

The Weddell seals of Larsen Harbour, South Georgia: a unique but apparently declining colony

Robert Burton

63 Common Lane, Hemingford Abbots, Huntingdon PE28 9AW (rwburton@ntlworld.com)

Received December 2014 ; first published online 7 January 2015

ABSTRACT. The small population of Weddell seals at Larsen Harbour, South Georgia, is isolated from the rest of the species and is unique because nearly all pups are born on land rather than on sea-ice. Observations of seals in Larsen Harbour during the breeding season are summarised. These have been infrequent until cruise ships started to visit. With often only a single observation in a year, accurate estimates of pup production are impossible but it appears that the population has decreased over the last three decades.

Introduction

A colony of Weddell seals (*Leptonychotes weddellii*; Fig. 1) has been observed irregularly and infrequently in and near Larsen Harbour at the south-eastern end of South Georgia (Fig. 2). This is the most northerly breeding site of the species and is separated by about 800 km from the nearest colony in the South Orkney Islands. The Larsen Harbour colony is unique because almost all pups are born on snow-covered beaches rather than on fast-ice as at all other sites in Antarctica (Vaughan 1968; Bonner 1985).

This paper summarises and reviews observations of Weddell seals in Larsen Harbour made over the past century by scientists, tourists and other visitors. Visits to the colony in the breeding season (September–November) have been infrequent, and counts of seals have almost always been incomplete. Pups may start to enter the water for short forays when eight to ten days old (Stirling 1969) and may be missed or not recorded by observers. It has been rare for more than one count to be made in a single season. As births occur over several weeks, counts of pups seen during a single day or even over a few days can only be a minimum estimate of the season's reproductive output, although a count in late October is closest to the total births. More cows than pups have been recorded in all counts and their numbers might be a better estimate of reproductive output, although not all cows may give birth each year and not all cows might be hauled out during the count (K. Ericson, personal communication, 14 June 2014).

The main aggregation of breeding seals is on Bonner Beach on the south side of Larsen Harbour. Early observers considered that this was the only breeding site and consequently it was the only place they visited to count seals. The smaller aggregation on Laws Beach on the other side of Larsen Harbour was overlooked and the inner part of Larsen Harbour, where a few pups have been born, was rarely visited until cruise ships started visiting the area in the 1970s. Most cruise ship visits are too late in the year for pups to be seen.

Nearby coves and bays have been visited even more infrequently. Weddell seal cows are known to give birth at sites up to several kilometres apart between one year

and another and sometimes move their pups by similar distances after giving birth (Smith and Burton 1970; Lugg 1966).

All these factors limit the use of occasional counts of seals at particular sites to estimate local abundance or trends in abundance, particularly where there are so few seals. Nevertheless they can provide some insight into the relative persistence of Weddell seals at Larsen Harbour and at South Georgia generally.

Early history

Weddell seals were presumably known, and killed, by 19th century sealers at South Georgia but this has not been recorded. The sealer James Weddell, after whom the species is named, does not mention seeing them in 1823 (Weddell 1825). Von der Steinem (1984) of the German International Polar Year Expedition 1882–1883 noted three species of seal at South Georgia (Antarctic fur seal (*Arctocephalus gazella*), leopard seal (*Hydrurga leptonyx*) and southern elephant seal (*Mirounga leonina*)) but did not mention the Weddell seal.

Sealers of the Compañía Argentina de Pesca at Grytviken hunted Weddell seals commercially occasionally from 1910 to 1916, when the species received protection at South Georgia (Laws 1953). A total of 97 were killed, with 48 in 1912, which suggests that the seals were taken in Larsen Harbour where they had gathered for the breeding season. The harbour was discovered between 1909 and 1911 by Captain C. Rasmussen of *Undine*, a steam yacht used for sealing, and he reported that pups were born in September (Clark, R. Unpublished 1914). Members of the *Deutschland* expedition visited Larsen Harbour aboard *Undine* on 28 November 1911 but they did not report any Weddell seals (Brennecke 1912).

James Innes Wilson, the stipendiary magistrate of South Georgia, was observing sealing operations when bad weather forced his vessel to seek shelter in a small harbour in Drygalski Bay. on 20 September. This presumably refers to Larsen Harbour. Wilson counted 'about 30 Weddell seal, including young pups of nearly two weeks old' (Wilson 1914). Later that year, on 18 November, members of Ernest Shackleton's Imperial Trans-Antarctic Expedition aboard the sealing vessel *Lille Carl*



Fig. 1. A Weddell seal cow with a full-grown pup reacts aggressively to the approach of another cow (photo R. Burton).



Fig. 2. Larsen Harbour looking towards Drygalski Fjord and showing Bonner Beach and Laws Beach (photo B. Mair).

visited Larsen Harbour. Frank Hurley took photographs which have not survived and Robert Clark recorded that Weddell seals 'had young' (Clark *circa* 1919).

L. Harrison Matthews, a vertebrate zoologist with the *Discovery* Investigations, visited Larsen Harbour once with the sealers in November 1925 and estimated the population (presumably the number of seals he could see) as 20–30 (Matthews 1929), although he gives figures of 30–40 in his book on South Georgia (Matthews 1931). Pups were mentioned only as skeletons found on the beach and he thought cows gave birth in January.

The post of Government Naturalist and Sealing Inspector was occupied by W.N. Bonner from 1956 to 1961 and by R.W. Vaughan from 1961 to 1965. The inspector's main duty was to accompany and observe the sealing crews. Sealing vessels entered Larsen Harbour to shelter from severe weather or to rest overnight and it was usually impossible to get ashore. Landings at Bonner Beach were made only during the breeding seasons of 1956, 1958, 1960 and 1964 (Vaughan 1968). Estimates were sometimes made from on board the sealing vessel but these would not have been accurate and are omitted here. The inspectors noted pups in the water but did not include them in counts. There is no indication that

observations were made of seals on Laws Beach or elsewhere.

Bonner (1988) visited Larsen Harbour seven times and landed on Bonner Beach three times. Vaughan (personal diaries now in the author's possession) visited Larsen Harbour seven times from 1961 to 1964 but landed only on 2 November 1964. On this occasion he counted 27 live and 10 dead pups although in his paper (Vaughan 1968: 71) he records only six dead pups. The observations of Bonner and Vaughan are summarised in Table 1. These overnight visits missed the peak haul-out period between noon and 16.00 hours when pups are most likely to be ashore (Reijnders and others 1990: 301).

Recent history

Since sealing operations at South Georgia ended in 1965, observations in Larsen Harbour have been made by the crews of sailing yachts. A few have stayed for several days or longer and some visited neighbouring coves. Observations are summarised below and in Table 1.

Clark (1988) visited Larsen Harbour on 4 September 1984 and counted 95 adults and 21 pups (including three dead). If most of the adults had either given birth or were pregnant, reproductive output would have been even higher. However, the numbers reported are already surprisingly high for such an early date and are anomalous.

In September and October 1985, McCann (1985) conducted a detailed survey of elephant seals at South Georgia. Three days were spent in Larsen Harbour and the entire length was examined for Weddell seals in the first thorough survey of the colony. 58 pups were counted.

In late September 1995 Tim and Pauline Carr recorded 24 pups in Larsen Harbour (T. Carr, personal communication, 5 December 2013).

On 30 September 1999, Harald and Hedel Voss counted Weddell seals on Bonner Beach and Laws Beach (H. Voss, personal communication, 27 August 2013). On 8 October there were 30 adults and 15 pups. Between 26 September and 4 October 2001 they counted 20 pups, including one dead.

Fraser and Mark Carpenter made the most extensive survey on record when they spent several weeks in 2001 studying the seals in Larsen Harbour and some neighbouring coves (F. Carpenter, personal communication, 15 October 2013). They found 20 pups in Larsen Harbour of which one was dead. Two others would probably have died if the Carpenters had not helped them out of the water. Two pups were on fast ice at the back of the harbour. In Doubtful Bay there were 10 pups on fast ice of which two were dead, and another pup was found in Smaaland Cove.

The author visited Larsen Harbour on 22 and 23 October 2009 and found nine pups.

Kicki Ericson and Thies Matzen arrived in Larsen Harbour on 12 September 2010 and made detailed observations over the next five weeks (K. Ericson, personal communication, 14 September 2013). This extended visit

Table 1. Counts of Weddell seals in Larsen Harbour.

Year	Date	Adults	Cows	Pups	Observers
1956	3 October	39	32	26	Bonner*
1958	27 October	35	-	27	Bonner*
1960	1 November	31	-	25	Bonner*
1961	20 October	-	-	19	Bonner*
1964	2 November	26	20	33	Vaughan*
1985	4 September	95	-	21	Clark
1985	1 to 3 October	83	67	58	McCann
1995	late September	-	-	20	Carr
1999	2 October	-	23	20	Carpenter
1999	5 to 9 October	31	-	15	Voss
2001	September/October	-	-	20	Voss
2009	22 October	14	12	9	Burton
2010	13 October	29	20	7	Ericson
2013	29 October	15	8	6	Beinart
2014	30 October	11	7?	5	Day

*Bonner Beach only

with several counts allowed a relative accurate assessment of births. Seven pups (four males, three females) were born in Larsen Harbour, one dying when about one week old. The last birth was on 11 October. On 13 October, 15 cows and six bulls were counted, the highest single count, but they identified 20 cows and nine bulls by photographs over the five week period. (Only the count for 13 October is recorded in Table 2.)

2013 and 2014 survey

In 2013 and 2014, at the author's behest, Weddell seals were recorded by staff on board various cruise ships and yachts planning to visit Larsen Harbour during late spring and early summer. The aim was to obtain several counts throughout the pupping season for a more complete assessment of numbers born and their dispersal from the colony. The Government of South Georgia and South Sandwich Islands issued permits to these vessels which allowed one of their staff to land on Bonner Beach and count seals that might not be seen from the sea.

Seven vessels visited Larsen Harbour between 29 October and 28 November 2013 (Table 2). Late October is already two months into the breeding season and pups were already entering the sea and therefore easy to miss. This was demonstrated on 29 October when experienced observers from the cruise ship *Expedition* observed no pups on Laws Beach (B. Stewart, personal communication, 7 December, 2013) but the yacht *Kamiro*s was anchored off Laws Beach from 27 to 30 October and Hans Beinart made several observations from the mast (H. Beinart, personal communication, 13 February 2014). Four pups were seen on Laws Beach every day and pups were sometimes seen swimming. The variability of pup counts is also shown by the results in Table 2. The most pups observed at any one time in Larsen Harbour was six.

Two counts were made in 2014 (Table 2). On 28 October, the yacht *Pelagic* observed a cow and pup on Laws Beach but no seals on Bonner Beach. Two

days later on 30 October, *Pelagic Australis* searched the entire coast of Larsen Harbour and found 10 adults and five pups (M. Day, personal communication, 30 October 2014).

Pupping outside Larsen Harbour

Visits to coves neighbouring Larsen Harbour have been rare and there is little information on Weddell seals breeding at these sites. Vaughan (1968) recorded a group of seals that was seen several times on a beach on the 'south west side' of Drygalski Fjord but he could not confirm breeding. Bruce Mair found three pups in Smaaland Cove on 4 November 1976 (B. Mair, personal communication, 6 September 2013) and McCann (1985) recorded three pups there on 6 October 1985 but none in Esbensen Bay, Doubtful Bay or Drygalski Fjord. Fraser Carpenter saw ten pups (two were dead) in Doubtful Bay and one pup in Smaaland Cove on 30 September 2001, but none in Brandt Cove, Esbensen Bay or Drygalski Fjord (F. Carpenter, personal communication, 28 November 2013). On 30 October 2013 Beinart found one pup on a beach east of the Jenkins Glacier in Drygalski Fjord.

It is impossible from these few observations to say whether pups are born regularly in Smaaland Cove, Doubtful Bay or Drygalski Fjord and whether they are ever born in other bays. The records do show that the colony is more widely distributed than had been first supposed.

Breeding season

The earliest date that pups have been seen is 4 September when Clark (1988) counted 21 pups. Bonner observed 'several pups' on Bonner Beach from a vessel on 6 September 1960 (Bonner 1988). Carpenter found half the pups had been born in early September, with one probably in late August (F. Carpenter, personal communication, 28 November 2013). Ericson found two pups not more than 4–5 days old on 12 September and a third was

Table 2. Detailed counts of Weddell seals in Larsen Harbour in 2013 and 2014.

Vessel	Date	Bonner Beach				Laws Beach				Other Sites				Total Larsen Harbour				
		Cows	Bulls	Unsexed	Pups	Cows	Bulls	Unsexed	Pups	Cows	Bulls	Unsexed	Pups	Cows	Bulls	Unsexed	Pups	
	2013																	
<i>Expedition</i>	29 October	1			0		5	0								1	5	0
<i>Kamiro</i>	29 October		1		1	4	4	4		2		1					7	6
<i>Australis</i>	31 October		2		0	6	6	0		7		2					15	2
<i>Sea Spirit</i>	14 November	4	1	0	0	4	1	0				8		2			6	0
<i>NG Explorer</i>	18 November	3	1	0	0	7	5	1				10		6			0	1
<i>Ocean Diamond</i>	23 November		1	4	0			0						1			4	0
<i>Ioffe</i>	28 November				0			0				0					16+	0
	2014																	
<i>Relagic</i>	25–27 October			3	2	1	1	1				2					6	0
<i>Pelagic australis</i>	30 October	2			1	2	1	1		2		2		1		5	5	5

born that day (K. Ericson, personal communication, 14 September 2013). These records show that pupping starts in early September and sometimes in late August. At Signy Island, South Orkney Islands, the start of pupping is variable; the mean date of the first pup is 16 August (ranging from 10 to 24 August) (Smith and Burton 1970). In the McMurdo Sound area of the Ross Sea pupping starts in the second week of October (Reijnders and others 1990; Lugg 1966).

The pupping season extends over 40 days across the species' range although there appear to be regional differences (Reijnders and others 1990; Kaufman and others 1975). If the date of the first birth in Larsen Harbour is taken conservatively as 1 September, then the last pup might be born around 10 October. With weaning and dispersal taking place from anything up to 33 days of age (Stirling 1969; Lindsey 1937), at least some Larsen Harbour pups might have dispersed before observations made in late October and November. The latest observation of a pup was a full-grown, moulted individual seen on 18 November (S. Martin, personal communication, 20 November 2013), the same date as Clark's visit in 1914.

Ice breeding

The Larsen Harbour colony is described as unique because it is the only site where Weddell seals routinely breed on land rather than on land-fast ice or pack-ice. Elsewhere in the species' range, for example Signy Island, cows sometimes haul out and bear their pups on beaches or even on frozen freshwater lakes in years when there is little or no sea ice (Smith and Burton 1970).

Sea-ice occasionally forms in sheltered bays on South Georgia especially where submerged terminal moraine bars dampen the ocean swell and fresh water emanating from glaciers or streams floats on top of the sea water (B. Mair, personal communication, 5 September 2013). The only records of pupping on sea ice at South Georgia are at the heads of Larsen Harbour and Doubtful Bay in 2001 (F. Carpenter, personal communication, 28 November 2013; H. Voss, personal communication, 27 August 2013). In Doubtful Bay during that year, the sea ice was thick enough to walk on and the seals had made breathing holes.

Population decline

Variations in the dates of pup counts and the areas searched make comparison of numbers between years very difficult. Most visits to Larsen Harbour in the breeding season have been in October when pupping is well-advanced, the pups are taking to the water and may be missed from counts unless they are swimming at the surface with their mothers. Others may have dispersed from the colony.

The failure to search for seals other than on Bonner Beach, the principal aggregation, reduces the value of early counts. It is impossible to assess the proportion of pups born outside Larsen Harbour.

With such scant data it is difficult to draw any conclusion about the Larsen Harbour population except to draw attention to an apparent increase in the mid-1980s and decline in pup production that appears to start in the 1990s and continues to the present date.

There is a parallel between the Larsen Harbour population and the most southerly population of Weddell seals at White Island, McMurdo Sound, in the Ross Sea. These seals are also isolated from conspecifics, in this case by approximately 20 km of thick, multi-year sea ice (Gelatt and others 2010). The adult population, numbering from nine in 1968–1969 to 26 in 1993–1994, has been studied intensively (Testa and Scotton 1999) and the prediction is that the population is at risk of extinction through inbreeding depression which is indicated by the observed high pup mortality, female-biased pup sex ratio and low reproductive rate. From 2001 to 2007 fewer than three pups were born per year.

The Larsen Harbour population might possibly be heading towards a similar fate. However, such a conclusion remains speculative until adequate genetic information can be collected from the Larsen Harbour colony. To date, nothing is known about genetic exchange between this colony and any other. Further, at present, there is no sign from the limited data available that there is high pup mortality except in 1960 when Bonner (1988) found 18 live and seven dead pups. Ericson's count of 4 males and 3 females is the only observation on the sex ratio of pups. That there might be a low reproductive rate is suggested by Ericson's detailed counts. Only seven of the 20 known females pupped. However, one cow never seen with a pup appears from photographs to have given birth a few weeks earlier, possibly outside Larsen Harbour (B. Stewart, personal communication, 16 June 2014).

In conclusion, there remains the possibility that the colony's position at the edge of the species' range, its small numbers, apparent low breeding rate and assumed very limited, if any, recruitment from other colonies could lead to its extinction simply through random events in the environment.

Acknowledgements

I am grateful to Ian Stirling, Phil Trathan and especially Brent Stewart for comments and discussions. The last named greatly improved the text and commented on photographs of the seals. Fraser Carpenter, Harald and Hedel Voss, and Kicki Ericson and Thies Matzen gave me details of their observations. Jenny Bonner and Jean Vaughan made their late husbands' diaries and field notebooks available. I enjoyed the co-operation of the staff of cruise ships and crews of yacht in making counts. The Government of South Georgia and the South Sandwich Islands is thanked for making many of the later counts possible.

References

Bonner, W.N. 1988. *The Weddell seal colony in Larsen Harbour. October 1956, with additional sheets for 1958 and 1960.*

- Cambridge: British Antarctic Survey Archive LS/B2 Bonner WN 1988/38/16.
- Bonner, W.N. 1985. Birds and mammals - Antarctic seals. In: Bonner, W.N. and D.W.H. Walton. *Antarctica*. Oxford: Pergamon Press: 202–222.
- Brennecke, W. 1912. Ozeanographische Arbeiten der Deutschen Antarktischen Expedition. (Buenos Aires-Süd-Georgien-Süd-Sandwich Inseln). IV. Bericht von Dr. W. Brennecke. (Hierzu Tafeln 7 und 8). *Annalen der Hydrographie und Maritimen Meteorologie* 40 (3): 124–131. (Translated J.D.M. Blyth, 1955. Cambridge: Scott Polar Research Institute *82:551.46)
- Clark, G. 1988. *The 'Totorore' voyage*. London: Century Hutchinson.
- Clark, R. S. 1914. *Journal 26 October to 29 November*. Cambridge: Scott Polar Research Institute MS 1619/14;D.
- Clark, R.S. circa 1919. *Biology log book*. Cambridge: Scott Polar Research Institute MS 1619/15;D.
- Gelatt, T.S., S. Corey Davis, I. Stirling, D.B. Siniff, C. Strobeck and I. Delisle. 2010. History and fate of a small isolated population of Weddell seals at White Island, Antarctica. *Conservation Genetics* 11: 721–735.
- Kaufman, G., D. Siniff and R. Reichle. 1975. Colony behavior of Weddell seals, *Leptonychotes weddelli*, at Hutton Cliffs, Antarctica. In: Ronald, K. and A. W. Mansfield (editors). *Biology of the seal*. Charlottenlund, Denmark: Rapp. P. V. Reun. (Conseil international pour l'exploration de la mer).
- Laws, R. M. 1953. The elephant seal industry at South Georgia. *Polar Record* 6 (46): 746–754.
- Lindsey, A. A. 1937. The Weddell seal in the Bay of Whales, Antarctica. *Journal of Mammalogy* 18: 127–144.
- Lugg, D. J. 1966. Annual cycle of the Weddell seal in the Vestfold Hills, Antarctica. *Journal of Mammalogy* 47: 317–322.
- Matthews, L.H. 1929. The natural history of the elephant seal with notes on other seals found at South Georgia. *Discovery Reports* 1: 233–256.
- Matthews, L.H. 1931. *South Georgia: the British Empire's sub-antarctic outpost*. London: John Wright and Sons.
- McCann, T.S. 1985. *Report of the 'Damien II' South Georgia elephant seal survey 1985*. Cambridge: British Antarctic Survey AD6/2M/1985/N.
- Reijnders, P. J. H., J. Plötz, J. Zegers and M. Gräfe. 1990. Breeding biology of Weddell seals (*Leptonychotes weddellii*) at Drescher Inlet, Riiser Larsen Ice Shelf, Antarctica. *Polar Biology* 10: 301–306.
- Smith, E.A. and R.W. Burton. 1970. Weddell seals of Signy Island. In: Holdgate, M.W.(editor). *Antarctic ecology* Vol. 1. London: Academic Press: 415–428.
- Stirling, I. 1969. Ecology of the Weddell seal in the McMurdo Sound, Antarctica. *Ecology* 50: 573–586.
- Testa, J.W. and B.D. Scotton. 1999. Dynamics of an isolated population of Weddell seals (*Leptonychotes weddelli*) at White Island, Antarctica. *Journal of Mammalogy* 80(1): 82–90.
- Von den Steinem, K. 1984. Zoological observations, Royal Bay, South Georgia 1882–1883. Part 1. (translator, W. Barr). *Polar Record* 22(136): 57–71.
- Vaughan, R.W. 1968. The status of the Weddell seal (*Leptonychotes weddelli*) at South Georgia. *British Antarctic Survey Bulletin* 15: 71–74.
- Weddell, J. 1825. *A voyage towards the South Pole*. London: Longman, Rees, Orme, Brown and Green.
- Wilson, J.I. 1914. Report by the stipendiary magistrate on sealing operations conducted at South Georgia during the season ended 30 September 1914. Enclosure to Falkland Islands despatch No. 146. Cambridge: Scott Polar Research Institute MS 1228/7/4.