotic length and of length at age zero obtained to *T. truncatus* in the present study and literature data: (i) the curve in this study was plotted for both sex; literature data have indicated sexual dimorphism (see Fernandez & Hohn, 1997; Read et al., 1993; Seargeant et al., 1973); (ii) occurrence of large animals in our sample (300.0-315.0 cm); e.g., the largest male and female in the literature were 280.0 and 260.0 cm, respectively (see Read et al., 1993; Seargeant et al., 1973); (iii) stranding of individuals from two different population of *T. truncatus*, coastal and offshore; e.g. the offshore animals seem to be larger than those found along the coast (see Hohn, 1980); and (iv) possibly geographical variation; there is incredible variation between different populations of *T. truncatus* (Jefferson et al., 1993).

Delphinus capenseis

Age estimated for 20 *D. capensis* ranged from 0.5 to 18 years old (Table 4). The age classes of 9-14 were better represented (50.0%) in our sample. Only one specimen was 18 years old (5.0%). The ages of 0-8 years were under represented; 5.0% by age class.

Predicted asymptotic length of 215.9 cm occurs at about 5-6 years old (Fig. 4 and Table 2). The length at age zero was estimated from the Gompertz curve at 111.7 cm. The smallest *D. capensis* aged was 154.0 cm and one year old. The single individual with 0.5 year was of unknown length.

Following the criterion of fusion of the premaxillae and the maxillae at the tip of the rostrum, Heyning & Perrrin (1994) suggest that mature males of *D. capensis* ranged from 202.0 to 235.0 cm and females, 193.0 to 224.0 cm long. Considering age and length predicted by our curve, 22.6% of the specimens may be considered immature individuals, 48.4% mature and 29.0% was not possible to measure and collect teeth for age estimation.

Steno bredanensis

The age range to 18 *S. bredanensis* was zero to 24 years old (Table 5). Age classes 0-3 years and 19-24 years were the most representative; 38.8% and 33.3%, respectively. A gap was observed among the age classes from 4 to 18 years. The contribution of individuals in these age classes was reduced; 5.6% by age.

The age of specimen #119 had been previously estimated in 33 years (Siciliano et al., 1987). We were able to count only 24 GLGs. The difference in the number of GLGs could be due to (i) distinct GLG pattern considered to one complete year; (ii) counting of accessory layers; or (iii) decrease in the acuity of count of the last layers in the etched half tooth used by us. Then, we exclude this individual of growth curve fitted to length-at-age data.

The asymptotic length of 258.1 cm predicted by growth curves occurs at about 10 years (Fig. 4 and Table 2). The length at age zero estimated from the Gompertz curve was 152.5 cm. The two younger specimens measured, both with 0.5 years, was higher (172.0 and 179.0 cm) than length at birth predicted. Only one foetus was collected (#115, Table 5) – 5% of the sample. The pregnant female (#114) was 6 years and 250.0 cm long.

The asymptotic length predicted by growth curves in our specimens (10 years) is

within of the range size to adults of *S. bredanensis* (e.g. Miyasaki, 1980). Miyazaki (1980) suggests that males of *S. bredanensis* reach a larger maximum size than females; 253.0 cm for males and 247.0 cm for females and sexual maturity is reached by the male at 231.0 cm long or 14 dentinal layers, and by the female at 225.0 cm, or 17 layers. However, the pregnant specimen (#114) of the present study had already reached sexual maturity at 6 years. All the animals analysed by Miyasaki (1980) were adults with more than 15 years. Perhaps, the age at attainment of sexual maturity estimated by Miyasaki (1980) might be overestimated due to absence of younger animals (<15 years).

Regarding the others individuals in our sample, 60.0% had body length between 240.0 and 283.0 cm long and 10 years or older. A male of 19 years and 240.0 cm (#112) had already vertebral epiphyses totally fused, indicating physical maturity. The juveniles (35.0%) had body lengths from 171.5 to 212.0 cm and up to three years.

Lagenodelphis hosei

Age estimated for 14 *L. hosei* ranged from one to 19 years old (Table 6). The distribution of age frequencies shows mode at age of 14 years (21.4%); however, two age classes were dominant from 1-4 years (35.7%) and 8-14 years (57.1%). No specimens at ages of 15-18 years were present in the sample.

The asymptotic length of 231.2 cm predicted by growth curves occurs at about 7-8 years (Fig. 4 and Table 2). The length at age zero estimated from the Gompertz curve was 105.8 cm. No newborn was present in the sample.

Life history parameters of *L. hosei* were examined by Amano et al. (1996) from a school captured in Japan. Age and body length at sexual maturity was estimated at 7-10 years and 220-230.0 cm long in males and 5-8 years and 210-220.0 cm long in females. Both sexes reach the asymptotic length at about age of 10 years: 230-260.0 cm in males and 220-250.0 cm in females. Mignucci-Giannoni et al. (1999) estimated the age in two *L. hosei* specimens found off Puerto Rico. The age of 3 years was estimated for a 227.0 cm subadult male and the age of a second, a 121.0 cm female, was estimated at less than a week old. The authors considered this consistent with Amano et al. (1996) who suggested length at birth at around 100.0 cm and 124.0 cm long.

Van Bree et al. (1986) analysed 11 individuals of *L. hosei* collected in a mass stranding on the northern coast of Brittany, France. The authors suggest that males and females reach sexual maturity from a total body length of 230.0 cm and at about 7 years of minimum age.

The asymptotic length predicted by our growth curve (231.2 cm long at about 7-8 years) is within the estimate of maturity to *L. hosei*. Therefore, of the 13 specimens stranded at Rio de Janeiro State from November to December 1997, 61.5% were adults and 38.5%, juveniles. The relationship between age and body length indicates that the specimens collected in the following years may also to be considered as adults (#128, 129 and 142, Table 6).

Amano et al. (1996) suggested that *L. hosei* could have a relatively shorter longevity than other pelagic delphinids; the oldest specimens in Japan were two males and a female of 17.5 years. Van Bree et al. (1986) showed that the oldest dolphin was 16 years old. The oldest individual in our sample was 19 years, which supports the above considerations.

Pseudorca crassidens

Two out of three *P. crassidens* examined in our sample were zero year: a 179.0 cm

female (MN) incidentally captured in gillnet fishery off northern Rio de Janeiro State (~21ºS) in 1992, and a 177.0 cm male (UERJ/MQ) stranded in the eastern Rio de Janeiro State (23º00'S) in 1995. The teeth sections in both specimens showed only the neonatal line and they were considered newborns. The third individual, a 503.0 cm long of unknown sex (UERJ/MQ) was found stranded in the eastern Rio de Janeiro State (23º00S). The age was estimated in 14 years old.

Adults of *P. crassidens* are up to 600.0 cm (males) or 500.0 cm (females) long. Newborns are 150.0 to 210.0 cm (Jefferson *et al*., 1993). Pinedo & Rosas (1989) estimated the age of four *P. crassidens* found at Rio Grande do Sul State coast, southern Brazil (~32ºS). A 436.0 cm male was 10 years, two females measuring 412.0 and 440.0 cm long were 17 and 18 years, respectively, and a 391.0 cm long specimen of unknown sex was 12 years. The authors considered all as adults.

Our oldest specimen in our sample had the age corresponding to a mature individual. No seasonality in breeding is known for *P. crassidens* (Jefferson, et al., 1993). Our two newborns were collected in different seasons (July - Winter and November - Spring).

Stenella sp.

Species identification was not possible in three *Stenella* specimens (CEEMAM) found stranded in the São Paulo State (24º00'S). A 210.0 cm male with no teeth for age estimation, a 205.0 cm male at 11 years of age and a 202.0 cm female at eight years of age.

Stenella attenuata

Two individuals of *S. attenuata* (UERJ/MQ) were found stranded in the eastern Rio de Janeiro State (23º00'S); a 194.0 cm female at 11 years in 1995, and a 195.0 cm male with no teeth for age estimation in 1997. The total length of our two specimens and the age estimated for the female is within the size range known for mature dolphins.

Perrin et al. (1976) estimated the average age at attainment of sexual maturity for offshore eastern tropical Pacific Pantropical spotted dolphins. Sexual maturity was approximately 12 layers and average length about 195.0 cm long in males. Females attain sexual maturity on the average at about 9 layers and 181.0 cm long. Asymptotic length was 190.0 cm at predicted age of 18 layers for females and 206.0 cm achieved at predicted age of 26 layers for males.

Growth of *S. attenuatta* in the Pacific coast of Japan is well known (see Kasuya, 1976, 1985; Kasuya et al., 1974). Sexual maturity is attained at 8.2 years in females and 10.3 years in males (Kasuya et al., 1974). The asymptotic length in females is estimated to be 193.9 cm at the age more than 12 years. The mean growth curve of the male indicate slower growth after 12 years of age and seems to reach the asymptotic length of 207.1 cm at the age of about 22 years (Kasuya, 1976).

Globicephala macrorhynchus

Schmiegelow (1990) reported a *G. macrorhynchus* (MZUSP) collected in the São Paulo State (24º50'S) in 1986. The body length and sex are unknown and the teeth were not collected. In 1997, a 235.0 cm specimen (ORCA) was collected in the Espírito Santo State (20º40'S). We estimated the age of two years for this specimen.

Kasuya & Matsui (1984) estimated that the maximum age attained by females of *G. macrorhynchus* was 62 years and 45 years for males. Females attain the sexual maturity at

nine years and reached the asymptotic length of 364.0 cm at age 22 years. The male growth was similar to that of female until age nine years, when the secondary male growth spurt started. Males attained an asymptotic length of 473.5 cm at 27 years.

The relationship between age and body length of our specimen, a 235.0 cm juvenile at two years, is in good agreement with the age-length predicted by growth curve to *G. macrorhynchus* off the Pacific coast of Japan (see Kasuya & Matsui, 1984).

Stenella longirostris

In 1999, a 109.5 cm female was found stranded in the southern Rio de Janeiro State (23º05'S) (UERJ/MQ) and had less than one complete layer in the teeth. We did not considered this female a newborn since it had already deposited dentinal layers.

In the eastern tropical Pacific, the length at birth estimated was 75.5 cm long (Perrin et al., 1975). Lately, Perrin et al. (1977) estimated average length at birth of 76.9 cm long and the largest fetus found was 84.0 cm long. Average body length of adult female was 170.6 cm (range from 153.0 to 187.0 cm) and attainment of sexual maturity at 167.0 cm long. Males attain sexual maturity at 170.0 cm and the average length of adult was 175.5 cm (range from 160.0 to 192.0 cm) (Perrin et al., 1975).

Barreto & Lodi (2000) estimated the age of two female *S. longirostris* collected in the northeastern Brazil (3º51'S): a 187.0 cm considered an adult with at least 18 years, and a 149.0 cm long juvenile between one and two years old. Considering the small sample size no extensive comparisons were possible.

Stenella coeruleoalba

In 1999, a *S. coeruleoalba* was found stranded in the eastern Rio de Janeiro State (23º00'S) (UERJ/MQ). The age was estimated at 21 years. The body length and sex could not be determined, but according to published data on growth of *S. coeruleoalba* we considered this specimen as an adult.

Life history of *S. coeruleoalba* is well known to the Pacific coast of Japan (see Kasuya, 1972, 1976, 1985; Miyazaki, 1977). Kasuya (1972) estimated that *S. coeruleoalba* attain sexual maturity at 9 years and 212.0 cm long in females and 220.0 cm long in males, and physical maturity at 14 to 15 years and 222.0 cm long in females and 236.0 cm long in males. Miyazaki (1977) estimated the mean age at attainment of sexual maturity of males at 8.7 years (219.0 cm) and of females at 8.8 years (216.0 cm).

CONCLUSIONS

In conclusion, the age-at-length data were consistent for *S. frontalis, D. capensis, S. bredanensis* and *L. hosei*, suggesting a good agreement with previous work on these species. For *T. truncatus*, the age at asymptotic length obtained in this study might be confirmed by increasing the sample size. The results obtained for *P. crassidens, Stenella* sp., *S. attenuata, S. longirostris, S. coeruleoalba,* and *G. macrorhynchus* were limited because of the small sample size available. No extensive comparisons were possible for these species.

While the sample analysed in the present study is small and it is not possible to draw many inferences about population structure and geographical variation based solely on these data, some parameters estimated are consistent with previous findings for these species of delphinids. The results of the present study will be helpful to create a new scenario about the biological knowledge of the delphinids in the western south Atlantic coast.

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REFERENCES (colocar títulos por extenso)

AMANO, M., MIYAZAKI, N. & YANAGISAWA, F., 1996. Life history of Fraser's dolphin, *Lagenodelphis hosei*, based on a school captured off the Pacific coast of Japan. *Mar. Mammal Sci.*, **12**(1), 199-214.

ALVES JR., T.T, ÁVILA, F.J.C., OLIVEIRA, J.A., FURTADO NETO, M.A.A. & MONTEIRO NETO, C., 1996. Registros de cetáceos para o litoral do Estado do Ceará, Brasil. *Arq. Ciên. Mar*, **30**(1-2), 79-92.

BARRETO, A.S., 1995. *Idade e desenvolvimento craniano de Tursiops truncatus (Delphinidae, Cetacea) do litoral sudeste do Brasil*. MSc thesis, Fundação Universidade do Rio Grande, Porto Alegre?, Brazil.

BARRETO, A.S., 2000. *Variação craniana e genética de Tursiops (Delphinidae, Cetacea) na costa Atlântica da América do Sul.* PhD thesis, Fundação Universidade do Rio Grande, Porto Alegre?, Brazil.

BARRETO, A. & LODI, L., 2000. Estimativa de idades do golfinho-rotator, *Stenella longirostris* (Cetacea, Delphinidae) no nordeste do Brasil. *Bioikos*, **14**(1), 24-27.

CHIVERS, S.J. & MYRICK JR., C., 1993. Comparison of age at sexual maturity and other reproductive parameters for two stocks of spotted dolphin, *Stenella attenuata*. *Fish. Bull.*, **91**, 611-618.

COCKCROFT, V.G. & ROSS, G.J.B., 1989. Age, growth and reproduction of bottlenose dolphins *Tursiops truncatus* from the east coast of southern Africa. *Fish. Bull.*, **88**, 289-302.

DI BENEDITTO, A.P.M., RAMOS, R.M.A. & LIMA, N.R.W., 1998. Fishing activity in northern Rio de Janeiro State (Brazil) and its relation with small cetaceans. *Braz. Arch. Biol. Tech.*, **41**(3), 296-302.

FERNANDEZ, S. & HOHN, A.A., 1998. Age, growth and calving season of bottlenose dolphins, *Tursiops truncatus*, of coastal Texas. *Fish. Bull.*, **96**, 357-365.

HERZING, D., 1990, Underwater and close up with spotted dolphins. *Whalewatcher*, pp. 16-19.

HEYNING, J.E. & PERRIN, W.F., 1994. Evidence for two species of common dolphins (Genus *Delphinus*) from the eastern north Pacific. *Contributions in Science*, **442**, 1-35.

HOHN, A.A., 1980. Age determination and age-related factor in the teeth of western north Atlantic bottlenose dolphins. *Sci. Rep. Whales Res. Inst.*, **32**, 39-66.

HOHN, A.A., 1990. Reading between the lines: analysis of age determination in dolphins. In: *The Bottlenose Dolphin* (ed. Leatherwood, S. & Reeves, R.R.), pp. 575-585. San Diego: Academic Press.

HOHN, A.A., SCOTH, M.D., WELLS, R.S., SWEENEY, J.C. & IRVINE, A.B., 1989. Growth layers in teeth from known age, free-ranging bottlenose dolphins. *Mar. Mammal*

Sci., **5**(4), 315-342.
JEFFERSON, T.A., LEATHERWOOD, S. & WEBBER, M.A., 1993. *FAO species identification guide, Marine Mammals of the world*. Rome: FAO-UNEP. 320 pp.
KASUYA, T., 1972. Growth and reproduction of *Stenella coeruleoalba* based on the age determination by means of dentinal growth layers. *Sci. Rep. Whales Res. Inst.*, **24**, 57-79.
KASUYA, T., 1976. Reconsideration of life history parameters of the spotted and striped dolphins based on cemental layers. *Sci. Rep. Whales Res. Inst.*, **28**, 73-106.
KASUYA, T., 1985. Effect of exploitation on reproductive parameters of the spotted and striped dolphins off the Pacific coast of Japan. *Sci. Rep. Whales Res. Inst.*, **36**, 107-138.
KASUYA, T. & MATSUI, S., 1984. Age determination and growth of the short-finned pilot whale off the Pacific coast of Japan. *Sci. Rep. Whales Res. Inst.*, **35**, 57-91.
KASUYA, T., MIYAZAZI, N. & DAWBIN, W.H., 1974. Growth and reproduction of *Stenella attenuata* in the Pacific coast of Japan. *Sci. Rep. Whales Res. Inst.*, **26**, 157-226.
LODI, L. & CAPISTRANO, L., 1990. Capturas acidentais de pequenos cetáceos no litoral norte do Estado do Rio de Janeiro. *Biotemas*, **3**(1), 47-65.
MIGNUCCI-GIANNONI, A.A., MONTOYA-OSPINA, R.A., PÉREZ-ZOYAS, J.J., RODRIGUEZ-LÓPEZ, M.A. & WILLIAMS JR., E.H., 1999. New record of Fraser's dolphins (*Lagenodelphis hosei*) for the Caribbean. *Aquatic Mammals*, **25**(1), 15-19.
MIYAZAKI, N., 1977. Growth and reproduction of *Stenella coeruleoalba* off the Pacific coast of Japan. *Sci. Rep. Whales Res Inst.*, **29**, 21-48.
MIYAZAKI, N., 1980. Preliminary note on age determination and growth of the rough-toothed dolphin, *Steno bredanensis*, off the Pacific Coast of Japan. *Rep. Int. Whal Commn*, special issue, **3**, 171-179.
PERRIN, W.F., 1975. Distribution and differentiation of populations of dolphins of the genus *Stenella* in the Eastern Tropical Pacific. *J. Fish Res. Board Can.*, **32**, 1059-1067.
PERRIN, W.F., HOLTS, D.B. & MILLER, R.B., 1975. Preliminary estimates of some parameters of growth and reproduction of the eastern spinner porpoise, *Stenella longirostris* subspecies southwest. *Fish. Cient. Administrative Rep*. **número**? **paginação**?
PERRIN, W.F., COL, J.M. & ZWEIFEL, J.R., 1976. Growth and reproduction of the spotted porpoise, *Stenella attenuata*, in the offshore eastern tropical Pacific. *Fish. Bull.*, **74**(2), 229-270.
PERRIN, W.F., HOLTS, D.B. & MILLER, R.B., 1977. Growth and reproduction of the eastern spinner dolphin. A geographical form of *Stenella longirostris* in the eastern tropical Pacific. *Fish. Bull.*, **75**, 725-750.
PERRIN, W.F. & MYRICK JR., A.C. (ed.), 1980. Reports of the International Whaling Commission. In: *Age determination of toothed whales and sirenians*. *Rep. Int. Whal. Commn.*, special issue, **3**, 1-50.
PIERCE, K.V. & KAJIMURA, H., 1980. Acid etching and highlighting for defining growth layers in cetacean teeth. *Rep. Int. Whal. Commn.*, special issue, **3**, 99-104.
PERRIN, W.F. & REILY, S.B., 1984. Reproductive parameters of dolphins and small whales of the family delphinidae. *Rep. Int. Whal. Commn*, special issue, **6**, 97-133.
PINEDO, M.C. & HOHN, A.A., 2000. Growth layer patterns in teeth from the franciscana, *Pontoporia blainvillei*: developing a model for precision in age estimation. *Mar. Mammal Sci.*, **16**(1), 1-27.
PINEDO, M.C. & ROSAS, F.C.W., 1989. Novas ocorrências de *Pseudorca crassidens* (Cetacea, Delphinidae) para o Atlântico Sul Ocidental, com observações sobre medidas cranianas e alimentação. *Atlântica*, **11**(1), 77-83.
PINEDO, M.C., ROSAS, F.C.W. & MARMONTEL, M., 1992. *Cetáceos e pinípedes do Brasil: uma revisão dos registros e guia para identificação das espécies.* Manaus: UNEP/FUA. 213 pp.

RAMOS, R.M.A., DI BENEDITTO, A.P.M. & LIMA, N.R.W., 2000a. Growth parameters of *Pontoporia blainvillei* and *Sotalia fluviatilis* (Cetacea) in northern Rio de Janeiro, Brazil. *Aquatic Mammals*, **26**(1), 65-75.

RAMOS, R.M.A., DI BENEDITTO, A.P.M. & LIMA, N.R.W., 2000b. Relationship between body length or age and dental morphological in *Pontoporia blainvillei* and *Sotalia fluviatilis* (Cetacea) in northern Rio de Janeiro, Brazil. *Rev. Bras. Biol.*, **60**(2), 283-290.

READ, A.J., WELLS, R.S., HOHN, A.A. & SCOTT, M.D., 1993, Patterns of growth in wild bottlenose dolphins, *Tursiops truncatus*. *J. Zool.*, **231**, 107-123.

ROSAS, F.C.W., 2000. *Interações com a pesca, mortalidade, idade, reprodução e crescimento de Sotalia guianensis e Pontoporia blainvillei (Cetacea, Delphinidae e Pontoporiidae) no litoral sul do Estado de São Paulo e litoral do Estado do Paraná, Brasil*. PhD thesis, Universidade do Paraná, Curitiba?, Brazil.

SANTOS, M.C.O., 1999. *Novas informações sobre cetáceos no litoral sul de São Paulo e norte do Paraná com base em estudos sobre encalhes e na aplicação da técnica de foto-identificação individual de Sotalia fluviatilis (Cetacea, Delphinidae).* MSc thesis, Universidade de São Paulo, São Paulo, Brazil.

SCHMIEGELOW, J.M.M., 1990. *Estudo sobre cetáceos odontocetos encontrados em praias da região entre Iguape (SP) e Baía de Paranaguá (PR)(24º42'S-25º28'S) com especial referência a Sotalia fluviatilis (Gervais, 1853) (Delphinidae).* MSc thesis, Universidade de São Paulo, São Paulo, Brazil.

SERGEANT, D.E., 1959. Age determination in odontocete whales from dentinal growth layers. *Norsk Hvalfangsttid*, **48**(6), 273-288.

SERGEANT, D.E., CALDWEEL, D.K. & CALDWEEL, M.C., 1973. Age, growth and maturity of botlenosed dolphin (*Tursiops truncatus*) from northeast Florida. *J. Fish Res. Board Can.*, **30**, 1009-1011.

SICILIANO, S., 1994. Review of small cetaceans and fishery interactions in coastal waters of Brazil. *Rep. Int. Whal. Commn*, special issue, **15**, 241-250.

SICILIANO, S., DE ANDRADE, L. & CAPISTRANO, L., 1987. Observações sobre a presença de *Tursiops truncatus* e *Steno bredanensis* na Baía de Guanabara, Rio de Janeiro - Brasil. In *II Reunião de Trabalho de Especialistas em Mamíferos Aquáticos da América do Sul*, instituição? Rio de Janeiro, Brazil, pp. 85.

SIMÕES-LOPES, P.C. & XIMENEZ, A., 1993. Annotated list of the cetaceans of Santa Catarina coastal waters, southern Brazil. *Biotemas*, **6**(1), 67-92.

VAN BREE, P.J.H., COLLET, A., DESPORTES, G., HUSSENOT, E. & RAGA, J.A., 1986. Le dauphin de Fraser, *Lagonodelphis hosei* (Cetacea, Odontoceti), espéce nouvelle pour la faune d'Europe. *Mammalia*, **50**(1), 57-86.

XIMENEZ, A., SIMÕES-LOPES, P.C. & PRADERI, R., 1987. Notas sobre mamíferos marinhos de Santa Catarina e Rio Grande do Sul (Pinnipedia-Cetacea). In *II Reunião de Trabalho de Especialistas em Mamíferos Aquáticos da América do Sul*, Instituição? Rio de Janeiro, Brazil, pp. 100-103.

ZANELATTO, R.C., DANS, S. & CRESPO, E.A., 1996. Análise da estrutura de idade de uma população de *Sotalia fluviatilis* Gray, 1866 (Cetacea, Delphinidae) capturadas acidentalmente durante a atividade pesqueira no litoral do Estado do Paraná, Brasil. In *VII Reunion de Trabajo de Especialistas en Mamiferos Acuaticos de America de Sur*, Vinã del Mar, Chile, pp. 64.

ZULLINGER, E.M., RICKLEFS, R.E., REDFORD, K.H. & MACE, G.M., 1984. Fitting sigmoidal equations to mammalian growth curves. *J. Mamm.*, **65**(4), 607-636.

CAPTIONS

Figure 1. Southeastern Brazil, indicating the coast of Espírito Santo, Rio de Janeiro, São Paulo and Paraná states.

Figure 2. Midlongitudinal stained thin sections (40μm) from the tooth of (A) *Stenella frontalis* (PA 047) with seven dentinal layers and (B) a 190.0 cm male *Delphinus capensis* with nine dentinal layers (UERJ/MQ 42) from southeastern Brazil. The symbols arrow (→), black line (__) indicate, respectively, the presence of neonatal line and dentinal layer.

Figure 3. Acid-etched half tooth of a 250.0 cm female *Steno bredanensis* (MN 53648) with six dentinal layer from southeastern Brazil. The symbols arrow (→), black line (__) indicate, respectively, the presence of neonatal line and dentinal layer.

Figure 4. Scatterplots of length-at-age for delphinids (26 *Stenella frontalis*, 22 *Tursiops truncatus*, 16 *Delphinus capensis*, 14 *Steno bredanensis* and 13 *Lagenodelphis hosei*) in the southeastern Brazil. The solid line represents the predicted growth trajectory from the Gompertz model (BL: body length; GLGs: Growth Layer Groups).

Table 1. Specimens of *Stenella frontalis* (*n*=44) collected from Espírito Santo to São Paulo states, southeastern Brazil.

No.	State / Latitude	Year	Sex	Age (GLGs)	BL (cm)	Observations	Collection
	Espírito Santo State						
01	21º00'S	1997	female	9	189.0	sp	[1]
	Rio de Janeiro State						
02	21º18'S	1996	female	-	146.0	nc	
03		1999	female	2	145.0		[1]
04	21º35'S	1997	male	5	163.0		[1]
05			male	4	156.5		[1]
06			female	3	159.0		[1]
07		1999	male	5	170.0		[1]
08	22º05'S	1988	male	1	138.1		[2]
09	22º07'S	1992	female	3	170.0		[1]
10	23º00'S	1993	male	12	*ca* 201.0		[3]
11		1996	-	7	*ca* 165.0		[3]
12			female	11	188.0		[3]
13		1997	-	10	*ca* 197.0		[3]
14		1998	male	0	123.0		[3]
15			male	12	197.0		[3]
16			male	-	195.0		[3]
17			male	12	203.0		[3]
18			male	10	216.0		[3]
19			male	9	195.0		[3]
20		1999	female	-	*ca* 178.0		[3]
21			female	-	198.0	Sp, fve	[1]
22	23º05'S	1988	male	12	208.0		[2]
23		1994	-	-	-		[1]
24		1996	male	5	*ca* 173.0		[3]
25		1999	male	9	*ca* 175.0		[3]
26	23º10'S	1994	-	-	199.0	fve	[1]
27			female	11	214.0		[3]
28		1995	-	2	151.0		[3]
29		1996	-	10	*ca* 197.0		[3]
30			male	3	171.5		[3]
31		1998	-	-	*ca* 160.0		[3]
	São Paulo State						
32	24º00'S	1997	male	11	223.0		[4]
33		1998	male	-	155.0		[4]
34			male	-	170.0		[4]
35		1999	female	-	200.0		[4]
36	24º50'S	1987	male	23	218.0		[2]
37			-	-	-		[2]
38		1996	-	16	-		[5]
39			-	1	-		[5]
40			-	7	-		[5]
41			-	6	-		[5]
42			-	12	-		[5]

43		1998	male	6	187.0	[5]
44	25º30’S	1986	-	15	-	[2]

GLGs, Growth Layer Groups; BL, Body Length, [1] Museu Nacional/Universidade Federal do Rio de Janeiro; [2] Museu de Zoologia da Universidade de São Paulo; [3] Universidade Estadual do Rio de Janeiro/MAQUA; [4] Centro de Estudos sobre Encalhes de Mamíferos Marinhos; [5] Projeto Atlantis da Universidade de São Paulo; nc, not collected; sp, spotting pattern; fve, fused vertebral epiphyses.

Table 2. Growth parameters values from the Gompertz growth model fitted to length-at-age data of *Stenella frontalis, Tursiops truncatus, Delphinus capensis, Steno bredanensis* and *Lagenodelphis hosei* in the southeastern Brazil.

Species	*n*	Age range (GLGs)	Body length range (cm)	Asymptotic length (cm)	Correction factor	Growth rate constant	Correlation coefficient (*r*)
S. frontalis	27	0-23	123.0-223.0	224.4	-0.5876	0.1473	0.92
T. truncatus	22	0.5-26	166.0-319.0	301.3	-0.6243	0.1601	0.90
D. capensis	17	1-18	154.0-237.0	215.9	-0.4116	0.6151	0.82
S. bredanensis	13	0.5-23	171.5-283.0	258.1	-0.6424	0.5443	0.90
L. hosei	13	1-19	144.0-247.0	231.2	-0.2459	0.9463	0.94

GLGs, Growth Layer Groups.

Table 3. Specimens of *Tursiops truncatus* (*n*=36) found at Espírito Santo (ES), Rio de Janeiro (RJ) and São Paulo (SP) states, southeastern Brazil, including northern Paraná State (PR).

No.	State / Latitude	Year	Sex	Age (GLGs)	BL (cm)	Observations	Collection
	Espírito Santo State						
45	20º20'S	1998	male	18	280.0		6
	Rio de Janeiro State						
46	21º35'S	1992	male	4	237.0		1
47			male	1	184.0		1
48			male	-	54.0	f	1
49	22º00'S	1996	female	0.5	166.0		1
50	22º05'S	1991	female	0.5	162.0		1
51	22º25'S	1992	male	1	200.0		1
52	23º00'S	1995	male	15	287.0		3
53		1997	-	-	*ca* 259.0		3
54		?	female	12	-		2
55	23º05'S	1985	-	-	280.0		2
56		1998	-	-	-		3
57	23º07'S	1994	-	-	300.0	fve	1
58		1995	-	7	266.5		3
59		1996	-	16	295.0		1
	São Paulo State						
60	24º00'S	1997	female	-	315.0		4
61			female	9	264.0		4
62			-	7	210.0		4
63		1998	-	13	290.0		4
64	24º50'S	1996	-	19	312.0		5
65			-	5	-		5
66			female	7	252.0		5
67			-	6	-		5
68		1997	male	0.5	-		5
69			female	17	300.0		5
70			-	4	-		5
71		1998	-	9	-		5
72	25º00'S	1986	-	-	-		2
73	25º30'S	1987	-	2	-		2
74		1996	-	0.5	193.0		5
	Northern Paraná State						
75	25º45'S	1996	-	26	276.0		5
76			female	1	232.0		5
77		1997	male	5	205.0		5
78			male	9	262.0		5
79			male	7	280.0		5
80			-	13	294.0		5

GLGs, Growth Layer Groups; BL, Body Length; [1] Museu Nacional/Universidade Federal do Rio de Janeiro; [2] Museu de Zoologia da Universidade de São Paulo; [3] Universidade Estadual do Rio de Janeiro/MAQUA; [4] Centro de Estudos sobre Encalhes de Mamíferos Marinhos; [5] Projeto Atlantis da Universidade de São Paulo; [6] Organização Consciência Ambiental; f, foetus; fve, fused vertebral epiphyses.

Table 4. Specimens of *Delphinus capensis* (*n*=26) found at Rio de Janeiro (RJ) and São Paulo (SP) states, southeastern Brazil, including northern Paraná State (PR).

No.	State / Latitude	Year	Sex	Age (GLGs)	BL (cm)	Observations	Collection
	Rio de Janeiro State						
81	22º05'S	1996	female	1	154.0		[1]
82	22º20'S	1987	male	3	187.0		[2]
83	23º00'S	1994	male	9	*ca* 190.0		[3]
84		1998	male	7	215.0		[3]
85	23º05'S	1985	-	2	175.0		[2]
86		1993	female	-	218.0		[3]
87	23º07'S	1962	-	-	-		[2]
88		1995	-	-	-		[1]
	São Paulo State						
89	24º00'S	1999	-	18	220.0		[4]
90	24º50'S	1987	-	-	-		[2]
91			-	9	211.0		[2]
92			-	-	-		[2]
93		1997	-	6	216.0		[5]
94			-	10	214.0		[5]
95		1998	-	11	213.0		[5]
96			-	5	228.0		[5]
97	25º00'S	1964	-	2	-		[2]
98	25º30'S	1986	male	8	210.0		[2]
99		1987	-	0.5	-		[2]
100			-	-	219.0		[2]
101		1996	-	10	230.0		[5]
102			male	13	210.0		[5]
103	?	?	-	12	237.0		[7]
	Northern Paraná State						
104	25º45'S	1987	-	14	195.0		[2]
105			-	12	-		[2]
106			-	14	228.0		[2]

GLGs, Growth Layer Groups; BL, Body Length; [1] Museu Nacional/Universidade Federal do Rio de Janeiro; [2] Museu de Zoologia da Universidade de São Paulo; [3] Universidade Estadual do Rio de Janeiro/MAQUA; [4] Centro de Estudos sobre Encalhes de Mamíferos Marinhos; [5] Projeto Atlantis da Universidade de São Paulo; [7] Instituto de Oceanografia da Universidade de São Paulo.

Table 5. Specimens of *Steno bredanensis* (*n*=20) found at Espírito Santo (ES), Rio de Janeiro (RJ) and São Paulo (SP) States, southeastern Brazil.

No.	State / Latitude	Year	Sex	Age (GLGs)	BL (cm)	Observations	Collection
	Espírito Santo State						
107	20º20'S	1997	-	2	212.0		[6]
108		1999	-	1	-		[6]
109	20º40'S	1999	female	13	270.0		[6]
	Rio de Janeiro State						
110	21º35'S	1987	-	3	-		[2]
111		1988	female	0.5	179.0		[2]
112		1993	male	19	240.0	fve	[1]
113	22º05'S	1992	male	0.5	171.5		[1]
114			female	6	250.0	p (#115)	[1]
115			male	-	38.0	f	[1]
116	22º25'S	1987	male	2	195.0		[2]
117	23º00'S	1995	male	23	283.0		[3]
118		1999	-	-	*ca* 194.0		[3]
119	23º05'S	1986	male	24	246.0		[2]
120		1997	female	3	260.0		[1]
121	23º07'S	1994	male	21	263.0		[1]
122			male	10	*ca* 244.0		[1]
123		1997	-	23	-		[3]
	São Paulo State						
124	24º00'S	1997	male	15	249.0		[4]
125	24º50'S	1987	-	21	254.0		[2]
126	25º00'S	?	-	11	-		[5]

GLGs, Growth Layer Groups; BL, Body Length; [1] Museu Nacional/Universidade Federal do Rio de Janeiro; [2] Museu de Zoologia da Universidade de São Paulo; [3] Universidade Estadual do Rio de Janeiro/MAQUA; [4] Centro de Estudos sobre Encalhes de Mamíferos Marinhos; [5] Projeto Atlantis da Universidade de São Paulo; [6] Organização Consciência Ambiental; p, pregnant; f, foetus; fve, fused vertebral epiphyses.

Table 6. Specimens of *Lagenodelphis hosei* (*n*=16) found at Rio de Janeiro (RJ) and São Paulo (SP) states, southeastern Brazil.

No.	State / Latitude	Year	Sex	Age (GLGs)	BL (cm)	Observations	Collection
	Rio de Janeiro State						
127	23º00'S	1997	female	10	245.0		[3]
128		1998	-	-	*ca* 180.0		[1]
129		1999	male	-	220.0		[1]
130	23º05'S	1997	male	14	244.0		[3]
131			female	14	*ca* 220.0		[3]
132			male	19	247.0		[3]
133			female	1	151.0		[3]
134			female	14	230.0		[3]
135			male	1	144.0		[3]
136			male	2	182.0		[3]
137			female	9	*ca* 220.0		[3]
138			female	3	203.0		[3]
139			female	12	238.0		[3]
140			male	4	-		[3]
141			female	10	210.0		[3]
	São Paulo State						
142	24º00'S	1999	-	8	220.0		[4]

GLGs, Growth Layer Groups; BL, Body Length; [1] Museu Nacional/Universidade Federal do Rio de Janeiro; [3] Universidade Estadual do Rio de Janeiro/MAQUA; [4] Centro de Estudos sobre Encalhes de Mamíferos Marinhos.

Figura 1

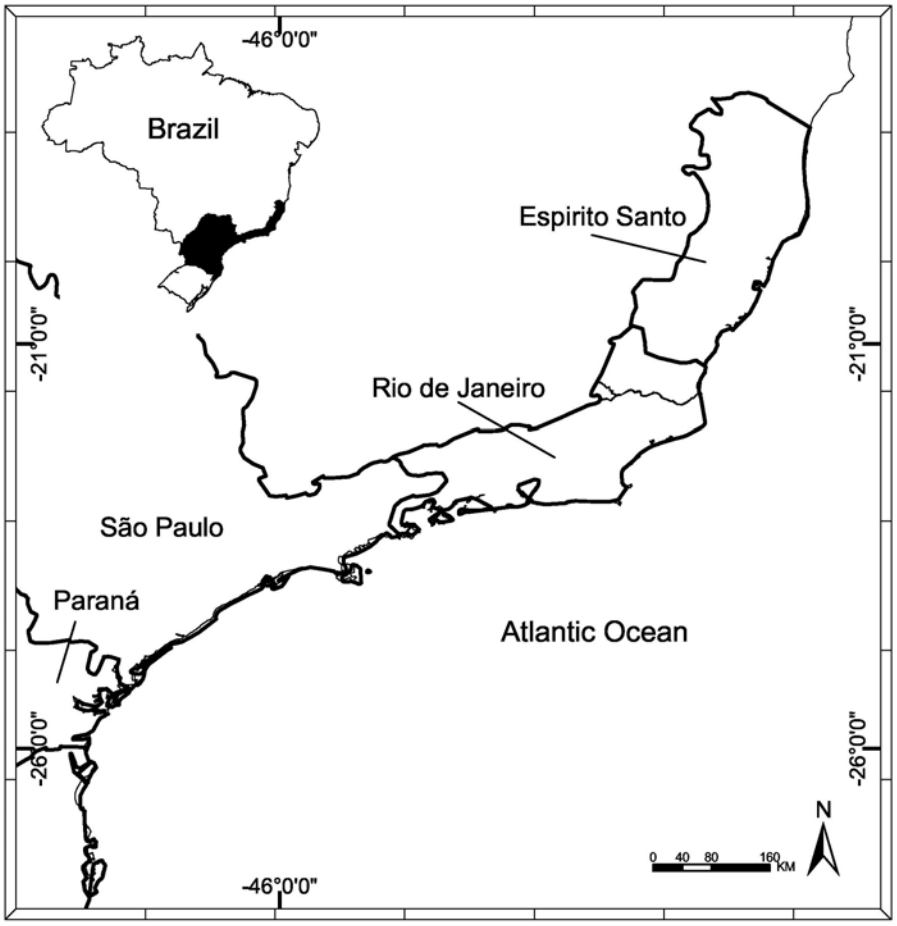

-46°0'0"
Brazil
Espirito Santo
-21°0'0"
Rio de Janeiro
São Paulo
Paraná
Atlantic Ocean
-26°0'0"
N
0 40 80 160
KM
-46°0'0"

Figura 2A

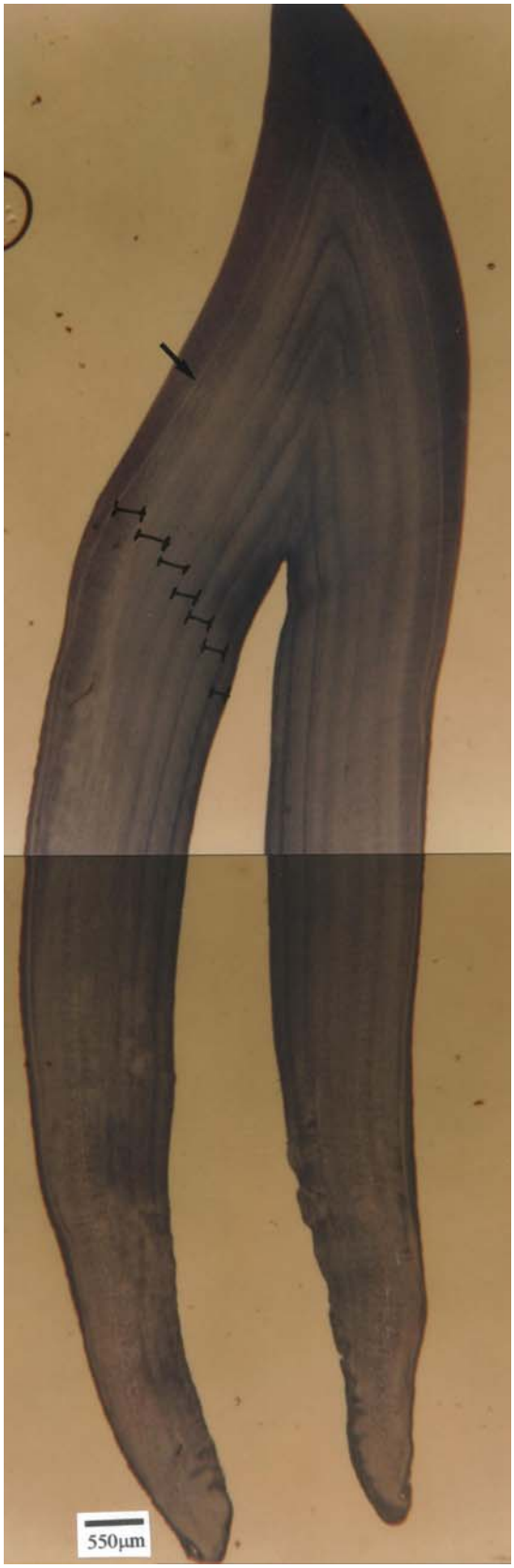


Figure 2B

Figura 3

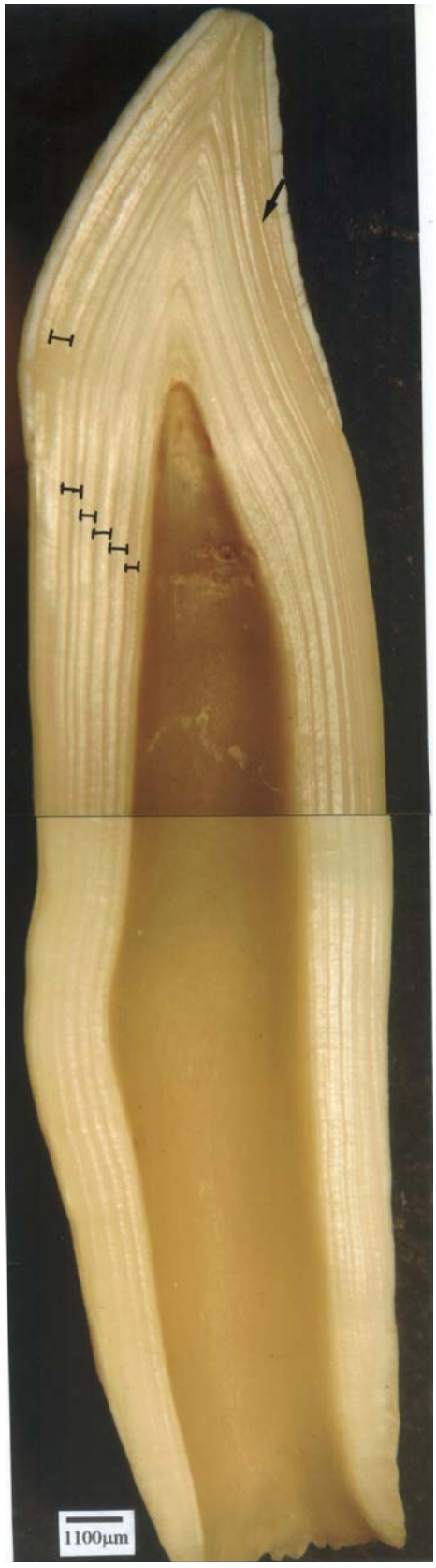
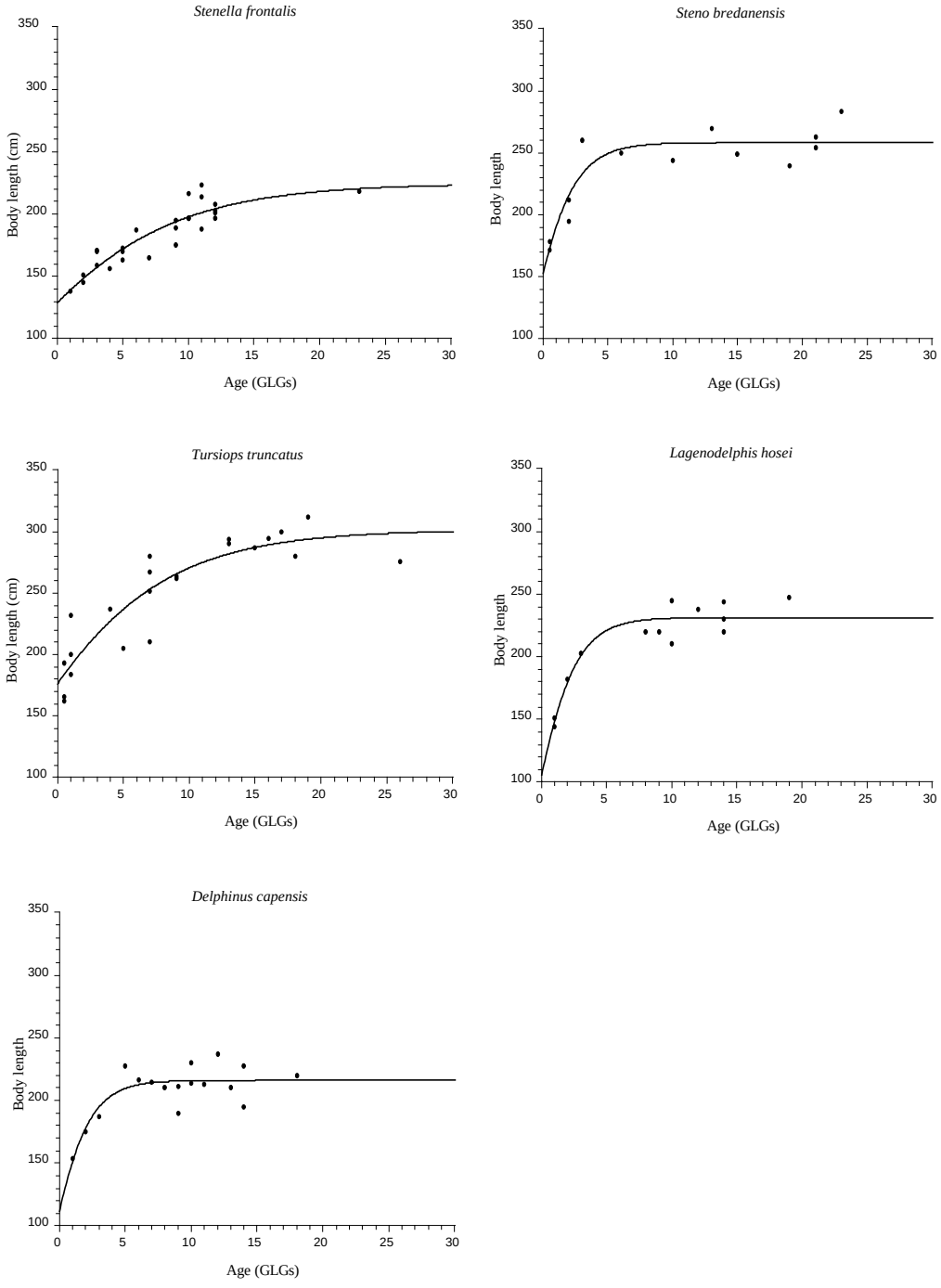


Figura 4


Stenella frontalis
Body length (cm)
Age (GLGs)
Steno bredanensis
Body length
Age (GLGs)
Tursiops truncatus
Body length (cm)
Age (GLGs)
Lagenodelphis hosei
Body length
Age (GLGs)
Delphinus capensis
Body length
Age (GLGs)