

Original Article

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Half a century of sightings data of southern right whales in Mar del Plata (Buenos Aires, Argentina)

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Abstract

In South-western Atlantic waters, individuals of the southern right whale (SRW) *Eubalaena australis* spend part of the year (the austral winter and spring) in northern inshore waters where they breed and then migrate to southern feeding grounds during the summer. Mar del Plata (MDP) is located between two main reproductive areas (Península Valdés-Argentina and Santa Catarina-Brazil). The purpose of the present study is to report the presence of SRWs on their journey off the coast of MDP based on sighting records during the past half century. We carried out whale observations through systematic weekly coastal marine mammal surveys in different points of the MDP area from 1966 to 2016. The first SRW sighting was recorded in 1970; since then, sighting frequency has gradually increased, reaching a peak of 28 sightings (N = 63 whales) in 2016. These are unique long-term sighting records of SRWs in Argentina and the first on their journey off the shores of Buenos Aires province. We expect that these results will help local authorities to regulate tourism and other activities in the area and thereby contribute to the conservation of the species.

Introduction

Populations of the southern right whale (SRW) *Eubalaena australis* (Desmoulins, 1822) are distributed between 18°S and 65°S (Bastida *et al.*, 2007). In the South-western Atlantic, the major calving areas are located in Argentina (Península Valdés, 42°46'S 65°02'W) (PV) and Brazil (Santa Catarina, 27°35'S 48°28'W) (SC). These whales spend part of the year (the austral winter and spring) in northern inshore waters where they breed and then migrate to southern feeding grounds during the summer (Bastida & Lichtschein de Bastida, 1984; Payne *et al.*, 1990; Best, 2000; Rowntree *et al.*, 2001; Santos *et al.*, 2001; Arias *et al.*, 2015, 2017).

SRWs were exploited along the South American Atlantic coast for many years. During the 18th and 19th centuries, commercial whaling caused a drastic decline in SRW populations, leading the species to the brink of extinction (Baker & Clapham, 2004). Historically, whalers were continuously distributed from Brazil down to southern Argentina including Tierra del Fuego, Malvinas-Falkland Islands and South Georgia Islands (Townsend, 1935; Richards, 2009). Catches showed a sharp increase during the mid-1800s, with a slow decrease following international protection in 1935, and another increase as a result of illegal Soviet catches in the 1960s (Tormosov *et al.*, 1998).

Towards the end of the 20th century, SRW populations in Argentina, Brazil, South Africa and Australia have shown signs of recovery, doubling over a period of 10–12 years (Bannister, 2001; Best *et al.*, 2001; Cooke *et al.*, 2001; Crespo *et al.*, 2015; Groch, 2018). Since the 1970s, the population that breeds in PV (Argentina) grew at a rate of 6.9% per year (Cooke *et al.*, 2001; Crespo *et al.*, 2014), and between 1999 and 2015, although it also grew, it did so at lower rates (Crespo *et al.*, 2019).

The increase in SRW numbers observed during the 1980s was followed by a tendency to re-occupy historical areas along the South-west Atlantic coastline like SC in Brazil, the Uruguayan coast and different regions of the Patagonian coast (Santos *et al.*, 2001; Iñiguez *et al.*, 2003; Piedra *et al.*, 2006; Belgrano *et al.*, 2008; Failla *et al.*, 2008; Vermeulen, 2013; Danilewicz *et al.*, 2016).

The coast of Mar del Plata (MDP) is located between the two main reproductive areas of the species in the South-west Atlantic (SC and PV). It is important to follow the presence of this whale not only in its breeding and feeding grounds, but also along its journey. In the case of the coastal area of MDP, in the last decade there is a potential interest in whale-watching from land, both from tourists and local residents.

SRWs have been protected in Argentina's territorial waters since 1984, when they were declared a National Natural Monument (Law 23.094, 1984). The species is listed as of least concern (LC) in the IUCN Red List of Threatened Species (Cooke & Zerbini, 2018); nevertheless, in Argentina the species was listed as Vulnerable (VU) (Ojeda *et al.*, 2012).



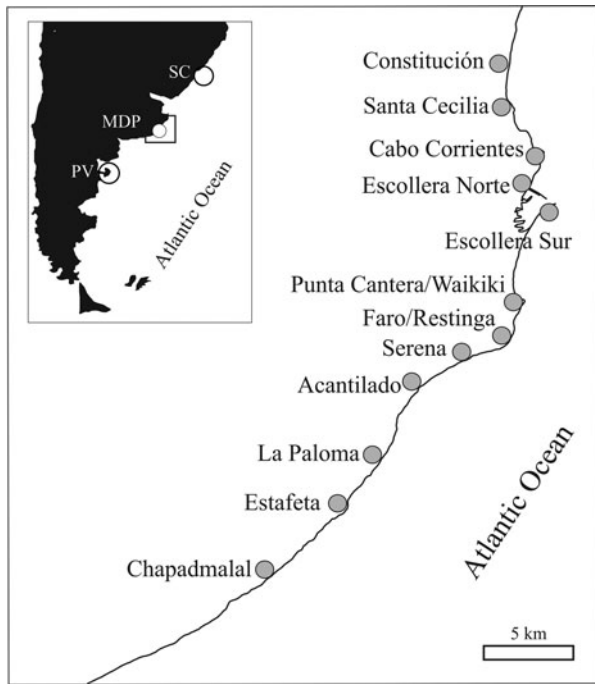


Fig. 1. Sighting points along Mar del Plata coast (MDP) during 1970–2016. The circles on the upper map indicate the closest breeding grounds: Santa Catarina (Brazil) (SC) and Península Valdés (Argentina) (PV).

Monitoring the presence and frequency of marine mammal species in coastal areas is a basic step in providing information for conservation and management and because of their value as educational and touristic resources. The purpose of the present study is to report the presence of SRWs on their journey off the coast of MDP, an intermediate area between the two main breeding grounds of the species, based on sighting records during the past half century. Our hypothesis is that SRWs use the study area as a passage zone on their migratory route and as a transit area to the southern feeding grounds at the end of the austral spring.

Materials and methods

Study area and sighting period

The fieldwork took place along the coasts of MDP (38°03'S 57°31'W) (Figure 1). The area consists of ~40 km of sandy beaches, quartzite rock outcrops and sedimentary rock cliffs that reach heights of up to 40 m. These topographic features allow a better observation of marine mammals from the shore, making it one of the best areas in Buenos Aires Province (BAP) for such activities.

Observations were carried out as part of a marine mammal-monitoring project. Weekly surveys were made every month throughout year during the study period (1966–2016), in different points of MDP, between Constitución and Chapadmalal (Figure 1).

Sightings were performed from land by one or two observers, with either the naked eye or using binoculars and a monocular Bushnell Stalker Zoom 10 × 30 mm. For sightings at very great distances, we used a Bushnell Sport View telescope zoom 20–60 × 60 mm Spotting Scope.

For each sighting, we recorded the following data: number of individuals, general behaviour, eventual presence of calves, and displacement direction of individuals (when the animals were swimming actively and followed a fixed course sustained over time). Associated with whale sightings we also recorded the

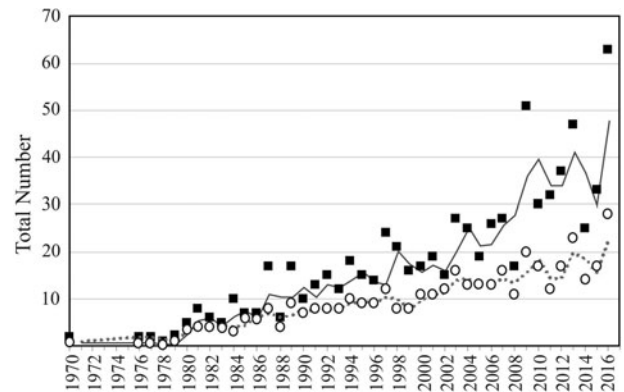


Fig. 2. Number of SRW sightings (white circle) and number of whales (black box) recorded per year along MDP coast during 1970–2016 period. The lines represent the trends of sighting and whales records.

presence of other marine mammal species and seabirds. When whales were at a distance less than 1000 m from the observer, we recorded behavioural information of the individuals as defined by Costa et al. (2007). We collected data on SRW activity patterns via an *ad libitum* sampling mode. Permanence time in the area was estimated based on direct observation of the same number of animals, in the same site, during continuing hours or days, assuming that those animals were always the same ones.

In addition, as complementary information, during 2007–2017, marine mammal observers obtained records of SRWs (which were not designed for the assessment of marine mammal populations, but were opportunistic sightings) and two seismic surveys in the Argentine continental shelf off BAP.

Data analysis

We analysed the frequency of SRW coastal sightings, geographic distribution and pod size throughout the 1966–2016 period and along different months of the year. We defined the total number of whales per year as the sum of individuals recorded from land along the year.

Time series analysis techniques were applied to assess the trends of sightings during the study period. We used non-parametric regression techniques to test the trend and the seasonality of a time series. For this purpose, a seasonal decomposition of a time series X_t determining a T_t trend was used; seasonal component St from the difference $X_t - T_t$ was calculated (Cleveland et al., 1990). For the analysis of mean stability and seasonality, the original time series was plotted to establish if a trend was observed in relation with time and if there was seasonality or periodicity.

All analyses were carried out using R 3.3.1 Software (R Development Core Team 2015).

Results

Abundance and seasonality

Between 1966 and 2016 we recorded 344 SRW coastal sightings ($N = 718$) in the MDP area. Although coastal sighting routines began in 1966, we recorded the first SRW in 1970 and there were no further sightings of the species until 1976. Since that year until now, SRW sightings have increased gradually, reaching a peak of 28 sightings ($N = 63$ whales) in 2016 (Figure 2).

SRW presence in MDP has a clear trend and seasonality, as observed through the analysis of non-parametric regression techniques (Figure 3). Although we recorded SRWs between April

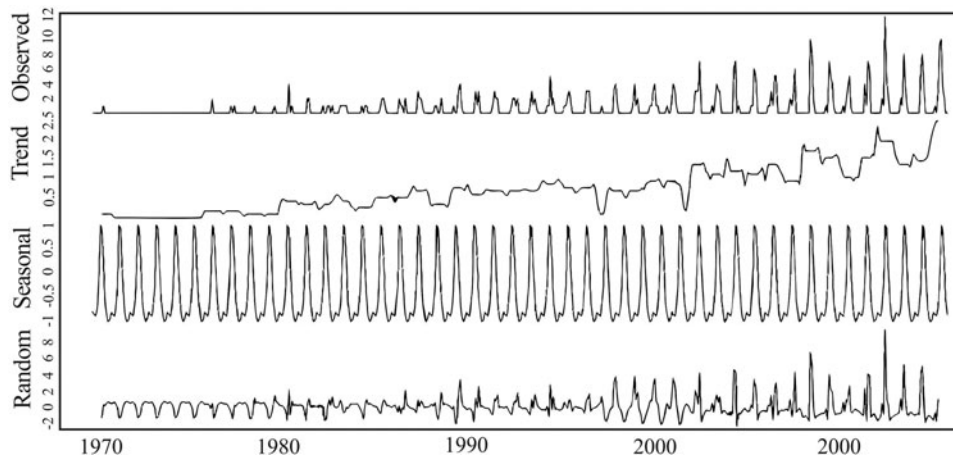


Fig. 3. Seasonal decomposition of a time series X_t by determining a trend T_t and calculating a seasonal component S_t from the difference $X_t - T_t$ for SRW sighting along MDP coast during 1970–2016.

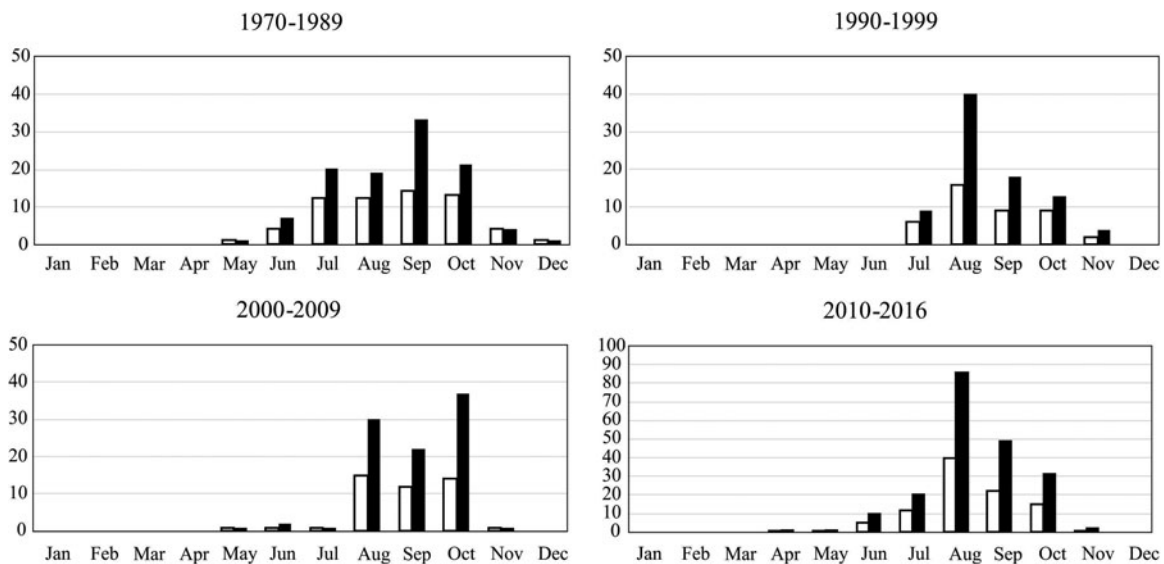


Fig. 4. Number of SRW sightings (white bars) and number of whales (black bars) recorded along MDP coast throughout the different months, during 1970–2016, expressed by decades. The decades of 1970 and 1980 were plotted together due to the low amount of data obtained.

and November, sightings were more frequent between July and mid-October (86.2%). In the 1970s, a few sightings occurred between July and November, and the number of sightings was similar to the number of whales observed; in the 1980s, the sighting season had extended and occurred from May to December, with a maximum number of whales and whale sightings in September. In the 1990s, sightings were more frequent in August, while in the 2000s they were more frequent in October followed by August and September, the latter with more sightings and a higher number of whales. Finally, in the first years of the current decade (2010–2016), the sighting peak was in August, followed by September and October (Figure 4).

During the first years of our study, sightings of SRWs in MDP consisted of solitary individuals passing through the area. As time went by, group size increased to 2–8 individuals. Along the period of study 41.2% of sightings corresponded to groups of 2 individuals, 35.4% were solitary specimens, while 23.4% were groups comprising between 3 and 8 individuals (Figure 5). The mean group size registered during the last decade was 2.8 ± 0.4 whales, with the largest group made up of 8 individuals recorded in 2013.

Whales observed in the study area were mainly adults. The first calves recorded in MDP date back to 1983. The presence of calves

during the whole period of this study was an unusual event. In spite of the fact that there was an increase in number of calves in the area during the last decades, the relative number of calves/number of SRWs along the five decades of this study was consistently low, with calves representing 5% of the total number of specimens sighted in MDP (Figure 6).

Finally, we found that there is a positive tendency between increase of SRW sightings in MDP and the number of mother-calf pairs observed in the closest breeding grounds of the South-west Atlantic: PV, Argentina and SC, Brazil (Figure 7).

Route and permanence

The majority of whales recorded from land in MDP before mid-October were travelling north, but later in the year most whales headed south ($\chi^2 = 15.589$, $df = 2$, $P < 0.005$).

In complementary oceanographic expeditions we recorded 17 SRW sightings ($N = 32$) within the Argentine continental shelf off BAP, between July and December. Sightings occurred between July and September at depths of up to 50 m. In contrast, sightings made between October and December were of animals moving close to the continental slope (depth > 200 m) (Figure 8).

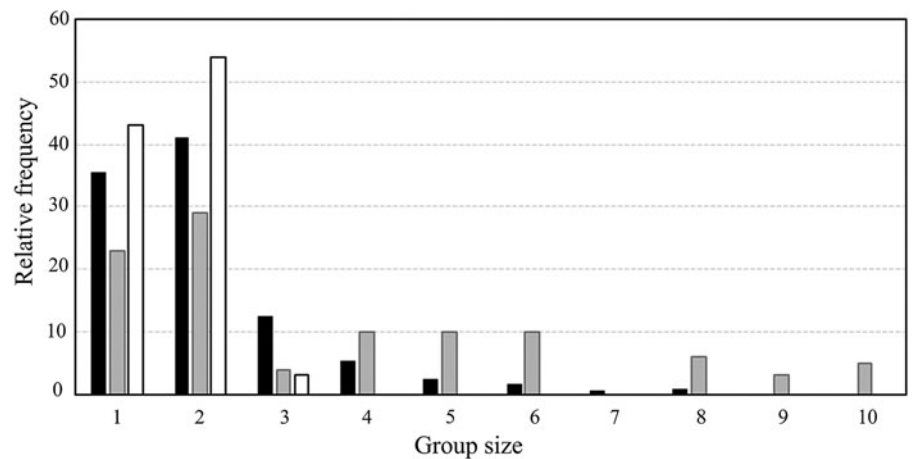


Fig. 5. Comparison of SRW pod size observed: along the MDP coast during 1970–2016 period (black bars), Uruguay (sampling in 2001–2003; Costa *et al.*, 2005, 2007) (grey bars) and Torres, southern Brazil (sampling in 2002; Danilewicz *et al.*, 2016) (white bars).

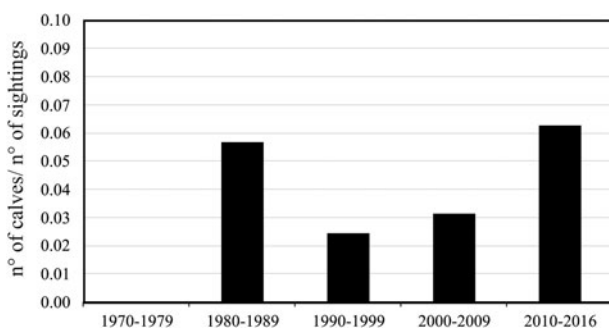


Fig. 6. Relationship of number of calves/total number of sightings on the coast of MDP during 1970–2016 period.

During the period of study, SRWs remained in MDP for an average period of 2 days (mean = 1.78 ± 1.43 ; max = 5 days). However, in the last 10 years, their permanence increased slightly (before 2005: mean = 1.46 ± 1.46 ; after 2005 mean = 2.21 ± 1.1). Of all sightings, 3.16% (N = 11) were recorded in the harbour area, probably because whales were looking for shelter or calm waters.

The most frequent behaviour recorded during the period of study was free movement (travelling) (57%), followed by socializing (31%) and resting (12%). Other behaviours were observed within the socializing category, but were not quantified (flipper/tail exhibitions and slaps, breaching, spy hopping, mother-calf contacts, etc.).

We recorded other marine species at close distance to SRWs. Of these, the most frequent was the kelp gull (*Larus dominicanus*), present in about 30% of whale sightings. Less frequent (less than 5%) was the brown-hooded gull (*Larus maculipennis*), the South American tern (*Sterna hirundinacea*), the great grebe (*Podiceps major*), the Magellanic penguin (*Spheniscus magellanicus*), the South American sea lion (*Otaria flavescens*), the South American fur seal (*Arctocephalus australis*), the bottlenose dolphin (*Tursiops truncatus gephyreus*) and the killer whale (*Orcinus orca*).

Discussion

To research the recovery of commercially overexploited species such as the SRW, it is essential to carry out studies both in space and time, not only in breeding areas, but also throughout their entire geographic range (Payne *et al.*, 1990; Cooke *et al.*, 2001; Richards, 2002; Costa *et al.*, 2005; Aguayo-Lobo *et al.*, 2008; Arias *et al.*, 2015; Danilewicz *et al.*, 2016). In this paper,

we present a unique record of sightings of SRW in Argentina over a period of 50 years, and the first data obtained during the journey of these whales off the coast of BAP.

SRW sightings in MDP have increased gradually since 1970 to the present. Over the last decades, sighting records in different sites are indicative of the growth of the main South Atlantic breeding populations (Argentina, Brazil, South Africa and Australia), after severe depletion by commercial whaling (Townsend, 1935; Bannister, 2001; Best *et al.*, 2001; Cooke *et al.*, 2001; Richards, 2009; Crespo *et al.*, 2019). Moreover, during the last decade, SRW breeding pods and non-social active groups have been increasing in the Golfo San Matías (Northern Patagonia), as it is a suitable habitat for social and reproductive activities (Vermeulen *et al.*, 2012; Vermeulen, 2013; Arias *et al.*, 2015; 2017). This growth is further confirmed by an increase in the frequency and number of sightings off the coast of MDP, as well as in other areas of the species' range (Uruguay and Southern Brazil) registered over the last years (Santos *et al.*, 2001; Costa *et al.*, 2005; 2007; Groch *et al.*, 2005; Danilewicz *et al.*, 2016).

We recorded SRWs in MDP from April to November, with peaks between July and mid-October. This pattern coincides with the period of the highest number of sightings recorded in Uruguay (Costa *et al.*, 2005) and Brazil, where the season is shorter (July–October), with a maximum in August–September (Groch *et al.*, 2005; Danilewicz *et al.*, 2016; Seyboth *et al.*, 2016; Groch, 2018). In addition, the season's length is similar to the reproductive period observed in Patagonia, where the first whales arrive in early April to May, and leave from November until late December (Crespo *et al.*, 2014, 2019), although the extension of seasonal presence varies from year to year (Greig *et al.*, 2001; Crespo *et al.*, 2019).

As MDP is located between the breeding grounds of SC (Brazil) and PV (Argentina), whales recorded at the beginning of the season off the MDP coast could be individuals travelling from their southern feeding areas to the breeding areas of southern Brazil. All the sighted whales showed a clear south-north swimming direction, using the MDP area as a displacement route. Nevertheless, satellite tracking of individuals marked in Golfo San Matías and Península Valdés shows variations in movement patterns of individuals making coastal and offshore migrations to feeding grounds after the breeding season. During the coastal migration, some individuals moved southwards and others moved northwards along the coast of the BAP in Argentina and Uruguay before undertaking their final movement to the southern feeding grounds (Zerbini *et al.*, 2016, 2018).

The first SRW sightings off the coasts of MDP were solitary individuals. Currently the whales also appear in small pods,

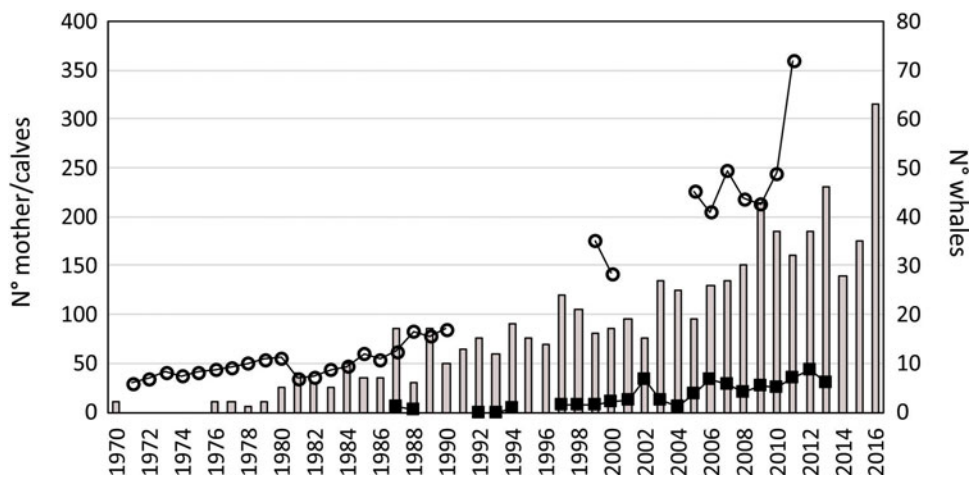


Fig. 7. Number of whales per year recorded along MDP coast during 1970–2016 period (grey bars). Number of mother–calf pairs observed in the breeding areas of Peninsula Valdés (white dots) and Santa Catarina (black box). (Brazil: Groch *et al.*, 2005; Seyboth *et al.*, 2016. Argentina: own records, period 1981–1990; Payne *et al.*, 1990; Crespo *et al.*, 2014, 2015; Cooke *et al.*, 2015).

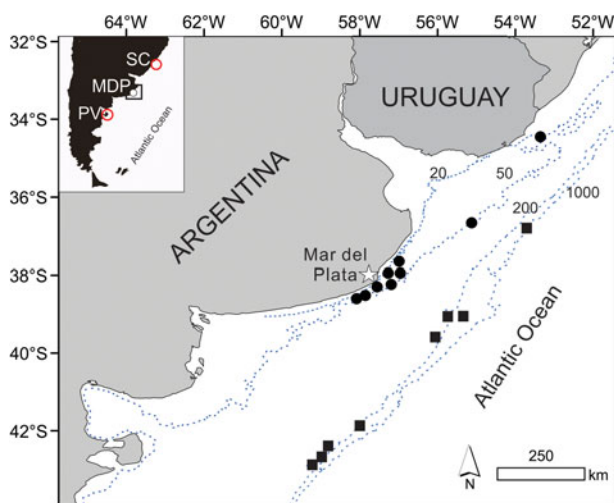


Fig. 8. Records of southern right whale obtained during seven oceanographic campaigns and two seismic surveys in the Argentine continental shelf off Buenos Aires Province in different months of the 2007–2017 period. Black dots: sightings between July and September. Black box: sightings between October and January.

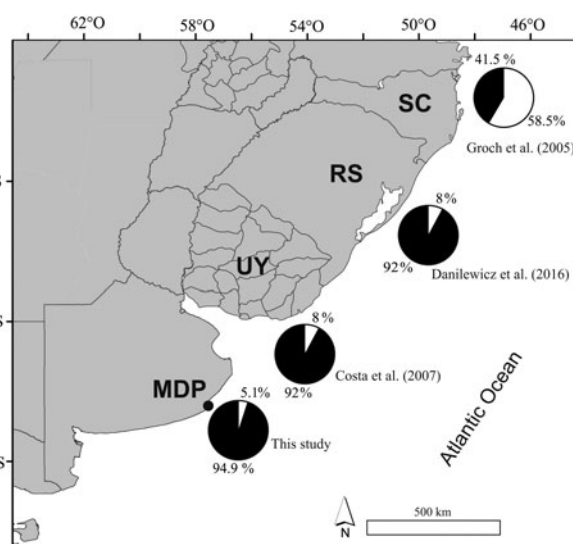


Fig. 9. Percentage females with calves (white) and SRWs without calves (solitary and groups) (black), sighted along Mar del Plata (MDP; sampling 1970–2016), Uruguayan (UY; sampling in 2001–2003) and Brazilian coasts: Rio Grande do Sul State (RS; sampling in 2002), and the main aggregation area in Santa Catarina (SC; sampling in 2001–2003).

similar to what happens in Torres (Brazil) and Uruguay, where the most frequent sightings were pairs and solitary individuals (Figure 5) (Costa *et al.*, 2007; Danilewicz *et al.*, 2016). Pods of more than three individuals were less frequent in the three non-breeding grounds (MDP, Uruguay and Torres). On the other hand, the permanence time of SRWs off MDP is about two days, a shorter time span than that recorded off the Uruguayan coast (Costa *et al.*, 2007).

SRWs observed around MDP showed free movement as the most frequent behaviour. A different behaviour was observed off the Uruguayan coast, where interaction between animals was dominant, indicating that this area is a socialization place, where in the last years courtship/mating behaviour had been registered (Costa *et al.*, 2007). Furthermore, Costa *et al.* (2007) suggest that the adjacent areas of the Uruguayan and Rio Grande do Sul (Brazil) coasts could be a single ‘mating ground’ south of the main reproductive area of Brazil (SC).

The differences recorded in whale behaviour between MDP and the Uruguayan coast could be a consequence of dissimilar environmental conditions. The sheltered waters of the Uruguayan coast as opposed to the stormy open sea of MDP,

could probably be linked to the greater interaction between individuals in Uruguay, and the use of the area for courtship/mating (Costa *et al.*, 2007). Likewise, the search for protected and calm waters is confirmed in our work by the frequent presence of whales observed inside the MDP harbour.

There is a clear increase in the number of females with calves from BAP to the south of Brazil (Figure 9) (Groch *et al.*, 2005; Costa *et al.*, 2007; Danilewicz *et al.*, 2016). SWR adults were the most frequently observed individuals off the coast of MDP, with an absence of calves during the 1970–1979 period. In the following decades the presence of mother–calf pairs was low, lasted a short period of time and its percentage did not vary throughout the different studied decades. We believe that the few cases of mothers with calves off MDP during the first months of the season are cases of natural premature births during the migratory period to the breeding ground off SC (Brazil).

We observed different marine species associated with SRWs in MDP, like seabirds and other marine mammals, similar to situations observed in the South West Atlantic breeding areas

(Sironi et al., 2009; Marón et al., 2015). The most common seabirds recorded in MDP were juvenile kelp gulls (*Larus dominicanus*); however, we did not register individuals feeding on whale's skin and blubber, as is frequently the case in PV (Bastida et al., 2007; Sironi et al., 2009; Fazio et al., 2012). Among the marine mammals interacting with SRWs we noted non-aggressive killer whales (*Orcinus orca*) on a few occasions; in contrast, harassment or predatory behaviour by killer whales was reported in Brazil (Ott et al., 2017) and PV (Sironi et al., 2008; Bastida et al., 2018).

Whale watching activities of SRWs are currently quite common. Globally, this activity has increased exponentially in recent decades (O'Connor et al., 2009). In Argentina, and particularly in PV, whale watching from boats is an important natural tourism resource for Chubut Province (Chalcobsky et al., 2017). The calm and sheltered waters of Golfo Nuevo and Golfo San José offer suitable environmental conditions for SRW reproductive activities during the extensive breeding season and are an appropriate area for regulated tourist activity (Bastida, 1987). In contrast, we consider that the MDP coast is not suitable for whale watching from boats and we do not recommend this activity for several reasons: the presence of SRWs is unpredictable and sightings are opportunistic; animals may just swim through the area or remain in these waters for only a few days. Furthermore, the open and stormy seas of the studied area are not suitable for whale watching from small boats due to the water turbulence and the lack of sheltered coastal areas. MDP has the advantage of high coastal cliffs that allow whale watching from the shore, making it a valuable educational and accessible resource for both residents and tourists.

Based on our results, we consider that during the last 50 years the MDP area has been used by SRWs fundamentally as a transit area to the breeding ground in Southern Brazil (SC) and to the southern feeding grounds after the southern breeding season at the end of the austral spring. The opportunistic sightings obtained during oceanographic campaigns and seismic surveys allowed us to conclude that SRWs off BAP are also migrating, both in a northerly and in a southerly direction, not only in the coastal zone but also in the continental shelf and on the edge of the continental slope.

The data presented in this study are the only available data of SRWs in the MDP area obtained during such a long period of time. This information has value for future monitoring of the species in the north of BAP and outside their breeding grounds, where most of the studies have concentrated. These results may help local authorities to regulate coastal fishing activities, shipping traffic, tourism and other coastal activities in the area and thereby contribute to the conservation of the species. This would also allow the Argentine Government, an active member of the Convention on Migratory Species (CMS), to report periodically on the conservation status and threats affecting the SRW on its migratory routes in Argentine waters.

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References

- Aguayo-Lobo A, Acevedo J, Brito JL, Olavarria C, Moraga R and Olave C (2008) La ballena franca del sur, *Eubalaena australis* (Desmoulins, 1822) en aguas chilenas: análisis de sus registros desde 1976 a 2008. *Revista de Biología Marina y Oceanografía* 43, 653–668.
- Arias M, Romero MA, Svendsen G, Curcio N, Jarra D, Coscarella M, Dans S, Crespo E and González R (2015) Current status of SRW *Eubalaena australis* in San Matías Gulf (Patagonia, Argentina) and results of experimental whale watching activities. *Scientific Committee Annual Meeting IWC SC/66b/WW/07*, pp. 1–19.
- Arias M, Coscarella M, Svendsen G, Romero MA, Curcio N, Sueyro N, Crespo E and González R (2017) Changes in the distribution and abundance of southern right whale *Eubalaena australis* in San Matías Gulf (Patagonia, Argentina). *Scientific Committee Annual Meeting IWC SC/67A/CMP/06*. pp. 1–14.
- Baker CS and Clapham PJ (2004) Modelling the past and future of whales and whaling. *Trends in Ecology & Evolution* 19, 365–371.
- Bannister J (2001) Status of southern right whales off Australia. *Journal of Cetacean Research and Management* (Special issue) 2, 103–110.
- Bastida R (1987) La Ballena Franca Austral: un recurso turístico peculiar. *Revista Patagónica VI* 29, 24–28.
- Bastida R and Lichtschein de Bastida V (1984) Informe preliminar sobre los estudios de ballena franca austral (*Eubalaena australis*) en la zona de Península Valdés (Chubut, Argentina). *Revista del Museo Argentino de Ciencias Naturales Bernardino Rivadavia (Serie Zoología)* 13, 197–210.
- Bastida R, Rodríguez D, Secchi ER and Da Silva VMF (2007) *Mamíferos Acuáticos de Sudamérica y Antártida*, 1ra. Edición. Buenos Aires: Vázquez Mazzini Press.
- Bastida R, Rodríguez D, Secchi ER and Da Silva VMF (2018) *Mamíferos Acuáticos América do Sul Antártica*, Primeira Edição em Português. Buenos Aires: Vázquez Mazzini Press.
- Belgrano J, Iñiguez M, Gibbons J, García C and Olavarria C (2008) South-west Atlantic right whales *Eubalaena australis* (Desmoulins, 1822) distribution nearby the Magellan Strait. *Anales del Instituto de la Patagonia* 36, 69–74.
- Best PB (2000) Coastal distribution, movements and site fidelity of right whales, *Eubalaena australis*, off South Africa, 1969–1998. *South African Journal of Marine Science* 22, 43–55.
- Best P, Brandão A and Butterworth DS (2001) Demographic parameters of southern right whales off South Africa. *Journal of Cetacean Research and Management* (Special issue) 2, 161–169.
- Chalcobsky BA, Crespo EA and Coscarella MA (2017) Whale-watching in Patagonia: what regulation scheme should be implemented when the socio-ecological system is changing? *Marine Policy* 75, 165–173.
- Cleveland RB, Cleveland WS, McRae JE and Terpenning I (1990) STL: a seasonal trend decomposition procedure based on loess. *Journal of Official Statistics* 6, 3–73.
- Cooke JG and Zerbini AN (2018) *Eubalaena australis*. The IUCN Red List of Threatened Species 2018: e.T8153A50354147. Available at <http://dx.doi.org/10.2305/IUCN.UK.2018-1.RLTS.T8153A50354147> (accessed 24 October 2018).
- Cooke J, Rowntree V and Payne R (2001) Estimates of demographic parameters for southern right whales (*Eubalaena australis*) observed off Península Valdés, Argentina. *Journal of Cetacean Research and Management* (Special issue) 2, 125–132.
- Cooke J, Rowntree V and Sironi M (2015) Southwest Atlantic right whales: interim updated population assessment from photo-id collected at Península Valdés, Argentina. *Scientific Committee Annual Meeting IWC SC/66a/BRG/23*, pp. 1–9.
- Costa P, Praderi R, Piedra M and Franco-Fraguas P (2005) Sightings of southern right whales, *Eubalaena australis*, off Uruguay. *Latin American Journal of Aquatic Mammals* 4, 181–185.

- Costa P, Piedra M, Franco P and Paez E (2007) Distribution and habitat use patterns of southern right whales, *Eubalaena australis*, off Uruguay. *Journal of Cetacean Research and Management* **9**, 45–51.
- Crespo EA, Pedraza SN, Dans SL, Coscarella MA, Svendsen GM and Degradi M (2014) Number of southern right whales *Eubalaena australis* and population trend in the neighborhood of Península Valdés during the period 1999–2013 by means of aerial and boat surveys. *Scientific Committee Annual Meeting IWC SC65B*, pp. 1–17.
- Crespo EA, Pedraza SN, Dans SL, Coscarella MA, Svendsen GM and Degradi M (2015) More whales *Eubalaena australis* growing at a decelerated speed. *Scientific Committee Annual Meeting IWC SC66*, pp. 1–20.
- Crespo EA, Pedraza SN, Dans SL, Svendsen GM, Degradi M and Coscarella MA (2019) The southwestern Atlantic southern right whale, *Eubalaena australis*, population is growing but at a decelerated rate. *Marine Mammal Science* **35**, 93–107.
- Danilewicz D, Moreno IB, Tavares M and Sucunza F (2016) Southern right whales (*Eubalaena australis*) off Torres, Brazil: group characteristics, movements, and insights into the role of the Brazilian–Uruguayan wintering ground. *Mammalia* **81**, 225–234.
- Failla M, Vermeulen E, Carabajal M, Arruda J, Godoy H, Lapa A, Mora G, Urrutia C, Balbiano A and Cammareri A (2008) Historical records of southern right whales (*Eubalaena australis*) of the province Rio Negro, North Patagonia, Argentina (1991–2008). *Scientific Committee Annual Meeting IWC SC/60/BRG1*, pp. 1–10.
- Fazio A, Bertelotti M and Villanueva C (2012) Kelp gulls attack southern right whales: a conservation concern? *Marine Biology* **159**, 1981–1990.
- Greig AB, Secchi ER, Zerbini AN and Rosa LD (2001) Stranding events of southern right whales, *Eubalaena australis*, in southern Brazil. *Journal of Cetacean Research and Management* **2**, 157–160.
- Groch K (2018) Conservation advances for the southern right whales in Brazil. In Rossi-Santos M and Finkl C (eds), *Advances in Marine Vertebrate Research in Latin America*, Vol. 22. Cham: Springer, pp. 441–474.
- Groch K, Palazzo Jr JT, Flores PAC, Adler FR and Fabian ME (2005) Recent rapid increases in the right whale (*Eubalaena australis*) population off southern Brazil. *Latin American Journal of Aquatic Mammals* **1**, 41–47.
- Iñiguez M, Belgrano J, Tomsin A, de Haro C, Gribaudo C and Tossenberger V (2003) Sighting and stranding of southern right whales (*Eubalaena australis*) off Santa Cruz, Patagonia Argentina (1986–2003). *Scientific Committee Annual Meeting IWC SC/55/BRG8*, pp. 1–55.
- Marón CF, Beltramino L, Di Martino M, Chirife A, Seger J, Uhart M, Sironi M and Rowntree VJ (2015) Increased wounding of southern right whale (*Eubalaena australis*) calves by kelp gulls (*Larus dominicanus*) at Península Valdés, Argentina. *PLoS ONE* **10**, e0139291, ISO 690.
- O'Connor S, Campbell R, Cortez H and Knowles T (2009) *Whale Watching Worldwide: Tourism Numbers, Expenditures and Expanding Economic Benefits*. Special Report from the International Fund for Animal Welfare 228. Prepared by Economists at Large, Yarmouth MA, USA. 205 pp.
- Ojeda R, Chillo V and Diaz G (2012) *Libro rojo de los mamíferos amenazados de la Argentina*. Sociedad Argentina para el Estudio de los Mamíferos (SAREM).
- Ott PH, Sucunza F, Wickert J, Danilewicz D and Tavares M (2017) Evidences of attack of a killer whale on a calf southern right whale. *Mastozoología Neotropical* **24**, 235–240.
- Payne R, Rowntree VJ, Perkins JS and Cooke J (1990) Updated estimate of population size, trends and reproductive parameters of right whale (*Eubalaena australis*) off Península Valdés, Argentina. *Report of the International Whaling Commission* (Special issue) **12**, 271–278.
- Piedra M, Costa P and Franco-Fraguas P (2006) Ballena franca *Eubalaena australis* en la costa atlántica uruguaya. In Menafrá R, Rodríguez Gallego L, Scarabino F and Conde D (eds), *Bases para la conservación y el manejo de la costa uruguaya*. Sociedad Uruguaya para la Conservación de la Naturaleza, pp. 585–590.
- R Core Team (2017) *R: A Language and Environment for Statistical Computing*. Vienna: R Foundation for Statistical Computing.
- Richards R (2002) Southern right whales: a reassessment of their former distribution and migration routes in New Zealand waters, including on the Kermadec grounds. *Journal of the Royal Society of New Zealand* **32**, 355–377.
- Richards R (2009) Past and present distributions of southern right whales (*Eubalaena australis*). *New Zealand Journal of Zoology* **36**, 447–459.
- Rowntree V, Payne R and Schell DM (2001) Changing patterns of habitat use by southern right whales (*Eubalaena australis*) on their nursery ground at Península Valdés, Argentina, and their long range movements. *Journal of Cetacean Research and Management* (Special issue) **2**, 133–143.
- Santos MC, Siciliano S, Pacheco de Souza S and Almayor Pizzorno JL (2001) Occurrence of southern right whale (*Eubalaena australis*) along southern Brazil. *Journal of Cetacean Research and Management* (Special issue) **2**, 153–156.
- Seyboth E, Groch KR, Dalla Rosa L, Reid K, Flores PAC and Secchi ER (2016) Southern right whale (*Eubalaena australis*) reproductive success is influenced by krill (*Euphausia superba*) density and climate. *Scientific Reports* **6**, 28205.
- Sironi M, López JC, Bubas R, Carribero A, García C, Harris G, Intrieri E, Iñiguez M and Payne R (2008) Predation by killer whales (*Orcinus orca*) on southern right whales (*Eubalaena australis*) off Patagonia, Argentina: effects on behavior and habitat choice. *Journal of Cetacean Research and Management* **29**, 1–18.
- Sironi M, Rowntree VJ, Snowdon CT, Valenzuela L and Marón C (2009) Kelp gulls (*Larus dominicanus*) feeding on southern right whales (*Eubalaena australis*) at Península Valdés, Argentina: updated estimates and conservation implications. *Scientific Committee Annual Meeting IWC SC/61/BRG19*, pp. 1–12.
- Townsend CH (1935) The distribution of certain whales as shown by logbook records of American whaleships. *Zoologica* **19**, 1–50.
- Tormosov DD, Mikhalev YA, Best PB, Zemsky VA, Sekiguchi K and Brownell Jr JL (1998) Soviet catches of southern right whales, *Eubalaena australis*, 1951–1971, biological data and conservation implications. *Biological Conservation* **86**, 185–197.
- Vermeulen E (2013) Abundance estimates of southern right whales (*Eubalaena australis*) in Bahía San Antonio, Patagonia Argentina. *Journal of Cetacean Research and Management* **13**, 47–51.
- Vermeulen E, Cammareri A and Holsbeek L (2012) Alteration of southern right whale (*Eubalaena australis*) behaviour by human-induced disturbance in Bahía San Antonio, Patagonia, Argentina. *Aquatic Mammals* **38**, 56–64.
- Zerbini A, Rosenbaum H, Mendez M, Sucunza F, Andriolo A, Harris G, Clapham P, Sironi M, Uhart M and Ajó A (2016) Tracking southern right whales through the southwest Atlantic: an update on movements, migratory routes and feeding grounds. *Scientific Committee Annual Meeting IWC SC/66a/BRG22*, pp. 1–10.
- Zerbini A, Fernandez Ajos A, Andriolo A, Clapham P, Crespo E and Gonzalez R (2018) Satellite tracking of southern right whales (*Eubalaena australis*) from Golfo San Matias, Rio Negro Province, Argentina. *Scientific Committee of the International Whaling Commission SC67b*, Bled, Slovenia.