Acoustics & Technology: Knowledge for Scientific Conservation and "Management"

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The Ocean is Alive with the Sounds of Life.

How Far Can Sound Travel in the Ocean?

Basic Messages

- **Survival and habitat loss**

- **Science and technologies help**

- **Human activities impose large scale risks**

- **Present regulatory paradigm is not based on best available scientific concepts and/or evidence.**

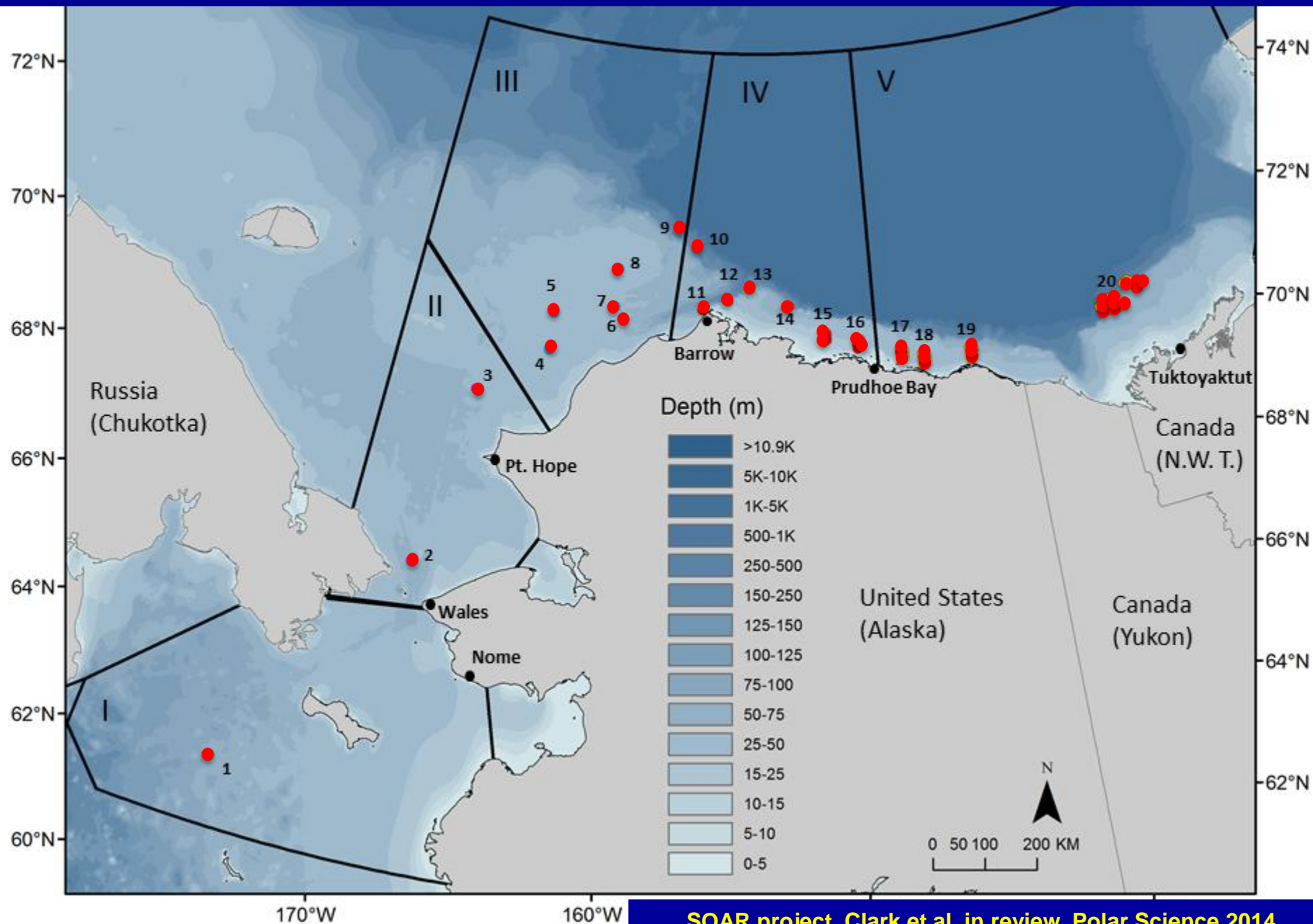- **It's not about whales, science and technology. It's about us.**

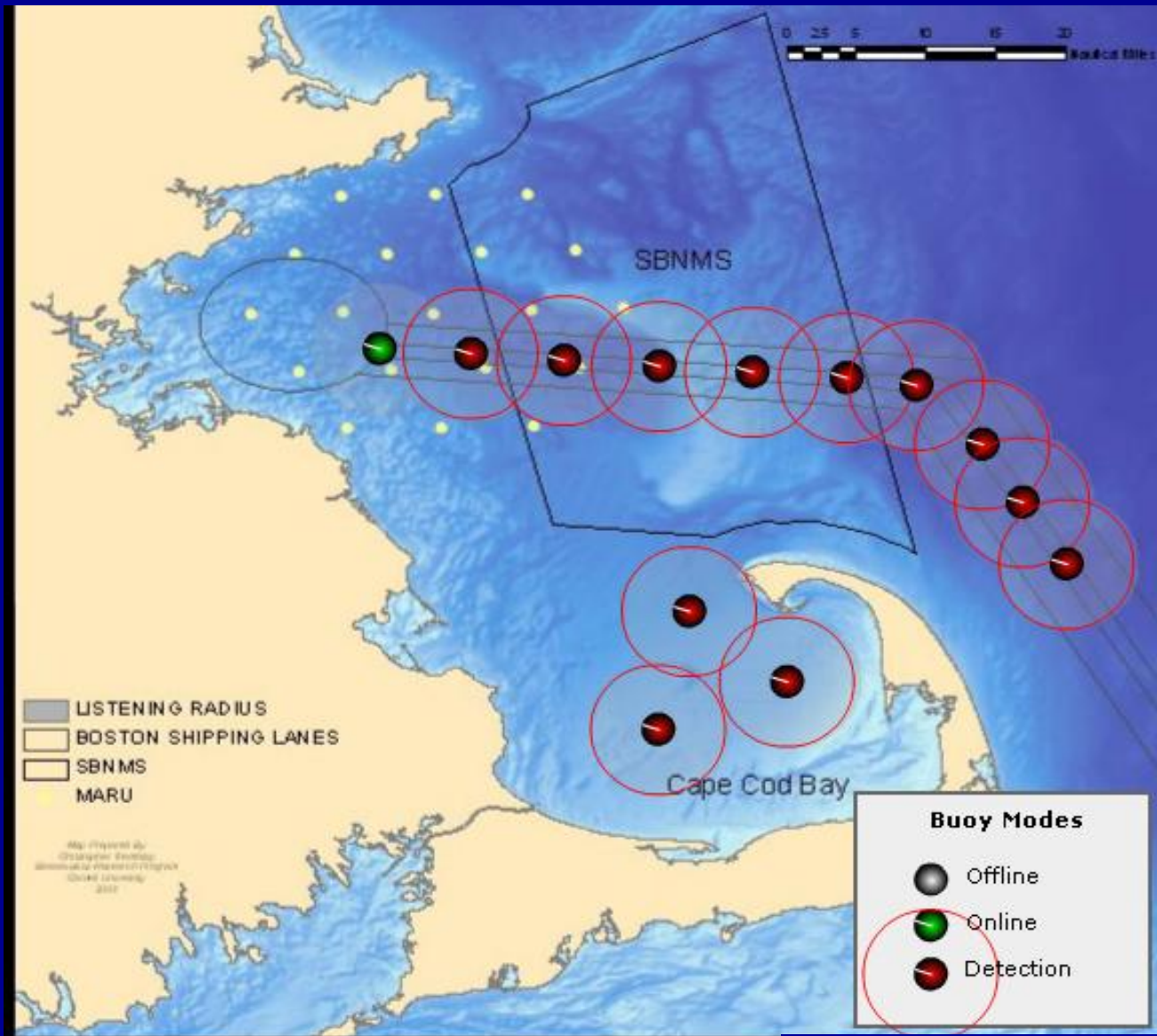# We now collect very large amounts of data.

Acoustic mouse traps

© C. W. Clark, Cornell Bioacoustics Research Program, HARP photo courtesy of J. Hildebrand, SIO

The Arctic is Next

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
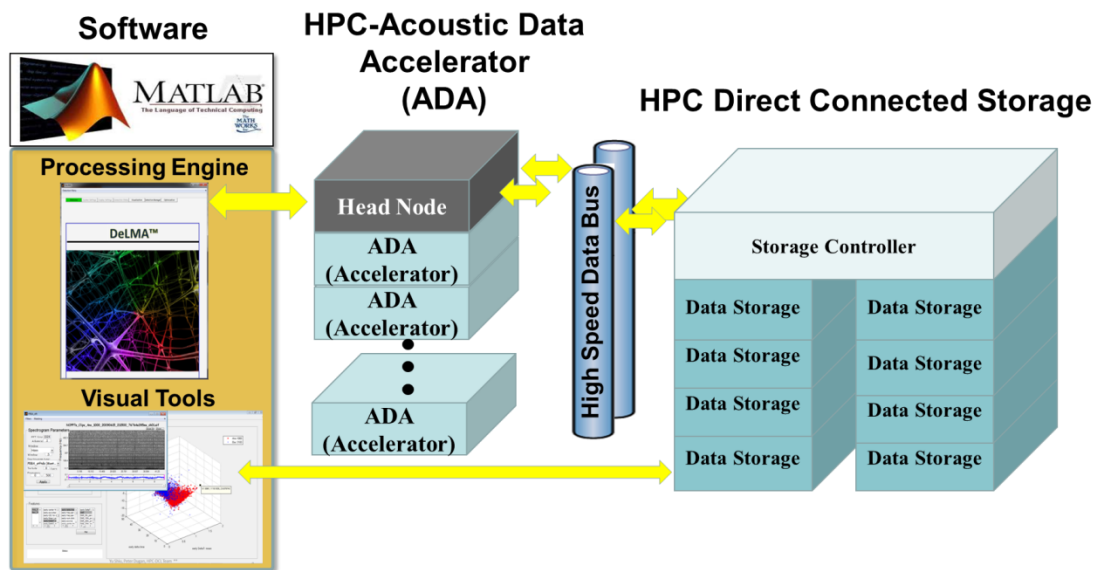

09/02/18 11:30 to 09/02/23 00:20
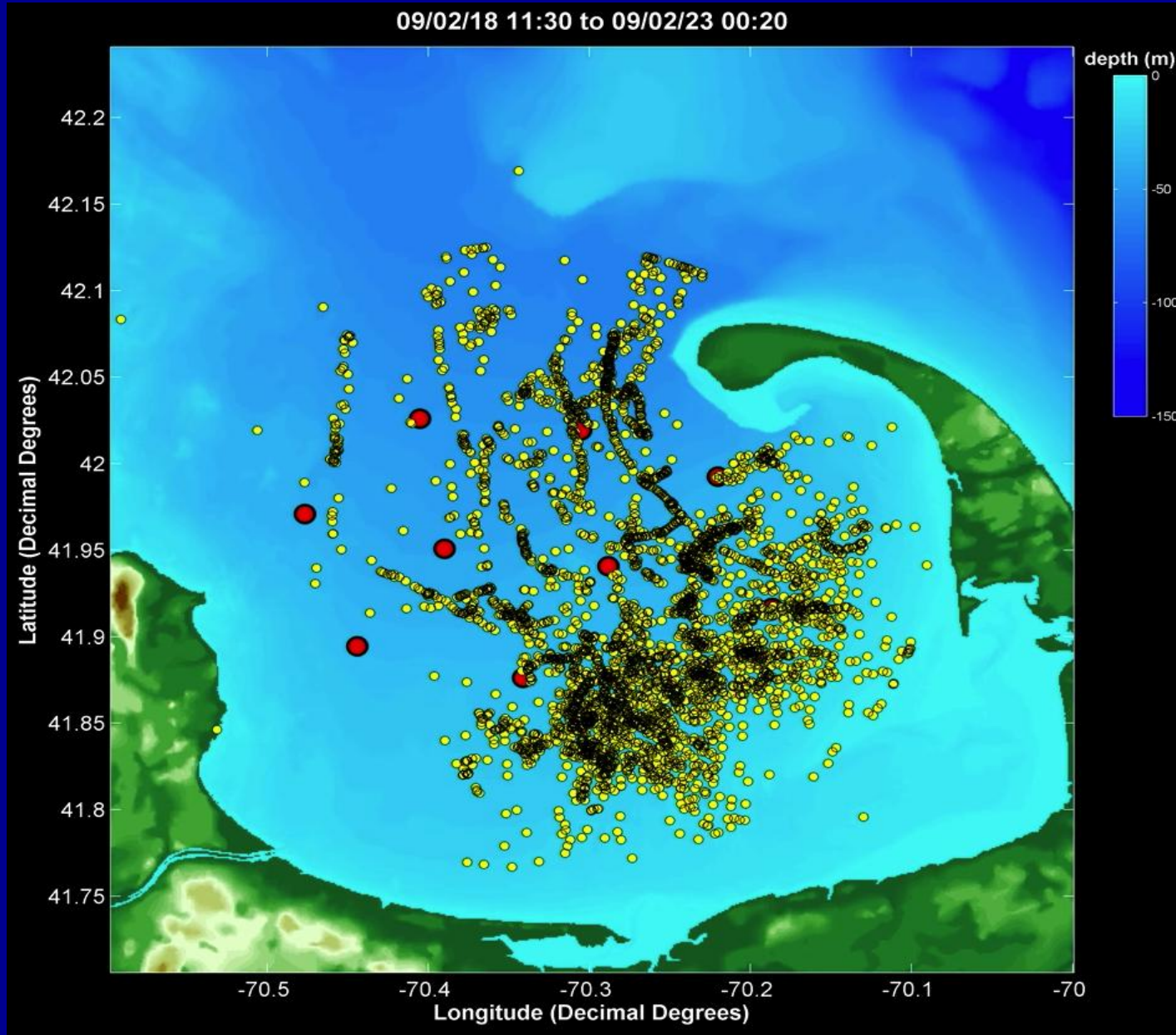
The Mission

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

Software

MATLAB
The Language of Technical Computing

Processing Engine

DeLMA™

Visual Tools

HPC-Acoustic Data Accelerator (ADA)

Head Node

ADA (Accelerator)

ADA (Accelerator)

ADA (Accelerator)

High Speed Data Bus

HPC Direct Connected Storage

Storage Controller

Data Storage	Data Storage
Data Storage	Data Storage
Data Storage	Data Storage
Data Storage	Data Storage

GPU C410x expansion

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

100%

300h

11%

2h

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, SDD drives.
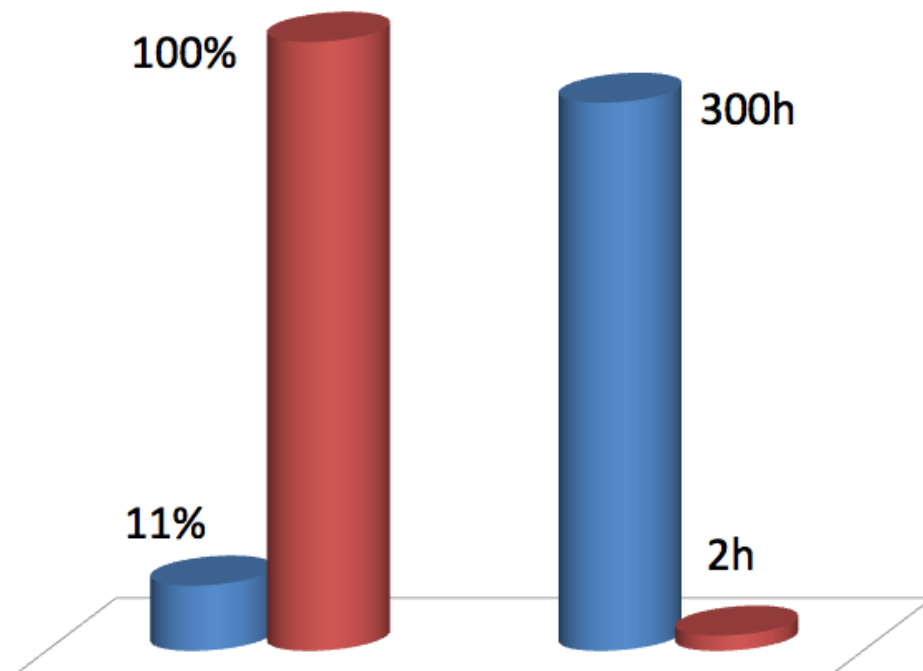
Crowd Sourcing for Data Analytic Solutions

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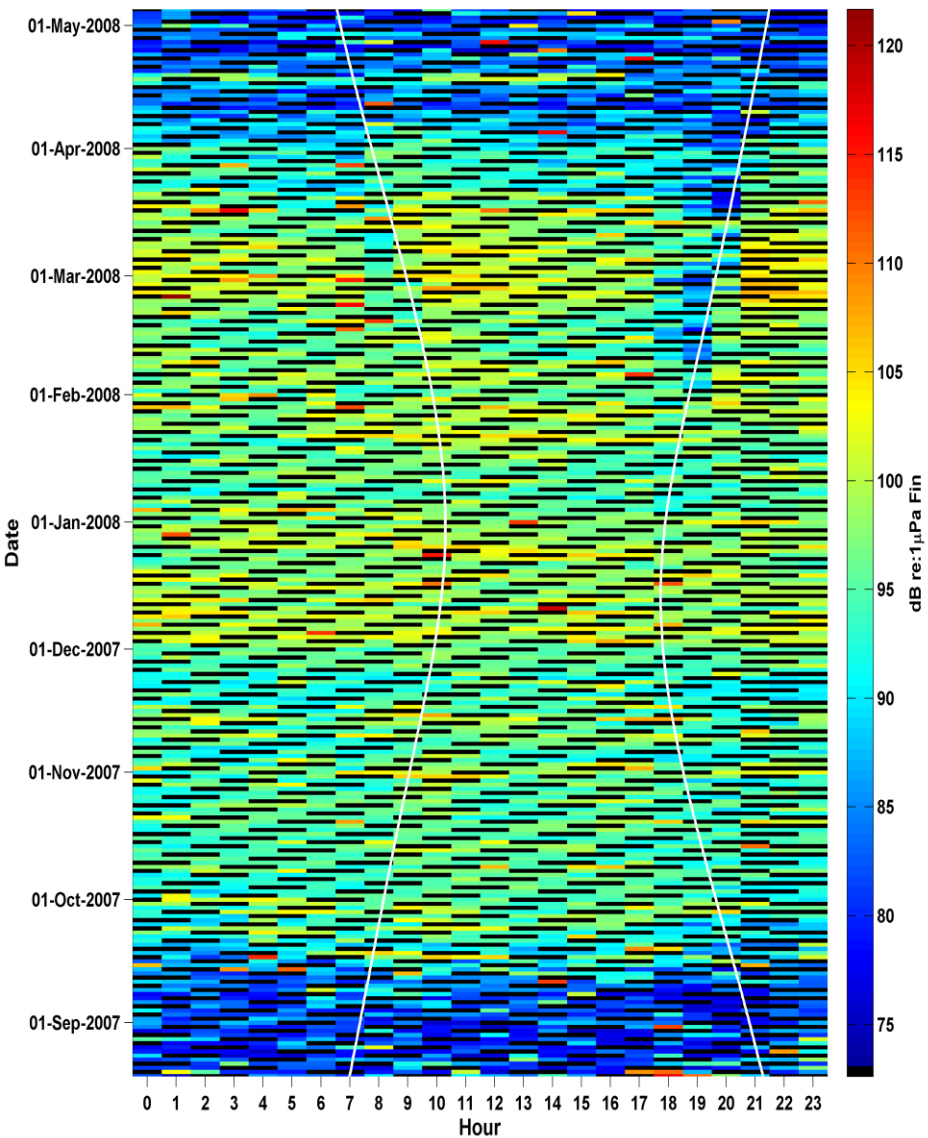### *Supported by Marinexplore and Kaggle*

- 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	--

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

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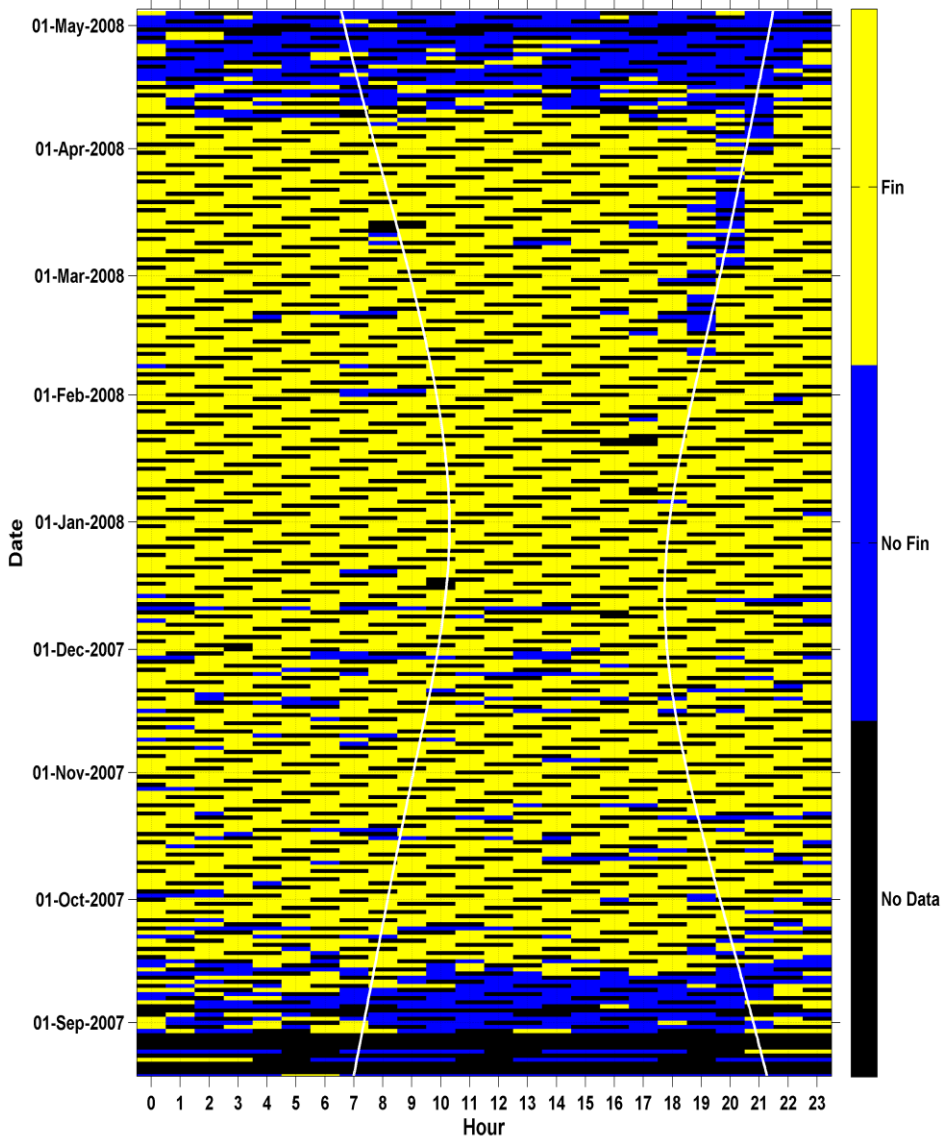
Big Data Platforms, Data Analytic Systems, Data Integrations

http://Marinexplore.org/explore and MarineOS
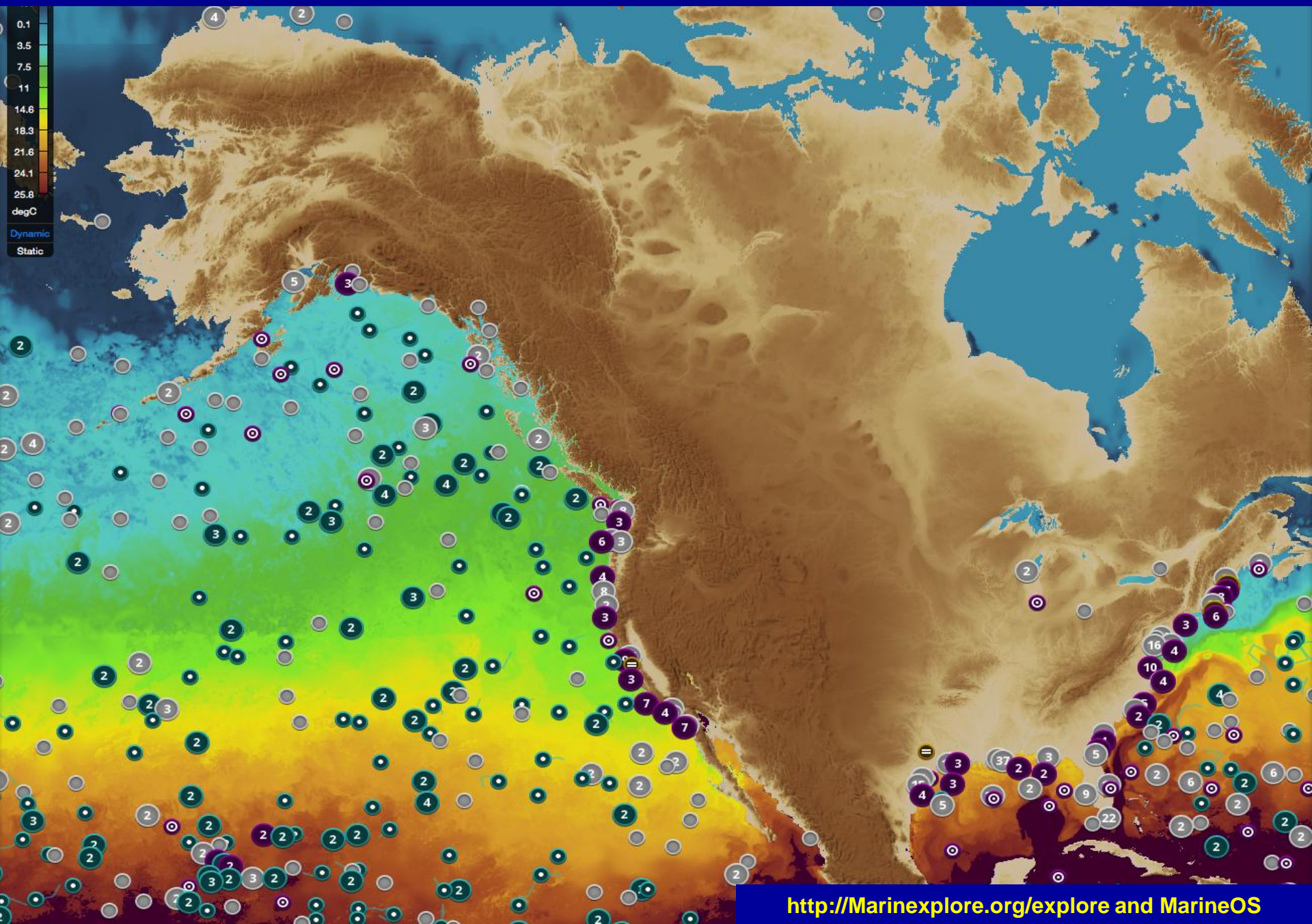
Global Commercial Shipping Traffic
96% of world's commerce
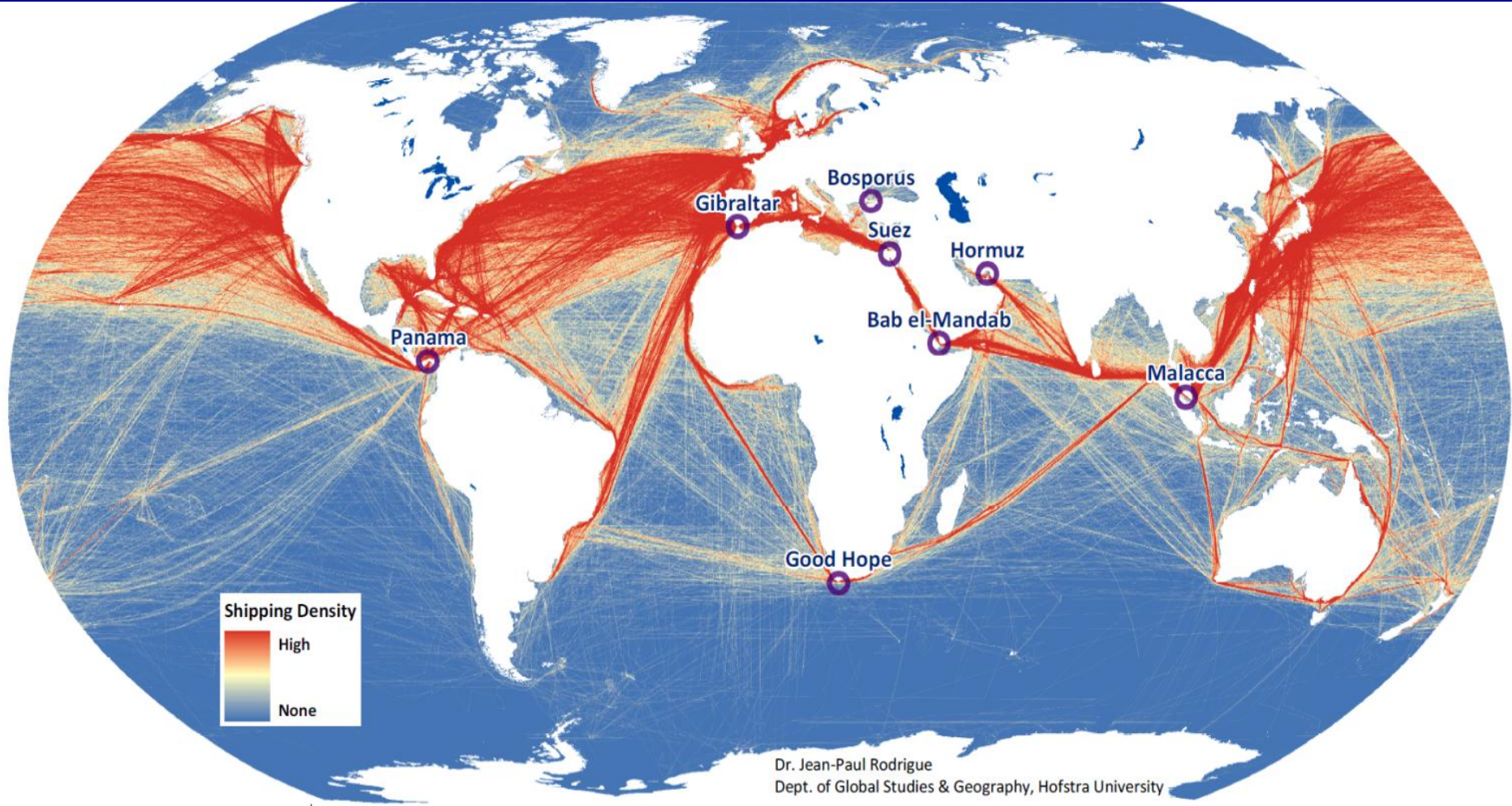
Dr. Jean-Paul Rodrigue
Dept. of Global Studies & Geography, Hofstra University

Ship Traffic off Boston
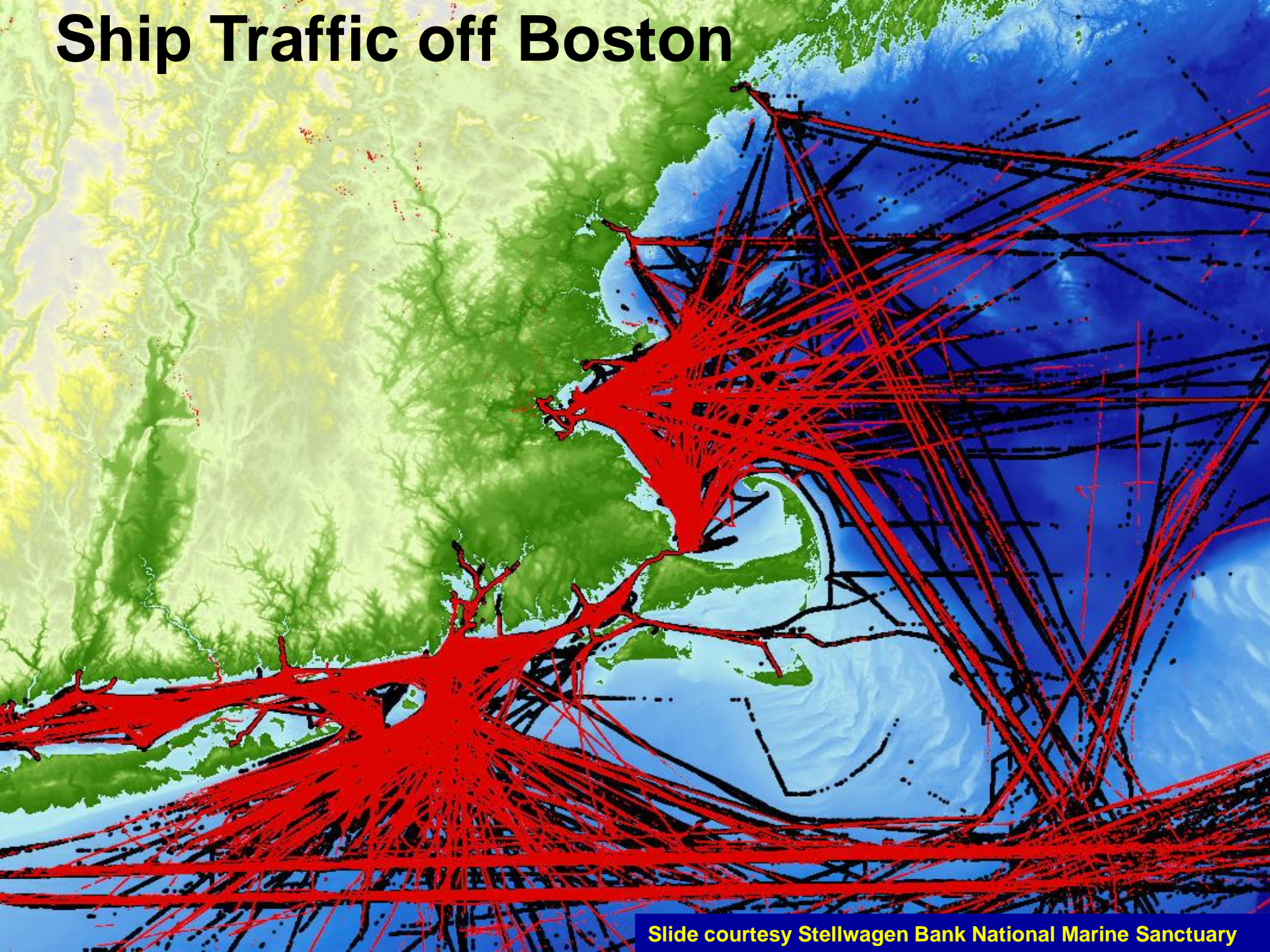
Translating Scientific-Tech Results into Ecological Risk Example: endangered right whales off Boston
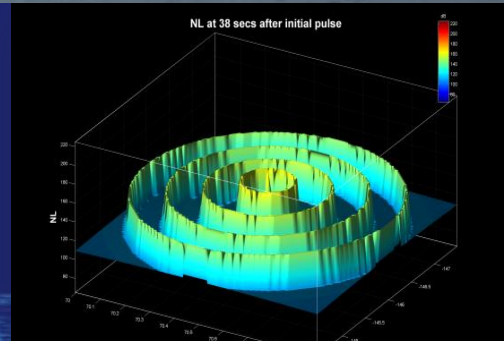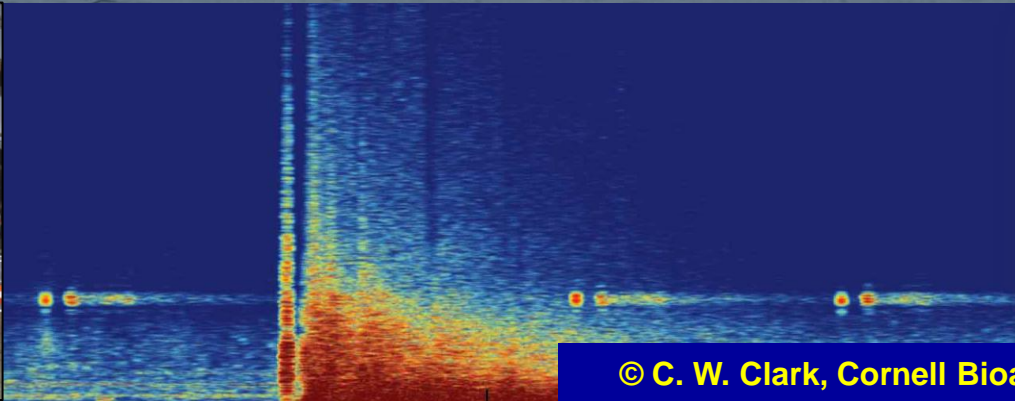

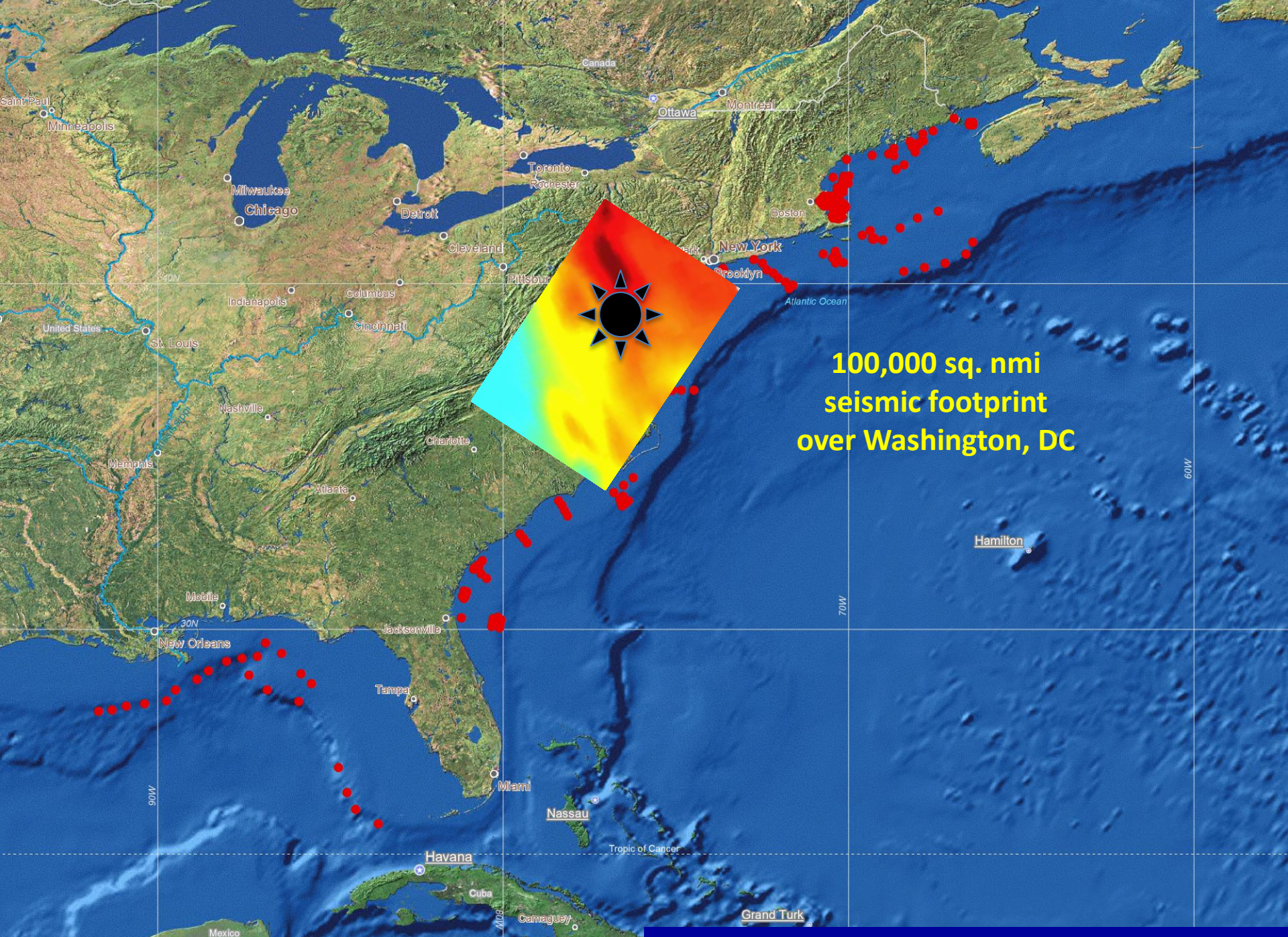21-Apr-2008 12:00
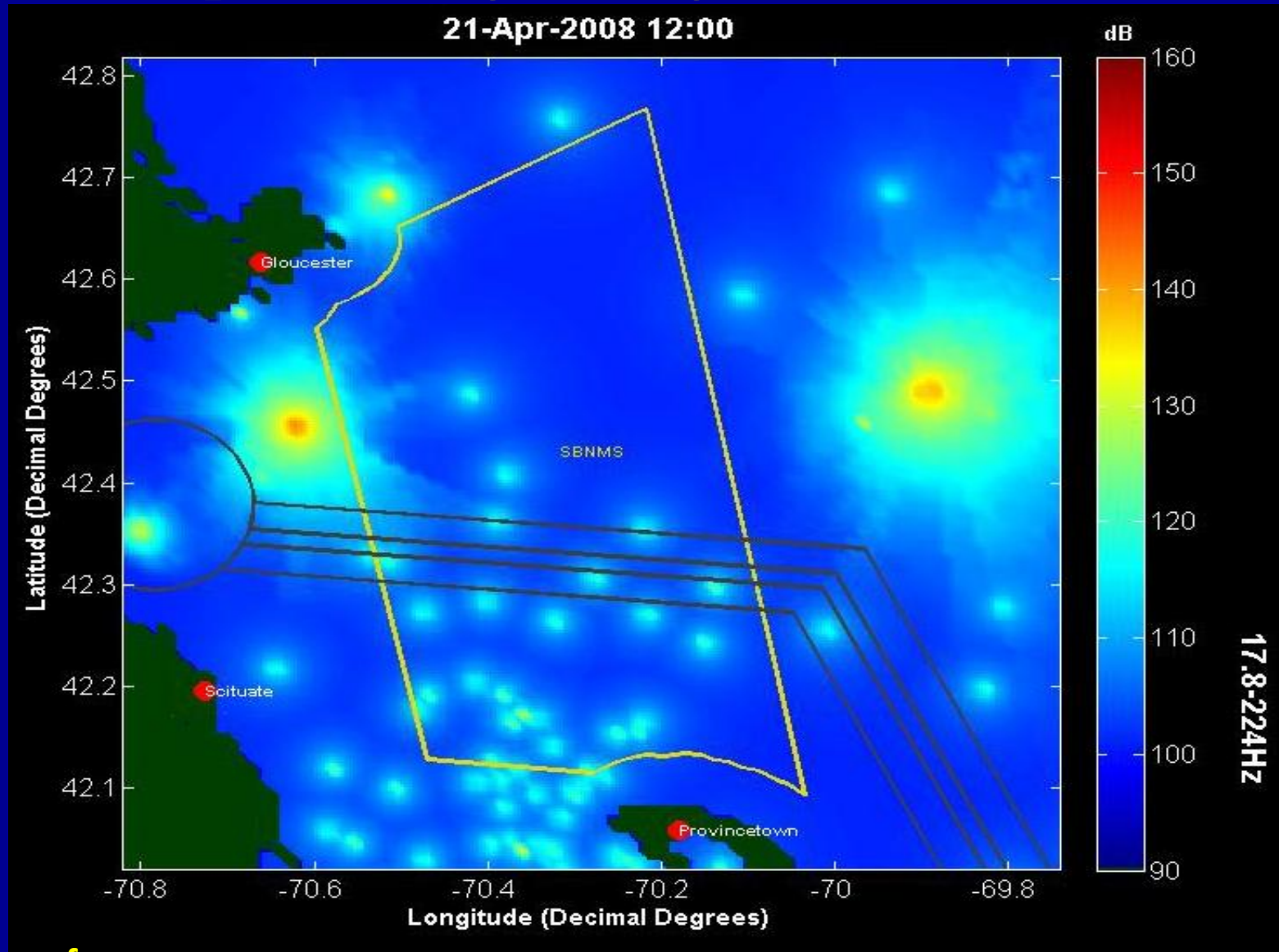
Click image for animation

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

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

High : 115 dB

Low : 40 dB

Marine Geospatial Ecology Lab, Duke University (2012)
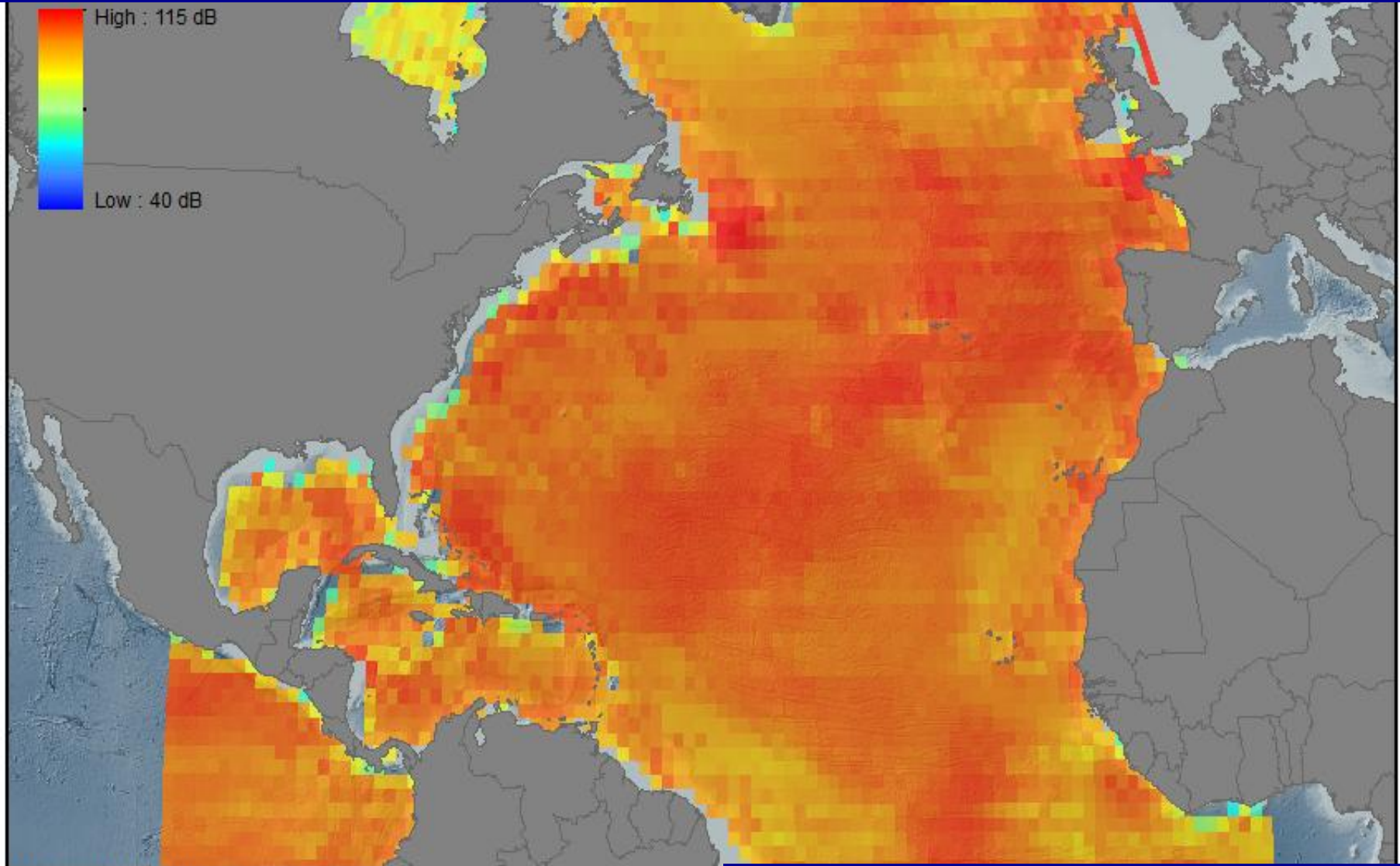
Offshore Seismic Airgun Surveys
(Intentionally High Noise Levels, Large Areas, Long Times)

NL at 38 secs after initial pulse

100,000 sq. nmi
seismic footprint
over Washington, DC

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