

First Southern right whale aerial surveys in Golfo San Jorge, Santa Cruz, Argentina

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ABSTRACT

The population of Southern right whales (SRW) from Argentina and South Africa register an annual growth of 6.9%. As a result, SRW became more common, but their distribution was difficult to assess for some regions of Argentina. Thus, with the goal of studying the distribution of SRW in Santa Cruz province, we carried out aerial surveys in the region. Flights were carried out since 2007, covering 80 nautical miles between Comodoro Rivadavia (45°47'S/67°27'W) (Chubut) and Bahía Mazzaredo (46°58'/66°31'W) (Santa Cruz), using a helicopter of the Prefectura Naval Argentina. Not only did we gather preliminary information on habitat use of this species, but photo-identification of the individuals served to create a catalogue, which can be further used for potential individual comparison with other regions. Furthermore, behavioral records revealed a change in the displayed behaviors with the presence of the helicopter. It remains to be clarified whether the noise generated by the aircraft is triggering the animals' response, or another cue, such as the shadow of the helicopter, is eliciting a change in the behavior.

KEYWORD: SOUTHERN RIGHT WHALE, SURVEY-AERIAL, GOLFO SAN JORGE, ARGENTINA

INTRODUCTION

Southern right whales (SRW) (*Eubalaena australis*) (Desmoulins, 1822) are distributed southern from 18°S (de Oliveira Santos *et al.*, 2001). In fact, in winter they are encountered in the south of Argentina, Brazil, Uruguay, Tristan da Cunha, Namibia, south of Mozambique, South Africa, St. Paul Island, southwest and southeast of Australia, Kemadec Islands and Chile (Rice, 1998). This species migrate approximately 2000km probably from its feeding grounds to the protected waters of Península Valdés (Best *et al.*, 1993), where they breed (Payne, 1986). Currently, the populations of Argentina and South Africa present an annual growth of 6.9%. In particular, an increasing number of SRW has been reported in the last years during autumn, winter and spring in Golfo San Jorge, between Paraje La Lobería and Caleta Olivia (46°26'S/ 67°31'W) (see Fig. 1). This information has been collected from studies carried out from land and boats from 2004 to 2008. Since data southern from Golfo San Jorge is missing, we have been conducting aerial surveys in the area since 2007. These flights also allowed us to photograph callosity patterns of each individual and to register the behavior of the sighted individual.

MATERIALS AND METHODS

We used coast guard helicopters (Dauphin and Puma) to photo identify SRW individuals in the southern area of Golfo San Jorge, applying the same methodology as Projeto Baleia Franca (Groch *et al.*, 2005). Despite the higher cost/hour in comparison with airplanes, the helicopter has proved to be a better platform because of its safety, maneuverability and a better view of the whales. Surveys were conducted at an altitude of ~300m, a speed of ~167km/h and ~500-800m off the shoreline. Attempts were made to conduct surveys during days with optimal conditions, i.e. low wind, low sea states (<3 Beaufort Sea Scale) and adequate lighting.

Each flight covered 80 nautical miles. We flew a transect between Comodoro Rivadavia (45°47'S/67°27'W) (Chubut) and Bahía Mazzaredo (46°58'/66°31'W) (Santa Cruz) (see Fig. 1).

For each sighting the location was plotted in a map and thus identifying areas of presence.

To make our results comparable between flights, we always followed the same protocol: Two or three observers were in the aircraft in addition to the pilot. The principal observer sat next to the pilot and looked continuously in front of the aircraft and recorded whale number, group composition, location, behavior, and the information that could be relevant for the analysis and photographic information. The second observer sat behind the pilot, watched for whales on the pilot's side of the aircraft, took photographs and observed whale behavior and group composition. The third observer sat next to the photographer, watched for whales on the other side of the aircraft and assisted the photographer. Once the photos were taken or if anything changed in the whales' behavior, the helicopter moved ahead following the marked route.

Whenever a whale or group of whales was spotted, they were approached at a minimum height of 100m and the number of whales was counted. The helicopter hovered over the group and, as the callosity patterns of individuals became visible, they were photographed.

Groups were defined as individuals swimming in a coordinated manner within 100m of each other and performing the same behavior. We continuously recorded all behavioral states. To describe and evaluate the behaviors of the SRW, four behavioral states were defined: foraging, travelling, resting and socializing.

Individual behaviors are taken into account to define those behavioral states. Travelling was considered as such when one or more individuals were swimming with a consistent direction, rising to the surface only to breathe. Socializing consisted of more than one individual carrying out different behaviors such as exposing fins, drafts, etc., interacting with each other. Rest is when an individual is on surface, being dragged by the current, and there were no other whales in the vicinity, i.e. no closer than 5 whale body lengths (Tomas and Taber, 1984; Sironi, 2004). For foraging behavior we used the definition described by Mayo and Marx (1990) for the whales of the North hemisphere.

Tail slap, fluke up, pectoral up and pectoral exposure were all behaviors considered as aerial displays.

Individuals were assigned to age categories using the characteristics, definitions and assumptions detailed by Payne *et al.* (1983): newborn, juveniles and adults. However, for this work we only considered to categories adults and mother-calf associations.

RESULTS AND DISCUSSION

The flights were conducted systematically in July and August of every study year; months in which the largest number of whales had been observed in the area (Belgrano *et al.*, 2004). Also, in 2009, two flights were done in the summer months (January and March), to evaluate presence/absence of SRW (table 1).

During the flight between Bahía Mazarredo to Comodoro Rivadavia, the surveys were conducted as we explained in the materials and methods section.

Table 2 shows, specified by year and month, the amount and age class observed of SRW. Note that in 2007 and 2010, the biggest numbers of individuals were observed. The presence of two groups of mother-calf was seen only in one occasion (2007).

In July 2008 three whales were observed, including an albino. In 2010 observed again an albino individual and we took pictures, which are being analyzed to compare them with others from the SRW catalogues in the Southwest Atlantic Ocean.

One of the groups observed in 2007 was made up of 4 adults in courtship, behavior associated with socialization. A group of 3 adults performing behaviors that are attributed to the socialization was also seen in 2008. This same behavioral state was observed in a group of 2 adults that were observed in 2009. These data may represent a piece of evidence indicating that, at least in daytime and for the studied months, the area is used by SWR mainly to socialize.

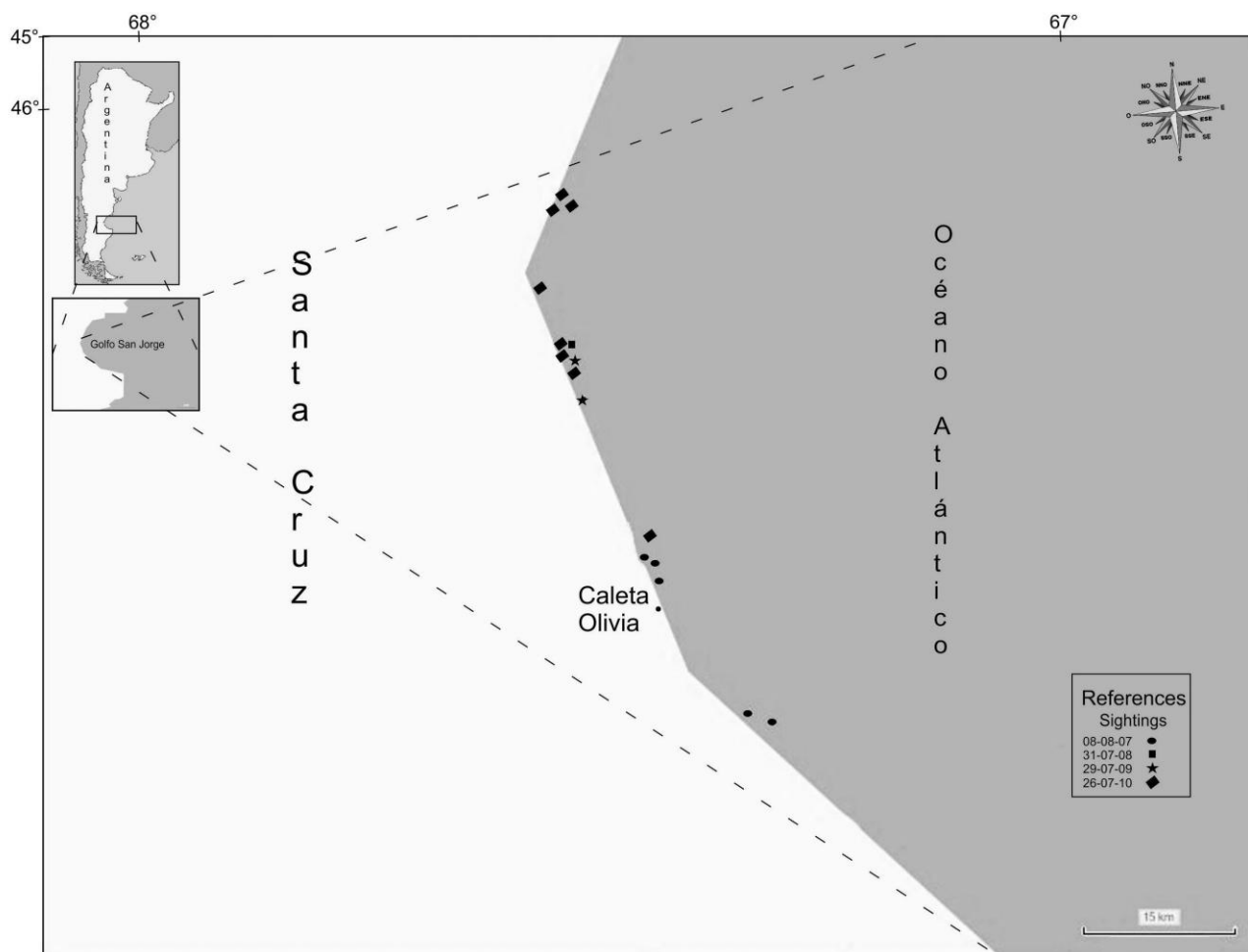
In 2010 we were able to identify specific behavioral displays but not behavioral states. This was due to the fact that every time the helicopter approached, the animals changed their behavioral display submerging, making it more difficult to assign a particular behavioral state to the observed individuals. This was noted widely in 8 groups observed during this flight (table 3).

It is noteworthy that in most sightings we observed the whale submerging as the helicopter closed in. The question is whether this change in observed behavior is due to the noise produced by the helicopter or there is another factor (like the aircraft's shadow) eliciting a submersion more often than when the helicopter is farther away. To answer this question it would be worth recording the received levels underwater proceeding from the helicopter to estimate whether the noise could have an impact on SRW. A higher sampling is also desired to prove –if any– a behavioral response as well as the inclusion of additional data such as shadow of the helicopter on the whale.

When we flew with the Dauphin helicopter, most of the time the whales were traveling when the helicopter hovered over them and they changed the behavior. Only when SRW were involved in courtship they did not change their behavior. The only time we flew with the Puma helicopter, we did not observe any change in the whale's behavior, and the whales were socializing.

Since the current work is a preliminary study, more research needs to be done to know whether the helicopter has behavioral and/or physiological impact on these whales. However, we show a piece of evidence that whales could be indeed affected by the presence of helicopters and an acoustic approach should be therefore a key study to tell apart whether noise is affecting the animals.

Fig. 1 Map of the Golfo San Jorge area showing the sightings for each aerial survey day.



Tables:

Table 1: Summary of aerial surveys between 2007 and 2010

DATE	HELICOPTER	FLIGHT TIME	LENGTH (KM)
8-Aug-07	DAUPHIN	3.04	415
31-Jul-08	PUMA	2.11	373
27-Aug-08	DAUPHIN	2.10	357
27-Jan-09	DAUPHIN	2.12	358
25-Mar-09	DAUPHIN	2.23	421
29-Jul-09	DAUPHIN	2.34	460
27-Aug-09	DAUPHIN	1.59	378
26-Jul-10	DAUPHIN	2.25	454

Table 2: Quantity and age class of SRW sighted

DATE	ADULT	CALF	TOTAL
8-Aug-07	9	2	11
31-Jul-08	3	0	3
27-Aug-08	0	0	0
27-Jan-09	0	0	0
25-Mar-09	0	0	0
29-Jul-09	3	0	3
27-Aug-09	0	0	0
26-Jul-10	14	0	14

Table 3: Behavior of the BFA on the helicopter having approached and on having be positioned on the whales

DATE	GROUP	BEHAVIOUR	
		Helicopter approaching	Helicopter above the whales
8-Aug-07	sighting 1	Travelling	Dive
	sighting 2	Courtship	Courtship
	sighting 3	Undetermined	Aerial displays
	sighting 4	Travelling	Dive
	sighting 5	Travelling	Travelling
31-Jul-08	sighting 1	Socializing	Socializing
29-Jul-09	sighting 1	Travelling	Travelling
	sighting 2	Aerial displays	Dive
26-Jul-10	sighting 1	Undetermined	Dive
	sighting 2	Aerial displays	Dive
	sighting 3	Aerial displays	Dive
	sighting 4	Aerial displays	Dive
	sighting 5	Aerial displays	Dive
	sighting 6	Travelling	Dive
	sighting 7	Undetermined	Dive
	sighting 8	Undetermined	Dive

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