

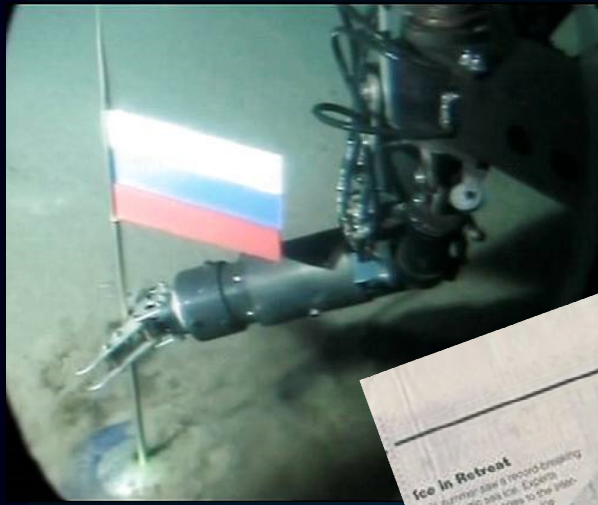
# An Emerging Arctic



John Farrell  
Executive Director



Council for Chemical Research  
May 5, 2015  
Alexandria, VA



**Science Times**  
The New York Times

TUESDAY, OCTOBER 2, 2007

**ice in Retreat**  
This summer the ice is melting faster than in any other year, and the changes in the distribution of ice suggest a shift from gradual warming to a more abrupt one.

**SUMMER SEA ICE EXTENT**  
A major sign of global warming is the retreat of the Arctic sea ice. This year's summer sea ice extent was the lowest since 1979, and the melt was the earliest.

**SEA ICE SURVEY**  
The U.S. Navy's Operation Ice Bridge is the first satellite mission to measure the thickness of Arctic sea ice.

**PERMANENT SEA ICE**  
The Arctic Ocean is home to a small but growing area of permanent sea ice.

**ATMOSPHERIC PRESSURE**  
High pressure over the Arctic and low pressure over Siberia caused sustained winds from the north.

**AIR TEMPERATURE**  
Warm air from the Tropics and the Gulf of Mexico brought heat to the region from the coast.

**SOLAR HEATING**  
Cooler water reflects less sunlight, and clouds cover less of the sky, so the heat absorbed by the water is higher.

**CLOUD COVER**  
High clouds also helped create a hazy layer of clear sky over the Arctic, allowing more sunlight to heat the ocean.

**Arctic Melt Unnerves the Experts**

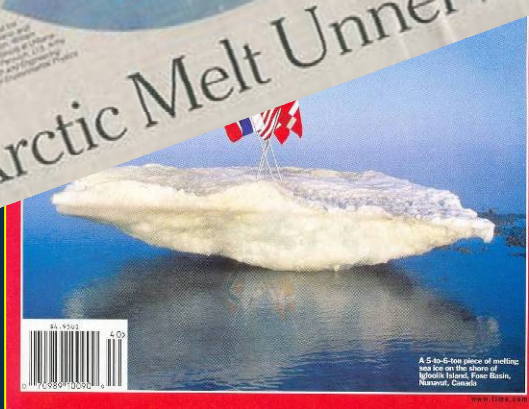
**The next land rush**

As countries race to file claims to areas of the sea floor before a United Nations deadline, geo logist and geophysicist are getting caught up in the frenzy, *Daniel Clancy* reports.

**Therapeutic Arctic oil rigs are a test of the Arctic's ability to support offshore oil production.**

**— Fox and the Arctic**

© 2007 News Publishing Group



**POWER**

**COLD WAR?**

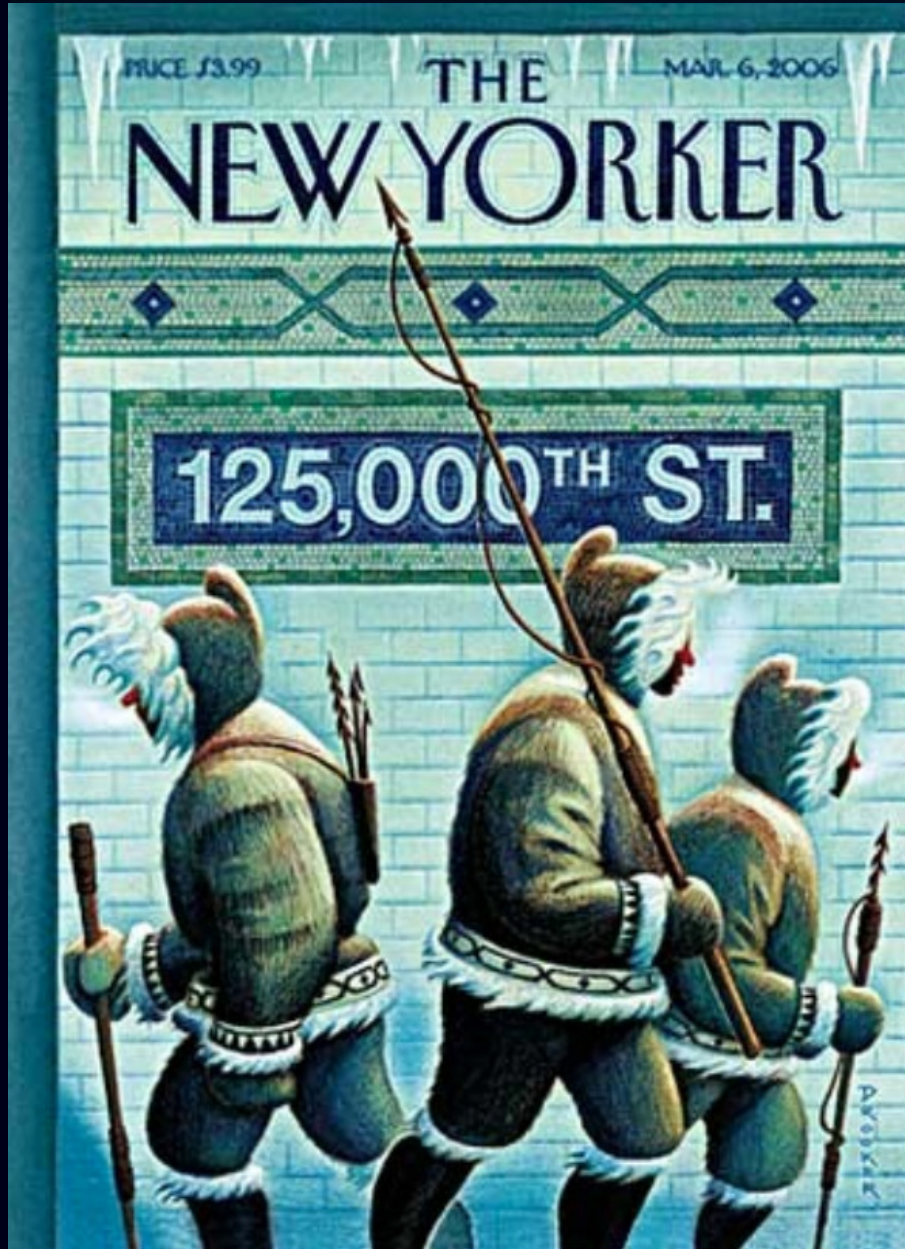
U.S., Canada, Russia, Denmark Rush to Stake Arctic Claims

October 2007 \$4.50  
NAVY LEAGUE OF THE UNITED STATES  
www.navyleague.org

MARAD'S NEW GATEWAY / SPECIAL REPORT: U.S. NAVY PROGRAM REVIEW



A 5-to-6-100 piece of printing...  
see us on the shore of...  
Nanavut, Canada

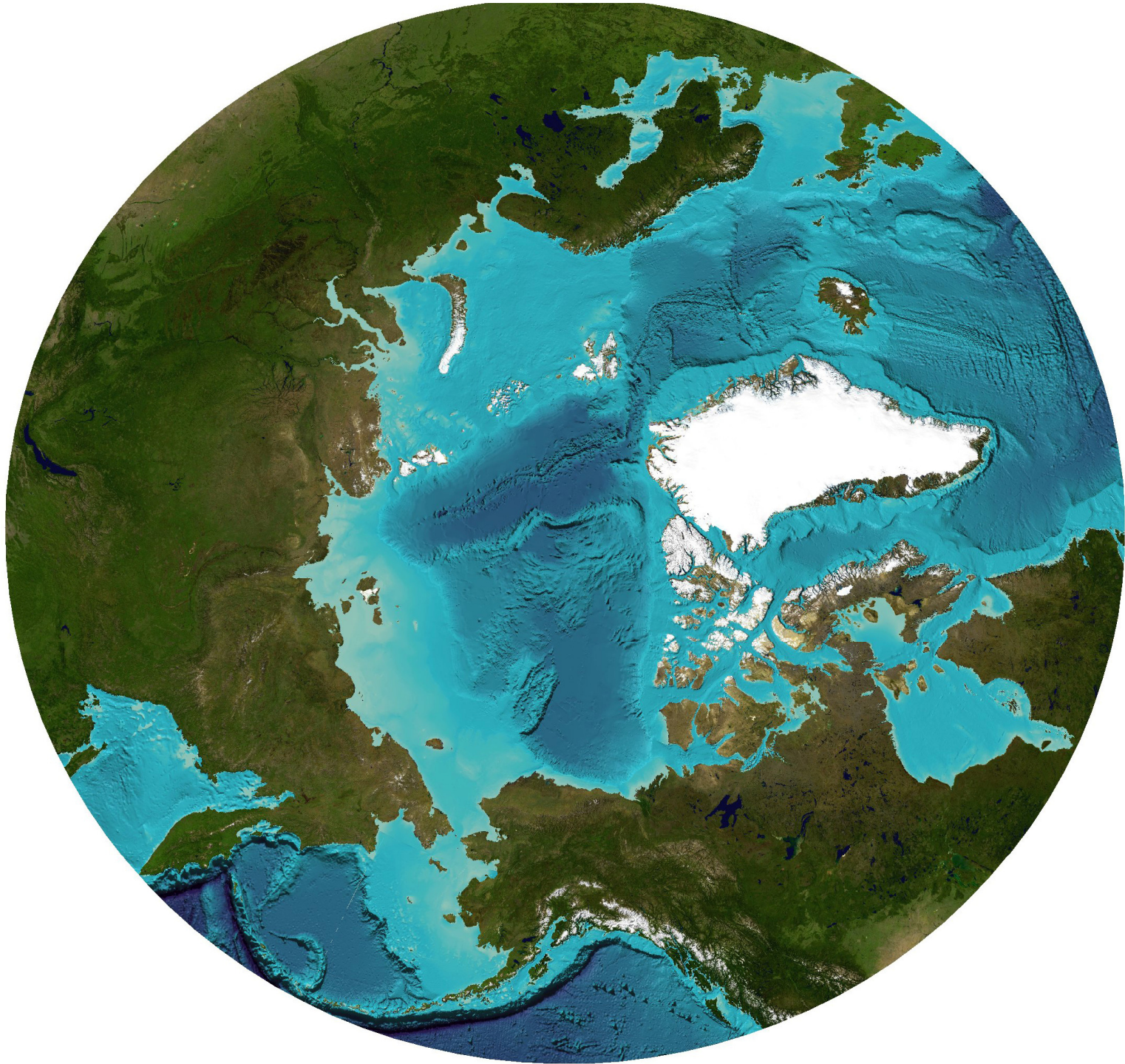


*“The opening of the ‘fifth ocean,’ the Arctic, for longer periods of time, will provide new access to resources, migration of fishing stocks and eventually new trade routes, that can’t be overstated.”*

**- Chief of Naval Operations  
Adm. Gary Roughead**

**Remarks at University of Chicago  
Conf. on Terrorism & Strategy  
October 12, 2010**





# Arctic region, as defined in US law



Credit: US Arctic Research Commission



Credit: US Arctic Research Commission







# Trillion Dollar Arctic Issues

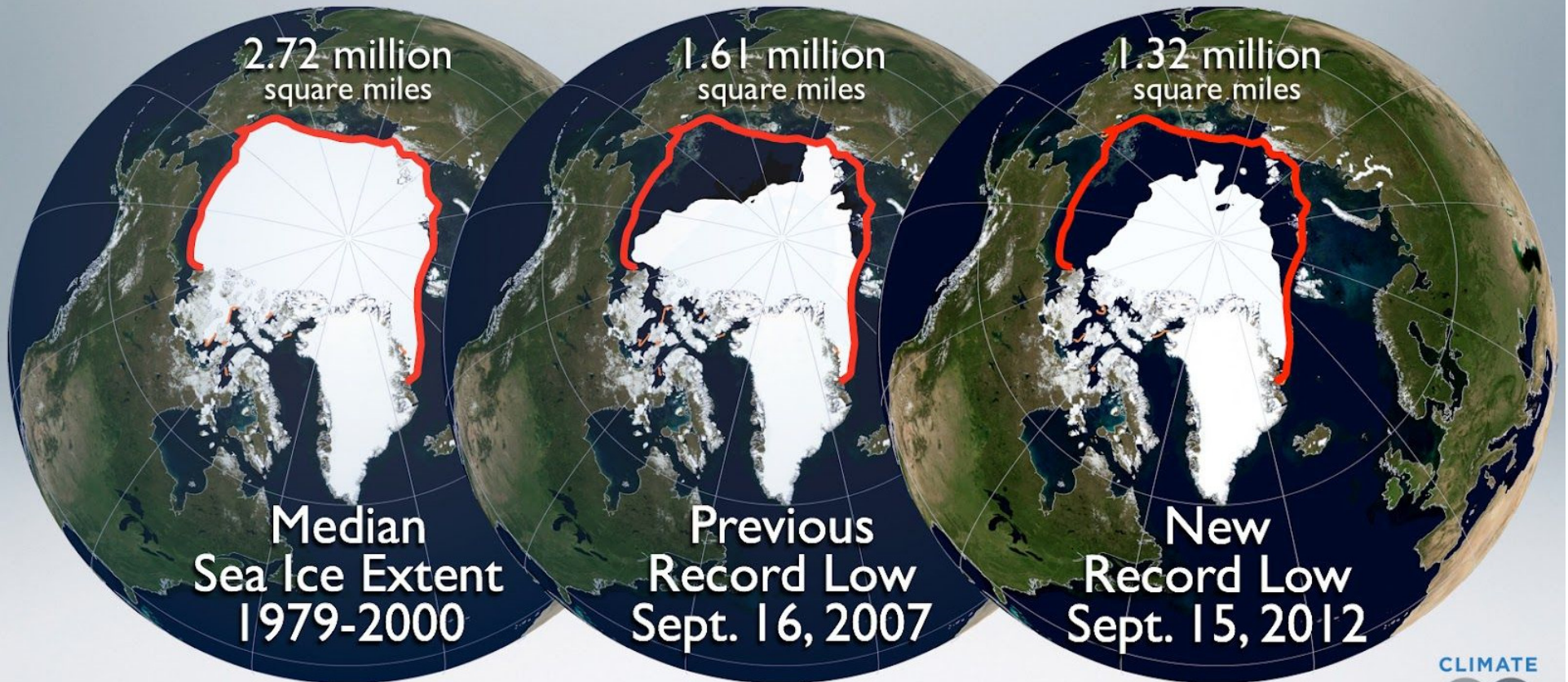


- Ownership, sovereignty
- Climate change mitigation/adaptation
- Resources (fish, O&G, minerals)
- Global trade: trans-Arctic shipping
- Shared values – culture & conservation

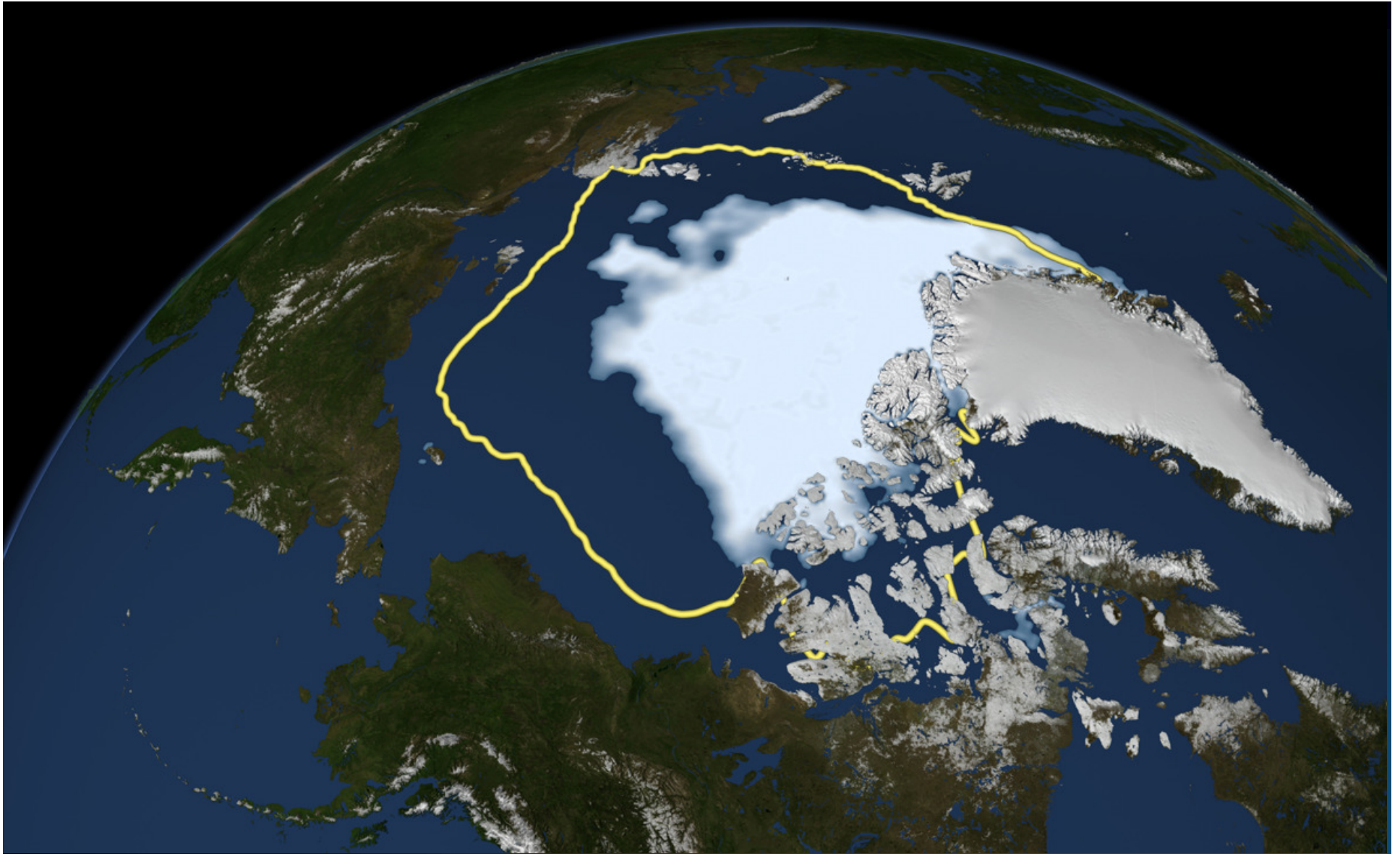
# US bought our way into the club



# RECORD LOW ARCTIC SEA ICE



Source: The National Snow and Ice Data Center Sea Ice Index  
Records are for 5 day running averages



September 16, 2012

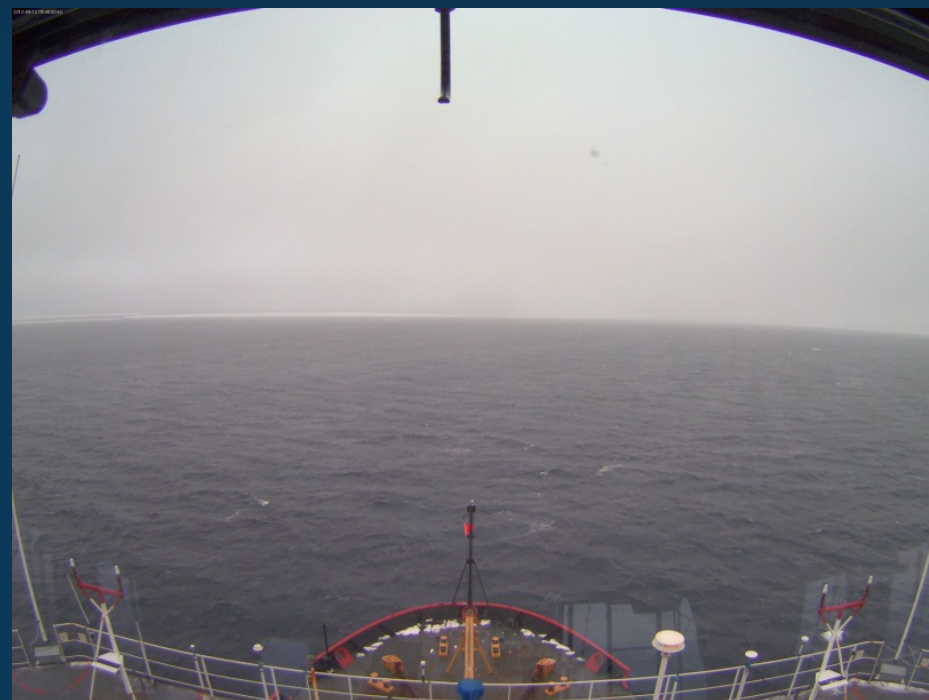
# Two views from USCGC Healy at 80°N (156W)

9/6/07



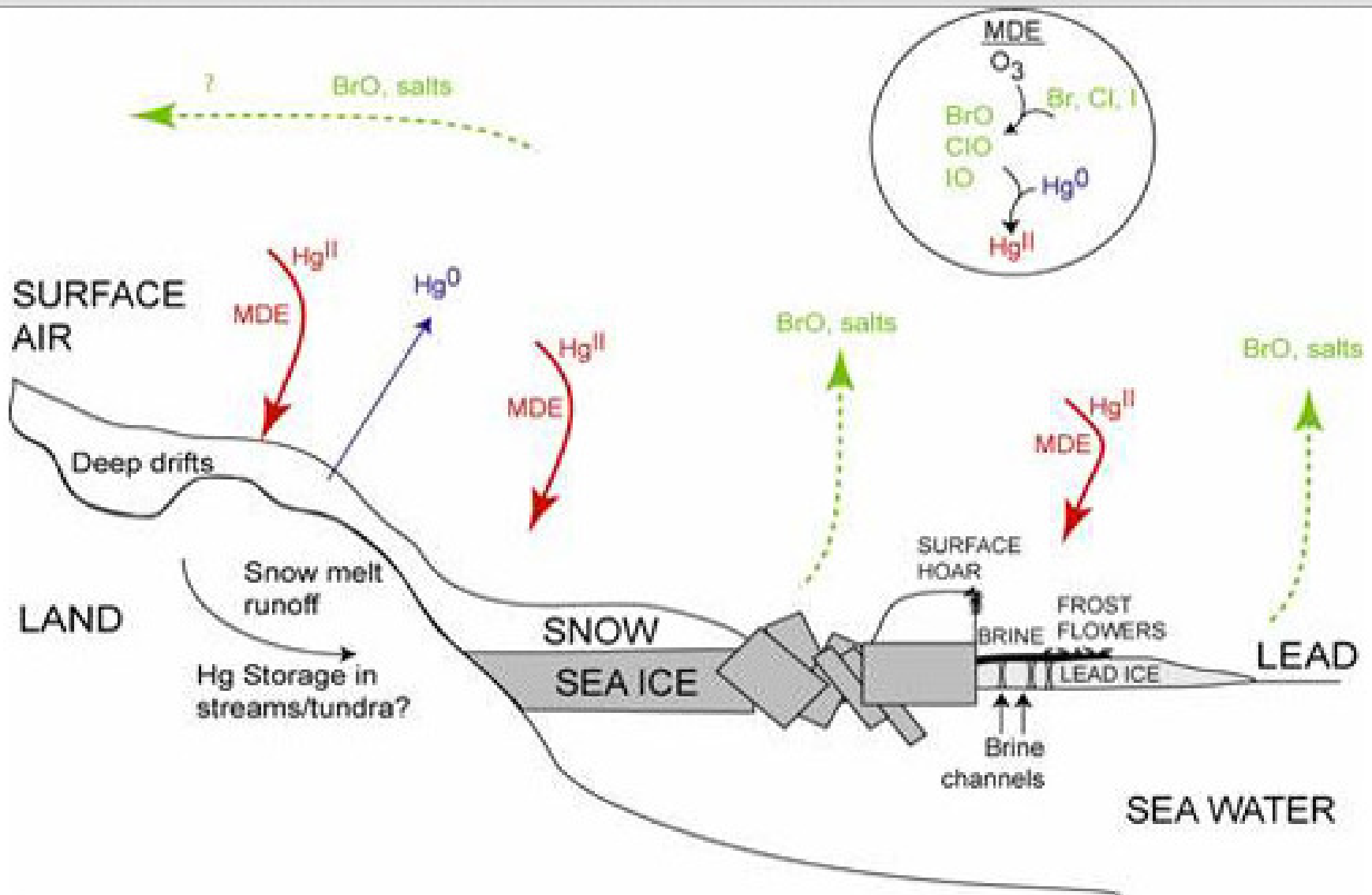
ALOT1 Conn 2007-09-06 13:45:01

9/12/12

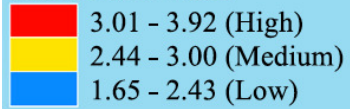


Larry Mayer

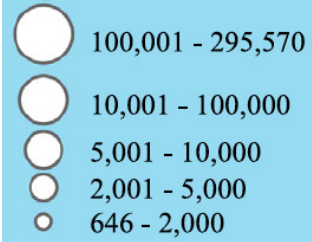
# Arctic photochemistry



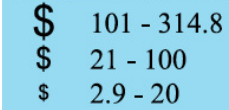
**Final Index Value**



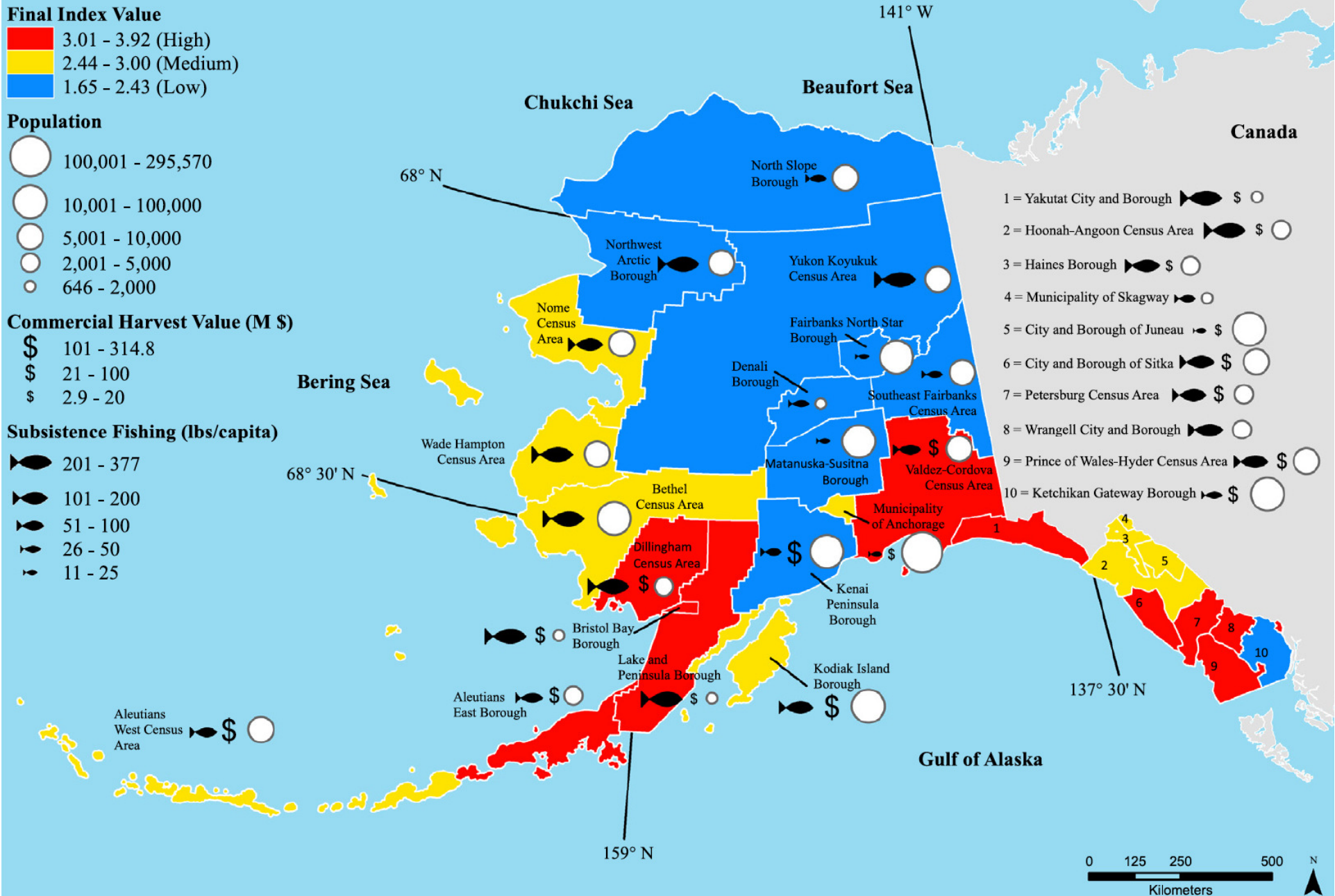
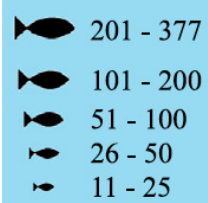
**Population**



**Commercial Harvest Value (M \$)**



**Subsistence Fishing (lbs/capita)**



- 1 = Yakutat City and Borough
- 2 = Hoonah-Angoon Census Area
- 3 = Haines Borough
- 4 = Municipality of Skagway
- 5 = City and Borough of Juneau
- 6 = City and Borough of Sitka
- 7 = Petersburg Census Area
- 8 = Wrangell City and Borough
- 9 = Prince of Wales-Hyder Census Area
- 10 = Ketchikan Gateway Borough



Arctic oil...



Arctic has much of world's remaining "undiscovered" fossil fuel

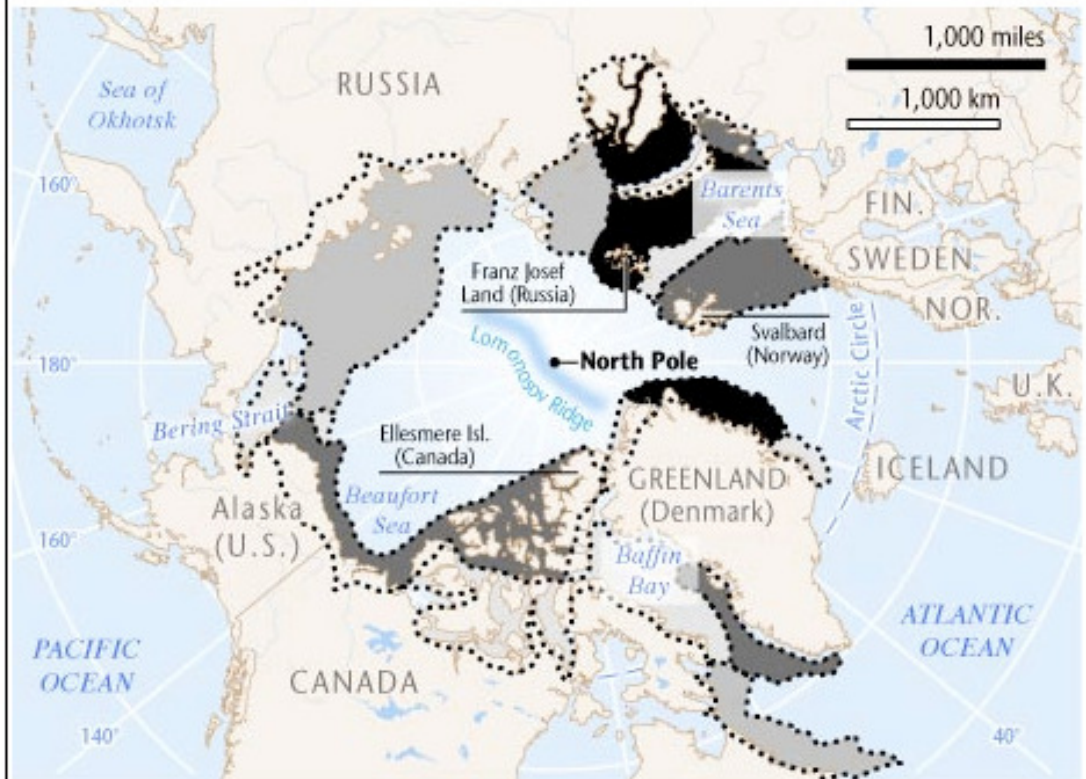
13% oil

30% natural gas

20% natural gas liquids

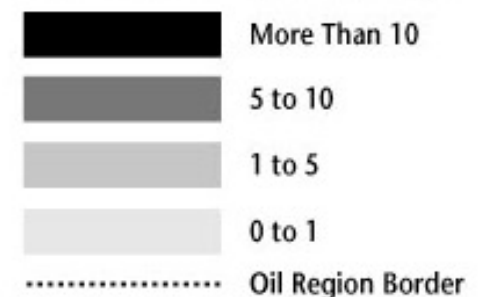
2009 USGS CARA report

## Arctic Oil and Gas Potential



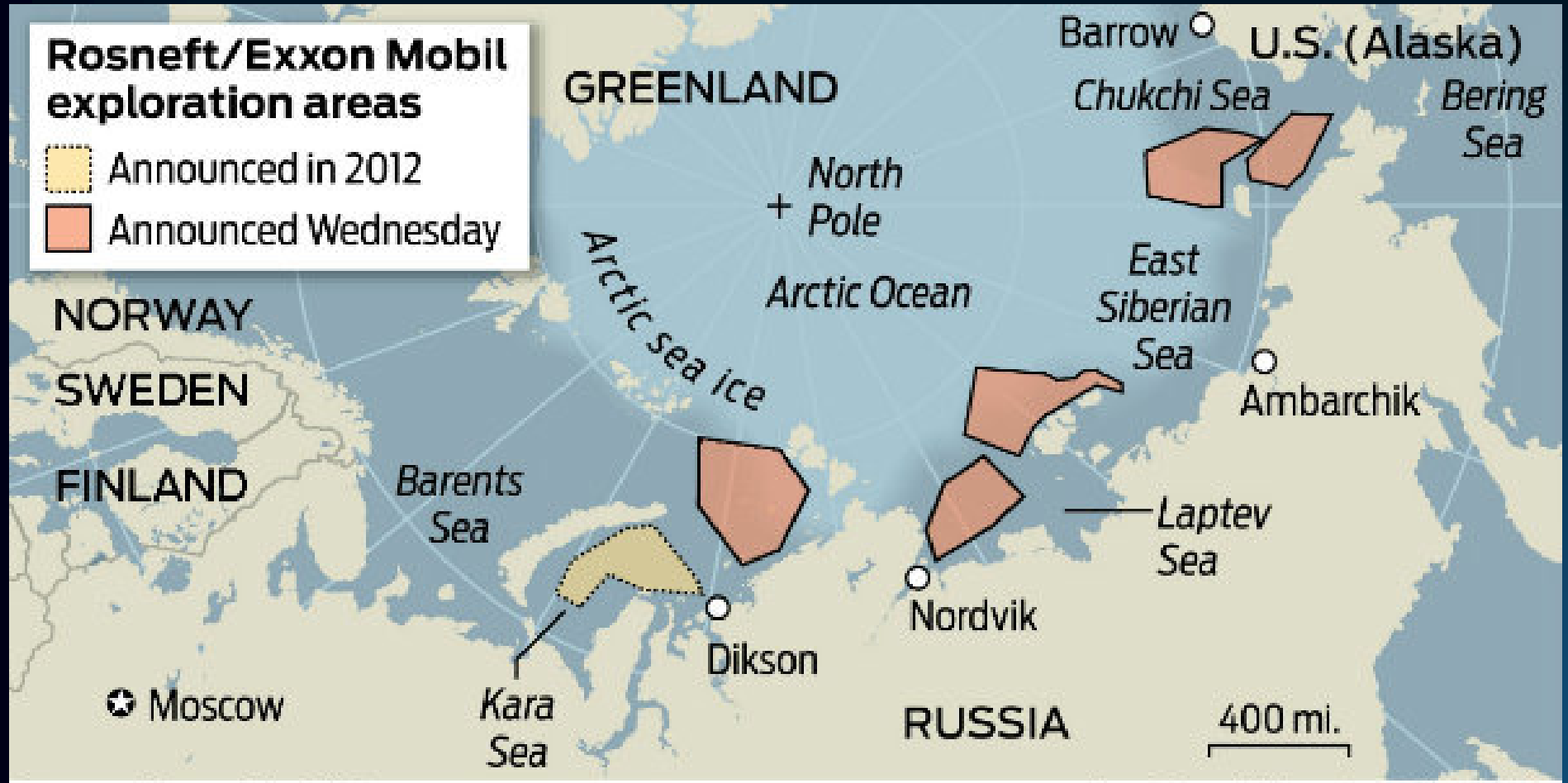
### Estimated Oil, Gas Yet to Be Found

In billions of barrels of oil equivalent



SOURCE: Wood Mackenzie  
Map based on a *Financial Times* graphic

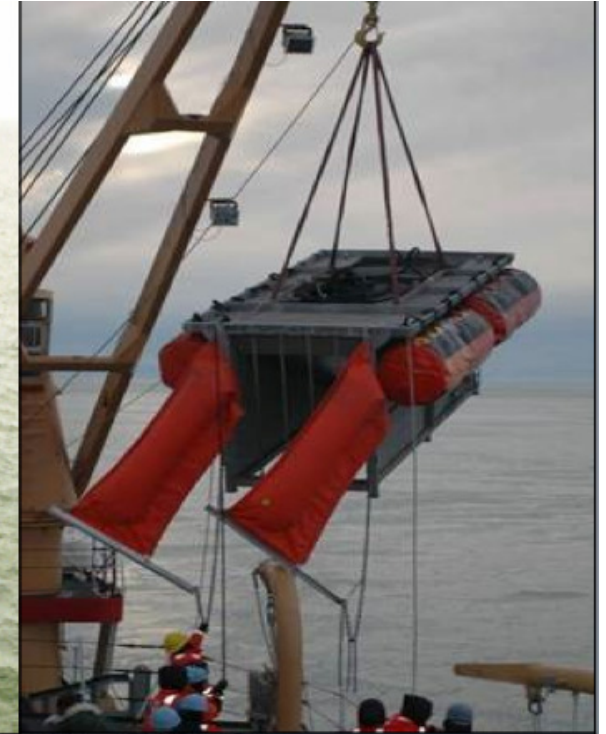
# ExxonMobil and Rosneft expand JV (2/13)



Source: Exxon Mobil Corp.

Jay Carr / Houston Chronicle

# Shell and Gazprom ink new deal (4/13)



...oil spills in  
ice-covered  
waters...



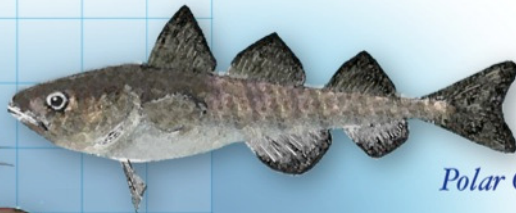


**Black  
carbon**





*Arctic Eel Pout*



*Polar Cod*



*Deep Sea Prawn*



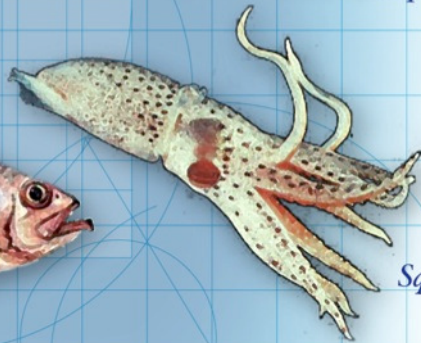
*Arctic Cod*



*Capelin*



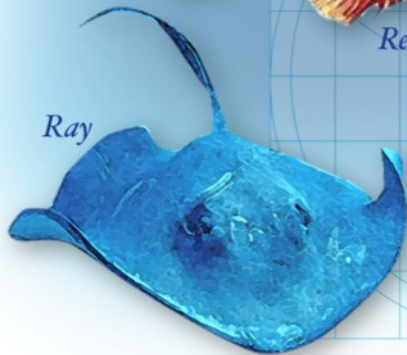
*Roughhead Grenadier*



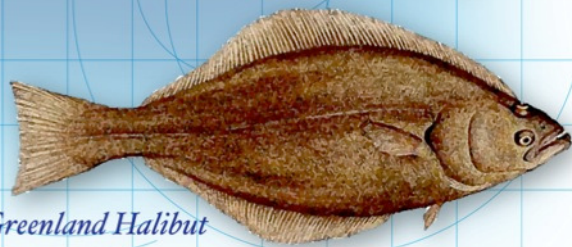
*Squid*



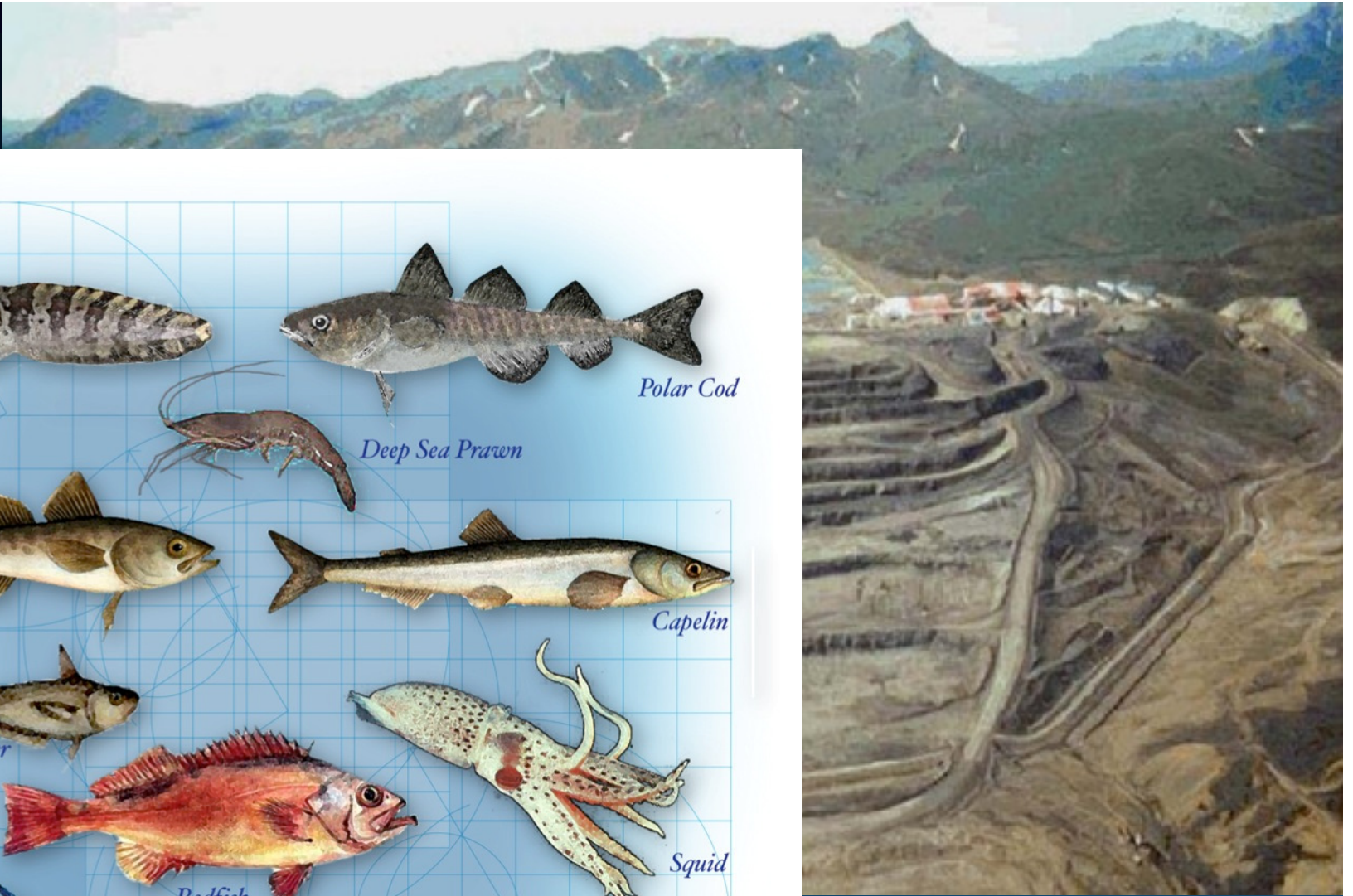
*Redfish*



*Ray*



*Greenland Halibut*

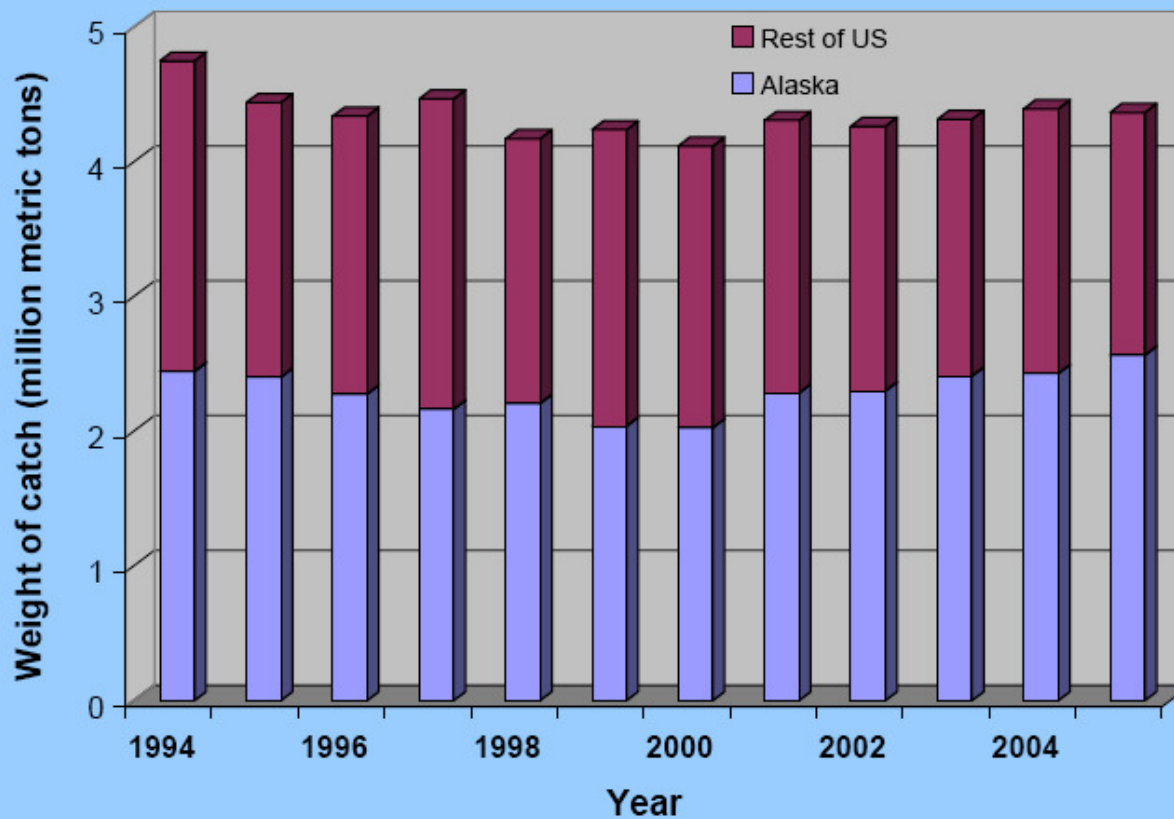


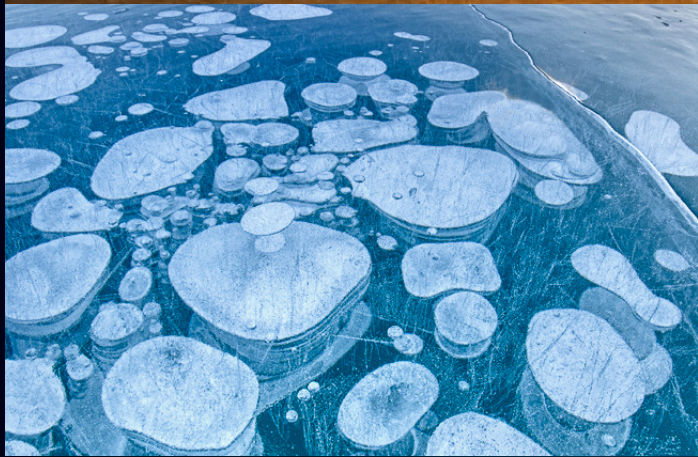
# Alaska Feeds the Nation

Largest private sector employer in Alaska



### US Domestic Commercial Fisheries

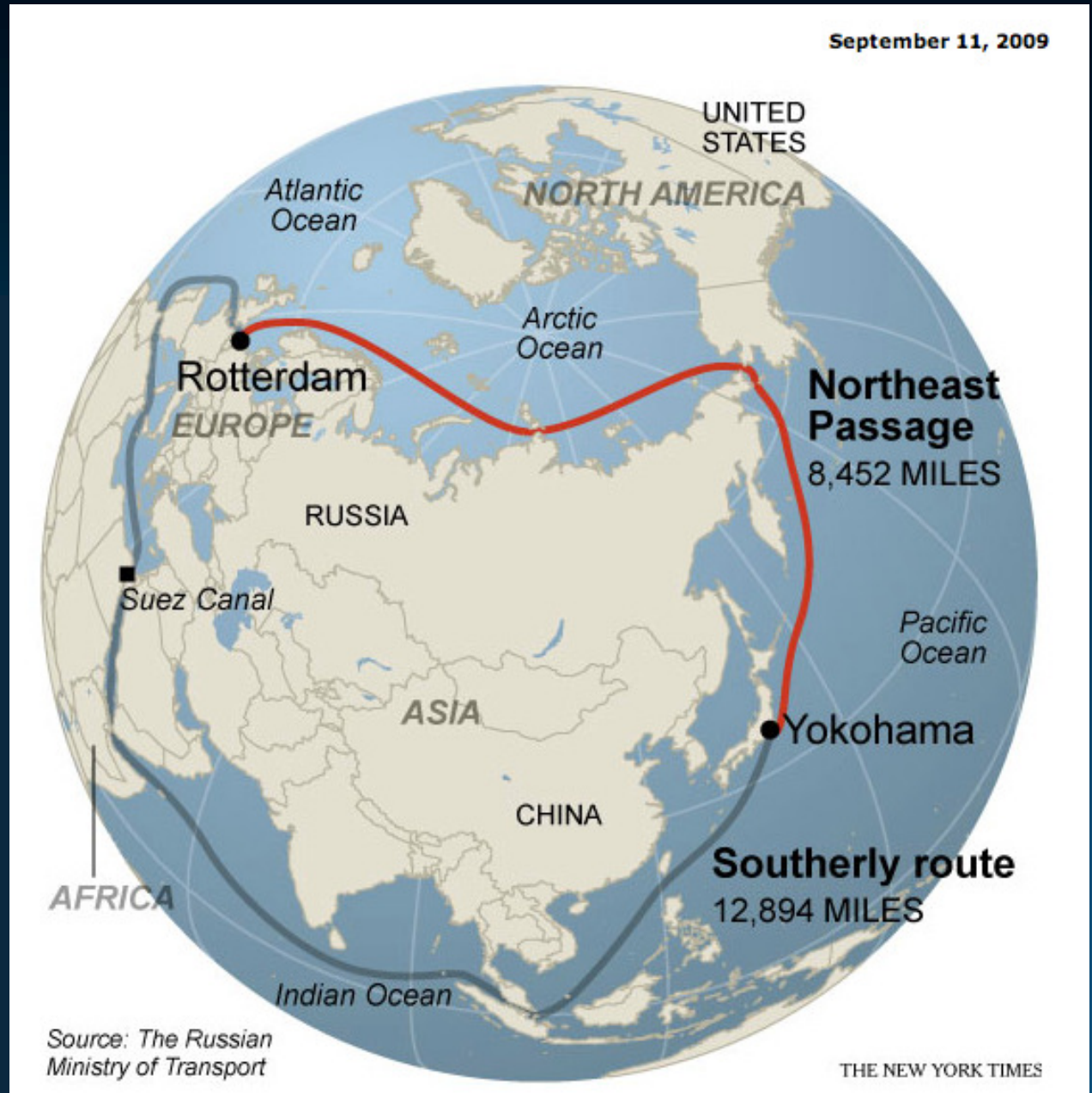




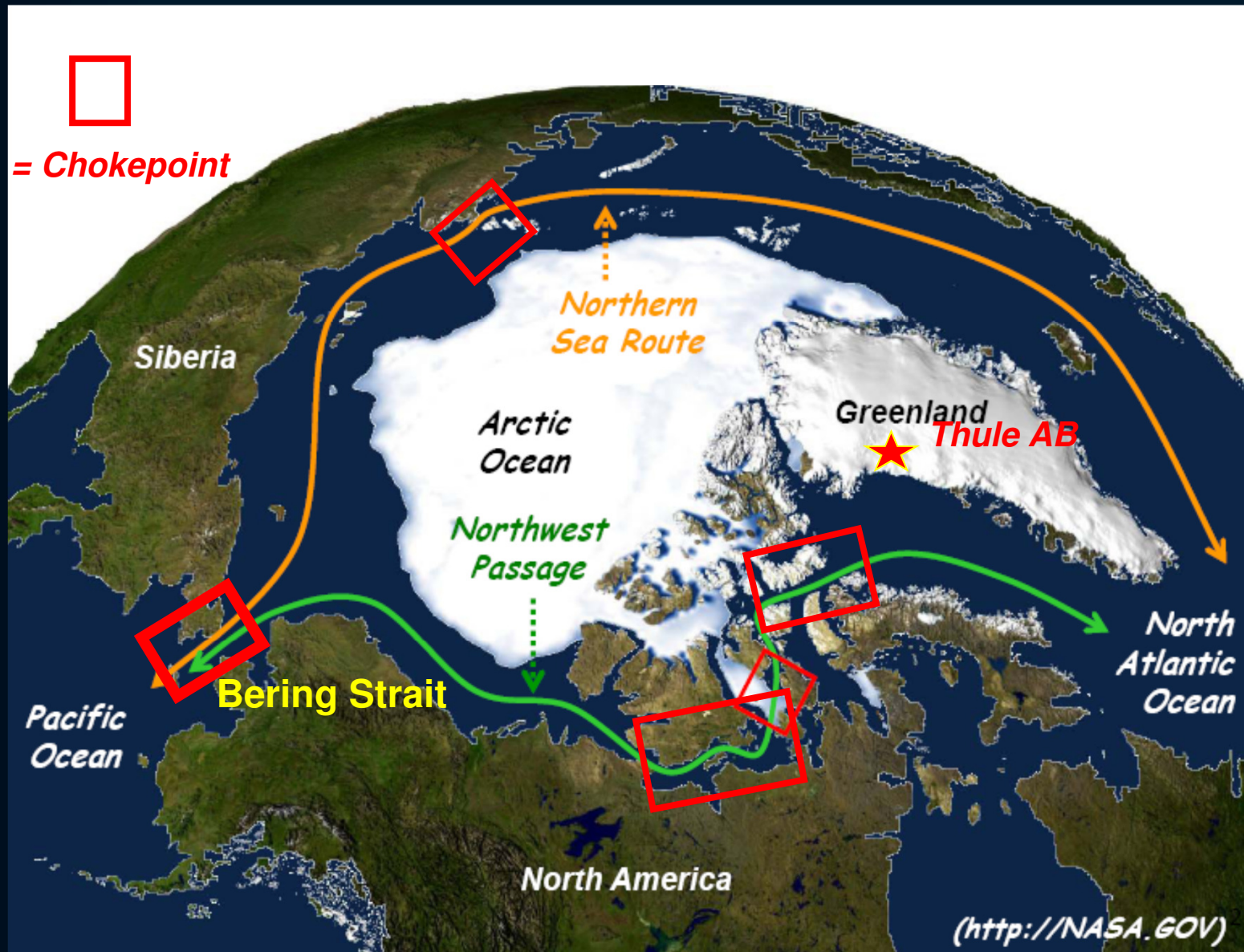
Methane  
release



# Why Arctic shipping?



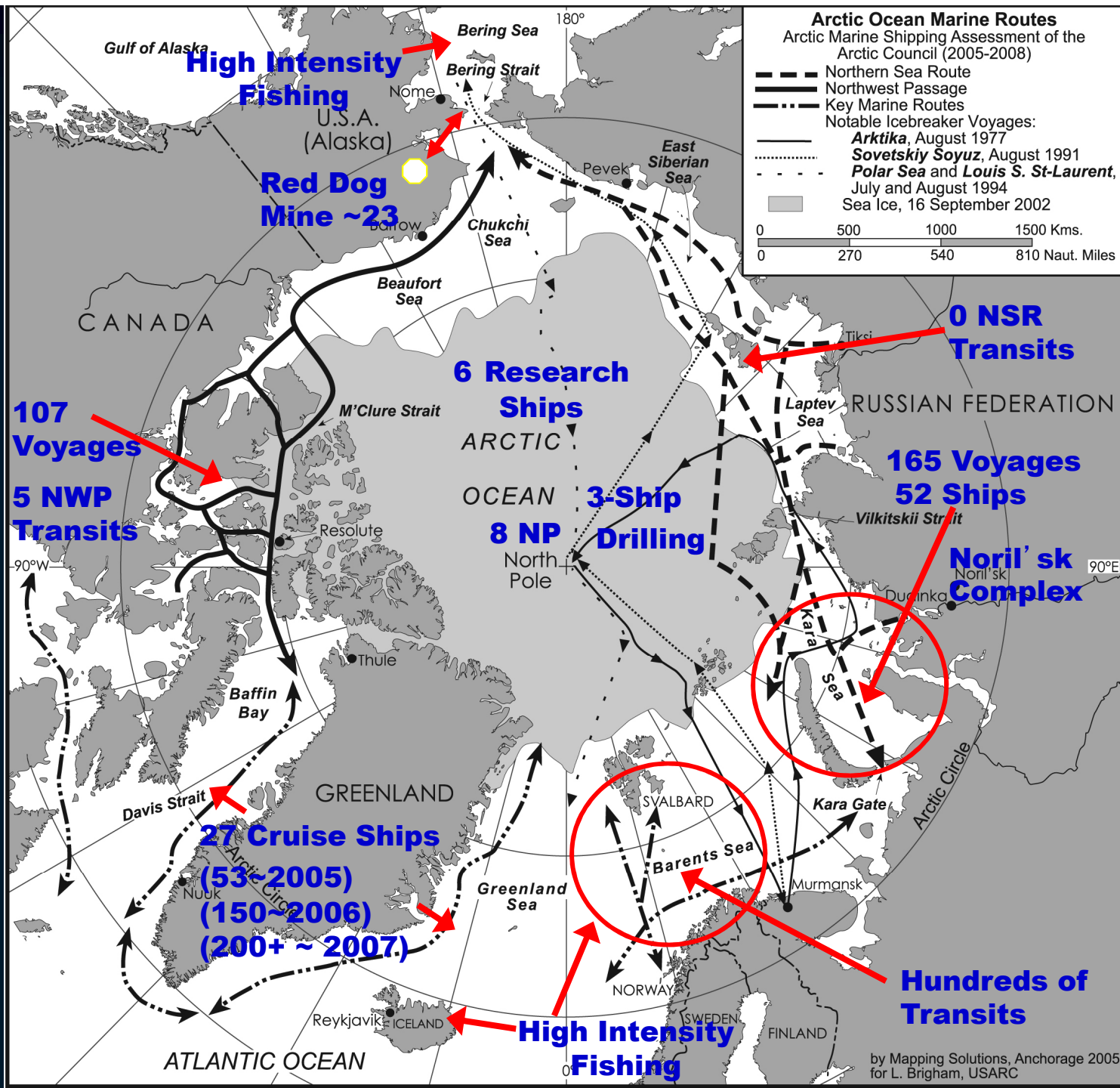
# Potential Routes



2004

Activity

(over 5K ships)

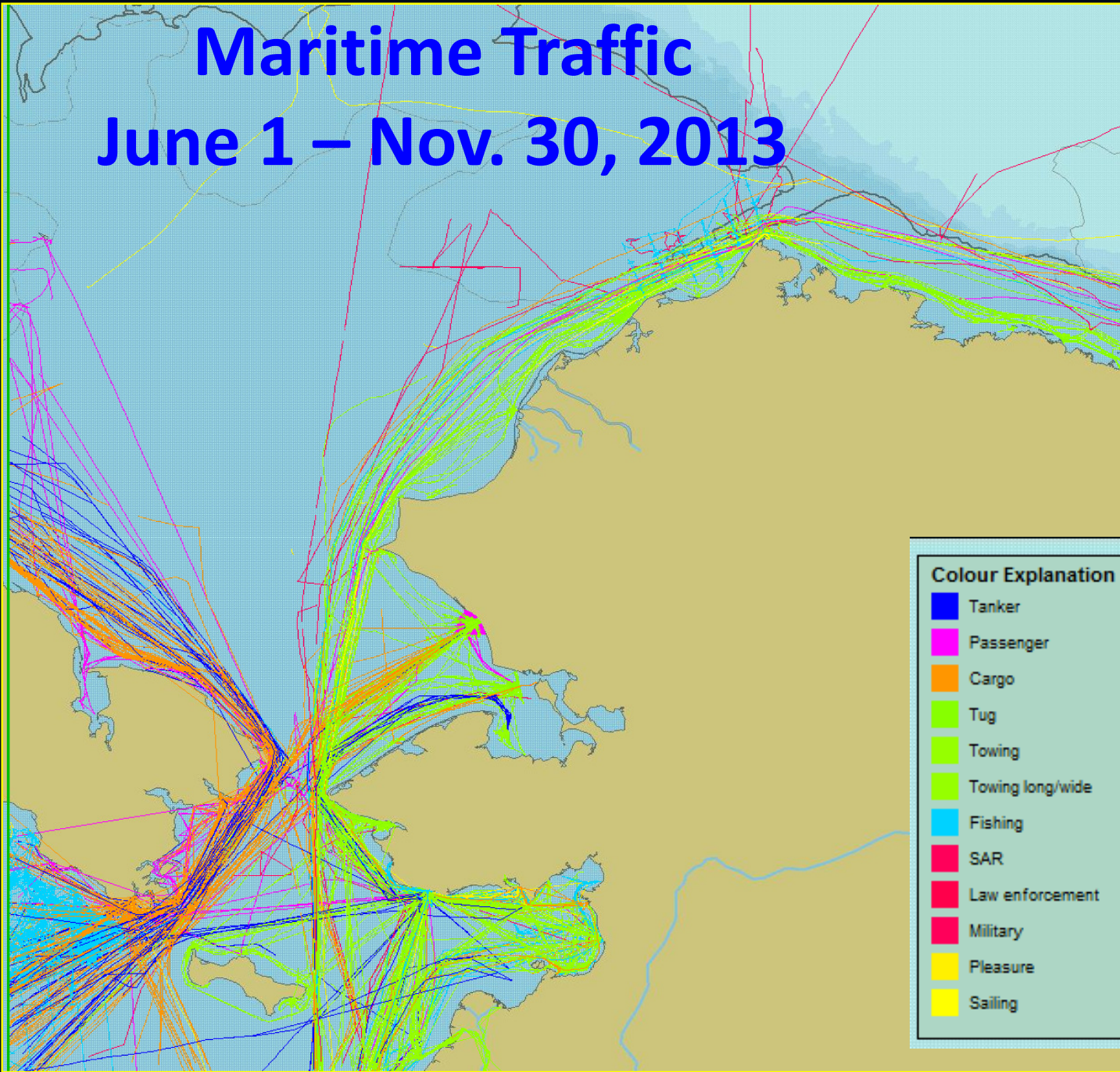


# Maritime Traffic Jan 1 - May 31, 2013

Alaska Marine Exchange



# Maritime Traffic June 1 – Nov. 30, 2013





# ARCTIC UPDATE



THE US ARCTIC RESEARCH COMMISSION DAILY EMAIL NEWSLETTER

July 9, 2013

## Today's Events

The House of Representatives will begin debate on **H.R. 2609 - 2014 Energy-Water Appropriations Act**, which President Obama has threatened to veto over reduced research funding for renewable energy.

## Media



### **NASA's polar robotic ranger passes first Greenland test.**

"Defying 30 mph gusts and temperatures down to minus 22 F, NASA's new polar rover recently demonstrated in Greenland that it could operate completely autonomously in one of Earth's harshest environments. The robot known as GROVER, which stands for both Greenland Rover and Goddard Remotely Operated Vehicle for Exploration and Research, was designed by

teams of students attending engineering boot camps at Goddard in the summers of 2010 and 2011. Built to carry a ground-penetrating radar to analyze layers of snow and ice, the rover was later transferred to Boise State University for fine-tuning with NASA funding." [Phys.org](http://Phys.org)

### **Arctic environmentalist wary of federal resource assessment review.**

"Northern environmentalists say a deal between the Northwest Territories and a federal economic development agency could water down how proposed resource projects are reviewed. Federal officials say the agreement is intended to make sure different government departments work together to ensure the assessment goes smoothly." [Edmonton Journal](http://Edmonton Journal)

**Murkowski: Pebble should provide more specifics.** "U.S. Sen. Lisa Murkowski called on the companies seeking to develop a massive copper and gold prospect

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Thank you

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703-525-0113