Seabee Junkyard:
A holistic and locally inclusive approach to site management and interpretation

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Abstract
The United States of America (U.S.) Navy's Construction Battalion called 'Seabees' were born in January 1942 from the demand for a unique set of both engineering and combat skills: "We Build, We Fight". The Seabees were instrumental in the Pacific theater, and played a significant role in rebuilding Guam. Known as the Seabee Junkyard due to the dumping of Seabee materials and equipment after the war, the site located within Apra Harbor, Guam is a popular dive site amongst local and visiting divers. Research on the significance of the site has revealed that it also represented the rapid demobilization of U.S. Navy after World War II (WW II). In July 2012, the University of Guam conducted a Nautical Archaeology Society maritime archaeology training course funded by the Guam Preservation Trust, which resulted in the material identification and surveying of the site. Further site investigations have taken a holistic and locally inclusive approach to the management and interpretation of the site. This includes non-disturbance wreck diving and underwater cultural heritage education in association with developing site preservation strategies, and compilation of a nomination to the U.S. National Register of Historic Places. Additional activities in promoting the site and educating the diving public will include underwater dive guides, development of a comprehensive site plan and an underwater cultural heritage trail. Engagement with various government agencies and community groups are being implemented to gauge their various levels of interest and assistance in managing and interpreting the site. Baseline environmental assessment surveys are to be conducted to determine the differences in natural communities with significant man-made substrates and those without. Further outreach proposals are being investigated to see if it can fulfill a role as an Educational and Interpretive Park.

Key words: Seabees, Apra Harbor, Guam, Marianas archipelago, Micronesia

Introduction

Guam is the largest and most populated island of the Marianas archipelago. Exposed to European contact since the 1500's and administered by the U.S. since 1898, the island has been heavily influenced by its colonizers. During WW II, Guam came under the

possession of Japan from 1941 until 1944, at which time the U.S. rapidly developed its military facilities on the island including Advanced Base Guam. Largely responsible for this build-up were the U.S. Navy Construction Battalions, popularly known as the Seabees. With the Seabees came vast amounts of equipment required to conduct such a massive and rapid build-up. At the end of the war, equipment was arriving on island in its largest quantities (Hammer, 1947). When the war ended, men on the front and families at home demanded their immediate return. Large amounts of equipment were dumped in the jungles and oceans of Guam. One dump site known as the Seabee Junkyard contains a large and dense area of submerged equipment in seemingly good condition. The site is positioned at the end of the Glass Breakwater of Apra Harbor; of which the building was one of the highest priority projects undertaken by the Seabees upon repossession in 1944. Little is known about the specifics of when and how the equipment was dumped. Much of the material was unidentified until a July 2012 site survey. The large quantity of man-made substrate provides an opportunity to describe and monitor the natural environment in contrast to other sites lacking the unnatural substrates but with otherwise comparable environmental conditions.

The site provides a unique opportunity for a first of its kind holistic management and interpretative project on Guam as it is regularly accessed by recreational divers and exposed to commercial and military activities. Sites on Guam are protected from looters and salvagers today through recent legislation, but they have been plagued by them since the end of WW II. The state of such sites is of concern on the island but difficult to manage because of the ease of access to them and lack of on-site regulatory management. The holistic management and interpretative approach would be inclusive of educational outreach, a U.S. National Register of Historic Places nomination pending the confirmation of its historical significance, as well as the establishment of environmental and site baseline monitoring.

Historical Overview

The Marianas archipelago is a chain of 15 islands in the Pacific which includes Rota, Saipan and Tinian. Anthropological and archaeological evidences support the biological and cultural diversity of pre-contact Micronesia from around 3,500 BCE, which includes the Chamorro group of people (Dixon et al., 2013). Ferdinand Magellan’s arrival in 1521

marked the beginning of Guam's European contact and colonization. Spain officially claimed Guam in 1565 and occupied the island until the U.S. took possession in 1898 following the Spanish, American War (Rogers, 2011). A seaplane base was established in Apra Harbor, in 1921, where the most suitable anchorage was located (Hammer, 1947) (Fig. 1). In 1938, the Hepburn report recommended Guam as a location for an advanced base, a fortified base with airfields and naval facilities that could be used to keep combatant forces on the move during future wars (Bureau of Yards and Docks, 1947). The development of Apra Harbor was prioritized, including building a breakwater along the northwest side of the harbor to protect it from exposure to the natural environment and potential attacks (Hammer, 1947). A mile of the breakwater had been completed when the Japanese bombed Guam on December 8, 1941. The attack resulted in the Japanese occupation. Advanced base work was halted (Bureau of Yards and Docks, 1947) and pre-existing U.S. documents on the island were destroyed by the Japanese (R. Glass, personal communication, 2013).

Fig. 1 Apra Harbor including the location of Seabee Junkyard and Sumay Village. (Sean Newsome, 2012)

Guam was liberated on July 21, 1944 and a Japanese occupational presence on the island ended officially on August 10. The liberation of Guam marked the beginning of the end for Japanese forces. Arriving with the Marines and Army Corp of Engineers were the Seabees, conceived to support combat forces while building advanced bases in military-active areas (Hammer, 1947). Seabees were organized in 'Lions' which provided all support needed to build an advanced base, including multiple battalions and great quantities of equipment. Lion Six, the Lion responsible for work in Guam, began movement on May 1, 1944 (Hammer, 1947). Liberation marked the beginning of a rebuilding period for Guam that resulted in the largest base west of Pearl Harbor and the second largest base in the world (Hammer, 1947). Possession of Apra Harbor was among the invasion objectives. The harbor developments resulted in the 17,000 lineal-foot breakwater, 7,500,000 cubic feet of inner harbor dredging and 26,000 lineal-foot quay wall (Fig. 2). The Seabees can be credited with 75 percent of the total construction on Guam with 37,000 construction troops used in the completion of the Advanced Base Guam (U.S.N., 1946).

Fig. 2 Seabees at work on Guam in the 1940's. (Bill Jeffery, 2013)

Much of the Seabee's work did not appear to be the product of any pre-planning and consequently was completed regardless of property lines particularly with the production of Marine Corp Drive (one of Guam's main and longest roads) (Rogers, 2011). Much of the land used by the military was private land and was not properly rented or paid for by the military. Previous occupants of Sumay village actually remained in refugee camps during this time (Rogers, 2011). The 'Magic Carpet' operations to get troops home began shortly after the end of the war due to demand and public outcry that forces were not needed any longer (Hammer, 1947). The result was a rapid pace and scale

demobilization resulting in disorganization, misconceptions and infighting. The Truman administration sought post war foreign policy aimed at establishing economic not military power. Truman avoided the increase in deficits and military expenditures, prioritizing the balancing of the budget and 'dismantling the military machine' (Pollard, 1985). At the time of the end of the war, Seabee equipment was being shipped out to the Pacific in its highest quantities and could not be sent back without contributing to the chaos (Hammer, 1947). As they demobilized on Guam, the Seabees dealt with their equipment by dumping tractors in the jungle and tearing roofs off storage sheds, exposing it to the elements and hastening deterioration (Hammer, 1947). Seabees ruined their material for two reasons. The first was that it was too expensive to ship home; many of the Seabee locations during WWII were very far from the U.S. mainland. The second was that not returning it home created the demand for continued production in the domestic market; returning tractors and dozers that could be re-purposed after their use in the war effort did not stimulate the economy (J. Sprengle, Personal Communication, 2013). The Seabees were among those severely reduced in the post war period. By 1946, more than half of the men on Guam had been sent home and the Naval Operating Base was falling apart (Hammer, 1947). At least thirty-one known locations of submerged material are in Apra Harbor. Among them are two Nationally Registered Historic Places (NRHP) and Guam Register of Historic Places (GRHP), *Tokai Maru*, a Japanese passenger-cargo freighter struck down by a U.S. submarine in 1943 and SMS *Cormoran*, a German ship destroyed in 1917 (Dixon, personal communication, 2013). A number of sites in the area qualify as NRHP and or GRHP but have not yet been nominated.

Fig. 3 Unidentified material at the Seabee Junkyard in 2012. (Bill Jeffery, 2012)

Natural Environment

Guam is 32 miles long and varies from 4 to 8 miles wide. It differs in its natural environment with a higher

limestone plateau occupying the northern half and red clay volcanic soil in the southern half which is vulnerable during the regular heavy rains. The island is surrounded by a reef system (Bureau of Yards and Docks, 1947). Changes in the natural environment have occurred since WW II. Apra Harbor has been predominantly used by the U.S. Navy for the naval station and naval supply depot but is also accessed commercially and recreationally. Commercial uses include the Port Authority, the Cabras power plant and recreational uses include diving, snorkeling, fishing, and jet skiing. Recreational, military and commercial activity in the area can be considered a human disturbance that may affect coral reef health. Currently, 27% of the world's coral reefs are at high risk and 31% at moderate risk due to human disturbance (World Resources Institute, 2013). Confirmed disturbances that are factors at the Seabee Junkyard include coastal development, port installation, recreational activities, tourist facilities, and nuclear activity (Chabanet et al., 2005). The Seabee Junkyard is located at a depth of eight meters, 200 meters inside of Apra Harbor along the Glass Breakwater (Fig. 1). The site covers an estimated two acres of benthic surface area which includes four tractors, an amtrac, ten pontoon outboard motors, cranes, vehicle remains and hundreds of meters of one steel piping (Figs. 3-5). Fish found at the site can include Porcupinefish, *Diodon nicthemerus*; Moorish idols, *Zanclus cornutus*; Blue chromis, *Chromis cyanea*; and Yellow tangs, *Zebrasoma flavescens*. Invertebrates at the site may include Day octopi, *Octopus cyanea*; blue Linckia, *Linckia laevigata*; and Cnidarians including jellyfish and corals. The coral community at the site appears to differ in diversity, quantity and size from those at similar sites without material but this has not yet been confirmed quantitatively.

Existing Underwater Archaeological work

Since 2002, the National Park Service gave WW II sites a threatened status as a result of the 'significant deterioration, vandalism and looting'. WW II sites on Guam comprise about 20 percent of the islands submerged cultural heritage sites (Jeffery, 2013). Natural and cultural processes at submerged sites 'intermingle' with each other and may be interpreted and managed simultaneously. Environmental processes which affect a site are specific to the environment they are located in and are inclusive of regional

biology, water movement and quality (Keith, 2004). Multidisciplinary studies surrounding mid-20th century underwater cultural resource sites and the hazards to the environment are emerging. A study on the USS *Arizona* which was sunk during the battle of Pearl

Fig. 4 One of four dozers at the Seabee Junkyard in 2012. (Bill Jeffery, 2012)

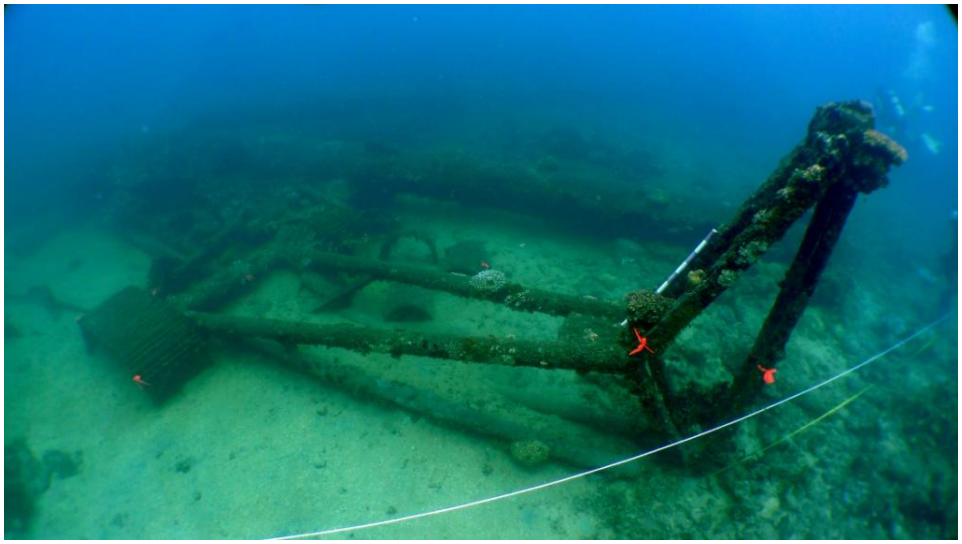

Fig. 5 Unidentified material at the Seabee Junkyard in 2012. (Bill Jeffery, 2012)

Harbor in 1941 was geared towards monitoring the rate of oil release into the ocean as well understanding the nature of and rate of deterioration of the vessel (NPS, 2013). Baseline monitoring was designed and completed to quantifiably assess the changes

over time. Diverse disciplines of research were investigated simultaneously; each related directly or indirectly to overall project objects (Russell et al., 2004). Similarly, an Earthwatch Project in 2006-2008 was completed in Chuuk comparing reef communities, coral and fish diversity, at natural sites with shipwrecks (Jeffery, 2012). Guidelines for monitoring the natural and cultural attributes of submerged historic sites were for the National Historic Preservation Office (HPO) Federated States of Micronesia, Pohnpei (Jeffery et al., 2007). They were intended for use throughout Micronesia and aimed to promote education and training so that additional culturally significant sites could be studied using the same guidelines. Guidelines encompass maritime archaeology, marine biology, corrosion surveying, site conservation and conservation components and stress regular, locally based monitoring for the best management. The development of a database with files on each submerged site was also among the recommendations from the report (Jeffery et al., 2007).

There is no existing comprehensive framework for assessing risk and managing polluting wrecks although a series of regional frameworks exist according to Landquist (2013) which sought to analyze risk assessment methods and suggest a framework for risk assessment. Factors in coral reef and resource decline include complications inhibiting abandoned vessel removal as well as vessel impact resulting from contact with reefs according to a 2003 National Oceanic and Atmosphere Administration Damage Assessment Center by Smith et al., 2003. The study promotes the need for a data collection identifying abandoned vessels linked to a Geographic Information System. Risks from WW II wreck pollution exist and continue to increase. Thirteen million tons of vessels are reflected in the Pacific WW II information database that consists of 3,800 shipwrecks. Pollution results from leaking oil, fuel, chemicals and unexploded ordinance. Many of these sites are rapidly deteriorating. The Pacific Ocean Pollution Prevention Program of the South Pacific Regional Environment Program (SPREP) developed a regional strategy to investigate ways of minimizing environmental damage resulting from these sites while also preserving site sanctity (Monfils et al., 2006). Creating artificial reefs by sinking de-fouled ships or other materials has been increasingly popular. The Victorian Artificial Reef Society in Australia scuttled the ex HMAS *Canberra* in 2005 to develop an artificial reef dive site. A biological assessment

of the site conducted in 2006 established that the wreck may still be less diverse than the natural reef in the area nearby although home to multiple fish and invertebrate species. The study was intended as a baseline study for which future assessments could be compared (Schlacher-Hoenlinger et al., 2006).

Project Focus

In July 2012, the Seabee Junkyard was mapped and surveyed by a Nautical Archaeology Field School at the University of Guam funded by Guam Preservation Trust. The field school recommended the distribution of the site plan (Fig. 6) as well as community outreach, and further historical research to improve site interpretation and management. The site survey resulted in the positive identification of WW II Seabee material at the site. Funded by Guam Preservation Trust, an intensive program of community and stakeholder engagement was conducted in July 2013. The program collected feedback on potentially renaming the site as well as further developing it as an underwater educational and interpretive park. This project is being conducted in conjunction with the program. Outcomes from stakeholder engagement included the production of educational and recreational tools for divers, tourists and community members.

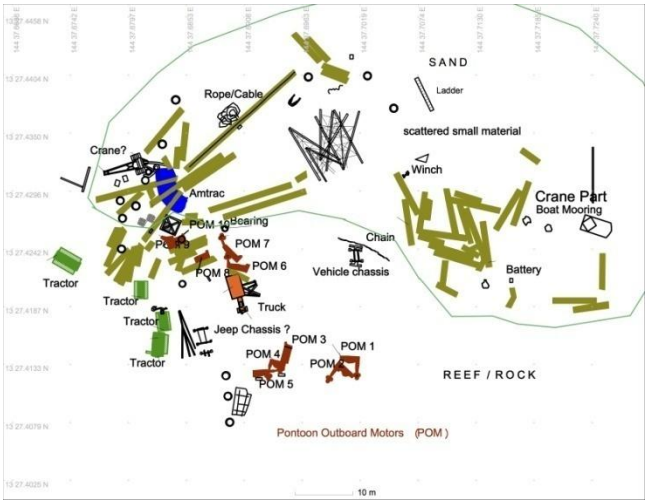

Fig. 6 Seabee Junkyard Site Map. (Bill Jeffery, 2013)

This project will take a holistic approach to *in situ* interpretation and management that incorporates the site history, site value, and environmental baseline studies of sites. This will promote protection of both the history and the environment with non-disturbance diving techniques promoted throughout the region. The easy accessibility of the site and diversity of substrates, both man-made and natural as well as its exposure to human disturbances in a relatively protected natural environment provides a unique opportunity for research, monitoring and education. Gaining a better understanding of the natural environment at the site can give insight as to the impacts of the WWII

material on the environment. Studying the secondary depositional process of the salvage of a site after wreckage, predominantly by looters, which alters the archaeological record left since the primary depositional process of the actual wreckage of the material can complement interpretation of the site (Keith, 2004; Muckelroy, 1978). At the site, there is little to no material that may be lifted by hand with much of it removed by local and visiting looters (M. Beggs, Personal Communication, 2013). Local management of these sites has not been effective in preventing the extensive looting from cultural sites and damage to both natural and cultural heritage. In contrast, in Chuuk, dive guides generally help in curbing looting and there for the protection of these submerged cultural heritage sites (Jeffery, 2012). There is some legal protection in place; permits administered by Guam Historic Preservation Office are required to recover material under Title 21 (Real Property) Chapter 76 (Historical Objects and Sites). The U.S. protects the sovereignty of sunken government vessels, aircraft and spacecraft. Recovery of such craft is not allowed without permission (Federal Register, 2004). The U.S. Navy does not allow recovery or disturbance of the material nor alteration of the site which is on land managed both by either the U.S. Navy or the Guam Historic Preservation Office. Studies carried out on the Seabee Junkyard have to be approved by both entities.

Methods

Establishing and conducting the environmental baseline assessment requires preliminary surveys of the water column and the benthic community will be conducted. The assessment for all categories will record down to the lowest taxon possible. The water column study will be conducted using the Stationary Point Count (SPC) method which is optimal for monitoring large and mobile species. Three cylindrical areas in the research site and the control site will be assigned and fish, mobile invertebrates, and mega fauna will be tallied in the area. The cylindrical area will be five meters in diameter and data collected will reflect all fish in the entire water column with only those penetrating the area recorded for species. Surveying will start with five minutes of observation and species listing before counting for five minutes (Ayotte et al., 2011). Data collected will also include bottom current, visibility, transect depth and

slope. Rugosity measurements will be made dissecting the SPC monitoring zones along a 10 m transect tape.

The benthic community survey data will be collected using quadrats and line-intersect transects. Data collected will be in two parts: the substrate type, and what is on the substrate. Categories for substrate type are man-made or natural. Man-made substrates include wood, metal, plastic. Natural substrates include pavement, dead coral, sand patches, rubble, and rock. Growth on substrate may be categorized as live hard coral, soft coral, coraline algae, macroalgae, other, recently killed/dead coral, rubble, pavement, and sand. Benthic community data will be statistically analyzed using a one-way ANOVA and a Cluster Analysis, hierarchically grouping data by similarity, will be applied for the results of the SPC survey. This preliminary analysis is a question driven monitoring framework which will assist in determining the survey design (Houk and van Woesik, 2013).

Conclusion

In order to meet the project objective of holistically interpreting and managing the site *in situ*, the following outputs are being developed: U.S. National Register of Historic Places Nomination, Environmental Baseline Assessment, and development of public outreach and education including a dive map, presentations to schools and tourism operators. Research to produce a NRHP nomination for Seabee Junkyard is being conducted to ascertain the site's historical significance. Interpreting and nominating the site promotes awareness about the lasting effects of WWII dumping, moving undesirable goods out of sight and out of mind at the likely expense of the natural environment. Revealing the site's history helps to understand the site's value, which may be utilized as an educational and tourism oriented asset for present day Guamanians.

The baseline environmental assessment will provide a snapshot (Chabanet et al., 2005) of the site by describing the benthic community, invertebrate populations, and fish populations. Findings from the site will be compared to that of another site without material but similar conditions, depth and proximity along the Glass Breakwater. Information obtained from the assessment includes fish community descriptors, coral morphological diversity, and the ratio of dead and live standing coral on man-made as

opposed to natural substrates. This comparison which is yet to be undertaken will help to understand the impact of the manmade material on the environment as well the impact of the environment on the material. Questions to be investigated also include the quantity and diversity of species at the site as well as the settlement success of coral on the man-made material. The assessment is intended to establish a method for surveillance monitoring (Houk and van Woesik, 2013) of the site that can be conducted with its continued management. This assessment would be the first of its kind conducted on submerged cultural heritage sites on Guam and can act as a model for future monitoring design on other sites on island and in the region.

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References

Ayotte, P., McCoy, K., Williams, I., and Zamzow, J., 2011. Coral Reef Ecosystem Division Standard Operating Procedures: Data Collection for Rapid Ecological Assessment Fish Surveys. Pacific Island Fish. Sci. Cent., Natl. Mar. Fish. Serv., NOAA, Honolulu, HI. Pacific Islands Fish. Sci. Cent. Admin. Rep. H-11-08, 24, accessed online 17 October 2013, <http://www.pifsc.noaa.gov/library/pubs/admin/PIFSC_Admin_Rep_11-08.pdf>

Chabanet, P., Adjeroud, M., Andrefouet, S., Bozec, Y., Ferraris, J., Garcia-Charton, J., and Schrimm, M., 2005. Human-induced physical disturbances and their indicators on coral reef habitats: A multi-scale approach. *Aquatic Living Resources*, Vol. 18: 215-230.

Department of the Navy Bureau of Yards and Docks. 1947. *Building the Navy's Bases in World War II: History of the Bureau of Yards and Docks and the Civil Engineer Corps, 1940-46*, accessed online <http://www.ibiblio.org/hyperwar/USN/Building_Bases/index.html> 28 February 2013.

Department of State, 2004. Federal Register 69-24, 5 February 2004. Federal Register online via the Government Printing Office, accessed online <www.gpo.gov/fdsys/pkg/FR-2004-02-05/html/04-2488.htm> 1 September 2013.

Dixon, B., Gilda, L., and Mangieri, T., 2013. Archaeological Identification of Stone Fish-weirs Mentioned to Freycinet in 1819 on the Island of Guam. *The Journal of Pacific History*, Vol. 48 (4): 349-368, DOI: 10.1080/00223344.2013.856666.

Hammer, D, H., 1947. *Lion Six*. United States Naval Institute. Menasha, Wisconsin.

Houk, P., and van Woesik., 2013. Progress and Perspectives on Question-Driven Coral-Reef Monitoring. *BioScience*, Vol. 63 (4): 297-303.

Jeffery, B., Beger, M., MacLeod, I., Richards, V., Hengeveld, M., and Carpenter, J., 2007. *Guidelines in Recording and Monitoring the Natural and Cultural Attributes of Submerged Historic Sites in the Federal States of Micronesia*. National Historic Preservation Office Federated States of Micronesia Pohnpei, September 2007.

Jeffery, B., 2012. The future of Chuuk Lagoon's submerged WWII sites. *Bulletin of the Australiasian Institute for Maritime Archaeology,* Vol. 36: 15-30.

Jeffery, B., 2013. *Concept Plan, Seabee Underwater Heritage Park*. Unpublished Report for Guam Preservation Trust, Hagatna, Guam.

Keith, M., 2004. *A Model for Studying Wolrd War Ii-era Lcms in the Archaeological Record*. Electronic Theses, Treatises and Dissertations. Paper 3240, accessed online <http:diginole.lib.fsu.edu/etd> 12 Dec 2013.

Landquist, H., 2013. Environmental risk assessment of shipwrecks: A fault-tree model for assessing the probability of containment release. *Integrated Environmental Assessment and Management*, Vol. 9-3: 537-538.

Monfils, R., Gilbert, T., and Nawadra, S., 2006. Sunken WWII shipwrecks of the Pacific and East Asia: The need for regional collaboration to address the potential marine pollution threat. *Ocean and Coastal Management*, Vol. 49: 779-788.

Muckelroy, K., 1978. Maritime archaeology. Cambridge University Press, Cambridge.

National Park Service. 8 September 2013. World War II Valor in the Pacific Frequently Asked Questions, accessed online <http://www.nps.gov/valr/faqs.htm> 30 September 2013.

Pollard, R, A., 1985. *Economic Security and the Origins of the Cold War, 1945-1950*. Columbia University Press, New York: 20-23, accessed online <https://www.mtholyoke.edu/acad/intrel/pollard.htm> 12 September 2013.

Rogers, R. F., 2011. *Destiny's Landfall: A history of Guam*. University of Hawaii Press, (First edition 1995), Guam.

Russell, M. A., Murphy, L. E., Johnson, D. L., Foecke, T. J., Morris, P. J., and Mitchell, R. 2004. Science for Stewardship: Multidisciplinary Research on USS Arizona. *Marine Technology Society Journal*, Vol. 38 (3): 54-63.

Schlacher-Hoenlinger, M. A., Walker, S. J., Johnson, S. T.A., and Hooper, J. N. A., 2006. *Final Report on Biological baseline survey of the ex-HMAS Brisbane artificial reef*. Environmental Protection Agency (EPA): 110.

Smith, A., Helton, D., and Zelo, I., 2003. *Developing a Database to Support and Prioritize the Removal of Abandoned Vessels Impacting Coral Resources*. International Oil Spill Conference: Prevention, Preparedness, Response and Restoration-Perspectives for a Cleaner Environment, Vancouver, British Columbia, Canada, American Petroleum Institute publication No. I 4730 B: 575-578.

World Resources Institute. 2013. *Status of the world's coral reefs*. Washington, DC, accessed online <www.wri.org/publication/content/8354> 30 September 2013.

Biography

Kalle Applegate Palmer *is a Master of Science student in the University of Guam Environmental Science Management Program completing her work through the Marine Laboratory. She completed her undergraduate degree at the University of Washington, College of Architecture and Urban Planning in 2006 majoring in Community, Environment and Planning and minoring in History and Finnish Language. Kalle received a certificate in Aquarium Science from Oregon Coast Community College in 2010 and has worked at Oregon Coast Aquarium, Birch Aquarium and Underwater World Guam. She is a PADI Open Water SCUBA instructor, American Academy of Underwater Sciences Certified Diver and currently working on her Level Three Nautical Archaeology Certification.*

Bill Jeffery *has been working as a maritime archaeologist for over 30 years. Bill formulated and coordinated a maritime heritage program for a state government agency, Heritage South Australia from 1981-2001. He went onto working with the Federated States of Micronesia National Historic Preservation Office and completing a PhD in maritime archaeology at James Cook University. He is a consulting maritime archaeologist to ERM Hong Kong, the CIE-Centre for International Heritage Activities*

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