Biological and Chemical Oceanography Data Management Office (BCO-DMO)

Cyndy Chandler
25 April 2011

BCO-DMO

- What is BCO-DMO?
- Who is BCO-DMO?
- Why is BCO-DMO different?
- How do we accomplish our task?
- Why is BCO-DMO needed? Why now?
- What else is needed?

What is BCO-DMO?

BCO-DMO staff provide data management support for investigators and projects funded by NSF Ocean Sciences Biological and Chemical Oceanography Sections or NSF OPP ANT Organisms & Ecosystems Program

- partner with individual investigators and those associated with collaborative research projects
- data management support throughout the project
- capture and record documentation (metadata) sufficient to support data reuse and re-purposing
- load data and metadata into a relational database and ensure their availability online
- ensure final archive in appropriate data center (e.g. NODC); contribute to special repositories (e.g. CDIAC, OBIS, GenBank)

'proposal to preservation'

BCO-DMO Staff

- Biology Department
  - Peter Wiebe (Lead Investigator)
  - Robert Groman (co-PI)
  - Dicky Allison (Data Specialist)
  - Tobias Work (Programmer)
- Marine Chemistry and Geochemistry
  - David Glover (co-PI)
  - Cyndy Chandler (co-PI)
  - Stephen Gegg (Data Specialist)
- additional data specialists, consultants and collaborators as needed

BCO-DMO staff are funded to …

- support NSF OCE and OPP funded researchers
- ensure that data are …
  - available to the research community in a timely manner
  - sufficiently documented to facilitate reuse and re-purposing
- work with investigators during all phases of research:
  - data management planning and stewardship
    - proposal writing
    - cruise preparation
    - cruise and data documentation
    - effective organization of data in the BCO-DMO data system
  - permanent archive of data at NODC

BCO-DMO staff work in partnership with PIs

- to create well-documented data sets from research programs involving a wide variety of sampling gear

Data Discovery and Availability

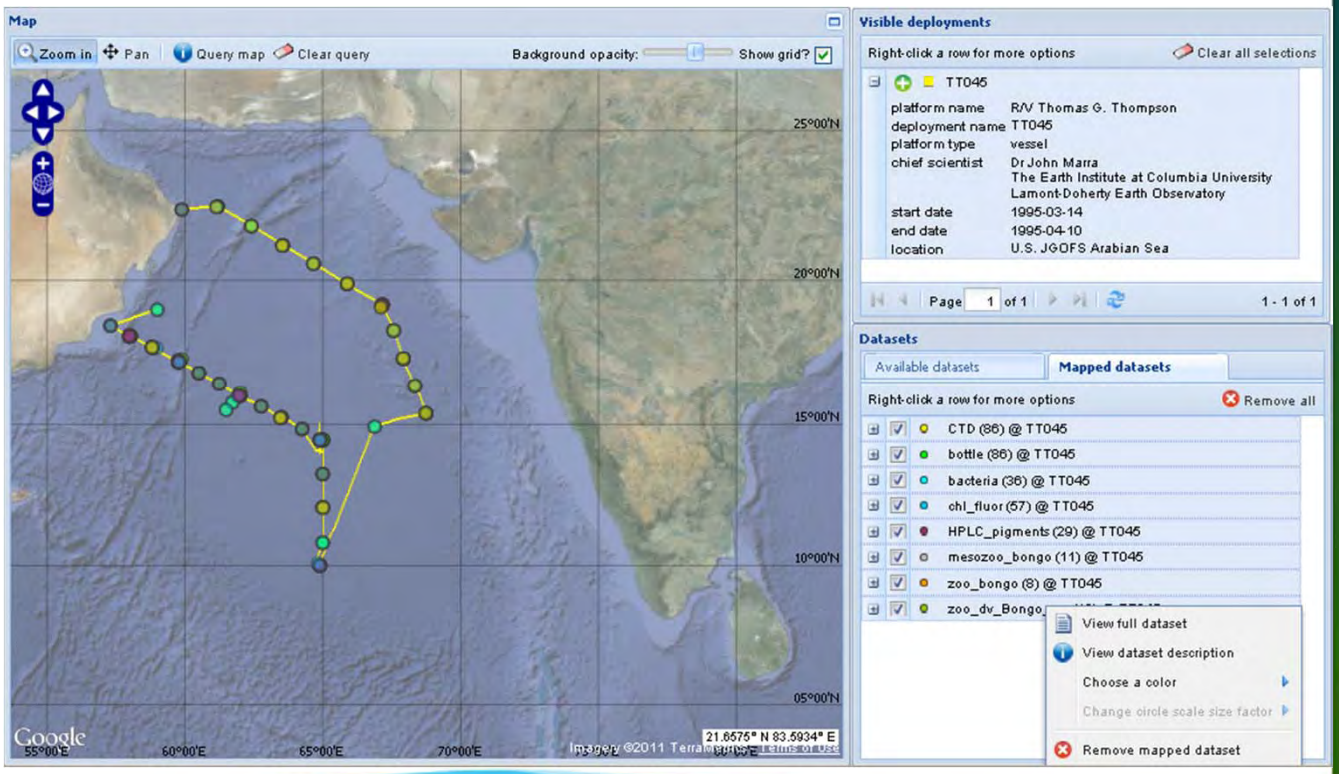
- our primary task is to ensure that data from NSF OCE funded awards are freely available online

- the BCO-DMO data system and interfaces facilitate
  - data discovery
  - data access to assess fitness-for-purpose
  - data export and download
  - data preservation in a permanent archive (the National Oceanographic Data Center (NODC))

Field Data to Database

in situ data from research cruises are documented and contributed to the online data system and discoverable through a variety of user interfaces

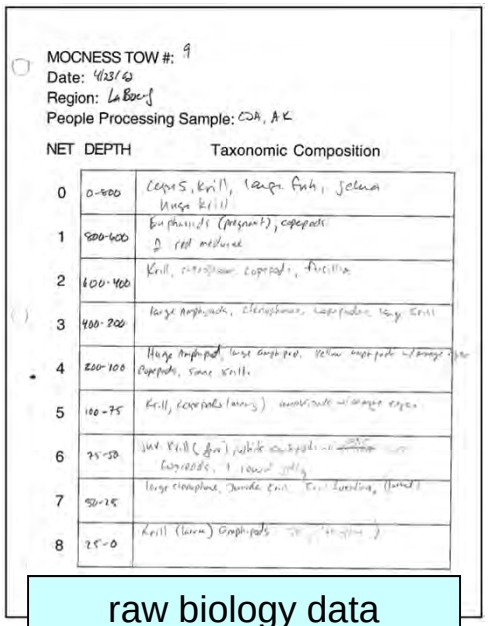
Original data from
Bongo net tows
and CTD/Niskin Rosette



“Data Management in the Wild” ~ MOCNESS Data

hauled in by people . . .

MOCNESS Sampling

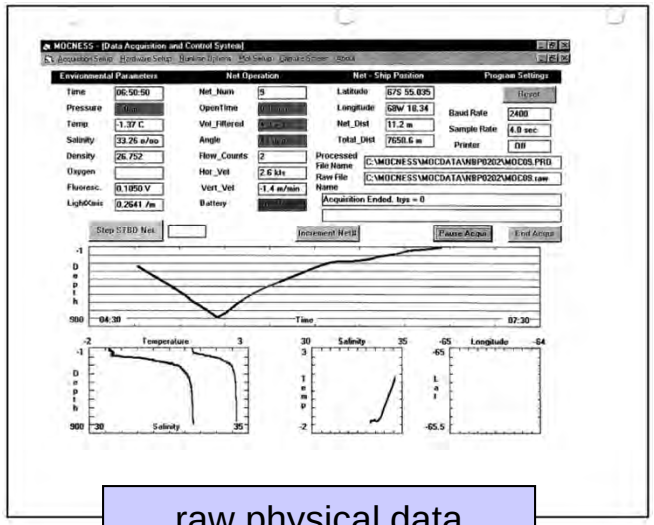


MOCNESS TOW #: 9
Date: 4/23/02
Region: LaBoeuf
People Processing Sample: COR, AK

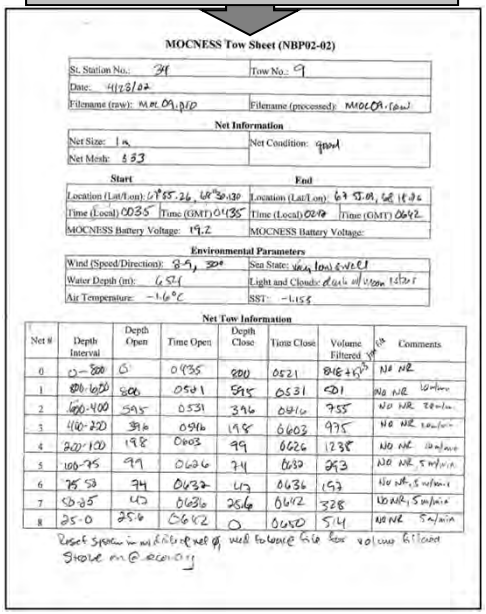
NET	DEPTH	Taxonomic Composition
0	0-800	Copes, krill, large fish, jellies, large krill
1	800-600	Euphausiids (pregnant), copepods, 2 red medusae
2	600-400	Krill, [illegible] copepods, fish eggs
3	400-200	large amphipods, chaetognaths, copepodites, tiny krill
4	200-100	Large amphipods, large amphipods, yellow amphipods w/ orange [illegible] copepods, some krill.
5	100-75	Krill, copepodites (many) [illegible]
6	75-50	[illegible] Krill (fair) [illegible] copepodites, 1 round jelly
7	50-25	large chaetognaths, juvenile krill, fish [illegible]
8	25-0	Krill (large) amphipods [illegible]

raw biology data

CTD sensor data



raw physical data



MOCNESS Tow Sheet (NBP02-02)

St. Station No.: 34 | Tow No.: 9
Date: 4/23/02
Filename (raw): MOC09.DAT | Filename (processed): MOC09.raw

Net Information
Net Size: 1 m | Net Condition: good
Net Mesh: 333

Start		End	
Location (Lat/Lon): 67°55.26, 68°30.130		Location (Lat/Lon): 67 51.09, 68 18.06	
Time (Local) 0035	Time (GMT) 0135	Time (Local) 0240	Time (GMT) 0642
MOCNESS Battery Voltage: 19.2		MOCNESS Battery Voltage:	

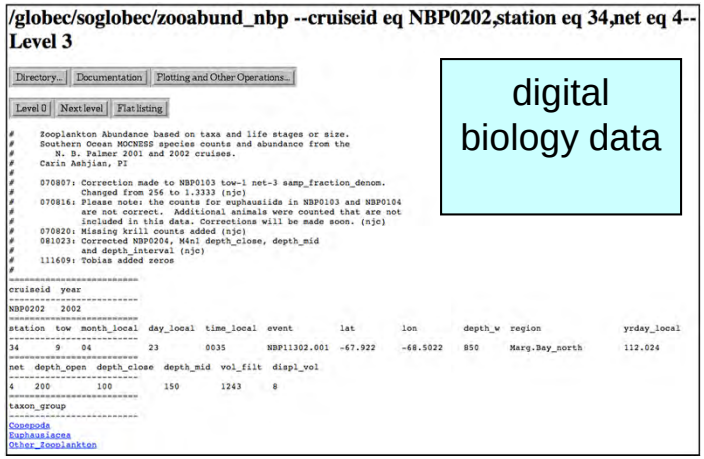
Environmental Parameters
Wind (Speed/Direction): 8-9, 320° | Sea State: [illegible]
Water Depth (m): 654 | Light and Clouds: [illegible]
Air Temperature: -1.6°C | SST: -1.155

Net Tow Information

Net #	Depth Interval	Depth Open	Time Open	Depth Close	Time Close	Volume Filtered	Comments
0	0-800	0	0135	800	0521	818+15	No NR
1	800-600	800	0541	595	0531	501	No NR bottom
2	600-400	595	0531	396	0416	755	No NR [illegible]
3	400-200	396	0416	198	0603	975	No NR [illegible]
4	200-100	198	0603	99	0626	1238	No NR [illegible]
5	100-75	99	0626	74	0630	593	No NR 5 m/min
6	75-50	74	0632	49	0636	157	No NR, 5 m/min
7	50-25	49	0636	25.6	0642	328	No NR, 5 m/min
8	25-0	25.6	0642	0	0650	514	No NR 5 m/min

Reset sparce in middle of net @ well below 600 [illegible] volume filtered
Stove on @ [illegible]

. . . the samples are processed by people, observations recorded by people, and digital data sets created by people



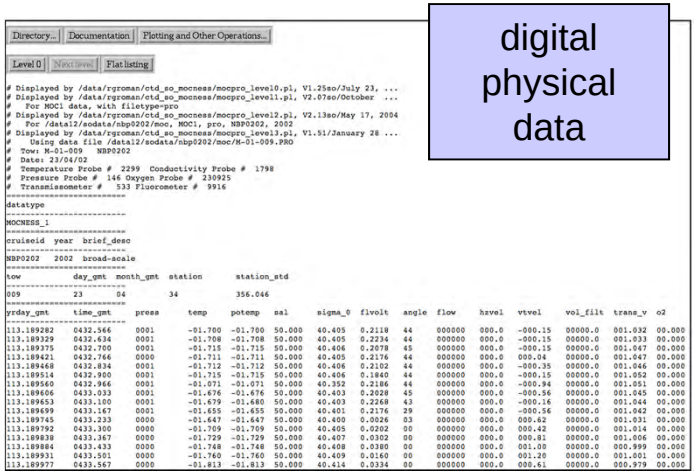
/globec/soglobec/zooabund_nbp --cruiseid eq NBP0202,station eq 34,net eq 4--Level 3

Directory... | Documentation | Plotting and Other Operations...

Level 0 | Next level | Flat listing

```
#     Zooplankton Abundance based on taxa and life stages or size.
#     Southern Ocean MOCNESS species counts and abundance from the
#       N. B. Palmer 2001 and 2002 cruises.
#     Carin Ashjian, PI
#
#     070807: Correction made to NBP0103 tow-1 net-3 samp_fraction_denom.
#             Changed from 256 to 1.3333 (njc)
#     070816: Please note: the counts for euphausiids in NBP0103 and NBP0104
#             are not correct.  Additional animals were counted that are not
#             included in this data. Corrections will be made soon. (njc)
#     070820: Missing krill counts added (njc)
#     081023: Corrected NBP0204, M4n1 depth_close, depth_mid
#             and depth_interval (njc)
#     111609: Tobias added zeros
#
==========================
cruiseid  year
--------------------------
NBP0202   2002
==========================
station  tow  month_local  day_local  time_local  event        lat        lon        depth_w  region          yrday_local
--------------------------------------------------------------------------------------------------------------------------
34       9    04           23         0035        NBP11302.001 -67.922    -68.5022   850      Marg.Bay_north  112.024
==========================
net  depth_open  depth_close  depth_mid  vol_filt  displ_vol
--------------------------------------------------------------
4    200         100         150        1243      8
==========================
taxon_group
--------------------------
Copepoda
Euphausiacea
Other_Zooplankton
```

digital biology data



Directory... | Documentation | Plotting and Other Operations...

Level 0 | Next level | Flat listing

```
# Displayed by /data/rgroman/ctd_so_mocness/mocpro_level0.pl, V1.25so/July 23, ...
# Displayed by /data/rgroman/ctd_so_mocness/mocpro_level1.pl, V2.07so/October  ...
#   For MOC1 data, with filetype=pro
# Displayed by /data/rgroman/ctd_so_mocness/mocpro_level2.pl, V2.13so/May 17, 2004
#   For /data12/sodata/nbp0202/moc, MOC1, pro, NBP0202, 2002
# Displayed by /data/rgroman/ctd_so_mocness/mocpro_level3.pl, V1.51/January 28 ...
#   Using data file /data12/sodata/nbp0202/moc/M-01-009.PRO
# Tow: M-01-009   NBP0202
# Date: 23/04/02
# Temperature Probe #  2299  Conductivity Probe #  1798
# Pressure Probe #  146 Oxygen Probe #  230925
# Transmissometer #   533 Fluorometer #  9916
=========================
datatype
-------------------------
MOCNESS_1
=========================
cruiseid  year  brief_desc
-------------------------
NBP0202   2002  broad-scale
=========================
tow          day_gmt  month_gmt  station      station_std
-------------------------------------------------------
009          23       04         34           356.046
=========================
yrday_gmt    time_gmt    press    temp     potemp   sal      sigma_0  fivolt   angle  flow     hzvel    vtvel    vol_filt  trans_v  o2
-------------------------------------------------------------------------------------------------------------------------------------
113.189282   0432.566    0001     -01.700  -01.700  50.000   40.405   0.2118   44     000000   000.0    -000.15  00000.0   001.032  00.000
113.189329   0432.634    0001     -01.708  -01.708  50.000   40.405   0.2234   44     000000   000.0    -000.15  00000.0   001.033  00.000
113.189375   0432.700    0001     -01.715  -01.715  50.000   40.406   0.2078   45     000000   000.0    -000.15  00000.0   001.047  00.000
113.189421   0432.766    0000     -01.711  -01.711  50.000   40.405   0.2176   44     000000   000.0    000.04   00000.0   001.047  00.000
113.189468   0432.834    0001     -01.712  -01.712  50.000   40.406   0.2102   44     000000   000.0    -000.35  00000.0   001.046  00.000
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113.189560   0432.966    0001     -01.671  -01.671  50.000   40.352   0.2186   44     000000   000.0    -000.94  00000.0   001.051  00.000
113.189606   0433.033    0001     -01.676  -01.676  50.000   40.403   0.2028   45     000000   000.0    -000.56  00000.0   001.045  00.000
113.189653   0433.100    0001     -01.679  -01.680  50.000   40.403   0.2268   43     000000   000.0    -000.16  00000.0   001.044  00.000
113.189699   0433.167    0001     -01.655  -01.655  50.000   40.401   0.2176   29     000000   000.0    -000.56  00000.0   001.042  00.000
113.189745   0433.233    0000     -01.647  -01.647  50.000   40.400   0.0026   03     000000   000.0    000.62   00000.0   001.031  00.000
113.189792   0433.300    0000     -01.709  -01.709  50.000   40.405   0.0202   00     000000   000.0    000.42   00000.0   001.014  00.000
113.189838   0433.367    0000     -01.729  -01.729  50.000   40.407   0.0302   00     000000   000.0    000.81   00000.0   001.006  00.000
113.189884   0433.433    0000     -01.748  -01.748  50.000   40.408   0.0380   00     000000   000.0    001.00   00000.0   000.999  00.000
113.189931   0433.501    0000     -01.760  -01.760  50.000   40.409   0.0160   00     000000   000.0    001.20   00000.0   001.001  00.000
113.189977   0433.567    0000     -01.813  -01.813  50.000   40.414   0.0334   00     000000   000.0    000.61   00000.0   000.979  00.000
```
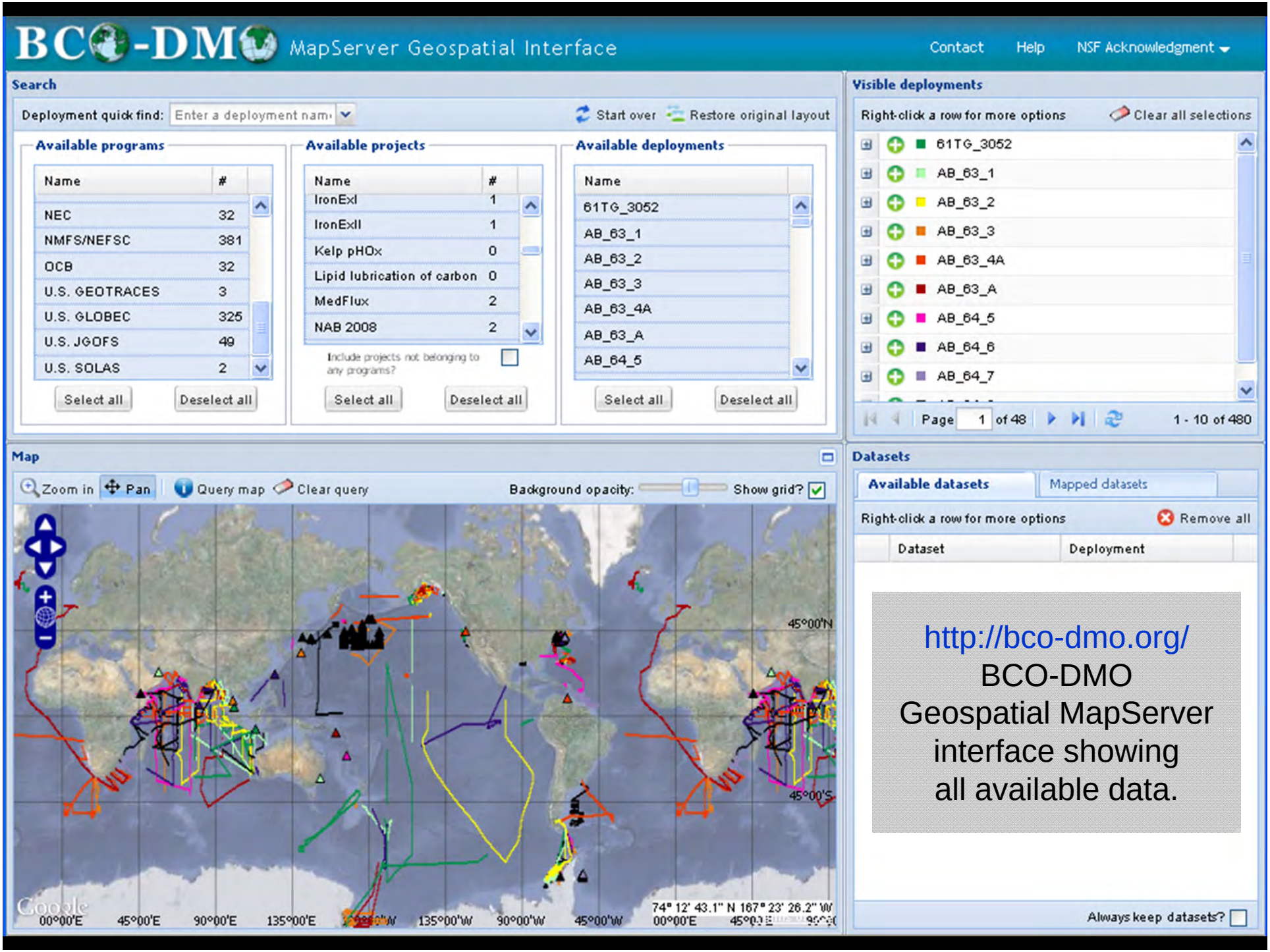
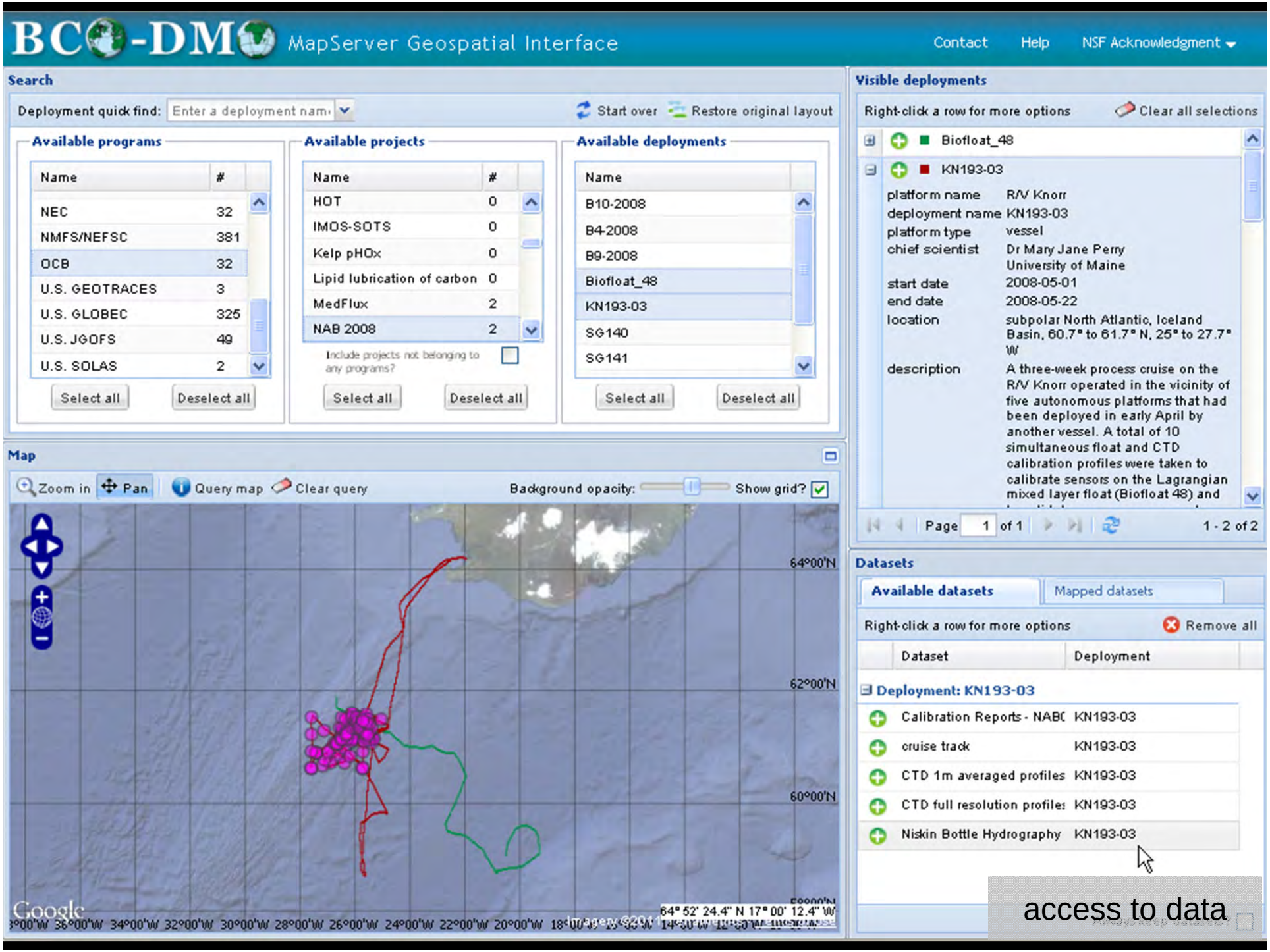

digital physical data



http://bco-dmo.org/
BCO-DMO
Geospatial MapServer
interface showing
all available data.


BCO-DMO MapServer Geospatial Interface
Contact
Help
NSF Acknowledgment
Search
Deployment quick find: Enter a deployment nam
Start over
Restore original layout
Available programs
Name #
NEC 32
NMFS/NEFSC 381
OCB 32
U.S. GEOTRACES 3
U.S. GLOBEC 325
U.S. JGOFS 49
U.S. SOLAS 2
Select all
Deselect all
Available projects
Name #
HOT 0
IMOS-SOTS 0
Kelp pHOx 0
Lipid lubrication of carbon 0
MedFlux 2
NAB 2008 2
Include projects not belonging to any programs?
Select all
Deselect all
Available deployments
Name
B10-2008
B4-2008
B9-2008
Biofloat_48
KN193-03
SG140
SG141
Select all
Deselect all
Map
Zoom in
Pan
Query map
Clear query
Background opacity:
Show grid?
64°00'N
62°00'N
60°00'N
Google
64° 52' 24.4" N 17° 00' 12.4" W
Visible deployments
Right-click a row for more options
Clear all selections
Biofloat_48
KN193-03
platform name R/V Knorr
deployment name KN193-03
platform type vessel
chief scientist Dr Mary Jane Perry University of Maine
start date 2008-05-01
end date 2008-05-22
location subpolar North Atlantic, Iceland Basin, 60.7° to 61.7° N, 25° to 27.7° W
description A three-week process cruise on the R/V Knorr operated in the vicinity of five autonomous platforms that had been deployed in early April by another vessel. A total of 10 simultaneous float and CTD calibration profiles were taken to calibrate sensors on the Lagrangian mixed layer float (Biofloat 48) and
Page 1 of 1
1 - 2 of 2
Datasets
Available datasets
Mapped datasets
Right-click a row for more options
Remove all
Dataset Deployment
Deployment: KN193-03
Calibration Reports - NABC KN193-03
cruise track KN193-03
CTD 1m averaged profiles KN193-03
CTD full resolution profiles KN193-03
Niskin Bottle Hydrography KN193-03
access to data

BCO-DMO and Other Data Repositories

BCO-DMO is part of a network of distributed data repositories working to support the research community and ensuring that data are available in the public domain.

Ocean CO2 CDIAC — Carbon Dioxide Information Analysis Center

North American Carbon Program

LTER — Long Term Ecological Research Network

CCHDO — CLIVAR & Carbon Hydrographic Data Office

NCBI — National Center for Biotechnology Information: GenBank

nbii — National Biological Information Infrastructure

OBIS — OCEAN BIOGEOGRAPHIC INFORMATION SYSTEM

rvdata.us — Rolling Deck to Repository (R2R)

NOAA — NATIONAL OCEANOGRAPHIC DATA CENTER (NODC) UNITED STATES DEPARTMENT OF COMMERCE

BCO-DMO staff work in partnership with PIs

- to create well-documented data sets to enable reuse and re-purposing of data
- to support US contributions to large coordinated research programs and global ocean research themes

OCB
Ocean Carbon & Biogeochemistry

U.S. JGOFS

U.S. GLOBEC
GLOBAL OCEAN ECOSYSTEMS DYNAMICS

International Council for Science
SCOR
Scientific Committee on Oceanic Research

GEOTRACES

solas

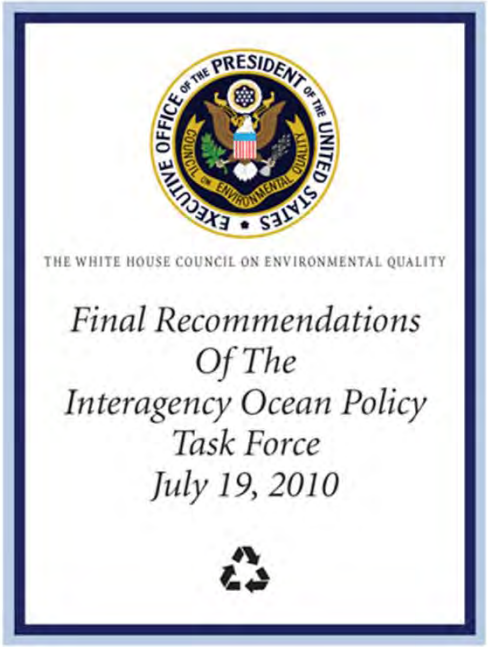
IMBER
Integrated Marine Biogeochemistry and Ecosystem Research

oceanironfertilization

ocean acidification
Jean-Pierre Gattuso and Lina Hansson

Stewardship of Research Data is Essential

- to provide valuable research findings that inform:
  - US policies for use, management, and conservation of water resources
  - Coastal and Marine Spatial Planning
  - IPCC Fifth Assessment Report (AR5)
  - National and global research initiatives



EPOCA
European Project on OCean Acidification

Ocean Acidification
Studying ocean acidification's effects on marine ecosystems and biogeochemistry

Interoperability

- the ability of different data repository systems to exchange and integrate data and information and present a unified view to the user
- requires syntactic (format) compatibility
  - e.g. access/security, file formats, transfer protocols
  - to retrieve data and information
- requires semantic (language) compatibility
  - e.g. metadata standards, controlled vocabularies, ontologies
  - to understand data and information

Trans-disciplinary, cross-agency collaboration and cooperation

Geo-Data Informatics 2011 Workshop
Exploring the Life Cycle, Citation and Integration of Geo-Data

- a workshop of 100 invited participants
- held in Broomfield, Colorado in March 2011
- NSF sponsored with support from USGS
- primary objective: "to substantially advance discussions and directions of data life cycle, data integration and data citation, with strong emphasis on end-use, and to provide a state-of-the-field report to NSF and the USGS of the geoinformatics community's capabilities and needs ... "
- final report (in progress)
  http://tw.rpi.edu/web/Workshop/Community/GeoData2011

“A scholar’s positive contribution is measured by the sum of the original data that he contributes. Hypotheses come and go but data remain.”

In: Advice to a Young Investigator (Santiago Ramón y Cajal, 1897)

Ocean Research and Resources Advisory Panel
Consortium for Ocean Leadership

April 25 – 26, 2011

OceanSITES and Proper Data Management Responsibilities to Meet the Global Ocean Observing System (GOOS) Requirements

William Burnett

Mission Control Center Manager

U.S. NOAA/National Data Buoy Center

Presentation Logic

- More countries and capabilities to collect ocean observations
- However, controversies like “Climate-Gate” create a need to adequately describe and understand the observations
- OceanSITES is leading the way in proper data management for ocean observations

NOAA and Climate/Ocean Observations

- There is an increasing demand for global climate change & ocean information, services and products – this includes observations from the GOOS and IOOS arrays.

- Partnerships enhance ocean observations in the region and also build the regional capacity to apply these observations to understand climate risk management, coastal resilience, ecosystems, MPAs, and other socio-economic benefits,

- NOAA is interested in advancing a strong, equitable and mutually beneficial collaboration with Regions for capacity building, socio-economic applications and ocean observations in the region, and

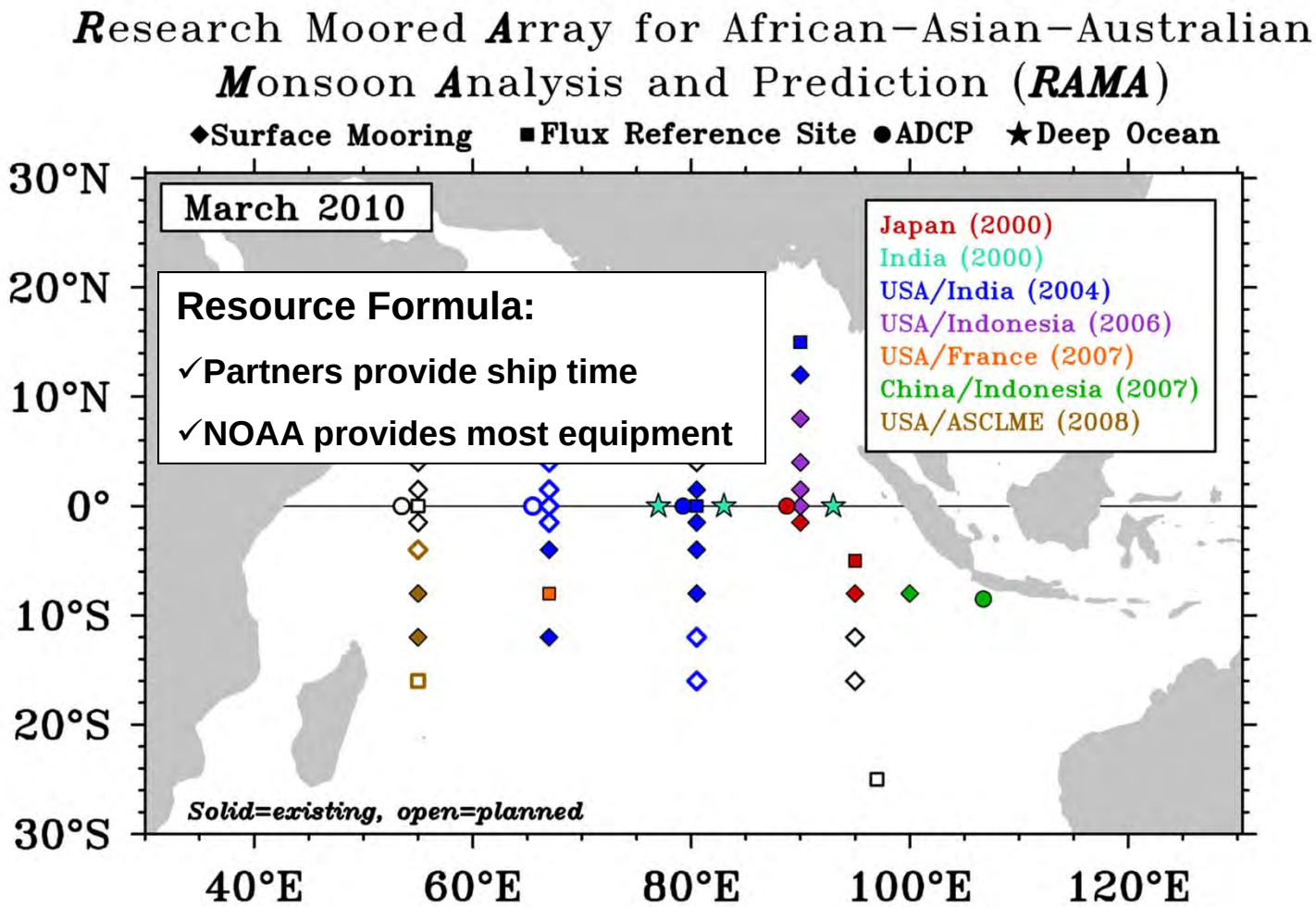
- Training & education is important for countries building the next generation ocean observatories. NOAA is pleased to be able to provide USA training & educational opportunities through Memorandums Of Understanding or Agreements.

International Cooperation

Formal bilateral agreements between NOAA and agencies in:

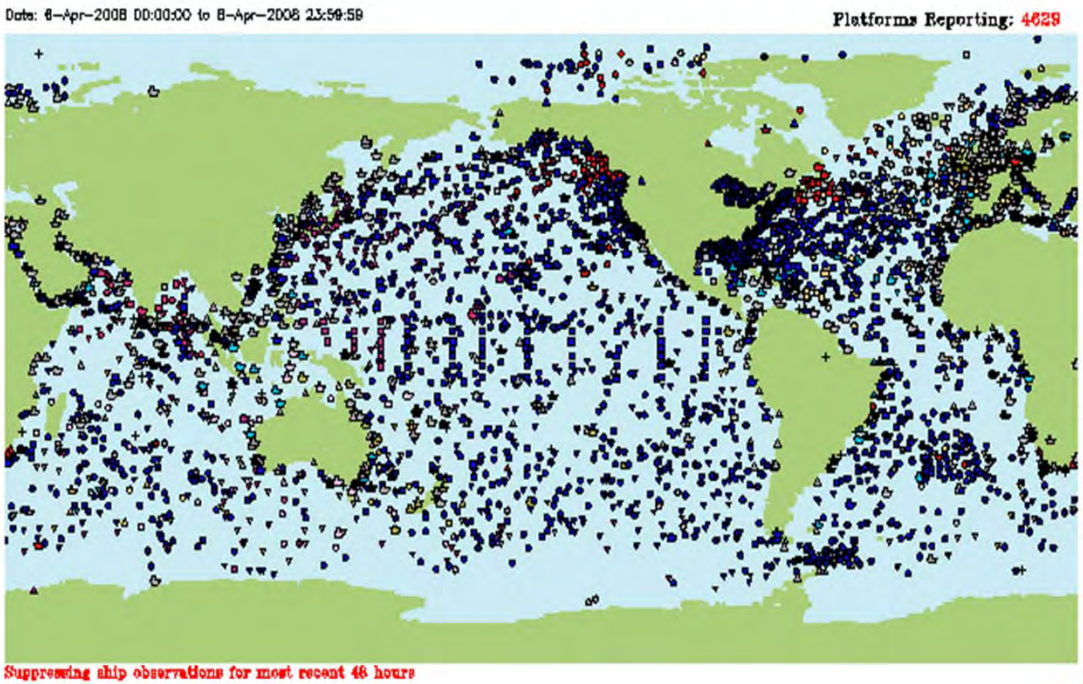
- **Indonesia--signed in 2007**
- **India--signed in 2008**
- **Japan--signed in 2008**
- **France--planned in 2009**
- **ASCLME (9 East African countries)**

RAMA: Implementation Status

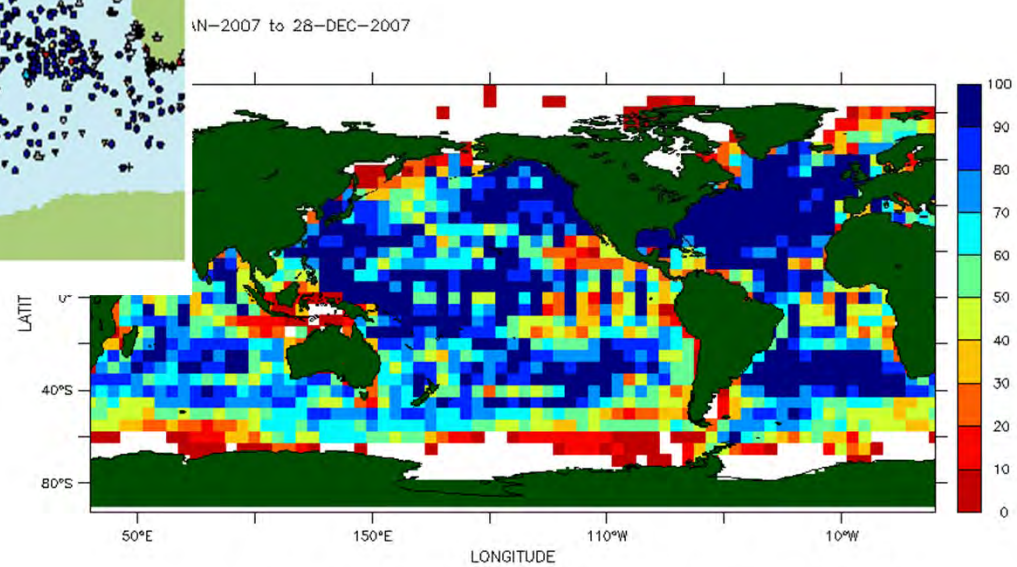


57% of sites occupied by March 2010 (26 of 46)

Currents Status
More global ocean observations

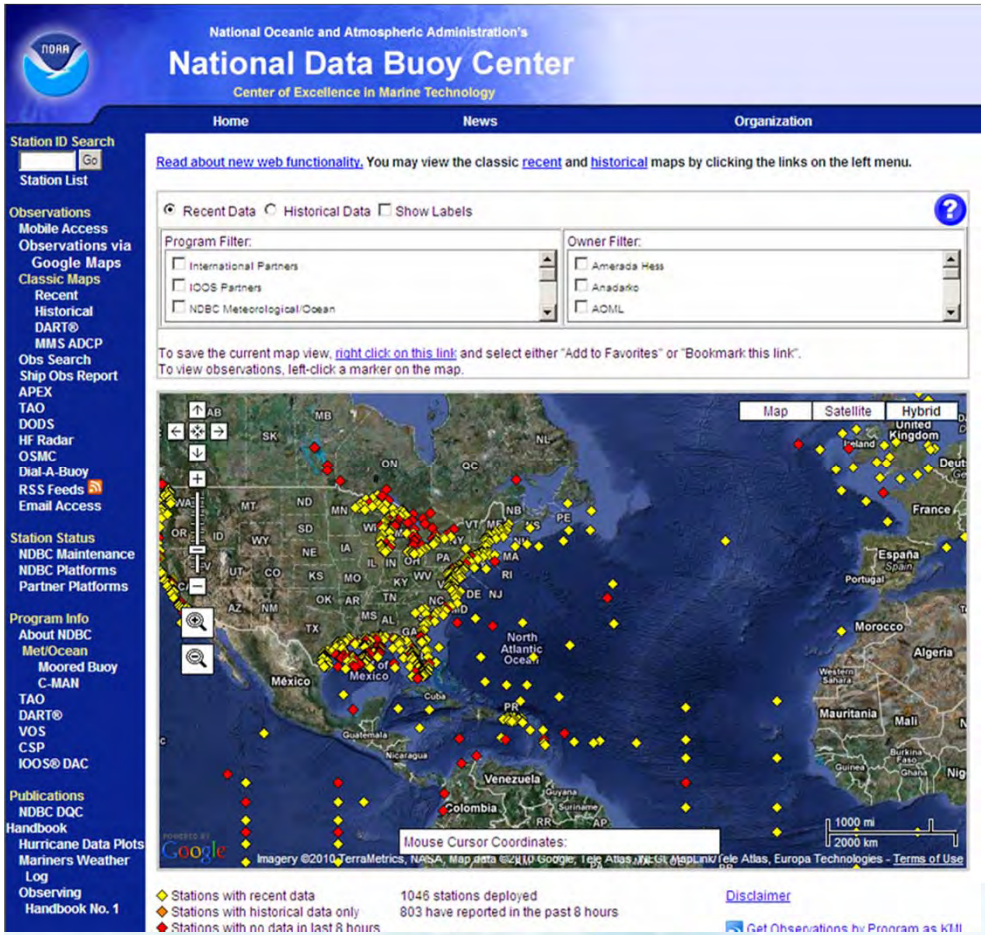


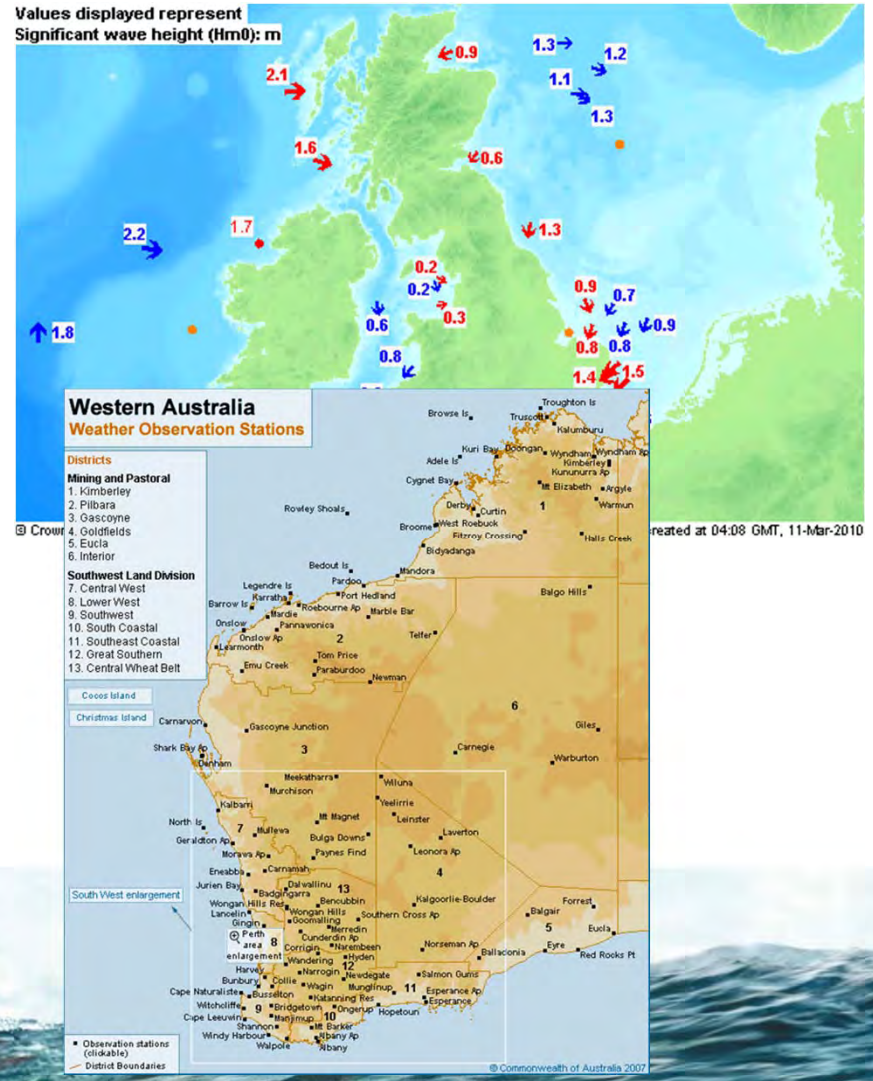
http://www.osmc.noaa.gov



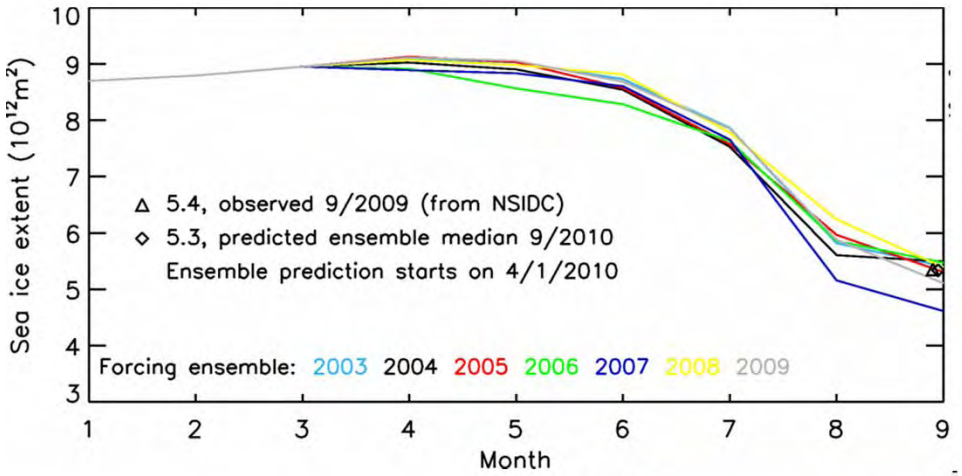
Percent of Weeks with 10 sst obs in 5x5 Box for 2007

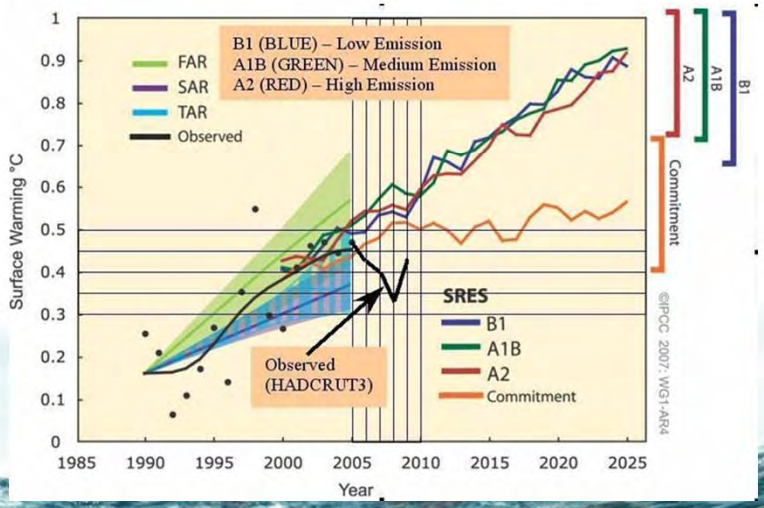
Current Status
Expansion in free data sets





Current Status
Climatic Research Unit e-mail
"Climategate" Controversy





Proper Data Management

- More than just placing a meteorological, oceanographic or geophysical instrument in the water or on the land,
- More than just collecting an observation, and
- More than just disseminating the data via a data portal

WMO Strategic Thrusts

1.Strategic Thrust –

Improving Service Quality and Service Delivery

2. Organization-Wide Expected Results –

Enhanced capabilities of Members to **deliver and improve access to high quality weather, climate and water** and related environmental predictions, information and services in response to user's needs and to enable their use in decision-making by all relevant societal sectors.

GCOS Climate Monitoring Principles

1. Assess impact of new systems or changes to existing systems prior to implementation.
2. Ensure a suitable period of overlap for new and old observing systems.
3. The details and history of local conditions, instruments, operating procedures, data processing algorithms and other factors pertinent to interpreting data **(i.e., metadata)** should be documented and treated with the same care as the data themselves.
4. **Regularly assess quality and homogeneity of data as a part of routine operations.**
5. Integrate into national, regional and global observing priorities the needs for environmental and climate-monitoring products and assessments, such as IPCC assessments.
6. Maintain operation of historically-uninterrupted stations and observing systems.
7. Focus on data-poor regions, poorly observed parameters, regions sensitive to change, and key measurements with inadequate temporal resolution as high priorities for additional observations.
8. Specify to network designers, operators and instrument engineers at the outset of system design and implementation the long-term requirements, including appropriate sampling frequencies.
9. Promote the conversion of research observing systems to long-term operations in a carefully-planned manner.
10. **Data management systems that facilitate access, use and interpretation of data and products should be included as essential elements of climate monitoring systems.**

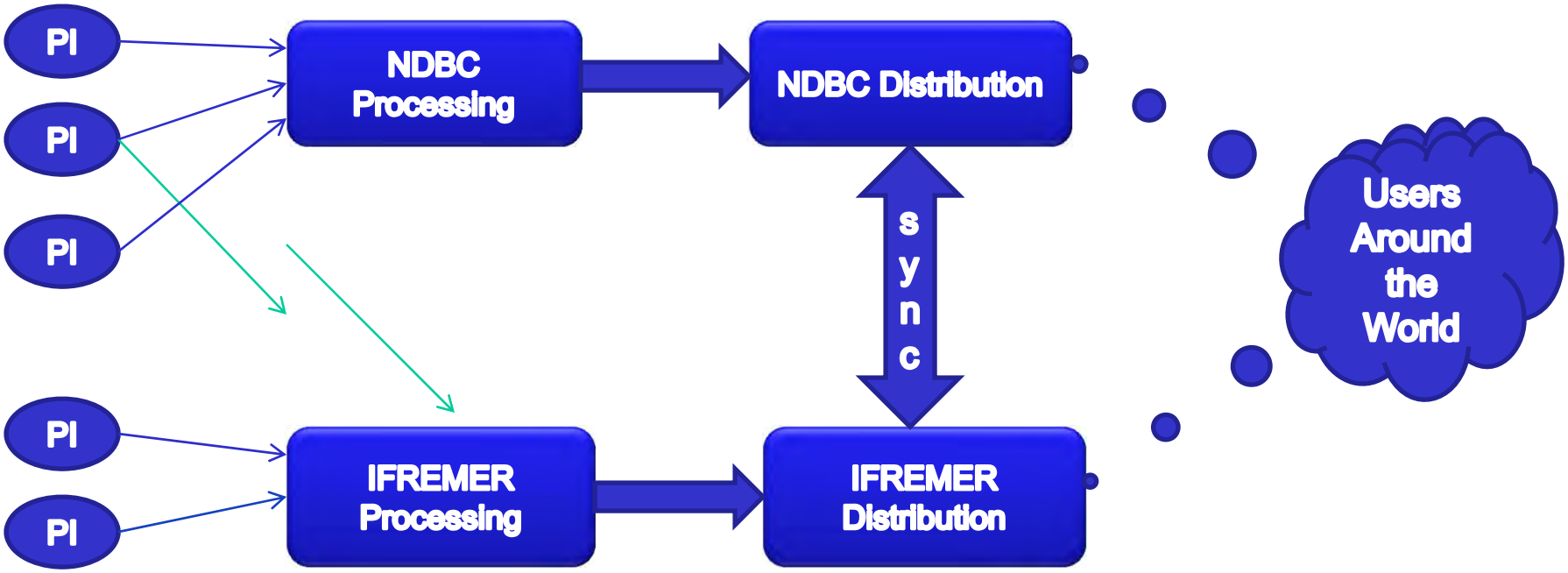
Seven Data Management Laws

1. A quality descriptor will accompany every real-time observation distributed to the ocean community.
2. Subject all observations to some level of automated real-time quality test.
3. Sufficiently describe the quality flags and quality test descriptions in the accompanying metadata.
4. Observers should independently verify or calibrate a sensor before deployment.
5. Observers should describe their method / calibration in the real-time metadata.
6. Observers should quantify the level of calibration accuracy and the associated expected error bounds.
7. Manual checks on the automated procedures, the real-time data collected and the status of the observing system must be provided by the observer on a time-scale appropriate to ensure the integrity of the observing system.

Recommendation

ORRAP should recommend that agencies that collect marine observations implement proper data quality techniques into their newly developed marine observation platforms - now – before the instruments are placed in the water.

OceanSITES Data Flow

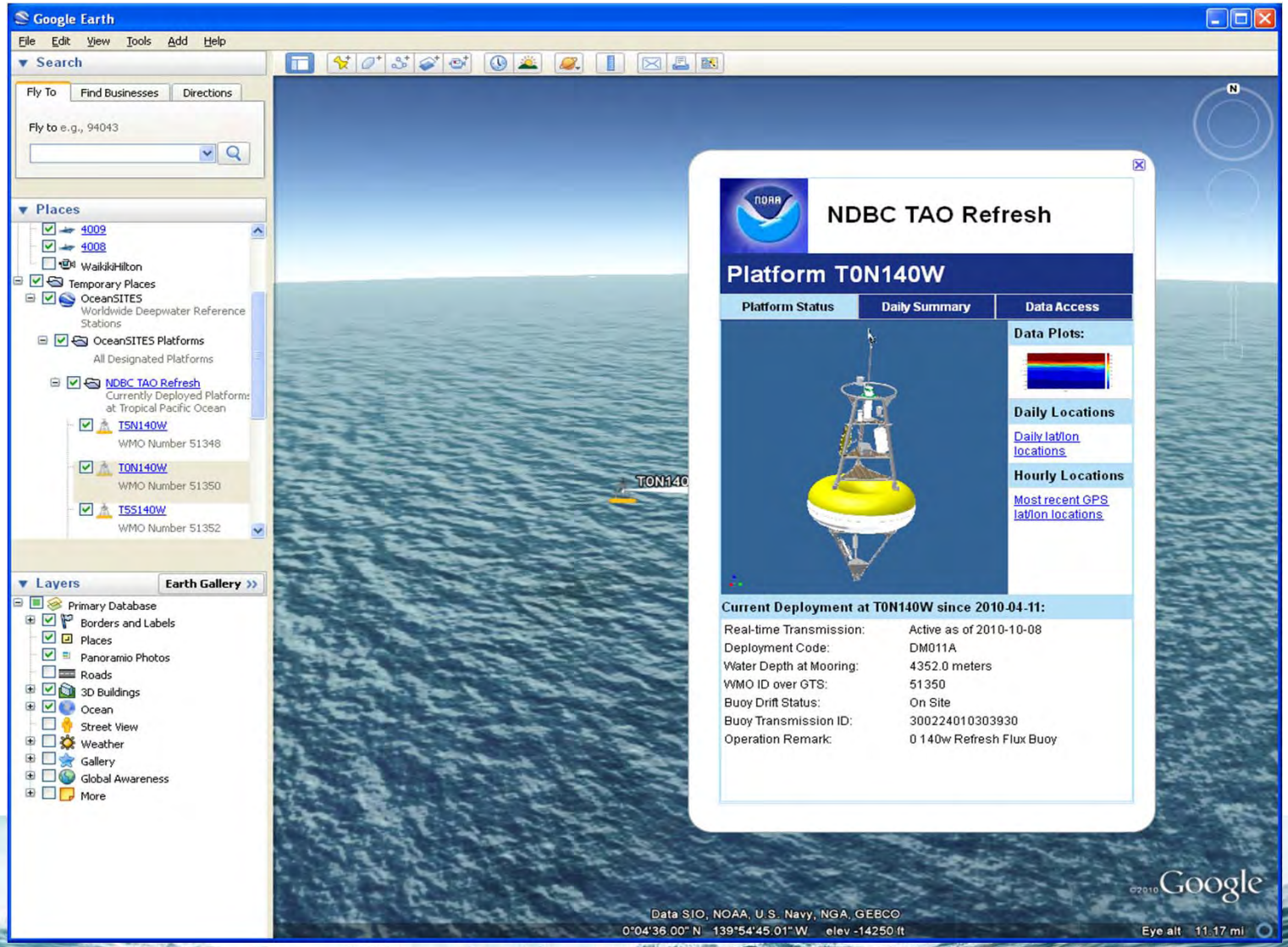


Each of PIs representing a DAC submit data to the corresponding GDAC.
Each of GDACs process the data and put them onto data distribution channels, which are synchronized with the other GDAC on daily basis.

OceanSITES Standards

- NetCDF (network Common Data Form) system for file format
- Climate and Forecast (CF) Specification for metadata
- OceanSITES specific specifications in the Users' Manual 1.2
- CF standard names and CF/COARDS compliant units
- ISO8601 time encoding in metadata
- SensorML/KML (for Google Earth) being considered /researched for metadata

OceanSITES in Google Ocean



Conclusion

- More countries and capabilities to collect ocean observations
- However, controversies like “Climate-Gate” create a need to adequately describe and understand the observations
- OceanSITES is leading the way in proper data management for ocean observations

ORRAP Data Management Session
Marine Biological Data: a Federal Perspective

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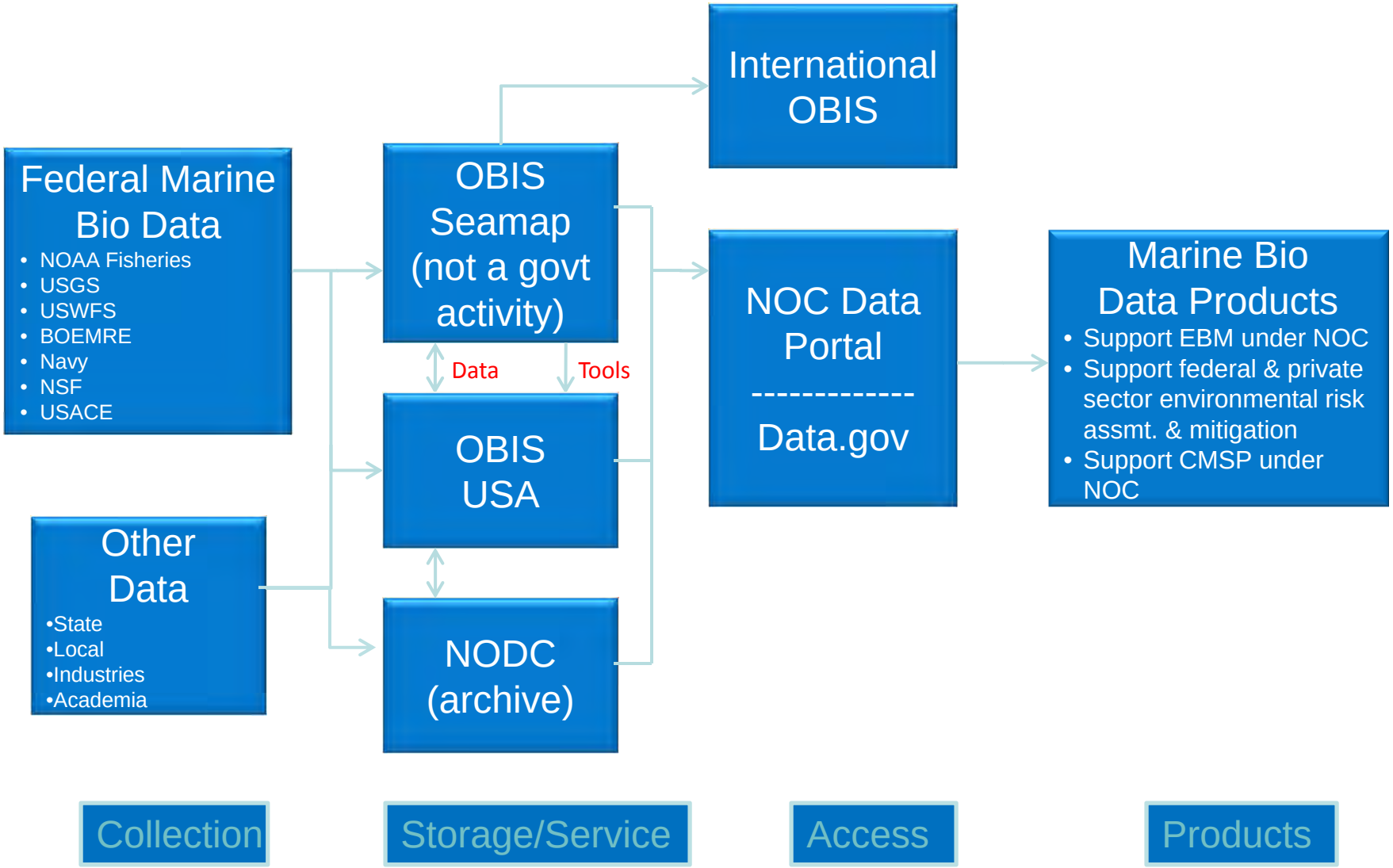
Acknowledgements

- Pat Halpin, for text and materials on the Duke University OBIS SEAMAP project.
- Jonathan Blythe, Earth Resources Technology Institute and the NODC Biochemical Team for text and materials on NODC.
- Philip Goldstein, U. of Colorado, for materials and text on the USGS OBIS USA project.

A Notional Federal Marine Biological Data Architecture



Why is a Federal Marine Biology Database Needed?

- Environmental Risk Assessment and Mitigation
  - Federal Responsibilities/Missions
    - Fishery Management
    - Offshore minerals and energy leasing
    - Military training and exercise
    - Research
  - Public and Private Sector
    - Fisheries
    - Minerals extraction, offshore energy production
    - Recreation
    - Shipping
- Support new National Ocean Policy Priority Objectives
  - Ecosystem Based Management
  - Coastal and Marine Spatial Planning

How Will Marine Biology Data Be Provided?

- At present data are dispersed among agencies and the private sector.
  - No consistent application of federal data or metadata standards across datasets.
  - No consistent application of a standardized QA process across datasets.
  - Activity to incorporate existing or new data is dispersed and inconsistent
    - A point of coordination is needed such as USGS or an interagency data committee
- Anticipated data portal under NOC is data.gov
  - At present data.gov does not have the capacity or infrastructure to accept, serve, archive and manage marine biological data on its own
    - And probably shouldn’t try to duplicate such capacity already in place at ocean mission agencies like NOAA, USGS, Navy or BOEMRE.

Current Efforts I

- OBIS USA
  - Maintained by USGS
  - Meets standards of the National Biological Information Infrastructure (NBII), Federal Geographic Data Committee (FGDC), other national and international data standards.
  - Contains selected subsets of the OBIS/COML data collection.
  - Current Limitations
    - Primarily species/location only
    - Limited tools for data synthesis and analysis
    - Limited archival and QA support
    - Small core USGS budget with small additional support from Navy and BOERME

What do people do with OBIS-USA?

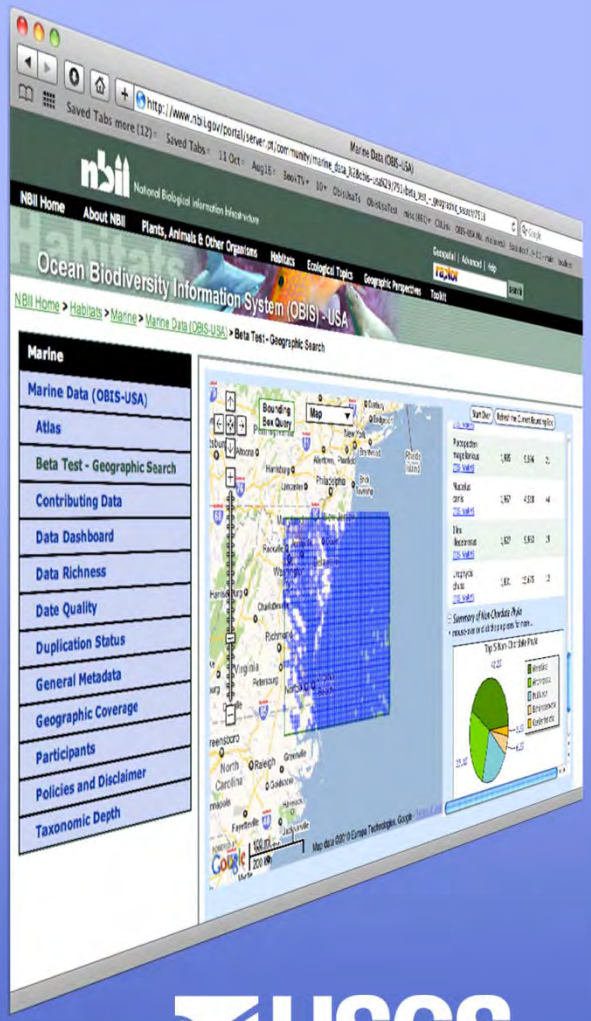
Collaborators

Data Originators

NODC

Other Agencies & Communities

iOBIS and OBIS-SEAMAP



Public

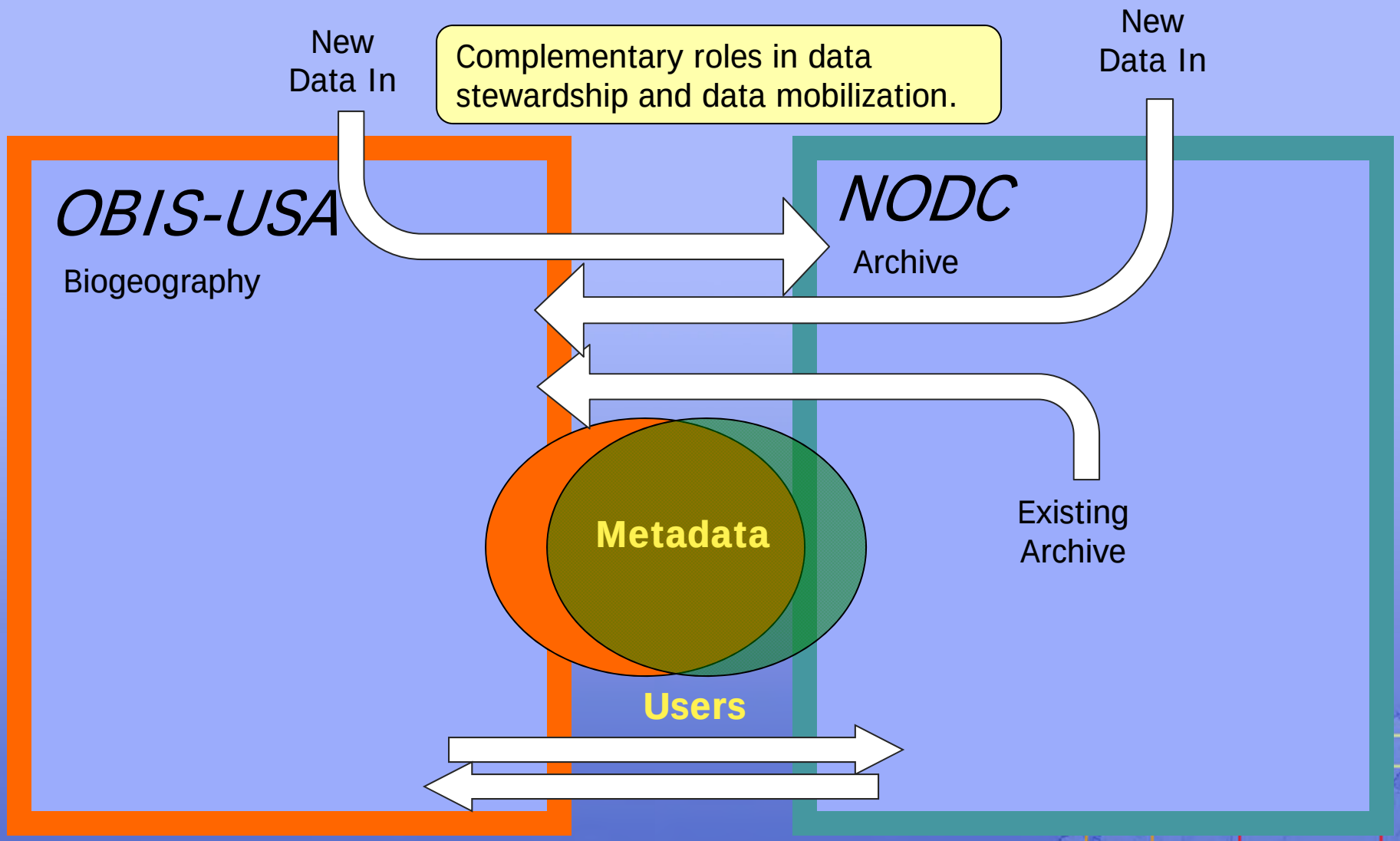
Participants Put Data In
Includes Automation

Users Get Data Out
Enable Applications

Discovery and Referral
OBIS – NODC – Related Data

Build Community
Data – Standards - Applications

OBIS-USA and NODC

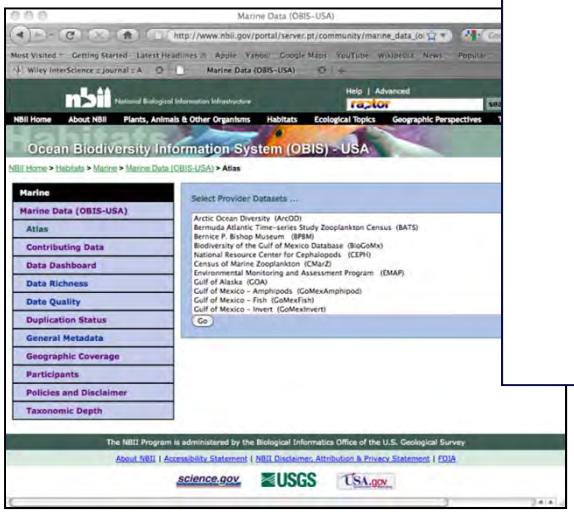


Current Efforts II

- OBIS SEAMAP
  - Resides at Duke University, supported by grants.
  - Contains a number of data synthesis, geospatial display and decision support tools.
  - Works with academic community to develop and support new sources of data
    - Mark-recapture data, including tagged animal data and photo-ID
    - Acoustic data
  - Contains mainly mammal, bird, turtle data with access to the larger International OBIS collection.
  - Current Limitations
    - Focused on a limited number of taxa (with access to broader resources).
    - Limited archival capacity
    - No long term core support, not a federal budget activity

OBIS-USA, OBIS-SEAMAP, iOBIS

OBIS-USA



National marine biodiversity data archive

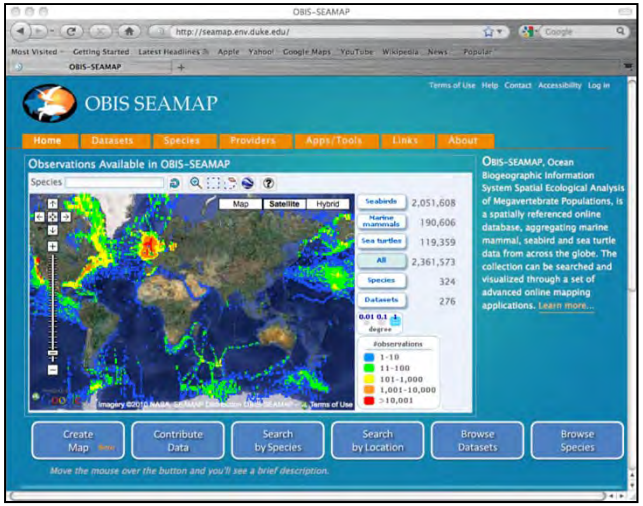
OBIS-SEAMAP Niche:

Protected species data / tools

- Telemetry / tracking data
- Photo-ID
- Passive acoustics
- Spatial Decision Support

Mapping & Analysis R&D*

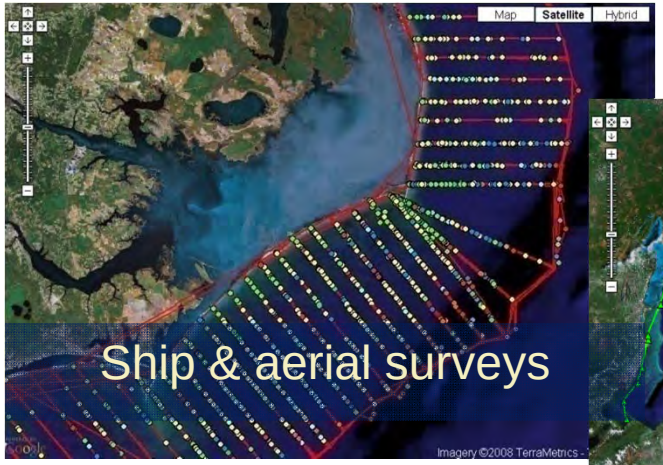
OBIS-SEAMAP

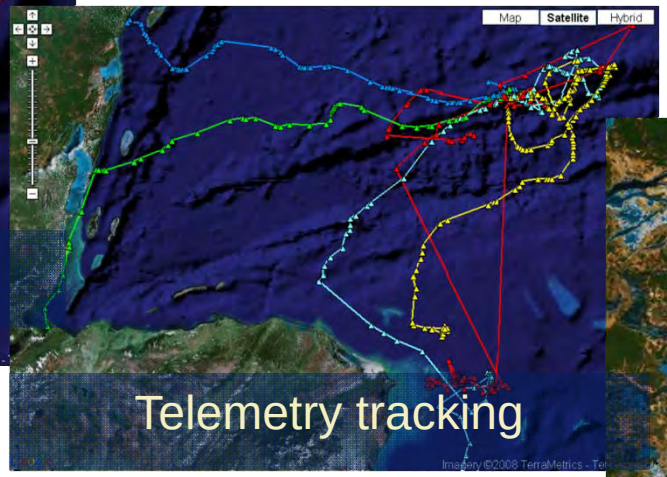


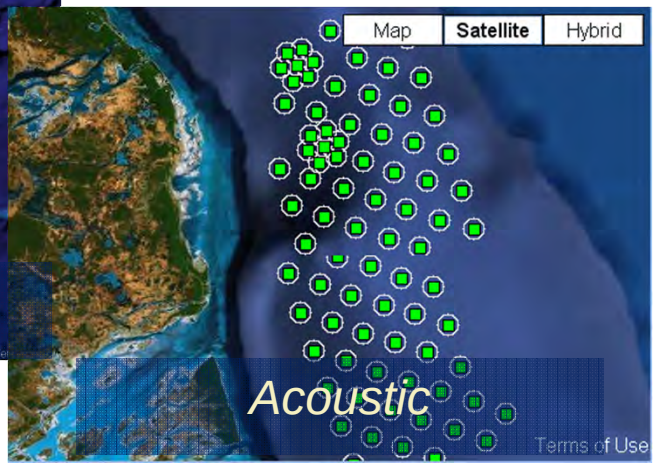
iOBIS

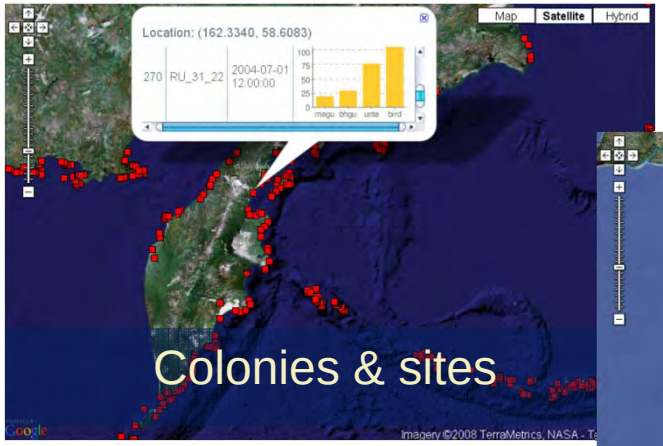
International marine biodiversity data archive

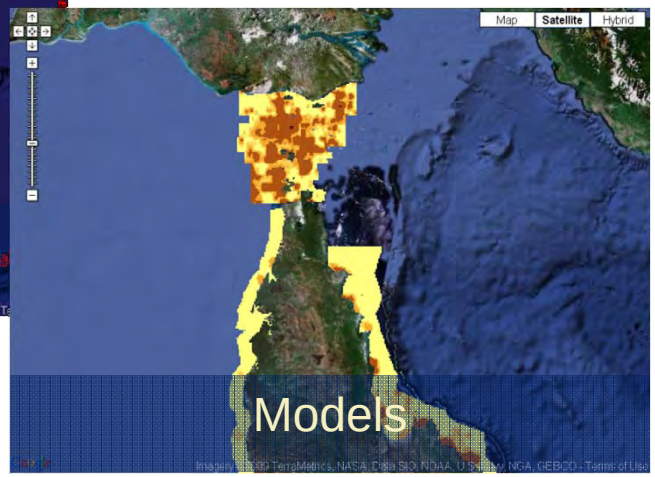
OBIS-SEAMAP supports multiple data types

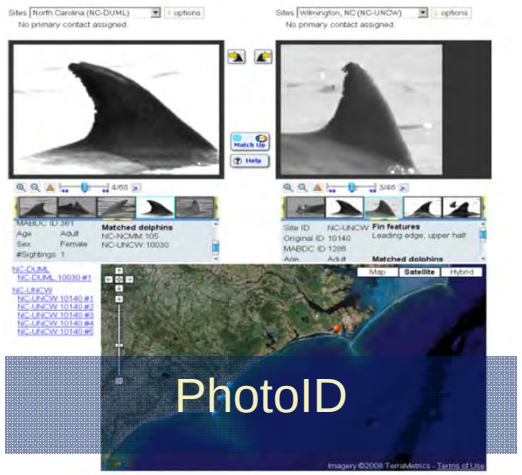








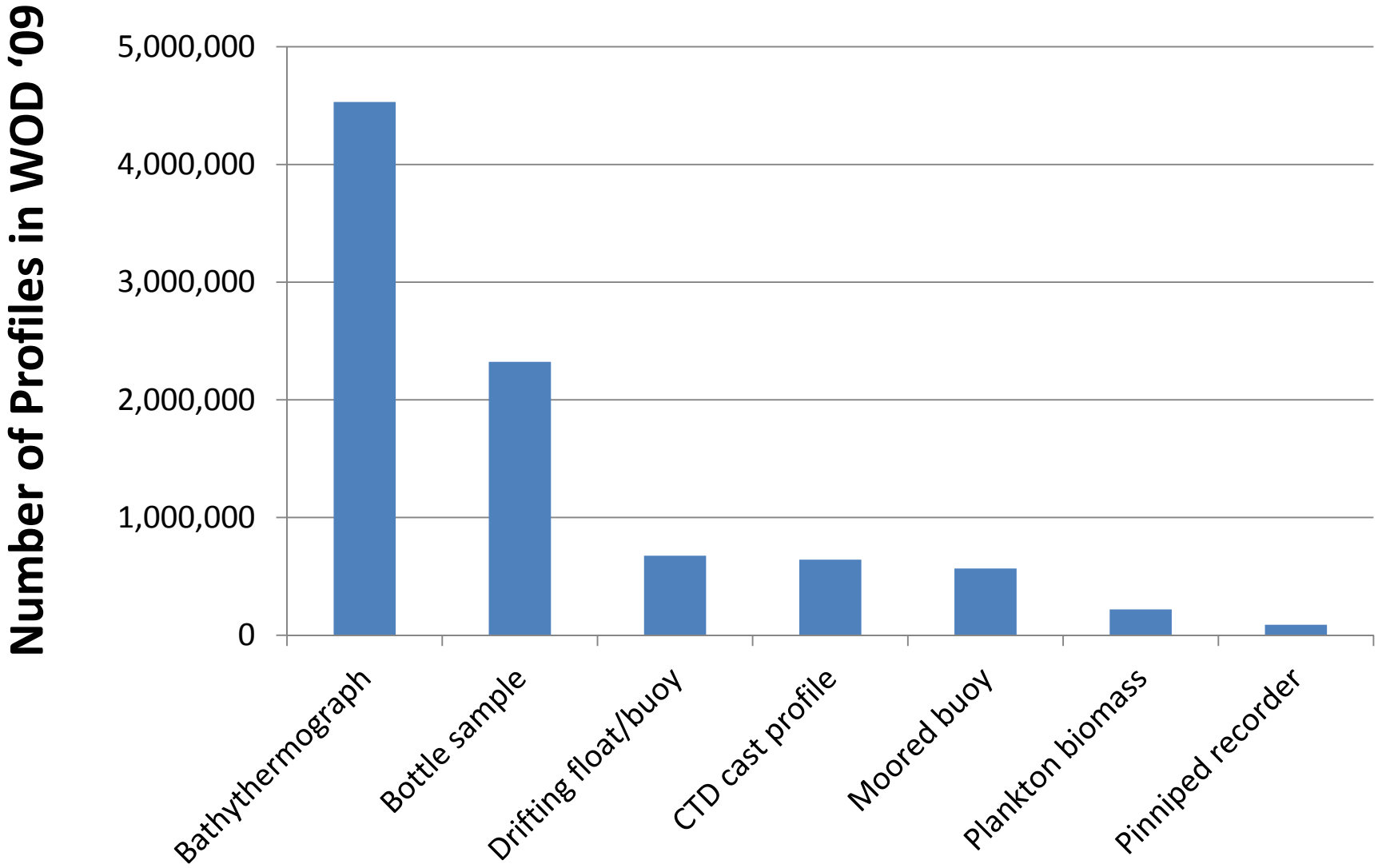




Current Efforts III

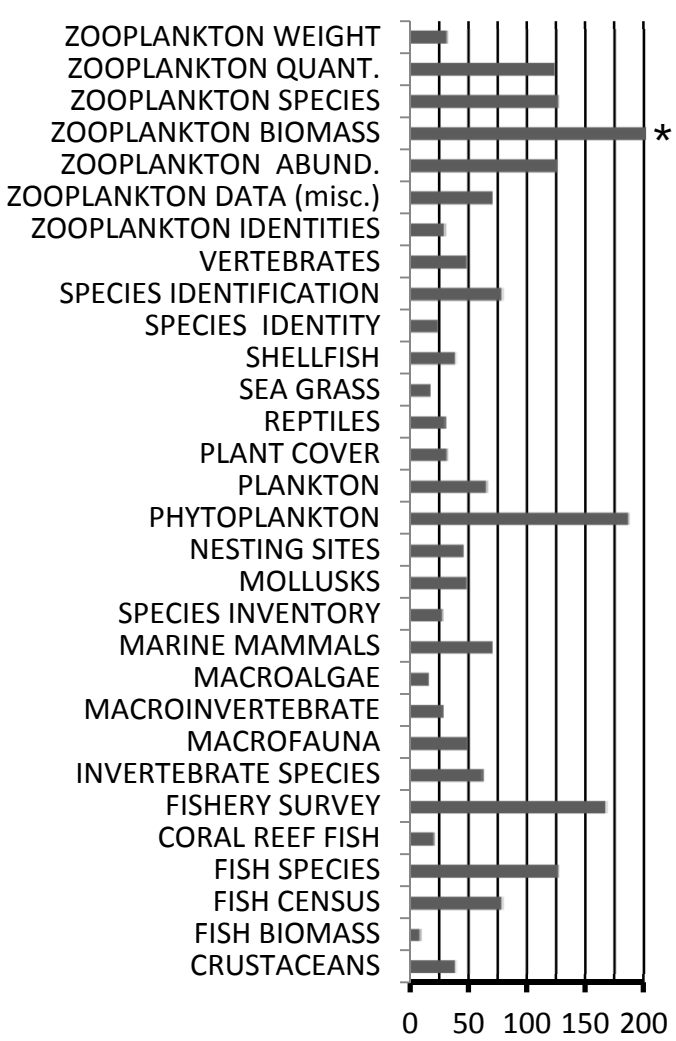
- National Oceanographic Data Center (NODC)
  - Permanent core support through NOAA.
  - Contains a vast archive of oceanographic data.
  - Access data w/ federal metadata standards (such as FGDC and GCMD).
  - Developing a suite of web services for archive, including a Geoportal.
  - Archive services are integrated w/ the ocean observing infrastructure.
  - MOA between USGS and NOAA to archive (back-up) OBIS USA data.
  - Biological data holdings and data products are being developed.
  - Current Limitations
    - Historically focused on physical data, but also has biological data (see graphs)
    - Search and data access tools may be geared towards researchers and experts
    - Limited support for non-conforming metadata (e.g. metadata on effort-based acoustic recordings analysis), though they may be necessary for long-term preservation and stewardship of some important biological data sets.
    - NODC only promotes data formats that meet the Archive's statutes for long term preservation. Other formats and database schema are not supported.

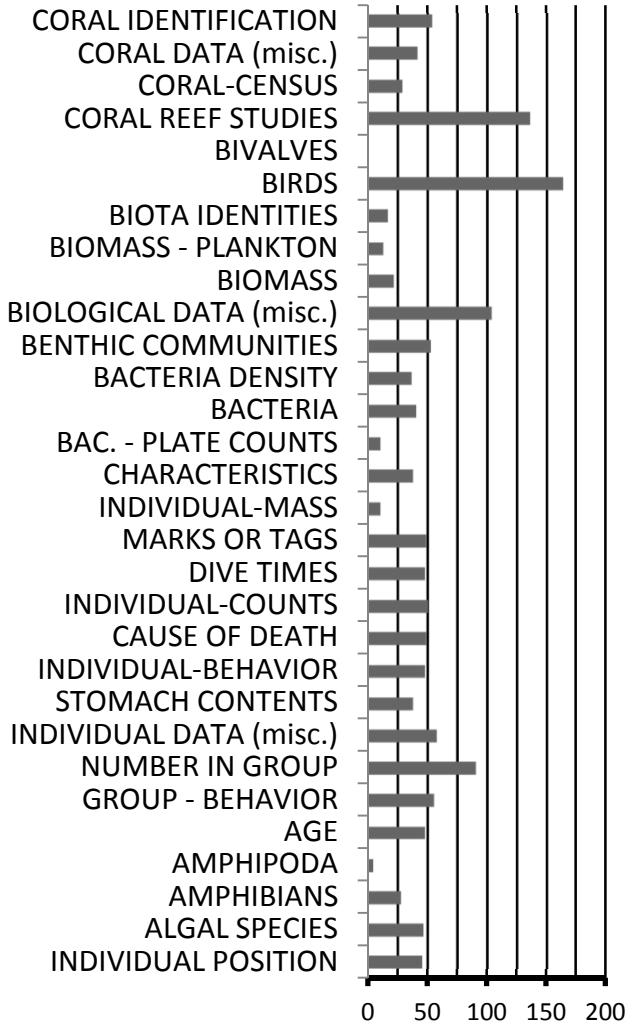
Comparison of Physical to Biological Data



Source: T. P. Boyer, et al. 2009. *World Ocean Database 2009. S. Levitus, Ed., NOAA Atlas NESDIS 66*

Overview of NODC Biological Data Categories and Number of Instances for Each Category





Number of Data Sets (in units of NODC Accessions) * > 200

Many Other Relevant Programs

- Smithsonian
  - STRI GIS Portal: http://mapserver.stri.si.edu/geonetwork/srv/en/main.home
- NSF
  - NSF Data Management policies: http://www.nsf.gov/bfa/dias/policy/dmp.jsp
- NOAA
  - IOOS: http://oceanservice.noaa.gov/programs/ioos.html
- NASA (and others)
  - GEOBON: http://www.earthobservations.org/geobon.shtml
- Biodiversity Working Group
  - Federal working group under OST-ICP
    - Attaining an Operational Marine Biodiversity Observation Network (BON) Synthesis Report is now available online: http://www.nopp.org/wp-content/uploads/2010/03/BON_SynthesisReport.pdf.
- USGS and Global Biodiversity Information Facility (GBIF)
  - An international network with US participants from NSF, USGS, others: http://www.gbif.org/
  - U.S. (NBII) node: http://www.nbii.gov/
- Citizen Science Programs
  - National Phenology Network (http://www.usanpn.org/)
  - OBIS NaGISA program (http://www.nagisa.coml.org/)

Data Sources – Non-Federal

- Energy industry
  - Joint Industry Program (JIP), other research
  - Environmental compliance monitoring
    - Current emphasis on the Arctic
- Academia
  - TOPP, OBIS SEAMAP, many others
- States
  - Bering Sea Integrated Ecosystem Research Pgm
  - Cal COFI

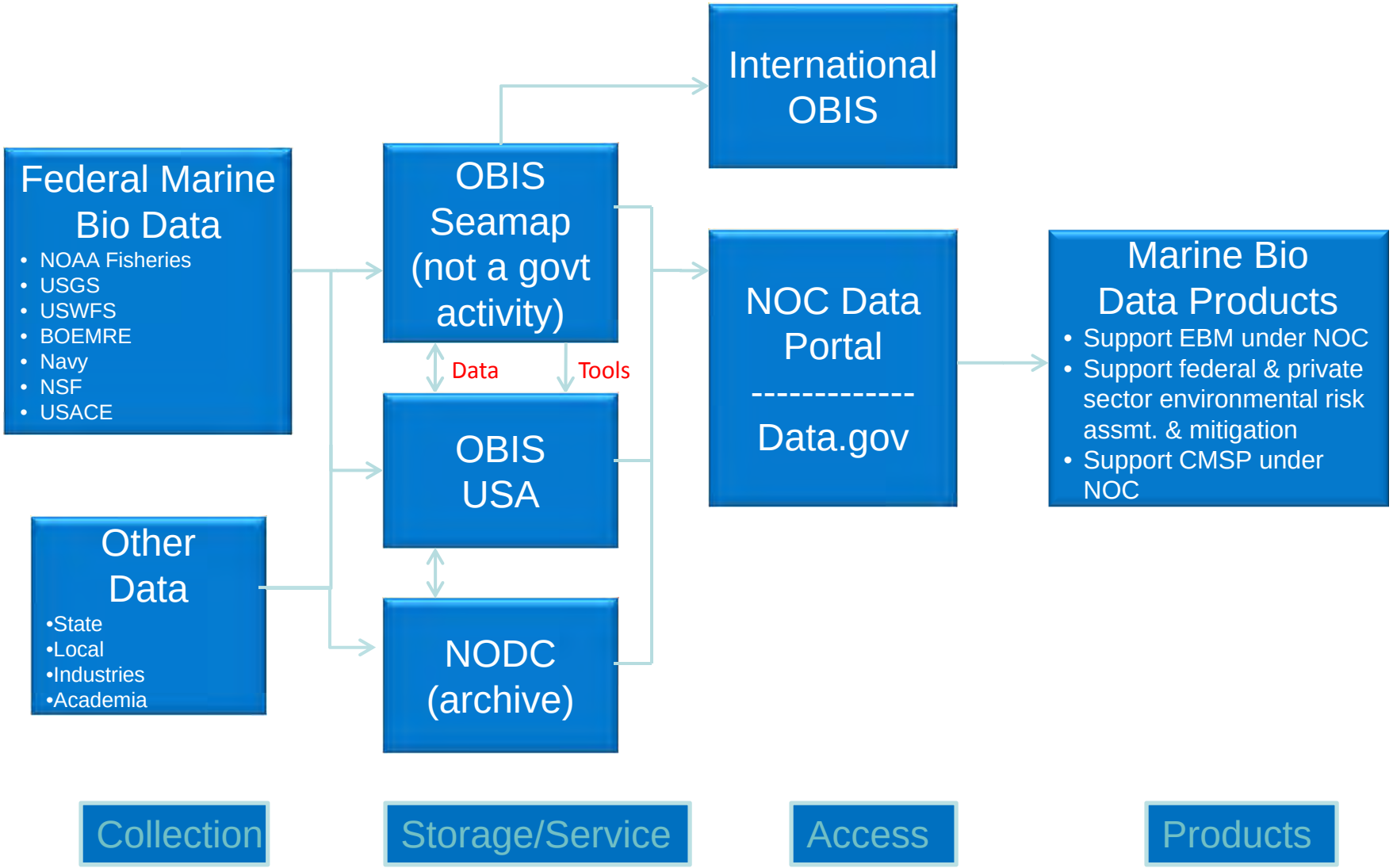
Data Sources – Federal I

- USFWS
  - Marine birds and mammals (walrus, polar bear, sea otter)
  - Currently not available, or standardized
- NOAA
  - Fisheries
    - An industry-unique, but rich, data set
    - Sensitivity of data often produces long delays in accessibility
  - Protected Species (mammals and turtles)
    - Historically managed as a fishery, data are often not suited for current environmental risk analyses
    - Sensitivity of data often produces long delays in accessibility
    - Marine Mammal Stranding Network
  - Currently available as Stock Assessment Reports, standardization improving

Data Sources – Federal II

- **Navy**
  - Research data sets (ONR, NAVSEA/CNO N45)
  - Surveys for environmental risk assessment
  - Surveys for mitigation monitoring.
  - These are currently not being centrally archived
    - New contractual language, requirements in process
- **BOEMRE**
  - Research programs in U. S. federal waters for environmental impact assessments and leasing authorizations (oil and gas ; renewable energy)
  - Surveys in support of lease authorizations, etc.
    - AMAPPS (joint BOERME, FWS, NOAA, Navy)
- **NSF**
  - Research data from OOI (long-term goal) and other programs
- **Other Agencies**: EPA, BLM, USGS, USACE, etc.

A Notional Federal Marine Biological Data Architecture



Current Status

- A rich potential pool of data, of two main types
  - Occurrence only (Biodiversity databases): species, location, time
  - Effort-based (Abundance and density): density, habitat correlations, trophic behavior, other.
- We have a nucleus of national capability
  - OBIS USA, NODC
- Current limitations
  - Insufficient core federal budget support for long term development and maintenance
  - Need interagency data and metadata standards
  - Need consistent federal requirements for timely data archival and release
    - For agency data collections
    - For federal contracts, grants that produce biological data

How Can ORRAP Help?

- Encourage the federal government to create marine biological data policies and protocols (ORM-IPC?).
- Recommend the creation of more data sharing agreements between agencies like those between BOEMRE and NODC.
- Recommend that agencies agree upon federal centers for marine biological data archival and service, such as NODC and OBIS USA to reduce duplication of effort.
- Encourage agencies and OMB to draft an interagency budget plan to ensure support for shared data infrastructure needs.

OBIS-SEAMAP
Protected Species Information & Analysis System

ORRAP
April 25th, 2011

P.N. Halpin
The OBIS-SEAMAP Team

Marine Geospatial Ecology Lab
Nicholas School of the Environment
Duke University

Marine Biogeographic Data Centers

GBIF

OBIS

OBIS-SEAMAP

An international government-initiated and funded initiative, **Global Biodiversity Information Facility** (GBIF) collects biodiversity data on all forms of life on Earth.

Initialized as a data center for the 10-year Census of Marine Life project, **Ocean Biogeographic Information System** (OBIS) holds the largest collections of marine life data. OBIS is now maintained under the Intergovernmental Oceanographic Commission (IOC) of UNESCO.

Started as a thematic node of OBIS, **Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations** (OBIS-SEAMAP) focuses on marine protected species. Funded by NOPP ONR, the Alfred P. Sloan Foundation, Navy, NSF, NASA, SERDP...

OBIS-USA, OBIS-SEAMAP, iOBIS

OBIS-SEAMAP Niche:
Protected species data / tools
- Telemetry / tracking data
- Photo-ID
- Passive acoustics
- Spatial Decision Support

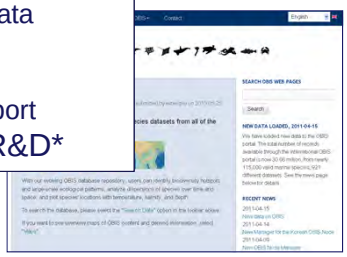
Mapping & Analysis R&D*

OBIS-USA

National marine biodiversity data archive

OBIS-SEAMAP

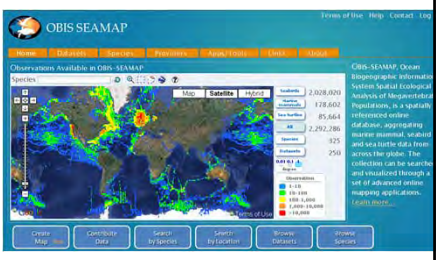
iOBIS

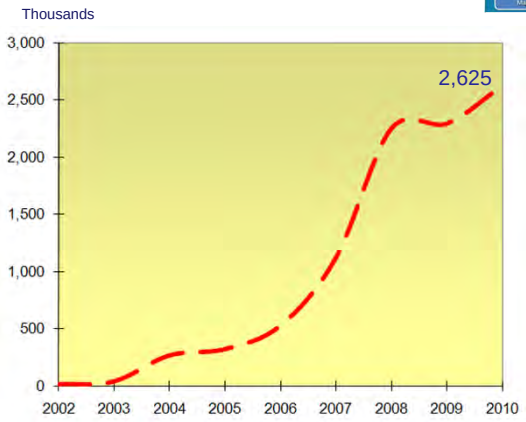


International marine biodiversity data archive

OBIS-SEAMAP

Spatially referenced online database, aggregating marine mammal, seabird and sea turtle data from across the globe





310 datasets
1935 – 2011
>2,625,000 records

National Science Foundation
WHERE DISCOVERIES BEGIN

NOPP

ALFRED P. SLOAN FOUNDATION

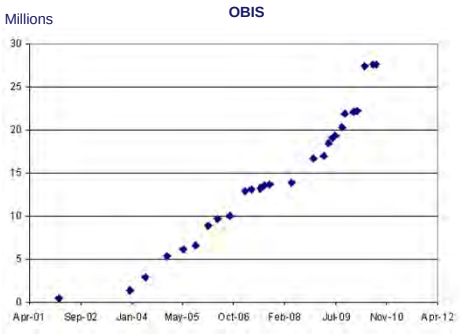
Office of Naval Research

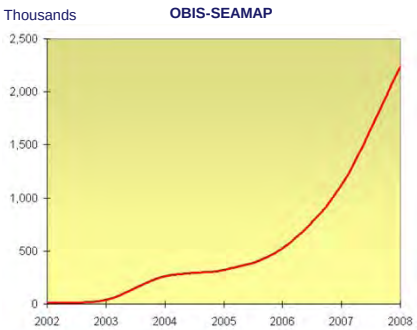
The largest protected species data archive

Ocean Biogeographic Information System

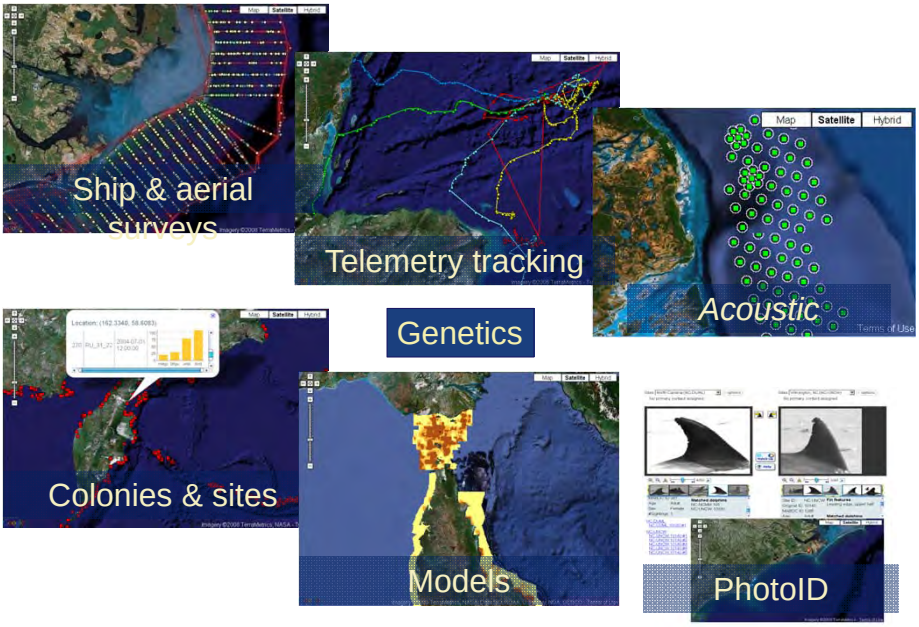
OBIS-SEAMAP

- ~99% of marine mammal data in US territorial waters in OBIS come from OBIS-SEAMAP
- OBIS is the largest marine data contributor to GBIF





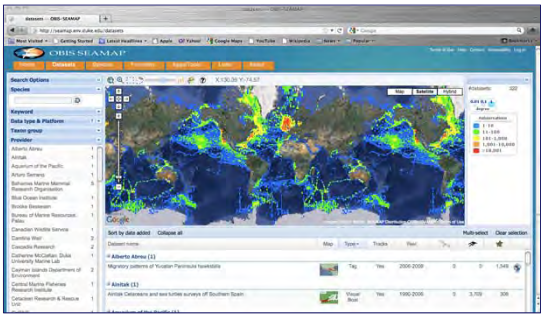
OBIS-SEAMAP supports multiple data types



Observation data in OBIS-SEAMAP

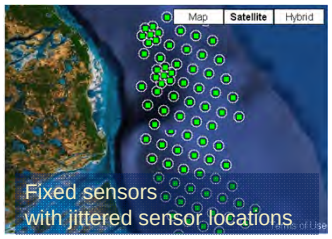
The inclusion of survey effort (tracklines) and additional attributes is essential for the development of statistical models of density or habitat preference.

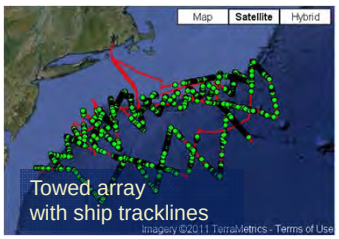
Observation data
Survey effort data
Survey metadata
Links to species pages
Links to data providers



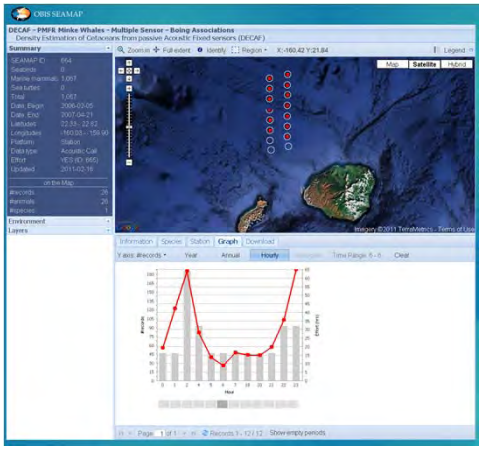
Passive acoustic data in OBIS-SEAMAP

Various acoustic data types





Advanced mapping & visualization



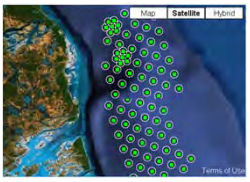
Navy-funded DCAF datasets are in the final stages of approval for publishing through OBIS-SEAMAP.

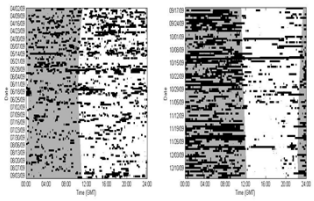
Passive acoustic data in OBIS-SEAMAP

New NOPP / NSF funding: "Expansion of metadata management, visualization and data processing functionality of OBIS-SEAMAP for passive acoustic monitoring data"

Objectives of the new project

- To expand the existing metadata standards to incorporate **P**assive **A**coustic **M**onitoring (PAM) specific elements
- To improve OBIS-SEAMAP visualization features for PAM data
- To facilitate data / metadata exchange between acoustic data portals (partnerships with NOAA NEFSC , Cornell Lab of Ornithology, Scripps, San Diego State)

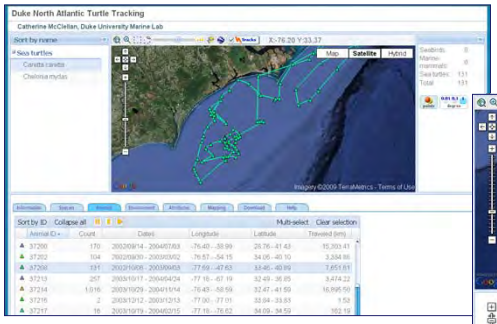




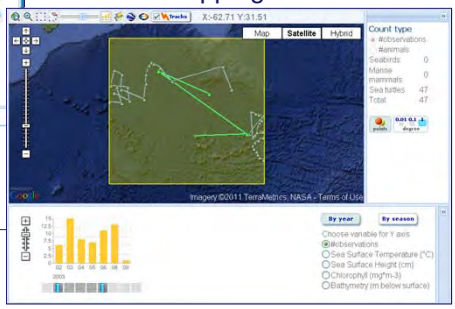
A sample of the proposed date-hour plot

Telemetry data in OBIS-SEAMAP

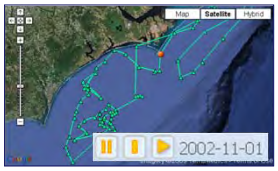
Movement of individual animal



Advanced mapping & visualization



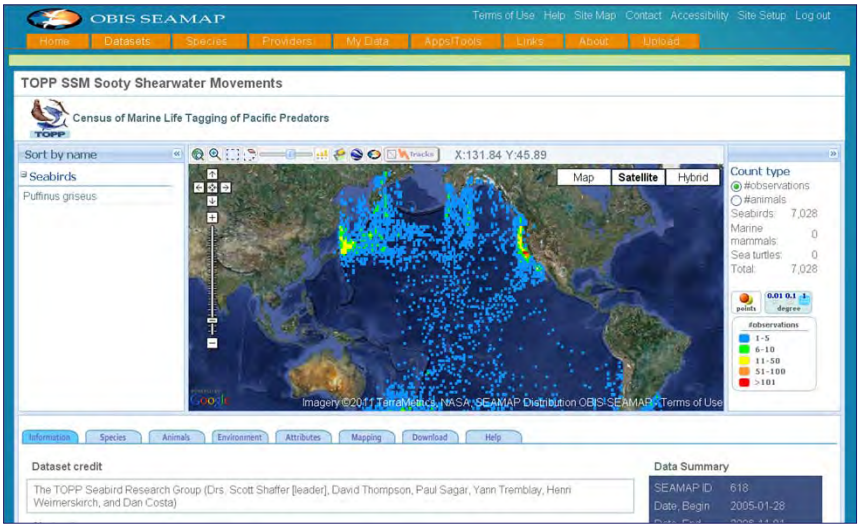
Animation of movement



Movement of multiple animals in an area of interest within a defined time period

Telemetry data in OBIS-SEAMAP

TOPP State Space Model outputs registered in OBIS-SEAMAP



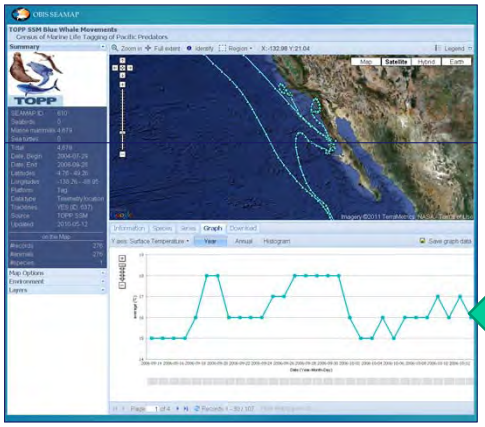
Aggregated summary uploaded into OBIS via OBIS-SEAMAP

Telemetry data in OBIS-SEAMAP

Toward biological and physical ocean observing

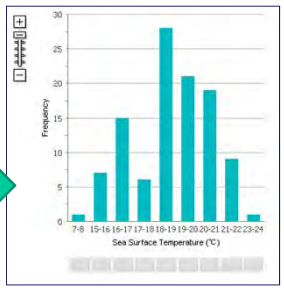
OBIS-SEAMAP…

- Can be a center for animal tagging data with in-situ environmental data
- Currently holds more than 2TB of remote sensed oceanographic data
- Relates oceanographic data against all biological observations



Blue whale movement with daily SST changes (from Pathfinder SST)

Sampled SST is also visualized as a histogram

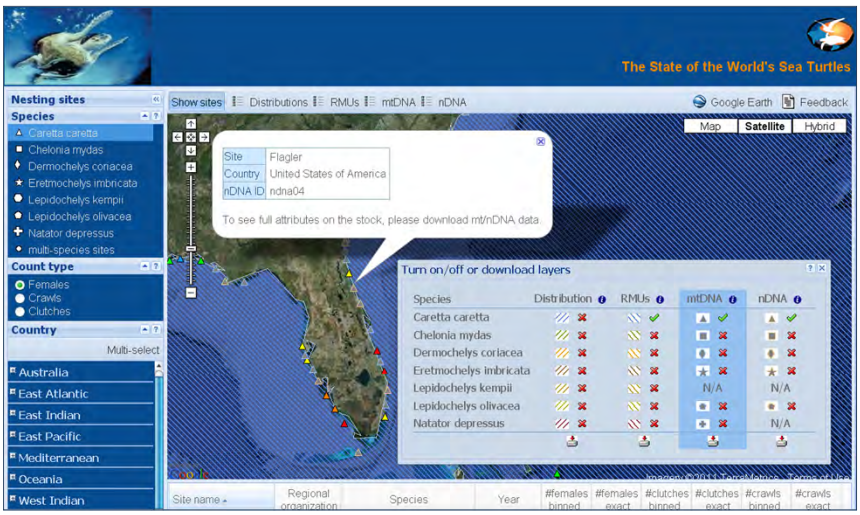


Turtle nesting data in OBIS-SEAMAP

Two of the biggest nesting data collections supported by OBIS-SEAMAP

Turtle nesting data in OBIS-SEAMAP

New approach ties genetic research with nesting site data

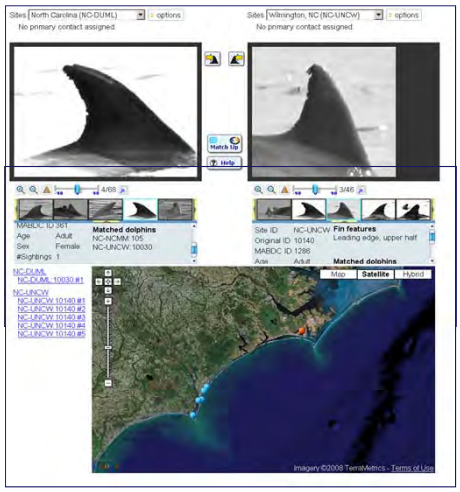


DNA sampling sites along with nesting sites (*both are downloadable*)

PhotoID in OBIS-SEAMAP

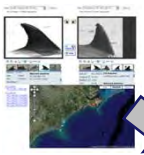
Community-oriented expansion of OBIS-SEAMAP

- Started for Mid-Atlantic Bottlenose Dolphin Catalog
- Provides an online scientific workflow for fin matching processes

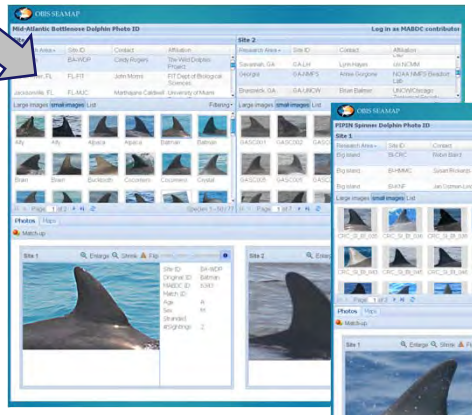


PhotoID in OBIS-SEAMAP

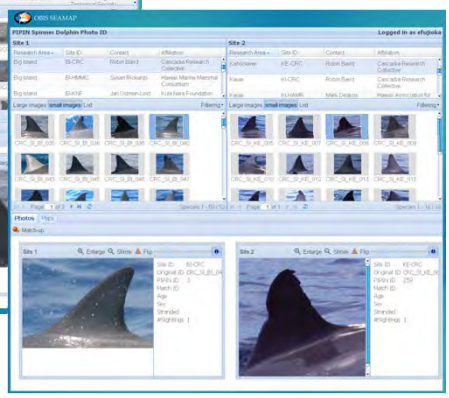
Building common framework to incorporate other PhotoID catalogs



Initial application for MABDC



New interface for MABDC built on the common framework



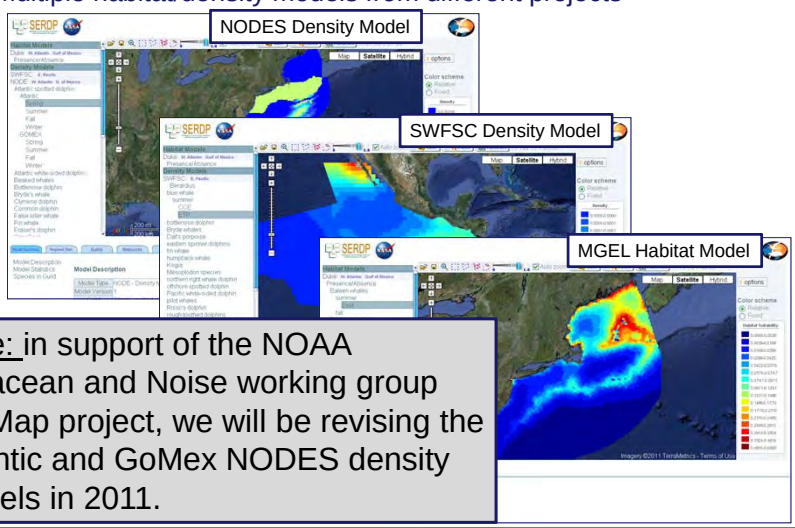
Same framework applied to PIPIN
(Spinner dolphins in Hawaiian waters)

Cetacean density models in OBIS-SEAMAP

SERDP Spatial Decision Support System

originally funded by SERDP continuing development by NASA

Multiple habitat/density models from different projects

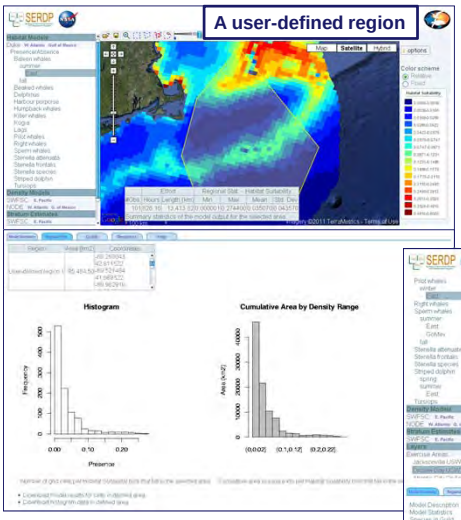


Note: in support of the NOAA Cetacean and Noise working group CetMap project, we will be revising the Atlantic and GoMex NODES density models in 2011.

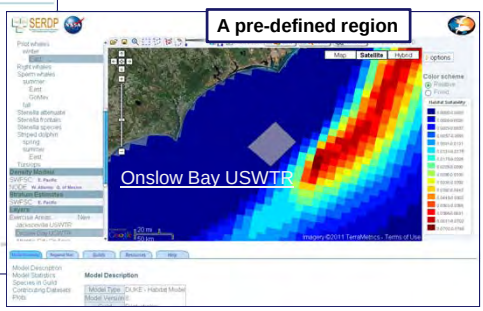
Cetacean density models in OBIS-SEAMAP

Interactive decision support

Queries by regions of interest



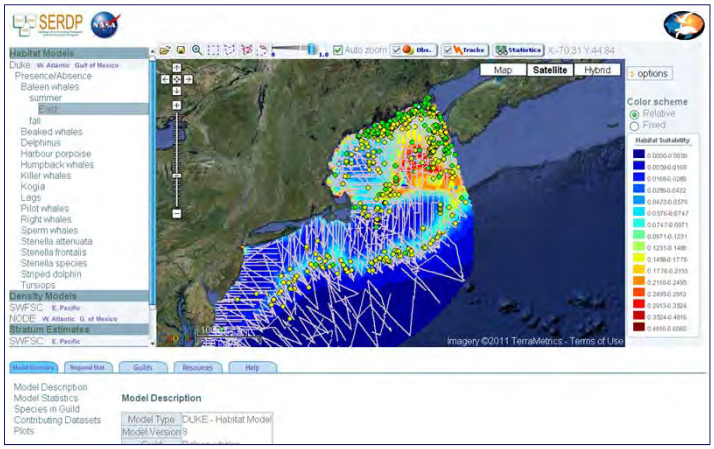
Queries can be calculated against pre-defined areas (*e.g.* Navy operation areas)



Cetacean density models in OBIS-SEAMAP

Interactive decision support

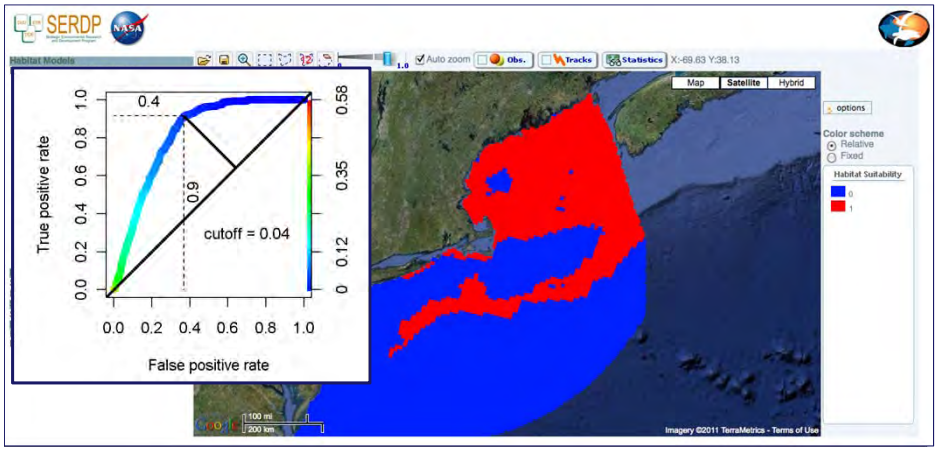
Model outputs presented with original data (including effort)



Cetacean density models in OBIS-SEAMAP

Interactive decision support

Critical habitats evaluated with ROC analysis



Cetacean density models in OBIS-SEAMAP

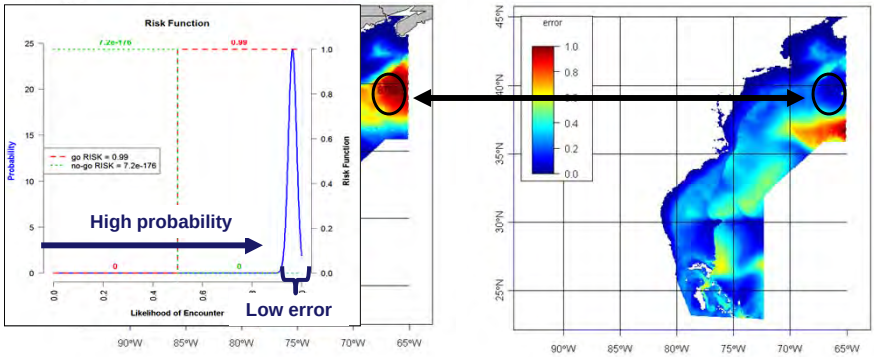
Interactive decision support

Model predictions and model error used to assess decision risk

High probability of encounter | Low model error

Prediction

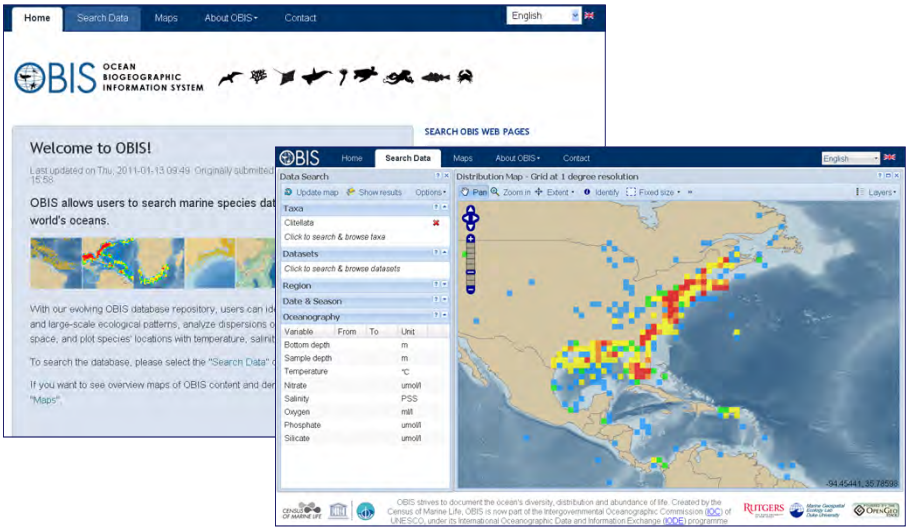
Model Error



Area of high predicted encounter ⟷ Area of low model error

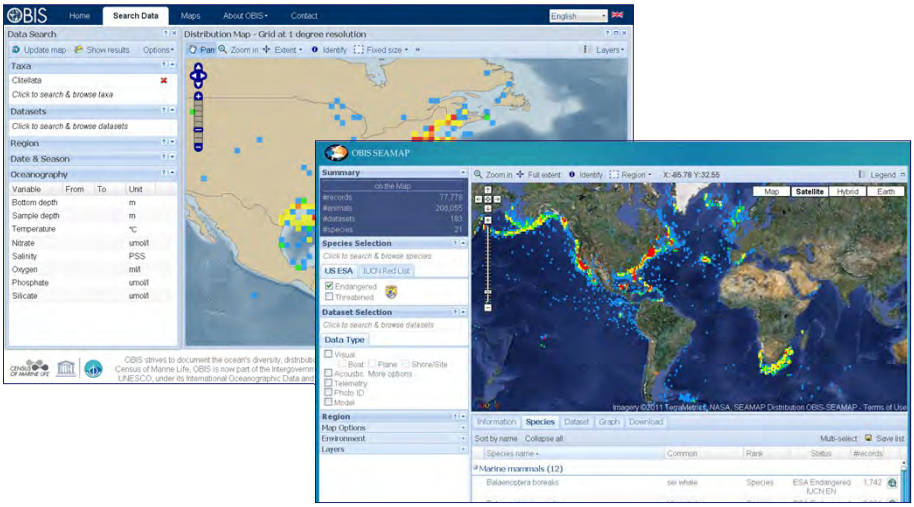
OBIS-SEAMAP and iOBIS

The OBIS-SEAMAP Team at MGEL plays a leading role in the renovated OBIS Portal development



OBIS-SEAMAP and iOBIS

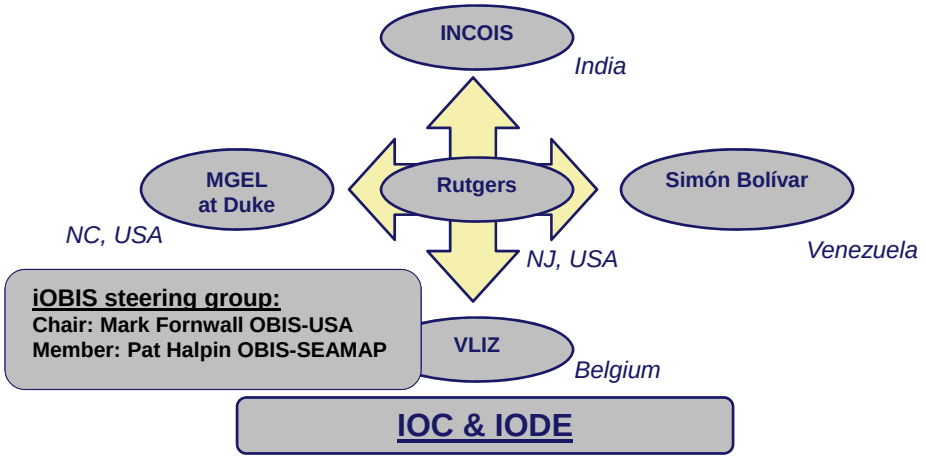
As the OBIS-SEAMAP Team develops both the OBIS and OBIS-SEAMAP systems, the potential to consolidate and utilize both data for advanced marine spatial researches is enormous.



OBIS-SEAMAP and iOBIS

International OBIS Network

After OBIS was adopted by IOC/UNESCO, MGEL at Duke becomes one of the official partners of iOBIS Network



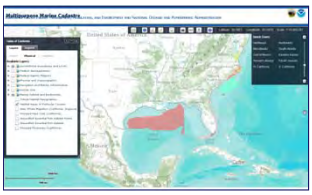
Meeting new demands

- Ecosystem based management
- Marine spatial planning
- Renewable energy site selection
- Cetacean habitats and noise
- Habitat protection in areas beyond national jurisdiction

Example new demand: *Using web-services to simultaneously serve cetacean density models to a multiple government clients and applications*

OBIS-SEAMAP Modeling System

Marine Cadastre



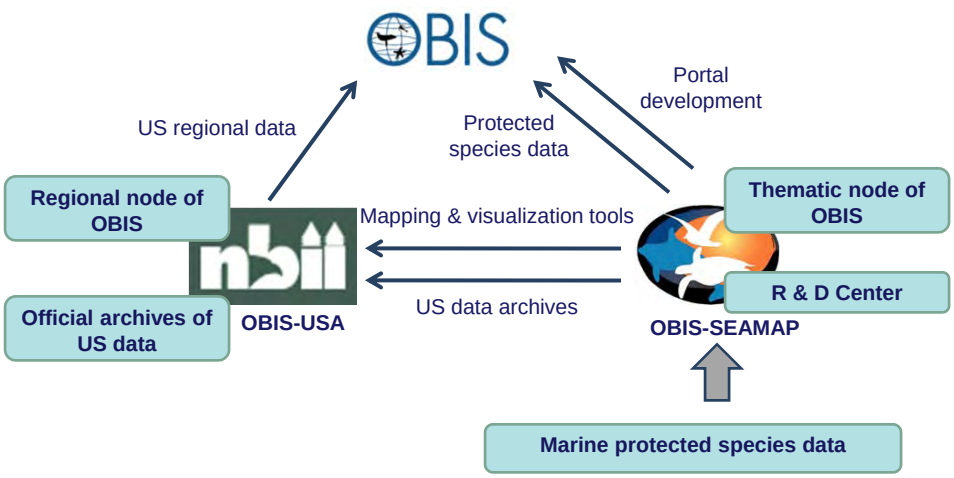
NOAA S&T CetMap

EIMS

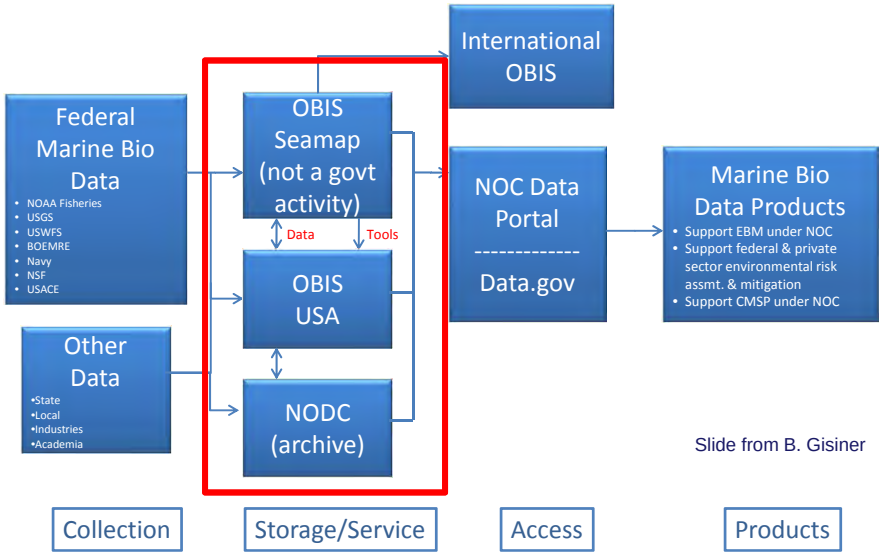
Navy EIMS

OBIS-SEAMAP and OBIS

Mutually beneficial data & tool sharing among iOBIS, OBIS-SEAMAP and OBIS-USA

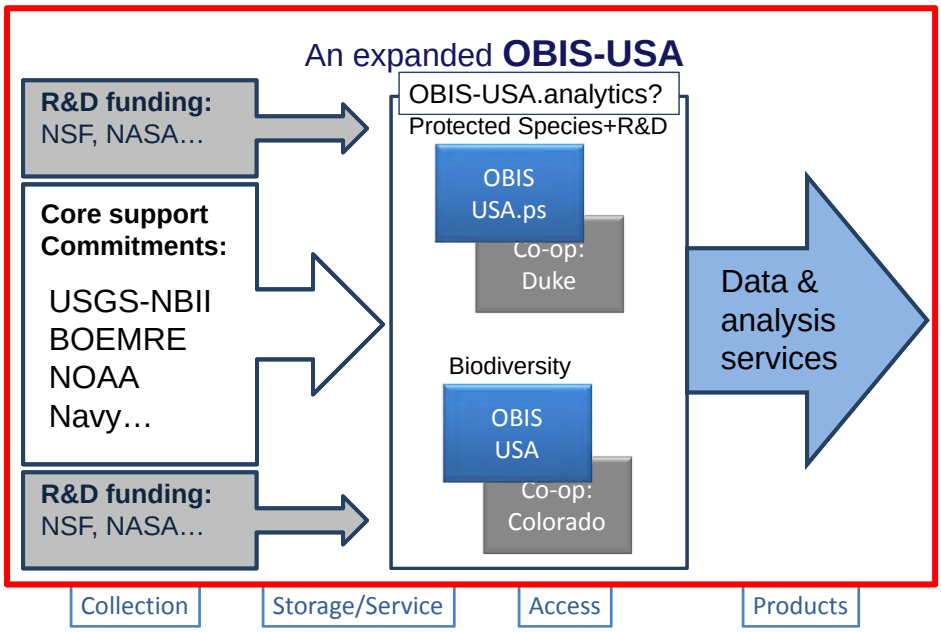


A Notional Federal Marine Biological Data Architecture



Slide from B. Gisiner

A potential path forward



Take-home Messages

- OBIS-SEAMAP is the protected species node of the larger OBIS information network;
- OBIS-SEAMAP specializes in R&D for the synthesis and analysis of marine biological data;
- OBIS-SEAMAP strives to actively provide innovative and relevant products and services to our end users;
- The OBIS-SEAMAP team is very interested in formally coordinating our efforts with the emerging national OBIS-USA program, the NODC data archive and the NOC data portal;

OBIS-SEAMAP
http://seamap.env.duke.edu/

OBIS
http://iobis.org/

Thank you

National Science Foundation
WHERE DISCOVERIES BEGIN

Office of Naval Research

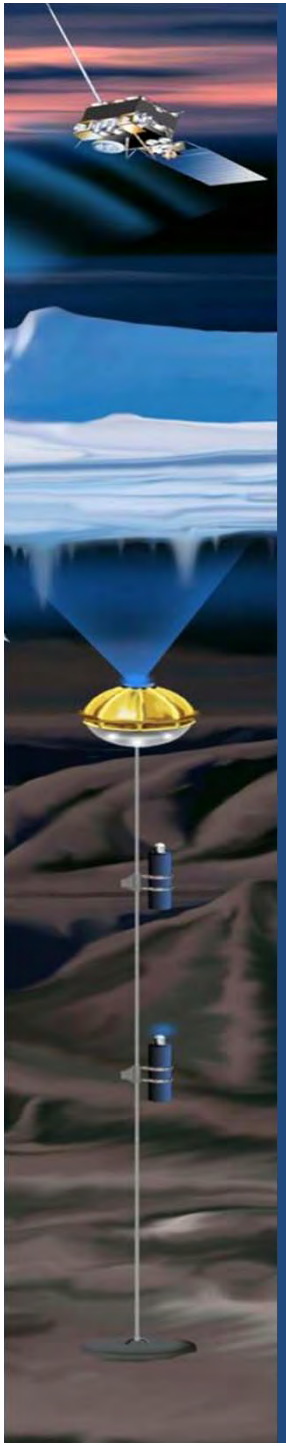
NOPP

NASA

SERDP
DOD • EPA • DOE

Marine Geospatial Ecology Lab
Duke University

Marine Geospatial Ecology Lab
Nicholas School of the Environment
Duke University



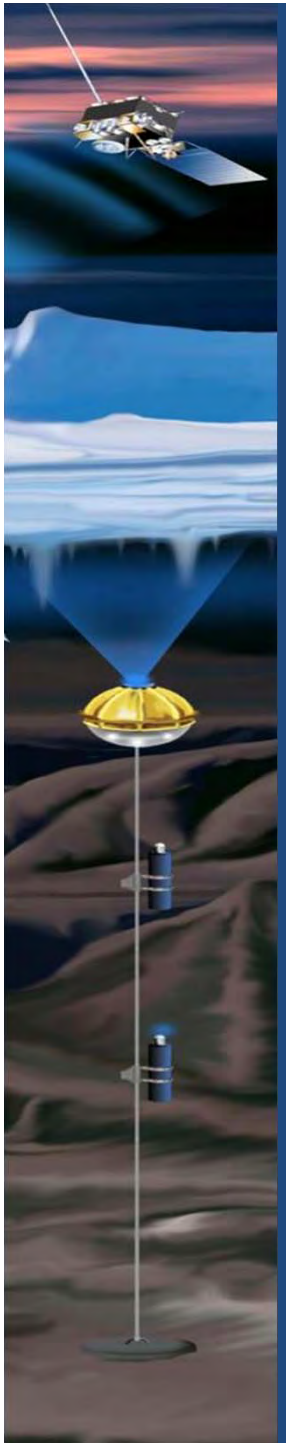
Critical Infrastructure for Ocean Research and Societal Needs in 2030

Ocean Studies Board
National Research Council

Briefing for the Ocean Research and Resources Advisory Panel

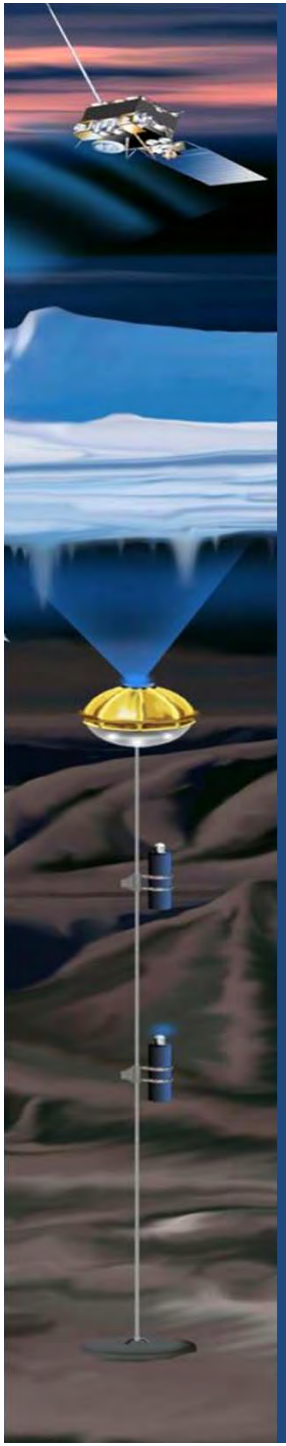
Steven Ramberg

April 25, 2011



National Research Council

- The working arm of the National Academy of Sciences
- Created in 1916 to advise the federal government on science and technology policy
- Non-profit, non-governmental organization
- Sponsors are usually federal agencies, with occasional state, local, corporate, and nonprofit support



Background

U.S. Commission on Ocean Policy (2004)

- Aged, obsolete infrastructure
- Insufficient capacity
- Growing technology gap
- Decline of national leadership in marine technology development

Degrading infrastructure

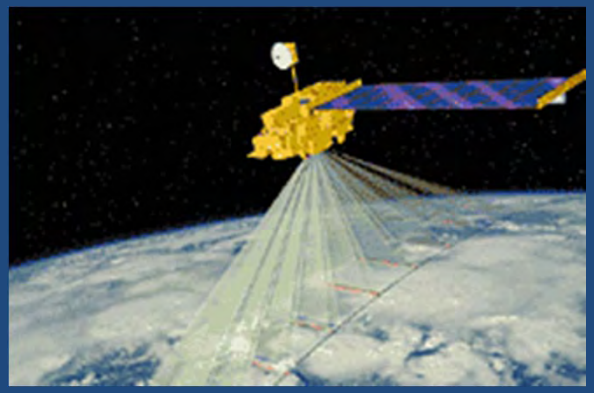
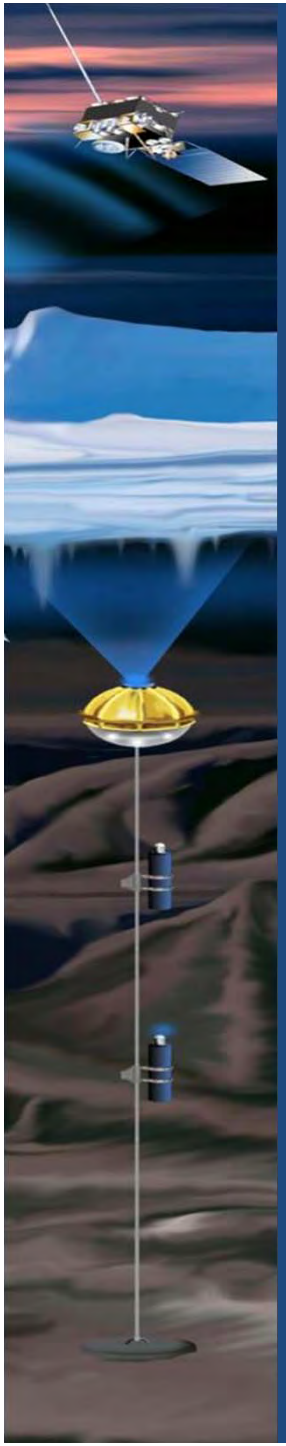
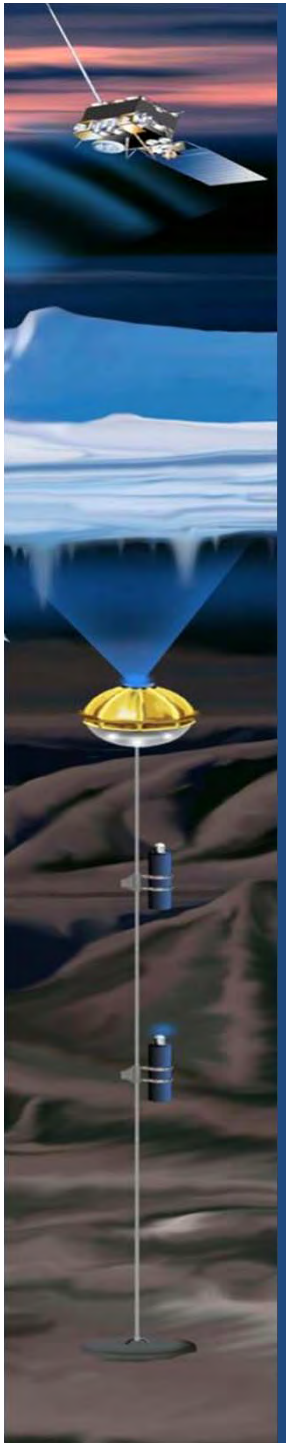


Photo credits: USCG, NASA



Abbreviated Statement of Task

1. **Identify major research questions** anticipated to be at the forefront of ocean science in 2030
2. **Define categories of infrastructure** that should be **included in planning** for the nation's ocean research infrastructure of 2030
3. Provide **advice on the criteria and processes** that could be used **to set priorities** for the development of new ocean infrastructure or replacement of existing facilities
4. Recommend ways in which the **federal agencies** can **maximize the value** of investments in ocean infrastructure
5. Address **societal issues** in the same context as the *Ocean Research Priorities Plan*



Committee Roster

ERIC J. BARRON (Chair), Florida State University

RANA A. FINE (Vice Chair), University of Miami, Florida

JAMES G. BELLINGHAM, Monterey Bay Aquarium Research Institute

EMMANUEL S. BOSS, University of Maine

EDWARD A. BOYLE (NAS), Massachusetts Institute of Technology

MARGO EDWARDS, University of Hawaii at Manoa

KENNETH S. JOHNSON, Monterey Bay Aquarium Research Institute

DEBORAH S. KELLEY, University of Washington

HAUKE KITE-POWELL, Woods Hole Oceanographic Institution

STEVEN RAMBERG, National Defense Univ. /Pennsylvania State Univ.

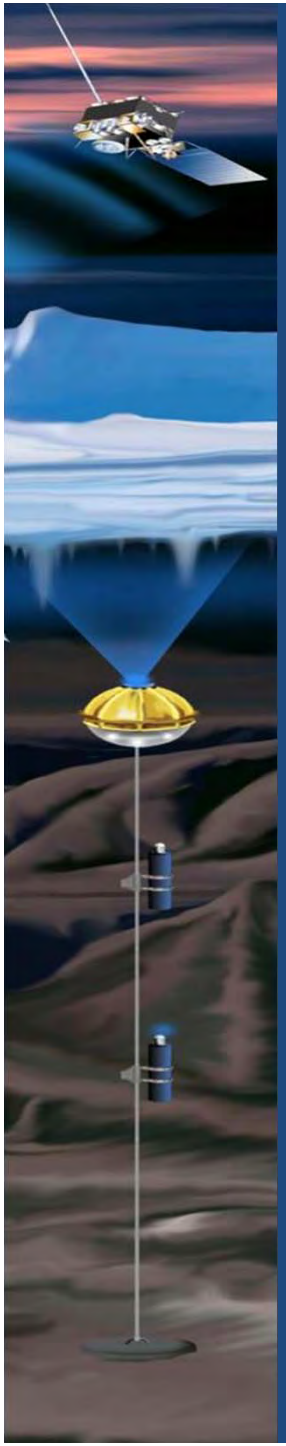
DANIEL L. RUDNICK, Scripps Institution of Oceanography

OSCAR M.E. SCHOFIELD, Rutgers University, New Jersey

MARIO N. TAMBURRI, University of Maryland Center for Environmental Science

PETER H. WIEBE, Woods Hole Oceanographic Institution

DAWN J. WRIGHT, Oregon State University



Committee Work Process

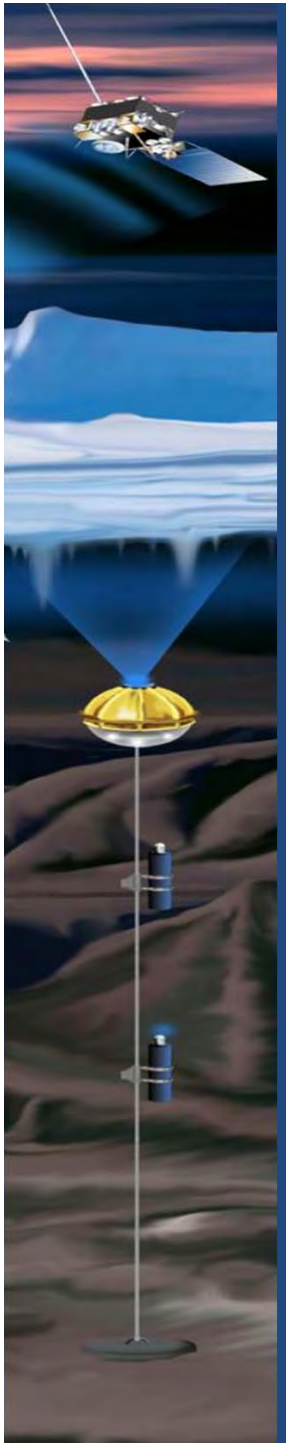
Science Questions

↓

Infrastructure Requirements and Needs

↓

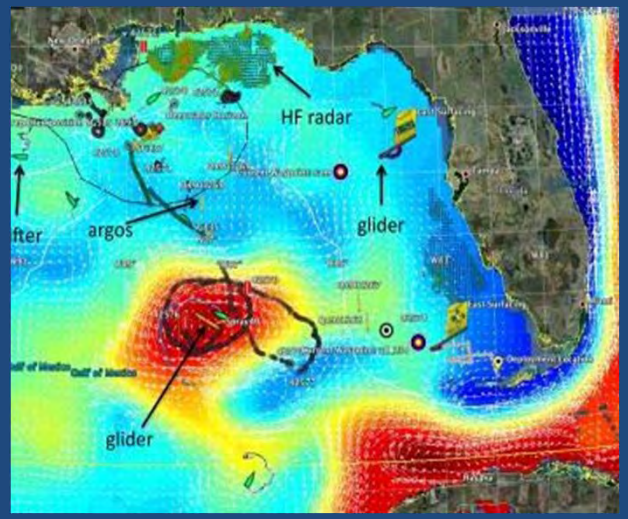
Infrastructure Categories

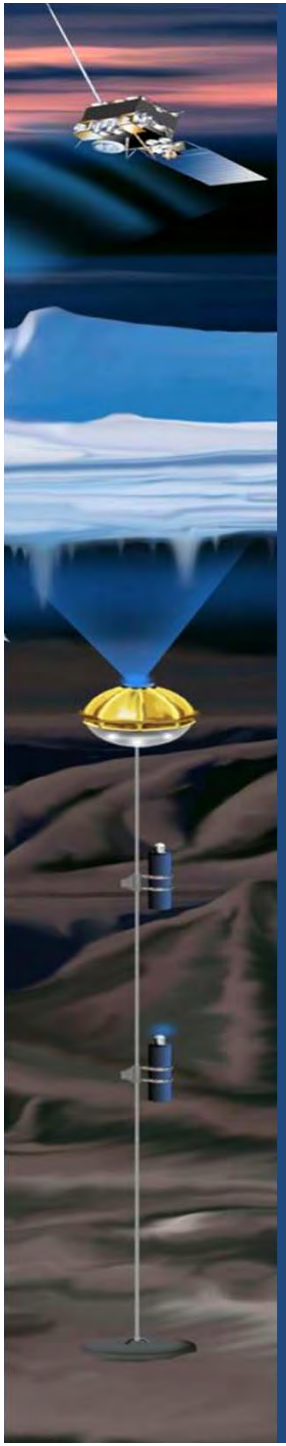


Societal Drivers

Four major themes are of compelling interest to society and will drive scientific research for the next two decades:

- **Enabling stewardship of the environment**
- **Protecting life and property**
- **Promoting economic vitality**
- **Increasing fundamental scientific understanding**





Science Questions for 2030

How Will Sea Level Change and What Are the Potential Impacts?

How Can Understanding and Prediction of Tsunamis Be Improved?

What is the Role of Coastal Pollutants and Pathogens on Human and Ecosystem Health?

32

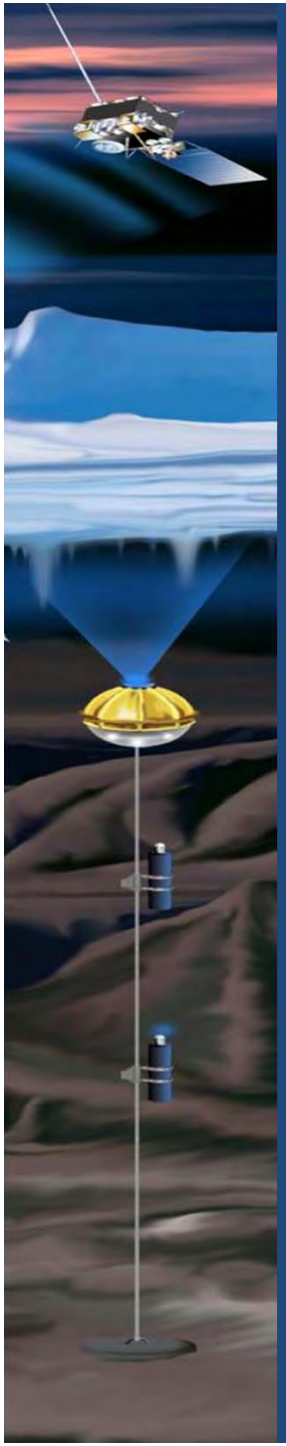
What are the Plausible Rates and Magnitudes of Climate Change?

What Advances Will Be Made in Prediction and Mitigation of Oil Spills and Industrial Accidents in the Ocean?

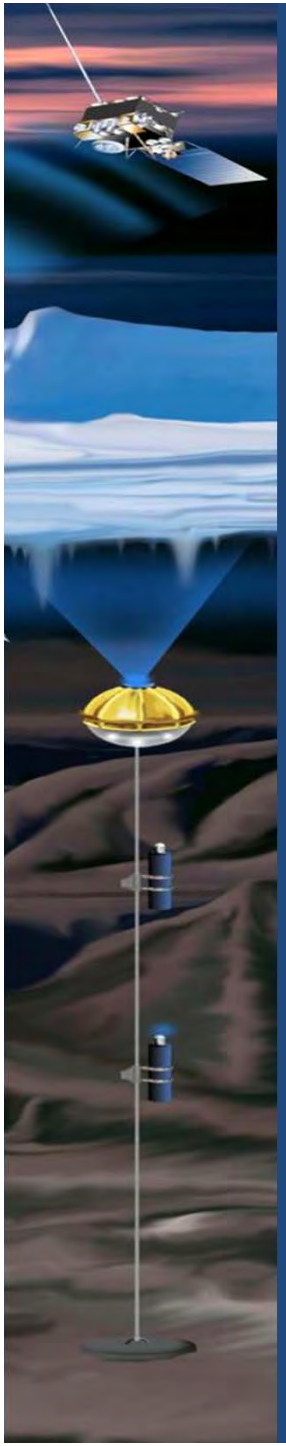
How Can Humanity Ensure Sustainable Food Production in the Ocean?

What Is the Ocean's Potential as a Source of Renewable Energy?

How Will Marine Organisms and Ecosystems be Affected by Ocean Acidification?



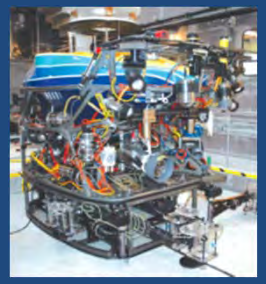
- The importance of these questions **demands continued investment in ocean research infrastructure**
- U.S. ocean research infrastructure will be required **to serve a broad set of needs**.
- A comprehensive **range of ocean research infrastructure will be needed** to overcome the challenge of aged, obsolete infrastructure and to meet growing societal demand for scientific information to enable safe, efficient, and environmentally sustainable use of the ocean.
- More **interdisciplinary and multidisciplinary** research will require a growing suite of infrastructure.



Infrastructure Categories

Mobile Platforms

ROVs



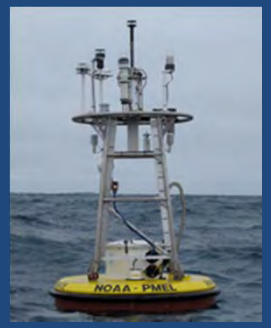
HOVs

drifters

Data Telemetry and Communications

Fixed Platforms

borehole observatories



moorings

cabled observatories

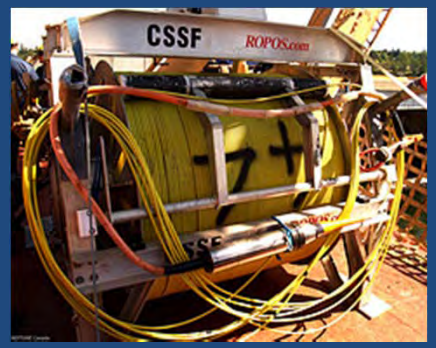
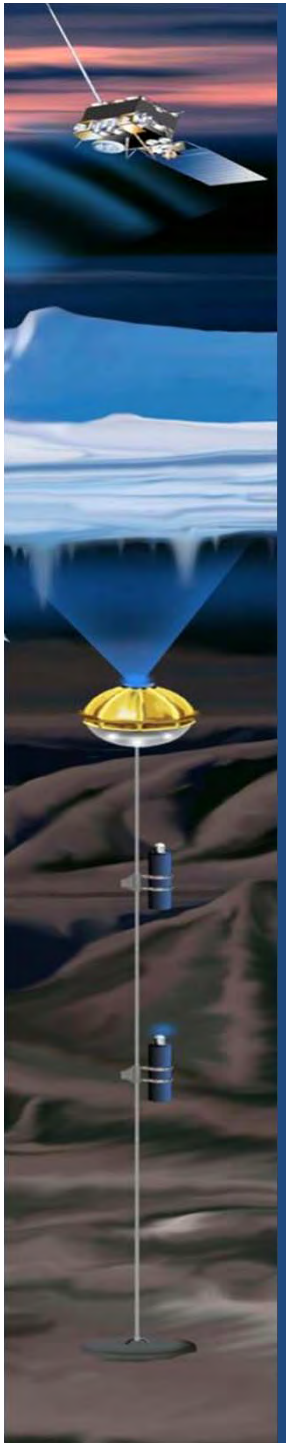


Photo credits: NOAA, WHOI, COL, Rutgers University, Neptune Canada

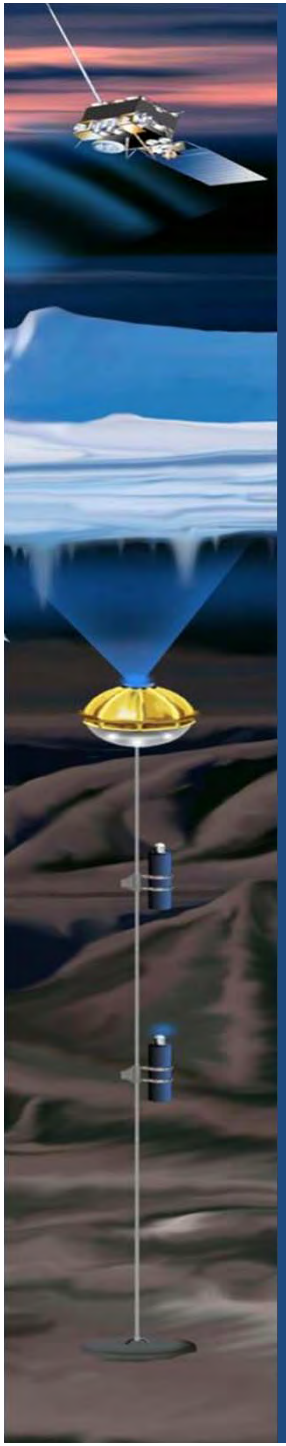


Recommendations

- Implement a comprehensive, long-term research **fleet plan** to retain access to the sea

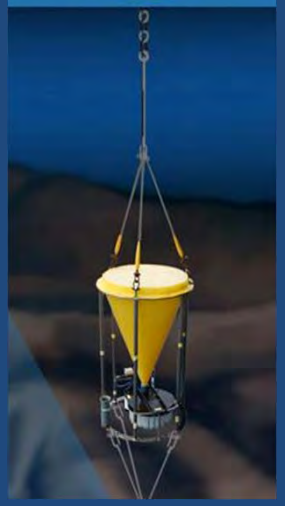
Photo credits: WHOI

- Recover U.S. capability to **access** full and partially **ice-covered seas**

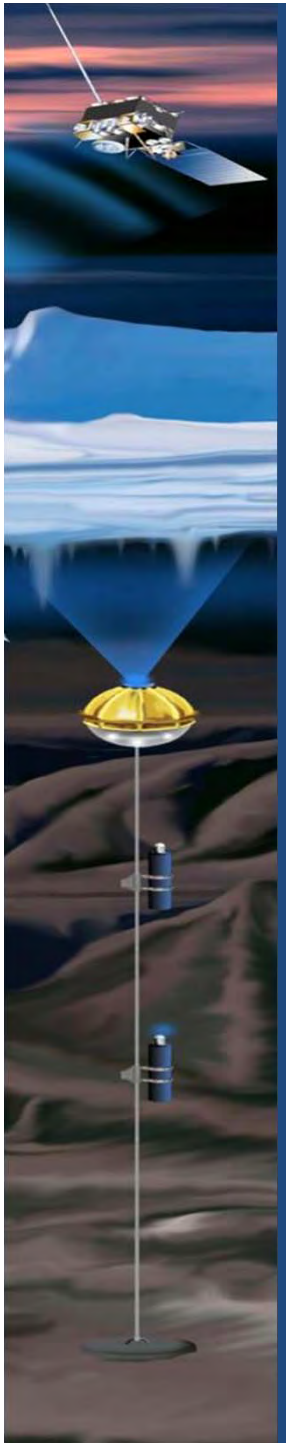


Recommendations

- **Expand abilities for autonomous monitoring** at a wide range of spatial and temporal scales with greater sensor and platform capabilities

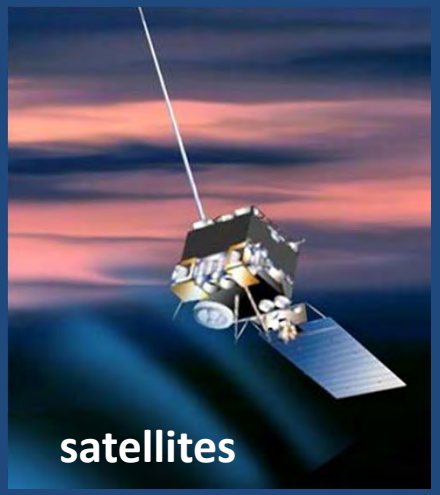


- **Facilitate broad community access to infrastructure assets**, including mobile and fixed platforms and costly analytical equipment



Infrastructure Categories

Remote Sensing



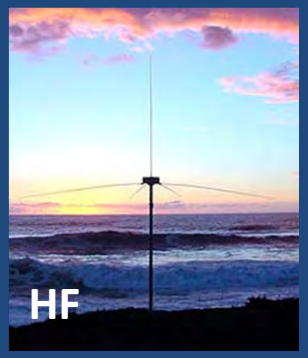
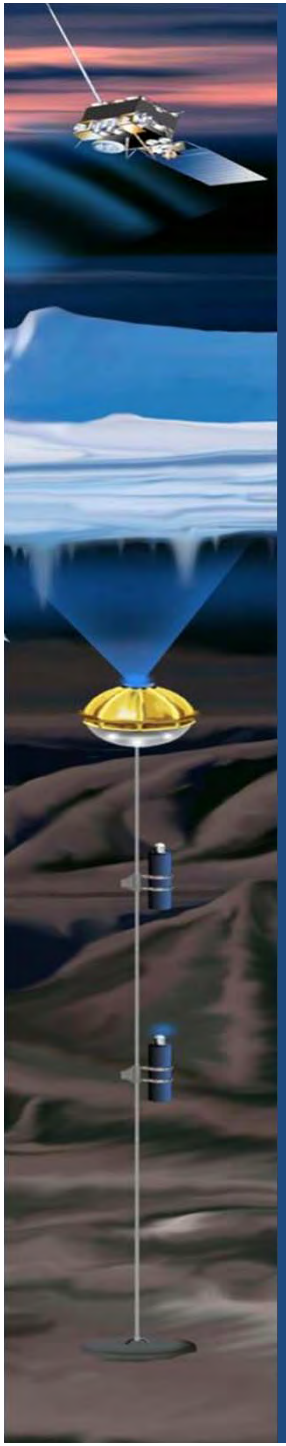


Photo credits: NOAA, UC Davis

Modeling and Computational Infrastructure

Data Management



Recommendations

- Maintain **continuity of satellite remote sensing** and communication capabilities for oceanographic data and sustain plans for new satellite platforms, sensors, and communication systems

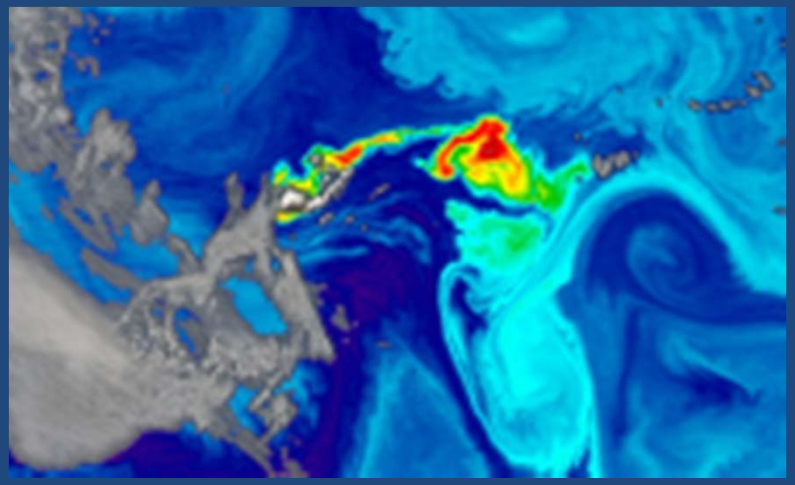
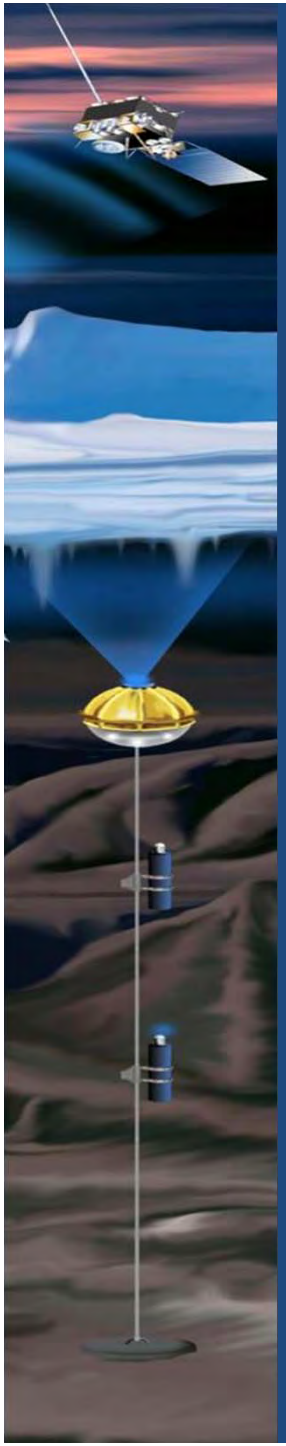


Photo credit: NASA

- Increase the number and capabilities of broadly accessible **computing and modeling facilities** with exascale or petascale capability that are **dedicated to future oceanographic needs**



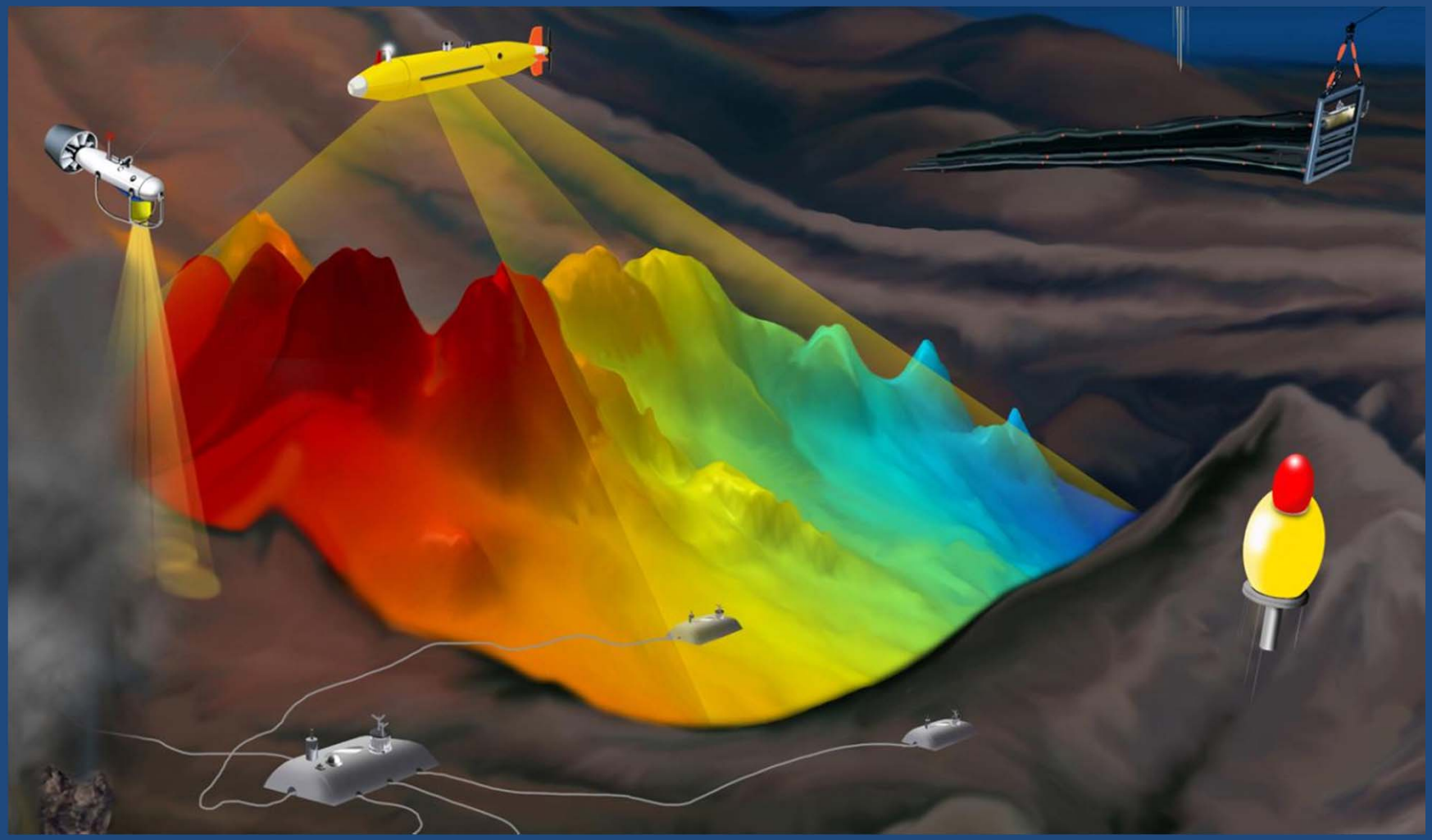
Recommendations

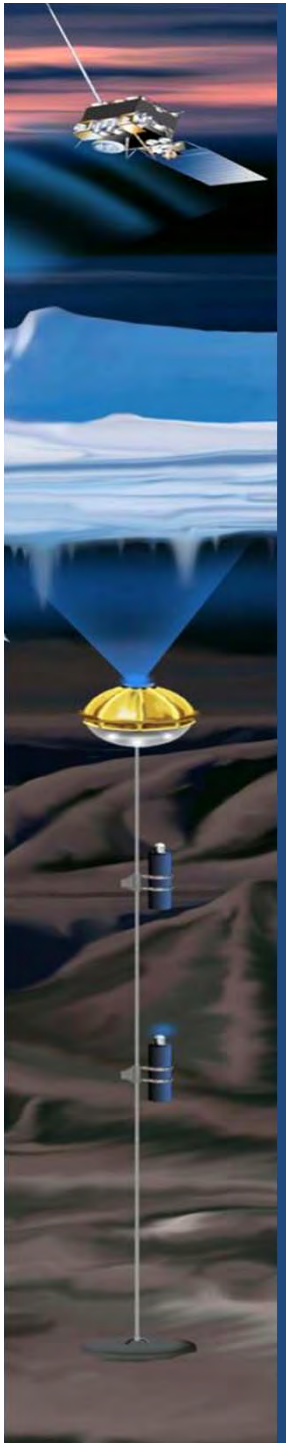
- Establish broadly accessible **virtual (distributed) data centers** that have seamless integration of federally, state, and locally held databases, accompanying metadata compliant with proven standards, and intuitive archiving and synthesizing tools

- Examine and adopt proven **data management** practices from allied disciplines

Infrastructure Categories

In Situ Sampling and Sensing





Recommendations

- Enable sustained, continuous **timeseries** measurements

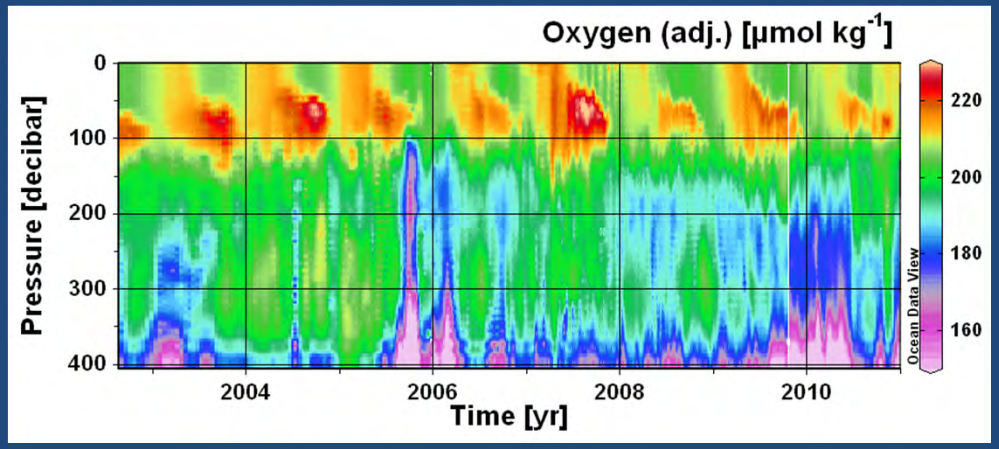
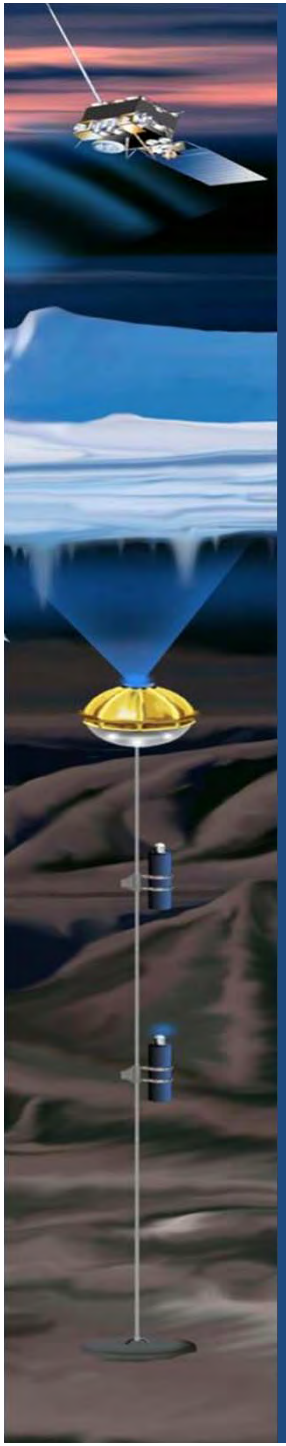


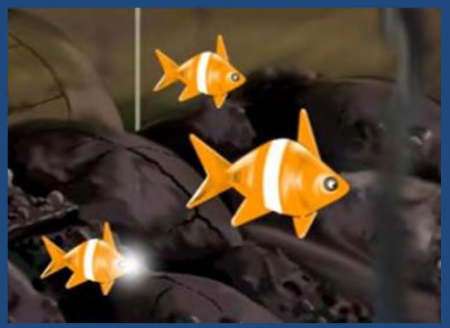
Photo credit: MBARI

- **Support continued innovation in ocean infrastructure development**, especially **biogeochemical** and other in situ **sensors**

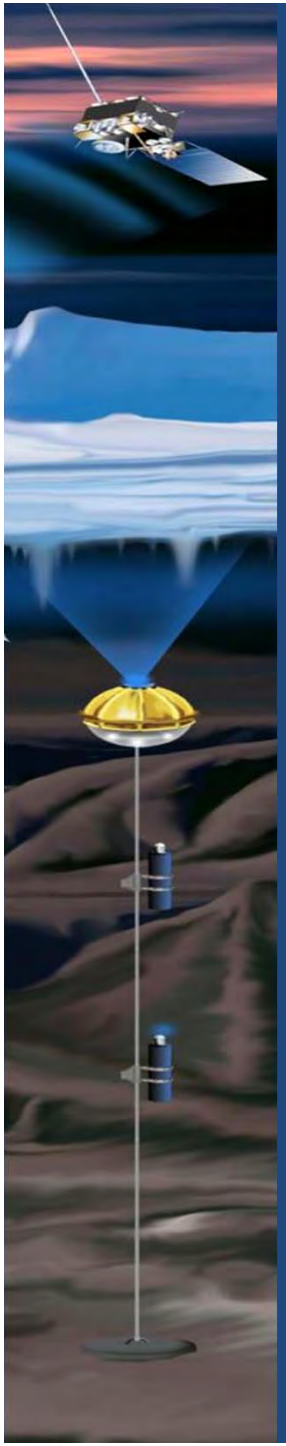


Recommendations

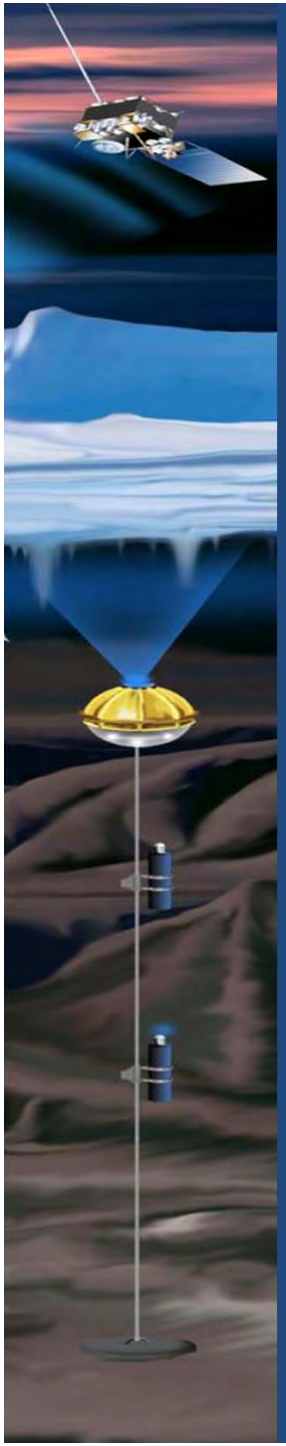
- Engage allied disciplines and diverse fields to **leverage technological developments outside oceanography**



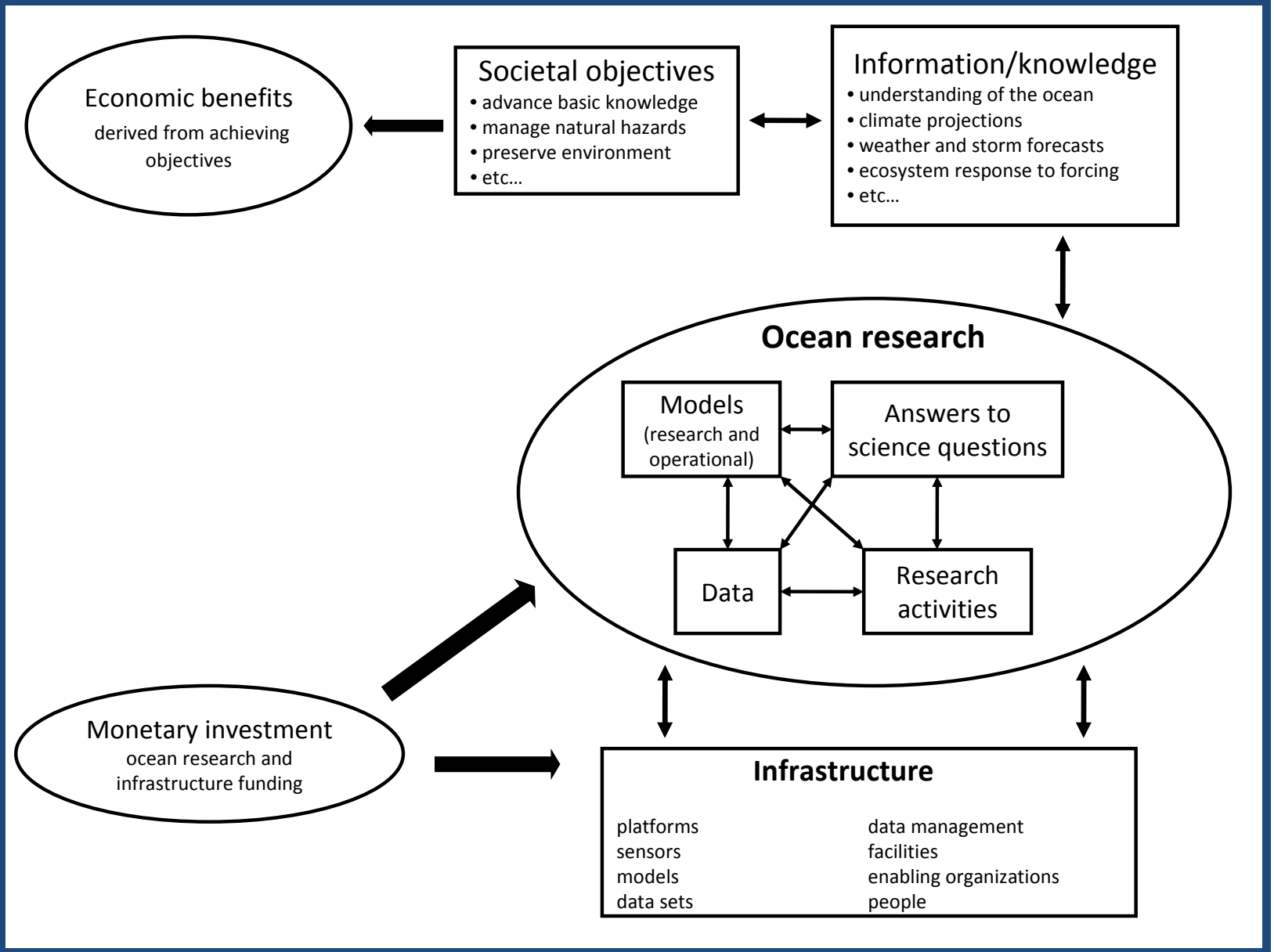
- Expand **interdisciplinary education and promote a technically-skilled workforce**

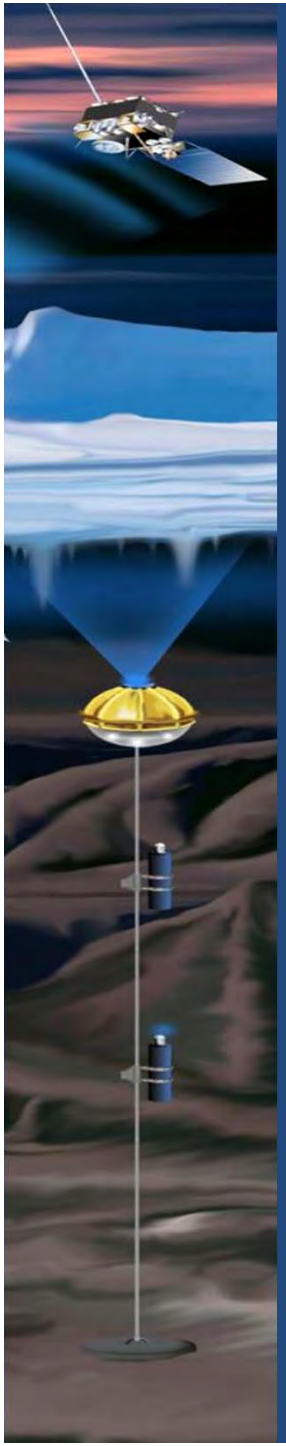


The challenge of prioritizing ocean research infrastructure investments is best approached by **estimating the economic costs and benefits** of each potential infrastructure investment, and funding those investments (subject to budget constraints) that collectively produce the **largest expected net benefit** over time.



Prioritizing Assets

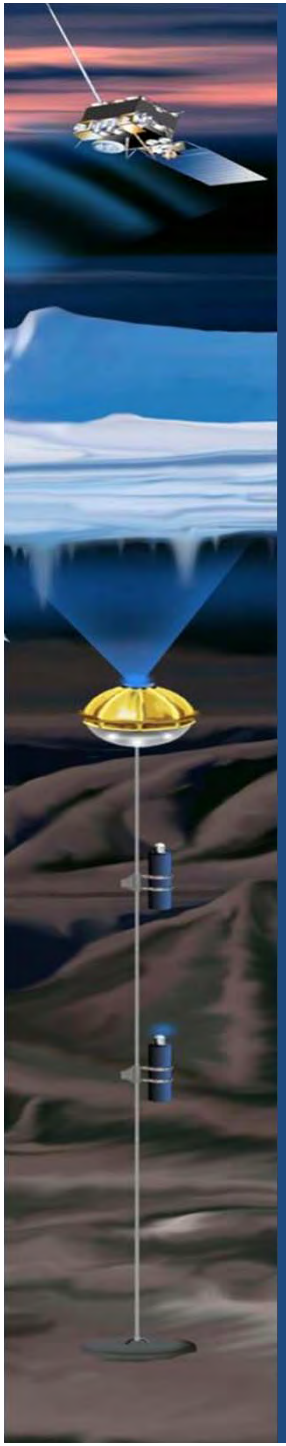




Recommendation

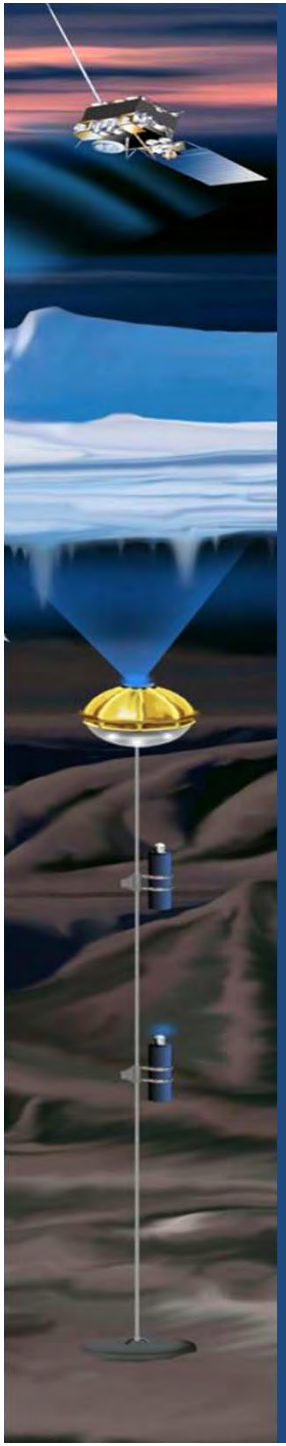
Development, maintenance, or replacement of ocean research infrastructure assets should be **prioritized in an economic framework**, including these factors:

1. **Usefulness for addressing important science questions**
2. **Affordability, efficiency, and longevity**
3. **Ability to contribute to other missions or applications**



Maximizing Federal Investments

- Providing Access to Data, Information, and Facilities
- Promoting Collaboration
- Enabling Transition of Ocean Infrastructure from Research to Broader Societal Application
- Ensuring the Next Generation of Ocean Science Infrastructure



Recommendation

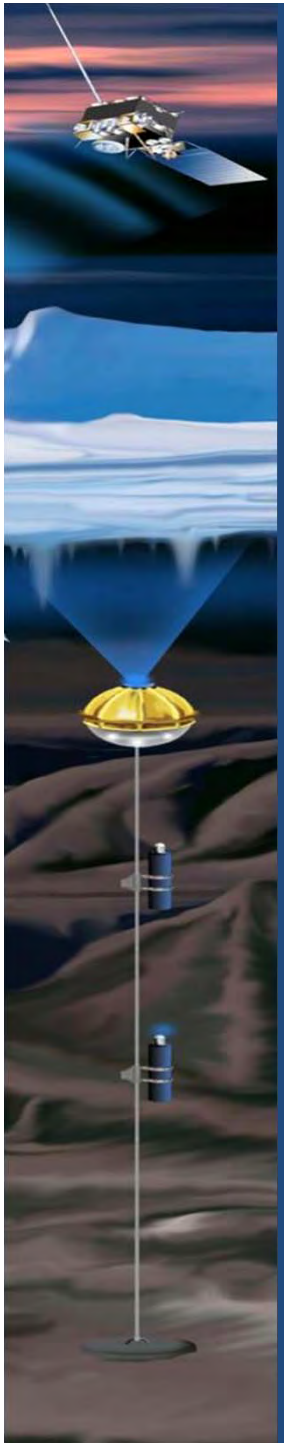
- Federal ocean agencies should establish and maintain a **coordinated national strategic plan for critical shared ocean infrastructure investment, maintenance, and retirement**.

- It should be **based upon a set of known priorities and updated through periodic reviews** (every 5-10 years) in order **to ensure optimal federal investment across a full range of ocean science research and societal needs**.

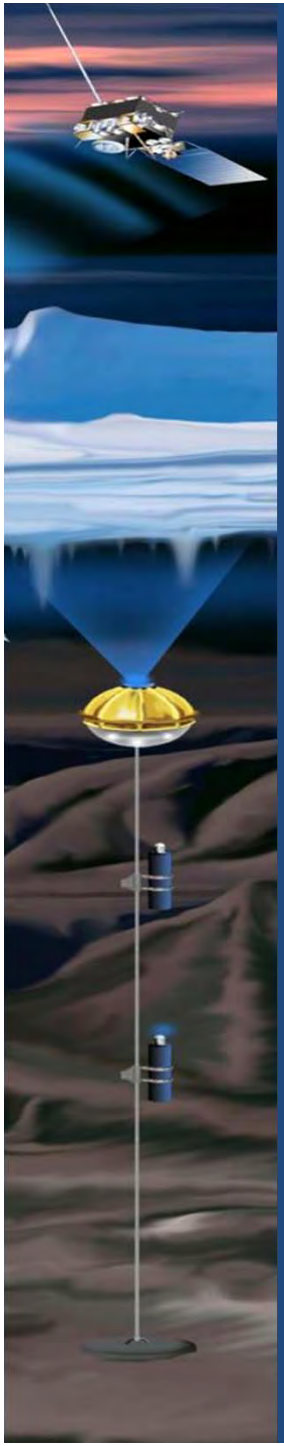
The prepublication is available online:

http://www.nap.edu/catalog.php?record_id=13081

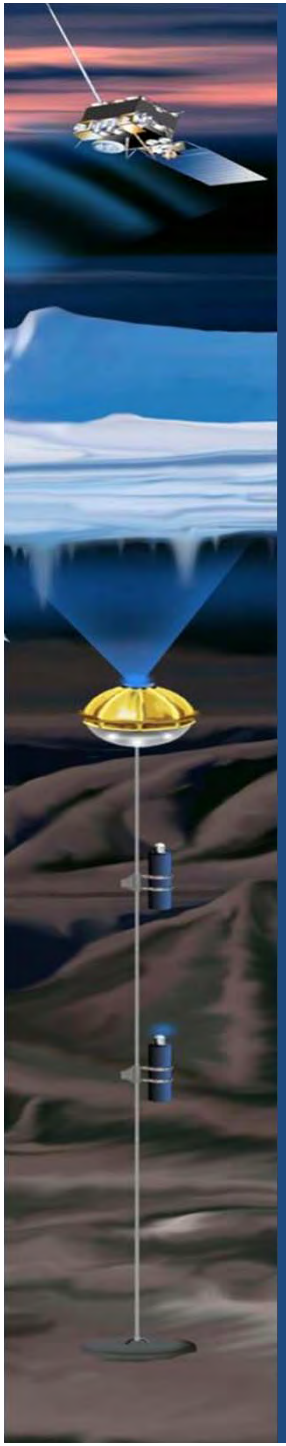
The final printed report will be available July 2011.



Thank you



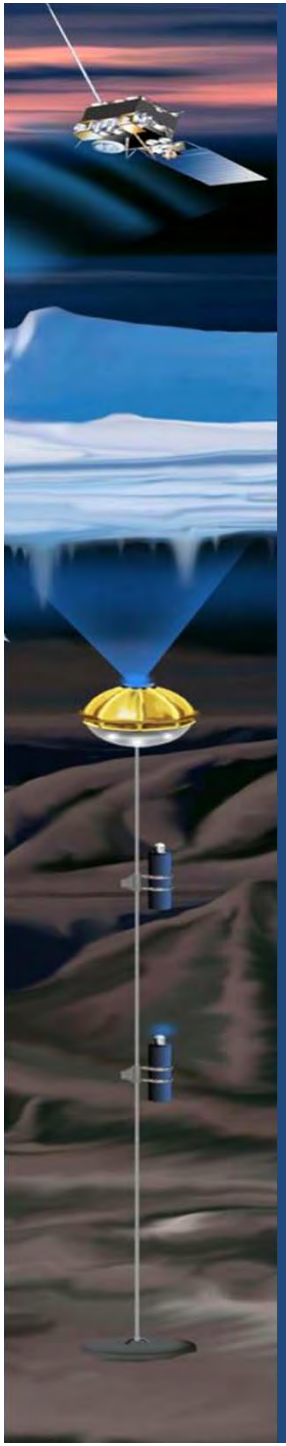
Supplemental Material



Statement of Task

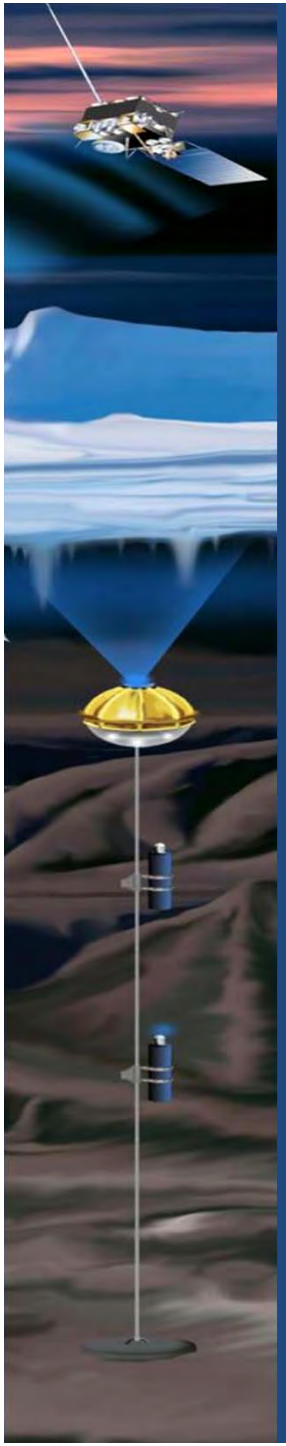
NRC will assemble an expert committee to provide advice and a perspective from the worldwide ocean community on the types of U.S. ocean infrastructure that will facilitate research in 2030, including advice as to what criteria may be most appropriate for setting priorities.

- The committee will **identify major research questions anticipated to be at the forefront of ocean science in 2030** based on national and international assessments, input from the worldwide scientific community, and ongoing research planning activities. Next, the committee will **define categories of infrastructure that should be included in planning for the nation's ocean research infrastructure of 2030** and that will be required to answer the major research questions of the future, taking into consideration:



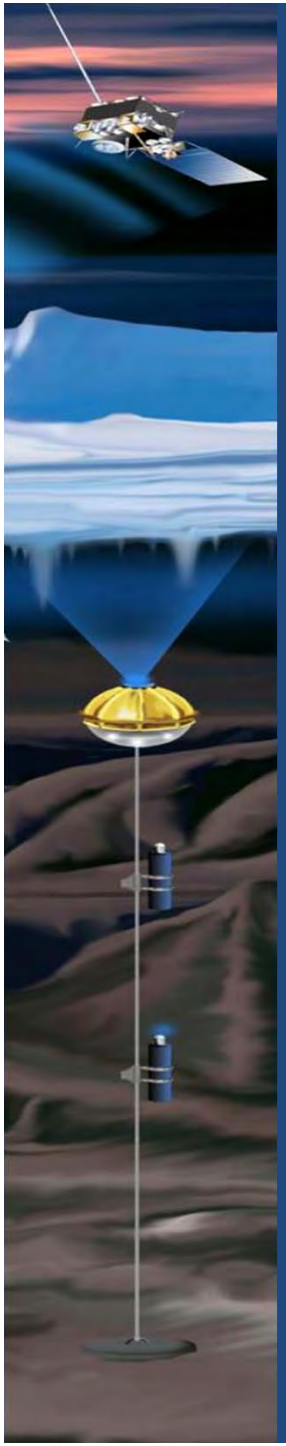
Statement of Task (cont.)

- New scientific and technological developments - including adoption of capabilities and discoveries outside of the ocean sciences,
- Interdependence of various infrastructure assets and multi-purpose or multi-user assets,
- How anticipated changes in the oceans, its interactions with the atmosphere, land, sea ice, marine and terrestrial ecosystems, and humans, and commercial enterprises might affect demand for various assets and operational characteristics,
- Potential use of infrastructure assets supported by Federal, State, and Local governments and by industry to collect data for multiple goals,
- Potential for emerging technology to increase the substitutability of various infrastructure components, thus providing greater flexibility or surge capacity,
- Potential opportunities to phase out programs or facilities in order to develop capabilities in new research areas, and
- Institutional or policy barriers, if any, that may hinder the optimal use of facilities and infrastructure. This would include restrictions on the use of facilities and infrastructure by non-traditional users, including private industry, and possible ways to optimize the use of research facilities.



Statement of Task (cont.)

The report will **provide advice on the criteria and processes that could be used to set priorities** for the development of new ocean infrastructure or replacement of existing facilities. It will not recommend specific new infrastructure or facility fabrication/construction investments. In undertaking this task, the committee will consider a variety of issues, such as partnerships with other nations and industry, constraints on acquisition and operation of research platforms, and suitability of facilities for addressing a diversity of scientific endeavors. In the same context as "Charting the Course of Ocean Science in the United States for the Next Decade: An Ocean Research Priorities Plan and Implementation Strategy", this study will **address societal issues**. In addition, the committee will **recommend ways in which the federal agencies can maximize the value of investments in ocean infrastructure**. This may include practices that would facilitate the transition of facilities and infrastructure for research into operational use.



Study Sponsors

The study is sponsored by the Subcommittee on Ocean Science and Technology. Contributing agencies include:

- Arctic Research Commission
- Department of Energy
- Environmental Protection Agency
- Food and Drug Administration
- Joint Chiefs of Staff/Oceanographer of the Navy
- Marine Mammal Commission
- Minerals Management Service
- National Aeronautics and Space Administration
- National Institute of Environmental Health Sciences
- National Oceanic and Atmospheric Administration
- National Science Foundation
- U.S. Geological Survey

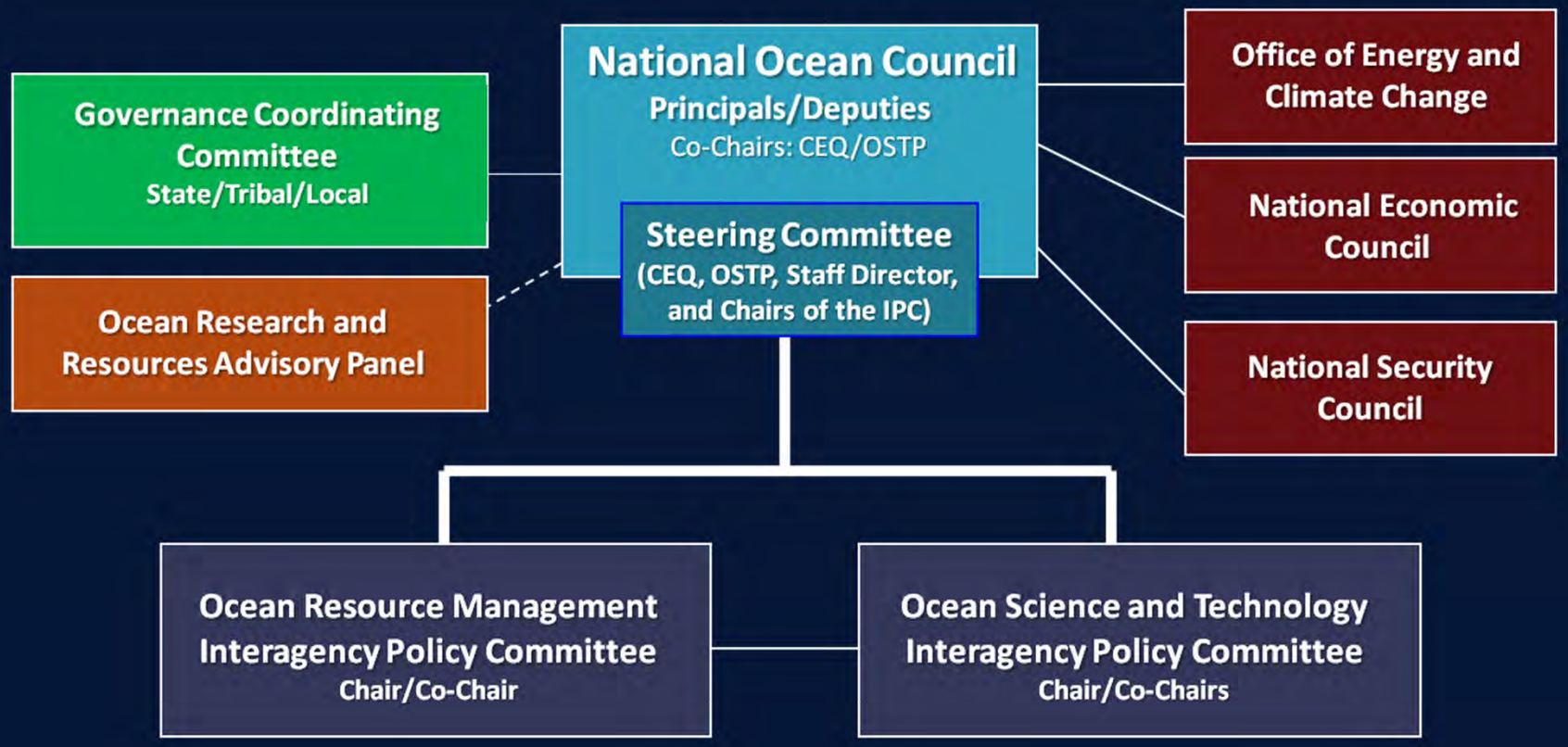
NATIONAL POLICY FOR STEWARDSHIP OF THE OCEAN, OUR COASTS, AND THE GREAT LAKES

Ocean Research and Resources Advisory Panel
April 25, 2011

Jerry Miller, OSTP

Michael Weiss, CEQ

National Ocean Council



Working groups could be retained or established as standing or ad hoc Sub-Interagency Policy Committees (IPCs): e.g., Coastal and Marine Spatial Planning, Ocean Acidification, Ocean Observations, Mapping, Ocean Education, Climate Resiliency and Adaptation, Regional Ecosystem Protection and Restoration, Water Quality and Sustainable Practices on Land, and Arctic.

The Extended Continental Shelf Task Force and other designated interagency committees, as appropriate, would report to the Steering Committee and coordinate with the two IPCs.

▬ Reporting
— Coordination
---- Communication

Nine Priority Objectives

- Four priority objectives to improve the way we do business:
  - ✓Ecosystem-based management
  - ✓Coastal and marine spatial planning
  - ✓Inform decisions and improve understanding
  - ✓Coordinate and support
- Five areas of special focus:
  - ✓Resiliency/adaptation to climate change and ocean acidification
  - ✓Regional ecosystem protection and restoration
  - ✓Water quality and sustainable practices on land
  - ✓Changing conditions in the Arctic Ocean
  - ✓Ocean, coastal, and Great Lakes observations and infrastructure

ORRAP Input on SAPs

- Scoping Phase
  - Have received preliminary thoughts from ORRAP based on direction in the National Ocean Policy and questions posed for public comment during the scoping phase
- Outlines
  - Have asked for ORRAP input on draft outlines of the plans
  - Discussion will take place today and tomorrow
- Full Plan
  - Will seek ORRAP input once the draft plans are complete later this year

Progress Made

- First year focused on getting the National Ocean Policy up and running and getting Federal family in order
- Finalized establishment of the Governance Coordinating Committee with their first meeting March 10 – GCC = state, local and tribal representatives that serve as a coordinating body for the National Ocean Policy
- Federal interagency drafting teams are developing strategic action plans to address the nine national priority objectives
- Federal interagency team is developing the National Information Management System to support CMSP
- National CMSP workshop scheduled for June 21-23 with a dedicated public and stakeholder session.
- Finalizing Federal representatives and Federal co-leadership on the nine regional planning bodies

Council Engagement in Policy Resolution and Coordination

- HF Radar for Operational Oceanography
- Responding to the Japanese Nuclear Incident
- Interaction with Other Federal Policy Entities, such as the Gulf Coast Ecosystem Restoration Task Force

Areas of Consideration

- Regions of Special Interest
- Renewable Energy
- Importance of National Ocean Policy in Diplomatic Efforts
- Role of National Ocean Policy in Economic Issues

Public Opportunities for Engagement

- Strategic Action Plans
  - Public Comment Website to provide initial input into development of Strategic Action Plans - through April 29
  - Listening Sessions, Public Meetings, or other fora to provide input into the development of Strategic Action Plans - To be scheduled Spring-Winter 2011
  - Release of Draft Full Content Outlines for Public Comment - June 2011
  - Release of Draft Strategic Action Plans for Public Comment - October 2011
- Stakeholder and Public Input into the Design of a National Information Management System via Public Comment Website - Spring/Summer 2011
- Public and Stakeholder Session of the National CMSP Workshop – June 21 at the Department of the Interior
- Regional Planning Bodies, once established - Summer 2011
  - Regional CMSP Workshops-to be scheduled - Summer 2011 and Beyond
  - Establishment of Stakeholder and Public Participation mechanisms - 2012


Questions?

Ocean Science & Engineering Implications National Oil Spill Commission

Donald F. Boesch

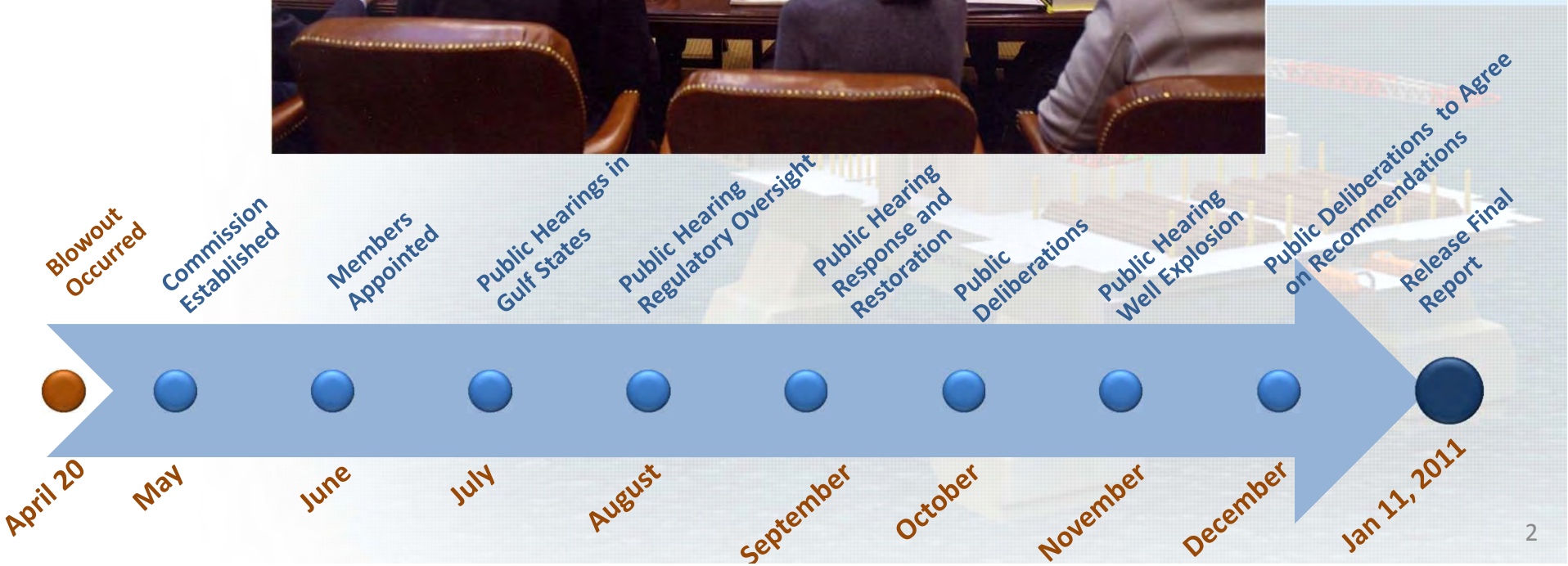
University of Maryland Center for Environmental Science

Public Policy Forum
March 9, 2011

National Commission on the
BP DEEPWATER HORIZON OIL SPILL
AND OFFSHORE DRILLING

CONSORTIUM FOR
Ocean Leadership
DISCOVERY • UNDERSTANDING • ACTION

The Commission



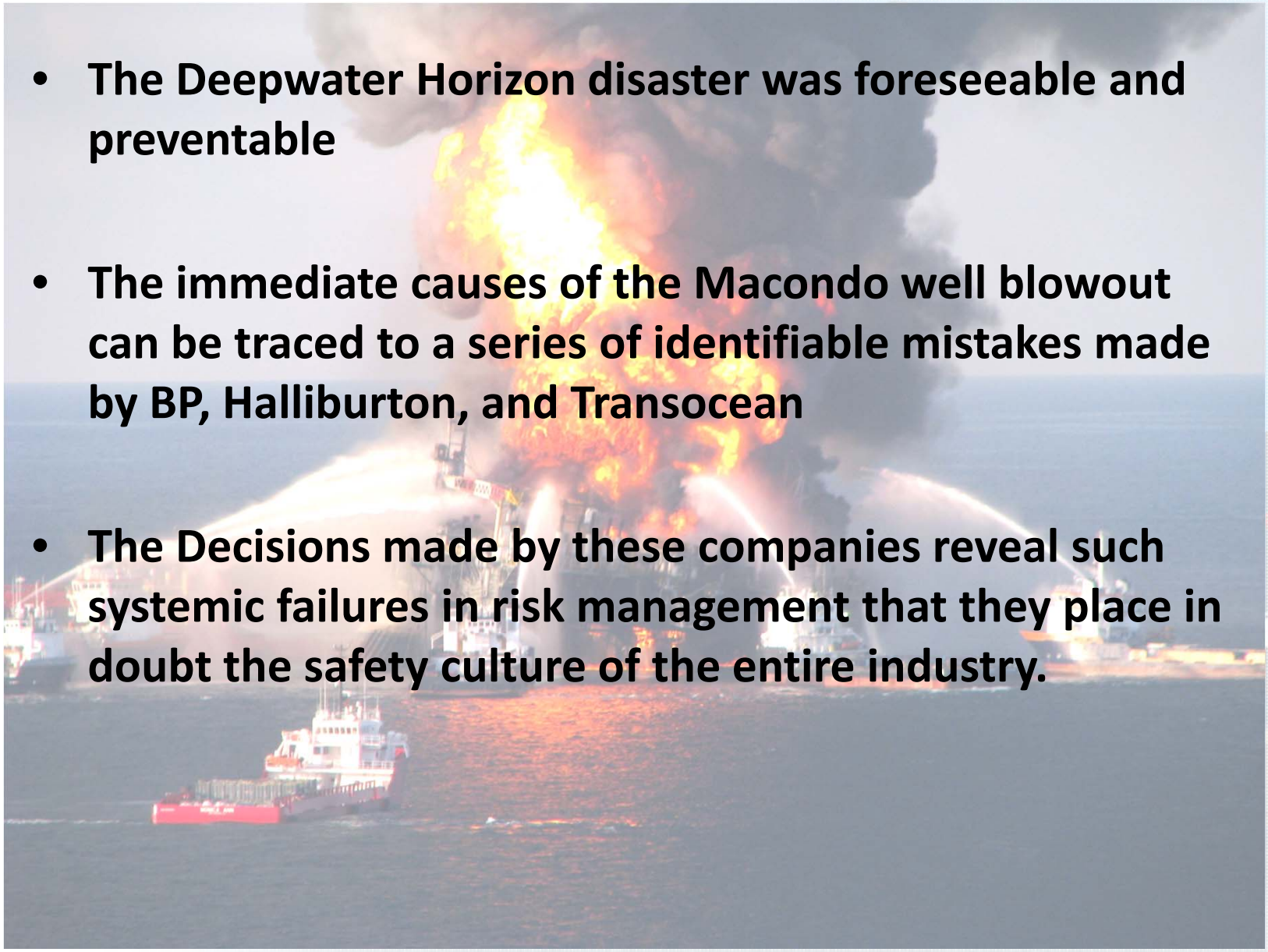
Our Mission

- **Created by Executive Order 13543, dated May 21, 2010**
- **The President asked the Commission to**
  - Examine the relevant facts and circumstances concerning the root causes of the Deepwater Horizon oil disaster;
  - Develop options for guarding against, and mitigating the impact of, oil spills associated with offshore drilling, taking into consideration the environmental, public health, and economic effects of such options
- **The Commission did not attempt to:**
  - Fix legal culpability
  - Reformulate US energy policy

Reports and Website

www.oilspillcommission.gov

Key Findings on Causes of Explosion

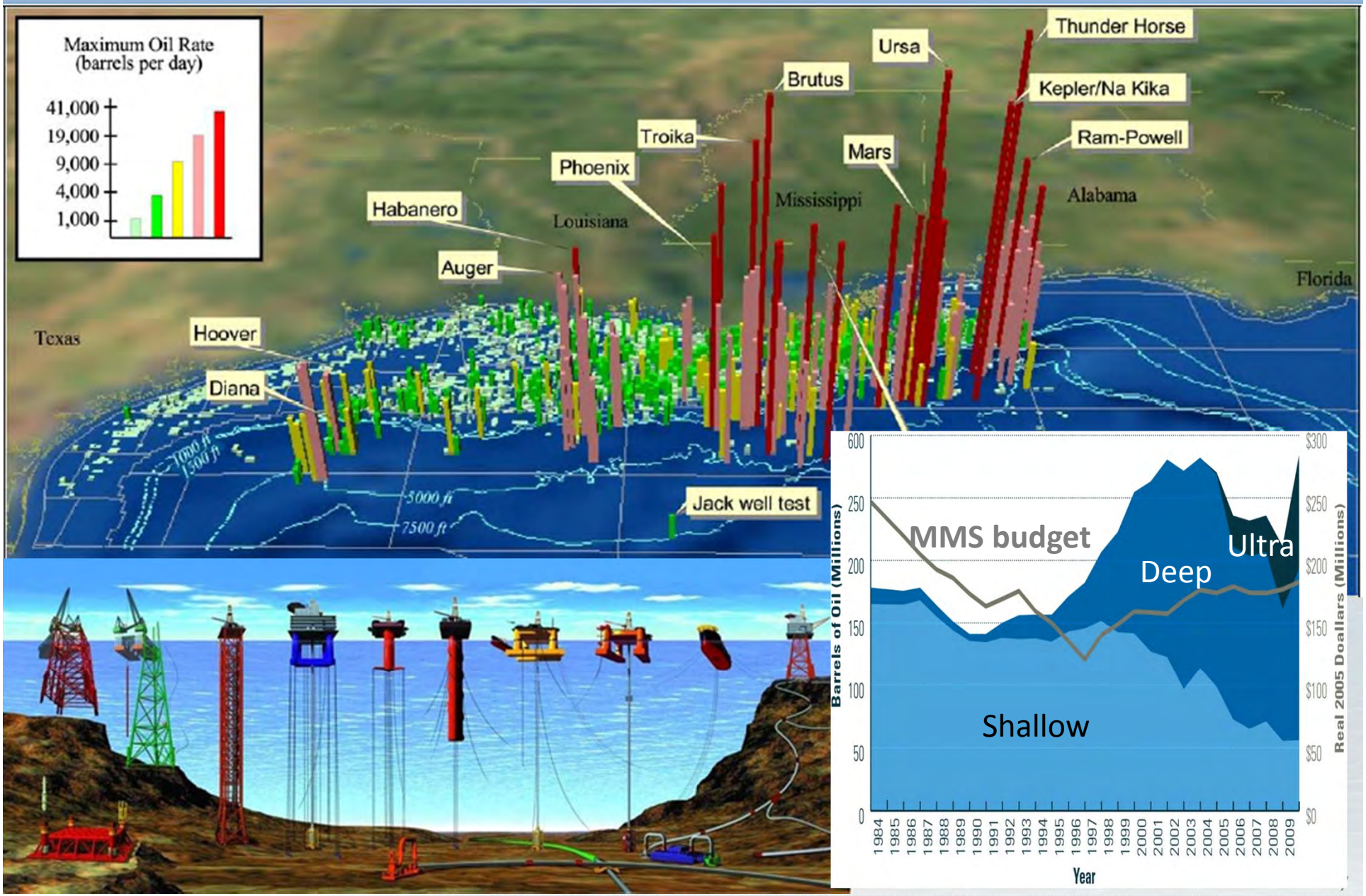


- **The Deepwater Horizon disaster was foreseeable and preventable**
- **The immediate causes of the Macondo well blowout can be traced to a series of identifiable mistakes made by BP, Halliburton, and Transocean**
- **The Decisions made by these companies reveal such systemic failures in risk management that they place in doubt the safety culture of the entire industry.**

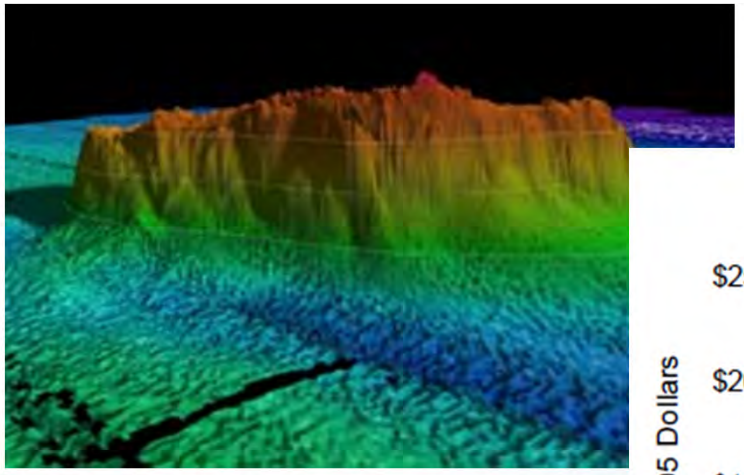
Commission's Recommendations

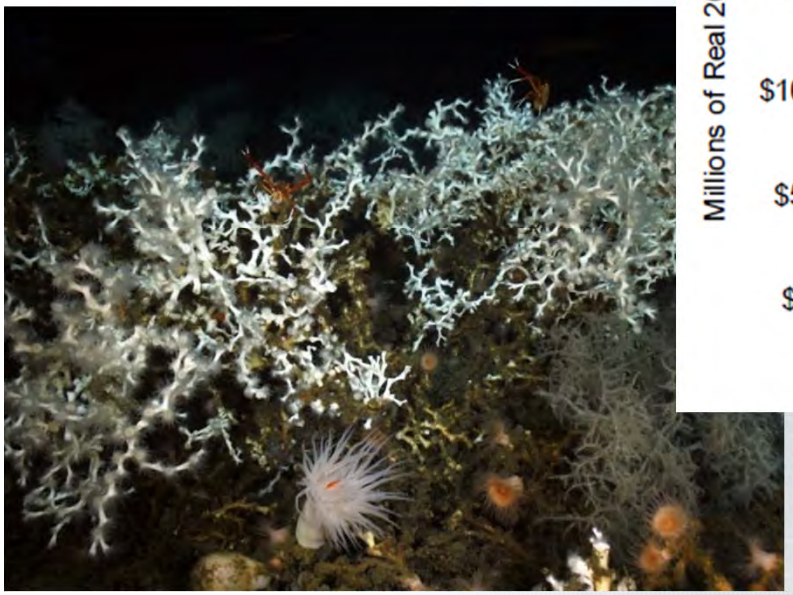
A. Improving the safety of offshore operations
B. Safeguarding the environment
C. Strengthening oil spill response, planning and capacity
D. Advancing well-containment capabilities
E. Overcoming impacts of the spill and restoring the Gulf
F. Ensuring financial responsibility
G. Promoting Congressional engagement to ensure responsible drilling
H. Moving to frontier areas

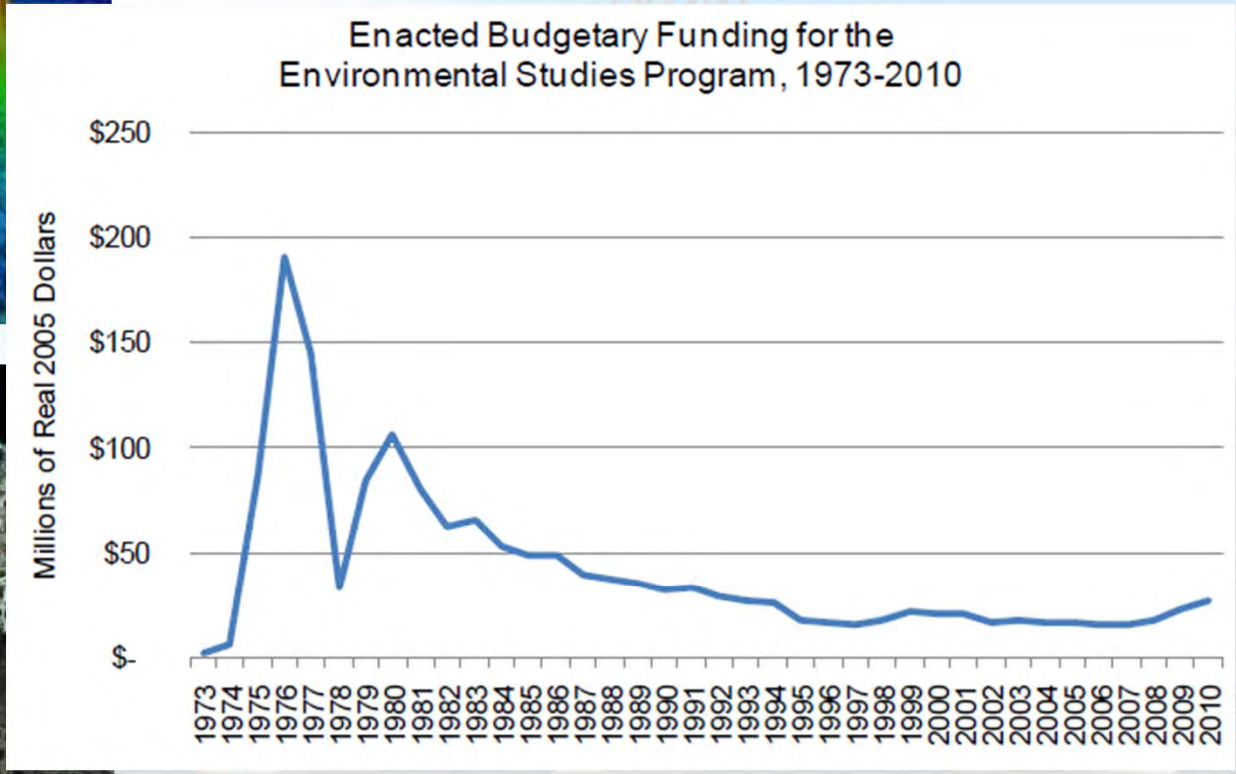
Exploration and Development in Deep Gulf



Inadequate Investment in Environmental Understanding



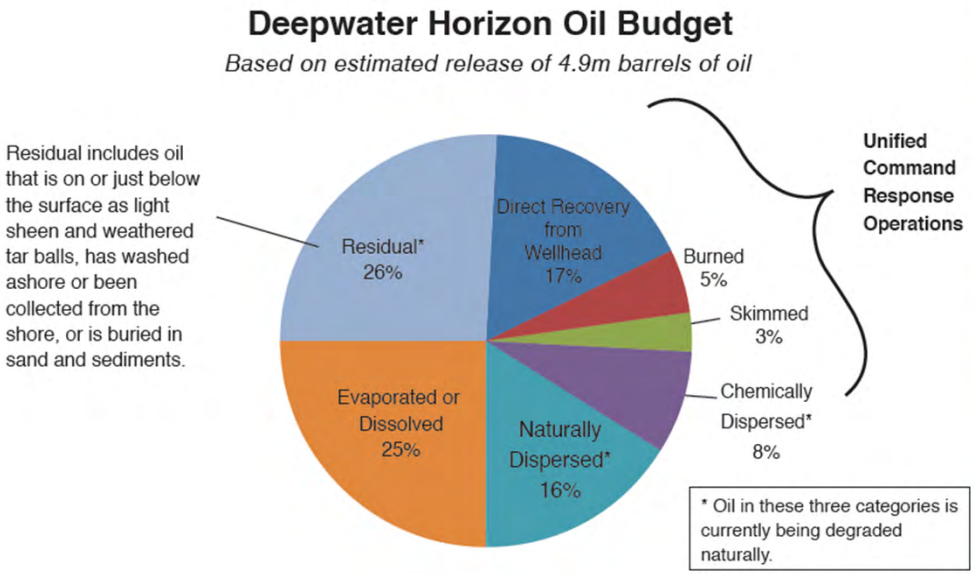


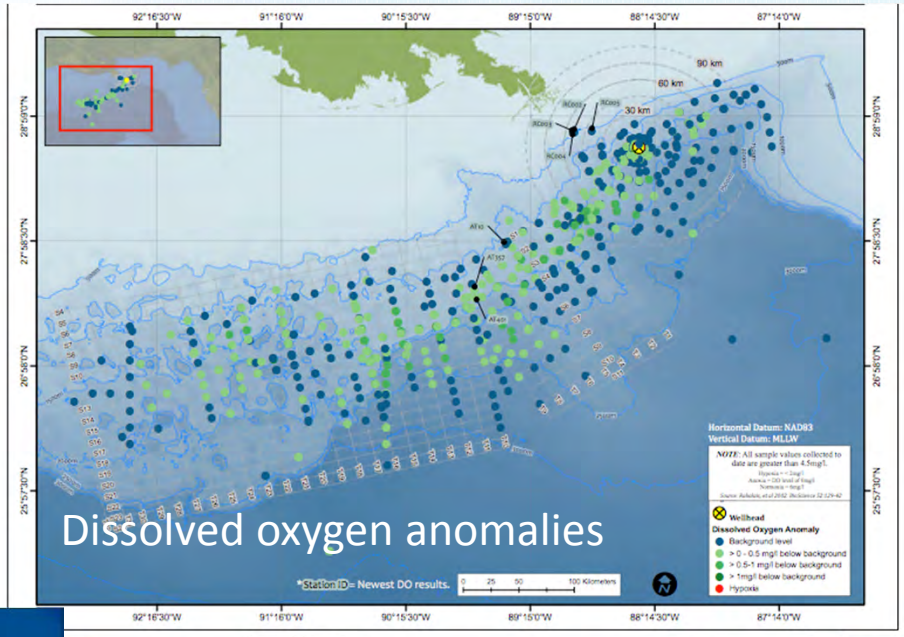


www.oilspillcommission.gov

Scientific Research to Support Offshore…

What Happened to the Oil and Gas?

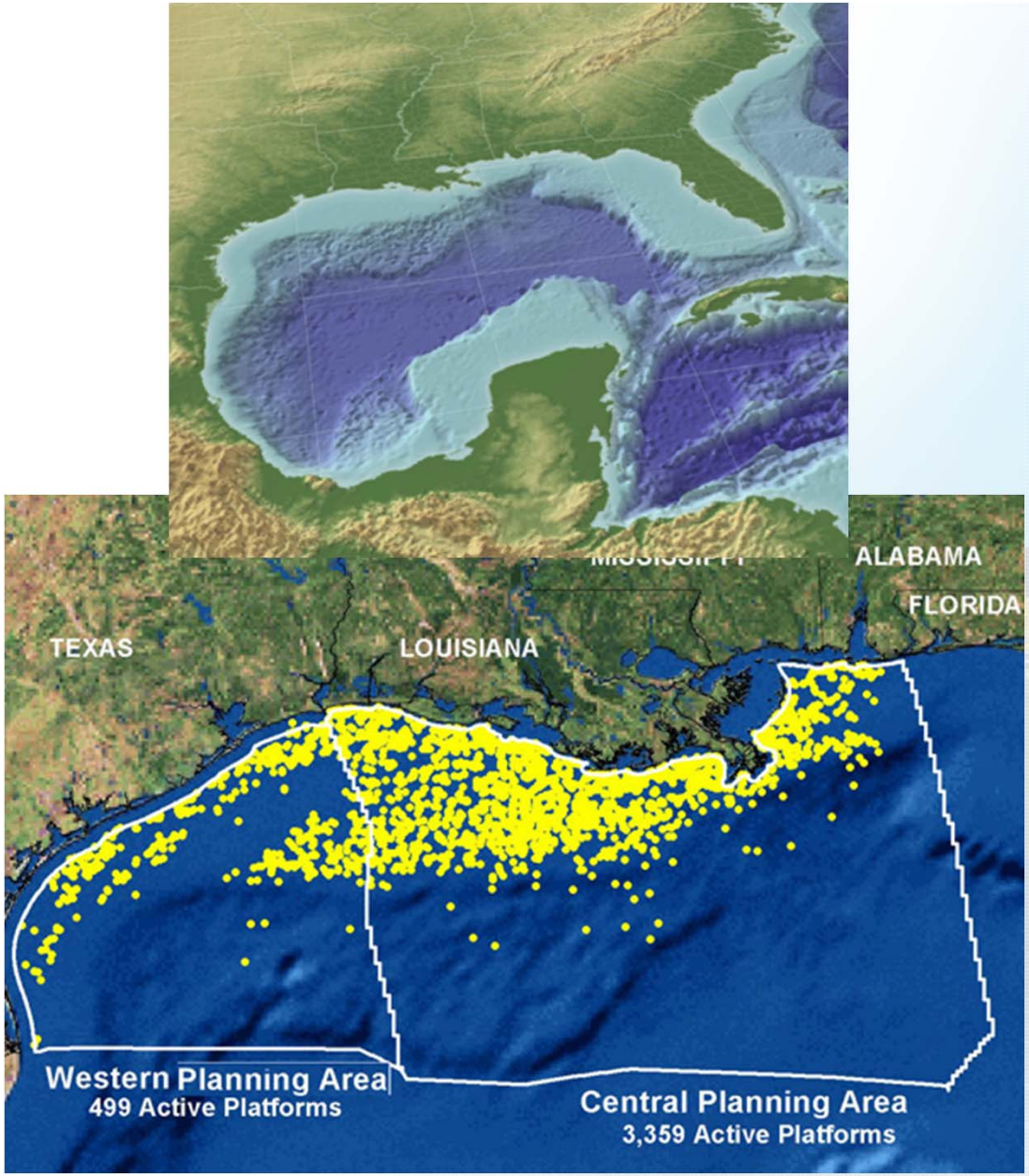




BOEM Environmental Science Office

- Led by a Chief Scientist.
- Conduct all NEPA reviews and coordinate other reviews when appropriate.
- Administer Environmental Studies Program
- Work with DOE, NOAA and USGS in a joint research program to systematically collect scientific data and provide comprehensive reviews to support decision making, monitoring impacts and damage assessment.
- Engage non-federal scientists through NOPP.
- Supported by industry fees.
- Reviewed every 5 years by NAS.

Gulf of Mexico Observing System



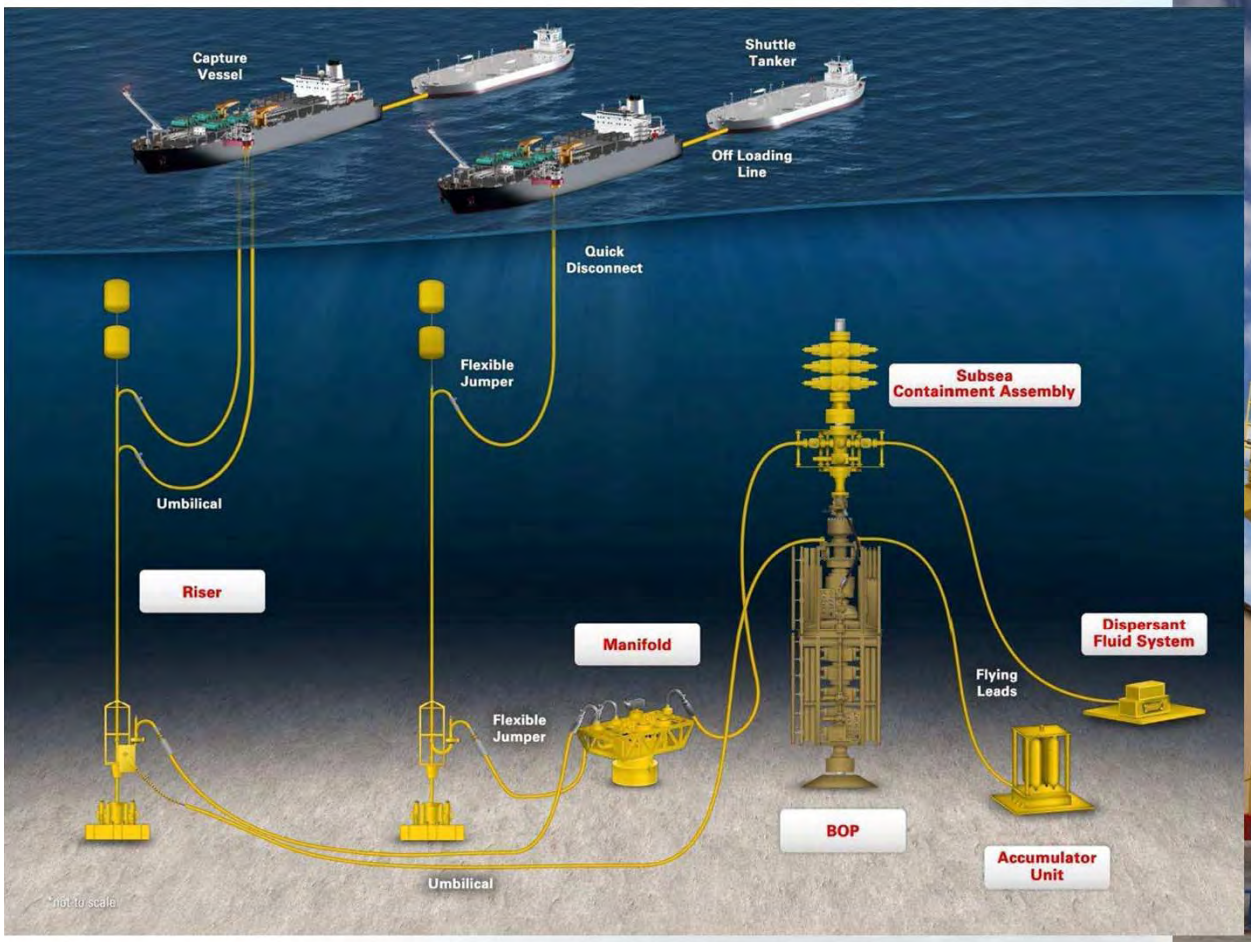
- Build on GCOOS
- Involve DOI and USCG
- Enlist industry as operating partner using its extensive infrastructure
- Develop with operational products in mind
  - Oil and gas operations
  - Extent of hypoxia
  - Fisheries recruitment
  - Emergency response

R&D Related to Safety, Containment & Spill Response

- Environmental threats to operational safety
- Rigorous, transparent and meaningful oil spill risk analysis
- Operational responses and facilitation of input from the scientific community
- Evaluation of responses not pre-authorized, e.g. barriers
- Source-control expertise and containment technologies
- Accurate estimation of flow rate or spill volume
- Dispersant testing and protocols

Subsea Containment Challenges

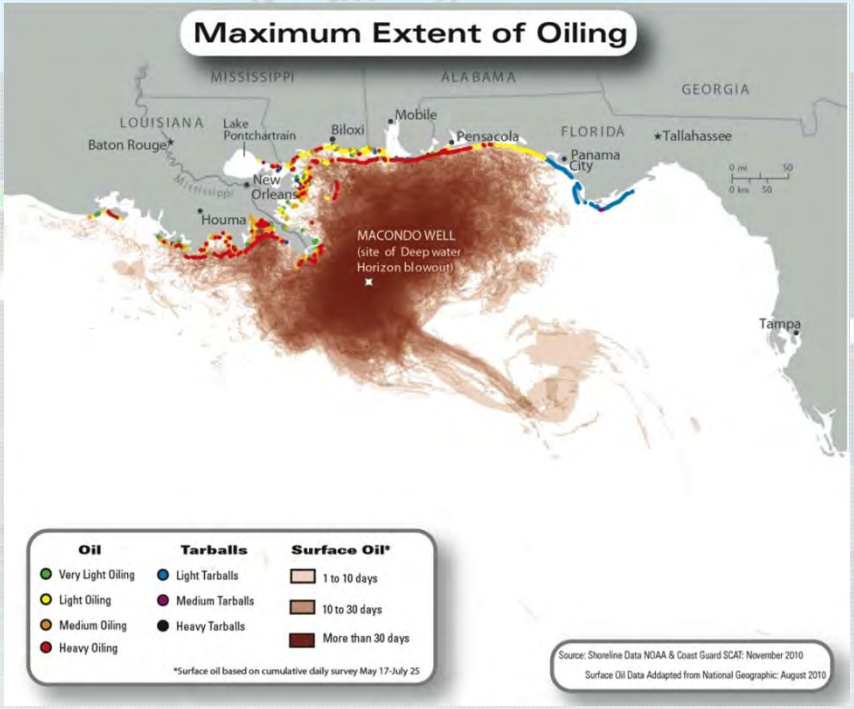
Marine Well Containment Corporation Concept (July 2010)



Capping stack (February 2011)

Assessing Long-Term Impacts

- **Monitoring during spill and dispersant application**
- **Natural Resources Damage Assessment**
- **Gulf of Mexico Research Initiative (BP funded)**
- **BOEM Environmental Studies Program**



Restoration beyond the Spill Damages

- Oil spill just added to other problems
  - Rapid land loss
  - Hypoxia
  - Katrina-Rita-Gustav-Ike
- Gulf Coast Ecosystem Restoration Council
  - 80% of CWA penalties into Restoration Fund
  - Key criteria: national significance, resilience, addressing problems due to national policies
  - Guided by science, accountable
- Increased attention should be given to new tools such as Marine Spatial Planning

Gulf Coast Ecosystem Restoration S & T Program

- Integral component of the Gulf Coast Ecosystem Restoration Council
- Supported by the Gulf Restoration Fund
- Needed to guide effective region-wide restoration strategy, advance transparency and enhance credibility
- Address issues by:
  1. Creating a scientific research and scientific research and analysis program to support the design of sound restoration.
  2. Creating a science panel to evaluate projects for technical effectiveness and consistency with the comprehensive strategy.
  3. Supporting adaptive management based on monitoring and assessment.

Recommendations for the Arctic

- Drilling must be done with the utmost care because of the sensitive Arctic environment
- An immediate, comprehensive research program to provide a foundation of scientific information is needed
- Industry and the Coast Guard should address gaps with respect to:
  - Oil-spill response
  - Containment
  - Search and rescue
- The U.S. should promote the development of international drilling standards for the Arctic

For More Information

National Commission on the
BP DEEPWATER HORIZON OIL SPILL
AND OFFSHORE DRILLING

Web Site: **www.oilspillcommission.gov**

Reports – *All available in PDF format from web site*

- Final Report: **Deep Water –** *also available in paperback from the Government Printing Office, Amazon.com, and Barnes and Nobel*
- Chief Counsel's Report: **Macondo** – *also available in interactive multimedia mode on web site*
- **The Gulf Spill** – *A multimedia summary of the Commission's findings available on the web site*
- Summary Report: **Deep Water: Recommendations**

Thank you!


National Commission on the
BP DEEPWATER HORIZON OIL SPILL
AND OFFSHORE DRILLING
Questions or
Comments?
boesch@umces.edu
by Tom MacKenzie, USFWS, May 3, 2010