

Acoustics & Technology: Knowledge for Scientific Conservation and “Management”



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The Ocean is Alive with the Sounds of Life.



Low-frequency Sounds Travel Very Far in the Ocean: Explosions, Whales and Ships



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Basic Messages

Problem: Activities (i.e. shipping noise) impose large-scale risks to ocean acoustic ecosystems.

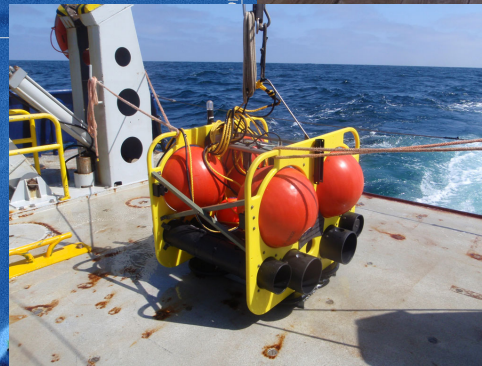
- Present regulatory paradigm is not based on best available scientific concepts and/or evidence.**
- We know how to calculate cumulative noise environments (science and technology).**
- We know how to conceptually translate cumulative noise into an ecological cost.**

**Actually, it's not about noise, whales and science.
It's about us. Social and political will.**

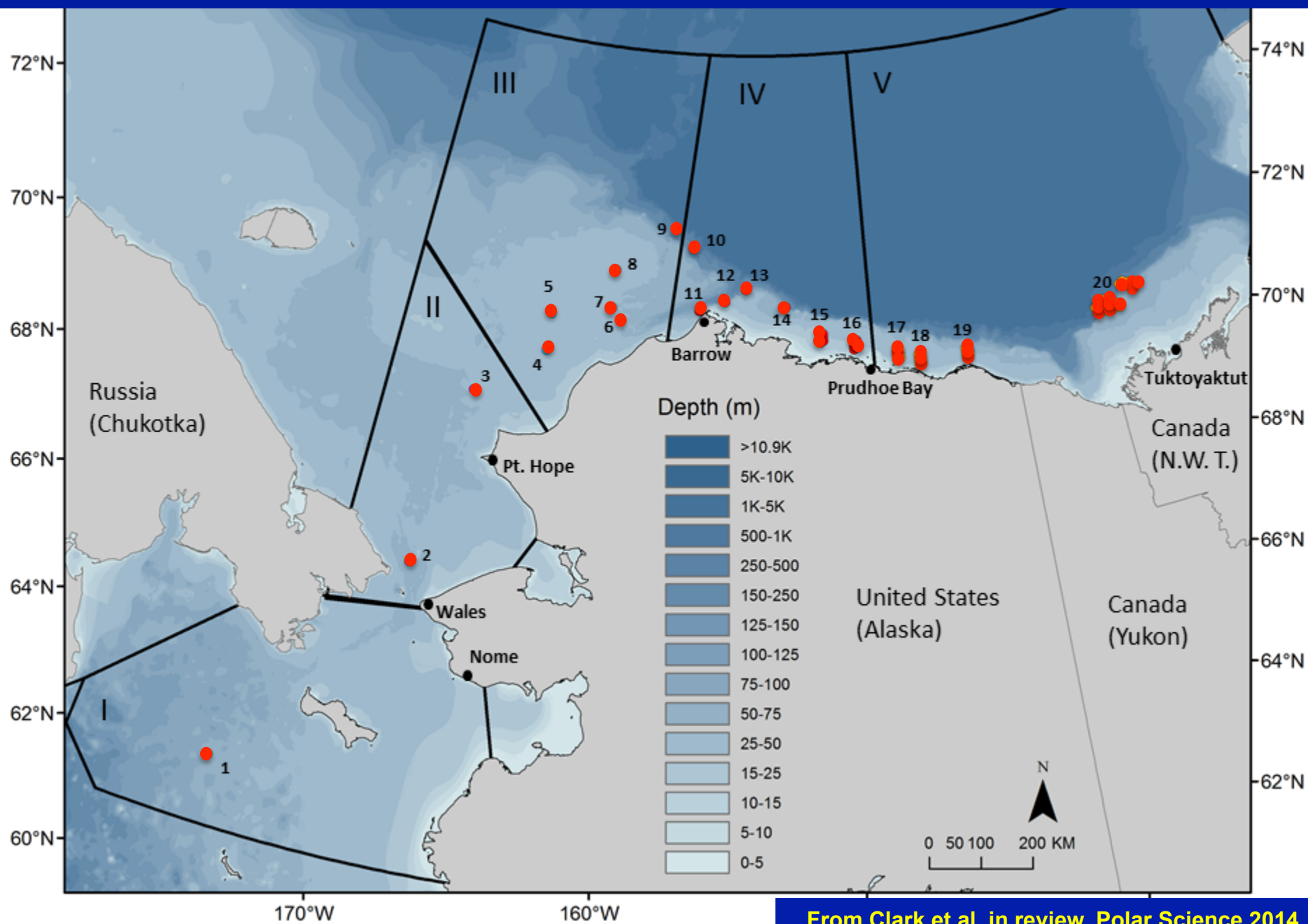
“We” collect very large amounts of acoustic data.



Acoustic mouse traps

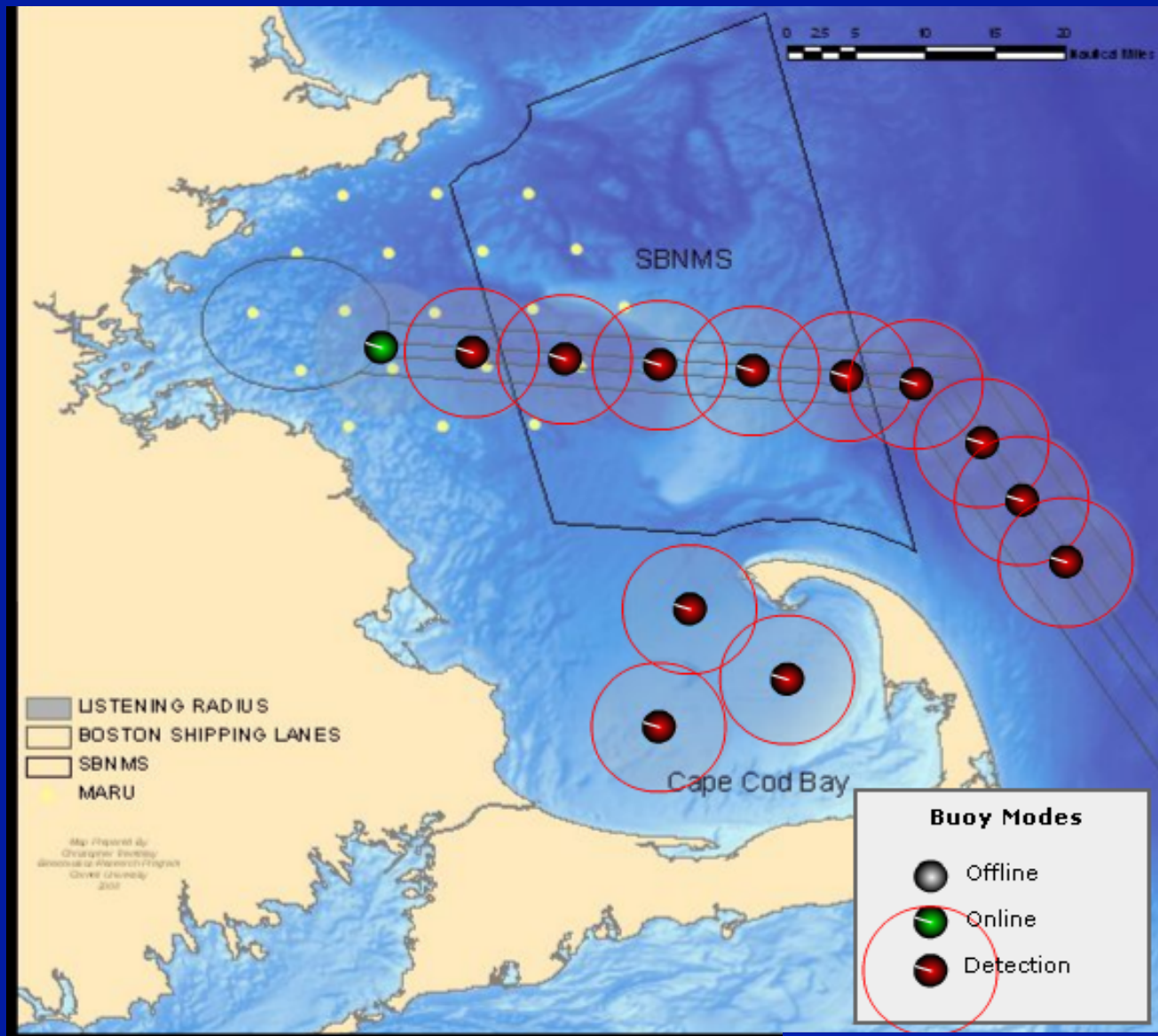


The Arctic



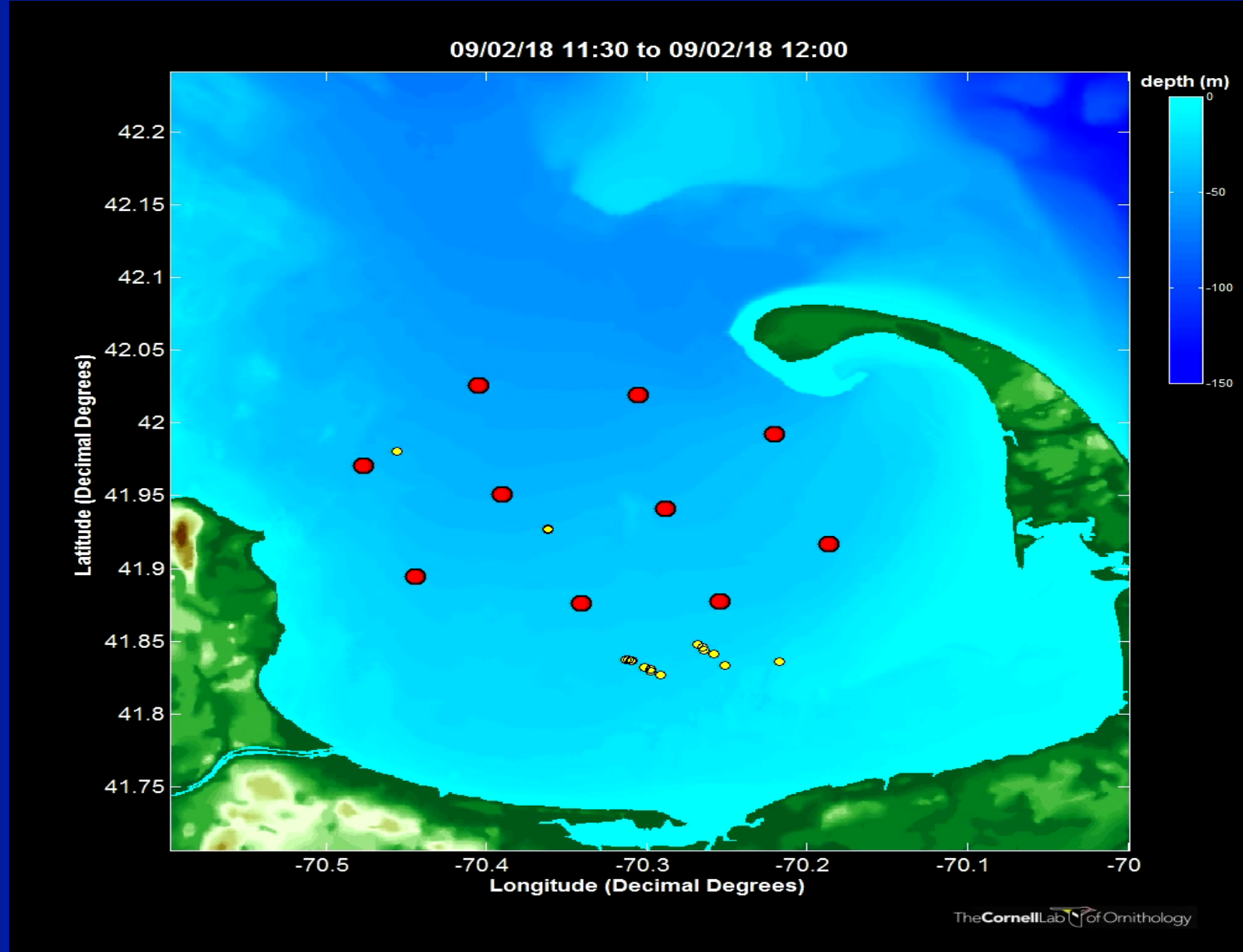
From Clark et al. in review, Polar Science 2014

We Monitor the Ocean in Real-time.
<http://www.listenforwhales.org/>



Team Players
Cornell
Woods Hole
NOAA
Excelerate Energy
Neptune LLC
IFAW
NEA
CCS

Acoustic Location-Tracks of Calling Right Whales

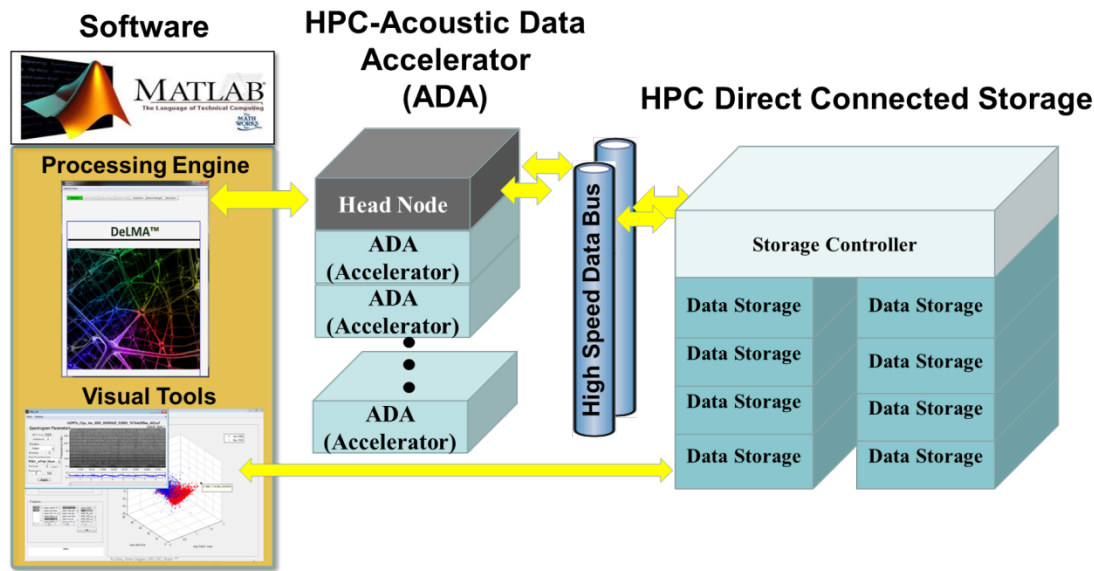


The Mission

There are advanced technologies for automatically detecting, locating, tracking and counting acoustically active marine mammals using BIG DATA at ecologically meaningful scales.

“Beam me up, Scottie!”

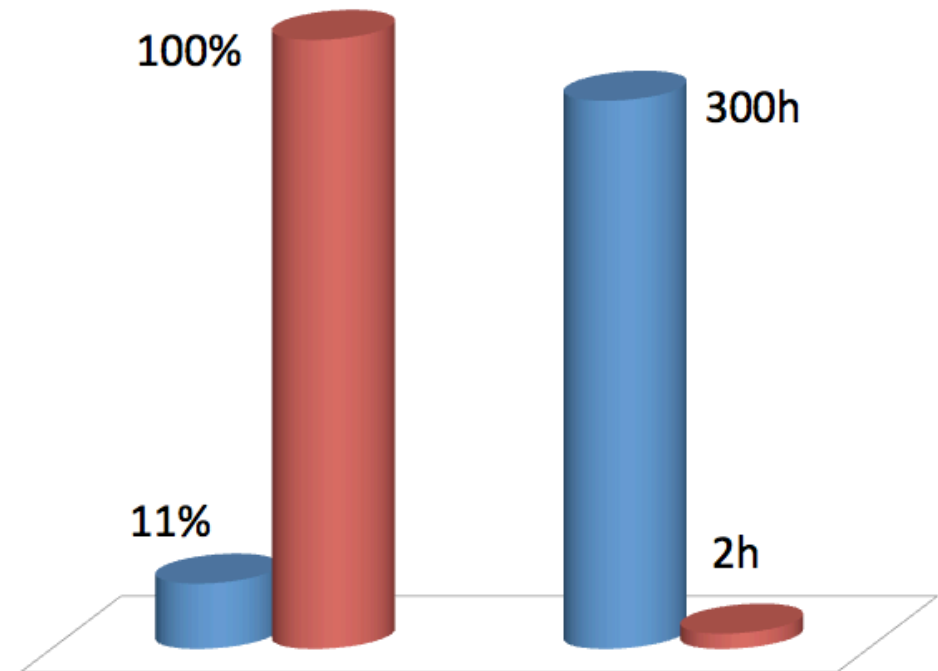
High Performance Computer (HPC) – Detection Accelerator



GPU C410x expansion



**HPC: 100% of the data in 2h
Vs. 11% of the data in 300h**

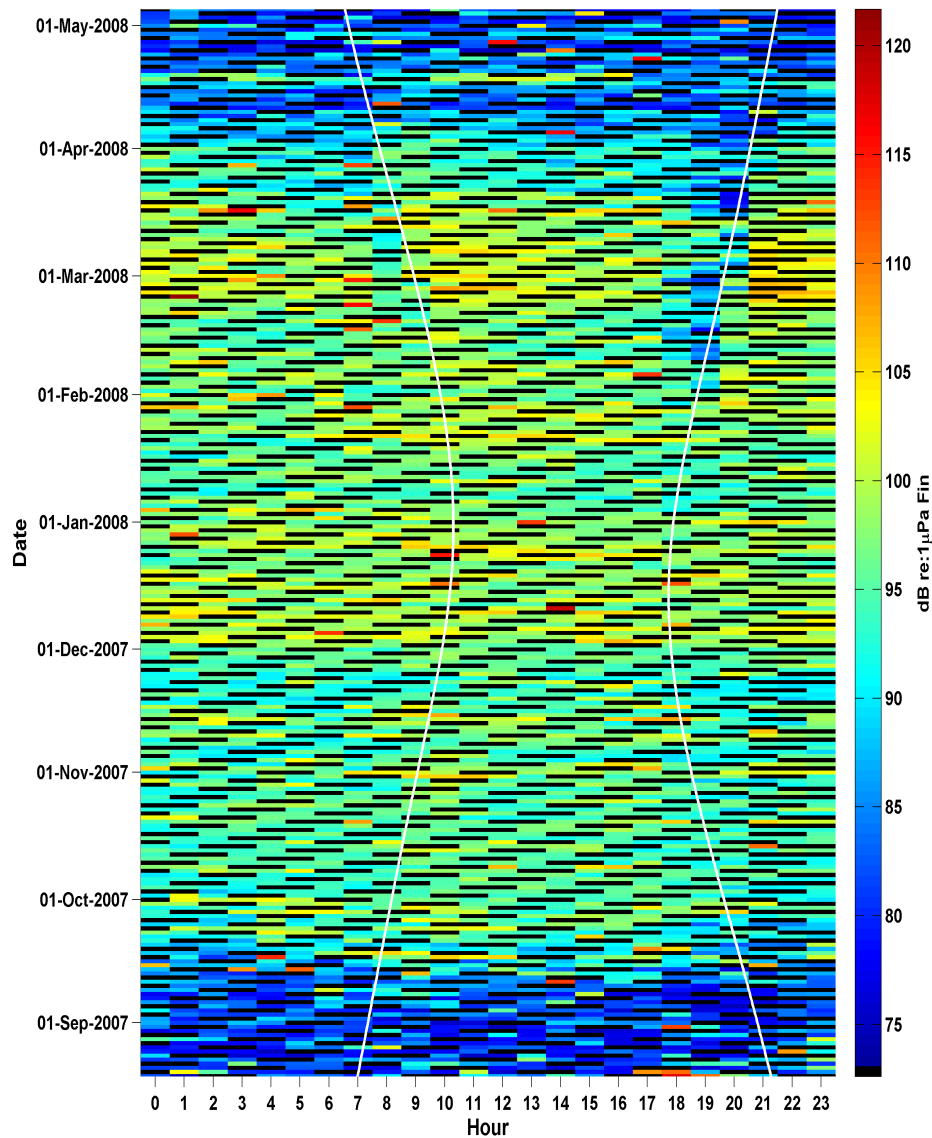


Specifications

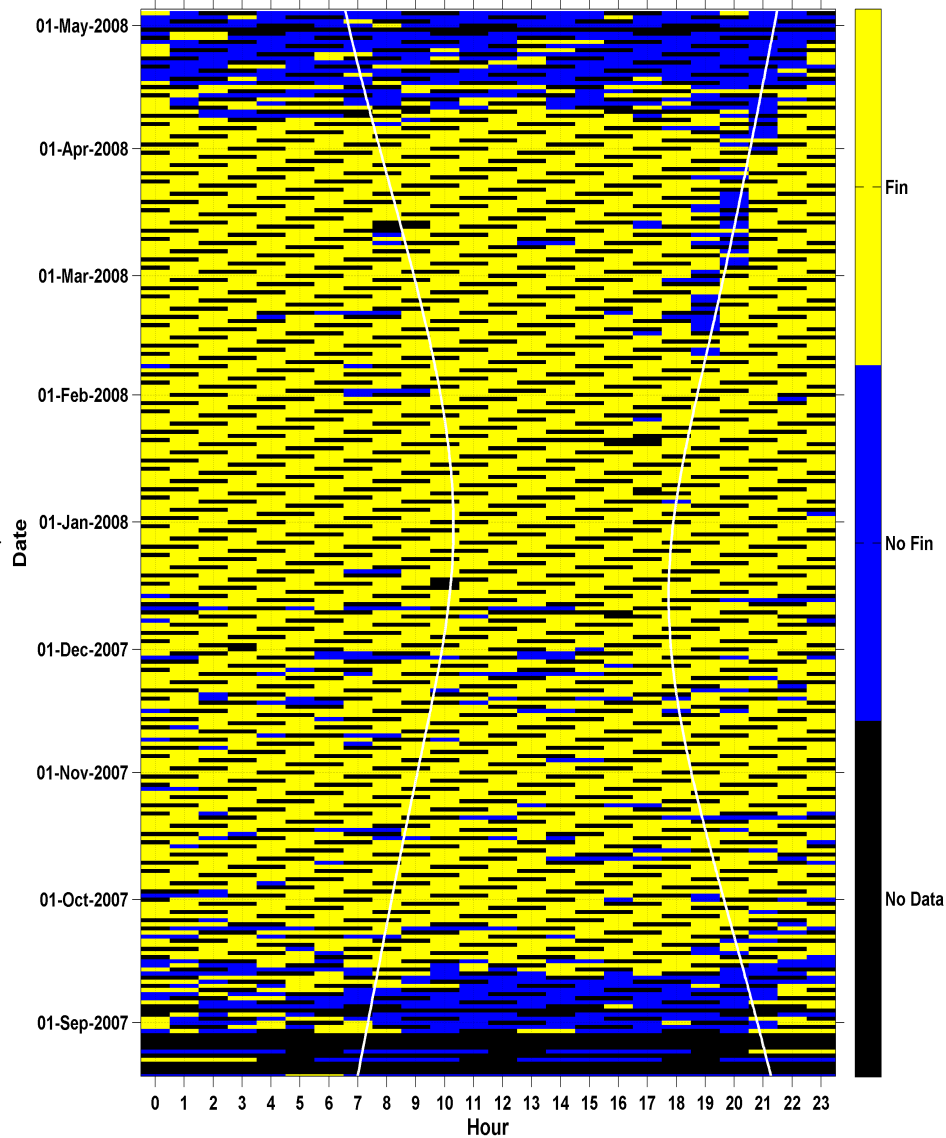
- C6220 Class, Cloud Server.
- 64 Distributed Nodes, 4 mother boards.
- 192 GB RAM.
- dual Intel® Xeon® E5-2600.
- GPU support, external C410x Rack Server.
- 16 GPU's via dynamic allocation.
- Tesla NVIDIA M2075/M2090 GPUs.
- 18TB NAS with Open Indian, running NAPPit.
- Mirror fast CACHE, SSD drives.

Fin Whale Acoustic Occurrence Calendar: 1-yr by 1-h

Human (1 month)



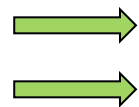
Automated (45 min)



Crowd Sourcing for Data Analytic Solutions

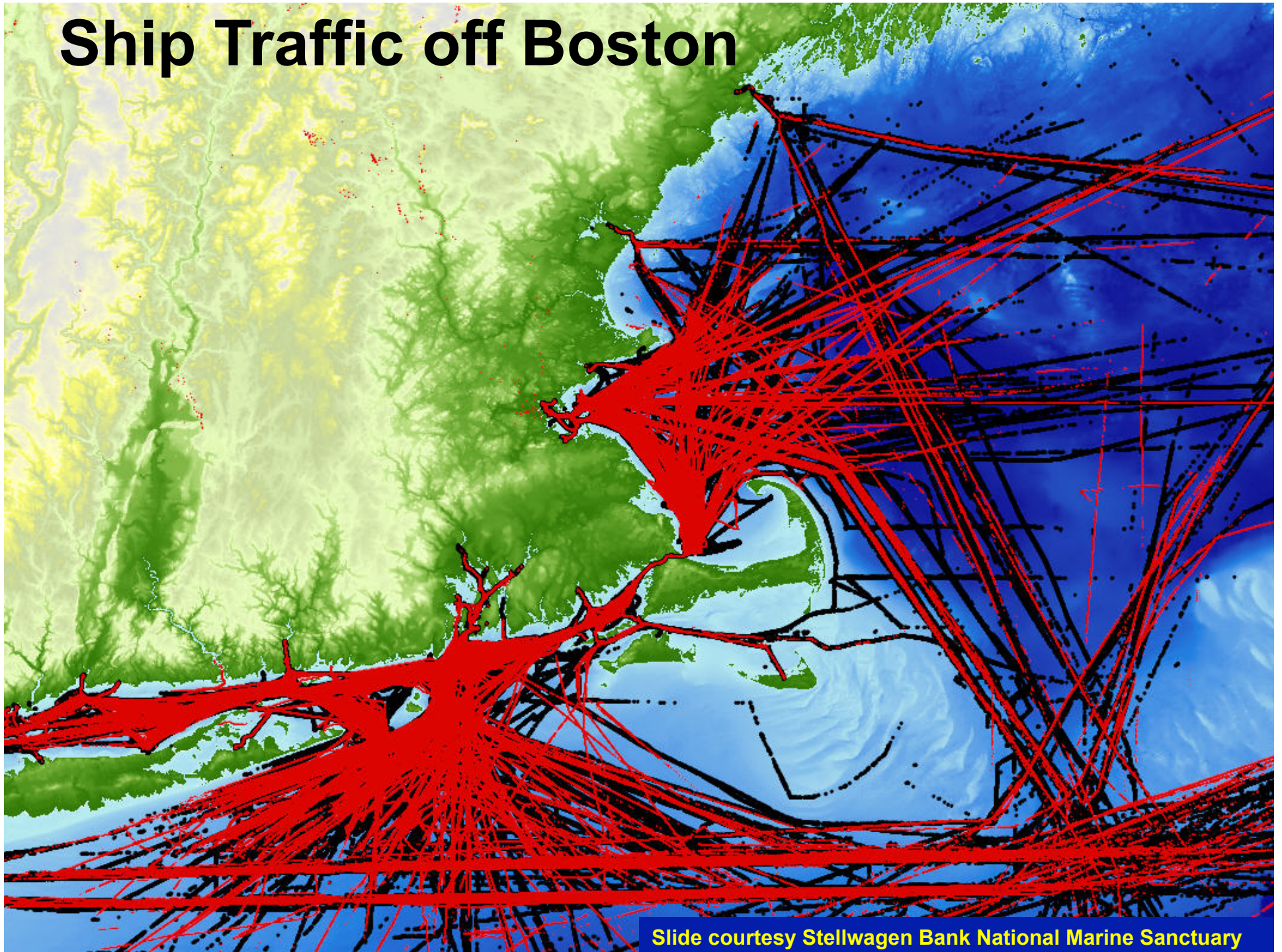
International Data Challenges – Right Whale Call *Supported by Marinexplore and Kaggle*

- Over 230 competitors world wide. \$10k in prizes.
- Source: Auto-Buoy Data looking for NARW's.
- 70,000+ Sound Clips: validated calls an non-call acoustic objects.
- 36 competitors produced code which performed at > 90%.
- We received the source code!



Method Name	Approach	Score	Who Submitted	Number of Features
Method 1	Template Matching + Gradient Boosting	0.9838	Dobson & Kridler	30
Method 2	Random Forest	0.9837	Nieto-Castanon	727
Method 4	ConvNet (CNN)	0.982	Cheung & Humphrey	--
HOG	HOG + Adaboost	0.964	Cornell -NYU	600
CRA	CRA+ANN	0.938	Cornell -NYU	22
Conv-Net	ConvNet (CNN)	0.926	Cornell - NYU	--

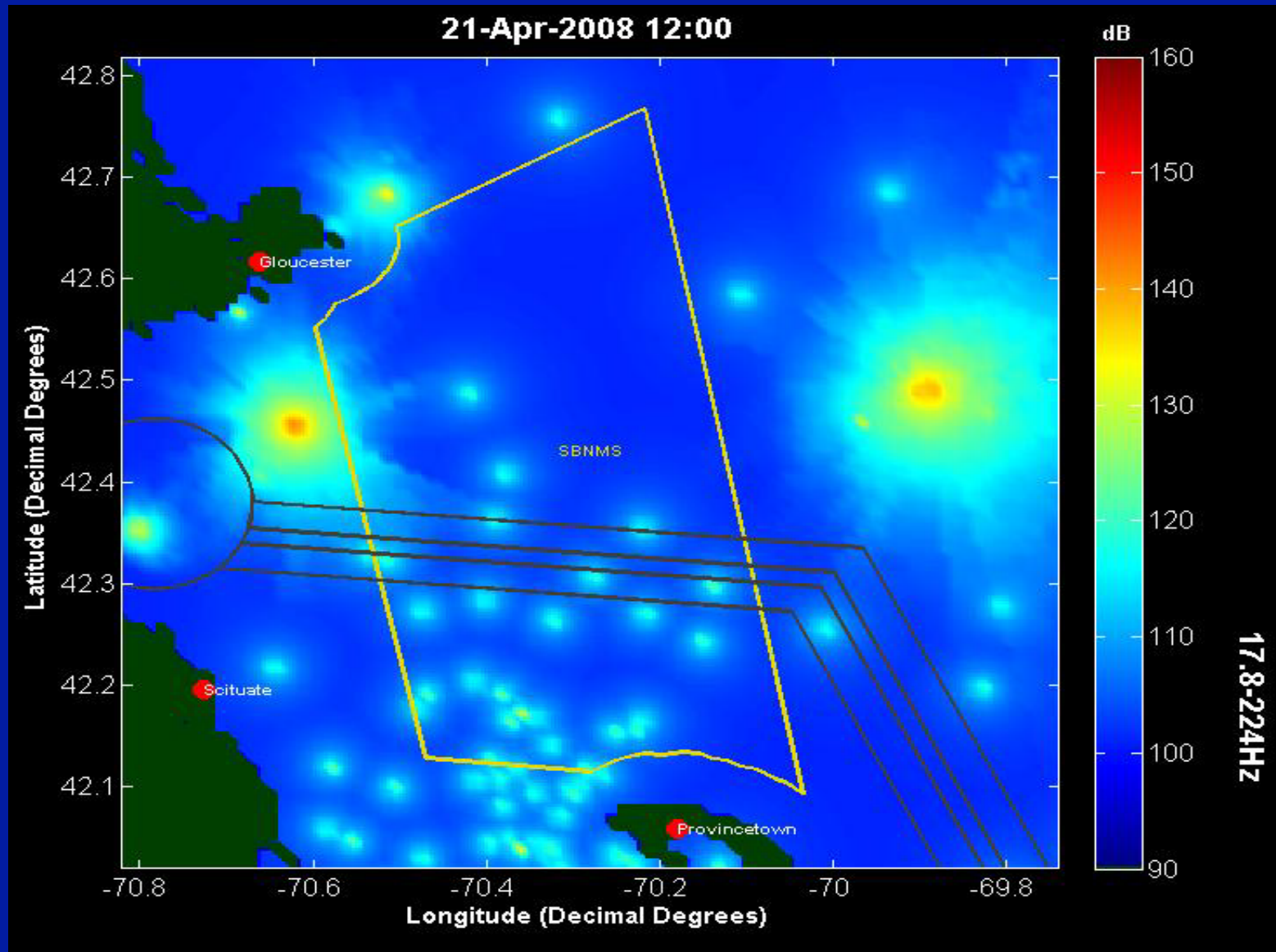
Ship Traffic off Boston



Slide courtesy Stellwagen Bank National Marine Sanctuary

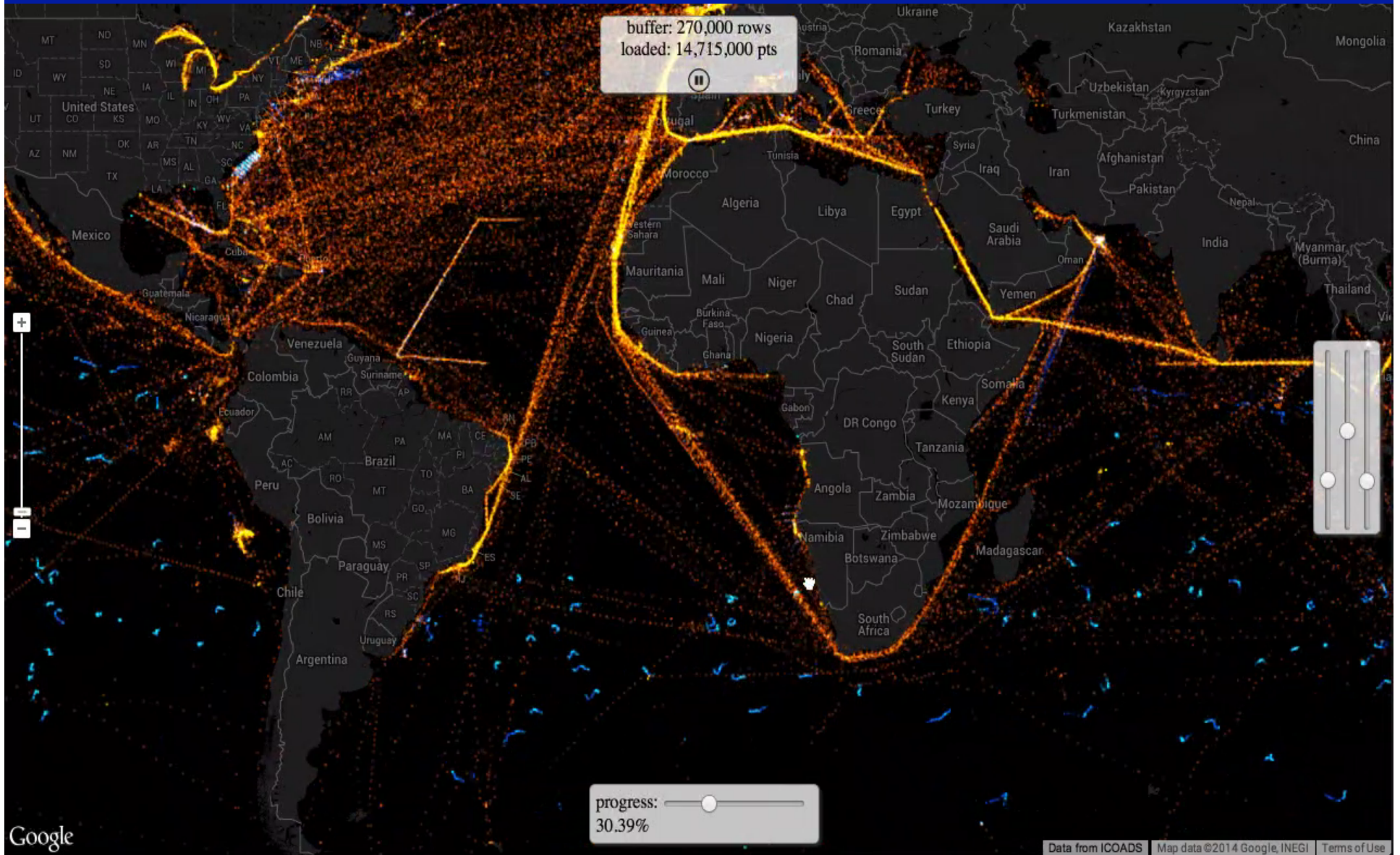
Translating Scientific-Tech Results into Ecological Risk

Example: endangered right whales off Boston



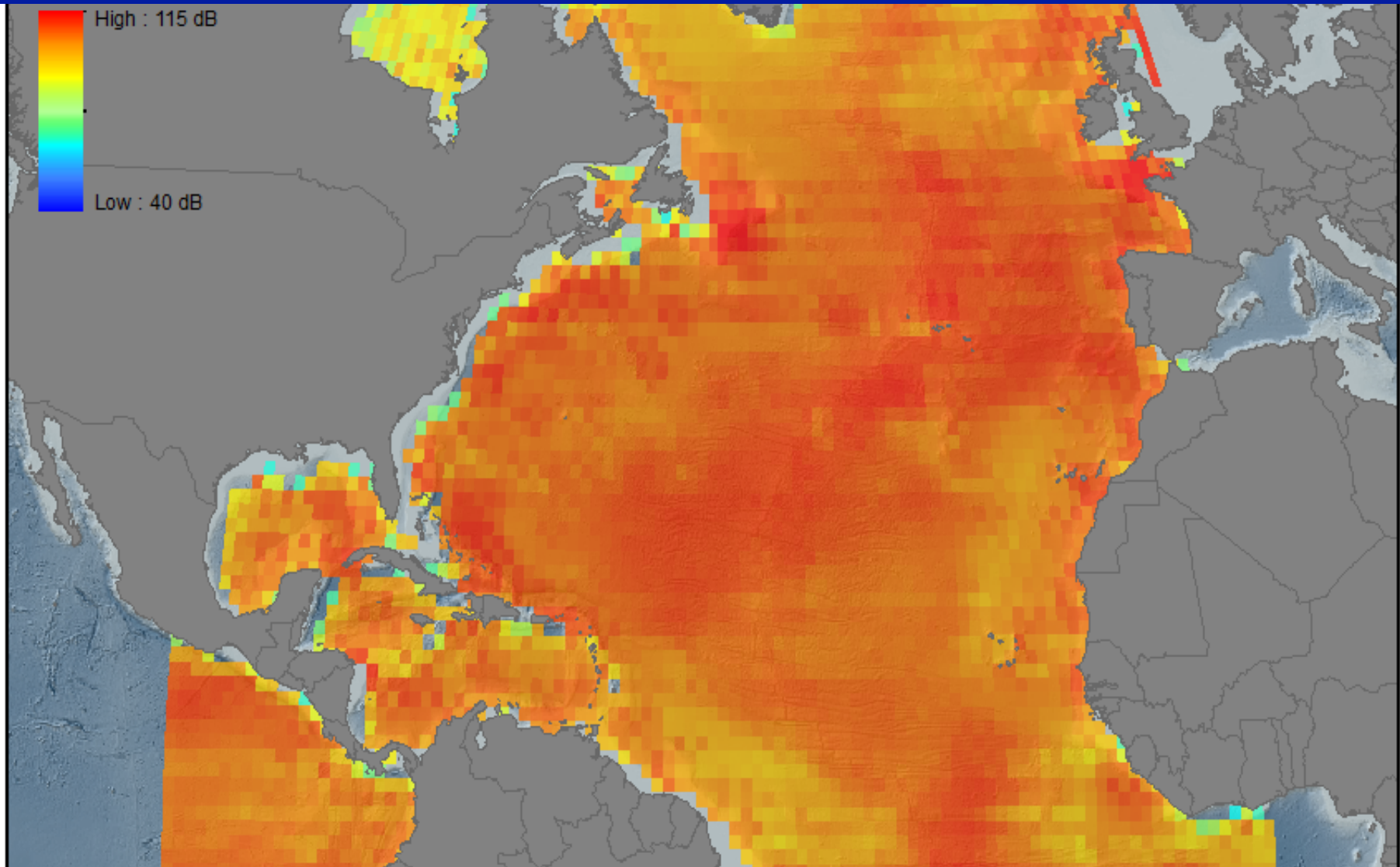
Clark et al. 2009, Ellison et al. 2012, Morano et al. 2012, Hatch et al. 2012

• Annual Global Shipping Traffic



Animation by Kurt Schwehr, Google Ocean: Google Maps API,, SpaceQuest AIS and NOAA ICOADS

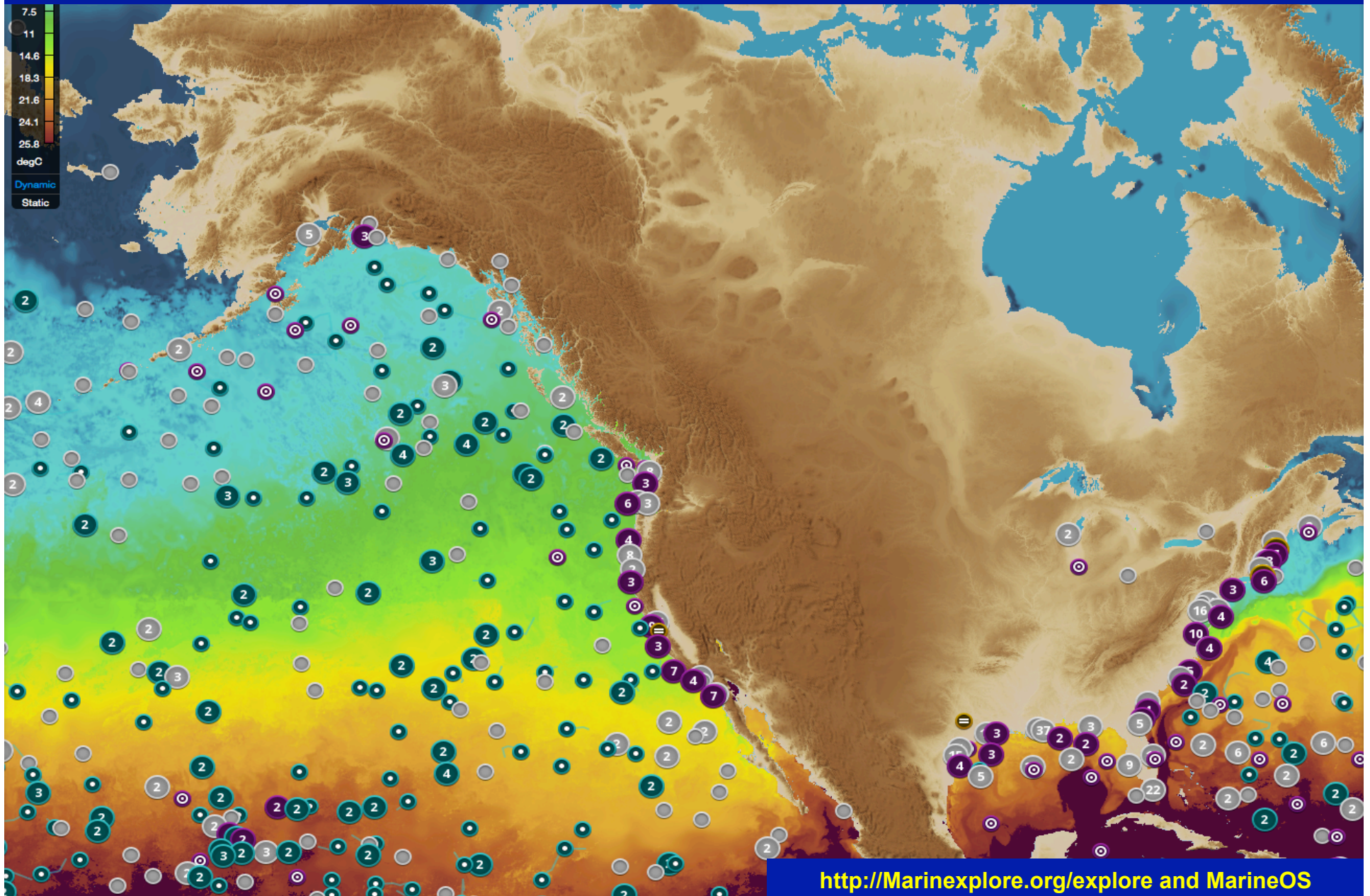
We can map shipping noise at ocean scales. E.g. NOAA Sound Mapping Group



Marine Geospatial Ecology Lab, Duke University (2012)

http://cetsound.noaa.gov/sound_data.html

Big Data Platforms, Data Analytic Systems, Data Integrations e.g. Planet OS



**We are aware, and the technology exists.
We have the responsibility to adopt a new paradigm.
Do we have the will?**

