SOUTHERN RIGHT WHALE, *EUBALAENA AUSTRALIS*, IN SOUTHEASTERN BRAZIL: ARE WE LOSING AN ILLUSTRIOUS VISITOR?

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Right whales in Southeastern Brazil.

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Abstract

The southern right whale, *Eubalaena australis*, is inserted in the category "least concern" in the IUCN Red List of Threatened Species. Although it is not a threatened cetacean species, apparently its notification in the Brazilian southeast coast is reducing, possibly due to human development. In order to detect this possible reduction, data from strandings and sightings in São Paulo State (SPS) and Rio de Janeiro State (RJS) coasts were gathered through literature review, visits to journal files, museums, aquariums and other institutions that had proofs of right whales' occurrence from 2000 to 2011. Emphasis was given to records that allowed safe identification of date, location and species identification. Photos and videos found in the World Wide Web were also used when they attended to the quoted specifications. A comparison to data gathered in the same way in the same area from 1981 to 1999 was conducted. A total of 36 records was observed (n=59 individuals): 23 sightings and 4 strandings in the RJS coast, 7 sightings and 2 strandings in the SPS coast. Records occurred between May and October. Mother and calf pairs represented 76% of all sightings, evidencing the use of the southeast coast of Brazil as breeding and possibly calving areas. In the last 12 years, 0.58 sightings/year were observed for the SPS and 1.92 sightings/year for the RJS. Annual sightings of *E. australis* were significantly reduced when compared to the period between 1981 and 1999, when the observed ratios were 0.74 in the SPS coast and 2.63 in the RJS coast. Considering the species habits, using coastal bays as mating, calving and resting areas, the reduction in the number of sightings could be related to the urbanization of the SPS and the RJS coasts, added to the increase in boat traffic in the last 10 years. Although the population is recovering after decades without whaling activities, and the number of researchers collecting data on cetaceans increased, a sensible reduction in the ratio of southern right whales records in the southeast coast of Brazil was detected and should be considered as a cause of concern regarding conservation issues.

Introduction

The southern right whale, *Eubalaena australis* (Desmoulins, 1822), is a mammalian species from the Cetartiodactyla order (Gatesy, 2009). It is the only species of the Balaenidae family found in the southern hemisphere (SH). *E. australis* can be recognized by the absence of the dorsal fin, relatively large head compared to the body size, black colored body with ventral white patches, narrow rostrum when seen from above, bowed mouthline, large and paddle-shaped pectoral flippers and callosities on the head (Jefferson *et al*., 1993; Kenney, 2009). Adults can reach up to 16 m in length, whilst calves are born with 4.5 m long and have a lighter color (Kenney, 2009). The species has a circumpolar distribution in the SH, from 20ºS to 55ºS, with eventual records down to 63ºS (IWC, 2001; Jefferson *et al.*, 1993). In the summer, *E. australis* migrates to feeding grounds in higher latitudes and in the winter it moves to lower latitudes for breeding and calving areas, occupying coastal areas (IWC, 2001).

The southern right whale stock was significantly reduced in the SH by commercial whaling in the 1900s (Townsend, 1935; Reeves *et al*., 2007). In South America it was captured from the Rio de Janeiro State coast (RJS), Brazil, to Uruguay and Argentina since the 17th century. In south and southeastern Brazil, several small-scale operations, which included right whales as targets, were conducted from the 1600s to the 1800s, (Ellis, 1969). Due to detections on the reduction of the SH stock, protests to protect the species and exhaust hunting began in the 1930s (Kenney, 2009). Thus, since the 1930s the right whales were declared protected by the International Whaling Commission (IWC) in the SH. However, in the 1960s soviets illegally hunted more than 3,300 individuals illegally in the SH (Reeves *et al.*, 2007). In the IUCN Red List of Threatened Species, the status of the southern right whale changed from "vulnerable" to "least concern" due to the increase in the SH population detected in the last decades (Reilly *et al*., 2008). On the other hand, *E. australis* is classified as "endangered" in the Brazilian List of Threatened Species (Ott *et al.*, 2008). Nevertheless, according to the IUCN, the population is still very small compared to its original size, and several stocks have fewer individuals, meaning that they require special care (Reilly *et al.*, 2008). The IWC evaluated an estimated population of 7,500 individuals in 1997, with a 7% increase in some areas (IWC, 2001). Another effort to estimate the population of right whales in the SH showed an estimated population of 1,300 mature females in 1997, doubling this value in 2007 (Taylor *et al.*, 2007). As of October 2012, no precise estimates on the abundance of southern right whales were presented for the Brazilian breeding grounds.

The occurrence of the southern right whale in the Brazilian coast is related to the species' migratory habits to tropical waters in winter and spring for breeding and calving areas, with peaks in August and September (Lodi *et al.*, 1996). The main area of occupation in Brazil is found in the Santa Catarina State coast at 28ºS (Groch, 2001). Sightings of *E. australis* are common in bays of the Brazilian south and southeast coasts, where they can spend a few days or even weeks in 1 to 6 individual groups, usually composed by mother-calf pairs (Ellis, 1969; Lodi *et al.*, 1996; Groch, 2001; Santos *et al.*, 2001).

Recent reviews indicated the use of the southeastern coast of Brazil by mother and calf pairs, with a historical higher number of records in the RJS coast compared to the São Paulo State (SPS) coast (see Lodi *et al.*, 1996; Santos *et al.*, 2001). The higher number of records in the RJS coast is probably related to the morphology of the

coast, which is composed by a higher number of bays. Many bays, which were once used as calving and breeding areas of *E. australis*, are now highly urbanized, which may increase conflicts between conservation issues and economic interests. Therefore, to vouch for the species recovery and to better evaluate its real status, continuous studies are necessary to manage long-term effects on the Brazilian stock (Groch, 2001; Groch *et al.*, 2005; IWC, 2001). Recent discoveries of large oil and gas reserves in southeastern Brazil, along with the expansion of the main SPS and RJS ports, induced an increase in boat traffic, posing cetaceans at risk (Santos *et al.*, 2010). Deaths of southern right whales due to vessel collision are a new cause of concern. According to Van Waerebeek (2007), 48 out of the 79 cases of death by vessel collision in the SH occurred with southern right whales, representing 61% of all reports.

Based on the described scenario, the aim of this study was to update southern right whale records from 2000 to 2011 in southeastern Brazil in order to evaluate sighting/stranding ratios between this recent period and data gathered from 1981 to 1999.

Material and Methods

Data on strandings and sightings of southern right whales in the SPS and RJS coasts from 2000 to 2011 were gathered through literature review, visits to newspaper files ("Folha de São Paulo", "O Estado de São Paulo" and "A Tribuna" in SPS; "O Globo", "Extra", "Meia Hora" and "Expresso" in RJS), museums, aquaria and other institutions that had proofs of the presence of *E. australis* in southeastern Brazil. Each record should include date, location and a photo, video footage or biological material, which could allow safe identification of the species. Different records made in the same day and cities were considered as belonging to the same individual. Photos and videos found in the World Wide Web were included since they attended the quoted specifications. Data used for comparison were compiled from Santos *et al.* (2001) considering just the period from 1981 to 1999 and SPS and RJS coasts. The annual reports of port authorities from the States of São Paulo and Rio de Janeiro ("Docas de Santos", "Docas de São Sebastião" and "Docas do Rio de Janeiro") were used to evaluate the statistics on boat traffic.

Results

A total of 36 records of southern right whales was observed, including 59 individuals observed in 30 sightings and 6 strandings. Sightings were higher in the RJS coast (n=23; 77%) when compared to the SPS coast (n=7; 23%). Strandings followed the same pattern, with 4 (67%) observed in the RJS coast and 2 (33%) in the SPS coast (Table 1). Records were concentrated between May and October, with 43% observed in August and 30% in September.

Table 1

Comparing the 12-year period that comprehends this study with the 17-year period described in Santos *et al.* (2001), it was possible to detect that stranding ratios remained quite the same in the SPS coast (from 0.24 to 0.17 strandings/year) and increased in the RJS coast (from 0.12 to 0.33 strandings/year). Annual sightings of *E. australis* had a significant reduction when comparing studies, from 0.74 to 0.58 sightings/year in the SPS coast, meanwhile the ratio observed in the RJS coast dropped from 2.63 to 1.92 sightings/year. In the SPS coast,

sighting records were observed only in the northern coast, specifically in São Sebastião, Ilhabela, Caraguatatuba and Ubatuba (Fig. 1). In the RJS coast, sightings were distributed through different cities along the coast, with a main concentration of records (37%) close to the city of Rio de Janeiro 37% (Fig. 2).

Figure 1

Figure 2

Mother and calf pairs represented 76% of all sightings, showing evidences on the use of the southeastern coast of Brazil as a breeding and calving area (see Figure 3). In the SPS coast, all sightings included mother and calf pairs (see Fig. 1) and in the RJS coast, 16 records were of mother and calf pairs (70%), with the 7 remaining represented by solitary individuals (30%) (see Fig. 2). One of the calves which stranded in the SPS coast had *ca*. 4.5m long (see Santos *et al*., 2010) meanwhile the other was a subadult which was not measured and had no determined gender. From the stranded whales in the RJS coast, one was related to a male calf and the remaining ones were related to adults. The calf live stranded and died just a day after stranding. The others were one adult male and two adult individuals with unknown gender.

Figure 3

Research in the World Wide Web resulted in 8 confirmed and 12 unconfirmed records. The latter were related to evidences presented by people who could not be reached to confirm date and location of sightings. Annual data gathered from Port Authorities regarding the traffic of vessels from 1976 to 2011 in “Porto de Santos”, the largest port of SPS, are presented in Figure 4. It was possible to observe a significant increase in boat traffic from 1999 to 2008. “Porto de Santos” and “Porto de São Sebastião”, the second largest port in SPS, compose the gathered data presented Figure 5 regarding the SPS. As “Porto de São Sebastião” has no longer been used for boat racings since 2003, as well as by fishing boats since 2007, a sensible reduction in such records was detected (Figure 5). RJS is represented by four major ports located in the cities of Rio de Janeiro, Angra dos Reis, Niterói and Itaguaí (Figure 5). Although the RJS coast has 4 major ports, the SPS coast always showed the most intense boat traffic.

Figure 4

Figure 5

Discussion

The development of new technologies brought greater access to information through the World Wide Web. Research in newspaper files was much easier when compared to the one conducted in the 1990s based on printed files. Archives are all digitalized and research is much facilitated using ‘key words’. Videos and photos posted in social networks were also of great help to recover sighting data of right whales in southeastern Brazil. As a consequence, the chances to lose data in modern years when compared to the 1990s were minimized. Besides that, the urbanization of the coastal area of the SPS and the RJS contributes to increase the detection of right whales in local beaches. Thus, the use of media and social networks to access newspapers files and other sources

which could render evidences on the presence of right whales along the overpopulated coasts of two States of southeastern Brazil proved to be an interesting tool to recover important information on their presence in local waters. With a lesser number of sources, previous studies (Lodi *et al*., 1996; Santos *et al*., 2001) rendered important statistical data, which could be used to compare with modern ones. Therefore, considering the recovery rate showed by previous studies regarding South Atlantic right whales (14% showed by Groch *et al.*, 2005 and 7-8% showed by IWC, 2001), and the access to modern tools to recover data, a significant increase in the number of records was expected when compared to previous decades, which was not the case. If the stock is recovering, which are the reasons for the reduction on the observed ratios of southern right whale sighting records in southeastern Brazil? What is the role of the increased boat traffic presented in this study in the observed reduction of right whale records?

Human activities such as boat traffic, seismic activities, use of low frequency sonar, oil, gas and mineral exploration, among others induce noise pollution which represents one of the cumulative impacts provoked by humans to cetaceans along time (see examples in IWC, 2001; Jefferson *et al.*, 1993; John *et al.*, 2007; Knowlton and Brown, 2007; Lodi *et al.*, 1984; Lodi *et al.*, 1996; Moore *et al.*, 2007; Van Waerebeek *et al.*, 2007). A study conducted between 1986 and 2005 in the North Atlantic (NA) showed that vessel strikes were responsible for 38% of the deaths of the NA right whale, *E. glacialis* (Moore *et al.*, 2007). According to Rolland *et al.* (*in press*), noise pollution in the NA can be related to an increase in hormonal metabolites, associated to stress, causing responses such as habitat shift, behavior and vocal repertory changes, as well as consequent negative influence on endangered populations. Kraus and Rolland (2007) showed that urbanization, increase in boat traffic and other human activities had a negative influence in the NA stock, inducing the whales to leave the coast and to occupy areas as far as 80km from their historical sighting spots. Those authors mentioned that the recovery of the SH stock was probably related to the lower urbanization rate in their breeding and calving areas. Nevertheless, the intense urbanization of the southeastern Brazilian coast and the increase in vessel traffic (see Figs. 4 and 5) seems to be affecting the South Atlantic stock recovery. Present data showed that the boat traffic in the SPS coast was always more intense than in RJS coast. This difference, added to coastal morphology, may explain the historical higher ratio of sightings of *E. australis* in the RJS coast when comparing to the SPS coast. To improve the presented analysis, it would be important if Port Authorities could invest on reports in which vessels could be classified by their size and frequency of use of local waters, which was not the case when considering the presented data. This procedure would be important in order to better evaluate the degree of impacts related to larger boats, as well as to start thinking on future routes to be followed by large commercial vessels in southeastern Brazilian coastal waters.

The great number of mother and calf pairs (77.8% of all sightings) is in agreement with the species intense use of bays in Brazilian waters as breeding and calving areas (Lodi *et al.*, 1996). Records of mothers with small calves (Fig. 3), added to stranded calves showing umbilical cord remains (Santos *et al*., 2001), may indicate that these individuals were possibly born in southeastern Brazil. Is the calving and breeding area expanding to northern bays along the Brazilian coast? This question should be considered when evaluating the conservation status of southern right whales in the SH.

The decrease in southern right whale records in SPS and RJS coasts in the last 12 years is probably related to human population growth and habitat loss caused by intense boat traffic, added to noise pollution and its effects. Nevertheless, considering the Southwestern Atlantic population recovery of *E. australis*, it would be expected an increase in the number of records. Where have the southern right whales gone? Are they avoiding the southeastern Brazilian coastal areas? Are they shifting to remote and deeper waters? With this shift, wouldn't they face other human impacts? Considering cetaceans as sentinels of their environment (Moore, 2008) and the expansion of human activities in southeastern Brazil, shouldn't it be the moment to evaluate the nature and intensity of these human impacts on southern right whales? To answer these questions, bio-ecological and oceanographic features related to the presence of *E. australis* in tropical waters must be better evaluated. Is there a movement pattern along the coast or are those movements erratic? How oceanographic events influence their behavior and movements in breeding and calving areas? Will it be possible for right whales to use the highly impacted southeastern coast of Brazil as a new important calving area? It is time to invest in robust research and conservation precautionary actions to protect southern right whales before a similar scenario such as the one observed with the northern right whale in the NA happens again in the SH.

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Tables and Figures

Table 1: Sighting and stranding records of the southern right whale, *Eubalaena australis*, in São Paulo State (SPS) and Rio de Janeiro State (RJS) coasts between 2000 and 2011. Strandings are represented by (*). # means number of individuals.

Location	Date	Latitute	Longitude	#
	3 Aug. 2003	23º46' S	45º45' W	2
	16 Aug. 2003	23º21' S	44º53' W	2
	14 Aug. 2007	23º21' S	44º55' W	2
	15 Aug. 2007*	24º10' S	46º45' W	1
SPS	26 Aug. 2009	23º46' S	45º38' W	2
	3 Sep. 2009	23º46' S	45º44' W	2
	7 Sep. 2009	23º49' S	45º24' W	2
	9 Sep. 2009	23º35' S	45º19' W	2
	4 Oct. 2011*	23º46' S	45º21' W	1
	11 Aug. 2000	22º57' S	42º03' W	2
	18 Aug. 2000	22º58' S	42º49' W	2
	25 Aug. 2000	22º56' S	42º23' W	2
	3 Sep. 2000*	21º21' S	41º58' W	1
	8 Sep. 2000*	21º41' S	41º14' W	1
	10 Aug. 2001	22º59' S	43º53' W	2
	17 Sep. 2001	22º58' S	43º10' W	2
	24 Sep. 2001	22º55' S	43º08' W	2
	16 Oct. 2003	22º59' S	43º12' W	2
	17 Jan. 2004*	22º56' S	42º29' W	1
	11 Aug. 2004	22º56' S	42º29' W	1
	13 Aug. 2004	22º56' S	42º18' W	1
	16 Aug. 2004	22º45' S	41º52' W	2
RJS	29 Aug. 2004*	22º57' S	42º02' W	2
	7 Sep. 2005	22º47' S	41º55' W	2
	8 Sep. 2005	22º29' S	41º53' W	2
	9 Sep. 2005	22º22' S	41º46' W	1
	30 May. 2007	22º58' S	42º00' W	2
	15 Aug. 2007	23º01' S	43º21' W	1
	26 Aug. 2007	23º01' S	43º21' W	1
	27 Jul. 2009	23º00' S	43º15' W	2
	11 Jun. 2010	23º00' S	43º15' W	1
	12 Jul. 2010	22º59' S	43º13' W	1
	15 Jul. 2010	22º59' S	43º12' W	2
	16 Sep. 2010	22º31' S	41º54' W	2
	5 Oct. 2010	23º01' S	43º21' W	2
	7 Oct. 2011	22º56' S	42º23' W	2

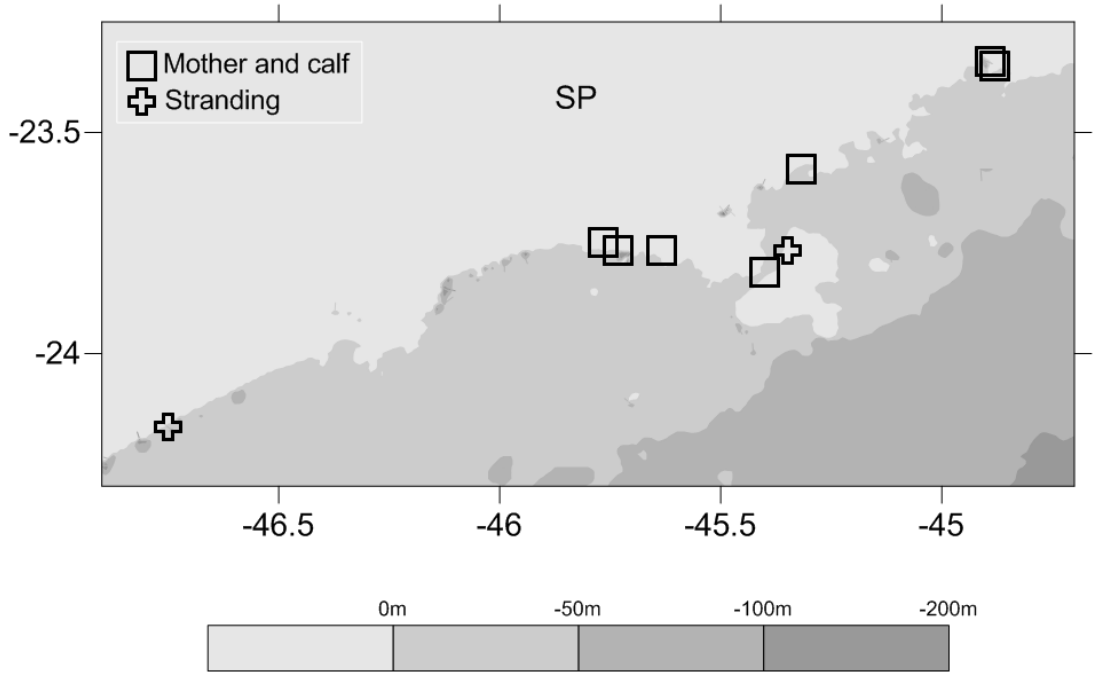

Figure 1. Sighting and stranding records of southern right whale, *Eubalaena australis*, along São Paulo State coast between 2000 and 2011. Squares represent mother and calf pairs and crosses represent strandings.

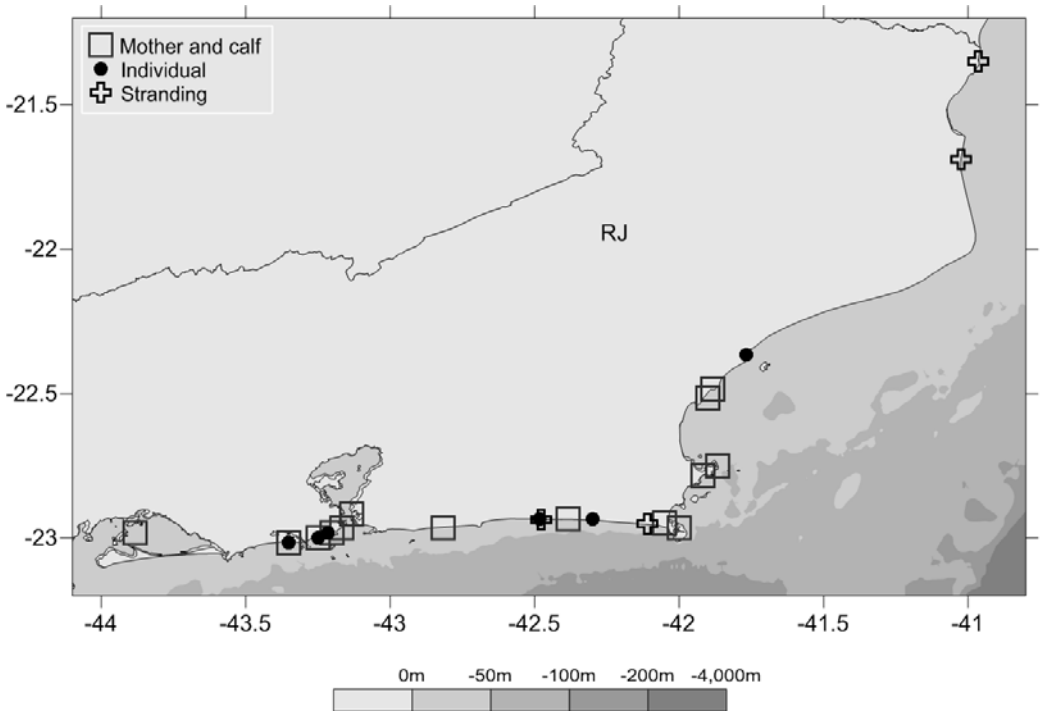

Figure 2. Sighting and stranding records of southern right whale, *Eubalaena australis*, along São Paulo State coast between 2000 and 2011. Squares represent mother and calf pairs, circles represent solitary individuals and crosses represent strandings.

Figure 3: Mother and calf pair of southern right whales, *Eubalaena australis*, sighted on September 3rd 2009 in Juquehy beach, São Sebastião (SPS). Photo: Leandro Saadi.

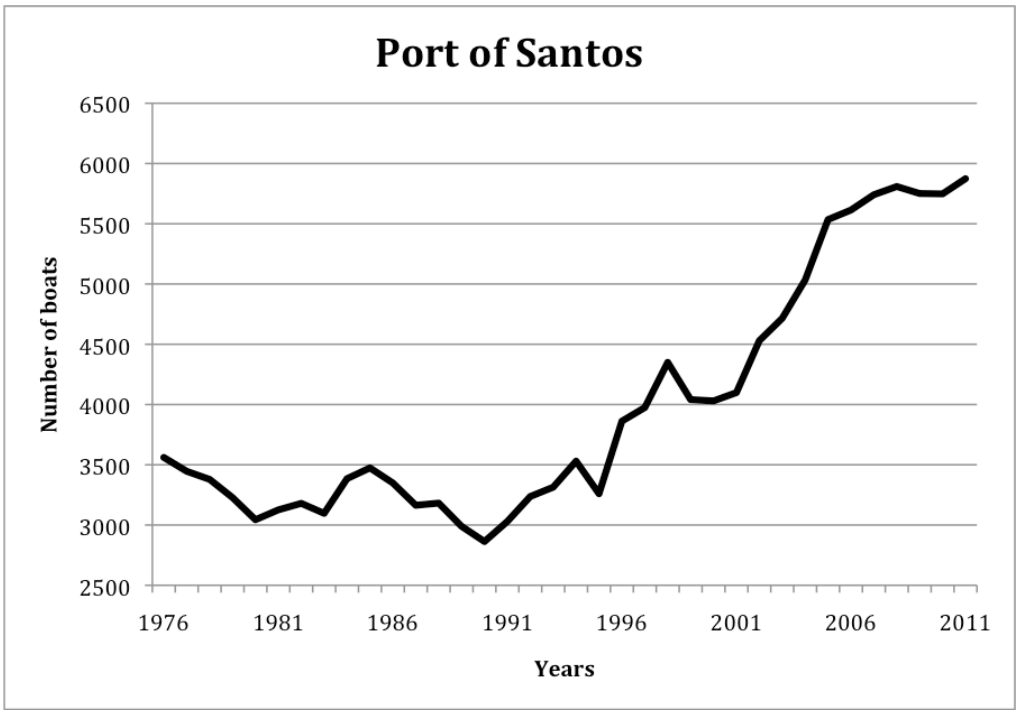

Figure 4: Annual number of vessels using the "Porto de Santos" between 1976 and 2011. Source: Companhia Docas de São Paulo – CODESP.

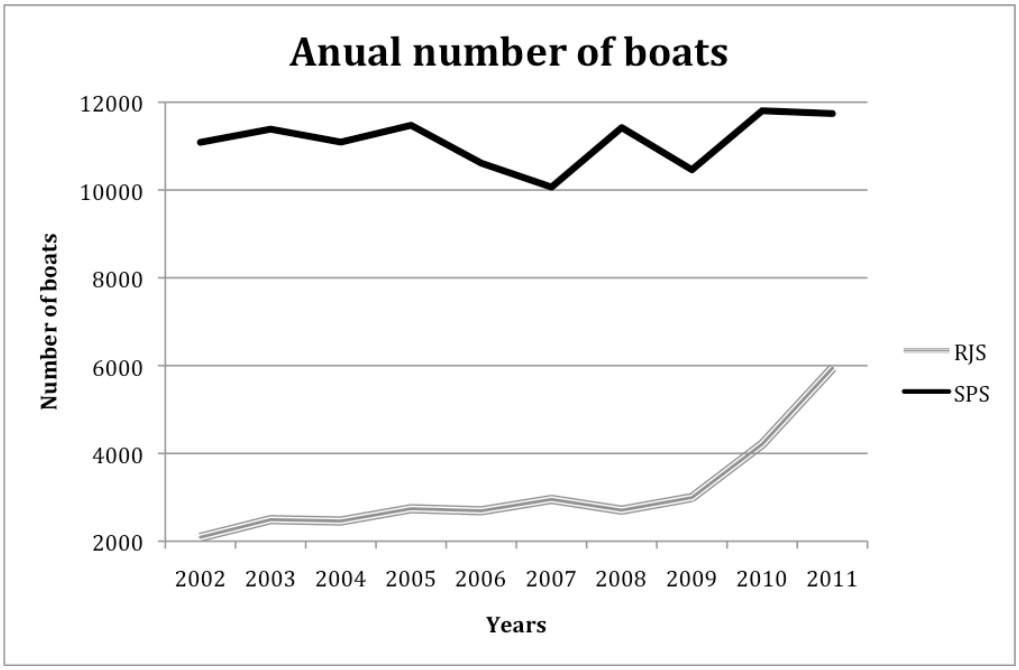

Figure 5: Annual number of vessels using two major ports of São Paulo State and four major ports of Rio de Janeiro State from 2002 to 2011. Sources: Companhia Docas de São Paulo - CODESP, Companhia Docas de São Sebastião and Companhia Docas do Rio de Janeiro.