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Southern right whale mortalities at Península Valdés, Argentina: updated information for 2018-2022

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INTERNATIONAL
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Southern right whale mortalities at Península Valdés, Argentina: updated information for 2018-2022

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ABSTRACT

Southern right whales (*Eubalaena australis*) have experienced high mortality rates at Península Valdés, Argentina in recent years. 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. Here we update information for the 2018-2022 seasons (no data for 2020 due to COVID-19 restrictions). A total of 928 dead whales were recorded on the Península Valdés calving ground since 2003. The annual number of dead whales for the study period was 23 (2018), 17 (2019), 45 (2021) and 73 (2022) totaling 157 individuals in four calving seasons. Most of the dead whales were calves (63%), followed by adults (30%) and juveniles (7%). As in previous years, the majority of dead whales were recorded in Golfo Nuevo (GN, 70%) and the remaining whales died in Golfo San José (GSJ, 30%). However, the distribution of strandings was very different among years. For instance, in 2019 all calves (10/10; 100%) died in GN and all adults (6/6; 100%) died in GSJ. However, in 2022 dead calves were distributed between the two gulfs (29/42 or 69% in GN and 13/42 or 31% in GSJ) and contrary to 2019, all but one adult died in GN (27/28 or 97%). All whales were dead when reported or found. Post-mortem examinations were performed when carcass condition allowed and when strandings were not on public beaches where only non-invasive sampling is performed. Potential causes of mortality will be discussed elsewhere. Of note, the adult female mortality in Golfo Nuevo in 2022 was the most extreme adult mortality event on record for the species since 1971. Results on the role of Paralytic Shellfish Poisons (PSP) in the mortality event of 2022 are reported in a separate paper.

INTRODUCTION AND BACKGROUND OF SOUTHERN RIGHT WHALE MORTALITIES AT PENÍNSULA VALDÉS

Southern right whale population dynamics have been studied continuously through annual aerial photoidentification surveys at Península Valdés since 1971 (Payne, 1986; Rowntree et al., 2001; Cooke, 2012; Cooke et al. 2015). During the first 30 years of the study, deaths appeared to increase at a rate similar to the increase in number of whales using the calving ground (Marón *et al.*, 2015b), but an unexpectedly large number of whales (47) died in 2005 (Uhart et al., 2008), and high mortality events continued annually with an average of 75 whales dying each year from 2007 through 2011 (Rowntree et al., 2013). The most extreme mortality events were a peak of 113 dead calves in 2012 (Sironi et al., 2014) and a peak of 28 dead adults in 2022 (Uhart et al., 2023, this meeting). These are considered the highest mortality events ever observed for the species. In view of these deaths, it seems that this whale population and its ecosystem may be less healthy and robust than previously thought.

The Southern Right Whale Health Monitoring Program (SRWHMP, the "Program") at Península Valdés is a non-governmental initiative run by the University of California, Davis and Instituto de Conservación de Ballenas from Argentina with the collaboration of Ocean Alliance (OA) and Wildlife Conservation Society (WCS). It was launched in 2003, and operates with funding from foundations, private donors and the organizations that lead the Program.

The aim of the Program is to evaluate the health status and learn about the biology of the southern right whale population by conducting post-mortem examinations of the animals that strand on the beaches of Península Valdés and surrounding area. Also, it aims at identifying the causes of deaths and their conservation implications for the species. Previous reports to the IWC included information through 2017 (Uhart et al., 2008, 2009; Rowntree et al., 2011; Sironi et al., 2012, 2014, 2016, 2018). Also, two workshops on the southern right whale die-offs at Península Valdés were

convened by the IWC in cooperation with Argentina's national government and the Province of Chubut in 2010 and 2014 (IWC 2011, 2015) and the most recent Conservation Management Plan (CMP) workshop held in 2022 in Brazil (IWC, 2023). Here we report data on strandings for the 2018-2022 seasons from June through December (no data for 2020 due to COVID-19 restrictions)

MATERIALS AND METHODS

Stranded whales are located by reports from a local Stranding Network complemented with systematic aerial surveys conducted by the Program's researchers along the 500-km coastal perimeter of Península Valdés (Table 1). The Stranding Network includes park rangers, whale watch captains and company owners, divers, tour operators, nature guides, sailors, airplane pilots, artisanal fishermen, researchers, NGOs, and local authorities such as the Argentine Navy and the Argentine Coastguard, and has been essential to the success of the Program.

When dead whales are found or reported, the Program's field team of veterinarians and biologists travels to the site and follows a necropsy protocol that includes recording the age class (Table 2), location (Table 3), an external examination for signs of human interaction and other injuries, photographing and measuring the body, tagging the carcass and, depending on carcass condition, a partial or complete necropsy to collect samples of external and internal organs and tissues. Samples are analyzed by laboratories in Argentina and overseas as needed. All results are reported annually to provincial and national government authorities.

Data for this report were collected during the southern right whale calving seasons of 2018, 2019, 2021 and 2022 in Península Valdés, Argentina. No data were collected in 2020 due to COVID-19 restrictions.

RESULTS

At least 928 southern right whales have died in Península Valdés since 2003 (Donini et al., 2022). All stranded whales in 2018-2022 were dead when reported or found. While the annual effort to find dead whales has remained the same, the number of deaths has shown strong variations among years (Fig. 1). The most outstanding result for the present study period is the dramatic increase in adult and juvenile mortality, with 0/23 adults (0% of strandings) in 2018, 6/17 (35%) in 2019, 13/45 (29%) in 2021 and 28/73 (39%) in 2022, and 1/23 juveniles (4% of strandings) in 2018, 1/17 (6%) in 2019, 7/45 (16%) in 2021 and 12/73 (16%) in 2022 (Table 2).

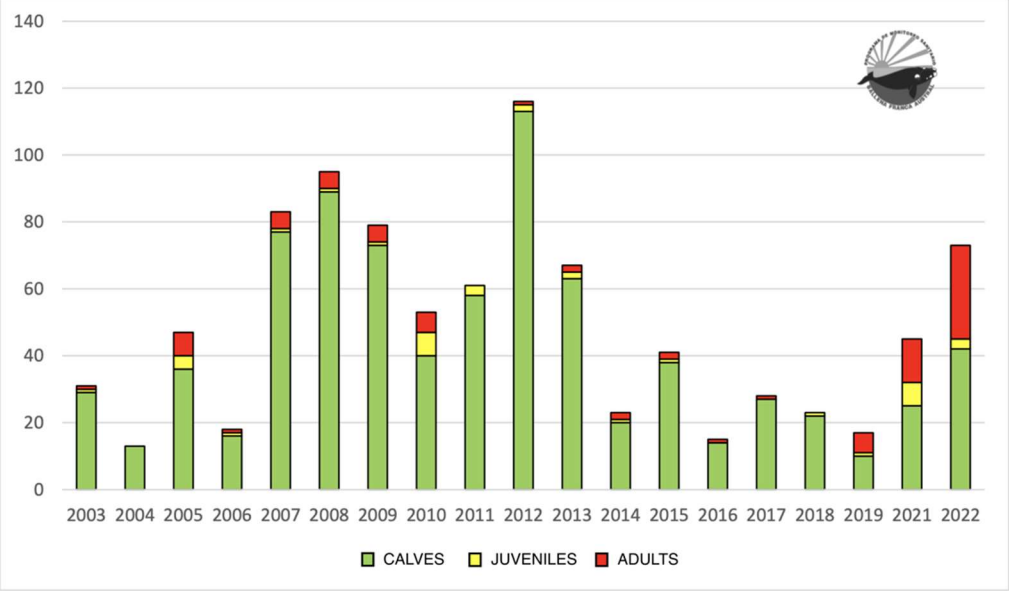

Figure 1. Annual number of dead southern right whales by age class recorded at Península Valdés since 2003 (no data for 2020 due to COVID-19 restrictions).

Table 1. Dead whales reported by the Stranding Network vs. found in systematic surveys at Península Valdés in 2018-2022. For context, the total number of live whales counted during annual photo identification surveys is provided in the last row (no data for 2020).

Source	2018	2019	2021	2022	Total (2018-2022)	% of Total (2018-2022)
Stranding network	16	10	31	38	95	60%
Survey	7	7	14	35	63	40%
Total	**23**	**17**	**45**	**73**	**158**	**100%**
Photo-id survey	**856**	**607**	**827**	**1420**	**3710**	**100%**

Table 2. Age class of dead whales recorded annually at Península Valdés in 2018-2022 (no data for 2020).

Age class	2018	2019	2021	2022	Total (2018-2022)	% of Total (2018-2022)
Calves	22	10	25	42	99	63%
Juveniles	1	1	7	3	12	7%
Adults	0	6	13	28	47	30%
Total	**23**	**17**	**45**	**73**	**158**	**100%**

Table 3. Location (by gulf) of dead whales recorded annually at Península Valdés in 2018-2022 (no data for 2020).

Area	2018	2019	2021	2022	Total (2018-2022)	% of Total (2018-2022)
Golfo Nuevo	18	10	25	58	111	70%
Golfo San José	5	7	20	15	47	30%
Total PV	**23**	**17**	**45**	**73**	**158**	**100%**

Summary for 2018:

Twenty-three strandings were recorded in 2018 at Península Valdés. Of these, 18 were recorded in Golfo Nuevo (78%) and five in Golfo San José (22%) (Fig. 2). For context, 856 living whales were recorded during a photoidentification aerial survey on 8 - 9 September 2018, of which 621 (73%) whales were in Golfo Nuevo and 235 (27%) were in Golfo San José (Sironi and Rowntree, 2018).

Most whales that died in 2018 were calves (22 or 96%), with only 1 dead juvenile (4%) (Table 2). The sex ratio was 10:9:4 for females, males and whales of uknown sex, respectively.

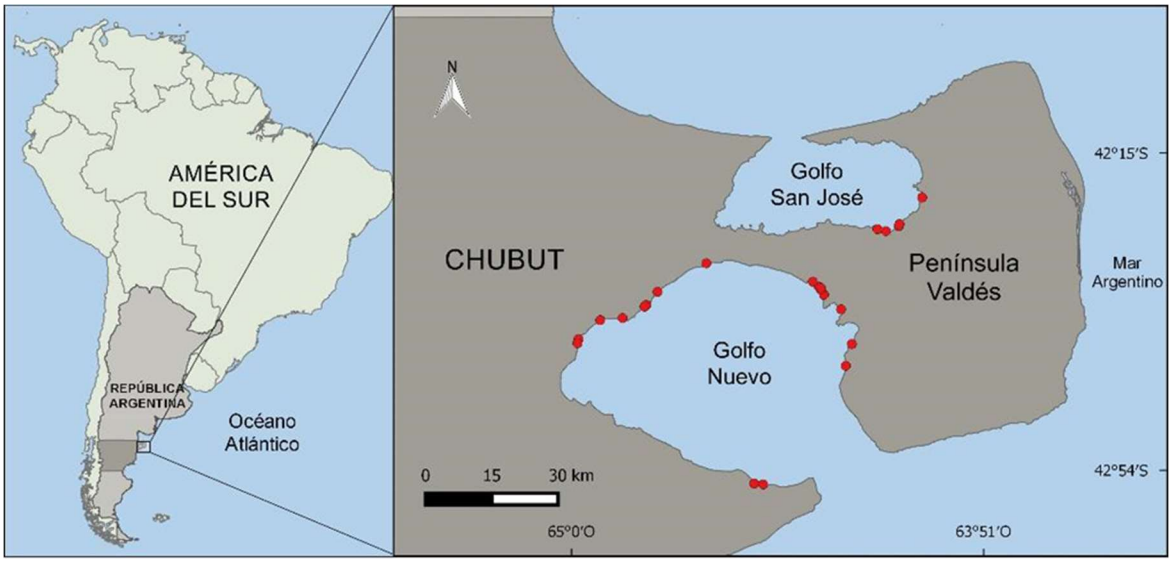

Figure 2. Location of dead whales (red dots) along the shores of Península Valdés in 2018.

Summary for 2019:

Seventeen whales died along the shores of Península Valdés in 2019. The spatial distribution of strandings was very unusual. All calves (10 or 59% of dead whales) died in Golfo Nuevo and all adults (6) and one juvenile (41%) died in Golfo San José (Fig. 3). For context, 607 living whales were recorded during a photoidentification aerial survey of living whales on 8 and 9 September 2019, of which 425 (70%) whales were in Golfo Nuevo and 182 (30%) were in Golfo San José (Sironi and Rowntree, 2019).

Most whales that died in 2019 were calves (10 or 59%) followed by adults (6; 35%) and one juvenile (6%) (Table 2). The sex ratio was 10:3:4 for females, males and whales of uknown sex, respectively.. All dead adults were females.

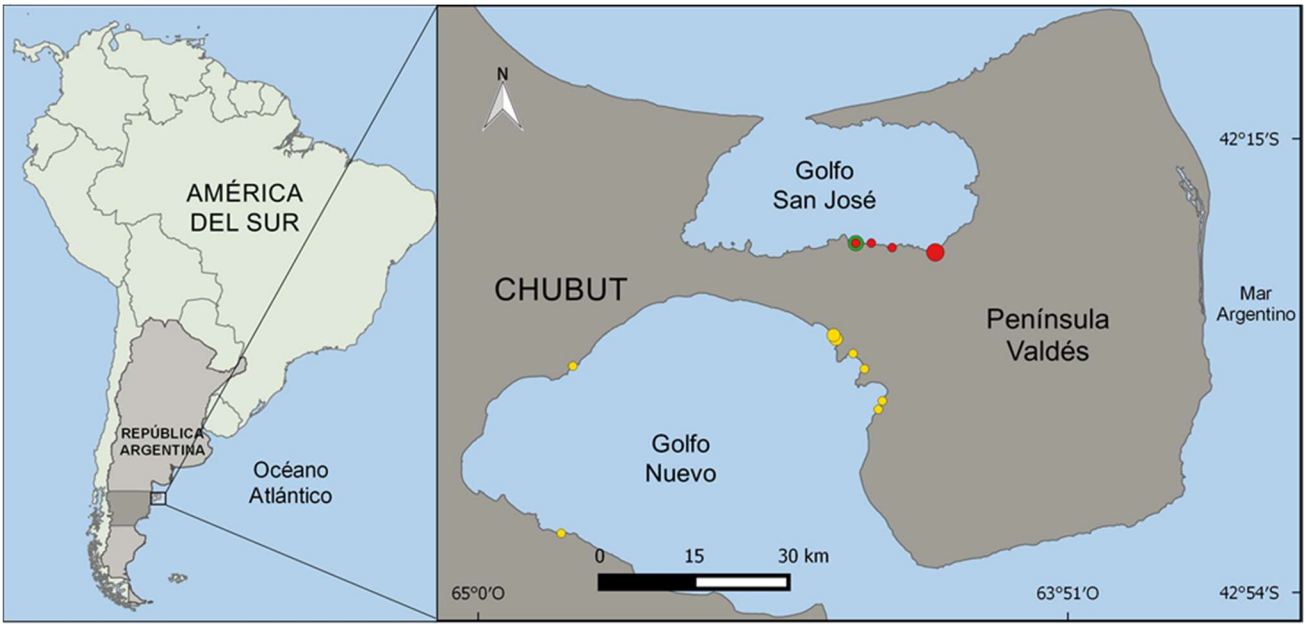

Figure 3. Location of dead whales along the shores of Península Valdés in 2019. Red: adults, yellow: calves, green: juvenile.

Summary for 2021:

Fourty-five whales died along the shores of Península Valdés in 2021. Strandings were distributed between the two gulfs as follows: Golfo Nuevo: 17 calves (68%), 1 juvenile (15%) and 7 adults (54%); Golfo San José: 8 calves (32%), 6 juveniles (85%) and 6 adults (46%) (Fig. 4). For context, 827 living whales were recorded during a photoidentification aerial survey of living whales on 17 and 18 September 2021, of which 638 (77%) whales were in Golfo Nuevo and 189 (23%) were in Golfo San José (Sironi and Rowntree, 2021).

Most whales that died in 2021 were calves (25 or 56%) followed by adults (13; 28%) and juveniles (7; 16%) (Table 2). The sex ratio was 21:7:17 for females, males and whales of uknown sex, respectively.. All but one of the dead adults were females (92%).

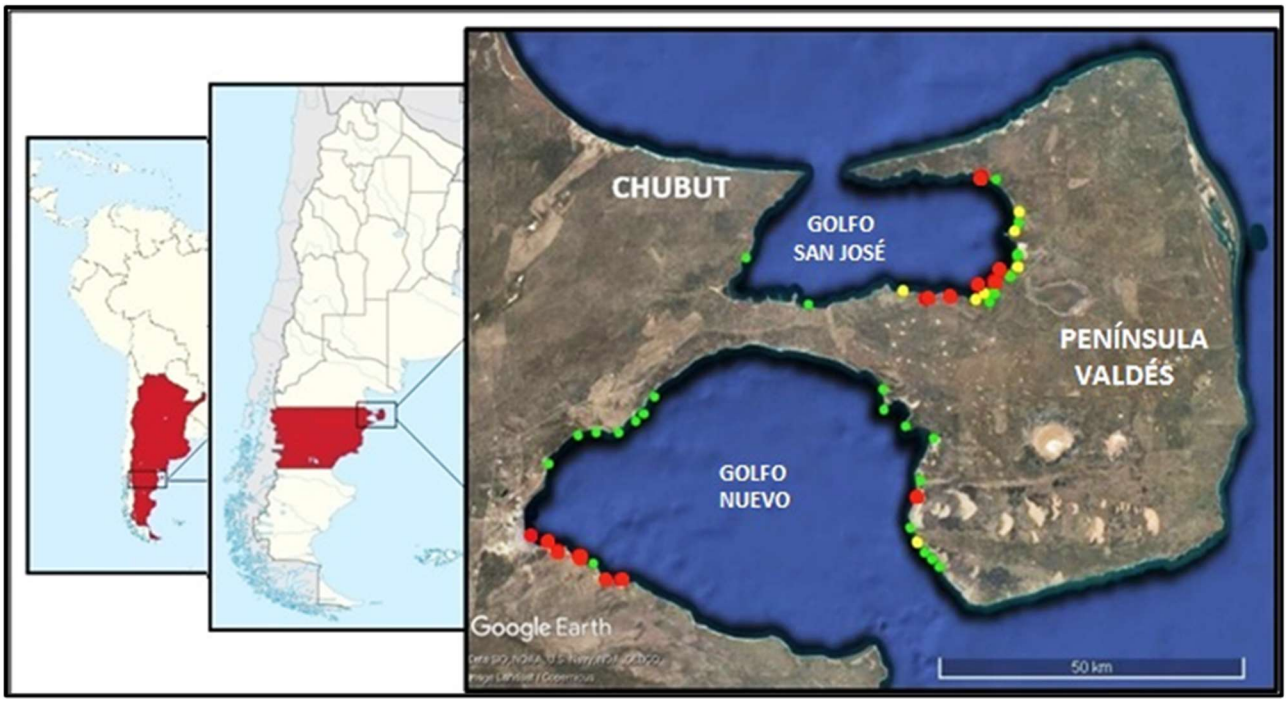

Figure 4. Location of dead whales along the shores of Península Valdés in 2021. Red: adults, yellow: juveniles, green: calves.

Summary for 2022:

Seventy-three whales died along the shores of Península Valdés in 2022. The spatial distribution of strandings was very skewed by an exceptionally high adult mortality in Golfo Nuevo. Most calves (29 or 69% of dead calves) died in Golfo Nuevo and 13 (31%) in Golfo San José (Fig. 5). In the case of adults, 27 (96%) died in Golfo Nuevo and 1 in Golfo San José (4%), while 2 juveniles died in Golfo Nuevo (67%) and 1 in Golfo San José (33%). For context, 1420 living whales were recorded during a photoidentification aerial survey of living whales on 31 August and 2 September 2022, of which 998 (70%) whales were in Golfo Nuevo and 422 (30%) were in Golfo San José (Sironi et al., 2022). This was the largest number of individuals counted during a photo identification survey to date since 1971.

Most whales that died in 2022 were calves (42 or 58%) followed by adults (28; 38%) and juveniles (3; 4%) (Table 2). The number of adult strandings is the highest on record since 1971. The sex ratio was 40:19:14 for females, males and whales of uknown sex, respectively. Most dead adults were female (22 or 79%).

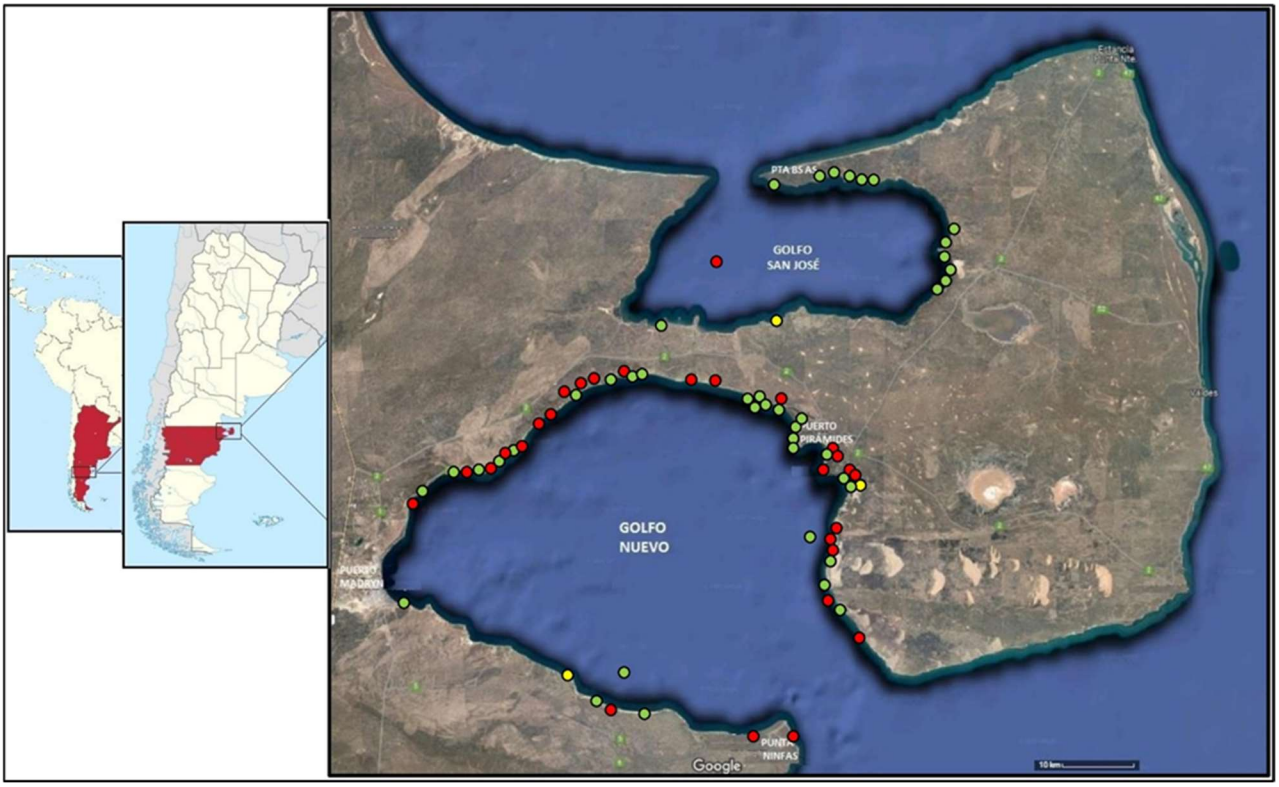

Figure 5. Location of dead whales along the shores of Península Valdés in 2022. Red: adults, yellow: juveniles, green: calves.

DISCUSSION

The annual number of southern right whale strandings at Península Valdés has shown variations between years (Fig. 1). In 2014-2019 there was a continuum of low mortality years when the estimated population growth rate is considered (Marón et al., 2015b). Twenty-three whales (including 20 calves) died in 2014, representing a marked decrease relative to the period 2007-2013 (see Fig. 1). The 2014 mortality toll was comparable to the number recorded a decade earlier (13 strandings in 2004). The number of deaths in 2015 (41) almost doubled the number of strandings in the previous year, yet still fits the population growth model for a low mortality year (Marón et al., 2015b). In 2016 (15 deaths) the mortality was the lowest since 2004 but then almost doubled in 2017 (28 deaths). Finally, in 2019-2022 (no data for 2020) there was a notable increase in the number of dead adults and juveniles.

In particular, 28 adult southern right whales died in Sept-Oct 2022 in Golfo Nuevo, representing the largest known adult mortality to date for the species. Deaths were attributed to PSP toxins, detected in tissues and fluids of 8 whales tested (Uhart et al., in prep). This unusual mortality event overlapped in time and space with a Harmful Algal Bloom (HAB) and unprecedented values of Paralytic Shellfish Toxins (PST) in shellfish and plankton in Golfo Nuevo (Uhart et al., in prep). Adult and juvenile deaths have been increasing at Península Valdés since 2019 and raise concern for conservation in a context of ocean and climate change.

Most live whales are found in Golfo Nuevo, the southern gulf of Península Valdés and fewer in Golfo San José, the northern gulf (Rowntree et al., 2001). It appears that in some years the percentage of dead whales in Golfo Nuevo is higher than that of live whales counted from aerial surveys during the peak of the concentration in September. For example, 86% of the whales that died in 2012 (the year with the highest calf mortality on record) were found in Golfo Nuevo, where only 64% of live whales were counted (Sironi et al., 2014). However, in other years the geographic distribution of strandings showed completely different patterns. In 2019, all calves (10 or 59% of dead whales) died in Golfo Nuevo and all six adults and one juvenile (41%) died in Golfo San José (Fig. 3). Conversely, in 2022 the spatial distribution of strandings was skewed by an exceptionally high adult mortality in Golfo Nuevo, where 28 adults died over two-three weeks while none were recorded in Golfo San José during the same period (Fig. 5). This suggests that ecological, environmental or physiological conditions potentially leading to mortality affect all age classes in different ways in Golfo Nuevo and in Golfo San José in different years.

The high mortality events of right whale calves at Península Valdés prompted the IWC Scientific Committee to establish a Conservation Management Plan (CMP) and to convene two workshops in Puerto Madryn, Argentina in 2010 and 2014, co-organized by the IWC, the US Marine Mammal Commission, Argentina's national delegation to the IWC and the government of Chubut Province at the Centro Nacional Patagónico (CENPAT-CONICET). Three leading hypotheses to explain the high mortalities were proposed in the first workshop: decreased availability of food, exposure to biotoxins, and infectious disease, or a combination of these factors. Two other hypotheses were added during the second workshop: the role of Kelp Gull attacks on whale health and density-dependent processes (Crespo et al., 2015; IWC, 2011, 2015; Thomas et al., 2013).

Based on the workshops' recommendations, researchers from the Southern Right Whale Health Monitoring Program and collaborators focused their efforts on collecting samples and information that would help to further investigate these hypotheses. Results on biotoxins (Wilson et al., 2016), Kelp Gull lesions (Marón et al., 2015a) and histological findings suggestive of infectious and non-infectious processes (McAloose et al., 2016) were published and reported previously to the IWC Scientific Committee. More recently, further analyses were published to test if other variables could help to explain the mortalities, including physiological stress from injuries from Kelp Gull attacks (Fernández Ajó et al., 2020), nutritional status of calves (Marón et al., 2020), body condition (Christiansen et al., 2020) and the effect of climate change on adult female survival (Agrelo et al., 2021).

Since 2003, thousands of biological samples from southern right whales have been collected at Península Valdés by the Program and analyzed by collaborating scientists in Argentina and abroad. Understanding the population dynamics of long-lived species like the right whale and the effects of environmental factors on their health requires long-term studies. Therefore, research efforts to unravel the causes of death continue. Consistent and sustained high calf mortality rates (Rowntree et al., 2013; Marón et al., 2015b) combined with increased adult and juvenile mortality since 2019 could slow the population's recovery. In particular, the 2022 unusual mortality event related to HABs at Península Valdés (Uhart et al., in prep.) raises concern for southern right whale conservation.

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