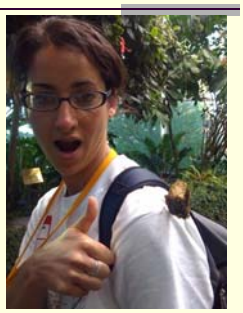
Ocean Beach School District and The Pacific Education Institute

Feet wet, hands dirty, minds engaged

Who are we?

Ocean Beach School Dist.

- 890 Students
- 2 – Elem, 1- HS/MS
- Chinook, Ilwaco, Long Beach, Ocean Park, Oysterville and Nahcotta
- Columbia River, Pacific Ocean, Willapa Bay, Numerous Rivers and Lakes
- Our Heritage and Our Future are tied to Natural Resources; Fishing, Shellfish, Cranberries, Timber, Tourism and ???
- Our staff and community have strong ties to this place – We are "Peninsula Proud"



Pacific Education Institute

Programs and Projects

- **Project ORCA: Outdoor Regional Curriculum Activities Initiative**
- **Shadow of the Salmon**
- **K-20 for E3**
- **Culminating Projects for High School Seniors**
- **Partnership with Teachers of Teachers of Science (TOTOS)**
- **New Market Skills Center**
- **Agriculture Education Partners in Project Based Learning**
- **Outdoor Academy**
- **Adopt-a-Farmer Project**
- **Project Black Bear, Tumwater School District**
- **Project Bluebird**
- **Project Burrow**
- **Project CAT**
- **Washington State's Project Learning Tree Program**
- **Washington State's Project WILD Program**
- **Washington State's Project WET Program**

Our Mission: To create the best K-12 natural resource education program in the Northwest.

Our Beliefs

- School is not a building, it is an experience.
- Students learn best by doing; and they do best when they are excited about, and engaged in, their learning.
- Stewardship and sustainability are concepts that we can no longer ignore and must be addressed in our schools.
- We have one of the greatest outdoor science laboratories around right here in on the Peninsula.
- Our best chance for success is to fully engage our community in this endeavor.

Our Priorities

- Utilize the incredible natural resource laboratory in our own backyard and get kids outside interacting with the natural world!
- Team with NR professionals to provide place-based learning opportunities for our students and staff.
- Create integrated, cross-curricular themes at each grade level for exploring our natural world.
- Empower our teachers with the best technology, professional development, and support materials available.
- Become a "Lighthouse" for other districts so they may create their own place-based educational program.

Our Plan

- Take the time to build it right and make it last
- Start with our Highly Capable program and expand into the regular classrooms.
- Build a cadre of NR specialists who can help us create and deliver the program.
- Utilize the expertise of PEI to help with professional development, curriculum development and program funding.
- Solicit outside financial support to off-set program costs.
- Archive and share our progress so that others may follow our lead.

What you can do to help!

- Contact us if you are willing to provide:
  - NR experts to help develop or deliver the program
  - Educational resources to supplement our work
  - Supplies and/or equipment for field-based scientific inquiry projects
  - Financial assistance to offset some of the costs of a program like this.
  - Stewardship to this important endeavor

How to Contact Us

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The Impact of Methane Flux on the Washington Margin: Glass Sponge Reefs and Massive Krill Swarms

Preliminary Results of

Three Cruises to the Grays Canyon Region of the Washington Shelf

(2007, 2008 and 2009),

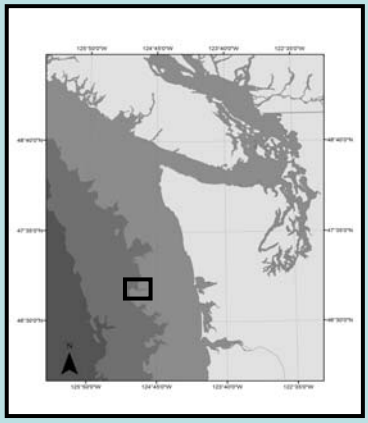
sponsored by

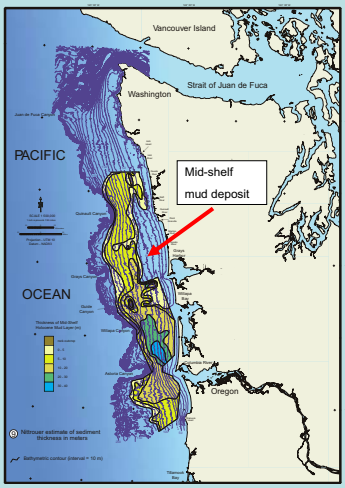
Washington Sea Grant

Paul Johnson

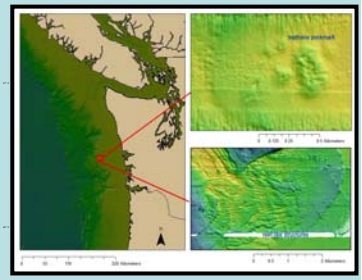
School of Oceanography

University of Washington

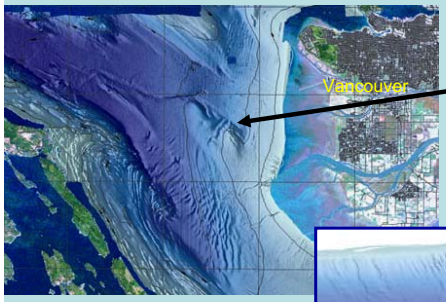




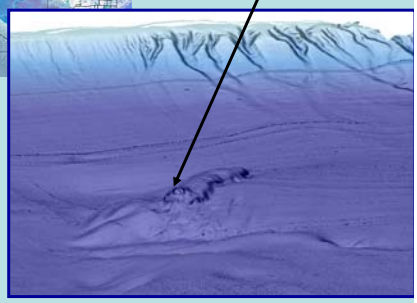
Flattening and truncation of the margin sediments during low sea stands during glacial periods has exposed the folded sediment layers.



Glass Sponges on the Washington Margin



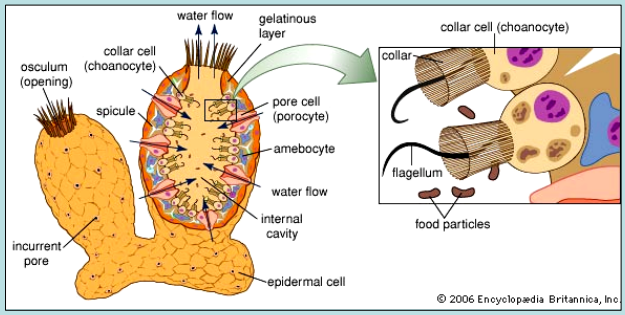
Fraser Ridge Sponge Reef, Strait of Georgia



Glass Sponges

Glass sponge reefs are <u>major nursery areas</u> for rock fish and other commercial species.

How do sponges 'work'?

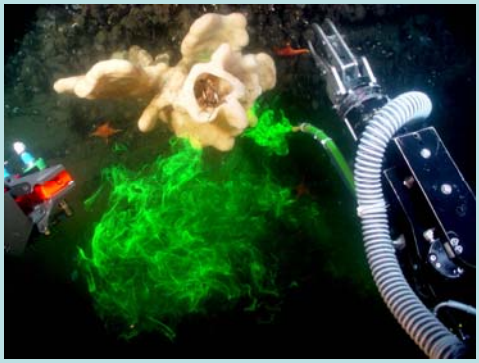


Glass sponges (Hexactinellida) are **NOT multi-cellular animals**.

The soft tissue of each individual glass sponge is a giant multi-nucleate syncytium – i.e., **they are essentially single-celled animals**.

GLASS SPONGES FROM GEORGIA STRAIT REEF CRUISE, 2005
V. TUNNICLIFFE/S.LEYS.

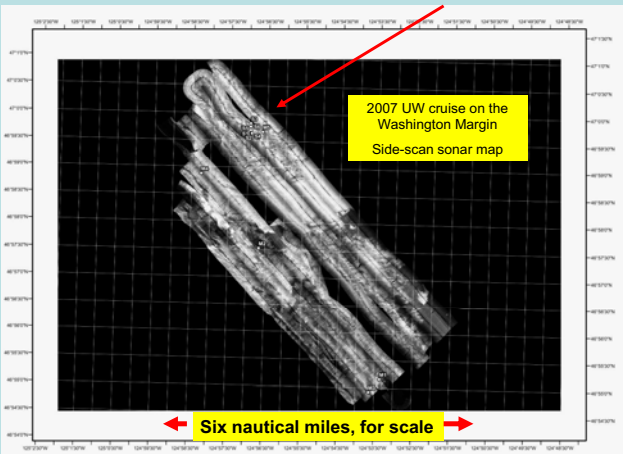
In situ feeding, metabolism, and geochemical fluxes in glass sponges



Sponges look like they are 'just sitting there', but they are actually working quite hard.

They can remove over 50% of the particulate matter from the bottom water, and can change the water chemistry over densely populated reefs.

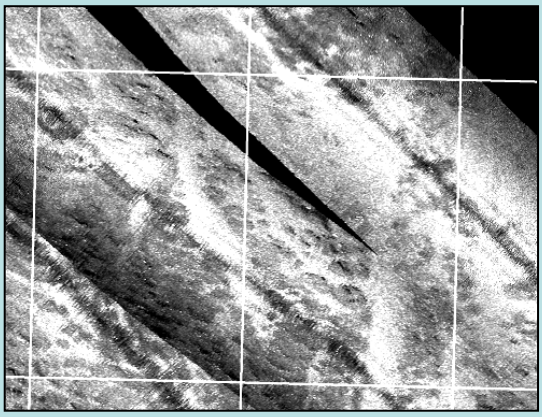
Side-scan sonar image of sponge reef site: dark areas are old reefs. Labels S are sponge sites.



Mound fields in area where we have observed glass sponges.

White areas are hard/flat sand,

Dark areas are (rough/soft reflectors) **reef**



VAN VEEN GRABS CONFIRMED SPONGE LOCATIONS

2008 Sponge Cruise

Sponsored by

Washington Sea Grant

and The College of Ocean and Fisheries Sciences, UW

Defender Class Catamaran;

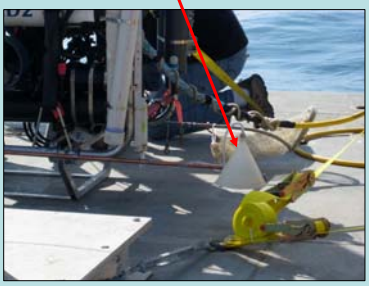
58' cruising speed 25 knots.

Crew of 2, scientific party of 5

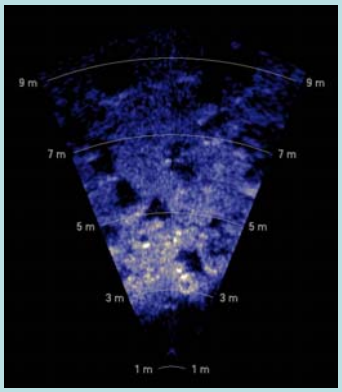
Preparing the ROV in Westport, WA

sunny Westport, Washington….

Bubble Catcher



Sample grab, with sponge

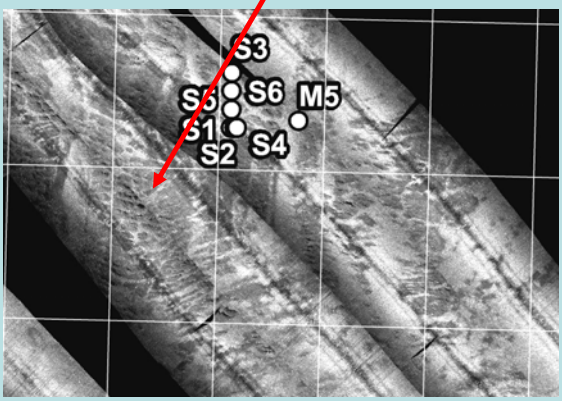


Scanning Sonar image from ROV

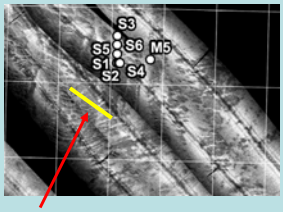
Glass sponge sitting on glacial erratic at 160 meters depth on the Washington outer continental shelf.

For scale; not product placement (yet).

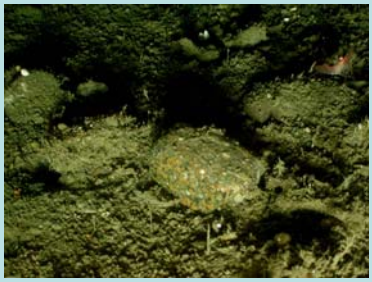
QUESTION from 2007 cruise – are these scars from fish trawls? Are the reefs being destroyed by the fishing fleet?



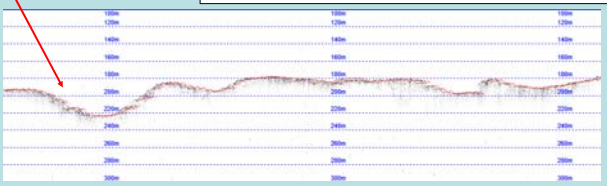
Answer – no, probably not.



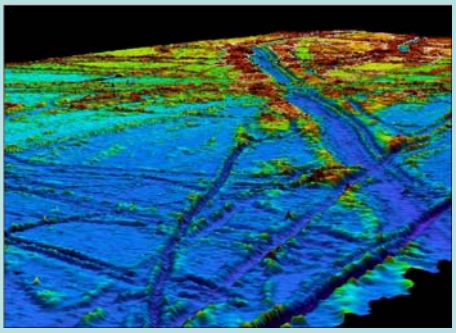
12 khz data over gouges, which contain glacial erratics.



ROV images of glacial erratics in **iceberg gouges**



How does that work?



When you have icebergs that are thicker than the water depth, their movement **gouges trenches** in the margin sediments (or in the existing sponge reefs).

During the **Last Glacial Period**, sea level was about 125 meters below present day sea level. And the depth of the Grays Canyon reefs is only 160 meters.

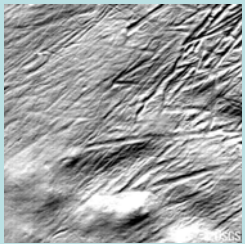
The observation that there are iceberg gouges (from 20,000 years ago) in the glass sponge reefs implies that the Washington Margin Reefs are older than the Last Glacial Maximum (22,000 years BP), and

Sea Level curves (sponges have to live BELOW the photic zone) mean that **our Washington glass sponge reefs are**….

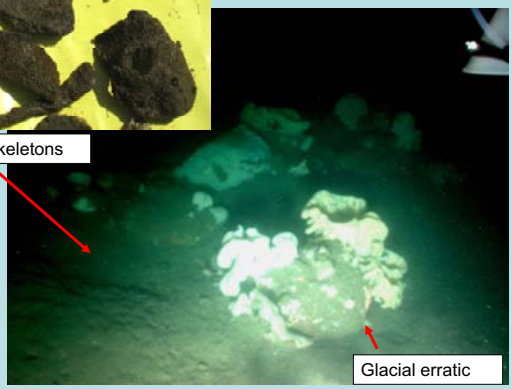
About 80,000 years old.

The oldest known continuous living ecosystem in the ocean.

Iceberg gouges in the Atlantic margin sediments at about the same depth, off New Jersey coast.



Old, dead sponge skeletons



Glacial erratic

So – the Washington margin off-shore of Grays Harbor has large-scale glass sponge reefs.

Which are **nurseries** for rock fish and other commercial species.

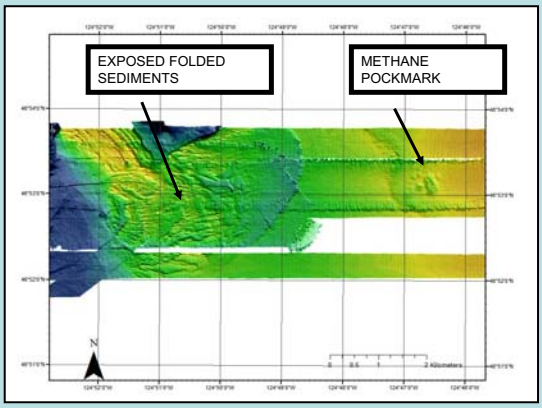
But now, another feature of our margin -

Methane vents, massive krill swarms, and

WHY the Washington margin is such a productive commercial fishing zone

The real 2008 **surprise**.

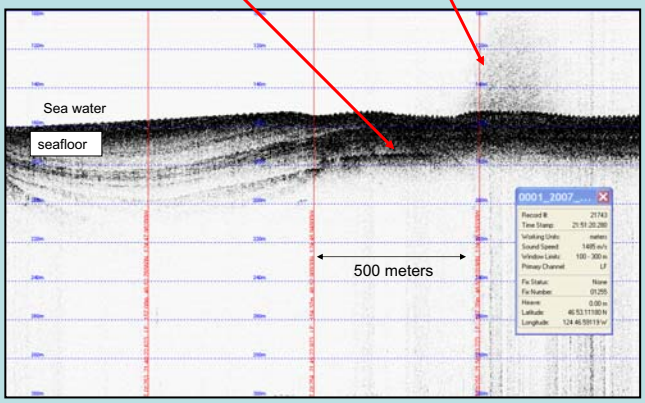
Methane Plumes and Krill Swarms



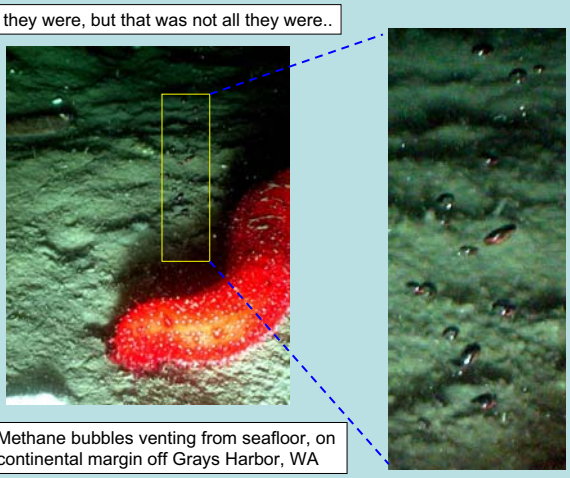
3.5 KHZ PASS OVER POCKMARK, showing structural control of fluid/gas flux

METHANE GAS IN SEDIMENTS

We assumed these were methane bubbles



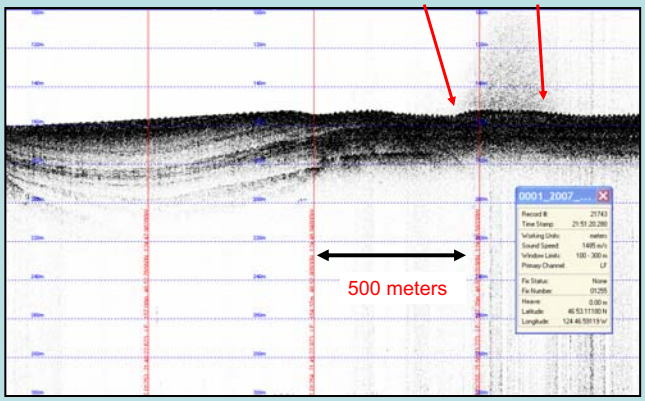
And they were, but that was not all they were..



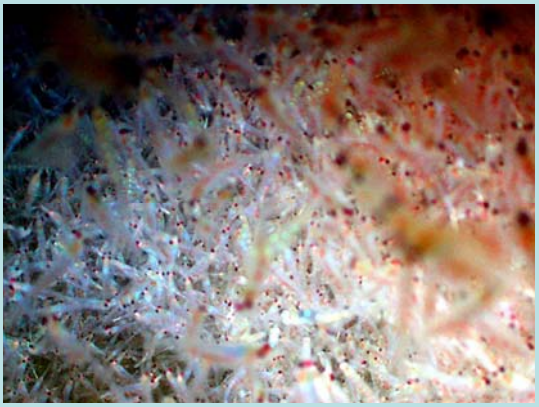
Methane bubbles venting from seafloor, on continental margin off Grays Harbor, WA

On our 4th dive, we took the ROV on a traverse through the acoustic 'fog' overlying the pockmark, expecting to see large methane bubble plumes

We went from here… to here



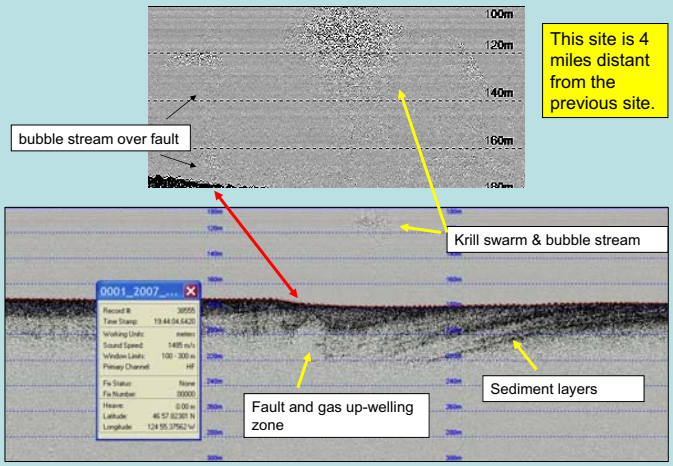
Krill swarm near methane bubble plume



Samples of these annoying animals were identified as

Thysanoessa spinifera (J. Keister, pers.comm.)

So now the question is – how common is this phenomena on the Washington margin?

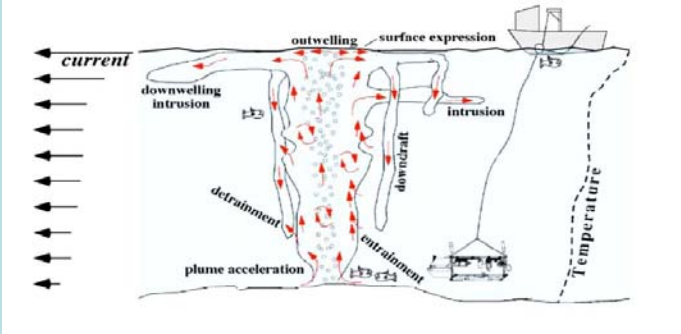


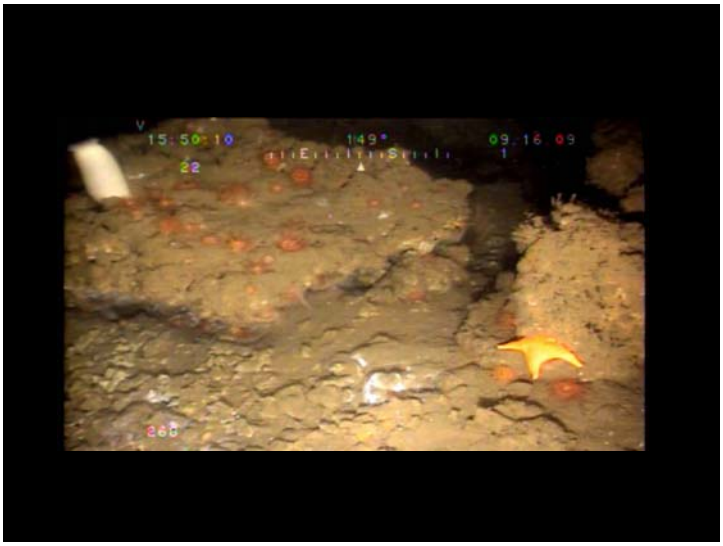
3.5 khz seismic image over methane vent area

Water circulation near a methane bubble plume.

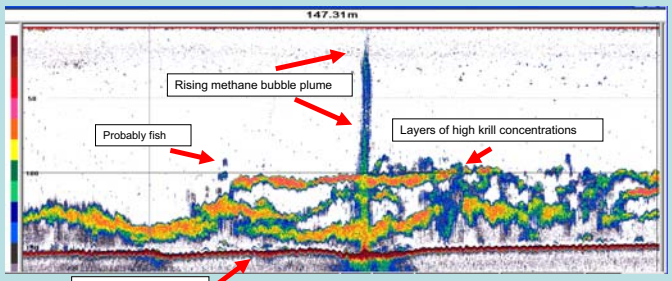
The buoyancy of the bubbles lifts the cold, saline and nutrient-rich bottom water up to the surface.

After release of the bubbles to the atmosphere (as a greenhouse gas), the bottom water descends as a 'reverse' plume, leaving nutrient-rich layers behind in the stratified water column.



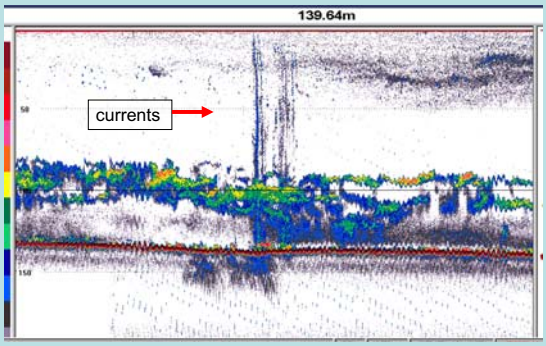


To get the Big Picture of the methane vent area – and it's biology, this year (Sept 2009), we did an acoustic profile over the same methane vent, using a 200 kHz sounder.



Courtesy Julie Keister, UW/Oceanography

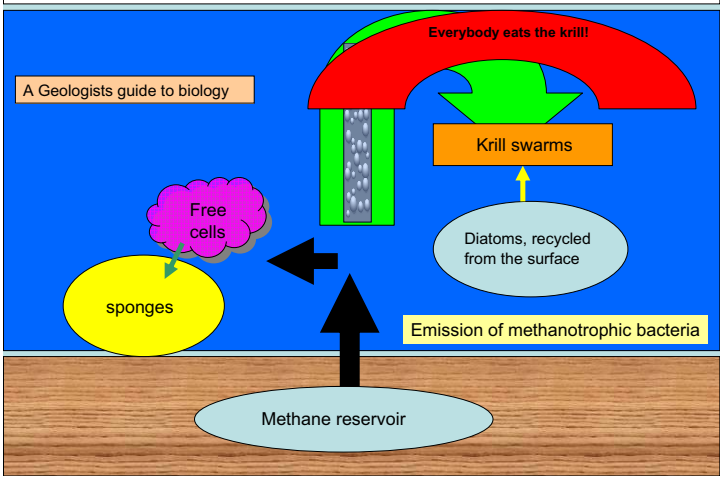
How common are these methane vents on the Washington margin?



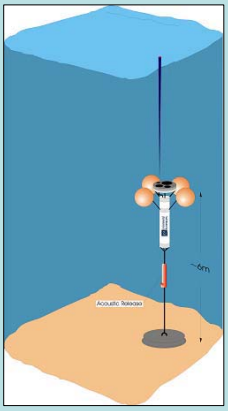
Another methane vent site; approximately 5 miles from the previous site.

Note many individual methane plumes from this site, and that 'downwind' from the plume, the concentration of biology increases dramatically.

Can emissions of methane from the sub-seafloor support a chemosynthetic ecosystem on the Washington margin?



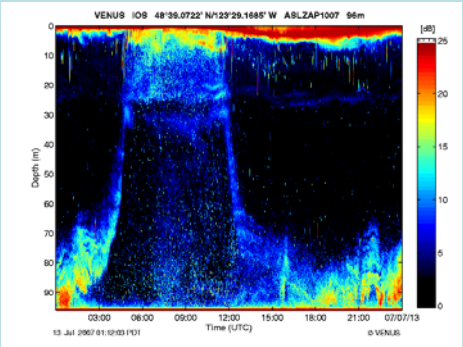
Inverted Echo Sounder from the bottom, looking up.



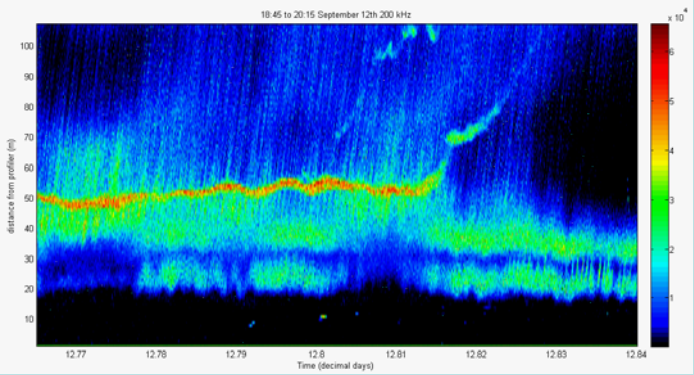
"Normal" krill behaviour, away from methane vents;

UP to surface to feed during the night:

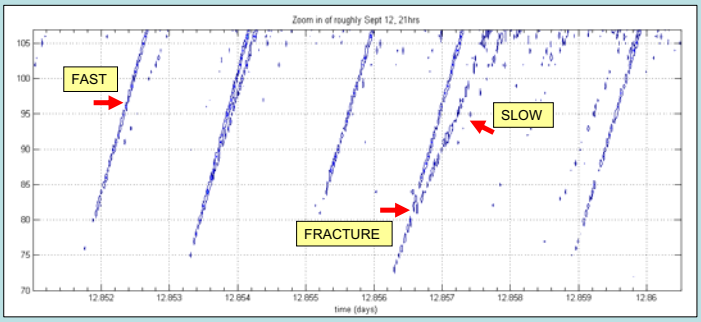
DOWN to bottom to avoid predators during day.



The non-traditional 'RISING' of krill on the Washington margin – in the presence of methane bubble plumes.



NOTICE that only some of the krill rise to the surface at sunset: substantial numbers stay close to the bottom; perhaps because of delivered 'fast food'.

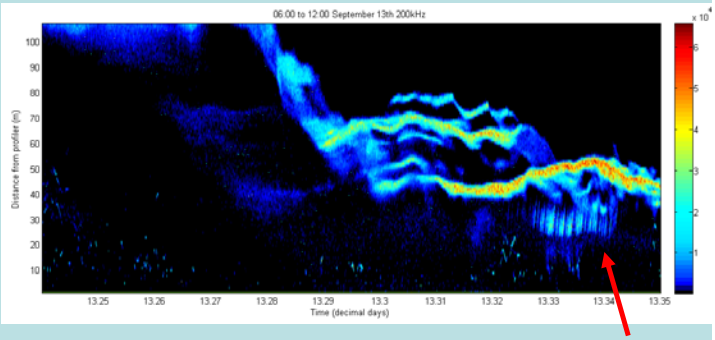


The bottom-mounted sonar can image individual bubble plumes as they rise to the surface, carrying bottom water and krill.

Methane bubbles grow in size to a maximum of about 1 cm, then they oscillate and fracture into smaller bubbles in mid-water.

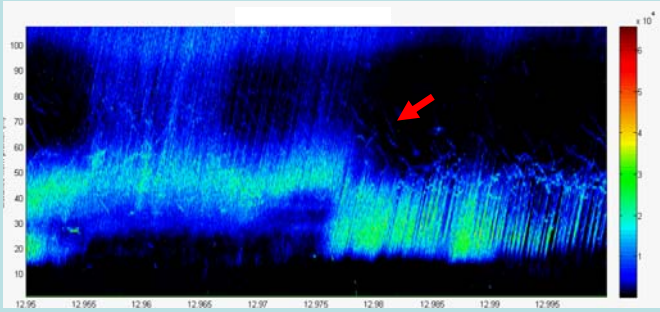
Large bubble plumes rising to the surface can impact the behaviour of seafloor biology – especially krill.

Descent of krill from the surface – at dawn.



Small burst of bubbles, lifting krill layer

LARGE blast of methane bubbles, lifting some of the krill up to the surface, **during the day, when they don't want to be there.**



So they form small groups – and swim back down to safety

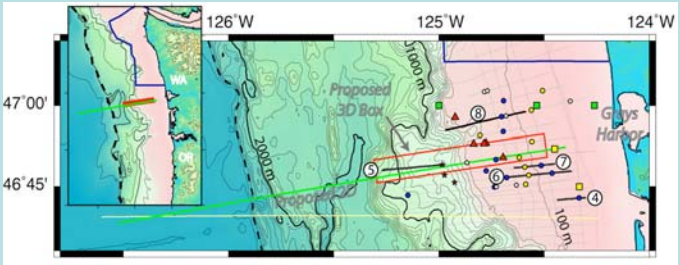
So what is going on – on the Washington margin?

1. There are large reefs of glass sponges, that are nurseries for commercial species of fish. These reefs are very old (+80,000 years).

2. There are many (>20?) sites of methane venting, just in the Grays Canyon area.

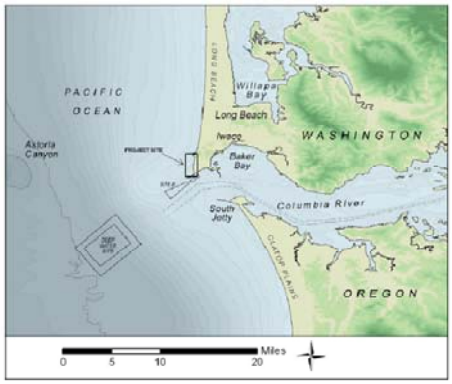
3.This methane venting has a dramatic impact on the marine biology of the WA shelf; including
   a. attracting large swarms of krill;
   b. providing a non-seasonal food source for fish;
   c. sustaining the sponge reef nurseries; and
   d. providing carbon for a partially chemosynthetic environment.

Are there many methane plumes on the Washington margin?

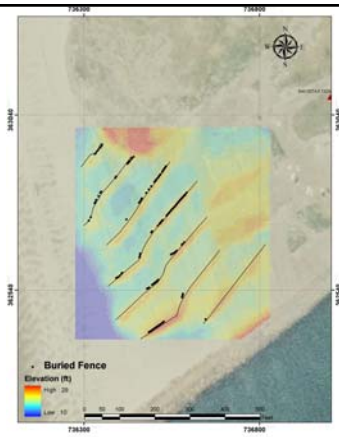


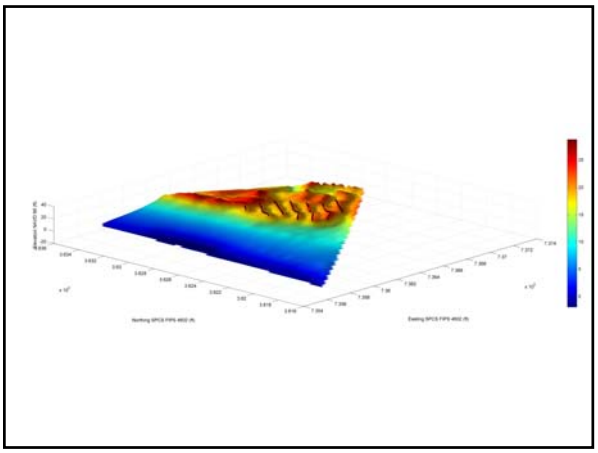
Preliminary examination of archive seismic data indicates that there are at least 23 mud diapirs, which are potential methane plumes sites.

We have looked at 4 sites: two are venting methane



Benson Beach
Sand Fencing



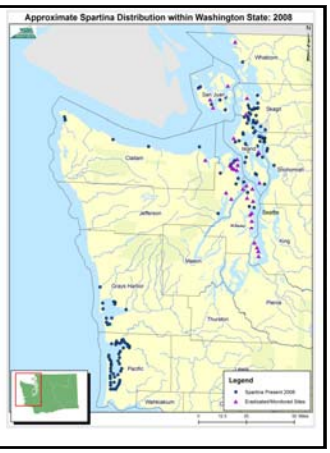


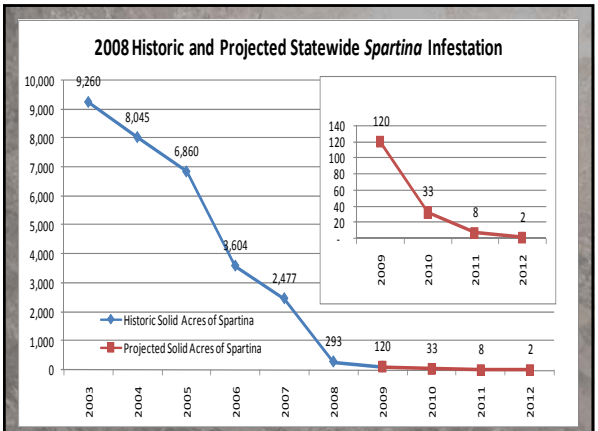
Spartina Update

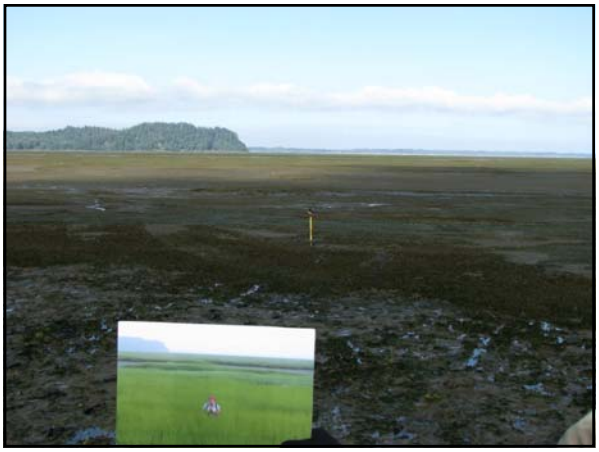
SOC

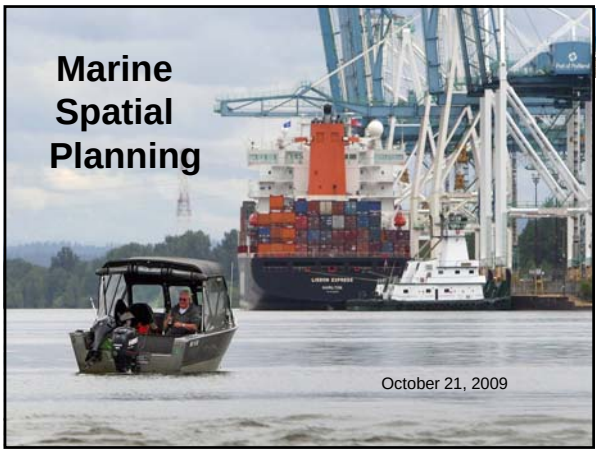
Ilwaco, WA

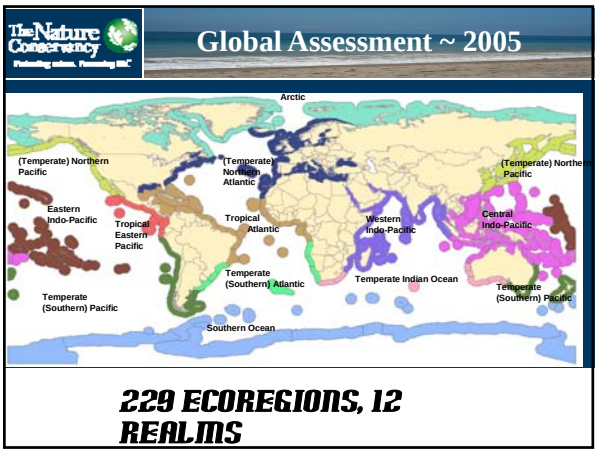
Oct. 21st, 2009

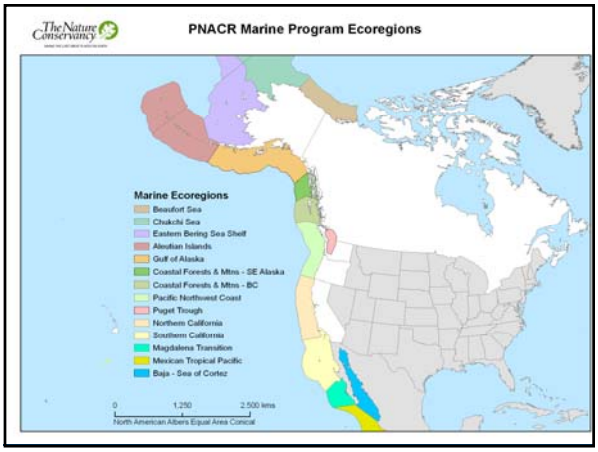


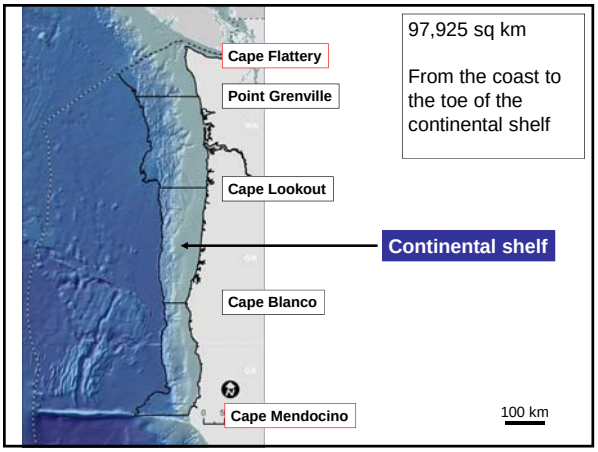






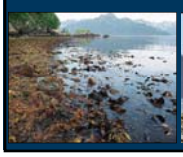


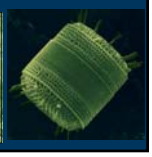




Habitats

- Estuaries
- Shorelines
- Deepwater Canyons
- Offshore islands
- Coastal upwelling (nutrients)
- Chlorophyll concentrations (nutrients)





Species

Criteria for Species:

- Rare or endemic
- Keystone
- Rapidly Declining
- Unique Communities

Species:

1. Kelp
2. Marine mammal haul outs
3. Seabird colonies
4. Corals and sponges
5. Snowy plover nests and critical habitat
6. Native oysters
7. Groundfish

Total List

Habitat	
Estuarine	24
Shoreline	47
Offshore islands and canyons	3
Benthic	64
Upwelling/chlorophyll	4
Species	
Birds	13
Fish	38
Invertebrates	9
Mammals	4
Plants & Algae	4
Total Marine	210

Data Sources

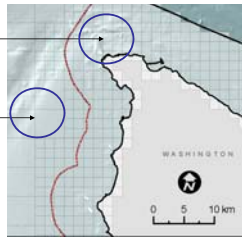
SeaWIFS

Data are organized into a grid

Minerals Management Service
"Outer Continental Shelf"

State waters = 1x1 miles

Federal waters = 3x3 miles



UNESCO: MSP Definition

MARINE SPATIAL PLANNING IS A PUBLIC PROCESS OF ANALYZING AND ALLOCATING THE SPATIAL AND TEMPORAL DISTRIBUTION OF HUMAN ACTIVITIES IN MARINE AREAS TO ACHIEVE ECOLOGICAL, ECONOMIC, AND SOCIAL OBJECTIVES THAT ARE USUALLY SET THROUGH A POLITICAL PROCESS.

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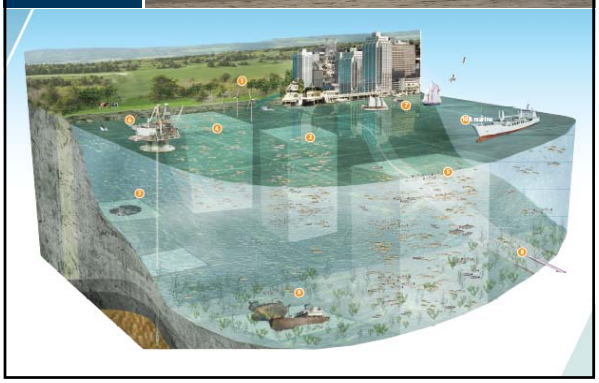
Many Uses of our Oceans



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Spatial Planning Steps

- AUTHORITY AND GOALS
- DESIGN A PUBLIC PROCESS
- STAKEHOLDER PARTICIPATION
- SCIENCE-BASED
- ANTICIPATING FUTURE CONDITIONS
- SPATIAL MANAGEMENT PLAN
- IMPLEMENTATION AND ENFORCEMENT OF PLAN
- MONITORING AND EVALUATION
- ADAPTIVE MANAGEMENT
- FINANCING

UNESCO Initiative on Marine Spatial Planning

- INTERNATIONAL EFFORTS – AUSTRALIA, CANADA, CHINA, EUROPE (BELGIUM, GERMANY, NORWAY, SWEDEN, THE NETHERLANDS, UNITED K
- GOOD PRACTICES
- DEFINITION
- STEP BY STEP APPROACH
- WORKSHOP PROCEEDINGS

HTTP://WWW.UNESCO-IOC-MARINESP.BE/

An Engaged Administration

"One of my goals at NOAA is to bring a more holistic understanding of these interactions across different sectors, and to think about Marine Spatial Planning in a comprehensive sense with all appropriate parties".

- Dr. Jane Lubchenco
Senate Confirmation Hearing
February 13, 2009

An Engaged Administration

"These activities will include multifaceted spatial planning effort. … It is anticipated that the Council on Environmental Quality will help coordinate this interagency effort."

- Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf; Final Rule, April 29, 2009

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release June 12, 2009

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

SUBJECT: NATIONAL POLICY FOR THE OCEANS, OUR COASTS, AND THE GREAT LAKES

The oceans, our coasts, and the Great Lakes provide jobs, food, energy resources, ecological services, recreation, and tourism opportunities, and play critical roles in our Nation's transportation, economy, and trade, as well as the global mobility of our Armed Forces and the maintenance of international peace and security. We have a stewardship responsibility to maintain healthy, resilient, and sustainable oceans, coasts, and Great Lakes resources for the benefit of this and future generations.

West Coast Governors Agreement

Oregon Territorial Sea Plan

EXECUTIVE ORDER NO. 08-07

- ***AMEND TSP - COMPREHENSIVE PLAN PROVISIONS ON WAVE ENERGY PROJECTS***

MOU BETWEEN STATE OF OREGON AND FEDERAL ENERGY REGULATORY COMMISSION

Rhode Island OCEAN samp

Rhode Island MSP

Ocean SAMP

Goal: Define use zones for RI offshore waters through research and planning process that integrates best available science with open public input and involvement

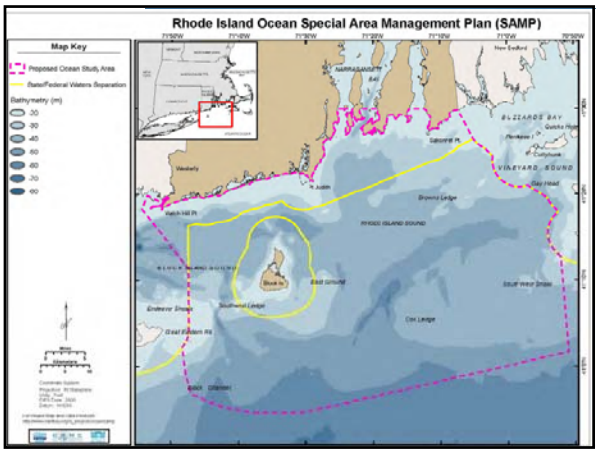
Duration: August 2008 to August 2010

Funding: $3.2 M (RI Renewable Energy Fund, reimbursed by DeepWater Wind (state selected developer))

Project Team: Lead by RI Coastal Resources Management Council(CRMC); Planning, Science, and Engineering Support by University of Rhode Island, Coastal Resources Center and faculty from selected colleges and departments.

Coordination: US Army Corp, MMS, Developer, USCG, USFWS, Adjacent State CZ Managers, and FERC

http://seagrant.gso.uri.edu/oceansamp/



TIER 1 – RESOURCES AND EXCLUSIONS

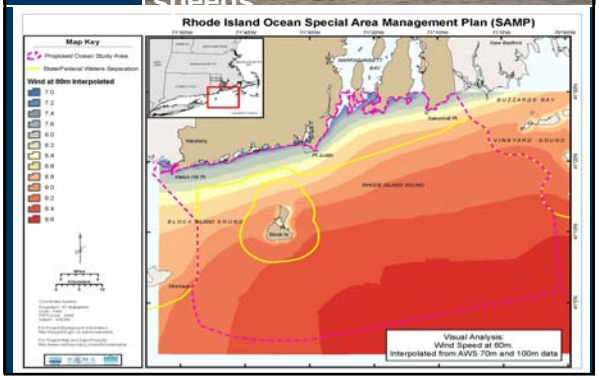
WIND RESOURCE

- ADEQUATE WIND RESOURCES (GREATER THAN 7 M/SEC AT 80 M, HUB HEIGHT)

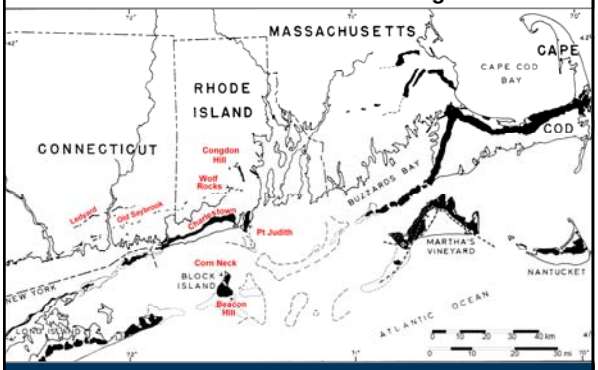
EXCLUSIONS

- NAVIGATION AREAS -REGULATED (SHIPPING LANES, PREFERRED ROUTES, PRECAUTIONARY AREAS)
- VESSEL TRACKS (AIS DATA)
- FERRY ROUTES
- REGULATED AREAS (DISPOSAL SITE, MILITARY AREAS, UNEXPLODED ORDNANCE, MARINE PROTECTED AREAS)
- AIRPORT BUFFER ZONES
- COASTAL BUFFER ZONE (1 KM)

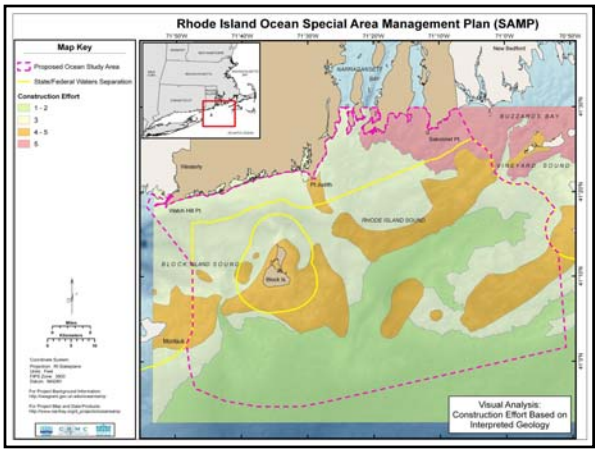
Estimates of 80 m wind speeds

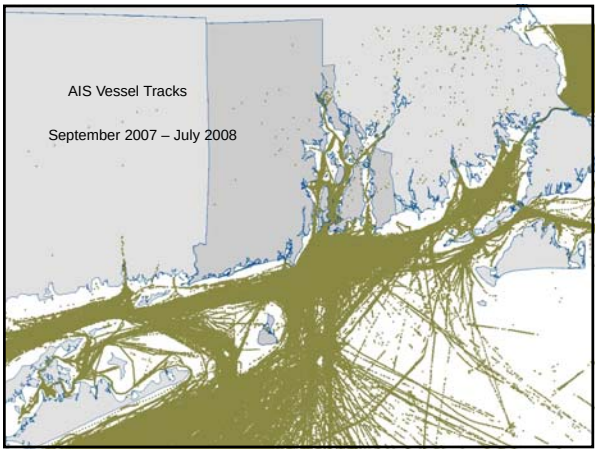


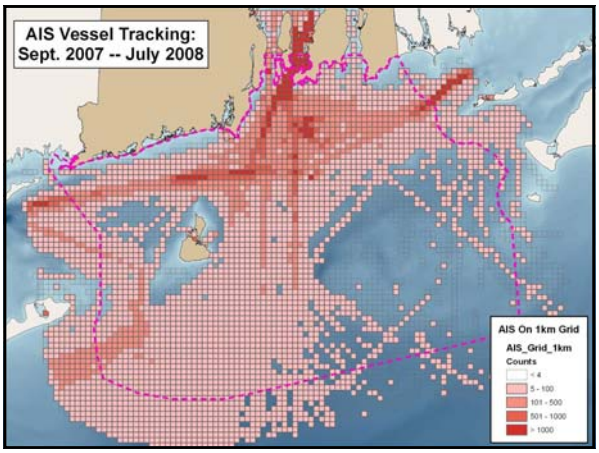
End Moraines of Southeastern New England

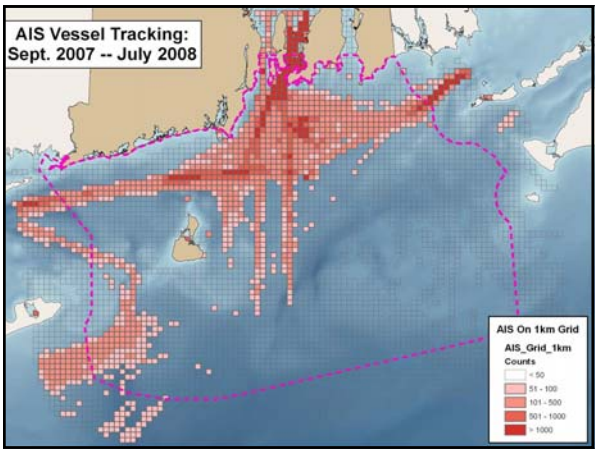


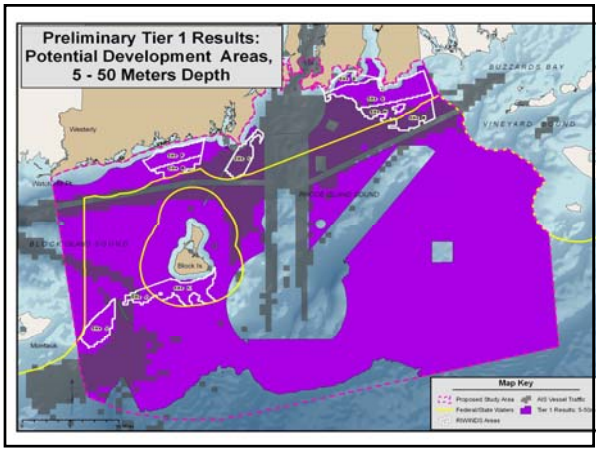
Schafer and Hartshorn, 1965; Sirkin, 1982

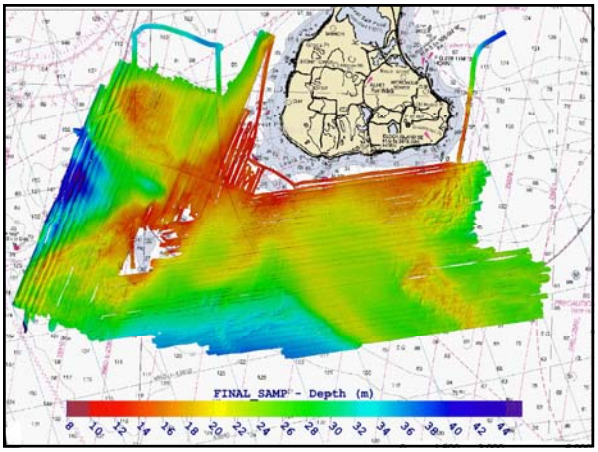












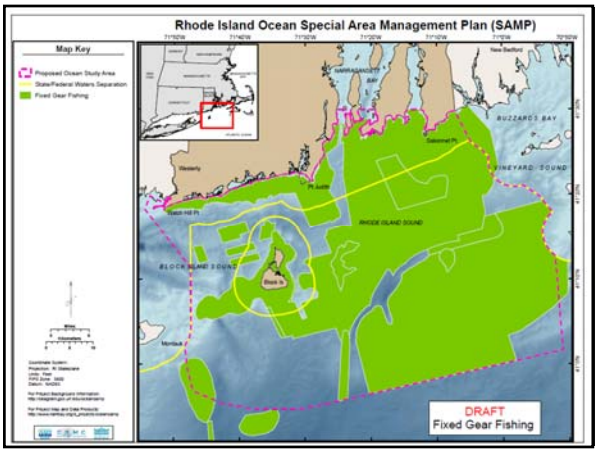
Tier Two - Existing Uses

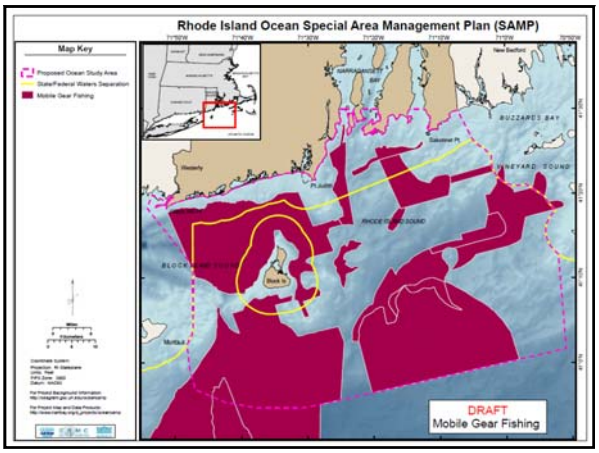
Use Mapping

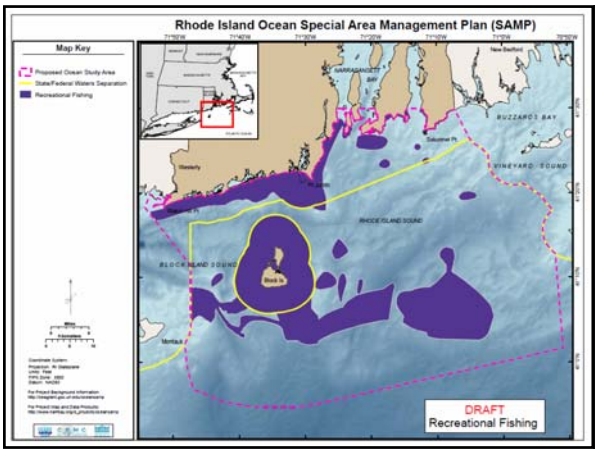
- Commercial and recreational fishing
- Recreational boating
- Existing Infrastructure
- Conservation
- Aquaculture

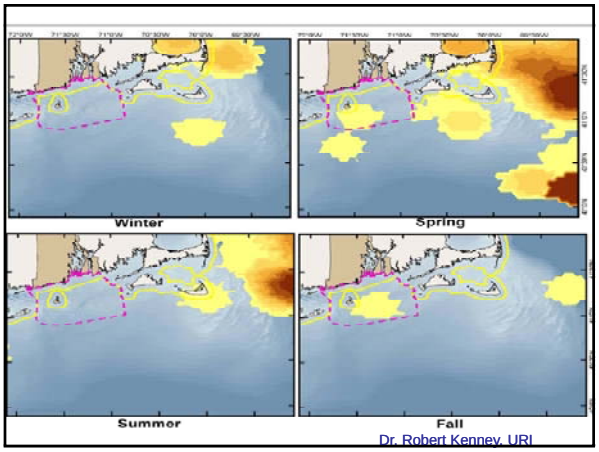
Resource Mapping

- Avian and Bats
- Fish and fish habitat
- Marine mammals and turtles
- Water and air quality
- Historical and cultural resources
- Endangered Species

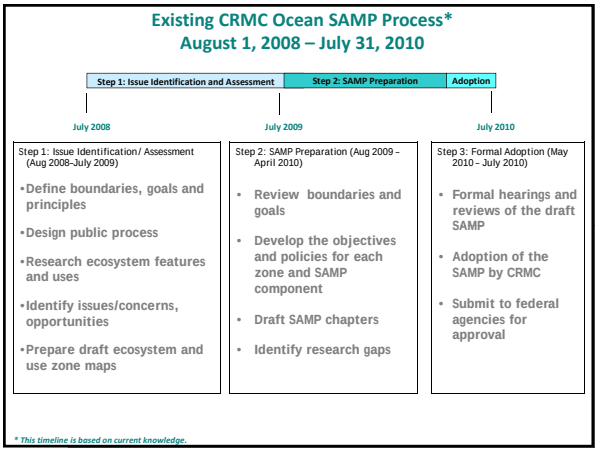








Dr. Robert Kenney, URI



MSP Concerns

- Many audiences don't know what MSP is
- Industry groups: additional bureaucracy
- Legislators: cautious of reforms could impact jurisdiction and cost
- Ocean users: MSP will impose additional constraints on where they can operate
- Science and Models

MSP Opportunities

- A blueprint for future ocean uses
- Bring together diverse oceans users
- Comprehensive picture of the ocean
- Proactively discuss and make decisions
- Providing a coordinated way to think about marine spaces
- Increasing transparency and accountability

MSP in Washington

- Yet to be determined…
- Grays Harbor MRC Workshop
  - Include all key players as early as possible
  - Identify important issues that resonate with the community
  - Important need to ground-truth the data and maps
  - Consider giving priority to existing ocean uses
  - Importance of goal or objective setting
  - Communities can and must participate in the dialogue – goals and strategies
  - Need to build upon or integrate existing authorities and plans

Bring a friend!!

EBM vs. MSP

EBM = maintain an ecosystem in a healthy, productive and resilient condition so it can provide the services humans want and need.

MSP = a process to achieve certain goals of ecosystem-based management. It focuses on the spatially explicit nature of many ocean activities and resources. It can also be used to inform management decisions by evaluating tradeoffs between different spatial management scenarios.

CRMC (Michael Tikonian, Chair) Ocean Special Area Management Plan (Ocean SAMP)
INSTITUTIONAL PROGRAM MANAGEMENT STRUCTURE

OSAMP Management Team
Grover Fugate, Executive Director, RI CRMC
Jennifer McGann, URI-CRC
Sam Bellino, URI GSO
Malcolm Spaulding, URI Ocean Engineering
Kathryn Moser, URI GSO

OSAMP Outreach Team
Laura Robinson-Dwyer, CRMC
Monica Allard Cox, URI-RI Sea Grant
Sue Kennedy, URI-CRC
Chip Young, URI-CRC

OSAMP Data Acquisition & Policy Team Leads
Malcolm Spaulding, Engineering
Saurjyo James Hu, Structures & Foundations
Christopher Baxter, Structures & Foundations
James Miller, Acoustics & Electromagnetics
Peter August, Geospatial Data
Robert Kenney, Marine Mammals & Turtles
John Merrill, Air Quality & Meteorology
John King, Sitting Study & Geology
Peter Paton, Marine & Coastal Birds
Scott Nixon, Biology
David Beutel, Commercial & Recreational Fisheries
Laura Dobbie, Commercial & Recreational Fisheries
Kenneth Payne, State Policy
Susan Fabello, Roger Williams University, Legal
Megan Higgins, Roger Williams University, Legal
Teresa Crean, Data Synthesis & Policy
Tiffany Smythe, Data Synthesis & Policy
Stephen Olsen, Comparative Policy Assessment
Barry Costa-Pierce, Comparative Policy Assessment

Federal Agency Advisory Committee
Dan Goulet, CRMC Liaison
Army Corps of Engineers
US Bureau of Ocean Energy Management
US Environmental Protection Agency
US Fish & Wildlife Service
NOAA National Marine Fisheries Service
US Coast Guard
US Navy

State Agency Advisory Committee
Dan Goulet, CRMC Liaison
RI Department of Environmental Management
RI Economic Development Corporation
RI Statewide Planning Program
Ad Hoc:
Massachusetts CZM
Connecticut CZM
New York CZM

Science Advisory Task Force
Co-Chair: Scott Nixon, URI GSO
Co-Chair: Carlton Hunt, Battelle
Carlton Hunt, Battelle Ocean Sciences, Duxbury, MA
Robert Beardsley, WHOI, emeritus
Roman Zajac, Biology Dept., University of New Haven
Robert Buchsbaum, Massachusetts Audubon
Carolyn Drumsey, The Nature Conservancy, RI Office
Jon Boothroyd, Geology, URI, RI State Geologist
Jonathan Garber, Director, US EPA Atlantic Ecology Laboratory
Jeremy Gallo, Oceanography, URI
Candace Oviatt, Oceanography, URI
Jim Yoder, WHOI
Osvaldo Sala, Brown University

Legal Advisory Task Force
Chair: Brian Goodman, CRMC
Susan Farady, Roger Williams University
Dennis Esposito, RWU/Adler Pollack & Sheehan
Cynthia Giles, Director, Conservation Law Foundation, Rhode Island Advocacy Center
Jerry Elmer, Staff Attorney, Conservation Law Foundation, Rhode Island Advocacy Center
Wendy Waller, Save the Bay
Michael Rubin, Special Assistant Attorney General, Unit Chief, State of RI
Paul Roberti, Assistant Attorney General, Unit Chief, State of RI
Terrence Tierney, Assistant Attorney, State of RI Attorney General Office

Stakeholder Group
Kenneth Payne, URI, Chair
Aquidneck Island Planning Commission
Atlantic Offshore Lobster Association
Audubon Society of Rhode Island
Charlestown Town Council
City of Newport
Conservation Law Foundation
Greater Providence Chamber of Commerce
Jamestown Chamber of Commerce
Jamestown Town Council
Narragansett Chamber of Commerce
Narragansett Indian Tribal Historic Preservation Office
Narragansett Indian Tribe
National Grid
Newport County Chamber of Commerce
Newport County Convention and Visitors Bureau
Northeast Marine Pilots
Ocean State Aquaculture Association
Ocean State Fishermen's Association
People's Power & Light
R.I. Chapter/Surfriders' Association
Rhode Island Commercial Fishermen's Association
Rhode Island Fishermen's Alliance
Rhode Island Historical Society
Rhode Island League of Cities and Towns
Rhode Island Lobstermen's Association
Rhode Island Marine Trades Association
Rhode Island Northfishermen's Association
Rhode Island Party & Charter Boat Association
Rhode Island Saltwater Anglers Association
Rhode Island School of Design
Rhode Island Wind Alliance
Save the Bay
Sierra Club
South County Tourism
Town of Little Compton
Town of Middletown
Town of Narragansett
Town of New Shoreham (Block Island)
Town of South Kingstown
Washington County Regional Planning Council
Westerly Town Council
Wind Power RI Project, Roger Williams University

With participation of members of the public and interested parties.

As of February 24, 2009