OCS Study
BOEM 2015-048

Developing Protocols for Reconstructing Submerged Paleocultural Landscapes and Identifying Ancient Native American Archaeological Sites in Submerged Environments:

Summary Report of the Initial Project Workshop

US Department of the Interior
Bureau of Ocean Energy Management
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Summary Report of the Initial Project Workshop

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1.0 INTRODUCTION

States within the New England Region (particularly southern New England) are increasingly becoming the focus of proposed offshore wind energy development to supplement or fulfill national and state alternative energy objectives. The Bureau of Ocean Energy Management (BOEM), within the U.S. Department of the Interior, relies on the best available science to make informed decisions when leasing offshore areas for potential renewable energy development. The absence of a scientifically proven, standardized, "best practices" methodology for identifying submerged relict landscapes on the Atlantic Outer Continental Shelf (OCS), and the ancient Tribal archaeological resources these landscapes may potentially contain, is a significant concern among Federal, State and Tribal historic preservation officers. In its 2011 Atlantic Wind Energy Workshop, BOEM identified both the development of geospatial databases of known submerged ancient Native American cultural resources and areas of cultural sensitivity, and standardized methodologies for identifying these resources on the Atlantic OCS as critical data needs.

In July 2012, the University of Rhode Island's Graduate School of Oceanography (URI-GSO) and its research partner, the Narragansett Indian Tribal Historic Preservation Office (NITHPO), entered into a cooperative agreement with BOEM to conduct a major four-year study entitled, "Developing Protocols for Reconstructing Submerged Paleocultural Landscapes and Identifying Ancient Native American Archaeological Sites in Submerged Environments." Multidisciplinary field investigations of four areas located in the waters off the coast of Rhode Island are being conducted to develop and test best practice methodologies for evidence-based reconstruction of submerged paleocultural landscapes, in addition to developing, testing and refining modeling approaches for predicting the locations of ancient Native American cultural and archaeological sites submerged by post-glacial sea level rise. Results from this study will assist BOEM, individual states, and Tribal communities to develop recommended information gathering protocols and survey guidelines for identifying, avoiding or mitigating adverse effects to submerged National Register-eligible or -listed ancient Native American cultural and archaeological sites identified during Atlantic continental shelf development.

1.1 WORKSHOP GOALS

The initial Project workshop in April, 2013 was facilitated by URI-GSO, NITHPO, BOEM, and the University of Rhode Island's Coastal Resources Center (URI-CRC) for the purpose of initiating a multi-year discussion between scientific, Tribal and regulatory communities. Specifically, the workshop was convened in order to:

1. Review and recommend best practices that will help inform the development of Tribally-sensitive, science-based guidelines for identifying, avoiding or mitigating adverse effects to ancient Native American submerged cultural resources on the Atlantic Continental Shelf. Of particular importance was the synthesis and incorporation of Tribal, regulatory and scientific perspectives into these best practices.

2. Identify appropriate techniques and steps that would foster open communication and meaningful interaction among all parties throughout the four-year initiative;

3. Develop a common understanding and language for the cultural, scientific, and archaeological aspects of the project;

4. Provide an overall understanding of the origins, goals, objectives, and tasks for the Project; and

5. Promote open and respectful scientific and oral history dialogs with participating Tribes.

1.2 Workshop Format

The study's initial "Submerged Paleocultural Landscapes Workshop" was held at URI-GSO from April 8 to April 10, 2013, with a special concluding session for Tribal members and the BOEM-URI Project team on April 10, 2013 at the Narragansett Indian Longhouse in Charlestown, Rhode Island. The Project organizers utilized a workshop format that allowed for the exchange of information, ideas, and values between all participants in an open and respectful manner. The meeting was designed to foster dialogue and open lines of communication between parties within a framework of partnership and cooperative/collaborative research. This format is different from the process the workshop's participants often experience, in which they are on opposite sides of a negotiation table during regulatory compliance/project review meetings. This latter situation has sometimes led to contentious relationships.

Workshop Days 1 and 2 of were divided into moderated, subject-specific sessions of approximately 20 to 50 minutes each, in which invited speakers gave short oral presentations, followed by open discussion between all attendees of the material presented. Breaks were provided throughout both days, and an on-site reception for all conference participants was held at the conclusion of Day 1 to facilitate additional interaction and discussion in an informal manner. In addition, blank posters with a variety of different subject headings (for example: "Best Practices for Integrating Tribal/Non-Tribal Oral Histories Into Predictive Modeling," "General Concerns/Issues," "Opportunities") were affixed to the walls of the workshop room. Participants were provided with blank "Post-It" notes and encouraged to document anonomously their thoughts and concerns, and attach the notes to the approprate poster at any time during the conference. The completed posters were discussed during Day 2. Day 3 consisted of a private meeting and workshop debriefing for Tribal members, followed by an opportunity for Tribal members, BOEM personnel, and URI-GSO project scientists to share lunch, and continue their discussions in an open-forum format. Comprehensive video documentation was recorded by the project's film-maker, Ted Timreck, of all scheduled activities at the workshop with the exception of the private meeting for Tribal members which occurred at the Narragansett Indian Longhouse during the morning of Day 3.

1.3 WORKSHOP AGENDA

Submerged Paleocultural Landscapes Workshop

University of Rhode Island Graduate School of Oceanography (URI-GSO) and
the Narragansett Indian Tribal Historic Preservation Office (NITHPO)
The Coastal Institute Building, URI Bay Campus
April 8 – 10, 2013

Event Purpose:

1. Review and recommend best practices that will contribute to the creation of a standard methodology and protocols for identifying and understanding ancient Native American submerged cultural resources on the Atlantic Continental Shelf. These best practices will respond to Tribal, scientific, and regulatory issues identified during the workshop.
2. Identify appropriate techniques/steps that will foster open communication and meaningful interaction among all parties throughout the four-year Initiative;
3. Develop a common understanding and language for the cultural, scientific, and archaeological aspects of this initiative;
4. Provide an overall understanding of the origins, goals, objectives, and tasks for this Research initiative; and
5. To promote scientific and oral history dialog with participating Tribes, an annual video progress report will be produced and will culminate in a documentary film. Toward that end, we requested that all workshop participants to sign a video release form during registration.

AGENDA – April 8, 2013

By the end of Day 1, participants will:

1. Have begun to develop a common understanding and language for the cultural, scientific, and archaeological aspects of this Initiative; and
2. Comprehend the origins, goals, objectives, and tasks for this research initiative.

Time	Activity
8:00	**Workshop Registration**
8:30	**Welcome and Introduction –** *Jennifer McCann, URI-GSO* • Official Ceremonial Welcome **–** *John Brown, Hereditary Medicine Man, Narragansett Indian Tribe* • Opening Remarks o *URI President, David Dooley (invited)* o *URI-GSO Dean, Bruce Corliss* o *U.S. Senator, Sheldon Whitehouse (invited)*

9:15	**How do you see things? -** *Jennifer McCann, URI-GSO*
9:30	**The Origin and Significance of the Research Initiative –** *John King, URI-GSO (moderator):* • *Grover Fugate, Rhode Island Coastal Resources Management Council (CRMC)* • *John Brown, Narragansett Indian Tribal Historic Preservation Office (NITHPO)* • *Bettina Washington, Wampanoag Tribe of Gay Head (Aquinnah) (WTGHA) THPO* • *Brian Jordan, Bureau of Ocean Energy Management (BOEM)*
10:35	**Break**
10:50	**Our Current State of Knowledge** – *James Moore, BOEM (moderator):* • **Tribal Oral Histories within the Southern New England Region –** *Doug Harris, NITHPO* • **Southern New England's Late Pleistocene-Early Holocene Archaeological Record –** *Brian Jones, Archaeological and Historical Services, Inc. (AHS)* • **Geological History of and Sea Level Rise in Southern New England –** *Bryan Oakley, Eastern Connecticut State University (ECSU)* • **Marine Archaeological Predictive Modeling in Southern New England –** *David Robinson, URI-GSO*
12:00	**Lunch**
1:00	**Introduction to the Afternoon Session** – *Monique LaFrance, URI-GSO*
1:15	**Integrating Tribal Values and Information –** *Jonathan Perry, WTGHA-THPO*
1:35	**Critical Aspects of the Submerged Paleocultural Landscapes Initiative: Objectives, Tasks and the Way We Will Work Together –** *Brian Jordan, BOEM* • *John King, URI-GSO* • *David Robinson, URI-GSO* • *Doug Harris, NITHPO*
2:25	**The Impact of Sea Level Rise and Marine Transgression of Submerged Paleolandscapes –** *Brandi Carrier, BOEM (moderator)* • *Simon Engelhart, URI* • *Daniel Belknap, University of Maine (Orono)*
2:45	**Break**
3:00	**The Evidence-Based Reconstruction of Submerged Cultural Landscapes/Predictive Modeling –** *John King, URI-GSO (Moderator)* • *Philip Verhagen, Vrije Universiteit Amsterdam (NL)* • *Kieran Westley, University of Ulster (UK)*
3:45	**The Nature and Excavation of Submerged Settlements –** *David Robinson, URI-GSO (moderator)* • *Jørgen Dencker*, Viking Ship Museum (DK)

4:15	**Identification of Concerns and Issues –** *Jennifer McCann and Monique LaFrance, URI-GSO*
4:40	**Insights from the Day –** *Gerrod Smith, Shinnecock Indian Nation*
4:55	**Logistics and Adjourn –** *Monique LaFrance, URI-GSO*
5:00	**On-Site Reception at Studio Blue**

AGENDA – April 9, 2013

By the end of Day 2, participants will:

1. Provide their recommendations for best practices that will contribute to the creation of a standard methodology and protocols for identifying and understanding ancient Native American submerged cultural resources on the Atlantic Continental Shelf.
2. Identify appropriate techniques/steps that will foster open communication and meaningful interaction among all parties throughout the four-year initiative;
3. Have contributed to the development of a common understanding and language for the cultural, scientific, and archaeological aspects of this pesearch initiative.

Time	Activity
8:30	**Welcome and Recap of day 1** – *Jennifer McCann, URI-GSO*
8:50	**Perspectives and Expectations: Interactive Discussion** – *Jennifer McCann, URI-GSO* • *Elaine Thomas, The Mohegan Tribe THPO* • *Kathleen Knowles, Mashantucket Pequot Tribal Nation (MPTN) THPO (invited)*
9:50	**Best Practices for Paleoenvironmental Reconstruction –** *Brandi Carrier, BOEM (moderator)* • *John King, URI-GSO* • *Richard Getchell, Aroostook Band of Micmacs (discussant)*
10:30	**Break**
10:45	**Best Practices for Predictive Modeling of Site Locations –** *William Hoffman, BOEM (moderator)* • *Philip Verhagen, Vrije Universiteit Amsterdam (NL)* • *Jørgen Dencker, Viking Ship Museum (DK)* • *Brian Jones, AHS (discussant)*
11:45	**Lunch**

1:00	**Best Practices for Integrating Tribal/Non-Tribal Oral Histories into Predictive Modeling -** *Doug Harris, NITHPO (moderator)* • *Kevin McBride, University of Connecticut/Mashantucket Pequot Museum and Research Center* • *Dennis Stanford, Smithsonian Institution (video presentation)*
2:10	**Best Practices for Identifying and Reconstructing Submerged Paleolandscapes** – *Monique LaFrance, URI-GSO (moderator)* • *William Schwab, U.S. Geological Survey* • *Amanda Evans, Tesla Offshore, LLC* • *Daniel Belknap, University of Maine (Orono)* • *Richard Getchell, Aroostook Band of Micmacs (discussant)*
3:15	**Break**
3:30	**Best Practices for Submerged Settlement Site Identification and Excavation –** *Kevin McBride, University of Connecticut/Mashantucket Pequot Museum and Research Center (moderator)* • *David Robinson, URI-GSO* • *Jørgen Dencker, Viking Ship Museum (DK)* • *Kieran Westley, University of UIster (UK) (discussant)*
4:30	**Words of Wisdom As We Move Forward –** *Jennifer McCann, URI-GSO* • *Brian Jones, AHS* • *Richard Getchell, Aroostook Band of Micmacs*
4:55	**Next Steps –** *John King, URI-GSO; David Robinson, URI-GSO; Doug Harris, NITHPO*
5:00	**Thank You and Adjourn –** *Brian Jordan, BOEM*

AGENDA – April 10, 2013

Narragansett Indian Longhouse

Time	Activity
9:00	**Open Forum Discussion Among Tribes** *(Tribes only; w/o video-documentation)*
11:30	**Intertribal Meet and Greet with BOEM and URI-GSO Project Scientists**
12:00	**Lunch**
1:00	**Intertribal Open Forum Discussion with BOEM and URI-GSO Scientists** *(w/video-documentation)*

3:00	**Thank You and Adjourn**

URI-GSO

Time	Activity
9:00	**De-Briefing Meeting** *(BOEM and URI-GSO Project Scientists only)*
11:00	**BOEM and URI-GSO Project Scientists Depart URI-GSO for Narragansett Indian Longhouse**
11:30	**Arrive at Narragansett Indian Longhouse**

Submerged Paleocultural Landscapes Project
University of Rhode Island, Graduate School of Oceanography (URI-GSO)
Narragansett Indian Tribal Historic Preservation Office (NITHPO)
Bureau of Ocean Energy Management (BOEM)

2.0 PRESENTATION SUMMARIES

2.1 DAY 1

The first day of the workshop focused on the origins, goals, objectives, and significance of the Submerged Paleocultural Landscapes Project to ensure that all participants had the opportunity to begin developing a common understanding and a shared language for its cultural, scientific, and archaeological aspects. In addition, summaries of the current state of knowledge for the Project area were presented and discussed. Information was provided as oral presentations followed by open forum discussion. Attendance was open to all workshop participants, as well as outside interested parties.

2.1.1 Welcome and Introduction

John Brown, *Hereditary Medicine Man, Narragansett Indian Tribe* (NIT) and Narragansett Tribal Historic Preservation Officer (NITHPO) opened the conference with an official Ceremonial Welcome, in which he asked the Creator to be with all participants, to look over their well-being and safety, and to bring the spirit of the workshop to all in attendance. *David Dooley, President, URI* (Univeristy of Rhode Island) and *Bruce Corliss, Dean, URI-GSO (URI Graduate School of Oceanography),* welcomed all participants to URI-GSO, expressed their interest in the Project, and thanked the Bureau of Ocean Energy Management (BOEM) for providing the opportunity to participate in such interesting and productive research. *David Dooley* also emphasized that the URI community was honored to have John Brown and Narragansett Tribal members on campus as research partners in the Project.

Jennifer McCann, URI-CRC, Director of U.S. Coastal Programs, Workshop Coordinator and Lead Facilitator, welcomed attendees and described the Project as a four-year effort that will bring scientists, archaeologists, Tribal members, and other interested parties together, so that they can better understand, value, and appreciate the landscapes that are now submerged and buried beneath nearby ocean waters, as well as the people and cultures that may have inhabited them. She emphasized that conference was not a formal government-to-government consultation, but instead should be viewed as an informal opportunity to share information, stories, values, and experiences with each other, and to learn from these interactions. She reviewed organizational and logistical matters for the three day event and concluded by emphasizing that respect was the primary principle governing the workshop, reminding participants that something which is not valuable to one person may be important to someone else. Since no one individual can know all the answers, a cooperative group effort is needed in order to understand underlying stories behind divergent experiences and perspectives and to recognize their value.

2.1.2 How Do You See Things?

Facilitator: Jennifer McCann, URI-CRC (URI-Coastal Resource Center) This short session was designed to demonstrate the differing perspectives that individuals bring to the Project, and the value of understanding and respecting this diversity. Prior to the beginning of the workshop, *Jennifer McCann* asked Project Co-PI's *David Robinson (URI-GSO)*, *Doug Harris (NITHPO)*, *and John King (URI-GSO)* to select an object of individual significance that would help symbolize their personal perspective on the Project, and to share and briefly discuss their chosen objects with workshop participants.

David Robinson chose a diving mask, because it is something he would use frequently for Project research. He described how he viewed the mask as symbolic of his participation in the workshop, since it gave him a window for seeing another world that he would not be be able to view without it. As with his diving mask, Robinson stated that he felt confident that he would see the world in a different way because of his experiences interacting with workshop participants.

Doug Harris shared a braid of sweet grass that was tied into a circle, describing how he hoped the conference could bring the diverse perspectives of workshop attendees closer to a unified whole. He explained that sweet grass brings with it the spirit energy of sweetness, harmony, and balance, and he hoped that the circle would bring forth that kind of energy moving forward in the future.

John King demonstrated a small, three-axis tumbling sample holder for an alternating field demagnetizer that was made in late 1950's - early 1960's. He described how much of the original work defining the theory of plate tectonics was done using this exquisite historical object, how it reminded him about the origin of his personal research specialty, and how it inspired him because it was used by a great scientist and the first paleomagnetist at URI-GSO.

2.1.3 The Origin and Significance of the Research Initiative

Moderator: John King, Project Co-PI, URI-GSO. This session provided the opportunity for scientists, BOEM personnel, and Tribal representatives to discuss their diverse views about the origins and significance of the Project. Invited speakers presented their perspectives, followed by open forum discussion.

2.1.3.1 Grover Fugate, Executive Director, Rhode Island Coastal Resources Management Council (CRMC)

The Submerged Paleocultural Landscapes Project originated with The Rhode Island "Ocean SAMP" (RI SAMP) project, which was an interdisciplinary initative to study and protect the unique, shallow shelf environments of Rhode Island's offshore waters. During the RI SAMP investigations, researchers attempted to perform a rudimentary paleolandscape reconstruction for submerged environments in Rhode Island waters and to identify paleochannels on those landscapes, but did not have the resources to perform these reconstructions on a large scale.

2.1.3.2 John Brown, Narragansett Indian Tribal Historic Preservation Office (NITHPO)

The Submerged Paleolandscapes Project provides a unique opportunity to integrate Tribal knowledge with scientific and general knowledge in a manner that could remove biases and guessing. John Brown emphasized that Tribal peoples understand that they did not travel across other lands to get to their current location and are not new to the land that the Project will be studying, but instead that they came into being as humans at this locale and have an vital ancestral connection to the land. Brown stated that joint projects of this nature may occur in the future; therefore, a primary priority will be to develop methods that will facilitate truly effective communication with one another. His opinion was that a Best Practice would be to hear everyone and take the word of everyone. Everything is part of a circle or sphere. Working together, we can broaden the width and depth of our individual knowledge.

2.1.3.3 Bettina Washington, Wampanoag Tribe of Gay Head (Aquinnah) (WTGHA) THPO

The Submerged Paleocultural Landscapes Project is important, because it provides an opportunity to finally assemble all of the information that is uniquely available from Tribes and scientists (geologists and archaeologists) and use that knowledge to determine the best methods to obtain additional information about the now-submerged paleocultural landscape on the continental shelf. It is important to merge diverse stories and truths, accept that "old" stories are equally as valuable as modern perspectives, and respect the fact that important information is not restricted to things that can be touched, documented, or dated. Projects and development are going to occur in the future; therefore, it is important for concerned individiduals and groups to participate in and learn from these projects.

2.1.3.4 Brian Jordan, Bureau of Ocean Energy Management (BOEM)

The Submerged Paleocultural Landscapes Project was funded to initiate better informed decision making. It is BOEM's hope that the Project will result in a shared understanding, common knowledge base, and key set of values representing the perspectives of diverse groups. This information will not only assist BOEM, but ideally will be used by everybody for the public good.

2.1.3.5 Discussion

All scientists are not in agreement, and do not all presuppose where and from what period people arose. As technology has advanced and the more scientists have learned, the less contradiction there appears to be between the scientific perspective and Tribal oral histories. Therefore, an important part of this Project and the workshop will be to identify approaches that have not worked, and to use that knowledge to move forward in a more positive manner. The workshop will represent a historical moment if it can facilitate an open dialog based on mutual respect of diverse perspectives and views. Historically, significant mistrust has existed between Native peoples, and scientists and resource managers. A major effort will be required to address that difficulty, if the Project is to have a positive outcome. Determining how archaeologists and Tribal people will work together on underwater projects will undoubtedly be a topic of discussion for future sessions on submerged cultural resource management. The Submerged Paleocultural Landscapes Project provides an extraordinary opportunity to do something special and important for today and for the future.

2.1.4 Our Current State of Knowledge

Moderator: James Moore, Marine Archaeologist, BOEM. The goal of this session was to "set the scene for the Project" by providing information regarding the Native American oral history and cultural traditions of the Project study area, as well as the geological and archaeological evidence that describes the area approximately 10,000 years ago. Invited speakers presented their perspectives, followed by an open forum discussion.

2.1.4.1 Tribal Oral Histories within the Southern New England Region - Doug Harris, NITHPO

Tribal oral history teaches that the ancient village settlements of the Narragansetts were situated on the continental shelf in areas that are currently submerged. Contrary to current western scientific theories about the peopling of the Americas, the oral histories of Tribal people indicate that they have always been here. Although Naragansett oral history does not include any mention of glaciation, it does teach that people living in ancient settlements experienced rising water overnight and were forced to evacuate. Harris's participation in the RI SAMP project provided him with the opportunity to correlate, for the first time, the Narragansett's Tribal oral history account of sea level rise with that of the geological record presented by RI SAMP project scientists. The geological investigations of the RI SAMP project indicated that portions of the outer continental shelf off of Rhode Island were open vegetated plains at least 24,000 years ago. Knowledge from Tribal oral history indicating that ancient Narragansett settlements existed in that area 15,000 years ago corresponds well with the scientific evidence. Tribal oral histories should not only inform, but shape the scientific process.

2.1.4.2 Southern New England's Late Pleistocene-Early Holocene Archaeological Record - Brian Jones, Archaeological and Historical Services, Inc.

From an archaeological perspective, the ancient Native peoples of New England are regarded as part of the general movement of human beings out of Africa, beginning as much as 120,000 years ago. The earliest Native American artifacts in New England date from after 13,000 calendar years before present and correspond, approximately, with the initation of a harsh climatic eposide called the "Younger Dryas" period. Paleoenvironmental evidence suggests that ancient Native people were required to adapt to significant changes in vegetation and natural resource availability resulting from climate change during the late Pleistocene and early Holocene.

Early settlement by Native peoples in New England has been divided into five discrete cultural phases by archaeologists: 1) "Exploration" (13,100 - 12,900 calibrated years Before Present [calBP]), represented by a sparse archaeological record; 2) "Colonization" (12,900 - 12,700 calBP), in which ancient peoples moved into the region; 3) "Settling In" (12,700 - 12,200 calBP), in which Native peoples adapted to the resources in their geographic area; 4) "Regionalization" (12,200 - 11,600), characterized by the development of varied traditions associated with adaptions to the land and population growth, and the begininings of ethnogenesis; and 5) "Holocene Adaptions" (11,600 - 8,900 calBP), in which ethnogenesis continues and ancient people show increased familiarity and association with the landscape, as well as an increasingly complex culture characterized by large, village-like basecamps. Each of these cultural phases is characterized by archaeologists based on the morphologies of distinct projectile points, craftsmanship, and site types, altough it is important to remember that the interpretation of the archaeological record is revised constantly based on the availability of new data.

2.1.4.3 Geological History of and Sea Level Rise in Southern New England - Bryan Oakley, Eastern Connecticut State University

The Laurentide Ice Sheet advanced across the New England landscape in the Late Wisconsin period, reaching its glacial maximum about 26,000 years ago before beginning to retreat back out of southern New England. As the glaciers retreated and sea level on the OCS rose, significant erosion and reworking of formerly terrestrial sediments occurred, which greatly altered the paleocultural landscape. Sea level rise is not analogous to filling a bathtub, but is a complex process that has profound impacts on the inundated landscape as it is submerged. A series of illustrations were presented showing sea level rise reconstructions of the RI SAMP area for the following time periods: 1) 11,650 yBP (years Before Present) (water depth 60 meters [m] below present); 2) 11,000 yBP (water depth 50 m below present); 3) 10,500 yBP (water depth 40 m below present); 4) 9,900 yBP (water depth was 30 m below present) 4) 7,300 yBP (water depth was 20 m below present); 5) 6,000 yBP (water depth was 10 m below present).

2.1.4.4 Marine Archaeological Predictive Modeling in Southern New England - David Robinson, Project Co-PI, URI-GSO

The concept that archaeological deposits and cultural sites could exist offshore is not something that is new to the field of archaeology. Archaeologists have long been aware of the serendipitous finds of fishermen who have recovered the remains of past landscapes (e.g., peat and faunal materials, such as mammoth and mastodon teeth and tusks) that once existed in locations now far offshore. Underwater archaeological investigations conducted elsewhere in the world, such as in Denmark, have discovered remnants of human settlement sites that are now submerged and demonstrate unparalleled levels of preservation of cultural materials. The primary question of where submerged paleocultural landcapes and resources are likely to be preserved, and in what context, remains to be fully answered.

The majority of archaeological investigations performed to date in submerged environments are conducted within the context of the environmental review/cultural resource management process, in response to federally-funded or permitted offshore undertakings. This context has limited the scope of the research that has been conducted. The first project in southern New England that involved broad reconstruction of a submerged paleocultural landscape and the identification of submerged ancient Native American cultural resources occurred in 2001 as part of the archaeological work done in support of the environmental review and permitting of a proposed offshore gas pipeline and transfer terminal project in Massachusetts. Prior to this investigation, most underwater archaeological projects conducted in the northeast U.S. were focused exclusively on the identification of shipwrecks. Submerged ancient Native American sites were considered at the time by most American archaeologists and geologists as either impossible to locate or destroyed by erosion. Developing the initial methodology for assessing archaeological sensitivy and identifying submerged ancient Native American cultural sites on the seafloor required then and now a major paradigm shift in the way underwater archaeological identification surveys are typically thought about and conducted. Instead of focusing on identifying in marine remote sensing survey data discrete, isolated targets of interest like those associated with shipwrecks, it was/is instead necessary to think of the seafloor in a broader manner and consider the submerged shelf as part of a continuum of the adjacent land that extends offshore underwater, but that has been modified significantly by the processes of marine inundation and post-submergence wave and tidal current regimes. Assessing archaeological sensitivity and identifying submerged ancient Native American sites requires a multidisciplinary approach that combines the geological and archaeological sciences and Tribal oral history and perspectives.

Our current understanding indicates that Tribal oral histories are in general agreement with the geological evidence that sea level was lower during the last glacial period, and that existing settlements on the continental shelf were abandoned approximately 15,000 years ago. Predications have been made regarding the location offshore of preserved and intact submerged paleocultural landscapes. Evidence from sediment cores indicates that some of these predictions were correct. Geophysical and visualization techniques can help clarify the extent to which the paleolandscape is preserved. Detailed analyses can be conducted that allow an understanding of the past environments represented by sediment core stratigraphy. The task now is to synthesize the existing information and use the power of a multidisciplinary perspective to develop a predictive model that effectively identifies the archaeological sensitivity of offshore areas and the locations of cultural sites. In the case of this Project, we are starting in a relatively well-known area (from a geological and archaeological perspective) (i.e., Greenwich Bay and Cedar Tree Beach) and working towards the progressively less-well known or unknown areas further offshore.

2.1.4.5 Discussion

A mutual understanding of the language and attitudes that are common in the geological and archaeological disciplines is very important for all parties involved in this research. The following terminology and concepts were identified as requiring clarification and/or explanation from the Tribal perspective:

- The word 'prehistoric' is widely perceived to be offensive among Tribal peoples, since it implies that there was not yet a history in the Americas prior to European colonization. In Latin-based languages, prehistoric literally means the period in human history before *written* records, rather than a period without history. Our collective knowledge about Tribal languages, oral histories, art and symbolism represented in material culture and ancient traditions demonstrates clearly that the people of the Americas possess a rich cultural history extending thousands of years into the past. Western scientists understand this, regardless of the term's assumed meaning; however, a more accepted and appropriate term to refer to cultures, materials, or sites existing in the Americas prior to European contact is 'pre-contact.' Those elements of Tribal culture that date from the time of or after European contact are referred to as deriving from the 'post-contact' period.

- The word 'colonization,' when discussing how ancient humans came to be in the Americas, is also offensive to contemporary Tribal peoples, since it suggests that a group of people arrived from an outside geographic location and applied their culture and manner of doing things to a new place. Since this term defines the European settlement of Native American lands, Tribal people are generally offended by the view that they are also colonizers. Their perspective is that they are the people of this place and have always been here since time immemorial. Use of the term colonization in reference to early human habitation of the Americas should be avoided.

- The prefix 'paleo' used by western scientists and archaeologists refers simply to something that is old or ancient. In cultural chronologies developed by archaeologists, the prefix is applied to the most ancient and chronologically distant people. Tribal people see this prefix as inappropriate when applied to ancient Native Americans (e.g., 'PaleoIndian'), since the Tribal perspective is that contemporary Native American peoples are not separate from their ancestors. Instead, their ancestors remain present in today's world and modern Native people represent the forward continutity of their ancestors. This view is significantly different from the manner in which archaeologists have traditionally perceived and seriated or categorized ancient Tribal cultures. It will be important as we move forward with the project to address this disparity of views by re-examining how the archaeological record has previously been interpreted and characterized by archaeologists and bringing Tribal perspectives and terminology to the development of a new, integrated lexicon and interpretation of ancient human cultures.

- The use of the terms 'ice sheet' and 'glacier' to describe the same feature causes confusion among the Tribal community, as ice sheet conveys the impression of a sheet of ice ending in a type of wall at the glacial ice-front, which is likely to be an innaccurate conceptualization of how the glacial ice-front actually appeared. Instead, a glacier or ice sheet would have likely thinned at its edges and near its southern terminus had a sediment-covered surface that blended into the landscape.

When considering the potential locations of submerged Native American cultural resources, it will be important to re-examine long-standing concepts that have been pervasive within both the archaeological research community and Tribal culture. For example, the assumption that cultural evolution is defined by population growth followed by migration episodes is not necessarily accurate. In addition, archaeologists often define ancient cultures by distinct stages, which is also inaccurate. A more contemporary understanding in archaeology is now that ancient cultures were fluid over time, that ancient peoples traveled into and out of regions, that ancient technologies changed over time, and ancient people shared ideas. Cultural transitions can be identified by examining the material evidence in the archaeological record and further defined by radiocarbon dating, but there is a poor understanding of people's day-to-day lives and the cultural effects of contact with outside people. Existing paradigms within the scientific community are often limiting. A more comprehensive understanding of the cultures and the behaviors of ancient peoples will be required to accurately assess where ancient submerged cultural resources might be found offshore.

2.1.5 Integrating Tribal Values and Information

Jonathan Perry, WTGHA-THPO

Key Tribal values pertaining to Tribal heritage are protection, respect, and acknowledgement. Moving forward with a discussion about Tribal knowledge and the Tribal cultural perspective requires acknowledgment and respect of the Tribal ancestors, who are considered by Tribal people to still have a living presence in the present world, as well as an acknowledgment of the wishes and needs of today's Tribal Nations. Tribal people native to this continent have not just survived, but have thrived for an extremely long time – 15,000 years or more. Over the course of this great span of time, Tribal cultures as complex as any on Earth have utilized and managed the resources necessary to support and sustain large populations of people living in communities and in households – people who raised families, performed ceremony and held feasts, all without destroying the natural world around them. Protection and preservation of Tribal heritage for the benefit of the people of the past, the people of the present, and the people of the future are considered among Tribal people to be ideal goals, the importance of which rises above all other objectives. If cultural sites cannot be cared for fully or data from them extracted without a process that is destructive, then the Tribal belief is that they should not be disturbed. Ancient cultural sites are non-renewable resources. Once they are destroyed, they are gone forever. From a technical standpoint, it is preferable to map the seafloor and any submerged cultural sites it contains using data generated by non-disturbing marine remote sensing survey technologies. Recognizing the capabilities and limitations of these technologies, being fluent in the methods of reviewing and interpreting their data, and being able to *see* the submerged and often buried ancient landscapes that are mapped without being able to physically step into and look at them in person represent processes for interacting with the natural environment that are new to Tribal people, but that are important to engage in and to understand.

2.1.6 Critical Aspects of the Submerged Paleocultural Landscapes Initiative: Objectives, Tasks and the Way We Will Work Together - Brian Jordan, BOEM (moderator) John King, URI-GSO; David Robinson, URI-GSO; Doug Harris, NITHPO

This Project's overall goal is to develop recommendations for best practices that will contribute to the creation of a standard methodology and protocols for identifying and understanding ancient Native American submerged cultural resources on the Atlantic outer continental shelf. To meet this goal, the approach that is planned will utilize different kinds of non-disturbance marine remote sensing survey technologies and techniques, visual examinations of the seafloor, reduced-impact geoarchaeological sampling, state-of-the-art data processing and presentation for interpretation, and the integration of Tribal oral history and the record of both existing and new geoarchaeological data acquired specifically for this Project. Bathymetric survey, side-scan sonar mapping and sub-bottom profiling will be some of the principal marine remote sensing/geophysical survey techniques employed during project fieldwork. Sub-bottom profiling will allow stratified sediment layers lying below the seafloor to be recorded and mapped, and archaeologically sensitive paleosols to be differentiated from the overlying non-archaeologically sensitive marine sediments that have accumulated on the sea floor during and after inundation. Once these ancient or paleo-landscapes have been identified, locations for geoarchaeological subsurface testing (i.e., coring or archaeological 1-x-1 m test unit excavations) will be chosen. Dating (e.g., pollen dating, radiocarbon dating, ^{210} Lead-isotope dating, regional curve dating, etc.) will be performed on sampled sediments. These dates can then be used to develop age models for sediments in the sampled locations. With an established sediment record and chronology, detailed paleoenvironmental analysis (e.g., fossil pollen data analysis) will be done to document human and climatic influences on the environment. These data can then be correlated with the archaeological record and Tribal oral history. Geoarchaeological sampling data generated by this study will also be used to refine local sea-level rise curve models, which informs the archaeological sensitivity assessment of different areas of the sea floor and planning of geoarchaeological investigations.

In the process of completing this Project, exploring and developing new approaches to using non-destructive remote sensing technologies for the purpose of identifying and investigating submerged ancient Native American cultural sites is a priority. Close-interval magnetometer survey to identify minor changes in the Earth's magnetic field, some of which are indicative of human habitation (e.g., ancient Native American hearth features) is planned for nearshore waters. In deeper waters offshore, the use of ROV (remotely operated vehicle) technology equipped with an HD (High Definition) camera, sonar, and a magnetometer array to detect submerged features of interest is planned. These techniques will be tested initially in shallow nearshore environments where we know or predict submerged paleocultural landscapes and ancient Native American cultural sites are present. Knowledge gained during this initial testing will then be applied to the examination of the sea floor in deeper waters further offshore.

Correlation of the paleoenvironmental and geoarchaeological records with shared Tribal oral histories is planned to see where there is convergence/divergence between them and to include elements of the shared Tribal oral histories that inform the overall development of a predictive model.

The ability for Tribal and non-Tribal researchers to work together requires mutual trust and respect between all involved parties. All have a role to play in the Project and each participant is a part of a web of converging lines of influence. Proceeding in a respectful manner will facilitate the achievement of new understandings by providing an opportunity for Tribal partners to be fully engaged in dialog and comfortable asking questions. It is from the fearless sharing of thoughts, perspectives, insights, and stories and trying to answer the questions that are asked during dialog that the opportunities to alter our path will come. Documenting these discussions and sharing this information will create a ripple effect that will rebound and ripple back into the process and transform it, so that it does what is ultimately necessary.

2.1.7 The Impact of Sea Level Rise and Marine Transgression on Submerged Paleolandscapes

Moderator: Brandi Carrier, BOEM. Archaeological investigations can provide insight about the interrelationships between human behaviors and activities, and geological processes. This session focused on developing a common understanding about the effects of sea level rise and marine transgression on submerged paleocultural landscapes after they were no longer inhabited.

2.1.7.1 Simon Engelhart, URI Geosciences

In the northeast United States, sea level rise associated with deglaciation is thought to be caused by a combination of isostatic rebound and the addition or redistribution of ocean water during glacial melting. The amount and rate of sea level rise has been identified by the United States Geological Survey (USGS) as a key factor in determining the likelihood of coastal change. Slower rates of sea level rise allow for the development of coastal features, such as berms, barrier beaches, coastal wetlands and marshes, and are associated with greater preservation of archaeological remains, whereas higher rates of sea level rise tend to produce more coastal erosion, and therefore potentially less preservation of cultural resources. The exact rate of sea level rise associated with preservation or erosion of coastal features varies according to local geomorphology and geology. In the Northeast U.S., studies suggest that an innundation rate of 2 millimeters (mm)/year or less is associated with increased coastal stability and the preservation of cultural material. Recently, a rate of 2.6 mm/year has been documented in Newport, Rhode Island, and is associated with unexpected amounts of coastal erosion; however, the 'tipping point' between erosion and preservation on a regional scale is not clear.

Understanding the sea level rise history of an area is necessary to assess where paleolandscapes might have formed and the extent to which they were preserved during innundation. During the past 4,000 to 5,000 years, the northeast coast of the U.S. has remained relatively stable, with sea level rise rates of approximately 2 mm or less, which will allow a reasonable prediction of where paleolandscapes might occur from that time period. Predictions become more difficult moving further back in time. It may be necessary to focus on specific time intervals where geologic information provides clues about possible landscape formation and preservation. For example, a drop or short stabilization of sea level rise that appears to have occurred at approximately 8,200 yBP was followed by a resumption of rapid sea level rise. This combination of conditions could have allowed time for landscape creation, followed by innundation that occurred rapidly enough to preserve the landscape. Other time periods in which very rapid innundation occurred should also be examined; however, it is important to remember that sea level rise is a very complex process, and that uncertaintities exist with sea level rise models.

2.1.7.2 Daniel Belknap, University of Maine (Orono)

Sediment cores capture layers of geologic material that can provide important insights into the environmental history of an area. The occurrence of peat in sediment cores is indicative of coastal salt marsh environments and is particularly useful when developing sea level rise reconstructions. Peat can be dated with a variety of methods and may also contain faunal and plant remains that provide clues about the elevation and environmental conditions characterizing the ancient salt marsh. It is important to understand, however, that all dating methods contain inherent error and that significant uncertainties are likely to exist regarding the depth and paleoecological reconstruction of an area. In addition, sea level rise curves vary significantly between northern and southern New England. The coastal response to inundation is complex and varies according to geographic location.

2.1.7.3 Discussion

Sea level rise curves are usually represented as smooth lines, but these curves are actually based on discrete data points with areas of unknown information occuring between data points. Environmental change did not occur as smoothly as most sea level curves imply. This fact has important implications for human settlement and marsh development in coastal areas when considered on a human, rather than geological, time scale. Consequently, it is important to understand the level of uncertainly that underlies sea level reconstructions. For example, accurate relative sea level data dating from before 7,000 yBP is difficult to obtain. Sediment core data can help to refine sea level rise models, and the models are valuable tools, but they should be used with caution and caveats.

2.1.8 The Evidence-Based Reconstruction of Submerged Cultural Landscapes/Predictive Modeling

Moderator: John King, URI-GSO. The purpose of this session was to provide workshop participants with an overview of archaeological predictive modeling and the techniques used to reconstruct submerged paleolandscapes.

2.1.8.1 Philip Verhagen, Vrije Universiteit Amsterdam, Netherlands

Archaeological predictive models have been used for over 30 years primarily as decision-making tools for cultural resource management. Traditional predictive models consist of maps that illustrate the likelihood of archaeological remains occuring in specific geographic areas. All predictive models begin with a theory that the model is designed to test. For example, it is commonly thought that settlements associated with hunter-gatherer cultures were located near important natural resources, such as productive fishing areas. A predictive model based on this theory would suggest that geographic areas located near these resources would have the highest probability of containing cultural remains.

Predictive models are complex and their underlying assumptions should be carefully examined. The application of "Middle-Range Theory," a conceptual framework that links human behavior to physical remains in the archaeological record, can strengthen models by establishing logical connections between the presence of archaeological materials and the human and geological processes responsible for their deposition.

The reliability of any model is dependent on the archaeological data used to create it. It is important to remember that sampling methodologies can have a significant impact on model outcomes. Proxy variables can assist with assessing the effects of landscape change and suitability for habitation and can be compared with archaeological test data to refine the model. Any input variables used in the modeling process should be weighted with respect to their predictive importance, and separate models should be created for each cultural entity of interest and each period of time.

It is critical to assess the quality of any predictive model before it is applied by validation, evaluation, and additional field investigations. Validation, or consistency testing, involves identifying any conceptual and factual errors that might have been incorporated into the model, such as errors in underlying theories, or unreliability and bias in the environmental and archaeological datasets. Evaluation, or performance testing, involves comparing model outcomes with existing archaeological knowledge and data and is generally accomplished using statistical methods. Finally, additional field testing is essential to test and, if necessary, refine the original theories underlying the model.

2.1.8.2 Kieran Westley, University of Ulster, Ireland

Predictive models are very attractive to underwater archaeologists, because they can help define geographic areas of potential cultural sensitivity without expensive and time-consuming underwater surveying. Accurate models require comprehensive paleolandscape reconstructions which, in turn, are dependent on the amount and type of data that can be acquired. Since submerged landscapes cannot be directly observed, reconstructions are necessary and must be based on paleoenvironmental and geological information derived from sediment cores and boreholes, remote sensing data such as sub-bottom profiles, and existing archaeological data, if available. A thorough understanding of the glacial and sea level rise histories of the area is also essential. Once a paleolandscape has been modeled and reconstructed, areas of potential cultural sensitivity can be hypothesized based on the topography, hydrography, potential resource locations, cultural preferences, and, in the Americas, on Native American oral history. Paleolandscapes are frequently subjected to coastal erosion associated with marine transgression, and may not be preserved intact. This greatly complicates the cultural sensitivity assessment process. Submerged paleolandscape reconstructions and cultural sensitivity assessments have been conducted for two case studies in Newfoundland and Northern Ireland with varying degrees of success.

2.1.8.4 Discussion

Most archaeological predictive models are based on the assumption that availability and type of natural resources dictated the settlement locations and behaviors of ancient peoples. This assumption, however, greatly oversimplifies the complexities and full-range of human behavior by ancient cultures. In Europe, there is strong evidence that Mesolithic peoples were adept at manipulating their environment, not just responding to it. Therefore, an accurate archaeologial predictive model needs to incorporate an understanding of the motivations behind the behaviors of ancient peoples, which presents a significant challenge. In North America, Native American oral history can be invaluable for providing a more complete understanding regarding the manner in which ancient peoples interacted with and regarded their environment. A detailed understanding of the environmental changes that ancient peoples experienced is also essential for the development of an accurate predictive model.

2.1.9 The Nature and Excavation of Submerged Settlements
Jørgen Dencker, Viking Ship Museum, Denmark

Research on submerged Stone Age settlements in Denmark is a sub-discipline of marine archaeology that is nearly four decades into its development in Denmark and is far more advanced methodologically than is similar research here in the U.S. This presentation provided examples of Danish submerged settlements archaeological research. Methodological approaches that have been employed successfully and the results from that research were described. Implications from the Danish research are: a) that there is a potential for a broader range of well-preserved cultural materials (particularly organic materials) and site types to be found underwater in North American than anything known thus far from the investigation of cultural sites on land; b) that preserved sites underwater can be quite ancient (e.g., ca. 9,500 yBP); c) that sites are generally preserved within and under organic layers of "*gyttja*" (i.e., intact paleosols); and that d) burials can be one of the types of sites that are found in Denmark preserved underwater.

2.1.10 Identification of Concerns and Issues

Moderators: Jennifer McCann, URC-CRC; Monique LaFrance, URI-GSO. This short session was designed to allow all conference participants to reflect on the information presented during Day 1, and to provide feedback to the project team regarding the issues that need to be taken into consideration as the Submerged Paleolandscapes Project moved forward.

The following issues were identified as concerns regarding interactions between Tribal and non-Tribal peoples:

- Technology might not answer all important questions;
- Two-way communication and learning is essential;
- The development of trust and respect needs to be central to the project;
- The Tribal concept of thinking outward from a central point in a circle or spiral shape should be incorporated into the project;
- Untold stories need to be heard;
- The development of protocols for incorporating Tribal oral history information into paleolandscape reconstruction and predictive modeling should be central to the project;
- Tribal peoples have a responsibility to stand with their ancestors in the protection of the integrity of their final resting places; and
- Tribal peoples should accept the opportunity to reach out and make build relationships in all manner of public places, including science, government, and private enterprise.

The following issues were identified as concerns regarding the scientific information presented in Day 1:

- Site preservation and excavation are not the same thing, and language describing these activities should be used carefully;
- Important cultural sites are not necessarily the same as identified archaeological sites;
- Laws are not in place for protection of sites found on the OCS, and;
- The effects of fishing and other commercial activities on site preservation should be considered.

2.1.11 Insights from the Day

Gerrod Smith, Chief Financial Officer and Natural Resource Advisor, Shinnecock Indian Nation, Long Island, New York. This short presentation provided insights into the Submerged Paleocultural Landscapes Project from the experiences of the Shinnecock Nation on Long Island, New York.

The Shinnecock peoples inhabit approximately 405 hectares (ha) of land in Southampton on Long Island. In the past, their lands extended further seaward and natural resources were more plentiful. The effects of climate change and sea level rise on Shinnecock lands are at the forefront of their concerns. During the Industrial Revolution, energy was obtained from the ocean in the form of whale oil. In the present day, the ocean is again being examined as the source of energy, in the form of alternative energy projects. This suggests that Tribal and non-Tribal peoples are coming back into balance and are moving forward together.

2.2 DAY 2

Jennifer McCann, URI-CRC opened the second day of the conference by providing a brief recap of Day 1 activities, and discussing the goals for Day 2. It was hoped that, by the end of Day 2, conference participants would have:

1. Provided their recommendations for best practices that would contribute to the creation of a standard methodology and protocols for identifying and understanding ancient Native American submerged cultural resources on the OCS;

2. Identified appropriate techniques and steps that would foster open communications and meaningful interaction among all parties throughout the four-year project; and

3. Contributed to the development of a common understanding and language for the cultural, scientific, and archaeological aspects of the project.

Sessions consisted of open-forum discussions or oral presentations followed by open discussion. Attendance was open to all workshop participants, as well as outside interested parties.

2.2.1 Perspectives and Expectations: Interactive Discussion

Jennifer McCann, URI-CRC (moderator). This session was interactive discussion designed to explore the diverse perspectives and expectations that participants brought to the conference. Jennifer McCann asked a representative from The Mohegan Tribe and from the Lenape Indian Tribe of Delaware to initiate the discussion by sharing their perspectives on the Project as Tribal members.

2.2.1.1 Elaine Thomas, The Mohegan Tribe THPO

The Mohegan people as a coastal tribe with an ancient and continuous relationship to water and the sea. Waterways were 'highways' for the Mohegan people. Their use enabled them to move easily throughout the landscape. It is important to understand that Tribal peoples did not just move around on the landscape for subsistence purposes, but also for ceremony, since spirituality is very important to the lifeways of Tribal peoples. Many shell middens from ancestral Mohegan peoples still exist. They should not be viewed as part of a 'lost' culture, but instead as lifeways that connect ancient and contemporary Tribal peoples. These sites still have a spirit that is waiting to be reawakened.

The shape of a circle has significant spiritual association for Tribal peoples. As the Project moves forward in its study of the association between ancient Native peoples and landscape they inhabited, it is worth incorporating the concept of a circle. Perhaps the four traditional compass directions (north, south, east, and west) could be replaced with the Tribal understanding of these directions; north representing life-sustaining water, south representing ceremony, east representing the movement of people on the landscape, and west representing spirituality. In the middle of this circle is medicine. Tribal peoples see things in the water and upon the water reflected in the stone on the landscape in ceremonial spaces. The spirituality and good medicine of the sea is brought onto the land in this way, and this project should carry this concept into the future for the betterment of all people. The future belongs to all of us.

Thomas shared the story of a Mohegan elder who recently provided the opportunity for six non-Tribal juvenile felons to build a dugout canoe with traditional Native American methods. When the canoe was completed, the Tribal elder and six boys piloted the canoe on a 26-kilometer (km) journey to Long Island. During the journey, a bald eagle followed the canoe and stayed at their camp overnight, which was interpreted as a manifestation of the 'good medicine' that resulted from the canoe-building experience. This example demonstrates the power of the good medicine that can be exchanged between the Tribal and non-Tribal communities.

2.2.1.2 Dennis Coker, Principal Chief, Lenape Indian Tribe of Delaware

Tribal engagement in long term projects is essential to help restore Native Americans to their strength and status prior to European contact. Technical scientific data are not always easy to understand for lay people, but participation in the Submerged Paleocultural Landscapes Project, and similar projects, provides the opportunity for Tribal peoples to begin aquiring the knowledge necessary to become the authorities and consultants on their ancient culture, and not be forced to accept the Eurocentric interpretations of their culture. This Project provides an important opportunity for knowledge to be conveyed to Tribal peoples who can then utilize existing scientific information to assist with the interpretation of the cultural significance of ancient sites. Tribal interaction with regulatory personnel assures that Tribal interests can be heard.

2.2.1.3 Discussion of Concerns, Expectations, and Opportunities

Each member of the audience was encouraged to write their concerns, expectations, and ideas regarding the opportunities provided by the Project on blank "Sticky Notes," and to affix them to posters displayed by topic on the conference room walls. In order to initiate an open forum discussion, *Jennifer McCann* posed questions to conference participants based on the Sticky Note responses. Questions and responses are summarized below.

1. Is it possible for Tribal people to identify submerged sacred landscapes from remote sensing techniques alone, or is it necessary for individuals to visit the sea floor?

    - It is essential for Tribal people to participate in offshore surveys, so that they can more fully understand the tools, technologies and processes that research-based scientists use to examine and interpret the seafloor. In this way, Tribal people can also bring Tribal "eyes" and their spiritual connection to what is ancient on, or under, the seafloor to the interpretation of data being collected. The assessment and interpretation of the data should be conducted so that the interpretations of the research-based scientists and Tribal people are integrated.

2. If culturally-sensitive sites are identified on the continental shelf, what concepts could form regulatory 'Best Practices' for managing and protecting these sites?

    - General knowledge and understanding of existing laws protecting culturally sensitive sites identified on the continental shelf need to be better understood by the Tribes and the language of those laws clarified, so that they can be understood. Laws need to be in-place that provide similar protections for offshore cultural sites as those established for land sites, particularly for human burial sites identified offshore. Relationships and communications between Tribal and non-Tribal governing bodies need to be improved and to be more consistent, so that all consulting parties have adequate information regarding anticipated impacts, planned survey operations, and identified cultural sites; and

    - While legislation already exits to protect culturally-sensitive submerged sites, enforcement of that protection can be problematic, particularly when it involes the overlapping jurisdictions of multiple agencies. Consequently, protection of sites is often inadequate. Existing laws protecting submerged cultural resources should be re-examined, and discussions should be initiated between the Tribes and federal and state agencies regarding these laws, so that all parties can develop a common understanding of the current legistative framework. BOEM is currently funding a study synthesizing all relevant statutes and case law related to the protection of underwater heritage sites, particularly as they pertain to the outer continental shelf, to address this very need. An online database will be produced making the results of this synthesis public and legislative gaps will be identified.[1]

[1] This study and the resulting document entitled "Underwater Cultural Heritage Law Study," has been completed and is available online: www.data.boem.gov/PI/PDFImages/ESPIS/5/5341.pdf

3. Tribal oral traditions can inform scientific research by providing information about what culturally-sensitive sites look like, where they are located, and the cultural traditions and behaviors of ancient peoples. Oral traditions can also assist with interpreting the scientific data by providing insight into how and why patterns occur in the data. What concepts should research-based scientists keep in mind when interacting with Tribal members and studying ancient sites? What can research-based science offer Tribal peoples?

   - Ancient Tribal peoples were not divided into soverign nations with boundaries and borders, but were united as one people with rich traditions and histories that are maintained by contemporary Tribal members. Research-based scientists can assist Tribal peoples by regarding Trial oral history as valid information, not mythology;

   - The Project team is committed to conducting research that will benefit Tribes, and to assist them with understanding their ancient past to the extent that they are able to do so. Tribal members feel that establishing truly respectful communication practices and diplomacy between research-based scientists and Tribal groups is an essential first step towards allowing Tribes to be instrumental in preserving the sites of their ancestors; and

   - Research-based scientists can assist Tribes by providing opportunities for Tribal members to develop expertise with scientific equipment and data, as well as training opportunities for Tribal youth.

2.2.2 Best Practices for Paleoenvironmental Reconstruction

Brandi Carrier, BOEM (moderator). Paleoenvironmental reconstructions require interdisciplinary data. It is important to begin compiling these data in one place, since there is one story to tell. This session focused on presenting methods for paleoenvironmental reconstructions, and disusssing best practices based on integrating research-based and Tribal perspectives. Invited speakers gave presentations, which were followed by open forum discussion.

2.2.2.1 John King, URI-GSO

The manner in which humans interacted with the environment is thought to have changed over time. In earliest times, the natural environment is thought to have controlled much of human behavior. As societies evolved and became more complex, human behavior was controlled more by the social environment. The Submerged Paleocultural Landscapes Project focuses on a time period when the human "footprint" on the environment was faint; therefore, identifying human activities on currently submerged paleolandscapes on the continental shelf will be a challenge.

A critical step toward identifying the locations of archaeologically sensitive areas is to use geological data to reconstruct the paleoenvironment in which ancient people lived as accurately as possible. The Project team will utilize geophysical survey and geotechnical sampling data (i.e., sediment cores, surface grab samples, etc.), combined with analyses of paleoenvironmental proxies, such as magnetic susceptibility, biogenic silica, nitrogen isotopes, fossil pollen, and foraminifera, to develop regional age models, produce paleoenvironmental reconstructions, and understand the timing and effects on the paleocultural landscape of marine transgression. It is anticipated that Tribal oral histories will provide invaluable information regarding the culture and behavior of ancestral peoples and the manner in which they interacted with the landscape. The combination of geological research-based paleoenvironmental reconstructions with Tribal oral history information will provide the most accurate information regarding the potential locations of submerged cultural sites.

2.2.2.2 Richard Getchell, Aroostook Band of Micmacs

Tribal knowledge should be applied to the paleoenvironmental landscape reconstruction process and to the process by which submerged cultural sites are located. Tribes should be asked if they have knowledge about what the natural environment was like in the ancient past. It is important to remember, however, that not all Tribes have recaptured their culture enough to be able to relate that type of traditional knowledge to the scientific community, and that some Tribes may not be comfortable providing the information they do have. In addition, it should also be acknowledged that Tribal oral history information originating after the time of European contact and settlement may reflect a degree of assimilation between cultures. Combining information from Tribal oral histories with research-based scientific knowledge is extremely important, but will take time and a significant amount of work for all involved to accomplish. Research-based scientists will need to understand details about Tribal culture, such as the traditional Tribal patterns of movement along the coasts, the preferences and behaviors associated with agricultural practices, the sources of natural resources used to trade and produce goods, and the types of activities that occurred at various sites. Tribal members should recognize that at one point in time, they were one nation, and that they can once again unite to protect the sites of their ancestors and provide Tribal oral histories that can inform the Project's paleolandscape reconstruction process.

2.2.2.3 Discussion

Tribal leaders attending the workshop felt that it is important for Tribal members to have the same degree of research-based knowledge as the scientific community, and that collaborations that develop this knowledge are viewed as meaningful investments for Tribes. Science comes naturally to Tribal young people, particularly when viewed from the perspective of traditional Tribal cultural teachings. For example, Tribal elders encourage young people to 'listen to the trees.' This statement has great meaning for Tribal peoples, because close attention to, and respect for, the natural world is necessary to access the resources they rely upon, and to undertand what is going on in the world. This type of knowledge makes Tribal people scientists, and is an integral part of who they are. Western scientists need to educate themselves about Tribal perspectives and understand that Tribal knowledge comes in many forms and from many sources.

One of the primary goals of the Submerged Paleocultural Landscapes Project is to create opportunities for Tribal members, including Tribal youth, to fully participate in the scientific process. However, there is significant concern that research-based scientists and regulators will view Tribal knowledge as simply another type of data that needs to be extracted from a new source. The scientific community needs to understand that Tribal peoples have a deeply significant connection to their ancestors and that this connection is at the center of Tribal oral history and tradition. This relationship must be viewed with reverence if Tribal oral history knowledge is to be combined with research-based science in a respectful and positive manner.

2.2.2.4 Best Practices Resulting from Discussion

- Understand that modern Tribal peoples have a vital connection to their ancient ancestors, and that their primary goal is to protect the sites that their ancestors occupied;

- Establish a genuine collaboration with Tribal peoples based on mutual respect and understanding before attempting to integrate traditional oral history information with research-based scientific data. Scientists should avoid regarding Tribal oral history information simply as data to be extracted from Tribal peoples;

- Regard Tribal traditional knowledge with equal importance as research-based scientific data and understand that the word 'science' should define both types of knowledge;

- Recognize that predictive models are based on assumptions about the manner in which ancient peoples interacted with their environment and that those assumptions may be incompletely developed or simply wrong;

- Understand that paleoenvironmental data alone will not produce an accurate prediction about the location of submerged cultural sites. Traditional knowledge regarding the cultural and societal attitudes and behaviors of ancient Tribal peoples is essential for any locational model;

- Recognize that not all Tribal people have recaptured their culture enough to provide detailed information derived from their Tribal oral history, or may not feel comfortable discussing their oral history with non-Tribal people;

- Understand that a respectful understanding of the traditions and practices of modern Tribal cultures may aid in deciphering the attitudes and behaviors of ancient Tribal peoples, and therefore should be considered while attempting to better understand and model the potential locations of submerged paleocultural landscapes and sites; and

- Involve Tribal youth in research-based scientific projects since Tribal young people are natural scientists and can provide a unique bridge between Western science and humanity-based Tribal science.

2.2.3 Best Practices for Predictive Modeling of Site Locations

William Hoffman, BOEM (moderator). Archaeological predictive models are commonly used within the academic community; however, BOEM is concerned that these maps may oversimplify the cultural sensitivity of a geographic area and suggest that 'low sensitivity' areas are unimportant and do not require investigation. This session provided an opportunity for conference participants to discuss their experiences and concerns regarding the use of archaeological predictive models to identify submerged cultural sites.

2.2.3.1 Philip Verhagen, Vrije Universiteit Amsterdam, Netherlands

Predictive models are attractive because they have the potential to provide information about geographic areas that have not been studied through field investigations, or for which limited amounts of data exist. Well-designed models may allow change scenarios to be created, provide context for understanding the importance of a site relative to other sites, and offer insight into choosing which geographic locations warrant field investigations. Predictive models are also the subject of considerable debate within the archaeological community, because they result in an oversimplification of the actual environment and are biased by the assumptions and data used in their development. In order to develop accurate and useful predictive models of archaeologically sensitive sites, models need to: 1) be designed using credible methods and a combination of methods; 2) be updated as new information becomes available; 3) be testable and reproducible; and 4) be developed with the understanding that they will serve as tools to inform the project, not as the primary basis for policy and decision making. The Submerged Paleocultural Landscapes Project provides a unique opportunity to develop an understanding about past environments and the culture and behavior of ancient Native peoples through its collaboration with contemporary Native peoples. It is predicted that the information resulting from this collaboration will be invaluable for developing models based not just on environmental characteristics, but on an better understanding of the the manner in which ancient peoples chose to interact with their surroundings.

2.2.3.2 Jørgen Dencker, Viking Ship Museum, Denmark

In Denmark, a successful site settlement model has been developed by mapping Stone Age sites along coastal shorelines that are currently above sea level. The model is based on identifying geographic areas that provide favorable environmental characteristics for fishing, such as locations at the outlet of freshwater streams, islands, sheltered lagoons, or points of land that project into a water body. A primary assumption underlying this model is that favorable places to fish are also likely to be favorable places to live. This model has been used successfully in Denmark since the 1980s, but it is essential to remember that it does not represent the entirety of Stone Age human behavior, nor is it always accurate. Significant settlements have been discovered in geographic areas that the model designates as 'low probability.' Predictive models should be used only as tools to assist the cultural resource management process, not as the primary source of information for policy decisions.

2.2.3.3 Brian Jones, Senior Archaeologist, Archaeological and Historical Services, Inc.

In the United States, the use of statistical, GIS-based predictive models for cultural resource management has been problematic, because only the most archaeologically-sensitive areas delineated by the model tend to be investigated due to the limited budgets associated with compliance surveys. Restricting focused investigations to 'high sensitivity' areas only tends to confirm what is already known about a project area and implies that other areas are of limited cultural and archaeological importance. Modeling is a necessary first step, but it should not be used as the only method to establish the locations of culturally sensitive sites. Our undersanding about how ancient peoples lived and interacted with their environment is oversimplified by typical predictive models.

2.2.3.4 Discussion

Workshop participants voiced significant concerns about using predictive models to determine the location of culturally sensitive sites, and about the high potential for such models to be misused. Well-designed models can be a useful starting point for cultural resource management, but should not be the primary basis for policy decisions for the following reasons:

1. Models are based on an oversimplification of environmental conditions, and on a very limited understanding of the behavior, motivations, and activities of ancient peoples;

2. Models are constrained by the data used to create them, and are biased according to the types of data used, and the quality and resolution of these data; and

3. Models often result in a ranking of geographic areas into low, medium, or high sensitivity, implying that low sensitivity areas are unimportant and do not warrant further investigation or consideration.

2.2.3.5 Best Practices Resulting from Discussion

- Use archaeological predictive models cautiously with a thorough understanding of the assumptions and biases underlying the model;

- Avoid using archaeological predictive models as the primary basis for policy decisions. Instead, regard predictive modeling as one of several tools available to inform cultural resource management decisions;

- Develop methods to insure that archaeological sensitivity maps can be validated and are not misused;

- Recognize that geographic areas designated as 'low sensitivity' by predictuve models may, nonetheless, contain important cultural resources;

- Design models so that they can be updated and revised as additional data becomes available; and

- Recognize that robust archaeological predictive modeling requires sophisticated data processing, as well as complex statistical and computer analysis skills, which take time and expertise to master.

2.2.4 Best Practices for Integrating Tribal/Non-Tribal Oral Histories into Predictive Modeling

Doug Harris (NITHPO) (moderator). This session was intended to provide an opportunity for workshop participants to engage in dialog about ways that Tribal and non-Tribal oral histories could be integrated into archaeological predictive modeling. The session included a question/response discussion and the screening of a filmed lecture followed by open dialog among all participants.

2.2.4.1 Kevin McBride, University of Connecticut & Mashantucket Pequot Museum and Research Center

The session began with the moderator asking for comment regarding an apparent tendency on the part of archaeologists to be restricted in their thinking when adhering to predictive modeling paradigms. The discussion was initiated by *Kevin McBride (MPMRC/UConn)* and quickly opened to all participants, and focused on the idea that archaeologists only know what they think they know and that the knowledge archaeologists have is based primarily on their previous experience doing archaeology. Their knowledge, which is somewhat limited on land, is even more limited when applied to the submerged environment. It must be acknowledged that archaeologists only see in the archaeological record what they expect to see – what they are trained to see. The result is an approach that is limited in its ability to think expansively and imaginatively or from a Tribal perspective. Broadening one's view on what is possible and thinking outside the boundaries of existing paradigms and predictive models is very important and necessary for knowledge gained through archaeological research to advance. Tribal people have the capacity to bring a wealth of traditional knowledge, combined with a Tribal cultural perspective that is very different from a Western scientist's perspective, to archaeology and the predictive modeling process that could inform our understanding of the past and impact long-standing paradigms in ways not yet imagined.

2.2.4.2 Screening of film by Dennis Stanford

New discoveries can also change existing paradigms. The session moderator screened for the workshop participants a filmed lecture by Smithosonian Institution (SI) archaeologist, Dennis Stanford, in which he described the 'Cinmar Find' and made the case for it potentially being such a discovery. Consisting of a 23,760-year old mastodon tusk and a stone blade of banded-rhyolite, these two elements of the Cinmar Find were purported to have been recovered together in 1970 in the same scallop-dredge trawl towed from the F/V *Cinmar* about 81 km off of the coast of Delaware in approximately 73 m of water. If legitimate, the find would provide the earliest evidence for people living in the Americas on the lands that are now part of the submerged outer continental shelf.

2.2.4.3 Discussion

The open forum discussion ocurring after the discussant comments and the film screening focused on the opportunity this project provides to engage groups of all interests, including fishermen. The importance of building trust and respect between individuals from diverse groups was emphasized as a requirement for effective collaboration.

While the Cinmar find is inherently compelling, from a scientific standpoint it represents, unfortunately, an unverifiable discovery with an unprovable association between the stone blade and mammoth tusk. Additionally, the find was made serendipitously some 45 years ago by the now-deceased captain of the F/V *Cinmar*, prior to being transferred to an artifact collector, before it was donated to the small local museum where it was found by one of Stanford's colleagues and brought to his attention. It was noted during the workshop by one of the participants that "extraordinary claims require extraordinary data to support them." Finding a site like that which may have produced the Cinmar Find with confirmable locational and contextual integrity that is excavated in a controlled manner using best practice protocols, such as those we are now trying to develop, will be necessary to alter present paradigms.

2.2.4.4 Best Practices Resulting from Discussion

It became clear from the dialog that occured in this session that hope of meeting the objective of the session was premature relative to the overall process of engaging Tribal workshop participants in a discussion about specific best practices for integrating Tribal/non-Tribal oral histories into predictive modeling. Instead, this session, and the overall workshop in general, must been seen for what they were - the start of necessary dialog between researchers, Tribes and agencies conducted in a way that has not happened before (i.e., from within a framework of partnership and cooperative/collaborative research rather than from a regulatory/compliance framework). Workshop participants (non-Tribal and Tribal) clearly needed more time beyond the alloted two-day timeframe of the workshop to process cognitively, symbolically, and spiritually the content and meaning of the workshop's discussions about the Project's goals, objectives, and proposed research design, and the current level of Western scientific knowledge about the submerged paleocultural landscape, to be able to comment on and provide specific guidance about the project and its proposed research.

2.2.5 Best Practices for Identifyng and Reconstructing Submerged Paleolandscapes

Monique LaFrance, URI-GSO (moderator). This session introduced workshop participants to the methodological approaches used to reconstruct submerged paleolandscapes in Massachusetts, the Gulf of Mexico, and Maine and provided a forum to exhange ideas regarding best practices derived from existing research.

2.2.5.1 William Schwab, U.S. Geological Survey

Reconstructing submerged paleolandscapes requires a three-dimensional characterization of the sea floor that is dependent on high-resolution, closely spaced datasets. A recent collaboration between the United States Geological Survey (USGS) and the Massachusetts Office of Coastal Zone Management produced a high-resolution geological and geophysical characterization of a 50-x-20 km area of Buzzards Bay, Massachusetts (*see Foster, D.S., Baldwin, W.E., Barnhardt, W.A., Schwab, W.C., Ackerman, S.D., Andrews, B.D., and Pendleton, E.A., 2015, Shallow geology, sea-floor texture, and physiographic zones of Buzzards Bay, Massachusetts: U.S. Geological Survey Open-File Report 2014–1220, http://dx.doi.org/10.3133/ofr20141220*). Seismic reflection profiles collected at 100-m line spacing, high-resolution multibeam bathymetry, acoustic backscatter data, seabed photographs, and surficial sediment samples were used to recreate the glacial and Holocene history of the area, and they formed the basis for a paleolandscape reconstruction. These data indicate that Buzzards Bay is characterized by a complex glacial and post-glacial morphology consisting of sedimentary deposits representing beaches, swamps, back lagoons, streams, glacial lakes and glacial outwash, and stratified morainal deposits. The pre-submergence land-surface was successfully recreated by 'backstripping,' or digitally removing the marine, estuarine, and fluvial sediments, to produce a three-dimensional representation of the paleolandscape prior to marine inundation. The Buzzards Bay project could serve as a model for the paleolandscape reconstruction component of the Submerged Paleocultural Landscapes Project, but it is important to consider that obtaining high-resolution data at this scale is extremely expensive and time consuming. The Buzzards Bay project required 3.5 months of ship time, 3 years of analysis, and cost approximately $3M, exclusive of the sediment coring that still needs to be completed in order to confirm existing paleoenvironmental interpretations.

2.2.5.2 Amanda Evans, Tesla Offshore, LLC

In the Gulf of Mexico, the potential cultural sensitivity of submerged paleolandscapes has been a concern within the regulatory community for the last 40 years. The Gulf of Mexico is characterized by a different geologic and human habitation history than the Rhode Island OCS, and the Tribal oral history traditions of the area do not extend as far back in time, but lessons used in the Gulf will be helpful in guiding the Submerged Paleolandscapes Project. Submerged paleolandscape reconstruction efforts in the Gulf of Mexico have benefited from access to good, large scale baseline data derived from oil and gas development. The following general methodology has been shown to be effective: 1) reconstruct paleolandscapes based on existing data; 2) conduct further geophysical surveys; and 3) perform physical sediment sampling and assess paleoenvironmental proxies to confirm geophysical interpretations and look for evidence of cultural materials and paleosols. Sea level rise was modeled by combining data sources from different regions throughout the Gulf and developing a consensus identifying minimum and maximum levels. It is important to note that this method does not attempt to identify specific culturally sensitive sites but instead focuses on assessing whether the paleolandscape could have supported human habitation. To date, evidence has been found for the existence of hospitable paleoenvironments in the Gulf of Mexico, but cultural sites have not been located.

2.2.5.3 Daniel Belknap, University of Maine (Orono)

In order to assess the archaeological sensitivity of an area, it is first necessary to establish the extent to which the paleolandscape was preserved during marine innundation. Sea level rise is often associated with significant erosion of the landscape, and culturally sensitive sites are only likely to occur in geographic areas where the currently submerged paleolandscape has been preserved intact. Studies in Delaware, Maine, and southern Ireland indicate that geographic areas that are subjected to high energy conditions during marine innundation are unlikely to preserve *in situ* cultural resources, whereas areas characterized by basins or depressions that were overtopped quickly by the encroaching sea, or sites protected by gradually transgressing barrier islands, have higher preservation potential. Understanding the paleolandscape preservation potential in a study area and then assessing whether the intact paleolandscapes provide paleoenvironmental conditions that would be favorable for habitation, ceremonial, and/or spiritual activites can be an effective approach for identifying culturally sensitive sites. Multibeam bathymetry, sub-bottom profiler surveys, and sediment coring are essential tools for paleolandscape and paleoenvironmental reconstruction. Tribal oral history can provide important information about site preferences of ancient peoples, but currently there is no single established method for utilizing these resources to produce a conceptual model that will predict where new culturally sensitive sites will be found.

2.2.5.4 Discussion

Three-dimensional models of submerged paleolandscapes can be powerful tools for visualizing the natural environment experienced by ancient Tribal peoples and for helping to assess the potential locations of submerged cultural sites. Landscape visualizations are easily understandable by diverse audiences and can serve as a common frame of reference for discussions regarding cultural resource preservation. However, it is important to remember that comprehensive paleolandscape reconstructions are derived from discrete datasets, not from continuous coverage of a geographic area, and that the modeling process may misrepresent or overlook locations of paleoenvironmental or cultural significance. In addition, robust paleolandscape models, particularly those that incorporate backstripping, require an extensive amount of data collection, and significant expertise is necessary to process and interpret these data. The following suggestions were discussed as methods to maximize the efficiency and effectiveness of paleolandscape modeling process:

1. To maximize project resources and assemble the most complete dataset possible, any data that has been previously-collected in the study area should be leveraged at the beginning of a new project and used to assist with survey planning and the interpretation of newly collected data. This process can be challenging since data from varying sources may not be easily accessible and will likely have been collected for varying purposes at different resolutions. The National Ocean Policy Implementation Plan may assist with maximizing the efficiency of Federally-funded surveying projects by providing a method by which Federal agencies collaborate with each other and share data;

2. Obtaining adequate numbers of sediment cores to ground-truth the interpretations derived from remote sensing data is highy desirable, but there is no agreement on the number of cores that are necessary to validate a paleolandscape model;

3. Federal agencies should focus on funding the development of a regional understanding of a particular area and then 'narrow down' the focus. There is great utility in obtaining a broad regional geological perspective through preliminary reconaissance surveys that can then be used to help focus subsequent and more detailed investigations. Detailed data for an entire region is optimal for accurately assessing cultural sensitivity. Small areas associated with project impact footprints or narrow swaths of data like those typically obtained when archaeological surveys are conducted for a proposed submarine cable or pipeline corridors are not likely to be particularly informative when trying to use them to reconstruct submerged paleocultural landscapes; and

4. Protocols should be developed to insure that paleolandscape reconstructions are robust enough to support the goals of a project, particularly with respect to assessing the locations of culturally sensitive areas. Three-dimensional landscape reconstructions are potentially useful tools, but if the limitations of the reconstruction are not fully understood, the potential exists for them to be misused. It is hoped that the Submerged Paleocultural Landscapes Project will result in clarification of the methodologies necessary to create accurate paleolandscape reconstructions.

2.2.5.6 Best Practices Resulting from Discussion

- Understand that accurate paleolandscape reconstructions require large amounts of high-quality, closely-spaced data that are expensive and time-consuming to collect and process, and require significant expertise to interpret;

- Employ 'back-stripping' techniques during sub-bottom data post-processing and plotting to remove marine sediments and produce data-based models of the ravinement surface to obtain the most accurate paleolandscape reconstruction;

- Use local sea level rise curves when conducting paleolandscape reconstructions, since regional sea level rise curves may not provide an accurate model for local geographic areas;

- Consider designing studies that focus on assessing the archaeological *preservation potential* of an area, not on identifying specific areas of varying archaeological *sensitivity*;

- Focus cultural sensitivity assessments on geographic areas where the paleolandscape has not been extensively modified by marine innundation;

- Combine multibeam bathymetry, sub-bottom profiler surveys, sediment coring, and Tribal oral history to create the most robust paleolandscape reconstructions;

- Conduct sub-bottom profiler surveys using the narrowest trackline spacing possible within the time and budgetary constraints of the project;

- Begin analysis on regional scale and narrow analysis as more data collected;

- Leverage previously collected data at the beginning of a new project to maximize project resources and assemble the most complete dataset possible; and

- Develop protocols to insure that paleolandscape reconstructions are robust enough to support the goals of a project, particularly with respect to assessing the locations of culturally sensitive areas, and are not misused.

2.2.6 Best Practices for Submerged Settlement Site Identification and Excavation

Kevin McBride (MPMRC/UCONN) (Moderator). This session was intended to provide an opportunity for workshop participants to engage in dialog about best practices for identifying and excavating submerged paleocultural landscapes, based on the experiences of two European researchers actively engaged in submerged settlement field research in the waters of the United Kingdom and Denmark. The session consisted of two presentations followed by a discussion led by the moderator.

2.2.6.1 Jørgen Dencker, Director of Research, Viking Ship Museum, Denmark

The session began with a presentation by Jorgen Dencker, a pioneer in submerged settlements field methods and applied research, describing the techniques he has developed for identifying and excavating submerged Stone Age sites in Europe over more than four decades of active field research. Much of his experience is based on the archaeological surveys done in Danish waters for offshore development projects, such as submarine cables, the routes of which extend long distances across large marine water bodies containing submerged paleoshorelines and paleochannels.

In most cases, Dencker has found that submerged Stone Age cultural materials in Danish waters are embedded and exposed in a 'cultural layer' consisting of '*gyttja*,' a sticky, erosion-resistant, organic-rich, mud deposit formed in exposed marshy/peaty topographic lows or deposited in nearshore environments on the margins of ancient water bodies within 10 to 20 m of their former paleoshorelines. Dencker's experience has been that the upland areas adjacent to the topographic lows are usually eroded away by sea level rise. While preservation of paleosols most often occurs in the low, peaty areas, it is not always the case. There have been times when the paleosols and surrounding sediments eroded all the way down to the culturally-sterile Pleistocene clay, except in areas under trees, rocks or thick layers of erosion-resistant peat where they have been preferentially preserved as small areas of pedestalled paleosols with cultural materials present within them.

When surveying for sites, it has sometimes been necessary to reduce the spacing of sub-bottom profiling survey lines to a distance of just 10 m apart in order to adequately characterize the submerged landscape and to predict the locations of submerged cultural sites within it. In shallow waters where marine sediments overlying archaeological paleosols are thin, sites are identified through visual surveys using archaeological divers swimming along long transects (i.e., the underwater equivalent of a visual reconnaissance walk-over survey on land). Paleosols are then identified by hand-fanning away thin marine sediments or with diver-acquired push-cores. Marine sediments overlying paleosols that are thicker than can be easily hand-fanned away are excavated in 1-x-1 m archaeological test units with a diver-held induction-dredge. Diver-acquired push-cores are taken around test units that contain cultural material. This coring is performed to document surrounding stratigraphy and to map the extent of the site's limits and the location of the adjacent paleoshoreline.

Excavation of test units takes 6 to 7 times longer than it does to excavate the same-sized test pits on land. Sediments are excavated by hand and fed into the 'head' or suction end of an underwater induction-dredge. Disturbance of silt inside of the test unit is minimized to maintain optimal underwater visibility and control while excavating. The exhaust end of the dredge hose is equipped with a mesh bag to capture any artifacts and ecofacts not recovered by hand during the excavation process. When excavating test units in deeper waters further offshore or in marine sediments deeper than about 2 m, it may be necessary to use large pumps/commercial dredgers and sift through the recovered materials on the surface as they are pumped up onto the deck of a boat to determine presence/absence of submerged cultural materials.

2.2.6.2 Kieran Westley, University of Ulster, UK

Field investigations in the United Kingdom have been conducted off the coast of Ireland to develop predictive models, to reconstruct submerged paleolandscapes and to identify submerged Stone Age settlements. Westley commented that Dencker's presentation made it abundantly clear that it is perfectly feasible to excavate submerged cultural landscapes in the same careful and respectful manner as one excavates them on land and to ensure that the maximum amount of information is retained as a result. Westley also noted that there is a need to bridge a methodological gap he sees between surveying for archaeological sites and mapping and reconstructing landscapes, citing the suitability of 30 to 100 m survey trackline spacing for larger-scale landscape reconstructions, but the tighter trackline spacing (as little as 10 m, according to Dencker) needed for identifying submerged sites. Finally, Westley addressed Dencker's interesting observation that paleosol preservation is often associated with peat deposits, the latter of which seem to be more stable than the upland landscape surrounding them.

2.2.6.3 Discussion

Methodological differences between identifying and characterizing submerged paleolandscapes and identifying cultural deposits within them, as well as how the preservation differential between sites preserved underwater versus those found on land could influence site identification survey methods, were topics of discussion following the session's presentations. While 30 m sub-bottom survey trackline spacing seems adequate for identifying paleolandforms, the experience in Denmark is that a sub-bottom profiler survey trackline spacing of as little as 10 m is necessary to predict with a high degree of certainty the locations of sites within a submerged paleolandcape. A recommended approach is that all geophysical/remote sensing survey capabilities should be exhausted before moving to sub-surface visual inspections (e.g., using a visual sediment probe) and sampling. Geotechnical sampling, such as coring, allows verification of interpretations of geophysical/remote sensing data and the identification of submerged landscapes. Coring can also be used to identify cultural sites within these landscapes and to guide sub-surface archaeological testing/site identification.

Micro-debitage density was suggested as a useful marker for refining sub-surface testing surveys from a program of broad-interval sampling to one of close-interval sampling (i.e., greater densities of micro-debitage presumably occur closer to the location where human tool-making activities were occurring, thus areas of greater micro-debitage densities should be foci for close-interval sampling). Sediment chemistry (e.g., levels of phosphorous) was also suggested as a useful marker for identifying archaeological sites from sediment coring data.

Survey areas in shallow waters that are not deeply buried by marine sediments are recommended for survey by divers performing visual reconnaissance underwater and using diver-operated hand-cores or a diver-held induction dredge. Site identification surveys of submerged paleolandscapes buried too deeply under marine sediments or located in waters too deep or unsafe for archaeologists to dive in can be sampled using vessel-based coring and industrial dredging systems. It was recommended that development of best practice methods for identifying paleocultural landscapes in submerged environments consider that the physical evidence of a submerged cultural site, once located, is often much better preserved and, thus, can be far less subtle, than those of similarly ancient sites found on land. This is true particularly for the organic components of submerged sites, which have been found to be the prevalent material type comprising most submerged site assemblages. Contrast this with the atypical preservation of organics for terrestrial sites where they are rarely found. Developing cultural site identification methods using terrestrially-biased paradigms and methodologies designed primarily for identifying only trace elements of sites (e.g., stone artifacts and chipping debris, charcoal, faint stains in soils, and chemical markers) may be less critical for confirming the identification of cultural sites in submerged contexts.

Regardless of the methodology developed that is best for informing archaeological research, from a Tribal perspective, destruction of cultural resources as part of the site identification process is not acceptable.

2.2.6.4 Best Practices Resulting from Discussion

- Acknowledge that there is a significant preservation differential between sites preserved underwater (better) versus those found on land (worse) that could influence site identification methods, and that the physical evidence of submerged cultural sites may be far less subtle and more obvious than that of similarly ancient sites found on land;

- Recognize that there are different methodological requirements for identifying and characterizing submerged paleolandscapes (likely to cover broader expanses of the sea floor) versus those for identifying cultural deposits preserved within a submerged paleolandscape (likely to be smaller and more discretely distributed);

- Design site identification processes that are minimally impactful to submerged cultural sites and are respectful of Tribal perspectives and traditions by exhausting non-disturbance geophysical/remote sensing survey options before conducting ground-disturbing sub-surface investigations and sampling;

- Consider erosion-resistant, organic-rich deposits formed in exposed marshy/peaty topographic lows or deposited in nearshore environments on the margins of ancient water bodies and former paleoshorelines to be areas with greater potential for post-inundation preservation of the submerged paleolandscape and cultural deposits within it;

- Recognize the possibility of and look for when surveying isolated instances where upland elements of the submerged paleolandscape can be preserved (e.g., when buried and protected from erosion under tree remains, rocks, and peat deposits);

- Employ conservative trackline spacings (as little as 10 m) when conducting detailed surveying for submerged cultural sites using sub-bottom profiling;

- Identify exposed or shallowly-buried (1 m or less) paleolandscapes and submerged cultural sites by employing archaeological divers performing visual reconnaissance underwater survey along series of parallel- and perpendicularly-oriented transects. Follow as needed to document surrounding stratigraphy, identify and map sites and their extents with diver-operated hand-coring and/or sub-surface testing using an induction dredge in survey areas located in relatively shallow waters where the paleolandscape is not deeply buried by marine sediments and the waters are safe for conducting diving operations. Allow 6 to 7 times more time to excavate the same size and number of test pits underwater as the time required to excavate them on land;

- Feed sediments excavated by hand into the 'head' or suction end of an underwater induction-dredge, rather than excavate by plunging the dredge-head blindly into the sediments, to prevent damaging or destroying fragile organic cultural materials and ecofacts typically found preserved on submerged cultural sites;

- Seek to minimize disturbance of silt inside of test units to maintain optimal underwater visibility and control while excavating;

- Affix a mesh bag to the exhaust end of the dredge hose to capture any artifacts and ecofacts not recovered by hand during the underwater excavation process. Change out the bag as each natural stratum or arbitrary level is excavated and have surface personnel sort through the bag's contents to recover artifacts and ecofacts for subsequent documentation, cataloging, preservation and curation, as warranted;

- Have adequate experience, equipment and facilities for recovering and stabilizing submerged cultural materials while in the field, and for analyzing, conserving and curating long-term artifacts recovered as part of the site identification process;

- Use vessel-based coring and industrial dredging systems for site identification surveys of submerged paleolandscapes buried too deeply (1 m or more) under marine sediments to be excavated by archaeological divers or located in waters too deep or unsafe for diving; and

- Employ vessel-based coring to verify results and interpretations of geophysical/remote sensing survey data acquistion and analysis, to assist in the identification of submerged paleolandscapes, to identify cultural sites, and to guide sub-surface archaeological testing by using markers, such as micro-debitage presence and density and sediment chemistry data.

2.2.7 Words of Wisdom As We Move Forward

Jennifer McCann, URI-CRC (moderator). This session provided an opportunity for members of the Project team and selected invited speakers to express their concluding thoughts at the close of the conference and to draw all participants together with a closing ceremony.

2.2.7.1 Brian Jones, Connecticut State Archaeologist

- Lessons learned from the archaeological record in Europe will be important for the Submerged Paleocultural Landscapes project. Investigations may need to focus on locating the discarded remains of human activity in wetland sediments, not on finding the intact occupation sites of ancient peoples on upland areas, which may not have survived inundation;

- Modeling techniques should be used to identify areas of the current seafloor that are characterized by erosive processes that might be putting culturally sensitive sites at risk. Consider stabilizing at-risk sites, or implementing other methods of preservation; and

- Archaeologists are trained to follow the scientific method, but to be successful, they must feel something of the people who came before them. 'Dig with your heart, not your head.'

2.2.7.2 Richard Getchell, Chief, Aroostook Bank of Micmacs; Tribal Co-Chair, Northeast Regional Ocean Council (NROC)

- Tribal people are one with the earth, making them natural scientists. That knowledge governs Tribal people and must be respected. It will outlast anything taught in textbooks;

- It is important for both Tribal and non-Tribal groups to to clearly identify the goals of the collaborative process, since endeavors such as the Submerged Paleolandscapes Project are likely to encounter resistance from both Tribal and scientific/regulatory parties; and

- Scientific and political practices are changing to accept Tribal people and the Tribal perspective. Research-based scientists will need to open their hearts and minds to understand that they are dealing with a group of people who have been here from the beginning of time. It is ironic that the people who typically have determined what is right for the Tribal peoples are individuals who 'came here,' and are not native to these lands. That process is beginning to change with the participation and input of Tribal peoples.

2.2.7.3 URI-BOEM Project Team Synthesis

The Project team expressed their gratutude to all workshop participants for sharing the knowledge, expertise and wisdom that will be required for Tribal members, research-based scientists, and regulatory agencies move forward together. The workshop was an enlightening and powerful experience that initiated a meaningful discussion between diverse groups in a supportive and positive manner. Like the sweetgrass braid, strength is derived from joining together. It is clear that Tribal people have a long history of being superb natural scientists, who utilized the environment around them without exploiting it. This lesson should guide the team as the project unfolds.

2.2.7.4 Closing ceremony

The above comments were made as workshop participants were gathered in a circle outdoors (see cover image, this report), in the courtyard of the workshop venue. *Doug Harris, Project Co-PI, Deputy THPO, NITHPO* explained that in Tribal culture, one way to call on the spirit world is to create a circle, as workshop participants did by standing together in the courtyard. The spirits of that place are drawn to the circle and stand with all in the circle at that time. Some spirit beings are not there physically when they are most needed, but when a circle is formed, the energy of the spirit world is called upon to assist with the work at hand. Tribal people are selective about whose spirits are called upon but have come to a time when they alone cannot do what is in front of them. It will require assistance from various communities and individuals who come with good heart. Participants in the workshop have all come with good hearts and therefore have been transformed by the process. Harris described how all who were standing in the circle might feel a little 'spirit tug' as they move on with the work of project, and if so, it might be 'us, asking for advice again.' Please offer it, a bit of who you are, and what your mind and spirit is all about, to assist. Just as the power of the sweetgrass braid comes from many strands being woven into a circle, we are also stronger from being woven together. Each person in the circle was then asked to repeat Harris's words: "*May our work succeed, because all of our hearts and spirits request it to be so.*"

2.3 DAY 3

2.3.1 Open Forum Discussion Among Tribes

This session provided an opportunity for Tribal members to exchange thoughts and ideas relating to their participation in the first two days of the workshop. This was a private meeting for Tribal members only and was conducted at the Narragansett Indian Longhouse in Charlestown, Rhode Island. No video documentation was recorded. The following individuals participated in the intertribal discussion:

- **Ginew Benton**, NITHPO
- **John Brown, III**, Hereditary Medicine Man, Narragansett Indian Tribe/NITHPO
- **John Brown IV,** Field Specialist, NITHPO
- **Dennis Coker**, Principal Chief, Lenape Indian Tribe of Delaware
- **Fred Corey**, Environmental Director, Aroostook Band of Micmacs
- **Richard Getchell**, Chief, Arrostook Bank of Micmacs; NROC Tribal Co-Chair
- **Doug Harris**, Project Co-PI; Deputy THPO, NITHPO
- **Muckquashim Hopkins**, Field Specialist, NITHPO
- **Elizabeth James-Perry**, Senior Cultural Resource Monitor, Wampanoag Tribe of Gay Head (Aquinnah) THPO
- **Kathleen Knowles**, Mashantucket Pequot THPO
- **Chali Machado**, Field Specialist, NITHPO
- **Jonathan Perry**, Senior Cultural Resource Monitor, Wampanoag Tribe of Gay Head (Aquinnah) THPO
- **Cheryl Stedtler**, Director, Project Mishoon, Nipmuc Nation
- **Elaine Thomas**, Mohegan THPO
- **Bettina Washington**, Wampanoag Tribe of Gay Head (Aquinnah) THPO

2.3.2 Intertribal Open Forum Discussion with BOEM and URI-GSO Scientists

This session was also conducted at the Narragansett Indian Longhouse in Charlestown, Rhode Island, after the private meeting for Tribal members had concluded. It provided an opportunity for Tribal members, the URI-GSO project team, and representatives from BOEM to discuss the information presented during the previous two days of the conference, and to address questions and concerns in an open forum and small group setting. The bulleted items below summarize the main themes of discussion.

- A primary priority of the Tribal representatives participating in the workshop was to convey the concept that they are representing their ancestors, the ancient peoples who lived on what is now the continental shelf, and that their primary responsibility is to respect and protect their ancestors. If asked who lived on the continental shelf, Tribal people will respond that 'we' lived there, emphasizing the living connection that exists between ancient and contempory Native peoples. It is essential for non-Tribal people who are involved in the Submerged Paleocultural Landscapes Project to understand and respect this concept, as it is fundamental to the Tribal perspective.

- The Tribal perspective is that prior to European contact, all Tribal peoples were unified as one nation, not divided into the separate Tribes that exist today. Members of all contemporary Tribes stand together to respect and protect their common ancestors. Ancient peoples were unified and cannot be represented by contemporary Tribal divisions, or contemporary laws and regulations based on those divisions.

- The Tribal and non-Tribal objectives of the Project can be met with respectful interactive dialog. Annual meetings between the Project team and Tribal people were viewed as an effective way of conveying information obtained during the course of the project and maintaining open lines of communication.

- The processes required for wind energy development on the continental shelf were explained, including data and surveying requirements, and implementation of the NHPA Section 106 process. If significant cultural resources are located during the site characterization process, then identification of appropriate consulting parties is essential. The Tribal representatives at the conference emphasized that because ancient Native people were one Tribe, consultation should be conducted with representatives from many contemporary Tribes, not just with the Tribe who currently occupies the State nearest the potential development site.

- It was hoped that the Submerged Paleocultural Landscapes Project would provide significant input to BOEM about the manner in which Tribes would like to be consulted with respect to continental shelf development projects. A significant challenge for BOEM is to involve Tribes in the site consultation process not only in a manner that is inclusive, convenient and beneficial for Tribal people, but that also adheres to the policies, legislation, and timelines inherent in the environmental review processes for undertakings on the continental shelf. Tribal representatives at the conference suggested three methods for consultation that could potentially address multiple Tribal concerns and streamline the consultation process. These suggestions could be discussed at BOEM's recently created Tribal Consultation Policy Working Group:

    1. Create a Tribal committee composed of representatives from a variety of Tribes, and regard this committee as the primary group with whom BOEM would consult for Tribal input. This would simplify the consultation process for both parties and insure that many Tribes have the opportunity to provide their perspective regarding offshore development projects. Although Federal mandates require that Tribal sovereignty be respected and that consultation be conducted with Tribes individually, Tribal representatives felt that the members of the suggested committee would be able to provide their individual Tribal perspective, as well as represent their unified ancestors;

    2. A multi-tiered consultation process with Tribes could be beneficial. The initial tier would address the common goal of protecting and respecting their ancestors, since this goal is shared by all contemporary Tribal people. Subsequent tiers could address regional, multi-Tribe, or individual Tribal concerns regarding offshore development and site preservation; and

    3. A two-phase consultation process could be developed. The inital phase would involve a meeting attended by representatives of multiple Tribes. The goals of this meeting

would be to disseminate information about an upcoming project and ensure that all Tribal representatives obtained adequate information to formulate comments with their concerns and questions. A second phase would involve meeting with individual Tribes to discuss and address concerns specific to sovereign groups.

- Tribal members requested clarification regarding the timing of, and extent to which, they would be consulted regarding potential development in the Area of Mutual Interest (AMI), which is located in Federal waters southwest of Martha's Vineyard, Massachusetts. BOEM personnel described the phases of the leasing process and the manner in which current legislation requires Tribes to be consulted during that process. Current Federal legislation requires that Tribes are consulted individually. BOEM personnel expressed concern that this process is contradictory to the idea of sovereign Tribes acting collectively to respect and protect their common ancestors. BOEM personnel also emphasized that anyone is welcome to post comments on the development process to the online website, and that all comments are reviewed and considered as the development process progresses;

- Methods should be devised to make the documents and information associated with offshore development more simplified and more easily accessible to Tribal personnel who may not have a research-based scientific background, or who are involved with consultation on multiple projects and have limited time to review information. Tribal members suggested that summit meetings or other face-to-face communications between Tribal and regulatory representatives should follow the distribution of printed material; and

- Science education for Tribal youth is a common goal shared by all members of the Project team. Tribal members appreciated the opportunity to be involved with the Project but expressed concerns that limited funding could hinder the effectiveness of their participation in the Project, particularly with respect to the participation of Tribal young people. The potential for using Federal job training funding, National Science Foundation funding for educational opportunities, or financial assistance in the form of PELL grants, was presented as an option for additional funds. The URI Project team also emphasized that the Tribal students participating in the Project through the URI Talent Development program are provided with cost-of-living fellowships. BOEM personnel encourged Tribal partipants to clearly identify their needs so that funds could be leveraged. The Project team emphasized that since science education for Tribal youth is a common goal, working together as a lobbying group to achieve that goal could be more effective than individual groups working alone.

3.0 CENTRAL THEMES AND RECOMMENDATIONS

The workshop was generally regarded as a very positive experience by attendees. Many individuals voiced their sincere appreciation for the opportunity to participate in such a necessary and exciting dialog between Tribal, scientific, and agency personnel, and the workshop was clearly meaningful on both personal and professional levels for many participants. Discussions were consistently open and respectful, and individuals from diverse backgrounds made a concerted effort to understand and value the opinions and varied perspectives that were presented. Individuals who attended the conference felt that that it was an important starting point towards establishing open lines of communication, building trust and respect, establishing common goals, and developing transparent and mutually agreed upon best practice protocols for identifying submerged paleocultural landscapes.

The primary outcome of the workshop was the initation of a truly collaborative and respectful dialog between researchers, Tribes, and agencies and the opportunity to begin working together toward a common goal. Although meaningful, positive progress was definitely made toward achieving the workshop's objectives outlined in Section 1.1 of this document, the dialog that occurred throughout the workshop sessions indicated that it was premature to expect that those goals would be fully realized during three days of interaction. Attendees clearly needed more time to process cognitively, symbolically, and spiritually the content and meaning of the discussions concerning the Project's goals, objectives, and proposed research design. Additionally, the information presented on the current level of Western scientific knowledge about the submerged paleocultural landscape will need to be considered carefully from a Tribal perspective before commenting on and providing specific guidance about the Project and its proposed research. Progress toward the achievement of conference goals and a summary of the recurring themes associated with these goals is presented below. In addition, recommendations for continuing to futher the project objectives are summarized as bulleted 'action items.'

3.1 Development of Best Practices

Five sessions occurring on Day 2 of the workshop were devoted to discussing and developing "Best Practices," with respect to 1) paleoenvironmental reconstruction; 2) predictive modeling of site locations; 3) integrating Tribal/non-Tribal oral histories into predictive modeling; 4) reconstructing submerged paleolandscapes, and 5) submerged settlement site identification and excavation. These sessions, and the initial best practices derived from them, are summarized in sections 2.2.2 – 2.2.6 of this document and will be the focus of an additional report from the Project team. In hindsight, it is clear that a three-day workshop was not enough time to fully develop best practices. Presentations made during the workshop clarified that the methodologies for predictive modeling, and for paleoenvrionmental and paleolandscape reconstruction, are highly complex and currently under development by a variety of research teams, rendering the development of a standard methodology premature, particularly within the context of a three-day session. In addition, the Submerged Paleocultural Landscapes Project itself, of which the conference was a part, was initiated to help solidify these methods. However, the conference did provide a valuable opportunity for researchers to share their experiences regarding the success and limitations of various methodologies and the manner in which future research should be conducted. These perspectives are reflected in the initial Best Practices presented earlier in this report.

Of particular importance to the Project team was the opportunity to develop best practices that integrated Tribal, scientific, and regulatory perspectives, and the preliminary results presented in this report reflect this synthesis. However, initial best practices could not be developed with respect to integrating Tribal oral history into predictive modeling of culturally sensitive sites. It was clear from the discussions at the workshop that the integration of Tribal oral history with the traditional scientific method first requires the development of open and respectful dialog between Tribal members, regulatory personnel, and research-based scientists. Fostering an initial dialogue between parties that historically have been mistrustful of each other was a major achievement of the workshop, but it was clear that a three-day workshop did not provide enough time to thoroughly develop the collaborative relationship necessary for Tribal representatives to feel comfortable discussing the details of their oral history. In addition, Tribal representatives stated that they needed more familiarity with the project's scientific methods and data in order to assess how to incorporate their oral history information into a Best Practice approach.

Discussions throughout the three days of the workshop made it clear that it will be necessary to continue developing a collaborative relationship between regulatory, scientific, and Tribal personnel before the diverse perspectives of each group can truly be synthesized into "Best Practices." The following recommendations are derived from discussions at the workshop and will assist with achieving this goal:

- Recognize that contemporary Tribes are united by a primary goal of protecting and respecting the sites of their ancestors. Tribal people have a deep spiritual connection to these sites and feel a serious responsibility to honor their ancient ones by safeguarding the areas in which they lived, including those areas that are now submerged or buried beneath marine sediments. Any best practice that is developed regarding culturally sensitive sites on the contiental shelf must respect and incorporate this concept;

- Avoid regarding Tribal personnel as consultants, or simply as a source of oral history information. Instead, involve Tribal personnel in all aspects of the project research so they can familiarize themselves with the research-based scientific method, and may become collaborators whose perspectives are equally as important as the empirically-based scientific data;

- Recommendations and best practices developed as a result of collaboration between Tribes, agencies, and scientists should be incorporated into the regulatory requirements for permitting on the continental shelf and to codify additional perspectives other than those based on empirical data provide valuable inputs to policy making; and

- Conduct additional workshop-style meetings throughout the course of the project in order to keep diverse groups engaged with each other. Workshop participants responded very positively to being provided with an opportunity to discuss their perspectives through personal, face-to-face interaction. Frequent meetings that allow for a 'round-table' exchange of ideas in a comfortable and somewhat informal setting may be particularly effective for fostering positive communication and collaboratively developing best practices.

3.2 Fostering Open Communication and Developing a Common Understanding

Two of the most important goals of the workshop were to begin identifying appropriate techniques and steps that would foster open communication and meaningful interaction among all parties throughout the four-year initiative, and to develop a common understanding and language for the cultural, scientific, and archaeological aspects of the project. The following recommendations were synthesized from recurring discussions that occurred at the workshop, and they represent initial progress towards achieving this goal:

- Recognize that there are significant philosophical differences between Tribal peoples, research scientists, and regulatory agencies. Genuine respect for one anothers' perspectives, experiences, and languages is essential for fostering open communication and a truly collaborative relationship;

- Research-based scientists should step back from their academic focus and understand that the Tribal perspective, which focuses on humanity, represents valuable knowledge, although it is not research-based physical data;

- Understand that non-academic groups may feel skeptical and distrustful of established agencies and of the traditional scientific approach. Communication styles and activities that convey genuine respect for the value of non-empirical, non-academic perspectives are likely to encourage trust and foster positive collaboration;

- Care should be taken to ensure that scientific information and scientific language are presented in understandable manners in order to facilitate effective communication with non-academic groups. Meaningful communication is predicated on informed participants; and

- Involve youth from diverse groups in the technical aspects of the project. This provides important education and training opportunities for youth, and fosters trust, communication and understanding between groups. Youth involvement also allows diverse groups to strengthen their cultural bonds by exploring their history in a manner that might not have been previously available to them prior to involvement with the project.

3.3 Promote Scientific and Tribal Oral History Dialog

One of the primary goals of the Submerged Paleolandscapes project is to integrate Tribal oral history with research-based scientific data in order to better understand where culturally sensitive sites might be located on the OCS. To this end, the workshop was convened in order to facilitate open and respectful scientific and oral history dialog with participating Tribes. Although the workshop did not result in the development of specific best practices relating Tribal oral history to archaeological predictive modeling, it did result in a more complete understanding about the important place that oral history has in the culture of Native peoples. Initial recommendations relating to Tribal oral history are summarized below:

- Establish a genuine collaboration with Tribal peoples based on mutual respect and understanding before attempting to integrate traditional oral history information with research-based scientific data. Avoid regarding traditional oral history information simply as data to be extracted from Tribes;

- Understand that Tribal peoples do not feel the need have scientific data to "validate" their oral history traditions since they view their oral history as the truth;

- Respect the fact that some Tribes have not yet reclaimed their pre-contact culture enough to establish an integrated oral history, or they may not be comfortable sharing oral history with non-Tribal people;

- Acknowledge that paleoenvironmental data alone will not produce an accurate prediction about the location of culturally sensitive sites. Traditional knowledge regarding the cultural and societal attitudes and behaviors of ancient Tribal peoples is essential for a complete locational model; and

- Recognize that ancient Tribal peoples were not divided into soverign nations with boundaries and borders but were united as one people with rich traditions and histories that are maintained by contemporary Tribal members, regardless of their current Tribal designation. Consult with representatives from many Tribes to assess how oral history traditions can assist with locating the sites of their common ancestors.

APPENDIX A:

PRESENTATIONS

POWERPOINT PRESENTATIONS

DAY 1 - MORNING

Brian Jones:

"Southern New England's Late Pleistocene-Early Holocene Archaeological Record"

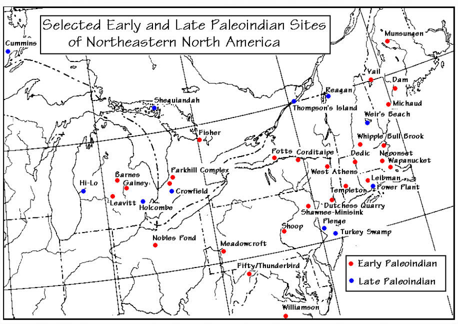
Terminal Pleistocene and Early Holocene New England

Brian Jones
AHS, Inc

Introduction

- The Paleoindian settlement of New England must be interpreted as part of the broader expanse of human colonizers across the Americas
- New England was likely one of the last regions settled
- The earliest known sites in the region date to approximately 10,800 rcBP, or 12,700 calBP.
- Colonizers entered a spruce forest environment that would soon become much colder with the YD
- All current information reflects interior adaptations only

A Paleoindian Landscape



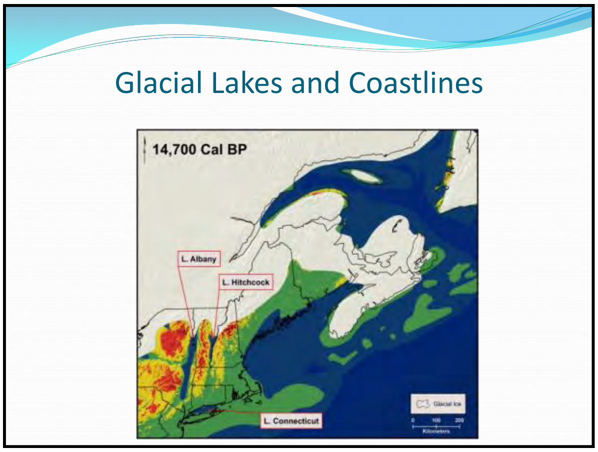
Phases of Early Settlement

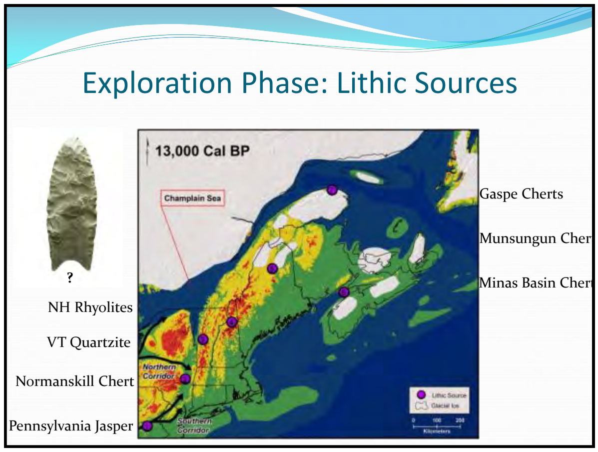
- **Exploration**: 13,100 – 12,900 calBP
  - Clovis-like?
- **Colonization**: 12,900 - 12,700 calBP
  - Kings Road-Whipple
- **Settling In**: 12,700 – 12,200 calBP
  - Bull Brook and Vail/Debert
- **Regionalization**: 12,200 – 11,600 calBP
  - Michaud/Neponset and Holcombe-like
- **Holocene Adaptations**: 11,600 – 8900 calBP
  - Lanceolate, Gulf of Maine Archaic and Atlantic Slope traditions

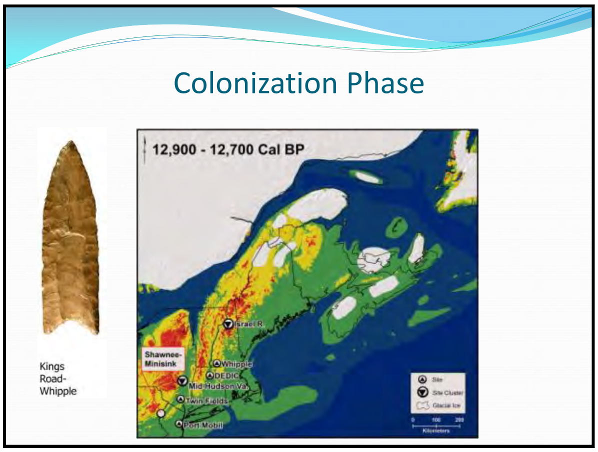
Paleoindian Point Typology

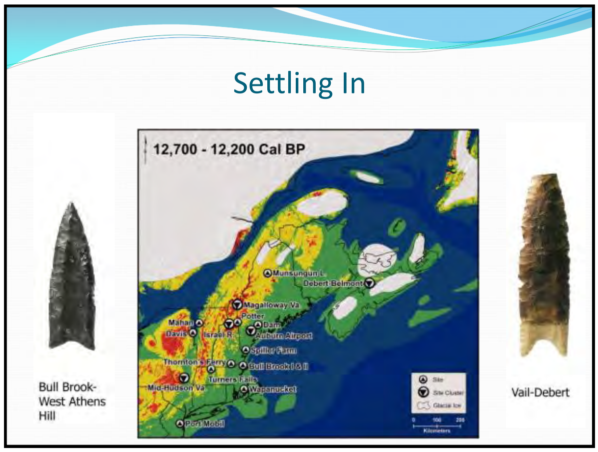
The Uninhabitable Northeast during the LGM

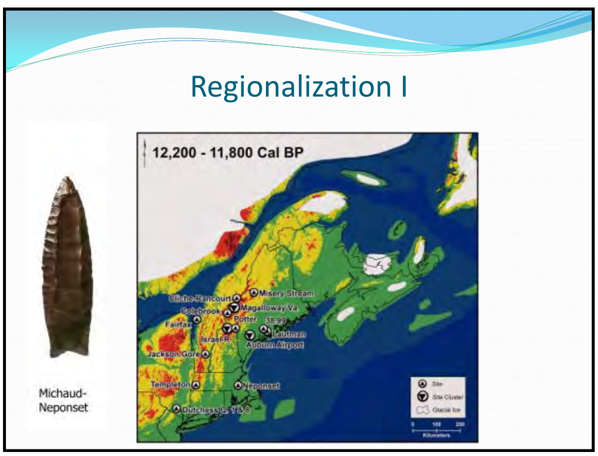
Refugium ->

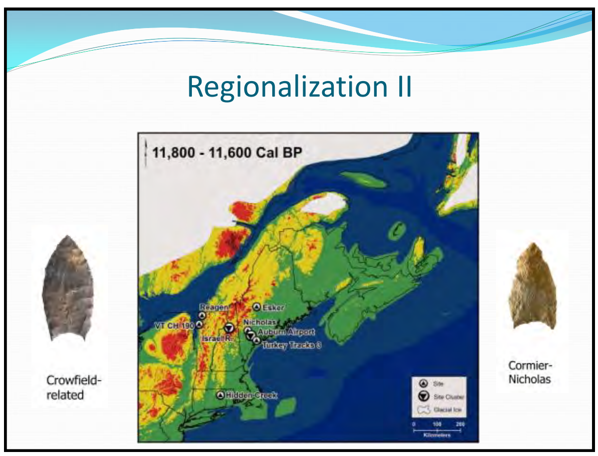

Glacial Lakes and Coastlines
14,700 Cal BP
L. Albany
L. Hitchcock
L. Connecticut


Exploration Phase: Lithic Sources
13,000 Cal BP
Champlain Sea
?
NH Rhyolites
VT Quartzite
Normanskill Chert
Pennsylvania Jasper
Gaspe Cherts
Munsungun Cher
Minas Basin Chert


Colonization Phase
12,900 - 12,700 Cal BP
Kings
Road-
Whipple

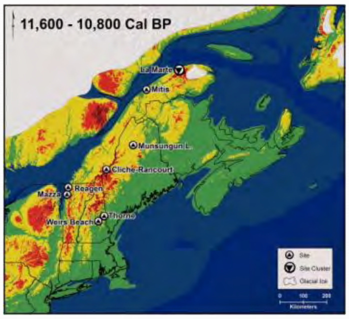

Settling In
12,700 - 12,200 Cal BP
Bull Brook-
West Athens
Hill
Vail-Debert


Regionalization I
12,200 - 11,800 Cal BP
Michaud-
Neponset


Regionalization II
11,800 - 11,600 Cal BP
Crowfield-
related
Cormier-
Nicholas

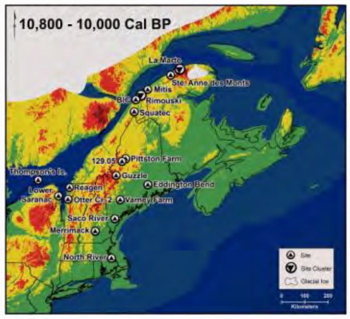
Holocene Adaptations I

Agate Basin-related

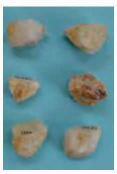


Holocene Adaptations II

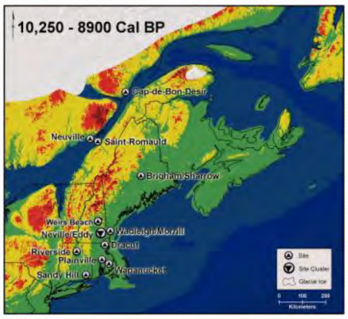
Ste. Anne-Varney



Holocene Adaptations III



Gulf of Maine Archaic quartz cores



Sandy Hill

Site Types

- **Exploration Phase (13,000? – 12,900** calBP)
  - Very small temporary transit camps and caches
    - Probable male-focused activities
    - Initial quarry exploration/testing
  - Positioned to maximize viewshed
  - Rare to archaeologically invisible
  - Site Function:
    - Landscape learning
    - Resource monitoring

Site Types

- **Colonization Phase (12,900 – 12,700** calBP)
  - Centrally-located aggregation camps
    - near good geographic markers (e.g. DEDIC)
    - Near game intercepts
  - Single and multi-family short term camps
    - Near wetlands and other predictable resource-harvesting locations
  - Site Function:
    - Demographic maintenance (survival)
    - Information exchange
    - Resource harvesting
    - Resource-sharing

Site Types

- **Settling In Phase (12,700 – 12,200** calBP)
  - More numerous seasonal aggregation sites
    - Large-scale shared resource harvests near game intercepts (caribou, seal?)
    - E.g. Bull Brook, Vail, Debert
  - Single and multi-family short term camps
    - Near wetlands and other predictable resource-harvesting locations
  - Site Function:
    - Social-economic maintenance
    - Resource harvesting
    - Resource-sharing

Site Types

- **Regionalization Phase (12,200 – 11,600** calBP)
  - Few aggregation sites
    - Increased population base
  - Single and multi-family short term camps most common
    - Situated near wetlands, game intercepts and other resource-harvesting locations
  - Increased regional adaptations
    - Decreased group mobility
    - Increased use of local/regional lithics
    - Interior and coastal(?) adaptations
  - Site Function:
    - Economic focus
    - Resource harvesting

Site Types

- **Holocene Adaptations Phase (11,600 – 8,900** calBP)
  - Seasonal Base Camps
    - Supported by satellite logistical camps
    - Associated cemeteries
  - Single and multi-family short term camps
    - Situated near wetlands, game intercepts and other resource-harvesting locations
  - Increased regional adaptations
    - Low group mobility
    - Focused use of local/regional lithics (quartz and rhyolite)
    - Northern maritimes, interior wetlands, coastal(?) adaptations
    - Ethnogenesis
  - Site Function:
    - Group/identity maintenance
    - Resource processing and storage

Conclusions

- **The earliest sites in the region have a strong social-maintenance function**
  - Lithic use patterns indicate extremely high group mobility
- **As the Northeast is settled, regional patterns emerge**
  - The need for very broad social cohesion decreases
  - Reduced movement of lithics from distant sources
  - Increased typological and cultural regionalization
- **New adaptations develop during the Holocene**
  - Possible northern maritimes focus of lanceolate tradition
  - Probable wetland focus of GMAT
  - Undocumented use of Atlantic coastal resources
- **Our current understanding is largely limited to interior land-use**
  - Northeastern archaeologists are probably missing a significant portion of the Terminal Pleistocene and early Holocene adaptive pattern
  - Inundated coastal sites are likely to express unique adaptations
  - Rich coastal resources likely supported large seasonal base camps

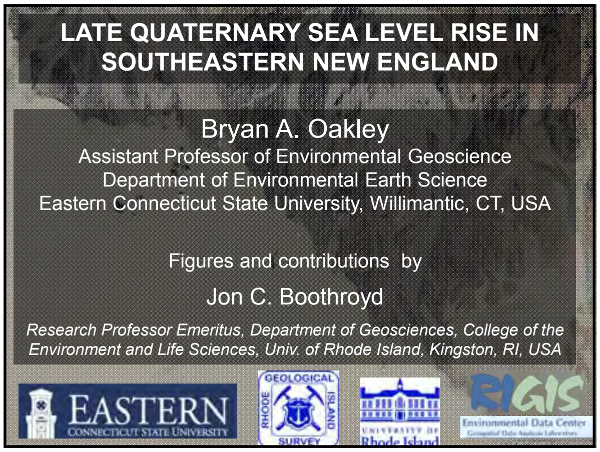
Acknowledgements

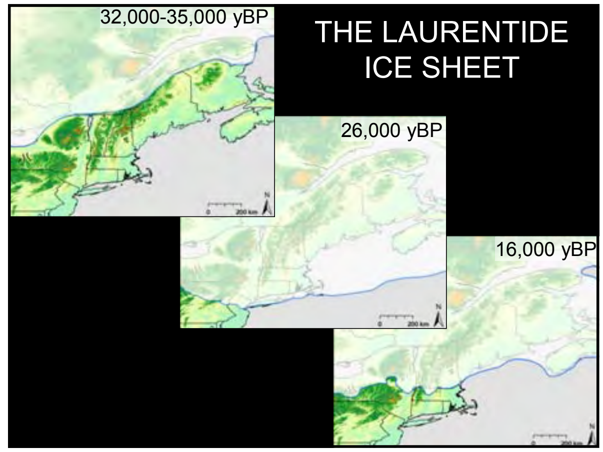
- **Special thanks to Jonathan Lothrop, Paige Newby, Arthur Spiess, and James Bradley for use of images from their recent paper:**
  - Paleoindians and the Younger Dryas in the New England-Maritimes Region, *Quaternary International* 242 (2011): 546-569.

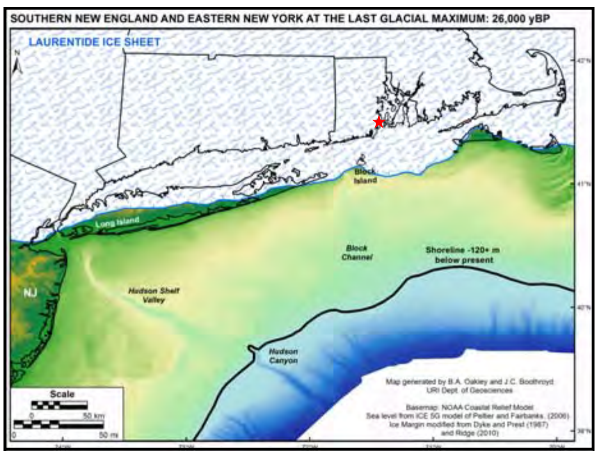
Image courtesy of the Illinois State Museum
http://museum.state.il.us/pub/dmmweb/Images/Paleo/Paleoindian%20Camp.jpg

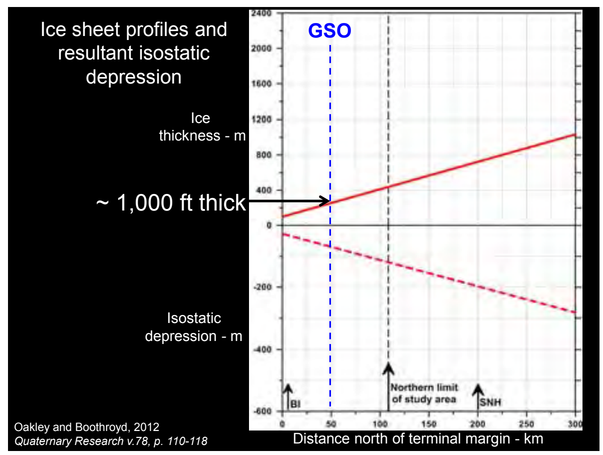
BRYAN OAKLEY:

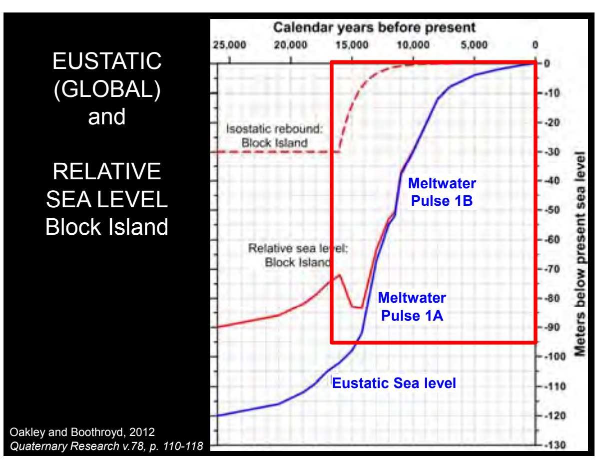
"GEOLOGICAL HISTORY OF AND SEA LEVEL RISE IN SOUTHERN NEW ENGLAND"

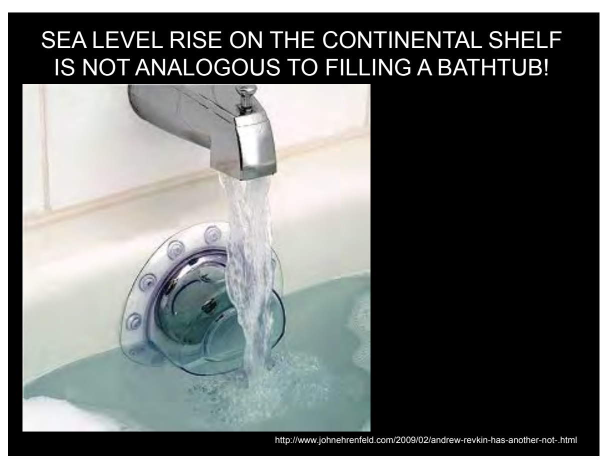

LATE QUATERNARY SEA LEVEL RISE IN SOUTHEASTERN NEW ENGLAND
Bryan A. Oakley
Assistant Professor of Environmental Geoscience
Department of Environmental Earth Science
Eastern Connecticut State University, Willimantic, CT, USA
Figures and contributions by
Jon C. Boothroyd
Research Professor Emeritus, Department of Geosciences, College of the Environment and Life Sciences, Univ. of Rhode Island, Kingston, RI, USA
EASTERN
CONNECTICUT STATE UNIVERSITY
RIGIS
Environmental Data Center


32,000-35,000 yBP
THE LAURENTIDE ICE SHEET
26,000 yBP
16,000 yBP

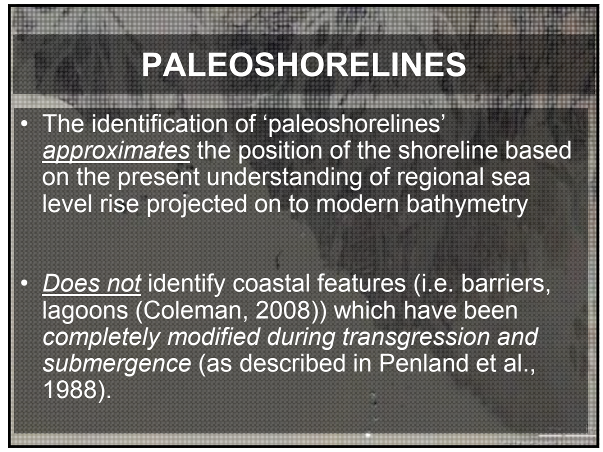

SOUTHERN NEW ENGLAND AND EASTERN NEW YORK AT THE LAST GLACIAL MAXIMUM: 26,000 yBP
LAURENTIDE ICE SHEET
Block Island
Long Island
Block Channel
Shoreline -120+ m below present
NJ
Hudson Shelf Valley
Hudson Canyon
Scale
Map generated by B.A. Oakley and J.C. Boothroyd
URI Dept. of Geosciences

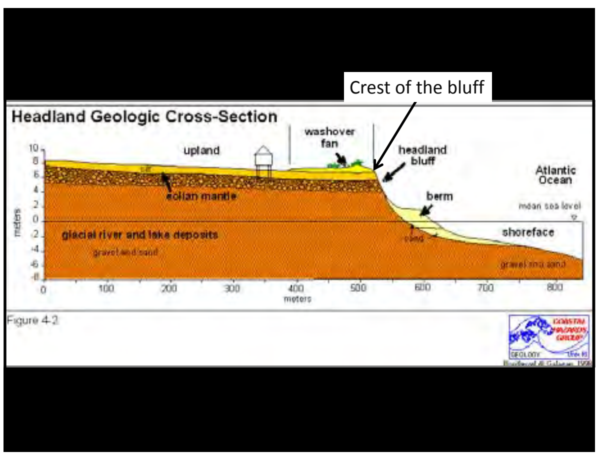

Ice sheet profiles and resultant isostatic depression
GSO
Ice thickness - m
~ 1,000 ft thick
Isostatic depression - m
Northern limit of study area
BI
SNH
Oakley and Boothroyd, 2012
Quaternary Research v.78, p. 110-118
Distance north of terminal margin - km


EUSTATIC (GLOBAL) and
RELATIVE SEA LEVEL Block Island
Calendar years before present
Isostatic rebound: Block Island
Meltwater Pulse 1B
Relative sea level: Block Island
Meltwater Pulse 1A
Eustatic Sea level
Meters below present sea level
Oakley and Boothroyd, 2012
Quaternary Research v.78, p. 110-118

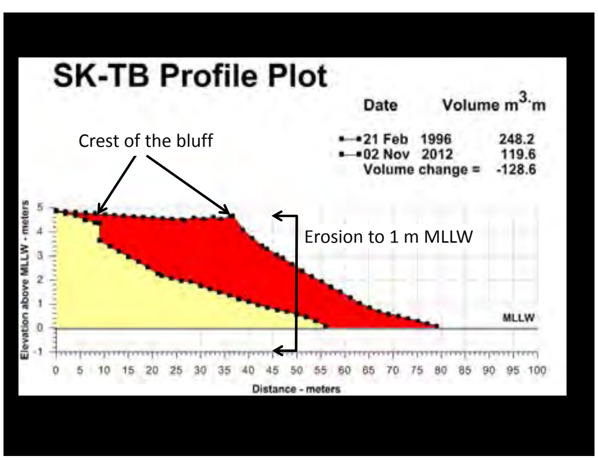

SEA LEVEL RISE ON THE CONTINENTAL SHELF IS NOT ANALOGOUS TO FILLING A BATHTUB!

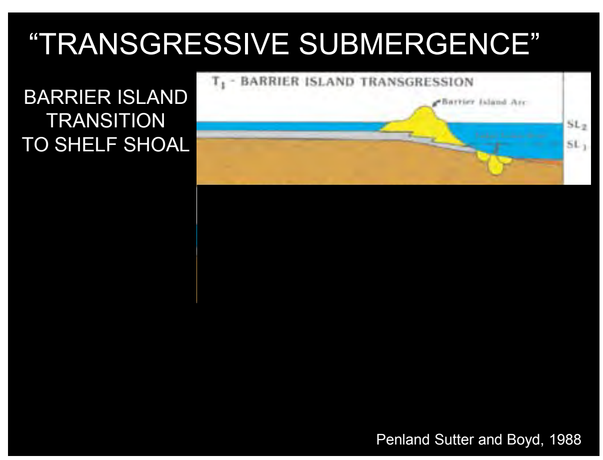

WAVE EROSION DURING A NOR'EASTER:
SOUTH KINGSTOWN TOWN BEACH, RI
Crest of the bluff

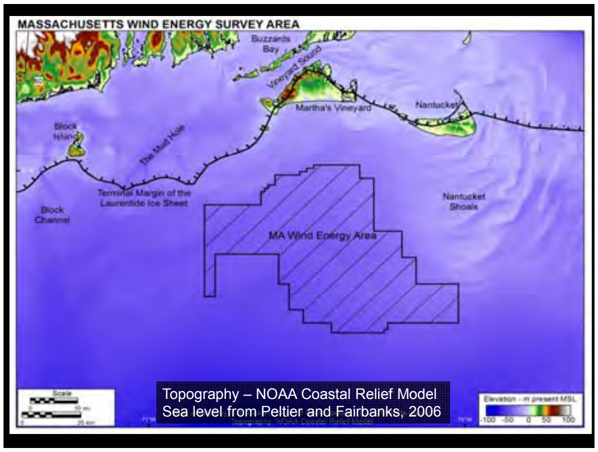

PALEOSHORELINES
• The identification of 'paleoshorelines' *approximates* the position of the shoreline based on the present understanding of regional sea level rise projected on to modern bathymetry
• *Does not* identify coastal features (i.e. barriers, lagoons (Coleman, 2008)) which have been *completely modified during transgression and submergence* (as described in Penland et al., 1988).

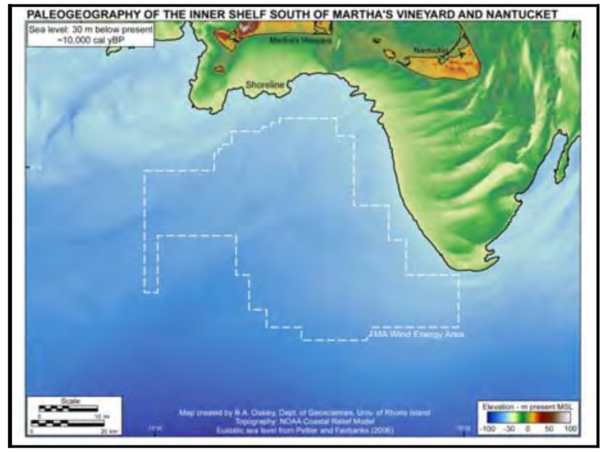

Crest of the bluff
Headland Geologic Cross-Section
washover fan
upland
headland bluff
Atlantic Ocean
eolian mantle
berm
mean sea level
glacial river and lake deposits
shoreface
meters
Figure 4-2

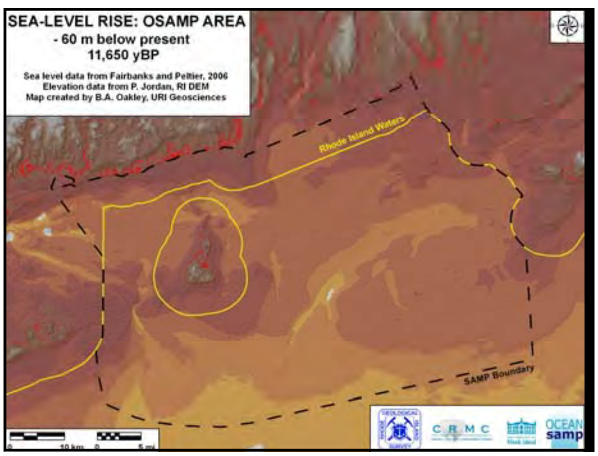

WAVE EROSION DURING A NOR'EASTER:
SOUTH KINGSTOWN TOWN BEACH, RI
Crest of the bluff

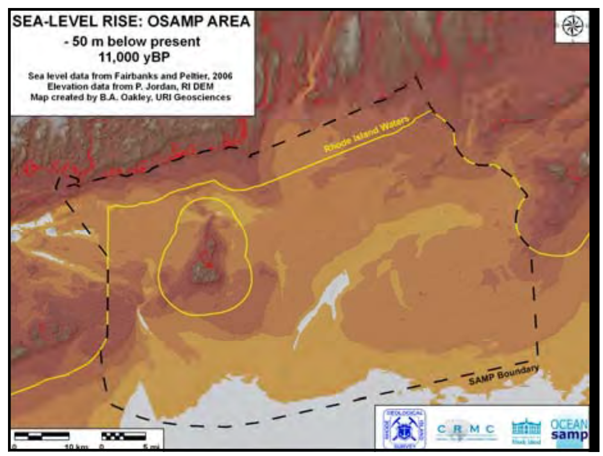

SK-TB Profile Plot
Date
Volume m3/m
21 Feb 1996 248.2
02 Nov 2012 119.6
Volume change = -128.6
Crest of the bluff
Erosion to 1 m MLLW
MLLW
Elevation above MLLW - meters
Distance - meters

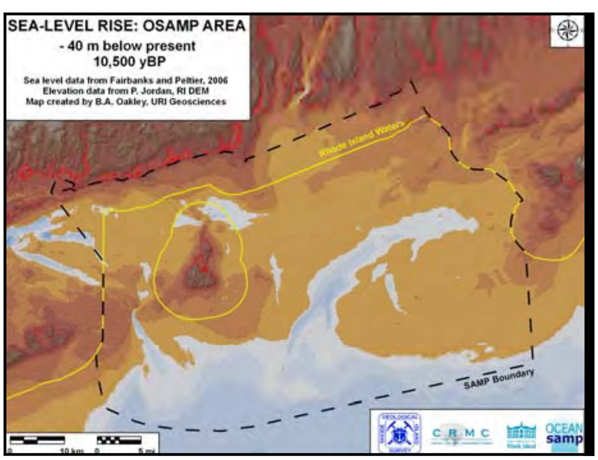

"TRANSGRESSIVE SUBMERGENCE"
BARRIER ISLAND TRANSITION TO SHELF SHOAL
T1 - BARRIER ISLAND TRANSGRESSION
Penland Sutter and Boyd, 1988

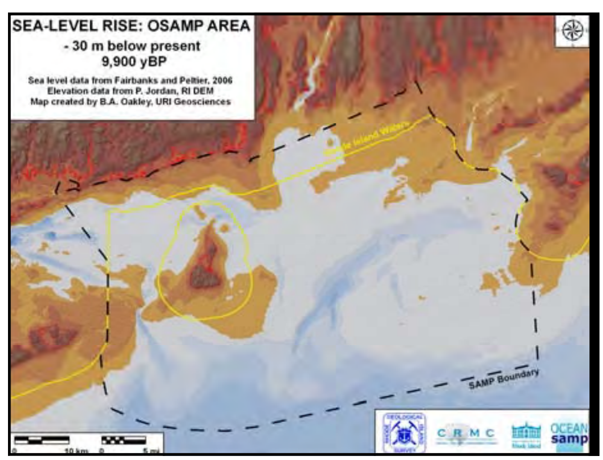

MASSACHUSETTS WIND ENERGY SURVEY AREA
Buzzards Bay
Vineyard Sound
Martha's Vineyard
Nantucket
Block Island
The Mud Hole
Terminal Margin of the Laurentide Ice Sheet
Block Channel
Nantucket Shoals
MA Wind Energy Area
Scale
Topography – NOAA Coastal Relief Model
Sea level from Peltier and Fairbanks, 2006
Elevation - m present MSL
-100 -50 0 50 100

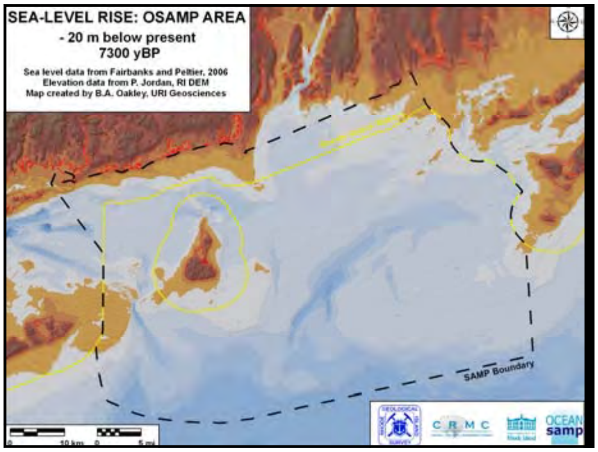

PALEOGEOGRAPHY OF THE INNER SHELF SOUTH OF MARTHA'S VINEYARD AND NANTUCKET
Sea level: 30 m below present
~10,000 cal yBP
Shoreline
MA Wind Energy Area
Scale
Topography: NOAA Coastal Relief Model
Elevation - m present MSL
-100 -30 0 50 100

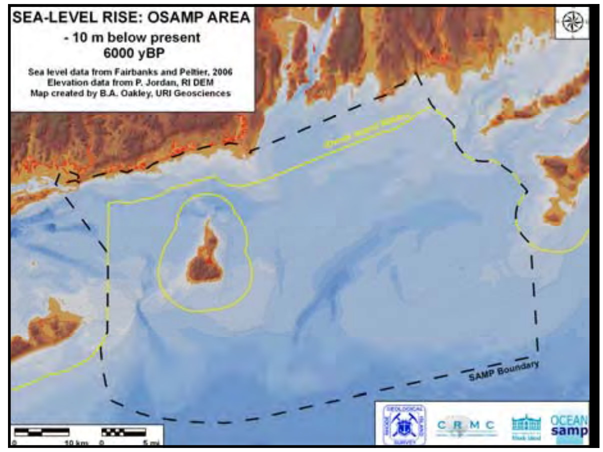

SEA-LEVEL RISE: OSAMP AREA
- 60 m below present
11,650 yBP
Sea level data from Fairbanks and Peltier, 2006
Elevation data from P. Jordan, RI DEM
Map created by B.A. Oakley, URI Geosciences
Rhode Island Waters
SAMP Boundary
C R M C
OCEAN samp

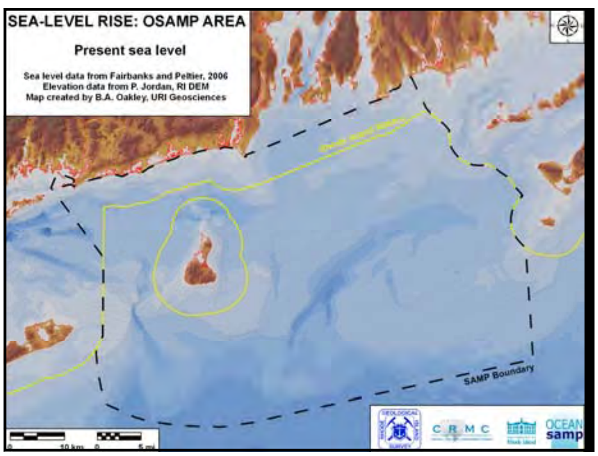

SEA-LEVEL RISE: OSAMP AREA
- 50 m below present
11,000 yBP
Sea level data from Fairbanks and Peltier, 2006
Elevation data from P. Jordan, RI DEM
Map created by B.A. Oakley, URI Geosciences
Rhode Island Waters
SAMP Boundary
C R M C
OCEAN samp


SEA-LEVEL RISE: OSAMP AREA
- 40 m below present
10,500 yBP
Sea level data from Fairbanks and Peltier, 2006
Elevation data from P. Jordan, RI DEM
Map created by B.A. Oakley, URI Geosciences
Rhode Island Waters
SAMP Boundary
C R M C
OCEAN samp


SEA-LEVEL RISE: OSAMP AREA
- 30 m below present
9,900 yBP
Sea level data from Fairbanks and Peltier, 2006
Elevation data from P. Jordan, RI DEM
Map created by B.A. Oakley, URI Geosciences
SAMP Boundary
C R M C
OCEAN samp


SEA-LEVEL RISE: OSAMP AREA
- 20 m below present
7300 yBP
Sea level data from Fairbanks and Peltier, 2006
Elevation data from P. Jordan, RI DEM
Map created by B.A. Oakley, URI Geosciences
SAMP Boundary
CRMC
OCEAN samp


SEA-LEVEL RISE: OSAMP AREA
- 10 m below present
6000 yBP
Sea level data from Fairbanks and Peltier, 2006
Elevation data from P. Jordan, RI DEM
Map created by B.A. Oakley, URI Geosciences
SAMP Boundary
CRMC
OCEAN samp


SEA-LEVEL RISE: OSAMP AREA
Present sea level
Sea level data from Fairbanks and Peltier, 2006
Elevation data from P. Jordan, RI DEM
Map created by B.A. Oakley, URI Geosciences
SAMP Boundary
CRMC
OCEAN samp

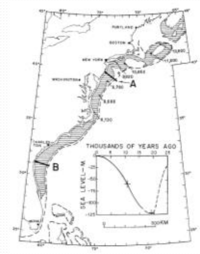
DAVID ROBINSON:

"MARINE ARCHAEOLOGICAL PREDICTIVE MODELING IN SOUTHERN NEW ENGLAND"

Marine Archaeological Predictive Modeling in Southern New England: Our Current State of Knowledge

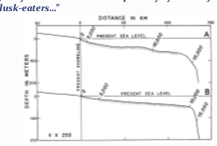
David S. Robinson, URI-GSO

Previous Experience Assessing Ancient Native American Archaeological Sensitivity Offshore



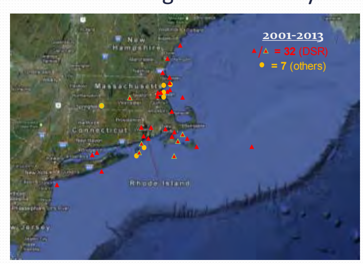
K. O. Emery & R. L. Edwards
"Archaeological Potential of the Atlantic Continental Shelf"
American Antiquity 30(5-1):733-37 (1966)

"It has been known for many years that broad expanses of the continental shelves were exposed during glacial stages of the Pleistocene Epoch. …when most of the now-submerged continental shelf was exposed… [it] almost certainly was ranged by nomadic hunters and possibly by marine fish- and mollusk-eaters…"

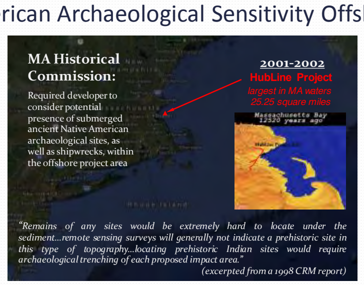


Previous Experience Assessing Ancient Native American Archaeological Sensitivity Offshore

Previous Experience Assessing Ancient Native American Archaeological Sensitivity Offshore



Previous Experience Assessing Ancient Native American Archaeological Sensitivity Offshore



How Do We Assess Ancient Native American Archaeological Sensitivity Offshore Here in SNE?

ANSWERS WERE FIRST DEVELOPED DURING THE 2001-2002 HUBLINE PROJECT

****Required Major Paradigm Shift in American Underwater Archaeology****

A. Away from a target- (i.e., shipwreck-) focus to a "submerged cultural landscape" focus

B. Consider the continental shelf part of a submerged, water-modified continuum of the adjacent land

C. Required a multi-disciplinary approach - similar to that which is used in terrestrial archaeology (i.e., one that is geologically and environmentally focused)

D. Necessitated using standard geophysical and geotechnical survey techniques in new ways (i.e., sub-bottom profiling and coring/boring)

E. Benefits from advanced data processing and visualization for archaeological interpretation

F. Requires Tribal input and active involvement in all phases of research

How Do We Assess Ancient Native American Archaeological Sensitivity Offshore Here in SNE?

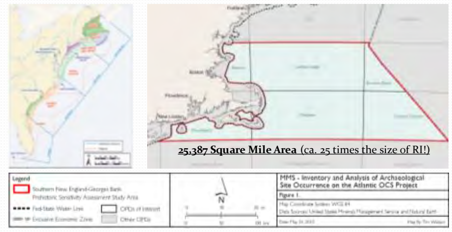
TWO-STEP PROCESS

1. **Examine the environmental history (regional and local geology and sea level rise)**
   - Background research – previous investigations & local sea level rise models – answer questions:
     - When was the area inundated? How fast was sea level rising at that time?
     - What was area's pre-submergence topography? How did that influence the timing, speed, and sequence of submergence?
     - What are conditions like currently? How has/are the modern wave and current regimes affecting the area? Is it a high-energy, erosional environment or a low-energy depositional one?
   - Survey - to define what, if anything, survives of the paleolandscape
2. **Examine the ancient cultural history (archaeological record/Tribal oral history)**
   - Background research – terrestrial investigations on-shore – What do they tell us about the cultural landscape? About site ages, types, densities, and locations?
   - Tribal coordination – What do Tribal oral histories tell us? How do Tribal people interpret the submerged landscape and survey data? What areas have sensitivity?

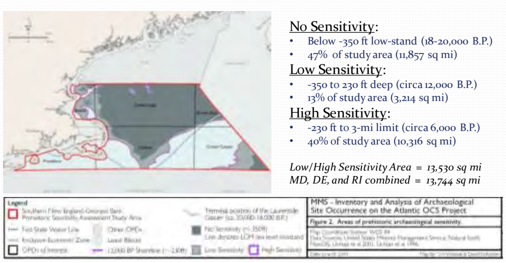
Our Current State of Knowledge

2011 BOEM/TRC STUDY:

"Prehistoric Site Potential and Historic Shipwrecks on the Atlantic Outer Continental Shelf"
(update of the 1979 DOI-BLM/Institute for Conservation Archaeology study)



Our Current State of Knowledge



No Sensitivity:
- Below -350 ft low-stand (18-20,000 B.P.)
- 47% of study area (11,857 sq mi)

Low Sensitivity:
- -350 to 230 ft deep (circa 12,000 B.P.)
- 13% of study area (3,214 sq mi)

High Sensitivity:
- -230 ft to 3-mi limit (circa 6,000 B.P.)
- 40% of study area (10,316 sq mi)

Low/High Sensitivity Area = 13,530 sq mi
MD, DE, and RI combined = 13,744 sq mi

Our Current State of Knowledge

Narragansett Tribal Oral History

Informs us that more than 15,000 years ago, the ancient villages of the ancestral Narragansett were out where the ocean is now, and that overnight the ocean's waters began to rise and their people had to evacuate their ancient homes.

Image courtesy of Deepwater Wind

Our Current State of Knowledge

Geophysical Survey Data
Large Areas of the Pre-Submergence Landscape May Be Preserved

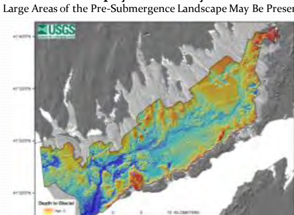
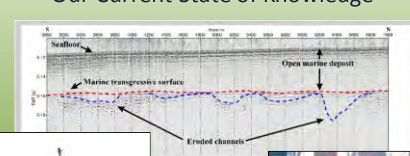
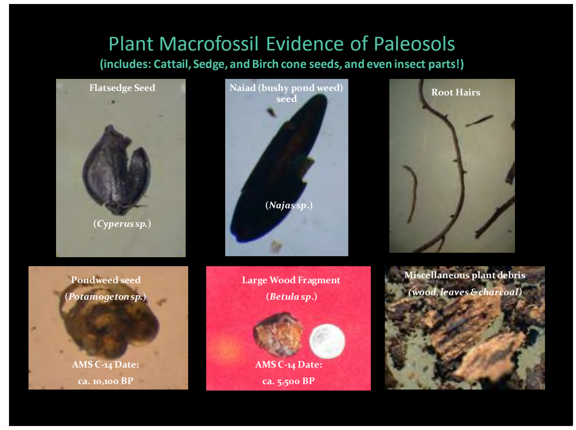
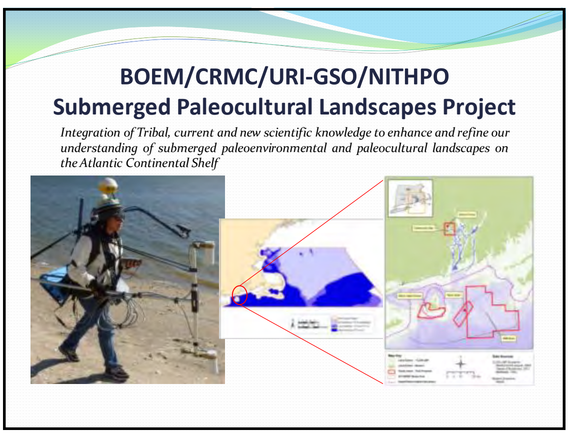


Image courtesy of U.S. Geological Survey

Our Current State of Knowledge




Plant Macrofossil Evidence of Paleosols
(includes: Cattail, Sedge, and Birch cone seeds, and even insect parts!)
Flatsedge Seed
(Cyperus sp.)
Naiad (bushy pond weed) seed
(Najas sp.)
Root Hairs
Pondweed seed
(Potamogeton sp.)
AMS C-14 Date:
ca. 10,100 BP
Large Wood Fragment
(Betula sp.)
AMS C-14 Date:
ca. 5,500 BP
Miscellaneous plant debris
(wood, leaves & charcoal)


BOEM/CRMC/URI-GSO/NITHPO
Submerged Paleocultural Landscapes Project
Integration of Tribal, current and new scientific knowledge to enhance and refine our understanding of submerged paleoenvironmental and paleocultural landscapes on the Atlantic Continental Shelf

POWERPOINT PRESENTATIONS

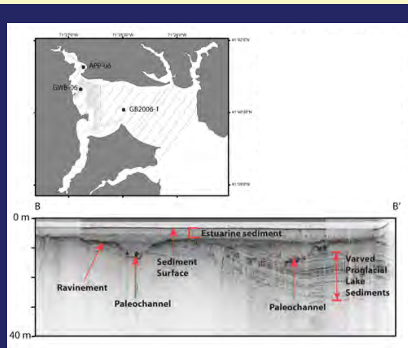
DAY 1 – AFTERNOON

Session:

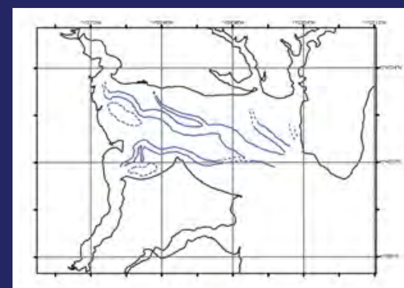
"Critical Aspects of the Submerged Paleocultural Landscapes Initiative: Objectives, Tasks, and the Way We Will Work Together"

JOHN KING

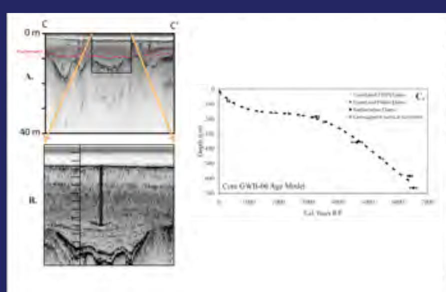
Geophysical Surveys



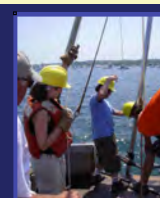
Paleolandscape Reconstruction



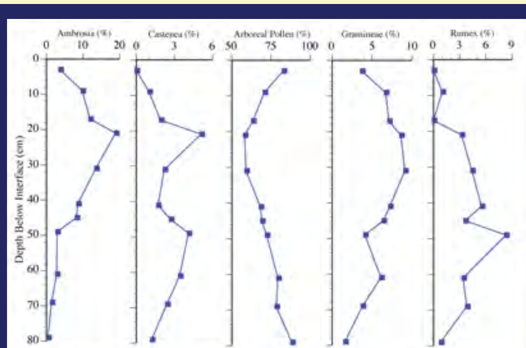
Age Model for Greenwich Bay Core



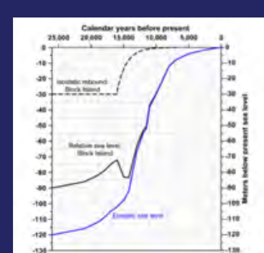
Sediment Coring

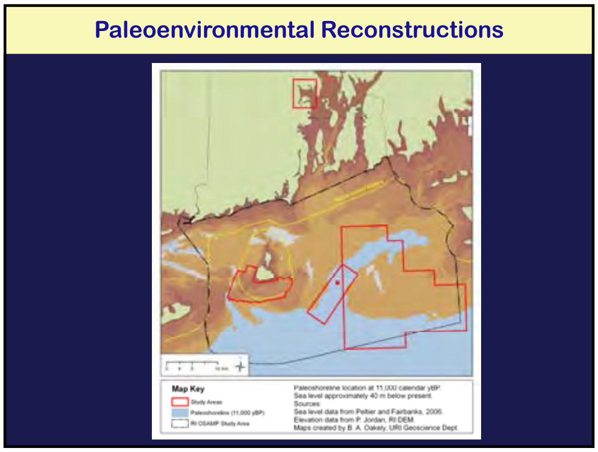


Proxy Paleoenvironmental Indicators (Pollen)

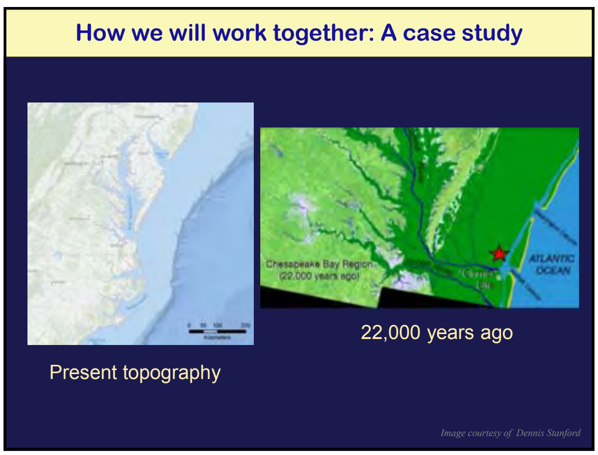


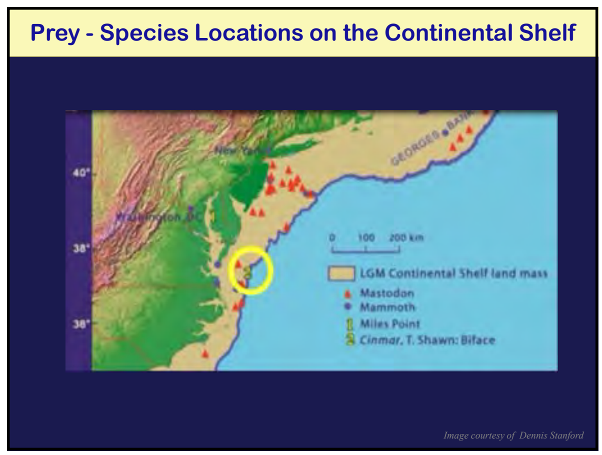
Improving Sea Level Rise Curves




Paleoenvironmental Reconstructions
Map Key
Study Areas
Paleoshoreline (11,000 yBP)
RI OSAMP Study Area
Paleoshoreline location at 11,000 calendar yBP.
Sea level approximately 40 m below present.
Sources:
Sea level data from Peltier and Fairbanks, 2006.
Elevation data from P. Jordan, RI DEM.
Maps created by B. A. Oakely, URI Geoscience Dept.


New Geophysical Survey Techniques


How we will work together: A case study
Chesapeake Bay Region (22,000 years ago)
ATLANTIC OCEAN
22,000 years ago
Present topography
Image courtesy of Dennis Stanford


Prey - Species Locations on the Continental Shelf
New York
Washington, DC
GEORGES
40°
38°
0 100 200 km
LGM Continental Shelf land mass
Mastodon
Mammoth
Miles Point
Cinmar, T. Shawn: Biface
Image courtesy of Dennis Stanford


Margin of a large ice sheet: Greenland today


An Ablation Moraine: How the Laurentide ice margin may have appeared

DAVID ROBINSON

Critical Aspects of the Submerged Paleocultural Landscapes Initiative: Objectives and Tasks and the Way We Plan to Work Together

Archaeological Objectives and Tasks

David S. Robinson, URI-GSO

BOEM/CRMC/URI-GSO/NITHPO Submerged Paleocultural Landscapes Project

ARCHAEOLOGICAL OBJECTIVES AND TASKS

Identification of Ancient Native American Cultural and Archaeological Sites in Four Study Areas Situated within the Environmental Continuum Extending from On-Shore to Off-Shore (i.e., known to unknown)

- Background Research /Oral History Research
- Development of a GIS geospatial database
- Acquisition & Analysis of High-Resolution Geophysical Survey and Geotechnical Sampling Results
- Ground-Truthing of Geophysical Data
- Sub-Surface Archaeological Testing
- Site Documentation
- Artifact/Ecofact Stabilization, Analysis, Cataloging, and Archiving

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BOEM/CRMC/URI-GSO/NITHPO Submerged Paleocultural Landscapes Project

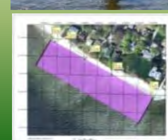
Background Research & GIS Geospatial Database Development

- **Greenwich Bay:** map of environmental parameters, geophysical/geotechnical data and *RIHPHC-inventoried cultural features situated within 0.5 mi of present shoreline, including:*
  - *Pre-Contact Archaeological Sites*
  - *Ancient Native American Burials*
  - *Previous Investigations*

BOEM/CRMC/URI-GSO/NITHPO Submerged Paleocultural Landscapes Project

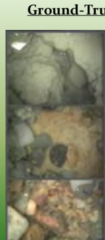
Acquisition and Analysis of High-Resolution Geophysical Data

- Non-Disturbance gradiometer survey of 50-x-200 m area @ 1 m track line spacing
- Purpose: to identify magnetic anomalies associated with ancient hearth features on submerged and buried paleo-terrace adjacent to Cedar Tree Beach archaeological site (Greenwich Bay)

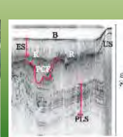


BOEM/CRMC/URI-GSO/NITHPO Submerged Paleocultural Landscapes Project

Ground-Truthing of High-Resolution Geophysical Data



- Systematic and minimally-invasive video hydro-probing to be conducted on a 10 m grid over 50-x-200 m gradiometric Cedar Tree Beach survey area to identify stratified elements of submerged and buried paleo-terrace with selective video hydro-probing of magnetic anomalies to identify hearth features and archaeological sites



BOEM/CRMC/URI-GSO/NITHPO Submerged Paleocultural Landscapes Project

Sub-Surface Archaeological Testing and Site Documentation

- Sub-surface archaeological testing (up to six 1-x-1 m test units) to obtain environmental and cultural data, and to document and further characterize the nature and former functions of identified submerged archaeological deposits and features will be performed.

Image 1 courtesy of Alan Leveillee/PAL; Images 2 & 3 courtesy of Jorgen Dencker/VSM

BOEM/CRMC/URI-GSO/NITHPO Submerged Paleocultural Landscapes Project

Artifact/Ecofact Stabilization, Cataloging, Analysis, and Archiving

- Recovered artifacts/ecofacts will be brought to the Public Archaeology Laboratory in Pawtucket, RI for stabilization, cataloging, analysis, and archiving (until which time the Narragansett Indian Longhouse's curation facility is in operation)

BOEM/CRMC/URI-GSO/NITHPO Submerged Paleocultural Landscapes Project

How We Plan to Work Together

- Geophysical and geotechnical data and paleoenvironmental proxy data will be synthesized and correlated with archaeological data and interpreted to development predictive models
- Tribal partners, NITHPO, will actively participate in all phases of the research and act as Tribal liaison between URI-GSO and the region's other Tribes

SESSION:

"THE IMPACT OF SEA LEVEL RISE AND MARINE TRANSGRESSION OF SUBMERGED PALEOLANDSCAPES"

SIMON ENGELHART

Challenges for development and preservation of landscapes under the marine transgression – the Relative Sea Level Perspective

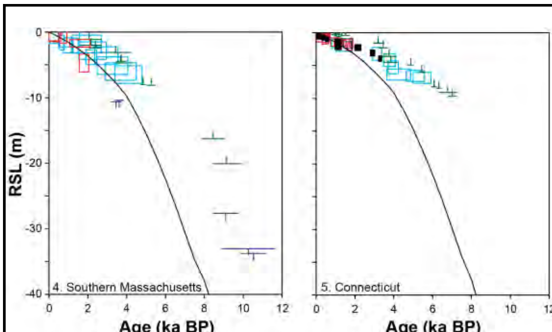
Simon Engelhart
Sea Level Research Lab, Geosciences, University of Rhode Island

Sea Level Research

Rates: How much is too much?

- Relative Sea Level (RSL) rise must be slow enough to allow landscape development
- Gulf of Maine: <5 m in ~4500 years (~1 mm/yr)
- Present day NE coastline relatively fixed since 4000/5000 years ago (< 2mm/yr RSL)
- RSL data from east and west of Rhode Island provides a broad guide

Sea Level Research



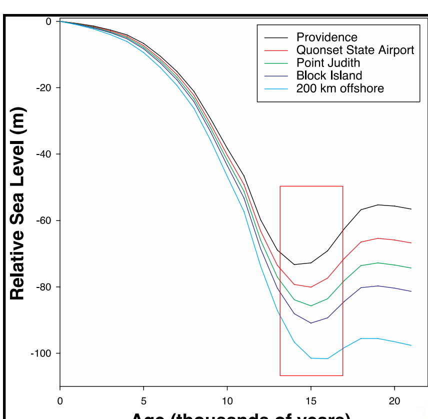
Why deposits survive under slow transgression? Geomorphology that provides protection from energy of the open ocean

Sea Level Research

Sweet spots?

- "Slowstands" to enable landscape development
- Problem: rapid marine transgression from ~14 thousand years ago to present
- 8.2 ka event – drop/stabilization in relative sea level followed by resumption of rapid rise?
- Rapid inundation – Cascadia earthquakes as an analog for meltwater pulses?
- Evidence from the Chesapeake. Is rapid rise needed to preserve features?
- Geomorphology and local geology the key, protect sites from erosion during transgression (or very rapid rise needed to preserve)

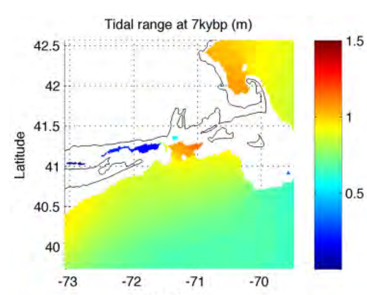
Sea Level Research



Can we treat Rhode Island as one site?

Sea Level Research

Added Complications?



Sea Level Research

What is needed?

- "This work underscores the importance of a well constructed *(relative)* sea-level chronology to predict the location of drowned terrestrial environments and associated cultural resources." Kelley et al., (2010), Geology
- RSL chronology can guide where to look and identify likely time periods for development and preservation
- Relative Sea-Level Data: sparse but sites east and west can guide especially for last 5000 years
- Beyond 5000 years – Models (as a guide): useful but caveats and limitations
- Good bathymetric mapping data and seismic reflection profiles to identify suitable geomorphic settings

Sea Level Research
University of Rhode Island

Daniel Belknap

Submerged Paleolandscapes - Determination of Sea-Level Rise and Coastal Change

Daniel F. Belknap

School of Earth and Climate Sciences,
Climate Change Institute, and
School of Marine Studies
University of Maine,
Orono, ME

Belknap@maine.edu

URI - 2013

Vibracoring

Webhannet River marsh,
Wells, 06/17/84

URI - 2013

D.F. Belknap

Dutch Coring

St. George River,
S. Warren, ME
08/06/02

Spartina alterniflora

Spartina patens

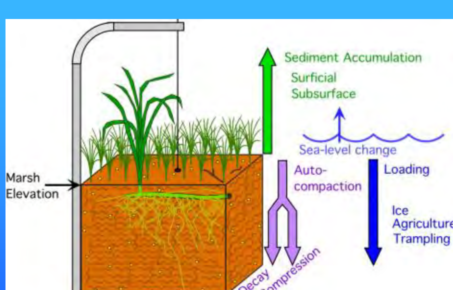
URI - 2013

Dutch corer

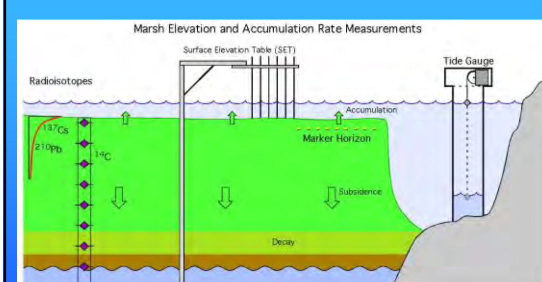
Latest Pleistocene Epoch
Presumpscot Formation
"blue clay"
S. Warren, ME

URI - 2013

Belknap 08/06/02



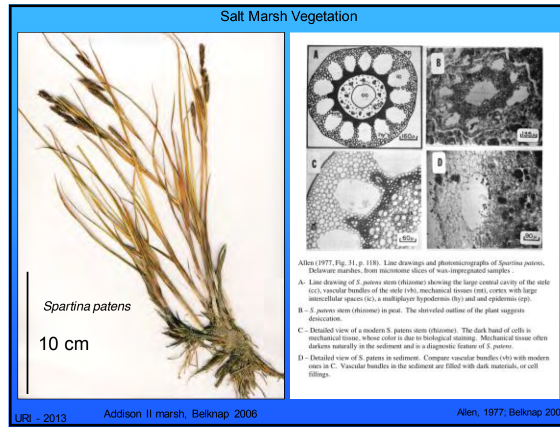
URI - 2013

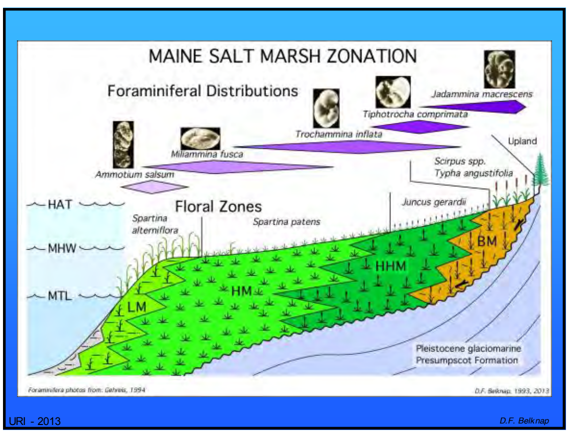


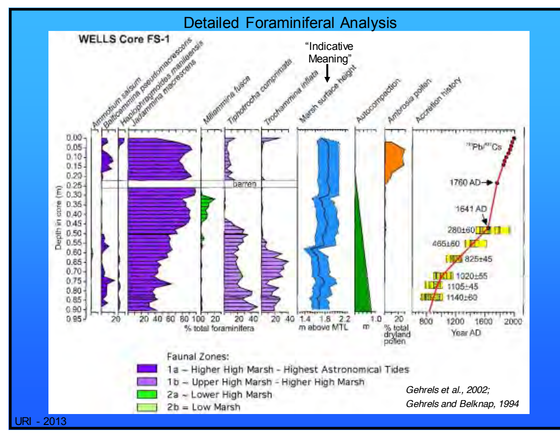
URI - 2013

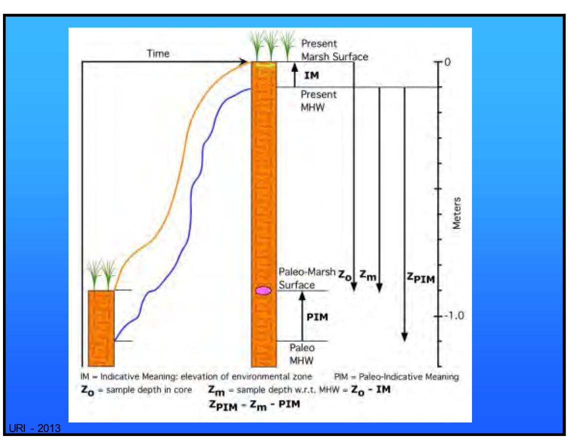
Belknap 2010

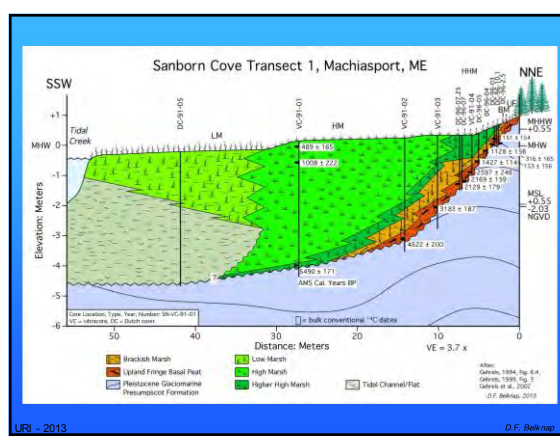

Brackish upland transition: Typha angustifolia rhizomes
Dutch core sample. Wells – Fire Station transect
Belknap 07/01/91
URI - 2013

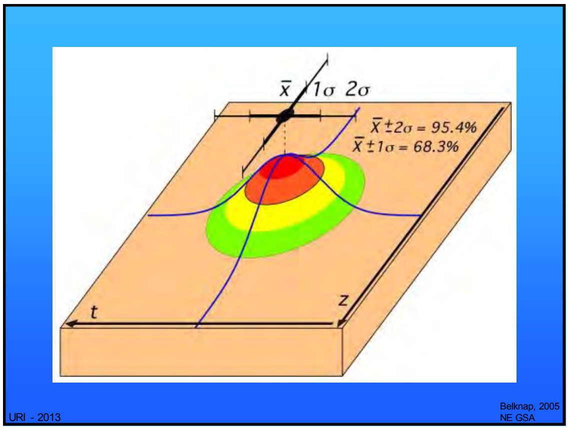

Salt Marsh Vegetation
Spartina patens
10 cm
Addison II marsh, Belknap 2006
Allen, 1977; Belknap 2006
URI - 2013

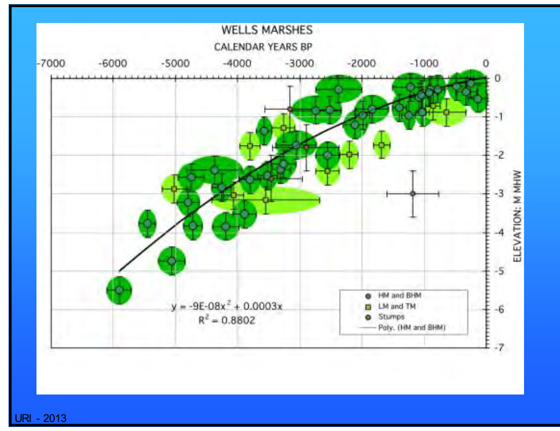

MAINE SALT MARSH ZONATION
Foraminiferal Distributions
Jadammina macrescens
Tiphotrocha comprimata
Trochammina inflata
Miliammina fusca
Ammotium salsum
Upland
Scirpus spp.
Typha angustifolia
Juncus gerardii
Floral Zones
Spartina alterniflora
Spartina patens
HAT
MHW
MTL
LM
HM
HHM
BM
Pleistocene glaciomarine Presumpscot Formation
Foraminifera photos from: Gehrels, 1994
D.F. Belknap, 1993, 2013
URI - 2013
D.F. Belknap

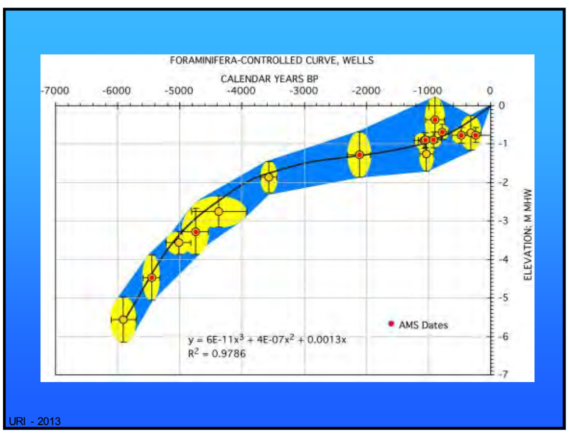

Detailed Foraminiferal Analysis
WELLS Core FS-1
"Indicative Meaning"
Ammotium salsum
Balticammina pseudomacrescens
Haplophragmoides manilaensis
Jadammina macrescens
Miliammina fusca
Tiphotrocha comprimata
Trochammina inflata
Marsh surface height
Autocompaction
Ambrosia pollen
Accretion history
Depth in core (m)
% total foraminifera
m above MTL
% total dryland pollen
Year AD
1760 AD
1641 AD
280±60
465±60
825±45
1020±55
1105±45
1140±60
Faunal Zones:
1a – Higher High Marsh - Highest Astronomical Tides
1b – Upper High Marsh - Higher High Marsh
2a – Lower High Marsh
2b – Low Marsh
Gehrels et al., 2002;
Gehrels and Belknap, 1994
URI - 2013


Time
Present Marsh Surface
IM
Present MHW
Paleo-Marsh Surface
PIM
Paleo MHW
Zo
Zm
ZPIM
Meters
0
-1.0
IM = Indicative Meaning: elevation of environmental zone
PIM = Paleo-Indicative Meaning
Zo = sample depth in core
Zm = sample depth w.r.t. MHW = Zo - IM
ZPIM = Zm - PIM
URI - 2013


Sanborn Cove Transect 1, Machiasport, ME
SSW
NNE
Tidal Creek
LM
HM
HHM
BM
MHW
Elevation: Meters
Distance: Meters
VE = 3.7 x
MHHW +0.55
MSL +0.55
-2.03 NGVD
AMS Cal. Years BP
Brackish Marsh
Upland Fringe Basal Peat
Pleistocene Glaciomarine Presumpscot Formation
Low Marsh
High Marsh
Higher High Marsh
Tidal Channel/Flat
D.F. Belknap, 2013
URI - 2013
D.F. Belknap


x̄ 1σ 2σ
x̄ ± 2σ = 95.4%
x̄ ± 1σ = 68.3%
t
z
URI - 2013
Belknap, 2005
NE GSA


WELLS MARSHES
CALENDAR YEARS BP
-7000 -6000 -5000 -4000 -3000 -2000 -1000 0
0 -1 -2 -3 -4 -5 -6 -7
ELEVATION: M MHW
y = -9E-08x² + 0.0003x
R² = 0.8802
HM and BHM
LM and TM
Stumps
Poly. (HM and BHM)
URI - 2013


FORAMINIFERA-CONTROLLED CURVE, WELLS
CALENDAR YEARS BP
-7000 -6000 -5000 -4000 -3000 -2000 -1000 0
0 -1 -2 -3 -4 -5 -6 -7
ELEVATION: M MHW
AMS Dates
y = 6E-11x³ + 4E-07x² + 0.0013x
R² = 0.9786
URI - 2013


Basal peat overlying soil and Presumpscot Formation
Grand Marsh, Gouldsboro, GB-DC-92-05, 07/16/92
URI - 2013

SESSION:

"THE EVIDENCE-BASED RECONSTRUCTION OF SUBMERGED CULTURAL LANDSCAPES/PREDICTIVE MODELING"

PHILIP VERHAGEN

TAKING IT OUT TO THE SEA

Some ideas on the development of underwater predictive models

Philip Verhagen

Submerged Paleocultural Landscapes Workshop

8 April 2013, Narragansett RI

outline

- the role of archaeological theory
- data issues
- the modelling procedure
- testing issues

(predictive) models are tools to open up theories to testing

it all starts with theory

- 'hunter-gatherer cultures depended on the availability of different natural resources (game, fish, plants, flint, …) throughout the year'

- find the best suited locations to obtain these resources, and you will find the most probable locations for archaeological sites

middle range theory

"A large part of what is now described as (…) theory consists of general orientations toward data, suggesting types of variables which theories must somehow take into account, rather than clearly formulated, verifiable statements of relationships between specified variables." (Merton, 1968)

- middle range theory provides a logical structure that connects general theory and empirical data
  - example: off-site scatters of pot sherds

middle range theory

- middle range theory (Binford 1981) is
  - unambiguous
  - based on cause and effect rather than simple correlation
  - applicable to the past by using uniformitarian assumptions
  - and intellectually independent of general theory
- middle range theory aims at explaining aspects of cultural systems that can be explored empirically (Raab and Goodyear 1984)
  - post-processual critique: processes involved in archaeological site formation are inherently inaccessible (Hodder 1991)

coming out of the ivory tower: the problem with 'environmental' data

- what we really *want* to have is information on where certain resources were found in the past
  - depends on (palaeo-)ecological theory
  - cultural aspects: what hunting, gathering and food storage techniques were used?
- what we *have* are proxy data
  - elevation, geology, soils, rivers and lakes, remote sensing images
  - derived data: slope, solar radiation received, visibility, (cost) distance
- we often *assume* stability
  - rivers change course, sea level changes, soils erode

the problem with archaeological data

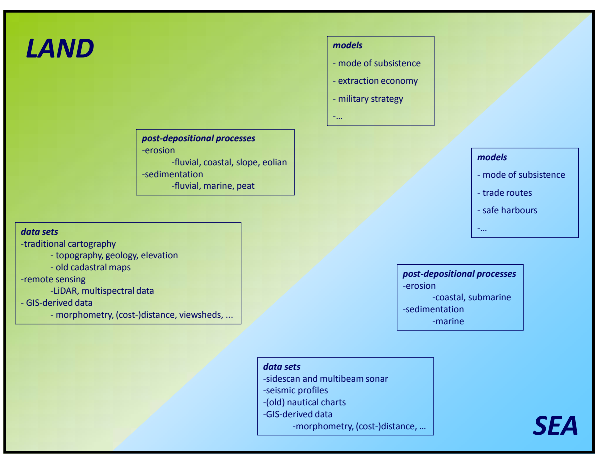
- representativity determines reliability of model
  - where has data collection taken place?
    - were all landscape zones sufficiently surveyed?
  - what methods were used?
    - depth of penetration
    - detection probability
    - (lack of) sampling strategies

archaeological data collection methods and representativity

	sampling depth	coverage	preference for high probability
field walking	ploughzone	vegetation dependent	moderate
core sampling	> 7 m	small	moderate
trial trenching	< 2 m	partial	strong
excavation	< 2 m	full	very strong
watching brief	< 2 m	full	weak

land and sea

- land and sea are different
  - nautical remains
  - different post-depositional processes
  - different 'environmental' data sets
  - different survey methods
- land and sea are connected
  - submerged terrestrial landscapes
  - marine sedimentation on land
  - similar heritage management goals (?)



the modelling exercise

- proxy variables are combined in an equation of suitability
- but how do we obtain the weights for each variable?
  1. find the factors that would definitely inhibit settlement
     - wet areas, high mountains, …
  2. assess effects of landscape change
     - where could sites have disappeared?
     - where have suitabilities changed?
  3. experiment and compare with archaeological test data
     - what combination of variables and weights produces the best prediction?

combining models

- create theoretical frameworks for each ‘chrono-cultural entity’ we’re interested in
  - use middle-range theoretical approach
  - include knowledge of landscape dynamics
- create predictive models for cases where the base (proxy) data are comparable
  - this will imply making different models for different regions, with different accuracy
- evaluate models separately
- only combine results at the very end for management purposes
  - stick to quantitative, if possible probabilistic measures

end result?

judging model quality

- first phase: validation (consistency testing)
  - conceptual errors
  - factual errors
  - observational bias
- second phase: evaluation (performance testing)
  - expert judgement
  - statistical testing
    - involves judgement as well!
- and lastly: field testing

KIERAN WESTLEY

The Evidence-Based Reconstruction of Submerged Cultural Landscapes/Predictive Modelling

Kieran Westley (Centre for Maritime Archaeology, University of Ulster, UK

University of ULSTER cma

Structure of presentation

Attraction of predictive model for submerged cultural landscape research

- Underwater archaeology can be difficult and time-consuming
- Divers limited by depth, air, visibility, burial of archaeological remains,
- Marine geophysical and geotechnical surveys; good for large areas, cannot detect individual sites
- Model could therefore can save time and effort: intensively survey predicted hotspots

---

Structure of presentation

- General issues in predictive modelling for submerged landscapes
- Case study: Newfoundland (Canada)
- Case study: north of Ireland (UK and Republic of Ireland)
- Conclusions and summary

General issues: site locations

Effective modelling needs understanding of the relationship between archaeological sites and the past landscape/environment

Options:

1) Directly correlate distribution of known sites to specific landscape features (e.g. water, topography)
2) Identify settlement rules based on archaeological, oral or historical knowledge of the society in question (e.g. large emphasis on salmon → look for areas near salmon rivers)

Issues:

- Do we have enough known sites to create an effective model (e.g. how to model coastal site locations when the coastlines are underwater)?
- How accurate are known site locations/knowledge of past settlement patterns?

General issues: landscape reconstruction

Key variables might include:

- Topography
- Hydrology (i.e. rivers & lakes)
- Resource locations (e.g. food, raw material)
- Socio-cultural

Issues

- Understanding of sea-level change (and glacial history if relevant)
- Submerged landscapes cannot be directly observed and must be reconstructed from evidence.
- Reconstructed variables depend on availability of marine geophysical/geotechnical evidence
    - Sidescan sonar, echosounders, swath bathymetry to map the seabed surface
    - Seismic profilers to detect buried layers/landsurfaces
    - Cores/boreholes to sample buried deposits, grabs/cameras to sample surface deposits

General issues: Preservation

Even if we have accurate modelled site locations and reconstructed the landscape, what certainty do we have that archaeological or palaeo-landscape material is preserved?

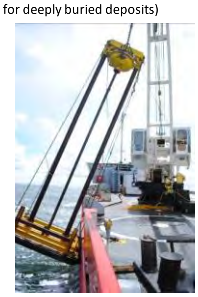
Options

- Evidence from modern conditions (e.g. rule out areas of strong currents, large zones of exposed bedrock or focus on areas of known erosion)
- Focus on areas with landsurface evidence (e.g. from geophysical/geotechnical work, intertidal sites)
- Consider the usefulness of secondary context material

General issues: Testing

Models need to be systematically tested and ground-truthed, otherwise we will never know if they work

- Results feed back into previous stages; refine models and reconstructions
- Tailor ground-truthing techniques to the inferred site types and preservation conditions (e.g. divers for surface and shallow buried deposits, cores for deeply buried deposits)



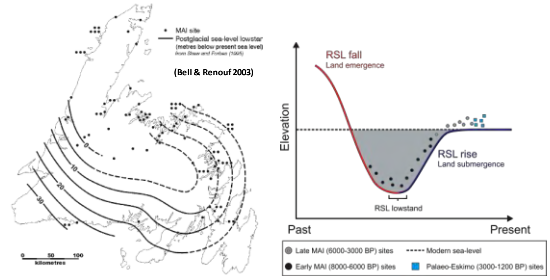
Case studies

Case Study 1: Newfoundland

Aim:

Identify Maritime Archaic (c. 8-3,000 years ago) sites in now submerged areas

Sea-level change:



Case Study 1: Newfoundland

Site location model (Bell & Renouf 2003; Renouf & Bell 2006)

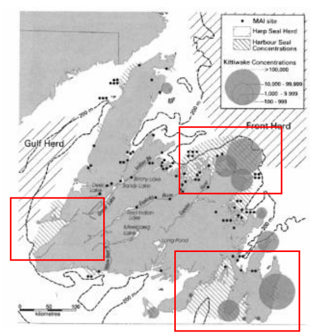
Island-wide pattern

Scale one: regional setting (n = 80 sites)			
Coastal 84%		Interior 16%	
Scale two: coastal / interior setting (n = 80 sites)			
Offshore 13%	Nearshore 71% Deep bays and arms (n = 25 sites) head 36% mid 48% mouth 16%	Near interior 7%	Deep interior 9%
Scale three: shoreline setting (n = 67 coastal sites)			
Cove 63%	Point 21%	Straight 16%	
Scale four: site setting (n = no. of sites for which criterion could be measured)			
Near potential monitoring site 70% (n = 56)	View in more than one direction 46% (n = 78)	Near stream or pond 89% (n = 64)	On route inland 21% (n = 82)

Case Study 1: Newfoundland

Site location model (Bell & Renouf 2003; Renouf & Bell 2006)

Regional variations relating to resource distributions



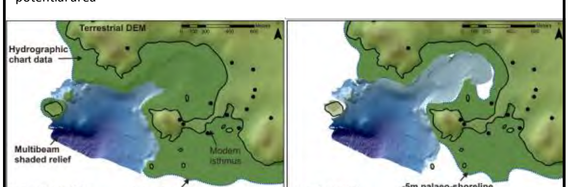
Concentration of MAI offshore & nearshore sites in area of historic (19th C) seal hunting

Seal concentrations but few sites. Deeper sea-level lowstand. Sites submerged?

Case Study 1: Newfoundland

Landscape reconstruction

-Local scale only due to data availability. Only 1 small area where data coincides with high potential area



- Transformation of Back Harbour from semi-exposed offshore location into more sheltered nearshore location through the MAI period

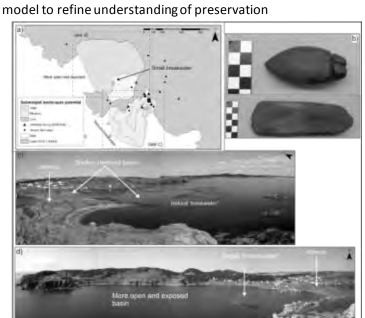
-Reduced shelter might imply lower probability of settlement; however this area (NE coast) has sites in exposed locations, possibly for migratory seal hunting

- Potential areas north and south of the isthmus

Case Study 1: Newfoundland

Testing

- Small scale intertidal survey only due to reconstruction availability and time constraints
- Feedback into model to refine understanding of preservation



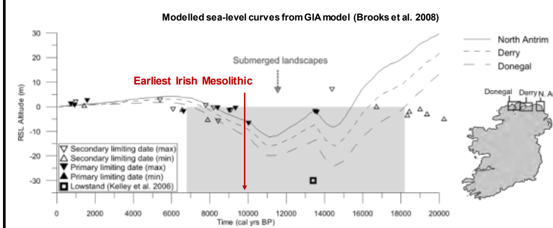
Case study 2: North of Ireland

Case Study 2: North of Ireland

Aim:

Identify Mesolithic (c. 10-6,000 years ago) sites and landscapes in now-submerged areas

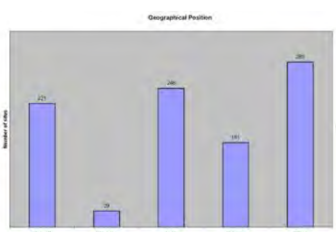
Sea-level change:

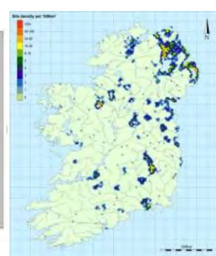


Case study 2: North of Ireland

Site location model (Woodman 1978; Woodman et al. 2006)

- Existing site distributions inaccurate; many sites poorly located
- Improvement of site database is currently ongoing (Woodman et al., in prep)
- Evidence suggests focus around rivers (eel/salmon fishing), lakes, coasts, avoidance of highlands

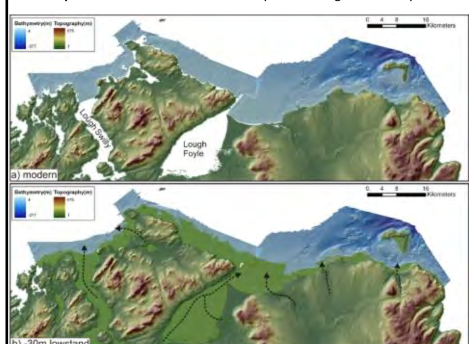




(Map & graph courtesy of Peter Woodman)

Case Study 2: North of Ireland

Landscape reconstruction - Data availability allowed large-scale analysis

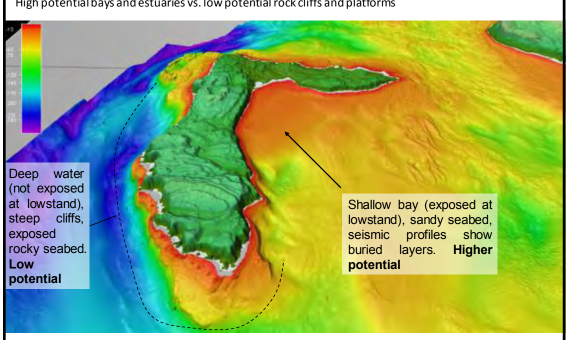


Coarse palaeo-geographic reconstruction assuming sea-level fall of -30m (c. 13,500 years ago). Note – this uses the seabed surface only

Case Study 2: North of Ireland

Landscape Preservation

High potential bays and estuaries vs. low potential rock cliffs and platforms



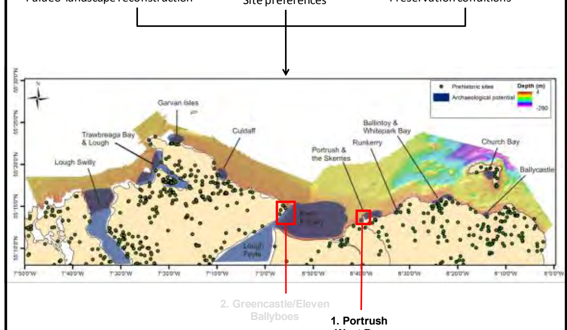
Case Study 2: North of Ireland

High potential areas identified for testing

Palaeo-landscape reconstruction

Site preferences

Preservation conditions

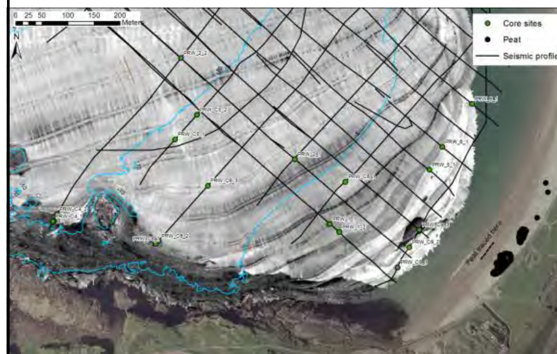


Case Study 2: North of Ireland

Testing - Started with areas where there is known intertidal evidence

Portrush West Bay – intertidal peat with wood, dated to 7-8000 years ago

Case Study 2: North of Ireland

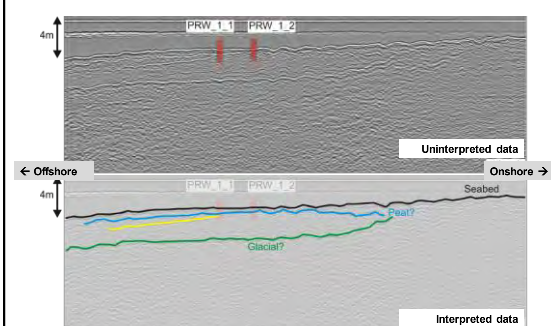


Backscatter data showing contrasting substrate offshore

Case Study 2: North of Ireland

Bathymetric data shows contrasting substrate lies within a depression – i.e. exposure of an underlying layer

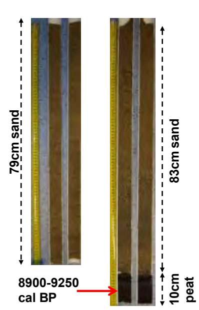
Case Study 2: North of Ireland



Seismic profiles show a distinct layer running just below the seabed in the area where the contrasting substrate was observed. Coring targets picked where the layer ran closest to the seabed

Case Study 2: North of Ireland

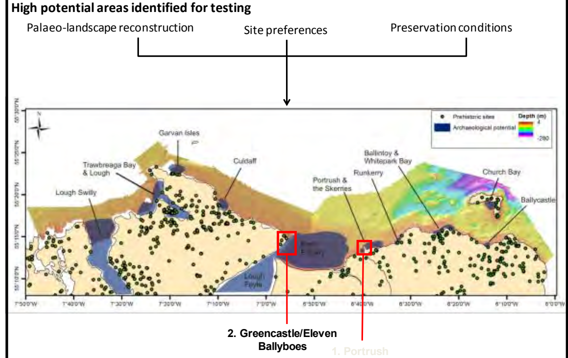
Extrapolated peat extent, up to -10m below sea-level



Ground truthing was successful; the peat was located offshore.

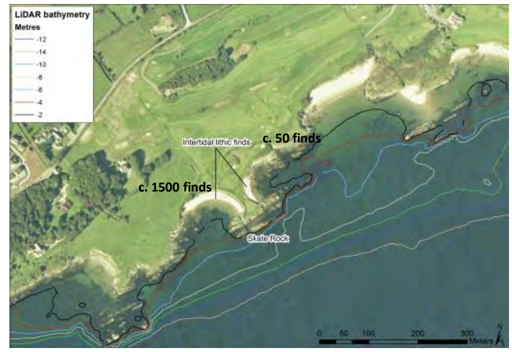
Case Study 2: North of Ireland

High potential areas identified for testing



Case Study 2: North of Ireland

Case Study 2: North of Ireland



Case Study 2: North of Ireland

Case Study 2: North of Ireland

Case Study 2: North of Ireland

Peat with in situ wood dated to 8700-9400 cal BP

Conclusions

	Newfoundland	N. Ireland	
Site location model	X	X	
Palaeo-landscape reconstruction	X	X	
Preservation assessment	X	X	
Systematic testing	X	X	
Success?	X	X	

Although submerged landscape investigation arguably needs all the above, we should remember that the level of detail and accuracy required of each will vary depending on a) data availability, b) the nature of your study area and c) what you want out of the model

Acknowledgments

Newfoundland

Trevor Bell, Priscila Renouf, Lev Tarasov, John Anderson, Jim Anstey, Alison Anstey, Rob Anstey, Elaine Anton, Stephen Hull, Dominique Lavers, Tim Rast, Ken Reynolds
Funding was provided by Memorial University

Northern Ireland

Rory Quinn, Ruth Plets, Peter Woodman, Wes Forsythe, Fabio Sacchetti, Sara Bennetti, Trevor Bell, Annika Clements, Fergal McGrath, Rhonda Robinson, Carl Gardner, Joe Breen, Tim Mackie, Claire Vincent, Koen Verbruggen, Archie Donovan, Brian Williams, Matt Service, Karl Brady, Connie Kelleher, Robin Edwards, Tony Brooks, Peter Wilson, Robert Stewart, Sam Smyth, Colin Breen, Paul Montgomery, Chris McGonigal, Rory McNeary.

Additional dive support in 2010-11 was provided by the UK National Facility for Scientific Diving (NFSD): Martin Sayer, Elaine Azzopardi, Hugh Brown, Simon Thurston

Special thanks are due to Brian McNaught, Tommy Gallagher and Eddie Harkin for the original discovery and collection of intertidal finds

This work was funded by the Heritage Council under the Irish National Strategic Archaeological Research (INSTAR) Programme 2008-2010, a Heritage Research grant for 2012 and a UK Natural Environment Research Council (NERC) NFSD grant (2010-11)

SESSION:

"THE NATURE AND EXCAVATION OF SUBMERGED SETTLEMENTS"

JØRGEN DENCKER

The Nature and Excavation of

Submerged Settlements

Jørgen Dencker

The Viking Ship Museum, Roskilde

Submerged Paleocultural Landscapes Workshop
Rhode Island 2013

20.000 BP

DOGGERLAND

12.000 BP

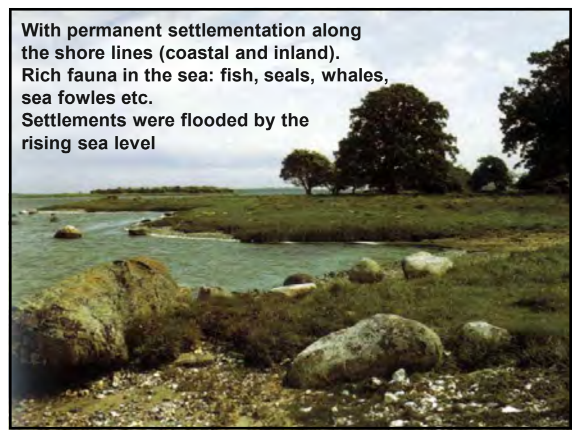
9-10.000 BP

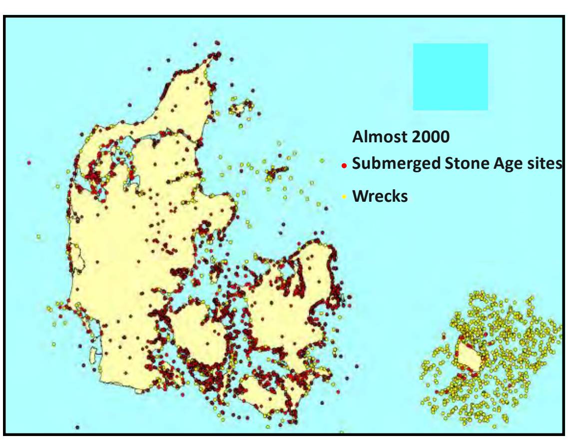
6-8.000 BP

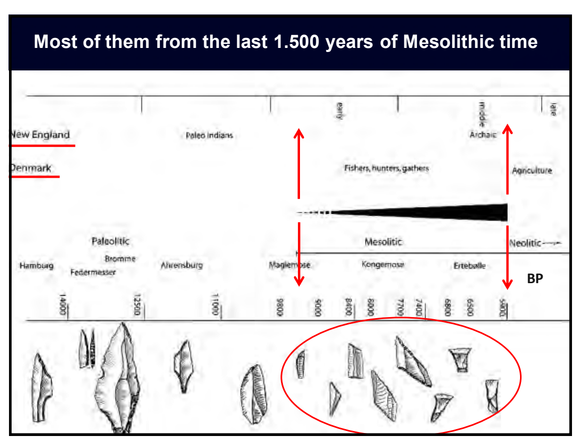

C-14: 9.200 BP

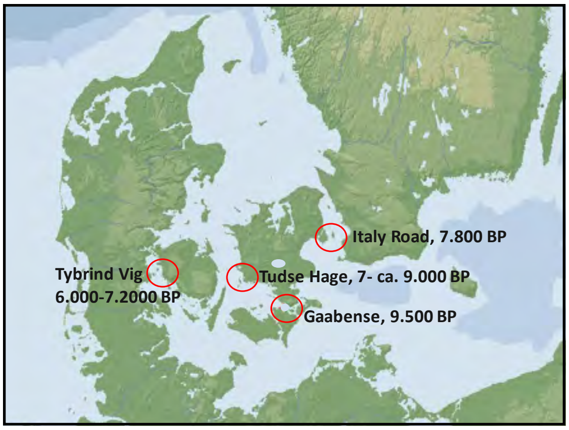

In a few thousands of years landscape
turned from being tundra with migrating
reindeers and hunters into a.....


Dense forest with a lot of game.
Wild boar, deer, roe, auroxe etc.

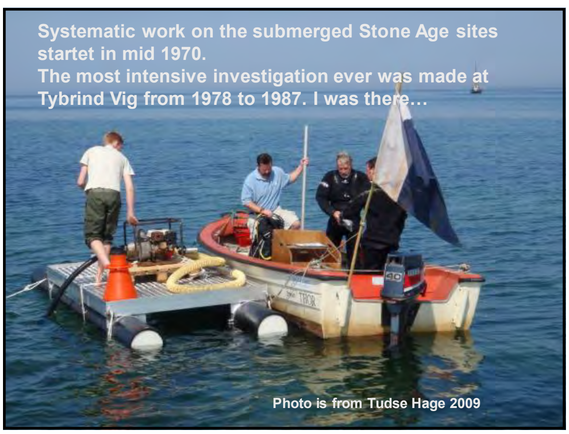

With permanent settlementation along
the shore lines (coastal and inland).
Rich fauna in the sea: fish, seals, whales,
sea fowles etc.
Settlements were flooded by the
rising sea level


Almost 2000
Submerged Stone Age sites
Wrecks


Most of them from the last 1.500 years of Mesolithic time
early
middle
late
New England
Paleo indians
Archaic
Denmark
Fishers, hunters, gathers
Agriculture
Paleolitic
Mesolitic
Neolitic
Hamburg
Bromme
Federmesser
Ahrensburg
Maglemose
Kongemose
Erteballe
BP
14000
12500
11000
8400
8000
7700
7400
6800
6500


Italy Road, 7.800 BP
Tybrind Vig
6.000-7.2000 BP
Tudse Hage, 7- ca. 9.000 BP
Gaabense, 9.500 BP


Diving on submerged Stone Age sites started already in 1958 with this top modern diving equipment


Systematic work on the submerged Stone Age sites startet in mid 1970.
The most intensive investigation ever was made at Tybrind Vig from 1978 to 1987. I was there…
Photo is from Tudse Hage 2009

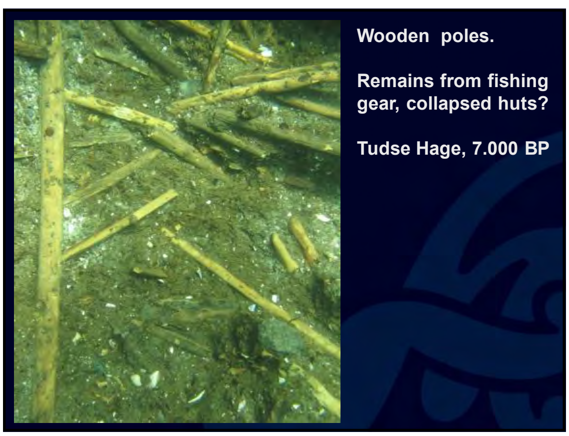

And very fast it was obvious that the preservation conditions were extremely good for organic material and totally new aspects of our ancient cultures were exposed.


Settlement area is normally eroded away

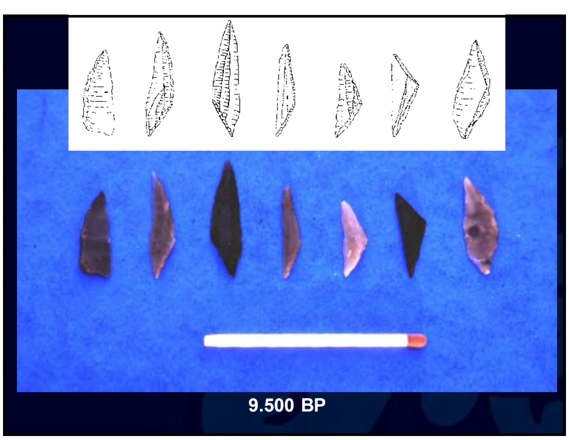

It’s in the area just outside the settlement we have the sediments with extremely good preservation conditions

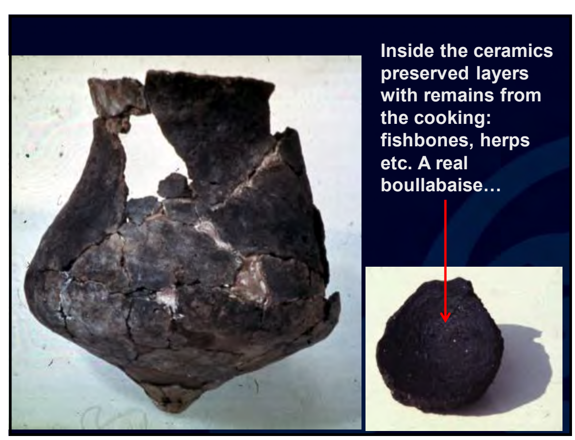

Gytje – non aerobic conditions preventing detoration
23 7 '86


Well preserved organic objects: wood, antler, bone, plant fibre etc.
Tudse Hage: 7.000 BP


Wooden poles.
Remains from fishing gear, collapsed huts?
Tudse Hage, 7.000 BP


Non eroded sharp edged flint perfect for analyzing


9.500 BP


Inside the ceramics preserved layers with remains from the cooking: fishbones, herps etc. A real boullabaise…

Tybrind Vig

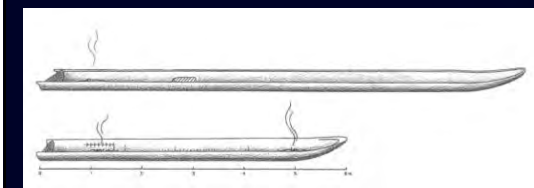
First recovered logboat in 1980

- 30 feet long
- two feet wide
- 1 inch thick

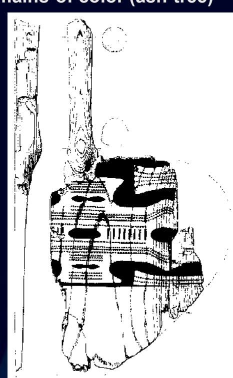
Fireplace in the aft end based on clay and sand

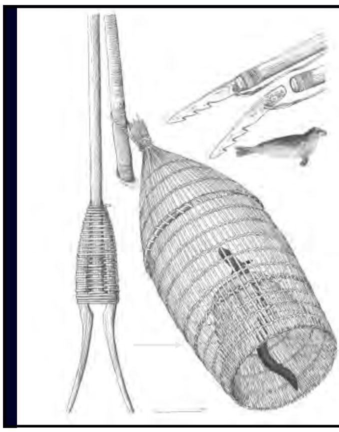
6.000 BP

Sketch of two log boats from Tybrind Vig, 6.000 BP (Linden)



Padles with carvings and remains of color (ash tree)





Fishing and hunting tools and gear:

- Fishing traps
- Leister prongs
- Fishing hooks
- Points
- Harpoons

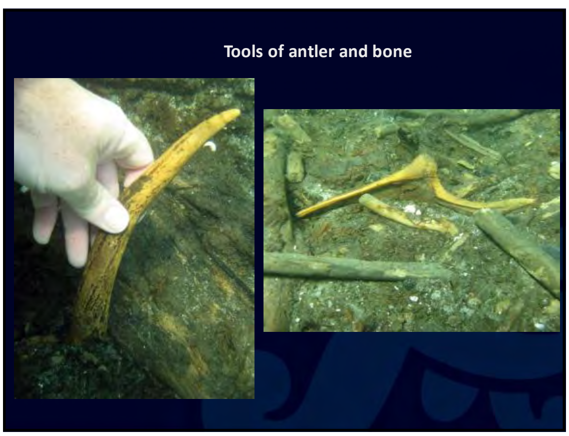
Details of the fish trap

Leister prongs of different types:

- Long ones
- Short ones


Long Y-shaped hazzlepoles of unknown purpose.
And a lot of other wooden tools which we don't know for what they have been used.
But all well preserved

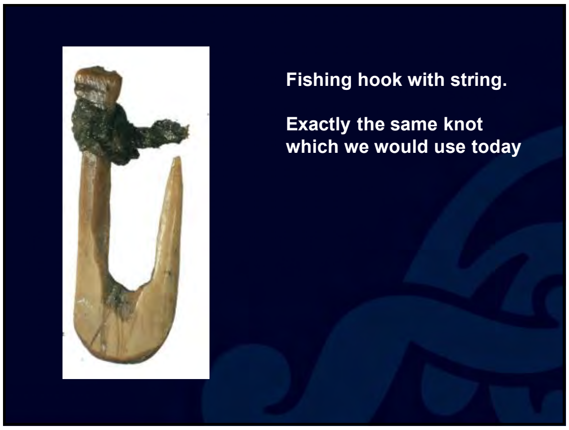

Wooden shafts – for what?


Tools of antler and bone


Adze with symbolic carvings made of antler from deer.

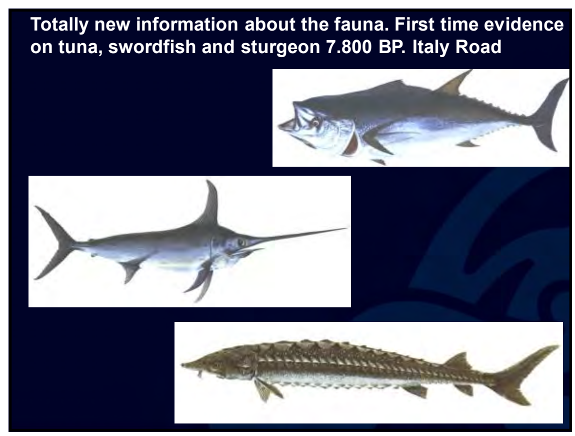

Pressure sticks for flint napping.
Made of antler from deer.


Harpoon made of antler from roe


Fishing hook with string.
Exactly the same knot which we would use today


Fishing hooks cut out of a splitted rib from a roe


Point from an eagle bone, 7.800 BP, Italy Road


Totally new information about the fauna. First time evidence on tuna, swordfish and sturgeon 7.800 BP. Italy Road


How were this big game caught?
Giant fishing hooks or harpoons?
Harpoon for big fish in Motala Stream in Sweden.
All 53 we found were broken because they had hit the rock


Textile, plant fibres. 6.000 BP, Tybrind Vig.

What we learned from Tybrind Vig, Tudse Hage and some of the other submerged Stone Age sites in Denmark is that the preservation conditions can be extremely good and a lot of new knowledge on our ancestors is hidden here. Knowledge that we can’t get else where.

If we want to know where to find the submerged sites we have to know what to look for and how to do it in the most effecient and non destructive way.

THANK YOU

Thin string and green leaves, 7.000 BP, Tudse Hage

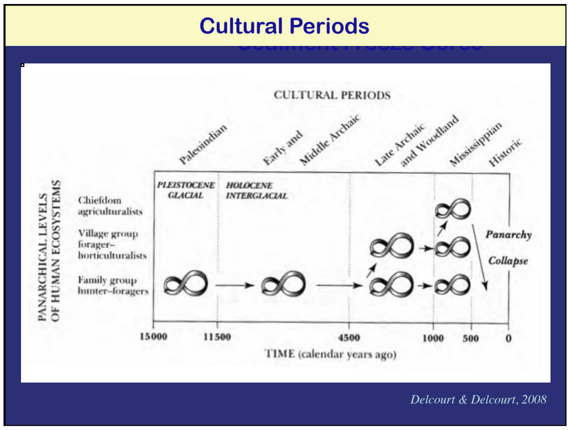
POWERPOINT PRESENTATIONS

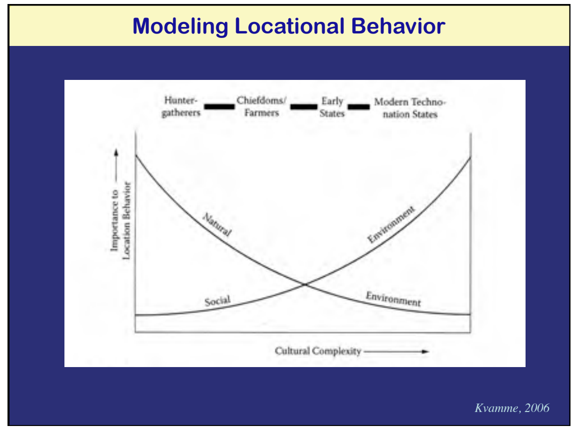
DAY 2 – MORNING

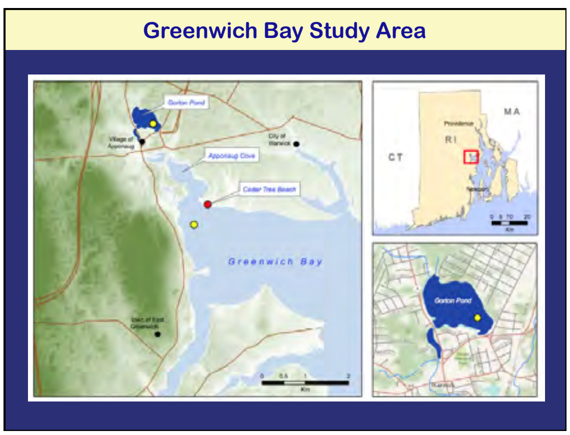
SESSION:

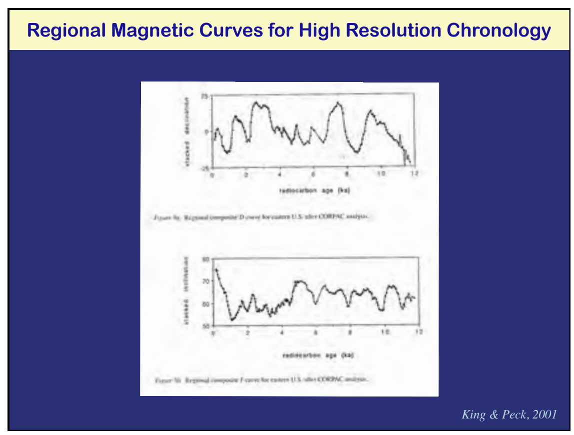
"BEST PRACTICES FOR PALEOENVIRONMENTAL RECONSTRUCTION"

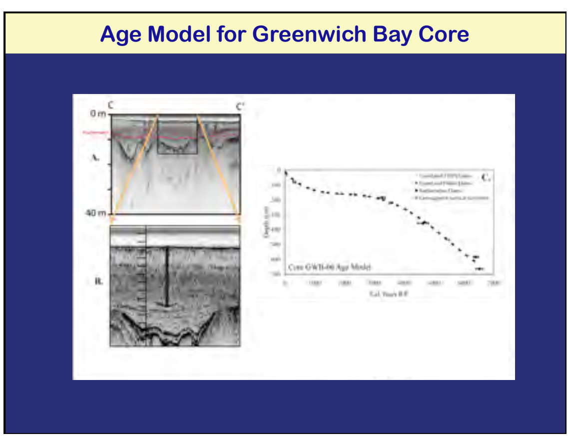
JOHN KING

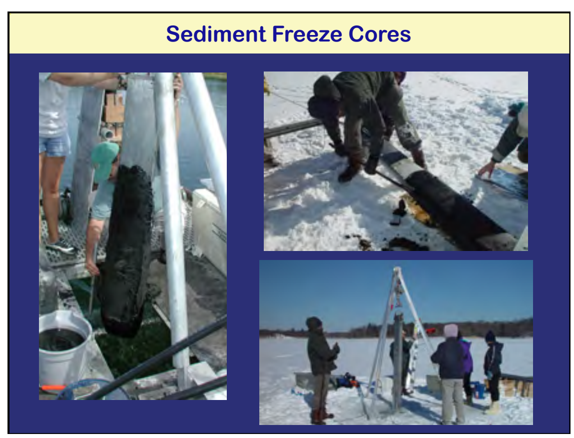

Cultural Periods
CULTURAL PERIODS
Paleoindian
Early and
Middle Archaic
Late Archaic
and Woodland
Mississippian
Historic
PLEISTOCENE GLACIAL
HOLOCENE INTERGLACIAL
PANARCHICAL LEVELS OF HUMAN ECOSYSTEMS
Chiefdom agriculturalists
Village group forager–horticulturalists
Family group hunter–foragers
Panarchy
Collapse
15000
11500
4500
1000
500
0
TIME (calendar years ago)
Delcourt & Delcourt, 2008


Modeling Locational Behavior
Hunter-gatherers
Chiefdoms/ Farmers
Early States
Modern Techno-nation States
Importance to Location Behavior
Natural
Environment
Social
Environment
Cultural Complexity
Kvamme, 2006

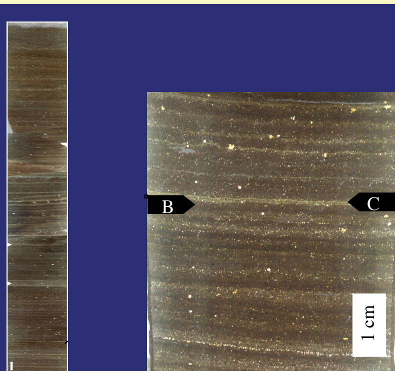

Greenwich Bay Study Area
Gorton Pond
Apponaug Cove
Cedar Tree Beach
Greenwich Bay
CT
RI
MA
Providence
Newport
Gorton Pond


Regional Magnetic Curves for High Resolution Chronology
radiocarbon age (ka)
radiocarbon age (ka)
King & Peck, 2001

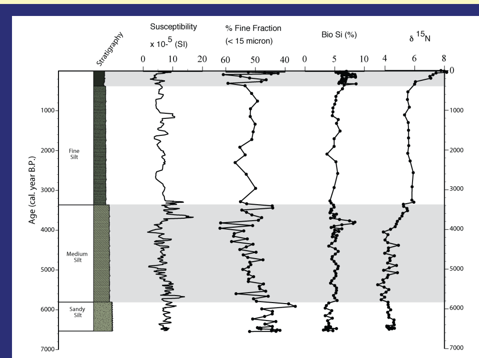

Age Model for Greenwich Bay Core
0 m
40 m
C
C'
A.
B.
Core GWB-08 Age Model
Cal Years BP


Sediment Freeze Cores

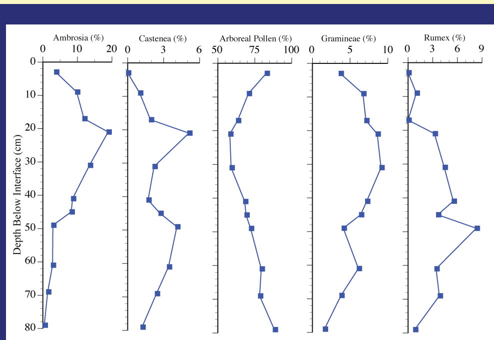
Varved Sediments



Environmental Proxy Data for Greenwich Bay



Pollen Data from Gorton Pond



Temperature estimates from pollen & δD_{BA}

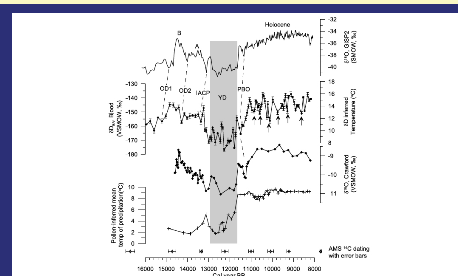


Figure 3. δD_{BA} record and pollen-inferred temperature from Blood Pond during the transition from late Pleistocene to Holocene in comparison with $\delta^{18}O$ data from Greenland Ice Sheet Project 2 (GISP2), and carbonate $\delta^{18}O$ from Crawford Lake. The abbreviations indicate the corresponding periods: OD1, Oldest Dryas; OD2, Older Dryas; IACP, Intra-Allerød cold period; YD, Younger Dryas; PBO, Pre-Boreal oscillation; B, Bølling; A, Allerød. The arrows beside the δD_{BA} curve indicate the freshwater outburst from proglacial lakes. Calibrated ages from accelerator mass spectrometry radiocarbon (AMS ^{14}C) dating with errors are shown.

Hou, et al., 2007

Human Artifacts: Microdebitage

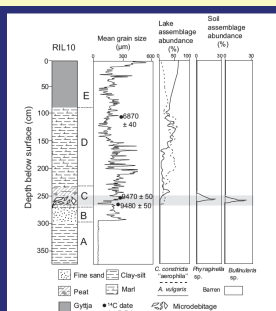


Figure 3. Core RIL 10 lithofacies, mean grain size, and thecamoebian abundances. Note shift from lake-based (*Arcella vulgaris*, *Centropyxis constricta* "aerophila") to soil and/or wetland thecamoebian assemblages (*Phyraginella*, *Bullinularia* sp.) at 250 cm in unit C. Radiocarbon dates are in yr B.P.

Sonnenburg, 2011

Microdebitage vs. Naturally-occurring grains

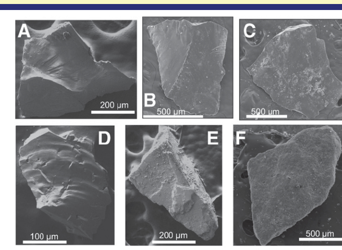
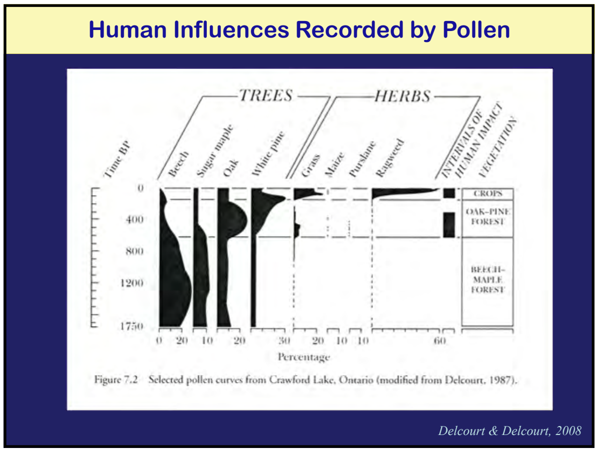
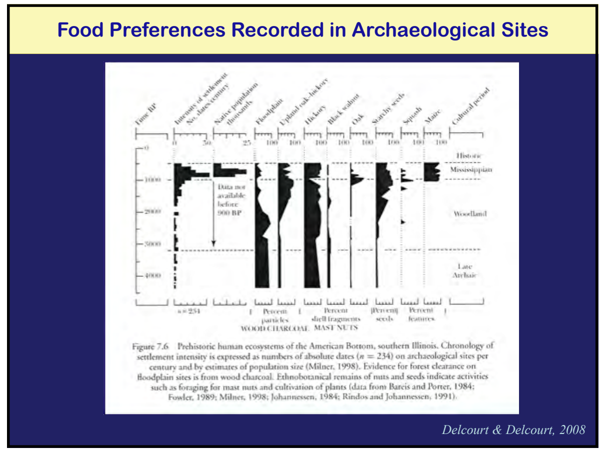
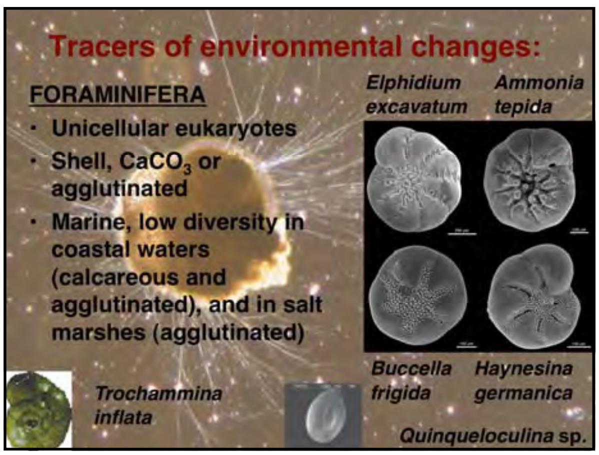


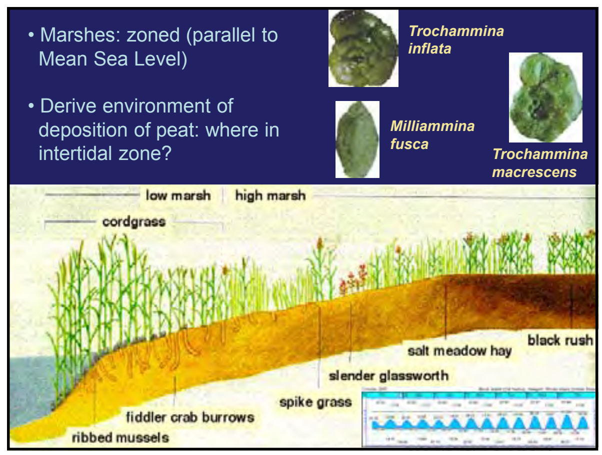
Figure 4. Scanning electron microscopy images of microdebitage and naturally occurring quartz particles. A–C: Microdebitage from core RIL 10 showing characteristic angular grains with conchoidal fractures and flake scars. Note conchoidal fractures and lack of surface weathering. D: Quartz microdebitage from McIntyre land site. E, F: Naturally occurring angular quartz grains from RIL 10. Note weathered and pitted surfaces and lack of conchoidal fractures.

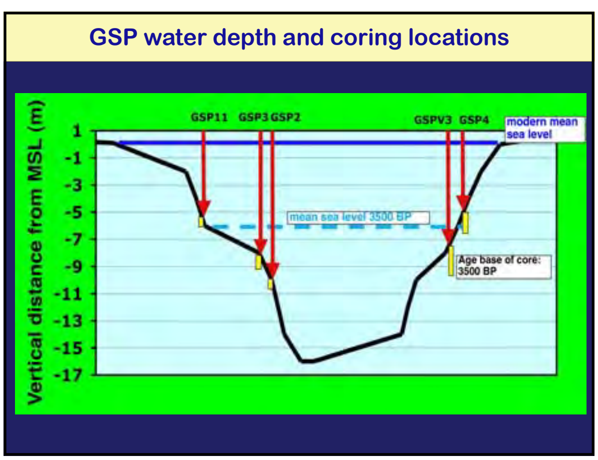
Sonnenburg, 2011


Human Influences Recorded by Pollen
TREES
HERBS
Time BP
Beech
Sugar maple
Oak
White pine
Grass
Maize
Purslane
Ragweed
INTERVALS OF HUMAN IMPACT
VEGETATION
CROPS
OAK-PINE FOREST
BEECH-MAPLE FOREST
Percentage
Figure 7.2 Selected pollen curves from Crawford Lake, Ontario (modified from Delcourt, 1987).
Delcourt & Delcourt, 2008


Food Preferences Recorded in Archaeological Sites
Historic
Mississippian
Woodland
Late Archaic
Delcourt & Delcourt, 2008


Tracers of environmental changes:
FORAMINIFERA
Unicellular eukaryotes
Shell, CaCO3 or agglutinated
Marine, low diversity in coastal waters (calcareous and agglutinated), and in salt marshes (agglutinated)
Elphidium excavatum
Ammonia tepida
Buccella frigida
Haynesina germanica
Trochammina inflata
Quinqueloculina sp.

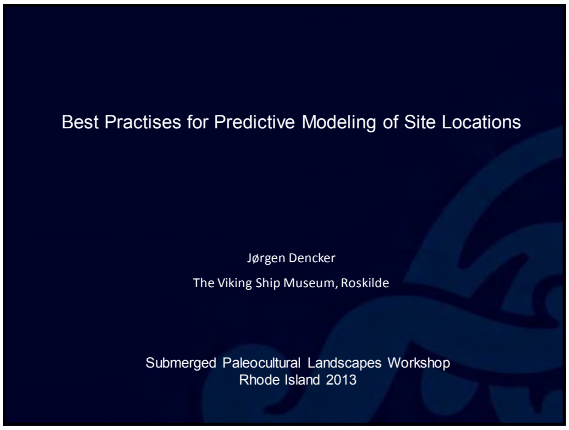

Marshes: zoned (parallel to Mean Sea Level)
Derive environment of deposition of peat: where in intertidal zone?
Trochammina inflata
Milliammina fusca
Trochammina macrescens
low marsh
high marsh
cordgrass
black rush
salt meadow hay
slender glasswort
spike grass
fiddler crab burrows
ribbed mussels

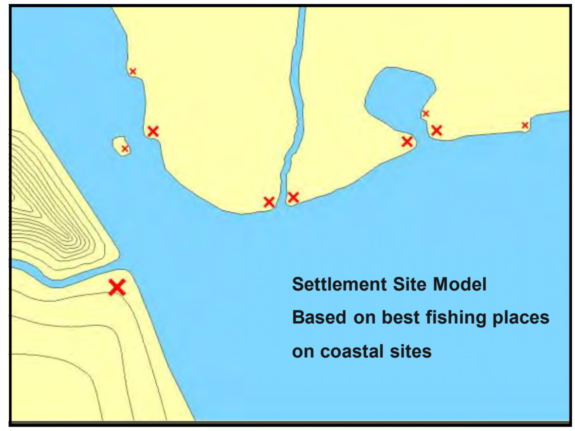

GSP water depth and coring locations
Vertical distance from MSL (m)
GSP11
GSP3
GSP2
GSPV3
GSP4
modern mean sea level
mean sea level 3500 BP
Age base of core: 3500 BP

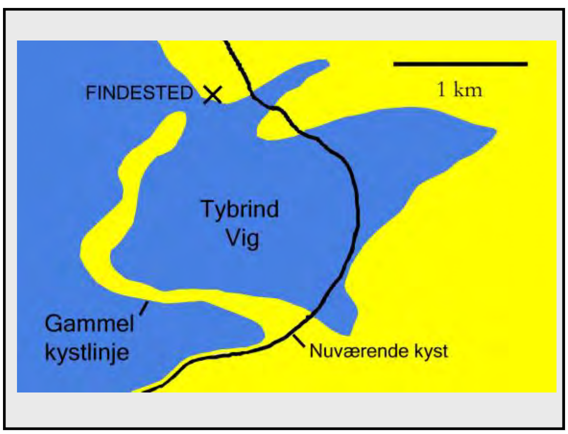
SESSION:

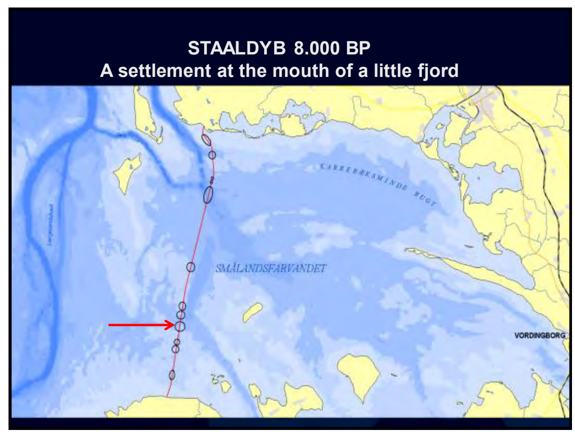
"BEST PRACTICES FOR PREDICTIVE MODELING OF SITE LOCATIONS"

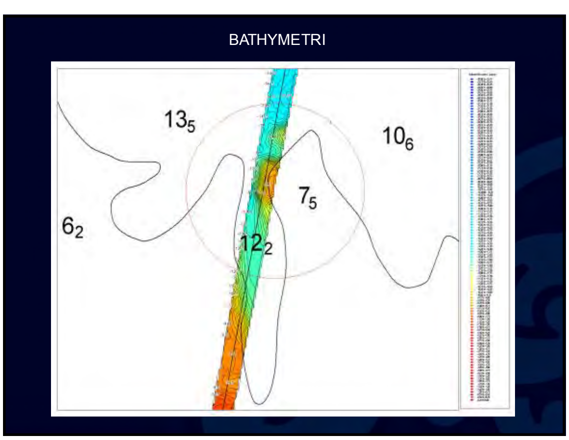
JØRGEN DENCKER

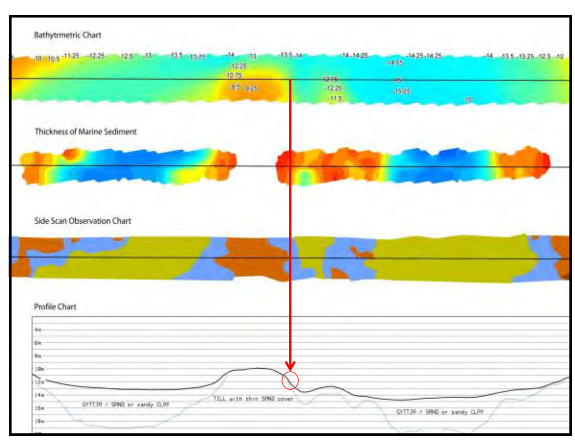

Best Practises for Predictive Modeling of Site Locations
Jørgen Dencker
The Viking Ship Museum, Roskilde
Submerged Paleocultural Landscapes Workshop
Rhode Island 2013


Settlement Site Model
Based on best fishing places
on coastal sites

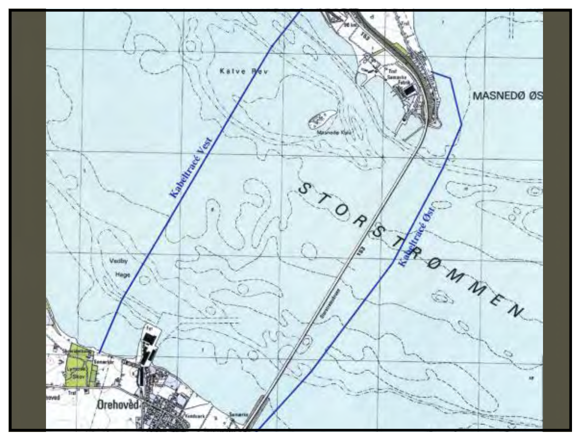

FINDESTED
1 km
Tybrind
Vig
Gammel
kystlinje
Nuværende kyst

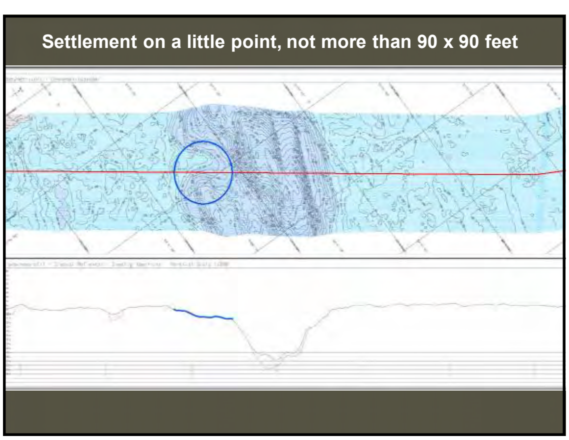

STAALDYB 8.000 BP
A settlement at the mouth of a little fjord
SMÅLANDSFARVANDET
VORDINGBORG

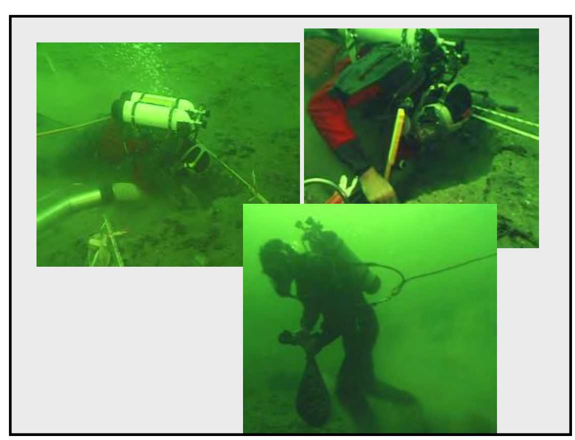

BATHYMETRI
13_5
10_6
7_5
6_2
12_2

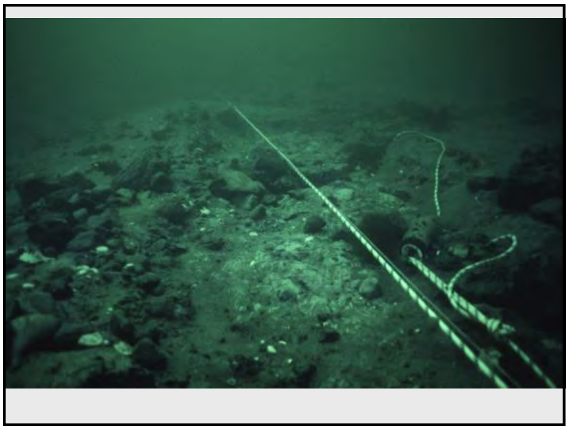

Bathytrmetric Chart
Thickness of Marine Sediment
Side Scan Observation Chart
Profile Chart

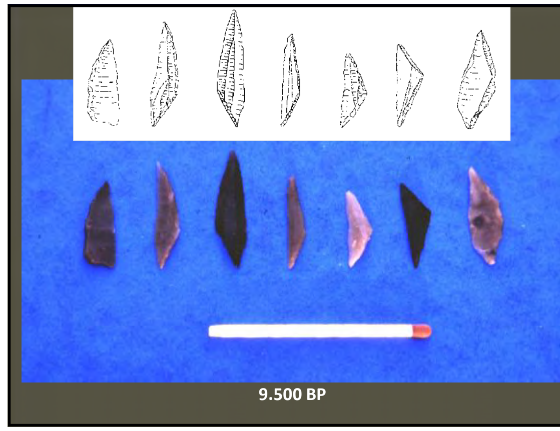

SWEDEN
DENMARK
Gaabense, 9.500 BP
GERMANY


Kalve Rev
MASNEDØ ØS
Kabeltracé Vest
S T O R S T R Ø M M E N
Kabeltracé Øst
Orehoved

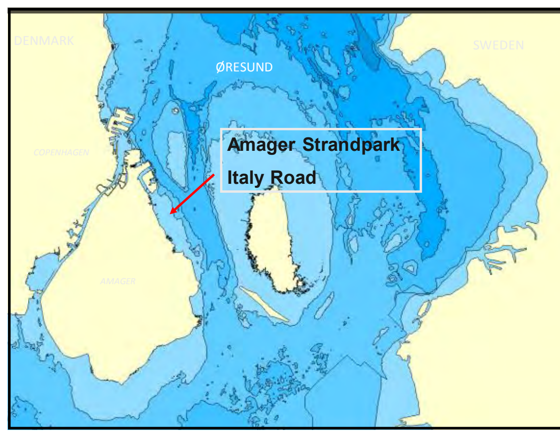

Settlement on a little point, not more than 90 x 90 feet

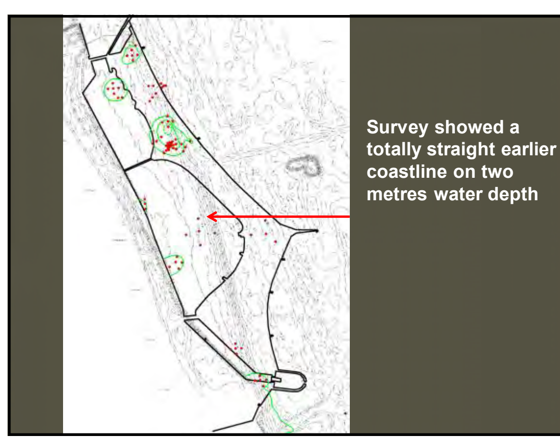


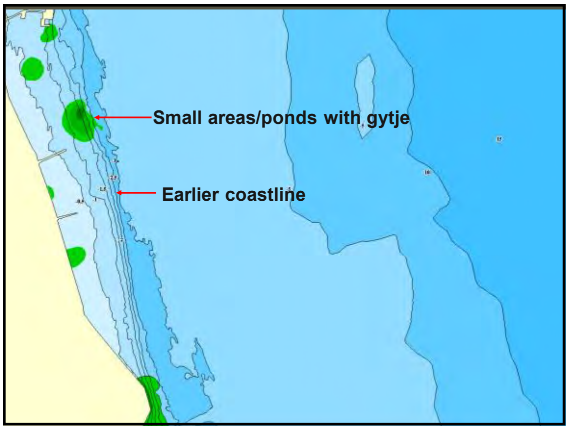


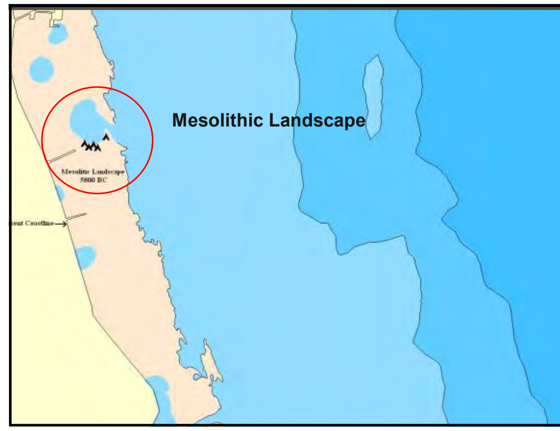

9.500 BP

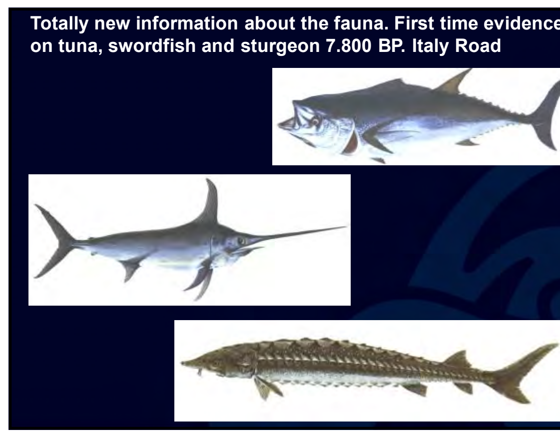

Exampel of a settlement which doesn't fit into the model is Italy Road along a totally straight coastline
SWEDEN
DENMARK
GERMANY

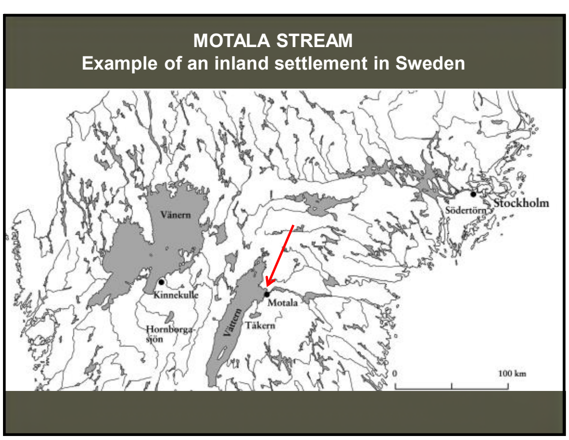

DENMARK
SWEDEN
ØRESUND
Amager Strandpark
Italy Road


Survey showed a totally straight earlier coastline on two metres water depth


Small areas/ponds with gytje
Earlier coastline


Mesolithic Landscape


Totally new information about the fauna. First time evidence on tuna, swordfish and sturgeon 7.800 BP. Italy Road

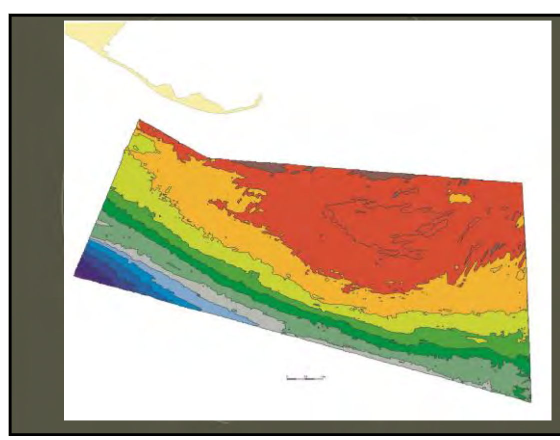

MOTALA STREAM
Example of an inland settlement in Sweden
Vänern
Kinnekulle
Hornborga-sjön
Vättern
Motala
Tåkern
Södertörn
Stockholm
0
100 km

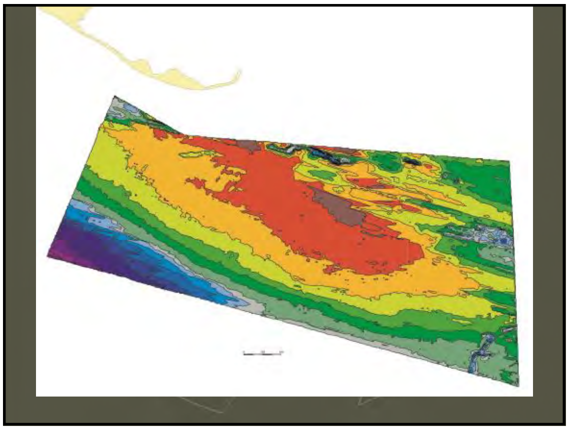
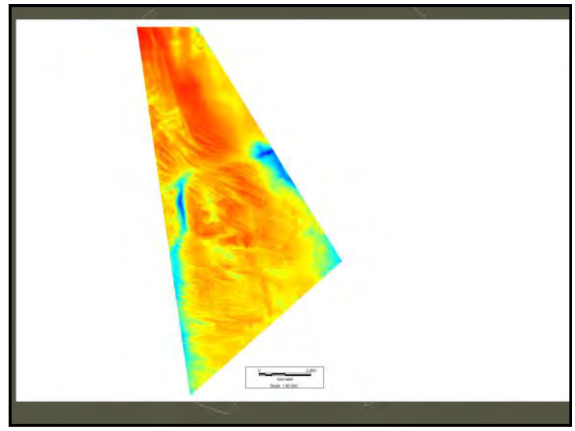
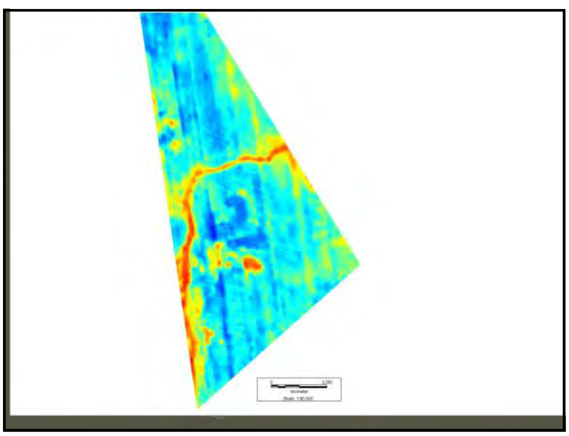

Settlement at the outlet of the lake Vänern


Fishing area in the sheltered back water


Harpoon for big fish in Motala Stream in Sweden.
All 53 we found were broken because they had hit the rock


Motala Stream, Sweden



PowerPoint Presentations

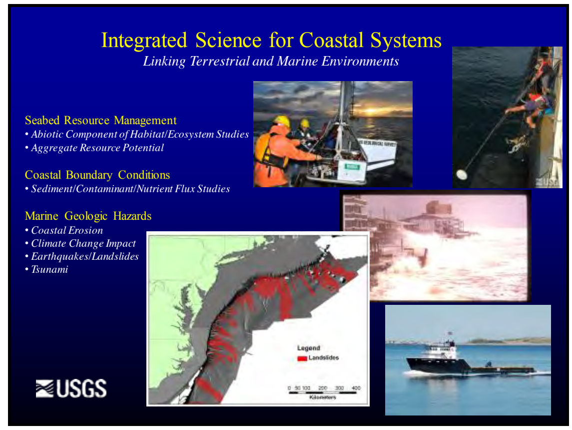
Day 2 – Afternoon

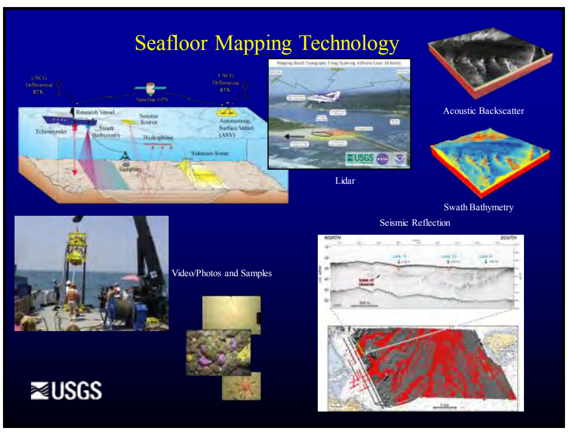
SESSION:

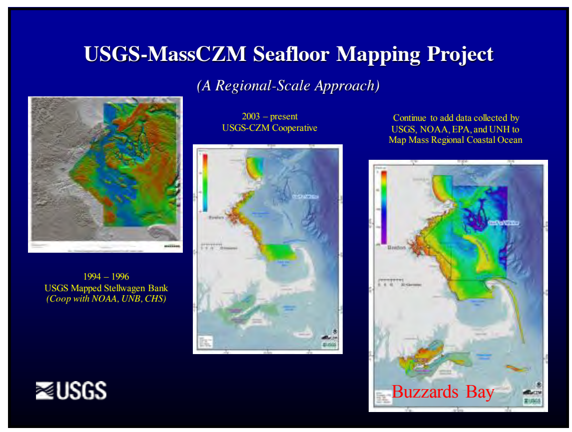
"BEST PRACTICES FOR IDENTIFYING AND RECONSTRUCTING SUBMERGED PALEOLANDSCAPES"

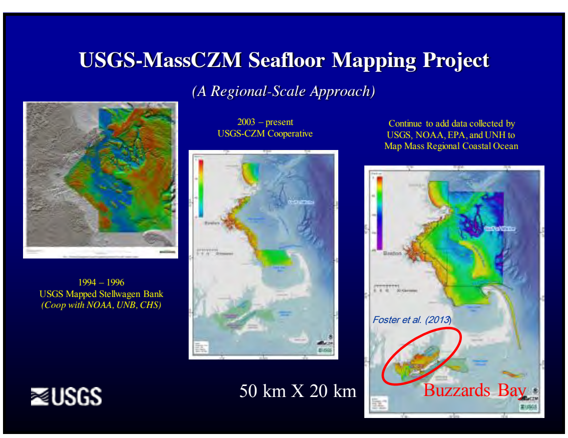
WILLIAM SCHWAAB

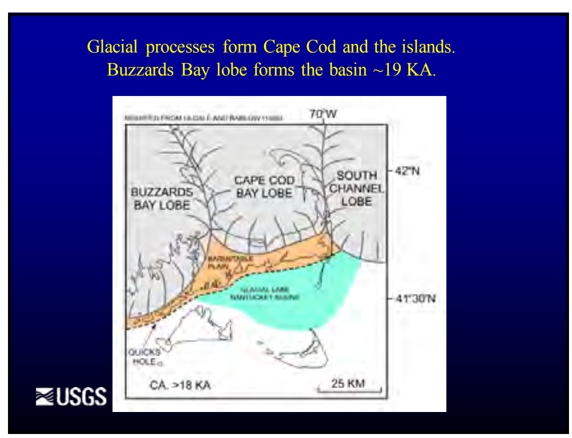

USGS
science for a changing world
Best Practices for Identifying & Reconstructing
Submerged Paleolandscapes (Seabed Characterization)
Bill Schwab
USGS Coastal & Marine Geology Science Center
Woods Hole, MA
U.S. Department of the Interior
U.S. Geological Survey


Integrated Science for Coastal Systems
Linking Terrestrial and Marine Environments
Seabed Resource Management
• Abiotic Component of Habitat/Ecosystem Studies
• Aggregate Resource Potential
Coastal Boundary Conditions
• Sediment/Contaminant/Nutrient Flux Studies
Marine Geologic Hazards
• Coastal Erosion
• Climate Change Impact
• Earthquakes/Landslides
• Tsunami
Legend
Landslides
USGS

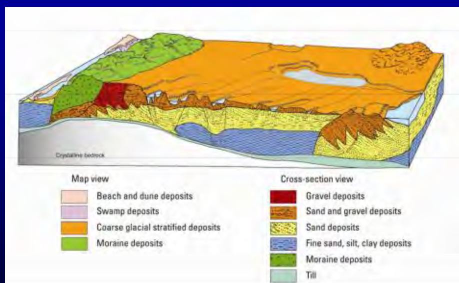

Seafloor Mapping Technology
Lidar
Acoustic Backscatter
Swath Bathymetry
Seismic Reflection
Video/Photos and Samples
USGS


USGS-MassCZM Seafloor Mapping Project
(A Regional-Scale Approach)
2003 – present
USGS-CZM Cooperative
Continue to add data collected by
USGS, NOAA, EPA, and UNH to
Map Mass Regional Coastal Ocean
1994 – 1996
USGS Mapped Stellwagen Bank
(Coop with NOAA, UNB, CHS)
Buzzards Bay
USGS


USGS-MassCZM Seafloor Mapping Project
(A Regional-Scale Approach)
2003 – present
USGS-CZM Cooperative
Continue to add data collected by
USGS, NOAA, EPA, and UNH to
Map Mass Regional Coastal Ocean
1994 – 1996
USGS Mapped Stellwagen Bank
(Coop with NOAA, UNB, CHS)
Foster et al. (2013)
Buzzards Bay
50 km X 20 km
USGS


Glacial processes form Cape Cod and the islands.
Buzzards Bay lobe forms the basin ~19 KA.
70°W
BUZZARDS
BAY LOBE
CAPE COD
BAY LOBE
SOUTH
CHANNEL
LOBE
42°N
41°30'N
QUICKS
HOLE
CA. >18 KA
25 KM
USGS

Typical "morphosequence" with lake basin (sand, silt clay), deltaic (sand), outwash fan (sand and gravel)…



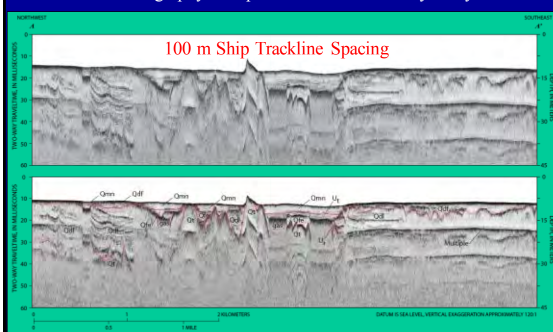
≈USGS

Block diagram illustrating the typical areal and vertical distribution of glacial and postglacial deposits overlying bedrock in the Cape Cod and islands region (from Stone and DiGiacomo-Cohen 2006)

Onshore geology compiled by Stone and others (2011) and glacial lake basins (this study). Morphosequences deposited as Buzzards Bay lobe retreats.

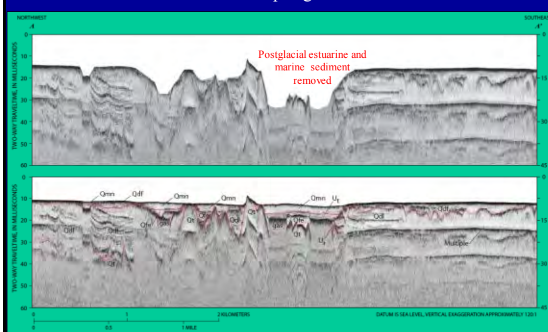
≈USGS

Seismic stratigraphy interpreted for Buzzards Bay study area.



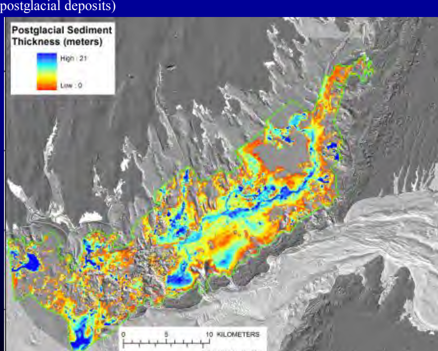
≈USGS

Remove postglacial



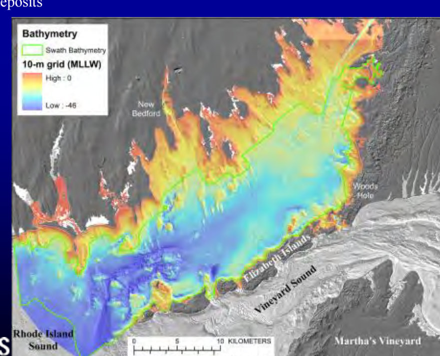
≈USGS

Total thickness of fluvial-estuarine and marine deposits defined by postglacial unconformity (postglacial deposits)

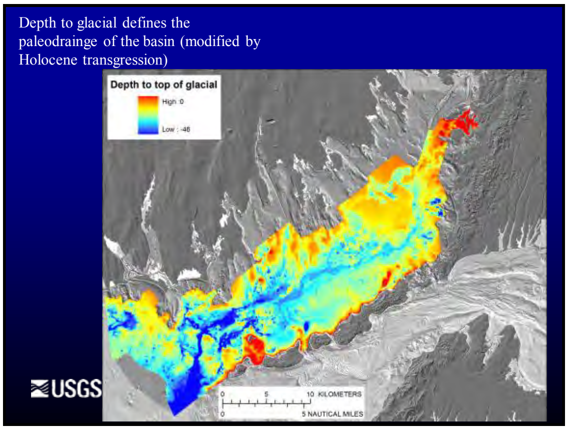


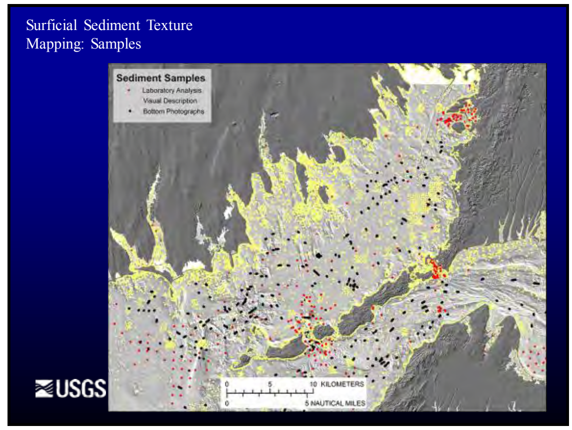
≈USGS

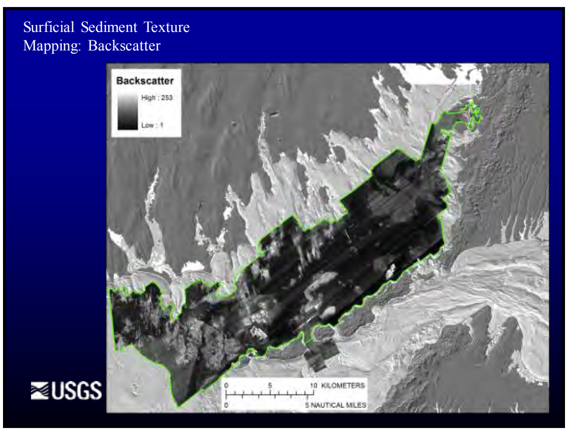
Bathymetry used to derive depth to glacial deposits

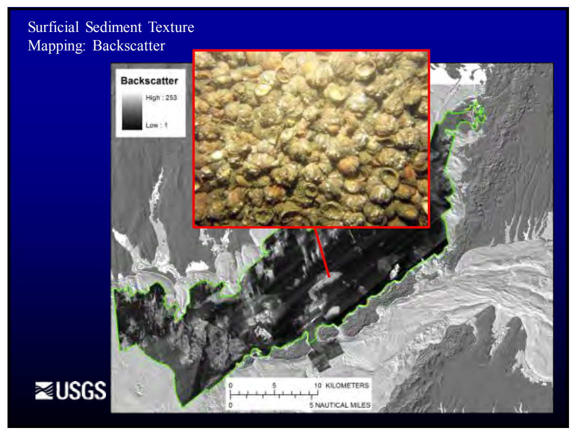


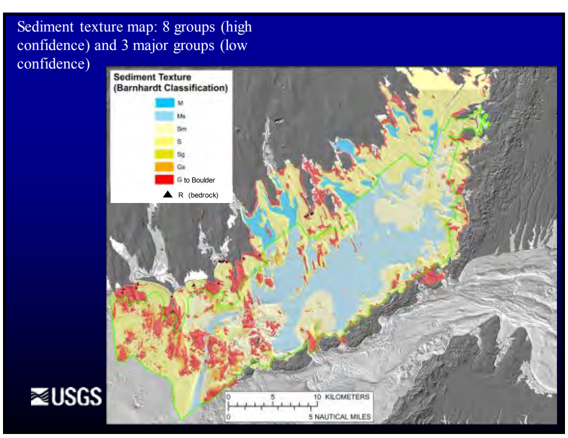
≈USGS

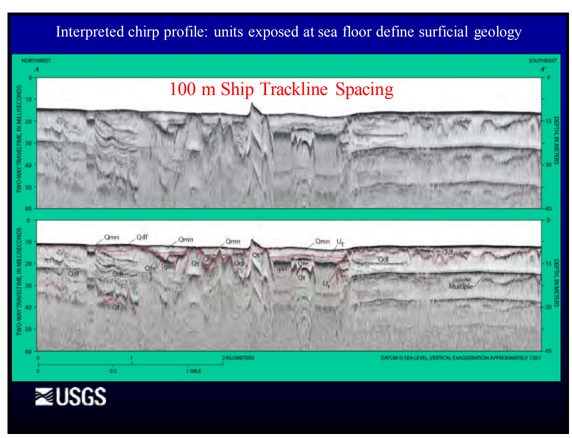

Depth to glacial defines the
paleodrainge of the basin (modified by
Holocene transgression)
Depth to top of glacial
High : 0
Low : -46
0 5 10 KILOMETERS
0 5 NAUTICAL MILES
USGS

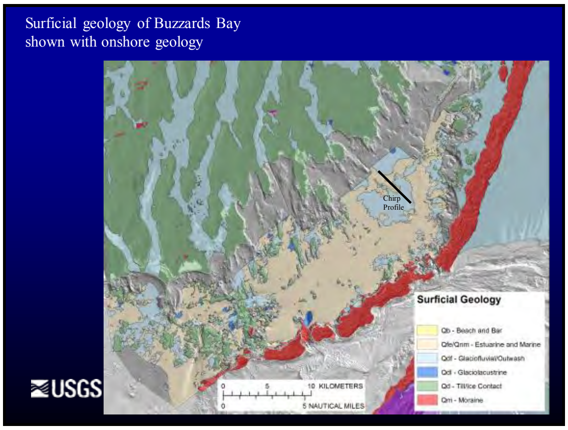

Surficial Sediment Texture
Mapping: Samples
Sediment Samples
Laboratory Analysis
Visual Description
Bottom Photographs
0 5 10 KILOMETERS
0 5 NAUTICAL MILES
USGS

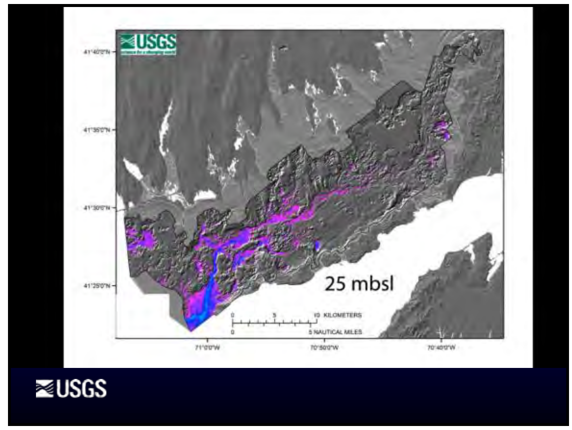

Surficial Sediment Texture
Mapping: Backscatter
Backscatter
High : 253
Low : 1
0 5 10 KILOMETERS
0 5 NAUTICAL MILES
USGS


Surficial Sediment Texture
Mapping: Backscatter
Backscatter
High : 253
Low : 1
0 5 10 KILOMETERS
0 5 NAUTICAL MILES
USGS


Sediment texture map: 8 groups (high
confidence) and 3 major groups (low
confidence)
Sediment Texture
(Barnhardt Classification)
M
Ms
Sm
S
Sg
Gs
G to Boulder
R (bedrock)
0 5 10 KILOMETERS
0 5 NAUTICAL MILES
USGS


Interpreted chirp profile: units exposed at sea floor define surficial geology
100 m Ship Trackline Spacing
NORTHWEST
SOUTHEAST
Qmn
Qdf
Qmn
Qmn
Qmn
Multiple
USGS


Surficial geology of Buzzards Bay
shown with onshore geology
Chirp
Profile
Surficial Geology
Qb - Beach and Bar
Qfe/Qnm - Estuarine and Marine
Qdf - Glaciofluvial/Outwash
Qdl - Glaciolacustrine
Qd - Till/Ice Contact
Qm - Moraine
0 5 10 KILOMETERS
0 5 NAUTICAL MILES
USGS


USGS
25 mbsl
0 5 10 KILOMETERS
0 5 NAUTICAL MILES
71°0'0"W
70°50'0"W
70°40'0"W
USGS

AMANDA EVANS

Best Practices for Identifying and Reconstructing Submerged Paleolandscapes: Western Gulf of Mexico

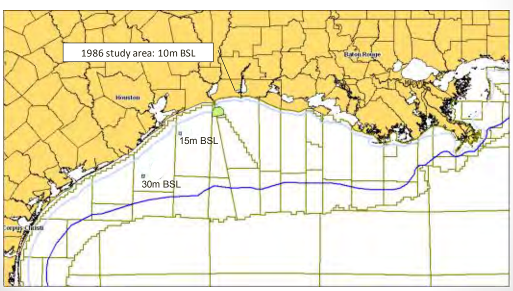
Amanda Evans, PhD, RPA
Tesla Offshore
April 9, 2013

Caveats

- Local geology
  - Alluvial plain
- Limited archaeological record
- No clear oral tradition
- Survey constraints

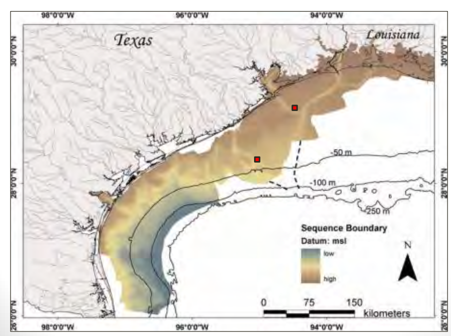
Image: Google Earth

Existing Submerged Landscape Studies

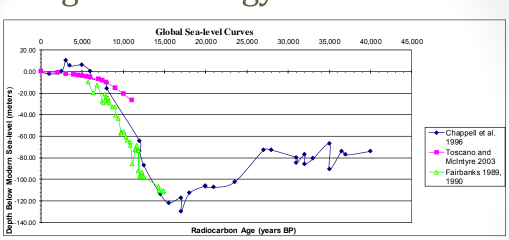


State/Federal Boundary
200m Bathymetric Contour

Regional Geology
(modified from Simms et al. 2008)



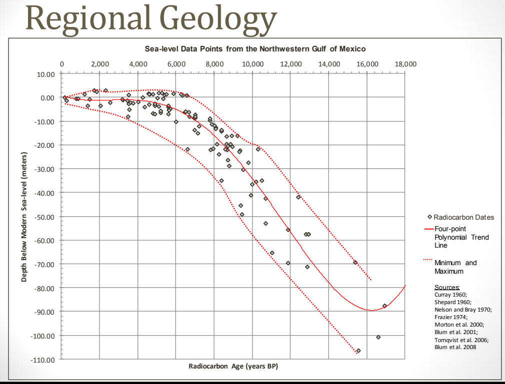
Regional Geology



Louisiana		Southeast Texas	
Middle Archaic [a]	7,950 – 3,950 BP	Archaic Coastal [b]	5,000 – 2,200 BP
Early Archaic [a]	9,950 – 7,950 BP	Archaic Inland [b]	8,000 – 1,500 BP
Late Paleoindian [a]	10,750 – 9,950 BP		
Middle Paleoindian [a]	11,450 – 10,750 BP		
Early Paleoindian [a]	13,450 – 11,450 BP	Paleoindian [b]	11,500 – 8,000 BP

Sources: (a) adapted from Rees 2010; (b) Ricklis 2004

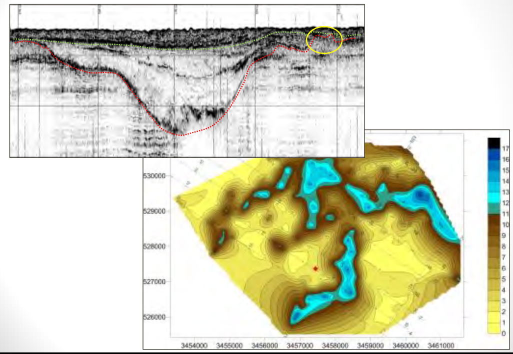
Regional Geology



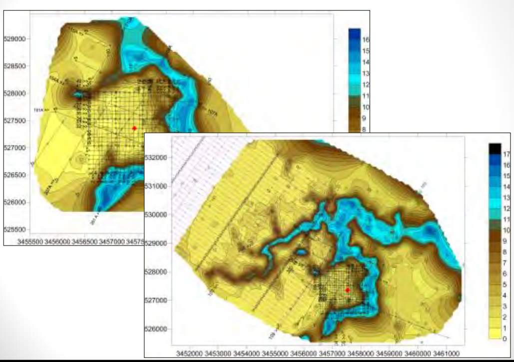
Geophysical Survey

Edgetech SB216 Chirp subbottom profiler

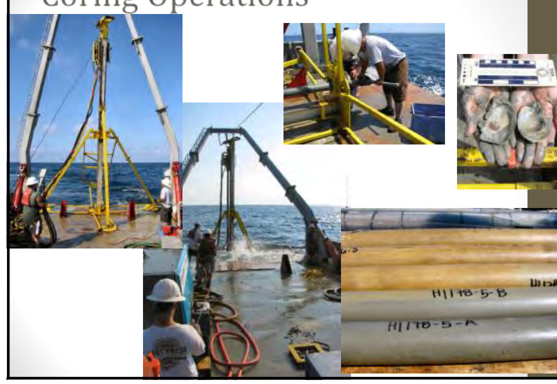
Survey data: HI 178



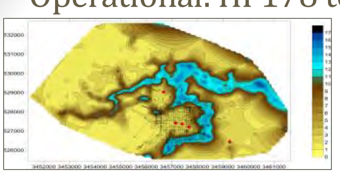
Survey data: HI 178

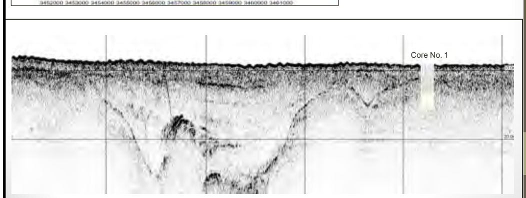


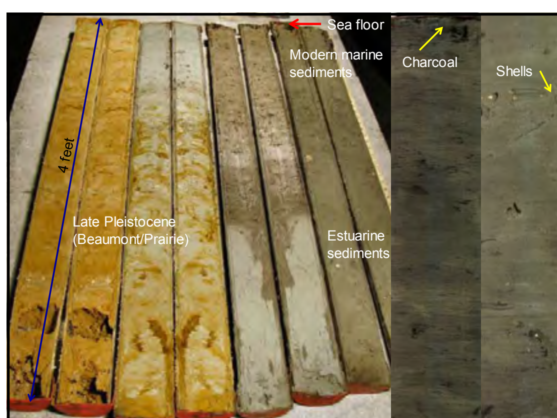
Coring Operations

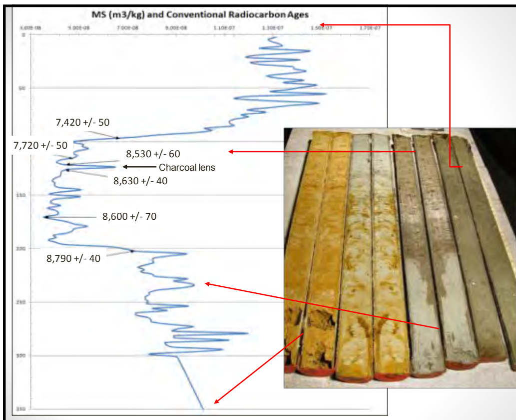


Operational: HI 178 terrace









Coring: HI 178

Photo courtesy Dr. Sophie Warny

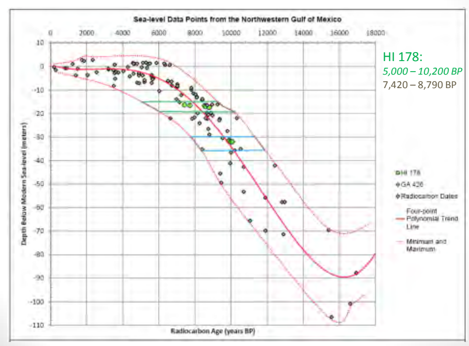
- Pollen species identified:
  - Hornworts
    - Stable water level
    - Moist soil
    - Salt intolerant
  - *Thalictrum* & *Poaceae*
    - grasses
  - Oak, walnut, pine, alder
  - Sunflowers, goosefoot, chokecherry, and currants
    - Exploited by black bears, raccoons, chipmunks, deer mice, and birds

Coring: HI 178

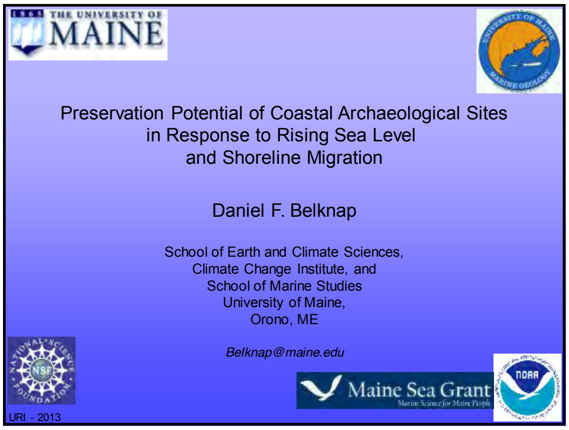
Images courtesy Dr. Sophie Warny

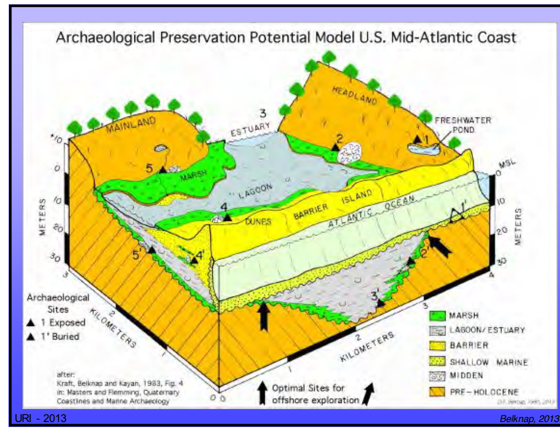
- *Chenopodiaceae*
- *Amaranthaceae*
- *Helianthoid*
  - Pioneer secondary succession
  - Multiple purposes
    - Food
    - Medicine
    - Insecticide
    - Vermifuge
  - Cultigens
    - 3,450 – 3,950 BP

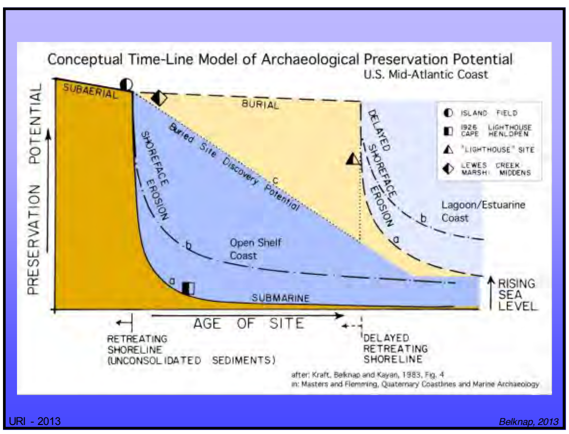
Local Geology

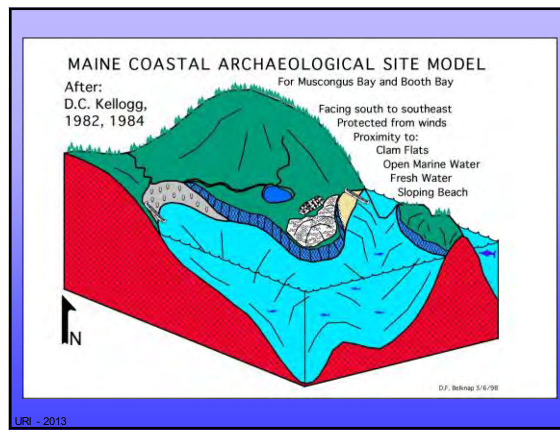


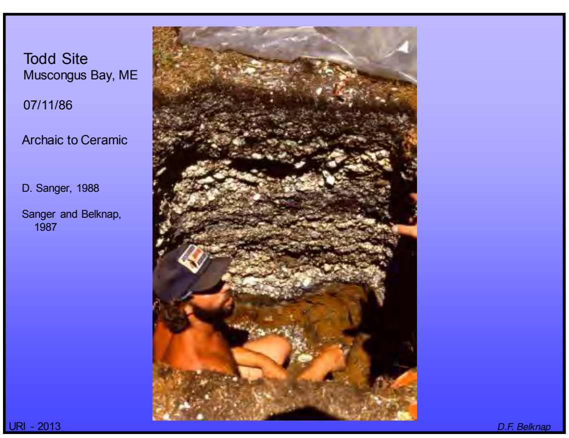
DANIEL BELKNAP

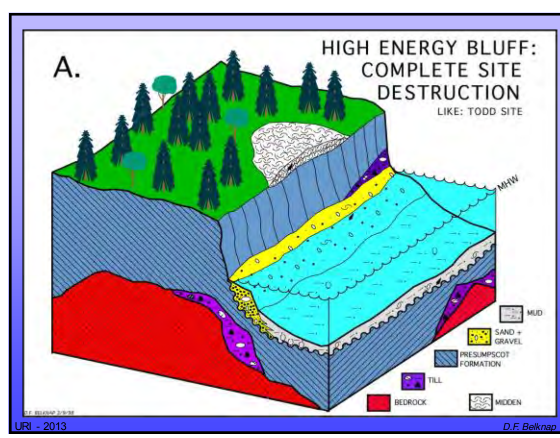

1865 THE UNIVERSITY OF MAINE
Preservation Potential of Coastal Archaeological Sites
in Response to Rising Sea Level
and Shoreline Migration
Daniel F. Belknap
School of Earth and Climate Sciences,
Climate Change Institute, and
School of Marine Studies
University of Maine,
Orono, ME
Belknap@maine.edu
Maine Sea Grant
NOAA
URI - 2013


Archaeological Preservation Potential Model U.S. Mid-Atlantic Coast
MAINLAND
ESTUARY
HEADLAND
FRESHWATER POND
MARSH
LAGOON
DUNES
BARRIER ISLAND
ATLANTIC OCEAN
MSL
METERS
KILOMETERS
Archaeological Sites
1 Exposed
1' Buried
MARSH
LAGOON/ ESTUARY
BARRIER
SHALLOW MARINE
MIDDEN
PRE-HOLOCENE
Optimal Sites for offshore exploration
after:
Kraft, Belknap and Kayan, 1983, Fig. 4
in: Masters and Flemming, Quaternary Coastlines and Marine Archaeology
URI - 2013
Belknap, 2013

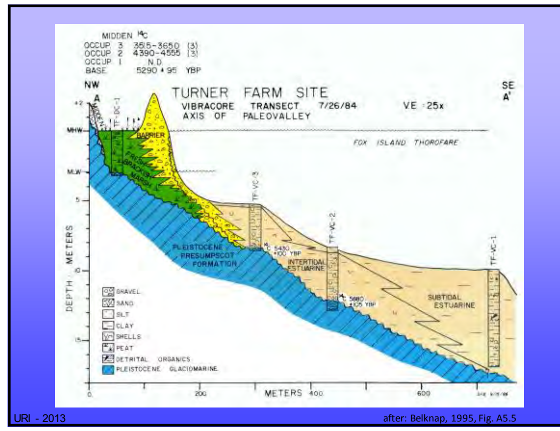

Conceptual Time-Line Model of Archaeological Preservation Potential
U.S. Mid-Atlantic Coast
PRESERVATION POTENTIAL
SUBAERIAL
BURIAL
Buried Site Discovery Potential
SHOREFACE EROSION
DELAYED SHOREFACE EROSION
ISLAND FIELD
1926 CAPE HENLOPEN LIGHTHOUSE
"LIGHTHOUSE" SITE
LEWES CREEK MARSH MIDDENS
Lagoon/Estuarine Coast
Open Shelf Coast
SUBMARINE
RISING SEA LEVEL
AGE OF SITE
RETREATING SHORELINE (UNCONSOLIDATED SEDIMENTS)
DELAYED RETREATING SHORELINE
after: Kraft, Belknap and Kayan, 1983, Fig. 4
in: Masters and Flemming, Quaternary Coastlines and Marine Archaeology
URI - 2013
Belknap, 2013


MAINE COASTAL ARCHAEOLOGICAL SITE MODEL
For Muscongus Bay and Booth Bay
After:
D.C. Kellogg,
1982, 1984
Facing south to southeast
Protected from winds
Proximity to:
Clam Flats
Open Marine Water
Fresh Water
Sloping Beach
N
URI - 2013

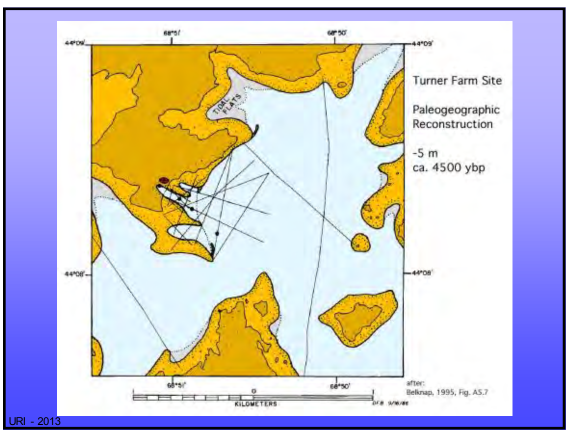

Todd Site
Muscongus Bay, ME
07/11/86
Archaic to Ceramic
D. Sanger, 1988
Sanger and Belknap, 1987
URI - 2013
D.F. Belknap


A.
HIGH ENERGY BLUFF:
COMPLETE SITE
DESTRUCTION
LIKE: TODD SITE
MHW
MUD
SAND + GRAVEL
PRESUMPSCOT FORMATION
TILL
BEDROCK
MIDDEN
URI - 2013
D.F. Belknap

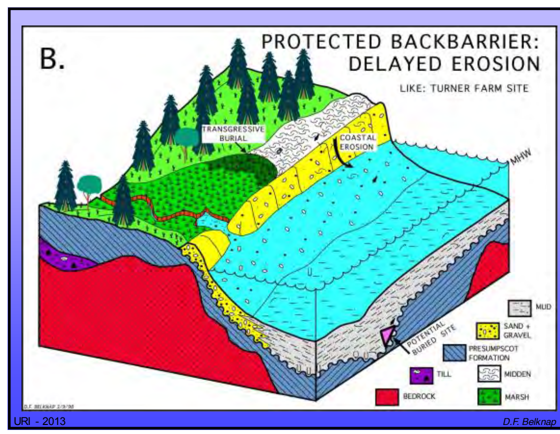
Turner Farm Site
B.J. Bourque, 1995
14C Dates 5300 - 2000 ybp and younger
Colonial to recent
Contact period ca. 1600 AD
Ceramic 3.0 - 0.3 ka
Susquehanna tradition 3.8 - 3.5 ka
Moorehead Phase 4.5 - 3.8 ka
Small Stemmed Point (Archaic) 5.0 - 4.5 ka
Fox Island Thorofare, North Haven Island, ME
URI - 2013



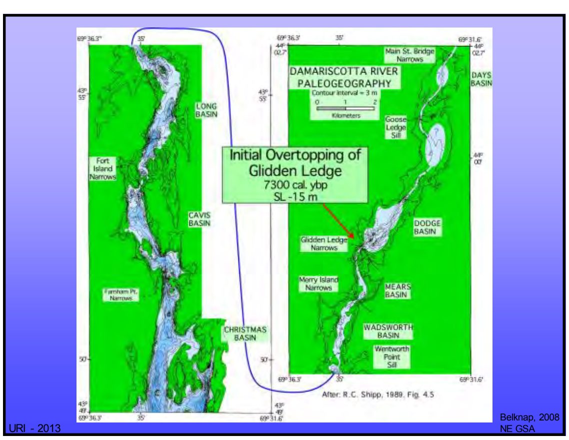
MIDDEN 14C
OCCUP 3 3515-3650 (3)
OCCUP 2 4390-4555 (3)
OCCUP 1 N.D.
BASE 5290 ± 95 YBP
TURNER FARM SITE
VIBRACORE TRANSECT 7/26/84
AXIS OF PALEOVALLEY
VE 25x
NW
A
SE
A'
MHW
MLW
BARRIER
FOX ISLAND THOROFARE
PLEISTOCENE PRESUMPSCOT FORMATION
INTERTIDAL ESTUARINE
SUBTIDAL ESTUARINE
DEPTH METERS
METERS
GRAVEL
SAND
SILT
CLAY
SHELLS
PEAT
DETRITAL ORGANICS
PLEISTOCENE GLACIOMARINE
URI - 2013
after: Belknap, 1995, Fig. A5.5



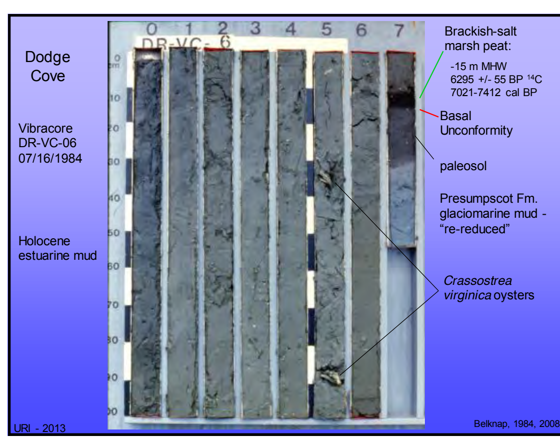
TIDAL FLATS
Turner Farm Site
Paleogeographic Reconstruction
-5 m
ca. 4500 ybp
KILOMETERS
after:
Belknap, 1995, Fig. A5.7
URI - 2013



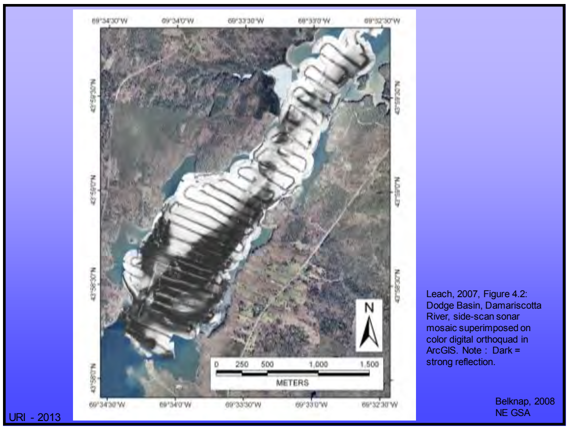
B.
PROTECTED BACKBARRIER:
DELAYED EROSION
LIKE: TURNER FARM SITE
TRANSGRESSIVE BURIAL
COASTAL EROSION
MHW
POTENTIAL BURIED SITE
MUD
SAND + GRAVEL
PRESUMPSCOT FORMATION
TILL
MIDDEN
BEDROCK
MARSH
URI - 2013
D.F. Belknap

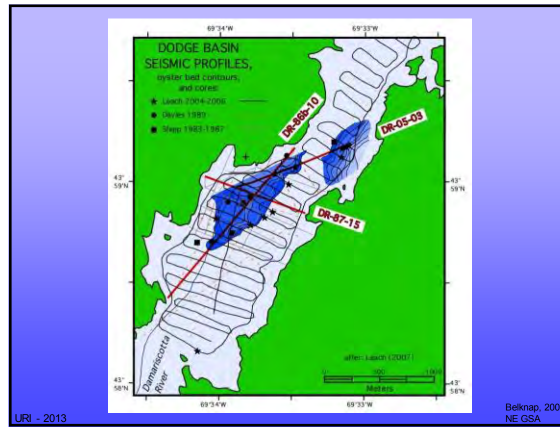


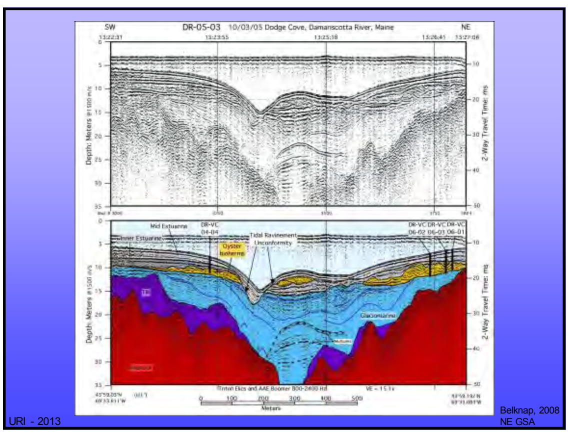
DAMARISCOTTA RIVER PALEOGEOGRAPHY
Contour interval = 3 m
Kilometers
LONG BASIN
Fort Island Narrows
CAVIS BASIN
Farnham Pt. Narrows
CHRISTMAS BASIN
Main St. Bridge Narrows
DAYS BASIN
Goose Ledge Sill
DODGE BASIN
Glidden Ledge Narrows
Merry Island Narrows
MEARS BASIN
WADSWORTH BASIN
Wentworth Point Sill
Initial Overtopping of Glidden Ledge
7300 cal. ybp
SL -15 m
After: R.C. Shipp, 1989, Fig. 4.5
Belknap, 2008
NE GSA
URI - 2013

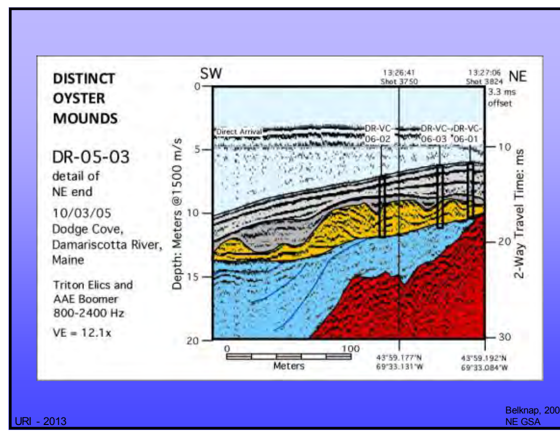


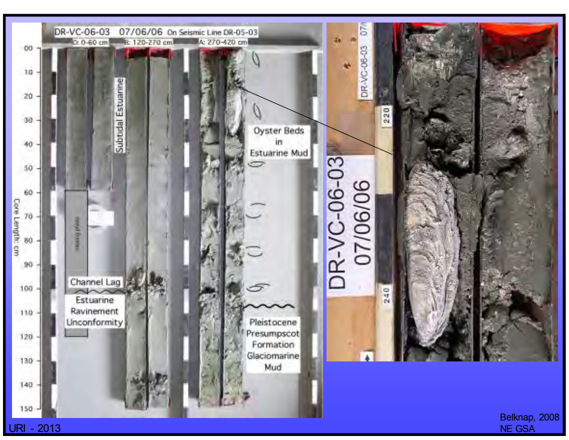
Dodge Cove
Vibracore
DR-VC-06
07/16/1984
Holocene estuarine mud
DR-VC-6
Brackish-salt marsh peat:
-15 m MHW
6295 +/- 55 BP 14C
7021-7412 cal BP
Basal Unconformity
paleosol
Presumpscot Fm. glaciomarine mud - "re-reduced"
Crassostrea virginica oysters
Belknap, 1984, 2008
URI - 2013


Leach, 2007, Figure 4.2: Dodge Basin, Damariscotta River, side-scan sonar mosaic superimposed on color digital orthoquad in ArcGIS. Note : Dark = strong reflection.
N
METERS
URI - 2013
Belknap, 2008
NE GSA

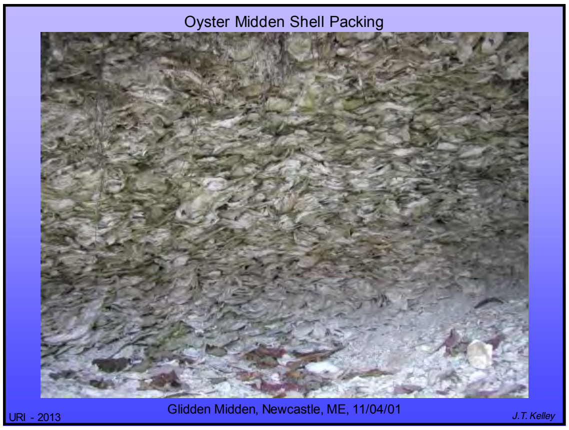

DODGE BASIN
SEISMIC PROFILES,
oyster bed contours,
and cores:
DR-86b-10
DR-05-03
DR-87-15
Damariscotta River
Meters
URI - 2013
Belknap, 2008
NE GSA


SW
DR-05-03 10/03/05 Dodge Cove, Damariscotta River, Maine
NE
Depth: Meters @1500 m/s
2-Way Travel Time: ms
Oyster bioherms
Glaciomarine
Meters
URI - 2013
Belknap, 2008
NE GSA

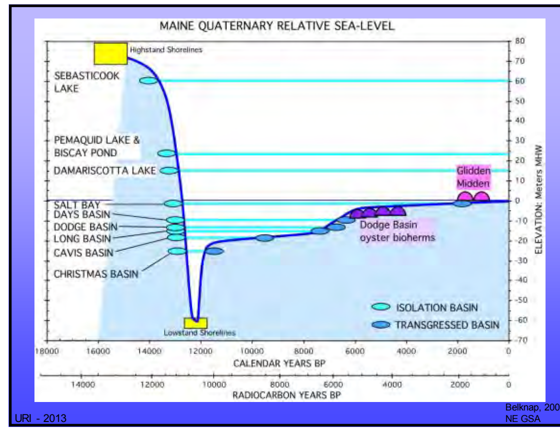

DISTINCT
OYSTER
MOUNDS
DR-05-03
detail of
NE end
10/03/05
Dodge Cove,
Damariscotta River,
Maine
Triton Elics and
AAE Boomer
800-2400 Hz
VE = 12.1x
SW
NE
13:26:41
Shot 3750
13:27:06
Shot 3824
3.3 ms
offset
Direct Arrival
DR-VC-06-02
DR-VC-06-03
DR-VC-06-01
Depth: Meters @1500 m/s
2-Way Travel Time: ms
Meters
43°59.177'N
69°33.131'W
43°59.192'N
69°33.084'W
URI - 2013
Belknap, 2008
NE GSA


DR-VC-06-03 07/06/06 On Seismic Line DR-05-03
Core Length: cm
Subtidal Estuarine
Oyster Beds
in
Estuarine Mud
Channel Lag
Estuarine
Ravinement
Unconformity
Pleistocene
Presumpscot
Formation
Glaciomarine
Mud
DR-VC-06-03
07/06/06
URI - 2013
Belknap, 2008
NE GSA

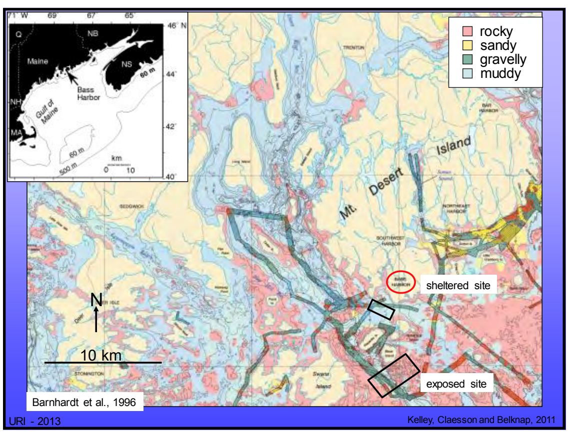

Glidden Midden
Crassostrea virginia oysters
Ceramic Period
14C dates 2,200 - 800 ybp
D. Sanger, 1981, 1988
Cloe Caputo Chunn
W bank Damariscotta River, near Rt. 1 Bridge, 03/21/83
URI - 2013
D.F. Belknap



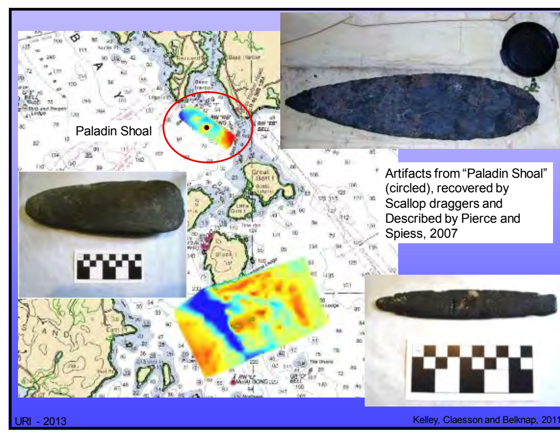
Oyster Midden Shell Packing
Glidden Midden, Newcastle, ME, 11/04/01
J.T. Kelley
URI - 2013



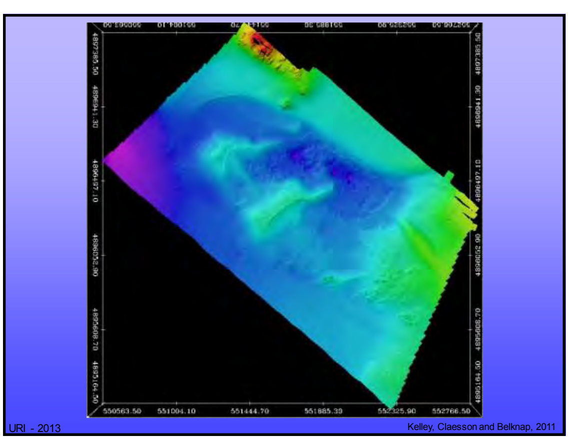
MAINE QUATERNARY RELATIVE SEA-LEVEL
Highstand Shorelines
SEBASTICOOK LAKE
PEMAQUID LAKE & BISCAY POND
DAMARISCOTTA LAKE
Glidden Midden
SALT BAY
DAYS BASIN
DODGE BASIN
LONG BASIN
CAVIS BASIN
CHRISTMAS BASIN
Dodge Basin oyster bioherms
ISOLATION BASIN
TRANSGRESSED BASIN
Lowstand Shorelines
CALENDAR YEARS BP
RADIOCARBON YEARS BP
ELEVATION: Meters MHW
URI - 2013
Belknap, 2008
NE GSA



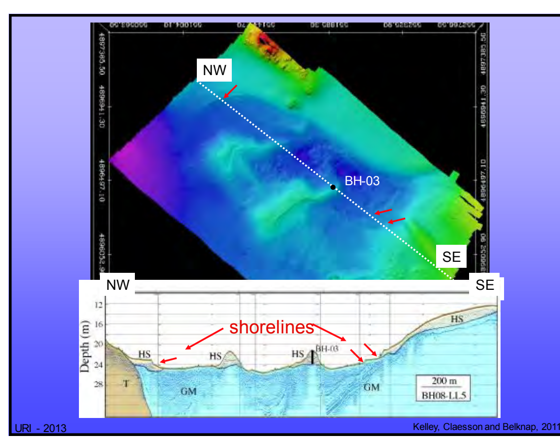
rocky
sandy
gravelly
muddy
Maine
NB
NS
Bass Harbor
Gulf of Maine
Mt. Desert Island
sheltered site
exposed site
N
10 km
Barnhardt et al., 1996
URI - 2013
Kelley, Claesson and Belknap, 2011



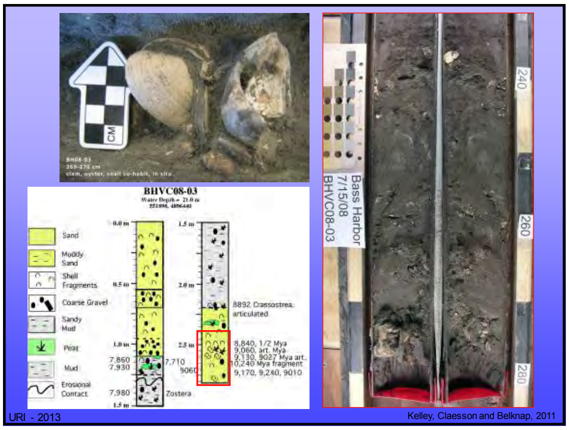
Paladin Shoal
Artifacts from "Paladin Shoal" (circled), recovered by Scallop draggers and Described by Pierce and Spiess, 2007
URI - 2013
Kelley, Claesson and Belknap, 2011

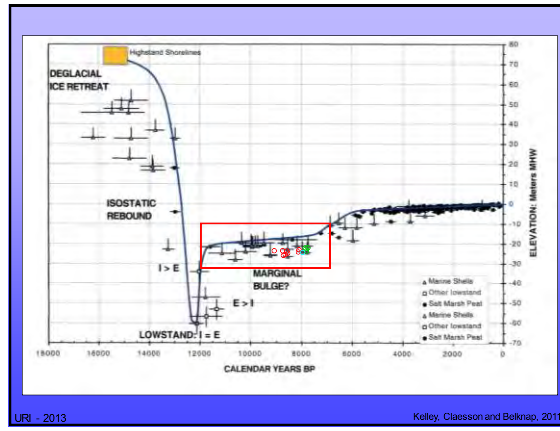


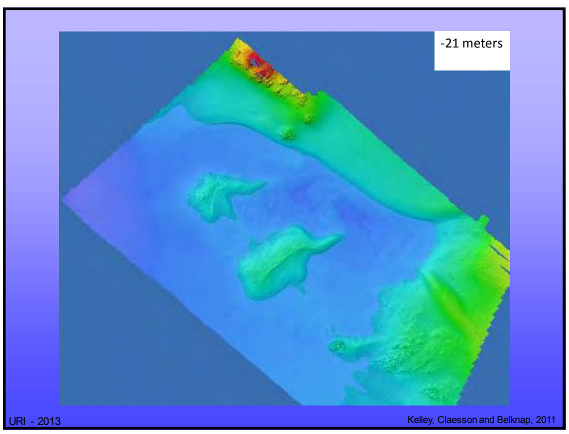
URI - 2013
Kelley, Claesson and Belknap, 2011

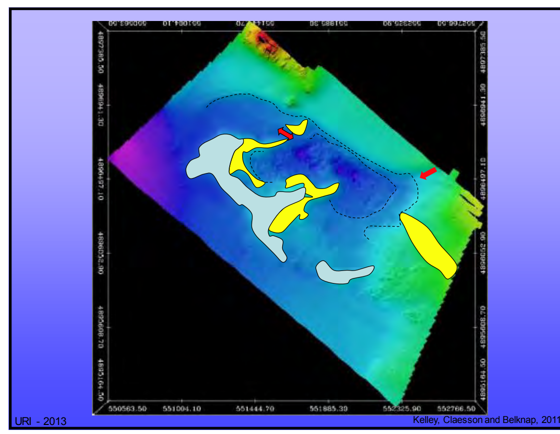


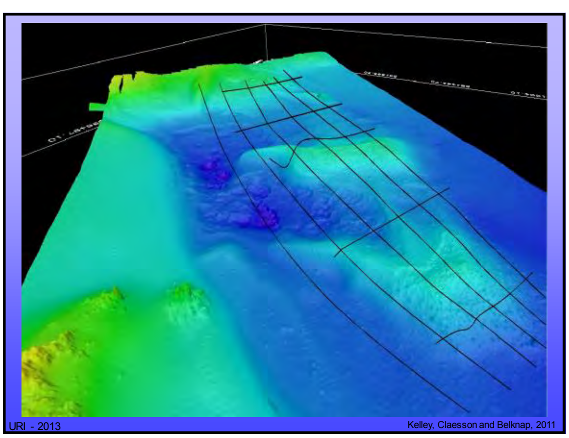
NW
BH-03
SE
NW
SE
shorelines
Depth (m)
HS
HS
HS
HS
GM
GM
T
200 m
BH08-LL5
URI - 2013
Kelley, Claesson and Belknap, 2011

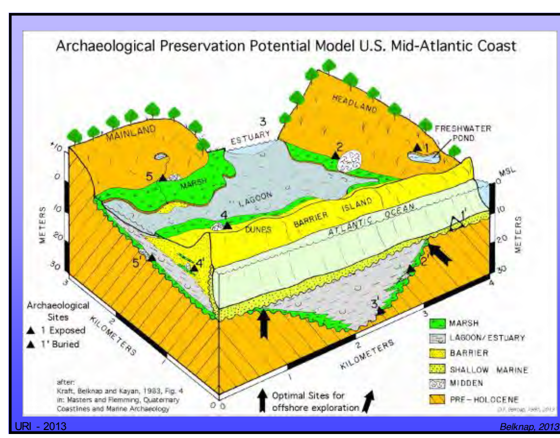

BHVC08-03
Sand
Muddy Sand
Shell Fragments
Coarse Gravel
Sandy Mud
Peat
Mud
Erosional Contact
Zostera
8892 Crassostrea, articulated
Bass Harbor 7/15/08 BHVC08-03
240
260
280
URI - 2013
Kelley, Claesson and Belknap, 2011


Highstand Shorelines
DEGLACIAL ICE RETREAT
ISOSTATIC REBOUND
I > E
MARGINAL BULGE?
E > I
LOWSTAND: I = E
CALENDAR YEARS BP
ELEVATION: Meters MHW
Marine Shells
Other lowstand
Salt Marsh Peat
URI - 2013
Kelley, Claesson and Belknap, 2011

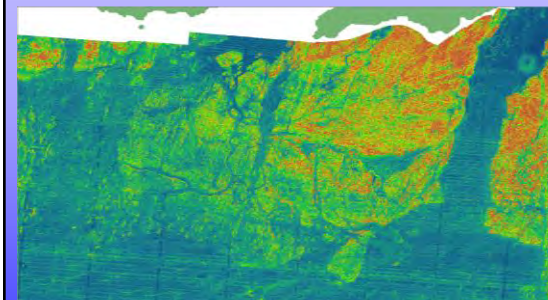

-21 meters
URI - 2013
Kelley, Claesson and Belknap, 2011


URI - 2013
Kelley, Claesson and Belknap, 2011


URI - 2013
Kelley, Claesson and Belknap, 2011


Archaeological Preservation Potential Model U.S. Mid-Atlantic Coast
MAINLAND
ESTUARY
HEADLAND
FRESHWATER POND
MARSH
LAGOON
DUNES
BARRIER ISLAND
ATLANTIC OCEAN
MSL
METERS
KILOMETERS
Archaeological Sites
1 Exposed
1' Buried
MARSH
LAGOON/ESTUARY
BARRIER
SHALLOW MARINE
MIDDEN
PRE-HOLOCENE
Optimal Sites for offshore exploration
after: Kraft, Belknap and Kayan, 1983, Fig. 4 in: Masters and Flemming, Quaternary Coastlines and Marine Archaeology
URI - 2013
Belknap, 2013

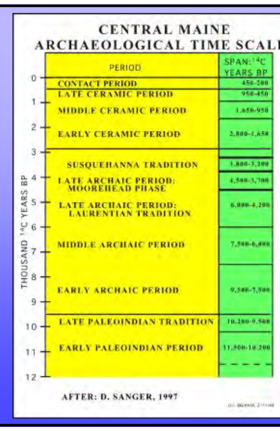
Waterford Shelf, southern Ireland – Paleochannels, Lowstand Topography



Ruth Plets, UU Coleraine

URI - 2013

NERC Sea-Level Minima Project NE/H02431/1 - 2010-13, Team Imagery



URI - 2013

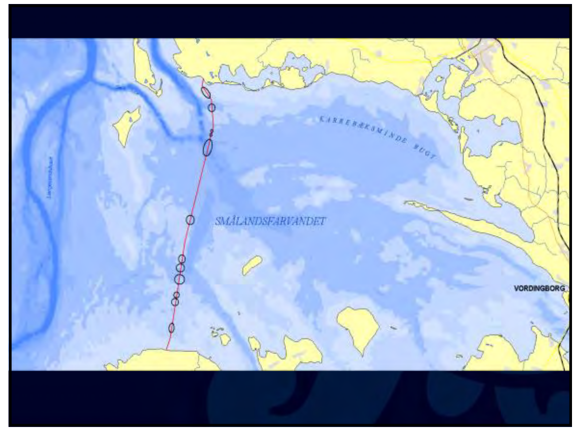
Belknap, 2013

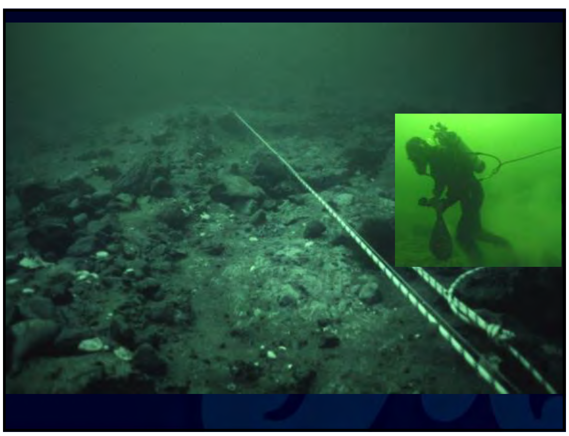
SESSION:

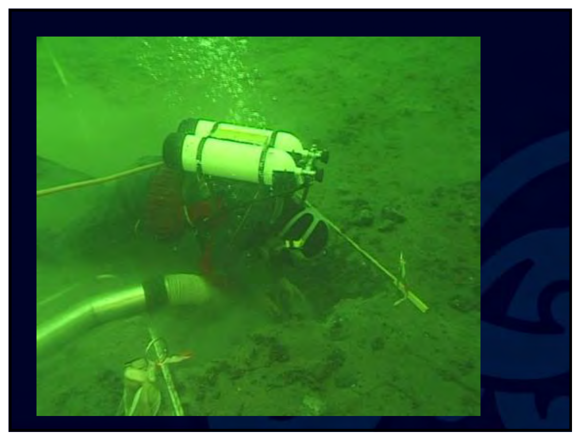
"BEST PRACTICES FOR SUBMERGED SETTLEMENT SITE IDENTIFICATION AND EXCAVATION"

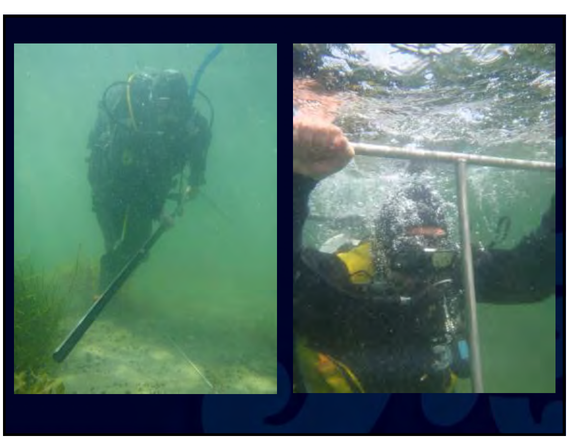
JØRGEN DENCKER

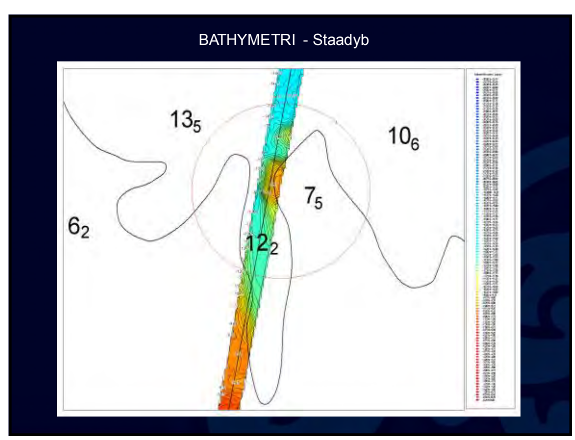

Best Practises for Submerged settlement Site Identification and Excavation
Jørgen Dencker
The Viking Ship Museum, Roskilde
Submerged Paleocultural Landscapes Workshop
Rhode Island 2013

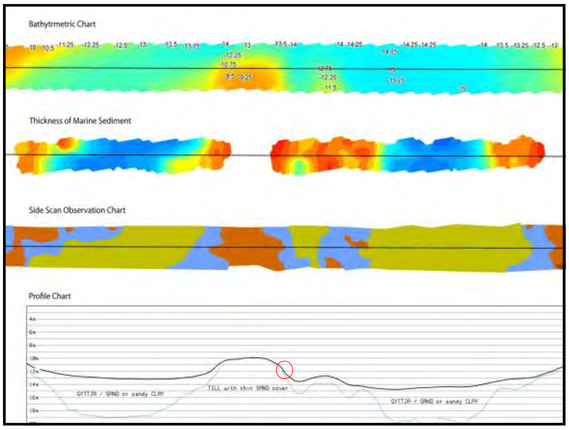

SMÅLANDSFARVANDET
VORDINGBORG



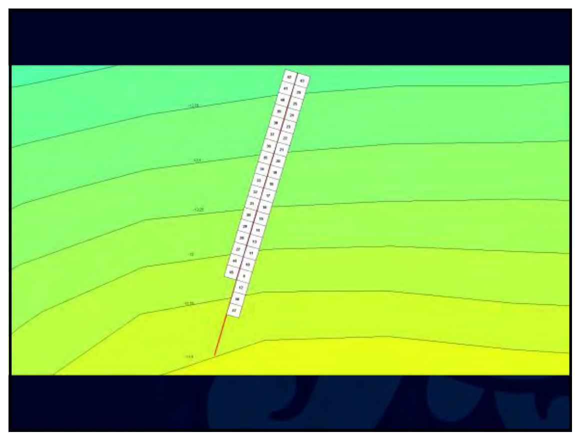




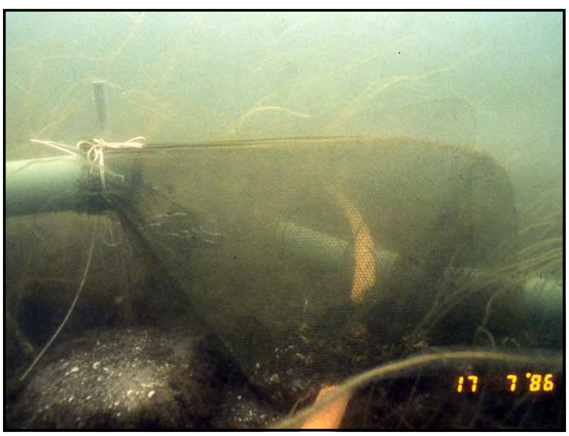

BATHYMETRI - Staadyb
13_5
10_6
7_5
6_2
12_2


Bathytrmetric Chart
Thickness of Marine Sediment
Side Scan Observation Chart
Profile Chart

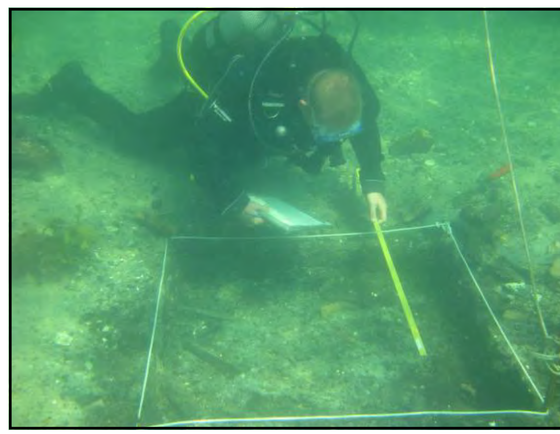

1 cm

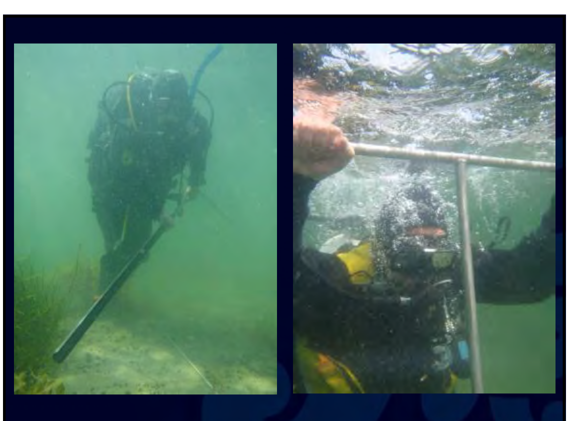


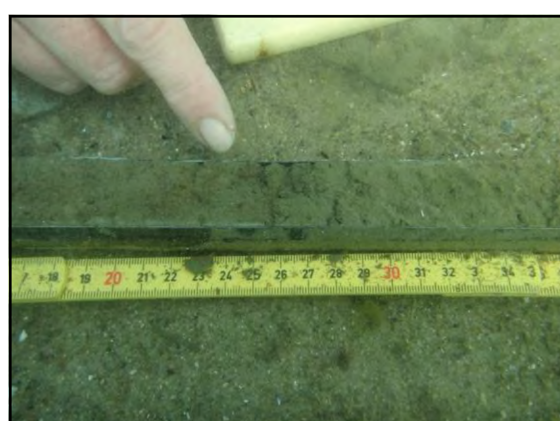

17 7 '86

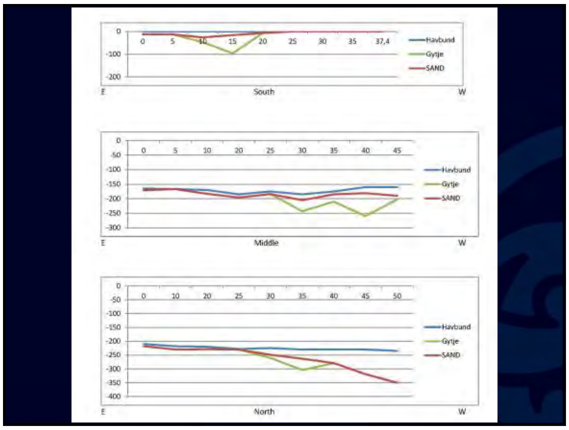

17 7 '86

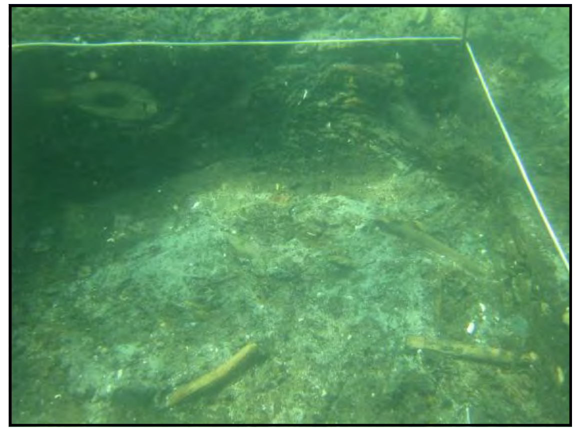

9000 BP

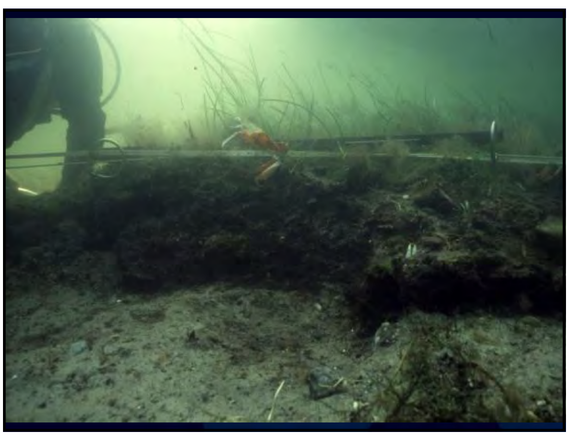


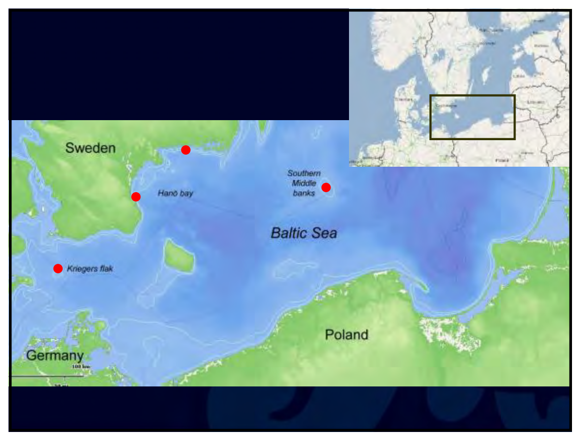


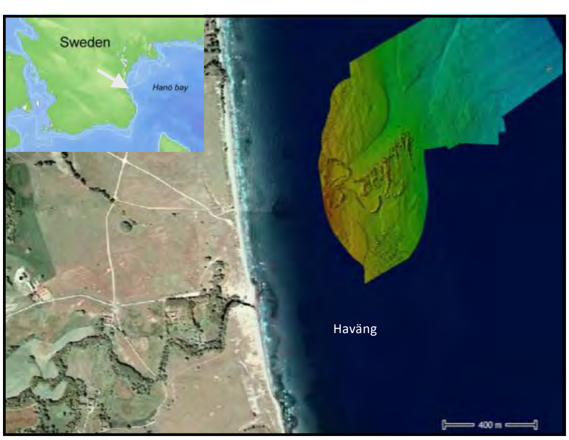


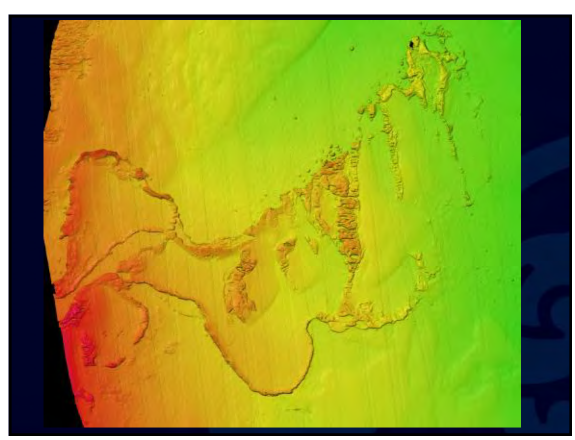

0
-100
-200
0
5
10
15
20
25
30
35
37,4
Havbund
Gytje
SAND
E
South
W
0
-50
-100
-150
-200
-250
-300
0
5
10
20
25
30
35
40
45
Havbund
Gytje
SAND
E
Middle
W
0
-50
-100
-150
-200
-250
-300
-350
-400
0
10
20
25
30
35
40
45
50
Havbund
Gytje
SAND
E
North
W

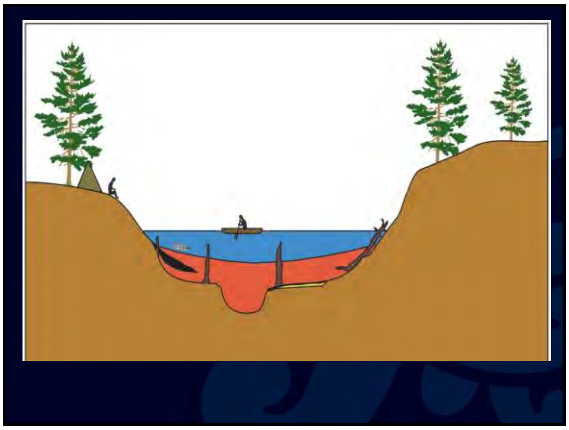


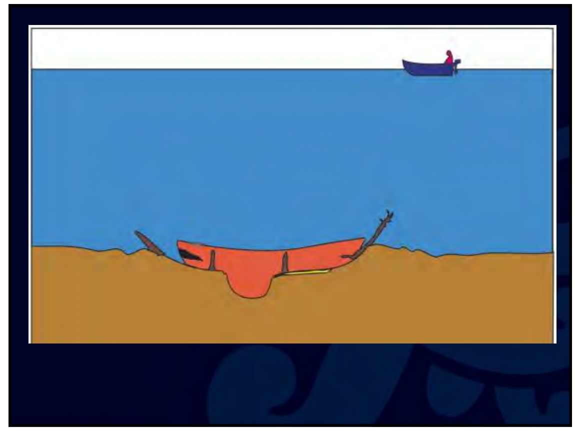


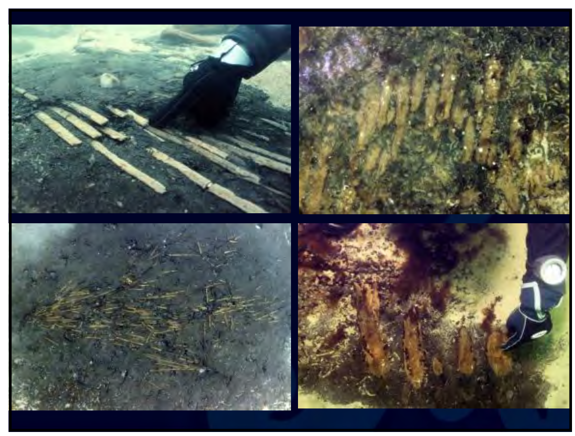

Sweden
Hanö bay
Southern
Middle
banks
Baltic Sea
Kriegers flak
Poland
Germany

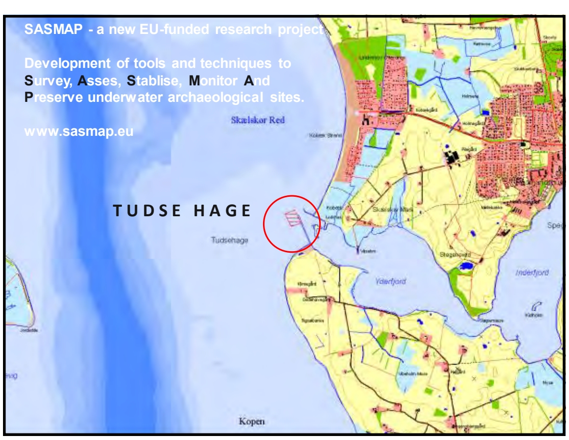

Sweden
Hanö bay
Haväng
400 m










SASMAP - a new EU-funded research project
Development of tools and techniques to
Survey, Asses, Stablise, Monitor And
Preserve underwater archaeological sites.
www.sasmap.eu
Skælskør Red
TUDSE HAGE
Tudsehage
Inderfjord
Kopen


Our own diving boats and working fleets


A hired professionel diving ship for off shore diving

APPENDIX B:

SPEAKER/PRESENTER BIOSKETCHES

SPEAKER/PRESENTER BIOSKETCHES
Listed in Alphabetical Order by Surname

Daniel Belknap
Professor, Climate Change Institute & School of Earth and Climate Sciences
University of Maine, Orono
belknap@maine.edu

Dr. Daniel Belknap has been at the University of Maine since 1982. His research is interdisciplinary, combining stratigraphy, sedimentology, Quaternary paleoclimates and geoarchaeology. His main research themes include sea-level change, coastal plan stratigraphy, deglaciation of the Gulf of Maine, and coastal geoarchaeology. Present studies include nearshore and inner shelf sedimentation and stratigraphy, coastal sediment processes and geomorphology, salt marsh environments, and effects of deglacial isostasy on coastal and lake systems. The University of Maine marine sedimentology working group, directed by Dr. Belknap, has a suite of primary research tools including seismic reflection profilers, side-scan sonar, multibeam sonar, Ground Penetrating Radar, vibrocorers, sedimentology laboratory, and acoustic current meters. Recent studies have concentrated on Maine and the Gulf of Maine, but other studies include Northern Ireland, the Irish and Celtic Seas, Peru, the Atlantic coastal plain and shelf, the eastern Mediterranean, and the Caribbean. Dr. Belknap is author or co-author of two books, 122 refereed journal articles and book chapters, 73 technical reports and other papers, and 312 published abstracts. He has been involved in over $13M in funded research since 1979. Dr. Belknap has directed 10 Ph.D.'s and 32 M.S. students, and has served on an additional 12 Ph.D. and 61 M.S. committees.

John Brown, III
Hereditary Medicine Man/Tribal Historic Preservation Officer
Narragansett Indian Trib/NITHPO
brwnjbb123@aol.com

Jørgen Dencker
Director of Research
Viking Ship Museum
Roskilde, Denmark
jd@vikingeskibsmuseet.dk

Jørgen Dencker is a professional marine archaeologist and the Head of Maritime Archaeology at the Viking Ship Museum in Roskilde, Denmark. He holds a Phil. Cand. degree in Prehistoric Archaeology from Århus University. He has been a certified diver since 1974 and a commercial diver since 1986. Dencker is considered one of the pioneers of the discipline of submerged settlements archaeology and has more than 40 years of international experience working at the forefront of the development of field survey methods and excavation techniques, as well as in the management, legislative development, and *in situ* monitoring and protection of submerged settlement sites. The bulk of Dencker's professional career has been in applied marine archaeology. Between 1986 and 1991 he worked primarily for the Ministry of Environment and carried out surveys of submerged settlement sites required by the cultural preservation laws of Denmark. From 1991 to 2004 he was employed by the Danish National Museum's Institute of Maritime Archaeology with responsibility for performing all aspects of the National Museum's mandated maritime cultural heritage management work from survey through publication. Dencker joined the staff of the Viking Ship Museum when the National Museum's maritime cultural heritage management responsibilities were transferred to it in 2004. He has been Head of Maritime Archaeology at the Viking Ship Museum since 2008. The breadth of Dencker's experience investigating submerged settlements has led to his involvement as an advisor to individual researchers and research projects in Finland, Northern Ireland, Sweden and the United States. He has been an invited speaker/lecturer on the archaeology of submerged settlements at numerous conferences, workshops, universities, and museums in Croatia, Denmark, England, Finland, Japan, Northern Ireland, Poland, Sweden, and the United States. Dencker currently serves as the Danish representative on the Underwater Cultural Heritage Working Group of the Baltic Sea States and on the European Archaeological Association Council.

Simon Engelhart
Assistant Professor
University of Rhode Island, Department of Geosciences
engelhart@uri.edu

Dr. Engelhardt earned his B.Sc. (2004) and M.Sc. in Geography at Durham University (UK), and his Ph.D. (2010) in Earth and Environmental Science at the University of Pennsylvania. His research interests include relative sea-level changes from the Last Glacial Maximum to present, glacial isostatic adjustment modeling, coastal paleoseismology and paleogeodesy, and paleoenvironmental recostruction using micropalentology. He is currently Assistant Professor of Geosciences at the University of Rhode Island, teaching courses in global climate change and coastal geologic hazards.

Grover Fugate
Executive Director/BOEM Project Principal Advisor
Rhode Island Coastal Resources Management Council
gfugate@crmc.ri.gov

Grover Fugate graduated from the University of Connecticut in 1976, with a degree in Natural Resource Management. After graduation Mr. Fugate worked as and urban forester for a private company in Connecticut. In 1978, Mr. Fugate moved to Canada and went to work in a series of positions including Forester, Land Use Planner, with the Department of Agriculture, Regional Resource Planner, with the Crown Lands Branch, and Director of Shore Zone Management. In 1984, Mr. Fugate completed his MBA from Memorial with a program specialization in resource policy analysis. In 1986, Mr. Fugate transferred to Rhode Island to assume the duties of the Executive Director of the Coastal Resources Management Council. The council is an independent state agency, set up to be the principle planning and management agency for the state's coastal areas. Mr. Fugate's current duties include, the day to day administration of the Rhode Island Coastal Resource Management Program for the State of Rhode Island. As part of his duties Mr. Fugate is the council's and states representative to a number of boards, commissions, task forces, and other coastal related organizations. Mr. Fugate also is a guest lecture at the University of Rhode Island and Roger Williams University and a trainer at the Coastal Resources Center for Integrated Coastal Management. He is the recipient of several citations from the Governor and the Legislature for his work in Coastal Management and Community Service. Mr. Fugate has published articles on various issues in coastal and natural resource management.

Richard Getchell
Chief/Northeast Regional Ocean Council (NROC) Tribal Co-Chair
Arrostook Bank of Micmacs/Northeast Regional Ocean Council
rgetchell@micmac-nsn.gov

Doug Harris
Project Co-PI/Deputy THPO/ NITHPO
dhnithpo@gmail.com

Doug Harris is a veteran of more than 20 years of training and service to the cultural resource mission of the Narragansett Indian Tribal Historic Preservation Office. Under the leadership of current Medicine Man/Tribal Historic Preservation Officer John Brown and the training in Narragansett history, culture and policy with Narragansett hereditary Elder Medicine Man Lloyd "Running Wolf" Wilcox and Medicine Woman/Ethno-Historian Dr. Ella Sekatau, Harris is adept as a protector of those cultural resources that are of significance to Narragansett tradition. He is a Deputy Tribal Historic Preservation Officer with a Tribal specialization as Preservationist for Ceremonial Landscapes. He is also a collaborative leader in the field of ceremonial stone landscape identification and mapping. Harris is Co-Principal Investigator on the URI-GSO/NITHPO/BOEM Submerged Paleocultural Landscapes Project.

John King
Professor/Project Co-PI
Graduate School of Oceanography, University of Rhode Island
jwking@uri.edu

Dr. King earned a B.A. (1975) in Biology, Geology, and Chemistry (Special Studies), and a Ph.D. (1983) in Geology and Geophysics at the University of Minnesota. He specializes in seafloor mapping, coastal resiliency studies, geological and geophysical surveying and analyses in support of cultural resource investigations of submerged environments, and paleoclimate and paleoenvironmetal studies. Dr. King has 31 years of experience planning and implementing complex field surveying and data analyses in coastal Rhode Island, Connecticut, and Long Island waters, and has received approximately $30M in funding from federal, industry and private sources conduct research in these areas. The data resulting from these projects have been instrumental in decision making at the federal, state, and local levels. He is frequently involved with investigations that integrate geology and geophysics with archaeological and oceanographic studies, with emphasis on the coastal zone and outer continental shelf, and has been involved in multiple ocean and lake drilling projects.

Brian Jones
State Archaeologist, State of Connecticut
brian.jones@uconn.edu

Dr. Jones has been working in the archaeology field for over 24 years, most recently as the Connecticut State Archaeologist. He received his undergraduate degree in Anthropology at Oberlin College in 1986. After living and traveling in Southeast Asia, he studied European prehistory at the University of Cologne, Germany. He returned to the U.S. in 1992 to complete his Ph.D. at UConn, Storrs. Dr. Jones was the Supervisor of Field Archaeology at the Mashantucket Pequot Reservation between 1998 and 2004, after which he worked at the CRM firm Archaeological and Historical Services, Inc. In 2008, he took the position of Associate Director of UMass Archaeological Services in Amherst, Massachusetts. Dr. Jones has also taught as an adjunct lecturer in the Anthropology Department at UConn since 2004. His primary research focus is the archaeology of northeastern Native American cultures. His dissertation explored human adaptation to the changing climate at the end of the last Ice Age. He is also experienced in geoarchaeology (the relationship of archaeology to landscape and soil formation processes) and stone tool analysis.

Brian Jordan
Project Officer/Federal Historic Preservation Officer
BOEM
brian.jordan@boem.gov

Dr. Brian Jordan is the federal preservation officer and headquarters archaeologist for the Department of the Interior's Bureau of Ocean Energy Management (BOEM). Prior to joining BOEM, Brian was the assistant state underwater archaeologist for Maryland, working for the Maryland Historical Trust. In Maryland, he built up the remote-sensing and data processing capabilities of the Maryland Maritime Archaeology Program. Other government experience included building and overseeing the cultural and historical resources component of NOAA's National Marine Protected Areas Center. In his career as a marine archaeologist, Brian has participated in and conducted marine archaeology surveys and excavations in numerous countries on four continents, including Turkey, Denmark, Portugal, and Morocco. He also worked with and advised institutes and government representatives of several countries on the survey, excavation, and management of submerged cultural resources. Past research focused on environmental factors affecting the preservation of wooden shipwrecks in the marine environment.

Jennifer McCann
Director of U.S. Coastal Programs/Director of Extension Programs
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Ms. McCann is the director of U.S. Coastal Programs at the Coastal Resources Center, Graduate School of Oceanography, University of Rhode Island, and Director of Extension Programs for Rhode Island Sea Grant. In this role, she was co-leader for the development and implementation of the Rhode Island Ocean Special Area Management Plan (SAMP); the first formally adopted Ocean Spatial Plan in the nation. She shares her knowledge and experience nationally, leading the national effort to develop monitoring protocols and modeling tools for improved management of offshore renewable energy. In addition, she leads statewide efforts to improve shellfish management and to minimize the impacts of coastal erosion and inundation. She began her career at the Center for Marine Conservation (CMC), now The Ocean Conservancy, building a strong and diverse educated constituency for the creation and management of the Stellwagen Bank National Marine Sanctuary. She represented CMC in the Dominican Republic to build the capacity of local nonprofits as institutions and implementers of integrated coastal management.

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David Robinson
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David Robinson is a Registered Professional Archaeologist and Senior Marine Research Specialist (archaeology) at the URI-GSO. He received his B.A. with honors in Anthropology/Art from the University of Rhode Island (1990), holds an M.A. in Anthropology/Nautical Archaeology from Texas A&M University (1999), and has completed doctoral coursework in anthropology/pre-contact period archaeology at the University of Connecticut (2004-2007). He has 24 years of underwater archaeological experience and has directed or participated in underwater investigations from Louisiana to Maine, in the Atlantic Ocean, Chesapeake Bay, Gulf of Mexico, Great Lakes, Lake Champlain, and major rivers of the southeastern United States, as well as internationally on multiple shipwreck and submerged settlements projects in Denmark and Sweden. Robinson, who specializes in submerged cultural resource management, has provided professional marine archaeological services to local, state, federal, and Tribal agencies and organizations, research institutions and museums, and industry. He is a Submerged Landscapes Research Steering Committee member and Graduate Thesis Examiner at Flinders University's (Adelaide, Australia) Graduate Program in Maritime Archaeology. Robinson has been at the forefront of the development of submerged settlements archaeology in the United States since 1995, and has been an active proponent of bringing Tribal people, their perspectives, their concerns, and their knowledge to the research and management processes.

William Schwab
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Dr. Schwab has over 37 years of experience as a research marine geologist/geophysicist with the U.S. Geological Survey (USGS). Schwab received his BA (Geology) from the State University of New York, Oswego in 1973, MS (Geology) from the University of Rhode Island in 1975, and PhD (Marine Geology) from Duke University in 1985. Research interests have included submarine slope stability and mobility of submarine mass movements, the formative processes of deep-sea fans, evolution of mid-ocean ridge neovolcanic zones, sedimentologic environment of central Pacific seamounts in relation to marine minerals research, shelf sediment transport and geologic controls on coastal evolution. He led the development of the USGS Woods Hole Sea-Floor Mapping Group and currently serves as a supervisory geophysicist at the USGS Woods Hole Coastal and Marine Science Center, Woods Hole, MA. He is responsible for supervision of research and technical staff, coordination and integration of scientific projects with USGS directives and line management, and at times serves as USGS spokesperson in matters concerning coastal and marine geology, sea floor mapping technology, and scientific programs.

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Philip Verhagen
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Dr. Verhagen is a Researcher at Vrije Universiteit Amsterdam, Netherlands, and a self-employed consultant at Verhagen GeoICT and Archaeology with over 24 years of experience in archaeological spatial analysis. Verhagen received his Ph.D. from Leiden University in 2007. His research interests include archaeological informatics, spatial analysis, archaeological predictive modelling, and landscape archaeology. Verhagen was a recipient of the VIDI grant from NWO (May 2012) to do research using spatial dynamical modelling to reconstruct and understand the development of the cultural landscape in the Dutch part of the Roman limes. He also was awarded a NIAS fellowship (January 2012), and received a Van Gogh travelling grant (2010-2011) from the Dutch-French Academy to start cooperation with CNRS in Besançon (Dr. L. Nuninger) and Nice (Dr. F. Bertoncello), and a VENI grant from NWO (August 2008) for his study entitled, "Introducing the human (f)actor in predictive modelling for archaeology."

Bettina Washington
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Kieran Westley
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Dr. Westley is an Archaeological GIS Technician with Coastal and Offshore Archaeological Research Services (COARS), an enterprise unit based at the University of Southampton (UK). He is a recognised specialist in maritime and coastal archaeology with over 10 years experience, mainly in the UK, Ireland and Canada. He has a BA in Archaeology & Anthropology from the University of Cambridge (UK) and a MA and PhD specializing in maritime archaeology from the University of Southampton. Kieran joined COARS in 2015 following a post-doctoral fellowship at Memorial University Newfoundland (Canada) between 2007-2008, and a research position at the Centre for Maritime Archaeology, Ulster University (UK) between 2009-2015. His research has focused primarily on the identification, reconstruction and investigation of submerged prehistoric landscapes and secondarily, on assessing the vulnerability of archaeological sites to coastal erosion and future sea-level rise. To date, this has included the first systematic investigation of a submerged Mesolithic site on the island of Ireland, and both large- and small-scale archaeological vulnerability assessments for Northern Ireland and Newfoundland. In his former position at Ulster University, he was also responsible for the provision of maritime archaeology research and services commissioned by devolved government's heritage agency: the Northern Ireland Environment Agency (NIEA) Historic Environment division. This included desk-based assessment and field survey projects to enhance coastal and maritime Historic Environment Records (HERs), such as multi-period maritime landscape surveys, offshore geophysical and dive surveys, a GIS-based vulnerability assessment of Northern Ireland's coastal archaeological sites, and assessment of marine geophysical data for shipwreck and submerged landscape research. As part of his role, he also conducted regulatory assessment of applications for development in the coastal and marine zones under Marine Licencing legislation.

APPENDIX C:

LIST OF ATTENDEES

Submerged Paleolandscapes Workshop University of Rhode Island (URI) Graduate School of Oceanography and the Narragansett Indian Tribal Historic Preservation Office (NITHPO) April 8-10, 2013			
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APPENDIX D:

LEXICON

SUBMERGED PALEOCULTURAL LANDSCAPES PROJECT
INITIAL WORKSHOP - APRIL 8-10, 2013

DRAFT LEXICON OF COMMONLY USED PROJECT-RELATED ACRONYMS AND TERMS

Acoustic – *associated with sound (e.g., sub-bottom profilers, side scan sonars, and depth sounders are all acoustic marine geophysical surveying instruments)*

Acoustic Impedance – *any condition preventing the transmission of sound energy*

Acoustic Reflector – *a characteristic "sharp" or "dark" return on a sub-bottom profiler record produced by a sediment layer(s)*

Aeolian Processes – *shaping of the Earth's surface and the erosion, transportation and deposition of sediments by the wind*

Aerobic – *a condition in which oxygen is present*

Alluvium – *sediments deposited by running water (e.g., river sediments)*

AMI – *Area of Mutual Interest; an area of shared interest between RI and MA for offshore renewable energy development*

Ancient Native American Period/Pre-Contact Period – *period in Native American history pre-dating European contact*

Anaerobic – *a condition in which oxygen is absent; usually applied to sediments wherein organic artifact preservation is expected to be excellent*

Archaeology – *a sub-discipline of anthropology (the study of people) focusing on the systematic study of past human life and culture through the identification, mapping, recovery, and analysis of material culture evidence (i.e., sites, features, artifacts and ecofacts) that is preserved; fundamental goals of archaeology include: 1) to reconstruct culture history; 2) to reconstruct ancient human behavior and lifeways; and 3) to understand the processes of culture change*

North Atlantic Continental Shelf – *submerged eastern border of the North American continent that slopes gradually and extends to a point of steeper descent (i.e., the continental slope) to the ocean bottom*

Bathymetry – *contoured water depths; equivalent to topography on land*

"Best Practices" – *a documented way of achieving specific results under specific circumstances in an effective way based on lessons learned by one group that are passed on to other groups. In this way an individual or organization can focus on performance of the task rather than first determining the best way to accomplish the task. The use of best practices can facilitate a more consistent set of results. Best practices are not static and are continually being improved upon.*

BOEM – *Bureau of Ocean Energy Management*

Bubble-Pulser – *low-frequency acoustic-/sound-source used for performing sub-bottom profiler surveys*

Buried (Soil) Horizon – *a buried sediment layer, usually oriented parallel to the land surface, whose physical characteristics (chiefly color and texture) differ from the layers above and beneath it*

Ceremonial Stone Landscape – *sacred ceremonial landscape incorporating massive or small stone structures, stacked stones, stone rows or stone effigies; these prayers in stone were prepared by pau waus/medicine people to sustain Tribal peoples' reliance on Mother Earth and the spirit energies of balance and harmony*

Chipping Debris – *sharp-edged stone flakes produced during the chipped-stone tool-making process*

Circa – *about; around; approximately*

Consultation – *formal dialogue between agencies and agencies and Tribes*

Context – *the relationship that cultural artifacts, features and sites have to each other and the situation in which they are found*

Contextual Integrity – *for an archaeological site: a relatively undisturbed cultural deposit with its patterns and layers of artifacts and other archaeological evidence relatively intact; for a traditional cultural property: a cultural site that is recognizable to today's affiliated cultural group, evidenced through tradition, and still used or revered in some way*

CRM – *Cultural Resource Management; involves research to identify, evaluate, document, register, and establish other basic information about cultural resources; planning, to ensure that this information is well integrated into management processes for making decisions and setting priorities; and stewardship, under which planning decisions are carried out and resources are preserved, protected, and interpreted to the public*

CRMC – *RI Coastal Resource Management Council*

Cultural Ecology – *study of relationships between humans and their environments; approach views culture as an adaptive system*

Cultural Landscape – *any system of interaction between human activity and natural habitat; defined by American human geographer, Carl Sauer (1889-1975), as: "The cultural landscape is fashioned from a natural landscape by a cultural group. Culture is the agent, the natural area is the medium, the cultural landscape is the result"*

Cultural Resource – *term reflecting the philosophy of the historic preservation movement; finite, non-renewable, valued elements of the human-made environment, which, once gone, cannot be recovered*

Datum – *the origin (or 0, 0) location of a survey grid*

Debitage – *the wastage produced during stone tool making*

Deep Borings – *geological samples obtained using a drill rig that are used to determine the age and history of deposition, and the physical properties (e.g., grain size, strength, etc.) of sediments and rock below the seafloor's surface; used in conjunction with sub-bottom profiler survey data to determine the local and regional geology of a study area*

Ecofact – *elements from the environment (i.e., bone, stone, wood, seeds, nuts, shell, etc.) collected by people for their use, but not themselves tools or manufactured objects*

Erosional Unconformity – *irregular surface of erosion or non-deposition that represents a significant break in sediment deposition; defined by the top of the buried soil and the base of the overlying deposits representing hundreds or thousands of years of non-deposition and/or erosion; triggered by changes in climate, a rise or fall in sea level, tectonic activity, etc.; waves eroding a coastline as sea level rises and inundates the land create erosional unconformities*

Eustatic Sea Level Rise – *uniform worldwide change in sea level caused especially by fluctuations in the amount of water taken up by continental and polar icecaps, or by a change in the capacity of ocean basins*

"Fishing Site Model" – *well-tested predictive model devised in Denmark for locating submerged Stone Age settlements; model indicates that coastal populations of the Mesolithic Period settled beside places that were good for fishing with stationary traps by river mouths, narrow parts of bays, and on headlands and islands where the bay floor slopes evenly*

Fluvial – *processes associated with rivers and streams and the geological deposits created by them*

Fore- or Peripheral-Bulge – *a bulge in the Earth's crust at the edge of a glacier caused by the downward and forward pressure of the ice*

Geophysical Surveying – *surveying the Earth's geology using instruments that measure natural physical fields (e.g., magnetic survey) or artificial physical fields (e.g., the acoustic pulse of a side scan sonar)*

Geotechnical Sampling – *physical sampling of sediments for examination, analysis and dating*

GIS (Global Information System) – *computer mapping and spatial analysis program in which each measured variable is treated as a separate map layer that can be combined, compared and contrasted with other layers (variables)*

Glacial Lake – a formation created when *a glacier erodes the land, then melts, filling the hole or space that they have created*

Glacial Till – an *unstratified glacial deposit consisting of pockets of clay, gravel, sand, silt, and boulders that has not been subject to the sorting action of water*

Glaciation – *alteration of any part of the earth's surface by passage of a glacier, chiefly by glacial erosion or deposition*

Global Sea Level Rise – *caused by a change in the volume of the world's oceans due to temperature increase, deglaciation (uncovering of glaciated land because of melting of the glacier), and ice melt.*

GPS (Global Positioning System) – *satellite-signal-based positioning system of precisely (3 m or less) locating any point on Earth*

Gradiometer – *an instrument for measuring the gradient of (i.e., changes in) an energy field (e.g., the horizontal gradient of the Earth's magnetic field)*

Gyttja (pronounced "*goot-chee-yuh*") – *mud rich in organic matter found at the bottom or near the shores of fresh or brackish bodies of water; referred to as "the cultural layer" in Danish submerged settlements archaeology for its common association with deposits of Stone Age cultural materials*

Holocene Epoch – *the last circa 12,000 years of the Earth's history — the time since the end of the last major glacial epoch, or "ice age"*

Indian – *English term applied erroneously by European explorers to the original inhabitants of the Americans, because they believed they had reached India by a new route upon arrival on North America's eastern coast*

Indigenous Native American – *contemporary descendants of the original inhabitants of the Americas*

Induction- (or Water-) Dredge – *a piece of underwater equipment consisting of a topside water pump and dredge-head guided by an archaeological diver that is used in a manner similar to using a household vacuum-cleaner in the systematic excavation of sediments from underwater sub-surface archaeological test excavation units; sediments are screened as they are excavated through a removable nylon mesh bag attached to the dredge-head's water-exhaust end in a manner similar to the screening that is done during terrestrial archaeological excavations*

Inundation – *process during which water floods and covers normally dry land*

Interstadial – *period of relative climatic warming during a glacial period*

Intertidal (also Foreshore or Littoral) Zone – *the area between the land and sea that is covered by water at high tide and uncovered at low tide*

Isostatic Rebound – *post-glacial rebound (sometimes called continental rebound or glacial isostatic adjustment); the rise of land masses that were depressed by the huge weight of ice sheets during glaciation; a process known as isostasy*

Katabatic Wind – *from the Greek word '*katabatikos*' meaning "going downhill", is the technical name for a drainage wind - a wind that carries high density air from a higher elevation down a slope under the force of gravity; katabatic wind originates from radiational cooling of air atop a plateau, a mountain, glacier, or even a hill; Katabatic winds are most commonly found blowing out from the large and elevated ice sheets of Antarctica and Greenland, and are intensely cold and sometimes reach hurricane force*

Kettle Pond – *a glacially-formed, water-filled depression that is isolated with no springs or streams in or out, which was created by massive chunk or chunks of ice that fell or were left behind and sank into the earth as a glacier melted and receded*

Lacustrine – *associated with a lake*

Lag Deposit – *coarser deposit left behind after the finer materials have been washed away*

Landscape Archaeology – *focuses on the broad distribution of archaeological material across a broad landscape seen as a spatially and temporally continuous record of human occupation and use*

Laurentide or Laurentian Ice Sheet – *principal glacial cover of eastern North America covering most of Canada and a large portion of the northern United States east of the Rocky Mountains during the Pleistocene Epoch between circa 90,000 and 20,000 yBP*

Law of Superposition – *common sense concept that the relative age of a soil layer (stratum) is determined by its position in an undisturbed vertical sequence of a number of layers (strata)*

LGM – *Last Glacial Maximum; when the most recent glaciation reached its maximum extent circa 18,000 to 22,000 years ago; coincides roughly with the most recent sea level low-stand (approx. -350 to -400 feet below present levels)*

Lithics – *chipped and ground stone tools*

Lithic Reduction Area – *location where chipped stone tools were produced*

Living Floor Surface – *horizontal layer of an archaeological site that was once the surface occupied by ancient peoples. It is identified both by the fact that it is hard-packed and also by the artifacts located on its surface*

Magnetometer – *instrument used for measuring magnetic forces, especially the earth's magnetic field; used in archaeology for identifying buried ferrous masses and areas impacted by fire*

Mammoth – *any of a genus (*Mammuthus*) of extinct Pleistocene mammals of the elephant family distinguished from recent elephants by highly ridged molars, usually large size, very long tusks that curve upward, and well-developed body hair. Many types of mammoths lived in northern climates, and their remains can be found in most northern regions of the world including: Europe, Northern Asia and North America. The oldest known mammoth fossil is 4 million years old. The last mammoth species was a dwarf species that lived near the coast of Siberia and went extinct around 4,000 years ago*

Marine Transgression – *a geologic event during which sea level rises relative to the land and the shoreline moves toward higher ground, resulting in flooding. Transgressions can be caused either by the land sinking or the ocean basins filling with water (or decreasing in capacity). Transgressions and regressions may be caused by tectonic events, severe climate change (i.e., ice ages), or isostatic adjustments following removal of ice or sediment load*

Marine Unconformity – *a buried surface that does not conform to the character of younger overlying bedding planes of marine sediments with evidence of subaerial exposure and erosion; forms as a result of a relative fall in sea level*

Mastodon – *any of several extinct mammals of the genus Mastodon (or* Mammut*). Mastodons resembled elephants and mammoths except that their molar teeth had conelike cusps rather than parallel ridges for grinding. Like elephants, mastodons had a pair of long, curved tusks growing from their upper jaw, but males also sometimes had a second pair from the lower jaw. Also like mammoths,* *mastodons were covered with hair. The oldest known mastodon fossil is about 28 million years old. They are thought to have gone extinct about 12,000 years ago.*

Material Culture – *any object made and used by humans (e.g., tools, weapons, containers, clothing, dwellings, items of adornment, art, craftwork, etc.)*

Medicine Man/Woman – *an English term describing a Tribe's priestly healer and spiritual leader*

Mesolithic (Middle Stone Age) Period (in Denmark) – *circa 13,500 to 6,000 yBP ; period of great environmental and climatic change as glaciers retreated, and a tundra gave way to dense forest; region was populated by small groups of mobile hunter-gatherers and now, we know from underwater research, sedentary coastal populations of fisher-people*

Micro-Debitage – *stone tool micro-fragments (<1 mm) that can be abundant (>106 per tool) and more dispersed around tool-making sites; recent research in Rice Lake, Ontario, demonstrated micro-debitage analysis of sediment samples can be an effective tool for identifying submerged cultural sites*

Microliths – *a tiny stone tool, often of geometric shape, mounted singly or in series as the working part of a composite tool or weapon*

Morphology – *study of structure or form*

Moraine – *mass of unstratified rocks and sediment (chiefly boulders, gravel, sand and clay) deposited by a glacier, typically as ridges, mounds or irregular masses, at its edges or extremity*

"Mud Hole" – *a deep site in Rhode Island Sound that because of its depth has a low-energy bottom currents and thus traps and retains fine grained sediments (i.e., "mud"); believed to have been part of a paleodrainage system when the continental shelf was exposed during low sea levels; likely inundated quickly during sea level rise; may be a high probability site for preservation of a formerly terrestrial landscape with cultural deposits*

Multi-Beam Echo Sounder – *acoustic survey instrument typically used to determine the depth of water and the nature of the seabed; works by transmitting a broad acoustic fan-shaped multi-beamed pulse from a specially designed sound source (i.e., a transducer) into the water and down to the seafloor; the sounds reflected echo off of the seafloor is received and processed to create a swath of depth data along a surveyed line; post-processed data can be displayed as color-coded 3-D contour maps of the seafloor*

Multi-channel Streamer – *a long, flexible, tubular array (usually 50 to 100 m long) of acoustic (seismic) receivers (hence multiple channels) that is towed behind a research vessel during sub-bottom profiler geophysical surveys and receives multiple recordings of the sub-bottom geology that can be stacked to better resolve the sub-bottom stratigraphy and used to plan the locations of drilling or coring sampling and the identification of formerly exposed inundated paleolandsurfaces*

NAGPRA – *Native American Graves Protection and Repatriation; enacted in 1990 to address the rights of lineal descendants, Indian Tribes, and Native Hawaiian organizations to Native American cultural items, including human remains, funerary objects, sacred objects, and objects of cultural patrimony. The Act assigned implementation responsibilities to the US Secretary of the Interior. Staff support is provided by the National NAGPRA Program*

National Register of Historic Places – *The National Register of Historic Places is the official list of the Nation's historic places worthy of preservation. Authorized by the National Historic Preservation Act of 1966, the National Park Service's National Register of Historic Places is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archeological resources. To be considered eligible, a property must meet the National Register Criteria for Evaluation. This involves examining the property's age, integrity, and significance and answering the following questions:*

- *Age and Integrity. Is the property old enough to be considered historic (generally at least 50 years old) and does it still look much the way it did in the past?*

- *Significance. Is the property associated with events, activities, or developments that were important in the past? With the lives of people who were important in the past? With significant architectural history, landscape history, or engineering achievements? Does it have the potential to yield information through archeological investigation about our past?*

Listing in the National Register of Historic Places provides formal recognition of a property's historical, architectural, or archeological significance based on national standards used by every state.

Native American – *anyone born in the Americas*

NHPA – *National Historic Preservation Act of 1966, as amended (Public Law 89-665; 16 U.S.C. 470 et seq.) is legislation intended to ensure that preservation values are factored into federal agency planning and decisions. Section 106 of the NHPA requires federal agencies to consider the effects of projects they carry out, approve, or fund on historic properties. Additionally, federal agencies must provide the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on such projects prior to the agency's decision on them. Section 106 review encourages, but does not mandate, preservation. Sometimes there is no way for a needed project to proceed without harming historic properties. Because of Section 106, federal agencies must assume responsibility for the consequences of the projects they carry out, approve, or fund on historic properties and be publicly accountable for their decisions.*

Regulations issued by the ACHP spell out the Section 106 review process, specifying actions federal agencies must take to meet their legal obligations. The regulations are published in the Code of Federal Regulations at 36 CFR Part 800, "Protection of Historic Properties."

Federal agencies are responsible for initiating Section 106 review, most of which takes place between the agency and state and Tribal organization officials. Appointed by governors, the State Historic Preservation Officer (SHPO) coordinates the state's historic preservation program and consults with agencies during Section 106 review.

Agencies also consult with officials of federally-recognized Indian Tribes when the projects have the potential to affect historic properties on Tribal lands or historic properties of significance to such Tribes located on Tribal lands. Some Tribes have officially designated Tribal Historic Preservation Officers (THPOs), while others designate representatives to consult with agencies as needed.

NROC – *Northeast Regional Ocean Council*

Older Dryas – *a geologically brief (circa 300 years) stadial (cold) period between the Bølling and Allerød oscillations (warmer phases) approximately 14,000 yBP, towards the end of the Pleistocene Epoch*

Onlapping – *arrangement of successively younger sediment layers extending progressively further inland across an eroded surface cut into older sediments on the floor of an advancing sea; generally associated with marine transgression*

Organics – *of, relating to, or derived from living organisms*

OSAMP (RI SAMP) – *RI Ocean Special Area Management Plan developed by the RI Coastal Resources Management Council and the URI Coastal Resources Center to properly plan the uses of the state waters, and adjacent federal waters, in RI and Block Island Sounds*

Oxidation – *chemical combination of a substance with oxygen*

Paleochannel – *a remnant of an ancient and inactive river or stream channel that has been either filled or buried by younger sediment*

Paleoenvironment – *an ancient environment of a past geological age*

Paleocultural Landscape – *ancient landscape inhabited and impacted by humans*

Paleoshoreline – *ancient shoreline now submerged as result of subsidence or sea level rise*

Paleosols – *soils that formed in the past and that are no longer actively forming today; often buried beneath more recently deposited sediment horizons*

Palynology – *study of pollen; can be used to reconstruct ancient plant communities and, by inference, ancient climates through comparisons of the ancient pollen record with modern ones from known environments*

Panarchy Theory – *a combination of "Pan", the ancient Greek God of nature, and "hierarchy" or organization by ranking, in which a hierarchically nested series of adaptive cycles result in self-organizing, evolving, complex natural systems that assemble across all scales of space and time*

Patination – *weathering of a stone surface caused by exposure to elements, especially in chert and flint, resulting in a whitish colored layer and indicative of site formation processes, such as stratigraphic deflation*

Peat – *brown, highly organic material found in marshy or damp regions, composed of partially decayed vegetable matter*

Phytolith – *microscopic, inorganic mineral particles produced by plants*

Late Pleistocene (also Upper or Terminal Pleistocene) – *end (circa 126,000 to 11,000 years ago) of the Pleistocene Epoch (1.8 million to 11,000 yBP); dominated by the Wisconsin glaciation in North America; period when modern humans spread to every continent except Antarctica and megafauna became extinct*

Predictive Modeling – *process by which a model is created or chosen to try to best predict the probability of an outcome or occurrence; used in archaeology to help guide and focus sub-surface archaeological sampling*

Prehistory(ic) – *period before development of a written system of record keeping; adjective modifying any site, culture, artifact, ecofact, feature, etc. that dates to a period before the development of writing; not the same time in all world areas, as writing was not developed or adopted uniformly across the globe*

Provenience – *the source, origin or location of an artifact or feature and the recording of the same*

Quaternary Period – *relatively short period spanning 2.6 million years ago to the present; characterized by a series of at least 20 major inter-glacial cycles when the formed, expanded, retreated and disappeared from the landscape, and by the appearance and expansion of anatomically modern humans; includes two geologic epochs: the Pleistocene and Holocene*

Ravinement Surface – *the erosional surface marking the depth of maximum disturbance by transgression*

Radiocarbon Dating – *a technique for determining the age of organic materials, such as wood, based on their content of the radioisotope ^{14}C acquired from the atmosphere when they formed part of a living plant. The ^{14}C decays to the nitrogen isotope ^{14}N with a half-life of 5,730 years. Measurement of the amount of radioactive carbon remaining in the material thus gives an estimate of its age*

Archaeological Reconstruction – *a mental construction of/inferences about past human activity based on a combination of archaeological, environmental, ethnohistorical, and, when available, oral history evidence*

Refugia – *a small, isolated area that has escaped the extreme changes undergone by the surrounding area, as during a period of glaciation, allowing the survival of plants and animals from an earlier period*

Relative Sea Level Rise – *occurs where there is a local increase in the level of the ocean relative to the land, which might be due to ocean rise or land subsidence*

Remote Sensing – *non-invasive technique of obtaining information about environmental/geological conditions and archaeological sites through the analysis of data collected by special instruments that are not in physical contact with the objects of investigation*
ROV – *Remotely Operated Vehicle; unmanned submersible; usually tethered to a surface vessel*

Sea Level Curve – *an idealized, yet evidence-based, graphic representation of changes in sea level throughout geological history*

Seismic (sub-bottom profiler) Survey – *low-frequency acoustic survey method used typically for mapping deeply buried geological structures based on the time interval between the start of a seismic wave at a selected shot point and the arrival of reflected or refracted impulses at one or more seismic detectors. Upon arrival at the detectors, the amplitude and timing of waves are processed and recorded as a cross-sectional view of the sub-surface geological structures, which is referred to as a seismic or sub-bottom profile.*

"Section 106" – *Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires Federal agencies to take into account the effects of their undertakings on historic properties, and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment. The historic preservation review process mandated by Section 106 is outlined in regulations issued and revised by ACHP (i.e., "Protection of Historic Properties" [36 CFR Part 800])*

Shoreface – *the narrow, steeply-sloping zone between the seaward limit of the shore at low water and the nearly horizontal offshore zone*

Shoreface Retreat – *erosion of previously deposited sediments by the combined forces of sea level rise, wave, tidal and current processes that cause the shoreline to retreat landward; dominant transgressive process; most common in areas where sea level rose slowly and subsidence rates were low*

SHPO – *State Historic Preservation Office(r)*

Side Scan Sonar – *a high-frequency acoustic survey system that emits conical or fan-shaped sound pulses laterally downward toward the seafloor across a wide angle, perpendicular to the path of the sensor through the water to create images based on the intensity of the acoustic return signal of large areas of the sea floor's surface and to characterize sediment types*

Split-Spoon Corer – *sediment sampling device with a partially open 2- to 3-inch diameter steel tube of 6-, 12-, or 18-inch length at the end of a T-shaped, hand-held driver; relatively easy and inexpensive method for collecting shallow soil samples (effective depth range approx. 0 to 12 feet below surface)*

Subaerial – *Existing, occurring, or formed in the open air or on the earth's surface; not underwater or underground*

Stepwise Retreat – *the sudden inundation or in-place drowning of coastal landforms and sediments; occurs most commonly in areas of rapidly rising sea level where the coast is rapidly subsiding and the gradient of the transgressed surface is shallow; less common process than shore-face retreat; more likely to preserve paleosols and their embedded cultural sites and archaeological deposits*

Stone Age (in Denmark) – *divided into three ages – Old Stone Age (Paleolithic Period) circa 200,000 to 14,000 yBP; Middle Stone Age (Mesolithic Period) circa 13,500 to 6,000 yBP; and the New Stone Age (Neolithic Period)*

Stratified Sediments – *sediment layers stacked over each other with the oldest sediments generally the deepest layer*

Stratigraphy – *science of describing the vertical and horizontal relationships of different layers of sediments or cultural deposits formed through time to understand their depositional history; related to the "Law of Superposition," which states that in any undisturbed sequence of sediments or cultural materials deposited in layers, the youngest layer is on top and the oldest on bottom, each layer being younger than the one beneath it and older than the one above it*

Submerged Cultural Landscape – *a submerged landscape impacted by humans (ancient as well as modern)*

Submerged Paleocultural Landscape – *a formerly terrestrial landscape inhabited and utilized by ancient Native Americans that is now submerged underwater*

Submerged Settlement Site – *the archaeological remains of a formerly terrestrial area and adjacent shoreline of human occupation and use that is now submerged and preserved underwater*

Subsoils – *layer of soils beneath surface soils overlying bedrock*

Sub-Surface – *below the surface of the ground or seafloor*

Subtidal – *below the level of the lowest low tide; continuously submerged*

Stadial – *period of relative climatic cooling during a glacial period*

Swash Zone – *where waves wash onto and back from the shore*

Terminal Moraine – *a moraine marking the farthest advance of a glacier or ice sheet (e.g., large elements of Long Island, Block Island, Martha's Vineyard, and Nantucket are defined by geologists as terminal moraines)*

THPO – *Tribal Historic Preservation Office(r)*

Traditional Cultural Property – *properties of traditional religious and cultural importance to an Indian Tribe or Native Hawaiian organization may be determined to be eligible for inclusion on the National Register of Historic Places, based on its associations with the cultural practices, traditions, beliefs, lifeways, arts, crafts, or social institutions of a living community*

Transect – *line through a project study area along which data is collected or samples taken*

Tribal People – *members and practitioners of the traditions of an Indigenous Native American Tribe*

Tudse Hage (pronounced "Tood-suh-hay") Site – *submerged Stone Age (Mesolithic) settlement site with similar preservation and artifacts as the Danish Tybrind Vig site (see below) situated on a drowned fjord valley dating from circa 9,000 to 7,000 to yBP currently under investigation by the Viking Ship Museum*

Tybrind Vig (pronounced "Too-brind Vee") Site – *site of the first intensively investigated (10 years – 1978 to 1987) submerged Stone Age (Mesolithic) settlement (circa 7,200 to 6,000 yBP) situated within an embayment excavated in Denmark; proved the feasibility and potential of submerged settlements archaeology to provide new information about ancient Danish ancestors, as well as demonstrated the extraordinary preservation of fragile organic materials in the submerged environment*

USET – *United South and Eastern Tribes, Inc.; group composed of (currently 26) Federally-recognized Tribes distributed between Texas and Maine in the southern and eastern United States dedicated to enhancing the development of Indian Tribes, to improving the capabilities of Tribal governments, and assisting the member Tribes and their governments in dealing effectively with public policy issues and in serving the broad needs of Indian people*

Varve – *sediments deposited annually in distinct, distinguishable layers along lake and ocean bottoms*

Vibrocore Sampling – *sampling technique wherein a 2 to 4-inch diameter x 3- to 40-foot steel tube is mechanically advanced into the seafloor through a process of vibrating or hammering to obtain a continuous sediment core sample*

Video Hydro-Probe – *water-powered jet-probe consisting of a PVC pipe with an internal pipe fitted with a self-lit color video-camera at its tip operated from a surface platform or underwater by a diver; used to probe, identify and record visual and tactile properties of sub-surface seafloor sediments and buried remote sensing targets of interest; effective depth range 0 to 20 feet below seafloor surface*

Wisconsin Glaciation – *the last glacial period (circa 85,000 to 10,000 yBP) as defined by geologists (also known as the Devensian, Midlandian, Würm, and Weichsel glaciation outside of North America); the maximum ice extent occurred approximately 18,000 to 20,000 years ago during the LGM (last glacial maximum), also known as the Late Wisconsin in North America. This glaciation radically altered the geography of North America north of the Ohio River. At the height of the Wisconsin Episode glaciation, two large ice sheets (i.e., the Laurentide and the Cordilleran) covered most of Canada, the Upper Midwest, and New England, as well as parts of Idaho, Montana and Washington*

yBP – *Before Present (present = circa 1950); also **calBP** – calibrated (with tree-ring dates) yBP*

Younger Dryas – *a rapid, although geologically brief (1,300 ± 70 years), return to cold, glacial climatic conditions and drought in the higher latitudes of the Northern Hemisphere between 12,800 and 11,500 yBP; Younger Dryas sharply contrasted the warming of the preceding interstadial deglaciation of the Bølling-Allerød interstadial (warm period) at the end of the Pleistocene, and preceded the preboreal of the early Holocene. It is named after an indicator genus, the alpine-tundra wildflower Dryas octopetala.*

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources, protectiong our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U. S. administration.

The Bureau of Ocean Energy Management

As a bureau of the Department of the Interior, the Bureau of Ocean Energy Management (BOEM) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS) in an envrionmentally sound and safe manner.

The BOEM Envrionmental Studies Program

The mission of the Environmental Studies Program (ESP) is to provide the information needed to predict, assess, and manage impacts from offshore energy and marine mineral exploration, development, and production activities on human, marine, and coastal environments.