

# Southern Right Whale (*Eubalaena australis*) 2015-2020

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## *Bibliography*

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## Table of Contents

Background & Scope .....	3
Sources Reviewed .....	3
Section I: Biology.....	4
Section II: Ecology .....	9
Section III: Population Abundance.....	24
Section IV: Threats .....	40
Section V: General Overview .....	55

## **Background & Scope**

The southern right whale is wide-ranging throughout the Southern hemisphere. Additionally, a preliminary examination of the literature shows that a lot of research has been done on this cetacean since the 2015 5-year review. This bibliography focuses on any relevant southern right whale literature (peer-reviewed, technical reports, memos, biological opinions, International Whaling Commission (IWC) reports, etc.) since April 2015. It is intended as a reference resource for staff of the NOAA Fisheries Office of Protected Resources when compiling and summarizing any relevant new (i.e. 2015-present) information for this cetacean species. It is organized into four sections: Biology, Ecology, Population Abundance and Trends, and Threats.

### **Section I – Biology**

Section one is intended to provide an overview of new information since 2015 on the biology of the southern right whale. The research in this area includes a compilation of literature on lifespan, metabolism, reproduction, genetics, and body size.

### **Section II – Ecology**

Section two is intended to provide an overview of ecology for the southern right whale. The research in this area includes migration, feeding, acoustics, behavior, and social ecology.

### **Section III – Population Abundance**

Section three is intended to provide an overview of the latest population estimates (since 2015) for the southern right whale.

### **Section IV – Threats**

A threat is defined as any factor that could represent an impediment to a species' recovery. Thus, section four is intended to provide an overview of any new and/or existing threats to the southern right whale. This may include anthropogenic noise, shipping, and climate change, as well as current conservation efforts related to the southern right whale.

### **Section V – General Overview**

Section five is literature that gives a generalized overview on southern right whales and factors surrounding their feeding, migration and general life history.

## **Sources Reviewed**

The following databases were used to identify sources: Clarivate Analytics' Web of Science: Science Citation Index Expanded and Social Science Index; International Whaling Commission (IWC); IUCN Red List of Threatened Species; ProQuest's Science and Technology including Aquatic Science Fisheries Abstracts; Elsevier's Science Direct; JSTOR; EBSCO's Academic Search Complete and Environment Complete; NOAA's Institutional Repository; the Biodiversity Heritage Library; BioOne Complete; and Google Scholar.

## Section I: Biology

Berta, A., Sumich, J. L., & Kovacs, K. M. (2015). Chapter 4 - Cetacean Evolution and Systematics. In *Marine Mammals (Third Edition)*. A. Berta, J. L. Sumich, & K. M. Kovacs (Eds.), (pp. 63-101). San Diego: Academic Press <https://doi.org/10.1016/B978-0-12-397002-2.00004-1>

Cetaceans (whales, dolphins, and porpoises), which include the majority of marine mammals, are defined using anatomical characters. The affinities, origin, and diversification of both stem and crown cetaceans (odontocetes or toothed whales and mysticetes or baleen whales) are reviewed. New discoveries of fossil whales provide compelling evidence for both their evolutionary connections as well as the evolutionary transformation from a terrestrial to a fully aquatic existence.

Berta, A., Sumich, J. L., & Kovacs, K. M. (2015). Chapter 7 - Integumentary and Sensory Systems. In *Marine Mammals (Third Edition)*. A. Berta, J. L. Sumich, & K. M. Kovacs (Eds.), (pp. 169-210). San Diego: Academic Press <https://doi.org/10.1016/B978-0-12-397002-2.00007-7>

This chapter summarizes the functional anatomy and physiology of the integumentary and sensory systems of marine mammals. The review of the integumentary system includes description of components of the system (i.e., skin, hair, glands, vibrissae, and claws). Discussion of the nervous system highlights how relative brain size is measured (and what it means) and how enlargements of different segments of the spinal cord are correlated with different patterns of locomotion. Similarities and differences among marine mammals with respect to the development of the visual, olfactory, and taste sensory systems are also described in this chapter.

Berta, A., Sumich, J. L., & Kovacs, K. M. (2015). Chapter 9 - Energetics. In *Marine Mammals (Third Edition)*. A. Berta, J. L. Sumich, & K. M. Kovacs (Eds.), (pp. 269-297). San Diego: Academic Press <https://doi.org/10.1016/B978-0-12-397002-2.00009-0>

The focus of this chapter is marine mammal energetics, major patterns of energy expenditure including basal metabolism, thermoregulation, swimming, and osmoregulation. Studies of energy allocation provide data that can be used to elucidate the evolution of physiological adaptations to the challenges of their existence in seawater. Benefits are typically expressed as improved performance or as additional tissue building, either through growth or reproduction.

Buono, M. R., Fernandez, M. S., Fordyce, R. E., & Reidenberg, J. S. (2015). Anatomy of Nasal Complex in the Southern Right Whale, *Eubalaena australis* (Cetacea, Mysticeti). *Journal of Anatomy*, 226(1), 81-92 <https://doi.org/10.1111/joa.12250>

The nasal region of the skull has undergone dramatic changes during the course of cetacean evolution. In particular, mysticetes (baleen whales) conserve the nasal mammalian pattern associated with the secondary function of olfaction, and lack the sound-producing specializations present in odontocetes (toothed whales, dolphins and porpoises). To improve our understanding of the morphology of the nasal region of mysticetes, we investigate the nasal anatomy, osteology and myology of the southern right whale, *Eubalaena australis*, and make comparisons with other mysticetes. In *E. australis* external deflection surfaces around the blowholes appear to divert water off the head, and differ in appearance from those observed in balaenopterids, eschrichtiids and cetotherids. In *E. australis* the blowholes are placed above hypertrophied nasal soft tissues formed by fat and nasal muscles, a pattern also observed in balaenopterids (rorqual mysticetes) and a cetotherid (pygmy right whale, *Caperea marginata*).

Blowhole movements are due to the action of five nasofacial muscles: dilator naris superficialis, dilator naris profundus, depressor alae nasi, constrictor naris, and retractor alae nasi. The dilator naris profundus found in *E. australis* has not been previously reported in balaenopterids. The other nasofacial muscles have a similar arrangement in balaenopterids, with minor differences. A novel structure, not reported previously in any mysticete, is the presence of a vascular tissue (rete mirabile) covering the lower nasal passage. This vascular tissue could play a role in warming inspired air, or may engorge to accommodate loss of respiratory space volume due to gas compression from increased pressure during diving.

Carroll, E. L., Baker, C. S., Watson, M., Alderman, R., Bannister, J., Gaggiotti, O. E., . . . Harcourt, R. (2015). Cultural Traditions across a Migratory Network Shape the Genetic Structure of Southern Right Whales around Australia and New Zealand. *Scientific Reports*, 5  
<https://doi.org/10.1038/srep16182>

Fidelity to migratory destinations is an important driver of connectivity in marine and avian species. Here we assess the role of maternally directed learning of migratory habitats, or migratory culture, on the population structure of the endangered Australian and New Zealand southern right whale. Using DNA profiles, comprising mitochondrial DNA (mtDNA) haplotypes (500 bp), microsatellite genotypes (17 loci) and sex from 128 individually-identified whales, we find significant differentiation among winter calving grounds based on both mtDNA haplotype ( $F_{ST} = 0.048$ ,  $\Phi_{ST} = 0.109$ ,  $p < 0.01$ ) and microsatellite allele frequencies ( $F_{ST} = 0.008$ ,  $p < 0.01$ ), consistent with long-term fidelity to calving areas. However, most genetic comparisons of calving grounds and migratory corridors were not significant, supporting the idea that whales from different calving grounds mix in migratory corridors. Furthermore, we find a significant relationship between delta C-13 stable isotope profiles of 66 Australian southern right whales, a proxy for feeding ground location, and both mtDNA haplotypes and kinship inferred from microsatellite-based estimators of relatedness. This indicates migratory culture may influence genetic structure on feeding grounds. This fidelity to migratory destinations is likely to influence population recovery, as long-term estimates of historical abundance derived from estimates of genetic diversity indicate the South Pacific calving grounds remain at <10% of prewhaling abundance.

Carroll, E. L., Ott, P. H., McMillan, L. F., Galletti Vernazzani, B., Neveceralova, P., Vermeulen, E., . . . Jackson, J. A. (2020). Genetic Diversity and Connectivity of Southern Right Whales (*Eubalaena australis*) Found in the Brazil and Chile-Peru Wintering Grounds and the South Georgia (Islas Georgias Del Sur) Feeding Ground. *Journal of Heredity*, 111(3), 263-276  
<https://doi.org/10.1093/jhered/esaa010>

As species recover from exploitation, continued assessments of connectivity and population structure are warranted to provide information for conservation and management. This is particularly true in species with high dispersal capacity, such as migratory whales, where patterns of connectivity could change rapidly. Here we build on a previous long-term, large-scale collaboration on southern right whales (*Eubalaena australis*) to combine new (nnew) and published (npub) mitochondrial (mtDNA) and microsatellite genetic data from all major wintering grounds and, uniquely, the South Georgia (Islas Georgias del Sur: SG) feeding grounds. Specifically, we include data from Argentina (npub mtDNA/microsatellite = 208/46), Brazil (nnew mtDNA/microsatellite = 50/50), South Africa (nnew mtDNA/microsatellite = 66/77, npub mtDNA/microsatellite = 350/47), Chile-Peru (nnew mtDNA/microsatellite = 1/1), the Indo-Pacific (npub mtDNA/microsatellite = 769/126), and SG (npub mtDNA/microsatellite = 8/0, nnew mtDNA/microsatellite = 3/11) to investigate the position of previously unstudied habitats in the migratory network: Brazil, SG, and Chile-Peru. These new genetic

data show connectivity between Brazil and Argentina, exemplified by weak genetic differentiation and the movement of 1 genetically identified individual between the South American grounds. The single sample from Chile-Peru had an mtDNA haplotype previously only observed in the Indo-Pacific and had a nuclear genotype that appeared admixed between the Indo-Pacific and South Atlantic, based on genetic clustering and assignment algorithms. The SG samples were clearly South Atlantic and were more similar to the South American than the South African wintering grounds. This study highlights how international collaborations are critical to provide context for emerging or recovering regions, like the SG feeding ground, as well as those that remain critically endangered, such as Chile-Peru. © The American Genetic Association 2020.

Christiansen, F., Sironi, M., Moore, M. J., Di Martino, M., Ricciardi, M., Warick, H. A., . . . Uhart, M. M. (2019). Estimating Body Mass of Free-Living Whales Using Aerial Photogrammetry and 3d Volumetrics. *Methods in Ecology and Evolution*, 10(12), 2034-2044  
<https://doi.org/10.1111/2041-210x.13298>

Body mass is a key life-history trait in animals. Despite being the largest animals on the planet, no method currently exists to estimate body mass of free-living whales. We combined aerial photographs and historical catch records to estimate the body mass of free-living right whales (*Eubalaena* sp.). First, aerial photogrammetry from unmanned aerial vehicles was used to measure the body length, width (lateral distance) and height (dorso-ventral distance) of free-living southern right whales (*Eubalaena australis*; 48 calves, seven juveniles and 31 lactating females). From these data, body volume was estimated by modelling the whales as a series of infinitely small ellipses. The body girth of the whales was next calculated at three measurement sites (across the pectoral fin, the umbilicus and the anus) and a linear model was developed to predict body volume from the body girth and length data. To obtain a volume-to-mass conversion factor, this model was then used to estimate the body volume of eight lethally caught North Pacific right whales (*Eubalaena japonica*), for which body mass was measured. This conversion factor was consequently used to predict the body mass of the free-living whales. The cross-sectional body shape (height-width ratio) of the whales was slightly flattened dorso-ventrally at the anterior end of the body, almost circular in the mid region, and significantly flattened in the lateral plane across the posterior half of the body. Compared to a circular cross-sectional model, our body mass model incorporating body length, width and height improved mass estimates by up to 23.6% (mean = 6.1%, SD = 5.27). Our model had a mean error of only 1.6% (SD = 0.012), compared to 9.5% (SD = 7.68) for a simpler body length-to-mass model. The volume-to-mass conversion factor was estimated at 754.63 kg/m<sup>3</sup> (SD = 50.03). Predicted body mass estimates were within a close range of existing body mass measurements. We provide a non-invasive method to accurately estimate body mass of free-living whales while accounting for both their structural size (body length) and relative body condition (body width). Our approach can be directly applied to other marine mammals by adjusting the model parameters (body mass model script provided).

Christiansen, F., Vivier, F., Charlton, C., Ward, R., Amerson, A., Burnell, S., & Bejder, L. (2018). Maternal Body Size and Condition Determine Calf Growth Rates in Southern Right Whales. *Marine Ecology Progress Series*, 592, 267-281 <https://doi.org/10.3354/meps12522>

The cost of reproduction is a key parameter determining a species' life history strategy. Despite exhibiting some of the fastest offspring growth rates among mammals, the cost of reproduction in baleen whales is largely unknown since standard field metabolic techniques cannot be applied. We quantified the cost of reproduction for southern right whales *Eubalaena australis* over a 3 mo breeding season. We did this by determining the relationship between calf growth rate and maternal rate of loss

in energy reserves, using repeated measurements of body volume obtained from unmanned aerial vehicle photogrammetry. We recorded 1118 body volume estimates from 40 female and calf pairs over 40 to 89 d. Calves grew at a rate of  $3.2 \text{ cm d}^{-1}$  (SD = 0.45) in body length and  $0.081 \text{ m}^3 \text{ d}^{-1}$  (SD = 0.011) in body volume, while females decreased in volume at a rate of  $0.126 \text{ m}^3 \text{ d}^{-1}$  (SD = 0.036). The average volume conversion efficiency from female to calf was 68% (SD = 16.91). The average volume conversion efficiency from female to calf was 68% (SD = 16.91). Calf growth rate was positively related to the rate of loss in maternal body volume, suggesting that maternal volume loss is proportional to the energy investment into her calf. Maternal investment was determined by her body size and condition, with longer and more rotund females investing more volume into their calves compared to shorter and leaner females. Lactating females lost on average 25% of their initial body volume over the 3 mo breeding season. This study demonstrates the considerable energetic cost that females face during the lactation period, and highlights the importance of sufficient maternal energy reserves for reproduction in this capital breeding species.

Cubaynes, H. C., Fretwell, P. T., Bamford, C., Gerrish, L., & Jackson, J. A. (2019). Whales from Space: Four Mysticete Species Described Using New VHR Satellite Imagery. *Marine Mammal Science*, 35(2), 466-491 <https://doi.org/10.1111/mms.12544>

Large-bodied animals such as baleen whales can now be detected with very high resolution (VHR) satellite imagery, allowing for scientific studies of whales in remote and inaccessible areas where traditional survey methods are limited or impractical. Here we present the first study of baleen whales using the WorldView-3 satellite, which has a maximum spatial resolution of 31 cm in the panchromatic band, the highest currently available to nonmilitary professionals. We manually detected, described, and counted four different mysticete species: fin whales (*Balaenoptera physalus*) in the Ligurian Sea, humpback whales (*Megaptera novaeangliae*) off Hawaii, southern right whales (*Eubalaena australis*) off Península Valdés, and gray whales (*Eschrichtius robustus*) in Laguna San Ignacio. Visual and spectral analyses were conducted for each species, their surrounding waters, and nonwhale objects (e.g., boats). We found that behavioral and morphological differences made some species more distinguishable than others. Fin and gray whales were the easiest to discern due to their contrasting body coloration with surrounding water, and their prone body position, which is proximal to the sea surface (i.e., body parallel to the sea surface). These results demonstrate the feasibility of using VHR satellite technology for monitoring the great whales.

Eroh, G. D., Clayton, F. C., Florell, S. R., Cassidy, P. B., Chirife, A., Marón, C. F., . . . Leachman, S. A. (2017). Cellular and Ultrastructural Characterization of the Grey-Morph Phenotype in Southern Right Whales (*Eubalaena australis*). *Plos One*, 12(2) <https://doi.org/10.1371/journal.pone.0171449>

Southern right whales (SRWs, *Eubalena australis*) are polymorphic for an X-linked pigmentation pattern known as grey morphism. Most SRWs have completely black skin with white patches on their bellies and occasionally on their backs; these patches remain white as the whale ages. Grey morphs (previously referred to as partial albinos) appear mostly white at birth, with a splattering of rounded black marks; but as the whales age, the white skin gradually changes to a brownish grey color. The cellular and developmental bases of grey morphism are not understood. Here we describe cellular and ultrastructural features of grey-morph skin in relation to that of normal, wild-type skin. Melanocytes were identified histologically and counted, and melanosomes were measured using transmission electron microscopy. Grey-morph skin had fewer melanocytes when compared to wild-type skin, suggesting reduced melanocyte survival, migration, or proliferation in these whales. Grey-morph melanocytes had smaller melanosomes relative to wild-type skin, normal transport of melanosomes to

surrounding keratinocytes, and normal localization of melanin granules above the keratinocyte nuclei. These findings indicate that SRW grey-morph pigmentation patterns are caused by reduced numbers of melanocytes in the skin, as well as by reduced amounts of melanin production and/or reduced sizes of mature melanosomes. Grey morphism is distinct from piebaldism and albinism found in other species, which are genetic pigmentation conditions resulting from the local absence of melanocytes, or the inability to synthesize melanin, respectively.

Kohl, K. D., Maron, C. F., Chirife, A., Di Martino, M., Dearing, M. D., & Rowntree, V. J. (2015). Intestinal Lactase Activity in Southern Right Whale Calves (*Eubalaena australis*). *Marine Mammal Science*, 31(1), 398-403 <https://doi.org/10.1111/mms.12155>

No abstract.

Loch, C., Vaz Viegas, S., Waddell, J. N., Kemper, C., Cook, R. B., & Werth, A. J. (2020). Structure and Properties of Baleen in the Southern Right (*Eubalaena australis*) and Pygmy Right Whales (*Caperea marginata*). *Journal of the Mechanical Behavior of Biomedical Materials*, 110, 103939 <https://doi.org/10.1016/j.jmbbm.2020.103939>

Baleen is a resilient and keratinised filter-feeding structure attached to the maxilla of mysticete whales. It is strong and tough, yet a pliant and resilient material, that withstands extreme pressures in the oral cavity during feeding. We investigated the structure, water content, wettability and mechanical properties of baleen of the Southern right (SRW) and Pygmy right whales (PRW), to understand the effects of hydration on the physical and mechanical properties of baleen. Sixty 25 × 15mm baleen subsamples were prepared from one individual of SRW and PRW. Half were hydrated in circulated natural seawater for 21 days and half were dry. Water content analysis showed that SRW baleen was 21.2% water weight and PRW was 26.1%. Wettability testing indicated that surfaces of both hydrated and dried SRW and PRW baleen were hydrophilic, with hydrated samples of both species having lower contact angle values. For the SRW, the average contact angle of hydrated baleen was 40° ± 13.2 and 73° ± 6 for dried samples. Hydrated PRW baleen had an average contact angle of 44° ± 15.3, which was lower than in dried samples (74° ± 2.9). Three-point bending mechanical tests showed that the average maximum flexural stress of dried SRW (134.1 ± 34.3 MPa) and PRW samples (117.8 ± 22.3 MPa) were significantly higher than those of hydrated SRW (25.7 ± 6.3 MPa) and PRW (19.7 ± 4.8 MPa) baleen. Scanning electron microscope images showed the stratification of the outer cortical layer, with cross-linked keratin fibres observed within and between baleen keratin sheets. Hydrated baleen, as in its natural and functional behaviour, has greater flexibility and strength, attributes necessary for the complex filter feeding mechanism characteristic of whales. Hydration must be considered when addressing the physical and mechanical properties of baleen, especially when using dried museum specimens.

Marón, C. F., Budge, S. M., Ward, R. E., Valenzuela, L. O., Martino, M. D., Ricciardi, M., . . . Rowntree, V. J. (2020). Fatty Acids and Stable Isotopes ( $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$ ) in Southern Right Whale *Eubalaena australis* Calves in Relation to Age and Mortality at Península Valdés, Argentina. *Marine Ecology Progress Series*, 646, 189 <https://doi.org/10.3354/meps13387>

Baleen whales accumulate fat reserves during the summer to sustain reproduction while fasting in the winter. The southern right whale *Eubalaena australis* population that calves off Península Valdés, Argentina, experienced high calf mortality events from 2003 to 2013 and poor nutritional states of mothers could be a contributing cause. Previous studies found that the population's reproductive



success is influenced by prey availability. Mothers unable to build sufficient fat reserves or feeding on prey with different nutritional value may fail to meet the demands of lactation. Milk is the only source of nutrients and energy for calves at Valdés, so their fatty acids (FAs) and stable isotopes should reflect their mother's diet and feeding-ground locations. Here, we compared FA profiles and C and N stable isotopes of dead calves with those of living calves to evaluate the potential impact of maternal nutrition on calf survival. We found no differences in the FA composition of blubber in dead and living calves, indicating similar maternal diets. Likewise, the isotopic values of living and dead calves imply that their mothers had similar foraging ranges. However, FA composition was greatly affected by calf length, indicating effects of calf age and duration of nursing. These findings suggest that mothers of dead calves did not feed on different diets or feeding grounds compared to mothers of living calves. Future research should further assess the overall health and body condition of the Valdés southern right whale calves.

Mourlam, M. J., & Orliac, M. J. (2017). Infrasonic and Ultrasonic Hearing Evolved after the Emergence of Modern Whales. *Current Biology*, 27(12), 1776-1781.e1779  
<https://doi.org/10.1016/j.cub.2017.04.061>

Mysticeti (baleen whales) and Odontoceti (toothed whales) today greatly differ in their hearing abilities: Mysticeti are presumed to be sensitive to infrasonic noises [1, 2, 3], whereas Odontoceti are sensitive to ultrasonic sounds [4, 5, 6]. Two competing hypotheses exist regarding the attainment of hearing abilities in modern whales: ancestral low-frequency sensitivity [7, 8, 9, 10, 11, 12, 13] or ancestral high-frequency sensitivity [14, 15]. The significance of these evolutionary scenarios is limited by the undersampling of both early-diverging cetaceans (archaeocetes) and terrestrial hoofed relatives of cetaceans (non-cetacean artiodactyls). Here, we document for the first time the bony labyrinth, the hollow cavity housing the hearing organ, of two species of protocetid whales from Lutetian deposits (ca. 46–43 Ma) of Kpogamé, Togo. These archaeocete cetaceans, which are transitional between terrestrial and aquatic forms, prove to be a key for determining the hearing abilities of early whales. We propose a new evolutionary picture for the early stages of this history, based on qualitative and quantitative studies of the cochlear morphology of an unparalleled sample of extant and extinct land artiodactyls and cetaceans. Contrary to the hypothesis that archaeocetes have been more sensitive to high-frequency sounds than their terrestrial ancestors [15], we demonstrate that early cetaceans presented a cochlear functional pattern close to that of their terrestrial relatives, and that specialization for infrasonic or ultrasonic hearing in Mysticeti or Odontoceti, respectively, instead only occurred in fully aquatic whales, after the emergence of Neoceti (Mysticeti+Odontoceti).

## Section II: Ecology

Argüelles, M. B., Fazio, A., Fiorito, C., Pérez-Martínez, D., Coscarella, M., & Bertellotti, M. (2016). Diving Behavior of Southern Right Whales (*Eubalaena australis*) in a Maritime Traffic Area in Patagonia, Argentina. *Aquatic Mammals*, 42(1), 104-108 <https://doi.org/10.1578/AM.42.1.2016.104>

Southern right whales (*Eubalaena australis*) come to the Peninsula Valdes coast in early June to mate and give birth to their calves, remaining in the area until mid-December. Peninsula Valdes is internationally known as one of the most important breeding areas for this species in the southwestern Atlantic Ocean. While recovering from its near extinction, the southern right whale population at Peninsula Valdes is growing at an annual rate of 6.9%. The whales surprisingly have left areas with minimum human disturbance and moved to areas with high levels of human activities close to Puerto Madryn city. They are currently concentrated around harbors and areas for water sports, vessel traffic,

whale-watching activities, and recreational use. Due to the increase in the number of southern right whales, the use of areas near the cities, and the reports of whales diving in relatively deep waters in the areas used by ships, an increase in the probability of collisions is expected.

Arias, M., Coscarella, M. A., Romero, M. A., Sueyro, N., Svendsen, G. M., Crespo, E. A., & Gonzalez, R. A. C. (2018). Southern Right Whale *Eubalaena australis* in Golfo San Matias (Patagonia, Argentina): Evidence of Recolonisation. *Plos One*, 13(12) <https://doi.org/10.1371/journal.pone.0207524>

Since the 1980s, the distribution range of the southern right whale (*Eubalaena australis*) in Argentina was mostly located in the winter calving grounds around Peninsula Valdes. After the international moratorium that forbade the commercial hunting, southern right whales have shown signs of recovery during the last few decades. Nowadays, it is thought that the species is experiencing a density-dependent process while expanding its distribution range in Patagonia. From 2007 to 2016, data on right whale distribution, group composition and relative abundance were collected in Golfo San Matias, Patagonia through aerial surveys. Generalized linear models with a negative binomial error distribution were used to determine the population trend of right whales in this area. In addition, the group composition and the relative abundance of right whales among the northern Patagonian gulfs were compared. Finally, a literature review was conducted to assess the historical presence of right whales in Golfo San Matias, revealing the presence of right whales in Golfo San Matias during and after the commercial exploitation. During aerial surveys (2007-2016), right whales were observed from August to October in the area, with a peak in late August-early September. Our results suggested a geographic distribution change with a regular use of the northwest coast of the gulf in recent years and a positive trend in the population growth rate inside Golfo San Matias. This area was dominated by unaccompanied whales (solitary individuals and breeding groups) as opposed to Peninsula Valdes where the dominant group type was the mother calf pairs. Therefore, Golfo San Matias appears to be important for socializing and mating but not as a nursery ground. In addition, the density of whales was four times greater in the gulfs of Peninsula Valdes. Our findings contribute to a better understanding of the recovery of this species in Patagonia, Argentina and should be considered for the management measures for right whales in this region.

Bailleul, F., Carroll, E. L., Baker, C. S., Boren, L., Carlyon, K., Donnelly, D. M., . . . Childerhouse, S. J. (2020). Satellite Derived Offshore Migratory Movements of Southern Right Whales (*Eubalaena australis*) from Australian and New Zealand Wintering Grounds. *Plos One*, 15(5) <https://doi.org/10.1371/journal.pone.0231577>

Southern right whales (*Eubalaena australis*) migrate between Austral-winter calving and socialising grounds to offshore mid- to high latitude Austral-summer feeding grounds. In Australasia, winter calving grounds used by southern right whales extend from Western Australia across southern Australia to the New Zealand sub-Antarctic Islands. During the Austral-summer these whales are thought to migrate away from coastal waters to feed, but the location of these feeding grounds is only inferred from historical whaling data. We present new information on the satellite derived offshore migratory movements of six southern right whales from Australasian wintering grounds. Two whales were tagged at the Auckland Islands, New Zealand, and the remaining four at Australian wintering grounds, one at Pirates Bay, Tasmania, and three at Head of Bight, South Australia. The six whales were tracked for an average of 78.5 days (range: 29 to 150) with average individual distance of 38 km per day (range: 20 to 61 km). The length of individually derived tracks ranged from 645–6,381 km. Three likely foraging grounds were identified: south-west Western Australia, the Subtropical Front, and Antarctic waters, with the Subtropical Front appearing to be a feeding ground for both New Zealand and Australian

southern right whales. In contrast, the individual tagged in Tasmania, from a sub-population that is not showing evidence of post-whaling recovery, displayed a distinct movement pattern to much higher latitude waters, potentially reflecting a different foraging strategy. Variable population growth rates between wintering grounds in Australasia could reflect fidelity to different quality feeding grounds. Unlike some species of baleen whale populations that show movement along migratory corridors, the new satellite tracking data presented here indicate variability in the migratory pathways taken by southern right whales from Australia and New Zealand, as well as differences in potential Austral summer foraging grounds. PMID:32380516

Best, P. B., Elwen, S. H., Palsboll, P. J., Thornton, M., Austin, E., & Vinding, K. (2015). Possible Non-Offspring Nursing in the Southern Right Whale, *Eubalaena australis*. *Journal of Mammalogy*, 96(2), 405-416 <https://doi.org/10.1093/jmammal/gyv042>

During the austral winter, adult female southern right whales *Eubalaena australis* enter the South African coastal waters to give birth and raise their young. Most births take place over a 4-month period, when the females congregate in specific coastal areas or nursery grounds for up to a recorded maximum of 105 days. At this time, the density of cow-calf pairs in nursery areas can reach as high as 3.2 pairs/km<sup>2</sup> over 26 km of coastline. Although a single young is born and suckled exclusively for 7 months to a year, recent observations on nursery grounds include 3 incidents where apparently abandoned/orphaned calves-of-the-year have been seen associating with a minimum of 2-3 different cow-calf pairs over periods of 11-38 days. Attempts to suckle from these females have been noted in 2 of the cases, with the response of the female varying from extreme avoidance to apparent tolerance. In one instance where the observations of the same trio extended over 21 days, the non-offspring appeared to compete at least equally with the offspring, even though the mother directed her evasive tactics more at the non-offspring than her own calf. At the same time, both of the calves exhibited some growth in length when compared with the size of the adult female: their subsequent survival is unknown. Non-offspring nursing in monotonous species is generally rare, and the costs to the female potentially high: this is certainly the case for seasonally feeding mysticetes such as the right whale, where the costs of lactation cannot be recovered until the cow resumes feeding about 4 months after parturition. Hence, it is perhaps not surprising that these are the first recorded observations of contemporaneous nursing attempts by offspring and non-offspring calves of any mysticete.

Carroll, E. L., Fewster, R. M., Childerhouse, S. J., Patenaude, N. J., Boren, L., & Baker, C. S. (2016). First Direct Evidence for Natal Wintering Ground Fidelity and Estimate of Juvenile Survival in the New Zealand Southern Right Whale *Eubalaena australis*. *Plos One*, 11(1) <https://doi.org/10.1371/journal.pone.0146590>

Juvenile survival and recruitment can be more sensitive to environmental, ecological and anthropogenic factors than adult survival, influencing population-level processes like recruitment and growth rate in long-lived, iteroparous species such as southern right whales. Conventionally, Southern right whales are individually identified using callosity patterns, which do not stabilise until 6-12 months, by which time the whale has left its natal wintering grounds. Here we use DNA profiling of skin biopsy samples to identify individual Southern right whales from year of birth and document their return to the species' primary wintering ground in New Zealand waters, the Subantarctic Auckland Islands. We find evidence of natal fidelity to the New Zealand wintering ground by the recapture of 15 of 57 whales, first sampled in year of birth and available for subsequent recapture, during winter surveys to the Auckland Islands in 1995-1998 and 2006-2009. Four individuals were recaptured at the ages of 9 to 11, including two females first sampled as calves in 1998 and subsequently resampled as cows with calves in 2007. Using

these capture-recapture records of known-age individuals, we estimate changes in survival with age using Cormack-Jolly-Seber models. Survival is modelled using discrete age classes and as a continuous function of age. Using a bootstrap method to account for uncertainty in model selection and fitting, we provide the first direct estimate of juvenile survival for this population. Our analyses indicate a high annual apparent survival for juveniles at between 0.87 (standard error (SE) 0.17, to age 1) and 0.95 (SE 0.05: ages 2-8). Individual identification by DNA profiling is an effective method for long-term demographic and genetic monitoring, particularly in animals that change identifiable features as they develop or experience tag loss over time.

Charlton, C., Ward, R., McCauley, R. D., Brownell, R. L., Guggenheimer, S., Kent, C. P. S., & Bannister, J. L. (2019). Southern Right Whales (*Eubalaena australis*) Return to a Former Wintering Calving Ground: Fowlers Bay, South Australia. *Marine Mammal Science*, 35(4), 1438-1462  
<https://doi.org/10.1111/mms.12611>

Southern right whales (SRW), *Eubalaena australis*, have reoccupied historically important winter habitat ranges (calving grounds) in recent years along the southern Australian coast. Here we present findings of increased abundance of SRW at Fowlers Bay, South Australia, a previous shore-based whaling station. This study investigates: SRW inter- and intraseasonal trends in relative abundance; changes to the relative proportion of the southwestern subpopulation represented by SRW at Fowlers Bay; distribution; and occupancy. Sighting and photo identification data were collected during annual aerial (1993-2016) and vessel surveys (2014-2016). The total number of female and calf pairs was 3 during 1993-2003 and 63 during 2004-2014. Despite high variability in annual relative abundance, the rate of mean increase from 1993 to 2016 (29.0%/yr, 95% CI = 0, 54.2) exceeded the maximum biological rate for the species (6%-7%/yr). Peak relative abundance was recorded in July and August. SRW at Fowlers Bay represent an increasing proportion of the southwestern subpopulation (range = 0.9%-7.4%). Mean occupancy was 23 d (range = 1-75) for female and calf pairs and 2 d (range = 1-15) for unaccompanied adults. Reduced sightings in 2015 and 2016 demonstrate plasticity in SRW abundance at Fowlers Bay. Research into the movement and connectivity of SRW is needed to understand drivers of habitat dispersal in Australia.

D'Agostino, V. C., Degradi, M., Santinelli, N., Sastre, V., Dans, S. L., & Hoffmeyer, M. S. (2018). The Seasonal Dynamics of Plankton Communities Relative to the Foraging of the Southern Right Whale (*Eubalaena australis*) in Northern Patagonian Gulfs, Península Valdés, Argentina. *Continental Shelf Research*, 164, 45-57 <https://doi.org/10.1016/j.csr.2018.06.003>

This is the first exploratory study that addresses simultaneously the phytoplankton and mesozooplankton seasonal dynamics associated with some environmental factors in the northern Patagonian gulfs: Golfo Nuevo (GN) and Golfo San José (GSJ), Argentina, during an annual cycle (December 2014–2015 and January 2015–2016, respectively). It also reports data on mesozooplankton composition and abundance in a sample collected while southern right whales (*Eubalaena australis*) were feeding at the sea surface in Bahía Pirámide (GN). The phytoplankton community was represented by 69 taxa in GN and by 83 taxa in GSJ. In GN, phytoplankton was mainly dominated by diatoms and dinoflagellates whereas in GSJ diatoms dominated the phytoplankton community throughout the year. In GN, the highest phytoplankton biomass and density values were registered during austral spring, 2015 which coincided with a *Pseudo-nitzschia australis* bloom. In contrast, the lowest biomass values, which were associated with elevated abundances of dinoflagellates, were observed in late spring 2014. In GSJ, the highest biomass values showed two equal peaks in austral autumn and spring 2015. The latter was associated with the maximum cell density recorded in this gulf during a *Chaetoceros debilis* bloom. In contrast, the lowest biomass values were recorded in winter 2015. Mesozooplankton was

represented by 63 taxa in GN and by 61 taxa in GSJ. In GN, this community was mainly represented by cladocerans and copepods, whereas it was dominated by copepods in GSJ. The lowest mesozooplankton abundances were recorded in austral winter in both gulfs. In GN, the highest abundances were recorded in austral summer and spring 2015, whereas in GSJ, the maximum mesozooplankton abundances were observed during austral summer and autumn 2015. The major prey items for *E. australis* were the copepods *Calanoides carinatus*, *Ctenocalanus vanus*, *Calanus australis*, and *Paracalanus parvus*, zoeae of the squat lobster *Munida gregaria*, calyptopis and furcilia of *Euphausia lucens*, and fish eggs and larvae. In both gulfs, the warm seasons were mainly characterized by higher relative abundances of diatoms, while the cold seasons were mostly associated with higher abundances of dinoflagellates and Dictyochophyceae. Salinity and phaeopigments were related with copepod and appendicularian abundances, whereas surface sea water temperature seemed to modulate the seasonal distribution pattern of cladocerans and decapods.

D'Agostino, V. C., Fioramonti, A., Varsky, F., Campos, C., Goity, J. M., & Degradi, M. (2017).

Nonreproductive Sexual Behavior in Baleen Whales: Sexual Harassment by an Adult Male on a Calf in Southern Right Whales (*Eubalaena australis*). *Aquatic Mammals*, 43(2), 213-218  
<https://doi.org/10.1578/AM.43.2.2017.213>

Nonreproductive sexual behaviour occurs between individuals whose age and sex present no possibility of conception such as female-female, male-male, immature-adult, or immature-immature interactions. Sexual interactions between individuals of the same sex have been documented for a wide range of species. Peninsula Valdes (PV) in Argentina is an important calving and mating ground for the southern right whale (*Eubalaena australis*) population in the southwestern Atlantic Ocean. Underwater observations of nonreproductive sexual interactions were not published in southern right whales until now, though they have been described in humpback whales (*Megaptera novaeangliae*; Pack et al., 2002) and in other baleen whales (e.g., grey and bowhead) from surface observations. This paper describes a sexual harassment by an adult male southern right whale to a conspecific calf while on the calving and mating grounds near PV. Observations were made opportunistically from a whale-watching motor vessel (13 m long, with a 3 x Honda 225-hp outboard engine) during the research project "Patagonia Documental."

D'Agostino, V. C., Hoffmeyer, M. S., & Degradi, M. (2016). Faecal Analysis of Southern Right Whales (*Eubalaena australis*) in Península Valdés Calving Ground, Argentina: *Calanus Australis*, a Key Prey Species. *Marine Biological Association of the United Kingdom. Journal of the Marine Biological Association of the United Kingdom*, 96(4), 859-868

<https://doi.org/10.1017/S0025315415001897>

Península Valdés (PV) is the most austral calving ground for the SW Atlantic population of *Eubalaena australis*. Recent studies indicate that *E. australis* often feeds in PV mainly in late September and October. A microscopic analysis of food chitin remains found in five whale faeces was performed in the present study in an attempt to obtain baseline knowledge about trophic ecology and degree of use of plankton food available for whales in PV during spring (September-December). The remains in faeces from stranded and live individuals included copepods, other zooplankton and centric diatoms, all of which were characterized. Copepod remains were found to be dominant. Scanning electron and confocal laser scanning microscopes were used for comparative analyses between the mandibular gnathobases found in whale faeces and those obtained from preserved specimens. Mandibular gnathobases were the same in structure and morphometry as those obtained from preserved *Calanus australis* (copepodites 4-6). The positive relationship observed between the total length and width of

the mandibular gnathobases edge of *C. australis* and those found in faeces allowed us to infer the developmental stages of the copepods ingested by *E. australis*. Our results indicate - for the first time - the relevant role of *C. australis* copepodite 5 as main prey for *E. australis* in PV during the calving season. Copepodite 5 of *C. australis* accumulates energy-rich lipids. This is energetically attractive for whales and it is the potential reason why *E. australis* feeds mainly on dense patches dominated by this developmental stage of *C. australis*.

Danilewicz, D., Moreno, I. B., Tavares, M., & Sucunza, F. (2017). Southern Right Whales (*Eubalaena australis*) Off Torres, Brazil: Group Characteristics, Movements, and Insights into the Role of the Brazilian-Uruguayan Wintering Ground. *Mammalia*, 81(3), 225-234  
<https://doi.org/10.1515/mammalia-2015-0096>

The southern right whale (SRW), *Eubalaena australis*, was heavily depleted by the whaling in the Southern Hemisphere. In the southwestern Atlantic, studies on SRWs have been concentrated in two main breeding grounds: Peninsula Valdes, Argentina (similar to 42 degrees'S) and Santa Catarina (SC) State, Brazil (similar to 28 degrees'S). To better understand the ecology of SRWs in the region located between these breeding grounds, shore-based surveys were carried out off Torres (29 degrees 19'S, 49 degrees 43'W), Rio Grande do Sul (RS). Whales were observed in the area between July and October with peaks in August and September. Group sizes were relatively small ( $\bar{x}$  over bar = 1.6; range = 1-3). Distribution in relation to distance from the coast varied from 0.5 to 8.9 km (median = 1.9 km). Unlike in other areas, mother-calf pairs were not observed to occur in shallower waters more often than unaccompanied whales. Mother-calf pairs presented northbound movements to SC more frequently than unaccompanied whales. A comparison of the present data with those from Uruguay and SC revealed that SRWs of different gender/reproductive status may use distinctively the eastern coast of South America. Within these regions, the proportion of mother-calf pairs increases progressively as latitude decreases (from 8% in Uruguay to 58.5% in SC), while the proportion of unaccompanied SRWs presents an opposite trend. This study indicates that RS is an important area for reproduction of SRWs because the three phases (birth, nursing, and mating) proposed for a breeding ground occur there.

Davidson, A. R., Rayment, W., Dawson, S. M., Webster, T., & Slooten, E. (2018). Estimated Calving Interval for the New Zealand Southern Right Whale (*Eubalaena australis*). *New Zealand Journal of Marine and Freshwater Research*, 52(3), 372-382  
<https://doi.org/10.1080/00288330.2017.1397034>

Southern right whales (*Eubalaena australis*) were widespread in New Zealand waters before commercial whaling in the nineteenth century caused drastic declines in their abundance and distribution. Following the cessation of whaling, the population has been recovering and is now slowly recolonising its former range. Estimates of population demographics, including reproductive output, are essential for predicting the trajectory of this population. We gathered photo-identification data on female southern right whales during annual field trips to the Auckland Islands, the principal calving area in New Zealand waters. Forty-five calving intervals were observed between 2006 and 2013 (mean interval = 3.31 years, 95% CI = 3.06-3.57). Incorporating the effects of possible missed calving events produced a plausible range of mean calving intervals from 3.17 to 3.31 years. Our results suggest that the calving interval of New Zealand southern right whales is similar to that found in populations elsewhere.



de Morais, I. O. B., Danilewicz, D., Zerbini, A. N., Edmundson, W., Hart, I. B., & Bortolotto, G. A. (2017). From the Southern Right Whale Hunting Decline to the Humpback Whaling Expansion: A Review of Whale Catch Records in the Tropical Western South Atlantic Ocean. *Mammal Review*, 47(1), 11-23 <https://doi.org/10.1111/mam.12073>

1. Historical catch records from whaling activity are crucial for assessments of whale populations. However, several gaps in the exploitation history for many populations from before the twentieth century create limitations that may lead to overestimates of the recovery of these populations. The history of modern whaling along the Brazilian coast is relatively well known. However, several questions relating to the pre-modern period, during and before the nineteenth century, remain unanswered. For example, the level of exploitation of humpback whales *Megaptera novaeangliae* and southern right whales *Eubalaena australis* in this period is unknown. 2. Pre-modern whaling in Brazil began in 1602 and lasted until the 1920s. Whales were captured using manual harpoons from either rowing boats or sailing boats, and processed at land stations called 'armacoes'. A review of the history and oil production of these stations indicates that substantial catches occurred. 3. Pre-modern whaling records also indicate the collapse of the southern right whale population in the western South Atlantic Ocean. Increasingly rare reports of sightings for the nineteenth century and the closing of the last armacao in the breeding grounds off southern Brazil indicate that this population collapsed by 1830. 4. Armacoes operating in north-eastern Brazil remained active through the 1800s, and targeted humpback whales until modern whaling techniques were introduced in the early 1900s. It is estimated that between approximately 11000 and 32000 individuals of this species were captured at these coastal whaling stations from 1830 to 1924.

De Rock, P., Elwen, S. H., Roux, J. P., Leeney, R. H., James, B. S., Visser, V., . . . Gridley, T. (2019). Predicting Large-Scale Habitat Suitability for Cetaceans Off Namibia Using MinxEnt. *Marine Ecology Progress Series*, 619, 149 <https://doi.org/10.3354/meps12934>

Knowledge of the occurrence and distribution of cetaceans is particularly important for conservation and management, but is still limited within Namibian waters. We collated 3211 cetacean records from the Namibian Exclusive Economic Zone (EEZ) for the period 2008 to 2016 and applied the principle of minimum cross entropy (MinxEnt) to predict habitat suitability. MinxEnt is a generalised form of maximum entropy modelling that allows incorporation of additional information such as sampling bias. The habitat suitability of 9 cetacean species or species groups (5 odontocete species, 2 mysticete species and 2 taxonomic groups: pilot whales *Globicephalus* spp. and balaenopterids *Balaenopteridae* spp.) were predicted per season, in relation to environmental variables likely to drive cetacean presence: sea surface temperature, chlorophyll a concentration, water depth or distance to shore, seabed slope and habitat complexity. The environmental variable which most frequently influenced habitat suitability was depth, which was the main environmental driver for bottlenose dolphin *Tursiops truncatus*, humpback *Megaptera novaeangliae* and southern right whales *Eubalaena australis*. Further, Heaviside's dolphin *Cephalorhynchus heavisidii* habitat was best predicted by distance to shore in all seasons, while common dolphin *Delphinus delphis* and the balaenopterid group habitats were best predicted by habitat complexity, and sperm whale *Physeter macrocephalus* habitats by chlorophyll a concentration. We identify distinct spatial patterns in habitat suitability for different species and provide baseline maps which can be used by managers of wildlife resources.

Dombroski, J. R. G., Parks, S. E., Flores, P. A. C., Lopez, L. M. M., Shorter, K. A., & Groch, K. R. (2020). Animal-Borne Tags Provide Insights into the Acoustic Communication of Southern Right Whales (*Eubalaena australis*) on the Calving Grounds. *Journal of the Acoustical Society of America*, 147(6), EL498-EL503 <https://doi.org/10.1121/10.0001391>

This study investigated the repertoire, call-type variability and call rates of southern right whales on a calving ground off Brazil in the western South Atlantic. Acoustic tag data were collected from four lactating females and one juvenile. Pulsive, hybrid, and upcalls showed the greatest variability among call-types with up to 23% of non-standard forms detected. Quiet sounds (grunt, single, and double pulse) were detected for the first time in this species on the calving grounds. Although the sample size was limited, results suggest that social interaction increased call-type diversity and call rates, in line with other acoustic studies on right whales.

Dombroski, J. R. G., Parks, S. E., Groch, K. R., Flores, P. A. C., & Sousa-Lima, R. S. (2016). Vocalizations Produced by Southern Right Whale (*Eubalaena australis*) Mother-Calf Pairs in a Calving Ground Off Brazil. *Journal of the Acoustical Society of America*, 140(3), 1850-1857 <https://doi.org/10.1121/1.4962231>

Aiming to gather information on southern right whale (*Eubalaena australis*) mother-calf pairs' vocal behavior, archival acoustic recorders were deployed at a calving area off Brazil. Manual inspection of spectrograms revealed seven call classes: upcall, downcall, down-upcall, tonal variable, tonal constant, hybrid, and pulsive calls, which are consistent with those previously described for this species in Argentina. Gunshots and warbles, vocalizations described from other right whale species, were not detected. Mean values of start, end, maximum, minimum and peak frequencies, frequency bandwidth and duration were calculated for each call class. Start and end frequencies, frequency bandwidth and duration of upcalls recorded off Brazil were compared to those from other right whale populations and species. Only mean duration of upcalls from Brazil were significantly different from upcalls from all other populations. Differences in call duration may be driven by differences in demographic factors or background noise features among study areas. The repertoire characterization presented in this study will contribute to increase the utility of passive acoustic monitoring as a tool for conservation and research of southern right whales off Brazil as it provides important baseline information on the vocal behavior of this species.

Dombroski, J. R. G., Parks, S. E., Groch, K. R., Flores, P. A. C., & Sousa-Lima, R. S. (2017). Upcall Production by Southern Right Whale (*Eubalaena australis*) Mother-Calf Pairs May Be Independent of Diel Period in a Nursery Area. *Marine Mammal Science*, 33(2), 669-677 <https://doi.org/10.1111/mms.12382>

No abstract.

Frans, V. F., & Augé, A. A. (2016). Use of Local Ecological Knowledge to Investigate Endangered Baleen Whale Recovery in the Falkland Islands. *Biological Conservation*, 202, 127-137 <https://doi.org/10.1016/j.biocon.2016.08.017>

Baleen whale populations have increased around the world after the end of commercial whaling in the 1980s. Anecdotes from local inhabitants of the Falkland Islands tell of an increase in whale sightings after an almost complete absence. However, no long-term monitoring exists to assess such recovery. With increasing maritime activities around the Islands, local managers need to understand the status



and distribution of baleen whales to avoid impeding the potential recovery process. In the complete absence of scientific data, harvesting local ecological knowledge (LEK) from residents could provide means to assess whether whale numbers are increasing. We collected historical knowledge and mapped historical observations through structured interviews with 58 inhabitants and filtered observations for the highest reliability. We also collated existing historical catch and sighting data to compare species composition in inshore and offshore waters. A total of 3842 observations were compiled from the 1940s to 2015. This collation of information provided first-time evidence on the return of the whales in the Falkland Islands' waters. There was a clear increase in numbers of whales sighted, from no observations in the 1970s to 350 observations between 2010 and 2015 for similar effort, mostly of endangered sei whales (*Balaenoptera borealis*) and fin whales (*Balaenoptera physalus*). We mapped contemporary whale sighting hotspots to inform current marine spatial planning efforts. The use of LEK is highlighted here as a useful way to gain a better understanding of changes in the status of threatened species when no scientific monitoring has been conducted.

González Carman, V., Piola, A., O'Brien, T. D., Tormosov, D. D., & Acha, E. M. (2019). Circumpolar Frontal Systems as Potential Feeding Grounds of Southern Right Whales. *Progress in Oceanography*, 176, 102123 <https://doi.org/10.1016/j.pocean.2019.102123>

All subpopulations of Southern Right whales (SRWs) have been subject of intense commercial whaling during the 18th, 19th and 20th centuries. Although the abundance and population status of some subpopulations are improving, their recovery could be compromised if inadequate advice are given rooted in poor data on basic aspects of their ecology, such as the location of feeding grounds. In this study, we combine historical whaling data with key environmental features known to be important for Balaenids to predict the offshore distribution of SRWs throughout the Southern Hemisphere using monthly Ensemble Distribution Models. We found that the location of potential feeding grounds of SRWs changes from mid-latitude shelf and oceanic waters in September towards higher latitude waters in December, a situation that holds throughout the summer. In March and April, suitable feeding grounds reach their minimum geographic coverage, being mostly restricted to areas near calving grounds. We also provide evidence that highly suitable areas of SRWs overlap with the Subtropical Frontal Zone and the Polar Front, so these frontal systems stand as important potential feeding grounds for SRWs from late spring to early fall at circumpolar scale. Improved identification of offshore feeding areas of SRWs will require more efforts to directly observe vast areas of the open ocean and to track individuals from calving to feeding grounds.

Jacobs, E., Duffy, M., Magolan, J., Barbara Galletti, V., Cabrera, E., Landea, R., . . . Sayigh, L. (2019). First Acoustic Recordings of Critically Endangered Eastern South Pacific Southern Right Whales (*Eubalaena australis*). *Marine Mammal Science*, 35(1), 284-289 <https://doi.org/10.1111/mms.12519>

No abstract.

Lindner, M. S., Carribero, A. A., & Klaich, M. J. (2020). Return Rate of Southern Right Whales (*Eubalaena australis*) to the Whale Watching Area, Peninsula Valdes, Patagonia, Argentina. *Ocean & Coastal Management*, 184, 104905 <https://doi.org/10.1016/j.ocecoaman.2019.104905>

No abstract.

Nielsen, M. L. K., Bejder, L., Videsen, S. K. A., Christiansen, F., & Madsen, P. T. (2019). Acoustic Crypsis in Southern Right Whale Mother-Calf Pairs: Infrequent, Low-Output Calls to Avoid Predation? *Journal of Experimental Biology*, 222(13) <https://doi.org/10.1242/jeb.190728>

Southern right whales (*Eubalaena australis*) invest substantial amounts of energy in their calves, while facing the risk of having them predated upon by eavesdropping killer whales (*Orcinus orca*). We tested the hypothesis that southern right whale mother-calf pairs employ acoustic crypsis to reduce acoustic detectability by such predators. Specifically, we deployed multi-sensor DTAGs on nine lactating whales for a total of 62.9 h in a Western Australian breeding ground, and used a SoundTrap to estimate the concomitant acoustic background noise. Vocalisations were recorded at low rates of <10 calls h<sup>-1</sup> (1 call per dive) and at low received levels between 123 +/- 18 and 134+10 dB re. 1  $\mu$  Pa RMS depending on call type. We conclude that such acoustic crypsis in southern right whales and other baleen whales decreases the risk of alerting potential predators and hence jeopardizing a substantial energetic investment by the mother.

Nielsen, M. L. K., Sprogis, K. R., Bejder, L., Madsen, P. T., & Christiansen, F. (2019). Behavioural Development in Southern Right Whale Calves. *Marine Ecology Progress Series*, 629, 219-234 <https://doi.org/10.3354/meps13125>

Most baleen whales migrate to low-latitude breeding grounds during winter to give birth and nurse their calves during the early stages of growth and development. While mothers invest a large amount of energy into the early development of their calves, the time allocated to important behaviours associated with maternal care (e.g. nursing) as well as the energetics related to the rapid growth of calves are important to quantify and understand to inform conservation measures. To investigate this, we conducted behavioural focal follows of southern right whale *Eubalaena australis* mother-calf pairs on a breeding ground in South Australia using unmanned aerial vehicles. Over the breeding season, we conducted behavioural focal follows of 51 mother-calf pairs for a total of 58 h across 75 d. Our observations showed that the proportion of time calves spent in nursing position and the duration of potential nursing bouts increased with increasing calf size throughout the breeding season, suggesting that calves seek to maximise energy acquisition. With increasing body size, the absolute metabolic expenditure of calves increased, underlining the importance of mothers being able to maintain low energy expenditure to ensure sufficient energy available for their calves during the nursing season. Our findings from this undisturbed population (1) demonstrate the considerable changes that calves undergo during the ~3 mo they spend on the breeding ground and (2) highlight the importance of these areas to be protected from anthropogenic disturbances that could disrupt the crucial maternal care, energy transfer and rapid early development of calves.

Purdon, J., Shabangu, F. W., Pienaar, M., Somers, M. J., & Findlay, K. (2020). Cetacean Species Richness in Relation to Anthropogenic Impacts and Areas of Protection in South Africa's Mainland Exclusive Economic Zone. *Ocean & Coastal Management*, 197, 105292 <https://doi.org/10.1016/j.ocecoaman.2020.105292>

The world's oceans are subject to the multiple impacts of human activity and to the consequent threats to the health of many and varied ocean ecosystems. Oceans around South Africa are no exception and, with the need for economic growth in the country, anthropogenic stressors on ocean resources are rapidly increasing. In this study, we investigated 14 different anthropogenic stressors that impacted ocean health between 2003 and 2013, and their cumulative anthropogenic effects on cetaceans in the South African Exclusive Economic Zone (EEZ) and South African Marine Protected Areas (MPA),

Important Marine Mammal Areas (IMMA), Ecologically or Biologically Significant Areas (EBSA) and ecoregions. We determined cetacean species richness in these five area categories using ensemble models, and identified anthropogenic impacts from relevant literature. We calculated and compared the average species richness, the average trend for each anthropogenic stressor and average cumulative impact between 2003 and 2013 in the five areas. Results highlight that climate related stressors (such as sea surface temperature and ocean acidification), together with shipping stressors, are increasing more rapidly than other stressors across the EEZ. Cetacean species richness was highest along the west coast shelf and shelf edge where sea level rise, ocean acidification, shipping, and commercial pelagic fishing with low by-catch were most pronounced. The results of this study will inform marine spatial planners and policy makers in determining priority areas for cetacean conservation and in identifying anthropogenic stressors that need to be addressed to mitigate cumulative anthropogenic impacts on cetaceans.

Rayment, W., Dawson, S., & Webster, T. (2015). Breeding Status Affects Fine-Scale Habitat Selection of Southern Right Whales on Their Wintering Grounds. *Journal of Biogeography*, 42(3), 463-474 <https://doi.org/10.1111/jbi.12443>

**Aim:** To develop and validate a model for fine-scale distribution of southern right whales (*Eubalaena australis*) on their calving grounds, accounting for breeding status. **Location:** Port Ross, a harbour at the northern end of the sub-Antarctic Auckland Islands, approximately 450km south of mainland New Zealand. **Methods:** Species-habitat surveys were conducted during annual winter expeditions to the Auckland Islands from 2010 to 2012. Presence locations for groups including calves (calf groups; n=462) and not including calves (non-calf groups; n=313) were recorded during small-boat surveys of Port Ross, and an equal number of pseudo-absence locations were generated in a GIS analysis. Explanatory variables tested were water depth, seabed slope, distance to coast, distance to shelter from prevailing wind and average wave exposure (estimated from a custom-built wave model). The occurrence of calf groups and non-calf groups was separately related to explanatory variables using binomial generalized additive models, with best models chosen via the minimum Akaike information criterion score. Multi-fold validation was conducted to assess model performance and temporal variation in distribution. **Results:** The best models for calf groups were consistent, always including wave exposure, distance to shelter, depth and distance to the coastline. In contrast, the best non-calf group models were more variable and explained only a small proportion of the variation in the data. Validation metrics indicated that the calf group models were useful predictors of distribution in Port Ross during winter, and that the calf group models performed better than the non-calf models using the same suite of environmental variables. **Main conclusions:** Breeding female southern right whales seek sheltered, nearshore waters during the early life-stages of their calves and are more selective of these habitats than non-calving whales. The results highlight the importance of sheltered habitat for taxa with vulnerable life-history stages, and the need to account for reproductive status to refine species-habitat models.

Romero, M. A., Sueyro, N., Svendsen, G. M., Crespo, E. A., & González, R. A. C. (2018). Southern Right Whale *Eubalaena australis* in Golfo San Matías (Patagonia, Argentina): Evidence of Recolonisation. *Plos One*, 13(12) <https://doi.org/10.1371/journal.pone.0207524>

Since the 1980s, the distribution range of the southern right whale (*Eubalaena australis*) in Argentina was mostly located in the winter calving grounds around Península Valdés. After the international moratorium that forbade the commercial hunting, southern right whales have shown signs of recovery during the last few decades. Nowadays, it is thought that the species is experiencing a density-dependent process while expanding its distribution range in Patagonia. From 2007 to 2016, data on right

whale distribution, group composition and relative abundance were collected in Golfo San Matías, Patagonia through aerial surveys. Generalized linear models with a negative binomial error distribution were used to determine the population trend of right whales in this area. In addition, the group composition and the relative abundance of right whales among the northern Patagonian gulfs were compared. Finally, a literature review was conducted to assess the historical presence of right whales in Golfo San Matías, revealing the presence of right whales in Golfo San Matías during and after the commercial exploitation. During aerial surveys (2007–2016), right whales were observed from August to October in the area, with a peak in late August-early September. Our results suggested a geographic distribution change with a regular use of the northwest coast of the gulf in recent years and a positive trend in the population growth rate inside Golfo San Matías. This area was dominated by unaccompanied whales (solitary individuals and breeding groups) as opposed to Península Valdés where the dominant group type was the mother calf pairs. Therefore, Golfo San Matías appears to be important for socializing and mating but not as a nursery ground. In addition, the density of whales was four times greater in the gulfs of Península Valdés. Our findings contribute to a better understanding of the recovery of this species in Patagonia, Argentina and should be considered for the management measures for right whales in this region.

Seyboth, E., Groch, K. R., Dalla Rosa, L., Reid, K., Flores, P. A. C., & Secchi, E. R. (2016). Southern Right Whale (*Eubalaena australis*) Reproductive Success Is Influenced by Krill (*Euphausia superba*) Density and Climate. *Scientific Reports*, 6 <https://doi.org/10.1038/srep28205>

The reproductive success of southern right whale (*Eubalaena australis*) depends on body condition and, therefore, on foraging success. This, in turn, might be affected by climatically driven change in the abundance of the species main prey, krill (*Euphausia superba*), on the feeding grounds. Annual data on southern right whale number of calves were obtained from aerial surveys carried out between 1997 and 2013 in southern Brazil, where the species concentrate during their breeding season. The number of calves recorded each year varied from 7 to 43 ( $\bar{x} = 21.11 \pm 11.88$ ). Using cross-correlation analysis we examined the response of the species to climate anomalies and krill densities. Significant correlations were found with krill densities ( $r = 0.69$ ,  $p = 0.002$ , lag 0 years), Oceanic Nino Index ( $r = -0.65$ ,  $p = 0.03$ , lag 6 years), Antarctic Oscillation ( $r = 0.76$ ,  $p = 0.01$ , lag 7 years) and Antarctic sea ice area ( $r = -0.68$ ,  $p = 0.002$ , lag 0 years). Our results suggest that global climate indices influence southern right whale breeding success in southern Brazil by determining variation in food (krill) availability for the species. Therefore, increased frequency of years with reduced krill abundance, due to global warming, is likely to reduce the current rate of recovery of southern right whales from historical overexploitation.

Seyboth, E., Groch, K. R., Secchi, E. R., & Dalla Rosa, L. (2015). Habitat Use by Southern Right Whales, *Eubalaena australis* (Desmoulins, 1822), in Their Main Northernmost Calving Area in the Western South Atlantic. *Marine Mammal Science*, 31(4), 1521-1537 <https://doi.org/10.1111/mms.12241>

The subtropical and temperate coastal waters of the western South Atlantic are an important calving ground for southern right whales, *Eubalaena australis*. From 2002 to 2008, data on right whale distribution and habitat characteristics were collected in 14 bays along the coastline of Santa Catarina State, Brazil. Generalized linear models with a negative binomial error distribution were used to determine which environmental (beach morphotype, bay mouth width, bay inclination angle, north-south and east-west wind components), and temporal (month and year) variables best explained the aggregation pattern of individuals. Our results suggested that both cow-calf pairs and adults unaccompanied by calves prefer bays with dissipative beaches, and that cow-calf pairs apparently avoid

bays facing southeast during days of strong east-west winds. The number of sightings peaked in September and tended to increase over the study period. One particular embayment (Ribanceira beach) had considerably higher numbers of animals and may be considered a preferred spot in this calving ground. Our findings contribute to a better understanding of the species' habitat use and ecological requirements and should be taken into account if new management measures are implemented to further increase protection of southern right whales in the region.

Sironi, M., Marón, C. F., Pettite, L., Guevara, J., Juan Pablo, M., & Rowntree, V. (2019). First Record of an Unsuccessful Parturition of a Southern Right Whale (*Eubalaena australis*) at Península Valdés, Argentina. *Marine Mammal Science*, 35(4), 1587-1596 <https://doi.org/10.1111/mms.12594>

No abstract.

Stefanski, S. F., & Villasante, S. (2015). Whales Vs. Gulls: Assessing Trade-Offs in Wildlife and Waste Management in Patagonia, Argentina. *Ecosystem Services*, 16, 294-305 <https://doi.org/10.1016/j.ecoser.2014.11.012>

In Península Valdés, (Patagonia) Argentina, the consequences of poor waste management and an overpopulation of kelp gulls has led to gulls feeding on living southern right whales, potentially causing losses to the tourism industry through loss in coastal quality and suboptimal right whale viewing experiences. Despite local progress in closing waste disposal sites and culling gulls, both waste and pest problems persist. While this problem could impact the long-term viability of the site as a whale watching destination and present conservation concerns, little research has been done concerning the socio-economic aspects of the problem. The present study interviewed 650 tourists about their willingness to pay to manage the gulls versus the waste in order to reduce the gull population and remove the risk to the whales. This research finds that tourists favor addressing the human-driven component of the problem, the waste, over culling the natural component of the problem, the kelp gulls. These findings present a remarkable insight to assessing trade-offs between two management strategies to a local problem associated with coastal development and tourism. The results could further be broadened to other destinations facing waste and pest management challenges in the face of growing tourism and urbanization.

Torres, L. G., Rayment, W., Olavarria, C., Thompson, D. R., Graham, B., Baker, C., . . . Carroll, E. L. (2017). Demography and Ecology of Southern Right Whales *Eubalaena australis* Wintering at Sub-Antarctic Campbell Island, New Zealand. *Polar Biology*, 40(1), 95-106 <https://doi.org/10.1007/s00300-016-1926-x>

Since the decimation of the southern right whale *Eubalaena australis* population in New Zealand by whaling, research on its recovery has focused on the wintering ground at the Auckland Islands, neglecting potentially important wintering habitat at Campbell Island. For the first time in 20 years we conducted an expedition to sub-Antarctic Campbell Island to document and describe *E. australis* occupying this wintering habitat. We used a variety of methods including photo-identification, genetic and stable isotope analyses of tissue samples, and visual surveys of abundance and distribution, to provide details on the demography, population connectivity and ecology of *E. australis* wintering at Campbell Island. Our primary findings include (1) a lack of calves observed at Campbell Island, (2) an age-class bias toward sub-adults encountered at Campbell Island, (3) nine photo-identification matches between individuals observed at Campbell Island and previously documented elsewhere in New Zealand, (4) no genetic differentiation between *E. australis* at Campbell Island and the broader New

Zealand population, (5) increased abundance estimates of *E. australis* at Campbell Island over the last 20 years, and (6) indications that *E. australis* forage within the sub-Antarctic region based on stable isotope analyses. Our results confirm that the Auckland Islands are currently the only significant calving area for *E. australis* in New Zealand, and therefore previous abundance estimates based on demographic data from the Auckland Islands are applicable to the entire New Zealand population of *E. australis*. However, future periodic surveys to Campbell Island are recommended to monitor population recovery and expansion.

Tulloch, V. J. D., Plaganyi, É. E., Matear, R., Brown, C. J., & Richardson, A. J. (2018). Ecosystem Modelling to Quantify the Impact of Historical Whaling on Southern Hemisphere Baleen Whales. *Fish and Fisheries*, 19(1), 117-137 <https://doi.org/10.1111/faf.12241>

Many baleen whales were commercially harvested during the 20th century almost to extinction. Reliable assessments of how this mass depletion impacted whale populations, and projections of their recovery, are crucial but there are uncertainties regarding the status of Southern Hemisphere whale populations. We developed a Southern Hemisphere spatial "Model of Intermediate Complexity for Ecosystem Assessments" (MICE) for phytoplankton, krill (*Euphausia superba*) and five baleen whale species, to estimate whale population trajectories from 1890 to present. To forward project to 2100, we couple the predator-prey model to a global climate model. We used the most up to date catch records, fitted to survey data and accounted for key uncertainties. We predict Antarctic blue (*Balaenoptera musculus intermedia*), fin (*Balaenoptera physalus*) and southern right (*Eubalaena australis*) whales will be at less than half their pre-exploitation numbers (K) even given 100 years of future protection from whaling, because of slow growth rates. Some species have benefited greatly from cessation of harvesting, particularly humpbacks (*Megaptera novaeangliae*), currently at 32% of K, with full recovery predicted by 2050. We highlight spatial differences in the recovery of whale species between oceanic areas, with current estimates of Atlantic/Indian area blue (1,890, <1% of K) and fin (16,950, <4% of K) whales suggesting slower recovery from harvesting, whilst Pacific southern right numbers are <7% of K (2,680). Antarctic minke (*Balaenoptera bonaerensis*) population trajectories track future expected increases in primary productivity. Population estimates and plausible future predicted trajectories for Southern Hemisphere baleen whales are key requirements for management and conservation.

Valenzuela, L. O., Rowntree, V. J., Sironi, M., & Seger, J. (2018). Stable Isotopes ( $\delta^{15}\text{N}$ ,  $\delta^{13}\text{C}$ ,  $\delta^{34}\text{S}$ ) in Skin Reveal Diverse Food Sources Used by Southern Right Whales *Eubalaena australis*. *Marine Ecology Progress Series*, 603, 243-255 <https://doi.org/10.3354/meps12722>

Skin samples collected from living southern right whales (SRWs) off Península Valdés, Argentina, show a wide range of stable isotope values ( $\delta^{15}\text{N}$ ,  $\delta^{13}\text{C}$ ,  $\delta^{34}\text{S}$ ). These were compared to the isotopic signatures of euphausiids and copepods from different areas across the southwestern South Atlantic and the Atlantic sector of the Southern Ocean. Our results suggest that this population of SRWs uses at least 3 distinct food sources. Each food source may represent a single feeding ground or a combination of feeding grounds with different prey species distributions. Individual whales pursue foraging strategies that vary substantially in the amounts of time they spend in different feeding grounds along their migratory paths. The 3 grounds that appear to contribute most to the diets of Península Valdés SRWs correspond to areas previously documented in the log books of whaling ships: the Patagonian Shelf, South Georgia and the waters of the Polar Front. It is possible that additional feeding areas are also currently being used in the South Atlantic. Age and sex classes differ isotopically, but these differences could be caused by biomechanical or physiological characteristics rather than by age- and sex-specific specialization in different feeding areas.



Vighi, M., Borrell, A., Crespo, E. A., Oliveira, L. R., Simoes-Lopes, P. C., Flores, P. A., . . . Aguilar, A. (2014). Stable Isotopes Indicate Population Structuring in the Southwest Atlantic Population of Right Whales (*Eubalaena australis*). *Plos One*, *9*(3), e90489  
<https://doi.org/10.1371/journal.pone.0090489>

From the early 17th century to the 1970s southern right whales, *Eubalaena australis*, were subject to intense exploitation along the Atlantic coast of South America. Catches along this coast recorded by whalers originally formed a continuum from Brazil to Tierra del Fuego. Nevertheless, the recovery of the population has apparently occurred fragmentarily, and with two main areas of concentration, one off southern Brazil (Santa Catarina) and another off central Argentina (Peninsula Valdes). This pattern suggests some level of heterogeneity amongst the population, which is apparently contradicted by records that traced individuals moving throughout the whole geographical extension covered by the species in the Southwest Atlantic. To test the hypothesis of the potential occurrence of discrete subpopulations exploiting specific habitats, we investigated N, C and O isotopic values in 125 bone samples obtained from whaling factories operating in the early 1970s in southern Brazil (n=72) and from contemporary and more recent strandings occurring in central Argentina (n=53). Results indicated significant differences between the two sampling areas, being  $\delta^{13}\text{C}$  and  $\delta^{18}\text{O}$  values significantly higher in samples from southern Brazil than in those from central Argentina. This variation was consistent with isotopic baselines from the two areas, indicating the occurrence of some level of structure in the Southwest Atlantic right whale population and equally that whales more likely feed in areas commonly thought to exclusively serve as nursing grounds. Results aim at reconsidering of the units currently used in the management of the southern right whale in the Southwest Atlantic Ocean. In the context of the current die-off affecting the species in Peninsula Valdes, these results also highlight the necessity to better understand movements of individuals and precisely identify their feeding areas.

Webster, T. A., Van Parijs, S. M., Rayment, W. J., & Dawson, S. M. (2019). Temporal Variation in the Vocal Behaviour of Southern Right Whales in the Auckland Islands, New Zealand. *Royal Society Open Science*, *6*(3) <https://doi.org/10.1098/rsos.181487>

Autonomous recorders are frequently used for examining vocal behaviour of animals, and are particularly effective in remote habitats. Southern right whales are known to have an extensive acoustic repertoire. A recorder was moored at the isolated sub-Antarctic Auckland Islands for a year to examine whether the acoustic behaviour of southern right whales differed seasonally and throughout the day at their main calving ground in New Zealand. Recordings were made in each month except June, and vocalizations were audible in all months with recordings except January. A total of 35 487 calls were detected, of which upcalls were the most common (11 623). Call rate peaked in August (288 +/- 5.9 [s.e.] calls/hour) and July (194 +/- 8.3). Vocal behaviour varied diurnally with highest call rates detected at dusk and night, consistent with the concept that upcalls function primarily as contact calls. Zero-inflated model results confirmed that seasonal variation was the most important factor for explaining differences in vocal behaviour. An automated detector designed to expedite the analysis process for North Atlantic right whales correctly identified 80% of upcalls, although false detections were frequent, particularly when call rates were low. This study is the first to attempt year-round monitoring of southern right whale presence in New Zealand.

Weir, C. R., & Stanworth, A. (2020). The Falkland Islands (Malvinas) as Sub-Antarctic Foraging, Migratory and Wintering Habitat for Southern Right Whales. *Journal of the Marine Biological Association of the United Kingdom*, *100*(1), 153-163 <https://doi.org/10.1017/s0025315419001024>

The historical and contemporary presence of southern right whales (SRWs; *Eubalaena australis*) around the Falkland Islands (Malvinas) has received little recognition. We assessed SRW occurrence in the Falklands via whaling records, a literature review, systematic surveys (boat, aerial and shore-based), and citizen science sightings. The combined data sources indicated a year-round (peaking in austral summer) presence of SRWs in pelagic areas around the Falklands. In contrast, most nearshore records originated in the austral late autumn and winter (May to August), including a marked increase in sightings along the north-east coast during 2017 compared with previous years. The data support spatio-temporal variation in the use of Falklands waters by SRWs. Pelagic waters appear to comprise summer foraging habitat, and may also be used by animals migrating between the Patagonian shelf and feeding grounds located further south and east. The peak numbers observed in nearshore waters occurred earlier in the winter (July) than those on the Argentinean or Brazilian calving grounds (Aug-Oct). Consequently, some whales may have continued migrating northwards to established breeding areas after departing Falklands waters. A component of the south-west Atlantic population could also be using the islands as a novel wintering destination, for mating and/or socializing (no calving has been confirmed to date). The importance of Falklands waters as a multi-use SRW habitat appears to be increasing. The region is important in the context of addressing current knowledge gaps regarding feeding grounds and migratory corridors highlighted in international SRW conservation and management plans for the wider South-west Atlantic.

Whitehead, H. (2017). Gene–Culture Coevolution in Whales and Dolphins. *Proceedings of the National Academy of Sciences of the United States of America*, 114(30), 7814-7821  
<https://doi.org/10.2307/26486117>

Whales and dolphins (Cetacea) have excellent social learning skills as well as a long and strong mother–calf bond. These features produce stable cultures, and, in some species, sympatric groups with different cultures. There is evidence and speculation that this cultural transmission of behavior has affected gene distributions. Culture seems to have driven killer whales into distinct ecotypes, which may be incipient species or subspecies. There are ecotype-specific signals of selection in functional genes that correspond to cultural foraging behavior and habitat use by the different ecotypes. The five species of whale with matrilineal social systems have remarkably low diversity of mtDNA. Cultural hitchhiking, the transmission of functionally neutral genes in parallel with selective cultural traits, is a plausible hypothesis for this low diversity, especially in sperm whales. In killer whales the ecotype divisions, together with founding bottlenecks, selection, and cultural hitchhiking, likely explain the low mtDNA diversity. Several cetacean species show habitat-specific distributions of mtDNA haplotypes, probably the result of mother–offspring cultural transmission of migration routes or destinations. In bottlenose dolphins, remarkable small-scale differences in haplotype distribution result from maternal cultural transmission of foraging methods, and large-scale redistributions of sperm whale cultural clans in the Pacific have likely changed mitochondrial genetic geography. With the acceleration of genomics new results should come fast, but understanding gene–culture coevolution will be hampered by the measured pace of research on the socio-cultural side of cetacean biology.

### **Section III: Population Abundance**

Bannister, J. L., Hammond, P. S., & Double, M. C. (2016). *Population Trends in Right Whales Off Southern Australia 1993-2015*. International Whaling Commission. Retrieved from  
<https://archive.iwc.int/?r=6111&k=1ceac92732>



Annual flights to survey southern right whales in winter/spring on the coast of southern Australia, between Cape Leeuwin (Western Australia) and Ceduna (South Australia) have been conducted over a 23-year period 1993-2015. These surveys have provided evidence of a population trend of around 6% per year, and a current (at 2014) population size of approximately 2300 of what has been regarded as the 'western' Australian right whale subpopulation. With estimated population size in the low thousands, it is presumed to be still well below carrying capacity. No trend information is available for the 'eastern' subpopulation of animals occurring around the remainder of the southern Australian Coast, to at least as far as Sydney, New South Wales and the populations size is relatively small, probably in the low hundreds. A lower than expected 'western' count in 2015 gives weak evidence that the growth rate may be starting to show signs of slowing, though an exponential increase remains the best description of the data. If the low 2015 count is anomalous, future counts may be expected to show an exponential increase, but if it is not, modelling growth as other than simple exponential may be useful to explore in future.

Bilgmann, K., Parra, G. J., & Möller, L. M. (2018). Occurrence, Distribution and Abundance of Cetaceans Off the Western Eyre Peninsula in the Great Australian Bight. *Deep Sea Research Part II: Topical Studies in Oceanography*, 157-158, 134-145 <https://doi.org/10.1016/j.dsr2.2017.11.006>

This study provides the first assessment of the occurrence, distribution and abundance of cetaceans in shelf and coastal waters off the western Eyre Peninsula, eastern Great Australian Bight, South Australia. We undertook aerial line transect surveys to estimate the abundance of common dolphins, and to assess the occurrence and distribution of other small and large cetaceans. Two along shore surveys were also flown to assess occurrence of endangered southern right whales in coastal waters. Five cetacean species were detected: seven southern right whales, three humpback whales, one minke whale (unknown species), 71 schools of common dolphins, and 14 schools of bottlenose dolphins. Abundance of common dolphins was estimated to be 20,000–22,000 using distance sampling methods with densities of 0.67–0.73 dolphin/km<sup>2</sup>. Comparisons of common dolphin densities off the Eyre Peninsula in the eastern GAB with other regions around the world show that shelf waters off the Eyre Peninsula represent an important habitat for common dolphins.

Caputo, M., Froneman, P. W., du Preez, D., Thompson, G., & Plön, S. (2017). Long-Term Trends in Cetacean Occurrence During the Annual Sardine Run Off the Wild Coast, South Africa. *African Journal of Marine Science*, 39(1), 83-94 <https://doi.org/10.2989/1814232X.2017.1304451>

During the austral winter, cetaceans and other apex predators follow the annual northeastward movement of shoaling sardines, known as the sardine run, along the southeast coast of South Africa, including a 400-km stretch called the Wild Coast. In total, 131 opportunistic aerial surveys were conducted between May and July, from 1996 to 2014, to monitor sardine movement. Cetacean-sighting data from these surveys were analysed, focusing on long-term trends in frequencies of the cetaceans. In total, 630 sightings involving five cetacean species were recorded: 268 (approximately 32 400 individuals) of Indo-Pacific bottlenose dolphin *Tursiops aduncus*, 108 (approximately 79 400 individuals) of long-beaked common dolphin *Delphinus capensis*, 242 (approximately 670 individuals) of humpback whale *Megaptera novaeangliae*, 1 (two individuals) of southern right whale *Eubalaena australis*, and 11 (16 individuals) of Bryde's whale *Balaenoptera edeni*. The occurrence of common dolphins, typically associated with sardines, decreased significantly in average group size over the study period ( $p = 0.0343$ ); bottlenose dolphins, considered generalist feeders, demonstrated no such trend ( $p = 0.916$ ). Humpback whales were most frequently sighted between 2010 and 2014, and with significantly larger

groups observed towards the end of the study period ( $p = 0.0121$ ). For all these species, more sightings were made inside than outside of marine protected areas (>70% of the dolphin species, and >65% of the humpback whales), both pre- and post-2005 (from 2005 the size of the survey area increased). The results indicate that movements of the common dolphin may be employed as a proxy for sardine occurrence. Long-term trends evident in the data also demonstrate the importance of this coastal region for bottlenose dolphins as well as use as a migratory corridor for humpback whales.

Charlton, C., Ward, R., McCauley, R. D., Brownell, R. L., Jr., Chandra Salgado, K., & Burnell, S. (2019). Southern Right Whale (*Eubalaena australis*), Seasonal Abundance and Distribution at Head of Bight, South Australia. *Aquatic Conservation (Online)*, 29(4), 576-588  
<https://doi.org/10.1002/aqc.3032>

Seasonal trends in the distribution and relative abundance of southern right whales (SRWs) *Eubalaena australis*, were assessed in Australia's largest calving aggregation ground at the Head of the Great Australian Bight, in the Commonwealth Marine Reserve, South Australia. Annual cliff-based surveys were undertaken between June and October from 1992 to 2016. SRWs were primarily distributed in a 15 km by 2 km area within the 10 m depth contour (with 95% of whale sightings made within a 10 km<sup>2</sup> area). The distribution of SRWs at Head of Bight varied within an individual season but was consistent among the years. The composition of SRW sightings was 70% female–calf pairs and 30% unaccompanied whales. Peak abundance occurred between mid-July and end-August for female–calf pairs and unaccompanied whales (juveniles or adults not accompanied by a calf), earlier than previously reported. A mean of 16% (range 8–28%, SD = 6.5, 95% CI = 0.15) of calving females were present at the site in mid-June and a mean of 37% (range 13–61%, SD = 15.8, 95% CI = 0.37) remained at the site at the end of September. Based on nearest-neighbour distances of 150 m, the area occupied by 95% of SRWs at Head of Bight could reach carrying capacity at 68 female and calf pairs. Results suggest that the primary aggregation area at Head of Bight may have reached saturation capacity and that habitat expansion can be expected as the population increases. This study provides information on SRW seasonal trends in distribution and abundance, timing of arrival and departure from the site and peak abundance periods relevant to application to conservation and marine park management. As management requirements increase with a growing population, there is a need to complete an Australia-wide assessment of SRW connectivity and habitat expansion.

Charlton, C. M. (2017). *Southern Right Whale (Eubalaena australis) Population Demographics in Southern Australia*. Curtin University, Retrieved from  
<https://espace.curtin.edu.au/handle/20.500.11937/59638>

Southern right whales (SRWs) *Eubalaena australis*, are listed as Least Concern under the International Union for Conservation of Nature (IUCN) Red List and in Australia they are listed as endangered under the Commonwealth Environment Protection Biodiversity and Conservation (EPBC) Act 1999. SRWs were reduced to near extinction globally from commercial whaling in the 19th century. Signs of the return of SRWs to Southern Hemisphere winter calving grounds were recorded in the late 1960's, but Soviet Pelagic Southern Hemisphere catches at that time slowed their recovery for several years. SRWs have a circumpolar distribution between 16° and 65° S. Four genetically distinct populations occupy the southern coastlines of Argentina, South Africa, Australia and New Zealand during the Austral winter where they calve, mate and rest. SRW numbers are increasing in Australia. However current abundance of the Australian population is approximately 2,500 and they are divided into two sub-populations (the 'western' with ~2,200 whales and the 'eastern' with ~ 300 individuals). The two sub-populations are estimated to be less than 20% of their pre-whaling abundance of approximately 15,000.

Christiansen, F., Dawson, S. M., Durban, J. W., Fearnbach, H., Miller, C. A., Bejder, L., . . . Moore, M. J. (2020). Population Comparison of Right Whale Body Condition Reveals Poor State of the North Atlantic Right Whale. *Marine Ecology Progress Series*, 640, 1  
<https://doi.org/10.3354/meps13299>

The North Atlantic right whale *Eubalaena glacialis* (NARW), currently numbering <410 individuals, is on a trajectory to extinction. Although direct mortality from ship strikes and fishing gear entanglements remain the major threats to the population, reproductive failure, resulting from poor body condition and sublethal chronic entanglement stress, is believed to play a crucial role in the population decline. Using photogrammetry from unmanned aerial vehicles, we conducted the largest population assessment of right whale body condition to date, to determine if the condition of NARWs was poorer than 3 seemingly healthy (i.e. growing) populations of southern right whales *E. australis* (SRWs) in Argentina, Australia and New Zealand. We found that NARW juveniles, adults and lactating females all had lower body condition scores compared to the SRW populations. While some of the difference could be the result of genetic isolation and adaptations to local environmental conditions, the magnitude suggests that NARWs are in poor condition, which could be suppressing their growth, survival, age of sexual maturation and calving rates. NARW calves were found to be in good condition. Their body length, however, was strongly determined by the body condition of their mothers, suggesting that the poor condition of lactating NARW females may cause a reduction in calf growth rates. This could potentially lead to a reduction in calf survival or an increase in female calving intervals. Hence, the poor body condition of individuals within the NARW population is of major concern for its future viability.

Cooke J.G., V.J., R., & M., S. (2015). *Southwest Atlantic Right Whales: Interim Updated Population Assessment from Photo-Id Data Collected at Península Valdéz*. International Whaling Commission. Retrieved from <https://archive.iwc.int/?r=5602&k=3abdb839b2>

Photo-id data collected during 1970-2012 on southern right whales (*Eubalaena australis*) in their winter calving grounds at Península Valdéz, Argentina were analyzed using an updated version of the stage structured model, that allows for birth intervals to depend on survival or mortality of the previous calf. The best-fitting model using the AIC criterion contained heterogeneity in capture probabilities between years, life stages and individuals, in addition to annual variability in the calf mortality rate and in the proportion of mothers recorded in association with their calves. The result show that almost all mothers of surviving calves take a resting year before getting pregnant again, whereas only about 40% of mothers who lose their calf take a resting year before getting pregnant again. Following a resting year, the pregnancy rate is over 90%. The calf mortality rate shows substantial variation over time around a median level of ~18%, with no overall upward or downward trend. The proportion of non-surviving calves that are still with the mother when she is sampled also varies over time, with an upward trend. Consequently, the model predicts a steep increase in observable calf mortality since 2000, despite the fact that the population calf mortality rate is not estimated to be higher than in previous decades. The steep rise in observable calf mortality since 2000 is consistent with the trend in recorded strandings in the gulfs of Nuevo and San José during this period. No change in the population growth rate of  $6.5 \pm 0.2$  % p.a. is detected yet, but it is important that recent data be processed and that the population continue to be monitored in the coming years.

Crespo, E. A., Pedraza, S. N., Dans, S. L., Svendsen, G. M., Degrati, M., & Coscarella, M. A. (2019). The Southwestern Atlantic Southern Right Whale, *Eubalaena australis*, Population Is Growing but at a Decelerated Rate. *Marine Mammal Science*, 35(1), 93-107  
<https://doi.org/10.1111/mms.12526>

This paper reports on aerial surveys conducted to estimate the relative abundance and trend in growth of the southern right whale (*Eubalaena australis*) population from Peninsula Valdes. The number of whales counted tripled from 1999 to 2016. We modeled the number of whales, the number of calves, the number of solitary individuals and the number of individuals in breeding groups using as predictive variables the year, Julian day, and Julian day(2) by means of generalized linear models. The rate of increase decreased from near 7% in 2007 to 0.06% and 2.30% for total number of whales and number of calves, respectively for 2016. Trends in the rates of increase for total number of whales and number of calves were negative (-0.732% and -0.376%, respectively). The habitat use of the whales changed along the years, with mothers and calves using more heavily the near-shore strip, resulting in a decreasing trend for solitary individuals and breeding groups in near-shore waters. We conclude that whales are still increasing their abundance, while the rate of increase is decreasing. Differences in the rates of increase of the group types and changes in habitat use are thought to be the consequence of a density-dependence process.

Davidson, A. (2016). *Population Dynamics of the New Zealand Southern Right Whale (Eubalaena australis)*. (Master), University of Otago, Dunedin, New Zealand. Retrieved from <https://ourarchive.otago.ac.nz/bitstream/handle/10523/6212/DavidsonAnthonyR2016MSc.pdf?sequence=1&isAllowed=y>

The southern right whale (SRW; *Eubalaena australis*), was nearly extirpated from New Zealand (NZ) waters by commercial whaling in the nineteenth century. The NZ population is thought to be recovering, but precision of the estimated population growth rate is low and population dynamics affecting the estimates are unknown. Population models act as powerful tools for estimating the population dynamics of endangered and vulnerable species, and help determine the viability of possible conservation actions. This thesis uses matrix population modelling to develop an understanding of the population dynamics, and specifically population growth, for the NZ SRW. Reproductive estimates are critical for population models. This thesis produces the first estimate of reproductive output for the NZ SRW. The calving interval is estimated to be 3.11 years (95% CI 2.79-3.43). The matrix population model constructed in this thesis incorporates new estimates of life history parameters estimated from photo-identification data collected in Port Ross, Auckland Islands (2006-2012) and additional estimates from similar conspecific populations. A three-stage, female-only, life cycle was used to estimate population growth using matrix population modelling techniques. The deterministic population growth rate was estimated to be 5.6%. Parameter uncertainty in demographic parameters was accounted for by incorporating estimates of variability from NZ SRW and conspecific estimates. The population growth rate decreases from 5.6% to 4.8% after parameter uncertainty was accounted for (95% CI 2.5% and 6.4%). Population projections included a range of year to year variability (SD=0.1, 0.5 and 1). These estimates were used to assess trends in abundance over 30 years and future population growth. As this variability increased, the mean population growth decreased from 4.8% to 3.3%. Abundance after thirty years decreased from 4333 to 2992 individual females. Estimates also became less precise as year to year variability increased. To understand which matrix entries and lower-level demographic parameters would have the greatest effect on population growth, a perturbation analysis was conducted. This included sensitivity and elasticity of the projection matrix. The resulting estimates of this analysis indicate that adult survival will have the highest absolute (sensitivity) and proportional effect (elasticity) on the population growth rate. The population models demonstrated in this thesis, coupled with recent re-colonization of former habitats around the NZ mainland and evidence from congeneric populations, suggest that NZ SRWs may become exposed to impacts such as fishing and shipping in the future. Conservation management aimed

at reducing anthropogenic impacts that affect survival (e.g. MPAs, shipping restrictions) will be vital during the re-colonisation of southern right whales to the New Zealand mainland.

Eduardo Pires, R. B., Groch, K. R., Paulo, A. d. C. F., Secchi, E. R., & Luciano, D. R. (2018). Area Usage Estimation and Spatiotemporal Variability in Distribution Patterns of Southern Right Whales, *Eubalaena australis*, of Southern Brazil. *Marine Ecology*, 39(3) <https://doi.org/10.1111/maec.12506>

Southern right whales—*Eubalaena australis* (Desmoulins, 1822)—migrate seasonally from high-latitude feeding grounds to coastal breeding and calving grounds at lower latitudes such as the southern coast of Brazil. Understanding how these whales are distributed along the coast is important for monitoring their postwhaling recovery and defining management strategies. In this study, we applied Kernel density estimators to aerial survey data to determine main occurrence and concentration areas of right whales in southern Brazil and investigate inter- and intra-annual distribution patterns between 2003 and 2012. Our results show considerable variation in area usage within and among years, and changes in the general distribution pattern of right whales in the last years of the study. Intra-annually, higher concentration area tended to expand from July to September and decrease in November. Some areas stood out as high-density areas for right whales: Ribanceira/Ibiraquera, Itapirubá Sul/Sol, and from Arroio to Gaivota. Some evidences also suggest preferential areas for mother–calf pairs. The higher concentration area of right whales in southern Brazil was estimated at 52,541 km<sup>2</sup> and the occurrence area was 682.69 km<sup>2</sup>, which is the whole study area. As right whale distribution in the region is likely expanding due to this population's current recovery, our study provides essential information for management plan of the Right Whale Environmental Protection Area.

Figueiredo, G. C. E., Goya, S. C. Y., & Santos, M. C. D. (2019). Southern Right Whales in the South-Western Atlantic Ocean: Proposed Criteria to Identify Suitable Areas of Use in Poorly Known Reproductive Grounds. *Journal of the Marine Biological Association of the United Kingdom*, 99(5), 1231-1236 <https://doi.org/10.1017/s0025315418001042>

Urbanization and intense vessel traffic in coastal areas are obstacles for right whales when selecting breeding and calving grounds. Human activities might be the main cause for the recently observed drop in right whale sightings along the south-eastern coast of Brazil. Information concerning the biology and the activities that can potentially affect the presence of individuals along the coast are essential for management purposes, as well as for the recovery of the species stocks after a period of whaling pressure. This study correlated the occurrence of right whales in the northern limit of the breeding ground in the South-western Atlantic Ocean with local geomorphology, degree of urbanization and oceanographic features to better identify suitable areas for use by these whales. The study area was divided into 14 sub-areas based on local coastal geomorphology and discharge of large rivers. The following five ranking criteria were applied to each sub-area: presence of whaling stations and whaling activity in the past; presence and activity of ports; protection from swell, coastal slope and composition of the bottom substrate. The sub-areas that offered conditions conducive to the presence of right whales received higher scores. The proposed criteria were validated by overlapping the ranking scores with the records of right whales sighted in each sub-area. In south-eastern Brazil, protected areas with sandy bottom and gentle slope were associated with more sightings of female-calf pairs. The criteria can be used as a primary diagnostic indicating suitable sub-areas for right whales in poorly known breeding grounds.



Findlay, K., Thornton, M., Wilkinson, C., Vermeulen, E., & Hoerbst, S. (2017). *Report on the 2016 Mammal Research Institute Whale Unit Southern Right Whale Survey, Nature's Valley to Lambert's Bay, South Africa*. International Whaling Commission Retrieved from <https://archive.iwc.int/?r=6759&k=a4b5c5ef85>

The South African southern right whale population has been monitored through annual aerial surveys across the Southern Cape coast since the early 1970's, and from 1979 onwards these annual surveys have incorporated identification using photography of natural markings resulting in an uninterrupted 38-year survey series. The planned 2016 survey was flown over the period 28 September 2016 to 5 October 2016 and westwards coastwise between Nature's Valley and Muizenberg. The survey was carried out in an Airbus EC120 helicopter as opposed to the Bell Jet Ranger helicopters used in previous years. A total of 21 hours and 15 minutes of flight operations was required to complete the survey, including 15 hours and 35 minutes of search effort and 3 hours and 33 minutes in transit to and from the survey start and end points. The general progress of the survey was extremely rapid compared to previous years, mainly due to the extremely low encountered abundance of southern right whales. Given such a paucity of encounters the survey was extended to Lambert's Bay on the west coast of South Africa on 10 October. Totals of 54 groups of 55 cow-calf pairs of southern right whales (110 animals) and eight groups of nine unaccompanied adult southern right whales were encountered during the survey. Marked declines of both the cow-calf and unaccompanied adult groups have been recorded in recent years with unaccompanied adult encounters declining since 2009 and cow-calf encounters declining from 2015. Whilst the decline in the unaccompanied adults since 2009 was originally thought to reflect movement of animals to the westward outside of the survey area, particularly to the west coast of South Africa, the paucity of sightings off the west coast this year suggest this is not the case. The fifty-five cow-calf groups encountered this year is the lowest sighting density over the last twenty-five years of survey and approximately thirty percent of the expected total based on surveys up until 2014. The reason for this decline remains speculative, but could reflect one of the two following scenarios. A temporal inter-annual shift in the 2015 and 2016 calving cohorts. The expected 2016 cohort may have extended their calving interval so that they calve in the 2017 cycle. Such a single year extension would not explain the decline in the 2015 encounters, as this scenario would require a lack of condition of resting females (precluding oestrus) in both 2014 and 2015. A spatial shift in calving in 2015 and 2016. However, no large concentrations of such animals have been reported from elsewhere on the southern African coast during the 2016 survey period. There is currently no evidence to suggest any marked decline in the adult population. At this stage, it is impossible to accurately speculate on any long-term changes to the population demographics and it is consequently imperative that the survey series continue so that the temporo-spatial components of the recent observed declines can be monitored and investigated.

Findlay, K. P., & Best, P. B. (2016). Distribution and Seasonal Abundance of Large Cetaceans in the Durban Whaling Grounds Off KwaZulu-Natal, South Africa, 1972-1975. *African Journal of Marine Science*, 38(2), 249-262 <https://doi.org/10.2989/1814232X.2016.1191042>

Daily charts of the aerial search effort (432 206 nautical miles) of the Union Whaling Company and 1 099 sightings of 10 497 whales were available from 628 flights off Durban between 1972 and 1975. Densities of whales were analysed by month and water depth distribution over the four-year period. Low observed densities of blue *Balaenoptera musculus*, right *Eubalaena australis*, sei *B. borealis* and humpback *Megaptera novaeangliae* whales most likely resulted from earlier whaling pressure. Seasonality of blue, sei and humpback whales was bimodal, indicative of winter migrations to the north of the Durban whaling grounds, whereas the unimodal seasonality of fin whales *B. physalus* and minke

whales *B. bonaerensis* or *B. acutorostrata* suggest the offshore region as the northern terminus of their migrations. Sperm whales *Physeter macrocephalus* migrate northwards offshore of the KwaZulu-Natal coast in autumn/early winter and southwards in late winter/spring, with larger males migrating later than the smaller males and females. Killer whale *Orcinus orca* presence was coincident with that of offshore minke whales and the southward migrations of other baleen whales, whereas densities of animals deemed as bottlenose whale *Hyperoodon planifrons* suggest strong early and late summer seasonal abundance in the offshore region. Such extensive surveys offshore of the KwaZulu-Natal coast are unlikely to be repeated; hence, data-extraction of whaling records provides a valuable source of seasonal and distributional information for marine management.

Gill, P. C., Pirzl, R., Morrice, M. G., & Lawton, K. (2015). Cetacean Diversity of the Continental Shelf and Slope Off Southern Australia. *The Journal of Wildlife Management*, 79(4), 672-681  
<https://doi.org/10.1002/jwmg.867>

We recorded a diverse cetacean assemblage from systematic aerial surveys in productive upwelling waters off southern Australia in 2002–2013. Surveys recorded 133 sightings of 15 identified cetacean species consisting of 7 mysticete (baleen) whale species, 8 odontocete (toothed) species, and 384 sightings of unidentified dolphins. This is the first assessment of cetacean diversity for the region and we found diversity to be comparable with other productive regions elsewhere. Differential spatial and temporal distributions of mysticete and odontocete species were apparent, and were associated with habitat variables and seasonal migration cycles. The study contributes new information to assist the environmental planning and management of activities in the region, including oil, and gas exploration and production, fishing, shipping, and renewable energy development.

Guzman, H. M., Capella, J. J., Valladares, C., Gibbons, J., & Condit, R. (2020). Humpback Whale Movements in a Narrow and Heavily-Used Shipping Passage, Chile. *Marine Policy*, 118, 103990  
<https://doi.org/10.1016/j.marpol.2020.103990>

The Magellan Strait is a narrow passage connecting the Pacific and Atlantic oceans in South America. An average of 2023 ships per year transit this corridor with 80% representing the international fleet. The southwestern part of the Strait in Chile is an important summer feeding area for humpback whales. Considering the risk to whales of feeding among dense ship traffic, the movements of 25 satellite-tagged whales relative to vessel density were analyzed, to provide policy recommendations for protecting the species from vessel collisions. A total of 3694 filtered whale positions from 21 individuals were obtained along the southwest passage. The daily range covered by individual whales was 8.8 km, and <25 km on 90% of all days. Ship density in the same square kilometers where whales were encountered was 0.27 per week, slightly more often than once per month, however this encounter rate varied by 100-fold between individuals, depending on how often animals were in the central shipping lane. One of the tagged whales stopped transmitting and washed up dead suggesting a ship strike. In the last decade, four other humpback whales and three sei whales were killed by probable ship strikes, all near Isla Carlos III, the core of the humpback feeding area. A 10-knot speed restriction and onboard observers are recommended during the five months of maximum whale abundance, applying to all merchant vessels traveling through the Strait, between Cabo Holland and Isla Bonete north of Carlos III Island, for a distance of 28 nautical miles (52 km).

Harcourt, R., van der Hoop, J., Kraus, S., & Carroll, E. L. (2019). Future Directions in *Eubalaena* Spp.: Comparative Research to Inform Conservation. *Frontiers in Marine Science*  
<https://doi.org/10.3389/fmars.2018.00530>

All three extant right whales (*Eubalaena australis* (Southern; SRW), *glacialis* (North Atlantic; NARW), and *japonica* (North Pacific; NPRW)) were heavily exploited, and the status of the two northern hemisphere species remains precarious. Limited gains made by the NARW have been reversed and urgent changes to management approaches are needed to avert extinction. By contrast, some SRW populations are recovering. Given their close phylogenetic relationship, morphological, demographic, and ecological similarities, the contrasting recovery rates suggest a comparative approach.

1. Recovery Right whales were protected in 1931, but NARW, NPRW and some SRW populations have barely recovered from whaling, while others are doing well. Are these differences a legacy of extreme depletion (e.g., loss of genetic diversity and cultural knowledge) or primarily due to anthropogenic factors (e.g. ship strike and fisheries entanglement). If modern anthropogenic threats are not affecting remote SRW populations, inform on NARW and NPRW?
2. Linking individuals to population level responses In the context of life history strategies strong links exist between reproductive indices and environmental conditions. Tracking survival, reproduction and other demographic parameters, and their population-level consequences, is possible with Individual identification. Robust life-history analyses link demography with environmental conditions, potentially teasing out influencing factors.
3. Adapting to shifting resources Recent reproductive declines in NARW appear linked to changing food resources and prey phenology. We know some large-scale movement patterns for NARW and a few SRW populations, we know little of mesoscale movements. For NPRW and some SRW populations, even broad-scale movements are poorly understood. In the face of climate change, can methodological advances help identify distributional and migratory responses?
4. Emergent diseases and the vulnerability of populations under stress Marine mammals are vulnerable to infectious diseases, particularly when subjected to stressors such as fishing gear entanglements, acoustic disturbance, and prey shortages. New tools to assess large whale health include body condition imaging, viromes, microbiomes, and stress hormones.
5. Comparative synthesis and cumulative effects A good cumulative effects analytical approach is urgently required, otherwise each stressor is managed in isolation, limiting efficacy. We propose a comparative synthesis to inform future cumulative effect analyses and outline future research priorities.

International Whaling Commission. (2018). *Intersessional Report of the International Whaling Commission Oct 2016 – Sept 2018*. International Whaling Commission. Retrieved from <https://archive.iwc.int/?r=6977&k=6445c2ac21>

The Intersessional Report is a relatively new concept at IWC and this is the second edition. It provides a short summary of IWC work over the last two years. It also aims to provide newcomers with an introduction to our purpose, structure and current areas of work. The desire for greater transparency is not unique to the IWC, but it is an organisation with much to gain from more effective sharing of information.

International Whaling Commission. (2018). Report of the IWC Scientific Committee from Its Annual Meeting Held from 9-21 May 2017 in Bled, Slovenia. *Journal of Cetacean Research and Management*, 19 Retrieved from <https://archive.iwc.int/?r=6940&k=619903c4cc>

No abstract.



Jackson, J. A., Carroll, E. L., Smith, T. D., Zerbini, A. N., Patenaude, N. J., & Baker, C. S. (2016). An Integrated Approach to Historical Population Assessment of the Great Whales: Case of the New Zealand Southern Right Whale. *Royal Society Open Science*, 3(3) <https://doi.org/10.1098/rsos.150669>

Accurate estimation of historical abundance provides an essential baseline for judging the recovery of the great whales. This is particularly challenging for whales hunted prior to twentieth century modern whaling, as population-level catch records are often incomplete. Assessments of whale recovery using pre-modern exploitation indices are therefore rare, despite the intensive, global nature of nineteenth century whaling. Right whales (*Eubalaena* spp.) were particularly exploited: slow swimmers with strong fidelity to sheltered calving bays, the species made predictable and easy targets. Here, we present the first integrated population-level assessment of the whaling impact and pre-exploitation abundance of a right whale, the New Zealand southern right whale (*E. australis*). In this assessment, we use a Bayesian population dynamics model integrating multiple data sources: nineteenth century catches, genetic constraints on bottleneck size and individual sightings histories informing abundance and trend. Different catch allocation scenarios are explored to account for uncertainty in the population's offshore distribution. From a pre-exploitation abundance of 28 800-47 100 whales, nineteenth century hunting reduced the population to approximately 30-40 mature females between 1914 and 1926. Today, it stands at less than 12% of pre-exploitation abundance. Despite the challenges of reconstructing historical catches and population boundaries, conservation efforts of historically exploited species benefit from targets for ecological restoration.

Lodi, L., & Tardin, R. (2018). Citizen Science Contributes to the Understanding of the Occurrence and Distribution of Cetaceans in Southeastern Brazil – a Case Study. *Ocean & Coastal Management*, 158, 45-55 <https://doi.org/10.1016/j.ocecoaman.2018.03.029>

Citizen Science projects involve ordinary people in scientific research, providing new insights and perspectives. Interested members of the public may contribute valuable information as they learn about wildlife in their local communities. This study investigates the spatiotemporal occurrence and distribution of cetaceans off the coast of Rio de Janeiro, Brazil, based on data obtained by citizen scientists (opportunistic observations - 2013/2016) and by cetacean researchers (dedicated observations - 2011/2016). The citizen scientists recorded 178 sightings of eight cetacean species along the whole Rio de Janeiro coast. Boat surveys (N = 118) were conducted by the authors in two Marine Protected Areas (MPA) and adjacent waters, resulting in a total of 77 records of four cetaceans species. Within the same area surveyed, citizen scientists contributed 98 reports of these four species. There was a high degree of information overlap, although the citizen scientists also expanded the database on the occurrence and distribution of cetaceans. The citizen scientists also confirmed the occurrence in the study area of four additional cetacean species, not recorded during the surveys. Opportunistic observations obtained from citizen scientists are thus a fundamentally important complementary tool for this type of investigation. The distribution records of the two datasets were also broadly compatible, in particular for the inshore sightings and the seasonal distribution of three of the four principal species. Overall, then, the data provided by from citizen scientists off the coast of Rio de Janeiro were validated by the boat surveys, which focused specifically on the area of the MPAs and adjacencies. The information provided by the combined dataset provides important insights for the creation of a buffer zone, which provide an additional layer of protection for the region's marine biota.

Mackay, A. I., Bailleul, F., Carroll, E. L., Andrews-Goff, V., Baker, C. S., Bannisters, J., . . . Childerhouse, S. J. (2020). Satellite Derived Offshore Migratory Movements of Southern Right Whales (*Eubalaena australis*) from Australian and New Zealand Wintering Grounds. *Plos One*, 15(5), 20  
<https://doi.org/10.1371/journal.pone.0231577>

Southern right whales (*Eubalaena australis*) migrate between Austral-winter calving and socialising grounds to offshore mid- to high latitude Austral-summer feeding grounds. In Australasia, winter calving grounds used by southern right whales extend from Western Australia across southern Australia to the New Zealand sub-Antarctic Islands. During the Austral-summer these whales are thought to migrate away from coastal waters to feed, but the location of these feeding grounds is only inferred from historical whaling data. We present new information on the satellite derived offshore migratory movements of six southern right whales from Australasian wintering grounds. Two whales were tagged at the Auckland Islands, New Zealand, and the remaining four at Australian wintering grounds, one at Pirates Bay, Tasmania, and three at Head of Bight, South Australia. The six whales were tracked for an average of 78.5 days (range: 29 to 150) with average individual distance of 38 km per day (range: 20 to 61 km). The length of individually derived tracks ranged from 645-6,381 km. Three likely foraging grounds were identified: south-west Western Australia, the Subtropical Front, and Antarctic waters, with the Subtropical Front appearing to be a feeding ground for both New Zealand and Australian southern right whales. In contrast, the individual tagged in Tasmania, from a sub-population that is not showing evidence of post-whaling recovery, displayed a distinct movement pattern to much higher latitude waters, potentially reflecting a different foraging strategy. Variable population growth rates between wintering grounds in Australasia could reflect fidelity to different quality feeding grounds. Unlike some species of baleen whale populations that show movement along migratory corridors, the new satellite tracking data presented here indicate variability in the migratory pathways taken by southern right whales from Australia and New Zealand, as well as differences in potential Austral summer foraging grounds.

Mandiola, M. A., Giardino, G., Bastida, J., Moron, S., Rodriguez, D. H., & Bastida, R. (2020). Half a Century of Sightings Data of Southern Right Whales in Mar Del Plata (Buenos Aires, Argentina). *Journal of the Marine Biological Association of the United Kingdom*, 100(1), 165-171  
<https://doi.org/10.1017/s0025315419001036>

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 (Peninsula Valdes-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.

Martins, A., & Dias, L. C. (2017). Actors and Networks in the Development of Environmental Territories: The Case of the Right Whale Environmental Protection Area. *Ambiente & Sociedade*, 20, 39-58 Retrieved from [http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S1414-753X2017000200039&nrm=iso](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1414-753X2017000200039&nrm=iso)

No abstract.

Melly, B. L., McGregor, G., Hofmeyr, G. J. G., & Plön, S. (2018). Spatio-Temporal Distribution and Habitat Preferences of Cetaceans in Algoa Bay, South Africa. *Journal of the Marine Biological Association of the United Kingdom*, 98(5), 1065-1079 <https://doi.org/10.1017/S0025315417000340>

Increasingly, baseline knowledge of habitat preferences and movement patterns of marine species is required to inform anthropogenic developments. The aim of this study was to determine baseline spatio-temporal distribution and habitat preference of cetaceans in the coastal waters of Algoa Bay. Areas of potential conflict with anthropogenic activities were also assessed. Monthly sea-based surveys were conducted between June 2008 and May 2011. A total of 500 cetacean sightings comprising six species were recorded in 106 surveys. *Tursiops aduncus* (Indo-Pacific bottlenose dolphin), *Sousa plumbea* (Indian Ocean humpback dolphin), *Delphinus capensis* (long-beaked common dolphin) and *Balaenoptera brydei* (Bryde's whale) were observed year-round, while *Eubalaena australis* (southern right whale) and *Megaptera novaeangliae* (humpback whale) were recorded from May to December. A large portion of sightings were associated with a Marine Protected Area and shipping zones. *Eubalaena australis*, *T. aduncus* and *S. plumbea* were found inshore (water depths < 12 m), while the other species were associated with deeper waters. *Tursiops aduncus* were most commonly seen (233 sightings). *Megaptera novaeangliae* were sighted often in austral winter, with 113 sightings. Only nine *D. capensis* sightings were recorded. Spatial distributions of species were corrected for search effort to identify habitat preferences. A number of key observations were made, including opportunistic foraging in *M. novaeangliae*, and the expansion of nursery grounds for *E. australis*, to include Algoa Bay. Four preferred habitat areas are proposed, providing important information for conservation and management of cetaceans in Algoa Bay. The spatial approach can be used to inform future relevant management decisions elsewhere.

Nijs, G., & Rowntree, V. J. (2017). Rare Sightings of Southern Right Whales (*Eubalaena australis*) on a Feeding Ground Off the South Sandwich Islands, Including a Known Individual from Península Valdés, Argentina. *Marine Mammal Science*, 33(1), 342-349 <https://doi.org/10.1111/mms.12354>

No abstract.

Pires Renault-Braga, E., Rejane Groch, K., de Carvalho Flores, P. A., Secchi, E. R., & Dalla-Rosa, L. (2018). Area Usage Estimation and Spatiotemporal Variability in Distribution Patterns of Southern Right Whales, *Eubalaena australis*, of Southern Brazil. *Marine Ecology*, 39 <https://doi.org/10.1111/maec.12506>

Southern right whales—*Eubalaena australis* (Desmoulins, 1822)—migrate seasonally from high-latitude feeding grounds to coastal breeding and calving grounds at lower latitudes such as the southern coast of Brazil. Understanding how these whales are distributed along the coast is important for monitoring their postwhaling recovery and defining management strategies. In this study, we applied Kernel density estimators to aerial survey data to determine main occurrence and concentration areas of right whales in southern Brazil and investigate inter- and intra-annual distribution patterns between 2003 and 2012.

Our results show considerable variation in area usage within and among years, and changes in the general distribution pattern of right whales in the last years of the study. Intra-annually, higher concentration area tended to expand from July to September and decrease in November. Some areas stood out as high-density areas for right whales: Ribanceira/Ibiraquera, Itapirubá Sul/Sol, and from Arroio to Gaivota. Some evidences also suggest preferential areas for mother–calf pairs. The higher concentration area of right whales in southern Brazil was estimated at 52,541 km<sup>2</sup> and the occurrence area was 682.69 km<sup>2</sup>, which is the whole study area. As right whale distribution in the region is likely expanding due to this population’s current recovery, our study provides essential information for management plan of the Right Whale Environmental Protection Area.

Rayment, W., Webster, T., Brough, T., Jowett, T., & Dawson, S. (2018). Seen or Heard? A Comparison of Visual and Acoustic Autonomous Monitoring Methods for Investigating Temporal Variation in Occurrence of Southern Right Whales. *Marine Biology*, 165(1), 1-10  
<https://doi.org/10.1007/s00227-017-3264-0>

Passive acoustic detectors are widely used for monitoring distribution of cetaceans. Autonomous visual methods are less frequently employed; they are limited to detections during daylight and good weather, but offer potential advantages due to certainty of species’ identification and longevity of deployment. To compare performance of acoustic and visual methods, temporal changes in distribution of southern right whales, *Eubalaena australis*, were monitored in the remote sub-Antarctic Auckland Islands (50°31’S, 166°16’E). A time-lapse camera was deployed for 2 years from August 2010, taking an image every 70 min. The presence of whales was scored for each image taken during daylight (n = 8295). A passive acoustic recorder was deployed in August 2011, recording for 3.75 min every hour until battery life expired after 10 months. Each recording (n = 6978) was aurally reviewed. Both methods revealed a similar seasonal distribution; maximum detection rates were in the austral winter and no whales were detected in January or February. However, at the peak of right whale occurrence, the proportion of samples with whales detected was much higher for the acoustic recorder (93.9% in August) than the time-lapse camera (14.8%). A generalised additive model fitted to the visual data revealed significant effects of sea state and visibility. Acoustic detection rates were higher, probably because detection range is greater, and less affected by weather. The solar-powered time-lapse camera system, however, functioned effectively for much longer. We discuss the relative merits of visual and acoustic detectors and attempt to draw conclusions about their efficacy for different focal species and monitoring locations.

Roux, J. P., Braby, R. J., & Best, P. B. (2015). Does Disappearance Mean Extirpation? The Case of Right Whales Off Namibia. *Marine Mammal Science*, 31(3), 1132-1152  
<https://doi.org/10.1111/mms.12213>

Right whales off Namibia were severely depleted by early 19th century whaling, and rarely featured in modern whaling catches in the 1920s. Aerial surveys of the Namibian coastline from 1978 and onwards revealed increasing numbers of right whales, but few cow-calf pairs. Aerial surveys off South Africa since 2009 showed a major decline in the availability of animals without calves. Twenty individual matches were made between 94 whales photographed off Namibia/Northern Cape in 2003-2012 and 1,677 photographed off South Africa in 1979-2012. Eight were adult females that calved in South African waters, but only one was also seen with a calf off Namibia. Twelve out of 13 individuals off Namibia with distinctive dorsal pigmentation were first seen as calves off South Africa. These results strongly indicate connectivity between the two regions, while the presence off Namibia of three adult females from the South African population in the season in which they are believed to conceive suggests that there is

unlikely to be any genetic differentiation between the two areas. We conclude that the reappearance of right whales off Namibia represents range expansion from South Africa rather than the survival of a few remnants of an originally separate stock.

Seguel, M., & Pavés, H. J. (2018). Sighting Patterns and Habitat Use of Marine Mammals at Guafo Island, Northern Chilean Patagonia During Eleven Austral Summers. [Patrones de avistamientos y uso de hábitat de mamíferos marinos en Isla Guafo, Patagonia Norte de Chile, durante once veranos australes]. *Revista de Biología Marina y Oceanografía*, 53(2), 237  
<https://doi.org/10.22370/rbmo.2018.53.2.1296>

The chiloense marine ecoregion, at the Northern Chilean Patagonia, has been considered a hotspot of marine mammal diversity, yet little is known regarding specific sites used by these species for reproduction, nursing, refuge, and foraging. This information is critical for proper spatial ecosystem planning and conservation of marine resources. In the austral summers of 2004 through 2008, and from 2012 to 2017, the presence, distribution, and behavior of 13 species of marine mammals was recorded at Guafo Island, an oceanic island located in the center of the chiloense ecoregion. Guafo Island is an important reproductive and feeding site for South American fur seals (*Arctocephalus australis australis*), South American sea lions (*Otaria byronia*) and marine otters (*Lontra felina*), and an important feeding, nursing, and transit location for humpback whales (*Megaptera novaeangliae*), Orcas (*Orcinus orca*), and blue whales (*Balaenoptera musculus*). We also recorded occasional sightings of fin whales (*B. physalus*), southern right whales (*Eubalaena australis*) and Peale's dolphins (*Lagenorhynchus australis*). The island coastline also serves as refuge for molting Southern elephant seals (*Mirounga leonina*) and vagrant Subantarctic fur seals (*Arctocephalus tropicalis*). The information presented here highlights Guafo Island as an important breeding, shelter, and feeding site for marine mammals in Chile. The growing anthropogenic pressure on this ecosystem emphasizes the importance of formal protection of this island as a priority site for marine conservation in the Northern Patagonia of Chile.

Stamation, K., Watson, M., Moloney, P., Charlton, C., & Bannister, J. (2020). Population Estimate and Rate of Increase of Southern Right Whales *Eubalaena australis* in Southeastern Australia. *Endangered Species Research*, 41, 373-383 <https://doi.org/10.3354/esr01031>

In Australian waters, southern right whales *Eubalaena australis* form 2 genetically distinct populations that have shown contrasting patterns of recovery since whaling ceased: a western population in South Australia and Western Australia and an eastern population in southeastern Australia (Tasmania, Victoria and New South Wales). Here, we provide an abundance estimate derived from a breeding female superpopulation mark-recapture model for the southeastern southern right whale population. The population comprises 268 individuals (68 breeding females) and has increased at a rate of 4.7 % per annum between 1996 and 2017. There has been no significant change in the annual abundance of mother-calf pairs sighted at the only calving ground (Logans Beach in Victoria) over the last 3 decades. The total number of southern right whales (i.e. all adults and calves) using the southeastern Australian coastline has increased by 7 % since 1985. Unlike the population estimate (which was restricted to breeding females sighted prior to the post-breeding southward migration), this estimate is likely to include transiting whales from the southwestern population. The theoretical population model predicts 19 breeding females at Logans Beach in 2018 and 28 in 2028; the actual number of breeding females, as of 2018, is 14. This study provides the first complete estimate of population size and rate of increase of southern right whales along the southeastern Australian coastline. This knowledge is critical for assessing population status and recovery of southern right whales in Australia. It provides a basis for monitoring persistence and responses of the population to environmental stressors.

Stephenson, F., Goetz, K., Sharp, B. R., Mouton, T. L., Beets, F. L., Roberts, J., . . . Lundquist, C. J. (2020). Modelling the Spatial Distribution of Cetaceans in New Zealand Waters. *Diversity and Distributions*, 26(4), 495-516 <https://doi.org/10.2307/26911455>

**Aim:** Cetaceans are inherently difficult to study due to their elusive, pelagic and often highly migratory nature. New Zealand waters are home to 50% of the world's cetacean species, but their spatial distributions are poorly known. Here, we model distributions of 30 cetacean taxa using an extensive at-sea sightings dataset ( $n > 14,000$ ) and high-resolution ( $1 \text{ km}^2$ ) environmental data layers. Location: New Zealand's Exclusive Economic Zone (EEZ). **Methods:** Two models were used to predict probability of species occurrence based on available sightings records. For taxa with  $< 50$  sightings ( $n = 15$ ), Relative Environmental Suitability (RES), and for taxa with  $\geq 50$  sightings ( $n = 15$ ), Boosted Regression Tree (BRT) models were used. Independently collected presence/absence data were used for further model evaluation for a subset of taxa. **Results:** RES models for rarely sighted species showed reasonable fits to available sightings and stranding data based on literature and expert knowledge on the species' autecology. BRT models showed high predictive power for commonly sighted species (AUC: 0.79–0.99). Important variables for predicting the occurrence of cetacean taxa were temperature residuals, bathymetry, distance to the 500 m isobath, mixed layer depth and water turbidity. Cetacean distribution patterns varied from highly localised, nearshore (e.g., Hector's dolphin), to more ubiquitous (e.g., common dolphin) to primarily offshore species (e.g., blue whale). Cetacean richness based on stacked species occurrence layers illustrated patterns of fewer inshore taxa with localised richness hotspots, and higher offshore richness especially in locales of the Macquarie Ridge, Bounty Trough and Chatham Rise. **Main conclusions:** Predicted spatial distributions fill a major knowledge gap towards informing future assessments and conservation planning for cetaceans in New Zealand's extensive EEZ. While sightings datasets were not spatially comprehensive for any taxa, these two best available approaches allow for predictive modelling of both more common, and of rarely sighted, cetacean species with limited available information.

Sueyro, N., Crespo, E. A., Arias, M., & Coscarella, M. A. (2018). Density-Dependent Changes in the Distribution of Southern Right Whales (*Eubalaena australis*) in the Breeding Ground Peninsula Valdes. *PeerJ*, 6 <https://doi.org/10.7717/peerj.5957>

**Background:** The Southern Right Whale (*Eubalaena australis*) population of the South-western Atlantic Ocean is recovering. In the breeding ground of Peninsula Valdes, as a consequence of the population growth, expansion to new areas by some types of groups and a change in the habitat use patterns at the coastal area were recorded. **Methods:** We analysed information gathered from aerial surveys conducted along the coast of Peninsula Valdes in 15 years of effective sampling in a 19-year span. These surveys were divided into four periods (1999-2000; 2004-2007; 2008-2012 and 2013-2016) and estimated the density of whales in a 620 km of coast divided into segments of five km. **Results:** The density of the whales increased to near three whales per  $\text{km}^2$  (averaged over each period) in the high-density areas. When this mean number was reached, the significant changes in density in the adjacent areas were detected in the following period. These changes were a decrease in density in the high-density areas and an increase of density in the low-density areas. **Discussion:** We propose that a threshold in density elicits a response in habitat use, with the Mother-calf pairs remaining in the area, while the other groups are displaced to new areas.



Zerbini, A. N., Fernandez Ajos, A., Andriolo, A., Clapham, P. J., Crespo, E., & Gonzalez, R. (2018). *Satellite Tracking of Southern Right Whales (Eubalaena australis) from Golfo San Matias, Rio Negro Province, Argentina*. International Whaling Commission Bled, Slovenia. Retrieved from <https://archive.iwc.int/?r=8874&k=0a2ff02deb>

Satellite transmitters were deployed on nine southern right whales (*Eubalaena australis*) in Golfo San Matías, Province of Rio Negro, Argentina in October 2016 (n=1) and September 2017 (n=8). This region is located nearly 200 km north of Peninsula Valdés (PV), the main breeding and calving ground for this species in the western South Atlantic Ocean. Tag duration varied between 46 and 204 days (average of 117 days). Movement patterns showed marked individual variation. Five individuals moved southwards towards Golfo San José and Golfo Nuevo, in PV shortly after tagging. Four other whales moved north along the coast of the Buenos Aires Province in Argentina and of Uruguay. Movement patterns in coastal areas suggest that whales in the northern Golfo San Matías regularly visit areas further to the south in PV, but interestingly only whales tagged in the former migrated northward along the coast. All whales eventually moved east towards offshore waters of the outer continental shelf and shelf break along the coast of Argentina (from the La Plata River to the Falkland/Malvinas Islands). Most whales tracked until later in the season (after January) migrated east/southeast towards South Georgia/Islas Georgia del Sur and the Scotia Sea/Mar de Escocia, where they remained for the duration of their tags. One individual was migrating east past 22oW of longitude when the tag stopped transmitting. Behavioral states estimated by a hierarchical space-state model indicate areas of potential foraging importance in the outer continental shelf off southern South America, the South Atlantic Basin, the Eastern Scotia Sea/Mar de Escocia and the northern Weddell Sea/Mar de Weddell. These findings complements others from an ongoing long-term study to understand the migratory routes and destinations of southern right whales wintering off the coast of Argentina and, overall, reveals that this species inhabits vast extensions of the South Atlantic Ocean and visits multiple potential feeding areas each season.

Zerbini, A. N., Rosenbaum, H., Mendez, M., Sucunza, F., Andriolo, A., Harris, G., . . . Aió, A. F. (2016). *Tracking Southern Right Whales through the Southwest Atlantic: An Update on Movements, Migratory Routes and Feeding Grounds*. International Whaling Commission Retrieved from <https://archive.iwc.int/?r=6094&k=a1cad47dc1>

Satellite transmitters were attached to seven southern right whales (*Eubalaena australis*) in their breeding grounds in Golfo Nuevo, Península Valdés, Argentina, to monitor their movements and migration towards feeding destinations. Fifteen integrated transdermal implanted tags were deployed in juvenile and adult whales. Tag duration varied between 10 and 237 days (average of 90 days). Movement patterns showed substantial individual and yearly variation. Tagged whales visited the outer Patagonian shelf east of Península Valdés and north of the Falkland/Malvinas Islands, the Scotia Sea near South Georgia/Islas Georgia del Sur and the South Sandwich Islands/Islas Sandwich del Sur, and the South Atlantic basin between 38 and 58 degrees S. State-space models were used to estimate behavioral states and suggested areas of potential foraging importance in the Patagonian shelf, the subtropical convergence and the continental shelf break east of South Georgia/Islas Georgia del Sur. A preliminary investigation of movement patterns relative to oceanographic features indicated that SRWs may be using anti-cyclonic cold eddies in the Subtropical Convergence for foraging. In addition, dive profiles suggest potential differences in how juvenile and adult whales explore the water column.

## Section IV: Threats

Ajo, A. A. F., Hunt, K. E., Giese, A. C., Sironi, M., Uhart, M., Rowntree, V. J., . . . Buck, C. L. (2020). Retrospective Analysis of the Lifetime Endocrine Response of Southern Right Whale Calves to Gull Wounding and Harassment: A Baleen Hormone Approach. *General and Comparative Endocrinology*, 296 <https://doi.org/10.1016/j.ygcen.2020.113536>

Physiological measurements are informative in assessing the relative importance of stressors that potentially impact the health of wildlife. Kelp Gulls, *Larus dominicanus* (KG), resident to the region of Peninsula Valdes, Argentina, have developed a unique behavior of landing on the backs of southern right whale adults and calves, *Eubalaena australis* (SRW), where they feed on their skin and blubber. This parasitic behavior results in large open wounds on the dorsal surface of the whale. Coincidentally, the SRW population off the coast of Peninsula Valdes has experienced elevated calf mortality. We quantified levels of glucocorticoids and thyroid hormone extracted from baleen of dead calves to evaluate, retrospectively, the endocrine response of whale calves to gull wounding and harassment. Baleen accumulates hormones as it grows, allowing evaluation of long-term trends in physiological condition. While glucocorticoids (GCs) are known to increase in response to stressors such as disturbance, the metabolic hormone triiodothyronine (T-3) has been shown to decrease under sustained food deprivation but is largely unaffected by disturbance stress. We quantified lifetime patterns of GCs and T-3 in baleen recovered at necropsy from 36 southern right whale calves with varying severity of wounding from KGs. GC levels in baleen correlated positively with the degree of wounding, while T-3 levels remained stable irrespective of the severity of the wounding. Our results suggest no evidence of malnutrition in low vs. severely wounded whales. However, the positive correlation of GCs with wound severity indicates that heavily wounded calves are suffering high levels of physiological stress before they die. This suggests that KG wounding may have contributed to the high southern right whale calf mortality observed in the Peninsula Valdes region of Argentina.

Ajo, A. A. F., Hunt, K. E., Uhart, M., Rowntree, V., Sironi, M., Maron, C. F., . . . Buck, C. L. (2018). Lifetime Glucocorticoid Profiles in Baleen of Right Whale Calves: Potential Relationships to Chronic Stress of Repeated Wounding by Kelp Gulls. *Conservation Physiology*, 6 <https://doi.org/10.1093/conphys/coy045>

Baleen tissue accumulates stress hormones (glucocorticoids, GC) as it grows, along with other adrenal, gonadal and thyroid hormones. The hormones are deposited in a linear fashion such that a single plate of baleen allows retrospective assessment and evaluation of long-term trends in the whales' physiological condition. In whale calves, a single piece of baleen contains hormones deposited across the lifespan of the animal, with the tip of the baleen representing prenatally grown baleen. This suggests that baleen recovered from stranded carcasses of whale calves could be used to examine lifetime patterns of stress physiology. Here we report lifetime profiles of cortisol and corticosterone in baleen of a North Atlantic right whale ('NARW'-*Eubalaena glacialis*) calf that died from a vessel strike, as well as four southern right whale ('SRW'-*Eubalaena australis*) calves that were found dead with varying severity of chronic wounding from Kelp Gull (*Larus dominicanus*) attacks. In all five calves, prenatally grown baleen exhibited a distinctive profile of elevated glucocorticoids that declined shortly before birth, similar to GC profiles reported from baleen of pregnant females. After birth, GC profiles in calf baleen corresponded with the degree of wounding. The NARW calf and two SRW calves with no or few gull wounds had relatively low and constant GC content throughout life, while two SRW calves with high



numbers of gull wounds had pronounced elevations in baleen GC content in postnatal baleen followed by a precipitous decline shortly before death, a profile suggestive of prolonged chronic stress. Baleen samples may present a promising and valuable tool for defining the baseline physiology of whale calves and may prove useful for addressing conservation-relevant questions such as distinguishing acute from chronic stress and, potentially, determining cause of death.

Argüelles, M. B., Coscarella, M., Fazio, A., & Bertellotti, M. (2016). Impact of Whale-Watching on the Short-Term Behavior of Southern Right Whales (*Eubalaena australis*) in Patagonia, Argentina. *Tourism Management Perspectives*, 18, 118-124 <https://doi.org/10.1016/j.tmp.2016.02.002>

In the last 30 years, whale watching tours in Patagonia, which are primarily based on viewing pods of Southern right whale, have become increasingly popular. The aim of this study was to evaluate the impact of whale watching boat trips on the behavior of whales. Data were analyzed by means of a Generalized Linear Model using a log-link function for categorical data. The model that best fitted the data had four selected first-order interactions among factors. Whales showed short-term reactions to boats, changing their behavior in response to the approaching boats. If the boat approached appropriately (i.e. with the engines off), whales reacted positively by approaching the boat and seeking contact, whereas if the boat approached inappropriately (i.e. with the engines on), whales reacted negatively by moving away from the boat and avoiding contact. The results of this study may have significant implications for whale watching regulations and their enforcement.

Arias, M., Coscarella, M. A., Romero, M. A., Svendsen, G. M., Reinaldo, M. O., Curcio, N. S., . . . González, R. A. C. (2018). Impact of Whale-Watching on Southern Right Whale (*Eubalaena australis*) in Patagonia: Assessing the Effects from Its Beginnings in the Context of Population Growth. *Tourism Management Perspectives*, 27, 1-9 <https://doi.org/10.1016/j.tmp.2018.03.005>

No abstract.

Bellazzi, G., Orri, R., & Montanelli, S. (2012). *Entanglement of Southern Right Whales (*Eubalaena australis*) in Gulf Nuevo, Chubut, Argentina*. International Whaling Commission SC/64/BC1. Retrieved from <https://archive.iwc.int/?r=5386&k=c63efd2b83>

The first organized disentangling response in Argentina took place in the bay of Puerto Piramides in September 2002 when a juvenile male Southern Right whale became tangled in the mooring of a large Whale Watching (WW) catamaran. Since then, the number of entangled whales has increased in the area, especially between 2009 and 2011. During that period of time, the Network has received 8 reports most of them from WW Captains, commercial divers and local fishermen. Of a total of 12 entangled whales reported in our area over the past decade, 9 of the cases (75%) were confirmed and documented and 3 animals (25%) could not be found. Of the 9 confirmed cases of entanglement, 6 whales (67%) were successfully released and 3 (33%) were not re-sighted in spite of the search efforts by the Coast Guards, Whale Watching operators and RFCC members. Of the documented entanglements 56% corresponded to moorings, and the remaining 44% to marine debris (rope) and fishing gear.

Bengtson Nash, S. M. (2018). Chapter 14 - Toxicological Risks and Considerations Associated with Lipophilic Contaminant Burdens of Southern Ocean Mysticetes. In *Marine Mammal Ecotoxicology*. M. C. Fossi & C. Panti (Eds.), (pp. 381-400): Academic Press <https://doi.org/10.1016/B978-0-12-812144-3.00014-0>

Southern Ocean foraging baleen whales, as with other capital breeders, represent a “special case” scenario for the evaluation of the toxicologic risk posed through lipophilic chemical exposure. Feeding on seasonally productive prey species, followed by extended fasting associated with energy intensive activities, such as migration, competitive breeding behavior, pregnancy, and lactation, results in massive fluctuations in lipid reserves. These fluctuations are mirrored in the toxicokinetics of lipophilic contaminant burdens, with significant mobilization and redistribution of contaminants taking place between the individual's tissues during this time. While the toxicologic consequence of this life-history behavior remains unquantified, fasting should be thought of as a time of “reexposure” of target sites of toxicity to harmful chemicals. Of significant relevance is the temporal cooccurrence of pregnancy and nursing of young calves, with elevated circulating maternal chemical burdens. Elevated maternal offloading of persistent organic pollutants to the young is further exacerbated by the disproportionate exposure experienced by the embryo and calf on account of a smaller body size. The interplay of multiple stressors, for example, chemical exposure, negative energy balance, and immune function, during migration remains a critical nexus of priority for future investigation. The importance of such investigations are underscored by the vulnerability of the Antarctic sea-ice ecosystem to the direct effects of polar climate change, which may result in further energetic challenges to Southern Ocean mysticetes, already adapted to metabolic extremes.

Bianchi, M. V., Ehlers, L. P., Vargas, T. P., Lopes, B. C., Taunde, P. A., de Cecco, B. S., . . . Sonne, L. (2018). Omphalitis, Urachocystitis and Septicemia by *Streptococcus Dysgalactiae* in a Southern Right Whale Calf *Eubalaena australis*, Brazil. *Diseases of Aquatic Organisms*, 131(3), 227-232  
<https://doi.org/10.3354/dao03293>

Southern right whales *Eubalaena australis* (SRW) use the southern coast of Brazil as a wintering and calving ground. Other than anthropogenic threats, there is limited knowledge on health and disease aspects for this species. We report the gross and microscopic findings and microbiological identification of streptococcal septicemia in a SRW calf. Main gross findings included fibrinosuppurative omphalitis and urachocystitis, suppurative cystitis, valvular endocarditis and myocarditis, embolic pneumonia, suppurative myositis and osteoarthritis, and lymphadenomegaly. Histological examination confirmed the above inflammatory processes and indicated disseminated Gram-positive coccoid septicemia. PCR analysis, based on the 16S rRNA gene from bacteria isolated on blood agar, identified *Streptococcus dysgalactiae*. Pathologic and microbiologic analysis indicated that beta-hemolytic *S. dysgalactiae* septicemia, presumably initiated as ascending omphalic infection, was responsible for stranding and death in this individual. These results further confirm pathogenicity of streptococci in cetaceans and add to the limited health and disease related pathology knowledge for this species.

Chalcobsky, A., Crespo, E. A., & Coscarella, M. A. (2020). Short-Term Effects of Whale Watching Boats on the Movement Patterns of Southern Right Whales in Península Valdés, Patagonia, Argentina. *Marine Environmental Research*, 157, 104927 <https://doi.org/10.1016/j.marenvres.2020.104927>

Whale watching in Patagonia began in 1973, with the southern right whale (*Eubalaena australis*) as a target. Thus far, only short-term effects of whale watching on behaviour have been evaluated. The southern right whale population is increasing locally and expanding to adjacent areas. We evaluated boat effects on the biological system through the analysis of breathing rate, linearity, reorientation rate and total distance travelled. Short-term movement patterns of SRW in the area are not severely affected by whale watching operations in Puerto Pirámide at this level of activity. However, significant changes in breathing rates in the presence of boats deserve further attention considering that whales return the

same location. In light of the present work, the whales that breed at Península Valdés may be tolerant to whale watching boats.

Chalcobsky, B. A., Crespo, E. A., & Coscarella, M. A. (2017). Whale-Watching in Patagonia: What Regulation Scheme Should Be Implemented When the Socio-Ecological System Is Changing? *Marine Policy*, 75, 165-173 <https://doi.org/10.1016/j.marpol.2016.11.010>

Whale-watching began informally at Península Valdés in 1973. The activity primarily targeted southern right whales (*Eubalaena australis*). Since the early 1970s the number of people sailing out on whale-watching trips increased from several tourists a year to more than 100,000 in 2014. In this paper the fluctuations in the number of passengers, the biological changes and the socio-economic factors that influenced the development of the activity were reviewed. There are effectively four periods in the history of the development of whale-watching in Península Valdés. These periods correspond to international events, whilst some are related to domestic matters. The development of whale-watching regulations in relation to these events is also reviewed. Although the current whale-watching regulation scheme is appropriate, there are some aspects that could be improved by making the rules easier to be altered and modified, i.e., an adaptive management approach. As a case study the regulation prohibiting watching whale mothers with newborns, before August 31st every year, is examined, including the problems that boat operators face while attempting to comply with this regulation. Many of these problems arise due changes in the biological system (i.e. whale population growth).

Christiansen, F., Nielsen, M. L. K., Charlton, C., Bejder, L., & Madsen, P. T. (2020). Southern Right Whales Show No Behavioral Response to Low Noise Levels from a Nearby Unmanned Aerial Vehicle. *Marine Mammal Science*, 36(3), 953-963 <https://doi.org/10.1111/mms.12699>

Unmanned aerial vehicles (UAVs) are increasingly used for wildlife research and monitoring, but little information exists on their potential effect on marine mammals. We assessed the effects of a UAV on the behavior of southern right whales (*Eubalaena australis*) in Australia. Focal follows of ten right whale mother-calf pairs were conducted using a theodolite. Control data were recorded for 30 min, and then a DJI Inspire 1 Pro was flown above the whales for 10 min at 5 m altitude. Potential changes to horizontal behavior (swim speed and turning angle) and surfacing pattern (interbreath intervals) were investigated by comparing mother-calf behavior before and during UAV approaches. Changes in respiration rate were used to quantify energetic effects. We also explored acoustic cue perceptibility of the UAV at 5, 10, and 30 m altitude, by measuring the received UAV underwater noise level on whales equipped with acoustic tags (DTAGs). The received noise levels were  $86.0 \pm 3.9$  dB re 1  $\mu$ Pa, while the measured ambient noise was  $80.7 \pm 7.3$  dB re 1  $\mu$ Pa in the same frequency band (100–1,500 Hz). No behavioral response to the UAV was observed. This provides support for UAVs as a noninvasive tool to study baleen whale behavior and ecophysiology.

D'Agostino, V. C., Degradi, M., Sastre, V., Santinelli, N., Krock, B., Krohn, T., . . . Hoffmeyer, M. S. (2017). Domoic Acid in a Marine Pelagic Food Web: Exposure of Southern Right Whales *Eubalaena australis* to Domoic Acid on the Peninsula Valdes Calving Ground, Argentina. *Harmful Algae*, 68, 248-257 <https://doi.org/10.1016/j.hal.2017.09.001>

The gulfs that surround Peninsula Valdes (PV), Golfo Nuevo and Golfo San Jose in Argentina, are important calving grounds for the southern right whale *Eubalaena australis*. However, high calf mortality events in recent years could be associated with phycotoxin exposure. The present study evaluated the transfer of domoic acid (DA) from *Pseudo-nitzschia* spp., potential producers of DA, to living and dead

right whales via zooplanktonic vectors, while the whales are on their calving ground at PV. Phytoplankton and mesozooplankton (primary prey of the right whales at PV and potential grazers of *Pseudo-nitzschia* cells) were collected during the 2015 whale season and analyzed for species composition and abundance. DA was measured in plankton and fecal whale samples (collected during whale seasons 2013, 2014 and 2015) using liquid chromatography coupled to tandem mass spectrometry (LC-MS/MS). The genus *Pseudo-nitzschia* was present in both gulfs with abundances ranging from  $4.4 \times 10^2$  and  $4.56 \times 10^5$  cell l<sup>-1</sup>. *Pseudo-nitzschia australis* had the highest abundance with up to  $4.56 \times 10^5$  cell l<sup>-1</sup>. DA in phytoplankton was generally low, with the exception of samples collected during a *P. australis* bloom. No clear correlation was found between DA in phytoplankton and mesozooplankton samples. The predominance of copepods in mesozooplankton samples indicates that they were the primary vector for the transfer of DA from *Pseudo-nitzschia* spp. to higher trophic levels. High levels of DA were detected in four whale fecal samples (ranging from 0.30 to 710  $\mu\text{g g}^{-1}$  dry weight of fecal sample or from 0.05 and 113.6  $\mu\text{g g}^{-1}$  wet weight assuming a mean water content of 84%). The maximum level of DA detected in fecal samples (710  $\mu\text{g DA g}^{-1}$  dry weight of fecal sample) is the highest reported in southern right whales to date. The current findings demonstrate for the first time that southern right whales, *E. australis*, are exposed to DA via copepods as vectors during their calving season in the gulfs of PV.

D'Agostino, V. C., Hoffmeyer, M. S., Almandoz, G. O., Sastre, V., & Degradi, M. (2015). Potentially Toxic *Pseudo-Nitzschia* Species in Plankton and Fecal Samples of *Eubalaena australis* from Península Valdés Calving Ground, Argentina. *Journal of Sea Research*, 106, 39-43  
<https://doi.org/10.1016/j.seares.2015.09.004>

Península Valdés (PV) in Argentina is an important calving ground for the southern right whale *Eubalaena australis*. However, a high mortality of calves has been observed in the last years, which could be associated with phycotoxin exposure. During a sampling program conducted late in the calving seasons of 2004, 2005 and 2010, potentially toxic species of the genus *Pseudo-nitzschia* were observed to be an important component of the phytoplankton community and they were also found in fecal samples of two live whales and three stranded whales. In line with this, in the present study *Pseudo-nitzschia australis*, *Pseudo-nitzschia fraudulenta*, *Pseudo-nitzschia pungens* and the complex *Pseudo-nitzschia pseudodelicatissima* were identified in fecal samples and phytoplankton samples by light and electron microscopy. Although no toxin analysis was carried out in the present study, our findings suggest that *E. australis* could be exposed to domoic acid in their calving ground.

Evans, S., Briz i Godino, I., Álvarez, M., Rowsell, K., Collier, P., de Goodall, R. N. P., . . . Speller, C. (2016). Using Combined Biomolecular Methods to Explore Whale Exploitation and Social Aggregation in Hunter–Gatherer–Fisher Society in Tierra Del Fuego. *Journal of Archaeological Science: Reports*, 6, 757-767 <https://doi.org/10.1016/j.jasrep.2015.10.025>

Cetaceans were an important food and raw material resource for the South American hunter–gatherer–fisher (HGF) communities of Tierra del Fuego. Historic ethnographic evidence suggests that relatively mobile HGF groups came together in large numbers to exploit carcasses from individual cetacean stranding events. Substantial accumulations of whale bones within shell middens in the Lanashuaia locality of the Beagle Channel suggests that these social aggregation events may also have occurred in pre-historic periods. The difficulty in assigning taxonomic identifications to the fragmentary whale remains, however, made it difficult to explicitly test this hypothesis. Here, we applied two different biomolecular techniques, collagen peptide mass fingerprinting (ZooMS) and ancient mitochondrial DNA analysis to 42 archeological bone fragments from the Lanashuaia locality to provide accurate species

identifications. There was a clear correspondence between ZooMS and DNA results, identifying five different cetacean species (Southern bottlenose, blue, humpback, right, and sei whale) as well as human and sea lion remains. The biomolecular results were not conclusively consistent with HGF social aggregation, revealing an unexpectedly diverse range of cetaceans within the Lanashuaia middens. However, the results could not fully refute the hypothesis that cetacean remains can be used as anthropic markers of aggregation events, as the observed species and haplotypes revealed potential shared exploitation of some whale resources between midden sites.

Fazio, A., Arguelles, M. B., & Bertellotti, M. (2015). Change in Southern Right Whale Breathing Behavior in Response to Gull Attacks. *Marine Biology*, 162(2), 267-273 <https://doi.org/10.1007/s00227-014-2576-6>

Animals may develop behavioral responses to avoid discomforting situations. In particular, pain can result in learned avoidance behaviors. We report such a case in southern right whales (*Eubalaena australis*) that have been the target of attacks by kelp gulls (*Larus dominicanus*) that feed on their skin and blubber in the surrounded waters of Peninsula Valdés, Chubut (Argentina) since the 1980s. The increase in the attacks over the years triggered on whales the development of alternative postures to keep their backs protected from the gulls. Recently, a particular avoidance behavior has been observed, the "oblique breathing," in which whales breathe with only the head out of the water. The main goal of this work is to describe the emergence of oblique breathing in two areas of Golfo Nuevo (P. Valdés) which have high number of whales and gull attacks, during the whale reproductive seasons in 2010, 2012 and 2013. Results suggest that all age and sex classes of whales can breathe obliquely. Emergence of the oblique breathing seems to have proceeded in three stages: (1) the origin, with rare observations, (2) the spread, when the behavior was registered only during gull attacks and (3) the establishment, when whales performed it in a preventive manner, even when attacks were not occurring. Oblique breathing is likely to pose extra energy costs, which could be detrimental to whales, especially for recently born calves. However, given the increasing prevalence of this behavior, it seems to be a useful strategy to prevent harassment by gulls.

Figueiredo, G. C., de O Santos, M. C., Siciliano, S., & Moura, J. F. (2017). Southern Right Whales (*Eubalaena australis*) in an Urbanized Area Off the Southwestern Atlantic Ocean: Updated Records and Conservation Issues. *Aquatic Mammals*, 43(1), 52 <https://doi.org/10.1578/AM.43.1.2017.52>

The southern right whale (*Eubalaena australis*) has been placed in the category of "least concern" in the International Union for Conservation of Nature's Red List of Threatened Species and in the category of "endangered" in the Brazilian Red List of Threatened Fauna. The aim of this study was to update sighting and stranding records of right whales along the southeastern Brazilian coast between 2000 and 2015 and to assess the main threats they face. Records occurred mainly between May and October, and mother and calf pairs represented 78% of all sightings, evidencing the use of the southeast coast of Brazil as part of the breeding and possibly calving area. A total of eight strandings was reported. On 6 September 2012, the first confirmed ship strike on a right whale was reported in the surveyed area. The intensified conflicts between coastal development and the use of protected and calm waters along southeastern Brazil by southern right whales as breeding areas should be considered in management plans.

Fiorito, C., Palacios, C., Golemba, M., Bratanich, A., Arguelles, M. B., Fazio, A., . . . Lombardo, D. (2015). Identification, Molecular and Phylogenetic Analysis of Poxvirus in Skin Lesions of Southern Right Whale. *Diseases of Aquatic Organisms*, 116(2), 157-163 <https://doi.org/10.3354/dao02918>

Poxvirus skin disease has been reported in several species of cetaceans, principally in odontocetes, and a single report in mysticetes. Southern right whales *Eubalaena australis* in Peninsula Valdes, Argentina, show a variety of skin lesions of unknown etiology, and the number of these lesions has increased in recent years. Samples from dead whales were taken in order to establish the etiology of these lesions. One calf and one adult presented ring-type lesions, characterized by a circumscribed and slightly raised area of skin. Lesions were histologically characterized by the presence of microvesicles and vacuolated cells in the stratum spinosum, along with hyperplasia of the stratum corneum and eosinophilic inclusion bodies in the cytoplasm of the epithelial cells. Transmission electron microscopy showed aggregations of virions with typical poxvirus morphology. PCR of cetacean poxvirus (CPV) DNA polymerase, DNA topoisomerase I and parapoxvirus DNA polymerase gene fragments was done, and confirmed the presence of poxvirus in one sample. Phylogenetic analysis showed that the detected poxvirus belongs to the CPV-2 group. This is the first confirmed report of poxvirus in southern right whales in Argentina.

Fiorito, C. D., Bentancor, A., Lombardo, D., & Bertellotti, M. (2016). Erysipelothrix rhusiopathiae Isolated from Gull-Inflicted Wounds in Southern Right Whale Calves. *Diseases of Aquatic Organisms*, 121(1), 67-73 <https://doi.org/10.3354/dao03041>

Southern right whales *Eubalaena australis* from Peninsula Valdes, Argentina, show wounds produced by kelp gulls *Larus dominicanus* that feed on the whales' dorsal skin and blubber. During the 2013 whale season, several calves were reported showing kelp gull injuries with a swollen area surrounded by rhomboid-shaped raised edges. Samples from 9 calves were taken in order to establish the etiology of these rhomboid-shaped wounds; 2 calves (one living, one dead) showed gull-inflicted injuries with rhomboid-shaped edges. Samples from the dead calf were histologically characterized by the presence of dermal congestion, suppurative dermatitis and panniculitis, necrotizing vasculitis and vascular thrombosis. Erysipelothrix rhusiopathiae was detected by culture and PCR in samples from both calves. In this study we report, for the first time to our knowledge, the isolation of *E. rhusiopathiae* from wounds produced by gull attacks on southern right whale calves, supplying evidence that these wounds may act as an entry route for pathogens. This work provides new information about the consequences of gull-inflicted injuries for whale health.

Groch, K. R., Catao-Dias, J. L., Groch, K. R., Kolesnikovas, C. K. M., de Castilho, P. V., Moreira, L. M. P., . . . Diaz-Delgado, J. (2019). Pathologic Findings and Causes of Death in Southern Right Whales *Eubalaena australis*, Brazil. *Diseases of Aquatic Organisms*, 137(1), 23-31 <https://doi.org/10.3354/dao03424>

Southern right whales *Eubalaena australis* (SRWs) migrate to southern Brazil for breeding and calving from June through November. Overall, there is scarce knowledge on health status and pathologic conditions in SRWs. We report the pathologic and molecular investigation results of 8 SRWs that were necropsied between 2010 and 2017 within a breeding and calving ground in Santa Catarina state, Brazil. The animals were of various ages (7 newborns/calves, 1 adult) and sex (3 females, 5 males). Five whales stranded dead; 3 stranded alive and died shortly after (n = 2) or were euthanized (n = 1). The causes of stranding and/or death were neonatal respiratory distress syndrome with meconium aspiration (n = 3) with concomitant congenital hepatopathy in one of them; trauma of unknown origin (n = 3), infectious renal and lung disease with presumed sepsis (n = 1), and euthanasia (n = 1). Three animals were PCR-



positive for cetacean morbillivirus; one of them also had morbilliviral antigen in kidney via immunohistochemical analysis. These results, integrating novel findings and a published report, contribute to the pathology knowledge of this species.

Hays, G. C., Bailey, H., Bograd, S. J., Bowen, W. D., Campagna, C., Carmichael, R. H., . . . Sequeira, A. M. M. (2019). Translating Marine Animal Tracking Data into Conservation Policy and Management. *Trends in Ecology & Evolution*, 34(5), 459-473 <https://doi.org/10.1016/j.tree.2019.01.009>

There have been efforts around the globe to track individuals of many marine species and assess their movements and distribution, with the putative goal of supporting their conservation and management. Determining whether, and how, tracking data have been successfully applied to address real-world conservation issues is, however, difficult. Here, we compile a broad range of case studies from diverse marine taxa to show how tracking data have helped inform conservation policy and management, including reductions in fisheries bycatch and vessel strikes, and the design and administration of marine protected areas and important habitats. Using these examples, we highlight pathways through which the past and future investment in collecting animal tracking data might be better used to achieve tangible conservation benefits.

International Whaling Commission. (2016). Report of the Second Workshop on Mortality of Southern Right Whales (*Eubalaena australis*) at Península Valdés, Argentina. *Journal of Cetacean Research and Management*, 17, 583-598 Retrieved from <https://archive.iwc.int/?r=5542&k=9afe3da120>

No abstract.

Iwasa-Arai, T., Siciliano, S., Serejo, C. S., & Rodriguez-Rey, G. T. (2017). Life History Told by a Whale-Louse: A Possible Interaction of a Southern Right Whale *Eubalaena australis* Calf with Humpback Whales *Megaptera Novaeangliae*. *Helgoland Marine Research*, 71, 1-6 <https://doi.org/10.1186/s10152-017-0486-y>

Southern right whales (*Eubalaena australis*) are known to host three species of whale-lice, *Cyamus gracilis*, *Cyamus ovalis* and *Cyamus erraticus*. Such cyamids usually are generalists in toothed whales (Cetacea: Odontoceti) and host-specific in baleen whales (Cetacea: Mysticeti), and because they have no free-swimming stage, transmission only occurs by contact between whales. One southern right whale stranded at the southeastern coast of Brazil was found parasitized by a different species of cyamid. Over 300 specimens were collected and the only species identified based on morphological and molecular data was *Cyamus boopis*, a typical ectoparasite of humpback whales (*Megaptera novaeangliae*). This finding is the first record of *C. boopis* on the southern right whale. Both *E. australis* and *M. novaeangliae* are found in Brazilian waters and the presence of humpback's whale-louse together with the lack of the three specific parasites of right whales suggest an interspecific interaction between these whales based on the parasite's biology.

Knight, K. (2019). Whispering Southern Right Whale Mums and Calves Seek Refuge in Surf. *Journal of Experimental Biology*, 222(13) <https://doi.org/10.1242/jeb.208520>

No abstract.

Lanyon, J. M., & Janetzki, H. (2016). Mortalities of Southern Right Whales (*Eubalaena australis*) in a Subtropical Wintering Ground, Southeast Queensland. *Aquatic Mammals*, 42(4), 470  
<https://doi.org/10.1578/AM.42.4.2016.470>

Southern right whales (*Eubalaena australis*) migrate from high latitude (e.g., sub-Antarctic) feeding grounds to lower latitude breeding grounds in the austral winter each year (Bannister, 1986; Dawbin, 1986; Burnell & Bryden, 1997; Bannister et al., 1999; Carroll et al., 2011). As southern Australian populations continue to recover post-whaling, they have extended their winter ranges and recolonised coastal bays within their historical distribution and/or within new areas (Allen & Bejder, 2003). Newer wintering grounds or stopover sites during migration for the southeast population include embayments along the entire NSW coast (including Sydney Harbour) and into southern Queensland (Chilvers, 2000; Noad, 2000) and as far north as Hervey Bay (Brigden, 2001; Franklin & Burns, 2005). On Aug 26, 2013, the body of a 15-m adult female *E. australis* was sighted by Marine Parks officers, floating approximately 500 m offshore from Wurtulla Beach, Sunshine Coast (latitude -26° 44.54' S, longitude 153° 08.53' E). No other right whales were recorded in the area.

Loffler, S. G., Rago, V., Martinez, M., Uhart, M., Florin-Christensen, M., Romero, G., & Brihuega, B. (2015). Isolation of a Seawater Tolerant *Leptospira* Spp. From a Southern Right Whale (*Eubalaena australis*): E0144974. *Plos One*, 10(12)  
<https://doi.org/10.1371/journal.pone.0144974>

Leptospirosis is the most widespread zoonotic disease in the world. It is caused by pathogenic spirochetes of the genus *Leptospira* spp. and is maintained in nature through chronic renal infection of carrier animals. Rodents and other small mammals are the main reservoirs. Information on leptospirosis in marine mammals is scarce; however, cases of leptospirosis have been documented in pinniped populations from the Pacific coast of North America from southern California to British Columbia. We report the isolation of a *Leptospira* spp. strain, here named Manara, from a kidney sample obtained from a Southern Right Whale (*Eubalaena australis*) calf, which stranded dead in Playa Manara, Peninsula Valdes, Argentina. This strain showed motility and morphology typical of the genus *Leptospira* spp. under dark-field microscopy; and grew in Ellinghausen-McCullough-Johnson-Harris (EMJH) medium and Fletcher medium after 90 days of incubation at 28 degree C. Considering the source of this bacterium, we tested its ability to grow in Fletcher medium diluted with seawater at different percentages (1%, 3%, 5%, 7% and 10% v/v). Bacterial growth was detected 48 h after inoculation of Fletcher medium supplemented with 5% sea water, demonstrating the halophilic nature of the strain Manara. Phylogenetic analysis of 16S rRNA gene sequences placed this novel strain within the radiation of the pathogenic species of the genus *Leptospira* spp., with sequence similarities within the range 97-100%, and closely related to *L. interrogans*. Two different PCR protocols targeting genus-specific pathogenic genes (G1-G2, B64I-B64II and LigB) gave positive results, which indicates that the strain Manara is likely pathogenic. Further studies are needed to confirm this possibility as well as determine its serogroup. These results could modify our understanding of the epidemiology of this zoonosis. Until now, the resistance and ability to grow in seawater for long periods of time had been proven for the strain Muggia of *L. biflexa*, a saprophytic species. To the best of our knowledge, this is the first isolation of a *Leptospira* sp. from cetaceans. Our phenotypic data indicate that strain Manara represents a novel species of the genus *Leptospira*, for which the name *Leptospira brihuegai* sp. nov. is proposed.

Marega-Imamura, M., Michalski, F., Silva, K., Schiavetti, A., Le Pendu, Y., & de Carvalho Oliveira, L. (2020). Scientific Collaboration Networks in Research on Human Threats to Cetaceans in Brazil. *Marine Policy*, 112, 103738 <https://doi.org/10.1016/j.marpol.2019.103738>

To better understand the threats posed by human activities on cetaceans, we compiled published studies and determined where, how, and by whom the research on this subject has been conducted in Brazil. We also determined which cetacean species were mostly investigated in these studies. We gathered the available scientific literature published from 1986 to 2016 that contained search terms in English that depicted major cetacean threats. Then, we developed a collaboration network among the authors' institutions and generated a distribution map of the investigated threats and study areas. From the 1047 compiled publications, we selected 103 studies that precisely addressed cetacean threats. The selected studies were carried out by 82 institutions from 12 countries. Most of these institutions were universities (n = 55), followed by non-governmental organizations (n = 15) and research institutes (n = 12). Among the two cetacean suborders, odontocetes were the most representative, with *Sotalia guianensis* and *Pontoporia blainvillei* present in 50 and 38 publications, respectively. For mysticetes, publications on *Megaptera novaeangliae* (n = 6) and *Eubalaena australis* (n = 5) were the most common. Among the addressed threats, more than half (54.4%) of the publications focused on pollution, followed by bycatch (19.4%) and vessel traffic (10.7%). Most of the study areas took place in the states of Rio de Janeiro (22.4%), São Paulo (19.7%), and Rio Grande do Sul (12.9%). Six institutions were the most prevalent in the collaboration networks, and their location corresponded to hotspots of cetacean diversity. Our findings may contribute to identifying research priorities and guide the conservation of cetacean species in Brazil.

Maron, C. F., Beltramino, L., Martino, M. D., Chirife, A., Seger, J., Uhart, M., . . . Rowntree, V. J. (2015). Increased Wounding of Southern Right Whale (*Eubalaena australis*) Calves by Kelp Gulls (*Larus Dominicanus*) at Peninsula Valdes, Argentina: E0139291. *Plos One*, 10(10) <https://doi.org/10.1371/journal.pone.0139291>

At least 626 southern right whale (*Eubalaena australis*) calves died at the Peninsula Valdes calving ground, Argentina, between 2003 and 2014. Intense gull harassment may have contributed to these deaths. In the 1970s, Kelp Gulls (*Larus dominicanus*) began feeding on skin and blubber pecked from the backs of living right whales at Valdes. The frequency of gull attacks has increased dramatically over the last three decades and mother-calf pairs are the primary targets. Pairs attacked by gulls spend less time nursing, resting and playing than pairs not under attack. In successive attacks, gulls open new lesions on the whales' backs or enlarge preexisting ones. Increased wounding could potentially lead to dehydration, impaired thermoregulation, and energy loss to wound healing. The presence, number and total area of gull-inflicted lesions were assessed using aerial survey photographs of living mother-calf pairs in 1974-2011 (n = 2680) and stranding photographs of dead calves (n = 192) in 2003-2011. The percentage of living mothers and calves with gull lesions increased from an average of 2% in the 1970s to 99% in the 2000s. In the 1980s and 1990s, mothers and calves had roughly equal numbers of lesions (one to five), but by the 2000s, calves had more lesions (nine or more) covering a greater area of their backs compared to their mothers. Living mother-calf pairs and dead calves in Golfo Nuevo had more lesions than those in Golfo San Jose in the 2000s. The number and area of lesions increased with calf age during the calving season. Intensified Kelp Gull harassment at Peninsula Valdes could be compromising calf health and thereby contributing to the high average rate of calf mortality observed in recent years, but it cannot explain the large year-to-year variance in calf deaths since 2000.

Marón, C. F., Kohl, K. D., Chirife, A., Di Martino, M., Fons, M. P., Navarro, M. A., . . . Uhart, M. (2019). Symbiotic Microbes and Potential Pathogens in the Intestine of Dead Southern Right Whale (*Eubalaena australis*) Calves. *Anaerobe*, 57, 107-114  
<https://doi.org/10.1016/j.anaerobe.2019.04.003>

Between 2003 and 2017, at least 706 southern right whale (*Eubalaena australis*) calves died at the Península Valdés calving ground in Argentina. Pathogenic microbes are often suggested to be the cause of stranding events in cetaceans; however, to date there is no evidence supporting bacterial infections as a leading cause of right whale calf deaths in Argentina. We used high-throughput sequencing and culture methods to characterize the bacterial communities and to detect potential pathogens from the intestine of stranded calves. We analyzed small and large intestinal contents from 44 dead calves that stranded at Península Valdés from 2005 to 2010 and found 108 bacterial genera, most identified as Firmicutes or Bacteroidetes, and 9 genera that have been previously implicated in diseases of marine mammals. Only one operational taxonomic unit was present in all samples and identified as *Clostridium perfringens* type A. PCR results showed that all *C. perfringens* isolates (n = 38) were positive for alpha, 50% for beta 2 (n = 19) and 47% for enterotoxin (CPE) genes (n = 18). The latter is associated with food-poisoning and gastrointestinal diseases in humans and possibly other animals. The prevalence of the cpe gene found in the Valdés' calves is unusually high compared with other mammals. However, insufficient histologic evidence of gastrointestinal inflammation or necrosis (the latter possibly masked by autolysis) in the gut of stranded calves, and absence of enterotoxin detection precludes conclusions about the role of *C. perfringens* in calf deaths. Further work is required to determine whether *C. perfringens* or other pathogens detected in this study are causative agents of calf deaths at Península Valdés.

McAloose, D., Rago, M. V., Di Martino, M., Chirife, A., Olson, S. H., Beltramino, L., . . . Uhart, M. M. (2016). Post-Mortem Findings in Southern Right Whales *Eubalaena australis* at Peninsula Valdes, Argentina, 2003-2012. *Diseases of Aquatic Organisms*, 119(1), 17-+  
<https://doi.org/10.3354/dao02986>

Between 2003 and 2012, 605 southern right whales (SRW; *Eubalaena australis*) were found dead along the shores of Peninsula Valdes (PV), Argentina. These deaths included alarmingly high annual losses between 2007 and 2012, a peak number of deaths (116) in 2012, and a significant number of deaths across years in calves-of-the-year (544 of 605 [89.9%]; average = 60.4 yr(-1)). Postmortem examination and pathogen testing were performed on 212 whales; 208 (98.1%) were calves-f-the-year and 48.0% of these were newborns or neonates. A known or probable cause of death was established in only a small number (6.6%) of cases. These included ship strike in a juvenile and blunt trauma or lacerations (n = 5), pneumonia (n = 4), myocarditis (n = 2), meningitis (n = 1), or myocarditis and meningitis (n = 1) in calves. Ante-mortem gull parasitism was the most common gross finding. It was associated with systemic disease in a single 1-2 mo old calf. Immunohistochemical labeling for canine distemper virus, *Toxoplasma gondii* and *Brucella* spp., and PCR for cetacean morbillivirus (CeMV), influenza A, and apicomplexan protozoa were negative on formalin-fixed, paraffin-embedded lung and brain samples from a subset of whales; PCR for *Brucella* spp. was positive in a newborn/neonate with pneumonia. Skin samples from whales with gull parasitism were PCR negative for CeMV, poxvirus, and papillomavirus. This is the first long-term study to investigate and summarize notable post-mortem findings in the PV SRW population. Consistent, significant findings within or between years to explain the majority of deaths and those in high-mortality years remain to be identified.

Robbins, W. D., Huveneers, C., Parra, G. J., Möller, L., & Gillanders, B. M. (2017). Anthropogenic Threat Assessment of Marine-Associated Fauna in Spencer Gulf, South Australia. *Marine Policy*, 81, 392-400 <https://doi.org/10.1016/j.marpol.2017.03.036>

Assessing the vulnerability of species to [anthropogenic threats is an essential step when developing management strategies for wild populations. With industrial development forecasted to increase in Spencer Gulf, South Australia, it is crucial to assess the ongoing effects of anthropogenic threats to resident and migratory species. Expert elicitation was used to assess 27 threats against 38 threatened, protected, and iconic marine-associated species. Species and threat interactions were assessed individually, and as taxonomic or functional groups. Climate change had the greatest overall exposure (c.f. risk) across species, followed by disturbance, pollution, disease/invasive species, and fishing/aquaculture threats. The largest overall sensitivities (c.f. consequences) were pollution and disease/invasive species, followed by climate change, disturbance and fishing/aquaculture threats. Vulnerability scores (exposure x sensitivity) showed the climate change group posing the greatest overall threat in Spencer Gulf, with individual climatic threats ranking as three of the top four biggest threats to most animal groups. Noise, shipping, and net fishing were considered the greatest region-specific individual threats to marine mammals; as were trawl fishing, line fishing, and coastal activities to fish/cuttlefish; trawl fishing, line fishing, and net fishing to elasmobranchs; and oil spill, disease, and coastal activities to sea/shorebirds. Eighteen of the 20 highest vulnerability scores involved the short-beaked common dolphin, Indo-Pacific bottlenose dolphin, and Australian sea lion, highlighting the particular susceptibility of these species to specific threats. These findings provide a synthesis of key threats and vulnerable species, and give management a basis to direct future monitoring and threat mitigation efforts in the region.

Senigaglia, V., Christiansen, F., Bejder, L., Gendron, D., Lundquist, D., Noren, D. P., . . . Lusseau, D. (2016). Meta-Analyses of Whale-Watching Impact Studies Comparisons of Cetacean Responses to Disturbance. *Marine Ecology Progress Series*, 542, 251-263 <https://doi.org/10.2307/24896698>

Whale-watching activities can induce behavioral changes that may negatively affect cetacean populations. However, these changes may vary depending on species, populations and environmental features. It is important to determine inter-specific variation in cetacean responses to stressors in order to identify the best metrics for evaluation of consequences of anthropogenic disturbance. We used meta-analyses to assess the consistency of cetacean responses to whale-watching vessels across a pool of suitable studies covering a variety of species and sites. We analyzed several metrics to capture cetacean heterogeneous responses and to explore their reliability across species. We found disruptions of activity budget and of path directionality as the most consistent responses towards whale-watching vessels. In a similar manner across species, animals were more likely to travel and less likely to rest and forage in the presence of vessels. Cetaceans also showed a tendency to increase path sinuosity (deviation index) and decrease path linearity (directness index) during boat interactions. We also explored the influence of socio-ecological factors on behavioral response but found no consistent results among studies. Further population-specific studies should address the potential long-term consequences of these behavioral responses to inform management of the whale-watching industry.

Seyboth, E., Botta, S., Mendes, C. R. B., Negrete, J., Dalla Rosa, L., & Secchi, E. R. (2018). Isotopic Evidence of the Effect of Warming on the Northern Antarctic Peninsula Ecosystem. *Deep Sea Research Part II: Topical Studies in Oceanography*, 149, 218-228 <https://doi.org/10.1016/j.dsr2.2017.12.020>

The Antarctic Peninsula (AP) region is one of the areas under faster warming rates worldwide, and where food web changes have been observed in the last decades. Among these changes are the development of cryptophytes under warmer conditions in detriment of diatoms, and the reduced krill availability in the environment. An isotopic approach was used to investigate whether the temporal and spatial patterns of energy transfer from phytoplankton (using particulate organic matter – POM – as a proxy of primary producers) to baleen whales (humpback – *Megaptera novaeangliae*, fin – *Balaenoptera physalus*, Antarctic minke – *Balaenoptera bonaerensis*), and killer whales – *Orcinus orca* – is similar in areas under different effects of warming around the northern Antarctic Peninsula (NAP). Samples of POM (n = 65), krill (n = 29) and skin of baleen (n = 106) and, opportunistically, killer whales (n = 5) were collected in Gerlache and Bransfield Straits (western AP) and the Powell Basin (northeastern AP) during the austral summers of 2013–2016. Mean isotope values for  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values were, respectively,  $-26.3\text{‰}$  ( $\pm 2.9$ ) and  $0.9\text{‰}$  ( $\pm 1.7$ ) for POM,  $-25.6\text{‰}$  ( $\pm 0.9$ ) and  $5.3\text{‰}$  ( $\pm 1.1$ ) for krill,  $-24.1\text{‰}$  ( $\pm 2$ ) and  $8.9\text{‰}$  ( $\pm 1.5$ ) for humpback,  $-24.6\text{‰}$  ( $\pm 1.2$ ) and  $8.2\text{‰}$  ( $\pm 0.7$ ) for fin,  $-24.4\text{‰}$  ( $\pm 1.6$ ) and  $8.7\text{‰}$  ( $\pm 1$ ) for Antarctic minke whales, and  $-23.6\text{‰}$  ( $\pm 1.2$ ) and  $8.9\text{‰}$  ( $\pm 1.7$ ) for killer whales. Interannual significant differences were found for  $\delta^{13}\text{C}$  values of POM and fin whales' samples, while spatial differences were found for  $\delta^{13}\text{C}$  values of POM samples and humpback whales and for  $\delta^{15}\text{N}$  values of POM, humpback and Antarctic minke whales. Lower  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values for the base of the food web tended to be observed towards open sea regions (Powell Basin and an area under the influence of the Bellingshausen Sea waters). The isoscapes generated for the baseline of the NAP ecosystem provided unprecedented information, to the best of our knowledge, of how the  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values of POM varied spatially and temporally in the region. HPLC-CHEMTAX pigment analysis indicated that two of the main phytoplankton groups in the study region were diatoms and cryptophytes. The contribution of these groups to the total phytoplankton biomass was positively and negatively correlated with the POM  $\delta^{13}\text{C}$  values, respectively. Despite the spatial and temporal limited interpretation of our results due to our reduced sampling effort to the east of the AP and to the relatively short temporal range investigated, the differences observed in the isotopic composition are considered representative of contrasting environmental conditions. The present study provides new insights on stable isotope values in the Antarctic ecosystem and may help to foresee the consequences of physico-chemical changes in water properties to the biota due to global warming.

Sironi, M., Rowntree, V. J., Di Martino, M., Beltramino, L., Rago, V., Marón, C. F., & Uhart, M. (2016). *Southern Right Whale Mortalities at Península Valdés, Argentina: Updated Information for 2014-2015*. International Whaling Commission Bled, Slovenia. Retrieved from <https://archive.iwc.int/?r=6118&k=2446d5178c>

Southern right whales (*Eubalaena australis*) have experienced high mortality rates at Península Valdés, Argentina in recent years (Rowntree et al., 2013). In 2003, the Southern Right Whale Health Monitoring Program was established by a consortium of NGOs to monitor the health status of this population by post-mortem examinations. Previous reports to the IWC included information on the mortalities through 2013. Here we update information for the 2014-2015 seasons. A total of 737 dead whales were recorded on the Península Valdés calving ground and surrounding areas along the Argentine coast since 2003. The number of dead whales was 23 in 2014 and 42 in 2015. As in previous years, most of the dead whales were newborn calves (87% of strandings in 2014 and 90% in 2015; 89% for both years combined). More dead whales were recorded in Golfo Nuevo (74% in both years) than in Golfo San José (22% in both years). One stranded whale was found in the outer coast of the peninsula in both 2014 and 2015 (4 and 2% of total annual strandings, respectively), in addition to 1 (2%) near the city of Rawson (to the south of Península Valdés) in 2015. Most whales died in August – September (65%) in 2014, and in July – August (60%) in 2015. All whales were dead when reported or found, and post mortem



examinations were performed when and to the extent that carcass condition allowed. Biotoxins, infectious diseases, malnutrition, the physiological and behavioral effects of Kelp Gull (*Larus dominicanus*) attacks on newborn calves and density-dependent processes have been proposed as hypotheses to explain the high calf mortalities in this calving ground (IWC 2011, 2015). Results on biotoxins (Wilson et al., 2015), Kelp Gull lesions (Marón et al., 2015a) and post-mortem findings on tissues and organs (McAloose et al., 2016) have been published recently by the Southern Right Whale Health Monitoring Program researchers and collaborators.

Sironi, M., Rowntree, V. J., Martino, M. D., Alzugaray, L., Rago, V., Marón, C. F., & Uhart, M. (2018). *Southern Right Whale Mortalities at Península Valdés, Argentina: Updated Information for 2016-2017*. International Whaling Commission. Retrieved from <https://archive.iwc.int/?r=8817&k=8642db636a>

Southern right whales (*Eubalaena australis*) have experienced high mortality rates at Península Valdés, Argentina in recent years (Rowntree et al., 2013). In 2003, the Southern Right Whale Health Monitoring Program was established by a consortium of NGOs to monitor the health status of this population by post-mortem examinations. Previous reports to the IWC included information on the mortalities through 2015. Here we update information for the 2016-2017 seasons. A total of 774 dead whales were recorded on the Península Valdés calving ground (Chubut Province) since 2003. The number of dead whales was 15 in 2016 and 28 in 2017. As in previous years, most of the dead whales were newborn calves (93% of strandings in 2016 and 96% in 2017; 94.5% for both years combined). More dead whales were recorded in Golfo Nuevo (87% in 2016 and 72% in 2017) than in Golfo San José (13% in 2016 and 28% in 2017). Most whales died in July - August (8 individuals, 56%) in 2016, and in September - October (19 individuals, 68%) in 2017. One juvenile whale stranded alive in Caleta de Los Loros, Río Negro Province on 24 June, 2016 and died seven days later. The remaining whales were dead when reported or found, and post-mortem examinations were performed when and to the extent that carcass condition allowed. Biotoxins, infectious diseases, malnutrition, the physiological and behavioral effects of Kelp Gull (*Larus dominicanus*) attacks on newborn calves and density-dependent processes have been proposed as hypotheses to explain the high calf mortalities in this calving ground (IWC 2011, 2015). Results on biotoxins (Wilson et al., 2015), Kelp Gull lesions (Marón et al., 2015a) and histological findings suggestive of infectious and non-infectious processes (McAloose et al., 2016) were published by Southern Right Whale Health Monitoring Program researchers and collaborators and reported to the IWC Scientific Committee. New lines of research are being developed at present to test the hypothesis that stress from injuries in southern right whales (predominantly due to Kelp Gull attacks) negatively affects their physiological homeostasis and could be a contributing factor to calf deaths in this population.

Sremba, A. L., Martin, A. R., & Baker, C. S. (2015). Species Identification and Likely Catch Time Period of Whale Bones from South Georgia. *Marine Mammal Science*, 31(1), 122-132  
<https://doi.org/10.1111/mms.12139>

Skeletal remains of baleen whales killed during the onset of 20th century commercial whaling lie scattered across the shores and abandoned whaling stations of the subantarctic island of South Georgia. Here we report on genetic species identification of whale bones collected from South Georgia using standard historical DNA protocols. We amplified and sequenced short fragments of the mitochondrial DNA (mtDNA) control region from 281 available bone samples. Of these, 231 provided mtDNA sequences of sufficient quality and length (174-194 bp) for species identification: 158 bones were identified as humpback whale (*Megaptera novaeangliae*), 51 bones were identified as fin whale

(*Balaenoptera physalus*), 18 bones were identified as blue whale (*B. musculus*), two bones were identified as sei whale (*B. borealis*), one bone was identified as a southern right whale (*Eubalaena australis*), and one bone was identified as a southern elephant seal (*Mirounga leonina*). The prominence of humpback, fin, and blue whale bones in the sample collection corresponds to the catch record of the early years of whaling on the island of South Georgia (pre-1915), prior to the depletion of these populations.

Torres, P., Miglioranza, K. S. B., Uhart, M. M., Gonzalez, M., & Commendatore, M. (2015). Organochlorine Pesticides and PCBs in Southern Right Whales (*Eubalaena australis*) Breeding at Península Valdés, Argentina. *Science of The Total Environment*, 518-519, 605-615 <https://doi.org/10.1016/j.scitotenv.2015.02.064>

Organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs) were assessed in blubber from 35 dead Southern Right Whales (SRW — *Eubalaena australis*) stranded at Península Valdés, Argentina. The life cycle includes a feeding period in high productivity areas of the South West Atlantic and a reproductive period in coastal temperate waters of Argentina. Organochlorine pesticides showed higher concentrations ( $22.6 \pm 13.8 \text{ ng} \cdot \text{g}^{-1} \text{ ww}$ ) than PCBs ( $7.5 \pm 10 \text{ ng} \cdot \text{g}^{-1} \text{ ww}$ ). Among pesticides, HCHs, DDTs, endosulfans, dieldrin, chlordans, heptachlor epoxide, and trans-nonachlor were detected. *p,p'*-DDE and *p,p'*-DDT were present in 69% and 26% of samples, respectively. *p,p'*-DDT/*p,p'*-DDE ratio showed low values ( $<0.33$ ) as a result of aged DDT inputs. However, the occurrence of only *p,p'*-DDT in some samples suggests a recent pesticide input.  $\alpha$ -HCH/ $\gamma$ -HCH ratio ( $<0.37$ ) indicated no recent contribution of technical HCH mixture and/or current use of lindane. Dieldrin was present in 77% of the samples and endosulfan was detected in all samples with predominance of  $\alpha$ - (75%) over  $\beta$ -endosulfan (19%) and scarce contribution of endosulfan sulphate (7%), suggesting a recent input of this insecticide to the environment in the SRW foraging area. A predominance of pentachlorobiphenyls was observed. In 21 samples at least one PCB indicator was found and PCB #118, highly toxic, contributed in 5% to total PCBs. Although all these organochlorine compounds are forbidden they were bioaccumulated in the blubber of SRW with a predominance of endosulfans, the more recently used pesticide. The absence of data on chemical pollutants in stranded dead whales is highlighted as a priority for research. This is the first study on levels, compositional patterns, and organochlorine sources in SRW. Moreover, more research including milk, and other tissues/organs is recommended considered that in the studied specimens, mostly calves, pollutants are likely transferred from the mother during pregnancy and nursing.

Vilardo, C., & Barbosa, A. F. (2018). Can You Hear the Noise? Environmental Licensing of Seismic Surveys in Brazil Faces Uncertain Future after 18 Years Protecting Biodiversity. *Perspectives in Ecology and Conservation*, 16(1), 54-59 <https://doi.org/10.1016/j.pecon.2017.11.005>

Marine Seismic Surveys are an important source of concern for marine biodiversity conservation worldwide. In Brazil, Environmental Federal Agency IBAMA has developed a considerably advanced mitigation/monitoring requirements package in 18 years of environmental licensing practice, with standardized guidelines since 2005. Adding to global efforts aiming at filling knowledge gaps over the impacts on biodiversity, IBAMA has been able to foster important marine research through environmental licensing requirements. Better communication of research findings to the international scientific community remains a challenge to be addressed. Nevertheless, current institutional and legal reforming initiatives jeopardize the evolution of environmental control of Marine Seismic Surveys in Brazil.

Wilson, C., Sastre, A. V., Hoffmeyer, M., Rowntree, V. J., Fire, S. E., Santinelli, N. H., . . . Uhart, M. M. (2016). Southern Right Whale (*Eubalaena australis*) Calf Mortality at Península Valdés, Argentina: Are Harmful Algal Blooms to Blame? *Marine Mammal Science*, 32(2), 423-451 <https://doi.org/10.1111/mms.12263>

Península Valdés (PV) in Argentina is an important calving ground for southern right whales (SRWs, *Eubalaena australis*). Since 2005, right whale mortality has increased at PV, with most of the deaths (~90%) being calves <3 mo old. We investigated the potential involvement of harmful algal blooms (HABs) in these deaths by examining data that include: timing of the SRW deaths, biotoxins in samples from dead SRWs, abundances of the diatom, *Pseudo-nitzschia* spp., and the dinoflagellate, *Alexandrium tamarense*, shellfish harvesting closure dates, seasonal availability of whale prey at PV and satellite chlorophyll data. Evidence of the whales' exposure to HAB toxins includes trace levels of paralytic shellfish toxins (PSTs) and domoic acid (DA) in tissues of some dead whales, and fragments of *Pseudo-nitzschia* spp. frustules in whale feces. Additionally, whales are present at PV during both closures of the shellfish industry (due to high levels of PSTs) and periods with high levels of *Pseudo-nitzschia* spp. and *A. tamarense*. There is a positive statistical relationship between monthly *Pseudo-nitzschia* densities (but not *A. tamarense*) and calf deaths in both gulfs of PV.

Wise, J. P., Wise, J. T. F., Wise, C. F., Wise, S. S., Zhu, C., Browning, C. L., . . . Wise, J. P. (2019). Metal Levels in Whales from the Gulf of Maine: A One Environmental Health Approach. *Chemosphere*, 216, 653-660 <https://doi.org/10.1016/j.chemosphere.2018.10.120>

One Environmental Health has emerged as an important area of research that considers the interconnectedness of human, animal and ecosystem health with a focus on toxicology. The great whales in the Gulf of Maine are important species for ecosystem health, for the economies of the Eastern seaboard of the United States, and as sentinels for human health. The Gulf of Maine is an area with heavy coastal development, industry, and marine traffic, all of which contribute chronic exposures to environmental chemicals that can bioaccumulate in tissues and may gradually diminish an individual whale's or a population's fitness. We biopsied whales for three seasons (2010–2012) and measured the levels of 25 metals and selenium in skin biopsies collected from three species: humpback whales (*Megaptera novaeangliae*), fin whales (*Balaenoptera physalus*), and a minke whale (*Balaenoptera acutorostrata*). We established baseline levels for humpback and fin whales. Comparisons with similar species from other regions indicate humpback whales have elevated levels of aluminum, chromium, iron, magnesium, nickel and zinc. Contextualizing the data with a One Environmental Health approach finds these levels to be of potential concern for whale health. While much remains to understand what threats these metal levels may pose to the fitness and survival of these whale populations, these data serve as a useful and pertinent start to understanding the threat of pollution.

## Section V: General Overview

Bester, M. N. (2020). Antarctic Marine Mammals. In *Encyclopedia of the World's Biomes*. M. I. Goldstein & D. A. DellaSala (Eds.), (pp. 635-647). Oxford: Elsevier <https://doi.org/10.1016/B978-0-12-409548-9.11938-4>

Sixteen species of cetaceans and pinnipeds frequent the Antarctic biome to various extents, from its northern limit in the Southern Ocean at the Antarctic Polar Front down to the Antarctic Continent that is fringed by numerous Antarctic islands and the seasonally contracting and expanding pack ice and fast

ice. Each species is considered within Antarctic biome context, emphasizing their distribution, abundance, biomass, life history, seasonality and foraging ecology. In the face of likely direct and indirect anthropogenic impacts on Antarctic marine mammals, threats to, and the conservation status of these animals are also considered.

Clapham, P. J., & Baker, C. S. (2018). Whaling, Modern. In *Encyclopedia of Marine Mammals (Third Edition)*. B. Würsig, J. G. M. Thewissen, & K. M. Kovacs (Eds.), (pp. 1070-1074): Academic Press <https://doi.org/10.1016/B978-0-12-804327-1.00272-7>

Modern whaling effectively began with the introduction of the explosive harpoon and the steam-powered catcher boat; this made all species of whales vulnerable to hunting, and the subsequent introduction of stern-slip factory ships provided a means to catch whales far from land. The huge untouched populations of whales in the Antarctic were exploited beginning in 1904. The establishment in 1948 of the International Whaling Commission failed to effectively regulate whaling, exacerbated by large-scale illegal catches by the former USSR and by Japan. In all, almost 3 million whales were killed in the 20th century, reducing the size of many populations by as much as 99%. Today, whaling continues at a much-reduced level (including so-called “scientific whaling” by Japan), despite the introduction by the IWC of a moratorium.

Dudzinski, K. M., & Gregg, J. D. (2018). Communication. In *Encyclopedia of Marine Mammals (Third Edition)*. B. Würsig, J. G. M. Thewissen, & K. M. Kovacs (Eds.), (pp. 210-215): Academic Press <https://doi.org/10.1016/B978-0-12-804327-1.00096-0>

Communication represents the exchange of information from one individual to another via a single or multiple signals, with a following response. Signals are shared via several modes (chemical, visual, tactile/behavioral, and acoustic) in both air and water, depending on the species. Various anatomical and physiological mechanisms can generate communicative signals via a single mode or via multiple modes in order to augment the message. Communication allows individuals to establish and maintain relationships, convey information about internal states or reproductive status, and coordinate activities. Marine mammal species have adapted their signaling behavior to an aquatic lifestyle, with an increased reliance on acoustic signals and a decreased reliance on chemical signals when compared to terrestrial species. With many marine mammal species living in complicated social groups requiring constant mediation of relationships, communicative behavior is commonly observed.

Hewitt, R. P., & Lipsky, J. D. (2018). Krill and Other Plankton. In *Encyclopedia of Marine Mammals (Third Edition)*. B. Würsig, J. G. M. Thewissen, & K. M. Kovacs (Eds.), (pp. 537-543): Academic Press <https://doi.org/10.1016/B978-0-12-804327-1.00162-X>

Summary Krill (euphausiids), the dominant planktonic food of marine mammals, are found throughout the world's oceans. Krill general morphology, life history, and behavior are described as they relate to the foraging tactics of marine mammals. Marine mammal diets and krill consumption are estimated by ocean basin. Total consumption of krill by marine mammals is on the order of 10–20 million tons/year in the North Pacific, 15–25 million tons/year in the North Atlantic, and 125–250 million tons/year in the Southern Hemisphere, with the bulk of the latter portion consumed in the Southern Ocean. In the Southern Hemisphere, crabeater seals and baleen whales consume comparable proportions of krill. Of the estimated total krill consumption by baleen whales in the Southern Ocean, Antarctic minke whales consume approximately two-thirds. Crabeater seals consume more krill than any other marine mammal

population in the world. Anthropogenic effects on krill production include large-scale fisheries and climate change.

Kenney, R. D. (2018). Right Whales: *Eubalaena Glacialis*, *E. Japonica*, and *E. Australis*. In *Encyclopedia of Marine Mammals (Third Edition)*. B. Würsig, J. G. M. Thewissen, & K. M. Kovacs (Eds.), (pp. 817-822): Academic Press <https://doi.org/10.1016/B978-0-12-804327-1.00217-X>

There are three species of right whales—in the North Atlantic, North Pacific, and Southern Ocean. The two Northern Hemisphere species are the world’s most endangered whales. Although whaling is no longer an issue, mortality from vessel collisions and entanglement is retarding recovery, with growing concern about the effects of climate change, pollution, and noise. Right whales migrate between high-latitude feeding grounds, where they feed on dense concentrations of copepods and other zooplankton, and low-latitude calving grounds. The species differ in habitats occupied—in the North Atlantic both calving and feeding grounds are in continental shelf waters, North Pacific right whales occur in offshore habitats year-round, and southern right whales calve in coastal areas and feed in pelagic waters. Their life history characteristics include maturity at about 10 years of age and an interbirth interval of 3 years, but longevity is not known.

Lowther, A. D. (2018). Antarctic Marine Mammals. In *Encyclopedia of Marine Mammals (Third Edition)*. B. Würsig, J. G. M. Thewissen, & K. M. Kovacs (Eds.), (pp. 27-32): Academic Press <https://doi.org/10.1016/B978-0-12-804327-1.00047-9>

The Southern Ocean is home to five species of seals, and the oceans surrounding the Antarctic continent support seasonal assemblages of odontocete and baleen whales. These species rely on sea ice, either directly by using it as a breeding substrate, or indirectly by exploiting prey such as Antarctic krill, which breed under the winter sea ice. The hostile climate and vastness of the Southern Ocean makes scientific research in the region challenging, and is reflected in the relatively poor understanding we have of even basic properties such as population sizes or demographic trends of most species of Antarctic marine mammals. However, the recovery of species such as the Antarctic fur seal and the blue whale after being hunted to the brink of extinction less than 50 years ago is testament to concerted effort of the international community in trying to conserve the Southern Ocean and the marine mammals that rely on it.

Mesnick, S. L., & Ralls, K. (2018). Mating Systems. In *Encyclopedia of Marine Mammals (Third Edition)*. B. Würsig, J. G. M. Thewissen, & K. M. Kovacs (Eds.), (pp. 586-592): Academic Press <https://doi.org/10.1016/B978-0-12-804327-1.00170-9>

Males and females behave as to maximize their lifetime reproductive success yet are subject to different selective pressures (sexual selection), resulting in a variety of mating strategies. Reproductive success is determined by both precopulatory (e.g., contest competition) and postcopulatory (sperm competition) sexual selection. Marine mammals are predisposed to polygyny but this takes many forms. The potential for polygyny, and the extent to which it is realized, depends on the degree to which receptive females are aggregated in space and time. In pinnipeds, species that mate on land are more polygynous than those that mate in the water. Female cetaceans are generally more mobile and dispersed and the basic male strategy is to rove, although males enhance their chances of mating through combat, cooperation, coercion, and display. Female marine mammals enhance their reproductive success by engaging in mate choice, mating with multiple partners, and selecting genetic partners separately from social partners.

Parente, C. L., Araújo, J. P. d., Monteiro-Neto, C., & Reis, E. C. (2017). 2 - Mamíferos Marinhos No Brasil: Aspectos Gerais, Ameaças, Pesquisa E Conservação. In *Mamíferos, Quelônios E Aves*. E. C. Reis & M. P. Curbelo-Fernandez (Eds.), (pp. 15-33): Campus <https://doi.org/10.1016/B978-85-352-7661-9.50002-6>

No abstract.

Parente, C. L., Moura, J. F. d., Secco, H. K. C., Reis, E. C., & Di Benedetto, A. P. M. (2017). 3 - Diversidade E Distribuição De Cetáceos Na Área De Influência Das Atividades De E&P Na Bacia De Campos. In *Mamíferos, Quelônios E Aves*. E. C. Reis & M. P. Curbelo-Fernandez (Eds.), (pp. 35-61): Campus <https://doi.org/10.1016/B978-85-352-7661-9.50003-8>

No abstract.

Reeves, R. R. (2018). Hunting. In *Encyclopedia of Marine Mammals (Third Edition)*. B. Würsig, J. G. M. Thewissen, & K. M. Kovacs (Eds.), (pp. 492-496): Academic Press <https://doi.org/10.1016/B978-0-12-804327-1.00155-2>

Marine mammals have been hunted for millennia, initially to supply subsistence needs and eventually also for commercial gain. The worldwide whaling and sealing industries supplied valuable products such as oil, skins, and tusks (from walruses) to global markets, driving numerous whale and pinniped species to very low levels. Sirenians have been hunted (and are still hunted) primarily by local people for food; in addition, a substantial commercial trade in manatee meat and hides existed in Amazonia from the late 18th century to the mid-20th century. Sea otters were hunted intensively for their valuable pelts, to the point where they became commercially extinct by the early 20th century. Polar bears have always been hunted by Arctic residents for food and hides as well as by nonresidents for sport. The scale of marine mammal hunting has declined markedly over the past half-century, in part because the stocks are depleted and in part because of changing societal norms with respect to harvesting these animals.

Reeves, R. R. (2019). Marine Mammals: History of Exploitation☆. In *Encyclopedia of Ocean Sciences (Third Edition)*. J. K. Cochran, H. J. Bokuniewicz, & P. L. Yager (Eds.), (pp. 601-609). Oxford: Academic Press <https://doi.org/10.1016/B978-0-12-409548-9.11620-3>

Marine mammals (cetaceans, pinnipeds, sirenians, marine otters, the polar bear) have been exploited for food, skins, ivory, and oil over much of their global range. This exploitation, for both subsistence and commercial gain, dates back millennia. It was not until the early 20th century that significant efforts were made to limit the impacts of over-exploitation, and today many marine mammal populations remain depleted. In recent decades, exploitation has come to include live-capture for oceanarium displays as well as the “non-consumptive” use of marine mammals as objects of nature tourism (whale-watching, seal-watching, etc.).

Reis, E. C. (2017). 7 - Cetáceos Da Bacia De Campos. In *Atlas De Sensibilidade Ambiental Ao Óleo*. S. de Oliveira Ferreira Lima (Ed.), (pp. 105-111): Campus <https://doi.org/10.1016/B978-85-352-7735-7.50014-4>

No abstract.