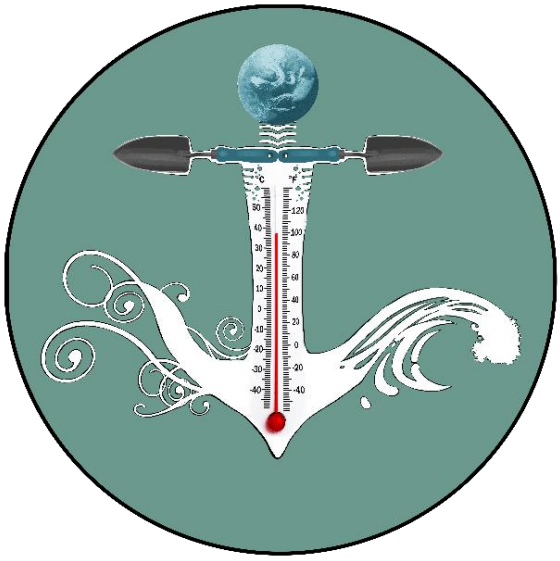

Climate Change and Maritime Heritage: Interdisciplinary Perspectives

Program and Schedule

DAY 1: April 5th, 2021 EDT

8:30 AM EDT: Introduction and Opening Remarks

McKenna Litynski, Senior Undergraduate Student, St. Mary's College of Maryland

8:45 AM EDT: Welcome to Maryland's Newest Marine Science Program

Presenter: Randolph K. Larsen III, Professor of Chemistry and Biochemistry, Program Coordinator for the Environmental Studies Department, St. Mary's College of Maryland

Abstract: St. Mary's College of Maryland announces the creation of the first undergraduate marine science program in Maryland. This new program directly addresses the use of the St. Mary's River and Chesapeake Bay to create a one-of-a-kind experience that will be unique, rigorous, and innovative. Because of the unique location of St. Mary's College on the St. Mary's River many opportunities exist for marine science that are not available at the other Maryland higher education institutions. Furthermore, Marine Science will consist of a rigorous curriculum of foundational physics, chemistry, and biology courses along with innovative new advanced courses that utilize our campus resources. Experiential learning will be at the heart of the program, with numerous opportunities to explore the waters of Maryland and build community

within the student cohort. Additionally, a required field experience, with its focus on application and professional development, offers a modern approach to a liberal arts curriculum.

9:00 AM EDT: Recording Heritage Along Scotland's Eroding Coast

Presenters: Tom Dawson, Principal Research Fellow in the School of History, University of St Andrews

Joanna Hambly, Research Fellow in the School of History, University of St Andrews

Abstract: Scotland has one of the longest coastlines in Europe, much of it vulnerable to rapid coastal erosion. For decades, heritage managers have grappled with how to protect threatened heritage, and the first coastal defenses for heritage sites date back to the nineteenth century. However, it was not possible to defend the entire coast and other ways of working with threatened heritage were developed. Over the last twenty years, the SCAPE Trust has been working with communities to locate and record coastal and intertidal sites. Work to date has seen local volunteers updating records using an app with the results used to priorities action. SCAPE has also initiated a range of different recording projects, with communities deciding on the course of action and providing help to complete the work. SCAPE is now working to update their website and heritage recording app for their next project (currently on hold due to lockdown). This will see a new program of community coastal surveys in areas yet to be explored, and it is hoped that the technology and methodology will be of use to others. This talk will give a summary of coastal heritage recording in Scotland and will discuss plans for the future.

9:30 AM EDT: Incorporating Climate Change into the Management of NOAA's Federally-Protected Underwater Maritime Heritage and Cultural Resources

Presenters: Zachary J. Cannizzo, National Marine Sanctuaries Fellow, NOAA Office of National Marine Sanctuaries and NOAA's Climate Program Office

Madeline Roth, CPC under contract to Maritime Heritage Program, NOAA Office of National Marine Sanctuaries

Abstract: NOAA's Office of National Marine Sanctuaries (ONMS) is the steward of 14 national marine sanctuaries and two marine national monuments, all of which contain tangible and intangible maritime heritage resources. From the wreck of the Civil War ironclad USS *Monitor* to sites of cultural importance to native Hawaiians, the diversity of maritime heritage resources under the stewardship of ONMS presents unique challenges and opportunities in a changing ocean. We will provide an overview of how climate change considerations are being incorporated into ONMS's framework for maritime heritage resources, which provides management guidance for the archaeological and cultural resources found within the National Marine Sanctuary System. By incorporating aspects of research, outreach, and management applicable across a diverse breadth of tangible and intangible archaeological and cultural resources, this framework not only acts to guide the management of some of the country's most

treasured heritage, but has the potential to advance our ability to successfully manage these resources in a changing ocean.

10:00 AM EDT: Addressing Climate Change and the Loss of Cultural Heritage: A Perspective from the Southeastern United States

Presenter: David G. Anderson, Professor of Anthropology, University of Tennessee

Abstract: Climate change is erasing the record of past as well as present human culture at an alarming rate. Major inter-related challenges facing those responsible for saving our shared cultural heritage include (1) determining what will be lost and deciding what will be saved; and (2) developing diverse and iterative approaches to our response. These include (a) ensuring collaboration and participation by all parties impacted, (b) capacity building, or making sure we have the individual and organizational resources needed to handle the challenge; (c) consideration of a wide array of cultural and research approaches—adopting multivocal as well as multiscale perspectives; (d) implement ting effective information management and curation—we need to link archaeological data at progressively larger scales, including input from all involved groups and perspectives on what is considered important, and making sure what is saved is maintained for the long term; (e) developing innovative fieldwork and analysis efforts for discovery, mitigation, and interpretation of threatened cultural properties; and (f) making sure the results at every stage of the process are publicly reported, widely shared, and guide subsequent activities. Knowing the scale of the challenge is critical, to understand the resources needed to address it. Fortunately, 150 years of prior research in the Southeast gives us a solid basis for planning.

10:30 AM EDT: Effects of Ocean Acidification on Pacific Arctic Bivalves and Implications for Maritime Heritage

Presenter: Christina Goethel, PhD Candidate, Chesapeake Biological Laboratory, University of Maryland Center for Environmental Science

Abstract: Recent sea ice retreat and seawater warming in the Pacific Arctic are physical changes that are impacting Arctic biological communities. Recently, ocean acidification from increases in anthropogenic CO2 has been identified as an additional stressor, especially to organisms that create calcium carbonate shells, such as bivalves. These bivalves are common prey items for benthivorous predators such as Pacific walruses (*Odobenus rosmarus divergens*), bearded seals (*Erignathus barbatus*), and diving seaducks, such as Spectacled Eiders (*Somateria fischeri*). In the Chukchi Sea, ocean acidification experiments indicate that after longer exposure (11 weeks) to acidified conditions some species showed declines in growth, while others show a potential resiliency at least at this exposure level. Much like calcifying organisms, maritime wreckages may be negatively affected by ocean acidification. Responses by organisms are often seen after long exposure times to these conditions, and maritime heritage is likely exposed for extended periods of time beyond that of some biological organisms. The Arctic, like other parts of the world are home to maritime wreckages, perhaps most famously the HMS *Erebus* and *Terror*,

ships used in Franklin's Northwest Passage trip where they were last seen in 1845 (https://www.rmg.co.uk/discover/explore/hms-erebus-and-terror). We can use lessons learned from the biological community in an area of the world that is one of the most rapidly changing for the maritime community when wrecks are found and moved towards preservation like the HMS *Erebus* and *Terror* were in 2014 and 2016.

11:30 AM EDT: Termites of the Sea: Climate Change and the Spread and Growth of Wood Boring Organisms that Degrade Underwater Cultural Heritage

Presenter: David Gregory, Senior Researcher and Visiting Research Professor, The National Museum of Denmark

Abstract: Wood boring organisms such as shipworm, gribble and boring piddocks are one of the major biological threats to underwater cultural heritage. Exposed wooden artefacts can be rapidly attacked and degraded by a range of wood boring mollusks (Shipworm) and crustaceans (Gribble). The contexts of archaeological sites, particularly submerged prehistoric sites, can be damaged by the activities of boring piddocks (Pholads), which although not using wood as part of their diet, can penetrate wooden artefacts and sediments.

All these organisms have strict environmental constraints for their growth and survival; key parameters including dissolved oxygen, temperature and salinity. The International Panel on Climate Change (IPCC) Assessment Reports have identified that sea level is predicted to rise by about 1 metre together with a rise in surface ocean temperatures between 0.2 and 0.5°C by the end of the 21st century. The IPCC, Fourth Assessment Report (AR4) further recognised ocean acidification, with projections of a reduction in average global surface ocean pH of between 0.14 and 0.35 pH units over the 21st century. All these changes will have a potential effect on the distribution, growth and survival of woodborers. The presentation will: give a brief overview of these wood degrading organisms and how they affect wood and underwater archaeology in general; studies to model the potential spread of shipworm in the Baltic Sea from the EU funded Wreck Protect project (www.wreckprotect.org) and how climate change is affecting their distribution within European water.

12:00 PM EDT: An Ontology of USS *Arizona*'s Preservation in a Changing Climate

Presenter: Jeneva Wright, Senior Lead Underwater Archaeologist, Defense POW/MIA Accounting Agency, Partnerships and Innovations (CTR).

Abstract: USS *Arizona*, a steel-hulled battleship sunk in Pearl Harbor, HI on 7 December 1941, is an iconic American shipwreck, a war grave and memorial, and is among many shipwreck sites that contain large amounts of potential marine pollutants. Unlike most similar sites, however, USS *Arizona* has been the subject of long-term multidisciplinary studies aimed at understanding the nature of structural changes to the hull. Such data have not yet been modeled against the rapidly-shifting environmental variables associated with anthropogenic climate change. This paper explores the available research on USS *Arizona*, and identifies areas where integration with climate data can improve understanding of the wreck's preservation, to help us grasp the complex and sobering interaction of rapidly changing marine environments, shipwrecks containing pollutants, and basic corrosion parameters.

12:30 PM EDT: Conclusion and Closing Remarks

McKenna Litynski, Senior Undergraduate Student, St. Mary's College of Maryland

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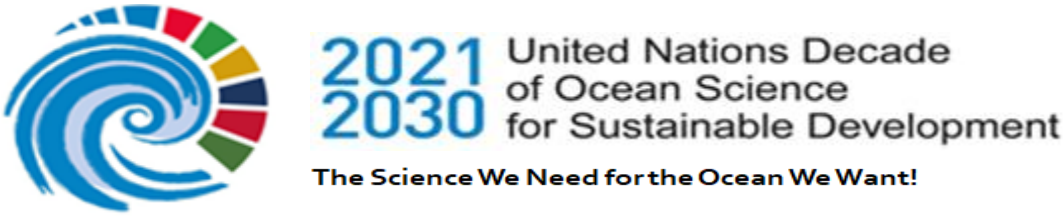

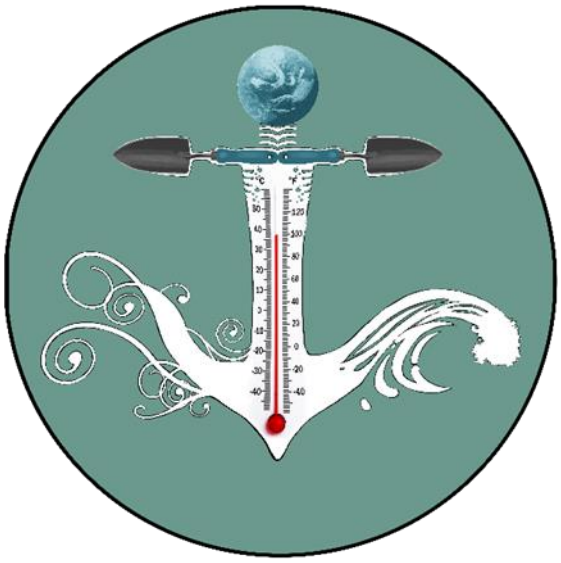

Climate Change and Maritime Heritage: Interdisciplinary Perspectives

Program and Schedule

DAY 2: April 6th, 2021 EDT

8:30 PM EDT: Introduction and Opening Remarks

McKenna Litynski, Senior Undergraduate Student, St. Mary's College of Maryland

8:45 PM EDT: Today's Footprints, Tomorrow's Loss: The Australasian Institute for Maritime Archaeology and the UN Decade of Ocean Science

Presenter: Kurt Bennett, Maritime Archaeologist, Australasian Institute for Maritime Archaeology

Abstract: The impacts of a changing environment on maritime cultural heritage (MCH) are not a new phenomenon; however, our understanding of these contemporary changes on a global scale remain ambiguous. Although not heritage specific, the UN's Decade of Ocean Science for Sustainable Development 2021-2030, which seeks to address the multiple stressors on global marine systems and manage them sustainably through ocean observations and research, is a key global research platform that encourages us to look at the links between a changing environment and the loss of MCH. The Australasian Institute for Maritime Archaeology (AIMA) aims to work constructively with the marine sciences and heritage practitioners, not only throughout the Australasian region, but also abroad, to enhance, engage and support the UN's Decade of Ocean Science. By supporting and encouraging interdisciplinary marine research we hope to obtain a

better understanding of how ocean acidification, warming waters and changing weather patterns are, and will continue to impact our shared heritage.

9:15 PM EDT: Synergetic Science: Climate Change and Maritime Heritage

Presenters: Deb Shefi, Assistant Curator, Western Australian Museum, Department of Maritime Heritage

Vicki Richards, Manager, Western Australian Museum, Materials Conservation Department

Abstract: For nearly half a century, maritime heritage managers and conservators around the world have mapped, analyzed, and documented maritime cultural heritage. Although ongoing research addresses climate change and archaeological sites, the focus has largely been on Paleolithic features and historic climate change. Simultaneously, marine scientists have established that ocean warming and acidification, increased extreme weather events, sea level rise, and changes in marine flora/fauna and sedimentary regimes are ongoing. Theoretically, we understand that archaeological sites will be impacted by these changes, and in some cases, this is being recorded site-specifically, but generalized knowledge has yet to be developed. As such, there is a lack of understanding in how changes in today's ocean chemistry will impact maritime cultural heritage sites moving forward. This presentation discusses the development of the sea-CCHAMP (Climate Change: Heritage and Marine Processes) Project - a cross-disciplinary study between maritime heritage practitioners and the marine science sector.

9:45 PM EDT: Climate Change and Potentially Polluting Wrecks in the Pacific

Presenter: Matthew Carter, Research Director, Major Projects Foundation

Abstract: Pacific Island Countries and Territories (PICT) are some of the most vulnerable places in the world to the impacts of climate change, the effects of which are already causing major disruption across the region. Amongst the many challenges the Pacific faces is the legacy of the Second World War which has left an archaeological signature of over 2700 potentially polluting wrecks (PPW) on the ocean floor. Despite having been underwater for at least 75 years, these wrecks still potentially contain millions of gallons of toxic oil carried as cargo and/or bunker fuel. Corrosion rate estimates demonstrate that these potentially polluting wrecks are approaching structural collapse, a process that is likely to be hastened by ocean acidification and increased storm intensity associated with climate change. In partnership with the Secretariat of the Pacific Regional Environment Programme (SPREP) and the Ocean Foundation (TOF), the Major Projects Foundation (MPF) is working to mitigate the impacts of oil spills posed by PPW as a means of safeguarding marine ecosystems and the cultures and livelihoods of coastal communities in the Pacific.

10:15 PM EDT: Lutruwita Traditional Practice, Maritime Archaeology, Climate Effect and How They are Connected

Presenter: Dean Greeno, Assistant Aboriginal Heritage Adviser, CMS Centre for Marine Socioecology and Aboriginal Heritage Tasmania

Abstract: I am a proud trawlwoolway, Pakana man from Lutruwita. My presentation will take you on a journey which was started when My mother, an award-winning traditional shell necklace maker, initiated a discussion some twenty years ago regarding her observation of the noticeable and appreciable changes in the physical structure and colour of the traditional Marineer shell. That conversation created the momentum for my ongoing research into climate effects on traditional cultural materials. The presentation covers: growing up on Flinders Island in a fishing family with houses built from shipwreck salvage; becoming an aircraft maintenance engineer and qualified builder; representing Lutruwita indigenous first peoples at a world ocean climate change conference in Hobart; and working on a pilot Elders oral history project with many connections to marine heritage. Muttonbirding, sealing, and shell harvesting are some of the oldest marine based practices in the world with over 14,000 years of ongoing activity.

10:45 PM EDT: GIRT Scientific Divers: A Conservation Focused Citizen Science Program for Underwater Cultural Heritage.

Presenter: Andy Viduka, PhD Candidate in Archaeology, University of New England

Abstract: To understand the impact from natural events and cultural activity, and to inform science-based decision making for the *in-situ* preservation of underwater cultural heritage, systematic longitudinal monitoring of sites is required. This presentation outlines a citizen science approach, which commenced in Australia in mid-2018, that enables systematic robust data collection by members of the public. Gathering Information via Recreational and Technical (GIRT) Scientific Divers is a citizen science program developed to capitalize on recent technological advances to bring spatial scale and longevity to underwater cultural heritage monitoring programs. GIRT was developed to inform our understanding of the impact of climate change on underwater cultural heritage and utilizes a no-impact, conservation and environmental monitoring methodology. Citizen scientists who participate in GIRT will potentially help management agencies address the lack of near real time *in-situ* management data to better target mitigation or rescue archaeology measures. This presentation will emphasize the importance of an informed and engaged public to provide information at the scale and resolution necessary to understand environmental change on submerged cultural heritage.

11:15 PM EDT: The Turning Tide: Maritime/Riverine Heritage Sites and Climate Change Indicators in NSW and Victoria (Australia)

Presenter: Brad Duncan, Adjunct Senior Lecturer, University of New England

Abstract: This paper will examine recent examples of how environmental change has affected maritime and other types of archaeological sites in NSW and Victoria (Australia). Extreme weather events are impacting both shipwrecks and other types of underwater cultural heritage

sites, both in the coastal zones but also in the estuarine and inland river systems. This work, undertaken as part of collaborative research between through University of New England and Heritage NSW (known as the NSW Rivers Project), is based on over a decade of ad hoc archaeological fieldwork observations sites conducted after severe meteorological episodes. The paper demonstrates the range of potential damage that has been observed at heritage sites and postulates that more systematic investigation is required to determine whether this is attributable to climate change.

11:45 PM EDT: Conference Discussion

Led by Deb Shefi, Assistant Curator, Western Australian Museum, Department of Maritime Heritage

12:45 PM EDT Conclusion and Closing Remarks

McKenna Litynski, Senior Undergraduate Student, St. Mary's College of Maryland

Session Organizers:

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