

Census of Marine Life

Bringing Life to Ocean Observation

Ron O'Dor
Kristen Yarincik

Census of Marine Life International Secretariat
Consortium for Ocean Leadership
Washington DC

17 Global Projects, microbes to whales, top to bottom, past to future
10 years, 2000 people, 80 countries, \$750M

www.coml.org



Life Questions

1. What is an oceanic ecosystem?

(bacteria to whales, migration, hotspots, top down, bottom up, middle out)

2. How will global warming effect them?

(relocation or disruption, animal oceanographers)

3. Will biodiversity decline?

Will production decline?

(extinctions vs. increased species mixing, trophic level shifts)

4. How much detail needed to monitor biodiversity?

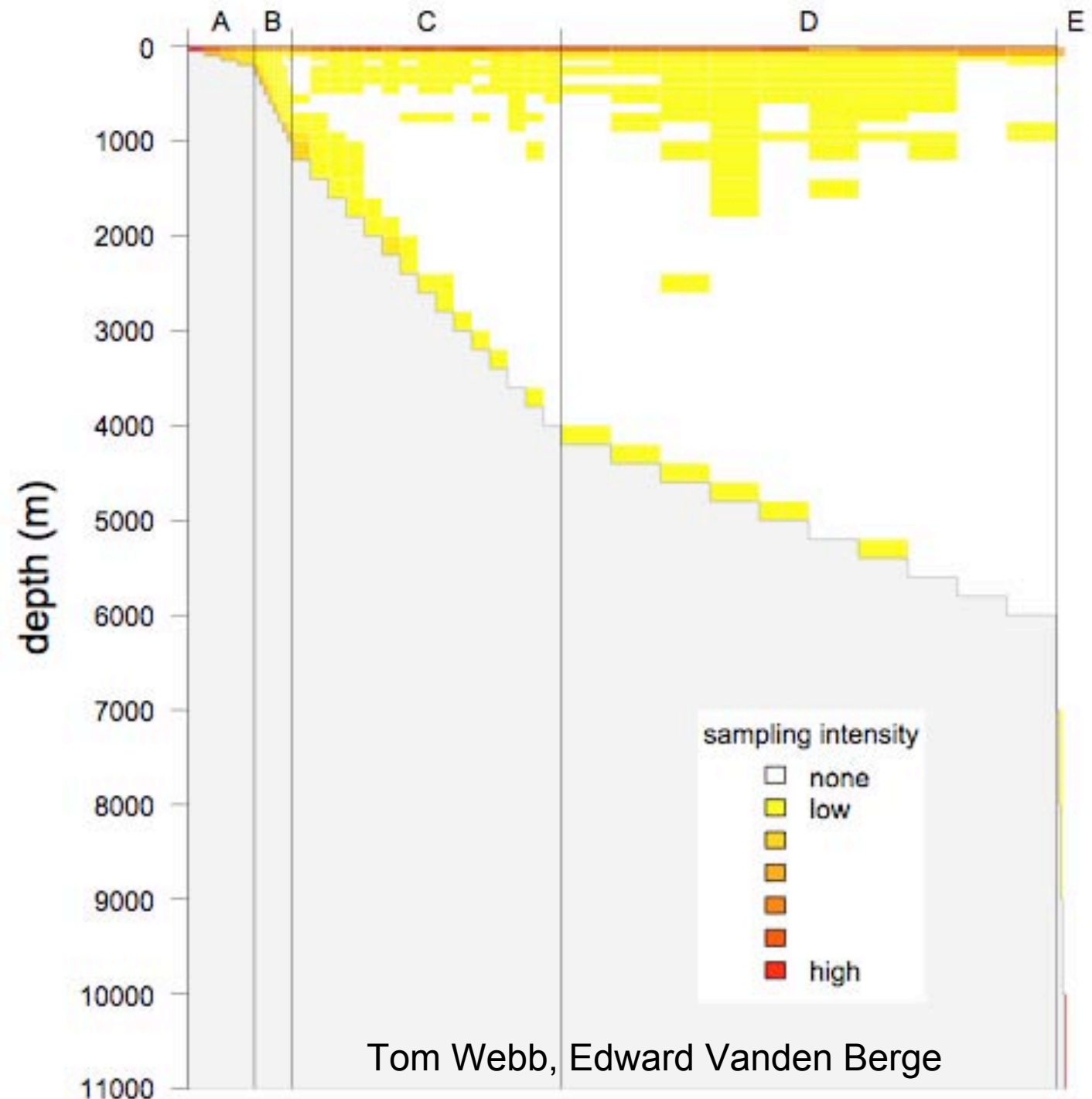
(role of the rare, sentinels, DNA technologies)

5. Can Ecosystem Based Management
differentiate climate from fishing effects?

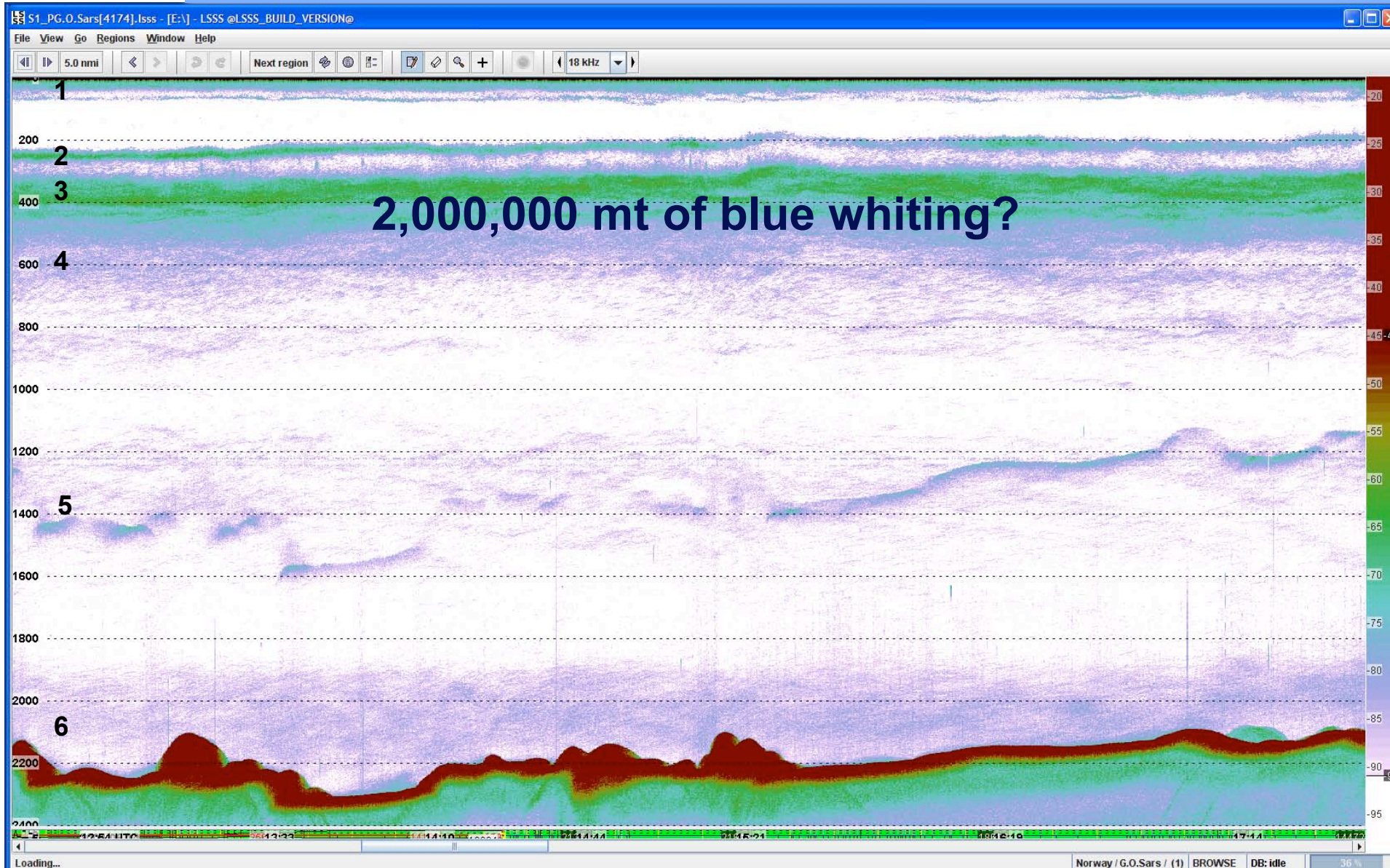
(in situ oceanography, humans vs. species interactions)

19,000,000 Records Relative to Depth

A - 0-200m
B - 200-1000
C - 1000-4000
D - 4000-6000
E - >6000
y axis ~ area



MAR-ECO Defines the Dark Zone to 3000m

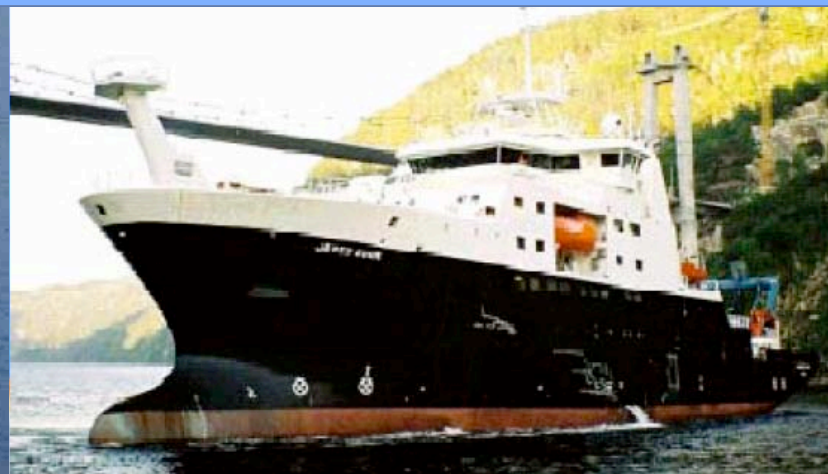


Sonar Technology, Opdal et al. Deep Sea Research 2008, Mid-Atlantic Ridge

MAR-ECO's Silent Vessels



Norway - *G. O. Sars*
100-fold sensitivity, shrimp 3 km down!



UK - *James Cook*

US - *Henry B. Bigelow*

IOC – *Patricio Bernal*

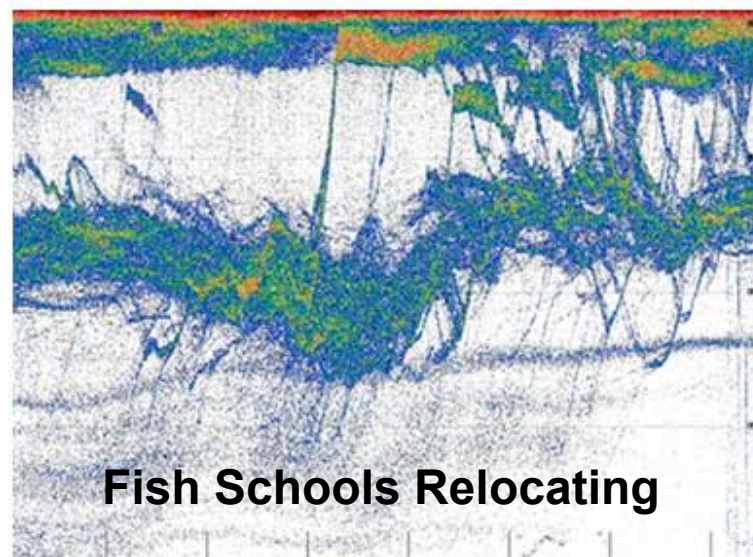
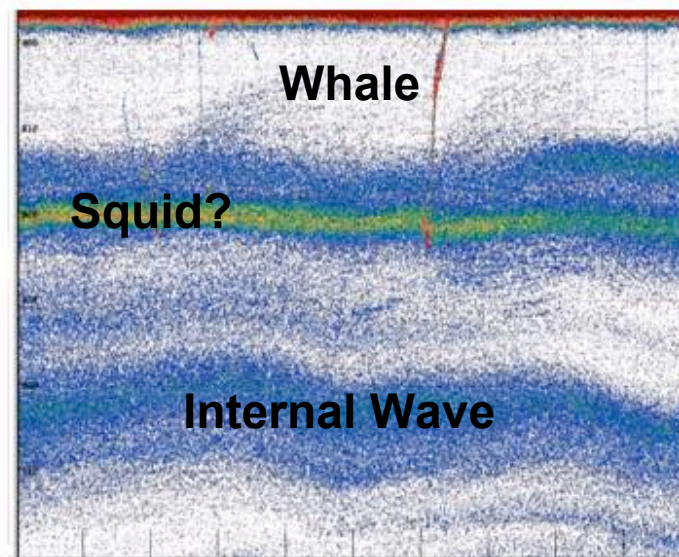
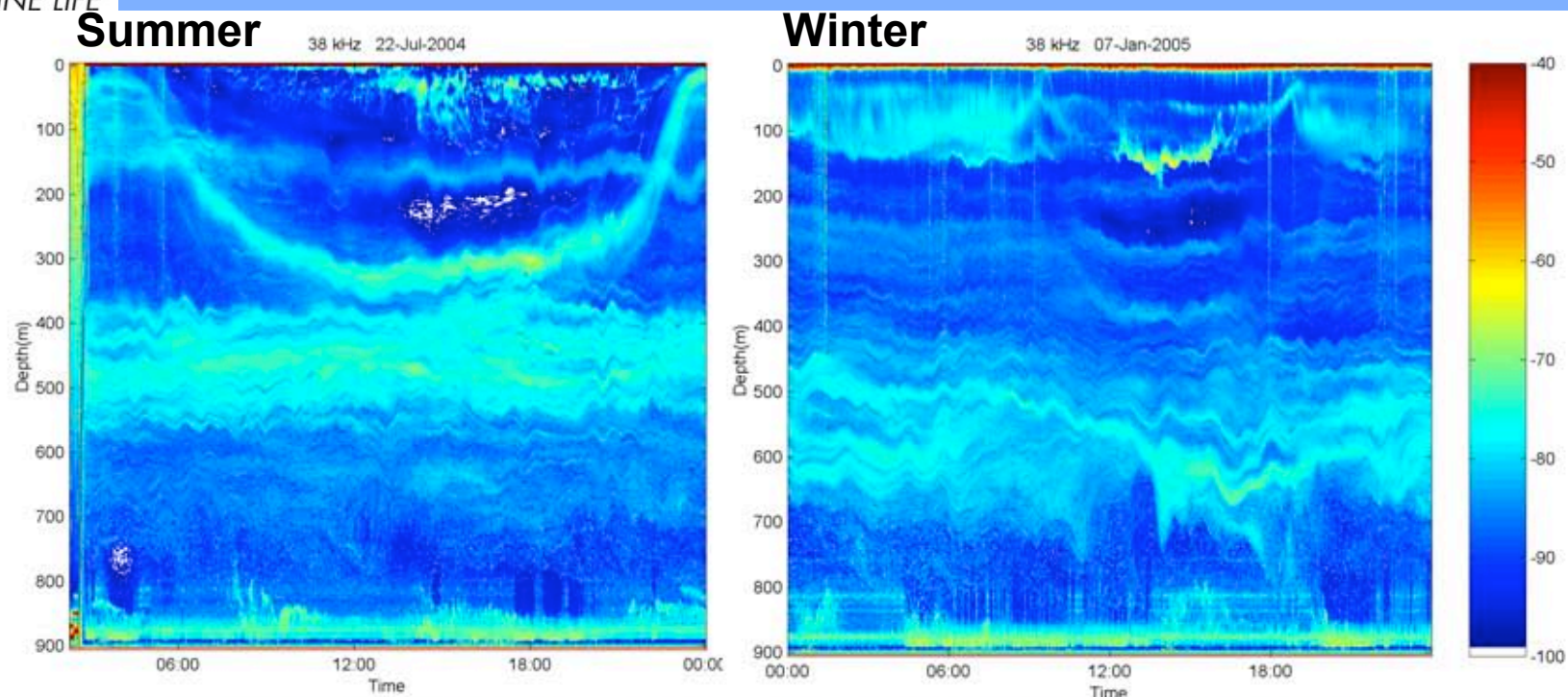


10,000 m wire

For the
Southern Hemisphere
?

South Atlantic starting

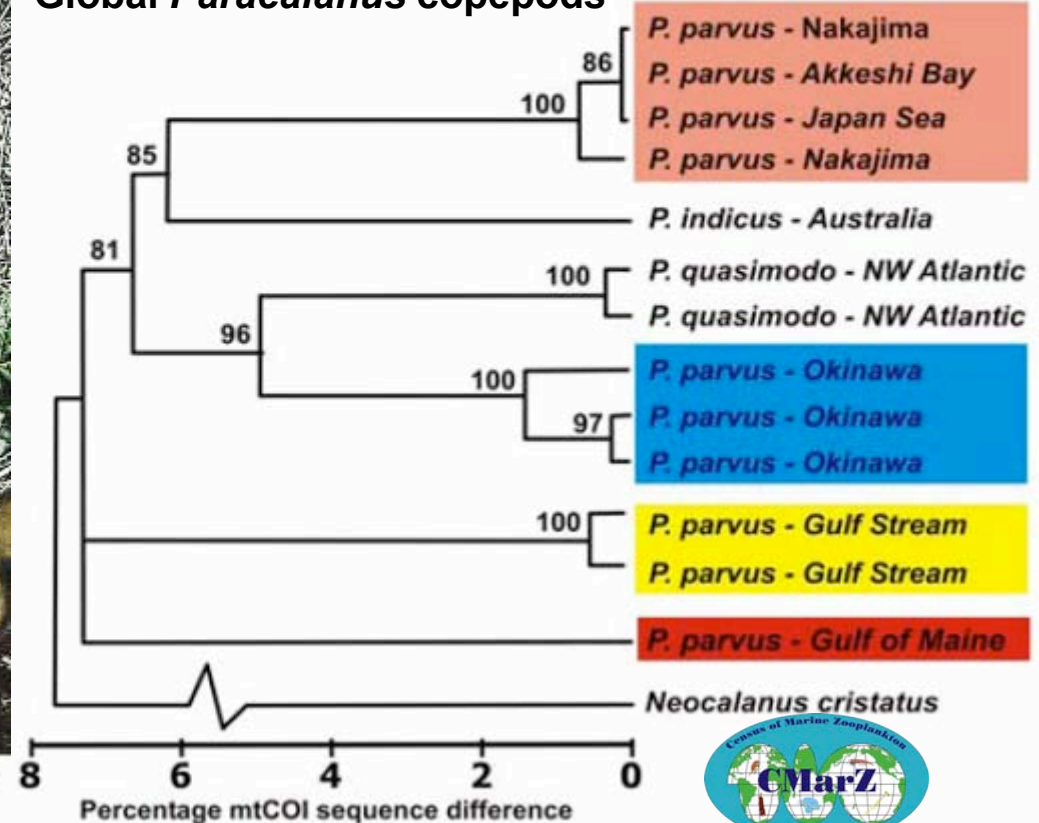
Upward-looking Sonar Observes from 1000m

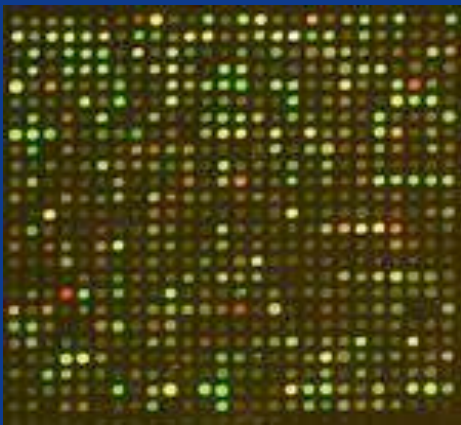
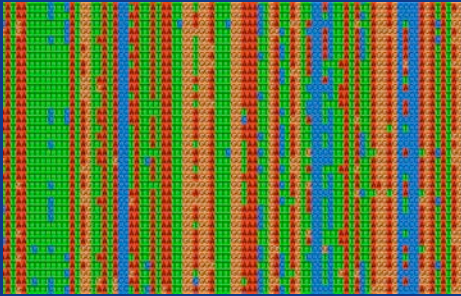


Consortium for the Barcode of Life (CBOL) CoML 'sister project' works on land and sea



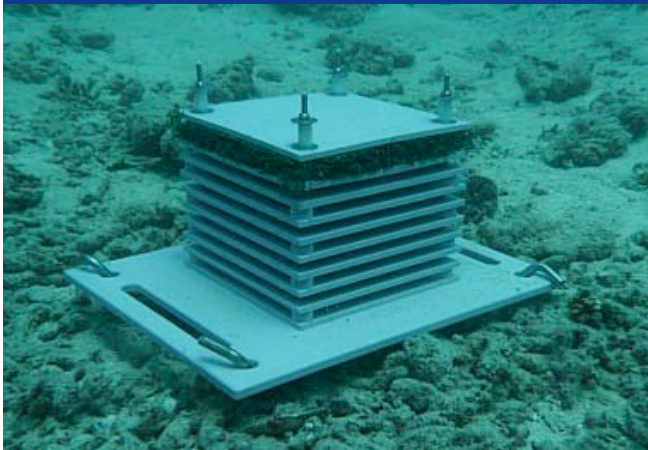
Global *Paracalanus* copepods





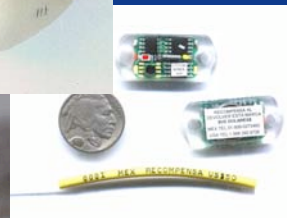
- **DNA barcoding:** CMarZ is sequencing a selected barcode gene – most usually the mitochondrial cytochrome oxidase I (mtCOI) gene – for each of the 7,000 described species of zooplankton.
- **Zooplankton metagenomics:** CMarZ and ICOMM are pioneering metagenomic analysis (i.e., the study of genomes recovered from environmental samples) of all metazoans collected by plankton nets.
- **DNA microarrays:** DNA barcode database will be used to fabricate DNA “chips” with recognition sequences for known species to be used for routine sample analysis and – eventually – autonomous and remote analysis of zooplankton species diversity.

Standardized sampling methods are essential!
>400 Autonomous Reef Monitoring Structures
have already been deployed in three oceans.
How will acidification affect biodiversity?

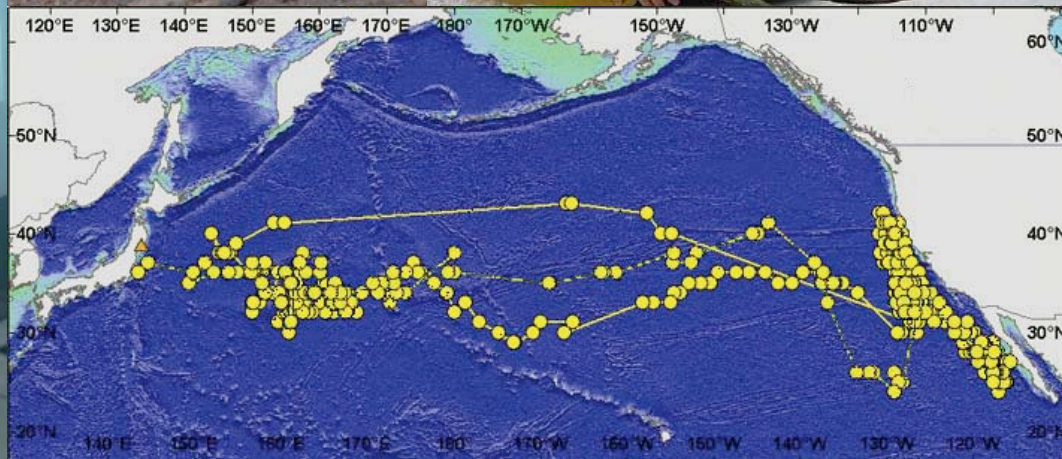
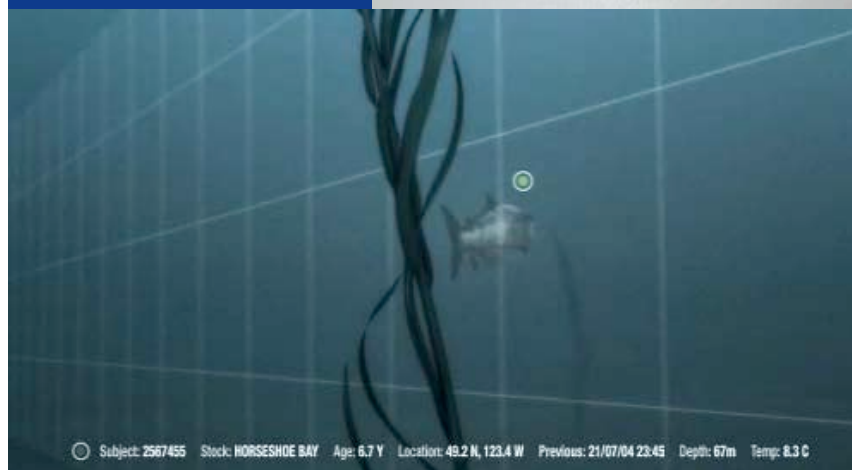


Tracking & Tagging

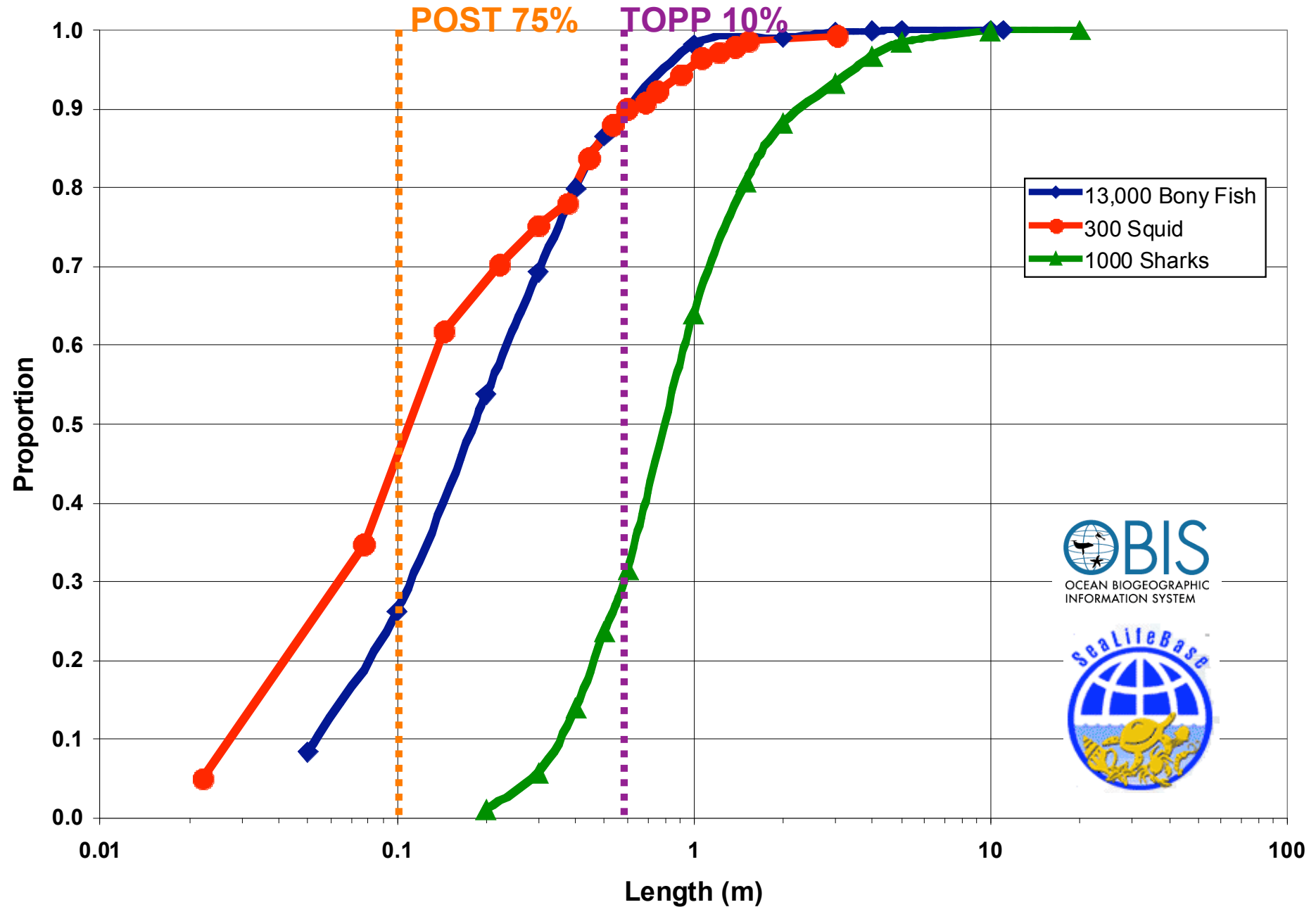
**Acoustic
tags talk to
receivers on
the seabed**

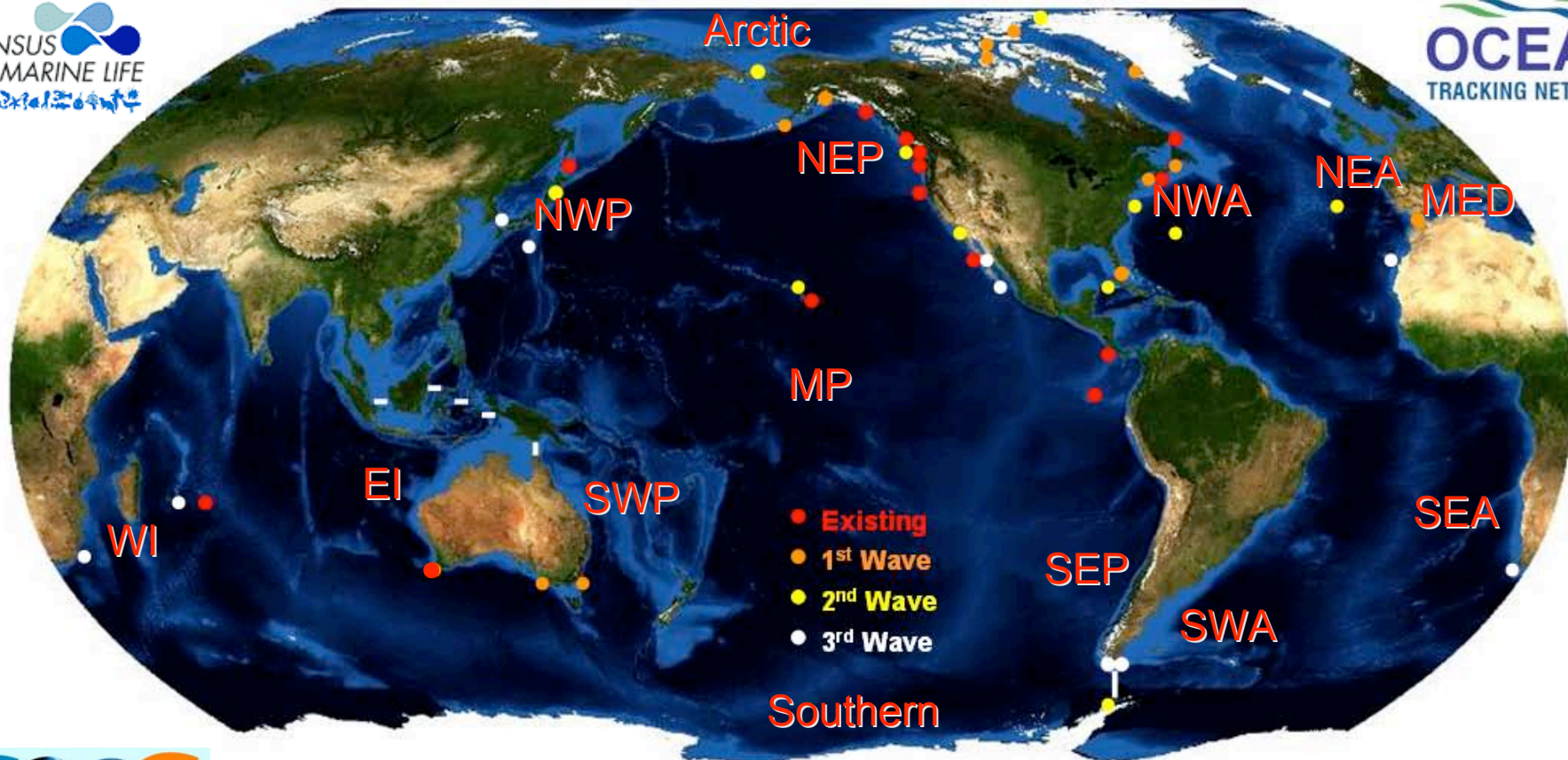


**Archival tags
retrieved or
transmit to
satellite**

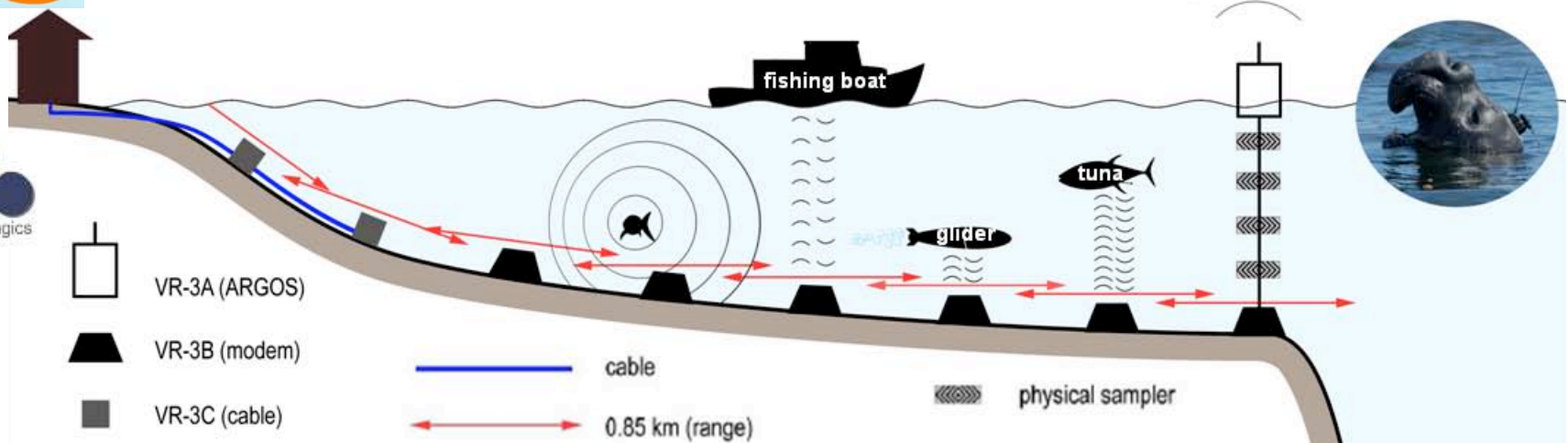


Cumulative Spectra of Maximum Size for Pelagics



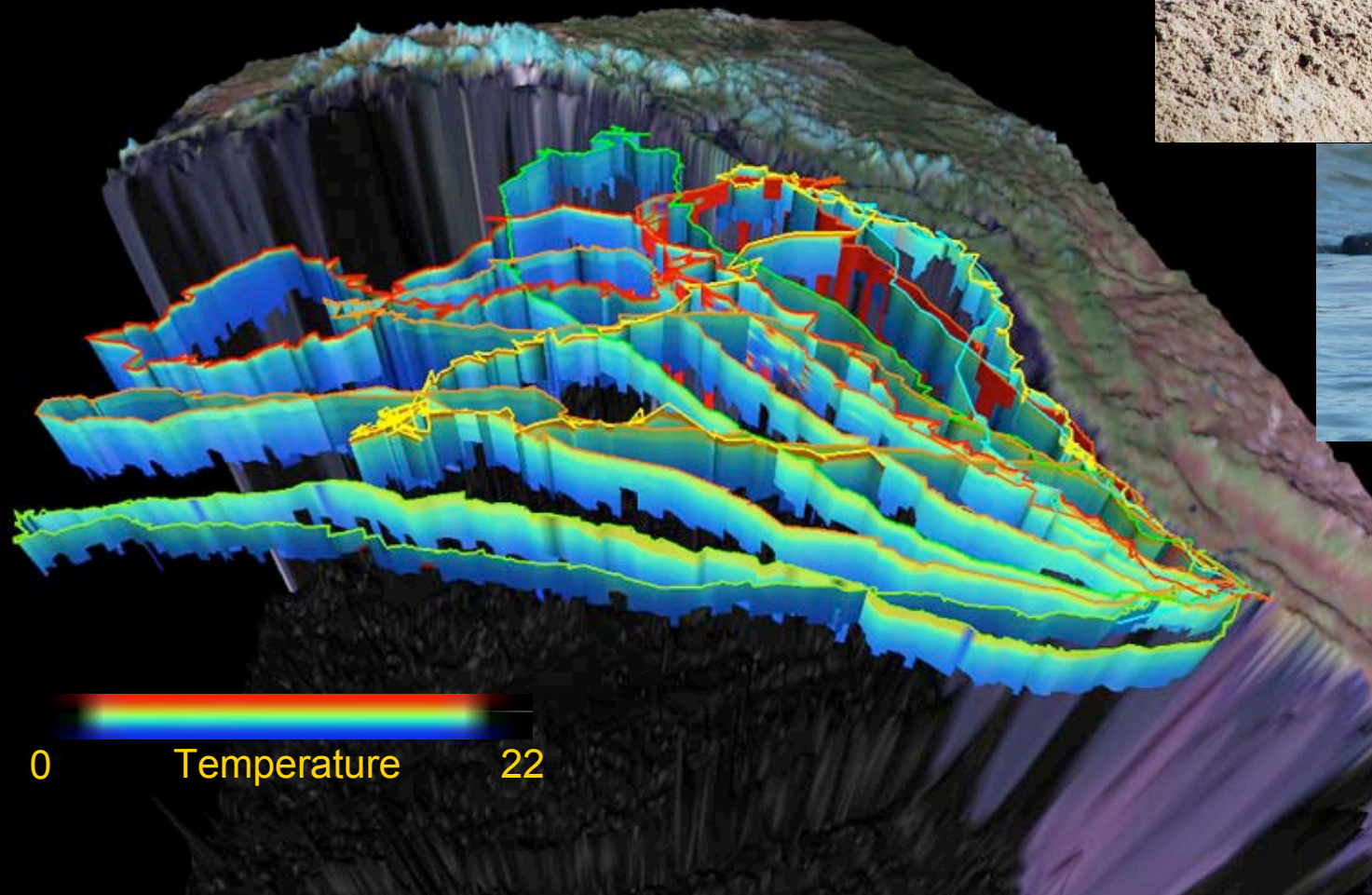


Global Ocean Tracking Network



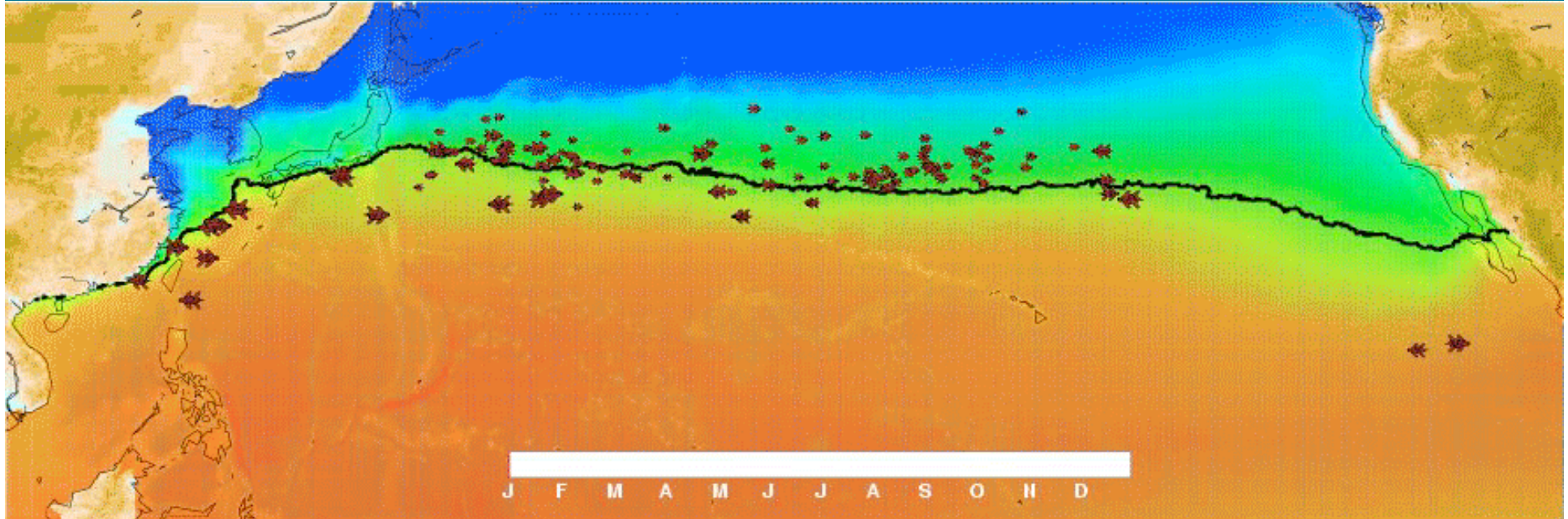
Science, Policy and Animal Oceanographers

**Collect oceanographic data (CTDs)
from deep diving animals like seals &
sea lions, equivalent to Argo Floats**



7 elephant
seals over
2-3 month
summer
period

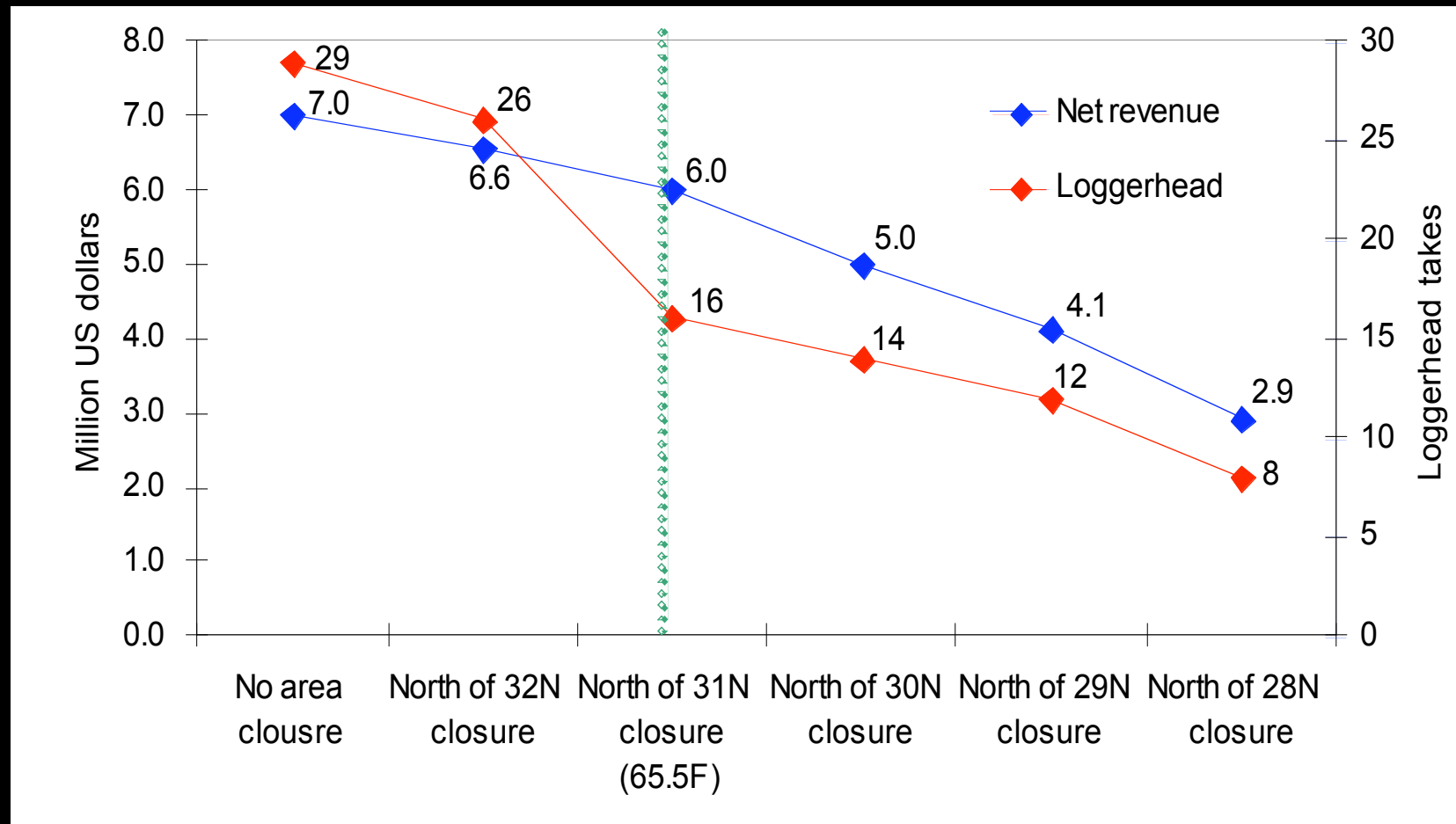
Climatological Daily Animation



- Loggerhead turtle tracks remapped to a single calendar year
- Climatological SST field, contour at 18.5°C for reference

Jeffery Polovina, NOAA, USNC IOOS Workshop

Trade-offs among Different Scenarios



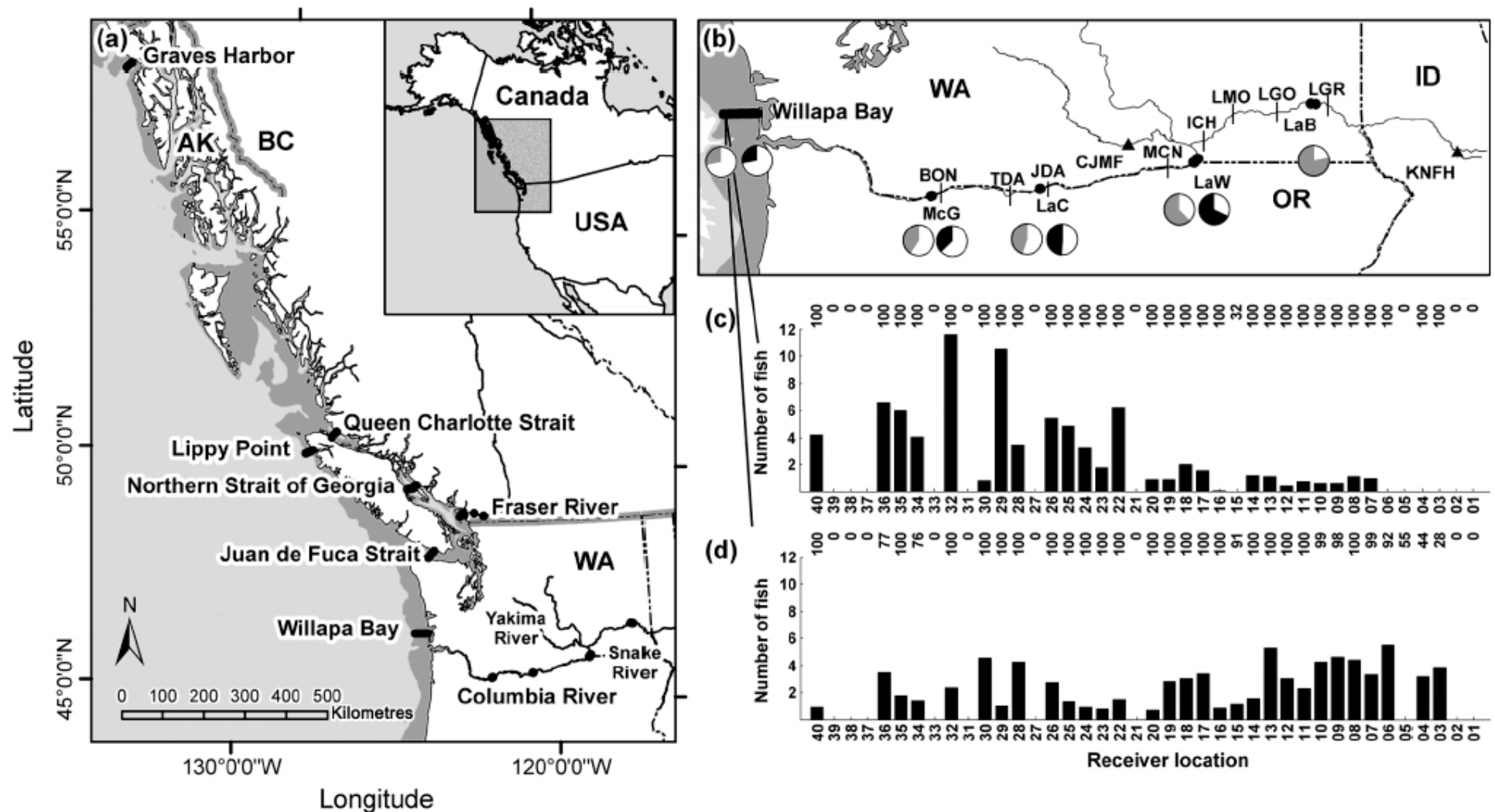
* Assuming 2120 sets fishing the first 4 months

CLIOTOP - Minling Pan, Ph.D. NOAA, Pacific Islands Fisheries Science Center

Experimental measurement of hydrosystem induced delayed mortality in juvenile Snake River spring Chinook salmon (*Oncorhynchus tshawytscha*) using a large-scale acoustic array.

EL Rechisky, DW Welch, AD Porter, MC Jacobs and A Ladouceur

Can. J. Fish. Aquat. Sci. 66: 1019–1024 (2009)





Striking a Balance Between Energy and the Environment in the Columbia River Basin

High-tech Gear Gives Scientists a New View of Salmon Survival in Rivers and the Ocean



Notes From the Chair

It's an article of faith in this fast moving world we live in to view technology as the key to solving many of our problems. And in certain ways, it does. In the cover story of this edition of the Council Quarterly, the POST project is shedding new light on the mysteries of the ocean environment and how fish and marine animals function in it. The project's high-tech monitoring systems are giving researchers important new data on the ocean survival of salmon and steelhead, and will offer opportunities to improve our understanding of fish survival in rivers as well.



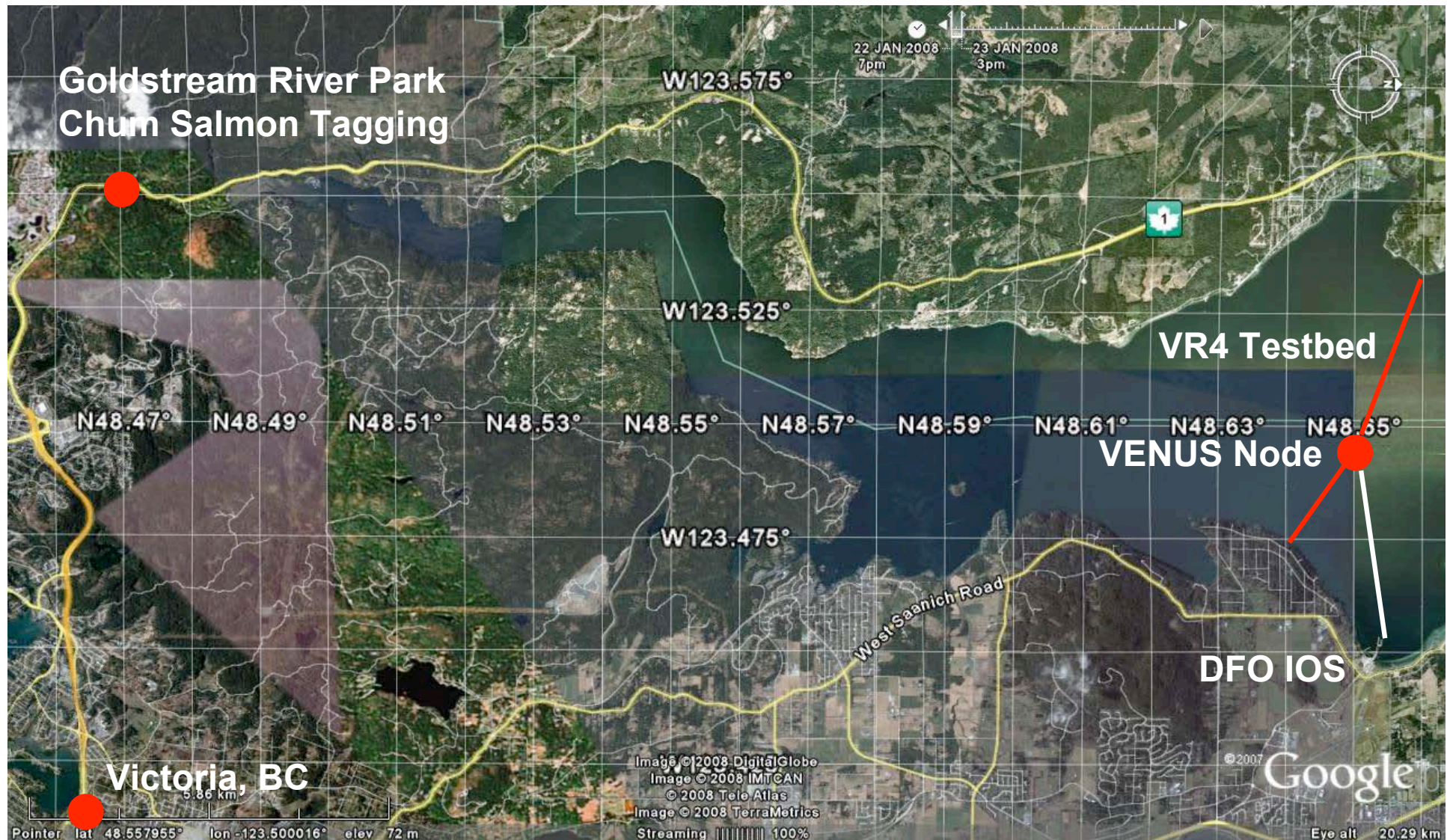
A
\$3 trillion
smile?

"So if all of the dams on the Columbia River were removed, it may actually do no good."

*George Jackson
POST senior scientist*

POST/OTN - Real Time, Saanich Inlet, BC

VENUS Daisy-Chain/Cable Tests Underway



Equipping the Halifax Line

Test Bed for OTN Monitoring Technology

Vemco VR4s

1. 500m depth capable
2. Daisy-chain capable
3. Benthic Pod modem links

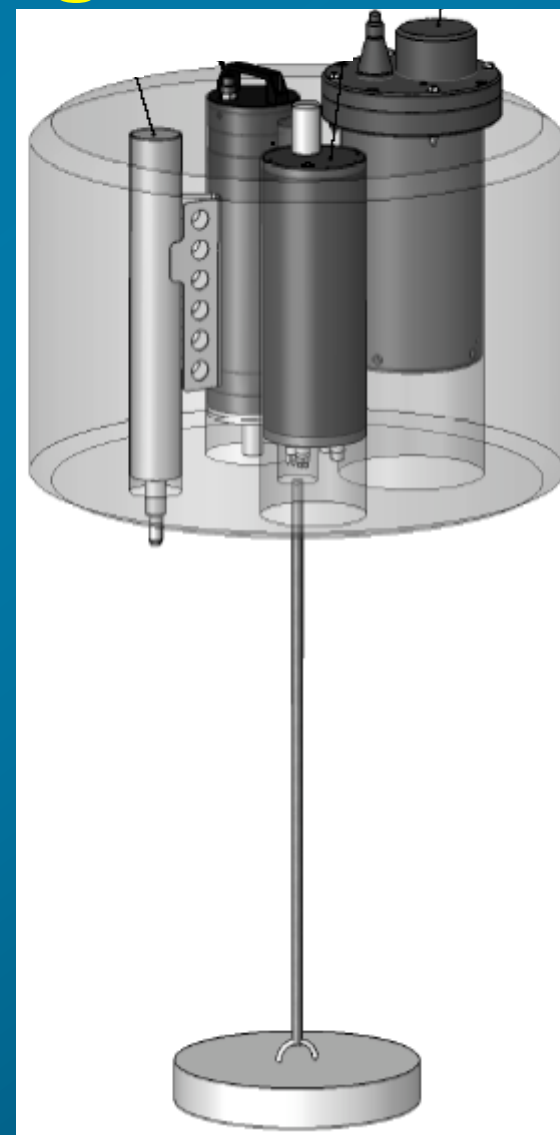
Satlantic Benthic Pods

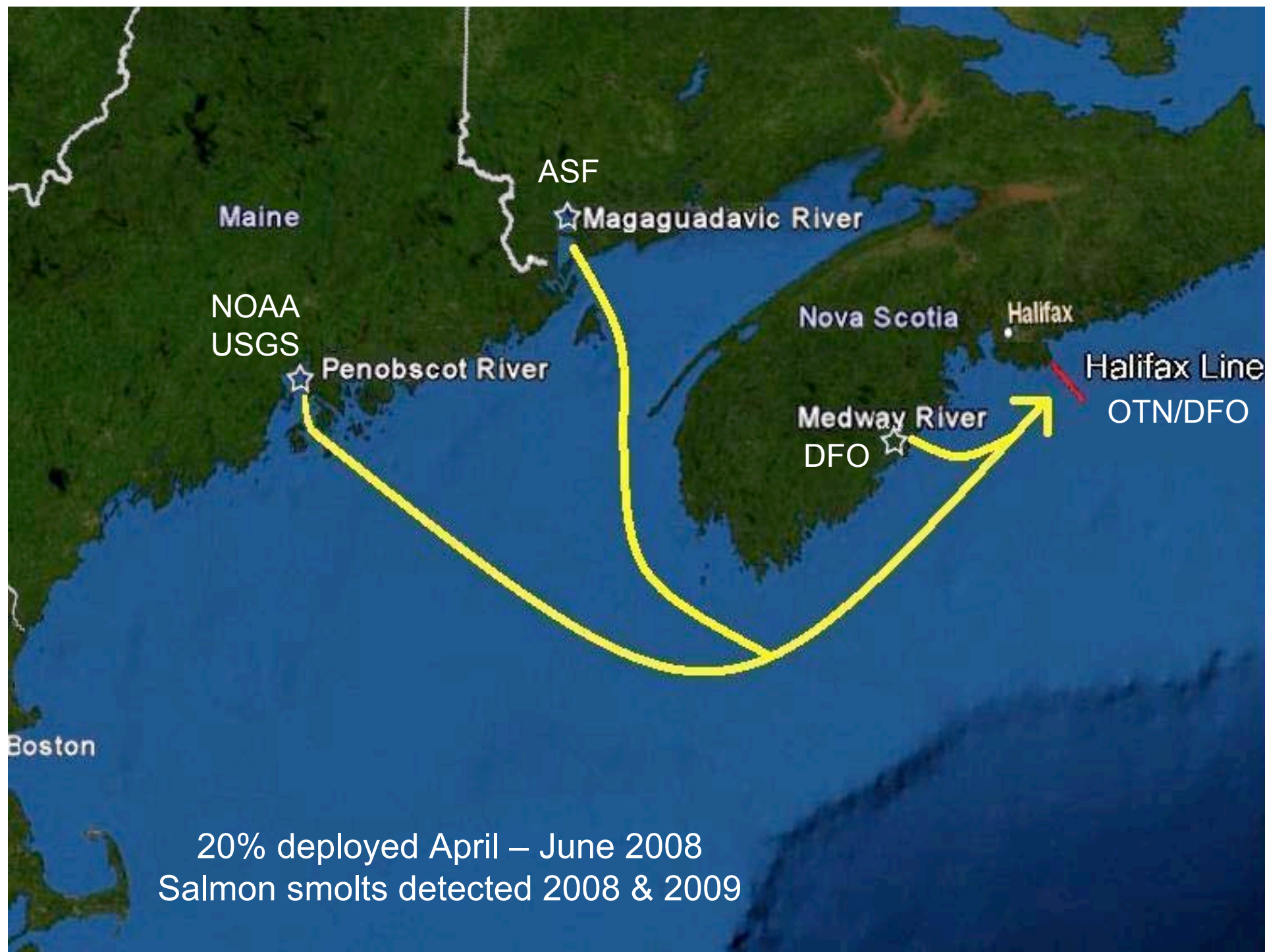
1. CTD
2. Dissolved Oxygen

Slocum Gliders

Cullen Real-time Microwave Link

DFO Co-located ADCPs





Navigation

OTN Global

OTN Canada

OTN HQ

AATAMS

POST

OTNDMC

Recent Changes



**Receiving:
Dalhousie**
Aug 14, 2008



**Biology Serials
Form**
Aug 14, 2008



Receiving
Aug 14, 2008



**Lost and Found
Equipment**
Aug 14, 2008









Lost equipment spreadsheet
Aug 14, 2008

[All recent changes...](#)

Groups

by [Robert M. Branton](#) — last modified Jun 16, 2008 09:03 PM

- 
[OTN Global](#) — by [Robert M. Branton](#) — last modified Jul 16, 2008 12:34 PM
Agreements, metadata and data organized by Ocean Region, Array and Subarray
- 
[OTN Canada](#) — by [Robert M. Branton](#) — last modified Jul 10, 2008 09:45 AM
for the NSERC projects
- 
[OTN HQ](#) — by [Robert M. Branton](#) — last modified Jul 10, 2008 09:46 AM
for OTN headquarters operations
- 
[AATAMS](#) — by [Robert M. Branton](#) — last modified Jun 13, 2008 06:44 PM
Australian Acoustic Tracking And Monitoring System
- 
[POST](#) — by [Robert M. Branton](#) — last modified Jun 13, 2008 12:10 PM
Pacific Ocean Shelf Tracking
- 
[OTNDMC](#) — by [Robert M. Branton](#) — last modified Jul 25, 2008 01:00 PM
Ocean Tracking Network Data Managers Committee (OTNDMC) - meeting announcements, agendas, presentations and reports.


Field Operations

by [Robert M. Branton](#) — last modified Jun 25, 2008 01:31 PM

- 
[Data Uploads](#) — by [Duncan Bates](#) — last modified Aug 01, 2008 03:58 PM
A repository for log files uploaded from acoustic receivers.
- 
[Metadata](#) — by [Duncan Bates](#) — last modified Aug 01, 2008 03:57 PM
- 
[Deployment Committee](#) — by [Stephane Kirchhoff](#) — last modified Jul 14, 2008 10:44 AM
- 
[Standard Operating Procedures](#) — by [Robert M. Branton](#) — last modified Jun 25, 2008 01:32 PM
- 
[Field Operations Estimate of Costs](#) — by [Stephane Kirchhoff](#) — last modified Aug 07, 2008 10:02 AM
This document describes in various level of details the costs of some our field operations

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News



Website Launch
Jul 30, 2008

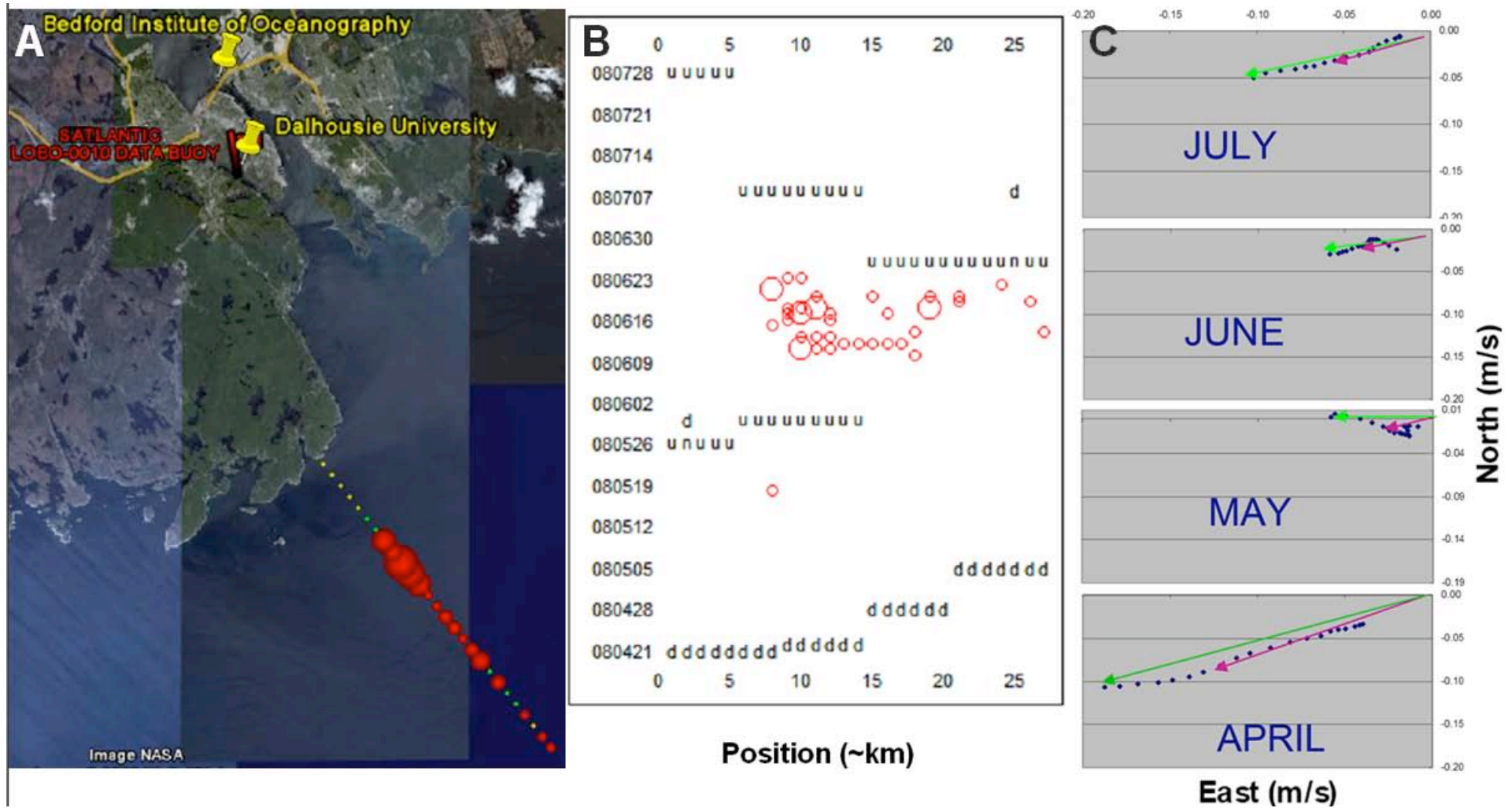
[More news...](#)

« August 2008 »

Mo	Tu	We	Th	Fr	Sa	Su
					1	2
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

www.oceantrack.org

Halifax Line Monitoring – Data & Conclusions!



34 Atlantic salmon 2008

Timed crossings

Minimum current

**From 60 years of asynchronous
sampling to NEPTUNE-lite with fish?**
O'Dor et al. OceanObs09 CWP – similar results 2009

Fully Integrated Tagging – FIT

Business Card Prototypes Out – Send/receive/archive VR2

1st Generation Sable Island seal tags - recover rate >90%:

(2009)

- External geolocating satellite tags
- External archival oceanographic data tags
- External BCT for ecological interaction data

Data integration on recovery = **Bioprobe**

2nd Generation - Internal receiver/archival/download tags.

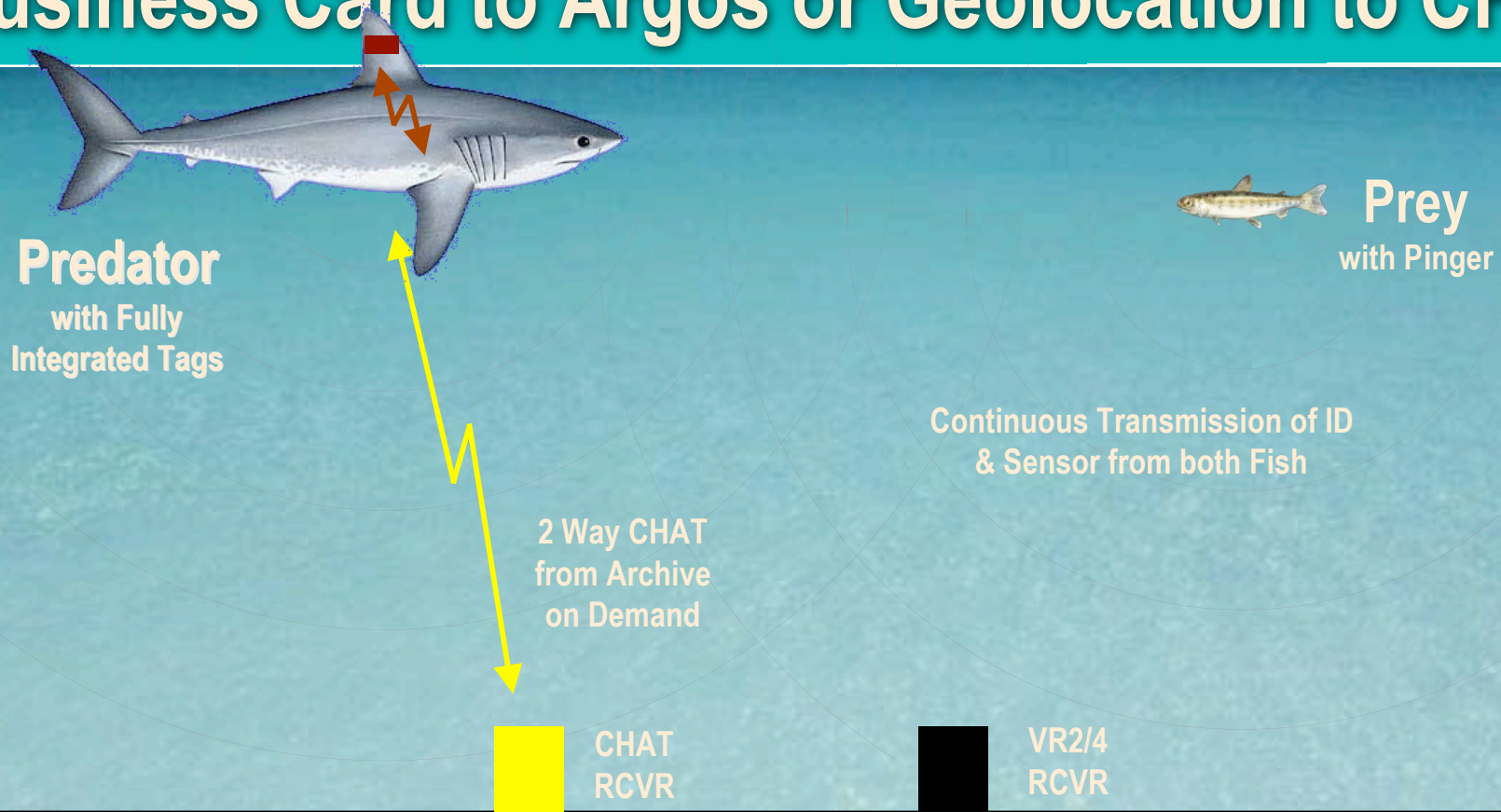
- What to archive - RAFOS, Daily Diaries?
- How much download?

3rd Generation - Better internal receiver/archival/download tags.

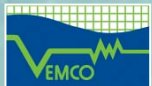
(2013)

- External "pills" relay information or internal tags relay to satellites?
- 20 year life?

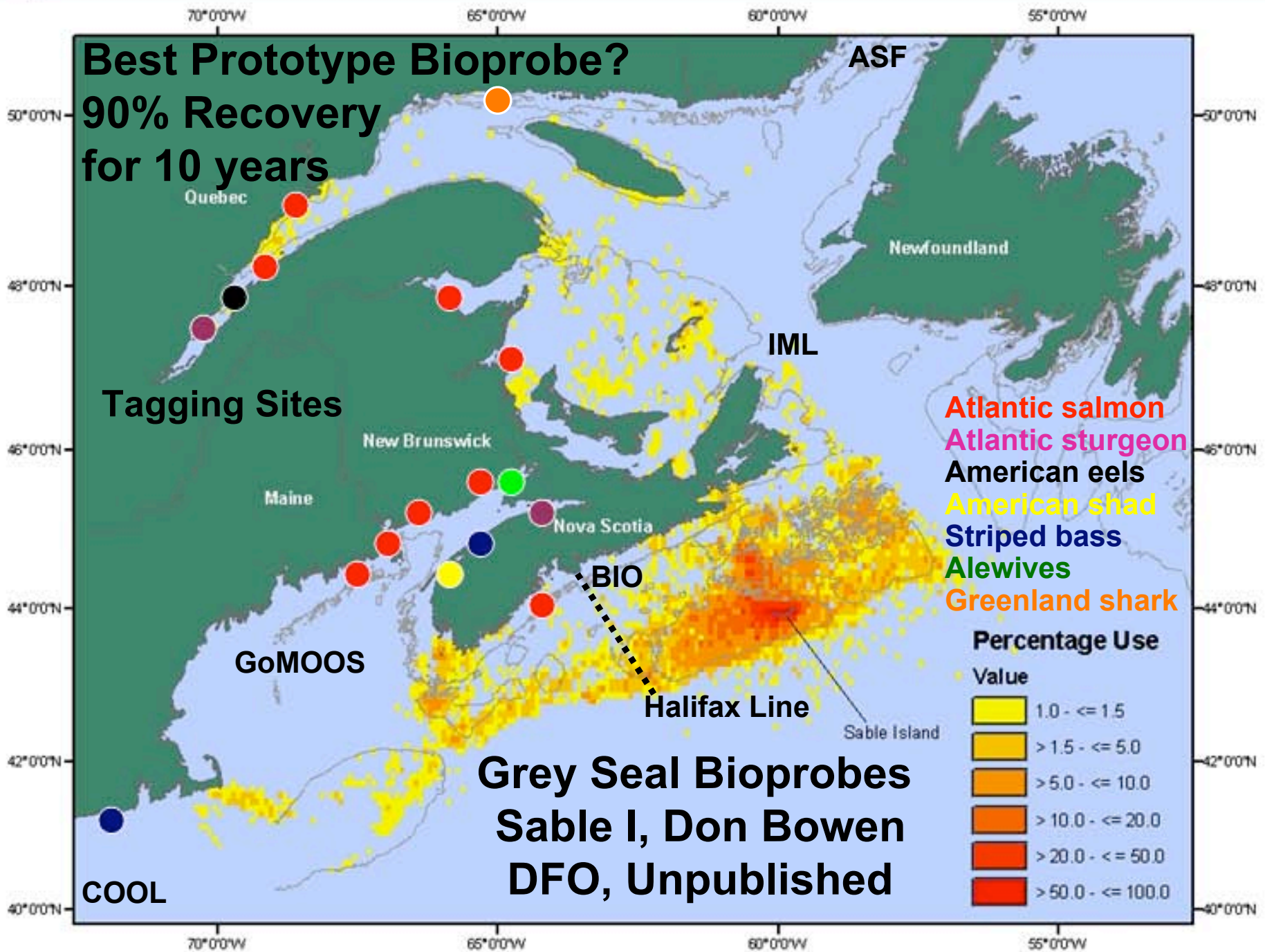
“Bioprobe” Fully Integrated Tagging: Business Card to Argos or Geolocation to CHAT



- ▶ Adding internal two-way communication link increases data types & odds for all systems
- ▶ Archival data is potentially backed up against tag losses
- ▶ Future Bioprobes for Ecosystem-Based Management



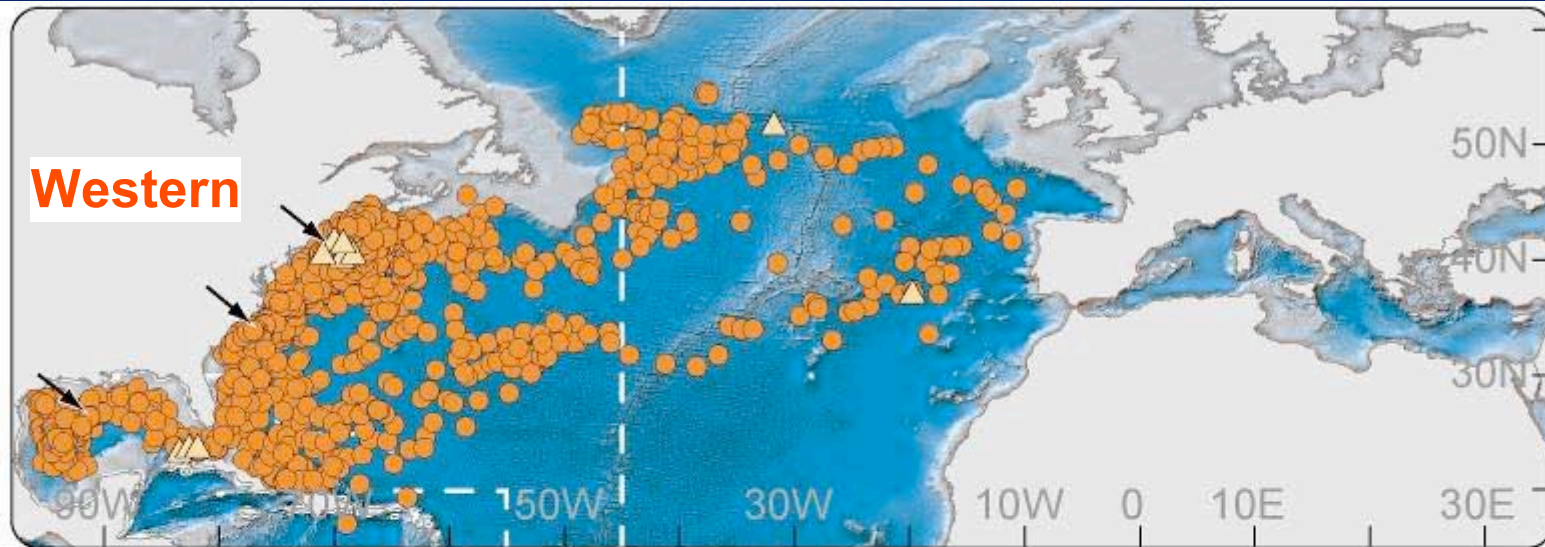
Next Generation Technology Development



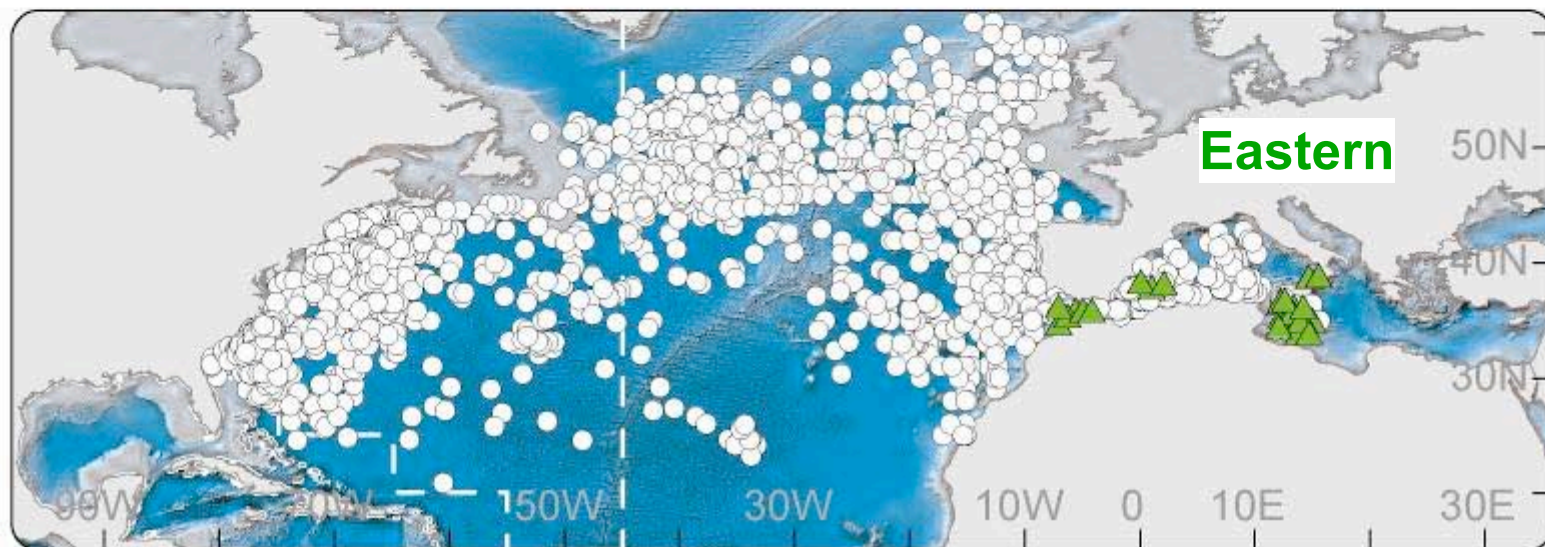
Tagged bluefin tuna link Atlantic & Mediterranean

- North America, Azores, Africa & Europe

Common feeding but separate breeding grounds

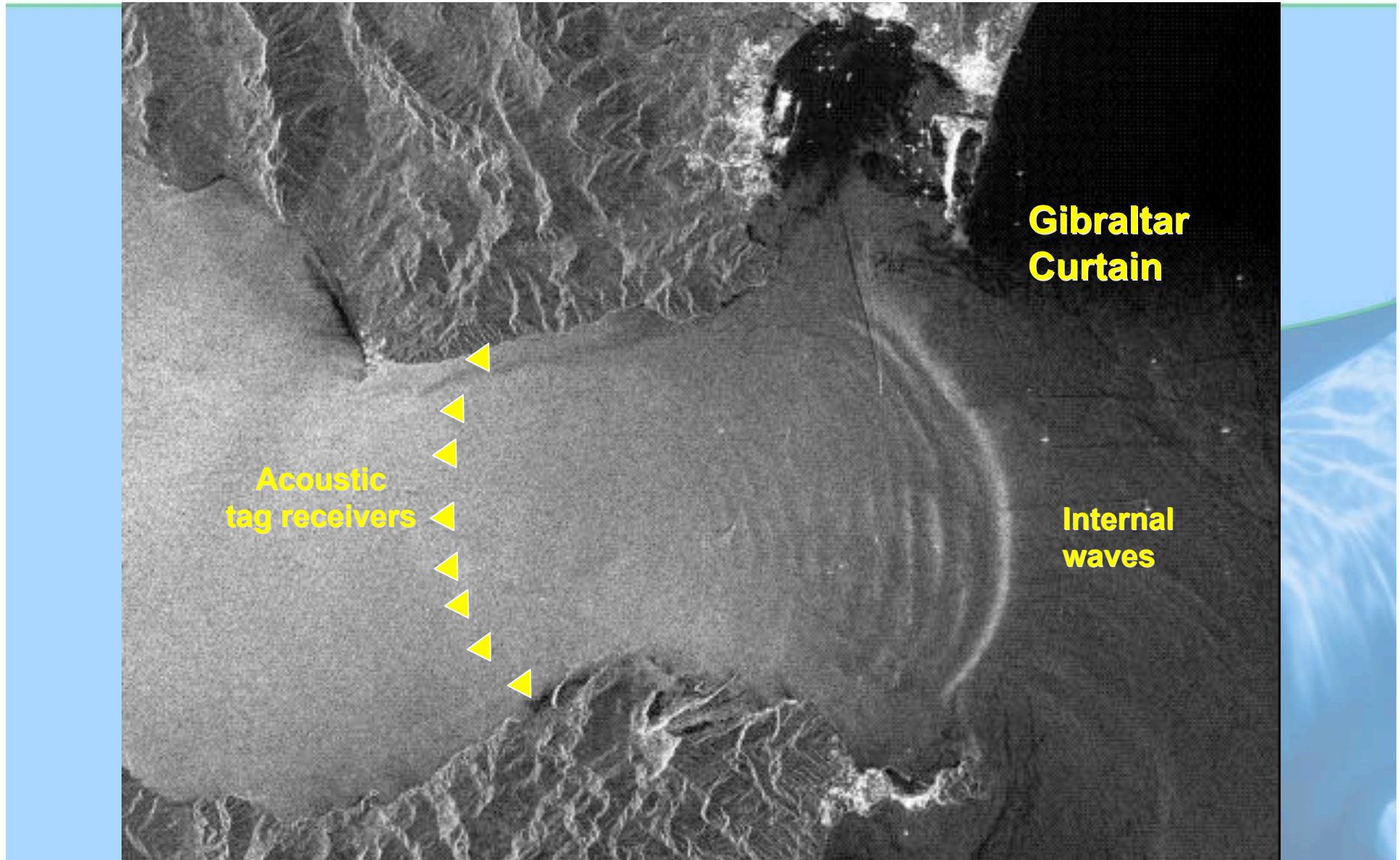


Block et al. Nature 2005



Coming to a strait near you!

Spanish Navy mapped Moroccan seabed



Life Questions

1. What is an oceanic ecosystem?

(bacteria to whales, migration, hotspots, top down, bottom up, middle out)

2. How will global warming effect them?

(relocation or disruption, animal oceanographers)

3. Will biodiversity decline?

Will production decline?

(extinctions vs. increased species mixing, trophic level shifts)

4. How much detail needed to monitor biodiversity?

(role of the rare, sentinels, DNA technologies)

5. Can Ecosystem Based Management
differentiate climate from fishing effects?

(in situ oceanography, humans vs. species interactions)