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Southern right whale mortalities at Península Valdés, Argentina: updated information for 2014-2015

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ABSTRACT

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.

INTRODUCTION AND BACKGROUND OF RECENT MORTALITIES

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). 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, but an unexpectedly large number of whales (47) died in 2005 (Uhart et al., 2008), and high mortality events have continued annually with an average of 75 whales dying each year from 2007 through 2011 (Rowntree et al., 2013) and a peak of 116 deaths in 2012 (Sironi et al., 2014). These are considered the most extreme 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 run by a consortium of the NGOs Instituto de Conservación de Ballenas (ICB), Ocean Alliance (OA), Wildlife Conservation Society (WCS), Fundación Patagonia Natural (FPN), the University of California, Davis and University of Utah, in collaboration with research centers and governmental agencies. It began in 2003 with support from the US National Marine Fisheries Service and the US Marine Mammal Commission, and runs with funds from foundations, private donors and the NGOs and universities that direct the Program.

The aim of the Program is to evaluate the health status of the southern right whale population by conducting post-mortem examinations of the animals that strand each year on the beaches of Península Valdés and surrounding area. Also, it aims at discovering the causes of deaths and their conservation implications for the species. Here we report data on strandings for the 2014-2015 seasons (June through December). Previous reports to the IWC included information

through 2013 (Uhart et al., 2008, 2009; Rowntree et al., 2011; Sironi et al., 2012, 2014). Also, two workshops on the southern right whale die-offs at Península Valdés were organized by the IWC in cooperation with Argentina's national government and the Province of Chubut in 2010 and 2014 (IWC 2011, 2015).

MATERIALS AND METHODS

Stranded whales are located by occasional land and systematic bimonthly aerial surveys conducted by the Program's researchers, and by reports from a local Stranding Network with nearly 70 members. The Network includes park rangers, fishermen, 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. The Stranding Network has been essential to the success of the Program.

The stranding field team regularly surveys the coastline of Península Valdés from land, in regions where the whales concentrate, and by plane along the 500-km perimeter of the peninsula. 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 location, an external examination, 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 the USA. All results are reported annually to provincial and national government authorities.

RESULTS

At least 737 whales died in Península Valdés and surrounding areas between 2003 and 2015 (Di Martino et al., 2015). The number of deaths has shown strong variations between years (Fig. 1). For instance, while the annual effort to find dead whales remained the same, the mortality in 2007 (83 deaths) was 4.6 times higher than in the previous year (18 deaths in 2006), the mortality in 2012 (116 deaths) equaled the total number of whale deaths in the two previous years combined (55 and 61 deaths in 2010 and 2011, respectively), and in 2014 (23 deaths) it was nearly one third of the mortality in the previous year (67 deaths in 2013) and was the lowest since 2006.

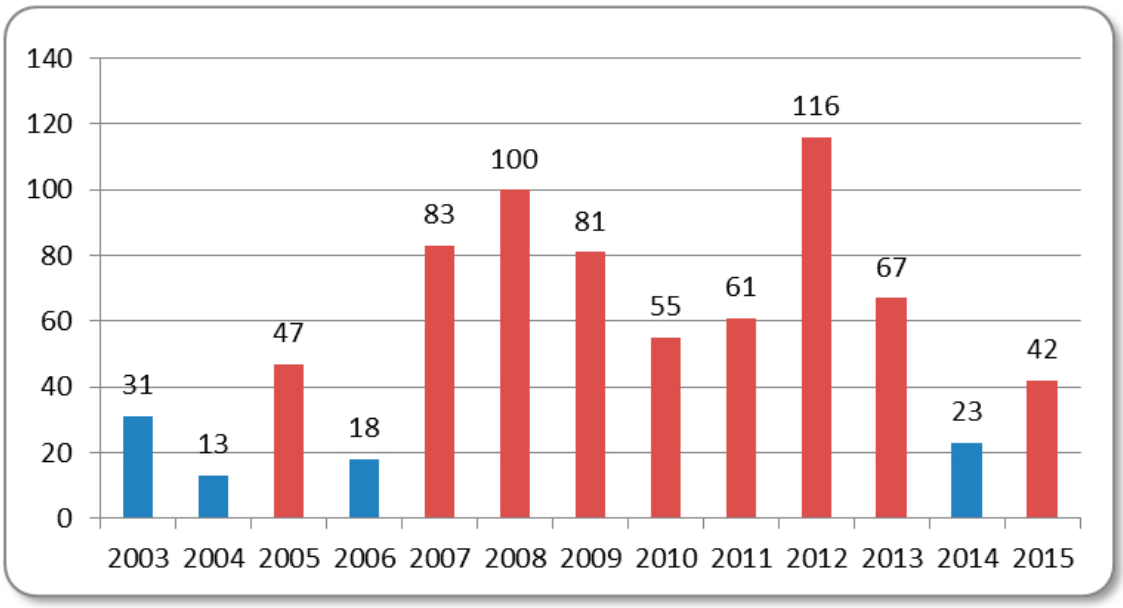

Figure 1. Annual number of dead southern right whales recorded at Península Valdés since 2003. Years in blue (2003, 2004, 2006 and 2014) are considered low-mortality years and years in red (2005, 2007-2013 and 2015) and considered high-mortality years (see criteria in Rowntree et al., 2013).

Summary for 2014:

Twenty-three strandings were recorded in 2014. More deaths were recorded in Golfo Nuevo (74%) than in Golfo San José (22%), with 1 stranding (4%) in the northern outer coast of the peninsula (Fig. 2). For comparison, during a photoidentification aerial survey of living whales on 12 - 13 September 2014, 585 (77%) whales were in Golfo Nuevo and 172 (23%) were in Golfo San José (ICB/OA, 2014).

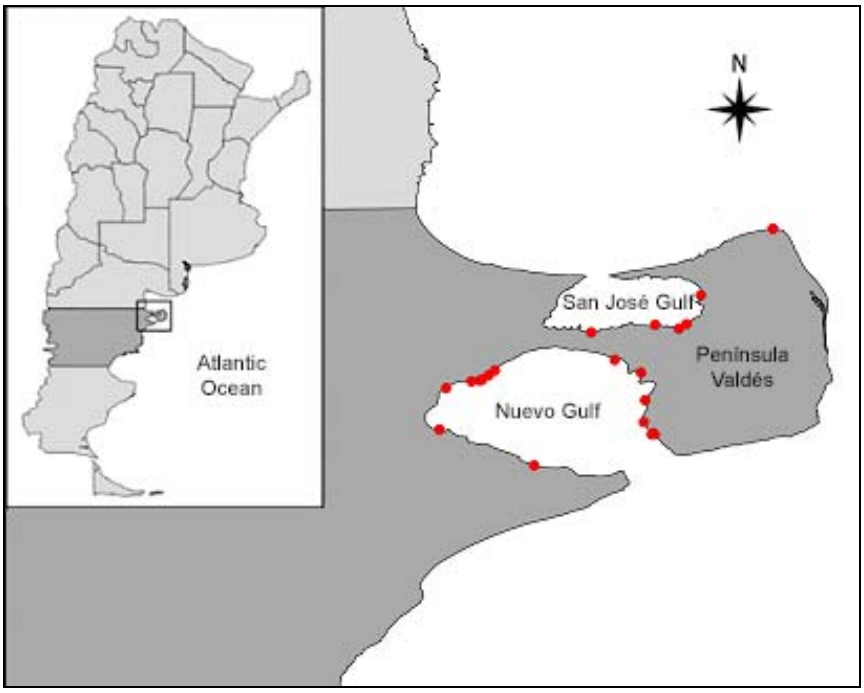

Figure 2. Location of dead whales (red dots) along the shores of Península Valdés in 2014.

The vast majority of the whales that died in 2014 were calves (20 or 87%), with only 2 dead adults (9%) and 1 juvenile (4%) (Table 1). The sex ratio was 13 females:10 males. Most whales died in August (7 animals or 30%) and September (8 or 35%) totaling 65% of the strandings in those two months. The Stranding Network reported 11 (48%) strandings, while 11 strandings (48%) were found during 8 systematic aerial surveys and 1 whale (4%) was found during land surveys by the Program's research team. All whales were dead when reported or found.

The prevalence of gull-inflicted lesions on dead whales was recorded on every whale that stranded with the back visible and skin present. Of 14 whales examined, 9 (64%) did not have ante-mortem gull lesions and the remaining 5 (36%) had lesions. The remaining 9 whales could not be assessed for gull lesions due to stranding position or because the skin was not present.

Marine debris was found in the digestive tract of a male juvenile (total length 10.83m) that stranded in Golfo Nuevo near the city of Puerto Madryn. It was examined on October 6, 2014. Debris included nylon threads, plastic bottle labels and wrappings and other synthetic materials (Fig. 3).

Figure 3. Juvenile whale examined on October 6, 2014 and debris found in its digestive tract (from Di Martino et al., 2014).

Summary for 2015:

Forty-two whales died along the shores of Península Valdés in 2015, almost doubling the number of strandings (23) in 2014. More deaths were recorded in Golfo Nuevo (74%) than in Golfo San José (22%), with 1 (2%) stranding in the northern outer coast and 1 (2%) near the city of Rawson (to the south of Península Valdés) (Fig. 4). For comparison, during a photoidentification aerial survey of living whales on 3 and 6 September 2015, 438 (79.6%) whales were in Golfo Nuevo, 111 (20%) were in Golfo San José and 1 (0.4%) was in the outer coast (ICB/OA, 2015).

The majority of the whales that died in 2015 were calves (38 or 90%), with only 3 dead adults (7%) and 1 juvenile (3%) (Table 1). The sex ratio of animals whose sex could be determined was 24 females:14 males with 4 animals of unknown sex. Most whales died in July (11 animals or 26%) and August (14 animals or 34%) totaling 60% of the strandings in those two months. The Stranding Network reported 19 (45%) dead whales, while 17 strandings (41%) were found during 7 systematic aerial surveys and 6 whales (14%) were found during land surveys by the Program's research team. All whales were dead when reported or found.

Of 24 whales examined for gull-inflicted lesions, 9 (38%) had ante-mortem gull lesions and 15 (63%) did not have lesions. The remaining 18 whales could not be assessed for gull lesions due to stranding position or because the skin was not present or the carcasses were too decomposed.

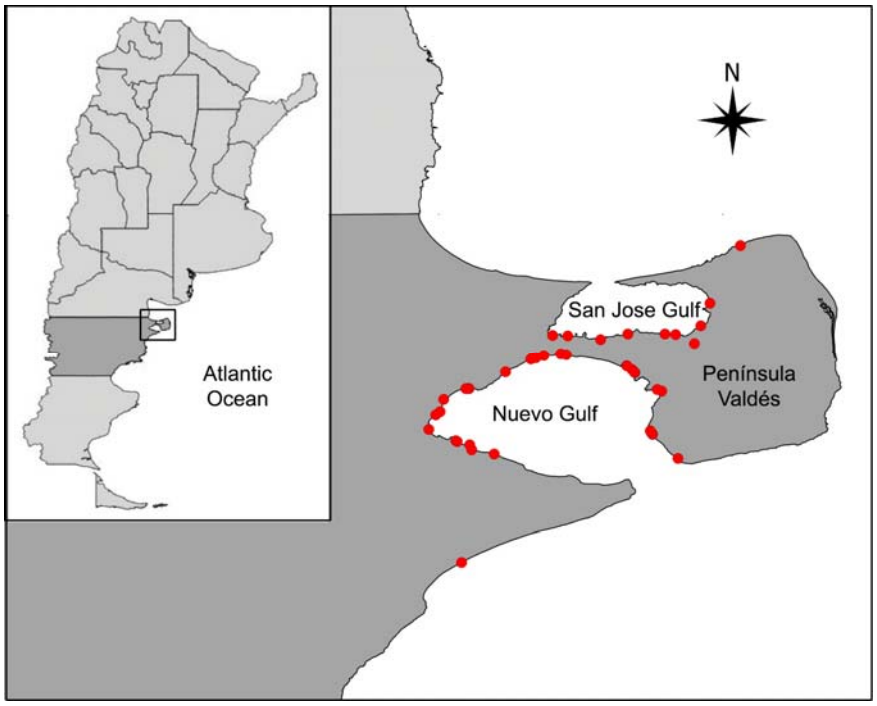

Figure 4. Location of dead whales (red dots) along the shores of Península Valdés in 2015.

Age class	2014	2015	Total (both years)	% of Total (both years)
Calves	20	38	58	89
Juveniles	1	1	2	3
Adults	2	3	5	8
Total	**23**	**42**	**65**	**100**

Table 1. Age class distribution of 65 strandings recorded at Península Valdés in 2014 and 2015.

DISCUSSION

The annual number of southern right whale strandings at Península Valdés continues to show significant variations between years. In 2014, 23 whales (including 20 calves) died, which represents a marked decrease relative to the period 2007-2013 (see Fig. 1). The 2014 mortality toll is comparable to the number recorded a decade earlier (13 strandings in 2004) when the estimated population growth rate (5.1%, Cooke, 2012) is considered in calculations. However, the number of strandings in 2015 (42) increased again and almost doubled the number of strandings in the previous year.

In 2012 a record 113 calves died in Península Valdés, i.e., 113 adult females lost their calves a few days or weeks after they gave birth. Adult females that experience perinatal calf losses may recover quickly and conceive a second calf in one year rather than two; thus the frequencies of two-year calving intervals (vs. the normal three-year intervals) are expected to increase when perinatal (late-term fetus and neonatal calf) mortality increases (Marón et al., 2015b; Seger et al., 2015). Consequently, it is likely that many adult females that lost their calves in 2012 returned to Península Valdés to give birth in 2014 and possibly were in better body condition to successfully raise their calves, hence reducing the annual calf mortality. Furthermore, 757 live whales were counted in 2014 during the annual aerial photoidentification surveys conducted by Instituto de Conservación de Ballenas and Ocean Alliance (ICB/OA, 2014). This was the highest number ever counted since the surveys began in 1971, supporting the hypothesis that an unusually large number of pregnant females (that possibly were in better body condition) migrated to Península Valdés in 2014 to give birth.

Most live whales in this calving ground are found in Golfo Nuevo, the northern gulf of Península Valdés (Rowntree et al., 2001). The percentage of whales that died in Golfo Nuevo in 2014 and 2015 (74%) was very similar to the percentage of live whales counted during aerial photoidentification surveys in September, 2014 (77%) and 2015 (79.6%) (ICB, 2014, 2015). However, in some years the percentage of dead whales in Golfo Nuevo was much higher than that of live whales, e.g., 86% of the whales that died in 2012 were found in Golfo Nuevo, where only 64% of live whales were counted (Sironi et al., 2014).

Kelp Gulls eat the skin and blubber of living southern right whales at Península Valdés, creating large wounds on the whales' back (Rowntree et al., 1998; Sironi et al., 2009; Thomas, 1988). The number and area of gull-inflicted lesions increases with calf age during the calving season (Marón et al., 2015a). It is possible that the calves that died in 2014 and 2015 and had no lesions would have acquired them as the calving seasons progressed. Nearly 99% of living mother-calf pairs and 56% of dead calves had lesions in the 2000's (Marón et al., 2015a).

The finding of marine debris in the digestive tract of a juvenile was the first record of its kind since the Program began to operate in 2003. From the type and size of the debris, it is unlikely that it caused the death of the whale. The vast majority of the carcasses examined at Península Valdés (nearly 90%) are newborn calves. Therefore, it is improbable that they will contain marine debris in their digestive tract, thus potentially underestimating this impact. However, this finding is a first alert that the problem of marine debris is affecting the southern right whale population in the southwest Atlantic.

The continuing high mortality of right whales at Península Valdés prompted the IWC Scientific Committee to convene two workshops of specialists 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 (see IWC, 2011, 2015; Thomas et al., 2013 for further details). Based on the workshops' recommendations, the Program focused its efforts on collecting samples and information that would help to further investigate these hypotheses. Results on the role of algal biotoxins (Wilson et al., 2015), Kelp Gull lesions (Marón et al., 2015a) and gross and histologic findings (McAloose et al., 2016) will be reported to the IWC in separate papers.

Since 2003, thousands of biological samples from southern right whales at Península Valdés have been collected by the Program and analyzed by collaborating scientists in a number of laboratories in Argentina and the USA. Research efforts to unravel the causes of these unexplained deaths continue. Consistent and sustained high calf mortality rates could affect/slow the Península Valdés southern right whale population's recovery (Rowntree et al., 2013).

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REFERENCES

Cooke, J. 2012. Southwest Atlantic right whales: updated population assessment from photo-id collected at Península Valdés, Argentina. IWC/64/Rep 1 Annex F.

Di Martino, M., Beltramino L., Rago V., Sironi M., Rowntree V. and M. Uhart. 2014. Annual Report of the Southern Right Whale Health Monitoring Program. 14 pp. *Available from* icb@icb.org.ar

Di Martino, M., Beltramino L., Rago V., Sironi M., Rowntree V. and M. Uhart. 2015. Annual Report of the Southern Right Whale Health Monitoring Program. 15 pp. *Available from* icb@icb.org.ar

Instituto de Conservación de Ballenas / Ocean Alliance. 2014. Annual Report of the Right Whale Research Program at Península Valdés, Argentina (in Spanish and English). *Available from* icb@icb.org.ar

Instituto de Conservación de Ballenas / Ocean Alliance. 2015. Annual Report of the Right Whale Research Program at Península Valdés, Argentina (in Spanish and English). *Available from* icb@icb.org.ar

International Whaling Commission. 2011. Report of the Southern right whale die-off workshop, 15-18 March 2010, Centro Nacional Patagónico, Puerto Madryn, Argentina. *J. Cetacean Res. Manage. (Suppl.)*12:365-398.

International Whaling Commission. 2015. Report of the second workshop on mortality of Southern right whales (Eubalaena australis) at Península Valdés, Argentina, 5–6 August 2014, Centro Nacional Patagónico, Puerto Madryn, Argentina. Pages 367–398. Document SC/66a/Rep/9.

Marón CF, Beltramino L, Di Martino M, Chirife A, Seger J, Uhart M, Sironi M and Rowntree VJ. 2015a. Increased Wounding of Southern Right Whale (*Eubalaena australis*) Calves by Kelp Gulls (*Larus dominicanus*) at Península Valdés, Argentina. PLoS ONE 10(10): e0139291. doi:10.1371/journal.pone.0139291

Marón, C. F., V.J. Rowntree, M. Sironi, M. Uhart, R.S. Payne, F.R. Adler, J. Seger. 2015b. Estimating population consequences of increased calf mortality in the southern right whales off Argentina. Document #SC/66a/BRG/1 presented to the International Whaling Commission Scientific Committee, San Diego, USA, May 2015. [Available from the IWC Office]. 30pp.

McAloose D., Rago, V., Di Martino M., Chirife A., Olson S., Beltramino L., Pozzi L., Musmeci L., La Sala L., Mohamed N., Sala J., Bandieri L., Andrejuk, J., Tomaszewicz, A., Seimon T., Sironi M., Samartino L., Rowntree V., Uhart M. 2016. Post-mortem findings in southern right whales (*Eubalaena australis*) at Península Valdés, Argentina, 2003 – 2012. Diseases of Aquatic Organisms 119: 17-36, 2016. doi: 10.3354/dao02986

Payne, R. 1986. Long term behavioral studies of the southern right whale (Eubalaena australis). Rep. Int. Whal. Commn. (special issue 10): 161-167.

Rowntree, V., MacGuiness, P., Marshall, K., Payne, R., Sironi, M. and J. Seger. 1998. Increased harassment of right whales (*Eubalaena australis*) by Kelp Gulls (*Larus dominicanus*) at Península Valdés, Argentina. Marine Mammal Science 14(1):99-115 (USA).

Rowntree, V., Payne, R. and D. Schell. 2001. Changing patterns of habitat use by southern right whales (Eubalaena australis) on their nursery ground at Península Valdés, Argentina, and in their long-range movements. J. Cetacean Res. Manage. (Special issue) 2: 133-143.

Rowntree, V., Uhart, M., Sironi, M., Chirife, A., La Sala, L., Pozzi, L., Musmeci, L., Mohamed, N., Andrejuk, J., Sala, J., Carribero, A., Franco, M., Seger, J., Brownell, R., and T. Rowles. 2011. Mortalities of right whales (*Eubalaena australis*) at Peninsula Valdes between 1971 and 2010: recent increases and their possible causes. SC/S11/RW2 presented to the International Whaling Commission, Sept 2011. [Available from the IWC Office]. 22pp.

Rowntree, V., Uhart, M. Sironi, M., Chirife, A., Di Martino, M., La Sala, L., Musmeci, L., Mohamed, N., Andrejuk, J., McAloose, D., Sala, J., Carribero, A., Rally, H., Franco, M., Adler, F., Brownell Jr., R., Seger, J. and T. Rowles. 2013. Unexplained recurring high mortality of southern right whale *Eubalaena australis* calves at Península Valdés, Argentina. Marine Ecology Progress Series, Vol. 493: 275-289.

Seger, J., C. Maron, V. Rowntree, M. Sironi, M. Uhart, R. Payne and F. Adler. 2015. Short and long-term population consequences of increased calf mortality in the southern right whales off Argentina. 21st Biennial Conference on Marine Mammals, San Francisco, CA, USA, 13-18 December 2015.

Sironi, M. Rowntree, V., Snowdon, C., Valenzuela, L. and C. Marón. 2009. Kelp Gulls (*Larus dominicanus*) feeding on southern right whales (*Eubalaena australis*) at Peninsula Valdes, Argentina: updated estimates and conservation implications. Paper SC/61/BRG19 presented to the International Whaling Commission Scientific Committee, Portugal, June 2009 (unpublished). [Available from the IWC Office]. 12 pp.

Sironi, M., Rowntree, V., Di Martino, M., Chirife, A., Bandieri, L., Beltramino, L., Franco, M. and M. Uhart. 2012. Southern right whale mortalities at Península Valdés, Argentina: updated information for 2010-2011. SC/64/BRG12 presented to the International Whaling Commission Scientific Committee, Panama (unpublished). [Available from the IWC Office].

Sironi, M., Rowntree, V.J., Di Martino, M., Beltramino, L., Rago, V., Franco, M. and Uhart, M. 2014. Updated information for 2012-2013 on southern right whale mortalities at Península Valdés, Argentina. Document SC-65b-BRG06 presented to the International Whaling Commission Scientific Committee, Bled, Slovenia, May 2014. [Available from the IWC Office]. 7pp.

Thomas, P.O. 1988. Kelp Gulls, *Larus dominicanus*, are parasites of the Right Whale, *Eubalaena australis*. Ethology. 79: 89-103.

Thomas, P., Uhart, M., McAloose, D.,Sironi, M., Rowntree, V., R. Brownell Jr., R., Gulland, F., Moore, M., Marón, C. and C. Wilson. 2013. Workshop on the Southern right whale die-off at Península Valdés, Argentina. SC/65/BRG15 presentado ante la International Whaling Commission Scientific Committee, South Korea (unpublished). [Available from the IWC Office]. 5pp.

Uhart, M., Rowntree, V., Mohamed, N., Pozzi, L., La Sala, L., Andrejuk, J., Musmeci, L., Franco, M., Sironi, M., Sala, J., McAloose, D., Moore, M., Touhey, K., McLellan, W.A. and T. Rowles. 2008. Strandings of southern right whales (*Eubalaena australis)* at Península Valdés, Argentina from 2003-2007. Paper SC/60/BRG15 presented to the International Whaling Commission Scientific Committee, Chile, June 2008 (unpublished). [Available from the IWC Office].

Uhart, M., Rowntree, V., Sironi, M., Chirife, A., Mohamed, N., Pozzi, L., Franco, M. and D. McAloose. 2009. Continuing southern right whale mortality events at Península Valdés, Argentina. Paper SC/61/BRG18 presented to the International Whaling Commission Scientific Committee, Portugal, June 2009 (unpublished). [Available from the IWC Office]. 10pp.

Wilson, C., Sastre, A. V., Hoffmeyer, M., Rowntree, V. J., Fire, S. E., Santinelli, N. H., Ovejero, S. D., D'Agostino, V., Marón, C. F., Doucette, G. J., Broadwater, M. H., Wang, Z., Montoya, N., Seger, J., Adler, F. R., Sironi, M. and Uhart, M. 2015. Southern right whale (*Eubalaena australis*) calf mortality at Península Valdés, Argentina: Are harmful algal blooms to blame? Marine Mammal Science. doi: 10.1111/mms.12263