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# The Hawaii Undersea Military Munitions Assessment

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ABSTRACT

The Hawaii Undersea Military Munitions Assessment (HUMMA) is the most comprehensive deep-water investigation undertaken by the United States to look at sea-disposed chemical and conventional munitions. HUMMA's primary scientific objective is to bound, characterize and assess a historic deep-water munitions sea-disposal site to determine the potential impact of the ocean environment on sea-disposed munitions and of sea-disposed munitions on the ocean environment and those that use it. Between 2007 and 2012 the HUMMA team conducted four field programs, collecting hundreds of square kilometers of acoustic data for high-resolution seafloor maps, tens of thousands of digital images, hundreds of hours of video of individual munitions, hundreds of physical samples acquired within two meters of munitions casings, and a suite of environmental data to characterize the ocean surrounding munitions in the study area. Using these data we examined six factors in the study area: (1) the spatial extent and distribution of munitions; (2) the integrity of munitions casings; (3) whether munitions constituents could be detected in sediment, seawater or animals near munitions; (4) whether constituent levels at munitions sites differed significantly from levels at reference control sites; (5) whether statistically significant differences in ecological population metrics could be detected between the two types of sites; and (6) whether munitions constituents or their derivatives potentially pose an unacceptable risk to human health. Herein we provide a general overview of HUMMA including overarching goals, methodologies, physical characteristics of the study area, data collected and general results. Detailed results, conclusions and recommendations for future research are discussed in the accompanying papers included in this volume.



## 1. Introduction

Following the World Wars, large quantities of obsolete, excess, unserviceable and captured munitions, including chemical weapons, were disposed in the global ocean. At that time, options for munitions disposal were limited to combustion, burial on land, or disposal at sea. The latter was considered the best option based on the need to rapidly dispose of large quantities of munitions while minimizing the risk to workers. Since the mid-twentieth century, coastal communities have expanded farther off-shore to

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extract resources or install infrastructure, resulting in public interaction with explosives and chemical agents that caused injuries and fatalities (Beddington and Kinloch, 2005; HELCOM, Helsinki Commission, 1994; USACE, United States Army Corps of Engineers, 1977). In 2006, the U.S. Congress directed the Department of Defense (DoD) to conduct research on the effects of ocean disposal of munitions (Congress, 2006) and a number of investigations were instigated.

The Hawaii Undersea Military Munitions Assessment (HUMMA) was established by the DoD in 2007 to investigate the region south of Pearl Harbor, Oahu, Hawaii. This site was selected based on the review of historical documents, which indicated that approximately 16,000 M47A2 100-lb mustard-filled bombs were disposed in the area between October and November of 1944 (Chemical Officer, 1944). The boundaries of this sea-disposal site, designated HI-05 by the DoD, were poorly defined and overlapped with another disposal site in the same general vicinity, designated HI-02. Historical information indicated that, in combination, HI-02 and HI-05 contained discarded military munitions (DMM) of both chemical and conventional varieties, providing the opportunity to investigate the environmental effects of different types of munitions constituents. This region, which stretches from Barber's Point on the western side of the Oahu to Diamond Head crater on the eastern side and from Pearl Harbor to 50 km due south of Oahu (Fig. 1), was selected for the HUMMA study on the basis of the archival research and because it:

- Encompasses the general area where three DoD contractors were injured in 1976 after recovering three cylindrical objects suspected to contain mustard agent (USACE, United States Army Corps of Engineers 1977);
- Is close to Pearl and Honolulu Harbors and their logistical support functions;
- Sits in proximity of Mamala Bay, the subject of multiple environmental studies with beneficial comparative data due to its use as a dredge disposal site for materials from the Ala Wai Canal, Honolulu Harbor and Pearl Harbor;
- Is known to contain fish and shrimp that are consumed by local residents, but is unlikely to be depleted of biological resources because the area is not regularly used for commercial or recreational fishing.

HUMMA's overarching scientific objective was to bound and assess a historic deep-water munitions sea-disposal site to determine the potential impact of the ocean environment on sea-disposed munitions

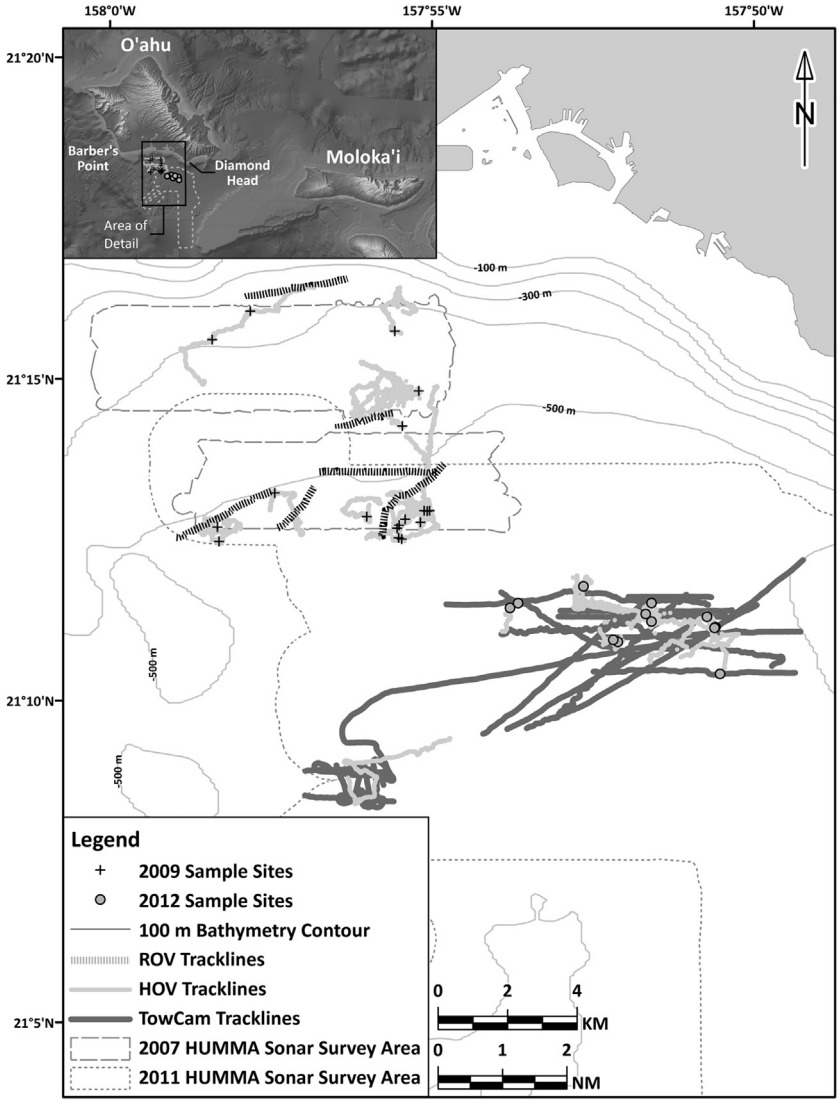


**Fig. 1.** Map depicting the extent of the 2007 and 2011 HUMMA sonar surveys as well as the tracks of the Pisces HOVs in 2009 and 2012, the RCV-150 ROV in 2009, and the WHOI TowCam in 2012. Sample collection sites are indicated by small crosses and circles. Inset: HUMMA sonar surveys shown relative to the Hawaiian Islands of Oahu and Molokai. Gray-shaded bathymetric relief and island topography are derived from Environmental Systems Research Institute, Inc. (ESRI).