

# RESOURCES AND UNDERSEA THREATS (RUST) DATABASE: AN ASSESSMENT TOOL FOR IDENTIFYING AND EVALUATING SUBMERGED HAZARDS WITHIN THE NATIONAL MARINE SANCTUARIES<sup>1</sup>

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## ABSTRACT

*Recent incidents within our National Marine Sanctuaries and throughout our country have directed the National Oceanic and Atmospheric Administration to begin to look proactively at catastrophic oil and other chemical releases from submerged sources. Integrating data from several federal, state, and private sources, the Resources and UnderSea Threats (RUST) database was developed to inventory and determine through analysis the scope of this potential threat. Although this tool was developed initially for use by sanctuary resource protection managers, its application has applicability to the broader response community.*

## DISCUSSION

### Background

The National Marine Sanctuary Program serves as the trustee for a system of 14 underwater parks, encompassing more than 150,000 square miles of marine and Great Lakes waters. The sanctuary program is part of the National Oceanic and Atmospheric Administration, which manages sanctuaries by working cooperatively with the public to protect sanctuary responses while allowing compatible recreational and commercial activities. The system includes 13 national marine sanctuaries and the Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve, which is being considered for sanctuary status. The program works to enhance public awareness of our marine resources and maritime heritage through educational programs, outreach, monitoring, scientific research, and exploration. The Resource Protection Team within the National Marine Sanctuary System responds to incidents which have potentially significant impacts on sanctuary resources, and the uses of those resources such as the crash of Alaska Air # 261, and oil spills from the M/V *Cape Mohican* and SS *Jacob Luckenbach*. For every incident, field and headquarters Resource Protection staff are required to make decisions and recommendations in a compressed amount of time.

The incidents noted above, combined with heightened national security awareness, have highlighted the need for coordinated, multi-hazard contingency planning to safeguard the marine, historical, and cultural resources within the National Marine Sanctuaries. In response to that need, the National Marine Sanctuary Program (NMSP) and NOAA's Office of Response and Restoration's Hazardous Materials Division have developed the Sanctuaries Hazardous Incident Emergency Logistics Database System (SHIELDS).

SHIELDS is a comprehensive web-based tool for preparedness in planning and protecting the National Marine Sanctuary System. SHIELDS enables NOAA, its partner trustees, and other response agencies to plan and respond to incidents in the sanctuaries using one source that provides information on all relevant sanctuary resources and maritime uses. The web-based interface guides users through critical steps to identify information about resources at risk, additional threats, available response assets, notification contacts, maps, coastal observations systems, and jurisdictional information. The system can also be set up for offline use necessary for on-scene field deployment.

Some response events stem from incidents that occurred years previously. These underwater sources (vessels, pipelines, abandoned well heads, ammunition and chemical weapon dumpsites) may no longer have structural integrity and may be introducing pollutants into the marine environment at a slow and steady rate. Often this type of pollution is perceived as normal seepage or emanating from passing vessels, and often requires years of repeated sampling and assessment to narrow down potential sources of these threats.

### A Proactive Approach

Over 150,000 ships are reported lost in US waters (Figure 1). Many of these reported sinkings are both historical and cultural time capsules, and the majority does not present a risk to the environment or to human safety. Since the late 1800s, however many vessels carried cargos that do pose a threat. The inevitable release of a sunken vessel's cargo, either through a chronic low-

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level discharge as in the SS *Jacob Luckenbach*, or by catastrophic failure as in the USS *Mississinewa*, is only a matter of time.

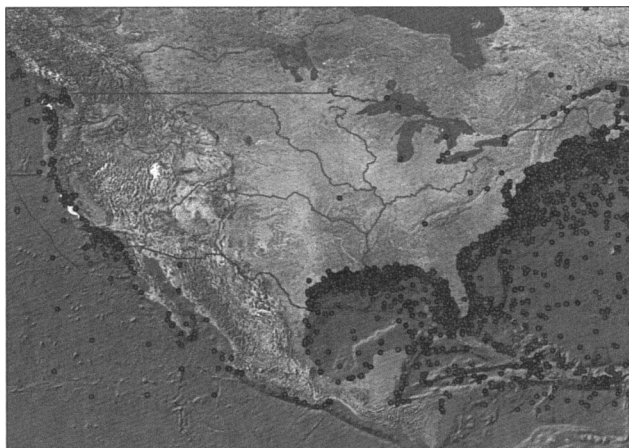


FIGURE 1. RUST DATA DISPLAYED IN ARCGIS

In an effort to take a proactive approach in identifying potential risks before an incident occurs within the sanctuaries, NOAA decided a national database of possible threats to be established, focusing specifically on those issues of concern to both federal and state resource protection personnel. Using this approach sites can be considered for direct intervention such as the removal of the threat sources, isolation of the threat, and management plan development or establishment of a monitoring protocol for the site.

Although oil release from World War I and World War II era vessels pose a concern to the NMSP Resource Protection Team, there are other hazards of concern as well. In the spring of 2004, for example, discarded naval ammunition from an offshore disposal site found itself underneath a fuel dock on the California coast. A century of open ocean dumping has left us with a legacy of chemical and conventional weapon, and nuclear waste dump sites, to name a few, that time has forgotten, but whose contents may contain additional threats to our ocean systems. Abandoned and exploratory wells are also part of our past and are themselves beginning to show signs of structural failure. As each year passes since the sinking of vessels and other steel structures and containers, the environment acts to further deteriorate them and increases the risk of a significant release of oil and other chemicals. One of the tools being incorporated into SHIELDS to address this situation is the Resources and UnderSea Threats (RUST) Database.

#### Development of the Database

As one of the first steps in discovering the point source of years worth of beach and bird oiling on the central California coast, a regional database search was conducted, using multiple database sources, to narrow down a list of potential contributors to the continued spills. It was through this successful query that a list of potential point source targets was identified. Through investigative techniques and oil 'fingerprint' analysis, the SS *Jacob Luckenbach* (Figure 2) was identified as the decade-long oil release point source. RUST builds upon the strategy used in identifying the point source through regional database analysis and expands the strategy to a national level.

The database development team was tasked to create a database that would establish a national database of undersea threats through a collation of existing historical databases and identification of data gaps (location, cargo contents, vessel types), and, through the database, determine what the likely impacts are to the surrounding Environment. In addition, should a historically or



FIGURE 2. MULTI BEAM IMAGE OF SS *JACOB LUCKENBACH*, RESPONSIBLE FOR MYSTERY OIL SPILL FOR OVER 50 YEARS (USCG, 2002)

archaeologically significant site be identified within the database, identify the outside influences that may pose a threat to the site.

The mission of the RUST database is to develop, maintain, and manage an active and comprehensive inventory of undersea threats and potential environmental hazards within United States waters. RUST assists NOAA and other trustees to locate and identify potential hazards and develop resource protection strategies improving emergency preparedness and contingency planning for America's coastal and maritime resources. RUST also serves as a repository for new assessment data as it is obtained. RUST focuses specifically on locating and identifying those underwater threats that may be pollution hazards such as abandoned wellheads, pipelines, platforms, and sunken tankers. Also, the database includes other hazards such as explosive ordnance, Atomic Energy Commission (AEC) and chemical weapon dumpsites, along with sites requiring protection of historical and cultural importance. The scope of RUST data collected extends from the coastline of the United States to the outer continental shelf.

#### Database Structure

The RUST database is a Sequel Server relational database designed by NOAA's National Marine Sanctuary Program and Special Projects Office, and is housed in a secure server maintained by the Information Management Division at NOAA headquarters in Silver Spring, Maryland. Fourteen tables have been built into the database with over 150 fields being populated for each record. This information includes, but is not limited to: positioning, ship typology, date of loss, cargo, amount of oil or fuel remaining, contact information, bottom type, site proximity to sanctuaries, and the inherent risks associated with the record. Each record has the capacity to store images, PDF files for Hazardous Materials Data Sheets, and other record source information.

RUST is comprised of federal, state, and private databases from around the United States. These databases are currently being identified, acquired, analyzed and incorporated into the RUST database. Each data set is compared to all the others; duplicate records are eliminated, while still retaining attributes unique to the individual data sets. The RUST database contains only select fields from the original databases found to be compatible with the mission of RUST. Initial database fields populated represent only 20% of the data that can be held for each record within the database; archival research combined with field investigation will result in an accurate and up-to-date representation of each individual record. RUST contains over 20,000 records currently, though will exceed 40,000 records by 2005.

Each record is given position coordinates in decimal degrees based upon its known or reported location, along with position quality / accuracy information associated with the coordinates assigned. This allows the data to be displayed in GIS for visual interpretation, evaluation, spatial analysis, and for the data to be queried through any GIS software application in either vector or

raster formats. Information regarding the proximity of a site to large population centers, maritime borders, ports, and coastal approaches are but a few areas that may be viewed. The database was designed with the capacity to expand into a geospatial database, increasing its functionality in GIS applications.

Initial analysis of the records concentrate on those sites with the best-known position quality and accuracy. Records with low or poor position quality / accuracy information will be subjected to other analytical tools (i.e. multi-beam surveys, magnetic anomaly maps, and other remote sensing applications) in an attempt to locate and identify, with a more precise degree of accuracy, 'targets' for further investigation. The site-specific information within each record includes depth associated with each record allowing for the plotting of potential 'targets' in 3-D applications.

### Data Security

The RUST database is held behind a secure firewall and is accessible only through NOAA's internal network by administratively controlled passwords, and only available to designated user through NOAA's intranet system. Prior to users being assigned a password to the database, they must sign a non-disclosure agreement to protect sites of historical and cultural significance. Each user is then assigned specific tables and fields, based on their needs, to view and access. The NMSP realizes that sensitive information contained within the databases acquired for this project needs to be protected. Addressing this concern, the NMSP has developed a non-disclosure statement representing our commitment to protecting sensitive historic properties contained in those databases.

### Risk Assessment

Hard lessons learned in the decade-long oiling of shoreline and seabirds along the California coast, finally attributed to the SS *Jacob Luckenbach* in 2002, and concerns about other casualties such as the *Puerto Rican*, *Montebello* and the recent *Bow Mariner* (Figure 3) sinking, prompted NOAA's National Marine Sanctuary Program to initiate a risk assessment of these undersea threats within the RUST database.

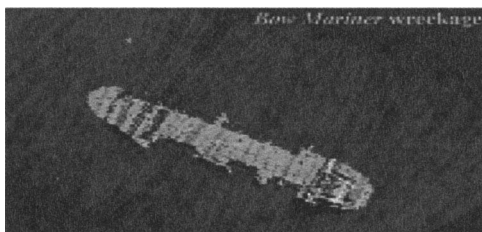


FIGURE 3. MULTI-BEAM IMAGE OF *BOW MARINER* (NOAA, 2004)

The RUST database, through the synthesis of the databases collected, provides its users with vulnerability assessment of undersea threats and presents a better picture of those threats currently lying within United States waters. One of the key components of the database is the Risk Assessment query. This query provides a baseline risk value for each record within the database and allows for a comparison of different site types. The assessment will allow Resource Protection staff members throughout the United States to determine the best method to approach each site. Pre-selected fields within each record (i.e. structural remains, position accuracy, fuel remaining, cargo type, its potential threat to pollution, navigation, human safety) have been selected to receive a numeric expression based on a pre-determined algorithm. Although subjective in nature, this will produce a base risk level

assessment for each record within the database. The risk value algorithm and numeric values may be changed for each record and fields to reflect new situations or better data acquisition.

Based on the initial data capture and assessment, the RUST database may be queried in a variety of ways. Two pre-set queries have been incorporated into the database. The Risk Assessment Query generates a regional report of threats identified within either a general or specific geographical area. The reports include information on the immediacy of the threats, geographic latitude/longitude/depth, type of threat, and source information. A more site-specific 'target' analysis can be performed on any individual record, and the report will include the above information in addition to site plans, schematics, and brief history of the target.

### Assessment Field Work

There are several fields within the risk value assessment that need additional research and first-hand knowledge. Assessment of ferrous-hulled submerged vessels generally occurs after an oil release has taken place continuing a "reactive" strategy to oil spill response. Analysis usually consists of identifying areas of the vessel that are leaking, attempting to patch the vessel, or remove the oil. A "preventative" approach to submerged vessels' potential to release oil, allowing for mitigation or salvage of the oil prior to release, will result in an active response strategy, but it is first necessary to understand elements critical in conducting vessel damage assessment.

The RUST marine archaeologist participated in a study of six steel-hulled vessels in 2004. The joint NOAA Office of Ocean Exploration and Department of the Interior's Minerals Management Service investigated six shipwrecks in the Gulf of Mexico sunk by German U-boats during World War II. The primary goal of the study was to assess the wrecks archaeologically and determine how the environment is affecting their degradation, and how these wrecks are affecting the environment. The RUST archaeologist focused on a *Corrosion Study of Deep Gulf Shipwrecks of World War II* and evaluated the present condition of the seven steel-hulled shipwrecks. Vessels analysis included:

- visual assessment of the areas of corrosion present at each site.
- documentation of environmental conditions affecting the wreck sites
- visual assessment of vessels' structural integrity
- determination of site formation characteristics unique to each site

The underwater evaluation allows the RUST project to update the current sites' conditions, provide valuable structural information on a variety of vessel types, and apply the knowledge gained from this project to other vessels in similar site conditions, that may present a threat within or in close proximity to national marine sanctuaries.

The 2004 field project also added valuable assessment data on ferrous-hulled vessels, contributed to the field of underwater research, allowed interpretation and peer review of the results, and provided baseline data to examine long-term protection strategies for national marine sanctuaries currently threatened by shipwrecks containing oil within or in close proximity to their boundaries.

### RUST Database Not Restricted to Sanctuaries Alone

NMSP Resource Protection Team, using data collected in RUST, has assisted in recent incidents off the New Jersey and Virginia coasts. An unidentified source of heavy oil washed up on the New Jersey shore Tuesday February 3, 2004 between Shark River Inlet, Monmouth County, and Seaside Heights, Ocean County. The spill spanned a 12-mile stretch of shoreline. Reported were "Tar Balls" and "Tar Patties" that ranged from 1/4-inch to 12 inches in

diameter, very light and sporadic, consistent with a low impact spill. Numerous over flights by Coast Guard Air Station Atlantic City, New Jersey State Police, and Monmouth County Sheriff Shade Tree Commission over several days reported no sign of oil sheen on the water.

Using information from the RUST database, several underwater wrecks were identified, analyzed, and suggested as possible point sources of the oil leak. The list of suspected vessels were passed onto US Coast Guard Marine Safety Office Group Philadelphia for further investigation. Oil samples recovered are currently being tested to determine type and age, and modeling of the oil release may further assist in the identification of the source.

Within hours of notification of the explosion and subsequent sinking of the *M/V Bow Mariner*, NMSP RPT was able to identify numerous RUST sites within a 50-mile radius of the tankers' submerged position. This data was provided to first responders and identified areas to be avoided should a salvage operation commence. The Resources and UnderSea Threats project is also currently working with the State of California's Office of Spill Prevention and Response in identifying and evaluating vessels thought to contain large quantities of fuel oil, building upon the assessment studies conducted during summer 2004.

## CONCLUSION

The scope of RUST data collected extends from the coastline of the United States to the outer continental shelf. RUST is used to inventory, assess and provide resource managers and responders with the necessary information to assess risk, and to plan and respond to a variety of submerged releases. It also allows NOAA to safeguard the marine, historical, and cultural resources of the United States that have significant value beyond the potential hazardous cargo or fuel they may contain.

Development of the RUST database is currently a "work in progress", focusing on the acquisition of federal, state, and private data sources. The database is being populated on a regional basis starting on the West Coast and moving into the Gulf of Mexico, Atlantic, and Great Lakes. Initial population of the RUST database for all US waters will occur by 2006. Additionally, the NMSP intends to share information with the appropriate governmental agencies for the protection of our nations security.

## BIOGRAPHY

Michael Overfield is a Marine Archaeologist working for NOAA's National Marine Sanctuary Program on the Resources and Undersea Threats database. Michael received his BA in Archaeology from California State University, Hayward and an MA in Maritime History and Nautical Archaeology from East Carolina University.