A Proposed Annex to the Wreck Removal Convention Treaty to Address Environmental Hazards of Sunken World War II Naval Vessels

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ABSTRACT

The devastation of World War II continues today. Over 9,000 vessels were sunk in all of the world's oceans, creating many potential threats. Hazards include oil spills, chemical releases, unexploded ordnance, coral-reef degradation, and hazards to navigation. World War II wrecks are still considered sovereign property as well as war graves. At present, there is not an international treaty to manage the potential threats from these wrecks. A new treaty, the Wreck Removal Convention, will be signed by all maritime nations in May 2007; however, this treaty does not address World War II wrecks. This Capstone provides an Annex to the Wreck Removal Convention specifically for sovereign naval wrecks, most of which are from World War II.

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ACKNOWLEDGEMENTS

I owe a special thanks to Rean Monfils of Sea Australia, the keeper of the AMIO database and the SPREP database. Rean provided me with the numbers and types of vessels sunk in the world's oceans during World War II. These tables are instrumental in showing just how significant an issue these wrecks are to our marine environment.

A very special thank-you goes to Ms. Paula Demos, my advising goddess at the University of Denver, and Dr. Milt Robinson, Capstone Advisor extraordinaire. Without those two, my academia journey at the University of Denver would not have been as fulfilling and memorable as it was.

I need to thank my wife Liz who has put up with me going to school the last ten years to finish my bachelor's and then my master's degrees. She was my editor and confidante and would bring me back to Earth. What will we do with the time now that I am not in school anymore?

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DISCLAIMER

The information, recommendations, and suggested Annex and Risk Assessment Matrix for the International Maritime Organization's Wreck Removal Convention Treaty is solely the work of the author and does not constitute endorsement of the United States Coast Guard, or other governmental agencies and organizations represented here.

INTRODUCTION

Damage wrought by the global conflict of World War II continues today. The six years of the war culminated in thousands of sunken vessels littering the Earth's ocean floors, altering the feeding and fishing grounds for marine life. The degradation of these wrecks, in combination with their hazardous cargoes, pose devastating threats toward the coastal environments, including the safety of nearby human and marine life. Incomprehensibly, little action has been taken to mitigate these imminent risks. Just as the United States failed to protect the borders and transportation systems of America from terrorist attacks prior to September 11, 2001, international governing bodies have turned a blind eye to the inherently devastating hazards of the long-ignored World War II wrecks. "Out of sight, out of mind" appears to be the policy.

World War II wrecks have significantly affected the waterways, shores, and submerged landmasses of the maritime nations of the world. These vessels pose an array of threats, including the release of oil, hazardous materials, and chemical weapons; entanglement of fishing gear; navigational obstructions; and physical destruction of marine habitats. For divers and anglers, wrecks may become an attractive nuisance, creating entrapment hazards, and may be the source of accidental exposure to chemical weapons and explosives. Federal and international environmental and safety concerns regarding World War II wrecks are challenged by the competing beneficial

value created by these vessels. World War II wrecks may have historical value, be the site of war graves, provide habitat for marine organisms, or create a recreational resource for divers and anglers.

This Capstone provides a literature review of known World War II shipwrecks, as well as the historical value, navigational, and fisheries issues, culminating with the environmental effects associated with these wrecks. A discussion of the existing United States federal law and policy is followed by customary international laws, including the recently proposed Wreck Removal Convention sponsored by the International Maritime Organization (IMO). Upon thorough research, it was concluded that an Annex to the Wreck Removal Convention, outlining how World War II wrecks are to be managed, is imperative. A draft of this Annex is developed, as well as a Risk-Assessment Matrix, for Coastal and Flag States to utilize in determining the realistic threat of each wreck.

The intended audience is the International Maritime Organization's Marine Pollution (MARPOL) counsel. The full intention is for the IMO to adopt this draft Annex to the Wreck Removal Convention (WRC). With the signatory states being full voting members of the IMO, it is this author's desire that this Annex to the WRC will come to fruition and be a bound and lawful treaty signed by all signatory maritime nations, thus providing for a sound, comprehensive method for determining legal governing ownership of not only World War II sunken naval wrecks, of which the vast majority of all

naval wrecks are, but for all sunken wrecks that carried or potentially carried oil, HAZMAT, explosives, et cetera. In addition, this Annex will outline how a risk-based matrix can be utilized to categorize each wreck and provide the impetus for Flag State and Coastal State nations to mitigate the effects of these vessels.

Coastal and Flag States will be able to urge the IMO to utilize this Annex and risk matrix. Other maritime nations exposed to naval wrecks (not just World War II wrecks) may find this Capstone of interest. Environmentalists around the world may be able to utilize this Capstone and urge Coastal and Flag States to take action in order to mitigate the real hazards posed by these wrecks.

Via a full review of current literature on World War II wrecks, this author concludes that there has been an oversight in the current federal and international rules, laws, and treaties that govern the management of World War II wrecks. This sixty-plus-year-old issue is only going to get worse as these vessels continue to deteriorate. Today's technology can be used to easily find vessels and mitigate the gross threats each vessel poses to the marine environment, regardless of the depth of the vessel.

The International Maritime Organization is the international governing body responsible for the welfare of the global maritime community. Currently, there is a treaty proposed to the IMO that addresses international wrecks within the oceans of the world. The Wreck Removal Convention

(WRC) is expected to be signed by all signatory nations of the IMO in Nairobi, Kenya, in May 2007. However, the WRC addresses only current wrecks of a commercial nature and does not address historic wrecks and naval wrecks, including World War II wrecks. The narrow scope of this verbiage, as well as the omission of addressing these concerns within other international treaties, has allowed World War II wrecks to be caught in limbo. The wrecks are there, the threats real.

Most nations affected by these wrecks have little political clout at the international level and must rely upon the larger nations to take action. This unfairly pits small nations with little to no response resources and money against the maritime juggernauts of the world. An Annex to the Wreck Removal Convention will give these smaller nations the tools necessary for proactive protection from and removal of these threats in their waters.

As a Lieutenant in the U. S. Coast Guard, I have been afforded the opportunity to develop an Abandoned/Derelict Vessel law for the State of Washington. The knowledge derived from the creation and implementation of this law, along with my hands-on experience with abandoned and derelict vessels and my fascination with World War II naval history, led me to this topic. The idea that over 9,000 vessels lay on the ocean bottom, posing all sorts of risks and hazards and without any mitigation plan or risk analysis, is bewildering.

Sunken World War II naval wrecks in our oceans and seas have created a multitude of environmental dangers, including oil spills, hazardous materials release, unexploded ordnance, and habitat degradation. The former Axis and Allied nations have yet to embark on a method to mitigate these wrecks. Over 9,000 military, auxiliary, and merchant marine vessels were sunk between September 1939 and September 1945. Every ocean and sea bears the effect of these wrecks (see fig. 1).

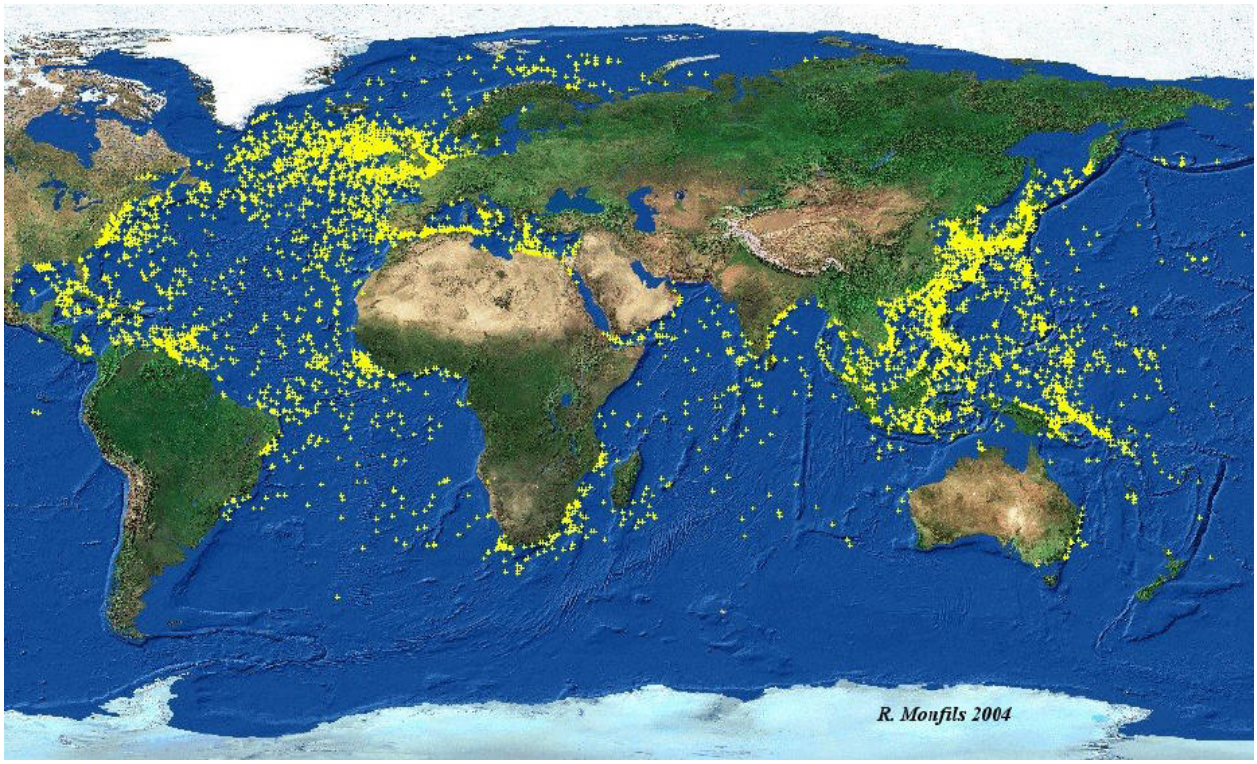

Figure 1. Locations of sunken World War II wrecks.

Source: Reproduced by permission from Rean Monfils, *The Global Risk of Marine Pollution from WWII Shipwrecks: Examples from the Seven Seas* (2005).

The United Nations, in company with the former Allied and Axis Flag States, must develop a comprehensive plan to identify, mitigate, and resolve the potential and real (current) hazards associated with these World War II

naval wrecks. Currently, there is not an international multilateral legal instrument governing ownership of sunken warships or military aircraft. However, there is a well-developed body of customary international law governing the treatment of sunken warships and military aircraft. Without a plan and a tool to determine legal ownership, threat level, and hazard mitigation, numerous small island nations and other coastal countries can be affected by oil spills, chemical releases, and threats to navigation, thus seriously impacting fisheries, local commerce, animal species, and native cultures.

In addition to the environmental concerns, there are record-keeping and political issues to overcome. Military records from this time are imprecise. Cargo manifests were often grossly inaccurate and quite a few records have been lost. Axis nations were known for their grossly inaccurate record keeping. Therefore, only estimates of the amount of oil and other hazardous materials on board each vessel at the time of sinking can be made. In addition, the amount lost due to bombing or torpedoing, and the amount of oil and other substances that have seeped out over time, must be estimated.

Political issues include sovereignty of the vessels and the change of certain governments/political parties and their assumption of title to the vessels. The highly emotional topic of war graves has led certain countries to walk out on any talks concerning their vessels. Lastly, the classified nature

of some of these vessels and/or their missions makes researching and discussing the records problematic. Most of the large seafaring nations have a stake in World War II wrecks. Table 1 depicts ownership of wrecks at the time of sinking, utilizing data from the South Pacific Regional Environment Programme (SPREP) and the Atlantic, Mediterranean and Indian Ocean (AMIO) databases. Tables 1 and 2 are described in detail in the sections that follow.

Table 1. Ownership of vessels at time of sinking

SPREP		AMIO	
Country	% of total	Country	% of total
Japan	41.3	Britain	51.0
Britain	24.5	USA	16.0
USA	12.9	Norway	8.0
Norway	3.9	Germany	5.0
Germany	2.5	Netherlands	4.0
Netherlands	2.4	Sweden	2.8
Greece	1.8	Panama	2.3
Sweden	1.3	…	…
Panama	1.2	…	…
Australia	0.1	…	…
Total	92%	Total	93%

Source: (R. Monfils, pers. comm.)

NB: The following countries were included in the databases with less than 0.1% of the total wrecks: Belgium, Burma, Canada, China, Denmark, Finland, France, Hungary, India, Italy, Korea, Malaya, New Zealand, Poland, Spain, Thailand, Turkey, and Union of Soviet Socialist Republics. For SPREP, data includes all vessels over 100 gross tons. For AMIO, data includes vessels greater then 1,000 gross tons.

World War II shipwrecks are deteriorating at an alarming rate. Casual factors and rate of deterioration include vessel type and construction; water depth and temperature; and the chemical, physical, and biological factors associated with salt-water corrosion. Other factors include shifting sea-bottom sediments, marine bacteria and organisms, destructive storms, and currents. Over time, a vessel will eventually be reduced to its natural elements. Along the way, the vessel will release some or all of its oil cargo, fuels, lubricants, or hazardous chemicals (Monfils 2005).

Over 9,000 vessels of all sizes were sunk or lost during World War II. Vessels were lost for a variety of reasons, including:

- Sunk by enemy action;
- Scuttled by the crew to avoid capture;
- Scuttled by the enemy after capture;
- Severely damaged in battle and sunk by own warships to avoid being seized by the enemy; and
- Accidents at sea, including groundings, collisions, cyclones, storms, and fires (Monfils et al. 2006, 779–788).

All of the world's oceans have felt the effects of sunken World War II wrecks. The majority of the vessels were sunk in the Pacific and Atlantic oceans. Table 2 describes the number of vessels and their respective tonnage in each of the world's oceans, as well as the Mediterranean Sea.

Table 2. Global distribution of shipwrecks from AMIO and SPREP databases

Ocean/Sea	# of Vessels	Total Tonnage	# of Tankers
Pacific	3,319	12,158,895	273
North Atlantic	3,002	15,108,305	452
Indian	313	1,813,398	35
Mediterranean	305	1,578,910	19
South Atlantic	198	1,143,374	20
Arctic	124	729,569	2
Total	7,261	32,532,451	801

Source: (Monfils 2005).

Top-of-the-line World War II warships and tank vessels carried millions of gallons of fuel. While all vessels used diesel or bunker fuel, some carried ammunition, chemicals, and other hazardous materials for the war effort. After the war, many vessels were loaded with surplus munitions, including chemical weapons, and were sunk at sea. Quite a few vessels sank in shallow waters (less then three hundred feet deep) and/or within a Coastal State's Exclusive Economic Zone (EEZ), affecting fisheries and creating other navigational hazards. Vessels sunk in the shallow warm waters of the South Pacific are killing coral reef systems due to the corrosion of steel hulls and the negative effects of rust on the coral organisms.

This Capstone creates enhanced awareness of the environmental threats created by the effect of spilled oil and hazardous materials from World War II naval wrecks, while respecting sensitive issues such as war graves, unexploded ordnance, and sensitive-habitat systems. This document lends credence to the establishment of an Annex to the Wreck Removal

Convention international treaty to be submitted to the Marine Pollution committee of the IMO.

LITERATURE REVIEW

World War II Wreck Databases. Douglas Helton of the National Oceanic and Atmospheric Administration's Office of Response and Restoration authored a paper for the 2003 National Maritime Salvage Conference entitled "Wreck Removal: A Federal Perspective." He notes that there is not one single database for shipwrecks in the United States or for the world. In particular, he discusses the following databases:

- **U.S. Naval Historical Center Database**: Lists over 3,000 wrecks owned or managed by the U.S. Navy, specifically those naval vessels lost through war or peacetime operations in United States or foreign waters from the colonial era to the present. World War II represents the largest number of wrecks (1,084), with the post-World War II period representing the second-largest group (740), and the Civil War era the third largest (564).
- **U.S. Department of the Interior**: The U.S. Department of the Interior has several bureaus that track shipwrecks, primarily as submerged cultural and archaeological resources. These include the Mineral Management Service (MMS) and the National Park Service (NPS). Historical research conducted for MMS for oil and gas leases

have identified over 400 ships sunk on the federal Outer Continental Shelf.

- **U.S. Coast Guard:** The United States Coast Guard (USCG) maintains several databases with shipwreck information. Under the Abandoned Barge Act of 1992, the USCG has responsibility for identifying and cataloguing abandoned barges and other vessels in each Coast Guard District. Under the Abandoned Vessel Inventory System (AVIS), vessels are categorized as to whether they are a threat to the environment (i.e., pollution), navigation, or public health. AVIS focuses on vessels over 100 gross tons and contains over 1,300 vessels nationwide. The USCG also maintains a database and tracks all sorts of maritime incidents through the Marine Information for Safety and Law Enforcement Database. Approximately 440 sinkings occur annually in U.S. waters, but most of these are small vessels that are refloated or removed.
- **NOAA:** NOAA maintains several databases with shipwreck information for archaeological, pollution, coral damage, and charting purposes. These include:
    - **NOAA Office of Coast Survey:** The Automated Wreck and Obstruction Information System (AWOIS) contains information on approximately 10,000 submerged wrecks and obstructions in the coastal waters of the United States. Information includes

latitude and longitude of each feature along with brief historic and descriptive details.

- **NOAA Abandoned Vessel Program:** Including over 1,000 vessels, this database focuses primarily upon wrecks that are a threat to coral reef habitats. Efforts are underway to ground truth the database and prioritize potential wreck-removal activities.
- **Pacific Coast Maritime Archaeological Summary**: Lists over 10,000 vessels along the Pacific Coast and Alaska. The Santa Barbara Maritime Museum and NOAA, working with other federal and state agencies and academic institutions, have attempted to compile all of the regional databases into one single dataset. Over 240 vessels are characterized as potential pollution threats.
- **NOAA National Marine Sanctuaries**. NOAA is currently updating "SHIELDS," the Sanctuaries Hazardous Incident Emergency Logistics Database System, which covers shipwrecks within the National Marine Sanctuary (National Oceanic and Atmospheric Administration 2003). The sanctuaries program is also developing "RUST," or Resources and UnderSea Threats. This database will include all potential threats to sanctuary resources, including pipelines, dredge-disposal sites, ordnance-

dumping sites, as well as shipwrecks. RUST will ultimately be incorporated into SHIELDS.

- **SPREP:** The South Pacific Regional Environment Programme (SPREP) is a regional organization developed by South Pacific island nations to protect their environment and pursue economic development. In addition to World War II wrecks, SPREP has made the issues of climate change, sea-level rise, extreme weather, solid waste, and invasive species its priorities. SPREP has a database of over 3,319 military vessels sunk in the Pacific region in World War II between 1941 and 1945. This includes vessels from all of the major combatants in the region. Currently, the SPREP database includes 23 large aircraft carriers, 22 battleships, 213 destroyers, and, of particular concern, over 50 tankers (Gilbert 2002).
- **Private Databases**: A number of historians, salvage firms, recreational divers, and anglers have developed private databases. A number of these sites are available free on line or for a small subscription fee. Some of these are quite extensive, including one database that has information on over 2,800 vessels sunk by German U-boats during World War II (Helton 2003).

An additional database is AMIO, the Atlantic, Mediterranean, and Indian Ocean. Much like SPREP, AMIO focuses on World War II wrecks in the rest of the world's oceans not covered by SPREP. However, AMIO only

includes vessels greater then 1,000 gross tons, thus leaving out over 2,000 minor vessels. The AMIO database includes nine aircraft carriers, five battleships, 172 submarines, 2,903 cargo ships, and 474 tankers (Monfils 2007). Currently, the Australian firm Sea Australia owns the AMIO database and works closely with SPREP to ensure information is shared and not repeated. Table 3 displays the number and type of vessels found in the AMIO and SPREP databases. In addition, United States vessels were extrapolated and an average of full fuel load in tons per vessel type is noted.

Table 3. Type and fuel load of naval and merchant marine ship losses during World War II

Type	AMIO	SPREP	Total World	U.S.	Ave. full fuel load in tons
Battleships/Battle Cruisers	5	14	19	2	2,000–8,000
Aircraft Carriers—Heavy/Light/Escort	9	45	54	11	2,000–4,000
Cruisers—Heavy/Light	30	65	95	10	1,200–3,000
Destroyers/Destroyer Escorts	138	209	347	82	225–600
Submarines	172	186	358	52	140
Mine Layers/Mine Sweepers	4	102	106	27	90
Small Patrol Craft—Subchasers/PT/CG/Gunboats/Frigates	Unk	399	399	258	15–100
Landing Ships/Craft—Tank/Infantry/Support/Troop Transports	1	53	54	21	200-3,315
Merchant Marine—Tankers/Cargo/Liberty Ships	3,383	2,709	6,092	914	834–20,066
Auxiliary Vessels—Tugs/Miscellaneous Patrol/Tenders	558	158	169	868	10-500
Total	3,942	3,319	7,261	2,245	

Source: American Merchant Marine at War for U.S. vessels. AMIO and SPREP data from Rean Monfils, *Sea Australia* (2007). Average full fuel load from Francis McCurtie, *Jane's Fighting Ships of World War II* (1996).

NB: There are 275 U.S. gallons in a metric ton of fuel oil. AMIO is the Atlantic, Mediterranean, and Indian Ocean database and SPREP is the South Pacific Regional Environmental Programme database. U.S. figures are included in the Total World figures. AMIO does not count vessels less then 1,000 gross tons. Small patrol craft fit this criteria and are thus marked as (Unk)nown. This Table does not reflect another 2,000+ vessels measuring less then 100 gross tons that were lost during World War II on all fronts.

Historical Wrecks. The possibility of World War II wrecks spewing oil, entangling fishing nets, or creating hazards to navigation are just a few of the reasons for locating these vessels. Relatives of lost crew members have begun their own research efforts into specific vessels to determine the reason the vessel sank and, ultimately, to find the final resting place of a lost relative. One such vessel is the USS *Grunion*, a 312-foot *Gato*-class submarine with a crew of 70 that sank in July or August of 1943 near the island of Kiska, Alaska.

Family members knew the vessel was on patrol in the Aleutian Chain and had sunk two Japanese submarine chasers and damaged a third (Lee 2006). Her last radio message placed her near Kiska Harbor, Alaska, and she still had 10 of her 24 torpedoes on board. The U.S. Navy could provide no other details. By a stroke of luck, a Japanese ship modeler saw the families' Web site on the Internet for the *Grunion* and thought he knew what had happened. He was a gunner on a freighter that allegedly sank a submarine at the same time and location from where the *Grunion* last reported.

Jeannette J. Lee's article "Object Off Alaska Coast May Be WWII Sub," which appeared in *USA Today* (2006), states that the U.S. Navy was asked to participate in the search for the submarine but declined. Dr. Robert Ballard, renowned marine archaeologist and best known for his 1985 discovery of the SS *Titanic*, also declined to participate, but briefed the families on the complications of searching for deep-sea wrecks (Lee 2006).

He stated that geological formations can conceal the vessel or that a large impact may have broken the vessel into multiple pieces. Undaunted, the families hired a marine salvage company to tow a sonar array over 240 square miles of water. A vessel resembling a submarine was found. In the summer of 2007, the family members will mount a second expedition with an underwater camera, which they hope will positively identify the *Grunion* (Lee 2006).

The article "No Mystery in the Depths," written by Norman Polmar for *Proceedings* magazine, discusses finding the *Graf Zeppelin*, Nazi Germany's only aircraft carrier. *Proceedings*, published by the Naval Institute, provides articles of interest to naval officers worldwide. At the outbreak of the war, the vessel was only 85% complete (see fig. 2). The estimated date for completion was late 1941. After discussions between the German navy and Adolph Hitler, construction was halted. The vessel was towed to Poland, where it was used to store lumber. At the conclusion of the war, the Soviet Union seized the vessel as war booty. The Allied tripartite commissions would not allow the Soviet Union to complete the vessel. Instead, the vessel was minutely examined by engineers and then used as a target for dive bombers and torpedo boats to study explosives damage. As part of its World War II history, the Polish navy began a search for the *Graf Zeppelin* and found her in July 2006 near Świnoujście, Poland. It is unknown how much oil, hazardous materials, and explosives remain on board. Germany states

that the Soviet Union took the *Graf Zeppelin* as a war prize at the end of hostilities and no longer lays any claim to the hull (Polmar 2006, 88–89).

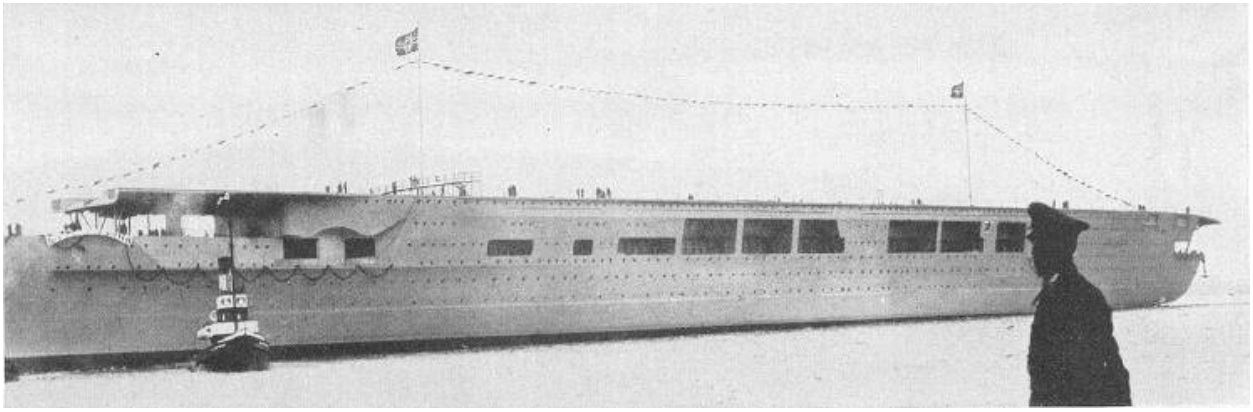

Figure 2. *Graf Zeppelin* at launching. *Source:* (Polmar 2006, 89).

Carl LaVo authored an article for *Naval History* magazine, which is published by the Naval Institute, regarding the search for one of the most famous submarines of World War II. On October 31, 2006, a Russian dive team photographed wreckage of the USS *Wahoo* in 213 feet of water in La Pérouse (Soya) Strait between Hokkaidō, Japan, and Sakhalin, Russia (see fig. 3). The divers were part of the Wahoo Project Group coordinated by Brian MacKinnon, a cousin of *Wahoo*'s skipper, Commander Dudley "Mush" Morton. The *Wahoo*, a *Gato*-class submarine, conducted a war patrol in the Sea of Japan in September 1943. Four Japanese vessels were reported sunk by the *Wahoo* prior to encountering Japanese shore-based artillery and aerial attacks in the shallow waters of the straight. Commander Morton was credited with sinking nineteen Japanese vessels, totaling over 60,000 tons, in four war patrols and was awarded the Presidential Unit Citation; he personally earned four Navy Crosses, an award second only to the

Congressional Medal of Honor. Finding the final resting spot of the crew of the *Wahoo* brings closure to the families of one of the greatest fighting submarines in the United States Navy (LaVo 2007).

Figure 3. View of USS *Wahoo*'s four-inch gun and conning tower. *Source:* Warfish.com, 2007.

A memorial, written in English and Japanese, now stands on Cape Sooya, not far from where the *Wahoo* was lost. The text reads:

> When the *Wahoo* was lost it was the highest-scoring submarine in the U.S. Navy. Eighty Americans sleep in the Sooya Strait 12 miles northeast of here. Many Japanese sleep in the Sea of

> Japan from *Wahoo* attacks. This monument was erected by the members of the Japanese Attack Group and relatives of Americans lying in the *Wahoo*. Old enemies met as brothers to dedicate that our countries will have lasting peace and war will never again destroy the friendship we now enjoy today (LaVo 2007).

The HMAS *Sydney*, the 555-foot light cruiser and queen of the Australian fleet, was lost under very mysterious circumstances 20 days prior to the attack on Pearl Harbor (see fig. 4). Six hundred and forty-five sailors lost their lives in what remains Australia's worst maritime disaster (Squires 2006). Its whereabouts are as mysterious as the events surrounding its sinking.

Figure 4. HMAS *Sydney.* Source: HMAS *Sydney* Memorial, 2007.

Cynthia Banham reported in 2005 that the Australian federal government would give $1.3 million dollars to the HMAS *Sydney* Search Party Ltd. in order to help fund a new search for the vessel. More than twenty previous searches for the *Sydney* have failed. Les Dwyer, President of the HMAS *Sydney* Search Party Ltd., is quoted by Banham as saying, "It was absolutely marvelous and the discovery of the wreck so important to put at rest the minds of relatives who still did not know the final resting place of their lost servicemen" (Banham 2005).

The two most popular theories speculate that the *Sydney* encountered either a German armed auxiliary cruiser or a Japanese submarine. The armed cruiser the *Sydney* allegedly hailed was the HSK *Kormoran*, an auxiliary cruiser masquerading as a Dutch merchant vessel. A terrifying gun battle ensued, with both vessels sinking and the entire crew of the *Sydney* perishing. Three hundred and forty Germans were captured and interred in Australia for the remainder of the war. The Australian government disputes the theory regarding an encounter with a Japanese submarine; however, conspiracy theorists believe the government covered up the account. Only upon finding the vessel will the actual theory become fact and one of the great-unsolved mysteries of the disappearance of World War II vessels will be put to rest as well as bring closure and comfort to thousands of relatives (Banham 2005).

Recent advances in technology have resulted in increased opportunities for undersea research. Advances in robotics, submersibles, Global Positioning Systems (GPS), and sonar have made undersea research accessible and affordable. In his film *Expedition: Bismarck*, James Cameron reported that he found the *Bismarck* in 2002 using the latest in undersea exploration submarines, the Russian-made and operated MIR I and MIR II submersibles. This undersea craft could attain depths of over 20,000 feet with a crew of three and was able to stay under for up to 12 hours at a time. These craft operated independently of the mother ship. In addition, Cameron's brother developed two smaller submersibles named *Jake* and *Elwood*, capable of being operated at depths to 20,000 feet and completely controlled with the use of Wi-Fi from the MIR subs. *Jake* and *Elwood* were instrumental in surveying the wreck of the *Bismarck* in order to determine its actual fate on May 28, 1941 (Cameron 2002).

The *Bismarck* was found at a depth of 15,700 feet 400 miles west of Brest, France. The vessel was almost completely intact, except for missing gun turrets and the admiral's bridge, which were scattered along the sea floor (see fig. 5). The submersibles and robotics were able to conduct a complete hull and interior survey of the *Bismarck*. Video taken from the wreck shows the hull integrity as being intact. Conclusive evidence was found that His Majesty's Royal Navy did not sink the *Bismarck*, as had been previously thought. Instead, the vessel was scuttled in order to prevent it

from falling into Allied hands. Without this technology, the true fate of the *Bismarck* would never have been known (Cameron 2002).

Figure 5. Artist's rendition of the *Bismarck* at final resting spot.

Source: MaritimeQuest.com, 2007.

Other historic wrecks include the American battleship USS *Arizona*, now a national monument, the HMS *Hood*, and the first capital ship sunk at the beginning of World War II, the British battleship HMS *Royal Oak* (see fig.

6). In addition, there are more than sixty World War II wrecks in the 40-square mile Truk Lagoon in the Federated States of Micronesia. Lastly, over 100 vessels, including two battleships, ten cruisers, and countless destroyers and cargo vessels, litter Iron Bottom Sound between the islands of Guadalcanal and Savo in the Solomon Islands of the South Pacific. Numerous other vessels, including John F. Kennedy's *PT-109* and the heavy cruiser, USS *Indianapolis*, which transported the first atomic bomb to the Mariana Islands, have been the targets of exhaustive searches.

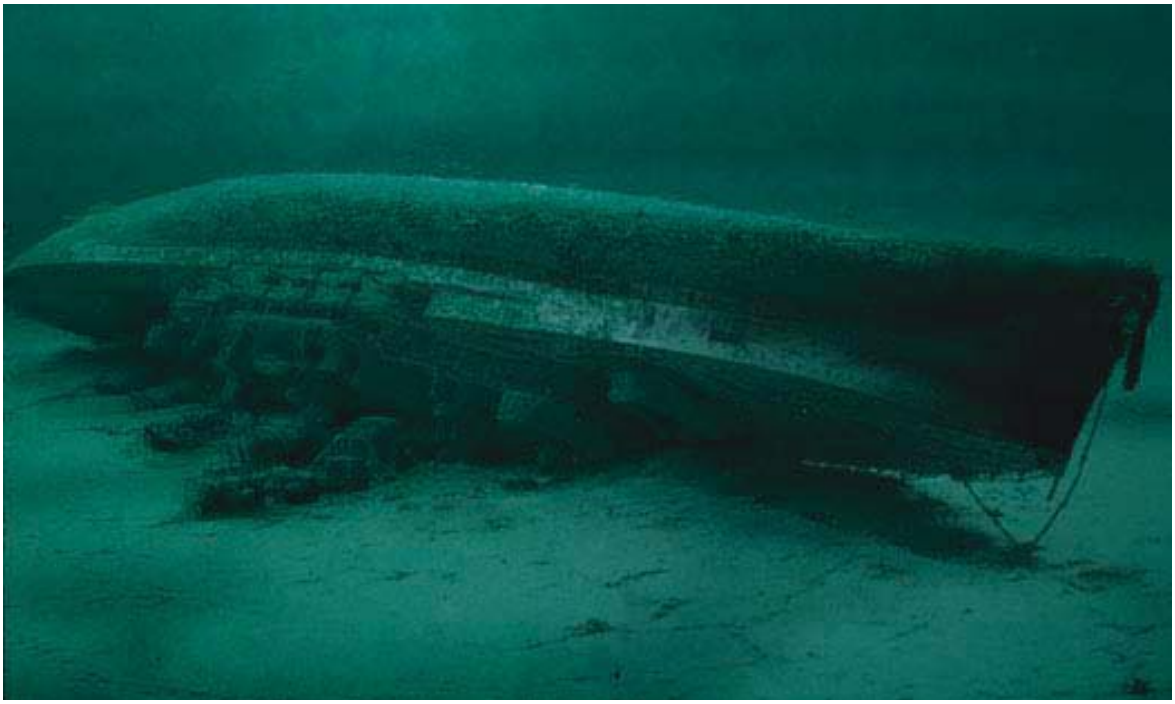

Figure 6. Artist's rendition of HMS *Royal Oak* on sea floor. *Source:* (Rowlands 2001).

Navigational and Fishery Issues. In an article written for WAVES, Trevor Gilbert, advisor for the Pacific Ocean Pollution Prevention Program, discussed the effect on a fishery from a sunken World War II tanker. The Yap Marine Resources Department authorities, in conjunction with the U.S.

Environmental Protection Agency, placed a ban on fishing in Ulithi Atoll during the height of the cleanup of the USS *Mississinewa* in July and August 2001. The plight of the *Mississinewa* is discussed in further detail in the Environmental Issues with Wrecks section of this document. Suffice it to say, this ban was placed to protect the health and safety of the citizens of Yap and was deemed as a "prudent and sound measure" (Gilbert 2002). After extensive studies led by Trevor Gilbert, the ban on fishing was lifted after two months. These studies included examinations of oil intoxication of seabirds and turtles, behavioral changes in bird and fish species, and abnormal crustacean and mollusk mortality (Gilbert 2002). For a small island nation where subsistence upon marine resources is a necessity, a two-month ban brought severe hardships upon the native peoples.

Small island nations are easily susceptible to possible cultural extinction if a sunken vessel has a catastrophic release and creates a dead zone around an atoll. Native peoples will be forced to emigrate to another island in their chain or possibly to another island nation. The possibility of cultural extinction cannot be ignored by Flag State nations (Gilbert 2002).

The Maritime and Coastguard Agency (MCA) is the United Kingdom's equivalent to the U.S. Coast Guard. Like their American counterpart, the MCA is responsible for search and rescue, vessel safety, and coastal pollution prevention. One vessel actively managed by the MCA is the SS *Richard Montgomery*, a 441-foot, 7,146-gross-ton liberty ship that dragged anchor in

heavy winds in the Thames Estuary in England on August 20, 1944. The ship ran aground on a sand bar and suffered a broken keel and cracked hull (see fig. 7).

Figure 7. Present-day image of SS *Richard Montgomery*. *Source:* Maritime and Coastguard Agency, 2005.

The vessel was carrying the following:

- 13,064 general-purpose 250 lb. bombs
- 9,022 cases of fragmentation bombs
- 7,739 semi-armor-piercing bombs
- 1,522 cases of fuses

- 1,429 cases of phosphorous bombs
- 1,427 cases of 100 lb. demolition bombs
- 817 cases of small arms ammunition

A month-long salvage operation continued until the vessel split in two, filling the holds with seawater. One thousand four hundred tons of explosives remain on board in the forward hull. Due to loose blasting caps in the ammo hold and unstable ammunition, no further effort was made to salvage the vessel. Sixty-two years later, the vessel is still considered to be highly unstable. The Maritime and Coastguard Agency of the United Kingdom maintains a no-entry exclusion zone around the wreck using radar, security boat patrols, and video surveillance to keep curious vessels away (Maritime and Coastguard Agency 2005). Figure 8 shows the vessel broken in two. The corresponding colors refer to water depth around the vessel and down river, dark blue being deeper and red being exposed sand at low tide.

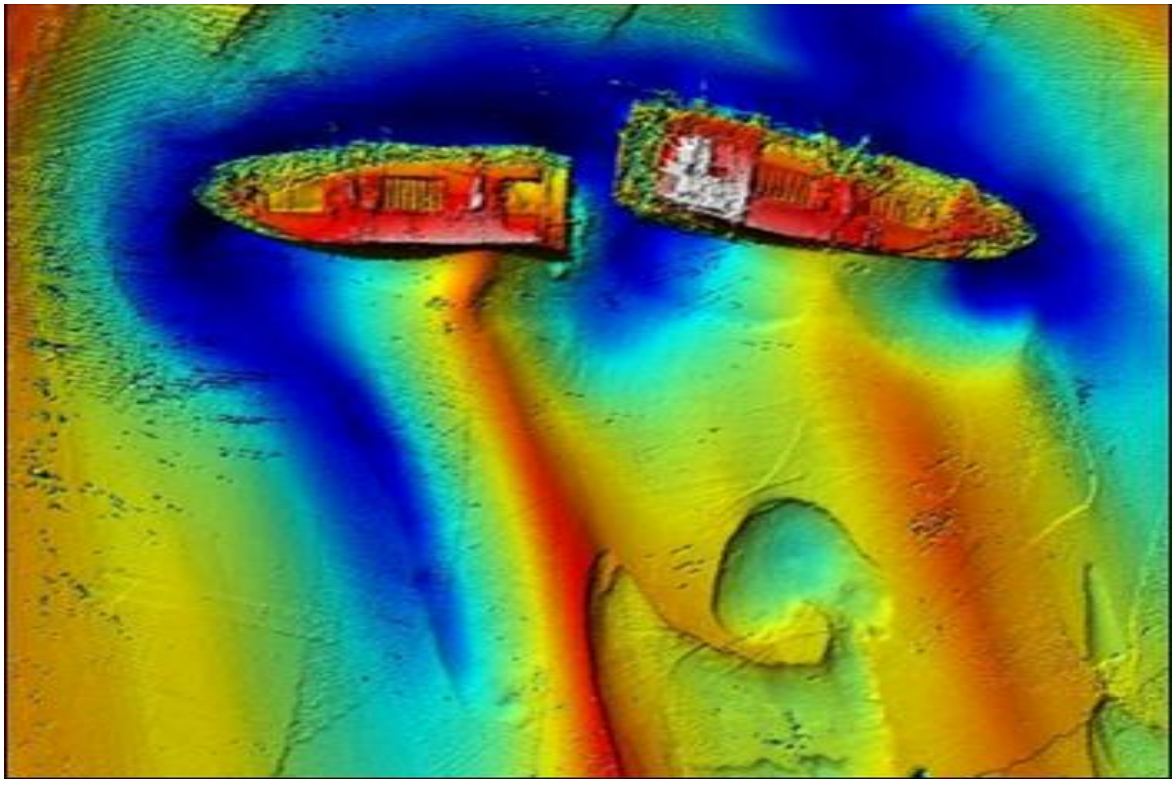

Figure 8. Side-scan sonar image of SS *Richard Montgomery*. *Source:* Maritime and Coastguard Agency, 2005.

Fiscal and Political Issues. In their article "The Need for a Proactive Approach to Underwater Threats," Basta and Kennedy (2004) state that sunken wrecks are deteriorating with time, creating a potentially significant threat for large oil and/or hazardous material releases, or cumulatively, from smaller releases, and impacting coastal and marine resources. Thousands of wrecks are located in United States coastal waters and within the Exclusive Economic Zone (EEZ), including a large number of merchant vessels sunk by German U-Boats in World War I and World War II. Because these vessels are not seen, the adages "out of sight, out of mind" and "the solution to pollution is dilution" come to mind. However, small releases by sunken

vessels such as the USS *Mississinewa*, USS *Arizona*, and the SS *Jacob Luckenbach* have proven to have significant natural resource impacts (Basta and Kennedy 2004, 9–11).

Trustees of coastal and maritime nations must be proactive in understanding the complex issues associated with underwater wrecks. "This requires an inventory of underwater sites, an assessment of which sites are serious underwater threats, surveying and monitoring of those threats, risk-based modeling as to how those sites may impact sensitive resources, and research into response options" (Basta and Kennedy 2004, 10). The amount of oil may not be the biggest hazard or risk associated with each wreck site. "The location, degree of deterioration, prevalent weather and current patterns, as well as proximity to sensitive resources, is critical" (Basta and Kennedy 2004, 10). There are also concerns related to war graves and historic vessels.

Small island nations have the potential to be severely impacted by a major oil spill or hazardous material release. These same nations were intricately involved with World War II, but were not directly involved in any of the naval actions. "The adversaries came and fought the war in our backyard and now we're expected to deal with this as well," stated Sefania Nawadra, marine pollution advisor for the South Pacific Regional Environmental Programme (Christie 2002). Nawadra further states, "What we've argued from the standpoint of countries in the Pacific is, okay hang

on, we didn't really have a choice in whether we participated or not in the war" (Christie 2002). The small island nations do not have the financial or technological resources available to mitigate the thousands of threats within their Exclusive Economic Zones. Joel Baker, Eileen Beard, Walter Hatch, and Carys Mitchelmore conducted a study for the Coastal Response Research Center on the acute and sub-lethal effects of dispersed oil to sensitive symbiotic *Cnidarian* sp., including coral. This study was used to promote the idea that the protection of coral species was paramount in oil spill response. Their study determined that coral species were extremely sensitive to water diluted with petroleum fractions. Short-term exposure (8 hours or less) to petroleum products proved lethal to soft-coral species (Baker et al. 2006). Further research is being conducted to determine if long-term exposure to petroleum causes bleaching in coral reef systems.

Andrew Smith, Doug Helton, and Ian Zelo of NOAA's Damage Assessment Center co-authored a paper for the 2003 International Oil Spill Conference. The authors' paper, entitled "Developing a Database to Support and Prioritize the Removal of Abandoned Vessels Impacting Coral Resources," discusses several case studies of vessels sunk or grounded on coral reef systems. The authors concluded "Derelict and abandoned vessels pose significant threats to coral ecosystems by releasing pollutants, physically destroying habitat, and causing algal blooms through iron deposition" (Smith et al. 2003). The authors advocate a need to develop a

database in order to categorize vessels affecting or potentially impacting coral reef systems.

Environmental Issues with Wrecks. On February 9, 1945, the HMS *Venturer*, a 740-ton, 200-foot submarine, engaged the *U-864*, a 1,060-ton, 275-foot U-boat (McCurtie 1996) carrying over 65 tons of mercury in 1,860 flasks in her keel off the coast of Bergen, Norway (Cowell and Gibbs 2007). The *U-864* was "on a last ditch secret mission code-named 'Caesar' that was to bring jet engine parts, missile guidance systems and mercury for weapons production" to Japan in order to draw allied troops and material away from Nazi Germany (Mellgren 2007). The *Venturer* sank the *U-864* in the only action in history where one submerged submarine sunk another submerged submarine.

The Kystverket/Norwegian Coastal Administration (NCA) is the equivalent to the MCA and the USCG. The NCA is tasked with coastal management, marine safety, and communication. The NCA found the *U-864* in 2003 after fishermen brought flasks of mercury to an NCA field office. Side-scan sonar showed the vessel in two pieces on the sea floor (see fig. 9).

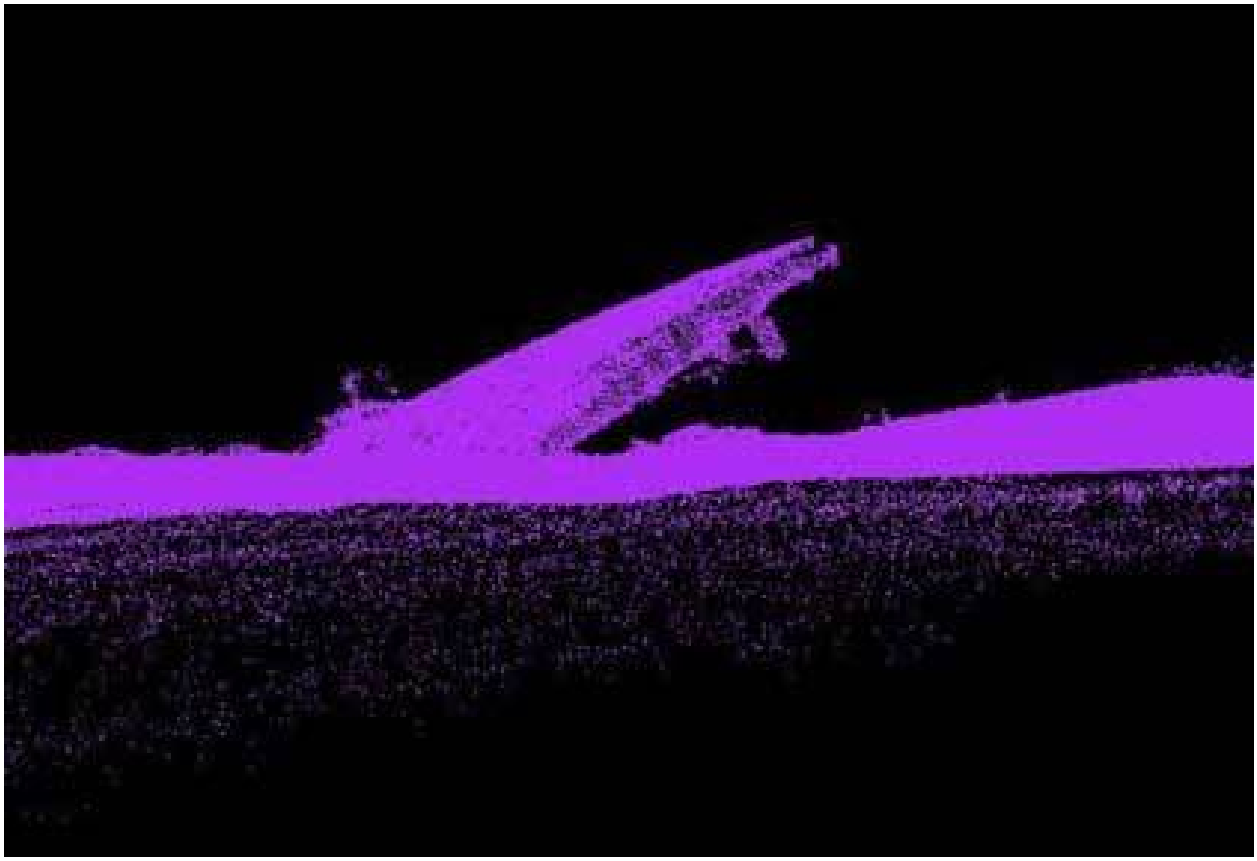

Figure 9: Side-scan sonar image of *U-864* stern. *Source:* Spiegel Online International, 2006.

Numerous mercury canisters have broken apart with surrounding crabs and fish showing increased levels of the chemical (Cowell and Gibbs 2007). Metallic mercury, when exposed to seawater, becomes the more dangerous organic mercury. Organic mercury is a known bioaccumulator and passes from microorganisms to fish and, ultimately, to upper mammals, including man (Mellgren 2007). The NCA proposed to the Norwegian Parliament a US$6 million plan to entomb the vessel with 300,000 tons of sand, topping it with a clay and rock cap (Cowell and Gibbs 2007), thus preventing further release of mercury into the environment. The NCA found the option to raise

the vessel as too risky due to the deteriorated condition of the hull (Kystverket 2007).

John Bull published an article for the *Daily Press* out of Hampton Roads, Virginia, on October 30, 2005, entitled "The Deadliness Below." His research through the National Archives and other army documents revealed numerous instances where chemical weapons were disposed of at sea. Only five miles from shore in Hawaii, 16,000 mustard-gas-filled 100-pound bombs were unloaded into deep water in 1944. Immediately following World War II, four railroad cars containing mustard gas bombs and mines were dumped off the coast of South Carolina. A few months later, up to 23 barges with German-produced nerve gas bombs were dumped in the same location. Each barge carried up to 350 tons of bombs. While the scuttling of damaged vessels and equipment immediately following World War II is well documented, the dumping of chemical weapons is not. The army claims 26 dump sites but only one is listed on a nautical chart (Bull 2005).

At the time, the best method to reduce weapon stockpiles was to dump it into the sea. There was too much to landfill, incinerate, or store. Barges and derelict vessels were loaded up and scuttled or used as target practice. "The sea was seen by the military and governments to have unlimited absorptive capacity" (Monfils 2005).

The USS *Mississinewa* was a 553-foot, 25,425-ton navy oil tanker (see fig. 10) that supplied aviation gas and heavy fuel oil to the Pacific Fleet

anchored in Ulithi Atoll, Yap State, Federated States of Micronesia. On November 20, 1944, the fully loaded *Mississinewa* was attacked by a manned Imperial Japanese Navy suicide torpedo and sank in 130 feet of water with 63 personnel on board (see fig. 11). The vessel lay undisturbed until July 2001, when a tropical storm passed over the vessel, causing it to leak (South Pacific Regional Environment Programme 2002).

Figure 10. USS *Mississinewa*. *Source:* (Walker 2003).

Figure 11. USS *Mississinewa* sinking in Ulithi Atoll. *Source:* (Walker 2003).

Lieutenant Commander Paul Albertson, USCG, discussed in his paper, entitled "Potentially Polluting Wrecks Warrant Further Dialog," the multi-year cleanup effort of the USS *Mississinewa,* amongst other vessels. The spilled oil immediately began to affect nearby islands. An estimated 18,000–24,000 gallons of oil was released over a sixty-day period. Local citizens were banned from fishing in the lagoon for four months. A U.S. Navy dive team responded, along with a USCG response team. The dive team estimated that up to 2.8 million gallons of oil remained on board, based upon soundings and surveys of tanks that had not failed. The divers also determined the

leaks came from rusted-out deck piping. The piping was plugged and the vessel quit sheening (Albertson 2004).

Another tropical storm passed over in December 2001, causing a small sheen to occur. This new spill prompted the Yap State government to make a formal request to the U.S. Navy through the State Department to have the oil removed from the *Mississinewa,* citing the possibility of a large oil release that could adversely affect the 773 residents living in the area. The local Yapese rely on fishing as a means of commerce and for subsistence. The U.S. Navy's Supervisor of Salvage (SUPSALV), along with the U.S. Coast Guard, commenced oil removal operations in August 2003 (Albertson 2004).

Bill Walker, U.S. Navy On-Scene Salvage Supervisor for the *Mississinewa* cleanup effort, stated in an article in the Summer 2003 edition of the U.S. Navy's *Currents* magazine, that numerous options were discussed in an Environmental Assessment. The "no action alternative" was considered impractical. Each new release would require a mobilization of response resources, which would take at least two weeks to arrive and cost at least $500,000. An option to add a solidifier to the oil products was overturned as being impractical and having future unknown consequences. Complete removal of the vessel was another option that was dismissed, due to the instability of the vessel, the potential for worsening the environment, and because of the war grave situation. Because the vessel had turned over, exposing the bottom of its hull, the method of "hot tapping" was decided

upon. Hot tapping is the method where holes are drilled into tanks and the tanks are pumped out using a vacuum pump with a heater attachment, thereby lowering the viscosity of the oil to a more manageable pour point (Walker 2003).

Due to the shallow depth, exceptional underwater visibility, warm temperatures, relatively calm sea conditions, and complete availability of all twenty-two tanks, the recovery effort was deemed a success. The oil was pumped out in four weeks, two weeks earlier than originally estimated. Approximately 1.95 million gallons of oil was pumped out of twenty-one tanks, the engine room, piping, and the pump room. Upon completion of operations, the vessel is believed to still have 14,000 gallons on board, broken down by 7,000 gallons still clinging to the tanks, 6,000 gallons in piping systems, and 1,000 gallons in other inaccessible locations (Walker 2003). During the four weeks of recovery operations, less then five gallons of oil were released into the water column. The cost of the cleanup operation was only $4.5 million dollars, due to the shallow location and warm waters around the vessel. The U.S. Navy and the Oil Spill Liability Trust Fund, maintained under the Oil Pollution Act, provided the funding for the cleanup. The recovered oil was refined and sold at market. The gravesite for sixty-three United States sailors lays untouched. The local Yapese no longer have to worry about a catastrophic release of oil that could threaten their livelihood (Albertson 2004).

LEGISLATION AND TREATIES

The following are reviews of pertinent U.S. policies, U.S. Regulations, and International treaties.

The United States National Ocean Policy. The United States National Ocean Policy began in 2001 with the presidential appointment of former Chief of Naval Operations, Admiral James Watkins, USN. The preliminary report, which was completed in May 2004, included 252 recommendations with a proposed annual budget of $3.9 billion (U.S. Commission on Ocean Policy 2004). In December 2004, President George Bush signed an executive order, creating the U.S. Ocean Action Plan. This plan established a cabinet-level Committee on Ocean Policy. Membership on the committee consisted of twenty-three senior executive branch officials, including directors of the EPA, NOAA, USCG, USACOE, and USN.

Of the 252 action items, none addressed the potential pollution of sunken World War II vessels. Instead, the U.S. National Ocean Policy focuses on national, regional, and state governance reform; international leadership; research; science; and education. The greatest number of recommendations involves Fisheries Management and Natural Resources Reform (U.S. Commission on Ocean Policy 2004). According to the U.S. Ocean Action Plan, the U.S. National Ocean Policy is focused on the near-term economic issues versus long-term sustainability.

Mitigating known future pollution threats is essential for the United States to take a strong leadership role in removing pollutants from World War II naval wrecks and maintaining the viability of our world's oceans (Walsh 2006).

Unfortunately, current U.S. federal rules and regulations do very little to mitigate oil, hazardous materials, and navigational issues from World War II wrecks. Each regulation specifically states that public vessels (i.e., government-owned and/or operated vessels not used for commerce or recreation) are not applicable. Only the Rivers and Harbors Act includes public vessels. One reason is that the U.S. Army Corps of Engineers (a directorate of the U.S. Army and, by default, the Department of Defense) is the enforcement agency. U.S. Navy and U.S. Army vessels posing a navigational threat in U.S. waters fall under the jurisdiction of the Rivers and Harbors Act. Other existing applicable U.S. federal laws are summarized in the following table.

Table 4. Summary of existing United States federal laws

Act	Agency	Removal Authority	Limitations	Restoration Provisions	Limitations	Funding Source	Applicability for Public Vessels
Oil Pollution Act, Clean Water Act	USCG, Trustees	Yes	vessels discharging or posing substantial threat of discharge; no seizure or abandonment required	Yes	for injuries caused by discharge or threat	Yes, Oil Spill Liability Trust Fund or litigation for claims for response costs and restoration	No—(33 USC 2702)
Superfund Act	EPA, USCG, Trustees	Yes, through CWA 1321	vessels releasing or threatening a release of a hazardous substance	Yes	for injuries caused by discharge or threat	Yes, for response only, not claims; natural resources damages only available through litigation	No—(42 USC 9601)
National Marine Sanctuaries Act	NOAA	Yes	seizure required, vessels violating act subject to forfeiture to U.S.	Yes	for injuries to sanctuary resources	No, but authorizes claims to recover response costs and damages, against owner or vessel	No—(16 USC 1435)
Rivers and Harbors Act	ACOE, USCG	Yes	of "abandoned" vessels, posing actual or potential threat to navigation, not removed by owner within 30 days; abandoned vessels not a hazard to navigation not covered	No	Act only provides for suits for damage for harm to navigational channels	No. However, Act does allow recovery costs of vessel removal, and penalties, from owner, operator, lessee, or vessel itself, but recoveries deposited into U.S. Treasury	Yes, for U.S. flag public vessels— (33 USC 401)
Abandoned Barge Act	USCG	Yes	vessels larger that 100 gross tons, abandoned for more than 45 days, in navigable waters	No		No. Suits may be brought to recover removal costs, and penalties-deposited into U.S. Treasury	No—(46 USC 4701)
Abandoned Shipwreck Act	DOI, States	No?	title to "abandoned and embedded" vessels passes to state, vessels to be managed as historic resources	Yes		No	No—(43 USC 2102)

Act	Agency	Removal Authority	Limitations	Restoration Provisions	Limitations	Funding Source	Applicability for Public Vessels
Intervention on the High Seas Act	USCG	Yes	vessels posing grave and imminent danger to coastal or related interests of U.S.; consultation with foreign Flag States required	No		No	No—(33 USC 1472)
Park System Resources Protection Act	DOI	Not really	makes vessels harming park resources subject to forfeiture, but does not define abandonment, does not authorize seizure, and does not authorize removal	Yes	injury to park system resources	No	No—(16 USC 19)
Endangered Species Act	NOAA, DOI	Yes	vessels violating or threatening to violate act may be seized, subject to forfeiture to U.S.	No		No	No—(16 USC 1531)
Common Law Claims—tort, trespass, nuisance	Any plaintiff with interest that has been harmed	Not likely	vessel removal would likely only be possible with a judgment after trial and a court order; claims subject to admiralty principles of limited liability requirements for negligence, etc.	Yes	damage to property interests can involve an award for costs of restoration	No	No—(Various)

Source: Adapted from "Wreck Removal: A Federal Perspective" summary of existing federal laws table (Helton 2003).

United Nations Treaties. Two international treaties discuss World War II wrecks and provide legal doctrine on the treatment of such vessels. However, these treaties make no mention of how the Flag State or affected Coastal State should manage environmental issues, such as spilled oil or hazardous materials. The United Nations Convention of the Law of the Sea (UNCLOS), Article 29, defines a warship as "a ship belonging to the armed forces of a state bearing the external marks distinguishing such ships of its nationality, under the command of an officer duly commissioned by the government of the State and whose name appears in the appropriate service list or its equivalent, and manned by a crew which is under the regular armed forces discipline" (United Nations, Division for Ocean Affairs and the Law of the Sea 2007). This article provides the definition of a warship in all international treaties.

Article 31 of UNCLOS discusses the "[r]esponsibility of the Flag State for damage caused by a warship or other government ship operated for non-commercial purposes" (United Nations, Division for Ocean Affairs and the Law of the Sea 2007). The accepted legal doctrine reads, "The Flag State shall bear international responsibility for any loss or damage to the Coastal State resulting from non-compliance by a warship…with the laws and regulations of the Coastal State concerning passage through territorial sea or with the provisions of this Convention or other rules of international law" (United Nations, Division for Ocean Affairs and the Law of the Sea 2007).

This Article is invalid for wartime non-compliance, thus World War II vessels are not held to Article 31.

Article 95, Immunity of warships on the high seas, states, "Warships on the high seas have complete immunity from the jurisdiction of any State other than the Flag State" (United Nations, Division for Ocean Affairs and the Law of the Sea 2007). Article 236, Sovereign immunity, further adds, "The provisions of this Convention regarding the protection and preservation of the marine environment do not apply to any warship, naval auxiliary…However, each State shall ensure, by the adoption of appropriate measures not impairing operations or operational capabilities of such vessels...that such vessels act in a manner consistent, so far as is reasonable and practicable, with this Convention" (United Nations, Division for Ocean Affairs and the Law of the Sea 2007).

The United Nations Convention of the Law of the Sea does not address vessels sunk in wartime conditions. However, it does consider these vessels immune from the laws of Coastal States.

The Convention of the Protection of the Underwater Cultural Heritage, as sponsored by the General Conference of the United Nations Educational, Scientific and Cultural Organization, was passed in Paris, France, in November 2001. Definitions under Article 1 defines Underwater Cultural Heritage as "having been partially or totally underwater for at least 100 years" (United Nations Educational, Scientific and Cultural Organization

2007). Thus, World War II wrecks are not protected by the Convention of the Protection of the Underwater Cultural Heritage.

On January 19, 2001, Bill Clinton, President of the United States, stated the U.S. policy on sunken government vessels of the United States and foreign nations. These foreign nations included the governments of France, Germany, Japan, the Russian Federation, Spain, and the United Kingdom. All nations quoted the sovereign immunity clause of warships under the United Nations Convention of the Law of the Sea. Furthermore, each nation strongly stated its position regarding ownership of said vessels. Also included were vessels under former governments, such as the Deutches Reich, Vichy regime, Union of Soviet Socialist Republics and the Italian Social Republic. Each country also explained that these wrecks are maritime graves and must be respected. Finally, each country reiterated its position that no intrusive action, such as salvage, may be taken without first contacting the host government (Department of State, Office of Ocean Affairs 2001). President Clinton further clarified the position of the United States by stating that not only are these sites marine graves, but they "may also contain objects of sensitive national security, archaeological or historical nature. They often also contain unexploded ordnance that could pose a danger to human health and the marine environment if disturbed, or other substances, including fuel oil and other hazardous liquids, that likewise pose a serious threat to human health and the marine environment if released"

(Department of State, Office of Ocean Affairs 2001). President Clinton concluded his remarks by stating, "The United States will use its authority to protect and preserve sunken State craft of the United States and other nations, whether located in the waters of the United States, a foreign nation, or international waters" (Department of State, Office of Ocean Affairs 2001).

Rean Monfils asks a key question regarding vessel sovereignty in his paper "The Global Risk of Marine Pollution from WWII Shipwrecks: Examples from the Seven Seas." He states, "If this immunity also applies to the property, cargo, or content on board the vessel at the time of sinking, could one then assume that the responsibility for any mitigation of marine pollution and environmental damage caused would then also be the responsibility of the Flag State?" (Monfils 2005). To date, no international treaty has discussed or mentioned this issue.

PROJECT DESIGN

The methodology of this study included research and review of national and international databases to fully identify and comprehend the potential hazards associated with sunken World War II naval wrecks. A thorough literature review garnered the facts necessary to draft a comprehensive Annex to the Wreck Removal Convention (WRC) to be submitted to the Marine Pollution committee of the International Maritime Organization (IMO). The literature review brought light to the worldwide magnitude of the problem, as well as described new vessels currently being

located. It is hoped that this report will lead to adoption by the WRC of the proposed Annex included in this Capstone. Only an international treaty upheld by all nations will garner the necessary financial resources to begin the process of determining governing ownership, developing a risk-based matrix, and removing the hazards associated with these naval wrecks.

Methods and procedures. Comprehensive databases, including the South Pacific Regional Environment Programme (SPREP) and the Atlantic, Mediterranean, Indian Ocean (AMIO) database, were searched to establish the number of vessels sunk due to military action and mishaps as well as to categorize these vessels (i.e., battleships, aircraft carriers, tankers, ammo ships, et cetera). The amount of oil, explosives, and hazardous materials would then need to be estimated. The number of vessels sunk in waters less then 100 meters deep or within a country's EEZ is easily determined by these databases. World War II treaties, international law, and current treaties provided a background on how the former Allied and Axis nations resolved sunken naval wrecks and war (or, in the case of the Japanese, marine) graves.

This Capstone is a comprehensive review of existing literature, studies, and facts that were used to develop a comprehensive proposal for action to address the problems caused by the naval wrecks. The intended audience is the International Maritime Organization's (IMO) Marine Pollution (MARPOL) counsel. The full intention is for the IMO to utilize this proposal in order to

adopt this Annex to the draft Wreck Removal Convention (WRC). With the signatory states being full voting members of IMO, it is this author's desire that this Annex to the WRC will come to fruition and be a bound and lawful treaty signed by all signatory maritime nations, thus providing for a sound, comprehensive method for determining legal governing ownership of not only World War II sunken naval wrecks (of which the vast majority of all naval wrecks are), but for all sunken wrecks that carried, or potentially carried, oil, HAZMAT, explosives, et cetera. In addition, this Annex will outline how a risk-based matrix can be used to categorize each wreck and provide the impetus for Flag State nations to mitigate the effects of their vessels.

PLAN OF ACTION

International Maritime Organization and the Draft Wreck Removal Convention. The International Maritime Organization (IMO) is a governing body of 167 member Flag State nations that either have seafaring capabilities or are member states that border on navigable water. These member states develop comprehensive guidance, protocols, and treaties in all manners pertaining to our world's oceans and waterways. The IMO is a specialized agency of the United Nations. The Convention establishing the IMO was adopted in 1948.

Comprehensive data are paramount to the success of this draft resolution to be approved by the Marine Pollution (MARPOL) sub-committee

and forwarded to the IMO voting members, versus being tabled for further discussion or summarily dismissed.

The main tasks associated with the IMO include safety, environmental concerns, legal matters, technical cooperation, maritime security, and efficiency of shipping. The purposes of the IMO, as summarized by Article 1(a) of the Convention, are:

> to provide machinery for cooperation among Governments in the field of governmental regulation and practices relating to technical matters of all kinds affecting shipping engaged in international trade; to encourage and facilitate the general adoption of the highest practicable standards in matters concerning maritime safety, efficiency of navigation and prevention and control of marine pollution from ships. The Organization is also empowered to deal with administrative and legal matters related to these purposes (International Maritime Organization 2007).

The IMO has specialized committees and sub-committees that focus on technical work to update legislation or to develop and adopt new regulations. These committees work closely with member governments, non-governmental organizations, and maritime experts. This results in a comprehensive body of international conventions supported by hundreds of countries.

One such committee is the Small Islands Developing States (SIDS), sponsored by the United Nations. In a meeting in Port Louis, Mauritius, on January 10–14, 2005, the final text on the SIDS Waste Management Convention was voted on and passed. Prior to passing, the United States and Japan successfully lobbied to remove any references to "World War II wrecks" from the final text. "Pacific Countries want the Flag States to remove oil from these wrecks and to take responsibility for the removal of the vessels from their waters" (PACNews 2005). In addition, the Japanese delegate left the proceedings and did not return until the words "war graves" were replaced with "marine graves." The watered-down final text now reads:

> recognizing there's a concern with the environmental implications of potential oil leaks from sunken vessels to marine and coastal ecosystems of small island developing states and taking into account sensitivities surrounding those vessels which are marine graves, small island developing states and relevant vessel owners should continue to address the issue bilaterally on a case-by-case basis…" (PACNews 2005).

The Oil Pollution Preparedness, Response and Cooperation Technical Group acknowledged the issue of sunken wrecks in March 2004. This IMO group encouraged "regional centres and secretariats…to assess the situation regarding World War II wrecks that may cause oil pollution on their respective sea areas" (International Maritime Organization 2004). So far,

this is the only action the IMO has taken in regards to World War II wrecks and the potential hazards they carry.

In May 2007, the IMO will meet in Nairobi, Kenya, to vote on the Wreck Removal Convention, which is currently in draft form. The following is from the IMO Web site:

> **Wreck Removal Convention**
>
> The Legal Committee, at its 92nd session in October 2006, approved a draft **Wreck Removal Convention,** which will be forwarded for adoption to a Diplomatic Conference, scheduled to be held from 14 to 18 May 2007, at the United Nations Office in Nairobi, Kenya.
>
> Once adopted and in force, the new convention will provide the legal basis for States to remove, or have removed, from their exclusive economic zones (EEZs), wrecks that may pose a hazard to navigation, or because of the nature of their cargo, to the marine and coastal environments, or to both. The new convention will also require ship owners to take out insurance to cover the costs of removal and provide States with a right of direct action against insurers.
>
> Proposals to extend the scope of the new convention to the territorial sea of States Parties are still under consideration and will be the subject of consultations by interested delegations

before the Diplomatic Conference.

The draft convention covers:

- reporting and locating ships and wrecks—covering the reporting of casualties to the nearest Coastal State; warnings to mariners and Coastal States about the wreck; action by the Coastal State to locate the ship or wreck);
- determination of hazard—sets out who is responsible for determining whether a hazard exists when the wreck or ship is beyond territorial waters, based on a list of specific criteria, including depth of water above wreck and proximity of shipping routes;
- rights and obligations to remove hazardous ships and wrecks—sets out when the ship owner is responsible for removing the wreck and when a State may intervene;
- financial liability for locating, marking, and removing ships and wrecks;
- time-bar: sets a time limit for claims for compensation;
- jurisdiction: sets out jurisdiction(s) where actions for compensation may be brought;
- financial security: sets out security required to cover liabilities regarding claims for compensation under the Convention; and

- settlement of disputes (International Maritime Organization 2007).

In the current draft of the WRC, there are certain Articles and definitions that preclude World War II wrecks from being included. Some of these major issues include:

Article 2, Objectives and general principles, of the WRC describes the objectives and general principles. Paragraph 3 states, "Such measures shall not go beyond what is reasonably necessary to remove a wreck posing a hazard and shall cease as soon as the wreck has been removed" (International Maritime Organization 2007). This Article does not consider mitigating the wreck, just removing the wreck.

Article 4, Scope of application of the WRC, specifically discusses warships. "This Convention shall not apply to any warship or other ship owned or operated by a State and used, for the time being, only on government noncommercial service, unless that State decides otherwise" (International Maritime Organization 2007). With warships specifically excluded, this prevents over 9,000 vessels from being mitigated.

Article 14, Time-bar, discusses the time constraints imposed upon wrecks. "Rights of compensation under this Convention shall be extinguished unless an action is brought hereunder within three years from the date when the hazard has been determined in accordance with Article 7" (International Maritime Organization 2007). No reference is made to the adjudication of

non-warship historical wrecks or for warships that pose a significant environmental hazard.

Nine separate databases are previously mentioned. This total does not include the myriad private databases known to exist. In order for the IMO to take a leadership role on this issue, one central database of all World War II wrecks needs to be compiled. This database can then follow NOAA's SHIELDS system and include the following additional tools:

- GIS data and maps
- Vessel particulars, including risk assessment scores
- Jurisdictional and policy information
- Protected cultural and natural resources
- Response tools and assets
- Spill projection and trajectory software
- Response plans
- Forms and documentation (National Oceanic and Atmospheric Administration 2004)

Developing and implementing these tools is outside the scope and intent of this paper. However, a single source of information will be crucial for the success of the draft Annex included below and can also be modified to include all known shipwrecks, including those that may be potential hazards or might be culturally or historically sensitive.

SUMMARY

Tens of thousands of vessels from over forty nations plied the waters of our world's oceans during World War II. Over 9,000 were lost due to enemy action, collisions, groundings, storms, or mechanical failure. The world will never see a maritime conflict of this magnitude again.

Larger nations who fought and/or otherwise participated in World War II do have the means to identify, develop a risk-based matrix, and mitigate the known threats. Most nations lack the resources to clean up every single wreck in a short amount of time due to fiscal constraints, condition of the vessel, location of the vessel, vessel cargo and munitions, and technological resources. However, work can begin on those wrecks deemed most likely to immediately spill and/or cause grave harm to the environment and local citizens.

Coastal nations need to take a proactive approach, regardless of the nationality of the vessels within their waters. Unfortunately, many nations, especially the small island nations of the South Pacific, do not have the necessary funding or technology to conduct these assessments. The Flag State nations must intercede on behalf of the potentially affected Coastal States and conduct a thorough and proper cleanup.

When an oil spill event occurs from a sunken wreck, it is usually handled on an ad-hoc reactive basis to solve the immediate pollution threat. Difficult issues such as jurisdiction, national sovereignty, political sensitivity,

and legal responsibility can stand in the way of a timely response to a spill (Monfils 2005).

It must also be recognized that most World War II sunken shipwrecks have:

- Suffered over sixty years of continual deterioration under water;
- Been weakened by the initial accident, fire, or explosion that caused the vessel to sink;
- Been crushed and deformed by the enormous forces of the sea, if sunk in deep water;
- Either served in combat or suffered prior wear and tear prior in merchant service;
- Settled over time into bottom sediments and will continue to do so, placing different structural stresses and strains on the vessel;
- Suffered the impacts of storms, typhoons, and ocean currents over many decades;
- Suffered slow and variable degradation of the metal structure due to general metal wasting from oxidation (rust) and electrochemical reactions;
- Suffered the loss of strength of fasteners throughout the vessel superstructure and pipe-work, causing possible internal and external leaks of oil (Monfils 2005).

This paper has detailed the extent of 7,216 World War II sunken vessels around the world's oceans by combining the SPREP database with the new AMIO database. The worldwide total tonnage of sunken World War II vessels amounts to just over 34 million tons of shipping, with about 20 million in the AMIO and 13 million in the SPREP databases. A large number of the vessels were sunk in the Atlantic Ocean, which currently hosts over 3,200 vessels and over 16 million tons. The SPREP database indicates that the Pacific Ocean hosts over 3,319 vessels, with a lower total tonnage of over 13 million tons. In total, there are 861 sunken World War II tankers and oilers on the bottom of the world's oceans (529 listed in AMIO and 332 in SPREP databases).

The following bar graph (see fig. 12) was developed utilizing the Risk Matrix of the draft Annex of this paper. Vessels analyzed include all vessels mentioned in this paper, the heavily studied battleship USS *Arizona*, as well as a standard cargo ship sunk in the North Atlantic for comparison's sake. It is interesting to note how a small submarine, the *U-864*, can score almost as high as the USS *Arizona*, mainly due to the extremely hazardous cargo carried by the submarine. Those vessels that scored 60 or higher would be considered "high risk," while those scoring between 25 and 59 are considered to be "medium risk." Those below 25 are deemed to be "low risk." Vessels with war graves do not warrant additional risk factors however

the issue must be taken into account on how to proceed with a response/mitigation.

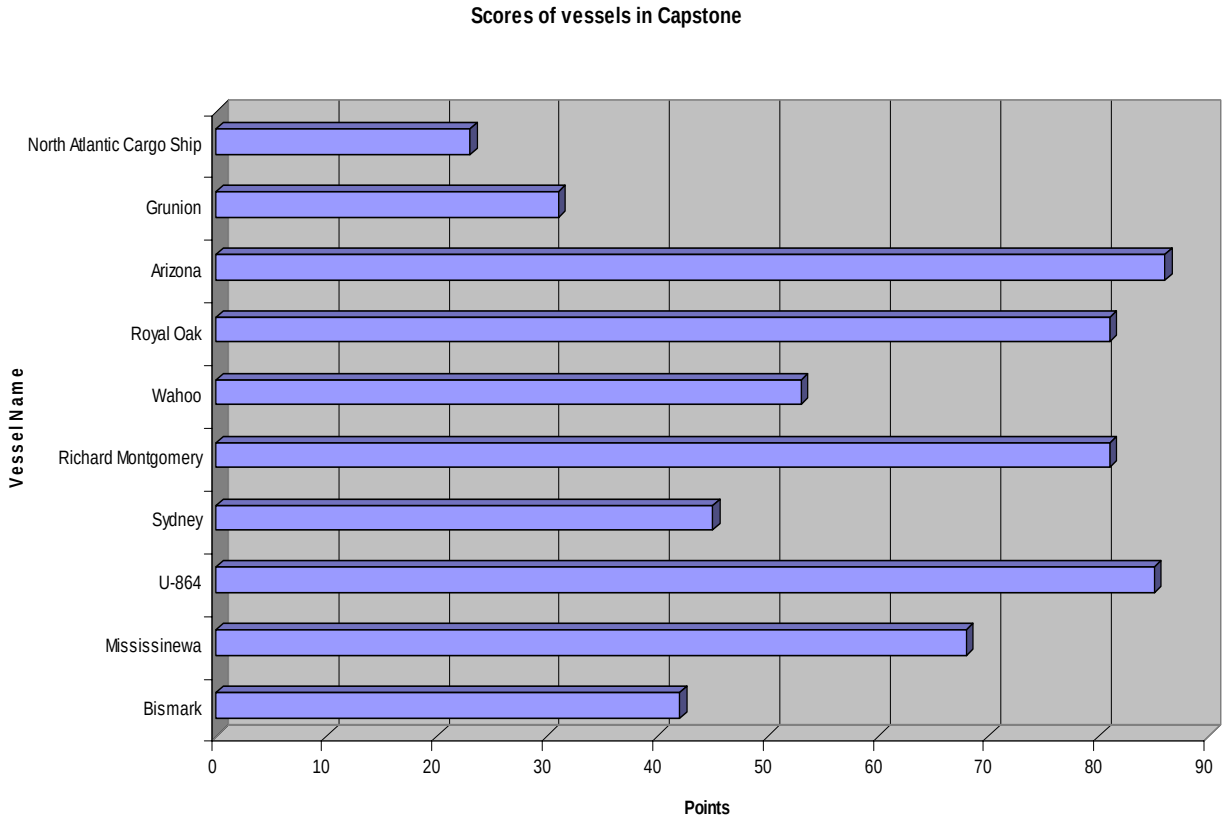

Figure 12. Scores of vessels using attached Risk-Assessment Matrix discussed in Capstone.

Even with state-of-the-art technology and advanced capabilities, such as dynamically positioned project vessels, remote operating vehicles, increased diving capabilities, hot tapping, greatly expanded oil pollution response capabilities, side-scan sonar, GPS, and the increased professional salvage community's abilities, the World War II wreck issue is not one of technology, but a failure on the part of the Flag States to accept that these vessels could and do pose a threat to the marine environment (Monfils 2005; Witte 2004, 12–14).

Rean Monfils of Sea Australia stated, "Complex maritime jurisdictional issues, along with overlapping claims on Economic Exclusion Zones and the interrelationships of the marine environments in the region, also underscore the need to address the potential pollution risk from WW II shipwrecks…multilaterally, rather than unilaterally" (Monfils et al. 2006). Only through comprehensive dialogue amongst stakeholders will positive action be taken to address the issue of World War II wrecks. It is not a question of *if* the vessels will pollute, but *when* they will pollute. The bomb is ticking…

CONCLUSIONS AND RECOMMENDATIONS

World War II wrecks are causing (or will cause unless successfully mitigated) harm to the marine environment. With all the damage or potential damage these vessels can and will cause, it is incomprehensible that the international community and the International Maritime Organization have not addressed the issue of World War II wrecks. The Wreck Removal Convention is a good start but only encompasses current wrecks of commercial vessels. Additional guidance is needed. The following is a proposal for an Annex to the Wreck Removal Convention to address the needs identified in this study. This Annex mirrors the format of other Annexes in the various conventions under the International Maritime Organization.

Annex 1

AMENDMENTS TO THE GUIDELINES FOR THE

WRECK REMOVAL CONVENTION

THE MARINE ENVIRONMENTAL PROTECTION COMMITTEE,

RECALLING the Wreck Removal Convention (WRC) and the Convention of the Protection of the Underwater Cultural Heritage.

NOTING that Wreck Removal Convention Regulation, Article 4, paragraph 2, and Article 1, "definitions," ignore sunken warships as defined by the United Nations Convention of the Law of the Sea,

RECOGNIZING the need for an Annex to the Wreck Removal Convention for the development of methodology for managing World War II wrecks,

HAVING CONSIDERED the below mentioned Annex for the development of a plan to manage sunken World War II wrecks,

ADOPTS the Annex to the Wreck Removal Convention for the development of a plan to manage sunken World War II wrecks,

URGES Governments to ensure this plan is developed in accordance with the Wreck Removal Convention and these Guidelines in the below Annex, pending its entry into force.

ANNEX to Include Sunken Naval Wrecks to the Requirements of the Wreck Removal Convention

Rule 1. Actions taken against sunken Flag State vessels may only be undertaken with the consent of the respective Flag State, as per customary international law, precedents under international law, and the United Nations Convention of the Law of the Sea. The Flag State must be a partner in all accords and agreements (South Pacific Regional Environment Programme 2002).

Rule 2. Flag State nations from World War II will jointly develop a database of all vessels known to be sunk (by military action, collision, grounding, weather, or other means). Governmental and/or known archives will then be used to determine the maximum amount of fuel, ammunition, and cargo (if warranted) on board each vessel at the time of sinking. Statistical estimations developed by the governing body of the Marine Environmental Protection Committee will be used for those vessels that sunk without full fuel, ammunition, and/or cargo loads. Furthermore, an estimation process

developed by the governing body of the Marine Environmental Protection Committee will be used to determine the approximate amount of fuel oil lost due to enemy action, sinking, seepage, and the effects of hull degradation over more than sixty years of being in the marine environment.

Rule 3. This database will then be used to assist in determining the exact location of each vessel. Governmental and private databases of known vessel locations will be used. Approximate vessel locations will be noted for those vessels where information is unknown and updated as future information is discovered. Wreck locations will then be overlaid on a geographical information system map and made available to all International Maritime Organization signatories. Flag States and Coastal States will cooperate to determine the viability of publishing the known vessel locations. The International Maritime Organization recognizes the economic advantages to Coastal States of allowing recreational divers to dive on World War II vessels in known locations. However, if the threat of illegal salvage or tampering with a war grave (marine grave) is high, the Flag State and/or Coastal State may elect to withhold publication of exact coordinates. Complete coordination and cooperation between Flag States and Coastal States is paramount and expected.

Rule 4. A preliminary site assessment and environmental impact assessment will be conducted on each known vessel by the respective Flag State. A risk analysis matrix will be used (see Table 5) to categorize the potential

environmental risk of each vessel. Categories (in no particular order) may include:

- Type of vessel
- Approximate amount of fuel oil/lube oil/gasoline on board
- Depth of sunken vessel
- Proximity to shoreline, reef systems, coastal waters, territorial seas, and Exclusive Economic Zones
- Past pollution incidents with vessel
- Proximity to shipping lanes, navigation channels, known fishing areas
- Amount of ammunition on board and type
- Other known/unknown hazardous cargoes/materials
- Average air and water temperatures
- Current condition of the vessel (upright, broken in two, et cetera)
- Possible inclusion of the vessel under the Convention on the Protection of the Underwater Cultural Heritage, once the vessel has been underwater for 100 years
- Number of known/estimated sailors/passengers that went down with the vessel

Categories will be labeled as High Risk, Medium Risk, and Low Risk to the marine environment. An overall risk factor will be achieved by this assessment. High-risk vessels will require the removal of oils or the salvage

of the vessel. Medium-risk vessels will focus on minimizing the impact to the environment through such methods as plugging vents and cracks or isolating the threat. Low-risk vessels pose no immediate risk, but are subject to monitoring (South Pacific Regional Environment Programme 2002).

Rule 5. Due to the age of the World War II naval wrecks, Flag States must conduct site visits and environmental impact assessments within 10 years of the date of adoption of this Annex.

Rule 6. Vessels causing an immediate threat to the environment through the spillage of oil or other major threat or actual harm to the environment must have contingency operations in place by the Flag State within two weeks of notification by the affected Coastal State. High-risk, non-polluting vessels must be mitigated to medium risk within two years of adoption of this Annex. Medium-risk vessels must be mitigated to low-risk within five years of adoption of this Annex.

Rule 7. Flag States are responsible for the cost of the site and environmental impact assessment, monitoring, response operations, salvage, or other mitigation factors deemed necessary and prudent to lowering the risk threshold of each Flag State vessel.

Rule 8. Affected Coastal States may appeal to the governing body of the International Maritime Organization for resolution if the Flag State fails to respond to notification of a pollution event by a known vessel. The Coastal State may then take action necessary to mitigate the threat until such time

as the Flag State properly responds. The Coastal State must take into account the potential status of each vessel as a war grave (marine grave) and must take all steps necessary not to desecrate the gravesites. The Flag State must make reparations to the Coastal State for the cost of mitigation of the pollution event within six months of the action being taken. If the Flag State is unable to make reparations, the Coastal State may, upon review of the case, impose sanctions for non-payment with the backing of the International Maritime Organization and the United Nations. These sanctions shall be adequate in severity to be effective in securing compliance with this Annex and to discourage future violations wherever they occur. State Parties shall cooperate to ensure enforcement of sanctions imposed under this Rule (United Nations Educational, Scientific and Cultural Organization 2001).

Rule 9. An adequate site safety plan shall be developed to ensure the health and safety of the response teams, assessment teams, monitoring teams, and third parties that will conform to applicable Flag State and Coastal State statutory rules, laws, and regulations.

Rule 10. An adequate environmental policy shall be prepared to ensure the seabed and marine life are minimally disturbed and be in accordance with the Flag State and Coastal State statutory rules, laws, and regulations.

Rule 11. Interim reports are due to the International Maritime Organization and the affected Coastal States within six months of conducting the initial site visits. In addition, once vessels have a site and environmental impact

assessment completed, recurring reports shall be made to the International Maritime Organization and to the affected Coastal States on the following schedule:

- High Risk—Annually
- Medium Risk—Biannually
- Low-Risk—Quadrennially

If/when a vessel is completely free of oils, hazardous materials, and explosives, reports may be made every decade. Reports will consist of graphic and photographic documentation, side-scan sonar images, results of testing conducted on flora and fauna (if required), results of sediment testing, metallurgical testing, and any other reports, images, or information useful to determining the status of the vessel to the International Maritime Organization, the Flag State, and the Coastal State.

The forgoing is the authentic text of the Convention duly adopted by the General Conference of the International Maritime Organization during its_____session, which was held in _____and declared closed the _____day of Month/Year.

IN WITNESS WHEREOF we have appended our signatures this _____day of Month/Year.

The President of the General Conference The Director-General

City,

Legal adviser

International Maritime Organization

Done in _____this _____day of Month/Year in two authentic copies bearing the signature of the President of the _____session of the General Conference and of the Director-General of the International Maritime Organization, which shall be deposited in the archives of the International Maritime Organization and certified true copies of which shall be delivered to all the States and territories party to the International Maritime Organization as well as the United Nations (United Nations Educational, Scientific and Cultural Organization 2001).

Table 5. Wreck Removal Convention Annex 1 Risk Matrix Table

Threat	High 10 points	Medium 5 points	Low 1 point	Score
Type of Vessel	Battleships, Aircraft Carriers, Tankers	Cruisers, Destroyers, Submarines, Cargo	All other vessels less then 1,000 gross tons	
Approximate amount of fuel on board	3,000+ tons	100–3,000 tons	Less then 100 tons	
Depth of sunken vessel	Less then 30 meters	30–100 meters	100+ meters	
Proximity to shoreline, reefs, coastal waters	Less then 5 km	5–50 km	50+ km	
Within Coastal State EEZ	…	Yes	No	
Proximity to shipping lanes, navigation channels, fishing grounds	Less then 1 km	1–5 km	5+ km	
Amount and/or type of ammunition	150 mm + shells, torpedoes, depth charges, mines, aerial bombs, battleships, carriers, submarines, ammo ships	Up to 150 mm shells	Small arms/none	
Past pollution events	Yes	…	No	
Condition of vessel in current state	Broke in two, multiple large explosive holes	Vessel on side, one or more large explosion holes	Upright, intact vessel with minimal holes	
Possible inclusion to Underwater Cultural Heritage Convention	Yes	…	No	
Other cargoes/hazards/materials	…	Yes	No	
Threat	High 10 points	Medium 5 points	Low 1 point	Score

Risk=All threats added together for a max score of 100 and a minimum score of 10

High Risk: 60+

Medium Risk: 25-60

Low Risk: Less then 25

NB: Risk assessment table and ratings developed and applied by the author.

ABBREVIATIONS

EEZ	Exclusive Economic Zone
EPA	U.S. Environmental Protection Agency
GPS	Global Positioning System
HMAS	His/Her Majesty's Australian Ship
HMS	His/Her Majesty's Ship
IJN	Imperial Japanese Navy
IMO	International Maritime Organization
MARPOL	Marine Pollution
MCA	Maritime and Coastguard Agency
MMS	Minerals Management Service
NPS	National Park Service
NCA	Norwegian Coastal Administration (Kystverket)
NOAA	National Oceanic and Atmospheric Administration
SPREP	South Pacific Regional Environment Programme
SHIELDS	Sanctuaries Hazardous Incident Emergency Logistics Database System
SIDS	Small Island Developing States
SS	Steam Ship
SUPSALV	Supervisor of Salvage and Diving, USN
UNCLOS	United Nations Convention on the Law of the Sea
USACOE	United States Army Corps of Engineers

USCG	United States Coast Guard
USN	United States Navy
USS	United States Ship
WRC	Wreck Removal Convention

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