

CANAPE 2015 Research Cruise in the Beaufort Sea Aboard R/V Sikuliaq



Peter Worcester

Scripps Institution of Oceanography, University of California at San Diego

Workshop Polar Research - Research Vessel Operations in Polar Regions

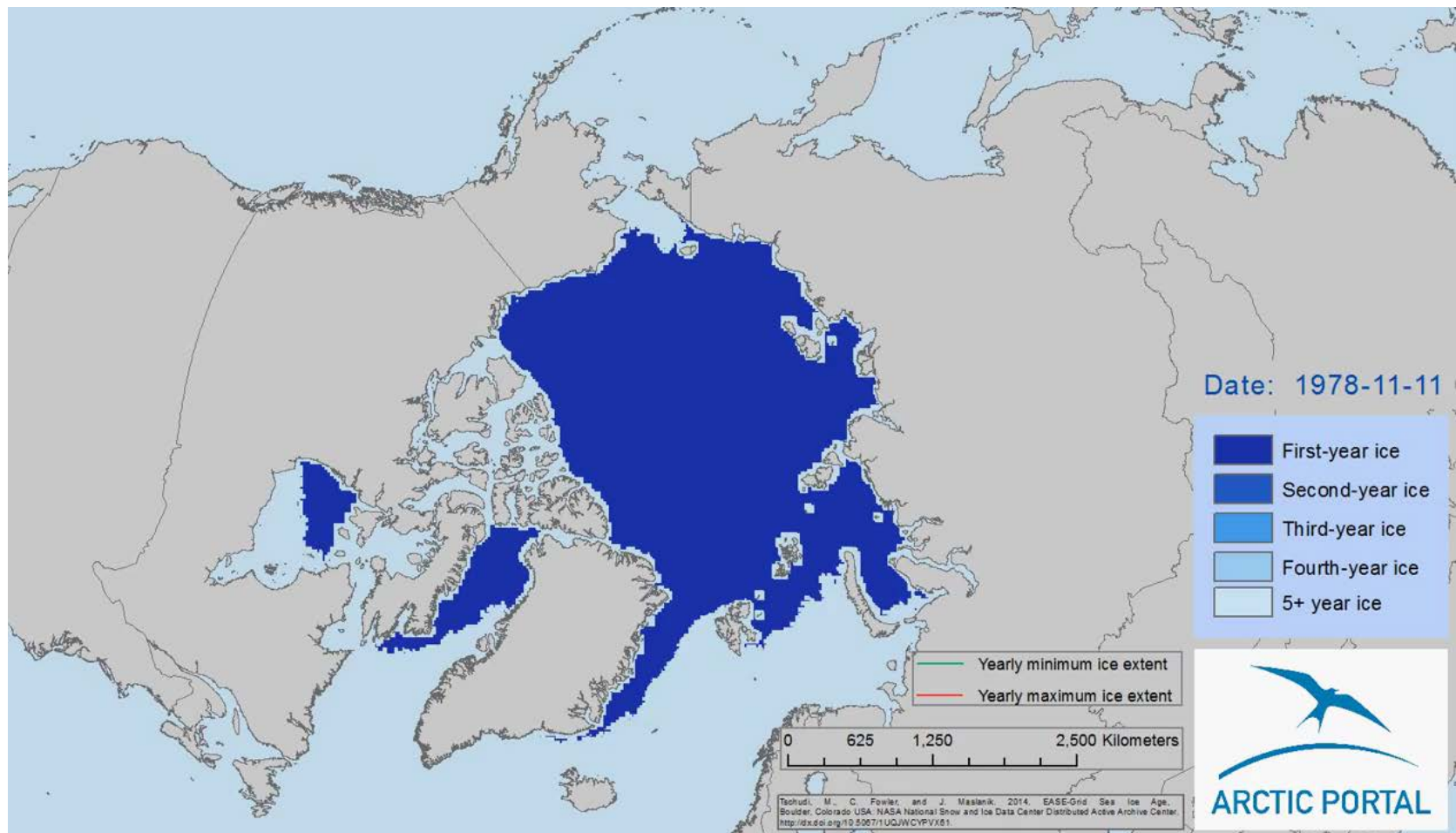
International Research Ship Operators Meeting

Scripps Institution of Oceanography

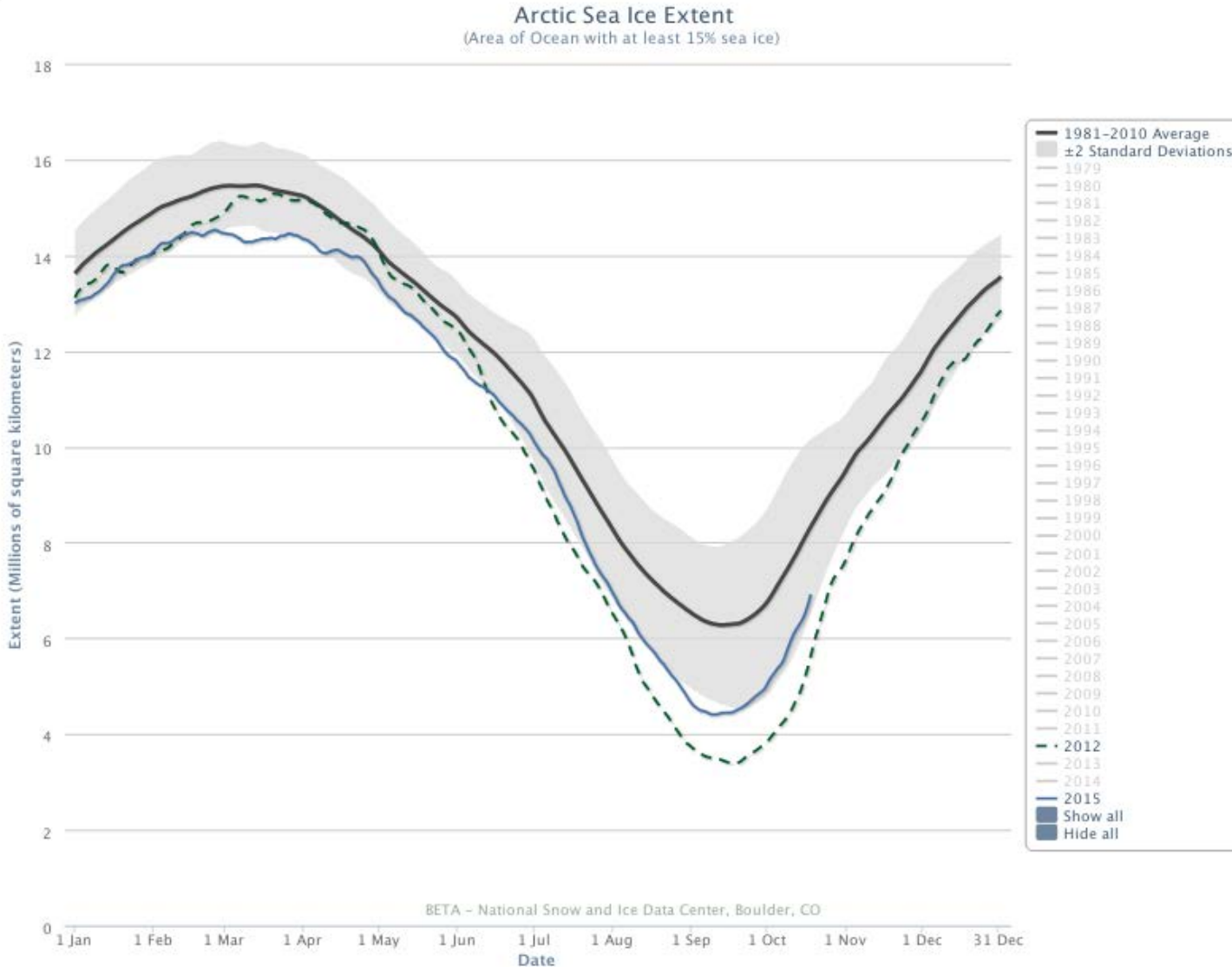
La Jolla, California

20 October 2015

Arctic sea ice extent and age 1978–2015



Arctic sea ice extent

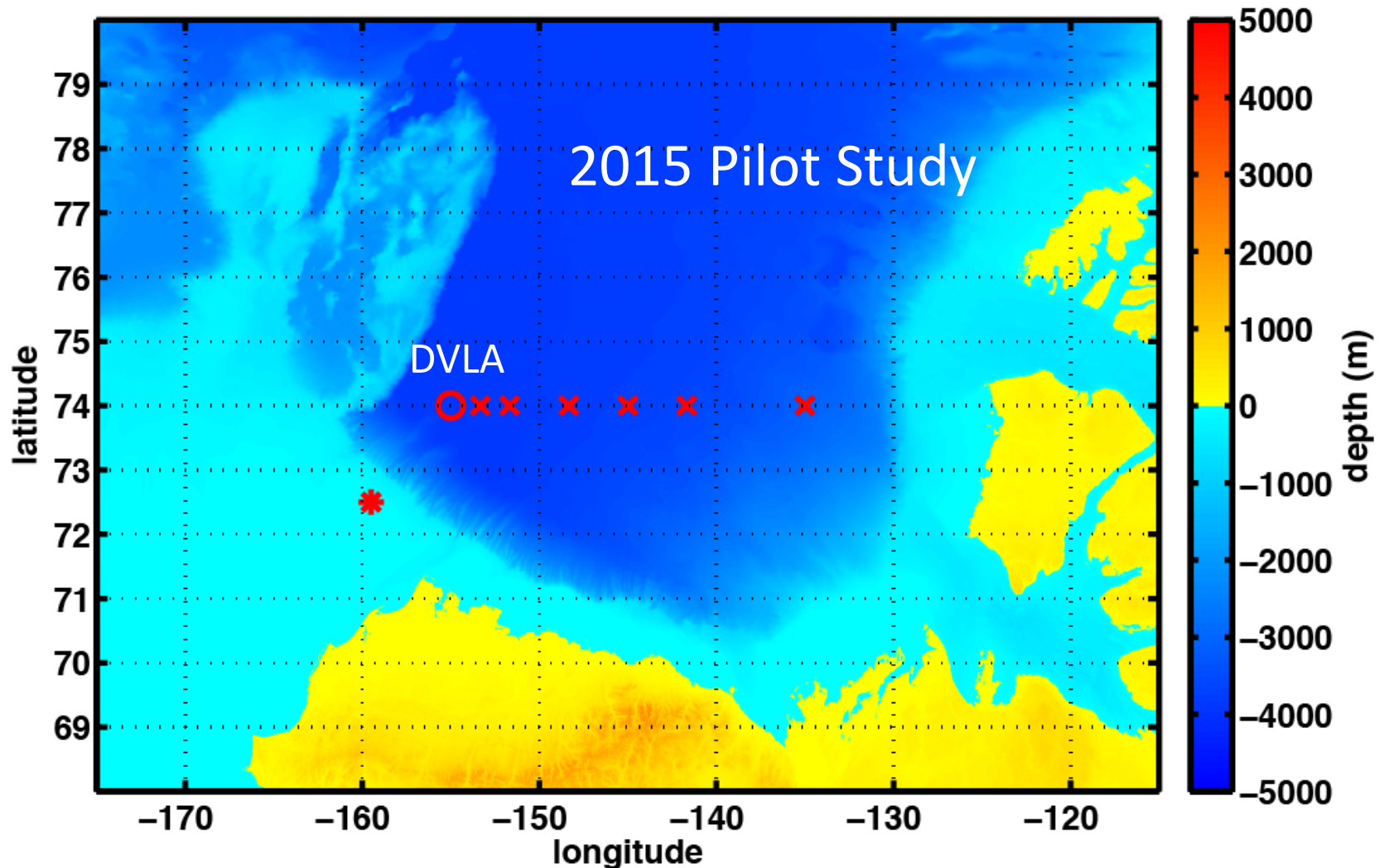


THAAW:

Thin-ice Arctic Acoustic Window

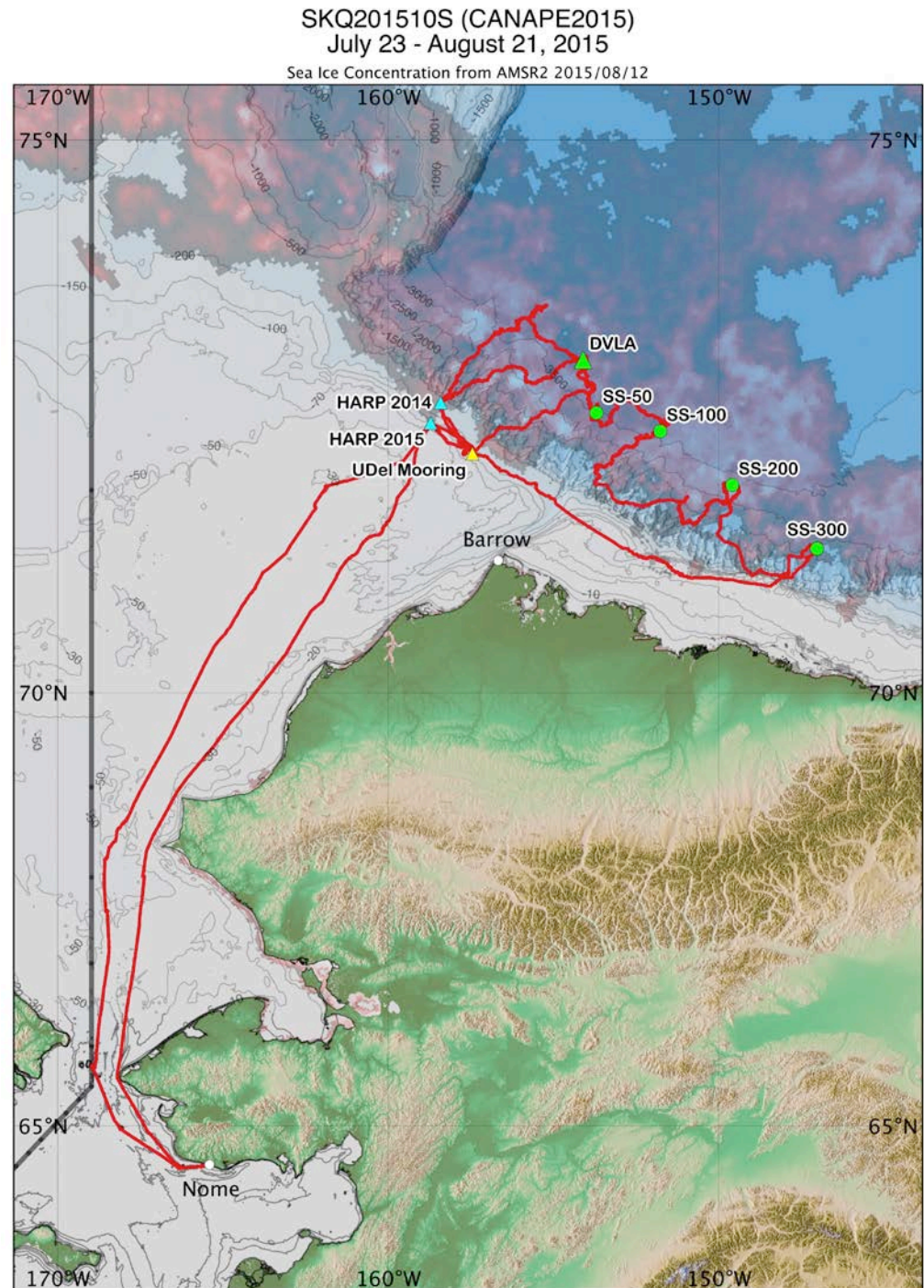
- Arctic now dominated by 1–2 year ice with reduced pressure ridging, resulting in lower transmission loss and allowing operation at higher frequencies.
- Reduced pressure ridging also results in more frequent periods of low ambient noise.
- Ice cover still present throughout much of the year, insulating the ocean from wind and solar forcing and preserving the stable Arctic acoustic channel.

Canada Basin Acoustic Propagation Experiment (CANAPE): The plan

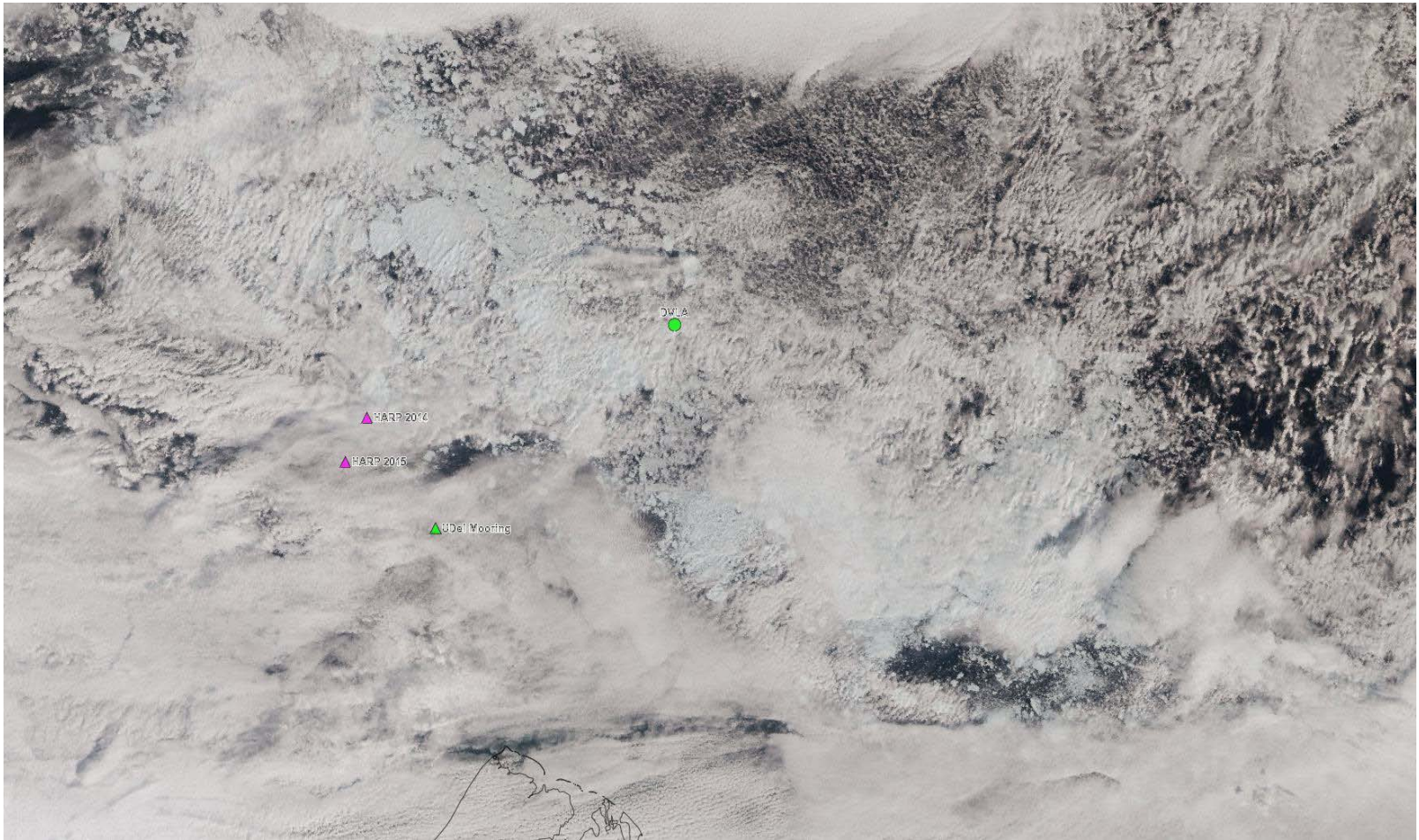


CANAPE 2015: The reality

July 18: Depart Dutch Harbor
July 21: Arrive Nome
July 23: Depart Nome
August 21: Arrive Nome

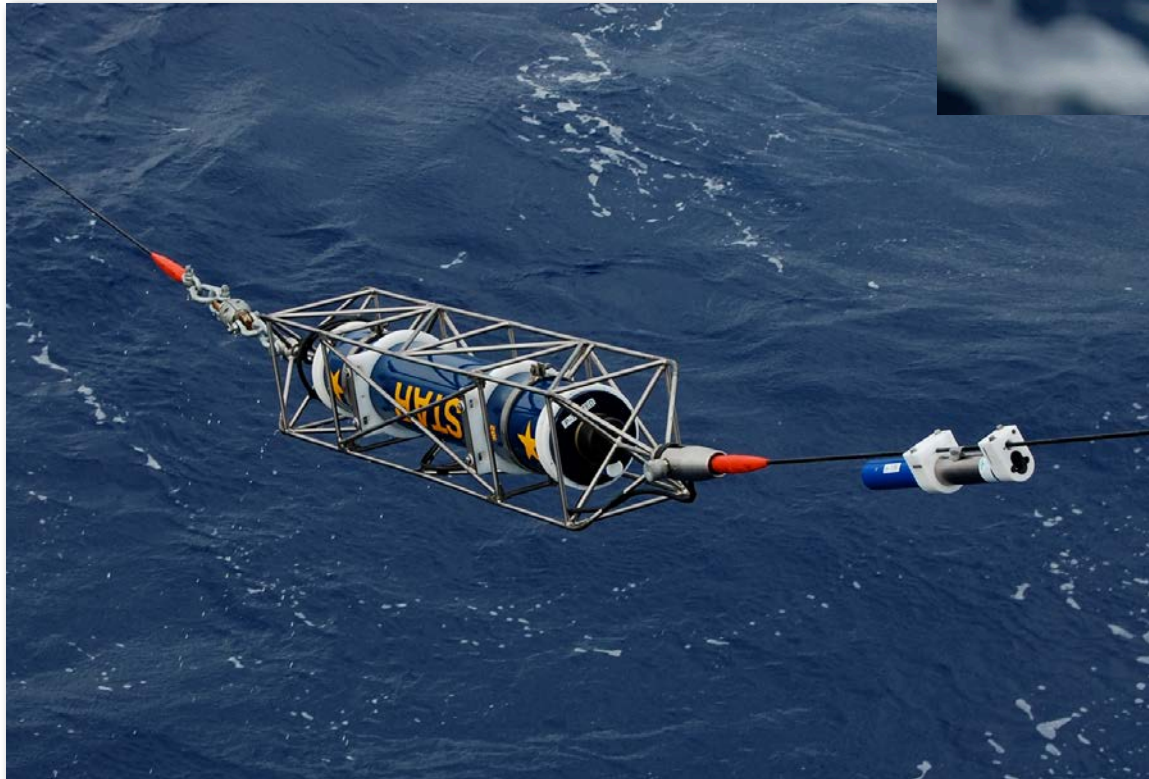
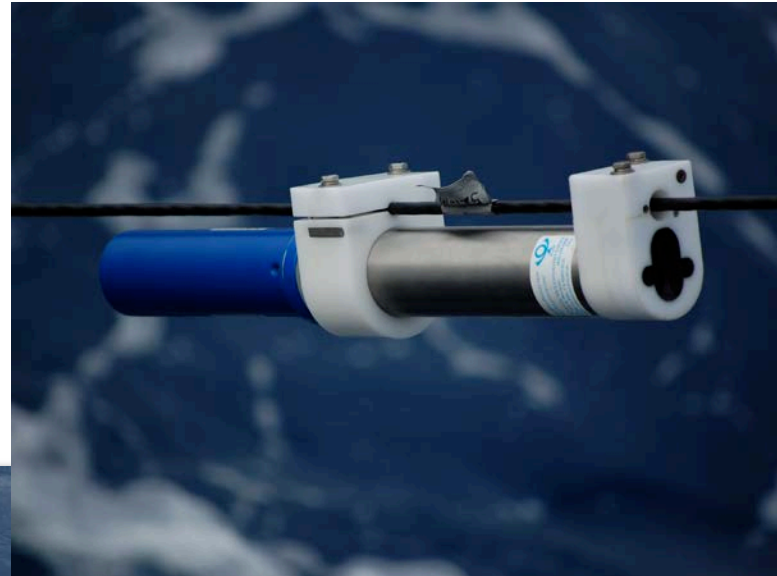


MODIS: 08-16-18:45 – 08-17-23:24



Credit: Steve Roberts

Distributed Vertical Line Array (DVLA)



Approach

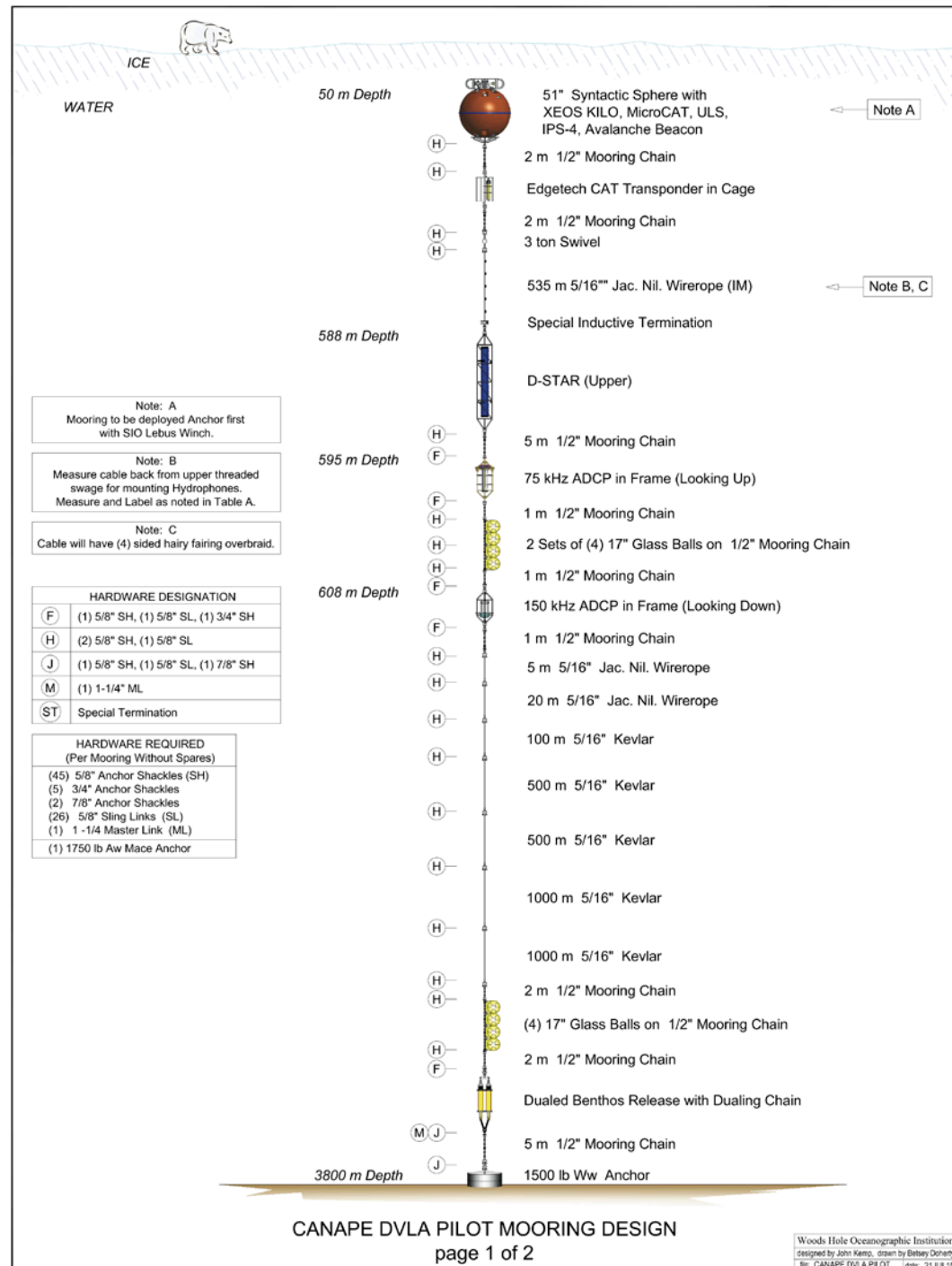
- Distributed, self-recording hydrophone modules
- Timing and scheduling provided by D-STAR controllers

Enabling technologies

- Flash memory modules that store gigabytes of data
- Inductively-coupled modems that use standard mooring wire

Distributed Vertical Line Array (DVLA)

- Depth ~ 60–600 m
- 60 Hydrophone Modules @ 9 m spacing
- Sample rate 1953.125 Hz
- Temperature $\pm 0.005^{\circ}\text{C}$
- LBL navigation system with four transponders



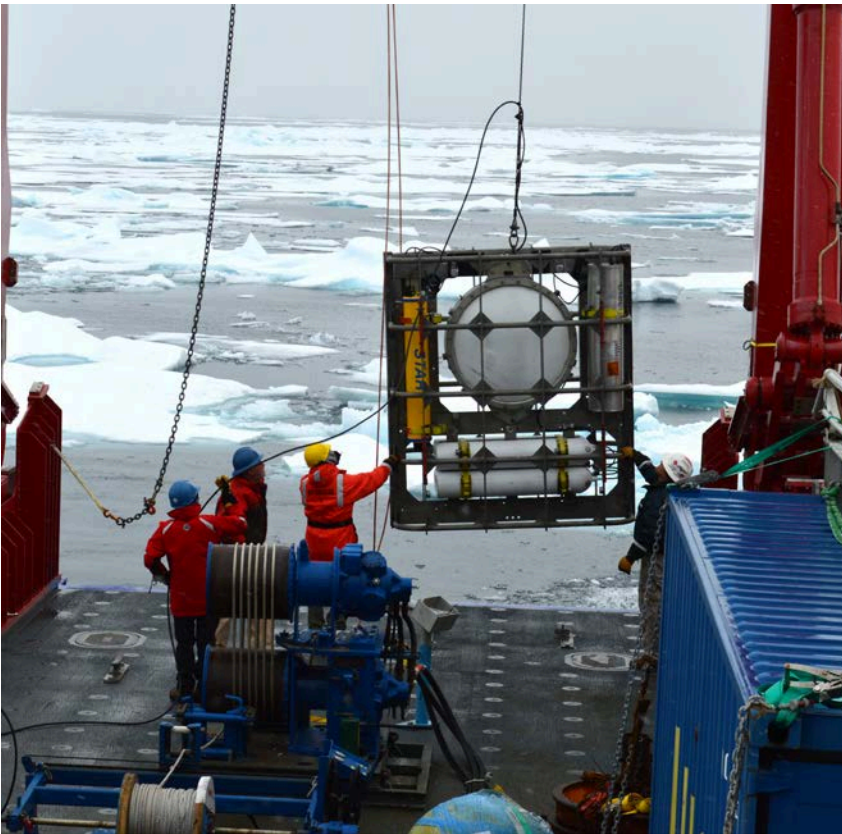
DVLA deployment



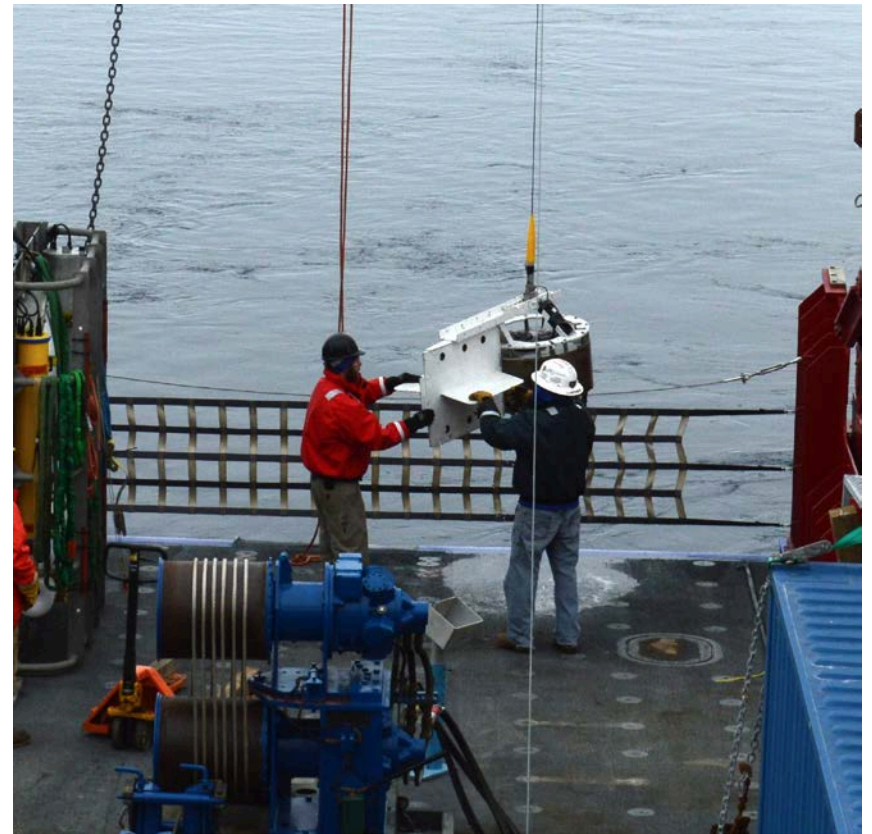
Credit: Justin Eickmeier

Ship stops: Acoustic sources

HLF-5 (250 Hz)



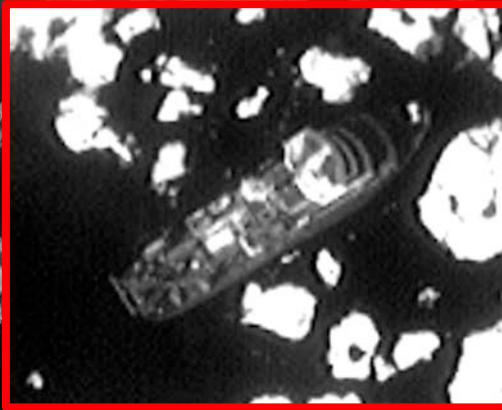
J15-3 (75 and 125 Hz)



DVLA Recovery

EROS-B satellite

Credit: Hans Graber



DVLA recovery



Credit: Alexandra Denby

Environmental compliance

U.S. Navy Record of Decision

NMFS Letter of Concurrence

NEGATIVE DECISION MEMORANDUM FOR
OFFICE OF NAVAL RESEARCH PARTICIPATION IN ACOUSTIC MEASUREMENTS IN THE
BEAUFORT SEA

- Ref: (a) Executive Order "Environmental Effects Abroad of Major Federal Actions," dated 4 January 1979
(b) DoD Directive 6050.7, "Environmental Effects Abroad of Major Department of Defense Actions," dated 31 March 1979
(c) Office of Naval Research Code 32 Preliminary Environmental Planning Work Sheet for the activity "Canada Basin Acoustic Propagation Experiment 15 (CANAPE 15)"
(d) "ONR CANAPE15 Acoustic Effects Analysis", Naval Undersea Warfare Center, May 11, 2015.
(e) Atlantic Fleet Testing and Training EIS/OEIS, November 2013.
(f) Letter of Concurrence from National Marine Fisheries Service (Alaska Regional Office) to Dr. Frank Herr, ONR Code 32.
(g) Letter from Foreign Affairs Trade and Development Canada to Roberta Barnes, U.S. Department of State
1. From July 23 to August 22, 2015, the Office of Naval Research (ONR) will conduct acoustic research in the exclusive economic zone of the United States, international waters, and the exclusive economic zone of Canada. A single moored receive acoustic array will be moored to the ocean bottom approximately 60 nmi from the coast of Alaska. Another receiving array will be placed approximately 180 nmi from the coast of Alaska, and acoustic sources will be deployed at approximately 180-250 nmi from the coast of Alaska. This memorandum documents the conclusion that this oceanographic and acoustic research does not constitute a "major federal action" under reference (a) and, therefore, neither an overseas environmental assessment (OEA) nor overseas environmental impact statement (OEIS) is required. The proposed action is not a major federal action because it involves the routine use of standard oceanographic equipment that does not expose marine life in the global commons to acoustic received levels that would constitute takes under the Marine Mammal Protection Act (MMPA) or affect Endangered Species Act (ESA) protected species.
 2. The purpose of the proposed action is to obtain information about acoustic propagation and ambient noise in the Arctic and determine the limits to acoustic signal processing in the Arctic imposed by ice and ocean processes. The acoustic sources are the HLF-5 (194 dB at 250 Hz) and the J-15-3 (180 dB at 50 or 125 Hz). The moored receiving arrays will be used to receive these acoustic transmissions. The Navy Acoustic Effects Model (NAEMO) was used to calculate the received levels for 6 species of marine mammals, including the Bowhead whale (Endangered) and Ringed Seal (Threatened). The NAEMO model estimated 0.00 potential exposures for all species, with the exception of Ringed Seal for which the 0.02 animals were predicted to be exposed to levels for which a behavioral response would be considered, with the only non-zero value being 0.02 Ringed Seals.

In addition to these sources, acoustic Doppler current profilers at 75 kHz and 150 kHz will be employed. These sources are considered to be "de minimis" under Navy environmental planning documents such as reference (e) given their very short pulse lengths, very low duty

Juneau, Alaska 99802-1668

July 22, 2015

Dr. Frank Herr
Office of Naval Research
875 North Randolph Street, Suite 1425
Arlington, Virginia 22203-1995

Re: Canada Basin acoustic propagation experiment (CANAPE) pilot study, NMFS #AKR-2015-9475

Dear Dr. Herr:

The National Marine Fisheries Service (NMFS) has completed informal consultation under section 7(a)(2) of the Endangered Species Act (ESA) regarding the Department of the Navy's (Navy) proposed Canada Basin acoustic propagation experiment (CANAPE) pilot study in the Beaufort Sea, in and outside of the Exclusive Economic Zone north of Alaska (see Figure 1). The National Science Foundation (NSF) is proposing to allow the use of its research vessel *Sikuliaq* for the proposed CANAPE project. This project is considered to be a military readiness activity as defined in section 315(f) of Public Law 107-314; 16 U.S.C. 703 note.

NMFS received your June 8, 2015, request for concurrence that the proposed action may affect, but is not likely to adversely affect, the endangered bowhead whale (*Balaena mysticetus*) or the threatened Arctic ringed seal (*Phoca hispida hispida*). Based on our analysis of the information you provided to us and additional literature cited below, NMFS concurs with your determination. A complete administrative record of this consultation is on file in this office.

The Navy determined that this project will have no effect on proposed critical habitat for the Arctic ringed seal.

Consultation History

On June 11, 2015, NMFS requested more information about the project and provided recommendations for mitigation measures via email. The Navy provided, by email, additional information about the project on June 19. During a phone call with the Navy on June 29, NMFS requested additional information about the Navy's modeling efforts and project activities. The Navy provided, by email, information about modeling efforts and project activities on July 1, 2, 6, and 7. NMFS and Navy staff participated in a conference call on July 8, and additional information from the Navy was provided, by email, to NMFS on the same date. NMFS and Navy staff participated in conference calls on July 14, 16, and 17, and the Navy provided additional project information on July 15, 16, and 17.

Predicted potential exposures

- The Navy Acoustic Effects Model (NAEMO) was used to calculate the received levels from the source transmissions for 6 species of marine mammals, including the Bowhead whale (Endangered) and Ringed Seal (Threatened).
- The NAEMO model estimated 0.00 potential exposures for all species, with the exception of Ringed Seal for which the 0.02 animals were predicted to be exposed to levels for which a behavioral response would be considered...

ESA informal consultation

- ONR engaged in informal consultation under Endangered Species Act Section 7 with the Alaska Regional Office of the National Marine Fisheries Service.
- The effect of vessel movement, object deployment, entanglement, vessel noise and acoustic transmissions were all analyzed.
- As a result of the consultation process, a mitigation plan for operating the acoustic sources was recommended by the Alaska Regional Office.

Mitigation measures (1)

- Two protected species observers will be present before and during sonar activities.
- There will be a 500-m exclusion zone for operation of sonar sources.
- The observers will scan the zone for the presence of marine mammals (1) for 30 minutes prior to the start of sonar activity and (2) throughout the sonar activity to ensure that marine mammals do not enter the exclusion zone.

Mitigation measures (2)

- If a marine mammal enters the exclusion zone during sonar activities (1) when on/off control of the sources is possible (i.e., at depths < 330 m), sonar activities will cease immediately and (2) when on/off control is not possible (i.e., for the HLF-5 source at depths ≥ 330 m), the source will be pulled up and shut off upon completion of a 10-minute transmission.

CANAPE: The Movie