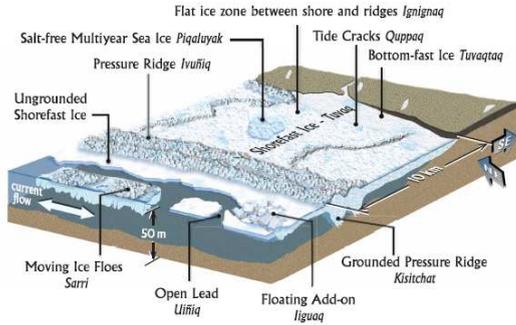


What is Coastal Sea Ice?



In Arctic areas wintertime temperatures are cold enough to solidly freeze the ocean, but ice does not uniformly cover the Arctic Ocean. Rather, the floating ice is moved around the Arctic by winds and ocean currents. Ice floes collide with others and with shore, breaking up to create piles of rubble called pressure ridges. Because sea ice floats mostly below water level, the below water part of the pressure ridges extends downward 4-5 times as much as the height of the ridge above water. Near the coast, these piles of rubble extend deep enough into the ocean to hit the bottom, providing a means of anchoring ice in water many times its thickness. Once a grounded ridgeline forms each year, the ice behind the ridge, called landfast ice, can freeze solidly and becomes a stable extension of the land toward deeper water. The boundary between the landfast ice and the moving pack ice is a very dynamic place. Ice is constantly being pushed inshore or offshore by ocean currents and wind. When ice is pushed away from shore, it creates an expanse of open water, called a lead, even in very cold weather. These leads are a key feature of the coastal ice zone, providing a place for marine mammals to live and travel, and a point of access for hunting.

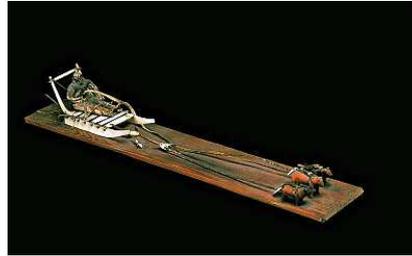


A composite satellite image shows the coastal ice zone off the northern tip of Alaska. Brown is land, white is ice, and black is open ocean. The landfast ice can be seen along the western coast, with a few loose pack ice floes in the lead beyond, and an expanse of open water between shorefast ice and the floating pack ice.

References

- *Dumas et al., 2006 Dumas, J., Flato, G., Brown, R. D., 2005. Future projections of landfast ice thickness and duration in the Canadian Arctic. *Journal of Climate*, 5175-5189.
- *Fox, 2002 S. Fox. These are things that are really happening: Inuit perspectives on the evidence and impacts of climate change in Nauyasu. In: I. Krupnik and D. Jolly, Editors, *The Earth is Faster Now: Indigenous Observations of Climate Change*, Arctic Research Consortium of the United States, Fairbanks, Alaska (2002), pp. 12-53.
- *George et al., 2004 J.C. George, H. Huntington, K. Brewster, H. Eicken, D.W. Norton and R. Glenn. Observations on shorefast ice dynamics in Arctic Alaska and the responses of the Inupiat hunting community. *Arctic* 57 (2004), pp. 363-374.
- *Huntington and Fox, 2005 H. Huntington and S. Fox. The changing Arctic: Indigenous perspectives. In: *Arctic Climate Impact Assessment—Scientific Report*, Cambridge University Press, Cambridge (2005) pp. 61-96.
- *Steffenson Collection. Rauser Special Collections Library, Dartmouth College
- *Steven Kazalowski Collection, World Wildlife Federation.
- *Thin Ice Exhibit. Hood Museum, Dartmouth College.

Artifacts Show Adaptation to Coastal Ice Stability



Hood Museum Thin Ice Exhibit

Artifacts from around the circumpolar Arctic tell us about the marine environment which the coastal peoples adapted to. Almost universally, coastal Arctic peoples used dogsleds (left) and small boats such as umiaks (right) in their travel and pursuit of marine mammals at the margins of the ocean. Their tools reflect an adaptation to moving about in an ice dominated ocean, where dogsled travel over a stable landfast ice cover provided ocean access for the light umiaks which were adapted to maneuvering in the small areas of open water.



Hood Museum Thin Ice Exhibit



WWF / Staffan Wickstrand/www.staffanwickstrand.se

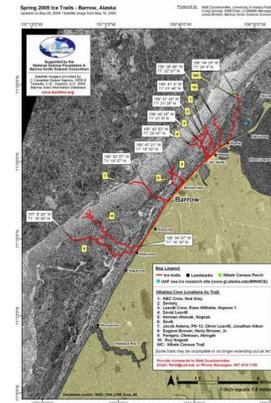


WWF / Staffan Wickstrand/www.staffanwickstrand.se

Traditional techniques shown in these artifacts are still practiced and, though sled dogs have been replaced in many areas by snow machines, even newer methods are clearly rooted in historic adaptation to the expected environment. Snowmachines still require a stable, well grounded landfast ice for safety and even small cracks in the ice can pose significant travel hazards. At the lead edge, stable ice is needed for safe campsites and small open water leads restricted by ice both concentrate marine mammals along the coast and moderate ocean swell by reducing wave fetch enabling umiak travel.

Impacts of a Changing Ice Cover

Coastal ice has only recently begun to be monitored in a standard way by western science because satellite monitoring is difficult near shore. Records of break up and ice stability are not long enough to determine trends amid the high year to year variability, yet traditional, historical, and circumstantial, and modeling evidence all suggest that the coastal ice is rapidly changing just like the pack. Elders in Barrow, AK tell us that the whale hunts, which have always ended with the onset of poor ice conditions used to end in mid June, while they now end by late May. They note that multiyear ice, necessary to supply fresh water away from shore and potentially very useful in helping anchor a stable landfast ice early in the season, is becoming rarer as well. Coastal erosion has accelerated dramatically as the shorefast ice retreats sooner and stays away longer allowing greater periods of long wave fetch. Records of commercial whaling (far right) show that shore ice barely retreated at all in the late 1800's where now it is gone for several months. Models of landfast ice in several Canadian locations suggest a further loss of 1-2 months of stable shorefast ice over the coming century in most locations. More formal studies of the subsistence use of the ice platform for whaling trails and the changes occurring in the seasonal ice are now underway. (right)




WWF / Staffan Wickstrand/www.staffanwickstrand.se

Coastal sea ice provides a number of services to the ecosystem and protects the shoreline as well. The ice loss not only reduces hunter access, but also deprives wildlife of access to a resting platform. Benthic, or bottom, feeders like the walrus require an ice platform on which to rest (left) while polar bears require ice to hunt from and seals need ice for dens. The base of the food chain, ice bottom algae which fall to the bottom in late spring is also tied dependent on ice. Just like the people, the entire ecosystem is adapted to the presence of stable coastal ice. The changes we are seeing may profoundly affect the future of the entire system.



http://earthobservatory.nasa.gov/Features/SeaIce/images/arctic_coastal_erosion.jpg