NOAA's Increased Preparedness for Arctic Response

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NOAA's Office of Response and Restoration/Coastal Response Research Center

Jun 11, 2009

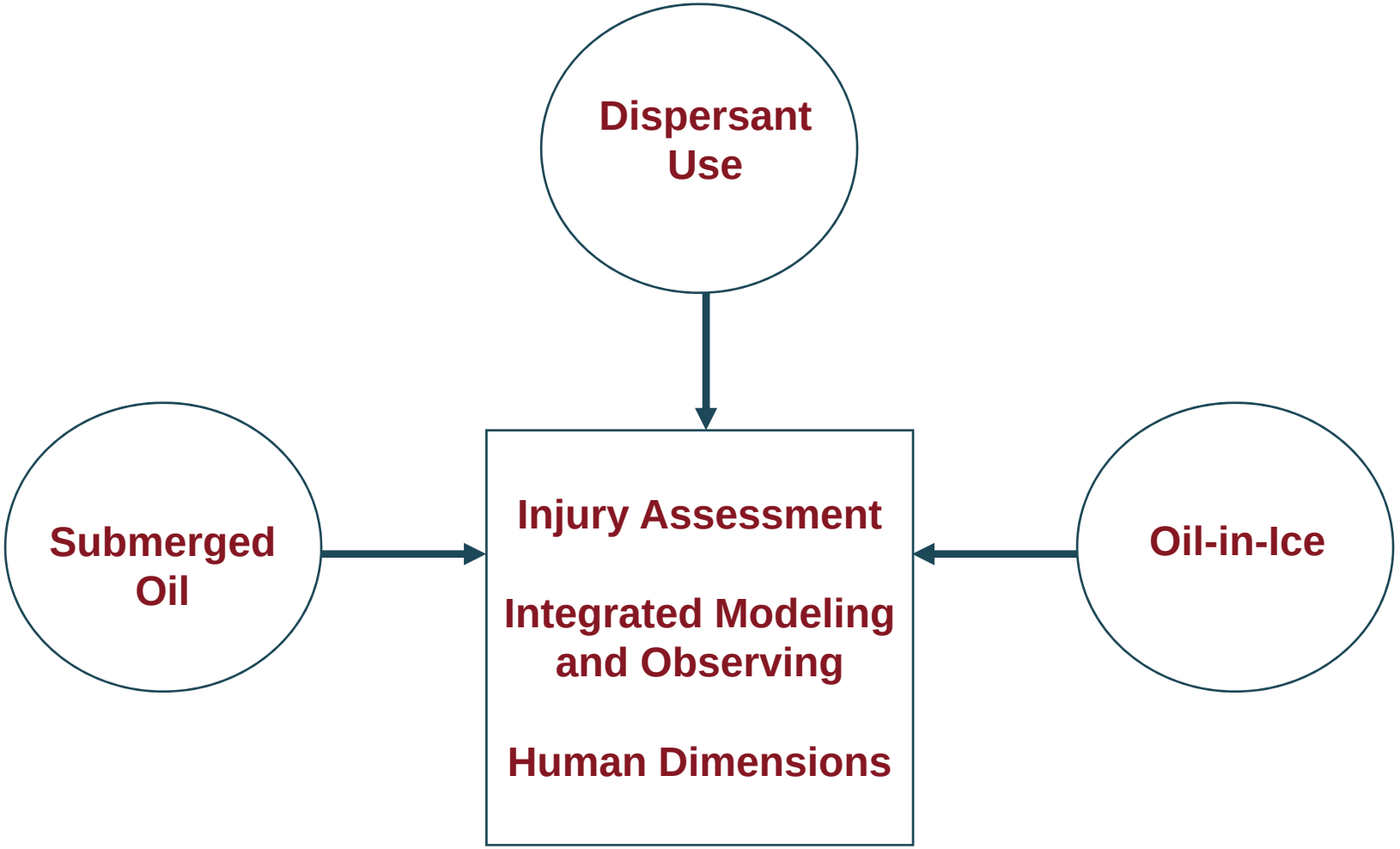
National Ice Center Symposium

Annapolis, MD

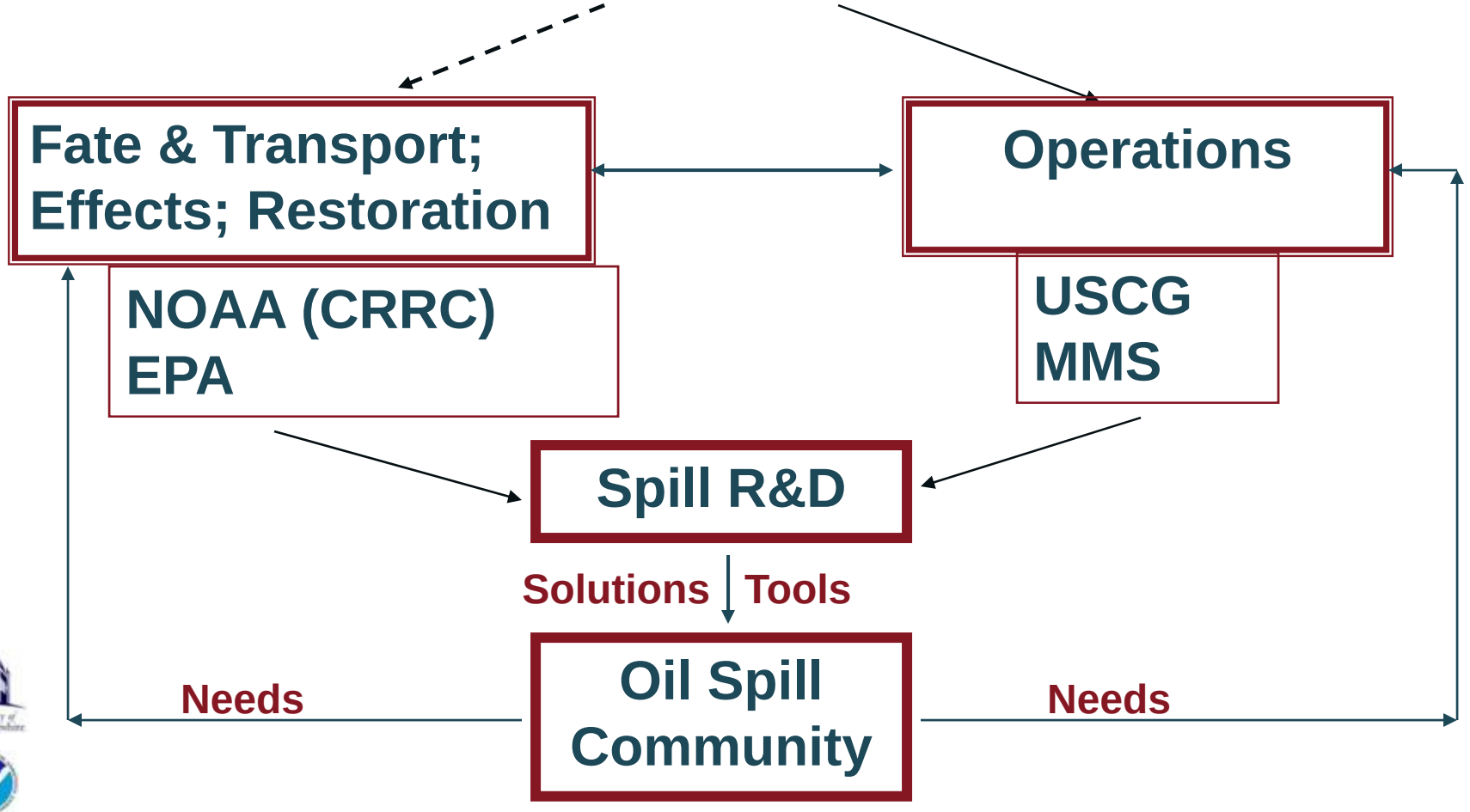
NOAA's Role in Spills

- Provide Scientific Support and Services to USCG
- Natural Resource Trustee
- Coastal Response Research Center –
  - Partnership between NOAA and the University of New Hampshire
- NOAA's Goals in Arctic Preparedness:
  - Arctic Disasters Workshop – Mar 2008
  - Joint Industry Project Oil-in-ice R&D Project
  - Environmental Response Management Application (ERMA)

Focus Topics

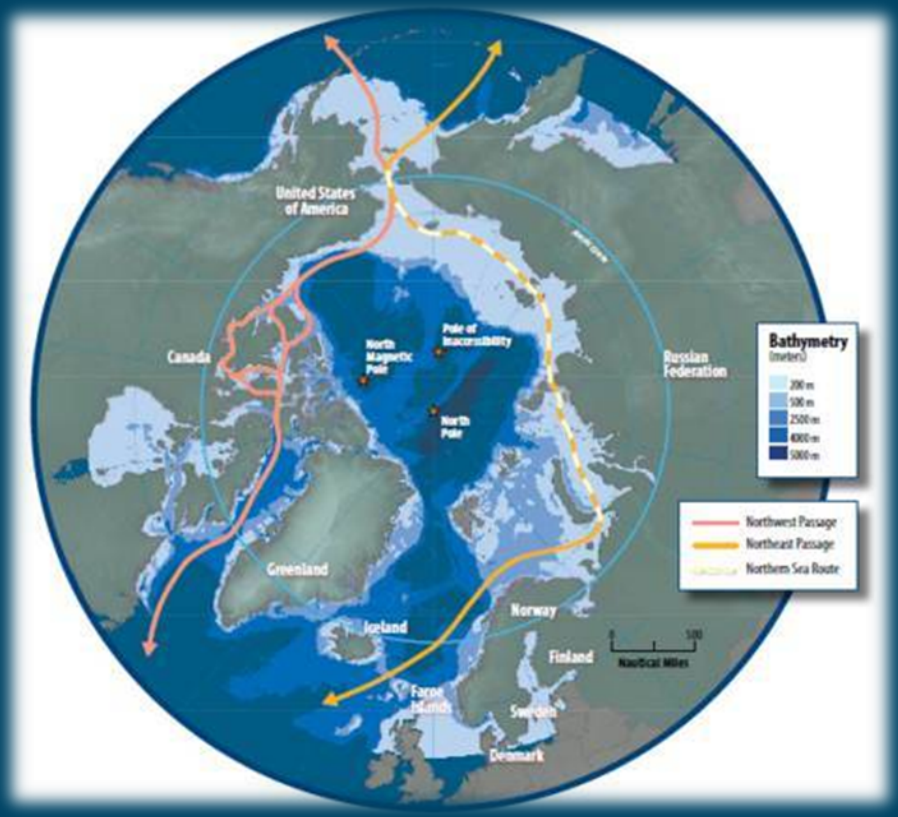


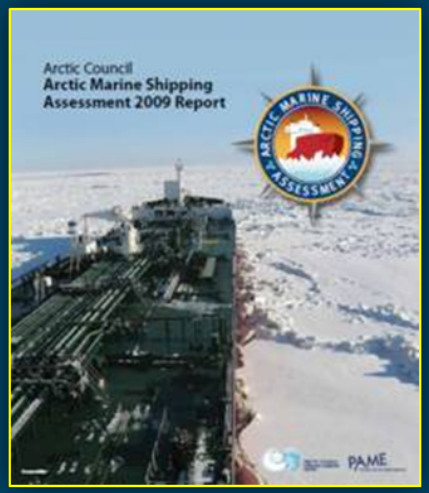
Federal Oil Spill R&D

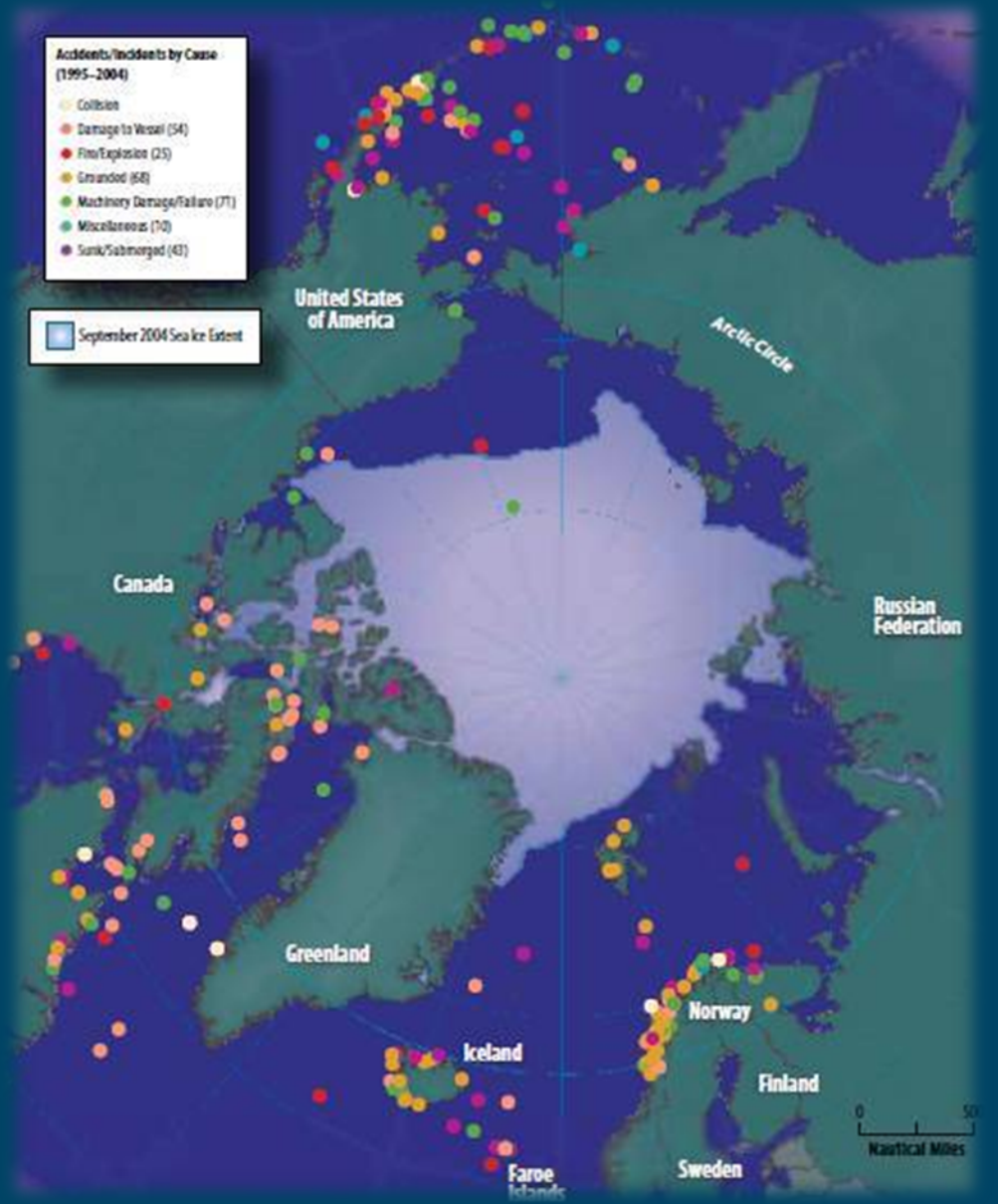


Pressures & Issues

- Increased Shipping
- Increased Oil Exploration and Production
- Governance
- Harsh Environmental Conditions
- Increased potential for environmental disasters
- Need for STRATEGIC PLANNING



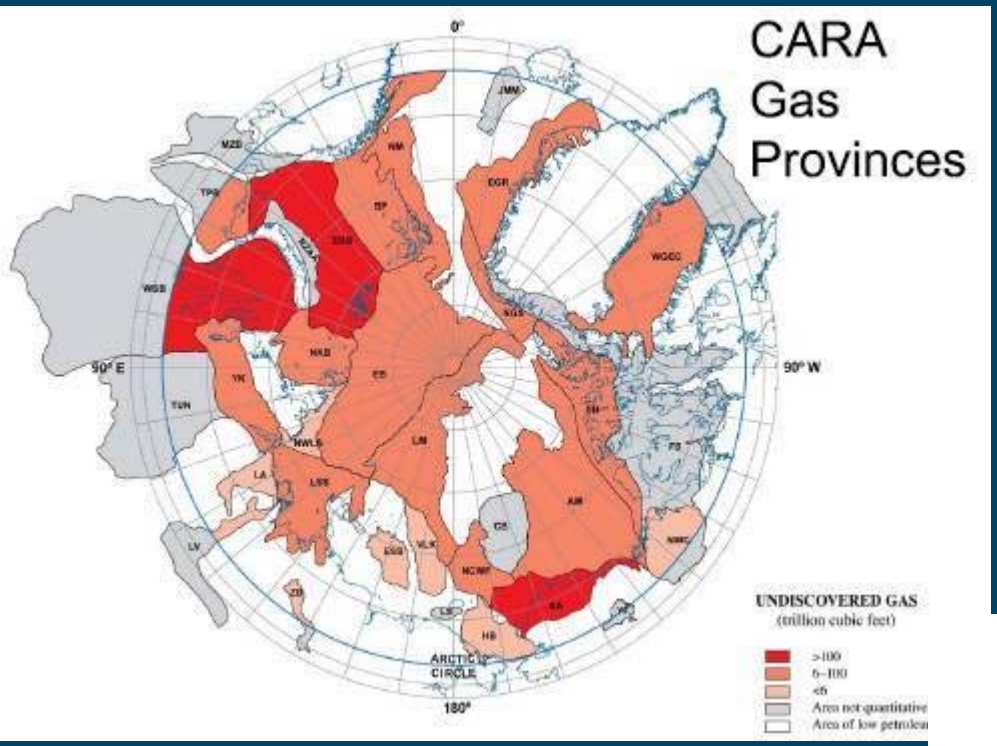




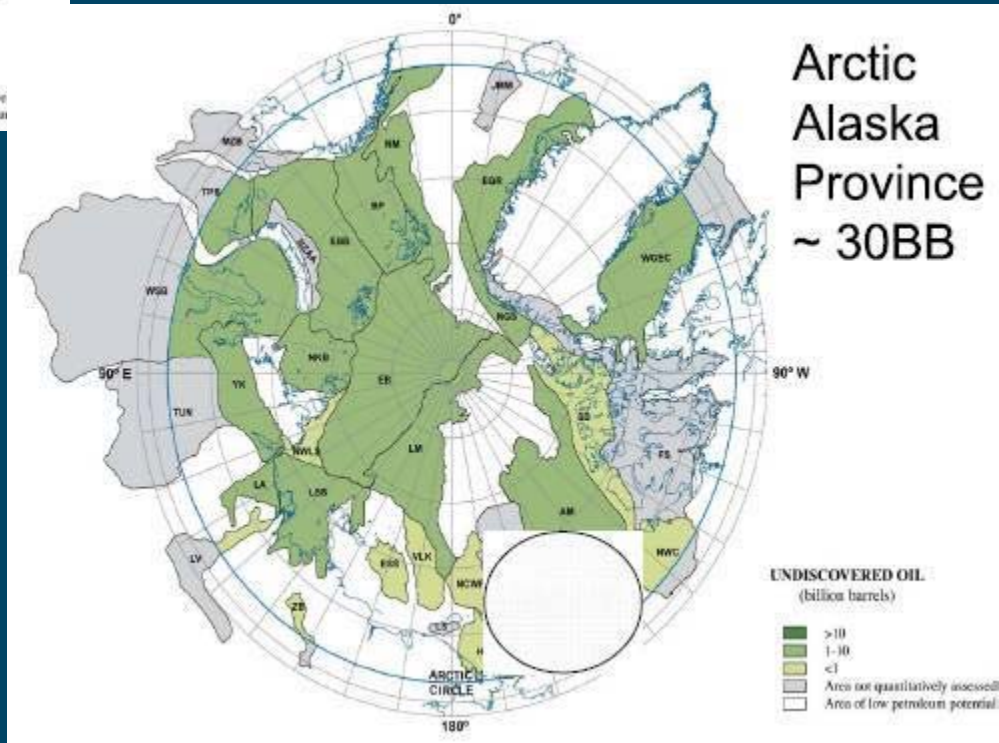
1995-2004 Accidents & Incidents

USGS 2008 Circum-Arctic Resource Appraisal

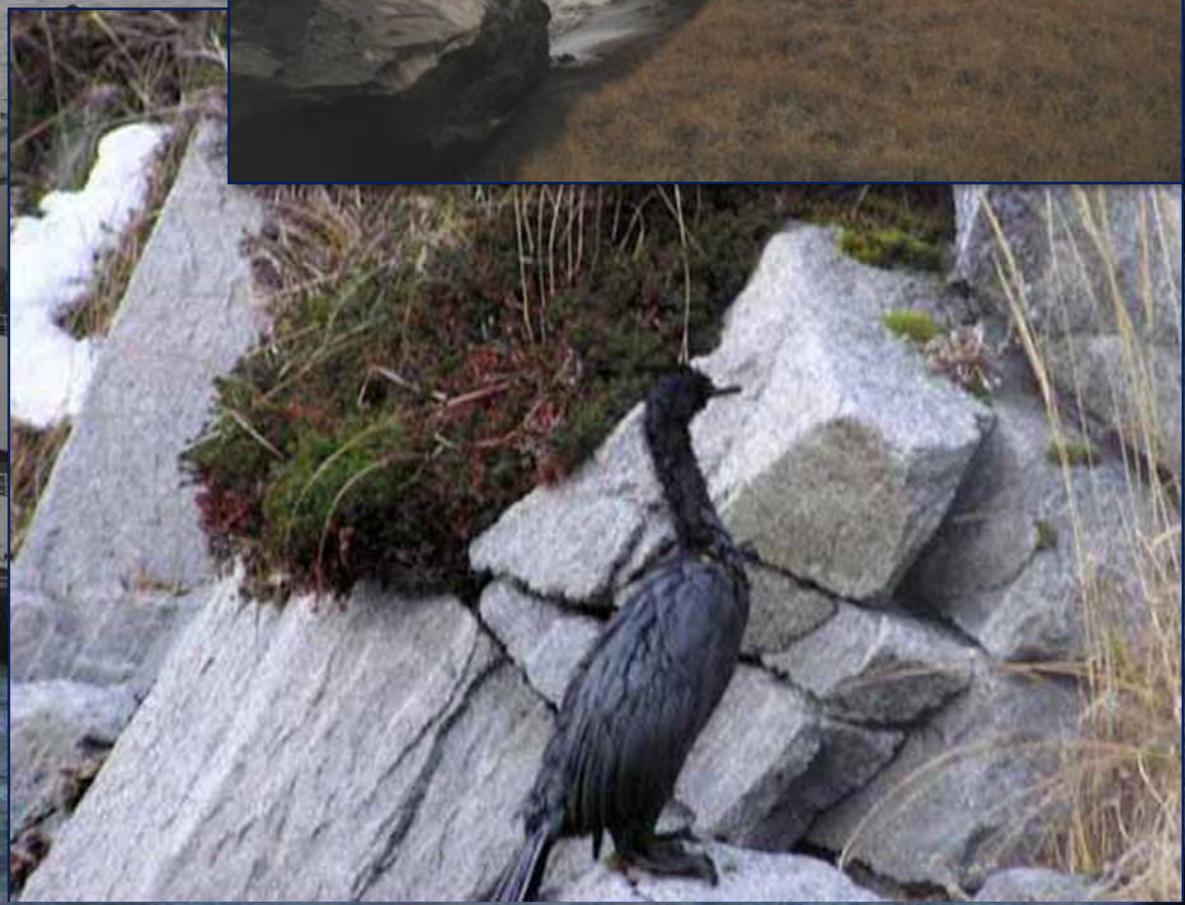
http://pubs.usgs.gov/fs/2008/3049/fs2008-3049.pdf



- 90 BBO – Undiscovered
- 1,669 TCF Gas – Undiscovered
- 44 BB Natural Gas Liquids



What's a



Arctic Initiatives

- Opening the Arctic Seas: Envisioning Disasters and Framing Solutions Workshop-March 2008
  - Goal: identify key strategies, action items and research needs so Arctic Nations and communities can prepare for and respond to marine disasters incidents
  - Participants: 7 Arctic states/3 indigenous nations, governments, NGOs, private sector
  - U.S. and Canadian Coast Guard, Danish Navy
  - Scenarios: oil tanker collision, cruise ship grounding, oil rig fire, tug/barge accident, fishing vessels trapped in ice
  - Agreement on overarching conclusions used directly by:
    - Arctic Maritime Shipping Assessment: Infrastructure Chapter
    - Arctic Council

CRRC Workshop Key Findings

- Designate ports of refuge
- Control and track vessel movement
- Strengthen multinational plans or create one Arctic agreement for all responses
- Increase training & logistical support for all stakeholders
- Increase emergency response assets
- Establish an international Arctic response fund
- Expand communications throughout the Arctic
- Update weather and navigational charts
- Improve ecological baseline information for Arctic resources at risk
- Better understanding of oil behavior in cold water and new spill response technologies

Coastal Response Research Center

Opening the Arctic Seas

ENVISIONING DISASTERS AND FRAMING SOLUTIONS

Durham, New Hampshire
March 18-20, 2008

Report Issued: January 2009

Photos courtesy of NOAA/Department of Commerce and CCOM/Center for Coastal and Ocean Mapping/Science party of HEALY 07-03 (Steve Roberts, Tom Weingartner)

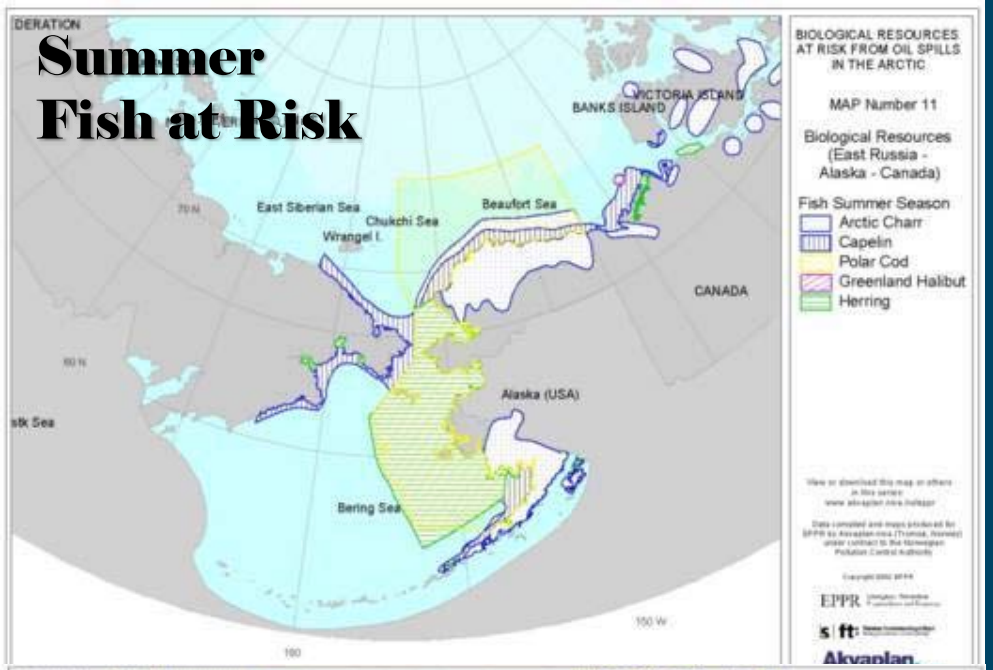
Coastal Response Research Center
at the University of New Hampshire

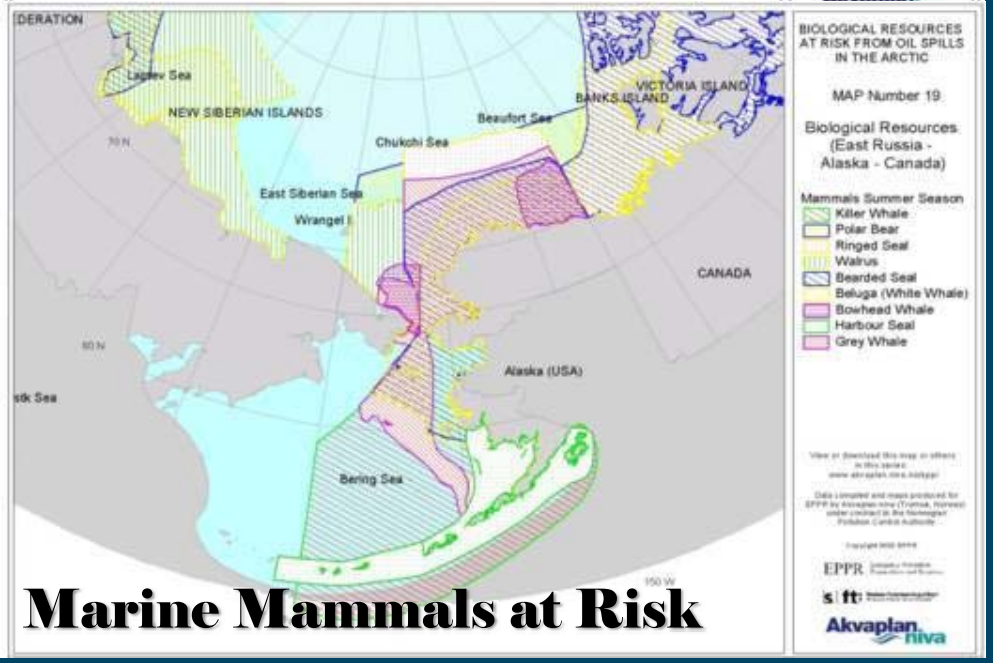
What We Need

- More **baseline information**
- More **resources** (NOAA currently has 1 SSC and 0 Damage Assessment/Restoration Personnel in the Arctic)
- More **research** on better response approaches and better restoration

What We Know

- Fragile and changing environment
- Ecosystems have strong temporal and spatial components
- Pristine resources
- Oil persistence in the environment
- Logistical nightmares

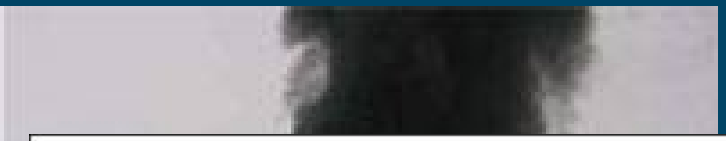




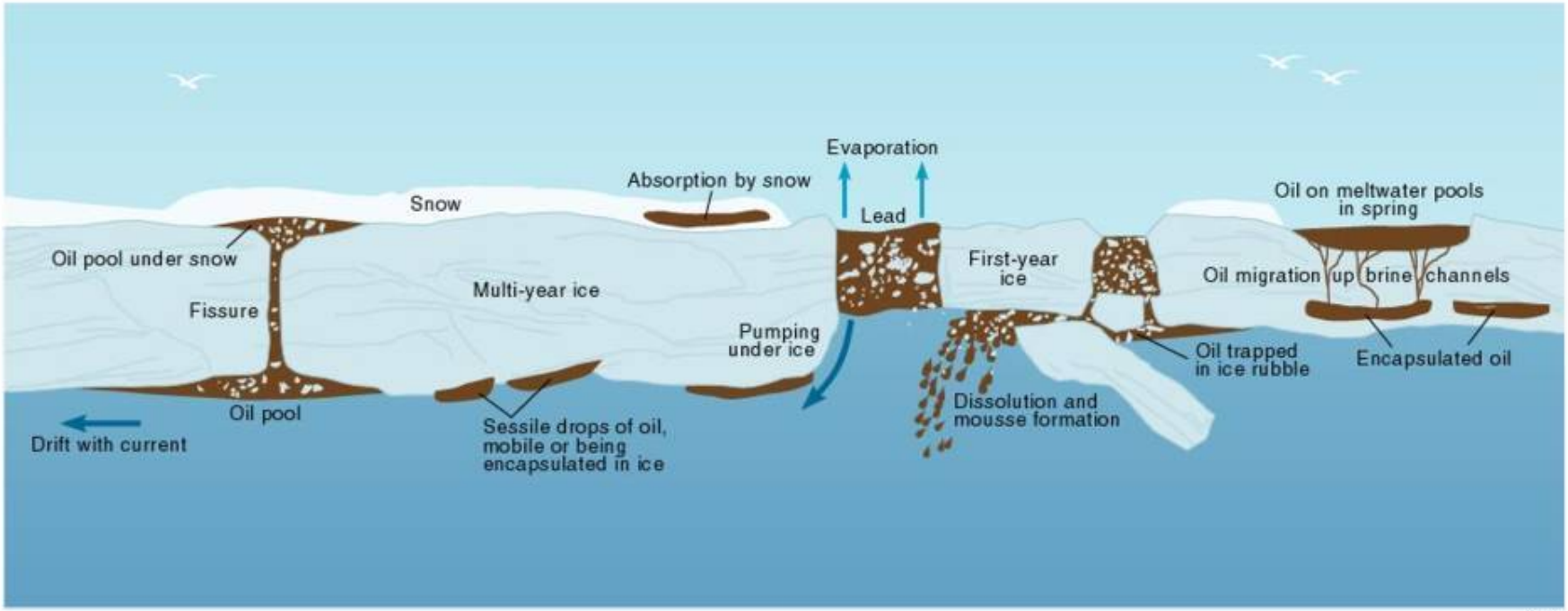
Arctic Council, EPPR, 2002
http://eppr.akvaplan.com/

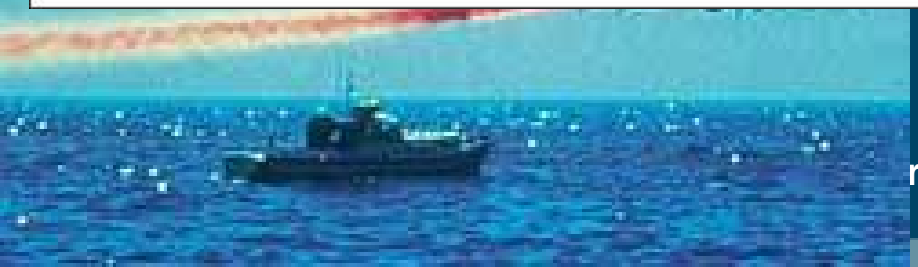
What we don't know

- Ecological impacts associated with oil in ice releases
  - Impacts of spill to fish spawning under the ice
  - Even small spills at ecologically sensitive times or locations can be significant
- Baseline information on ecosystems at risk
- Effective ways to overcome logistic challenges
- Effective ways and better technologies to recover oil in ice
- Long-term impacts of oil in ice
- How to effectively restore impacted ecosystems



Arctic Monitoring and Assessment Programme
AMAP Assessment Report: Arctic Pollution Issues, Figure 10-5





Overall objective of Joint Industry Project Oil in Ice

Develop tools and technologies for environmental beneficial oil spill response strategies for ice-covered waters

The program will utilize existing Arctic and oil spill technology and the deliverables can directly be used in oil spill contingency plans for Arctic and ice covered areas.

Program

9 projects, 25 tasks, approximately US$ 7 (8) mill, 3,5 years from September 2006

- **P1 Fate and behaviour**
  - Compile existing data
  - Upgrade oil weathering model
  - Meso scale experiments
  - Field experiments on Svalbard
  - Full scale experiment
- **P2 In situ burning**
  - Mapping of burnability as a result of weathering
  - Field test of herding agents
  - Test fire resistant booms
  - Weathering and window of opportunity.
- **P3 Mechanical recovery**
  - Test existing concepts – winterisation
  - Develope new concepts
- **P4 Chemical dispersants**
  - Effectivness by use of dispersants
  - Improve application technology
- **P5 Monitoring and remote sensing**
  - Dev and test remote sensing systems
  - Test Shell methane detection system
  - Develop detection and tracking concept
  - Field verification of Laser Fluorosensor system
- **P6 Generic Guide**
  - Describe a set of relevant (typical) ice regimes (scenarios)
  - Generic plan (scenarios and a set of recepies?)
- **P7 Field experpiments**
  - Field experiments at Svalbard
  - Offshore field experiments
- **P8 JIP Coordination**
  - Coordination and managment
  - Workshops and steering comittee meetings
  - Communication and publishing
- **P9 Biological effects**
  - Oil-ice interaction vs biological effects
  - Biological survey during field experiments
    - Birds, mammals

Organisation

- **Steering Committee**

  Oil Companies
  - **Agip KCO** Mark Shepherd
  - **Chevron Norge AS**, Gunnar H Lille
  - **Norske ConocoPhillips AS**, Eimund Garpestad
  - **Shell Technology Norway A/S**, Gina Ytteborg
  - **Statoil ASA** , Hanne Greiff Johnsen
  - **Total E&P Norge**, Ulf Einar Moltu

  - **Program coordinator**; Stein E Sørstrøm, SINTEF

  Cooperating Organisations
  - NOFO, Hans V Jensen
  - Alaska Clean Seas, Lee Majors
  - Norw. Coastal Admin., Johan M. Ly
  - MMS, Joe Mullins/Sharon Buffington
  - OSRI, Scott Pegau
  - CRRC/NOAA, Amy Merten

- **R&D Organisations**
  - SINTEF
  - Dave Dickins Associates
  - S L Ross
  - ++++

- **Projects**
  - **1 Fate and behaviour,** Per J Brandvik
  - **2 In-situ burning,** Ian Buist, USA
  - **3 Mechanical recovery**, Ivar Singsaas
  - **4 Chemical dispersants,** Per Daling
  - **5 Remote sensing,** Dave Dickens, USA
  - **9 Biological Effects,** Amy Merten, NOAA

  - **8 Field experiments,** Stein E Sørstrøm
  - **6 Generic guideline,** Gina Ytteborg
  - **7 Coordination,** Stein E Sørstrøm

Oil-in-Ice: Behavior, Biodegradation and Potential Exposure Research

Participation in Joint Industry Project (JIP):

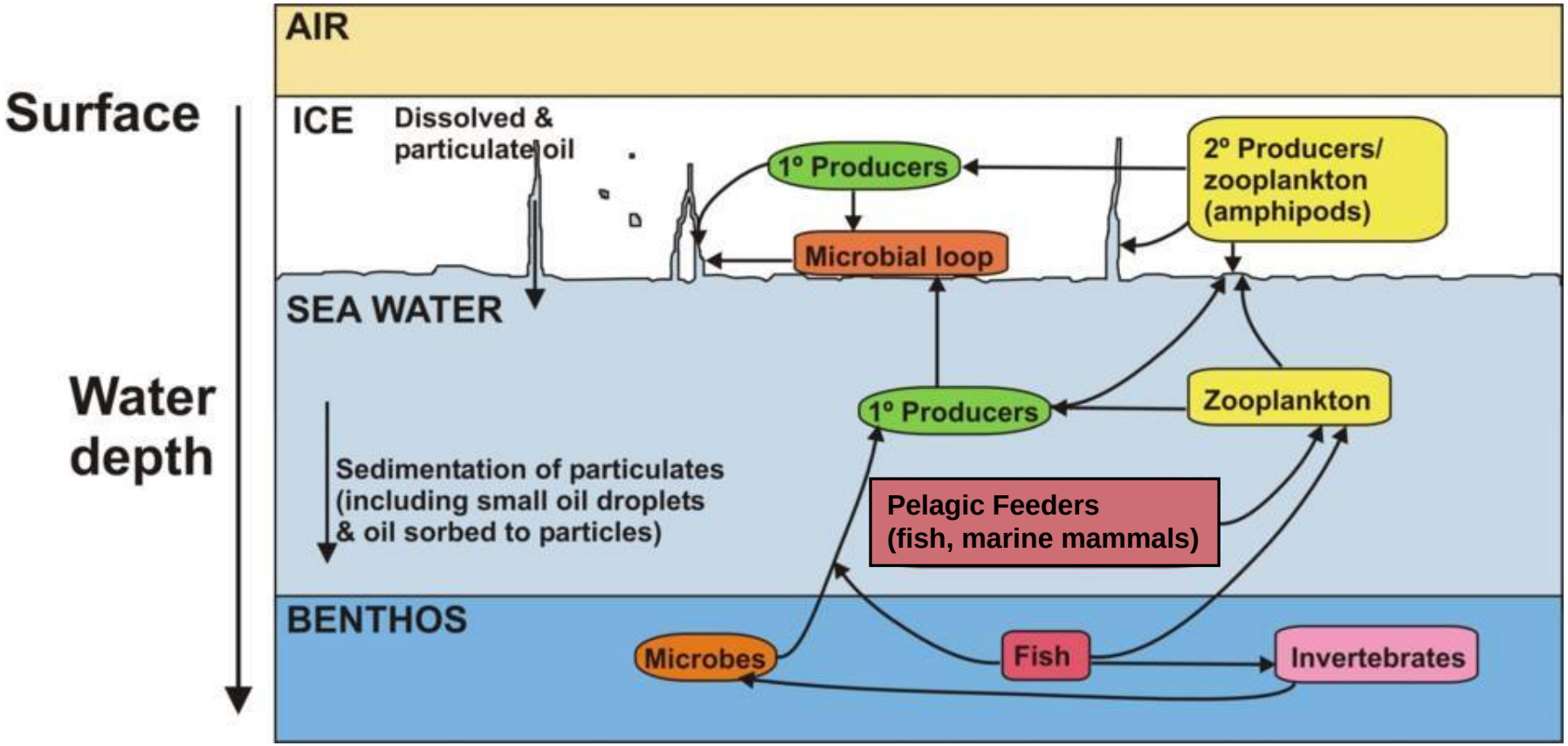
- $7+M
- Norwegian, Canadian, French, U.S., Russian participants
- Industry and Government partnership
- CRRC, OSRI, UAF, URI, SINTEF
- Oil Encapsulated in Ice Project = $500K

Oil-in-Ice: Behavior, Biodegradation and Potential Exposure

- Questions We Want to Answer?
  - What is behavior of oil in ice?
  - What are transport & degradation processes and rates that control fate of oil frozen in ice?
  - What are exposures and effects for ice-related organisms?
  - How will response options affect exposure?
  - First Year Ice Scenario

Conceptual Model

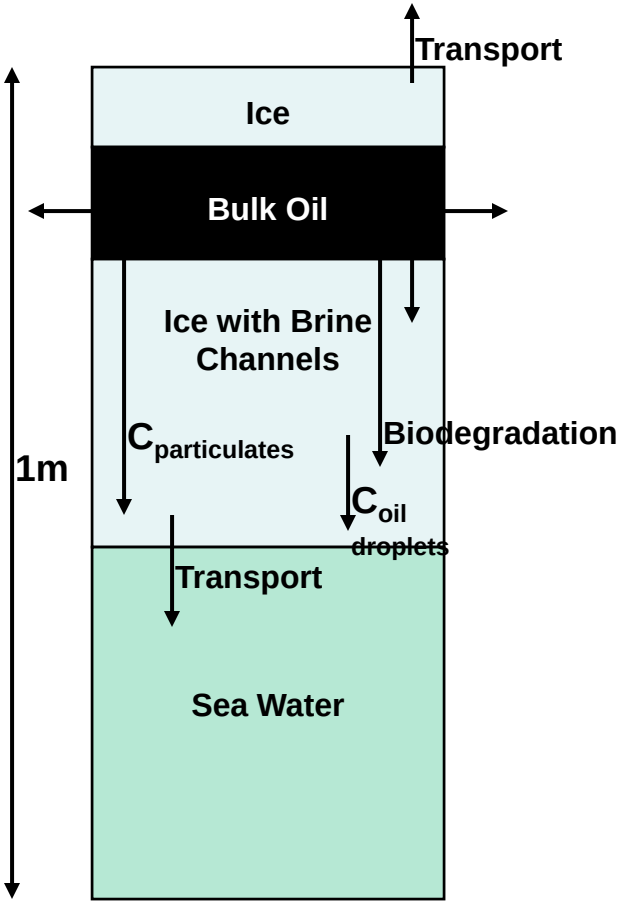
Food Web Cycle



Transport/Exposure Mechanisms

Bulk oil encapsulated in ice from below
→measure dissolved constituents
(e.g., PAHs)

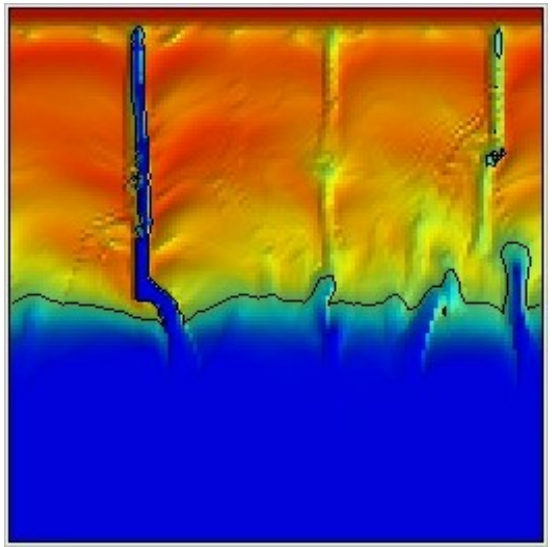
Density of brine transport downward
→will transport dissolved (bioavailable)
components of oil downward



Oil & WSC entrainment & movement in ice - University of Alaska Fairbanks (UAF)

Project team:

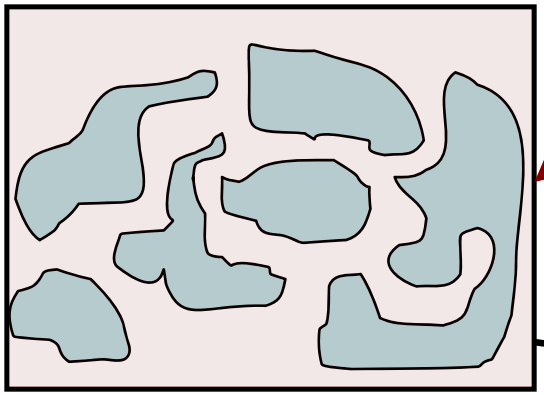
- Chris Petrich (Post-Doc, co-I) - fluid dynamics simulations
- Jonas Karlsson (Grad. Student) - oil-in-ice experiments
- Mette Kaufman (Research tech.) - oil-in-ice experiments
- Hajo Eicken (PI) - ice permeability & microstructure
- Financial support of this component of JIP through Oil Spill Recovery Institute (OSRI), Cordova, AK (Contract 08-10-13)

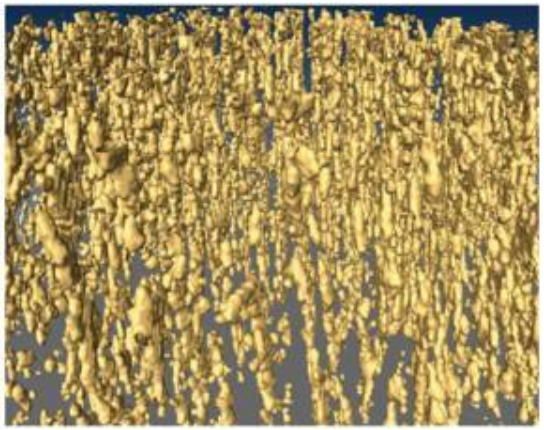


Scale in fluid dynamics model:

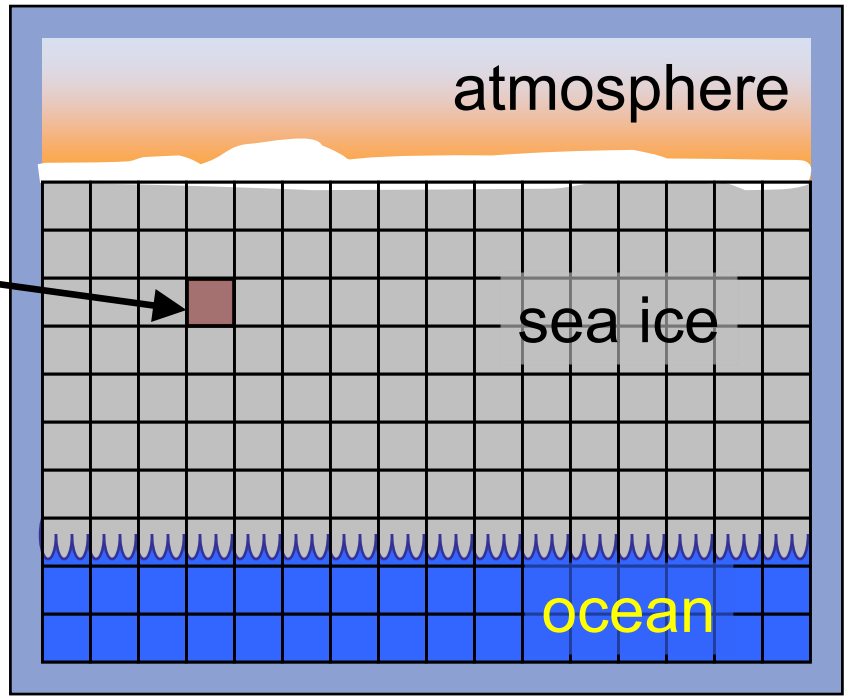
microscopic scale —*local average*→ effective medium/ continuum scale

microscopic structure described by one parameter: effective permeability Π



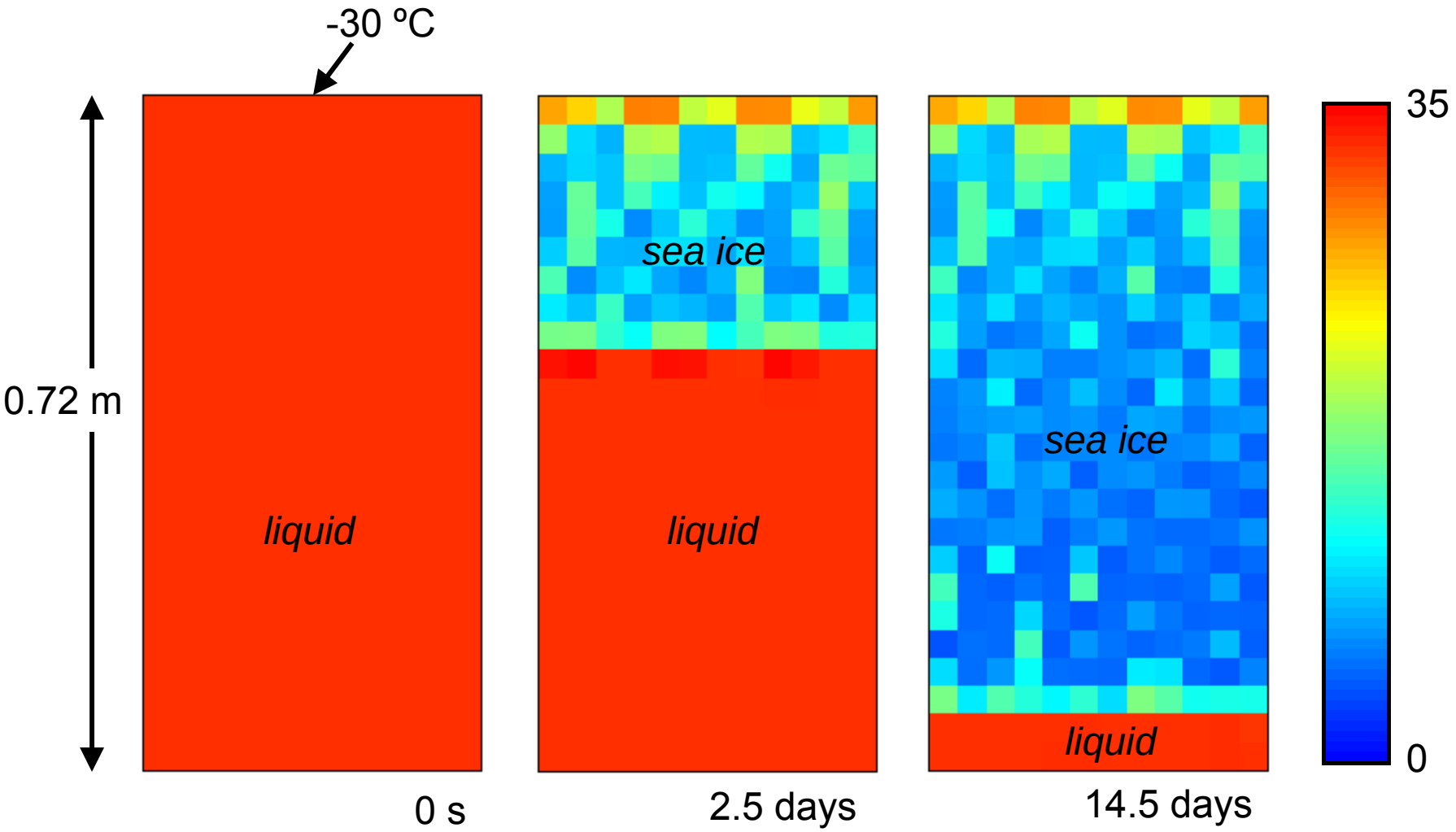


Golden et al. (2007)



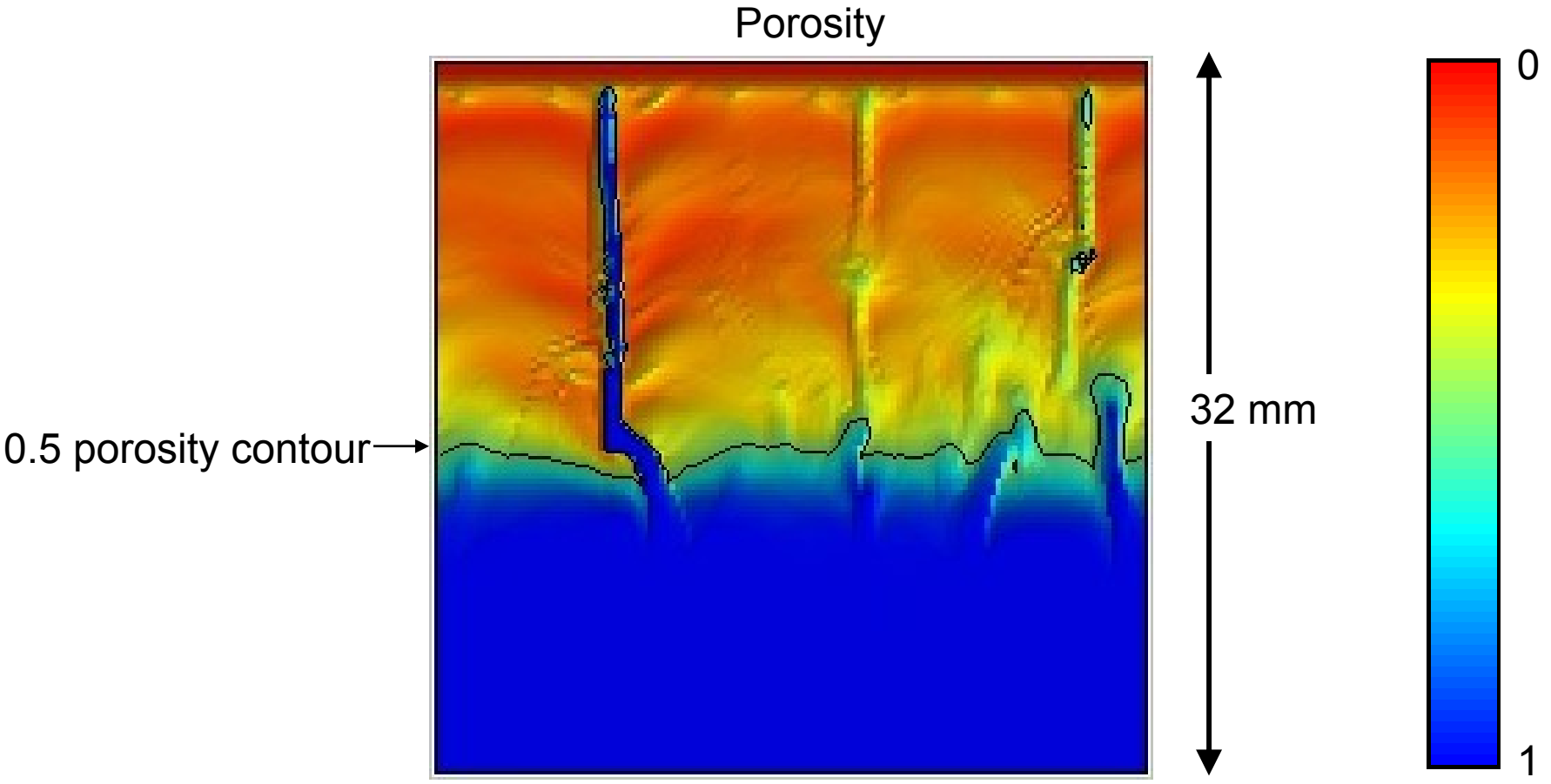
Example:

Development of the bulk salinity (salinity of the melt)



Temperature of brine entering domain: 10 mK above freezing point

High-resolution simulations of ice growth (250 um grid size)



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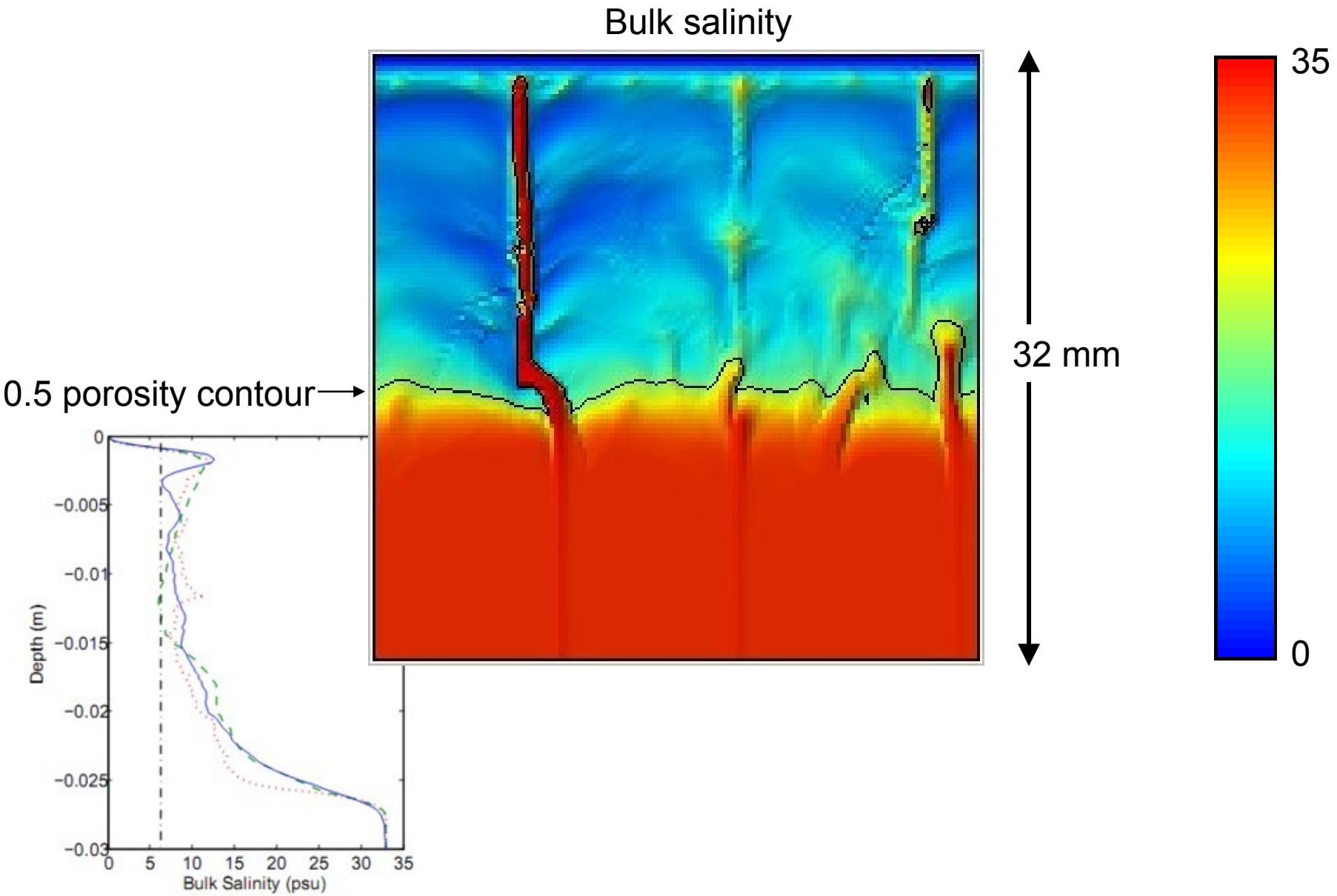


Environmental Response Management Application

Bobby Braswell, Stanley Glidden (UNH/EOS)
Steven Knight, Phil Collins, and Bob St. Lawrence (UNH/RCC)
Kurt Schwehr (UNH/JHC-CCOM)
Michele Jacobi (NOAA/ORR)

Concept for ERMA

- Take advantage of open-source, web-based mapping tools
- Integrate and synthesize various types of information
  - Include both static and real-time
  - leverage what already exists
- Provide fast visualization of current information
- Improve communication and coordination among responders and stakeholders
- Provide integrated and timely information to improve decision-making

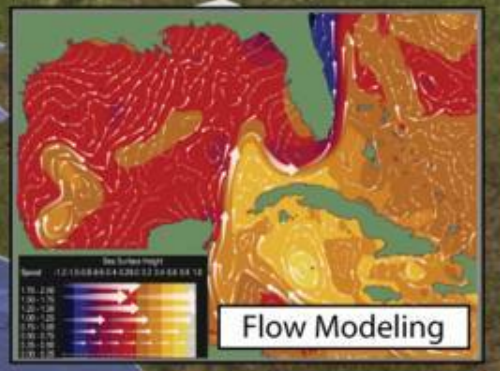
Environmental Response Management Application (ERMA)

Local Command

nowCOAST

ERMA Data Center

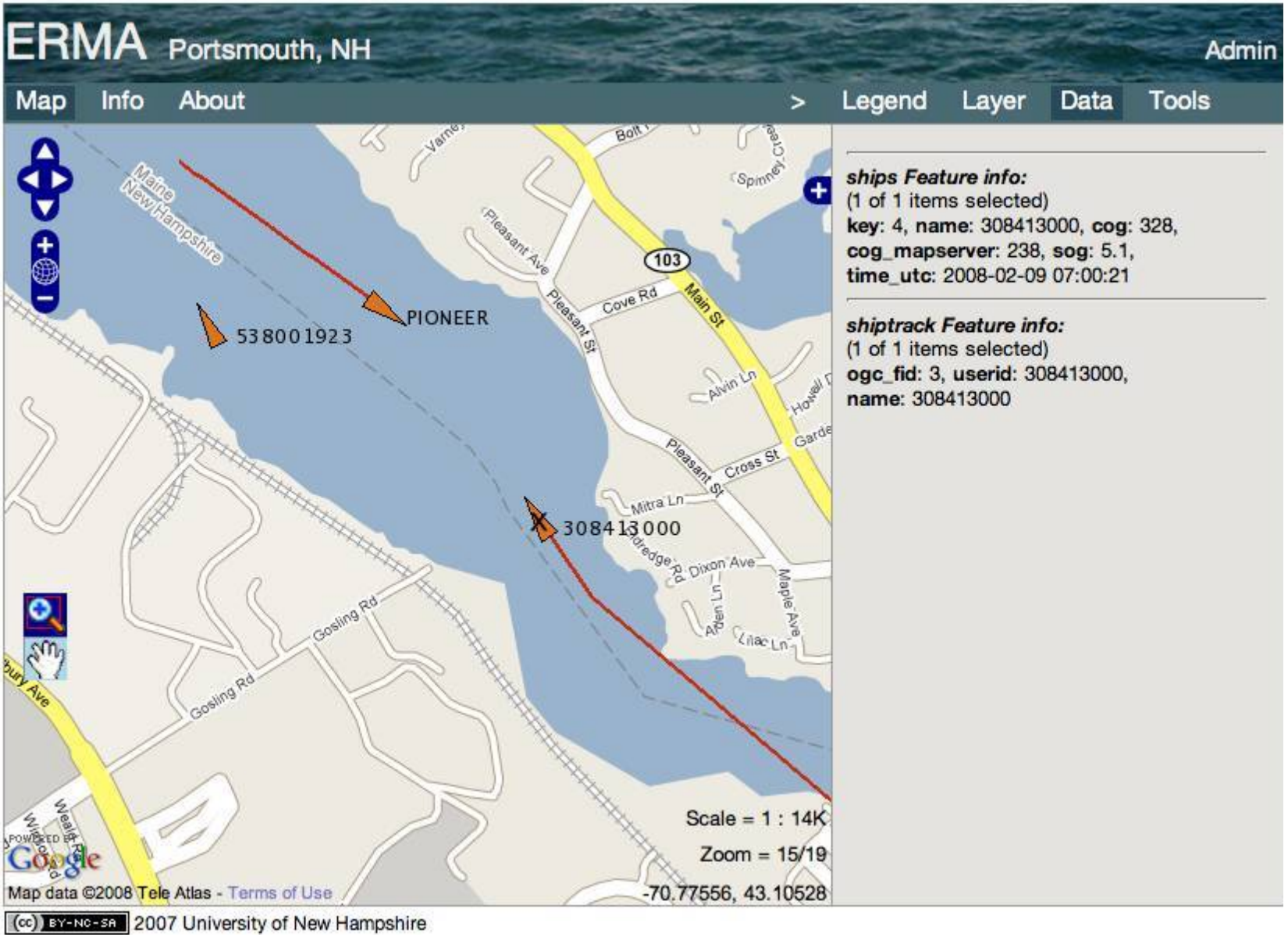
FlowVis2D



Moored Sensors

Kurt Schwehr
CCOM/JHC

Real-time vessel traffic from AIS



ERMA Architecture

Output to User
Download/Upload Source

Feature Server

Open Layers

Web Mapping
Service (Feature)

Other GIS Data
- AIS
- NowCoast
- ENCs
- Real Time Obs

Secure Server Authentication
Encryption (128kb)

Data Layer Management
Access Privileges

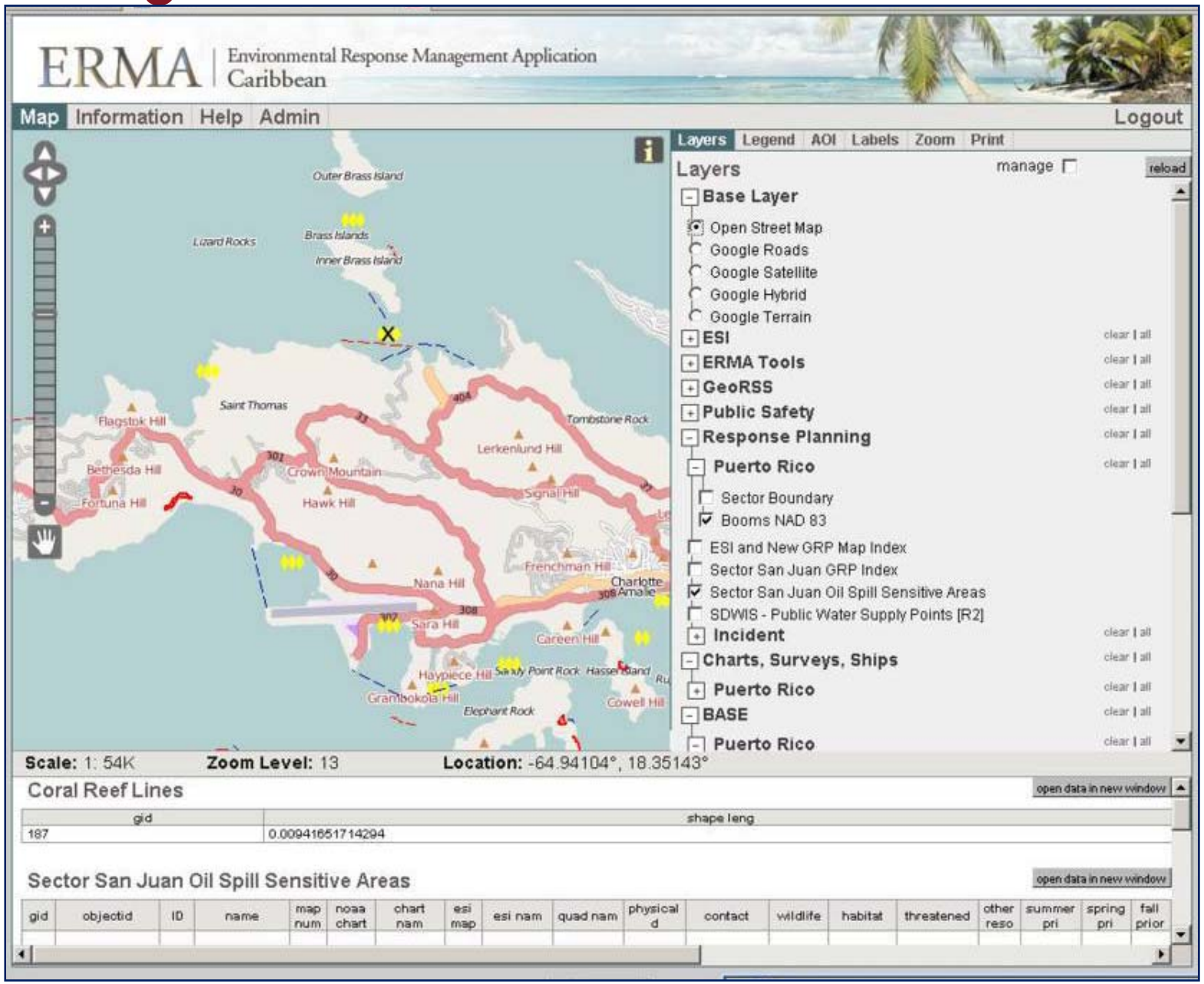
MapServer

PostGres/
PostGIS
Data Base

Public datasets
- ESI
- Landuse
- Bathymetry
- Regional Monitoring

Sensitive datasets
- Incident data
- SCAT Results
- Trajectories
- Etc….

Digitized GRPs with data links



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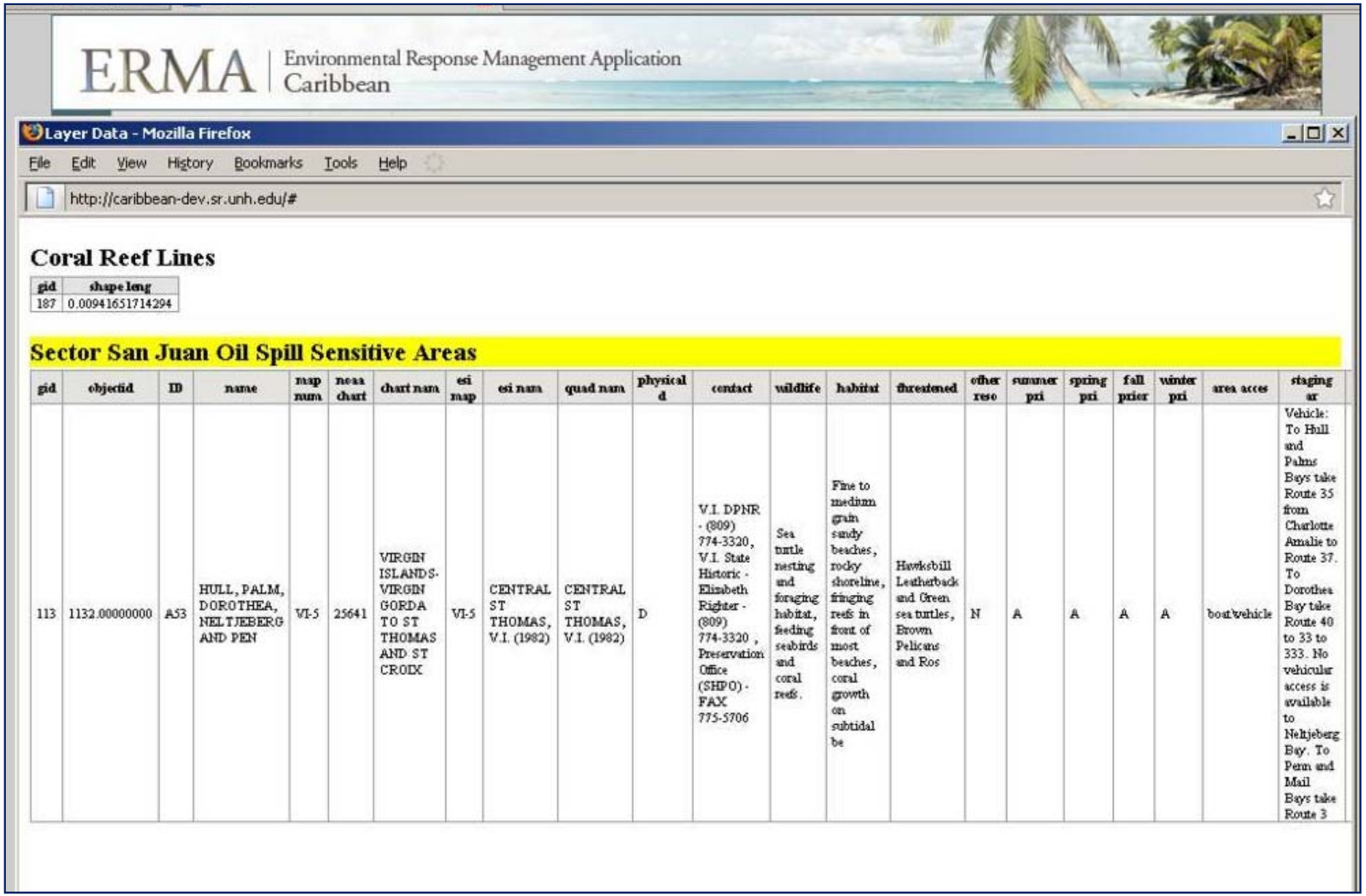


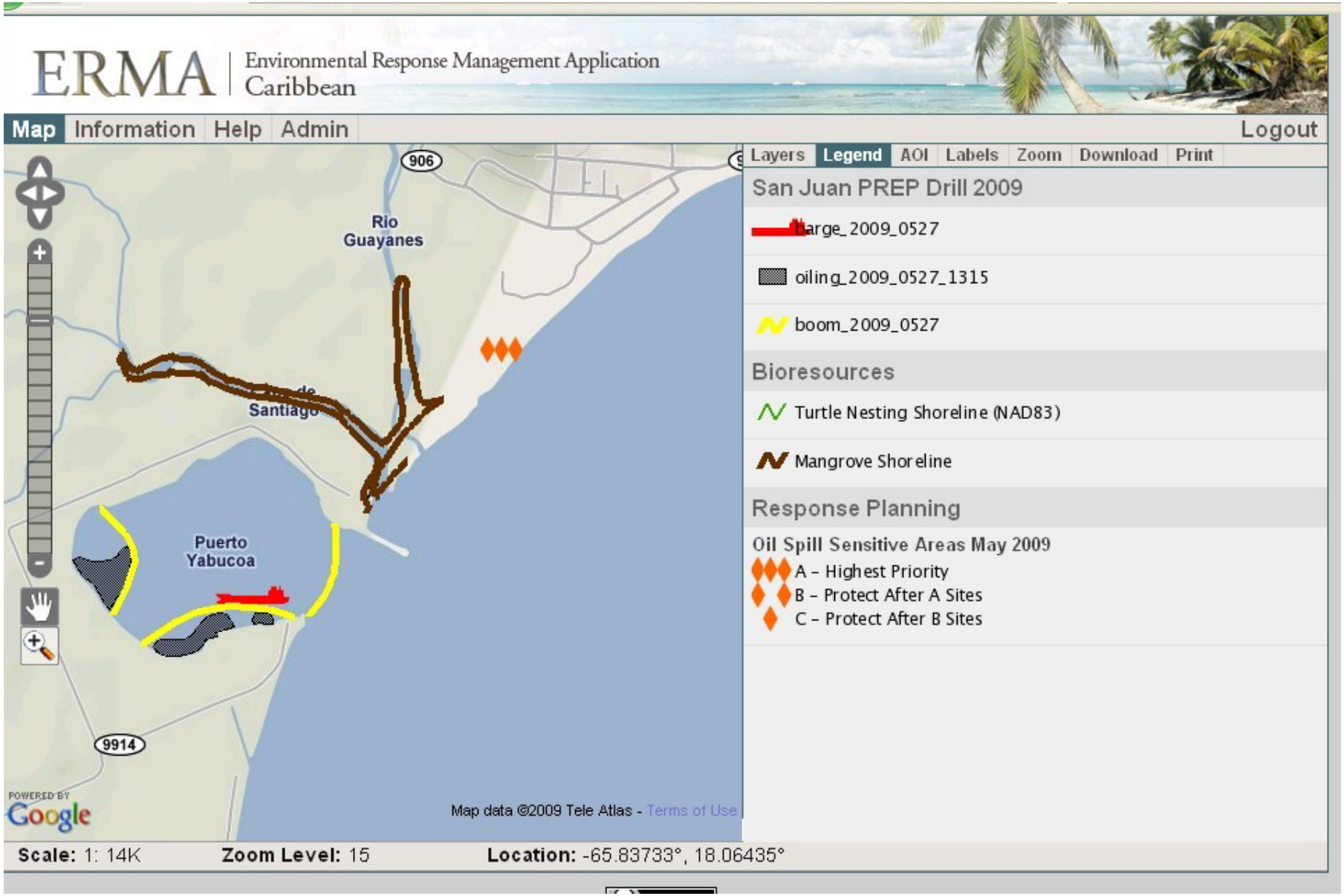
Coral Reef Lines

gid	shape leng
187	0.00941651714294

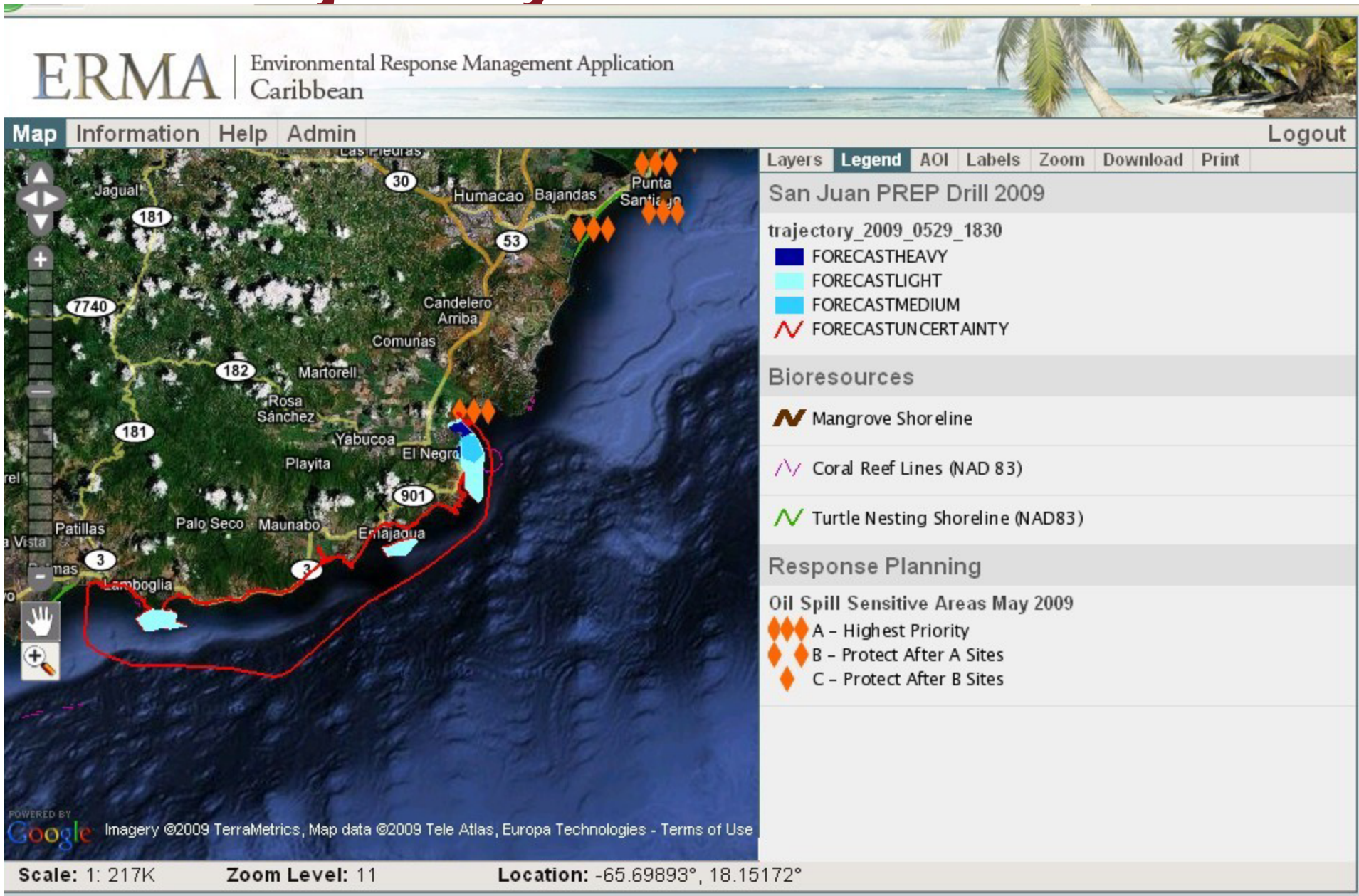
Sector San Juan Oil Spill Sensitive Areas

gid	objectid	ID	name	map num	noaa chart	chart nam	esi map	esi nam	quad nam	physical d	contact	wildlife	habitat	threatened	other reso	summer pri	spring pri	fall prior	winter pri	area acces	staging ar
113	1132.00000000	AS3	HULL, PALM, DOROTHEA, NELTJEBERG AND PEN	VI-5	25641	VIRGIN ISLANDS-VIRGIN GORDA TO ST THOMAS AND ST CROIX	VI-5	CENTRAL ST THOMAS, V.I. (1982)	CENTRAL ST THOMAS, V.I. (1982)	D	V.I. DPNR - (809) 774-3320, V.I. State Historic - Elisabeth Righter - (809) 774-3320 , Preservation Office (SHPO) - FAX 775-5706	Sea turtle nesting and foraging habitat, feeding seabirds and coral reefs.	Fine to medium grain sandy beaches, rocky shoreline, fringing reefs in front of most beaches, coral growth on subtidal be	Hawksbill Leatherback and Green sea turtles, Brown Pelicans and Ros	N	A	A	A	A	boat/vehicle	Vehicle: To Hull and Palms Bays take Route 35 from Charlotte Amalie to Route 37. To Dorothea Bay take Route 40 to 33 to 333. No vehicular access is available to Neltjeberg Bay. To Penn and Mail Bays take Route 3

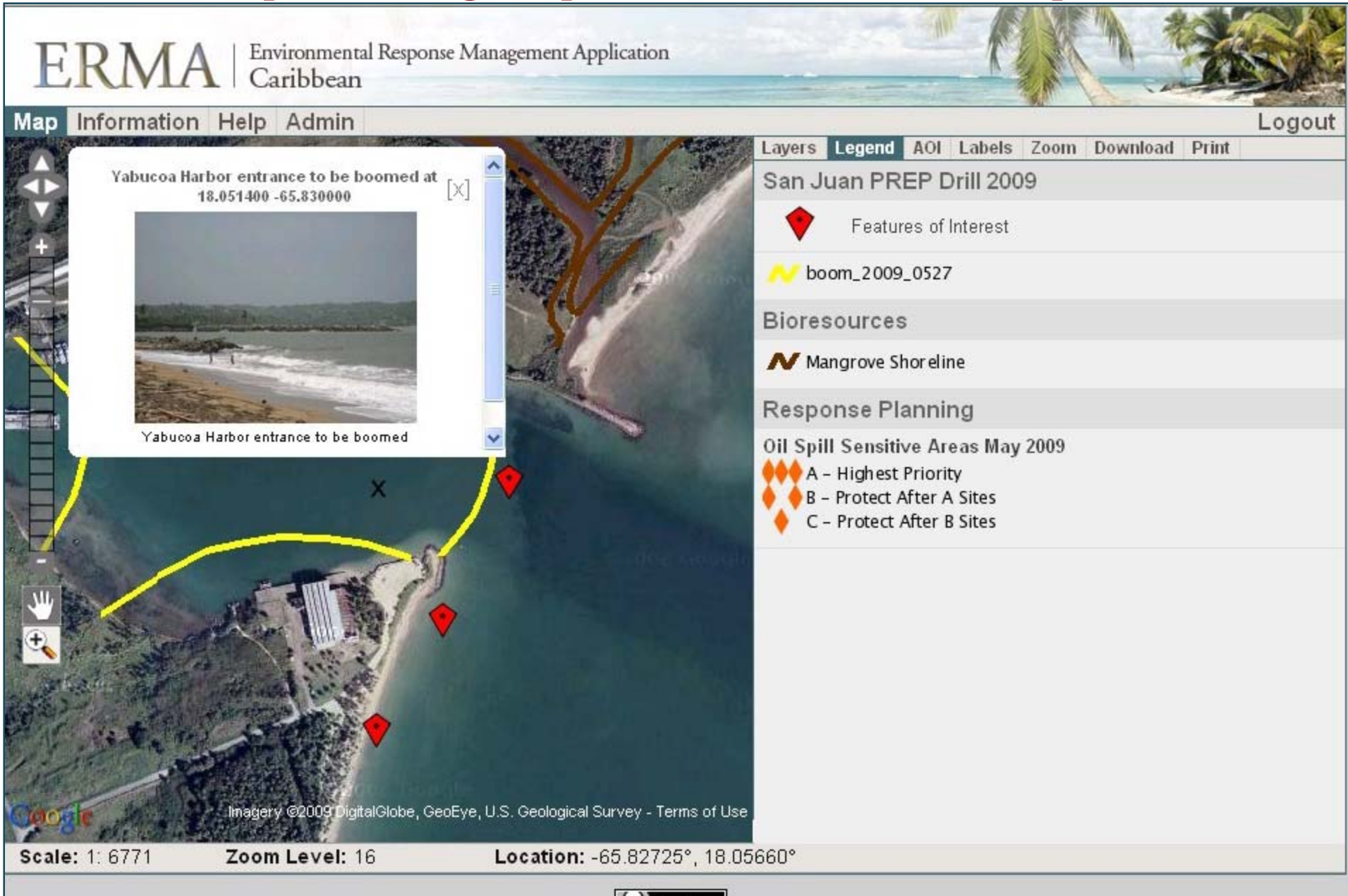
San Juan PREP Scenario



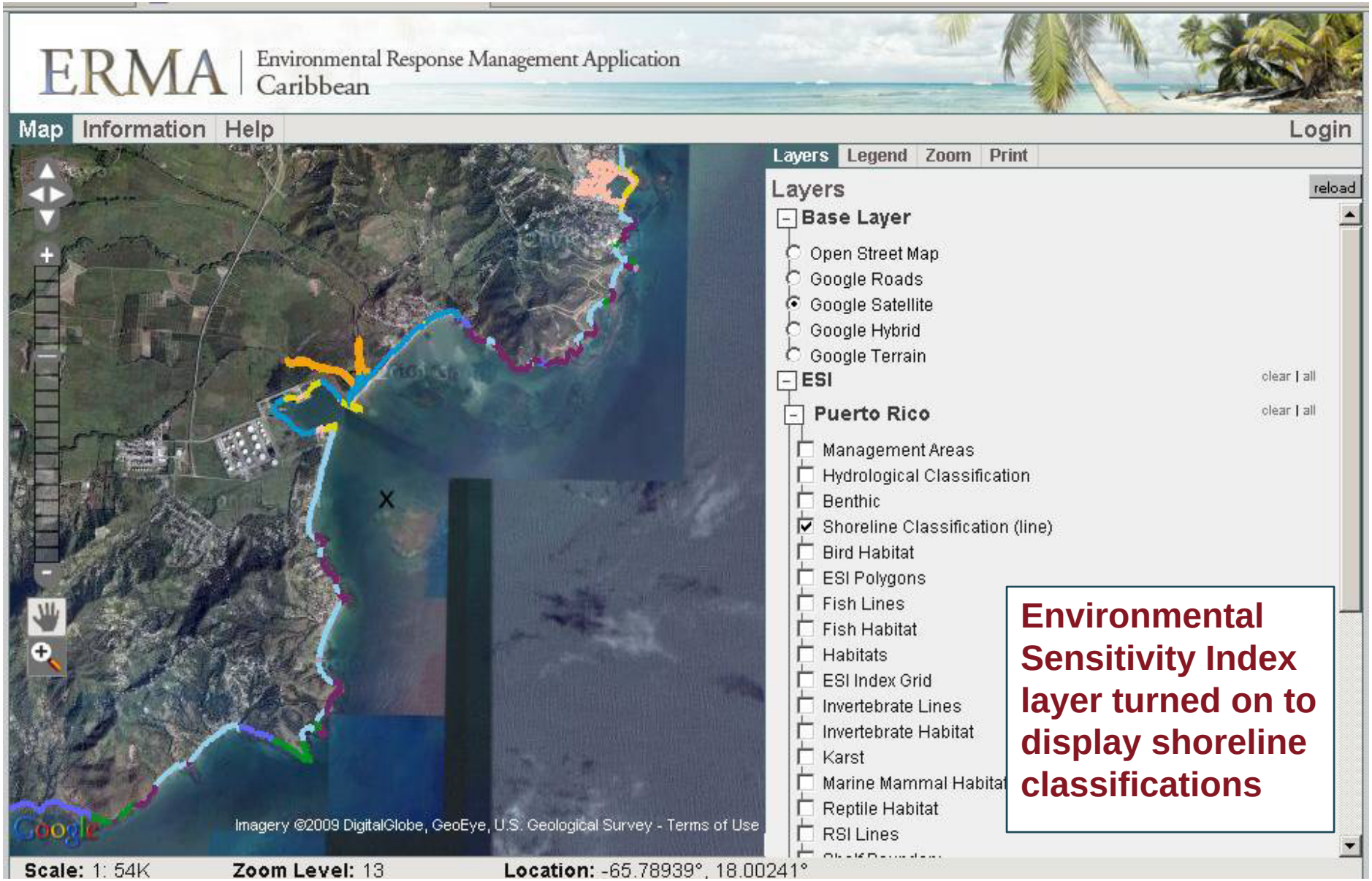
Drill Trajectory and Resources at Risk



Field photographs taken and posted

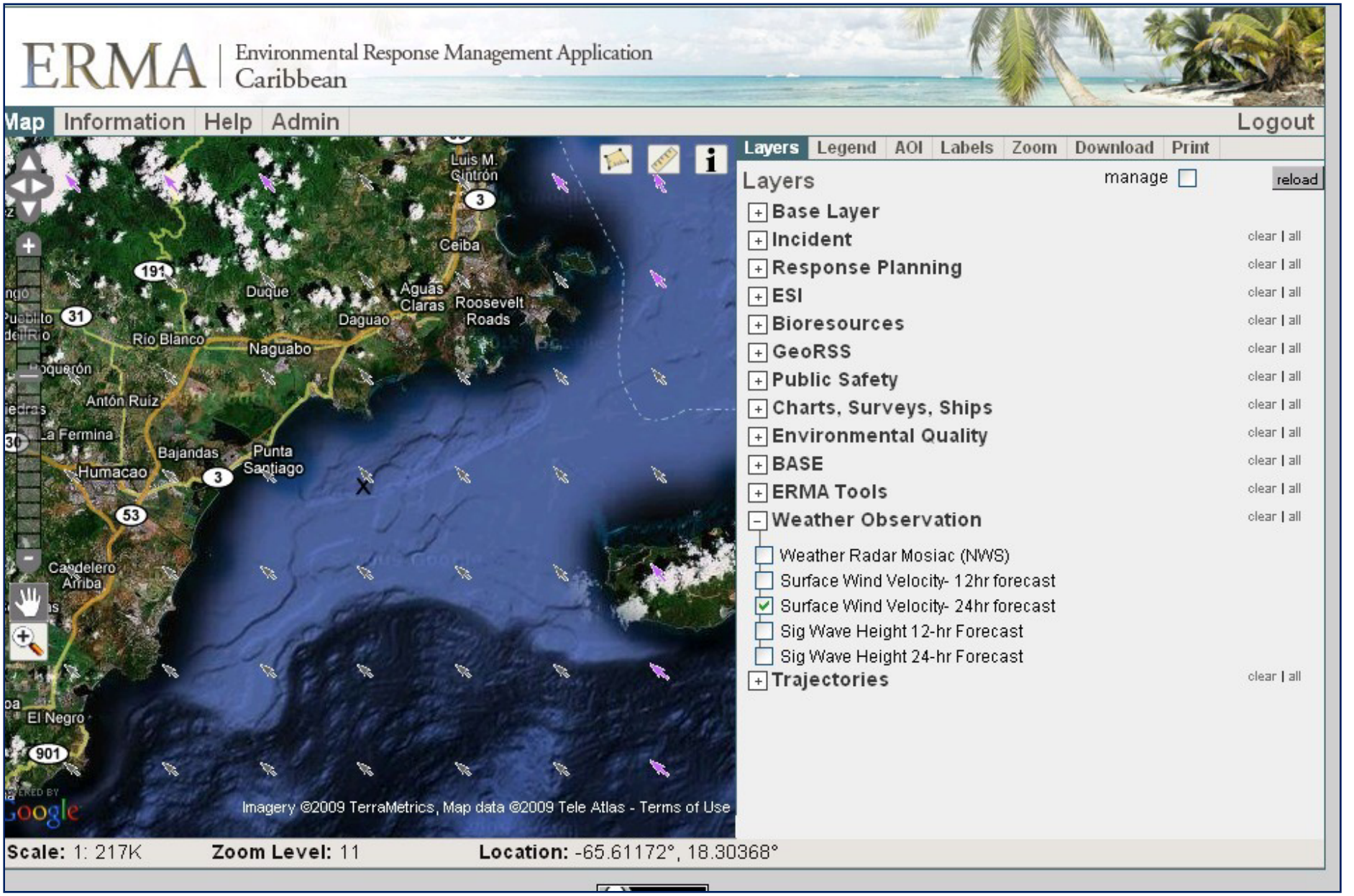


Imagery near drill site

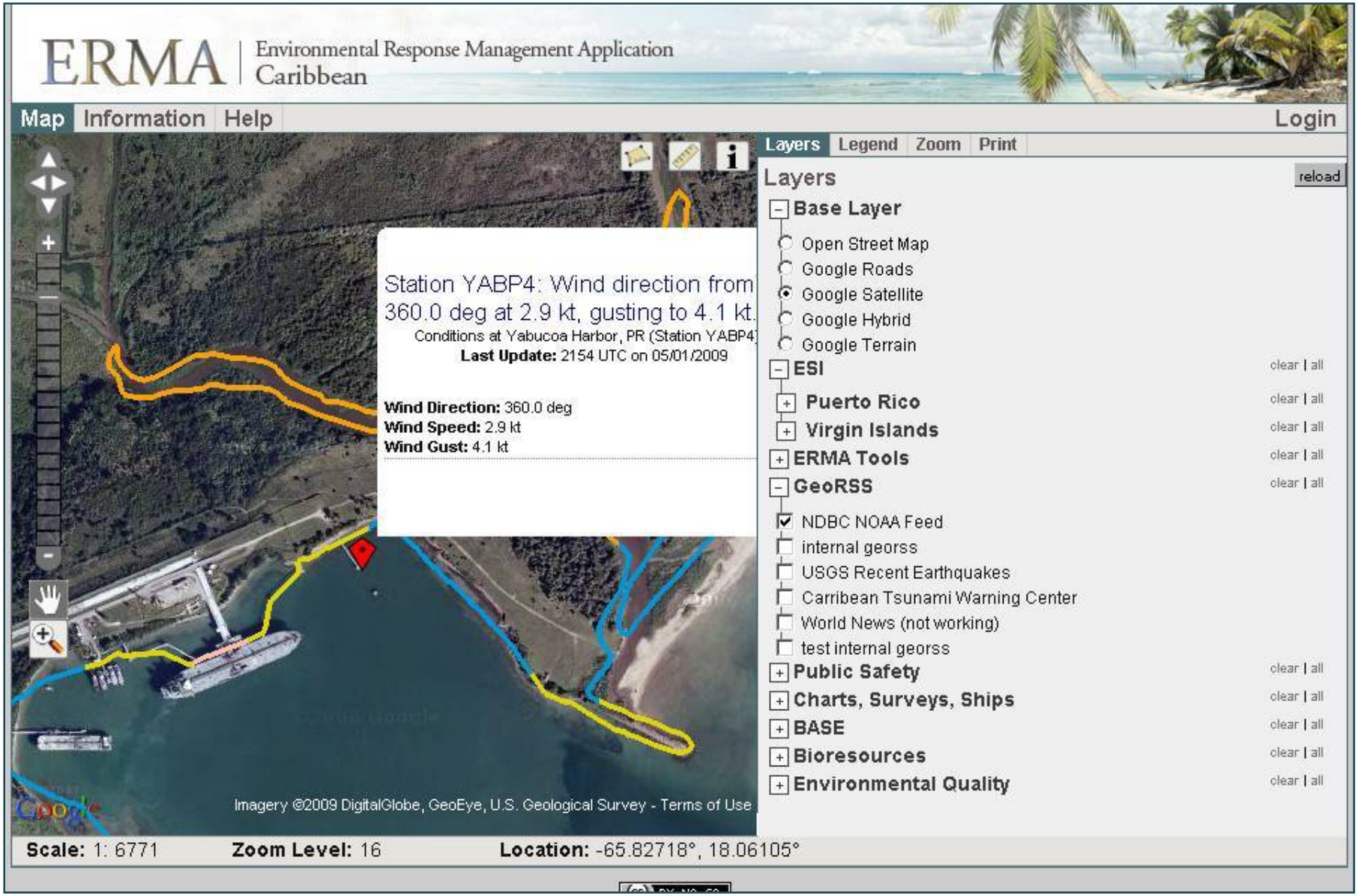


Environmental Sensitivity Index layer turned on to display shoreline classifications

Example Data: Forecasted Weather



Example Data: Real Time GeoRSS feed from Observation Buoys



ERMA Functionality

- Complementary to Digital ACP project, and other systems; integrates ‘one-plan’ concept
- Non-GIS expert can use it and interact with ERMA
- Multi-tailored password protection:
  - Public interface
  - Responder interface
  - Super-user interface
- Real-time data delivery
- Data upload/download capability – improves data sharing
- Tools:
  - On the fly map labeling
  - On the fly regions of interests
  - On the fly layers management

Pressures & Issues

- Increased Shipping
- Increased Exploration and Production
- Governance
- Environmental Conditions

- **Critical and Strategic need for planning, resources, research, and preparedness**

Coastal Response Research Center

www.crrc.unh.edu/workshops/arctic_spill_summit/