Ice Seasons at Wales, 2006–2007

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The story of the sea ice in the Arctic in summer 2007 has drawn attention by media and the general public because of a record reduction in ice extent to almost 25–35% below the previous levels, reported since the start of systematic satellite monitoring in 1979. Both in 2007 and in the later minimum record years, some of the largest reductions in sea-ice extent occurred in the Alaskan sector, that is, in the Chukchi and Beaufort Seas. What did hunters and ice experts in coastal Alaska villages, like Wales, observe during the ice year of 2006–2007? Here, we present a glimpse of what results from our collaborative work are telling us.

Observations by Winton Weyapuk, Jr. and satellite data for 2006–2007, along with information from Alfred Bailey's photographs taken at Wales in April–June 1922, are summarized in Figure A. According to the weather station at Tin City located less than 7 miles or 10 km from Wales, on the other side of Cape Mountain, the first day with freezing temperatures in fall 2006 was on October 6. Temperatures fell solidly below freezing from November 4 onwards. Between November 10 and 15, the first occurrence of an ice slush berm (qaimġuq – see photos on pp. 37–39) accumulating through wave action and wind driving slush ice (qinuliaq, photo on p. 38) ashore was noted in Winton Weyapuk's daily logs. This first ice can be very important for coastal communities as it usually calms ocean waves. In places like Wales and Shishmaref, 75 miles (120 km) from Wales along the coast, early formation of such a slush berm offers protection from the eroding action of violent fall storms, which have caused significant damage to the community in prior years.

Light slush ice on the water is very difficult to detect in the low-resolution satellite images. Thus, it was not until November 25, 2006, that the satellite registered the first formation of ice alongshore, with the start of offshore freeze-up reported for December 11, only. So, one lesson to learn from local observation is that people on the ground detect and monitor the beginning of the freezing period earlier and in more detail than the satellites do it from space.

Local experts in Wales indicate that compared to past decades, fall freeze-up has been delayed in recent years by up to several weeks. Instrumental observations and satellite images over the past several years also confirm a much later onset of ice formation across the Bering Strait area and North Alaska. Of great importance for a community such as Wales is the formation of shore-fast ice (tuaq), attached to land and stabilized by the foothold of grounded pressure ridges (iunġit) forming as a result of offshore pack ice moving in and piling ice into larger heaps. In late 2006, it took several weeks from the first appearance of a shore-fast ice cover, which subsequently broke off several times, before the shore-fast ice solidly remained in place on December 22. While the ice was thick enough to walk on by December 26, it was not until almost a month later, on January 22, 2007 that ice experts in Wales considered the shore-fast ice safe as a result of repeated pressure

ridge building. These pressure ridges (iuŋġit) that stabilized the shore-fast ice also cannot be seen in satellite data. Even so, lack of massive ridging, possibly a consequence of the lack in recent years of thick, old ice (utuqaq) making its way into Bering Strait, allowed the ice sheet to ride a few feet onshore (qaupik) creating a small berm on February 2. On February 4, the shore-fast ice broke out all the way back to the beach along several miles north of town.

A warming episode with rain a few days earlier also resulted in ponds forming on the ice surface. While not unheard of in the past, such mid-winter warming events appear to be more frequent in recent years, occasionally accompanied by rain. Episodes of wet surface snow and ice (misakłut) can pose danger to hunters and may harm the survival of ringed seal pups in their dens. In contrast with the spring melt, which is typically detected well by satellite, such winter warming events may be difficult to detect other than through local, ground-based observations.

In late March 2007, further ridging along the shore-fast ice edge helped stabilize the ice, coinciding with the early stages of establishing trails for hauling boats and gear out to a prospective launching site (pituqi). Hunting with boats launched off the shore-fast ice depends on ice conditions, allowing safe launching, passage and access to marine mammals, and the weather. For approximately one month between mid-April and mid-May 2007 conditions were quite favorable for hunters in Wales. After that date, a combination of adverse weather, offshore ice conditions and shore-fast ice decay (which broke out on May 30, see photo on p. 69) made hunting difficult. More importantly, after the removal of the shore-fast ice, the presence of drifting ice within the hunting grounds around the village was limited to a mere nine days, with the last floating ice seen on June 8, 2007 (see photo on p. 71). This extremely short transitional period between spring ice conditions and complete removal of sea ice was unusual. It is a big disadvantage to subsistence hunters, since it limits access to ice-associated marine mammals and eliminates a solid platform on which killed animals can be butchered (see photo on p.96).

The satellite data for 2007 show that the ice edge started to pull away towards the north of Bering Strait around May 21. The last time the ice was seen off Wales on the

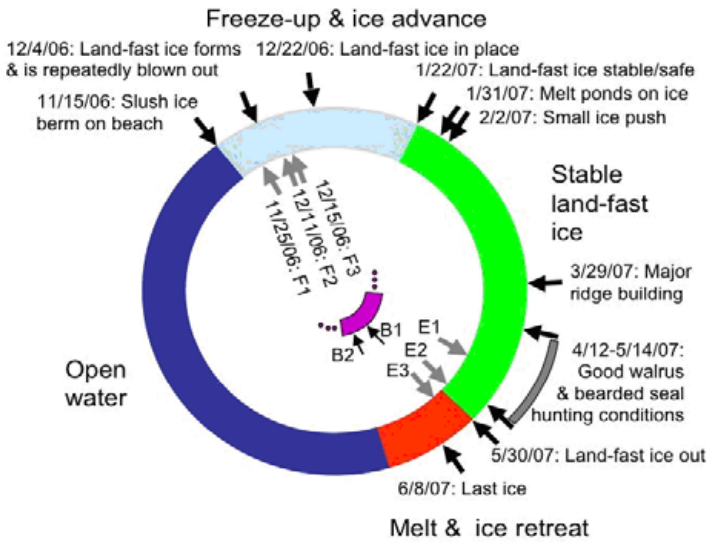

Figure 1: Seasonal ice cycle at Wales in 2006/07, based on observations by Winton Weyapuk Jr. (outermost set of black arrows), satellite remote sensing data (inner set of gray arrows), and Alfred Bailey's observations in 1922 (innermost purple circle, thin black arrows correspond to specific observations/photos).
Abbreviations: F1 - First ice growing out from shore, F2 – Start of freeze-up offshore, F3 – Ice edge south of Bering Strait; E1 – Ice edge reaches Bering Strait during ice retreat on 5/7/2007, E2 – Ice edge pulls away from Bering Strait to North on 5/21/2007, E3 – Last ice off Wales (6/8/2007); B1 – "Winter conditions still prevailed on June 3, 1922" (Alfred Bailey, photograph BA-21-451, p. 94), B2 – Land-fast ice still in place June 16, 1922 (Bailey photograph BA-21-327, p. 90).

satellite images was on June 2, almost a week earlier than observed on the ground. The weather station at Tin City puts the start of the melt season on May 20, 2007. Observations of sea ice during the melt season by satellite are difficult because of the presence of water at the surface, masking the signature of ice floes in remote-sensing data. Moreover, even the best modern satellites have difficulty distinguishing between the different types of ice that are of importance for coastal communities and are identified in hunters' vocabulary. Hence, there is potentially great value in more detailed analysis that combines both satellite data and ground observations by local observers, discriminating between different types of ice.

A further insight gained from the combination of satellite data and local observers' reports is the rapidity with which the ice edge moved north in spring 2007. Satellite data indicate that until the beginning of May, the southern extent of sea ice in the Bering Sea was normal or even slightly above normal. In late May and early June, ice retreated northward at well-above normal rates and by June 10, it was gone completely. This extremely rapid retreat continued into the summer, resulting in the record low Arctic ice extent of September 2007. In the case of Wales and other Alaskan communities, the lack of ice lingering near town over a longer stretch in late spring and early summer greatly impacts subsistence activities that depend on the presence of ice for successful hunting for marine animals, such as bearded seal and walrus.

Alfred Bailey's photographs from spring 1922 limit our 'window' into the past ice conditions in Wales for just three months of a single ice season. However, even as a momentary glimpse of what the ice was like in that particular year, they indicate significant differences between spring 1922 and 2007. In spring 2007 shore-fast ice (tuaq) had already been completely removed two weeks prior to when Bailey's photo on page 88 was taken, it shows a solid shore-fast platform likely to persist for several more weeks. Bailey refers to the ice being in a solid "winter" state on June 3, many weeks later than in 2007. In 1922 hunting in the ice pack was possible until late June, again, almost a month later in the season compared to 2007, and possibly much longer.

While spring 1922 may seem today as being anomalously cold, other records from the same era indicate that this used to be a rather 'normal' condition early in the past century. A year prior, Bailey paid a brief visit to Wales on the U.S.C.G.C. *Bear* and he reported heavy drifting ice south of King Island on June 27, 1921 (Bailey 1931; 1971). A few days later, on June 30, 1921, the *Bear* steered from St. Lawrence Island to Siberia through dense ice floes, so that at times her engines had to be stopped to avoid particularly heavy ice and full power was thrown on with the result that the ice moved out of her way (Burnham 1929: 53). At Cape Dezhnev, right across from Wales on the Russian side of Bering Strait, the ice cleared up on June 24, 1921.

Some years around Bailey's visit in 1921–1922 were even colder. According to the old Russian data, in spring 1918, the floating ice was cleared off the area around Cape Dezhnev by July 9, only; and in 1926, the shore-fast ice was not broken until July 23, so that the last drifting ice floes disappeared on August 6, 1926. In the past decade not a single year would have had pack ice in Bering Strait in late June. Without today's ground observations at Wales, we would have no chance to check those early ice records against modern satellite images and other instrumental data.