

US Geological Survey 2010 Cruise and Monitoring Plans for the Beaufort Sea

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**Arctic Stakeholder Open-Water Meeting
Anchorage, AK
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Take Home Message

Summarize IHA application for incidental takes of marine mammals by harassment during summer, 2010 experiment

- Concern is Level B harassment.
- No serious injury anticipated.
- No lethal takes are expected.
- Estimated takes are low.

Potential Sound Sources

3 x Sercel Airguns

Multibeam bathymetric Echosounder

Chirp Echosounder

Helicopter Operations

Icebreaking



Outline

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Why Joint Surveys?

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Subsistence Hunting

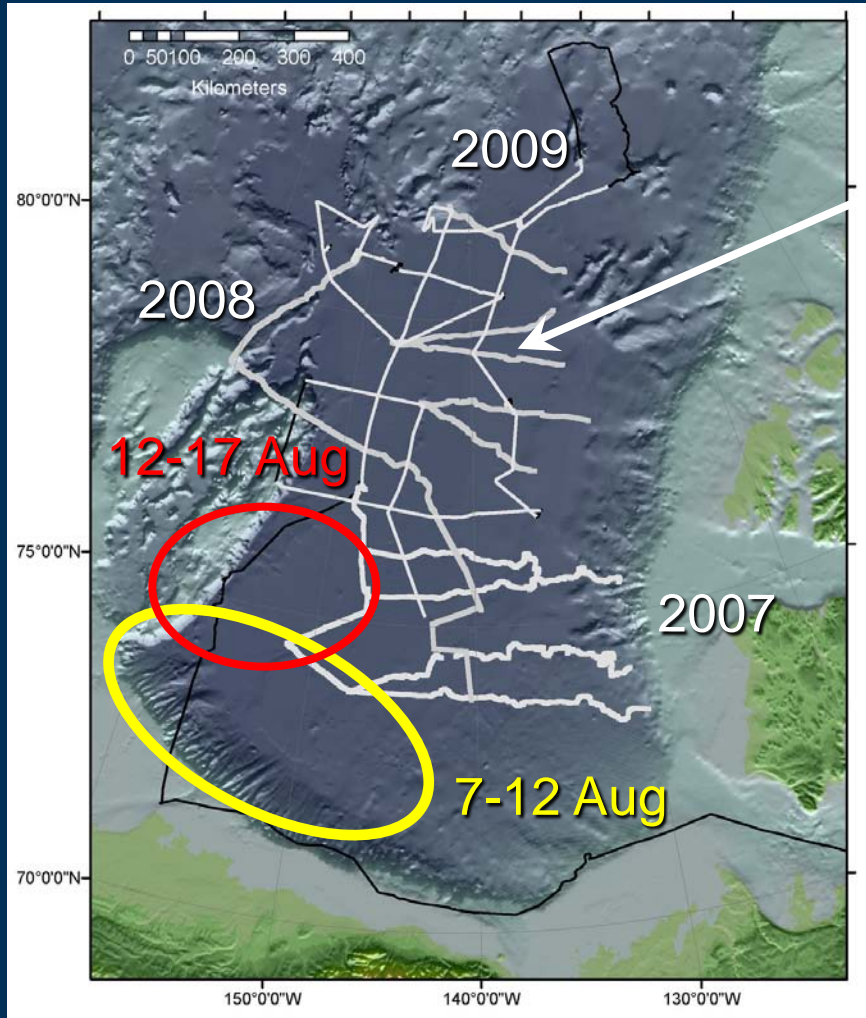
Monitoring

Mitigation

Coordinating Research



Overview of Seismic Experiment



Seismic tracks 2007-2009

Healy

2 Aug (Dutch Harbor)
6 Sept (Barrow)



Louis S. St-Laurent
4 Aug (Kugluktuk)
5 Sept (end two-ship
ops)

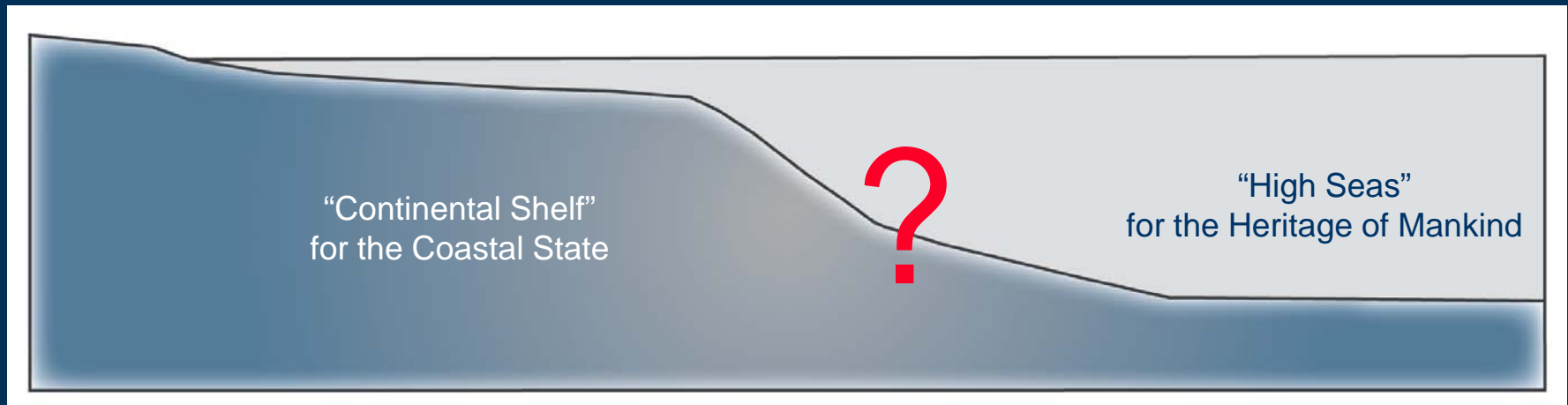


Why the Joint Surveys?

United Nations Convention on the Law of the Sea

“a constitution of the sea” that “sets forth a comprehensive legal regime governing activities on, over, and under the world’s oceans”

How to manage, conserve, and use the sea floor and sub-seafloor?

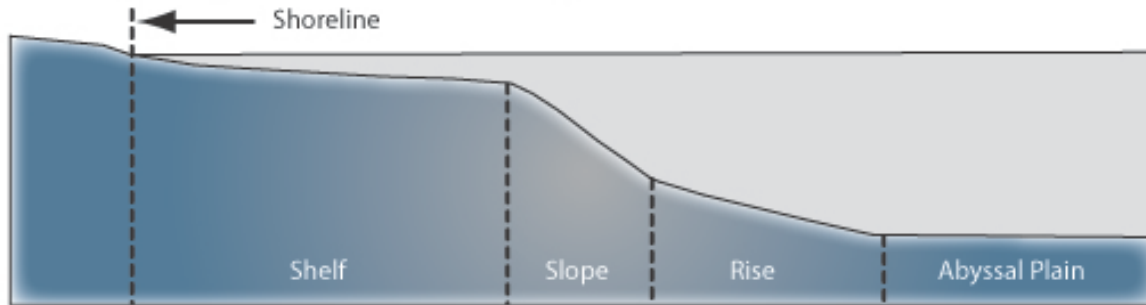


Article 76: Defines the boundary between the High Seas and the Continental Shelf

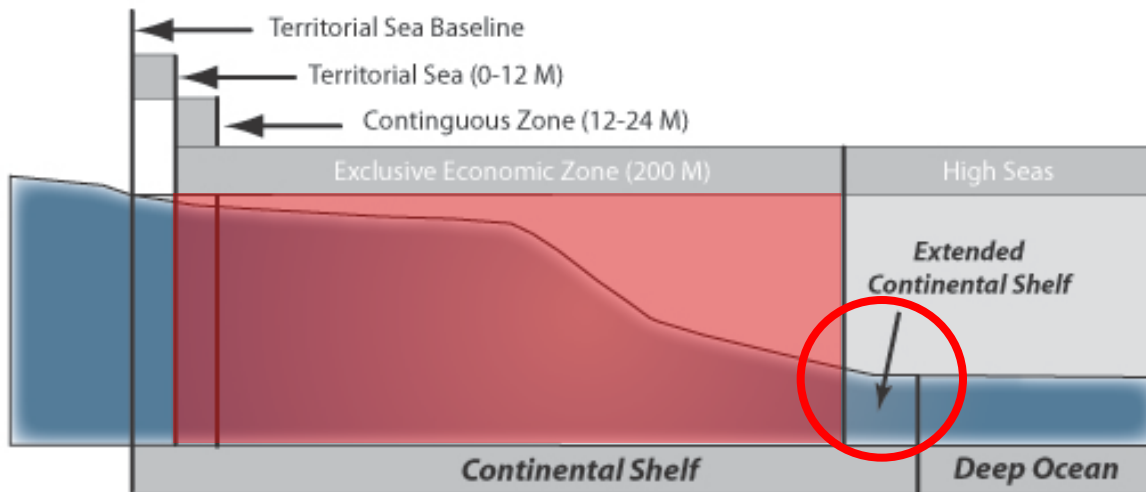


Extended Continental Shelf

A. Morphological Continental Margin

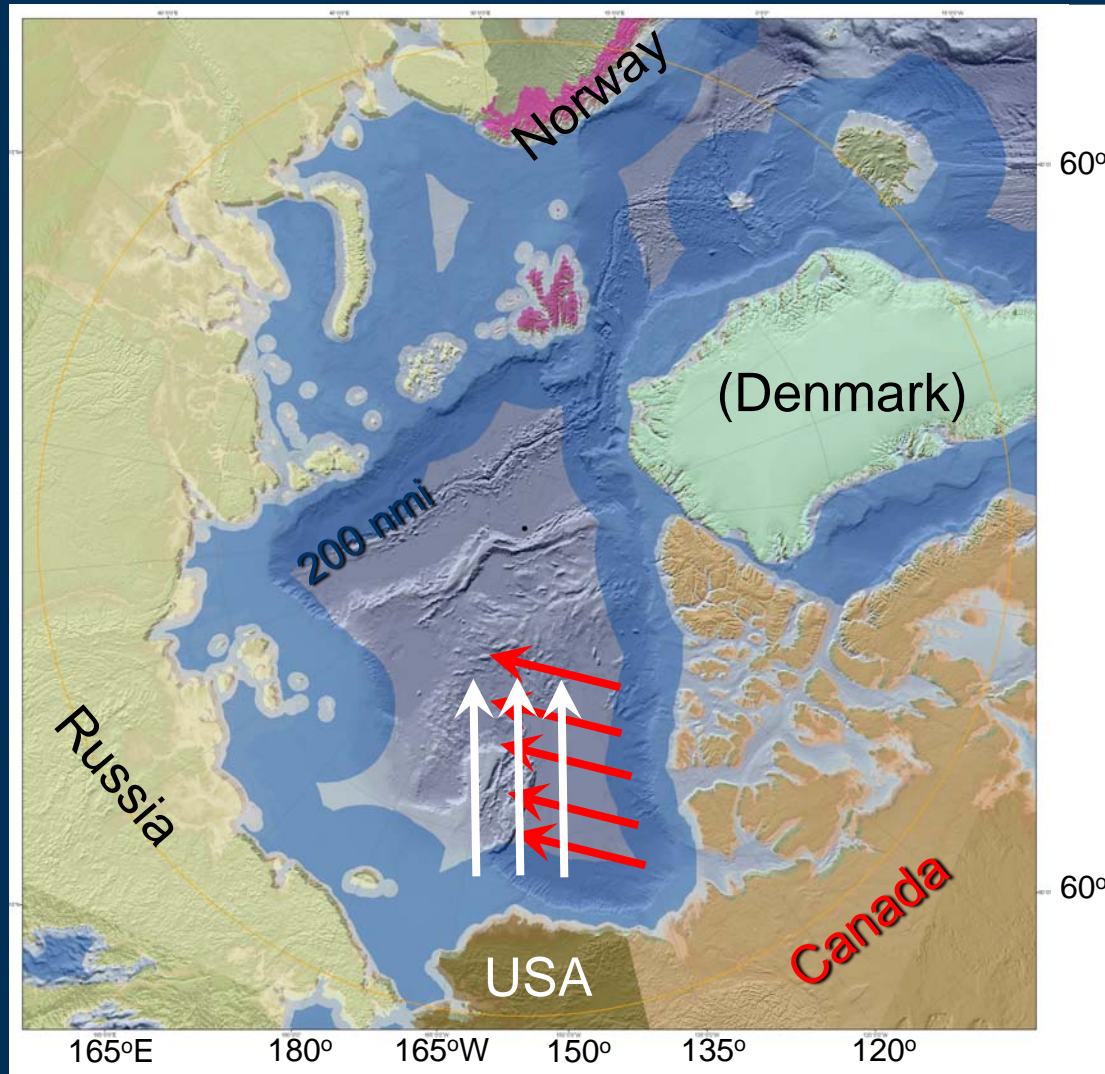


B. Legal Continental Shelf

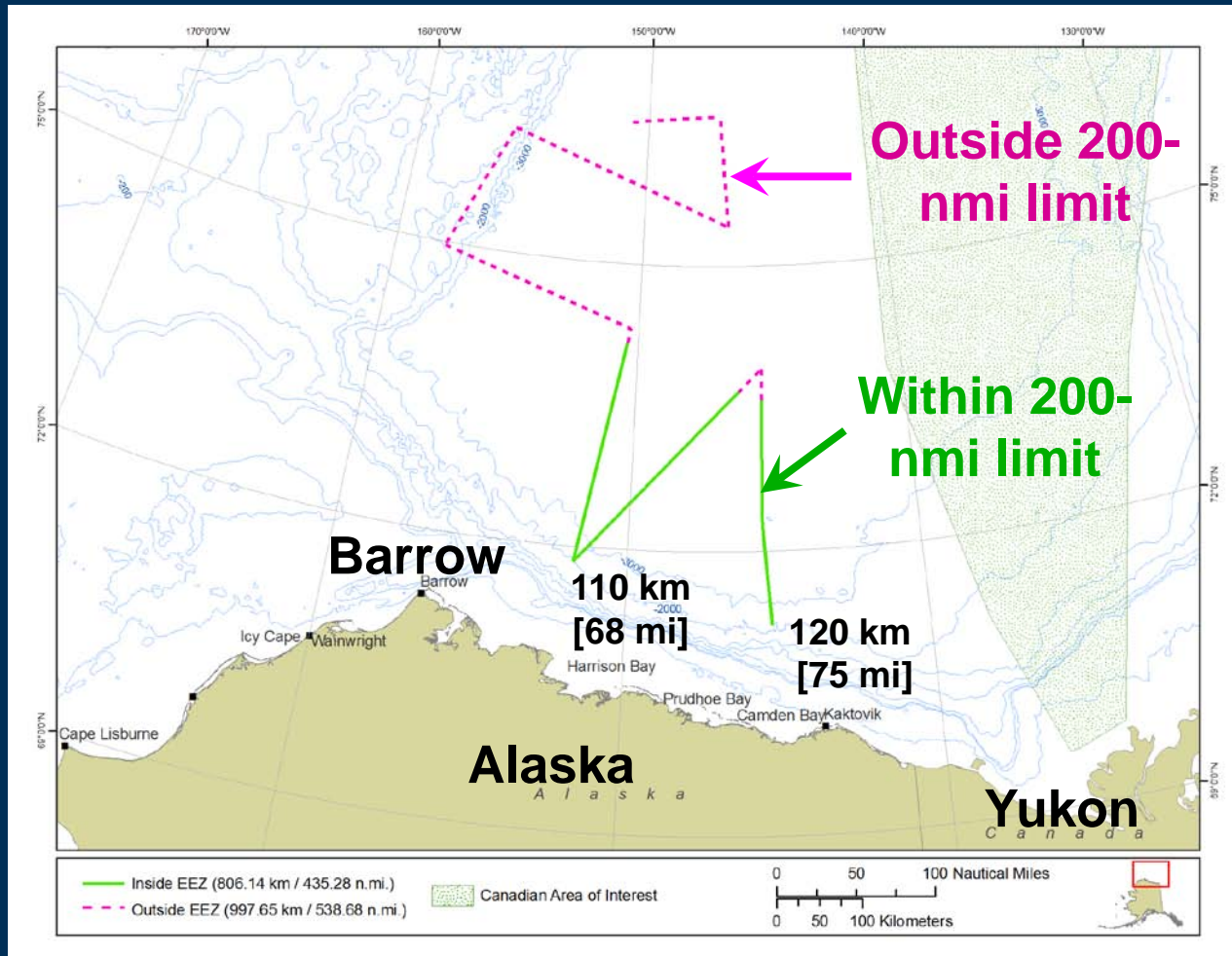


Seafloor beyond 200 nm where a coastal State has sovereign rights over the seafloor and sub-seafloor region.

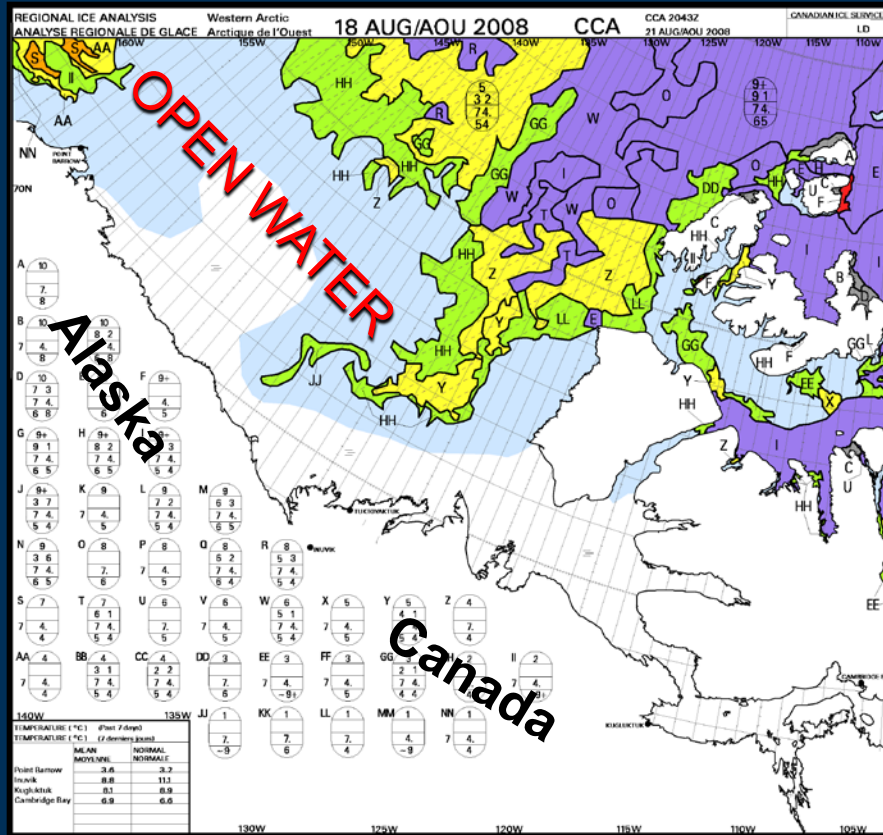
Extended Continental Shelf



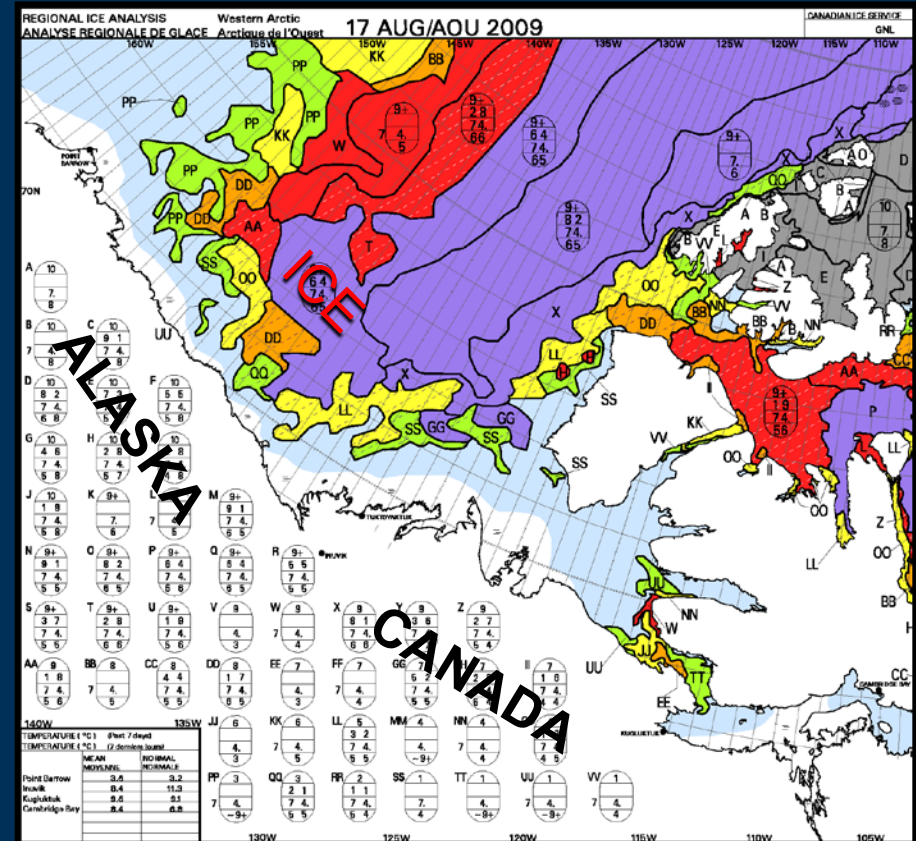
Lines of Concern for IHA



Ice Conditions to Determine 2010 Ops



18 August 2008



17 August 2009



For Multibeam Operations (US Ship):
All waters – US regulations apply



For the Seismic Operations (Canadian Ship):
Inside US 200-nmi Limit – US regulations apply
In International Waters – Canada regulations apply



Categorical Declaration

*“While in U.S. waters (i.e., the US 200-mile Exclusive Economic Zone), the GSC operators will comply with any and all environmental mitigation measures required by the U.S. National Marine Fisheries Service (NMFS) and/or the U.S. Fish and Wildlife Service (FWS). A NMFS-approved Marine Mammal Observer Team and a U.S. scientific liaison aboard the **CCGS Louis S. St-Laurent** will be responsible for ensuring that all mitigation measures required by NMFS and/or FWS are implemented while the **CCGS Louis S. St-Laurent** operates in U.S. waters.”*

Dr. Jacob Verhoef
Director, UNCLOS Program
Canada
5 March 2010



Seismic Source



Compressor



Airguns

Compressor Streamer
Airguns Sonobuoy Navigation

1 x 150 in³
2 x 500 in³
1150 in³

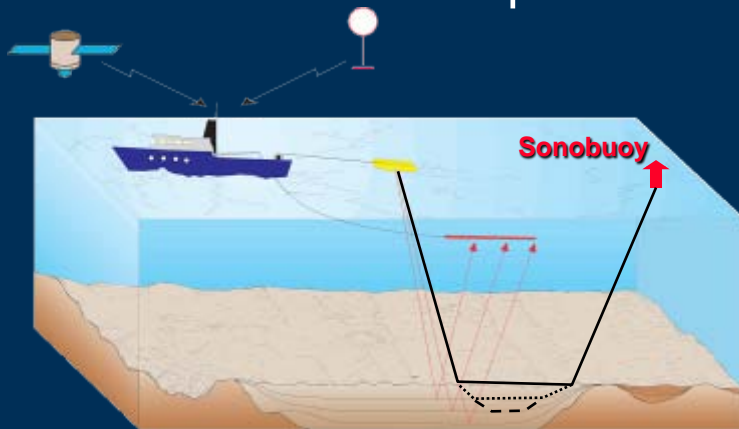


Streamer



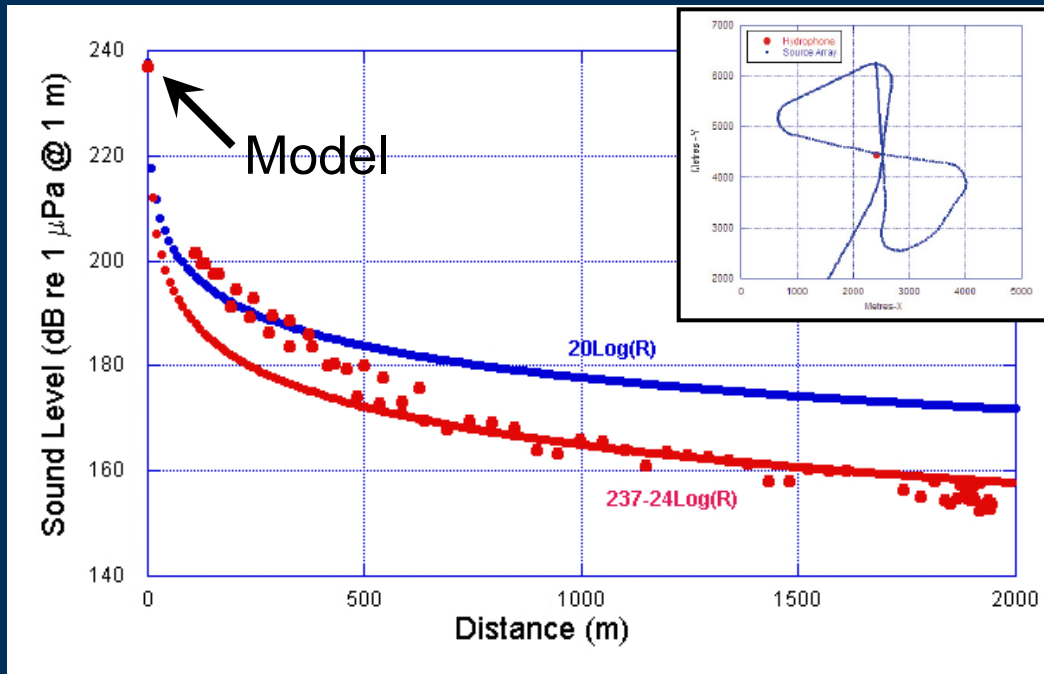
Sonobuoy Data

Seismic Refraction Data
velocities and depths



Seismic Source Levels

1. Decay Curves

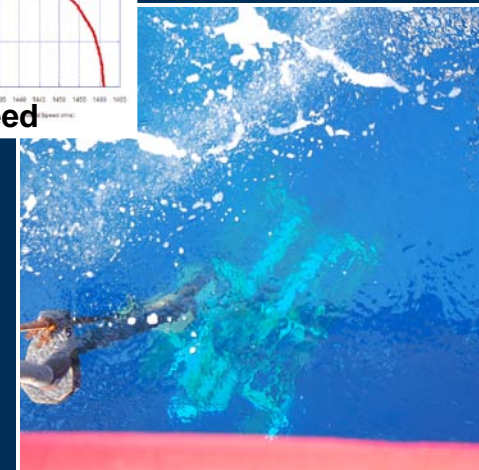
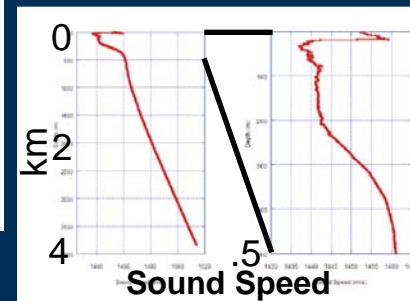


Note: 0-to-Peak measurements
RMS will be ~ 10 dB lower

2. Near-field Amplitude

Two experiments
Calibrated hydrophone
hung vertically off stern of
vessel while operating
airguns.

Analyses ongoing



Safety Radii based on RMS Values

Seismic Source Volume	Estimated Distance (m)	
	190 dB	180 dB
150 in ³ mitigation gun	20	62
1150 in ³ (3-gun array)	68	216 (<2 ship lengths)

Safety Radii still to be refined and proposed.





Inventory of Odontocetes and Mysticetes

SPECIES	HABITAT	ABUNDANCE	ESA ¹	IUCN ²	CITES ³
Beluga whale (<i>Delphinapterus leucas</i>)	Offshore, Coastal, Ice edges	3710 ⁴ 39,257 ⁵	Not listed	NT	
Narwhal (<i>Monodon monoceros</i>)	Offshore, Ice edge	Rare ⁶	Not listed	NT	II
Killer whale (<i>Orcinus orca</i>)	Widely distributed		Not listed	DD	II
Harbor Porpoise (<i>Phocoena phocoena</i>)	Coastal, inland waters, shallow offshore waters	Common (Chukchi) Uncommon (Beaufort)	Not listed	LC	II
Bowhead whale (<i>Balaena mysticetus</i>)	 Pack ice & coastal	10,545	Endangered	LC	I
Gray whale (<i>Eschrichtius robustus</i>) (eastern Pacific population)	Coastal, lagoons	488 ⁸ 17,500 ⁹	Not listed	LC	I
Minke whale (<i>Balaenoptera acutorostrata</i>)	Shelf, coastal	Small numbers	Not listed	LC	I
Fin whale (<i>Balaenoptera physalus</i>)	Slope, mostly pelagic	Rare (Chukchi)	Endangered	EN	I
Humpback whale (<i>Megaptera novaeangliae</i>)	Shelf, coastal	Rare	Endangered	LC	–



Inventory of Pinnipeds

SPECIES		HABITAT	ABUNDANCE	ESA	IUCN ²	CITES ³
Bearded seal (<i>Erignathus barbatus</i>)		Pack ice, open water	300,000-450,000 ¹⁰	In review for listing	LC	–
Spotted seal (<i>Phoca largha</i>)		Pack ice, open water, coastal haulouts	~59,214 ¹¹	Arctic pop. Segments not listed	DD	–
Ringed seal (<i>Pusa hispida</i>)		Landfast & pack ice, open water	18,000 ¹² ~208,000-252,000 ¹³	In review for listing	LC	–
Ribbon seal (<i>Histiophoca fasciata</i>)		Pack ice, open water	90-100,000 ¹⁴	Not listed	DD	–



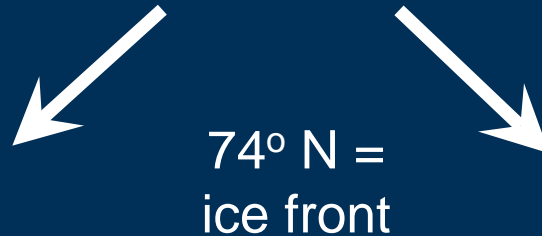
Take Estimates: Densities of Animals

Species	Open Water		Ice Margin	
	Average Density (# / km ²)	Maximum Density (# / km ²)	Average Density (# / km ²)	Maximum Density (# / km ²)
Odontocetes				
Beluga	0.0354	0.0709	0.0354	0.0709
Narwhal	0.0000	0.0001	0.0000	0.0002
Delphinidae				
Killer whale	0.0000	0.0001	0.0000	0.0001
Phocoenidae				
Harbor porpoise	0.0000	0.0001	0.0000	0.0001
Mysticetes				
<i>Bowhead whale</i>	0.0061	0.0122	0.0061	0.0122
Gray whale	0.0000	0.0001	0.0000	0.0001
Minke whale	0.0000	0.0001	0.0000	0.0001
<i>Fin whale</i>	0.0000	0.0001	0.0000	0.0001
<i>Humpback whale</i>	0.0000	0.0001	0.0000	0.0001
Pinnipeds				
Bearded seal	0.0096	0.0384	0.0128	0.0512
Spotted seal	0.0001	0.0004	0.0001	0.0004
Ringed seal	0.1883	0.7530	0.2510	1.0040



TAKE ESTIMATES

$$\begin{aligned} &\text{Expected Density} \\ &\times \text{Area of water insonified by } \geq 160 \text{ dB safety radii} \\ &= \text{Take Estimate} \end{aligned}$$



Open Water
80 % tracks

Ice Margin
20 % tracks

Bowhead takes: 25 (ave)/ 50 (max)
< ½ % Chukchi/Beaufort population
assumes no avoidance



Other Impacts on the Natural Environment



- Ice Breaking
 - Alters ice conditions around the vessel
 - Ice is highly variable at this time of year
 - Ice recloses and freezes
- Habitat Modification
 - Only small portions of available habitat are ensonified
 - Ice expected to be < 2 m thick

Subsistence Hunting

Information Gathering

- Trips to Barrow (2008, 2009, 2010)
 - AEWC
 - Whaling Captains
 - NS Borough Scientists
 - Mayor's staff, NSB
 - BASC
- Attendance at Open Water Meeting (2008, 2009, 2010)
- Community Observer (aboard Healy 2008, 2009)
- Louis – 3 MMOs (indigenous) Inuvialuit
- Louis – 1 Airgun technician (indigenous) Inuvialuit

Fall Bowhead hunt (September – October)
Coastal Hunting and Fishing
Offload Healy Sept 6 (Barrow)



Plan of Cooperation

- **Timing of survey at beginning of two-ship operation**
Avoid timing of hunt
- **Connect lines to existing seismic lines**
Stay >110 km (68 mi) offshore, well away from coastal area of concern
- **Plan for Community Observer Healy 2010**
Primary communicator with SAR and Barrow community
- **Plan to include Inupiat MMOs as possible**
Contracts being developed
- **Shutdown for 5 km (3.1 mi) radii for fishing and/or hunting activities**
- **Helicopter disembark with Barrow coordination**



Monitoring

MMOs

- 3 U.S. aboard Healy (generally from bridge, 19.5 m [64 ft])
- 3 Canadian aboard Louis (generally from flying bridge, 15.4 m [50.5 ft])
- 2 MMOs from Healy will join 3 from Louis for tracks in US waters
- For two-ship operations, 24 hr VHF communications
- Observations every ½ hour or upon seeing an animal
- Observations when no seismics, too
- U.S. MMOs aboard Louis have full authority for startup, ramp up, power down and shut down (for US waters)
- 90 day report to NMFS



Mitigation

- Stay in water depths > 1900 m [1.2 mi]
(*sound attenuates more rapidly than shallow water*)
- More than 110 km [68 mi] offshore (*avoid coastal subsistence activities*)
- **Survey at time of maximum daylight**
- Two ship operations – MMOs on both vessels/ 5 on US vessel
- 5 MMOs, 24 hour observations
- Ramp up airguns (150 in³, followed by one 500 in³, then the second)
- Standard start up (safety areas clear for 30 minutes)
- Standard power down (150 in³ mitigation gun) and shut down
- **GSC Categorical Declaration to abide by U.S. regulations in US waters**
- **Speed/course alteration without compromising safety**
- **Technology – night vision devices, laser ranging binoculars**
- **Ice Analysis and Ice Observing on both vessels**
- **Helicopter use will be minimized in US waters**
- **Inupiat communicator for return to Barrow**



CCGS LOUIS S. ST. LAURENT

Coordinating Research

AUGUST 15TH
2009
1606Z

USCGC HEALY

- **2007-2009 MMO** data made public through reports to DFO and published cruise reports.
- **2010 MMO data** will be reported to NMFS (US waters) and to DFO (international waters) as well as published in cruise reports.
- **Support non-interference** oceanographic, biological, and ice observation studies along cruise tracks (2008 and 2009)
- **Non-interference science** will also be supported in 2010.
- Funded Greenridge to analyze Shell data from DASARS for **propagation of sound over long distances** (*Louis* shots measured across the array).
- Funded SIO/UNH analysis of sonobuoys for **ship and background (ambient) noise** and provided ship time for recovery and redeployment of HARP moorings.

Take Home Message

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3 x Sercel Airguns

Multibeam bathymetric Echosounder

Chirp Echosounder

Helicopter Operations

Icebreaking



Questions?





Date [2010]	Healy			Louis S. St. Laurent	
	Location	Activity if ice	Activity if NO ice ¹	Location	Activity ²
03-Aug 04-Aug	US port	Healy dep. Dutch Harbor		Canada port	Louis dep. Kugluktuk
3/4-7 Aug	US EEZ	Steam to rendezvous		Can/US EEZ	Steam to rendezvous
7-12 Aug	US EEZ	break ice for Louis ³	multibeam - AK slope	US EEZ	Survey lines in US EEZ
12-17 Aug	International/US EEZ	break ice for Louis ³	multibeam - AK slope	International	Survey lines of interest to US outside US EEZ
17 Aug-1 Sep	International/Can EEZ	break ice for Louis ³		International/Can EEZ	Survey lines of interest to Can ⁴
17 Aug-1 Sep	International/Can EEZ	Occasional sampling ⁵		International/Can EEZ	Occasional CTD
17 Aug-1 Sep	International/Can EEZ	Occasional multibeam only		International/Can EEZ	Break ice for Healy
02-Sep	International	End two-ship work		International	End two-ship work
04-Sep	US Port	Healy port call Barrow			
2-13 Sep				International/Can EEZ	Survey lines of interest to Can ⁶
13-15 Sep				Can EEZ	Steam plus refuel (?)
16-Sep				Canada Port	Louis port call Kugluktuk



Indicates activity in US EEZ



Indicates activity in International waters or Canadian EEZ

¹Assume two-ship operations for 17 Aug-2 Sep

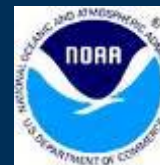
²Assume seismic data acquisition unless otherwise noted

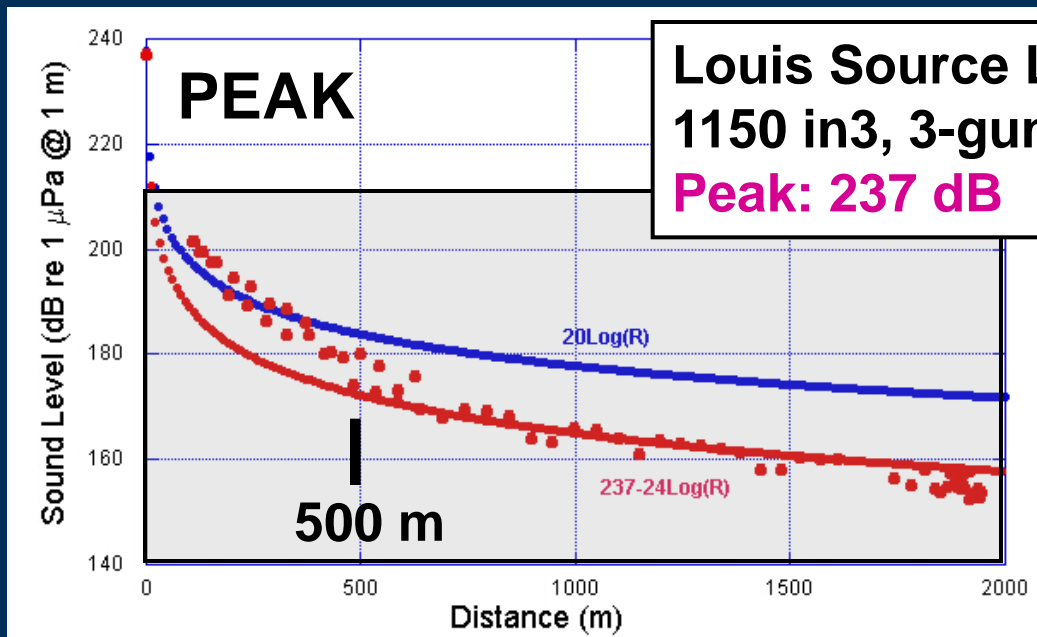
³Also acquire multibeam data

⁴Not all of these lines will be collected; final track decisions will depend on ice conditions in August, 2010

⁵Dredging and/or coring

⁶Northern part of line D may require two-ship operations





APPLES
VS
ORANGES

