



ON THE BEACH

Walrus haulouts are nothing new

Susan Crockford

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About the author

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Summary

Recent mass haulouts of walrus females and calves on the beaches of Alaska and Russia bordering the Chukchi Sea have been blamed by US government biologists and WWF activists on lack of summer sea ice, claims that have been amplified into alarming scare stories by a compliant media and embellished with alarming stories of trampling deaths. However, such claims ignore the published literature documenting previous events, which suggest a different cause. Rather than lack of ice, the presence of such massive herds onshore in six out of the eight years since 2007 indicate that the now well-protected walrus population may be so high that it is approaching the carrying capacity of its habitat. Sea ice maps for the months when known mass haulouts occurred, compared to years when they did not, suggest no strong correlation with low sea ice levels. Instead of there being a clear case for blaming this walrus behaviour squarely on global warming, the evidence suggests that high population numbers may be a significant factor, among other potential triggers not fully understood. Those who suggest these events are a sign of pending catastrophe are looking for victims of global warming to tally on a ledger, but in doing so they not only fail to acknowledge potential consequences of natural fluctuations in walrus population size but fail to concede the obvious resilience of this species to profound sea ice changes they have survived repeatedly before now.

1 Introduction

On 12 September 2014, biologists for the National Oceanic and Atmospheric Administration (NOAA) performing a routine aerial survey of marine mammals in the Chukchi Sea noted close to 10,000 Pacific walrus¹ hauled out at Point Lay, Alaska (see Fig. 1). The walrus, primarily females and calves, were moving on and off shore, feeding.² By 23 September, the number of walrus hauled out on the beach had declined to about 1500 but on the 27th, the herd had swelled to about 35,000 animals (Fig. 2). At least 36 animals had apparently been trampled to death, a not unexpected finding since any disturbance (e.g., airplane overhead, approaching polar bear) can cause a stampede of animals towards the safety of the water, and in such large herds, weak or young animals simply get crushed in the chaos.² The NOAA biologists took some aerial photos and a few days later, the phenomenon was international news.



Figure 1: Map of the Chukchi Sea and surrounding area

Locations relevant to recent walrus haulouts are marked.

It is hard to know for sure who alerted the media and when, but by 1 October, the US Geological Survey (USGS), National Marine Fisheries Service (NMFS, a NOAA agency) and the US Fish and Wildlife (USFWS) had organized a joint press conference.³ They provided a wealth of background information, much of it linking this event and similar ones in the last few years, to reduced sea ice in the Chukchi Sea.⁴ The media took up the story and blame was placed squarely on global warming. Statements from the World Wildlife Fund (WWF), often including strident calls for 'action' on climate change, were given prominence from the beginning.

One of the earliest stories appeared in the *Alaska Daily News* on 30 September 2014⁵ and it included the following quote from Margaret Williams,⁶ managing director of the World Wildlife Fund's Arctic program. The same words also appeared the same day on the WWF website:⁷

The massive concentration of walrus onshore -- when they should be scattered broadly in ice-covered waters -- is just one example of the impacts of climate change on the distribution of marine species in the Arctic.

Over the next few days, virtually all media outlets carried the story and almost all of the stories included a quote from Williams on behalf of the WWF. Overall, the hyperbole was something to behold -- as the quotes from some of the news reports below show:

Before 2006 I am not aware of any mass haul outs that included females on land.

Kit Kovacs, Norwegian Polar Institute biologist; via *The Guardian*.¹⁰

This mass convergence of walrus -- most of whom are females and calves -- is a new phenomenon....This is a real change that we see thousands and tens of thousands of animals coming to shore and resting together in these large haul-outs.

Tony Fischbach, USGS biologist; via ThinkProgress¹¹

The walrus are telling us what the polar bears have told us and what many indigenous people have told us in the high Arctic, and that is that the Arctic environment is changing extremely rapidly and it is time for the rest of the world to take notice and also to take action to address the root causes of climate change.

Margaret Williams, WWF; via *The Independent*¹²

Walrus are hauling out on land instead of ice because of climate-induced warming.

USGS news feature headline¹³

We are witnessing a slow-motion catastrophe in the Arctic.

Lou Leonard, WWF; WWF website¹⁴



Figure 2: Walrus at Point Lay, Alaska on 27 September 2014

These animals were not stranded, as some stories stated; they swam there willingly, perhaps from the ice edge, and were feeding there. NMFS aerial photo.^{8,9}

Since the first recordings of walrus gatherings in Alaska in the 1870s, groups of this size weren't observed until 2007.

Anthony Fischbach, USGS biologist; via National Geographic News¹⁵

Until 2007, it was unheard of for walrus to leave the sea ice for dry land for prolonged periods of time. But the retreat of sea ice has seen 'drastic changes' in behaviour...It is really a reduction in the sea ice that is causing the change in behaviour, and the reduction of sea ice is due to global warming.

Chadwick Jay, USGS biologist; via *The Guardian*¹⁶

These are astounding claims but are they really true? Did mass haulouts of female walrus and their calves on beaches in early autumn really never occur before 2007? Are these phenomena really due to low sea-ice coverage and therefore valid indicators of an impending Arctic catastrophe, or is there another plausible explanation?¹⁷

2 Past incidents

A quick search of the walrus literature reveals that large haulouts of walrus females and calves in late summer/early autumn such as the one making news at Point Lay this year and other recent events¹⁸ are not new phenomena for this region over the last 45 years.¹⁹ Nor are deaths by stampede within such large herds unusual.

At least two similar documented incidents have occurred in the recent past: one in 1978, on eastern St. Lawrence Island and the associated Penuk Islands, and the other in 1972, on the western end of Wrangel Island at Cape Blossom (see Fig. 1). The 1978 event involved an estimated total of almost 150,000 walrus hauled out within a small geographic area. Both events included mass mortalities, when the very large herds of females and calves stampeded, as recorded in a paper by Fay and Kelly.²⁰ Here are some excerpts from that report:

October/November 1978

pp. 226–228

In November 1978, residents of the Eskimo village of Savoonga, Alaska reported that unusually large numbers of walrus were hauling out on St. Lawrence Island in four locations where they had not been known to occur, for at least the past 40 to 50 years. At the same time, herds were hauling out on the Penuk Islands, off the eastern end of St. Lawrence Island...

The walrus, mainly adult females and young, were arriving from the northwest, presumably having swum from the edge of the pack ice which was then just north of Bering Strait, some 300 km away...

One night, an entire herd stampeded off the beach into the sea, leaving behind about 25 dead and disabled animals at the water's edge, below a wave-cut terrace.

October/November 1978

p. 239, regarding two of three eastern St. Lawrence Island haulouts

In late October [at Salghat Beach], when the animals hauled out on this shore, the beach was about 25 to 30 m wide. They had not advanced onto the tundra above the beach, but some probably were in the intertidal zone below. We have estimated that the total area occupied by the living animals had been at least 1,100 by 30 m or about 33 000 m², and that this could have accommodated about 19,000 (\pm 1,000) walrus.

A conservative estimate of the area covered by the animals [at Maknik Lagoon] is at least 2 km (i.e., about 60,000 which suggests the possibility that about 35,000) (\pm 2,000) walrus had hauled out there. This area is

not known to have been used previously as a haulout in autumn. The Eskimos believe that it was used in this case as an alternative to the Punuk Islands, which may have been fully occupied at the time.

October/November 1978

p. 241, regarding the haulouts at the Punuk Islands

The greater abundance of dead walruses on the western spit of the North Island than elsewhere implies that this area was utilized either more frequently or more intensively than any of the others. Since it has been the traditional haulout site, we presume that the other areas were utilized only when the spit was fully occupied. If all of the areas had been occupied at one time, it is conceivable that some 50,000 to 60,000 walruses were on shore on the Punuk Islands sometime during the late autumn of 1978.

Autumn 1930 to 1932

p. 242, regarding earlier haulouts at the Punuk Islands

The late Lawrence Kulukhon, who resided from 1916 to 1942 at Salghat Beach and who frequented the eastern end of St. Lawrence and the outlying Punuk Islands, reported that between 1930 and 1932 an unusually large number of walruses hauled out in autumn on the Punuk Islands. These were sufficient to cover the southwestern peninsula of the North Island and most of the Middle Island as well.

Autumn(?) 1964

p. 244, regarding past haulouts at Cape Blossom,²¹ Wrangel Island

At Cape Blossom, Wrangell Island, Gol'tsev (1968) observed that about 50 carcasses were left on the haulout after some 5,000 animals had utilized it in 1958. In the same location in 1964 he found about 500 carcasses that had accumulated in the interim, and he accounted for an additional 250 to 300 that died in that year when 33,000–35,000 animals hauled out there.

August and September 1972

p. 244, regarding past haulouts at Cape Blossom,²² Wrangel Island

Tomilin and Kibal'chich (1975) found about 2,000 carcasses on the Cape Blossom haulout in August 1972, these having accumulated from previous years. At that time, they observed that 21 calves were trampled and two fetuses aborted during a brief stampede of part of the herd that was utilizing the area. In addition, there were 149 new carcasses on the haulout when a congregation of about 36 000 females and young departed there in September of that year [1972].

3 Walrus haulouts and sea ice

It is certainly true that walrus females, especially those with calves, prefer to haul out on the sea ice over the continental shelf where the water is relatively shallow. This allows them easy access to clams and other foods they suck off the sea floor (Fig. 3).

Regardless of ice conditions, by late September, Chukchi Sea walrus females must contemplate their annual migration south, away from the pack ice. No one really knows what determines the actual start date of their migration, which entails swimming hundreds of kilometers south, well before the ice starts to reform²³ – is it changes in ice composition, food supply, air temperature, or even daylight?

Walrus females could wait until the ice itself moves south, but they do not. *Even in 1978, they did not wait for the ice to move south*:²⁴ even though the ice was well south of the area of Point Lay in October 1978 (see Fig. 4), female walrus took their calves and swam about 300 km south to eastern St. Lawrence Island, to haul out in massive herds on the beaches there. Similarly, in 1972, even though there was ice at the eastern end of Wrangel Island, a huge herd of females chose to haul out with their calves on a beach at the western end instead (Fig. 4).

The reason females and calves head to eastern St. Lawrence ahead of the ice every year is so that they can use the beaches there as a resting platform for foraging bouts in the shallow waters offshore, which are shallower than many areas in the Chukchi Sea (Fig. 3). The notion that females and calves are never found hauled out anywhere except the sea ice in late summer and autumn and never use beaches as foraging platforms in late summer/autumn – except when sea ice is low – is simply not true.

The 2014 haulout at Point Lay this September (and elsewhere in recent years) may represent the start of the annual migration of females and calves south, in which case they will not stay long. They simply stop to rest and feed at this convenient place – they are not stranded or starving.^{26,27}

But what about recent sea ice conditions? Has lack of sea ice over the Chukchi Sea since 2007 correlated with documented large-to-very large haulouts of female walrus and calves?

Figure 5 summarizes ice conditions in the Chukchi Sea at 7 September for selected years since 2002, with land haulouts indicated by yellow arrows and ice haulouts by blue arrows. There were large haulouts of females and calves on Alaskan beaches in mid-to-late September in 2009, 2010, 2011, 2013 and 2014.^{28,29,30,31} In 2007, there was a haulout of ‘tens of thousands’ of walrus at Cape Schmidt, Russia.³² However, in 2008, a large patch of remnant ice apparently accommodated all Chukchi Sea walrus^{33,34} because there were no

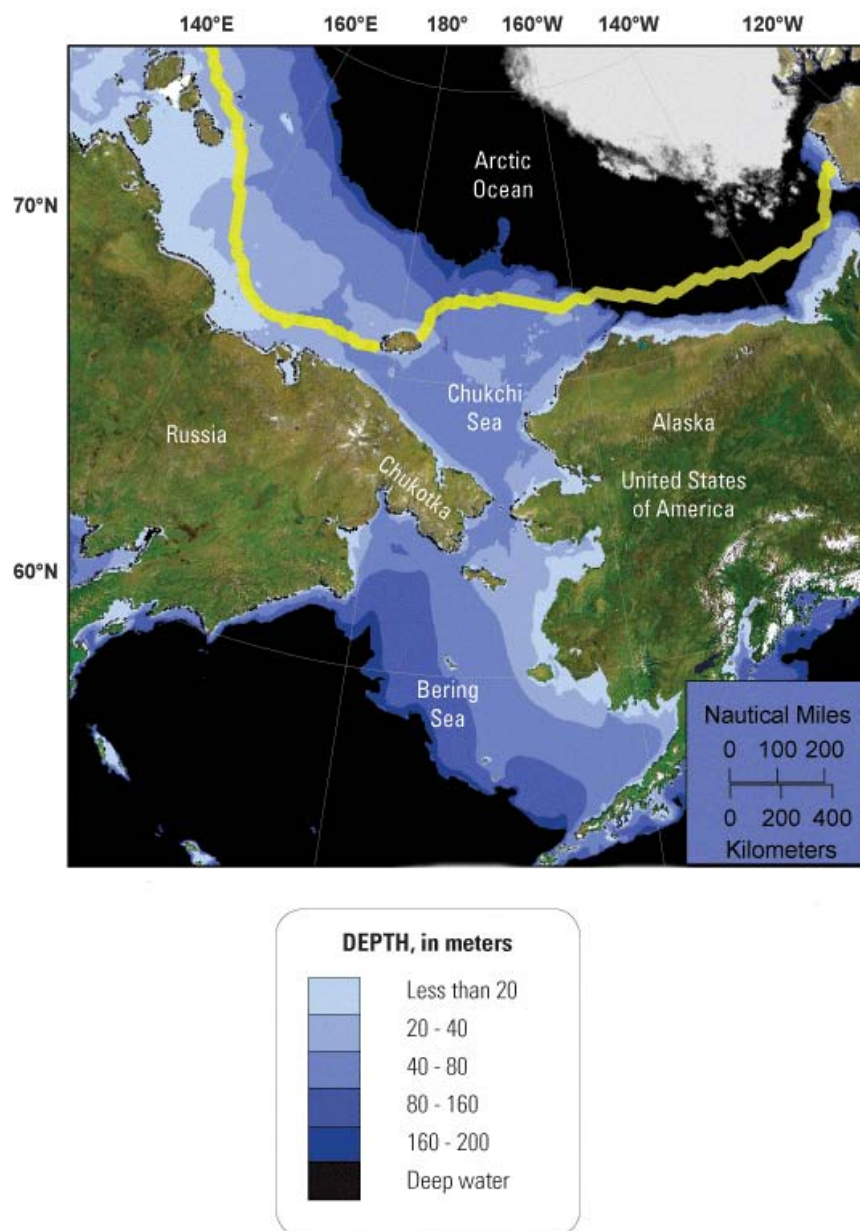


Figure 3: Summer range of walrus females over the continental shelf of the Chukchi Sea

Water depth in meters; yellow line shows the average minimum extent of sea ice for 1979–2000, with the extent for 2007 in white. Source: USGS Walrus Fact Sheet (2008).

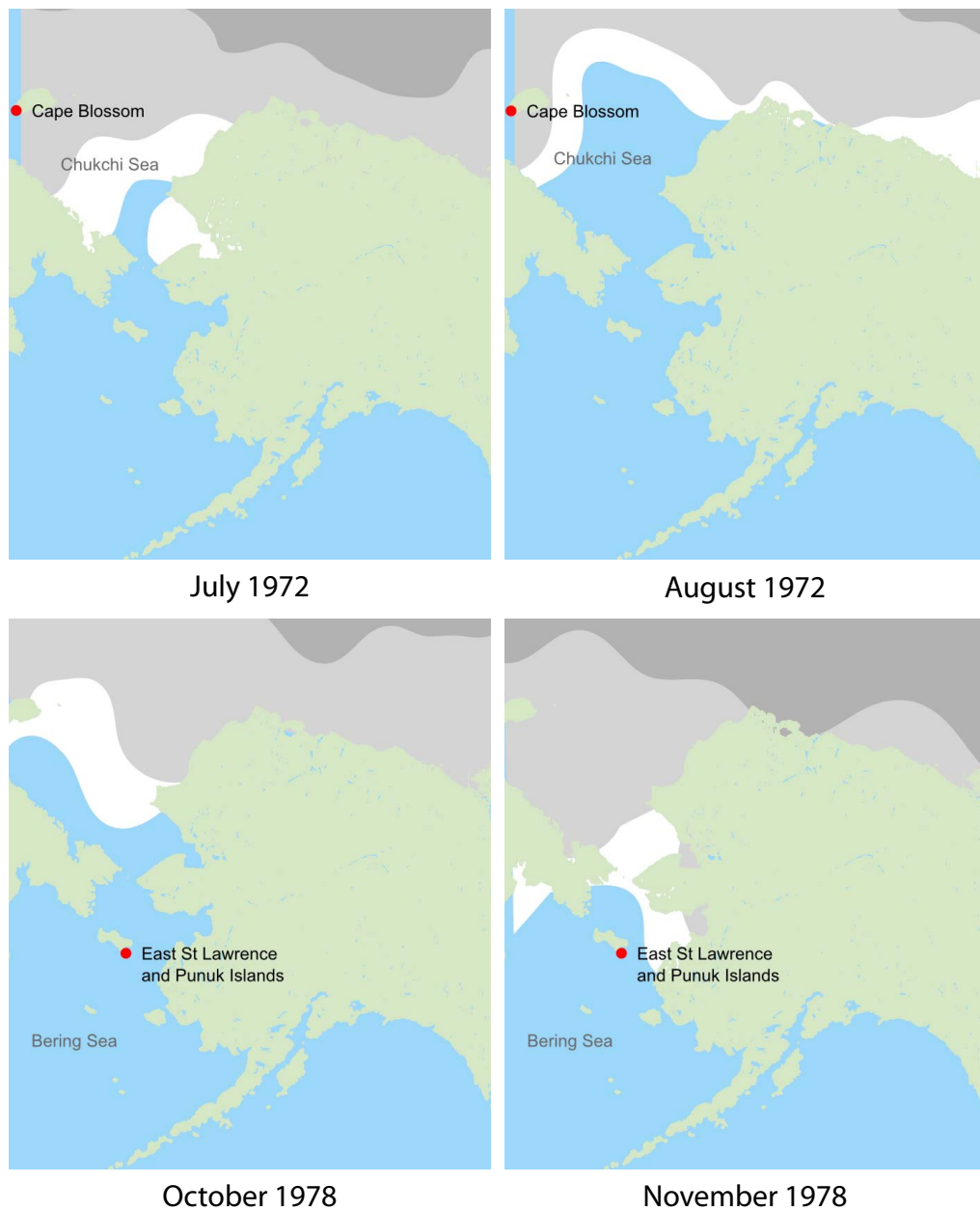


Figure 4: Haulouts and sea ice levels

Monthly averages for: (top) prevailing conditions before and during the haulout at Cape Blossom, Wrangel Island, 1972; and (bottom) prevailing conditions before and during the massive haulouts on eastern St. Lawrence Island and the nearby Penuk Islands, 1978. Sea ice concentrations: white, 0–30%, light grey, 30–90%, dark grey, 100%. Redrawn from the Historical Sea Ice Atlas, University of Alaska, Fairbanks.²⁵

mass haulouts reported that year. And surprisingly, in 2012, a small remnant of ice near Wrangel Island, barely visible on the ice maps, apparently accommodated all of the region's walruses (according to the USGS),³⁵ although some may have hauled out at unknown locations along the Russian coast (according to WWF).³⁶ Lastly, despite the fact that Chukchi Sea ice conditions for early September 2002 were very similar to those at the same time in 2014 (see Fig. 5), there were no mass haulouts of walruses reported in 2002.

But if low sea ice coverage in late summer/early autumn over the Chukchi Sea has not been a consistent correlate with huge onshore gatherings of walrus females and calves, what has? The answer may be high population numbers.

4 Population size and haulout behaviour

Walrus biologist Francis Fay and colleagues³⁷ noted that there had been a dramatic increase in walrus population numbers between the 1960s and the late 1970s. This is a fact not disputed by present-day biologists. Fay and colleagues also postulated that the population had approached or exceeded the carrying capacity of its environment in the early 1980s and that numbers had declined significantly since then.³⁸

Indeed, a recent study has confirmed that the population probably declined by at least half from its peak in 1980,⁴⁰ with the following statement included in the press release:⁴¹

The Pacific walrus population roughly halved between 1981 and 1999, the last year for which demographic data are available. A recent study by scientists at the U.S. Geological Survey quantifies this historic population decline. The 18 year decline identified by the study was not steady across that period. The decline was most severe in the mid-1980s, and then moderated in the 1990s.

Here is the question: are the recent mass gatherings of females and calves on the beaches of western Alaska and the Russian Far East a sign that the population has recovered and is again approaching the limit its habitat can support, as occurred in the 1970s?⁴² There are indications this is the case.

Here is what Fay and colleagues said about large populations:⁴³

The steady increase [during the 60s and 70s] was indicated also by the fact that the animals gradually reoccupied nearly all of their former range, including some areas that had been vacant for up to 100 yr (Fay et al. 1986)...

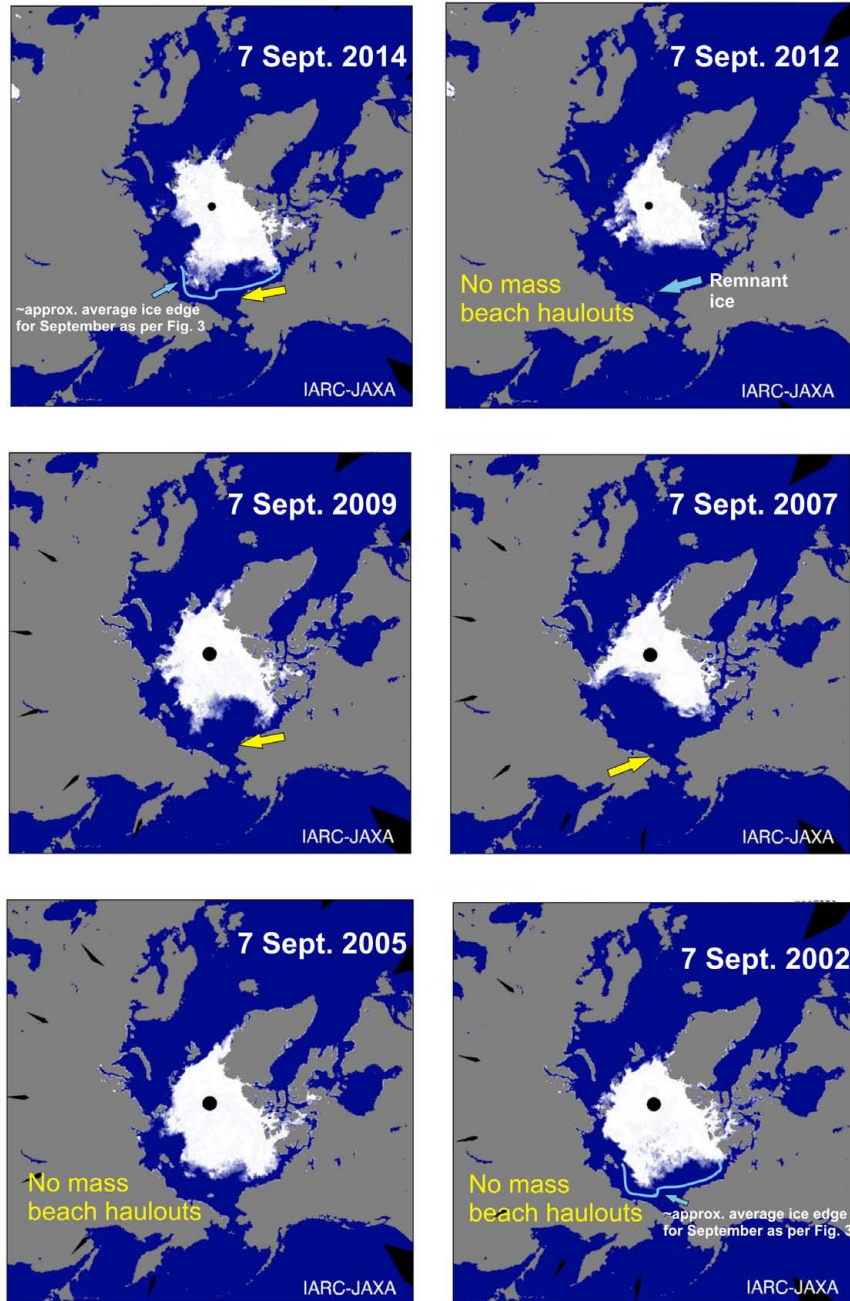


Figure 5: Sea ice and beach haulouts in early September

Yellow arrow: beach haulout; blue arrow, ice haulout. From upper left: 2014, Point Lay, AK; 2012, none; 2009, Icy Cape, AK; 2007, Cape Schmidt, RU; 2005, none; 2002, none. Source: JAXA Sea Ice Monitor.³⁹

Walrus populations are presumed to be food-limited, and the events that transpired in the late 1970s and early 1980s appeared to confirm that presumption.

Further evidence of the walrus population having increased greatly was seen in the steadily rising use of traditional haulouts on islands in the Bering Strait region during the 1960s and 1970s. At first, this amounted to increased use during seasonal migrations, but it later changed to prolonged (up to 6-mo) occupancy from spring to fall (Fay et al. 1986).

Walruses are now well protected by a diverse set of laws and regulations⁴⁴ and this seems to have done the job of allowing walrus numbers to rebound. But that means the population has to come to some kind of natural equilibrium with its environment and food supply.⁴⁵ Because of the propensity for females with calves to gather tightly together when on land (in part, as a defense against polar bear attacks),⁴⁶ this includes mortalities due to stampedes. Mass mortalities due to stampedes in large herds hauled out on beaches are therefore not new and are associated with high population numbers, not low sea ice extent.

How large is the population now? The most recent estimate, from 2006, at 129,000 individuals, represents one of the lowest counts since the 1950s, but came with an enormous error range (55,000–507,000) and was also strongly caveated, since poor weather during the survey had made a comprehensive inspection impossible.⁴⁷ In other words, biologists know that the 2006 estimate did not come close to accurately reflecting the actual population size, which was quoted as ‘at least 200,000’⁴⁸ a few years ago. Because of the uncertainty, however, the size and trend of the Pacific walrus population is officially considered unknown.⁴⁹

Worries about the distant future notwithstanding,⁵⁰ it does appear that walruses are now exhibiting some of the signs of having reached a very large population size,⁵¹ such as their hauling out together in large numbers on remote beaches and moving from one area to another in late summer and autumn to find more productive food sources.

5 Conclusions

Mass haulouts of female Pacific walrus and their calves in fall do not happen all the time but they do occur. University of Alaska Fairbank biologists Nicole Misarti and Lara Horstmann recently stated:⁵²

Just because the walrus haven’t hauled out in this specific location in such large numbers during the limited time we’ve been studying them

doesn't mean that the behavior is necessarily abnormal, or related to climate change.

Huge gatherings of females and calves on Chukchi Sea beaches since 2007 almost certainly have more to do with the fact that the population of walrus has now grown very large than it reflects changes in sea ice extent since 2007. If females and calves hauling out on land in very large numbers in late summer and early fall is a behaviour only seen when the walrus population is very high, you would expect to see this phenomenon in the 1970s, perhaps in the 1930s, and over the last few years, but not in between – which is exactly what has been reported. Large population size, not lack of sea ice, is the apparent common denominator.

The constant rush by government biologists and the WWF to blame global warming for any changes they see in walrus and polar bears – always seeing signs of pending catastrophe – fails to account for natural changes in sea ice (both up and down), natural fluctuations in population size, and most importantly, the resilience of both species to profound sea ice changes they have survived repeatedly before now.⁵³

6 Notes and bibliography

Notes

1. <http://www.businessinsider.com/35000-walruses-gathered-in-alaska-2014-10>
2. <http://www.adn.com/article/20140930/biologists-spot-huge-gathering-walruses-beach-near-point-lay>
3. <http://alaska.usgs.gov/outreach/Walrus%20teleconf%2010-01-2014.mp3>
4. http://alaska.usgs.gov/outreach/walrus\protect_media\protect_event\protect_10-1-14.html
5. <http://www.adn.com/article/20140930/biologists-spot-huge-gathering-walruses-beach-near-point-lay>
6. <http://www.worldwildlife.org/experts/margaret-williams>
7. <http://www.worldwildlife.org/stories/walruses-crowd-shore-as-arctic-sea-ice-nears-minimum>
8. <http://news.sky.com/story/1346008/melting-ice-leaves-35000-walruses-stranded>
9. <http://www.adn.com/article/20140930/biologists-spot-huge-gathering-walruses-beach-near-point-lay>
10. <http://www.theguardian.com/environment/2014/oct/03/walrus-alaska-beach-climate-change-arctic-ice>
11. <http://thinkprogress.org/climate/2014/10/01/3574540/walrus-stranding-adaptation-questions/>
12. <http://www.independent.co.uk/environment/35000-walrus-gather-ashore-on-northwest-alaska-beach-for-a-rest-9766616.html>
13. http://www.usgs.gov/blogs/features/usgs\protect_top\protect_story/walruses-are-hauling-out-on-land-instead-of-ice-because-of-climate-induced-warming/
14. <http://www.worldwildlife.org/stories/walruses-crowd-shore-as-arctic-sea-ice-nears-minimum>
15. <http://news.nationalgeographic.com/news/2014/10/141002-walruses-climate-change-science-global-warming-animals-alaska/>
16. <http://www.theguardian.com/environment/2014/oct/01/walrus-alaska-beach-trampled-death>
17. <http://www.thetimes.co.uk/tto/opinion/columnists/article4226559.ece>
18. http://www.nytimes.com/2009/10/03/science/earth/03walrus.html?\protect_r=3
19. <http://polarbearsience.com/2014/10/01/mass-haulouts-of-pacific-walrus-and-stampede-deaths-are-not-new-not-due-to-low-ice-cover/>
20. Fay and Kelly 1980
21. <http://marcinczech91.wordpress.com/2013/04/27/cape-blossom-russia/>

22. <http://marcinczech91.wordpress.com/2013/04/27/cape-blossom-russia/>
23. Fay and Kelly 1980
24. Fay and Kelly 1980
25. <http://seaiceatlas.snap.uaf.edu/>
26. <http://www.adn.com/article/20140930/biologists-spot-huge-gathering-walruses-beach-near-point-lay>
27. <http://www.hcn.org/articles/the-walrus-detectives>
28. http://www.nytimes.com/2009/10/03/science/earth/03walrus.html?_protect_r=3
29. <http://gallery.usgs.gov/videos/307#.VDmmexZZibt>
30. <http://www.usgs.gov/newsroom/article.asp?ID=2935&from=rss#.VDmlkhZZibt>
31. http://gallery.usgs.gov/search/Photos/walrus/thumb/09_protect_27_protect_2013_protect_a17Hyl3XWr_protect_09_protect_27_protect_2013_protect_0/1
32. http://www.nytimes.com/2009/10/03/science/earth/03walrus.html?_protect_r=3
33. <http://www.dailymail.co.uk/news/article-2441589/Pacific-Walrus-10-000-stranded-marine-mammals-packed-Alaskan-beach.html>
34. <http://www.ijis.iarc.uaf.edu/cgi-bin/seaice-monitor.cgi?lang=e>
35. <http://bigstory.ap.org/article/feds-lack-sea-ice-changes-walrus-behavior>
36. <http://www.wwfblogs.org/climate/content/walruses-haul-out-along-russian-coast-4oct2012>
37. Fay et al. 1997: Table 3
38. Fay et al. 1989, 1997
39. <http://www.ijis.iarc.uaf.edu/cgi-bin/seaice-monitor.cgi?lang=e>
40. Taylor and Udevitz 2014, in press
41. <http://www.usgs.gov/newsroom/article.asp?ID=3993&from=rss#.VDUUtBZZibt>
42. <http://polarbearsience.com/2014/10/04/high-walrus-numbers-may-explain-why-females-and-calves-are-hauling-out-in-droves/>
43. Fay et al. (1989), pp. 4–6
44. Garlich-Miller et al. 2011)
45. <http://polarbearsience.com/2013/06/10/signs-that-davis-strait-polar-bears-are-at-carrying-capacity/>
46. <http://www.dailymail.co.uk/news/article-2750784/They-ll-never-coming-Polar-bear-s-optimistic-bid-sneak-herd-walruses-doesn-t-plan.html>
47. Garlich-Miller et al. 2011:13
48. http://www.nytimes.com/2009/10/03/science/earth/03walrus.html?_protect_r=3
49. USFWS 2011
50. <http://www.fws.gov/alaska/fisheries/mmm/walrus/esa.htm>
51. <http://polarbearsience.com/2014/10/07/mass-haulouts-of-female-pacific-walrus-as-a-sign-of-population-health/>

52. <http://www.hcn.org/articles/the-walrus-detectives>
53. <http://polarbearsience.com/2013/11/12/eemian-excuses-the-warm-was-different-then-polar-bears-were-fine/>

Bibliography

Fay FH, Eberhardt LL, Kelly BP, Burns JJ and Quakenbush LT (1997). Status of the Pacific walrus population, 1950–1989. *Marine Mammal Science* 13: 537–565.

Fay FH and Kelly BP (1980). Mass natural mortality of walruses (*Odobenus rosmarus*) at St. Lawrence Island, Bering Sea, autumn 1978. *Arctic* 33: 226–245. http://www.aina.ucalgary.ca/scripts/minisa.dll/144/proe/proarc/se+arctic,+v.+33,+no.++2,+June+1980,*?COMMANDSEARCH.

Fay FH, Kelly BP and Sease JL (1989). Managing the exploitation of Pacific walruses: a tragedy of delayed response and poor communication. *Marine Mammal Science* 5: 1–16.

Garlich-Miller J, MacCracken JG, Snyder J, Meehan R, Myers M, Wilder JM, Lance E and Matz A. (2011). *Status review of the Pacific walrus* (*Odobenus rosmarus divergens*). US Fish and Wildlife Service, Anchorage, Alaska. <http://www.fws.gov/alaska/fisheries/mmm/walrus/esa.htm>

Taylor RL and Udevitz MS (2014). Demography of the Pacific walrus (*Odobenus rosmarus divergens*): 1974–2006. *Marine Mammal Science* in press doi: 10.1111/mms.12156

US Fish and Wildlife Service (2011). *Walrus Factsheet*. <http://www.fws.gov/alaska/fisheries/mmm/walrus/esa.htm>

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