

# 2010 BeaufortSPAN West 2D Seismic Survey

## NMFS 2010 Open Water Meeting

Joe Gagliardi - ION Geophysical

Darren Ireland - LGL Alaska



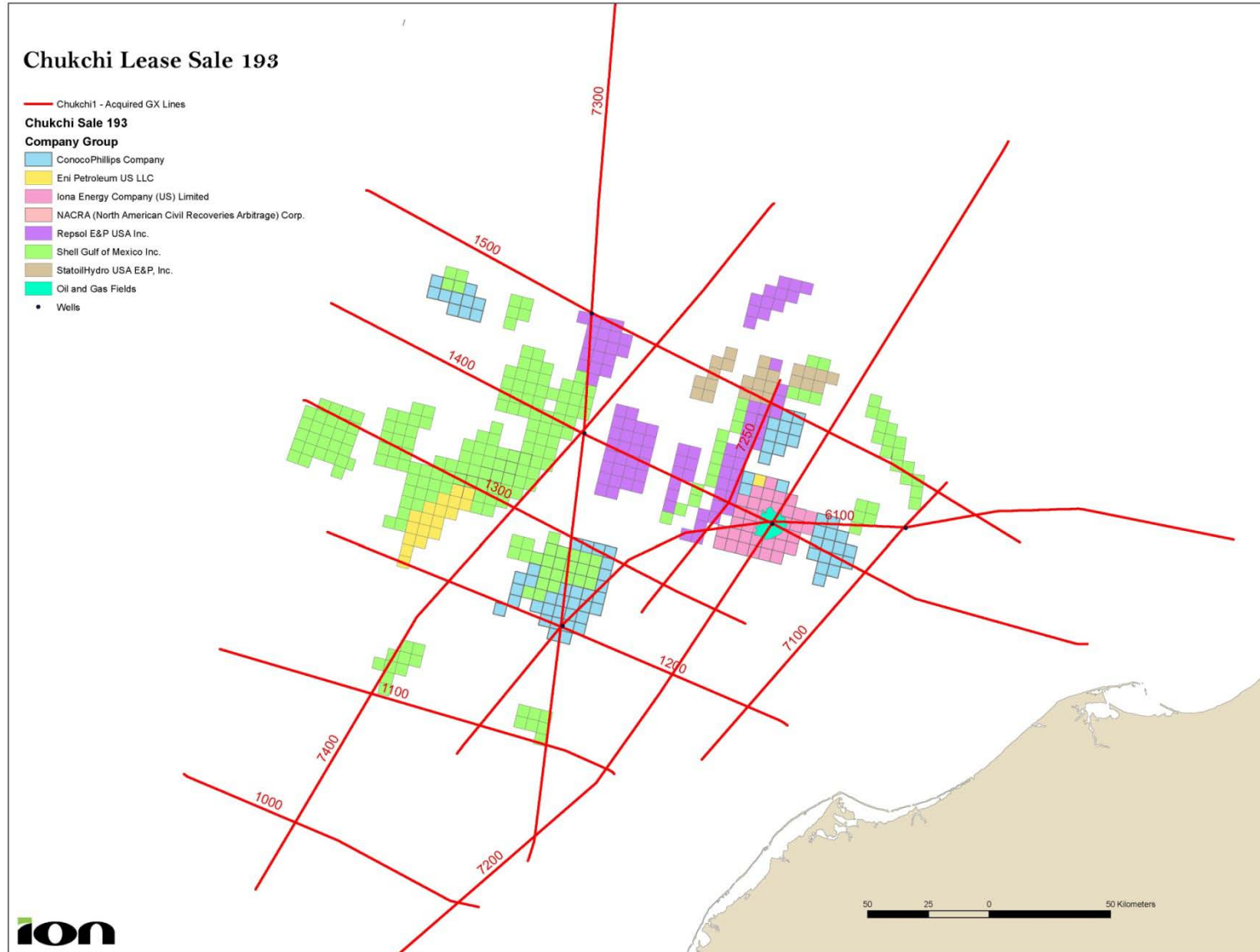
# BeaufortSPAN™ West OWM Project Review

- ION Arctic Experience.
- IA Arctic Solution Technology.
- 2010 BeaufortSPAN West 2D Survey.
- Stakeholder Outreach.
- Marine Mammal Monitoring and Mitigation.

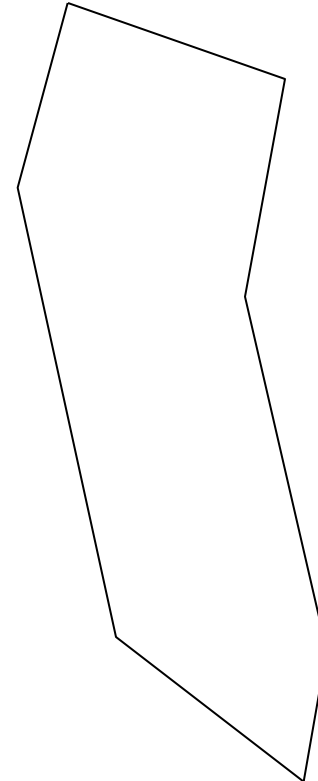
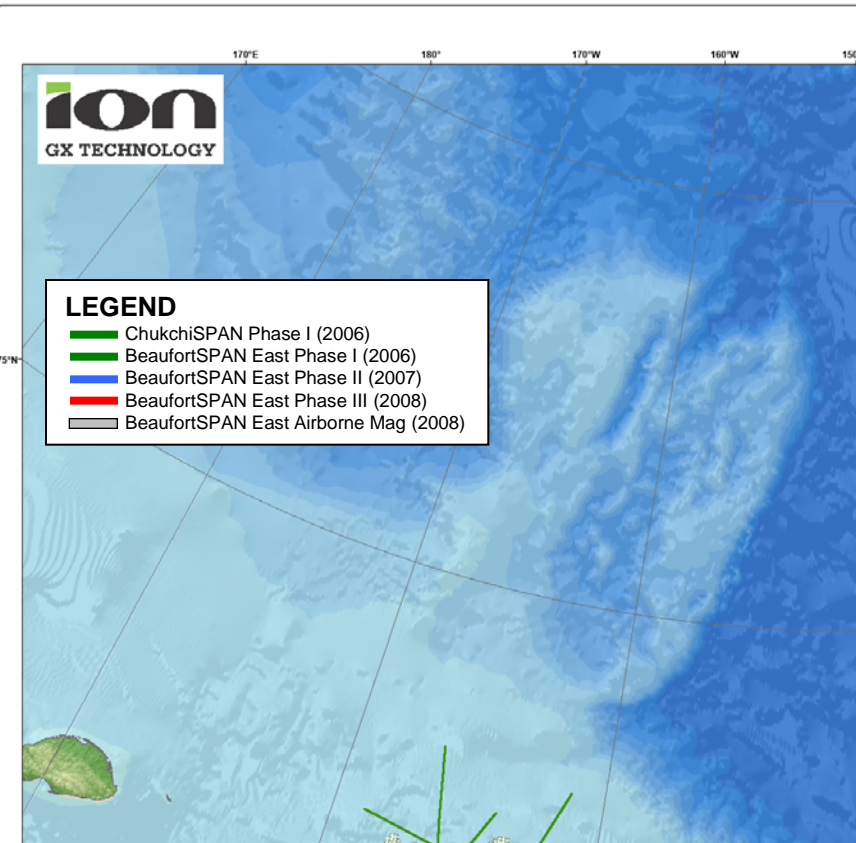
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# 2006 ION's First Arctic Survey Acquired



# 2006 - 2008 Acquired Survey Maps



# Experience In Management Of Surveys In Remote Locations And Harsh Environments



# ArcticSPAN™ HSE Performance

<b>Project</b>	<b>KM Acquired</b>	<b>Project Start Date</b>	<b>Project Completion Date</b>
NE Greenland (2009)	5,280	August	September
Flex Wave Test (2008)	35	April	April
Beaufort III (2008)	7,438	August	October
Beaufort II (2007)	5,645	August	September
Chukchi (2006)	3,129	October	November
Beaufort I (2006)	3,590	August	September
<b>TOTAL</b>	<b>25,117</b>		

<b>Project</b>	<b>Man-Hours</b>	<b>TRIR</b>	<b>LTIF</b>
NE Greenland (2009)	162,840	1.23	0.00
Flex Wave Test (2008)	24,092	0.00	0.00
Beaufort III (2008)	119,136	0.00	0.00
Beaufort II (2007)	77,412	0.00	0.00
Chukchi (2006)	52,992	0.00	0.00
Beaufort I (2006)	97,728	0.00	0.00
<b>TOTAL</b>	<b>534,200</b>	<b>0.20</b>	<b>0</b>

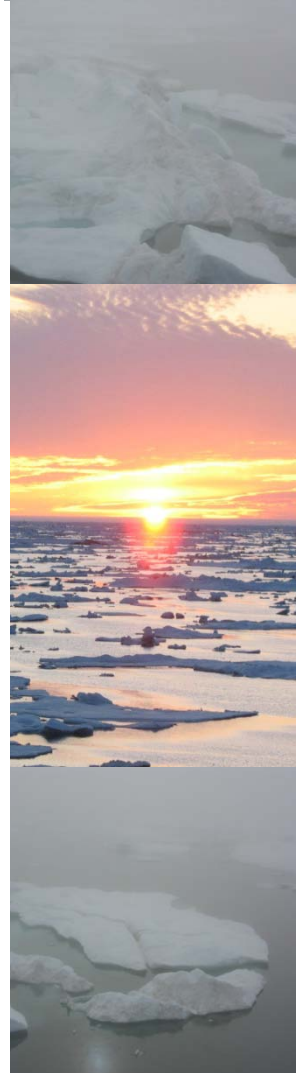
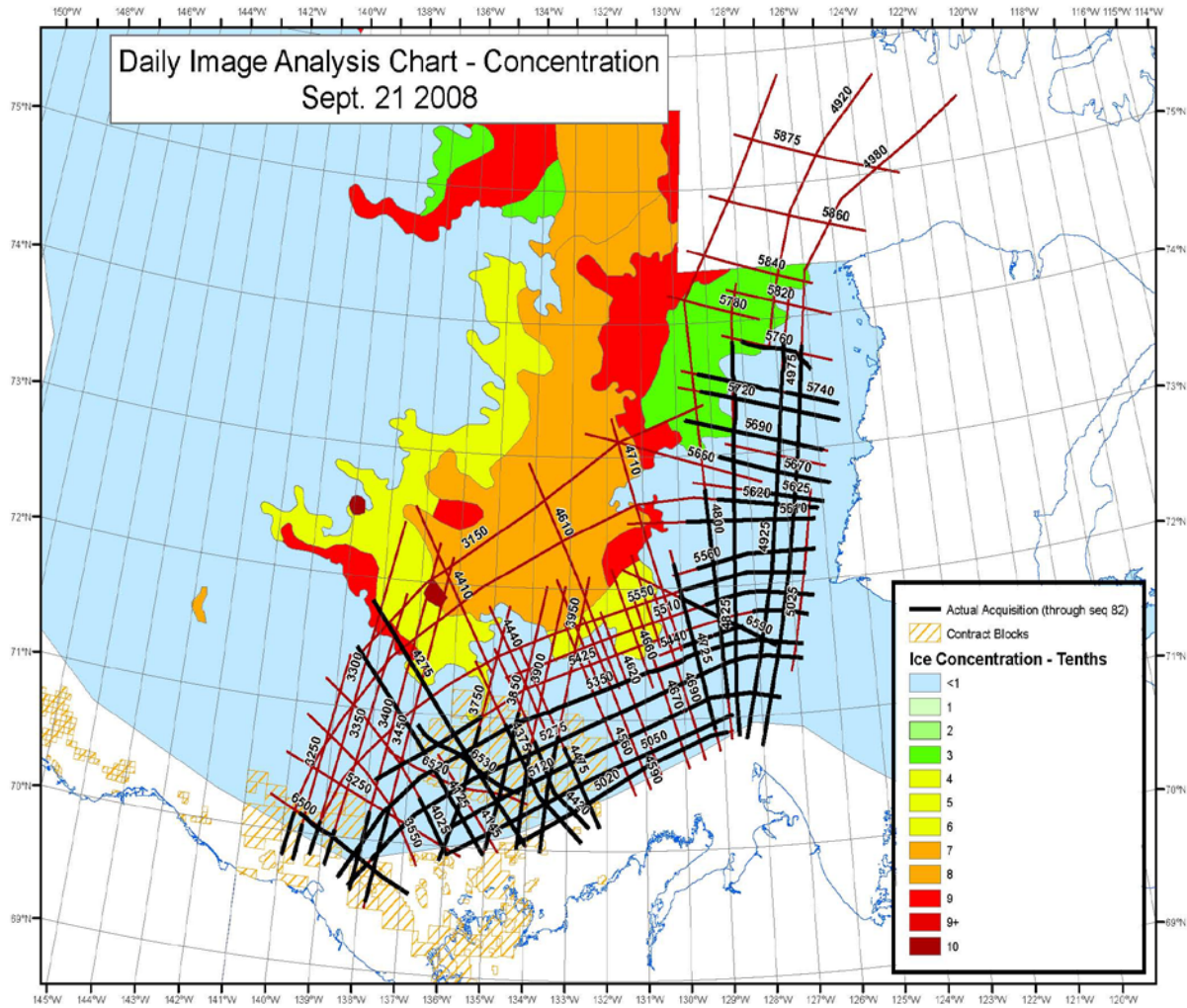
# Experience with Permitting Seismic Surveys In Complex Marine Mammal Issues:

- Advance Mitigation Measures
- Complex Regulation: IHA's, LOA's, EA's
- New Species Listing
- New Research

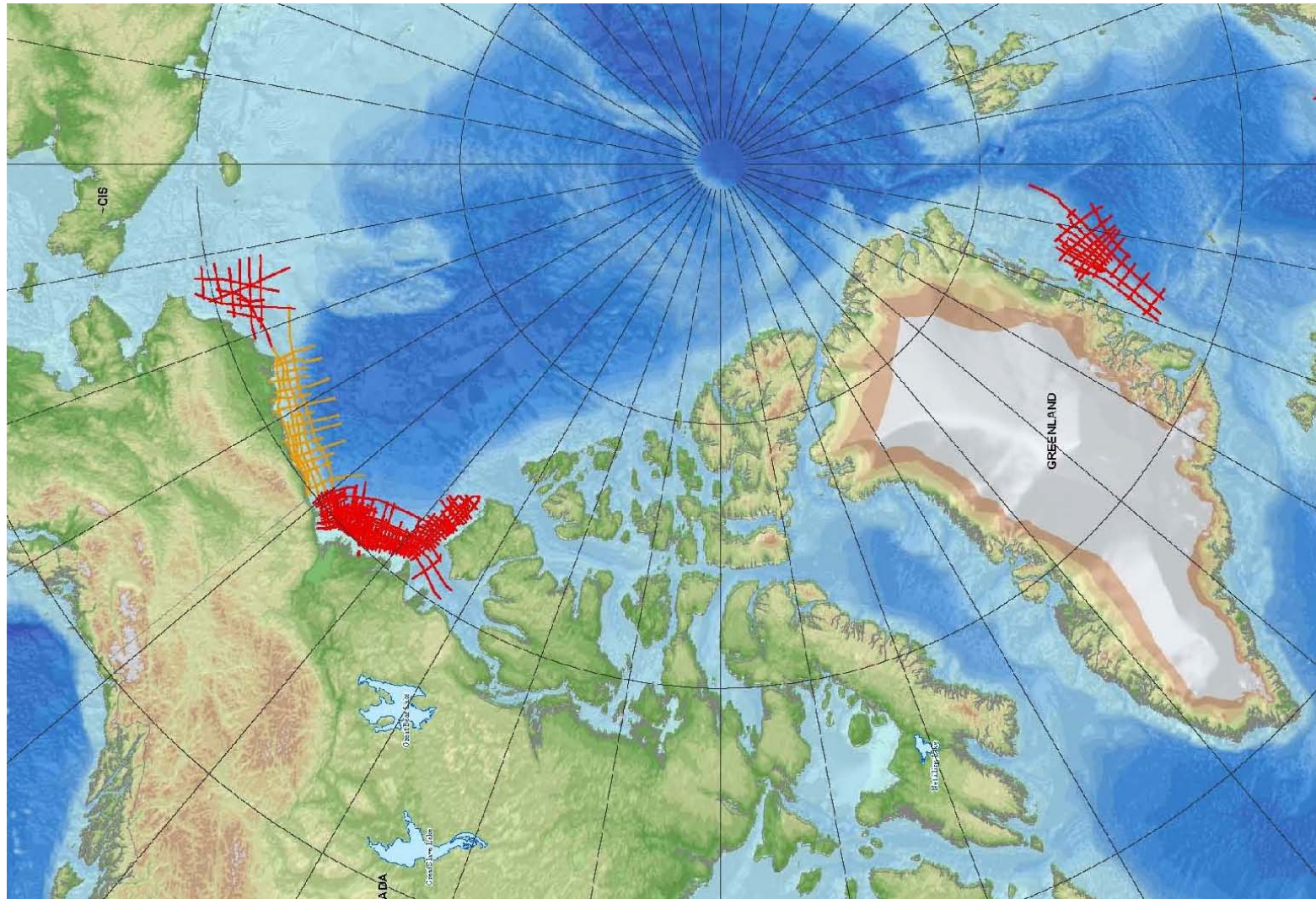




# Maritime Ice Management Experience



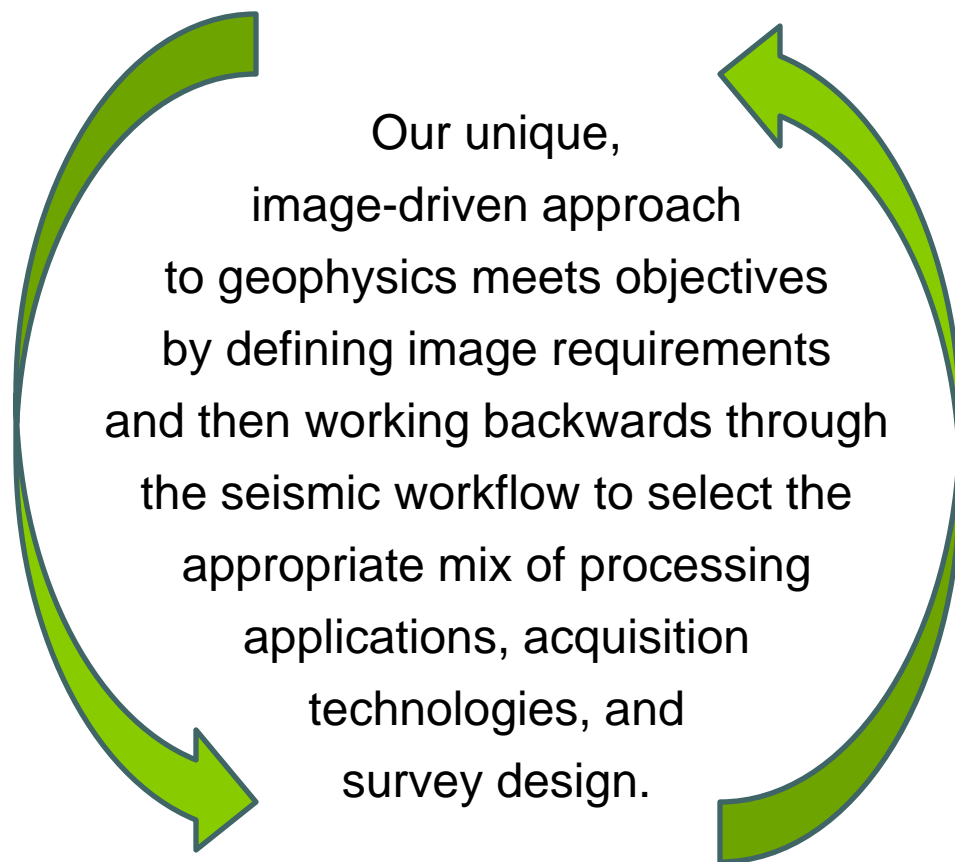
# 2006 - 2010 Survey Maps



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## Unique, Image-Driven Approach



# Survey Vessels

- Suitable Vessels

- Geo Explorer - Seismic Vessel
  - DNV 1A1 ICE-1A\* E0



- Talagy – Ice Breaker
  - Russian Icebreaker7



# The Method Of Acquisition

- ISS

- Arctic Operational Experience
  - Ice Management
  - Project Execution
- Handling Equipment
  - Ice Skeg
  - Source flotation

- GX Technology

- Arctic Focused Noise Removal
  - Ice Breaker Noise
  - Rugose Base Ice Noise
  - Submerged Permafrost
  - Lerner Noise
  - Coherent Seismic Interference



- MISD

- DigiStreamer
  - Continuous recording
  - Non foam matrix design
- DigiFin
  - Cable defense
- CompassBird
  - Upgraded for Arctic conditions
    - Cold conditions
    - Magnetic declination

- Concept Systems

- Orca
  - Integration with "Ice Nav"
  - Ghost Streamer capable
  - High latitude flexible

# Ice Encountered



1/10<sup>ths</sup> Ice



2/10<sup>ths</sup> Ice



3/10<sup>ths</sup> Ice



4/10<sup>ths</sup> Ice

# Ice Encountered



5/10<sup>ths</sup> Ice



6/10<sup>ths</sup> Ice



7/10<sup>ths</sup> Ice



8/10<sup>ths</sup> Ice



# Ice Encountered



9/10<sup>ths</sup> Ice



10/10<sup>ths</sup> Ice

# Survey Operations

## Ice Escort Operations



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# 2010 Survey Vessels

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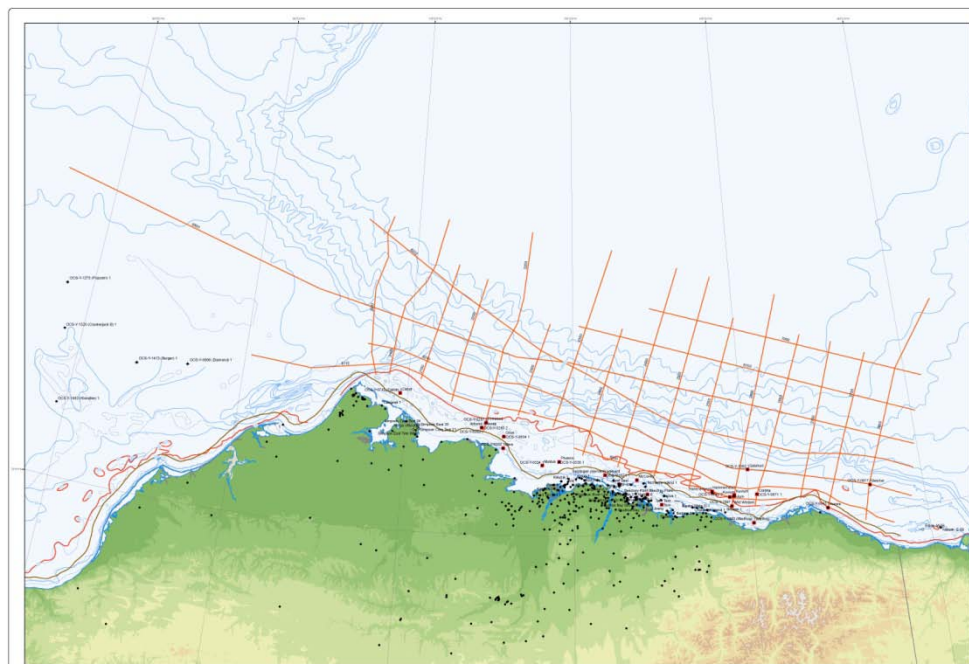


- Talagy – Ice Breaker
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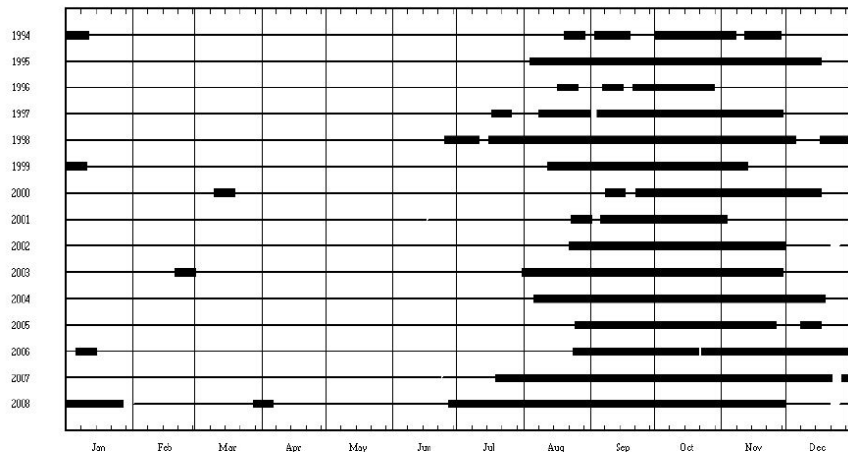
# 2010 BeaufortSPAN™ West Program

- **Proposed 6,811 kms**
- **Proposed Parameters**
  - **STREAMERS**
    - Streamer Length 9,000 m
    - Streamer Depth 9.5 m
  - **SOURCE ARRAY**
    - Volume: 4330 in<sup>3</sup>
    - Source Array Depth

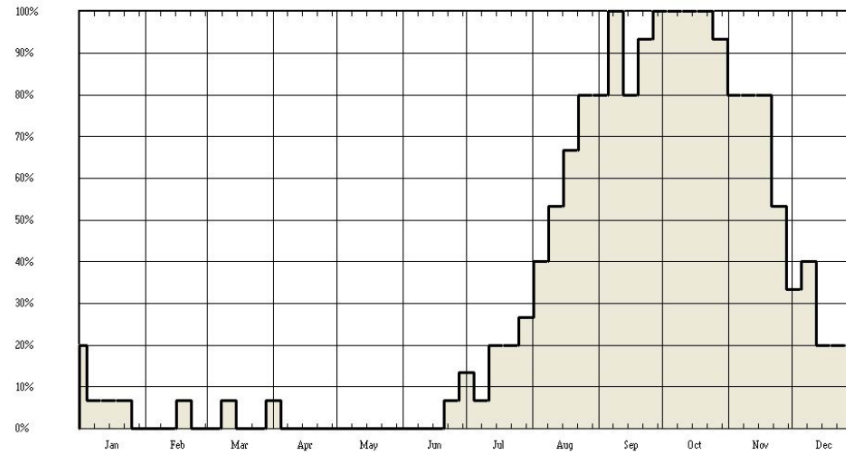


Acquisition in October & November 2010

# 2010 BeaufortSPAN™ West Trafficability



Fat Bars show when Defined Conditions Occur. Thin lines when they don't occur. Gaps = no data.  
 Latitude 71° 30'N and Longitude 148° 30'W  
 Fat bars indicate when All Ice is  $\leq 3/10$  in spring and when First Year Ice = to and  $> 30$  cm is  $\leq 8/10$  in fall.



Percentage Probability that Defined Operating Conditions Occur  
 Latitude 71° 30'N and Longitude 148° 30'W  
 Probability that concentration of All Ice is  $\leq 3/10$  in spring and First Year Ice = to and  $> 30$  cm is  $\leq 8/10$  in fall.

- The thick bars indicate when seismic could have been conducted over the past 15 years
- The mean season start date is Aug 2nd and end date is Nov 29th.

Forecast % chance of successes for an [IA] Arctic Solution survey during October & November 2010

Calculated based on when ALL ICE is  $\leq 3/10$  in spring and when First Year Ice is  $\leq 30$  cm and is  $\leq 8/10$ ths in the fall.

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# Stakeholder Outreach

- Met with NSB Wildlife Department (Robert Suydam) on December 15, 2009
- Attended AEWC 2010 Annual Captains' Mini Convention to discuss 2010 CAA (February 12 & 13, 2010)
- Leadership meetings March 16, 17, & 18, 2010 (details on next page)
- NMFS Open Water Meeting (March 22 – 24, 2010)
- NMFS Peer Review Meeting (March 25, 2010)
- Public meeting in Barrow, Nuiqsut, and Kaktovik (scheduled for April, 2010)



# Stakeholder Outreach – Leadership Meetings

- Met with Special Assistant to NSB Mayor Itta (March 16<sup>th</sup>)
- Nuiqsut (joint meeting March 17<sup>th</sup>)
  - KSOP, Inc.
  - Native Village of Nuiqsut
  - Mayor of City of Nuiqsut (Mr. Thomas Napageak, Jr., Mayor)
  - Representative of Kuukpik Corporation
- Barrow (March 18<sup>th</sup>)
  - NSB Planning Commission
  - Native Village of Barrow
  - ICAS
  - NSB Department of Wildlife Management (Taquulik Hepa, Harry Brower)

# Stakeholder Outreach – Leadership Meetings

- Kaktovik
  - Scheduled meeting with Kaktovik Mayor (Annie Tikluk) and Kaktovik Inupiat Corporation (Phillip Tikluk) for March 16<sup>th</sup>, but it was canceled due to illness
  - Was unable to schedule appropriate date/time to meet with Native Village of Kaktovik in March due to other planned activities in Kaktovik – they requested we meet with them in April.

# Conflict Avoidance Agreement

- ION is interested in signing a Conflict Avoidance Agreement with the AEWC and the effected villages.
- ION will not participate in the open water CAA that has been drafted and distributed to the 2010 operators.
- We instead look to sign a CAA tailored to our survey timing and scope.
- To this end we have drafted a CAA that would be acceptable to ION based on the AEWC draft and have forwarded it to the AEWC for review.

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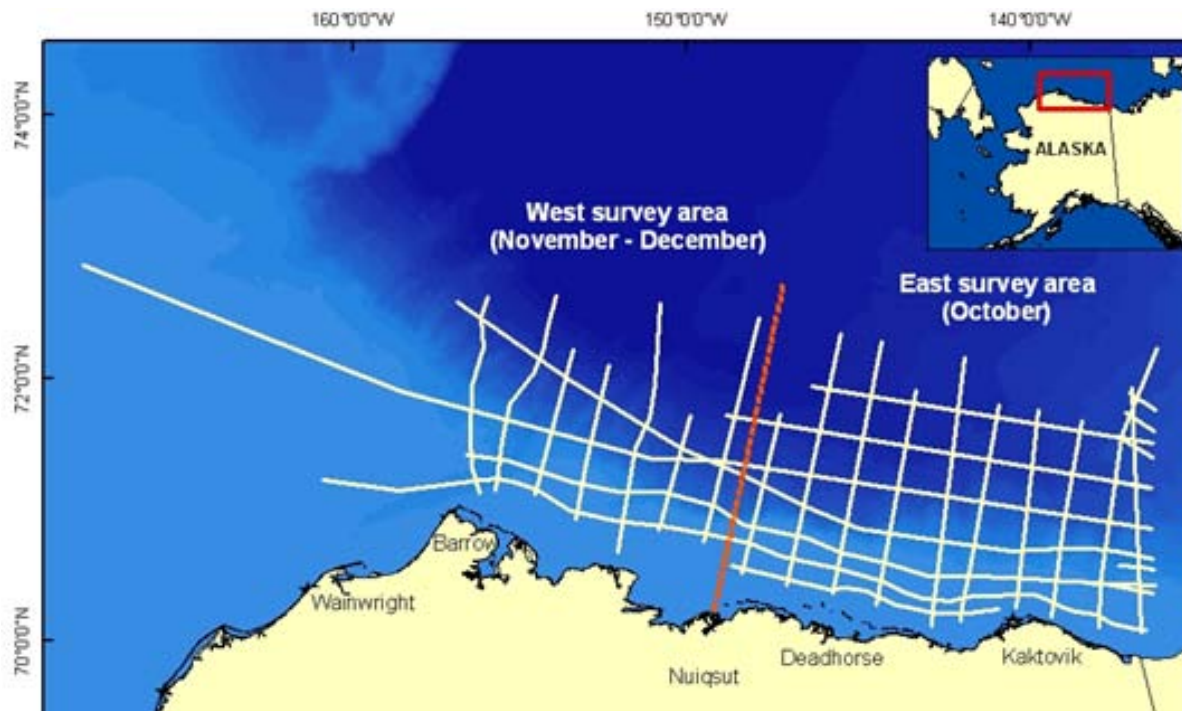
# Marine Mammal Monitoring

- Objectives:
  - Implement mitigation measures
  - Document marine mammal occurrence and activity near seismic operations
  - Collect baseline data on marine mammal occurrence in study area



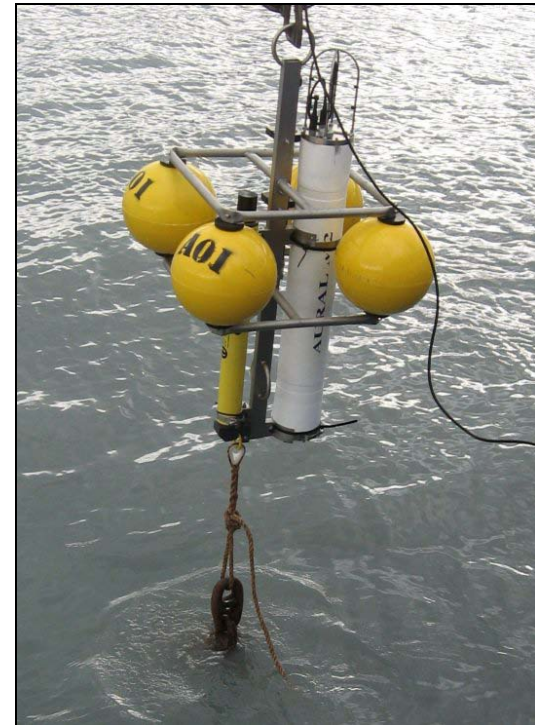
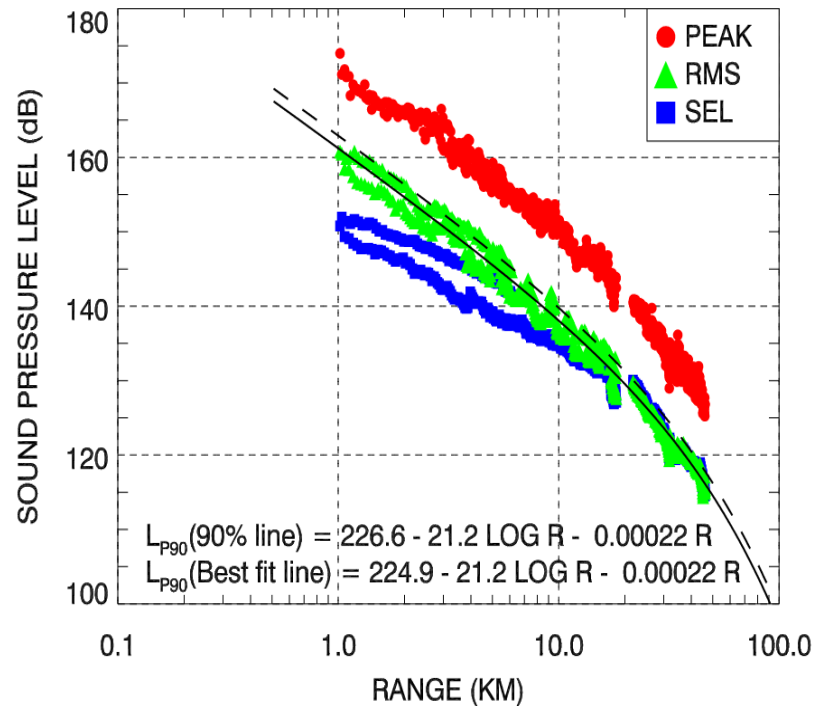
# Marine Mammal Monitoring

- Primary mitigation measure is timing
  - Start 1 Oct; end late Nov-Dec
  - Avoid Oct bowhead hunt in Barrow and most migrating whales by working East to West



# Marine Mammal Monitoring

- Sound Source Verification
  - Conducted prior to or early in the survey
  - Revise safety radii as needed for implementation by MMOs



# Marine Mammal Monitoring

- Vessel based observers
  - 3 on ice-breaker (operating ahead of source vessel)
  - 1 on source vessel
- On watch for:
  - all daylight seismic operations
  - most daylight non-seismic operations
  - 30 min before, and during ramp ups





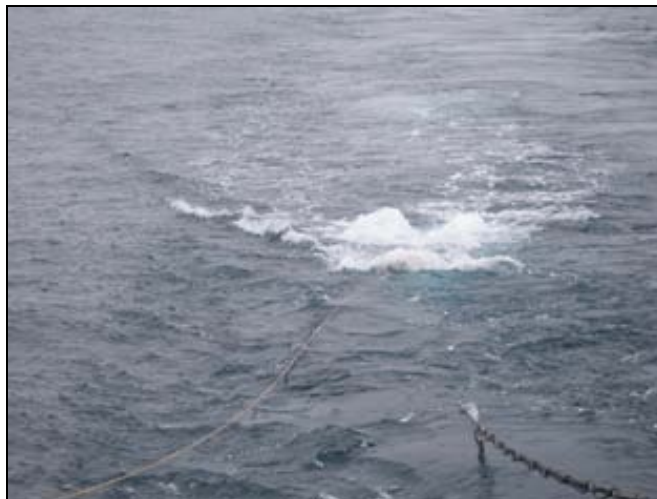
# Marine Mammal Monitoring

- Ensure safety radii are clear of respective marine mammals for 30 minutes prior to and during ramp ups
  - 180 dB zone for cetaceans and walruses
  - 190 dB zone for pinnipeds and polar bears
  - Start ups only performed when full safety radii are visible during daylight for  $\geq 30$  min



# Marine Mammal Monitoring

- Continually monitor safety zones during daylight airgun activity
  - Power down to mitigation gun if a marine mammal is sighted within or likely to enter the full airgun array safety radii
  - Shut down of all airguns if a marine mammal is sighted within or likely to enter the mitigation airgun safety radii



# Marine Mammal Monitoring

- Implement any additional mitigation measures stipulated by NMFS and USFWS IHAs
- Big-eye binoculars for use during daylight
- Infrared camera (FLIR) on ice-breaker for testing during darkness



# Marine Mammal Monitoring

- 90-day technical report
  - Address requirements of permits and agreements
  - Monitoring effort
  - Marine mammal sightings (e.g., species, numbers, locations, age/size/gender, environmental correlates)
  - Description of power downs, shut downs, ramp up delays
  - Analyses of factors influencing detectability of marine mammals
  - Estimate exposure of marine mammals to industry sounds
  - Analyses of effects of seismic operations (e.g., on sighting rates, sighting distances, behaviors, movement patterns)

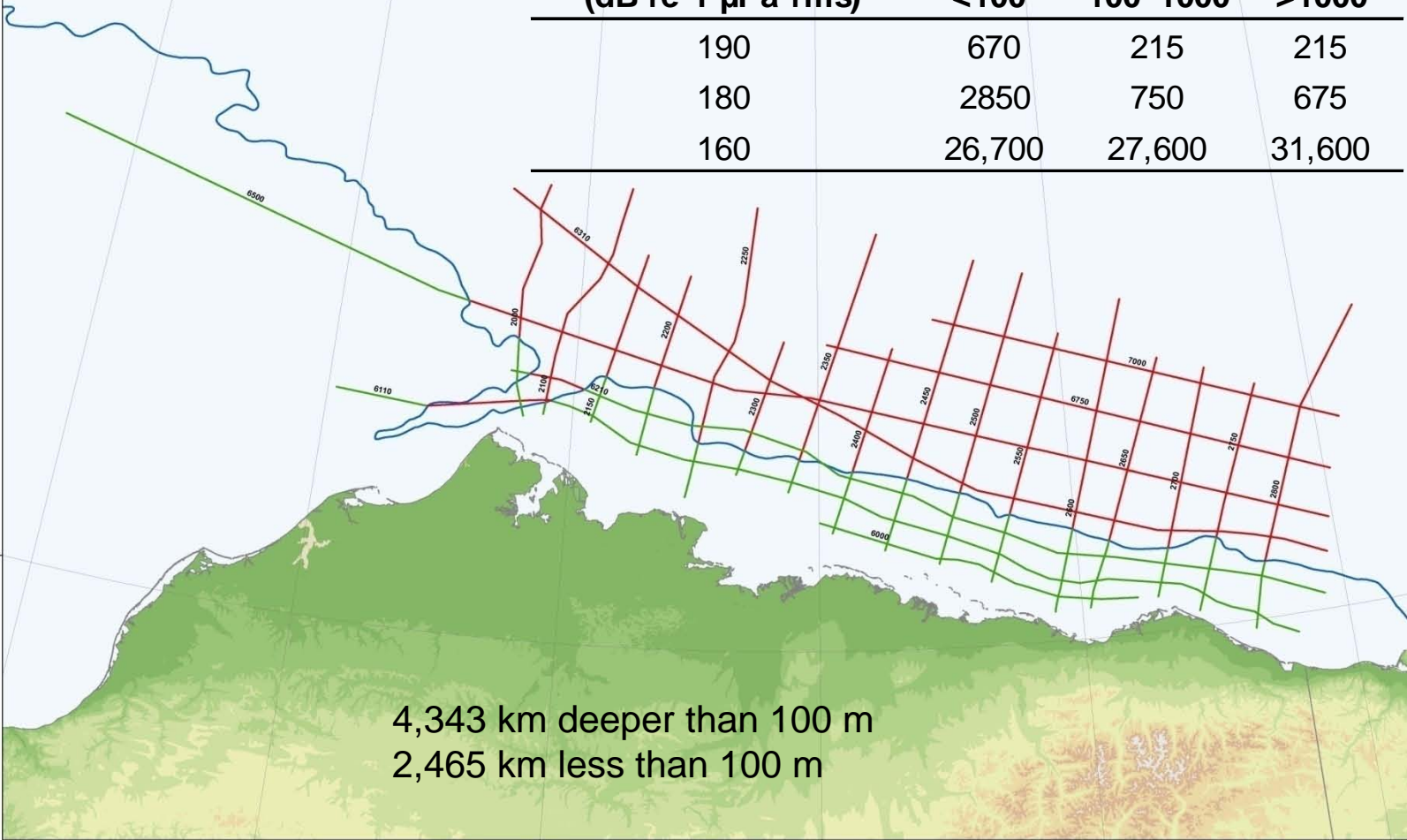
# Marine Mammal Monitoring

● Modeled Sound Radii

Received sound level  
(dB re 1  $\mu$ Pa rms)

Water depth (m)

	<100	100–1000	>1000
190	670	215	215
180	2850	750	675
160	26,700	27,600	31,600



4,343 km deeper than 100 m  
2,465 km less than 100 m

Legend  
BeaufortWest\_v6 100 m break  
Deep  
— Greater than 100 meters (4,343 km)  
— Less than 100 meters (2,465 km)  
— 100 meters

Prepared by: Ion Geomatics  
Map: BeaufortSPAN West (v6) 100 m break  
Scale: 1:500,000  
Projection: UTM  
Datum: NAD83  
Units: Meters  
Date: 10/2010



# Marine Mammal Monitoring

- Estimated Exposures to  $\geq 160$  dB rms

Species	<200 m		200–1000 m		>1000 m		Total	
	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.
<b>East survey area</b>								
<b>Odontocetes</b>								
Beluga	47	188	368	1471	965	3859	1380	5518
Harbor porpoise	3	12	1	4	6	25	10	40
<b>Mysticetes</b>								
<i>Bowhead whale</i>	741	2964	7	28	6	25	754	3017
Gray whale	3	12	1	4	6	25	10	40
Minke whale	3	12	1	4	6	25	10	40
<i>Humpback whale</i>	3	12	1	4	6	25	10	40
<b>West survey area</b>								
<b>Odontocetes</b>								
Beluga	7	28	30	120	60	241	97	389
Harbor porpoise	4	17	1	3	4	16	9	36
<b>Mysticetes</b>								
<i>Bowhead whale</i>	111	444	1	2	4	16	115	462
Gray whale	4	17	1	3	4	16	9	36
Minke whale	4	17	1	3	4	16	9	36
<i>Humpback whale</i>	4	17	1	3	4	16	9	36

# Marine Mammal Monitoring

- Estimated Exposures to  $\geq 160$  dB rms

Species	<100 m		100–1000 m		>1000 m		Total	
	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.
<b>East survey area</b>								
Ringed seal	2237	4474	945	1891	25	50	3207	6415
Bearded seal	11	21	5	9	25	50	40	80
Spotted seal	3	5	1	2	6	12	10	20
Ribbon seal	3	5	1	2	6	12	10	20
<b>West survey area</b>								
Ringed seal	43633	54241	5734	7359	16	31	49382	61630
Bearded seal	15	30	5	10	16	31	36	72
Spotted seal	4	8	1	3	4	8	9	18
Ribbon seal	4	8	1	3	4	8	9	18

# ion

[ CHARGED WITH INNOVATION ]



vision



evolution



innovation



solution



collaboration