

# The Last Arctic Sea Ice Refuge



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**Summary:** As global warming reduces the summer sea-ice in the Arctic Ocean, ecosystems which require ice year round are likely to survive longest in the region immediately north of Canada and Greenland. Models and satellite data indicate that summer sea ice will persist longer in this region than anywhere else in the Arctic. Analysis of models and satellite data indicate that ice in this natural refuge will come from both locally created sea ice, as well as drifting ice that forms originally over the central Arctic. Depending on future changes in melt patterns and sea ice transport rates, the Siberian shelf seas may also be a source of ice to the refuge.

An integrated, international system of monitoring and management of this sea ice refuge, along with the ice source regions, has the potential to maintain viable habitat for ice-associated species, including walrus and polar bears, for decades into the future.

## Walrus Need Sea Ice to Rest

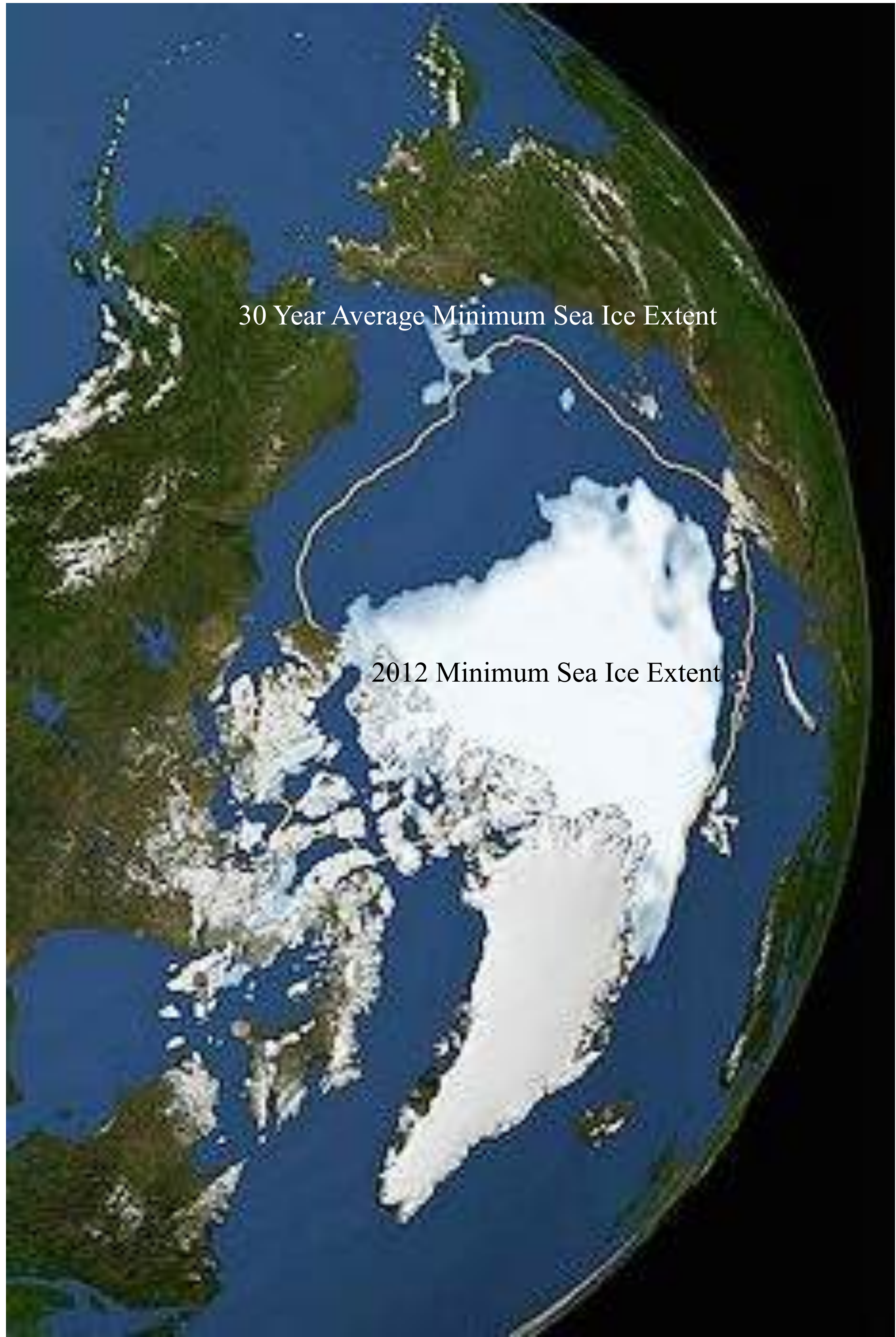
**Biggest Walrus Gathering Recorded as Sea Ice Shrinks**  
More than 35,000 of the marine mammals have congregated in Alaska.



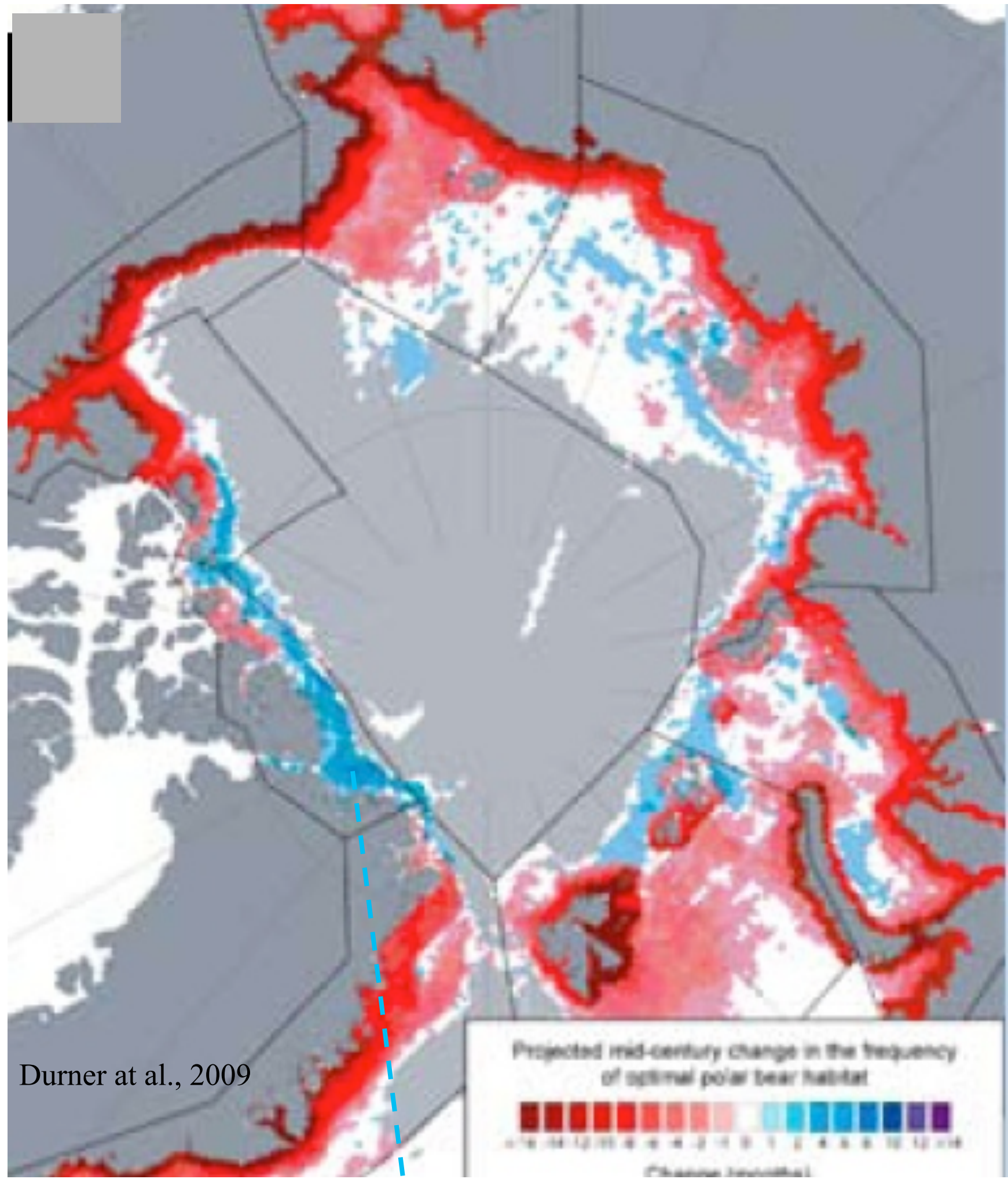
[http://www.scilogs.com/frontier\\_scientists/files/Walrus\\_sinkingNOAA.jpg](http://www.scilogs.com/frontier_scientists/files/Walrus_sinkingNOAA.jpg)



Over a thousand walrus gather on the northwestern coast of Alaska on September 23, 2014.

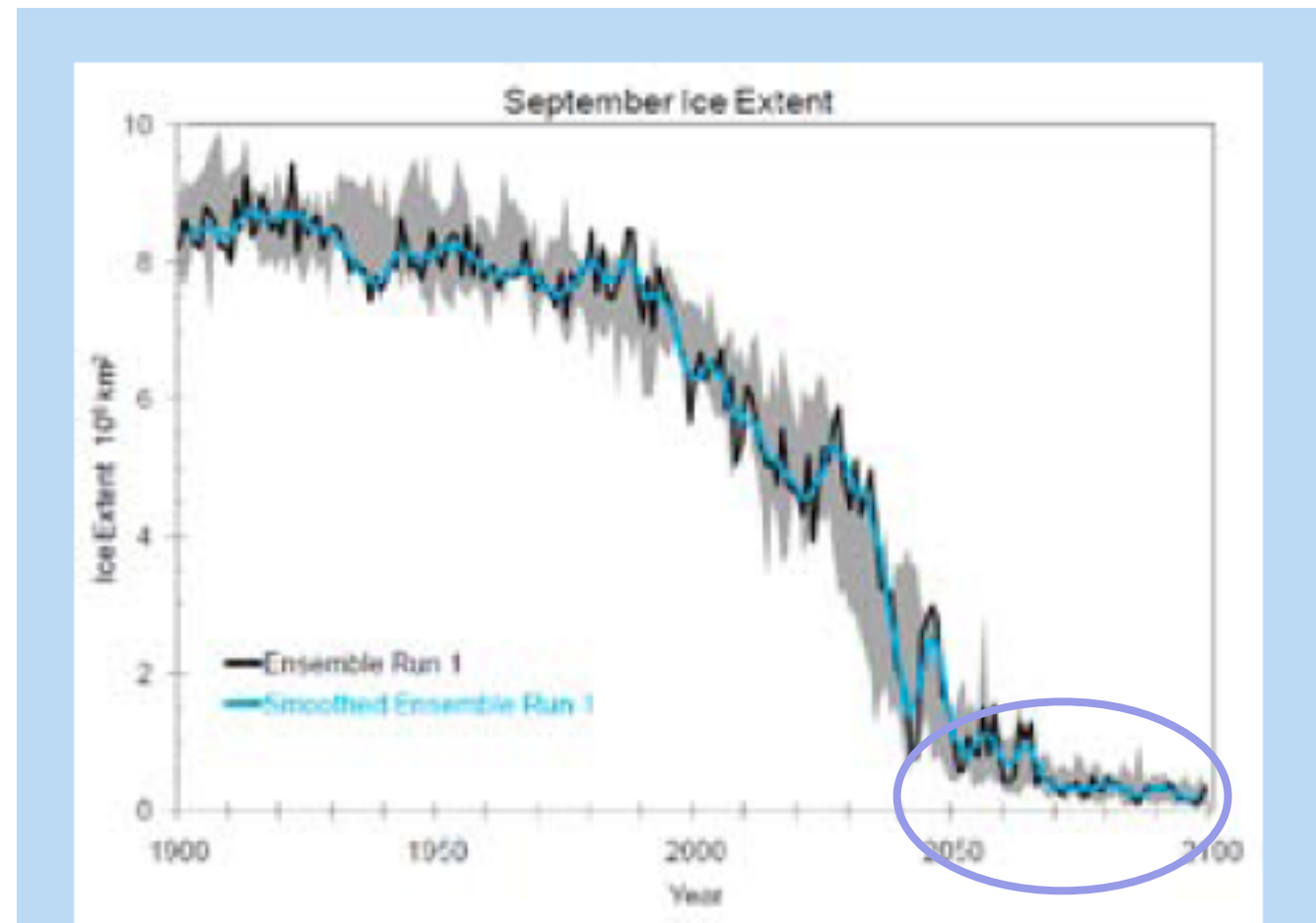


## Polar Bears Need Sea Ice to Catch Food



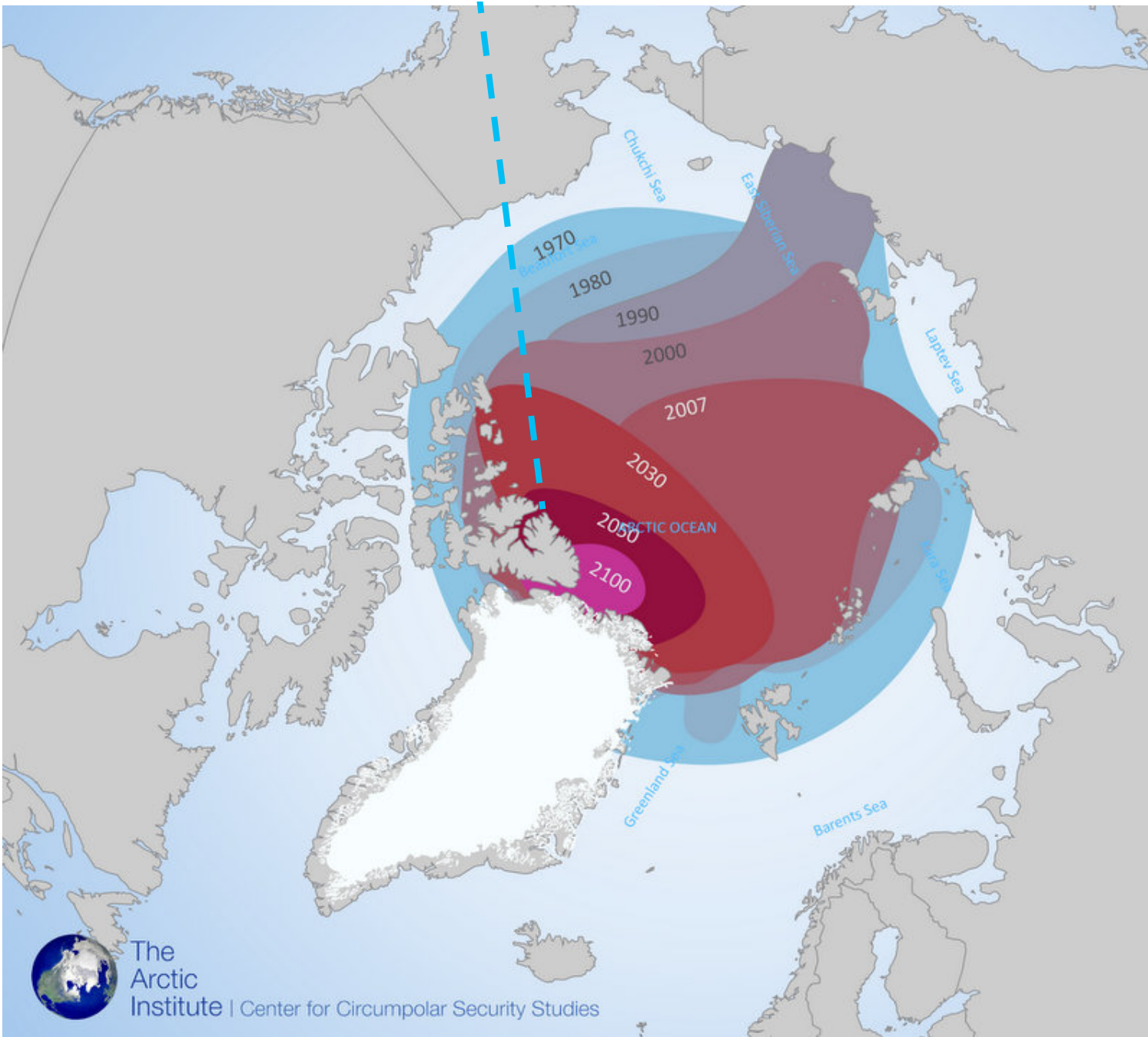
Projected changes in optimal polar bear habitat for 2050

## When Could We Lose the Sea Ice?



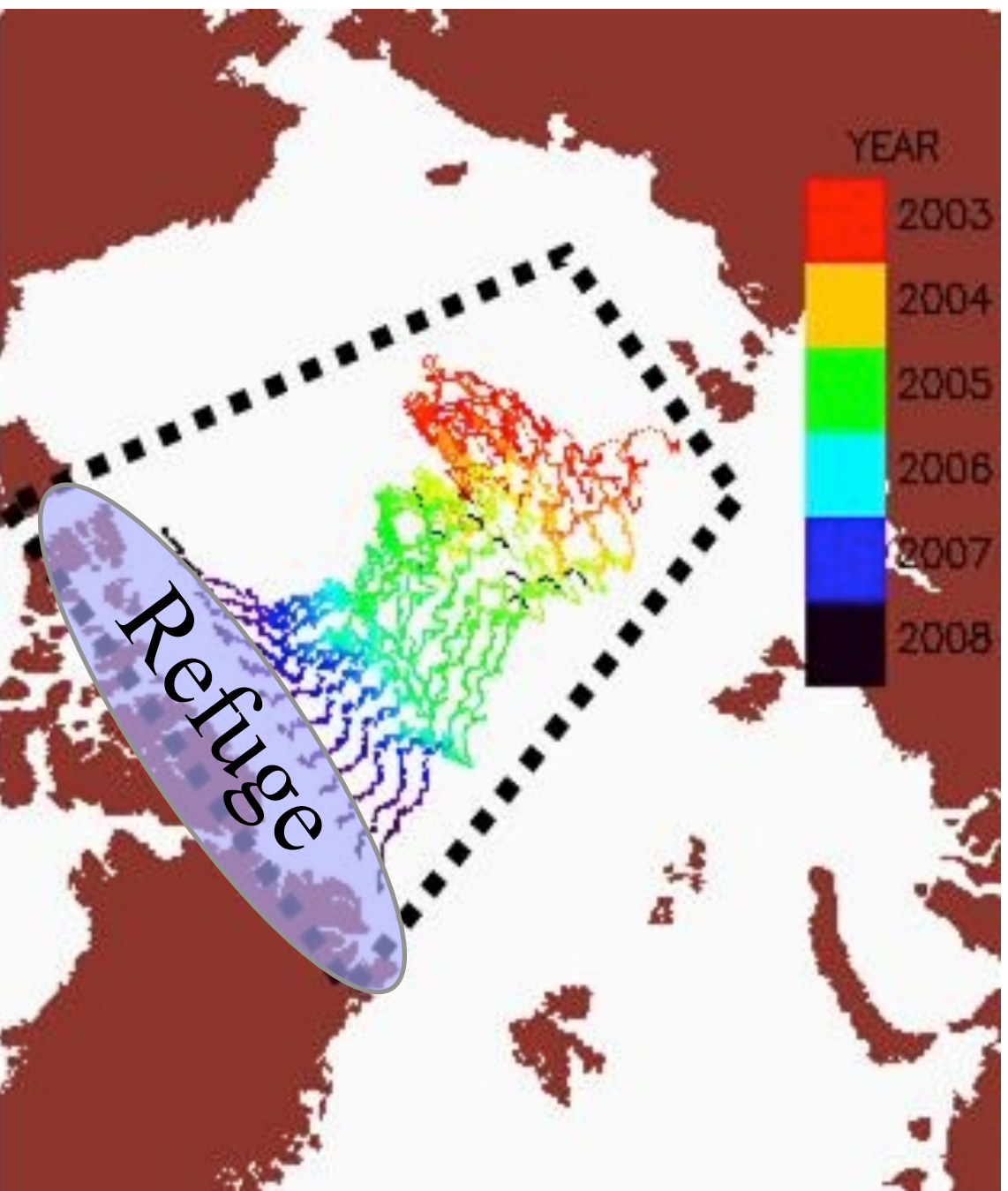
**Figure 1:** September mean (2040-2049) sea ice concentration projected by the Community Climate System Model (version 3, CCSM3), for the A1B global warming scenario  
(<http://www.researchgate.net/publication/207010101-arctic-sea-ice-decline-in-the-21st-century>; Holland et al., 2006)

## Where Could the Last Sea Ice Refuge Be?



<https://www.ccin.ca/home/sites/default/files/seaice/future/map2.jpg>

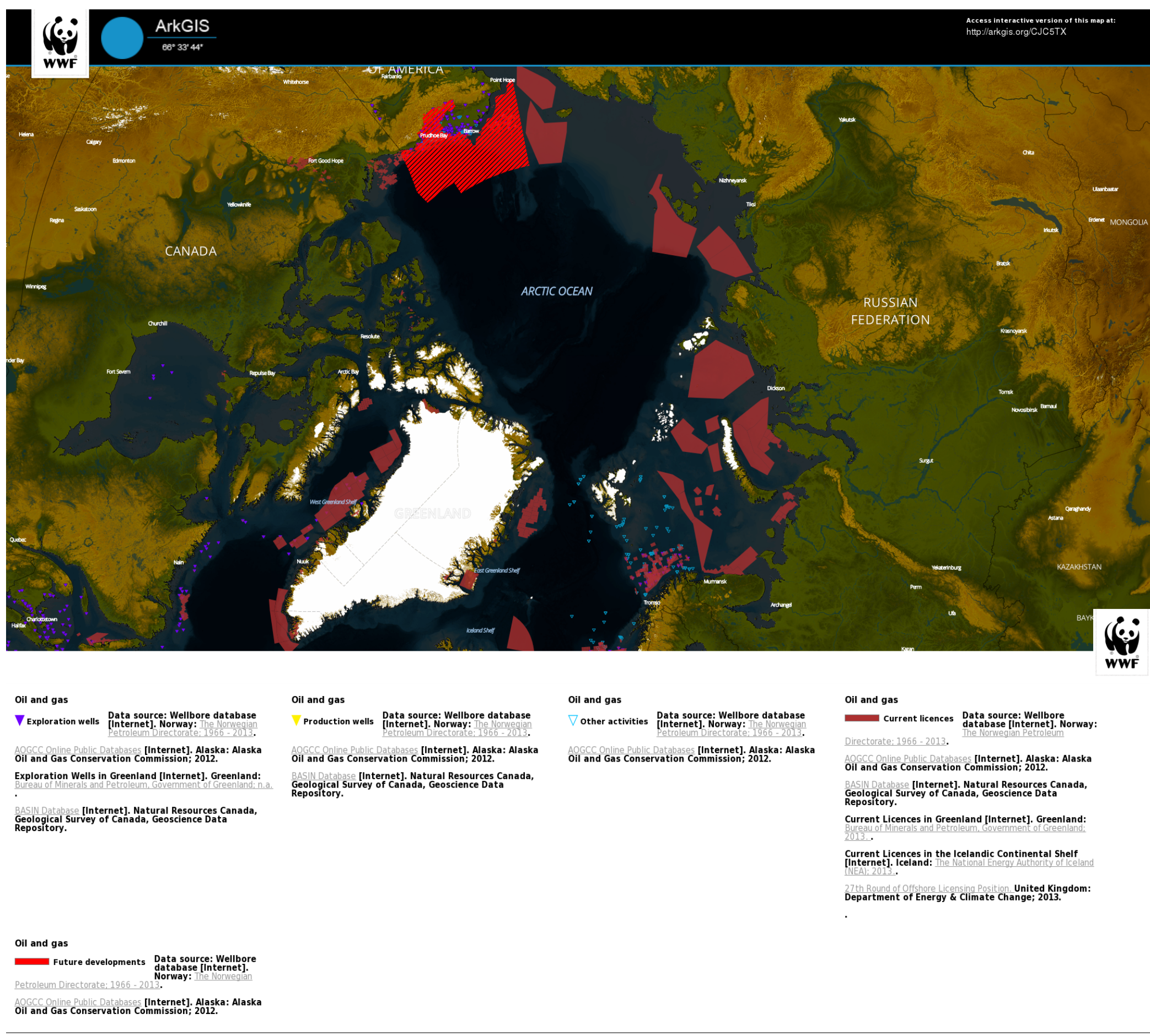
## Where is the “Ice Shed”



Pfirman et al. 2009, Arctic Circle

## Potential Pressures on the Refuge and its Ice Shed

### Oil/Gas/Mineral Production



### Transportation



Smith and Stephenson, 2013

Most models project rapid summer ice loss followed by some sea ice through ca. 2075

Need to manage the ice shed where sea ice forms that supplies the refuge as well as the September ice refuge area

Very Difficult to Clean Up Spills in Icy Waters