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Occurrence of pinnipeds in Santa Catarina between 2000 and 2010

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Along the Brazilian coast there are records of four otariid and three phocid species: *Otaria flavescens* (Shaw, 1800), *Arctocephalus australis* (Zimmerman, 1783), *A. tropicalis* (Gray, 1872), *A. gazella* (Peters, 1875), *Mirounga leonina* (Linnaeus, 1758), *Lobodon carcinophaga* (Hombron & Jacquinot, 1842) and *Hidrurga leptonyx* (Blainville, 1820) (Pinedo, 1990; Pinedo *et al.,* 1992; Simões-Lopes *et al.,* 1995; Silva, 2004). The first three species are regularly observed along the Brazilian coast (Moura *et al.,* 2011) and it is believed that most of these animals are from the large breeding colonies in Uruguay and Argentina (Silva, 2004). The most northern breeding colonies of *A. australis* in the Western Atlantic Ocean are the ones along the coast of Uruguay in *La Coronilla* (33°56'S, 53°29'W), *Cabo Polônio* (34°24'S, 53°46'W) and *Isla de Lobos* (35°01'S, 54°53'W) (Vaz-Ferreira and Ponce de León, 1984; Túnez *et al.,* 2006; Túnez *et al.,* 2008). The same locations are cited as breeding colonies for *O. flavescens* (Vaz-Ferreira, 1981; Túnez *et al.,* 2006), while *A. tropicalis* breeds on islands north of the Antarctic Convergence (Ferreira *et al.,* 2008).

After Rio Grande do Sul, Santa Catarina is the Brazilian state with highest pinniped occurrence (Silva, 2004) and solitary individuals of all ages of *A. australis* occur regularly during the winter and spring (Simões-Lopes *et al.,* 1995). Therefore, understanding the pattern of occurrence in this area is important for establishing baseline knowledge, which will allow researchers to evaluate future changes in the distribution and range of the species. Since there is a lack of recent studies related to pinniped distribution in Santa Catarina, the present study aims at identifying the patterns of occurrence of those animals in the state.

Data for this study were collected initially from a review of the scientific literature on the occurrence of pinnipeds in the state of Santa Catarina that had been published since the last review of the group for the state (Simões-Lopes *et al.,* 1995). Considering this time frame (2000 to 2010), only three reports could be used for this study: Filippini (2009), Sartori (2009) and (Serafini *et al.* 2010)[1]. As the presence of these animals on beaches is a topic of interest to the general population, newspapers and news websites were also reviewed for the same period. When more than one item of news referred to the same animal, the article with the most complete data was used.

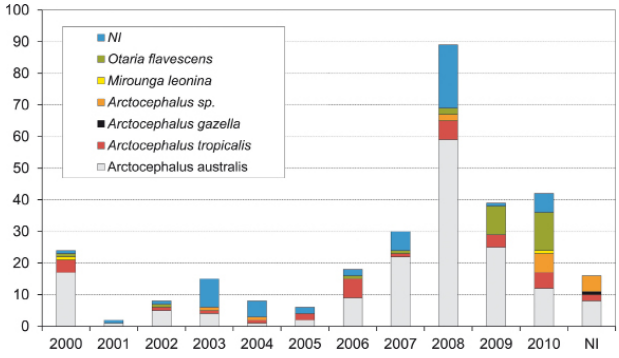

Figure 1. Number of pinniped records in Santa Catarina State between the years 2000 and 2010. 'NI' means that there was no information on the species or year.

[1] Serafini, P. P., Kolesnikovas, C. K. M., Moreira, L. M. P., Correa, A. A., Groch, K., Severo, S., and Rocha, M. E. C. (2010) Stranding Data at Right Whale Environmental Protection Area 2008/2009. *In* Asbtracts, XIV Reunião de Trabalho de Especialistas em Mamíferos Aquáticos da América do Sul, 24-28 October 2010, Florianópolis, Brazil.

In most cases, when an injured or dead pinniped appears on a beach, the environmental police or a research institution that is part of the local stranding network (*Rede de Encalhes de Mamíferos do Sul do Brasil* - REMASUL) is contacted. All institutions that are part of REMASUL in Santa Catarina were contacted and some institutions that may attend to a stranding (military and environmental police, firemen, zoological parks and NGOs) were also contacted. When data from different institutions referred to the same animal, the most complete or updated record was used.

The coast of Santa Catarina was divided into three different areas that extend from the municipalities of Itapoá to Navegantes (25°58'S to 26°54'S – North Area), from Itajaí to Imbituba (26°54'S to 28°22'S – Central Area) and from Laguna to Passos de Torres (28°22'S to 29°19'S – South Area) (Figure 1). The geographic positions of the occurrence sites were defined using Google Earth™ (version 2010) based on the information provided by each source. This information was usually the name of the beach where the animal was observed, or a distance from a geographic landmark. In the

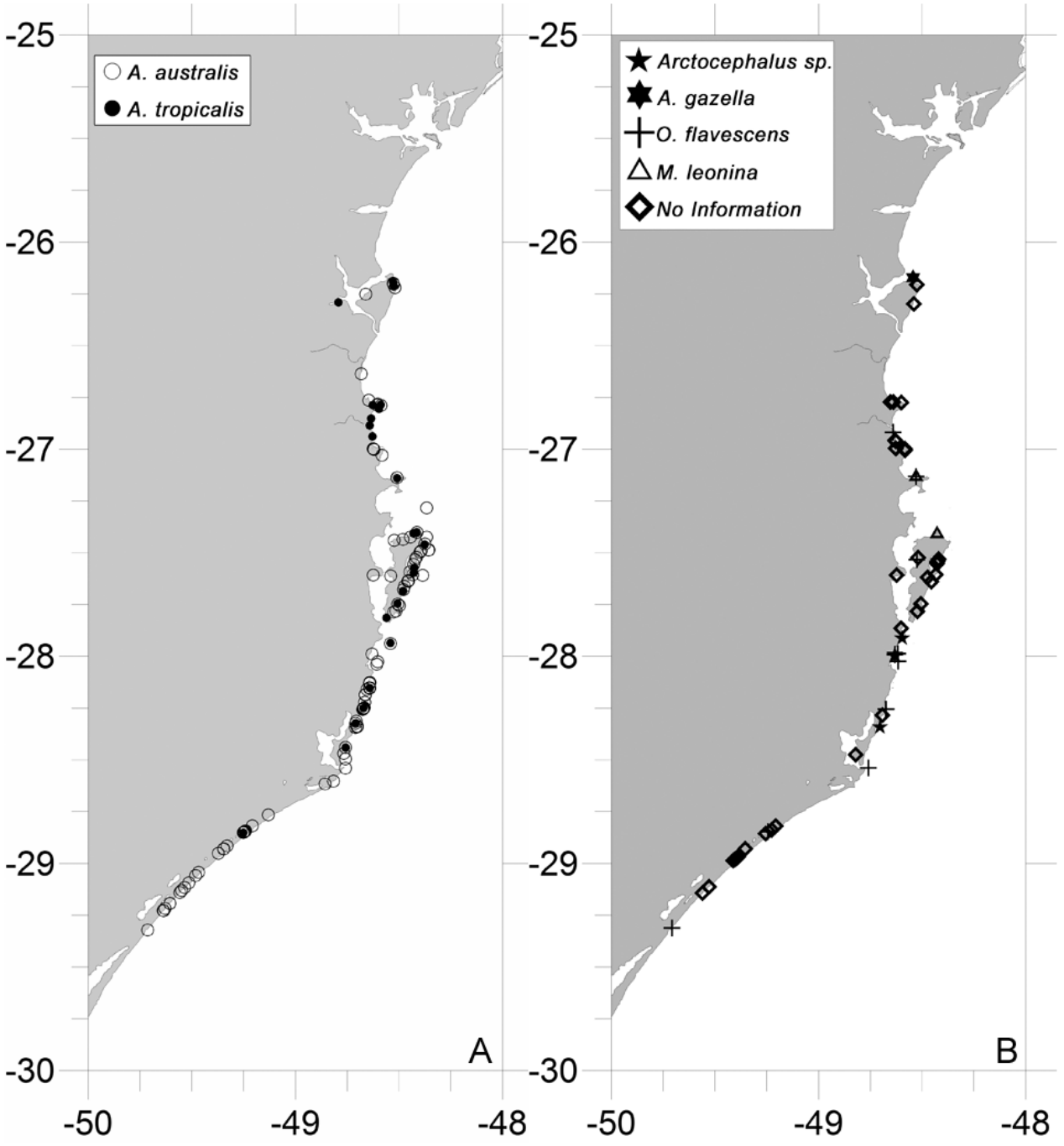

Figure 2. Distribution map of pinnipeds recorded for Santa Catarina State between 2000 and 2010: *Arctocephalus australis* and *A. tropicalis* (B) The remaining species.

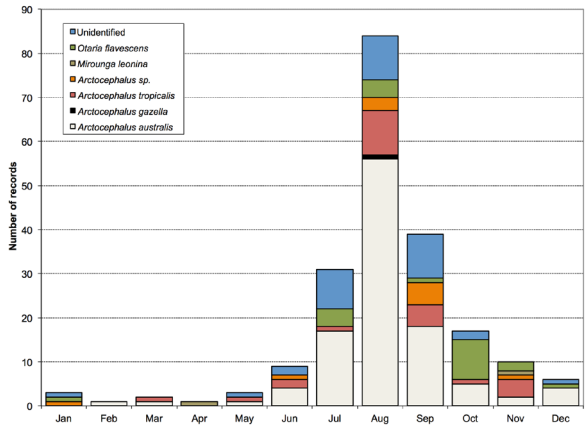

Figure 3. Monthly records of pinniped species in Santa Catarina State between the years 2000 and 2010.

general news there were 32 articles discussing the occurrence of pinnipeds in the state for the analyzed period. These came from four newspaper websites: *Diário Catarinense, Jornal de Santa Catarina, Click RBS* and *Zero Hora.*

Together, scientific papers, news and unpublished data from research institutions accounted for 266 records. All the records coming from the news referred to live animals. Such results were expected due to the fact that the occurrence of a live animal is more interesting to the media. Data from rehabilitation centers (*CETAS Florianópolis - Environmental Militar Police of Santa Catarina State/IBAMA/Associação R3 Animal* and *UNIVALI/LAM*) had only records of live animals, while data from scientific collections contained mainly dead animals (*UFSC/LAMAQ, UNIVALI/MOVI*). From the 266 records, 65% were for live animals, 26% dead animals and in 9% the animal's condition could not be ascertained.

Of the seven pinniped species mentioned for the Santa Catarina coast, five were reported in the present study: *A. australis, A. tropicalis, A. gazella, O. flavescens* and *M. leonina.* In the 266 records, 15 had only the genus without identifying the species. From the 44 news records, 36 did not provide details of the species or suitable photographs or other information that would have allowed an accurate identification of the species. Thus these incidents were considered as 'Not Identified' in this study (Figure 2). The distribution of *A. australis* was concentrated in the central and south areas. However the distribution of *A. tropicalis* (n=33) was concentrated in the central and northern regions of the state. The only record of *A. gazella* occurred in São Francisco do Sul, in the northern region. Both records of *M. leonina* occurred in the central region of the state. *Otaria flavescens* had its records distributed along the central and southern regions of the state (Figure 2).

Approximately 74% of the pinniped records in the coast of Santa Catarina occurred in winter months (July, August and September). The presence of *A. australis* and *A. tropicalis* was observed across all months with the exception of January. Both species had higher occurrence in winter and spring, with August being the month of highest abundance for these species. As expected, the records of *Arctocephalus* sp. followed the same seasonality pattern of *A. australis* and *A. tropicalis*. The only record of *A. gazella* also occurred in August. There were two isolated records of *M. leonina* that occurred in June and November. For the whole studied period, there were 25 records of *O. flavescens* that occurred mostly in October (Figure 3).

Juveniles were concentrated between June and November, while adults were more often sighted in August and September. In most records the age class of the animal was not identified. However for *A. australis* and *A. tropicalis* the number of animals with an identified category allowed an analysis of the adult/juvenile ratio. There were 52 juveniles and five adults of *A. australis*, with a ratio higher than 10:1, whereas *A. tropicalis* had nine adult animals and eight juveniles, showing a ratio closer to 1:1.

Comparing the data from the different sources, newspapers and research institutions, it appears that the former can be used, but with caution. There were a higher number of news items reporting on the occurrence of pinnipeds in winter and spring, which matches the information found in the scientific literature as well as data provided from research institutions. However, the general media regularly failed to differentiate between species, with common names for sea lions, fur seals and seals being used erroneously.

Even for data coming from research institutions, some animals were identified only to the genus level, usually as *Arctocephalus* sp. or as unidentified. Identifying species of *Arctocephalus* is not always easy in juveniles, especially if they are seen from a distance. These unidentified animals comprised 19% (51 out of 266) of the records, but should not interfere with the identification of general temporal patterns of pinniped occurrence in the area.

For the records coming from the research institutions, there was no information regarding the sampling effort and it is believed that possible double counts may have occurred in 2008 because several institutions worked in direct partnership in the same area. Taking into account the whole dataset, 24% of the records came from *Área de Proteção Ambiental (APA) da Baleia Franca/ICMBio* that is a Brazilian government protected area and has been actively participating in research and conservation of the region. Even though this institution had only data from the years 2008 to 2010, it was the major source of data for this work and this highlights the importance that protected areas may have in the development of studies in ecology and conservation.

In previous studies (Simões-Lopes *et al.,* 1995; Cherem *et al.,* 2004) Florianópolis was the city with the most records of *A. australis.* In the present study this city had the highest number of records of this species and also of *A. tropicalis.* Imbituba, further south, was the city with the highest reports

of *A. australis.* Filippini (2009) observed the presence of *A. australis* in seven coastal islands in the state: Arvoredo, Matafome, Ilha do Xavier, Ilha dos Corais, Ilha das Araras and Ilha do Batuta in the central region, and Ilhota in southern region. The Ilha do Batuta may be an important area for the species due to the fact that in only two visits to the island 11 *A. australis* and one dead *A. tropicalis* were found. This author also mentions the presence of *O. flavescens* on Ilhas das Araras and Ilhota.

In the present study, 155 individuals of *A. australis* and 33 of *A. tropicalis* were recorded. A recent article about the occurrence of pinnipeds in the coast of Rio de Janeiro observed six specimens of *A. australis* and 27 of *A. tropicalis* (Moura *et al.,* 2011). On the other hand, studies in Rio Grande do Sul showed a higher occurrence of *A. australis* compared to *A. tropicalis* (Silva, 2004; Oliveira *et al.* 2008). This shows the change in the proportion of occurrence of both species in latitudinal terms along the Brazilian coast and Santa Catarina seems to be the area where this change takes place. While the former species occurs more frequently in the central and southern regions, the latter occurs in the central and northern regions. These results corroborate the idea that the state of Santa Catarina is part of both the Southeastern Brazil and Rio Grande marine ecoregions, with boundaries in Santa Marta's Cape, located in the Laguna municipality (Spalding *et al.,* 2007). This pattern of species distribution between the two ecoregions extends to other marine mammals such as *Tursiops truncatus* (Barreto, 2000), *Pontoporia blainvillei* (Pinedo, 1991) and *Sotalia guianensis* (Pinedo *et al.,* 1992).

It is believed that most *A. tropicalis* that reach southern Brazil are from Gough and Tristão da Cunha islands. But a study using mitochondrial DNA analysis suggested those *A. tropicalis* may be from other islands of the Antarctic convergence, since one individual was from Crozet Island, having covered more than 16,500 km to reach the Brazilian coast (Ferreira *et al.,* 2008). The single record of *A. gazella* agrees with the literature, since this species has only sporadic occurrence in Brazil (Pinedo *et al.,* 1992; Silva, 2004). There were only two records of phocids, both of elephant seals *Mirounga leonina.* The small number of phocids for the state of Santa Catarina was expected, as the occurrence of phocids in the Brazilian coast is considered occasional and associated with the erratic movement of these animals (Cherem *et al.,* 2004; Silva, 2004; Moura *et al.,* 2011).

The dispersal pattern of some pinnipeds is frequently attributed to foraging, however little is known about where most species forage at sea and how far from the breeding colonies the species can disperse (Moura *et al.,* 2011). In some species juveniles are not present in the colonies during the breeding season, and during the post-reproductive period some adults can travel great distances (Riedman, 1990). Therefore the occurrence of pinnipeds in Santa Catarina is probably related to the reproductive cycle of these animals. Considering that the birth rates of otariids peak between October and February in the Southern Hemisphere (Capozzo, 2002; Arnould, 2002), juveniles recorded in winter and spring in Santa Catarina would correspond to those that left the colonies after the end of parental care.

Even considering that Santa Catarina does not have breeding colonies or regular resting areas of pinnipeds, the present study shows that the state may be the place where the proportion of occurrence of *A. australis* and *A. tropicalis* changes its pattern along the Brazilian coast. The number of records found also suggests that the state is an important foraging area for this group. This note came from a graduation thesis and more extensive details can be found there.

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