Potentially Polluting Wrecks in U.S. waters
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ABSTRACT

The past century of commerce and warfare has left a legacy of thousands of sunken vessels along the U.S. coast and Great Lakes. Some of these wrecks pose environmental threats because of the hazardous nature of their cargoes, presence of munitions, or because of bunker fuel left onboard. As these wrecks corrode and decay, they may release oil and/or hazardous materials. In 2010, the U.S. National Oceanic and Atmospheric Administration (NOAA) received funds to develop a list of the most ecologically and economically significant potentially polluting wrecks in US waters. This project supports the U.S. Coast Guard (USCG) in prioritizing threats to coastal resources while at the same time assessing the historical and cultural significance of these nonrenewable resources. Initial evaluations of shipwrecks located within US waters found that approximately 570 wrecks could pose a substantial pollution threat. Additional research narrowed the number of wrecks posing a potential pollution threat to 107 vessels due to the violent nature in which some ships sank and the structural reduction and demolition of those that were navigational hazards. To further screen and

prioritize these vessels, risk factors and scores are being applied based on the likelihood of fuel and oil cargo remaining onboard. Potential oil spills from the highest priority vessels are being modeled to evaluate possible environmental and socio-economic impacts.

INTRODUCTION AND HISTORY OF CONCERNS

The public has long been captivated by shipwrecks and there is growing interest in their potential environmental impacts. Dozens of stories have been written about the problems associated with leaking WWII era ships lost in both the Pacific and Atlantic Oceans. Although a few, such as USS *Arizon*a in Hawaii, are well-publicized oil pollution threats, most wrecks, unless they pose an immediate pollution threat or impede navigation, are left alone and are largely forgotten unless they begin to leak.

Over the past decade, a number of wrecks have been found intact and have been remediated, but others, long believed to be intact and potentially oil-laden, were found to be empty. Other sizable casualties are yet to be discovered, given the extreme depths and inaccurate position information about where they sank.

In 1953, the S.S. *Jacob Luckenbach* collided with another vessel and sank near San Francisco, CA, USA. In 2002, the decaying wreck was identified as the source of mysterious, recurring oil spills that had killed thousands of seabirds and other marine life along California's coast. The USCG led response removed approximately 100,000 gallons of oil remaining in the wreck.

On October 7, 1949, the tanker USS *Chehalis,* exploded, capsized and sank in Pago Pago, American Samoa. The *Chehalis* was carrying approximately 400,000 gallons of aviation gasoline when it sank. In April 2009, the United States Navy, in collaboration with the USCG, conducted preliminary site investigations and found roughly 115,000 gallons of fuel remaining on board the vessel. Fuel removal actions were completed in April 2010.

But not all wrecks contain oil. On December 23, 1941, a Japanese submarine sank the S/S *Montebello* off the central California coast, just south of the Monterey Bay National Marine Sanctuary. No significant releases were observed when it sank and a series of submersible dives showed the ship remarkably intact and found that the torpedo missed the cargo tanks where the 3 million gallons of crude oil was held. However, after an extensive underwater survey in October 2011, the USCG concluded that the wreck was empty and had lost its cargo sometime over the past 70 years.

PRIORITIZING WRECKS

The recent response efforts in the U.S. and elsewhere have led to interest from both government and industry to systematically identify, investigate and potentially lighter wrecks before they begin to leak. The Marine Technology Society published an issue focused on underwater pollution threats (MTS 2004), and the 2005 International Oil Spill Conference (Michel et al., 2005) furthered the discussion. Much of the interest is because removal of oil contained within a wreck can be planned and managed more cost-effectively than a reactive emergency spill response while preventing impacts to surrounding habitats and sensitive natural resources.

While response to an oil laden wreck is more cost effective than an uncontrolled spill, only a fraction of the 20,000 shipwrecks in US waters are likely to contain oil. Many older wrecks were coal fired, or sailing ships. More contemporary ships often came to a violent end, breaking apart in storms, collisions, or in battle. Many shallow wrecks were salvaged or were deemed hazards to navigation and were intentionally destroyed. Others sank off the continental shelf and were never located in the deep ocean abyss. All have suffered from corrosion and the passage of time.

Initial screening of NOAA's wreck data, based on the vessel's age, type and size, found 573 wrecks that could pose a substantial pollution threat. This includes vessels sunk after 1891 (when U.S. vessels began being converted to use fuel oil), vessels built of steel or other durable material, cargo vessels over 1000 gross tons (smaller vessels would have limited cargo or bunker capacity), and any tank vessel.

After detailed archival research, taking into account the potential cargo and fuel onboard, vessel casualty information and the violent nature in which some ships sank and the structural reduction and demolition of those that were navigational hazards, the priority list was further shortened to 107 wrecks. Most of these wrecks have not been directly surveyed for pollution potential and in some cases little is known about their current condition. To prioritize which vessels are candidates for further evaluation, we used a series of risk factors to assess the likelihood of substantial amounts of oil remaining on-board, and the potential ecological and environmental impacts if that oil spills.

The screening process includes risk factors that either increase or reduce the potential for pollution. For example, a tank vessel would be considered a higher risk because of the potential volume on board, but not all tankers were laden when sunk. Furthermore, the nature of the casualty could substantially reduce the potential for oil remaining on board. The more violent the sinking event, the lower the risk of remaining oil. A vessel that was struck by multiple torpedo explosions would be less likely to contain oil than one that sank due to foul weather. After this further evaluation, 23 wrecks are currently considered high priority based on their size and pollution potential, and 10 are known to periodically generate oil sheens.

The potential impacts from an oil release from a wreck depend greatly on the direction in which the oil slick moves, which, in turn, depends on wind direction and currents at the time of and after the release. To help evaluate the potential fates of releases from sunken wrecks, NOAA worked with Research Planning Inc., and Applied Science Associates (ASA) to run a series of generalized computer model simulations of potential oil releases of varying volumes. The most-likely scenario of oil release from most sunken wrecks is thought to be a small, episodic release that may be precipitated by disturbance of the vessel in storms, or damage from trawl nets.

In addition to natural resource impacts, spills from sunken wrecks have the potential to cause significant social and economic impacts including disruption of coastal economic activities such as commercial and recreational fishing, boating, vacationing, commercial shipping, and the loss of other activities that may become third-

party claims following a spill. NOAA is working with Environmental Research Consulting (ERC) to estimate potential economic impacts.

MOVING FORWARD

Most wrecks are thought to be empty or represent relatively minor threats, but a small number may contain hundreds of thousands of gallons of oil. Using available archival information and historical records we have developed an initial prioritization based on wreck condition, location, and potential environmental impacts. We haven't surveyed the vessels and confirmed that oil in fact remains onboard. Selecting vessels for proactive response will require more detailed and expensive assessments including underwater surveys, detailed spill trajectory studies, and salvage feasibility studies. While industry has demonstrated great advancements in underwater oil removal technologies, in many cases the best alternative may not be removal of oil, but to monitor the wreck and plan for potential spills.

REFERENCES

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