Thunder Bay National Marine Sanctuary

Draft Environmental Impact Statement: Boundary Expansion

June 2013
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service
Office of National Marine Sanctuaries

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
PROGRAM PLANNING AND INTEGRATION
Silver Spring, Maryland 20910

JUN 6 2013

Dear Reviewer:

In accordance with provisions of the National Environmental Policy Act (NEPA), we enclose for your review the National Oceanic and Atmospheric Administration (NOAA), Office of National Marine Sanctuaries, Draft Environmental Impact Statement (DEIS) for the Boundary Expansion of Thunder Bay National Marine Sanctuary (TBNMS or sanctuary).

This DEIS is prepared pursuant to the requirements of the National Marine Sanctuaries Act (NMSA) and NEPA to assess the environmental impacts associated with NOAA developing revised regulations for the TBNMS to expand the boundary of the sanctuary. Sanctuary expansion would require changes to the boundary description in the terms of designation for the sanctuary. The NMSA requires that an EIS be prepared for changes to terms of designation, regardless of the significance of the impacts of the proposed action. The notice of proposed rulemaking proposes new regulations and the text for the revised terms of designation and announces the availability of the DEIS.

Written comments will be accepted until August 14, 2013, and should be directed to the sanctuary official identified below.

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Sincerely,

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NOAA NEPA Coordinator

Enclosure

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About this Document

This draft environmental impact statement (DEIS) provides detailed information and analysis of a range of reasonable alternatives for a boundary expansion in the Thunder Bay National Marine Sanctuary, including location and regulation of various human uses in that area.

The National Oceanic and Atmospheric Administration (NOAA) prepared this DEIS in accordance with the National Environmental Policy Act of 1969 (NEPA; 42 USC §4321 *et seq*.) as implemented by the Council on Environmental Quality regulations (40 CFR Parts 1500-1508), and NOAA Administrative Order (NAO) 216-6, which describes NOAA policies, requirements, and procedures for implementing NEPA.

Accordingly, this document was preceded by a Notice of Intent to prepare a DEIS and carry out a public scoping process (77 FR 21878; April 12, 2012) . The public scoping period commenced in April and ended on May 25, 2012, during which time public hearings were held and NOAA received both written and oral comments on the concept of expanding the boundaries in the sanctuary. NOAA is the lead agency for this action. NOAA's Office of National Marine Sanctuaries (ONMS) is the implementing office for this action.

Recommended Citation:
Office of National Marine Sanctuaries. 2013. Thunder Bay National Marine Sanctuary Draft Environmental Impact Statement. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD.

Acknowledgements

This document was prepared by several staff members of NOAA's Thunder Bay National Marine Sanctuary, including Superintendent Jeff Gray, Deputy Superintendent Russ Green, and Education Coordinator Sarah Waters. Significant assistance also came from Northeast and Great Lakes Regional Coordinator Ellen Brody and Office of National Marine Sanctuaries Program Analyst Helene Scalliet. The proposal for an expanded Thunder Bay National Marine Sanctuary was developed over many years by the Thunder Bay National Marine Sanctuary Advisory Council. This dedicated group consisted of representatives of divers, fishermen, educators, tourism, economic development, and local elected officials (http://thunderbay.noaa.gov/management/advisory_council.html).

Acronyms

DEIS – Draft Environmental Impact Statement
FEIS – Final Environmental Impact Statement
MOA – Memorandum of Agreement
MPA – Marine Protected Area
NAO - NOAA Administrative Order
NEPA – National Environmental Policy Act
NMSA – National Marine Sanctuaries Act
NMSS – National Marine Sanctuary System
NOAA – National Oceanic and Atmospheric Administration
NOS – National Ocean Service
OLE – NOAA Office of Law Enforcement
ONMS – Office of National Marine Sanctuaries
TBNMS – Thunder Bay National Marine Sanctuary
TBNMSAC – Thunder Bay National Marine Sanctuary Advisory Council

Executive Summary

Thunder Bay National Marine Sanctuary

Located in northwestern Lake Huron, Thunder Bay is adjacent to one of the most treacherous stretches of water within the Great Lakes system. Unpredictable weather, murky fog banks, sudden gales, and rocky shoals earned the area the name "Shipwreck Alley". Fire, ice, collisions, and storms have claimed nearly 200 vessels in and around Thunder Bay. Today, the 448-square-mile Thunder Bay National Marine Sanctuary (TBNMS) protects one of America's best-preserved and nationally-significant collections of shipwrecks. To date, 45 historic shipwrecks have been discovered within the sanctuary. Although the sheer number of historic shipwrecks is impressive, it is the range of vessel types located in the sanctuary, their excellent state of preservation and accessibility to the public that makes the collection nationally significant. From an 1844 sidewheel steamer to a modern 500-foot-long German freighter, the shipwrecks of Thunder Bay represent a microcosm of maritime commerce and travel on the Great Lakes. Well preserved by Lake Huron's cold, fresh water, the shipwrecks and related maritime heritage sites in and around Thunder Bay are historically, archaeologically and recreationally significant.

NOAA designated the area (Figure 1) as a national marine sanctuary in 2000. The sanctuary is managed jointly by the National Oceanic and Atmospheric Administration (NOAA) and the State of Michigan. A description of the sanctuary and its resources can be found in section III (Affected Environment).

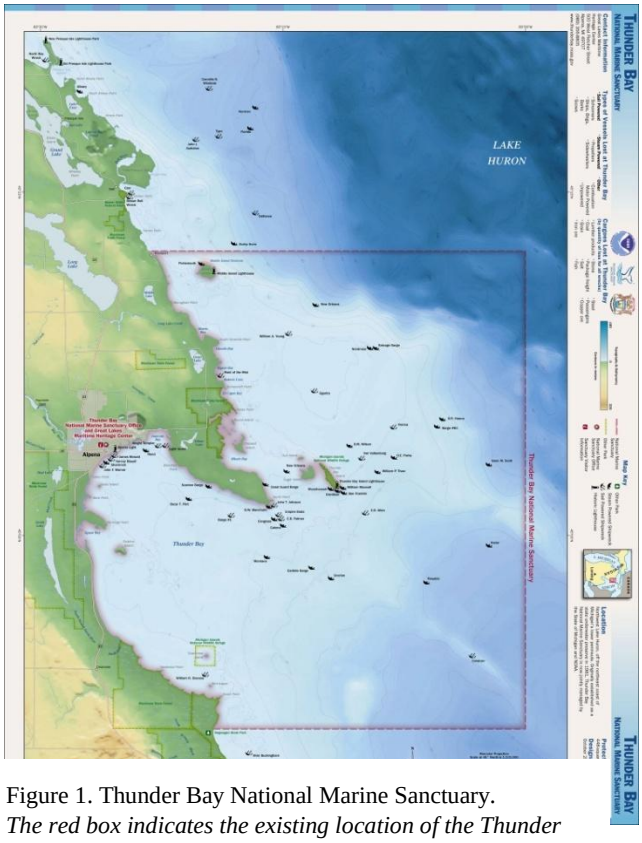

Figure 1. Thunder Bay National Marine Sanctuary.
The red box indicates the existing location of the Thunder Bay National Marine Sanctuary

NOAA is proposing to expand the boundaries of TBNMS. The three boundary alternatives are: (1) the existing boundary which is 448 square miles (the no-action alternative), (2) 880 square miles (Sturgeon Point Lighthouse to Presque Isle Lighthouse to 83 degrees W, and (3) 4,300 square miles (the preferred alternative).

Currently, the sanctuary's northern and southern boundaries are defined by the lakeward extension of the respective Alpena Country borders while its eastern boundary is longitude 83° degrees west (approximately 20 shipwrecks are in this area. Archival research indicates that as many as 40 additional historic

The genesis of the proposed expansion can be found in the Sanctuary's final management plan (2009), which explains how a Thunder Bay National Marine Sanctuary Advisory Council (TBNMSAC or Advisory Council) working group recommended that the sanctuary expand its boundaries to protect historic shipwrecks and other maritime heritage resources in waters adjacent to the existing sanctuary. The working group determined that expanding sanctuary boundaries would help balance protection of important national historic sites through the sanctuary's well-established research, resource protection (including law enforcement), and education programs with recreational use. The working group presented this recommendation to the full Sanctuary Advisory Council, which approved the recommendation and then forwarded it to the sanctuary superintendent.

Based on the Advisory Council's recommendation, research by sanctuary staff, and strong public support and comment during public meetings preceding this proposal, NOAA's preferred alternative is the expansion of the existing boundaries from 448 square miles to an area that encompasses 4,300 square miles of waters adjacent to Alcona, Alpena and Presque Isle counties, selected submerged maritime heritage resources in Cheboygan and Mackinaw counties, and extending lakeward to the Canadian boundary: http://thunderbay.noaa.gov/management/boundarycom.html).

Expanding the boundaries in NOAA's preferred alternative would add 47 known historic shipwrecks to the sanctuary. Among them are some of the Great Lakes' best preserved and recreationally significant shipwrecks. Archival research indicates that as many as 60 additional historic shipwrecks could be discovered in this proposed expanded area. Consequently, NOAA's preferred alternative would result in a 4,300-square-mile sanctuary (including the existing sanctuary) containing 92 known historic shipwrecks and the potential to discover as many as 100 additional sites (see Table 1).

Table 1: Summary of known and suspected shipwrecks in each boundary alternative

	Total Area of Sanctuary (sq. mi.)	**Known shipwrecks**	**Suspected shipwrecks**
Alternative A (No Action, retain current boundary)	**448**	**45**	**40***
Alternative B (Presque Isle Lighthouse to Sturgeon Point Lighthouse)	**808**	**60** (adds 15 sites to existing sanctuary)	**64*** (adds 24 suspected shipwrecks)
Alternative C (NOAA's Preferred Alternative)	**4,300**	**92** (adds 47 sites to existing sanctuary)	**100*** (adds 60 suspected shipwrecks)

*Approximate locations of undiscovered shipwrecks are based upon historic records.

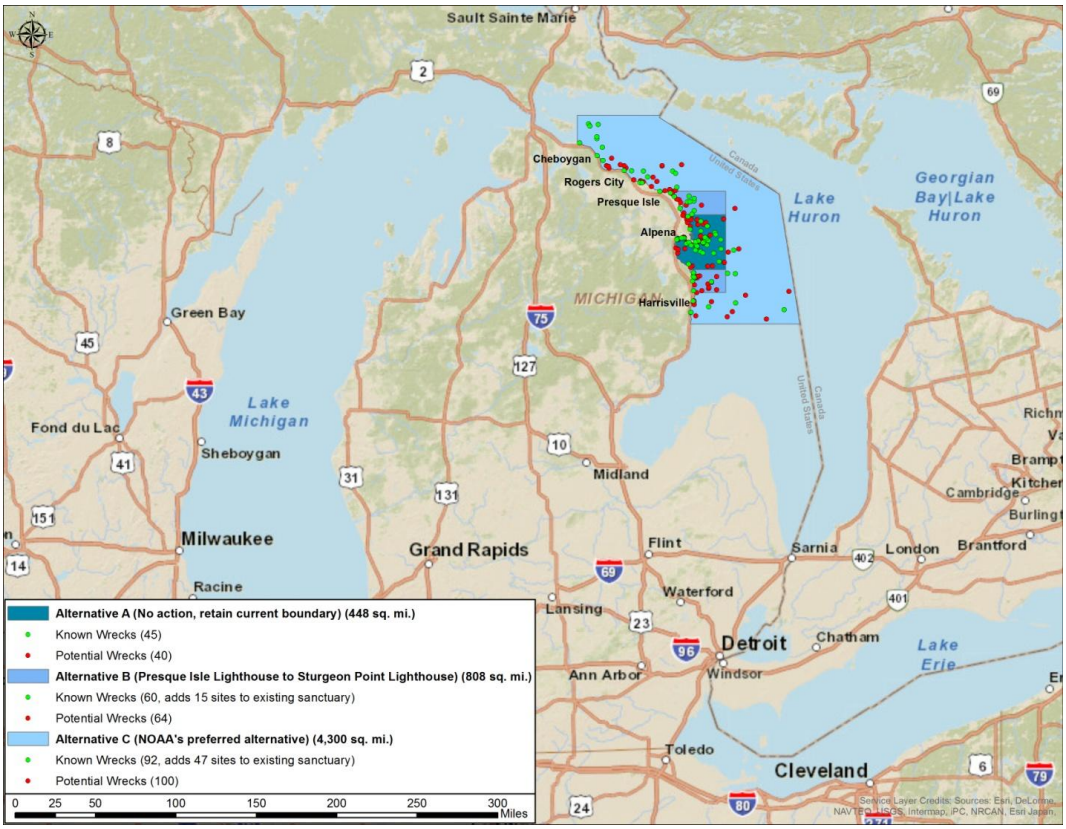

Figure 2: TBNMS boundary expansion alternatives in a regional context
Green dots represent known shipwrecks, red dots are potential shipwrecks (locations based on historical records).

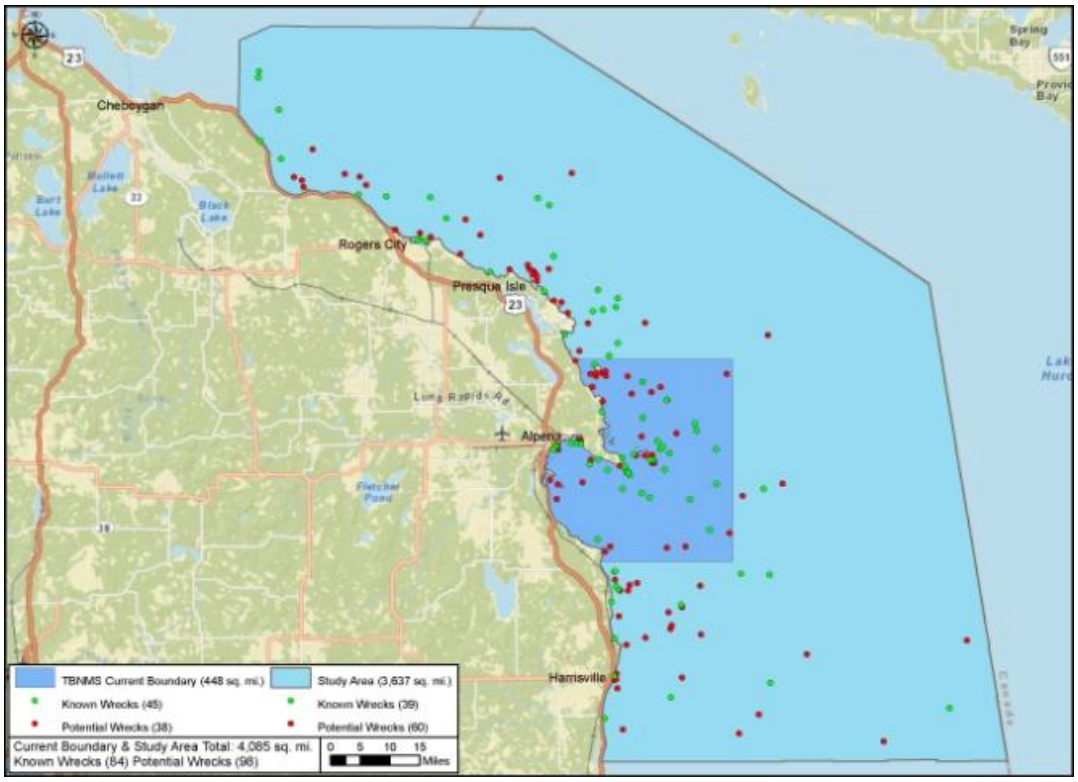

Figure 3: TBNMS boundary expansion alternatives in a regional context
Green dots represent known shipwrecks, red dots are potential shipwrecks (locations based on historical records).

Section I provides background on the National Marine Sanctuary System, Section II states the purpose and need for action, and Section III describes the Affected Environment.

Section IV (The Description of Proposed Action and Alternatives) provides a description of a range of alternatives. In addition to the preferred alternative, NOAA is evaluating an alternative that is smaller in area yet designed to address key heritage resources that lie beyond the existing sanctuary boundaries. NOAA is also evaluating the status quo in a no-action alternative.

Section V (Environmental Consequences) provides an analysis of the potential environmental impacts for each alternative. No significant adverse impacts to resources and the human environment are expected. Rather, long-term beneficial impacts are anticipated if the proposed action is implemented. Under NEPA (42 U.S.C. 4321 *et seq.*), an environmental assessment would have sufficed to analyze the impacts of this action since NOAA is proposing that no significant impacts are likely. However, the NMSA requires NOAA to publish a draft environmental impact statement regardless of the intensity of the impacts of the proposed action if NOAA is considering changing the terms of designation of a sanctuary (16 U.S.C. 1434).

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I. Background

This section places the proposed action into the context of the mission of Office of National Marine Sanctuaries (ONMS) and Thunder Bay National Marine Sanctuary (TBNMS) through the provisions of the National Marine Sanctuaries Act (NMSA).

The National Marine Sanctuaries Act

The NMSA (16 U.S.C. 1431 et. seq.) is the organic legislation governing ONMS (http://sanctuaries.noaa.gov/library/national/nmsa.pdf). The NMSA authorizes the Secretary of Commerce to designate as a national marine sanctuary any discrete area of the marine environment (including the Great Lakes) with special national significance due to its conservation, recreational, ecological, historical, scientific, cultural, archeological, educational or esthetic qualities. Among the purposes and policies of the NMSA are the mandates to:

- Enhance public awareness, understanding, appreciation and wise and sustainable use of the marine environment, and the natural, historical, cultural, and archeological resources of the National Marine Sanctuary System (NMSS; 16 U.S.C. 1431 (b)(4)).
- Support, promote, and coordinate scientific research on, and long-term monitoring of, the resources of these marine areas (16 U.S.C. 1431 (b)(5)).

The designation of the Thunder Bay National Marine Sanctuary directly follows these directives from the NMSA.

Office of National Marine Sanctuaries

ONMS is the federal program within the National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS) charged with managing national marine sanctuaries as the NMSS. The mission of ONMS is to identify, designate, protect, restore, and manage areas of the marine environment of special national significance due to their conservation, recreational, ecological, historical, scientific, educational, cultural, archeological, or esthetic resources and qualities. The ONMS serves as the trustee for a system of 14 marine protected areas encompassing more than 170,000 square miles of ocean and Great Lakes waters from Washington State to the Florida Keys and from New England to American Samoa (Figure 4). Within their protected waters, giant whales feed, breed and nurse their young, coral colonies flourish, and shipwrecks tell stories of our maritime history. Sanctuary habitats include beautiful rocky reefs, lush kelp forests, whale migration corridors and destinations, spectacular deep-sea canyons, and underwater archaeological sites. The marine protected areas range in size from one mile in diameter Monitor National Marine Sanctuary to almost 140,000 square miles in the Papahanāumokuākea Marine National Monument in the Northwestern Hawaiian Islands. Each area is a unique place deserving of special protection. They serve as natural classrooms, cherished recreational spots and places for valuable commercial activities. They represent many things to many people and are part of our nation's legacy to future generations.

Figure 4: The System of National Marine Sanctuaries.

ONMS raises public awareness of sanctuary resources and conservation issues through programs of scientific research, monitoring, exploration, education and outreach. ONMS provides oversight and coordination of the sanctuary system by setting priorities for addressing resource management issues and directing program and policy development. To protect the living marine and non-living resources of sanctuaries, ONMS works cooperatively with the public in developing sanctuary management plans and regulations consistent with the NMSA.

Sanctuaries as Marine Protected Areas

National marine sanctuaries, including Thunder Bay, are marine protected areas (MPAs) Executive Order No. 13158 (May 26, 2000, 65 F.R. 34909). Sec. 2. (a) of Executive Order No. 13158 defines a marine protected area as "…any area of the marine environment that has been reserved by Federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." MPAs are geographical areas "where natural and/or cultural resources are given greater protection than the surrounding waters (E.O. 13158, 2000)."[1] An MPA can be located in the open ocean, coastal areas, inter-tidal zones, estuaries, or the Great Lakes. Examples of MPAs in the Great Lakes, in addition to TBNMS, include: Isle Royale National Park, Apostle Island National Lakeshore, Pictured Rocks National Lakeshore, Indiana Dunes National Lakeshore, and Sleeping Bear Dunes National Lakeshore. A complete list of MPAs in the Great Lakes can be found at http://www.mpa.gov/helpful_resources/inventoryfiles/GreatLakes_MPAs_Wallmap_052809.pdf.

[1] http://www.mpa.gov/aboutmpas/definition/

Comprehensive Management of the NMSS

The NMSA includes a finding by Congress that ONMS will "improve the conservation, understanding, management and wise and sustainable use of marine resources" (16 U.S.C. 1431(a)(4)(A), §301(a)(4)(A)). The NMSA further recognizes that "while the need to control the effects of particular activities has led to enactment of resource-specific legislation, these laws cannot in all cases provide a coordinated and comprehensive approach to the conservation and management of the marine environment" (16 U.S.C. 1431(a)(3), §301(a)(3)). Accordingly, ONMS subscribes to a broad and comprehensive management approach to meet the NMSA's primary objective of resource protection.

Comprehensive sanctuary management serves as a framework for addressing long-term protection of a wide range of living, nonliving and marine heritage resources, while allowing multiple uses of the sanctuary to the extent that they are compatible with the primary goal of resource protection. The resources managed by the ONMS span diverse geographic, administrative, political and economic boundaries. Strong partnerships among resource management agencies, the scientific community, stakeholders and the public at-large are needed to realize the coordination and program integration that the NMSA calls for in order to comprehensively manage national marine sanctuaries.

National Historic Preservation Act of 1966

The National Historic Preservation Act of 1966 (NHPA; Public Law 89-665; 16 U.S.C. 470 *et seq.*) is intended to preserve historical and archaeological sites in the United States of America. The act created the National Register of Historic Places, the list of National Historic Landmarks, and the State Historic Preservation Offices. Section 106 of the NHPA requires Federal agencies to take into account the effects of their undertakings on historic properties, and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment. The historic preservation review process mandated by Section 106 is outlined in regulations issued by ACHP (36 CFR Part 800). The Michigan State Historic Preservation Office, which implements section 106 of the NHPA, is located in the Michigan State Housing Development Authority. When necessary, TBNMS coordinates directly with the State Historic Preservation Office, as is the case with the proposal to expand the sanctuary boundary.

TBNMS Management

In 1981, the State of Michigan created the Thunder Bay Underwater Preserve, a 290-square-mile area designated as the first of eleven preserves authorized by Michigan's "Bottomlands Act", 1980 PA 184, MCL 299.51 *et seq*. The Bottomlands Act has since been superseded, and the state's preserve program is presently authorized by Part 761 of the Natural Resources and Environmental Protection Act, 1994 PA 451, MCL 324.76101 *et seq*. On October 7, 2000, the Secretary of Commerce, under the NMSA, designated the Thunder Bay National Marine Sanctuary and Underwater Preserve as the nation's thirteenth national marine sanctuary. The State of Michigan

later officially expanded the Thunder Bay Underwater Preserve to 448 square miles. Thunder Bay National Marine Sanctuary is the only freshwater sanctuary, and the only national marine sanctuary located in the Great Lakes.

The 448-square-mile area of northwestern Lake Huron is now both a national marine sanctuary and a state underwater preserve. The sanctuary's northern and southern boundaries are defined by the lakeward extension of the respective Alpena Country borders while its eastern boundary is longitude 83° west (approximately 20 miles off the city of Alpena). The sanctuary's western boundary follows the contours of the Michigan shoreline at the ordinary high water mark. Forty-five known historic shipwrecks are in this area. Archival research indicates that as many as 40 additional historic shipwrecks are yet to be discovered.

The sanctuary is managed jointly by NOAA and the State of Michigan. The Michigan Historical Center, within the Department of Natural Resources, represents the state in managing the sanctuary. The NOAA sanctuary superintendent manages the day-to-day operations and activities of the site while a Joint Management Committee, consisting of the ONMS Director and a state agency member, makes major policy, budget, and management decisions. In addition, an advisory council provides advice to the NOAA sanctuary superintendent. Members of the Thunder Bay National Marine Sanctuary Advisory Council represent the community's interests, including government, education, maritime history and interpretation, fishing, diving, tourism, economic development, the state-designated underwater preserve, and the community-at-large.[2]

[2] The official name of the sanctuary is the Thunder Bay National Marine Sanctuary and Underwater Preserve. To simplify the name, the Joint Management Committee agreed to use the name Thunder Bay National Marine Sanctuary.

II. Purpose of and Need for Action

This section specifies the underlying purpose and need for the proposed action to expand the boundaries of TBNMS.

Purpose of Action

The purpose of this action is to provide long-term resource protection and comprehensive management for 47 additional known historic shipwrecks of special national significance, and other maritime heritage resources (i.e. docks, cribs), outside the sanctuary's existing boundaries. The action will also provide protection for historic shipwrecks and maritime heritage resources yet to be discovered.

The proposed action aligns with the NMSA purposes and policies and TBNMS goals and objectives in the following ways:

National Marine Sanctuaries Act (NMSA)

The purposes for this action, as it relates to the purposes and policies of the NMSA, are twofold:

> (1) to identify and designate as national marine sanctuaries areas of the marine environment which are of special national significance and to manage these areas as the National Marine Sanctuary System (16 U.S.C. 1431(b)(1));
>
> (2) to provide authority for comprehensive and coordinated conservation and management of these marine areas, and activities affecting them, in a manner which complements existing regulatory authorities (16 U.S.C. 1431(b)(2)).

Sanctuaries are managed to protect and conserve their resources and to allow uses that are compatible with the primary objective of resource protection.

TBNMS Designation, Goals and Objectives

NOAA designated the sanctuary as the nation's thirteenth national marine sanctuary in 2000 for the purpose of: "Providing long-term protection and management to the conservation, recreational, research, educational, and historical resources and qualities of the area."

TBNMS Management Plan

New challenges and opportunities emerge with time. For this reason, the NMSA requires periodic updating of sanctuary management plans (and regulations, if appropriate) to reevaluate site-specific goals and objectives and to develop management strategies and activities to ensure the sanctuary best protects its resources. The original TBNMS Management Plan was written as part of the sanctuary designation process and published in the final environmental impact statement.[3]

[3] http://thunderbay.noaa.gov/pdfs/thunderbayeis.pdf

In 2009, NOAA published an updated final management plan in coordination with the TBNMS Advisory Council.[4] The 2009 final management plan contained a strategy and action plan specifically for considering the expansion of the sanctuary in an upcoming public process (see Alternatives). This strategy was recommended by the Sanctuary Advisory Council and formed the basis for developing NOAA's current preferred alternative.

STRATEGY RP-1: Evaluate and assess a proposed expansion of the sanctuary to a 3,662-square-mile area from Alcona County to Presque Isle County, east to the international border with Canada to protect, manage, and interpret additional shipwrecks and other potential maritime heritage resources.

Need for Action

Beyond the sanctuary's existing boundaries are 47 additional historic shipwrecks that are at risk to threats which include both human activities and natural processes. Human threats include looting and altering sanctuary shipwreck sites and damaging or destroying sites by anchoring. Natural process include the impacts of wind, waves, storms and ice, as well as the impact of invasive species such as zebra and quagga mussels that today cover most of Lake Huron's shipwrecks. These processes threaten the long term sustainability of historic shipwrecks and other maritime heritage resources. As described in the environmental consequences section, to ensure their long-term protection, these 47 additional known historic shipwreck sites would require the same level of research and resource protection afforded sites within the existing TBNMS boundary.

These maritime heritage resources would require long-term protection and management in order to reduce threats that could impact their historical, archeological, recreational and educational value. In addition, the comprehensive and coordinated management that NOAA provides includes extensive research, education, and outreach programs that would fill important gaps in archeological knowledge and historical context of these shipwrecks as well as enhancing sustainable recreational and tourism opportunities.

While state laws and other federal laws intended to reduce the impact of human activities on historic shipwrecks and related maritime heritage resources have been effective, sanctuary expansion would provide additional protection in the following ways: (1) The Sanctuary regulations apply to all shipwrecks, not just abandoned shipwrecks as provided in the Abandoned Shipwreck Act; (2) The use of grappling hooks or other anchoring devices is prohibited on underwater cultural resource sites that are marked with a mooring buoy; (3) ''Hand-taking'' of artifacts outside the Thunder Bay Underwater Preserve, but still within the Sanctuary boundary, is prohibited; (4) Permit applications are required to satisfy the Federal Archaeology Program

[4] http://sanctuaries.noaa.gov/management/mpr/tbnmsmp.pdf

guidelines; and (5) as an additional enforcement mechanism, NOAA may assess civil penalties under the National Marine Sanctuaries Act for violation of Sanctuary regulations.

Additionally, there is a need to apply education and outreach efforts to shipwrecks beyond the sanctuary's current boundaries in order to promote responsible use of sanctuary resources and help reduce human impacts to these.

Support for an expansion is widespread as demonstrated by city, county and township resolutions, by comments provided during public processes (e.g., during Management Plan review, scoping process for boundary expansion). These entities have noticed that the designation of the Thunder Bay National Marine Sanctuary in 2000 has had a positive impact on community development and maritime heritage tourism in Northeast Michigan and as a result are interested in how a sanctuary expansion could contribute to enhancing recreational and tourism opportunities for those communities expansion of the sanctuary boundary could bring similar positive socioeconomic impacts to a larger geographic area in Michigan.

III. Affected Environment

This section provides a narrative of resources within NOAA's Preferred Alternative, which encompasses the other alternatives analyzed in Section IV (Alternatives). The Affected Environment section focuses primarily on the human uses of the environment, which includes maritime heritage resources of the sanctuary. This section also includes some parameters of the physical and biological environment (those aspects in which Thunder Bay NMS has a role in interdisciplinary research or where the natural environment has a direct effect on shipwrecks).

Human Environment

The Great Lakes and their connecting waterways provide a natural highway extending over a thousand miles into the heart of North America. For centuries before European contact, these inland seas and tributaries served as important lines of trade and communication for Native Americans. Over the past 300 years, these waters have been further exploited by Euro-Americans and have greatly contributed to the growth of the North American interior. Marine transport on the Great Lakes played a crucial role in the exploration, settlement, and industrialization of the region.

During the nineteenth and early twentieth centuries, the Great Lakes of North America evolved from an isolated maritime frontier on the western edge of the Atlantic World into the nation's busiest and the world's most significant industrial waterway, where innovative ships and technologies moved raw materials and agricultural products in larger quantities and at lower costs than at any previous time in history. During this period entrepreneurs and shipbuilders on the Great Lakes launched tens of thousands of ships of many different designs. Sailing schooners, grand palace steamers, revolutionary propeller driven passenger ships, and industrial bulk carriers transported America's business and industry. In the process they brought hundreds of thousands of people to the Midwest and made possible the dramatic growth of the region's farms, cities, and industries. The Midwest, and indeed the American nation, could not have developed with such speed and with such vast economic and social consequences without the Great Lakes.

Dubbed "Shipwreck Alley", the treacherous waters around Thunder Bay, including NOAA's Preferred Alternative, claimed nearly 200 ships. The oldest known shipwreck sank in 1849 (*New Orleans*), while the most recent shipwreck occurred in 1966 (*Nordmeer*). Intense weather patterns, islands and rocky shoals, and heavy vessel traffic and converging shipping lanes all contributed to the area's vast collection of shipwrecks. These submerged archaeological sites are nearly a complete collection of Great Lakes vessel types from small schooners and pioneer steamboats of the 1830s, to enormous industrial bulk carriers that supported the Midwest's heavy industries during the twentieth century. Among the wrecks in and around the sanctuary are those vessels that carried immigrants and pioneers traveling west for new homes, schooners carrying Midwestern grain and lumber, passengers and package freight steamers, and evolving generations of bulk freighters specially designed to carry iron ore, coal, grain, cement, and other bulk commodities.

They are evidence of the Great Lakes' pervasive influence in regional and national history, and capture the cultural, personal, environmental, technological and economic aspects of maritime history. Finally, the shipwrecks identified in this document reflect the movement, bravery, tenacity and innovative spirit of generations of maritime people.

Maritime Heritage Resources

Shipwrecks

The following narrative offers a representative account of shipwrecks, arranged thematically, in NOAA's Preferred Alternative (which includes the current 448 square mile sanctuary).[5] They are arranged here by vessel type and significance. After the name of each shipwreck, in parenthesis, are dates of build and loss, as well as the depth of water that the site is located in. A complete list of known shipwrecks in each of the three alternatives analyzed is presented in Section IV.

Early Steam

The oldest known shipwreck in the Thunder Bay area is the wooden paddle wheel steamer *New Orleans* (Figure 5). Rebuilt in 1843 on the hull of the burned steamer *Vermillion*, *New Orleans* ran aground west of Sugar Island on June 15, 1849 and now rests in 13 feet of water. Fishermen from Thunder Bay and Sugar Islands rescued the passengers and crew, and salvagers later recovered most of the cargo and machinery. Early steam paddle wheelers such as *New Orleans* are prime examples of the transition from sail to steam. Most were designed to carry large cargoes in their holds, while the upper works were elaborately decorated and furnished to accommodate ticketed passengers, many heading west to settle on the American frontier.

In addition to *New Orleans*, two other paddle wheelers, *Benjamin Franklin* (1842-1850; 15-foot depth), and *Albany* (1846-1853; 5-foot depth), grounded at Thunder Bay Island and Presque Isle, respectively. All three were extensively salvaged. The lower bilge, hull fragments, stern post and boiler area remnants of the *New Orleans* make for a complex and interesting shallow wreck site to visit. Little remains of the *Albany* and *Franklin* except the lower hull structure of each vessel, though *Franklin's* shafts, boilers, and machinery remain on the lake bottom only a few hundred yards from the Thunder Bay Island lighthouse. The side wheel steamer *Marine City* (1866-1880; 5-foot depth) is similarly broken up in shallow water north of the Sturgeon Point Lighthouse (Figure 5). Carrying over 150 people, the wooden vessel burned and sank in 1880 with the tragic loss of 20 lives.

[5] This section excerpted largely from Lusardi, 2011.

Figure 5. Left, the scattered remains of the paddle wheel steamer *New Orleans* (1843-1849; 13 foot depth) are a complex artifact. Right, the paddle wheel steamer *Marine City* (1866-1880; 5 foot depth) carried passengers and freight on a regular schedule to Alpena and other port towns along Lake Huron. (NOAA Thunder Bay NMS; Thunder Bay Sanctuary Research Collection)

Schooners

Several dozen wooden schooners are located in NOAA's Preferred Alternative. The quintessential workhorse of the day, thousands of schooners sailed the Great Lakes in the late nineteenth century, and dozens were lost around Thunder Bay. Many schooners such as *E.B. Allen* (Figure 6, 1864-1871; 100-foot depth), *Lucinda Van Valkenburg* (1862-1887; 60-foot depth), *Cornelia B. Windiate* (1874-1875; 180-foot depth), *Kyle Spangler* (1856-1860; 180-foot depth), *F.T. Barney* (1856-1868; 160-foot depth), and *Typo* (1873-1899; 160-foot depth), have become very popular recreational and technical dive destinations. Discovered by the sanctuary in 2011, the schooner *M.F. Merrick* (1863-1889; 300-foot depth) was lost with all hands after a collision with a southbound steamer and is the latest addition to this list.

Figure 6. The schooner *E.B. Allen* rests in 100 feet of water and displays a degree of preservation typical in this depth range. (NOAA Thunder Bay NMS)

These shipwrecks represent typical vessels of the late nineteenth century known as canalers, designed with dimensions specifically to allow passage through the Welland Canal connecting Lakes Erie and Ontario. The hulls configured as nearly as possible to the locks' dimensions (150 feet by 26 feet), and even the bowsprits were hinged to allow maximum hull length, and thus, cargo

carrying capacity. By 1871, two thousand canalers plied the Great Lakes, most carrying grain eastward and coal westward. All of the aforementioned vessels, with the exception of *Windiate*, were sunk as result of collisions with other vessels in the busy shipping lanes off Alpena and Presque Isle. With no survivors or witnesses, *Windiate's* sinking remains a mystery, though unpredictable November weather was likely a factor. Designed to carry 16,000 bushels of wheat, but reportedly carrying 19,000, she may also have been dangerously overloaded to maximize profits during the last voyage of the season.

Interestingly, a group of schooners sunk on a pair of reefs in northern Lake Huron offers a dramatic connection between the maritime landscape and the shipwrecks associated with it. Spectacle Reef and nearby Raynold's Reef are a pair of shoals about ten miles northeast of Cheboygan. Over the years scores of vessels stranded on these shallow water reefs. In 1871, construction began on an 86-foot tall lighthouse on Spectacle Reef which was completed in 1874 and still stands today. In September 1869, just prior to construction, the *Nightingale* (1856-1869) stranded on the reef. Bound from Milwaukee to Oswego with 15,000 bushels of wheat, the schooner *Kate Hayes* (1856-1856) stranded on Spectacle Reef on a clear calm night in 1856. Nearby are the schooners *Newell Eddy* (1890-1893) and *Augustus Handy* (1855-1861). The 242-foot three-masted schooner barge, *Newell A. Eddy*, built at West Bay City, Michigan, in 1890, foundered in a storm with a cargo of grain and all nine hands in 1893. Resting in 160 feet of water, the well preserved site is a popular dive attraction. In 1855 the *Augustus Handy* was struck by lightning, disabled and sunk.

Smaller schooners, usually involved in more local endeavors, are also found in the area considered in the Preferred Alternative. *Maid of the Mist* (1863-1878; 7 foot depth), for example, was contracted to haul cedar posts from Alpena County to Detroit when it washed ashore in a gale at Huron Beach. Typical of the rough and tumble careers of Great Lakes schooners, the 15 year-old-vessel was involved in a dozen mishaps before its ultimate demise, and evidence of large-scale repair is preserved in the archaeological record. The 117-foot *William Stevens* (1855-1863; 10 foot depth) and 112-foot *Corsican* (1862-1893; 160-foot depth) are further examples of these smaller sized schooners, as is the 115-foot *Defiance* (Figure 7, 1848-1854; 185 foot depth), the second earliest known shipwreck in the area. Remarkably well preserved with tiller steering and cookstove and galley remnants on deck, *Defiance* is an excellent example of an early Great Lakes schooner.

Larger than canal size schooners, 185-foot *American Union* (1862-1894; 8 foot depth) and 150-foot *Portland* (1863-1877; 6 foot depth), are both wrecked in shallow water near Presque Isle, their deep drafts likely contributing to their demise. Known, but yet unidentified remains of other large schooners in shallow waters may be those of the 156-foot *Fame* (1853-1887), 157-foot *Ishpeming* (1872-1903), and the 178-foot *Nellie Gardner* (1873-1883).

Figure 7. A photomosaic of the schooner *Defiance*, resting in 185 feet of water outside the sanctuary's northern boundary. Many popular, intact shipwrecks lay in deeper waters outside the sanctuary. In an effort to better understand and protect these impressive time capsules, sanctuary archaeologists regularly work outside sanctuary boundaries. (NOAA Thunder Bay NMS)

In deeper water is the 205-foot *John Shaw* (1885-1895; 130 foot depth), lost off Harrisville in a November snowstorm. Not all wrecking events are dramatic, however. The 162-foot, 3-masted schooner *Harvey Bissell* (Figure 8, 1866-1905; 15 foot depth), and canal-sized schooners *Knight Templar* (1965-1903; 5-foot depth) and *Light Guard* (1866-1903; 6-foot depth), were all abandoned along the inner reaches of Thunder Bay after serving long careers.

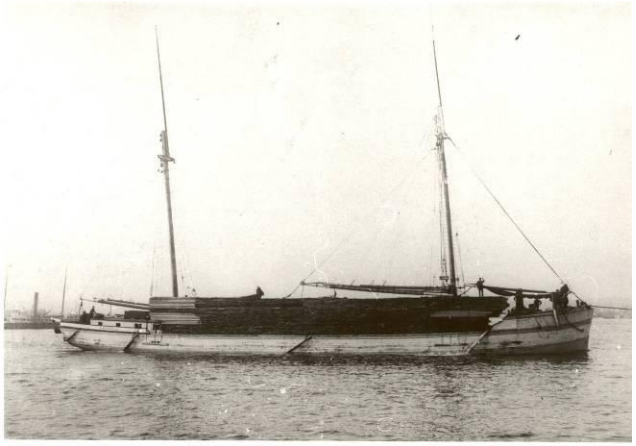


Figure 8. Originally built as a three-masted schooner, the 162-foot *Harvey Bissell* was later retrofitted to a two-masted "schooner barge," a typical conversion for schooners whose owners sought to keep the aging vessels in use. Pictured here with an enormous deck load of lumber, the *Bissell* wreck sits in 15 feet of water just off the Alpena waterfront. (Thunder Bay Sanctuary Research Collection)

Schooners are not the only sailing craft located in the region. The three-masted bark *Ogarita* (1864-1905; 30-foot depth) and brig *Bay City* (1857-1902; 11-foot depth) both wrecked in the sanctuary. *Ogarita* burned and sank when its cargo of 1,200 tons of coal ignited off Thunder Bay Island, while the aging and battered *Bay City* was abandoned along the Alpena waterfront. The 2-masted brigantine *John J. Audubon* (1854-1854; 170-foot depth) is located not far from its collision mate, the 2-masted schooner *Defiance* mentioned above. Their 1854 collision illustrates the hazards of Great Lakes shipping as it emerged in the mid-nineteenth century. The 1854 shipping season was the most costly to date with losses totaling 119 lives, 70 ships and 2 million dollars in property. The *Defiance* and *John J. Audubon* are victims of that dangerous year.

Steamers

Steamers, also known as steam barges, were purpose-built to carry bulk cargo while simultaneously towing as many as three "consort" barges. Steamers are also well represented in the area, particularly on North Point Reef, a geologic feature that extends over one mile from shore and rises to within five feet of the surface. The wooden steam barge *Galena* (1857-1872; 16 foot depth) went ashore on North Point carrying 272,000 feet of lumber on September 24, 1872 and quickly broke apart. Much of the machinery, furniture, bedding, and crews' possessions were removed from the wreck, and the engine was later salvaged for use in another vessel. Wreckage tentatively identified as disarticulated pieces of *Galena* lies intermingled with materials from later losses, a common occurrence in the shallow, dynamic waters off North Point Reef.

Similarly, the wooden steam barge *B.W. Blanchard* (Figure 9, 1870-1904; 9-foot depth) towing the wooden schooner barges *John T. Johnson* (1873-1904; 7-foot depth) and *John Kilderhouse* went aground on North Point during a blinding snowstorm in November 1904. *Blanchard* and *Johnson* were completely wrecked, while *Kilderhouse* was eventually recovered. The vessels carried a combined load of 2,000,000 feet of lumber, most of which was recovered. The suspected *Blanchard* and *Johnson* sites today rest a few hundred feet apart in less than 10 feet of water. Though difficult to identify with precision, the scattered remains of several other vessels are located on North Point Reef as well, including the brig *Empire State* (1862-1877), schooner *E. B. Palmer* (1856-1892), and steamer *Congress* (1861-1868), which saw service during the Civil War in Tidewater, Virginia. Broken up into several large sections in deeper water off Thunder Bay Island is the steam barge *William P. Thew* (1884-1909; 70-foot depth), while closer inshore is the steam barge *Oscar T. Flint* (Figure 10, 1889-1909; 30-foot depth), burned to the waterline and still filled with its limestone cargo.

Figure 9. The wooden steam barge *B.W. Blanchard* operated for 34 years before running aground in Thunder Bay during a blinding snowstorm. With much of the wrecked vessel exposed, it quickly succumbed to winds and waves. Today, its remains scattered in shallow water, mixed with the wreckage of other vessels that shared a similar fate. (Thunder Bay Sanctuary Research Collection)

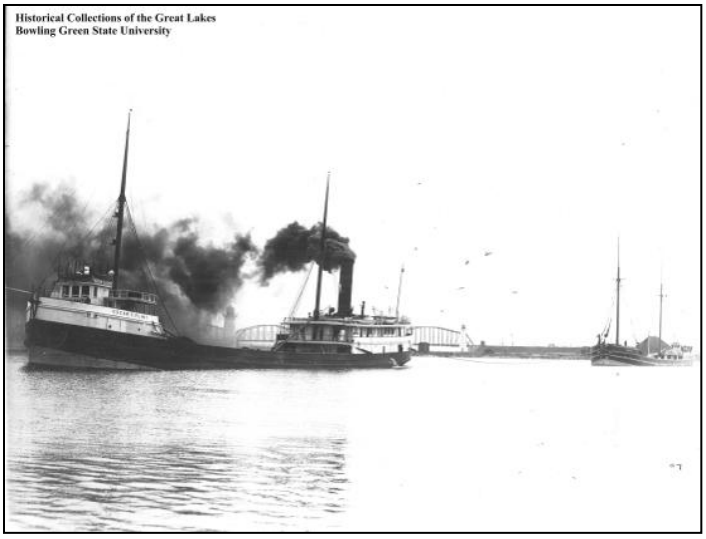


Figure 10. The steam barge *Oscar T. Flint* with a schooner barge in tow. In 1909, the *Flint* caught fire and sank in 30 feet of water in Thunder Bay. (Historical Collections of the Great Lakes, Bowling Green State University)

With examples spanning over 80 years, bulk and package freighters are also well represented in and around the sanctuary including *James Davidson* (1874-1883; 38-foot depth), *Joseph Fay* (1871-1905; 0-17-foot depth), *D. M. Wislon* (1873-1894; 48-foot depth), *Egyptian* (1873-1897; 230-foot depth), *New Orleans* (1885-1906; 130-foot depth), *William Rend* (1888-1917; 17-foot depth), *Shamrock* (1875-1905; 11-foot depth), *Monohansett* (1872-1907; 18-foot depth), *Florida* (Figure 11, 1889-1897; 200-foot depth), *Grecian* (1891-1906; 90-foot depth), and *Montana* (Figure 12, 1872-l914; 60-foot depth). Many of these wrecks are popular dive destinations because of their structural integrity or unique circumstances of loss. *Florida*, for example, collided with the *George W. Roby* off Middle Island and went down with a cargo of 50,000 bushels of wheat, 1,451 barrels and 3,150 sacks of flour, syrup, barrels of whiskey, and a full upper load of package freight, much of which remains on site.

Figure 11. Resting in 200 feet of water the wreck and cargo of the steamer *Florida* is well preserved. At left a diver swims between decks while hovering above are several air-tight barrels still buoyant after 114 years. At right a view from above into one of the package freighter's cargo holds, with cargo still stacked along the hull. (NOAA Thunder Bay NMS)

Figure 12. Launched in 1872, the package freighter *Montana* met her fiery end in Thunder Bay 42 years later – an incredibly long career for a Great Lakes vessel. The cavernous retrofitted vessel held one million board feet of lumber, enough to stretch for nearly 200 miles if placed end to end. (Thunder Bay Sanctuary Research Collection, NOAA Thunder Bay NMS)

The steel-hulled bulk freight steamer *Grecian*, a Globe Iron Works creation, stranded at De Tour, Michigan then foundered in Thunder Bay while under tow southbound for repairs. Two large steel tanks known as canalons were sunk and fastened to *Grecian's* stern by hardhat divers intending to raise the vessel in 1909. The tanks exploded when filled with air and remain attached to the wreck. *Grecian's* sistership, the 300-foot long *Norman* (Figure 13, 1890-1895; 210-foot depth), is located just 20 miles north, having collided with the Canadian steamer *Jack* in the busy shipping lanes off Presque Isle. Between 1890 and 1920, industrial giants like John D. Rockefeller created steel corporations that required vast Great Lakes fleets to carry iron ore, the main raw material used to make steel. The *Grecian* and *Norman* were part of the fleet serving J. P. Morgan's enormous U.S. Steel Corporation, the nation's first billion-dollar firm.

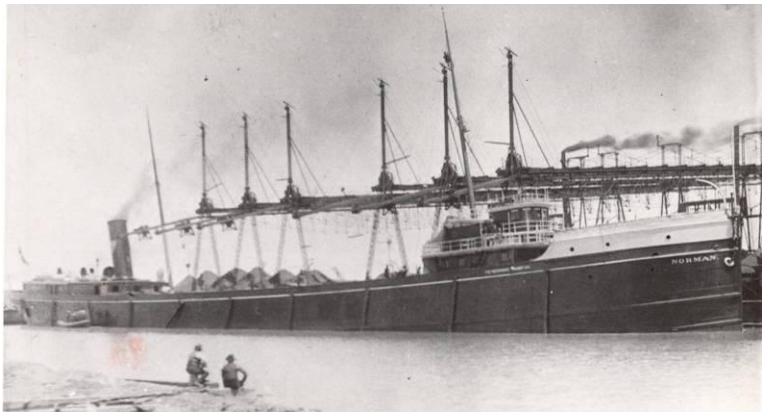


Figure 13. The 300-foot long steamer *Norman*, resting in 200 feet of water outside the sanctuary's northern boundary. Listing to port but amazingly intact, the enormous steel wreck contains many artifacts as well as human remains. (NOAA Thunder Bay NMS, Thunder Bay Sanctuary Research Collection)

Perhaps the most tragic accident in Thunder Bay occurred in August 1865 when the passenger freighter *Pewabic* (Figure 14, 1863-1865; 160-foot depth) was run into and sunk by its sister vessel *Meteor* with the loss of no fewer than 30 lives. Weather conditions were favorable and the vessels were in sight of one another for several miles before impact. Though injured, *Meteor* was able to continue to Sault Ste. Marie after rescuing many passengers from the water. Built by Peck and Masters of Cleveland, *Pewabic* went down with several hundred tons of valuable copper and iron ore in its hold. Search efforts began immediately, though the wreck was not discovered until June 1897. Much of the cargo was recovered using armored divers, submersible bells with manipulator arms, and bucket cranes, though at great cost; several divers perished on the wreck from drowning or decompression illnesses. At a time when Michigan's Upper Peninsula produced the majority of America's copper, vessels like the *Pewabic* were critical to the war effort. The 200-foot steamer raced through the water at 12 knots, powered by twin engines that turned 8-foot diameter propellers.

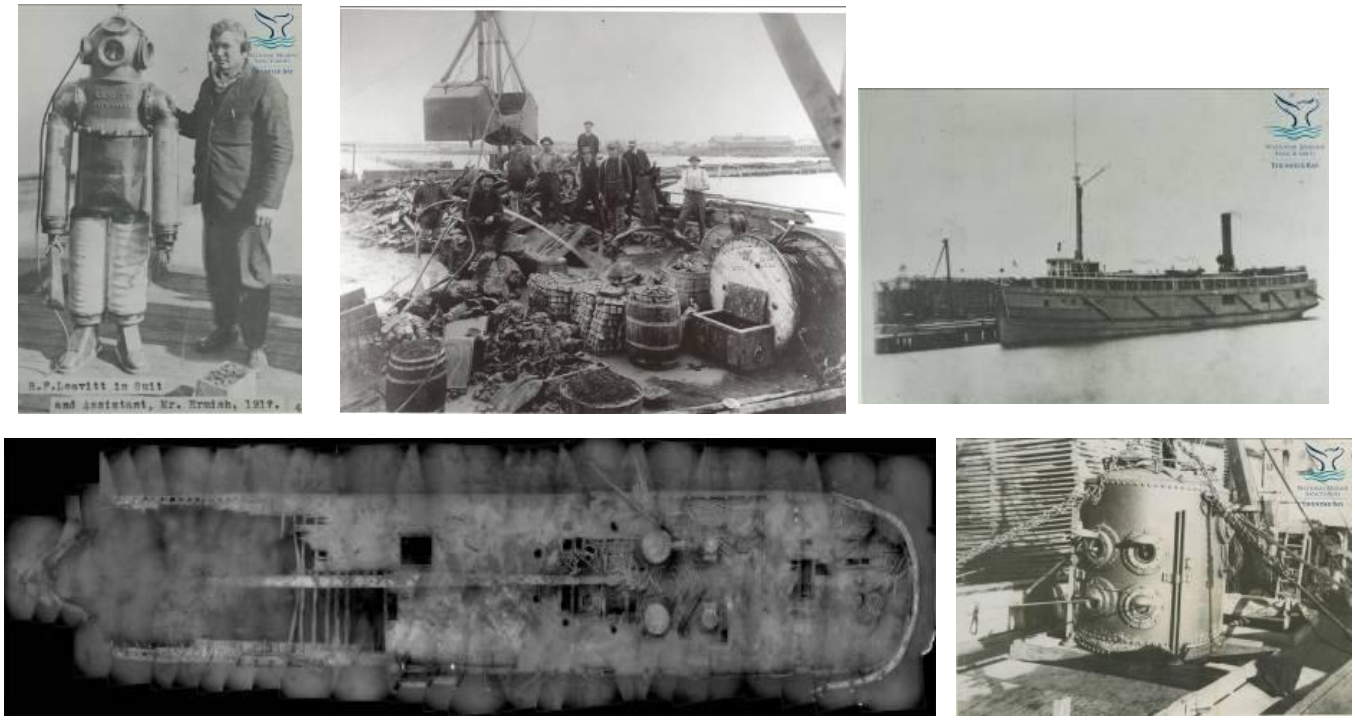


Figure 14. The steamer *Pewabic's* valuable cargo inspired a century of high-risk salvage efforts. Salvers employed divers, dynamite, dredges and even a custom-built diving bell in pursuit of the copper cargo lying 160 feet below the surface. (Thunder Bay Sanctuary Research Collection, NOAA Thunder Bay NMS)

Even with more accurate charts and advanced positioning, modern freighters still occasionally sunk in Lake Huron during the 20th century. *Isaac M. Scott* (1909-1913; 175-foot depth) was one of eight vessels that sank in Lake Huron during an infamous storm in 1913. The storm took the lives of 194 seamen. The *Scott*, which sank with all hands onboard, lies upside down on the lake bottom like many of its contemporaries. *D.R. Hanna* (1906-1919; 130-foot depth), *W.C. Franz* (1901-1934; 230-foot depth), *W. H. Gilbert* (1892-1914; 230-foot depth), *Viator* (1904-1935; 165-foot depth), *Etruria* (1902-1905; 300-foot depth), and *Monrovia* (Figure 15, 1943-1959; 130-foot depth) all went down resulting from collisions in the busy shipping lanes off Thunder Bay.

The German freighter *Nordmeer* (1954-1966; 35-foot depth), Thunder Bay's most recent shipwreck, ran upon a shoal and stuck fast in 1966. The steadfast crew remained onboard for several days hoping to free the freighter, necessitating a daring helicopter rescue by the U.S. Coast Guard amidst a November storm. A local landmark, the vessel's superstructure remained above the waterline for many years until finally succumbing to winter ice and storms and collapsing beneath the surface in 2010. A salvage barge, involved in recovery of scrap steel and machinery from *Nordmeer*, sits on the bottom near the larger wreck.

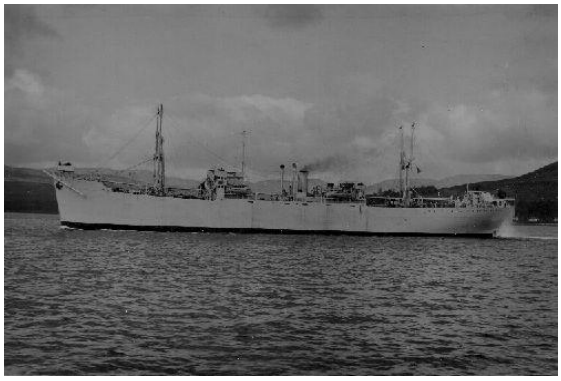


Figure 15. The *Monrovia*, pictured here as the SS *Empire Falstaff,* sank during a 1959 collision and became one of the first Great Lakes shipwrecks of the St. Lawrence Seaway era. Today, the wreck of the *Monrovia* sits in 140 feet of water and is a popular dive site. (left, Stuart Cameron Collection; right, Andy Morrison)

Perhaps not as romanticized as passenger vessels, paddle wheelers, or sailing craft, barges and tugs also played an important role in Great Lakes maritime history. *Lake Michigan Car Ferry Barge No. 1*, built in 1895 by James Davidson to haul 28 rail cars on four tracks across the decks, was converted to a tow barge before sinking with a deck load of lumber and 200 crates of live chickens in November 1918. *Barge No. 83* (1920-1941; 80-foot depth) foundered northeast of Thunder Bay Island with well-drilling machinery and sheet piling. *Scanlon's Barge* (unknown date of loss; 30-foot depth) sank off North Point with a derrick crane on board, and the *Carbide Barge* (unknown date of loss; 90-foot depth) and *Dump Scow* (unknown date of loss; 130-foot depth) also foundered in heavy seas with un-salvaged deck equipment still in place.

Examples of tugs and vernacular craft also exist in and around the sanctuary. The tug *William Maxwell* (Figure 16, 1883-1908; 12-foot depth) is viewable off Thunder Bay Island in only eight feet of water. Built in Chicago, *Maxwell* was employed by the Huron Fish Company to trawl the waters off Thunder Bay. Today the bilge, deadwood, propeller, and shaft of the vessel remain. Off Rogers City are the tugs W. G. Mason (1898-circa 1924; 13-foot depth) and *Duncan City* (1883-circa 1923; 15-foot depth), both excellent snorkel and kayaking sites with consistently clear water.

Figure 16. The tug *W. G. Mason*, built in 1898 and abandoned near Rogers City around 1924. Several smaller, local craft like these are found around Thunder Bay (NOAA Thunder Bay Sanctuary Research Collection).

Additional Maritime Heritage Sites and the Cultural Landscape

Shipwrecks are not the only submerged cultural resources located in and around Thunder Bay. Structural features and cultural landscape alterations are also evident on the lake bottom. Cribs, docks, pier footings, and pilings are located near the Alpena waterfront, off North Point, and around the many islands in the bay. Additionally, dozens of vessels were stranded on various shoals and eventually recovered, but not before leaving behind jettisoned cargo, lost salvage equipment, or other artifacts on the lake bottom.

In addition to the submerged resources described above, are other aspects of the region's maritime cultural landscape. As defined by the National Park Service, a cultural landscape is a geographic area including both cultural and natural resources, coastal environments, human communities, and related scenery that is associated with historic events, activities or persons, or exhibits other cultural or aesthetic values (NPS 1997). The Thunder Bay region is comprised of many shoreline features such as beached shipwrecks, lighthouses, aids to navigation, abandoned docks, working waterfronts and Native American sites(Figures 17 and 18). Also important are the intangible elements such as spiritual places and legends.

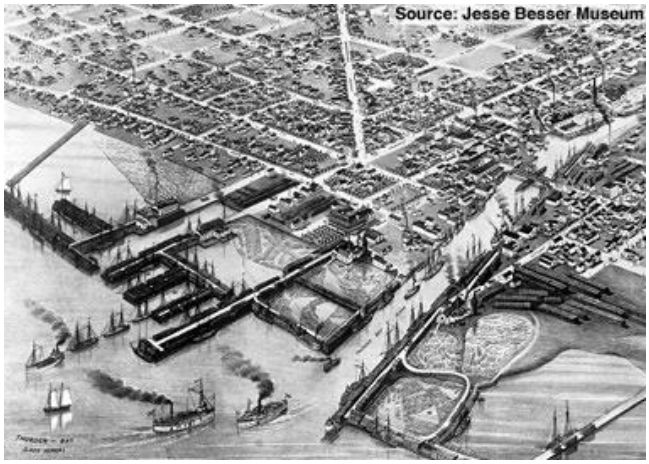


Figure 17. A bird's-eye view of the City of Alpena in 1880, including lumber docks to the left of the mouth of the Thunder Bay River and log booms to the right of the river. Submerged remnants of this historic waterfront still survive and are part of the area's maritime cultural landscape.

Figure 18. The beached remains of the 215-foot wooden steamer *Joseph Fay* and nearby Forty-Mile Point Lighthouse are dramatic and closely related aspects of the Thunder Bay area's maritime cultural landscape. Taking on water amidst a violent October storm in 1905, the *Fay's* captain drove the iron ore laden vessel ashore only 200 yards from the lighthouse. (NOAA Thunder Bay NMS)

Tourism

The region's position along the Great Lakes coast has been vital to its economic development. The lakes have served as the regional highway, allowing people and goods to move freely even when roads and other infrastructure was lacking or rudimentary. During the last half of the twentieth century, the rugged and relatively undeveloped coast began to attract tourists, who come for the area's hunting, fishing and natural beauty, and to visit the network of historic lighthouses and dive the many shipwrecks.

Approximately 53,000 people live in Alpena, Presque Isle and Alcona Counties, immediately adjacent to the sanctuary. Total employment in the three counties is around 25,000 and total personal income is upwards of $1.6 billion annually.

As a popular destination for outdoor recreation, people travel to the region for fishing, scuba diving and snorkeling on shipwrecks, visiting beaches, touring lighthouses, camping and hunting. Over one million people visit the region every year. A 2005 study estimated annual visitor spending in the three counties to be approximately $110 million supporting around 1,700 jobs (Michigan Sea Grant 2006). Of this $110 million spent by visitors in the study area, the state captures approximately $67 million (61%) in direct sales by tourism-related businesses. These sales directly support 1,365 jobs with a total payroll of $27.4 million and $36.9 million in value added. Every dollar of direct sales yields another $.38 in secondary sales through indirect and induced effects. Total impacts including secondary effects are $92 million in sales, $35.8 million in personal income, $51.3 million in value added, and 1,704 jobs.

The Thunder Bay National Marine Sanctuary's Great Lakes Maritime Heritage Center (the sanctuary's visitor center) is a major tourist destination for the region. Attendance in 2012 surpassed 83,000 visitors. This is an increase of over 10,000 from 2011, and an increase of nearly 30,000 from 2010. The Center features 9,000 square feet of immersive exhibits, a 93-seat theater showing films daily, an archaeological conservation lab and shipwreck artifact gallery, innovative education space for special programs, meetings, and events, scientific research facilities, including a dive operations center, a community boat-building center small watercraft workshop, outdoor access to the Great Lakes Maritime Heritage Trail and open-air picnic grounds, and a Maritime Heritage Center Gift Shop.

The Thunder Bay Maritime Festival is an annual day-long event on July 4, which draws over 10,000 to the sanctuary. The festival is free to the public and includes tours tall ships, research vessels, and fishing boats docked along the Great Lakes Maritime Heritage Trail. Visitors enjoy live music, kids' games and crafts, a small boat workshop, taste local whitefish, and explore the shipwreck exhibits.

Alpena and Thunder Bay NMS have become a major center of Great Lakes research. The sanctuary and its partners use and test a variety of marine technology while conducting research in Lake Huron. In 2011, sanctuary related research attracted nearly 200 researchers from around the United States, including government researchers, university faculty and students, nonprofit organizations and film makers. These research teams spent a total of 713 individual stays in Alpena.

Thunder Bay NMS has recruited several tourism related business to the area. Alpena Shipwreck Tours offers glass bottom boat tours of Thunder Bay that depart from the Great Lakes Maritime Heritage Center. In the company's second year of operation (2012), over 9,500 passengers cruised aboard their vessel, the *Lady Michigan*. Over 2,000 students participated in educational programs aboard the *Lady Michigan* in 2012. The vessel has had a positive impact on the local economy, and it features marine technology (ROVs and diving) as part of its tour.

The Alpena community has embarked on a new unified branding effort. It centers on the brand promise that Alpena is the Sanctuary of the Great Lakes. One of the three tenants of this brand promise is maritime research and education.

Fishing

Because the scope of Thunder Bay NMS regulations is limited to the protection of maritime heritage resources, there is no direct anticipated effect on fishing in an expanded sanctuary. However, because recreational and commercial fishing are important activities that would occur in an expanded sanctuary, the status of those activities is summarized below.

The primary groups using the Lake Huron fisheries are state licensed commercial fishers, recreational anglers, and Native American commercial fishers. Commercial fishing has declined significantly since the 1940s, when commercial fish stocks collapsed. In 1930, close to 7,000 people were employed in the commercial fishing industry, but by 1975, a little over 1,100 people were employed. Since 2001, only two state-licensed and two to four tribally licensed commercial fishing operations have been operating out of Alpena County. Gillnets are no longer permitted for commercial fishing in central and southern Lake Huron, including within the sanctuary boundaries; trapnets are the only gear used. Today, the Thunder Bay region of Lake Huron is considered one of the most lucrative whitefish fishing grounds in the Great Lakes, and whitefish is the principal commercially harvested species within the Thunder Bay region (NOAA 1999). In 2000, about 60% of all lake whitefish came from Lake Huron (Kinnunen 2003). This decrease in commercial fishing has led to less impact from fishing gear at shipwreck sites.

The popularity of recreational fishing has increased over the last century, particularly since the late 1960s, when salmon was introduced in the Great Lakes (NOAA 1999). In 1975, approximately 2.8 million recreational anglers were active on the Great Lakes (U.S. Comptroller General 1977). In 2006, 1.4 million persons age 16 years and older participated in recreational fishing in the U.S. waters of the Great Lakes, taking 13.3 million trips during 18 million days on the water and spending $1.5 billion on equipment and trip-related items (USFWS and U.S. Dept. of Commerce Census Bureau 2007). Recreational fishing primarily targets lake trout, brown trout, steelhead, walleye and salmon. Popular fishing techniques include the use of planer boards and downriggers to take fishing line to specified depths. With the downturn in Chinook salmon numbers after 2004, there has been a 73% reduction in recreational fishing pressure in the Main Basin of Lake Huron. Walleyes are now the leading target for recreational fishing in Thunder Bay (Johnson and Gonder, in press).

For recreational fishing, there were 606 licensed fishing charter boats in Michigan in 1996. Alcona County had the greatest amount of licensed charter boats, with 10 boats. Alpena County had 8 licensed charter boats and Presque Isle County had 4 boats (Northeast Michigan Integrated Assessment, Michigan Sea Grant, 2006).

Shipping

Commercial shipping occurs in upbound and downbound commercial shipping lanes located in Thunder Bay NMS. Commercial shipping to and from Alpena is associated predominately with cement producing operations, and occasional bulk coal and salt deliveries. Similar operations occur in the potential expanded boundaries, including quarries at Stoneport and Roger City. Related to these activities is the occurrence of "dry cargo residue."

Dry cargo residue (DCR) is a product of using "bulk dry cargoes." According to the *Final Environmental Impact Statement: U.S. Coast Guard Rulemaking for Dry Cargo Residue Discharge in the Great Lakes (August 2008)*:

> During ship loading or unloading operations, small portions of these cargoes often fall on ship decks or within ship unloading tunnels. Traditionally, Great Lakes shippers have managed DCR by periodically washing down both the deck and cargo unloading tunnels with water in a practice commonly known as "cargo sweeping." In order to reduce costs and minimize in-port time, ships typically conduct this cargo sweeping underway while traveling between ports, and the water and DCR together is washed off the ship and into the lake(that is, discharged).

The State of Michigan has determined that DCR sweeping is illegal in state waters. Because the sanctuary is jointly managed by NOAA and the state of Michigan, and because all bottom lands within the sanctuary are state owned, an expanded sanctuary will not alter this situation. The sanctuary has determined that dry cargo sweeping does not have an impact on maritime cultural resources.

Physical and Biological Environment

Because the scope of Thunder Bay NMS regulations is limited to the protection of maritime heritage resources, there is no direct anticipated effect on the physical and biological environment. However, it is possible that valuable research opportunities on the physical and biological environment could increase, due simply to the broader awareness of the area brought forth by the sanctuary's presence. A similar trend has occurred in the current sanctuary, though the actual avenues of research in an expanded sanctuary are necessarily difficult to predict. A minor increase in charter boats catering to tourist activities may occur as a result of boundary expansion. Given that sewage discharges from vessels are not permitted in the Great Lakes and a handful of additional charter boats are a negligible increase when compared to the numerous recreational fishing boats, NOAA does not expect any impacts on the biological environment as a result of increased tourism. In addition, since the designation of the sanctuary in 2000, the main increase in tourism has been seen on land rather than in the sanctuary. Section V of this document identifies

several potential consequences in an expanded sanctuary, based on experiences in the current sanctuary.

IV. Description of Proposed Action and Alternatives

This section describes the boundary expansion alternatives that NOAA is considering to meet the purpose and need for the proposed action. This section explains the process that led to development of the three final alternatives. The current alternatives were arrived at from boundary options as recommend by the Advisory Council during management plan review (2007), the result of public scoping meetings (2012), and analysis by sanctuary historians and archeologists.

Development of Alternatives

NOAA selected the Preferred Alternative boundary after considering the alternatives put forth during the sanctuary's original designation (2000), as well as expansion alternatives later developed by the Advisory Council (2007), and finally after receiving considerable public input during public scoping meetings (2012). Historical and archaeological research conducted since the sanctuary's designation was used to establish the number and condition of resources within each alternative, as well as the historical, archeological and recreational significance of these sites. Nearly all of the known sites within the Preferred Alternative are eligible for listing on the National Register of Historic Places. This section summarizes the phases of analysis and input that led up to the selection of NOAA's Preferred Alternative. During each phase, similar boundary alternatives were considered and finally developed into the three alternatives currently under consideration.

Interest by the public in TBNMS was first expressed when NOAA re-proposed the sanctuary to the Governor of Michigan in 2005 (in accordance with 15 CFR 922.34). During the re-proposal process in 2005, there was an opportunity for the public to comment on how the sanctuary was being managed. NOAA also sought public comments during the 2006 scoping process for management plan review. In both cases, NOAA received a number of comments expressing interest in boundary expansion to include Alcona and Presque Isle Counties. Several local government and non-governmental organizations including the City of Alpena, Alpena County, Alpena Township, Sanborn Township, Presque Isle Township, Rogers City, Alcona County, Michigan Sunrise Side Travel Association, and the Sunrise Side Coastal Highway Management Council passed resolutions or submitted written letters of support for expansion. Based on public interest, boundary expansion was identified as a priority issue for the sanctuary's management plan review. Letters of support can be found at: thunderbay.noaa.gov/management/expansion.

In 2007 as part of the management plan review process, NOAA established a sanctuary advisory council boundary expansion working group to evaluate whether the boundaries should be expanded to protect, manage, and interpret additional shipwrecks and other potential maritime heritage resources, and to make a recommendation to the sanctuary advisory council.

The boundary expansion working group identified and considered the following study area for evaluation of boundary alternatives: a 4,110-square-mile area that extended the current sanctuary

south into Alcona County, north into Presque Isle County, and east to the international border with Canada. The study area was identified based on the density of known and undiscovered resources, the historical, archaeological, and recreational significance of individual and collective resources, and the maritime landscape.

Sanctuary Advisory Council Boundary Evaluation and Recommendation

The boundary expansion working group evaluated three alternatives in the study area:

A. No expansion (sanctuary remains at 448 square miles). The working group rejected the "no expansion" alternative based on its evaluation of the distribution of shipwrecks outside the sanctuary. The working group concluded that there were enough known and potential shipwrecks outside the sanctuary to justify expanding the sanctuary boundary. There are 45 known shipwrecks within the current sanctuary boundaries.

B. Presque Isle Lighthouse in Presque Isle County south to Sturgeon Point Lighthouse in Alcona County, east to longitude 83 degrees west (808 square miles). The 808-square-mile area was evaluated because it was NOAA's preferred boundary during the sanctuary's initial designation in the year 2000. The area contains 60 known shipwrecks (15 additional shipwrecks than Alternative A). Approximately 64 undiscovered shipwrecks may be located in Alternative B, but limiting the sanctuary to the 808-square-mile area reduces the likelihood of inclusion of additional undiscovered shipwrecks. The working group rejected this alternative in favor of Alternative C because this alternative limited inclusion of known and undiscovered shipwrecks in the sanctuary.

C. Alternative C is 4,110 square miles and contains 78 known and approximately 100 undiscovered shipwrecks. This alternative includes all sites within Presque Isle, Alpena and Alcona Counties and extends westward to the international border with Canada. Among the sites are a number of historically, archaeologically, and recreationally significant shipwrecks not currently included in the sanctuary. Based on the density of known and undiscovered resources, the historical, archaeological, and recreational significance of individual and collective resources, the maritime landscape, and the ease of identifying the sanctuary as a three-county area, the working group recommended Alternative C.

Ultimately, the working group felt it was important and practical for the sanctuary to expand to include Alcona, Alpena, and Presque Isle Counties to the international border to provide protection for those maritime heritage resources currently known and those yet to be discovered. The working group also felt that by expanding sanctuary boundaries to the study area, important national treasures would be protected through the sanctuary's research and monitoring, education, and resource protection programs (including law enforcement), while allowing recreational use of the resources. On May 22nd, 2007, the boundary expansion working group presented this

recommendation to the SAC and the SAC passed a resolution to expand the boundary to the recommended area.[6] Based on this recommendation, two sanctuary expansion bills were introduced into the U.S. Congress by Senator Carl Levin, but, ultimately, were never brought to a vote.

In response to the Sanctuary Advisory Council's recommendation, the Thunder Bay NMS Final Management Plan (2009) contains a strategy (Strategy RP-1) to "Evaluate and assess a proposed expansion of the sanctuary to a 3,662-square-mile area from Alcona County to Presque Isle County, east to the international border with Canada to protect, manage, and interpret additional shipwrecks and other potential maritime heritage resources."

After issuing a Notice of Intent on April 12, 2012 (77 FR 21878), NOAA held three public scoping meetings in April 2012. The attendance at the three meetings was: Alpena (22), Harrisville (6), and Rogers City (14). In addition, NOAA received 21 letters and e-mails, with an additional seven comments submitted through the online portal. The overwhelming response by the public was support for boundary expansion. In addition, several people suggested that NOAA consider a slightly larger boundary north of the suggested boundary to protect an additional five historic shipwrecks. This larger area became the sanctuary's Preferred Alternative.

As the idea for a boundary expansion has been considered for many years, there is considerable documentation of support for expansion. Letters, resolutions, Congressional testimony, and Sanctuary Advisory Council recommendations from the past five years are posted on: http://thunderbay.noaa.gov/management/expansion.html

Description of Alternatives and Proposed Action

To provide protection for unique historic sites within the maritime landscape but beyond the current boundaries of the Thunder Bay National Marine Sanctuary, NOAA seeks to expand the current boundary from 448 square miles to 4,300 square miles. The current sanctuary contains 45 historic shipwrecks. The proposed expansion would protect an additional 47 known sites by including them in the sanctuary's well-established research, resource protection, education and outreach, and enforcement programs. Moreover, within the new boundary is the potential for the discovery of several dozen more shipwrecks, as well as related archeological sites such as docks, cribs, piers and prehistoric sites.

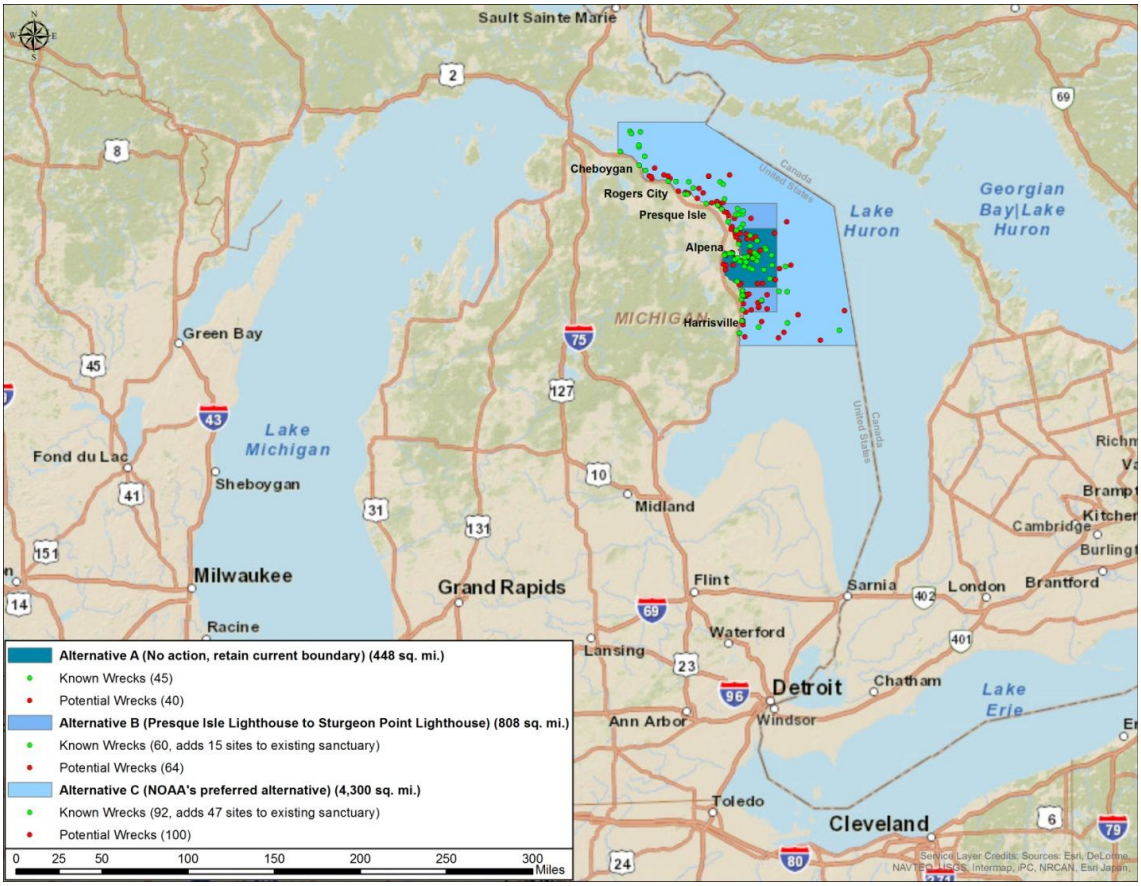
Table 2 and Figures 19 and 20 present the boundary expansion alternatives.

[6] The SAC resolution recommended adding an area of 3,662 square miles. This area added to the existing sanctuary would result in a total sanctuary area of 4,110 square miles, which is the figure used throughout this document.

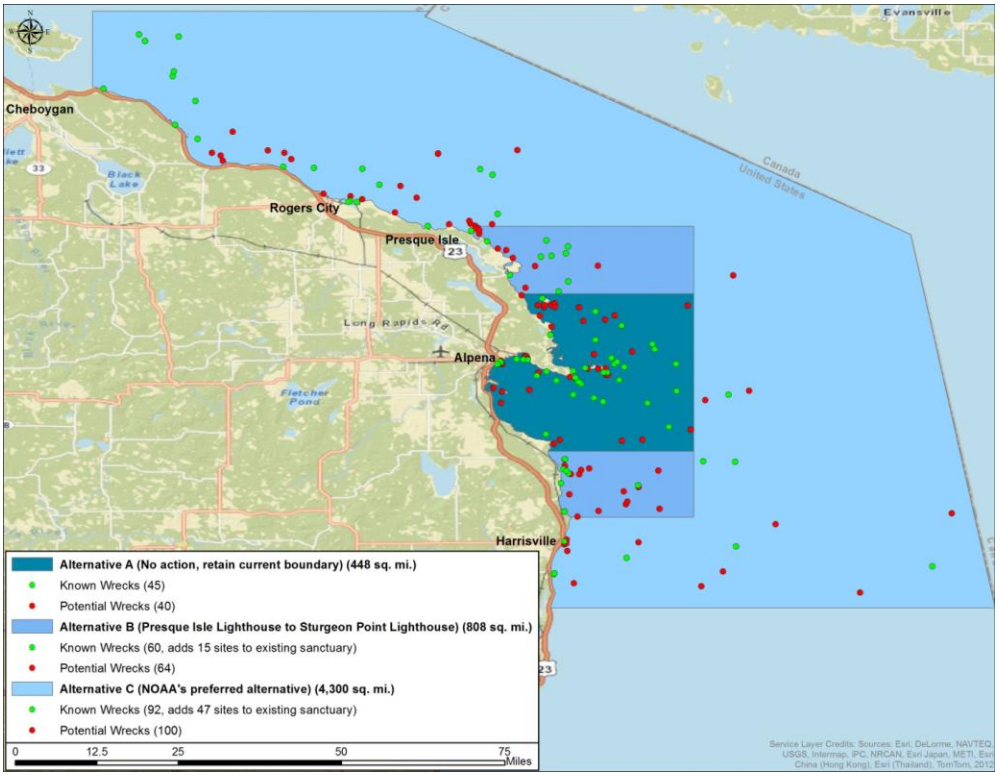
Table 2: Summary of known and suspected shipwrecks in each boundary alternative

	Total Area of Sanctuary (sq. mi.)	Known shipwrecks	Suspected shipwrecks
Alternative A (No Action, retain current boundary)	**448**	**45**	**40***
Alternative B (Presque Isle Lighthouse to Sturgeon Point Lighthouse)	**808**	**60** (adds 15 sites to existing sanctuary)	**64*** (adds 24 suspected shipwrecks)
Alternative C (NOAA's Preferred Alternative)	**4,300**	**92** (adds 47 sites to existing sanctuary)	**100*** (adds 60 suspected shipwrecks)

*Approximate locations of undiscovered shipwrecks are based upon historic records.



Figures 19 and 20 (above and below): TBNMS boundary expansion options. Green dots represent known shipwrecks, red dots are potential shipwrecks (locations based on historical records).



Alternative A (448 Square-Mile Boundary Alternative: No Action Alternative)

Under the no action alternative, NOAA would not expand the sanctuary's existing 448- square-mile boundary. The sanctuary's existing boundary extends lakeward to longitude 83 degrees west and is delineated to the north and south by the respective Alpena County lines.

This 448-square-mile area contains 45 shipwrecks. Archival research indicates that as many as 40 shipwrecks are yet to be found in this area.

Alternative B (808 Square-Mile Boundary Alternative)

This 808-square-mile boundary alternative is defined by the Presque Isle Lighthouse in Presque Isle County, south to Sturgeon Point Lighthouse in Alcona County, east to longitude 83 degrees west. The area contains 15 additional shipwrecks than Alternative A, for a total of 60 known shipwrecks. Approximately 64 undiscovered shipwrecks may be located in this alternative. As indicated previously, the Sanctuary Advisory Council working group on boundary expansion evaluated the 808-square-mile area because it was NOAA's preferred boundary during the TBNMS designation process.

Alternative C (4,300 Square-Mile Alternative) (Preferred)

NOAA's preferred alternative is to increase the sanctuary boundary to 4,300 square miles. The preferred boundary alternative would add 47 shipwrecks to the existing boundary, and include 32 more shipwrecks than Alternative B. Significantly, NOAA's preferred alternative includes Rogers City, Presque Isle, and Harrisville as communities adjacent to the sanctuary boundary. The new

boundary would include all 92 historic shipwrecks in Alpena, Alcona and Presque Isle Counties, and five shipwrecks from Mackinaw and Cheboygan Counties.

During the scoping process, NOAA received a suggestion that five additional significant historic shipwrecks should be included in NOAA's boundary expansion. Adding these shipwrecks would result in an area slightly larger than the Sanctuary Advisory Council's preferred alternative of 4,110 square miles (approximately 215 additional square miles, for a total sanctuary area of 4,300 square miles). NOAA analyzed this alternative in the DEIS and is proposing it as the preferred alternative.

The southern boundary of the preferred alternative begins where the southern boundary of Alcona County intersects with the ordinary high water mark of Lake Huron and runs east until it intersects the U.S. / Canada international boundary. The eastern boundary of this preferred alternative follows the international boundary until it intersects with the 45° 50'N line of latitude. The northern boundary follows this line of latitude (45°50'N) westward until it intersects the 84º 20'W line of longitude. The western boundary extends south along this line of longitude(84º 20'W) until it intersects the ordinary high water mark at Cordwood Point. From there, the western boundary follows the ordinary high water mark as defined by Part 325, Great Lakes Submerged Lands, of P.A. 451(1994), as amended, until it intersects the southern boundary of Alcona County.

This alternative would contain all the sites in Alternatives A and B, and is significant for the additional inclusion of shipwrecks around Spectacle Reef, recent discoveries made by sanctuary staff, several intact sites off Alcona County, and the potential for new discoveries. Although additional shipwrecks sites exist outside this area, NOAA's proposed action contains the sites whose protection would best complement, from an archaeological, historical and recreational perspective, the resources in the current sanctuary boundaries.

SECTION V
ENVIRONMENTAL AND SOCIOECONOMIC CONSEQUENCES OF THE ALTERNATIVES

Introduction

This section describes the anticipated environmental consequences of the preferred action and alternatives on the maritime heritage, physical and socioeconomic resources of TBNMS as described in the Affected Environment (Section III). The impacts are identified generally as either beneficial or adverse effects.

The chief benefit of sanctuary expansion is increased resource protection for as many as 47 additional historic shipwreck sites. Generally, the benefits of the three analyzed boundary alternatives relate proportionally to the number of shipwrecks that are in each alternative. (e.g. more resources would be protected in Area C, than Areas A and B (Table 3). Because many consequences are common to all of the analyzed alternatives, they are presented just once (see below), followed by a discussion of the unique consequences that would occur in each boundary alternative. The unique consequences of each boundary alternative are related to the number of sites within a particular boundary alternative, and the historical, archaeological and recreational significance of these sites.

Table 3. Summary of known and suspected shipwrecks in each boundary alternative.

	Total Area of Sanctuary (sq. mi.)	Known shipwrecks	Suspected shipwrecks
Alternative A (No Action, retain current boundary)	**448**	**45**	**40***
Alternative B (Presque Isle Lighthouse to Sturgeon Point Lighthouse)	**808**	**60** (adds 15 sites to existing sanctuary)	**64*** (adds 24 suspected shipwrecks)
Alternative C (NOAA's Preferred Alternative)	**4,300**	**92** (adds 47 sites to existing sanctuary)	**100*** (adds 60 suspected shipwrecks)

*Approximate locations of undiscovered shipwrecks are based upon historic records.

Additionally, although the application of sanctuary regulations and resource protection programs to 47 additional shipwreck sites is the chief and most direct benefit of the preferred action, there are several anticipated economic (e.g. increased tourism) and environmental (e.g. increased multidisciplinary research) benefits as well. These consequences are common (though proportional) to each boundary alterative and discussed in the following section. Similarly, the

consequences relative to the physical and biological environment are also common to each alternative, and summarized below.

Consequences Common to all Boundary Alternatives

Human Environment

Maritime Heritage Resources

Each boundary alternative would realize consequences (proportional to the number of shipwreck sites within it) through the application of the existing TBNMS Management Plan to that area. Primarily, this includes implementing the sanctuary's Resource Protection, Research, and Education and Outreach Actions Plans. Specifically, the anticipated benefits are:

Law Enforcement

There is existing Michigan state law and other applicable federal law regarding underwater cultural resources aimed at reducing the impact of human activities on historic shipwrecks and related maritime heritage resources. While those laws have been effective, they apply only to abandoned property. Sanctuary regulation in the proposed expanded area would provide increased protection by filling existing gaps in state law as follows:

- The sanctuary regulations would apply to all shipwrecks, not just abandoned shipwrecks.
- The use of grappling hooks or other anchoring devices is prohibited on underwater cultural resource sites that are marked with a mooring buoy.
- "Hand-taking" of artifacts outside the Thunder Bay Underwater Preserve, but still within the revised Sanctuary boundary, would be prohibited.
- Permit applications would be required to satisfy the Federal Archaeology Program guidelines for all sites located within the revised sanctuary boundary.
- As an additional enforcement mechanism, NOAA may assess civil penalties under the National Marine Sanctuaries Act for violation of Sanctuary regulations.

The enforcement of sanctuary regulations and state laws would require a sufficient on-water presence within the sanctuary. To accomplish this, the sanctuary partners with local, state and federal law enforcement agencies including NOAA's Office of Law Enforcement, the U.S. Coast Guard (USCG), Michigan Department of Natural Resources and the Environment (MDNRE), Alpena County Sheriff, and Michigan State Police. Coordination and communication among the several agencies involved in sanctuary law enforcement is critical. In 2006, the sanctuary established the Thunder Bay Law Enforcement Task Force to better coordinate enforcement efforts in the sanctuary. The

task force focuses on improving public education and providing additional on-water and dockside patrols of the sanctuary. The benefits of this task force would extend to the expanded sanctuary.

In 2011, the USCG Alpena-Station was underway 94 times and logged over 260 hours in and around the sanctuary, including operating at least 15 days near Presque Isle, Michigan, an area under study for potential sanctuary expansion and a popular marina for dive boats. Also, the USCG Auxiliary was underway 10 times in the same area, operating four times out of Presque Isle. Additionally, a USCG cutter operated in Thunder Bay proper conducting law enforcement operations for one week. This on-water presence constitutes a significant piece of law enforcement for the current sanctuary, and this benefit would extend to an expanded sanctuary.

In May 2013 Thunder Bay staff and the Michigan State Underwater Archaeologist met with the United States Coast Guard (Alpena station and Sector Sault Ste. Marie Intelligence Operations), Michigan Department of Natural Resources Law Enforcement Division and Department of Homeland Security Customs and Border Protection to discuss ways to increase law enforcement presence in the expanded sanctuary area. Discussions centered on pooling and better coordinating existing resources such as regular USCG vessel transits through the expanded sanctuary.

Finally, facilitating continuing education for local law enforcement officials is an important aspect of sanctuary law enforcement. In 2005, the sanctuary hosted a maritime heritage law enforcement workshop for regional agencies, bringing experts from NOAA's Office of Law Enforcement to Alpena, Michigan. In 2006, the sanctuary superintendent and four members of the USCG-Alpena Station and MDNRE attended a submerged cultural resources law enforcement class sponsored by Biscayne National Park. Additionally, maritime heritage law is a key component of the sanctuary's Nautical Archaeology Society training. During these classes, students learn the basics in shipwreck-specific legislation and how it applies to the sanctuary. Members of the Michigan State Police have attended this training. In 2009, the NOAA Maritime Heritage Program sponsored a workshop on federal heritage law. The workshop focused on the National Historic Preservation Act's Section 106, which provides a process to ensure that federal activities are reviewed for potential impacts on state lands. The benefits of this type of training would extend to an enlarged group of law enforcement officials operating and collaborating in an expanded sanctuary.

Shipwreck Mooring Buoys

Due to the large number of easily accessible shipwrecks, the area in and around the sanctuary is a popular snorkeling and diving destination. The sanctuary encourages public access to its resources and strives to balance increased visitation with resource protection.

Visiting dive boats and divers have the greatest potential to negatively impact the quality of sanctuary resources. Through its well-established mooring buoy program, TBNMS maintains and installs permanent U.S. Coast Guard approved mooring buoys at shipwreck sites to protect these often fragile resources (Figure 21).

Moorings are a fundamental resource protection strategy in four important ways: (1) they eliminate the need for a visiting dive boat to use its anchor to locate and secure itself to a fragile shipwreck site; (2) they eliminate the need for non-permitted moorings at shipwreck sites, which can become derelict over time, posing a risk to divers and potentially damaging the site; (3) they make for safer diving by providing a sturdy means of descent and ascent for divers, and an easy-to-find surface marker for kayakers; and (4) encourage public accessibility.

The sanctuary installed its first shipwreck mooring system in 2003; there are currently 32 moorings installed at 29 sites (some sites are large enough to require two moorings). Because the moorings are deployed seasonally to avoid ice damage, the sanctuary's website provides divers with the up-to-date status of each mooring.

Significantly, sanctuary regulations prohibit the use of grappling hooks or other anchoring devices on maritime archaeological resource sites if a mooring buoy is available at the site. This provision only applies to sites within sanctuary boundaries. Consequently, increasing the number of shipwrecks within the sanctuary's boundaries would enable both the installation of moorings at more shipwrecks sites, and the enforcement of the provision mentioned above.

Figure 21. Permanent moorings at sanctuary shipwrecks sites are a primary means of resource protection.

Research

Applying the sanctuary's Research Action Plan to the preferred boundary alternative would bring a larger number of historically, archaeologically and recreational significant shipwrecks under the umbrella of sanctuary research and characterization. In this sense, the timing for expanding the sanctuary to include more sites in its research program is excellent: as of 2011, three hundred sixty-one square miles have been surveyed within the sanctuary's existing 448-square-mile boundary, and 44 of the 45 known historic shipwreck sites in the existing boundary have been assessed by sanctuary archaeologists. The sanctuary's research program is poised to include more sites.

Research and characterization form the foundation of the sanctuary's resource protection efforts, and underpin responses to specific pressures on sanctuary resources. Characterization is the process through which resources are located, inventoried, assessed and ultimately analyzed within a broader historical, archaeological and resource management context. Characterization is accomplished through a variety of research methods, from archival research to remote sensing and individual site assessment and documentation. Characterization makes informed resource protection possible because it widens the view for resource managers, allowing research efforts to be prioritized. Including the additional 47 known historic shipwreck sites in the preferred alternative would increase research at these new sites, which in turn would allow for better resource management.

Archaeological and historical research is also at the heart of the sanctuary's exhibits, education initiatives and public programming, all of which are designed to foster greater public awareness and appreciation for the Great Lakes and their rich maritime history. Bringing additional shipwreck sites into the sanctuary's research program would in turn lead to these sites being more meaningfully included in the sanctuary's education and outreach efforts (see below).

Notably, much of the sanctuary's research is made possible with grants and other outside funding — since 2005, the sanctuary has obtained more than $435,000 from external sources for on-water research and resource protection, greatly supplementing its core resource protection budget. These added research dollars have helped to better research-and ultimately protect- sanctuary shipwreck sites. This benefit would extend to the additional shipwrecks included in an expanded sanctuary boundary.

Resource Protection through Diver Education and Conservation Awareness

Ultimately, resource protection is a shared responsibility between the sanctuary and a wide range of stakeholders. At the front lines of this effort are divers who visit sanctuary sites. Beyond their value as archaeological and historical sites, shipwrecks sites within the current sanctuary and Preferred Alternative are popular recreational sites. They also constitute an important asset for local and regional diving charter businesses. Fostering appreciation for sanctuary resources among divers is fundamental to reducing human impacts at these unique, irreplaceable sites. Divers, and other stakeholders, will protect what they value.

To preserve the archaeological, historical and recreational integrity and value of these sites, the sanctuary couples its regulations with targeted education and outreach. Poor diving practices by divers (e.g. moving or inadvertently damaging artifacts), and souvenir hunting and looting represent significant impacts to existing sanctuary resources (Figures 22 and 23). Additionally, new shipwreck discoveries continue to occur, opening up the potential for irreversible diver impacts at previously undisturbed sites.

Although sanctuary regulations and Michigan law prohibit moving artifacts, the practice still occurs at many sites where divers want to provide better viewing and photography opportunities. Clearly unacceptable is the handling and relocation of human remains. Thirteen sites in NOAA's preferred alternative have the potential for human remains, and visible remains have been reported at several sites. (NOAA Thunder Bay NMS, 2005 and 2011).

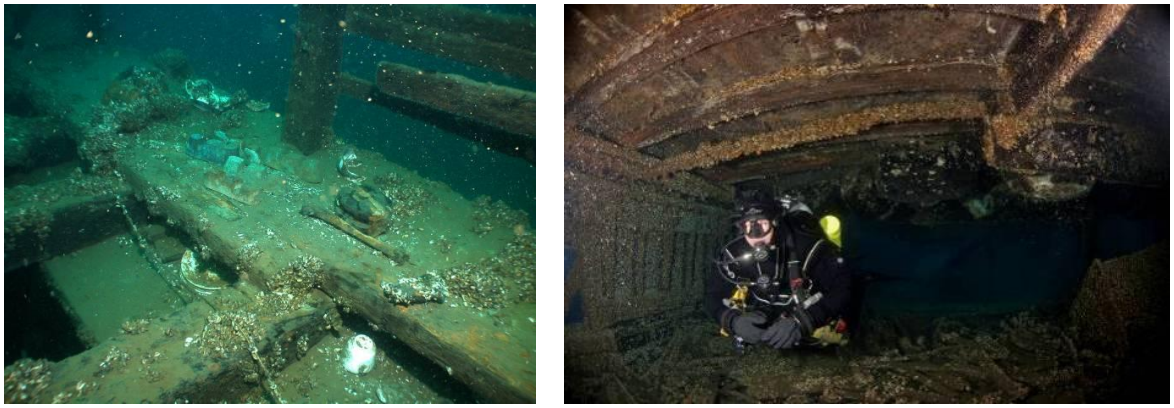


Figure 22. Left, the cabin skylight on the deck of the schooner *Defiance* (1848-1854) was in place in 2005. Sometime after the 2005 photo was taken, the fragile skylight was displaced, as indicated in the photo at right taken from a diving-related website.

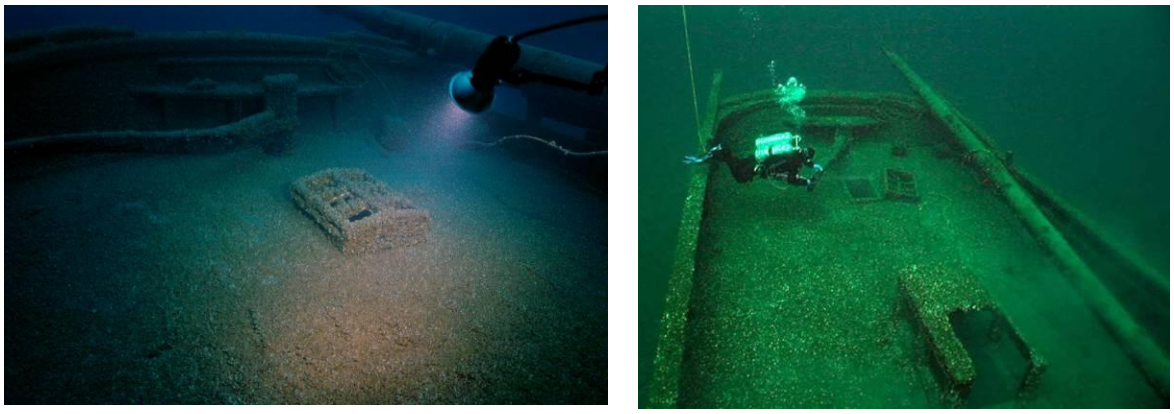


Figure 23. Left, moved by divers from their original disposition on the wreck of the steamer *Pewabic* (located in the current sanctuary boundaries), several artifacts such as copper ingots and ceramic cups and plates have been placed on deck and are more likely to be looted. Right, a diver swims between decks of the steamer *Florida* while hovering above are several air-tight barrels still buoyant after 114 years. Resting upright in 200 feet of water, the wooden package freighter's hold is still stacked with cargo.

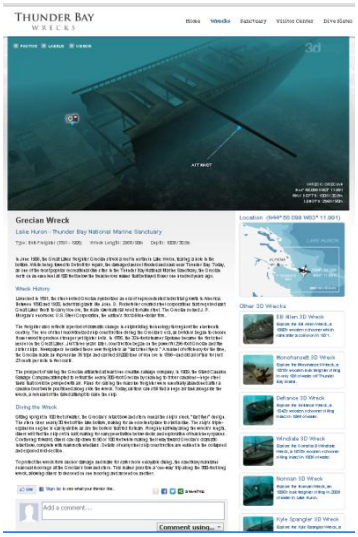
The sanctuary conducts substantial education and outreach activities designed to reach multiple audiences including educators, students, tourists and the local community, among others.[7] National and regional diving trade shows, maritime archaeological workshops and academic symposiums

[7] In 2011, the sanctuary's Great Lakes Maritime Heritage Center welcomed nearly 70,000 visitors. Tailored programs aimed at K-12 students reached approximately 2,700 local students, while additional specialized programming for all ages and interties reached an additional 6,800. Learn more about the sanctuary's education programs in the 2009 Final Management Plan and www.thunderbay.noaa.gov/education.

are important venues to meet with divers. These provide opportunities to discuss concerns in the dive community, reinforce the benefit of responsible diving through presentations and outreach literature, and build partnerships. Since 2004, sanctuary archaeologists have staffed informational booths and given presentations at many regional and national venues, including *Gales of November* (Duluth, Minn.), *Dive into the Past* (Minneapolis/St. Paul, Minn.), *Ghost Ships Festival* (Milwaukee, Wisc.), *Our World Underwater* (Chicago, Ill.), *Great Lakes Shipwreck Festival* (Ann Arbor, Mich.), *Boston Sea Rovers* (Boston, Mass.), and the *Society for Historical Archaeology Annual Conference* (various national locations). Sanctuary staff attend several of these events annually. In 2011, sanctuary archaeologists gave presentations and staffed informational booths at three major Midwest diving trade shows with an overall attendance of over 11,000 people.

Reaching a wider diving audience is also important, as the sanctuary seeks to deliver its preservation message via larger outlets and promote diving and tourism in the region. Since 2004, the sanctuary has facilitated and been featured in a number of television and film projects aimed at both diving and general audiences. These include: History Channel (*Deep Sea Detectives: Great Lakes Ghost Ship*), Jean-Michel Cousteau's Ocean Futures Society (*America's Underwater Treasures*), National Geographic Channel (*Drain the Great Lakes*), Radical Media/Current TV (*Project Shiphunt*), Discovery Channel Canada (*Daily Planet*), the Science Channel (*Great Lakes Shipwrecks*), and public television (*Tragedies in the Mist*).

Creating an increased sense of value toward sanctuary resources requires providing meaningful products that both facilitate public access and reinforce responsible diving. Consequently, many of the sanctuary's research products are repurposed as outreach material specifically for divers. For example, 17 of the sanctuary's archaeological site maps can be downloaded and printed via the sanctuary's website, and several have been rendered as computer animations and 2D graphics for dive planning (Figures 24 and 25). Divers can access these on the sanctuary's website, where they will also find coordinates, images and diving-related information on 69 shipwrecks in and around the sanctuary.



Figures 24 and 25. In 2004 graduate students from East Carolina University documented the steamer *Monohansett*, resting in shallow water in the sanctuary. Using this data, sanctuary partner Fourth Element created a printable 2D graphic (left). These can be viewed online at http://thunderbaywrecks.com and http://thunderbay.noaa.gov. (NOAA/Fourth Element)

Involving divers directly in the documentation of shipwreck sites helps foster a preservation ethic, while also expanding the sanctuary's research abilities. Using the Nautical Archaeology Society's curriculum and certification, the sanctuary has trained 69 divers in archaeological field methods.[8] During this hands-on archaeological training experience, students learn about historic preservation, maritime archaeological law and sanctuary-specific resource protection efforts. These "citizen scientists" include local residents, as well as members of the Michigan Underwater Preserve Council, Michigan State Police, U.S. Naval Sea Cadets and National Association of Black SCUBA Divers. Expanded the sanctuary to include the additional 47 historic shipwreck sites in the preferred alternative would both increase the number and range of volunteer opportunities, and also receive the benefit of being included in the sanctuary's effort to foster a greater preservation ethic among divers.

Resource Protection through Partnerships

The sanctuary relies heavily on the work of others to help respond to pressures on its resources. Many groups and individuals impart energy, expertise, and equipment critical to sanctuary resource protection. Leveraging these partnerships is critical to the sanctuary's successful and sustained management of its resources. Still other partners have their own research objectives, aimed at both cultural and natural resources, and the sanctuary actively supports these efforts. The benefit of partnerships in an expanded sanctuary is two-fold: (1) many existing partners would bring their expertise to bear on the study and management of the larger sanctuary and its resources; and (2) new partnerships would be cultivated that help address resource protection challenges unique to the expanded area.

[8] See http://www.nauticalarchaeologysociety.org/training

A research partner's presence in Alpena (and the region) also has an important effect on the local economy, further strengthening the sanctuary's tie to the community. In 2011, ninety-eight individuals spent 278 overnight-stays in the Alpena area in support of sanctuary-related work. This benefit would extend to a larger sanctuary.

The list below represents many of the TBNMS research partners to date:

- Cooperative Institute for Ocean Exploration, Research and Technology
- Dr. Robert Ballard's Institute for Exploration
- East Carolina University, Program in Maritime Studies
- East Carolina University, Diving and Water Safety Program
- Grand Valley State University, Annis Water Resources Institute
- Great Lakes Naval Memorial and Museum
- Michigan Department of Environmental Quality
- Michigan Department of National Resources
- Michigan Underwater Preserve System
- National Association of Black Scuba Divers
- NOAA, Great Lakes Environmental Research Laboratory
- NOAA, National Geodetic Survey, Remote Sensing Division
- NOAA, National Undersea Research Center
- NOAA, Office of Coast Survey, Navigation Response Team
- Noble Odyssey Foundation
- PAST Foundation
- University of Connecticut, Marine Sciences Program
- University of Michigan, Anthropology Department
- University of Michigan, Geomicrobiology Lab
- University of Michigan, Marine Hydrodynamics Lab
- University of Michigan, Naval Architecture and Marine Engineering
- University of Michigan, Perceptual Robotics Lab
- University of North Carolina, Coastal Studies Institute
- University of Rhode Island, Joint Program in History/Archaeological Oceanography
- University of Texas at Austin, Applied Research Lab
- University of Vermont, The Rubenstein School of Environment and Natural Resources
- University of Wisconsin-Stout, Biology Department
- U.S. Naval Sea Cadets-Great Lakes Division
- U.S. Coast Guard-Alpena Station
- Woods Hole Oceanographic Institution

Notably, the sanctuary also cultivates partnerships that enhance the protection of other types of maritime heritage assets important to the sanctuary and community. For example, since 2003 the

sanctuary has partnered with the Alpena County George N. Fletcher Public Library to jointly manage and make available to the public, the Thunder Bay Sanctuary Research Collection. The collection includes more than 1,000 published works, 80,000 photographs, 56 linear feet of vertical files, 40 feet of periodicals, 100 navigation charts, 350 shipbuilding plans, various manuscripts, and files on more than 20,000 Great Lakes watercraft.

Because it is a significant sanctuary resource and open to the public, a major focus has been to digitize the collection. A $235,000 grant from the Michigan Department of History, Arts, and Libraries, nearly $160,000 from the NOAA Climate Database Modernization Program and hundreds of volunteer hours made possible the creation of an online database of 17,000 vessels and related photographs. An expanded sanctuary would necessarily increase the number of opportunities for this type of resource protection partnership (see also Recreation and Tourism below).

Education and Outreach Directed at the General Public and Students

The sanctuary's Education and Outreach Action Plan enhances public awareness, understanding, and stewardship of the sanctuary, the Great Lakes and the ocean. Sanctuary education and outreach programs are designed to raise public awareness about the sanctuary and its resources, encourage public involvement in resource protection, increase knowledge about Great Lakes maritime history, and expand ocean and Great Lakes literacy. Expanding the sanctuary to include more sites would bring greater public attention to these sites and ensure their inclusion in sanctuary education and outreach efforts.

Education and outreach at Thunder Bay National Marine Sanctuary includes both formal programs for learners of all ages and informal programs for sanctuary visitors and constituents, including user groups impacting sanctuary resources. Education and outreach at the sanctuary also includes promotion of the sanctuary, the Great Lakes Maritime Heritage Center, and the Great Lakes Maritime Heritage Trail.

While education and outreach efforts are concentrated in and around the Great Lakes Maritime Heritage Center, they extend out to the region, state, and nation with initiatives in maritime heritage, archaeology, and ocean and Great Lakes literacy. Various strategies, from curriculum resources and traveling exhibits to eco- and heritage - tourism partnerships, allow the sanctuary to efficiently and effectively carry out its education objectives.

Sanctuary education initiatives reach a large number and wide variety of stakeholders. The sanctuary's Great Lakes Maritime Heritage Center (GLMHC) welcomed over 84,000 visitors in 2012. Additionally, in 2012, over 4500 pre-K through college students participated in educational programming that features Thunder Bay National Marine Sanctuary resources and nearly 12,000 individuals participated in specialized/targeted GLMHC programming. Also in 2012, over 1,800 local students participated in specially developed watershed or on-water programming. Through a

variety of successful partnerships and relying on over 2000 volunteer hours annually, the sanctuary is engaging the stewards of tomorrow by providing primary school students with place-based meaningful watershed experiences, high school students in Alpena may now take an elective science course that features TBNMS called, "Shipwreck Alley," and the sanctuary was recently asked by the Michigan STEM Hub Network to head up training educators in Remotely Operated Vehicle (ROV) technology.

Additional Maritime Heritage Sites and the Cultural Landscape

The maritime cultural landscape includes maritime heritage resources other than historic shipwrecks (the primary focus of TBNMS). With many additional miles of shoreline and the addition of several small communities, maritime cultural landscape features are more numerous (including lighthouses). The inclusion of the coastal communities of Rogers City and Harrisville would provide "anchor" points to the sanctuary, as these communities have a strong maritime history. There would also be greater shore-based access to the shipwrecks (e.g., marinas in Rockport, Rogers City). The Great Lakes Maritime Heritage Trail, which is currently located in Alpena County, would likely be expanded north and south to reach other coastal communities. This is one example of the anticipated investment in the additional coastal communities due to sanctuary expansion.

Recreation and Tourism

It is expected that the expanded sanctuary would draw more divers and tourists to the area, although the Great Lakes Maritime Heritage Center in Alpena, would continue to be the main tourist destination. Businesses that relate directly to the TBNMS, such as the glass-bottom boat charter, would likely see an increase in visitors and could potentially expand to the other coastal communities.

In each of the boundary alternatives, there is no anticipated negative consequence to recreation and tourism. Based on experiences within the existing sanctuary (summarized here), there are several potential positive consequences to sanctuary expansion:

Fishing

Commercial and recreational fishing and boating are potential stressors to sanctuary maritime archaeological resources, with the biggest threat being damage resulting from deploying, dragging and recovering anchors and nets. Although impacts from fishing lures from trolling is possible (e.g., drifting and anchored fishing boats can become snagged in wrecks sites and potentially damage a fragile site), the potential impact is slight. Derelict lines and lures pose a potential hazard to scuba divers. Although gillnet remnants are known to exist at a couple shipwreck sites in the sanctuary, the future threat is not great given the limited number of commercial fishers in the area and the prohibition of gillnets in U.S. waters of Lake Huron south of Hammond Bay. In addition, the few remaining Native American and commercial fishermen avoid known wreck sites, as they are

hazards to fishing gear. In each of the boundary alternatives, there is no anticipated consequence to fishing.

Shipping

Because the State of Michigan has determined that dry cargo residue sweeping is illegal in state waters, none of the boundary expansion alternatives would have an impact on this activity.

Physical and Biological Environment

As indicated in Section III. *Affected Environment*, sanctuary regulations pertain only to maritime heritage cultural resources. However, the presence of the sanctuary has in the past encouraged multidisciplinary research, and at times the sanctuary has provided logistical and operational support for this research. Three examples are cited here, as these are important avenues of research that could occur in an expanded sanctuary.

Invasive Species

Aquatic non-indigenous species can negatively impact ecosystem structure, shipwrecks and other maritime archaeological resources (EPA 2008, ONMS 2009). Since the 1800s, human activities have caused the introduction of more than 200 exotic aquatic organisms of all types into the Great Lakes. Invasive zebra and quagga mussels have had an exceptionally significant impact on shipwrecks maritime heritage resources, as they have an affinity for hard substrates and are commonly found attached to these sites. When first introduced into the Great Lakes in the 1980s, via ballast water discharge from transoceanic ships, zebra and quagga mussels first colonized shallow, well-lit shipwreck sites. Today, however, sanctuary archaeologists have observed significant zebra and quagga mussel infestation on shipwrecks sites as deep as 300 feet.

Although invasive mussels settle on all hard substrates, it has been documented that they appear to prefer wrought iron and steel surfaces (Watzin et al. 2001). As a result, there is concern over the effects of the spread of their colonization on shipwrecks. The latest lake-wide survey of quagga mussels, which included sites within the sanctuary, showed that mussel abundances increased twofold between 2003 and 2007 at depths greater than 50 meters, and about fourfold at depths between 51-90 meters (T. Nalepa, NOAA GLERL, unpubl. data).

The initial impact of mussel attachment is the loss of "archaeological visibility" – the surfaces of a historic shipwreck can literally disappear under layers of mussels (Kraft 1996, Watzin et al. 2001). While the shape of the shipwreck is still recognizable, the details of its surface and construction are obscured, thus severely impacting the ability to study these resources (Figure 26). Infestation of zebra and quagga mussels could also diminish the interest in diving on these wrecks, resulting in an adverse economic impact in the area through loss of tourism (Black et al. 2000). The weight of these mussels can also affect the structural integrity of the wrecks causing portions to break off or collapse. Also, removing mussels from the surfaces of these resources could result in further

damage and loss (Watzin et al. 2001). Finally, when mussels colonize steel structures such as walls, pipes, and iron fasteners and fittings on shipwrecks, the iron and steel corrodes at a significantly accelerated rate as compared to ferrous material not encrusted with mussels (Watzin et al. 2001). Since many of the wooden ships in the Thunder Bay sanctuary are primarily iron and steel fastened, the structural integrity of these resources could potentially be compromised (Watzin et al. 2001). Figures 26 and 27.

Figure 26. The nameboard of the schooner *Kyle Spangler* (1854-1860; 185 foot depth) in 2003 was vivid in its detail. In 2011, the carved relief of the wooden nameboard shows visible signs of wear, as divers brush away stubbornly attached quagga mussels to get a photo opportunity. This site is located in NOAA's Preferred Alternative. Stan Stock (2003) and NOAA (2011).

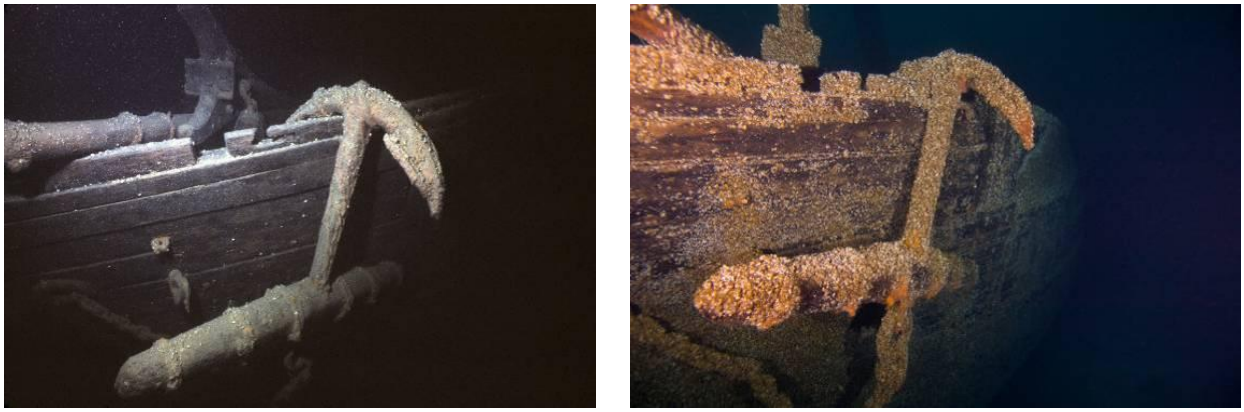


Figure 27. Left, a 2003 image of the anchor stowed on the port rail of the schooner *Kyle Spangler*, resting in 185-feet of water. Only a few quagga mussels are present. The variety of wood and iron features, many quite small but still easily made out, are a testimony to the preservative qualities of the Great Lakes cold, fresh water. Photo by Stan Stock. Right, a 2008 photo of the same anchor from a similar perspective. Many features are now obscured and have been since 2005. Quagga mussels completely cover the iron shank and flukes, as well as the iron anchor chain. Notably, the two small iron rings, presumably used as part of the apparatus to secure the anchor, are nearly undetectable.

Regionally, the sanctuary is working to develop and support partnerships with multi-disciplinary researchers and organizations to study Great Lakes ecology including the study of invasive species. From 2008 to 2010, the sanctuary research team conducted a series of dives in Saginaw Bay to support mussel sampling efforts by NOAA's Great Lakes Environmental Lab (GLERL) and several partner organizations. Begun in 2007, the five-year project is studying the complex multiple

stressors impacting the Saginaw Bay ecosystem. The research is being used to develop, evaluate and operationalize GLERL's Adaptive Integrated Framework, using Saginaw Bay as a blueprint that can be applied at other coastal systems facing similar stressors and management issues. Partners include the University of Michigan, Michigan State University, University of Akron, Limno-Tech, Western Michigan University, Michigan Department of Natural Resources, and Michigan Department of Environmental Quality. Sampling by sanctuary divers provides data critical to the project's invasive mussel component.

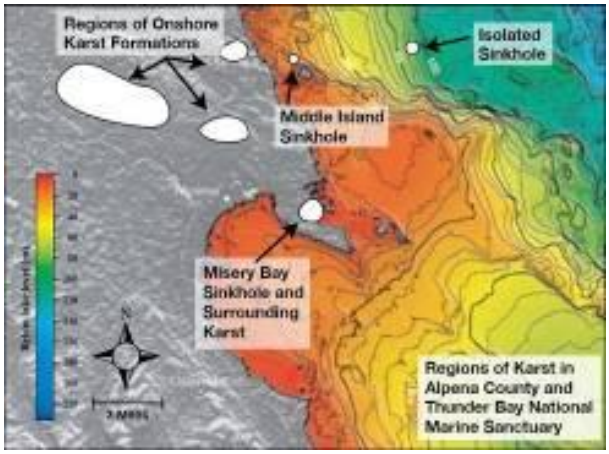
In 2012, as part of GLERL's Long-Term Ecological Research program, the mussel sampling model used and refined in Saginaw Bay were implemented in Thunder Bay. This effort coincided with the broader Lake Huron Coordinated Science and Monitoring Initiative (CSMI), which has a significant Thunder Bay component in 2012.[9] Among other research objectives, the CSMI aims to understand the impact of invasive species in Thunder Bay. The sanctuary supports the CSMI and its many partners by providing divers, research vessels, lab space and living quarters. Notably, the 2012 GLERL and CSMI efforts represent a significant milestone in the study of the Thunder Bay ecosystem, and one that is occurring in part because of the sanctuary's presence in Alpena. Supplementing ongoing research by the Michigan DNRE, U.S. Fish and Wildlife Service and U.S. Geological Survey, the CSMI effort represents the first step in a longer-term process of coordinated Lake Huron monitoring by multiple agencies.

Most, if not all of the shipwreck sites in each boundary alternative are colonized by invasive mussels. Consequently, these sites will benefit from sanctuary's current efforts and partnerships focused on invasive mussels. Additionally, the sanctuary's presence has precipitated a new focus on invasive mussels in northern Lake Huron. Expanding the sanctuary's boundaries is likely to enhance further research on the impact of invasive mussels on both shipwrecks and the natural environment.

Submerged Sinkholes

Submerged sinkholes are present in the sanctuary and support a specialized local ecosystem (Figure 28). Thousands of years ago, Lake Huron's limestone bedrock was exposed to extremely low lake levels following the last glacial maximum. Karst sinkholes were created between 10,000 and 8,000 years ago when a chemical reaction between limestone and acidic water dissolved away passages or holes in the rock, leaving behind weakly supported ceilings that could easily collapse or sink. The Lake Huron sinkholes were subsequently covered with water and are currently seeping groundwater to the bottom of the lake, providing a unique habitat for aquatic life. Researchers are now considering the Lake Huron sinkholes to be analogous to marine vent ecosystems – freshwater

[9] The CSMI is a bi-national effort between Canada and the U.S. to jointly address the top science and monitoring priorities for the Great Lakes on an individual lake level. Priorities are identified by the Lakewide Management Plan management committees and coordinated through a bi-national CSMI Steering Committee.



biogeochemical "hot spots" where nutrients recycle rapidly and where novel organisms and community processes may be observed (Voorhies et al. 2012).[10]

Figure 28. Above-ground offshore karst formations and submerged sinkholes in Thunder Bay sanctuary (NOAA)

In an ongoing effort to support and facilitate multidisciplinary research at the Middle Island submerged sinkhole, the sanctuary's research team regularly conducts scientific dives for researchers from Grand Valley State University's Microbial Biology Lab, the University of Michigan's Geomicrobiology Lab, the University of Wisconsin-Stout, and NOAA's Great Lakes Environmental Lab as they continue to characterize the specialized ecosystem present at the Middle Island sinkhole. As additional sinkholes are discovered in the potential expanded area, sanctuary resources may be brought to bear of this important avenue of research.

Great Lakes Water Levels

The Great Lakes, their connecting waterways, and their watersheds, comprise the largest surface freshwater system on the planet. The monthly, seasonal, and annual surface water elevations of the lakes fluctuate in response to a variety of factors.

Great Lakes water levels are at their lowest level since the mid 1960s. According to the U.S. Army Corps of Engineers (January 2013), the water level of Lake Superior is 1 inch below its level from one year ago, while Lake Michigan-Huron is 17 inches lower. Lakes St. Clair, Erie, and Ontario are 20, 23, and 15 inches lower, respectively, than their levels of a year ago. Over the next month, Lake Superior is forecasted to drop 3 inches from its current level while Lake Michigan-Huron is expected to fall 1 inch. A continued lack of rain and snowfall in the Great Lakes basin will lead Lakes Huron and Michigan to break the record monthly low set in March 1964 — 576.05 feet above sea level — while all of the lakes are predicted to see lower-than-normal water levels.

There is a direct link between low water levels and the deterioration of shipwrecks. As water levels drop, shallow water shipwrecks become more exposed to air, waves and ice, thus accelerating natural decomposition. Nearshore shipwrecks in sandy lakebed environments may suffer increased

[10]For a more general overview see Doermann 2012.

deterioration as increasingly mobile sediment (due to a more dynamic environment created by lower water levels) variously exposes and buries sites. Moreover, the sudden occurrence of a shallow-water shipwreck exposed by shifting sediment makes for an exciting discovery, but one that is also potentially very accessible, and can lead to both intentional and unintentional human impacts including looting.

In 2013, as Great Lakes water levels reach an historic low, the sanctuary began a program of using volunteers to locate, assess and document newly exposed cultural resources. Sanctuary staff analyzed the coast line and prioritized areas of concern (i.e. publicly accessible beaches, areas where known shipwrecks occurred just off shore, etc.). Volunteer teams are given training, documentation forms, GPS and a camera, and each team's results are logged and tracked by the sanctuary. This program would be applied to an expanded sanctuary.

Consequences Unique to Each Boundary Alternative

The unique consequences relative to each boundary alternative are the number of sites within each alternative, and the historical and archaeological significance of those sites. The sections below highlight these important aspects of each alternative.

Boundary Alternative A (No Action Alternative)

Taking no action would result in no change of the current management regime of the sanctuary. The Thunder Bay National Marine Sanctuary would continue to implement its management plan, including the action plans related to resource protection, research, and education would be applied in the existing boundary (Final Management Plan, 2009). The maritime heritage resources within the existing 448 square-mile boundary would continue to be protected by the TBNMS regulations.

This "no action" alternative would result in the status quo for conducting research, resource protection and education programs at TBNMS. This action would not protect additional shipwrecks and would not enhance existing education and research programs. Only the city of Alpena would be immediately adjacent to the boundary (Rogers City and Harrisville would continue to be outside the boundary). Because of the many historically, archeologically and recreationally significance shipwrecks beyond the sanctuary's current boundaries, and in response to public input regarding the socioeconomic benefits of sanctuary expansion, this alternative is not preferred.

Under the no action alternative, there are no social or economic consequences expected because no additional waters would be designated as a national marine sanctuary. It has no impact on socioeconomic or human uses within the sanctuary. The Great Lakes Maritime Heritage Center continue to operate as the visitors' center, Alpena would be the only coastal community adjacent to the boundary, and tourism-related activities, such as diving and glass-bottom boat tours, would operate in sanctuary waters.

Maritime Heritage Resources

As mentioned above, it is the number and historical, archeological and recreational significance of the sites within each boundary alternative that makes each alternative unique (Figure 29). The following are the significant sites with Alternative A:

Among the notable shipwrecks in this Alternative are the paddlewheel steamers *New Orleans* (1838-1849; 15 foot depth) and *Benjamin Franklin* (1842-1850; 15 foot depth), the two earliest shipwrecks in the sanctuary. North Point Reef, a geologic feature that extends over one mile from shore and rises to within five feet of the surface was a significant hazard to navigation and contains the remains of many shipwrecks. The wooden "steam barge" *Galena* (1857-1872; 16 foot depth) went ashore on North Point carrying 272,000 feet of lumber on September 24, 1872 and quickly broke apart. Similarly, the wooden steam barge *B.W. Blanchard* 1870-1904; 9-foot depth) towing the wooden schooner barges *John T. Johnson* (1873-1904; 7-foot depth) and *John Kilderhouse* went aground on North Point during a blinding snowstorm in November 1904. *Blanchard* and *Johnson* were completely wrecked, while *Kilderhouse* was eventually recovered. Though difficult to identify with precision, the scattered remains of several other vessels are located on North Point Reef as well, including the brig *Empire State* (1862-1877), schooner *E. B. Palmer* (1856-1892), and steamer *Congress* (1861-1868), which saw service during the Civil War in Tidewater, Virginia.

Notably, most shipwrecks within the sanctuary occur in shallow and intermediate diving depths and are very popular with SCUBA divers and dive charter business. These include the steamer *Montana* (1872-1914; 60 foot depth), bulk freighter *Grecian* (1891-1906; 100 foot depth), bulk freighter *Monohansett* (1872-1907; 18-foot depth), steam barge *William P. Thew* (1884-1909; 70-foot depth), steam barge *Oscar T. Flint* (1889-1909; 30-foot depth), schooner *E. B. Allen* (1864-1871; 100 foot depth), and schooner *Lucinda Van Valkenburg* (1862-1887; 60-foot depth).

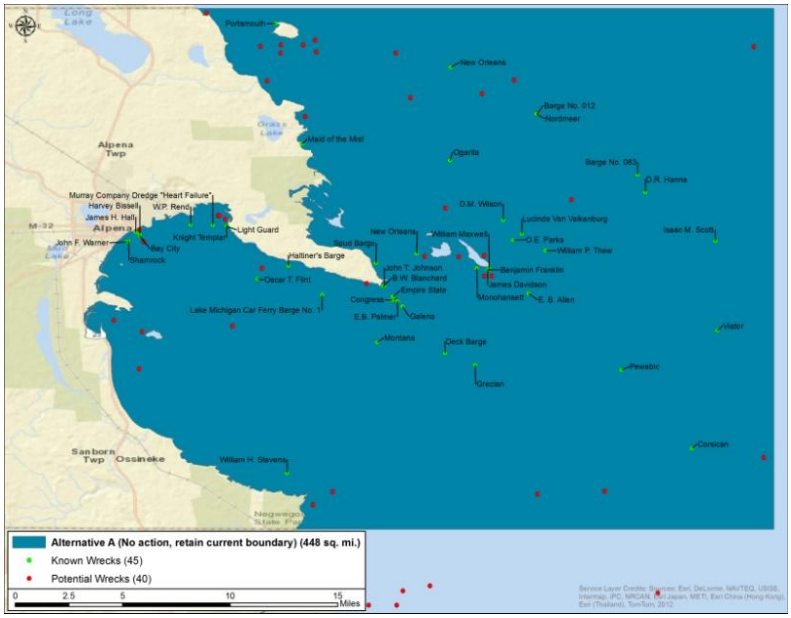


Figure 29: Shipwrecks within Alternative A.

Table 4. List of known historic shipwrecks in Boundary Alternative A.

	Vessel Name	Vessel Type	Hull	Built	Lost	Length	Loss Type	Cargo	County	Depth	Alternative
1	**Allen, E.B.**	Schooner	Wood	1864	1871	134	Collision	Grain	Alpena	100	A
2	**Barge No. 012**	Barge	Steel	1897	1975	160	Collision	Supplies	Alpena	40	A
3	**Barge No. 083**	Barge	Wood	1920	1941	200	Foundered	Well-drilling Machinery	Alpena	70	A
4	**Bay City**	Schooner Barge	Wood	1857	1902	146	Collision	Light	Alpena	11	A
5	**Bissell, Harvey**	Schooner	Wood	1866	1905	162	Abandoned	Lumber	Alpena	15	A
6	**Blanchard, B.W.**	Steam Barge	Wood	1870	1904	221	Stranded	Lumber	Alpena	9	A
7	**Congress**	Propeller	Wood	1861	1868	139	Stranded, Burned	Salt, Apples, Rail Iron	Alpena	17	A
8	**Corsican**	Schooner	Wood	1862	1893	112	Collision	Coal	Alpena	160	A
9	**Davidson, James**	Bulk Freighter	Wood	1874	1883	230	Stranded	Coal	Alpena	38	A
10	**Deck Barge**	Barge	Steel	Unknown	Unknown	60	Foundered		Alpena	92	A
11	**Empire State**	Brigantine	Wood	1862	1877	136	Stranded	Iron Ore	Alpena	12	A
12	**Flint, Oscar T.**	Steam Barge	Wood	1889	1909	218	Burned	Limestone	Alpena	32	A
13	**Franklin, Benjamin**	Paddle Wheeler	Wood	1842	1850	135	Stranded		Alpena	15	A
14	**Galena**	Steam Barge	Wood	1857	1872	190	Stranded	Lumber	Alpena	16	A
15	**Grecian**	Bulk Freighter	Steel	1891	1906	296	Foundered	Light	Alpena	98	A
16	**Hall, James H.**	Schooner	Wood	1885	1916	91	Stranded	Lumber	Alpena	6	A
17	**Haltiner's Barge**	Dredge	Wood	Unknown	1927	80	Foundered	Dredging Equip-ment	Alpena	17	A
18	**Hanna, D.R.**	Bulk Freighter	Steel	1906	1919	532	Collision	Wheat	Alpena	130	A
19	**Johnson, John T.**	Schooner Barge	Wood	1873	1904	171	Stranded	Lumber	Alpena	7	A
20	**Knight Templar**	Schooner Barge	Wood	1865	1903	136	Abandoned	Light	Alpena	5	A
21	**Lake Michigan Car Ferry Barge No. 1**	Barge	Wood	1895	1918	309	Foundered	Lumber, Chickens	Alpena	42	A
22	**Light Guard**	Schooner	Wood	1866	1903	143	Abandoned	Light	Alpena	6	A
23	**Maid of the Mist**	Schooner	Wood	1863	1878	90	Stranded	Cedar Posts	Alpena	7	A
24	**Maxwell, William**	Tug	Wood	1883	1908	66	Stranded	Fish	Alpena	12	A

	Vessel Name	Vessel Type	Hull	Built	Lost	Length	Loss Type	Cargo	County	Depth	Alternative
25	**Monohansett**	Steam Barge	Wood	1872	1907	164	Burned	Coal	Alpena	18	A
26	**Montana**	Steam Barge	Wood	1872	1914	236	Burned	Light	Alpena	66	A
27	**Murray Company Dredge "Heart Failure"**	Dredge	Wood		1906		Abandoned	Light	Alpena	18	A
28	**New Orleans**	Paddle Wheeler	Wood	1838	1849	185	Stranded	Freight	Alpena	13	A
29	**New Orleans**	Bulk Freighter	Wood	1885	1906	231	Collision	Coal	Alpena	130	A
30	**Nordmeer**	Ocean Vessel	Steel	1954	1966	470	Stranded	Steel	Alpena	35	A
31	**Ogarita**	Barkentine	Wood	1864	1905	173	Burned	Coal	Alpena	30	A
32	**Palmer, E.B.**	Schooner	Wood	1856	1892	138	Stranded	Red Sandstone	Alpena	16	A
33	**Parks, O.E.**	Steam Barge	Wood	1891	1929	134	Foundered	Pulpwood	Alpena	62	A
34	**Pewabic**	Propeller	Wood	1863	1865	198	Collision	Copper	Alpena	170	A
35	**Portsmouth**	Propeller	Wood	1853	1867	182	Stranded	Pig Iron	Alpena	8	A
36	**Rend, W.P.**	Steam Barge	Wood	1888	1917	287	Stranded	Stone	Alpena	17	A
37	**Scott, Isaac M.**	Bulk Freighter	Steel	1909	1913	524	Foundered	Coal	Alpena	175	A
38	**Shamrock**	Steam Barge	Wood	1875	1905	146	Abandoned	Lumber	Alpena	11	A
39	**Spud Barge**	Barge	Wood	Unknown	1937		Abandoned		Alpena	1	A
40	**Stevens, William H.**	Schooner	Wood	1855	1863	117	Stranded	Wheat	Alpena	10	A
41	**Thew, William P.**	Steam Barge	Wood	1884	1909	132	Collision	Light	Alpena	84	A
42	**Van Valkenburg, Lucinda**	Schooner	Wood	1862	1887	128	Collision	Coal	Alpena	60	A
43	**Viator**	Ocean Vessel	Steel	1904	1935	231	Collision	Pickled Herring	Alpena	188	A
44	**Warner, John F.**	Schooner, 2 mast	Wood	1855	1890	126	Abandoned	Lumber, Lath	Alpena	9	A
45	**Wilson, D.M.**	Bulk Freighter	Wood	1873	1894	179	Foundered	Coal	Alpena	48	A

Tourism
There would be no impact on tourism.

Shipping
There would be no impact on shipping.

Fishing
Commercial and recreational fishing would not be impacted.

<u>Physical and biological environment</u>
There would be no impact on the physical and biological environment.

Boundary Alternative B (808 square miles)
Under Alternative B, an additional 360 square miles would become sanctuary waters and an additional 15 shipwrecks would be in this boundary. This would result in an 808 square mile sanctuary boundary containing a total of 60 known historic shipwrecks (see figure 30).

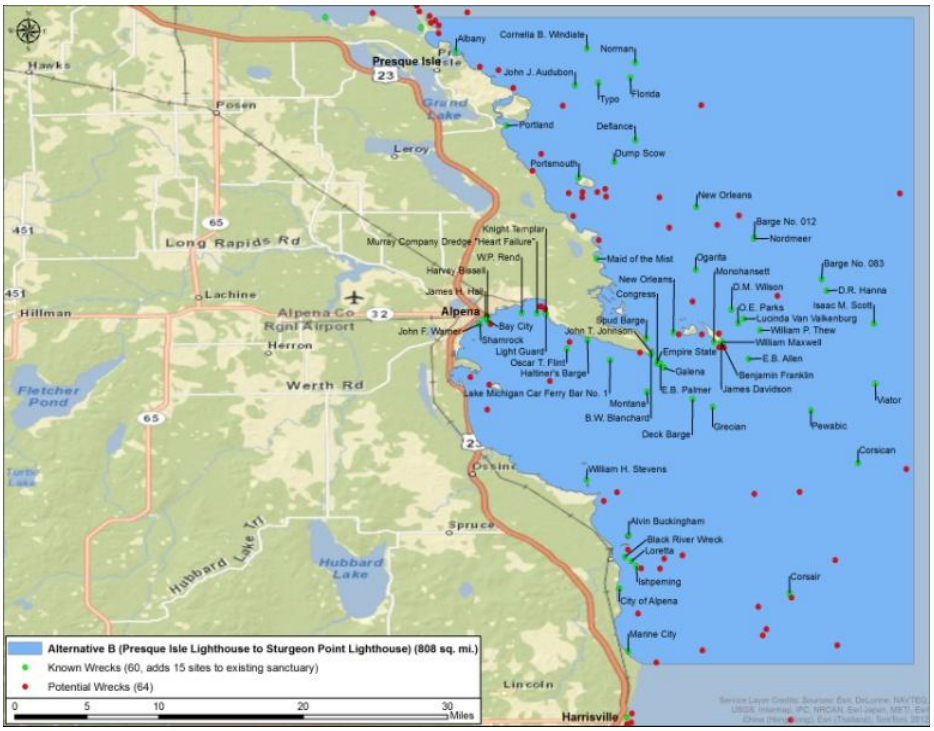


Figure 30. Shipwrecks within Alternative B.

Maritime Heritage Resources

The waters east of longitude 83 degrees west (the existing lakeward boundary) are some of the deepest areas of Lake Huron. Very little exploration or systematic archaeological survey has occurred in this area due to the depth and remoteness. Due to advances in mixed gas "technical"

and closed-circuit rebreather diving, there have been an increased number of divers at deepwater shipwreck sites (130-300' depths) over the last decade. Boundary Alternative B would add seven shipwrecks to the sanctuary in depths over 130 feet. Shipwrecks at these depths are generally better preserved than those in more dynamic, shallow water. Further, deep water shipwrecks have significantly greater numbers of artifacts associated with them. Consequently, the protection of deepwater shipwrecks represents the next frontier in maritime heritage preservation. The sanctuary and its partners have the capabilities to survey and document shipwrecks in this area and have before them an unprecedented opportunity to be ahead of the preservation curve. A positive consequence of this alternative (and the Preferred Alternative) would be the ability of TBNMS to include this area in the scope of its Management Plan. As indicated, these shipwrecks would benefit from sanctuary expansion and the resultant resource protection efforts.

Due to advances in mixed-gas "technical" and closed-circuit rebreather diving there have been an increased number of divers at deepwater shipwreck sites (130- to 300-foot depths) over the last decade. Generally, shipwrecks at these depths are more intact that shallower sites, due to a less dynamic environment. These sites also possess a greater potential for artifacts to survive, due to the limited — though increasing — number of visitors. Given this, the impacts of looting and anchor damage are relatively greater at these sites. Moreover, new shipwreck discoveries at deeper depths continue to occur. Local shipwreck hunters and divers continue to find remarkably well-preserved shipwrecks at these depths, as does the sanctuary and its partners, who discovered five shipwrecks between 2002 and 2011. Negative diver impacts at these sites have potentially greater consequences than at other sites given that they are generally more intact (often with fragile features preserved) and possess a greater number and variety of artifacts.

This alternative is significant chiefly due to a cluster of deeper, well preserved shipwrecks in Presque Isle County, just north of the current sanctuary boundary. Sites here include the schooners *Cornelia B. Windiate* (1874-1875; 180 foot depth), *Defiance* (1848-1854; 185 foot depth) and *Typo* (Figure 31, 1873-1899; 180 foot depth). All are popular technical dive sites and visited regularly by divers.

Figure 31. A photomosaic of the schooner *Defiance*, resting in 185 feet of water outside the sanctuary's northern boundary. Many popular, intact shipwrecks lay in deeper waters outside the current sanctuary boundaries. (NOAA Thunder Bay NMS)

The three-mast wooden schooner *Windiate* sank with all hands in December 1875 while bound from Milwaukee to Buffalo. With no survivors or witnesses, *Windiate's* sinking remains a mystery, although unpredictable November weather was likely a factor. Designed to carry 16,000 bushels of wheat, but reportedly carrying 19,000, she may also have been dangerously overloaded to maximize profits during the last voyage of the season. The *Defiance*, a two-masted schooner built in 1848, is the second earliest known
shipwreck in the region. Remarkably well-preserved with tiller steering and cookstove and galley remnants on deck, *Defiance* is a rare example of an early Great Lakes schooner. *Defiance* collided with the brig *Audubon*, in 1854. Finally, the schooner *Typo* sank during a collision with the steamer *Ketcham,* drowning four crew (Fig 31). Human remains have been reported at the site.

Figure 32. The schooner *Typo*.

The two-masted brigantine *John J. Audubon* (1854-1854; 170-foot depth) is located not far from its collision mate, the two-masted schooner *Defiance* mentioned above. Their 1854 collision illustrates the hazards of Great Lakes shipping as it emerged in the mid-19th century. The 1854 shipping season was the most costly to date, with losses totaling 119 lives, 70 ships and $2 million in property. *Defiance* (Figure 32) and *John J. Audubon* were among the victims of that dangerous year.

Figure 33. The 300-foot long steamer *Norman*, resting in 200 feet of water outside the sanctuary's northern boundary. Listing to port but intact, the enormous steel wreck contains many artifacts as well as human remains.

Two well-preserved but historically different steamers are off the Presque Isle area as well. Like nearly all of the wrecks in this offshore area, they were victims of collisions in the busy shipping lanes where upbound and downbound routes nearly converged. The wooden steamer *Florida* (1889-1897; 200 foot depth) today sits upright on the lake bottom and contains a large amount of cargo, including wheat, flour, syrup, and whiskey. The 300 foot long steel freighter *Norman* (1890-1895; 200 foot depth), is close by (Figure 33). The vessel was of many owned or leased by the U.S. Steel Corporation and helped fuel the fortune of J P Morgan.

Shallower sites close to the Presque Isle shoreline and accessible by beginning divers, snorkelers and kayakers, include the schooner *Portland* (1863-1877; 6 foot depth) and early sidewheel steamer *Albany* (1846-1853; 4 foot depth).

To the south, many of the known shipwrecks in Alcona County are found in shallow water. Included in this group are the *Marine City* (1866-1880; 5 foot depth) and *City of Alpena* (1874-1880; 9 foot depth). Twenty lives were lost when the wooden side-wheel steamboat *Marine City* burned off Alcona in 1880. The same year, the wooden harbor tug *City of Alpena* burned off Black River. Other

shallow water wrecks located off Alcona County include the schooner *Buckingham* (1853-1870; 9 foot depth), schooner *Ishpeming* (1872-1903; 12 foot depth), and steam barge *Loretta* (1892-1896; 7 foot depth).

The 808-square-mile area was evaluated because it was NOAA's preferred boundary during the sanctuary's original designation process. However, limiting the sanctuary to the 808-squaremile area excluded 32 significant shipwrecks (more have been discovered since) in the region and reduces the likelihood of inclusion of undiscovered shipwrecks. In 2009, during management plan review, an Advisory Council working group rejected this alternative in favor of a larger one because this alternative limited inclusion of known and undiscovered shipwrecks in the sanctuary. Public scoping meetings in 2012, and letters of support from local governments and NGOs indicated strong public support for a boundary larger than 808 square miles.

Table 5 lists the 15 additional historic shipwrecks in Boundary Alternative B that are not already identified in Alternative A.

Table 5. List of additional known historic shipwrecks in Boundary Alternative B.

	Vessel Name	Vessel Type	Hull	Built	Lost	Length	Loss Type	Cargo	County	Depth	Alternative
1	**Albany**	Paddle Wheeler	Wood	1846	1853	202	Stranded	Provisions	Presque Isle	5	B
2	**Audubon, John J.**	Schooner	Wood	1854	1854	148	Collision	Rail Iron	Presque Isle	170	B
3	**Black River Wreck**	Schooner	Wood	?	?	?	?	?	Alcona	6	B
4	**Buckingham, Alvin**	Schooner	Wood	1853	1870	124	Stranded	Iron Ore	Alcona	8	B
5	**City of Alpena**	Tug	Wood	1874	1880	72	Burned	Light	Alcona	9	B
6	**Corsair**	Schooner	Wood	1866	1872	133	Foundered	Iron Ore	Alcona	170	B
7	**Defiance**	Schooner	Wood	1848	1854	115	Collision	Corn, Wheat	Presque Isle	185	B
8	**Dump Scow**	Barge	Wood	Unknown	1930		Foundered		Presque Isle	130	B
9	**Florida**	Package Freighter	Wood	1889	1897	270	Collision	Package Freight	Presque Isle	206	B
10	**Ishpeming**	Schooner Barge	Wood	1872	1903	157	Stranded	Coal	Alcona	12	B
11	**Loretta**	Steam Barge	Wood	1892	1896	140	Burned	Chain	Alcona	7	B
12	**Norman**	Bulk Freighter	Steel	1890	1895	296	Collision	Light	Presque Isle	200	B
13	**Portland**	Schooner	Wood	1863	1877	150	Stranded	Salt	Presque Isle	6	B

	Vessel Name	Vessel Type	Hull	Built	Lost	Length	Loss Type	Cargo	County	Depth	Alternative
14	**Typo**	Schooner	Wood	1873	1899	137	Collision	Coal	Presque Isle	155	B
15	**Windiate, Cornelia B.**	Schooner	Wood	1874	1875	136	Foundered	Grain	Presque Isle	190	B

Additional Maritime Heritage Sites and the Cultural Landscape

The consequences under Alternative B are similar to Alternative A, but Rogers City would not be in the boundary. However, the lighthouses at Presque Isle would be included.

Tourism

There would be no negative consequences for tourism. Anticipated positive consequences are summarized in the *Consequences Common to all Boundary Alternatives* section.

Shipping

There would be no impact on shipping.

Fishing

Commercial and recreational fishing would not be impacted.

Physical and biological environment

A minor increase in charter boats catering to tourist activities may occur as a result of boundary expansion. Given that sewage discharges from vessels are not permitted in the Great Lakes and that a handful of additional charter boats is a negligible increase when compared to the numerous recreational fishing boats, NOAA does not expect any negative impacts on the physical or biological environment as a result of increased tourism. In addition, since the designation of the sanctuary in 2000, the main increase in tourism has been seen on land rather than in the sanctuary. Anticipated positive consequences are summarized in the *Consequences Common to all Boundary Alternatives* section.

Boundary Alternative C (preferred)

Under the preferred boundary alternative, an additional 3,852 square miles would become sanctuary waters and 47 additional historic shipwrecks would be in this boundary. This new boundary would contain a total of 92 known shipwrecks (Figure 34).

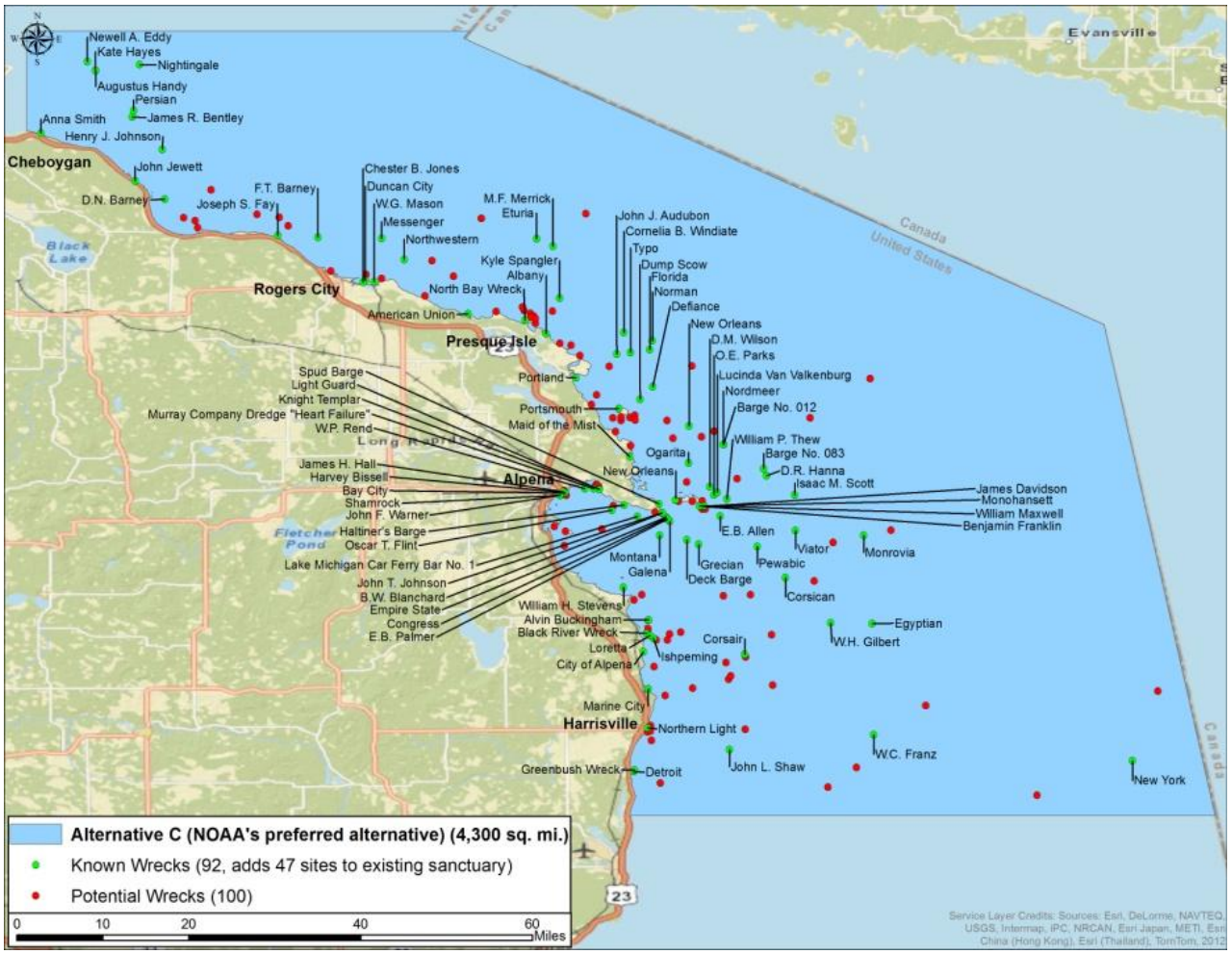


Figure 34. Shipwrecks located in Alternative C.

Maritime heritage resources

This boundary alternative would include all of the shipwrecks described in alternatives A and B, most notably a cluster of deep, well preserved shipwrecks off of Presque Isle, MI (described above). Alterative C would also include several additional significant shipwrecks, most notably a cluster of wrecks around Spectacle Reef.

Spectacle Reef and nearby Raynold's Reef are a pair of shoals in Lake Huron about ten miles offshore from Nine Mile Point. Over the years scores of vessels stranded on these shallow water reefs. In 1871, construction began on an 86-foot tall lighthouse on Spectacle Reef which was completed in 1874 and still stands today. In September 1869, just prior to construction, the *Nightingale* (1856-1869; 70 foot depth) stranded on the reef. Bound from Milwaukee to Oswego with 15,000 bushels of wheat, the schooner *Kate Hayes* (1856-1856) stranded on Spectacle Reef on a clear calm night in 1856. Nearby are the schooners *Newell Eddy* (1890-1893; 130 foot depth) and *Augustus Handy* (1855-1861). The 242-foot three-masted schooner barge, *Newell A. Eddy*, built at West Bay City, Michigan, in 1890, foundered in a storm with a cargo of grain and all nine hands in 1893. Resting in 160 feet of water, the well preserved site is a popular dive attraction. In 1855 the *Augustus Handy* was struck by lightning, disabled and sunk.

Ten miles north of Presque Isle are the schooner *M. F. Merrick* (Figure 35,1863-1889; 300 foot depth) and steamer *Etruria* (1902-1905; 300 foot depth), a pair of shipwrecks discovered by the sanctuary in 2011. Both are in 300 feet of water and coordinates have not yet been released to the public. Notably, both shipwrecks were discovered during the Sony and Intel sponsored *Project Shiphunt*, which brought five Saginaw, Mich. high school students to the sanctuary to locate and document an historic shipwreck. The student teamed worked closely with NOAA and Woods Hole Oceanographic Institution researchers to find the two shipwrecks. A one hour documentary was produced, as well as a curriculum aligned with The Science, Technology, Engineering, and Mathematics (STEM) Education Coalition objectives. The project is an excellent example of the opportunities that the sanctuary can help leverage, to both support its research efforts and make possible unique learning experiences for a wide range of students.

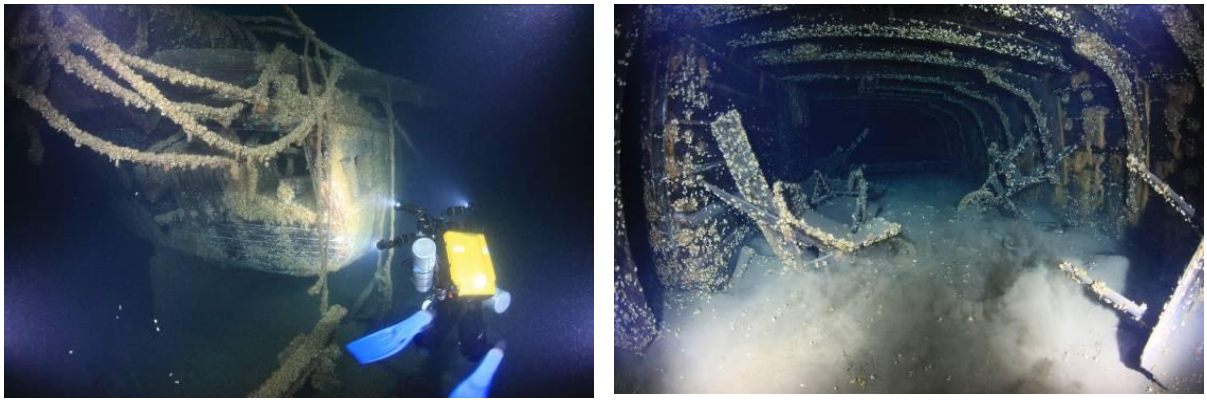


Figure 35. These excellent photos of the *M. F. Merrick* taken in 20ll by volunteers significantly enhanced the sanctuary's assessment of this newly discovered shipwreck. The image of the vessel's stern at left gives a good indication of site integrity and reveals some distinctive architectural elements, as well as coverage of invasive quagga mussels. To the right, the vessel's cargo hold, revealing substantial artifacts- several wheelbarrows used by the crew to handle the *Merrick's* bulk cargo. Note the presence of mussels, even inside the vessel. John Janzen.

Four miles off Presque isle is the schooner *Kyle Spangler* (1856-1860; 185 foot depth), sunk in an 1860 collision (Figure 36). The schooner *Kyle Spangler* was built by William Augustus Jones (1808-1888), son of Augustus Jones (1782-1841), the patriarch of an important but modestly researched family of shipbuilders. The Joneses collective output of Great Lakes vessels numbers in the hundreds and occurred at a seminal period in Great Lakes shipbuilding (see historical information section). Built to maximize cargo space and barely squeeze through the locks of the Welland canal, the "canaller" *Kyle Spangler* is a unique and well preserved archeological site; a tangible link to William Jones and to a distinctive type of Great Lakes craft.

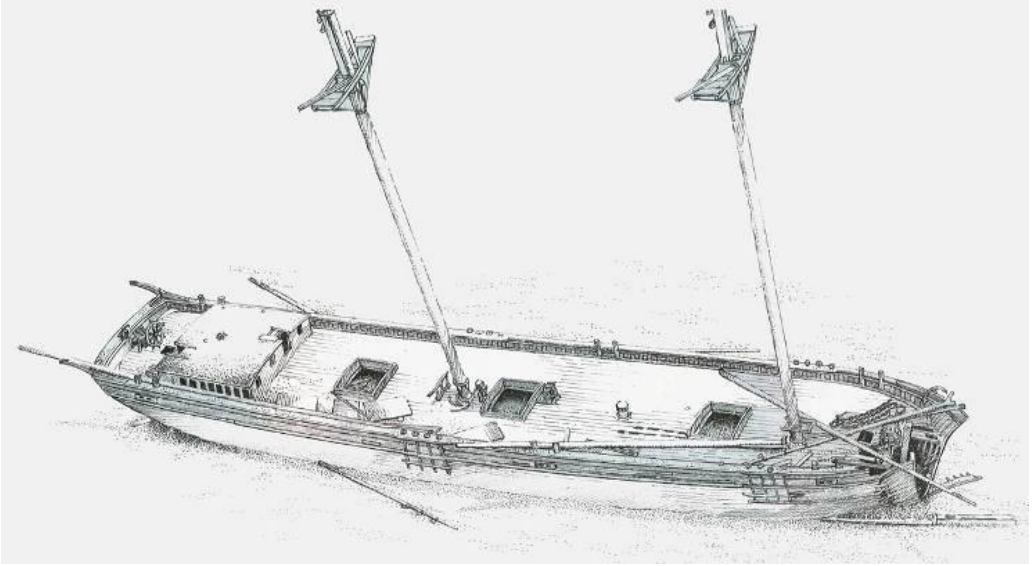


Figure 36. A perspective view of the wooden schooner *Kyle Spangler*, resting in 185 feet of water in the preferred boundary area. Largely intact, except for collision damage at the bow, the site represents the high degree of preservation of many shipwrecks in this depth range. In 2008, sanctuary archaeologists worked with the wreck's founder, Michigan diver Stan Stock, to document the site. (NOAA Thunder Bay NMS)

In shallower water near Presque Isle are the schooner *American Union* (1862-1894; 8 foot depth) and an unidentified schooner at North Bay (Figure 37). Other shallow shipwrecks in this boundary alternative include several off Rogers City, including the steamer *Joseph Fay* (1871-1905; 17 foot depth), tugs *Mason* (1898-1924; 13 foot depth) and *Duncan City* (1863-1923; 15 foot depth), and schooner *Chester Jones* (1873-1924; 16 foot depth). Notably, a large section of the starboard side of the *Fay* is located on the beach near 40 Mile Point Lighthouse in Presque Isle County. Closer to Cheboygan, off Cordwood Point, is the steamer *Anna Smith* (1873-1889).

Figure 37. A snorkeler explores the shallow wreck of the schooner *American Union* (NOAA TBNMS).

Approximately 20 miles east of Alpena is the steamer *Monrovia* (1943-1959; 130 foot depth), a popular dive site in 130 feet of water. In this alternative's southern waters are the newly discovered steamer *Egyptian* (1873-1897; 230 foot depth), located in 230 feet of water. In similar water depths are the *W.C. Franz* (1901-1934; 230 foot depth) and *W.H. Gilbert* (1892-1914; 255 foot depth). In 130 feet of Harrisville is the schooner *John Shaw* (1885-1894; 130 foot depth).

Notably, this alternative also contains an area that may possess prehistoric archeological sites. Recent research by the University of Michigan is attempting to discern the archaeological potential of the Alpena-Amberley Ridge, a now submerged land bridge that once connected Michigan with Canada (Figure 38). Roughly 9,900 – 7,500 years ago the ridge formed a dry land corridor extending across Lake Huron from Presque Isle in northeast Michigan to the Point Clark area in southern Ontario. This land bridge would have provided a natural causeway for the migration of caribou and valuable terrain for hunters seeking to exploit the herd.

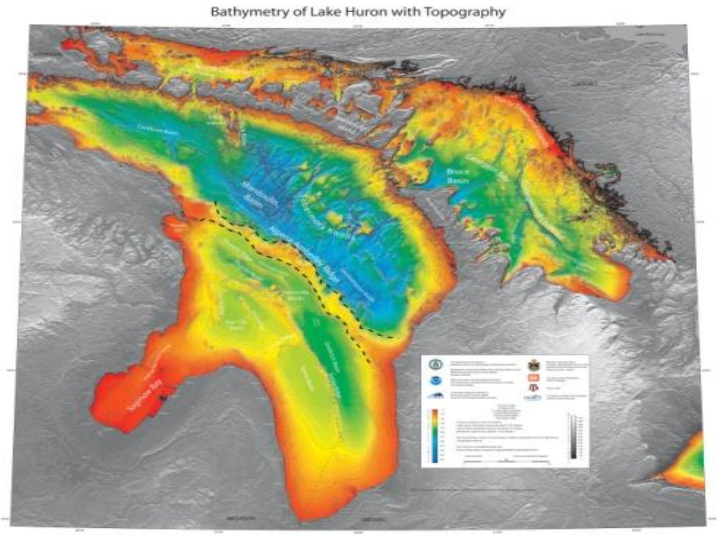


Figure 38. A bathymetry map of Lake Huron showing the Alpena-Amberley Ridge, which once connected Michigan with Canada. University of Michigan anthropologists are searching the area for prehistoric archaeological sites. (NOAA GLERL)

The archaeological integrity of individual resources within the current sanctuary and Preferred Alternative is strengthened tremendously by the fact that, collectively, Thunder Bay's shipwrecks present a microcosm of Great Lakes commercial shipping and culture. The area's shipwrecks reflect transitions in ship architecture and construction methods, from wooden sailboats to steel-hulled vessels, and represent virtually all types of vessels used on the open Great Lakes. These vessels were engaged in nearly every type of trade, thereby linking Thunder Bay inextricably to Great Lakes commerce. Encompassing an extensive array of historical themes, backed by an impressive archaeological record, Table 6 lists the 32 shipwrecks in Boundary Alternative C that are not in Alternatives A and B.

Table 6. List of additional known historic shipwrecks in Boundary Alternative C.

	Vessel Name	Vessel Type	Hull	Built	Lost	Length	Loss Type	Cargo	County	Depth	Alternative
1	**American Union**	Schooner	Wood	1862	1894	185	Stranded	Light	Presque Isle	8	C
2	**Barney, D.N.**	Schooner	Wood	1845	1849	110	Stranded		Presque Isle	5	C
3	**Barney, F.T.**	Schooner	Wood	1856	1868	126	Collision		Presque Isle	160	C
4	**Bentley, James R.**	schooner	Wood	1867	1878	178	Foundered	Rye	Presque Isle	165	C
5	**Detroit**	Paddle Wheeler	Wood	1859	1872	240	Stranded		Alcona	15	C
6	**Duncan City**	Tug	Wood	1883	1923	104	Abandoned	Light	Presque Isle	15	C
7	**Eddy, Newell A.**	Schooner	Wood	1890	1893	242	Foundered	Wheat	Mackinaw	168	C
8	**Egyptian**	Bulk Freighter	Wood	1873	1897	232	Burned	Coal	Alcona	260	C
9	**Etruria**	Bulk Freighter	Steel	1902	1905	414	Collision	Coal	Presque Isle	310	C*
10	**Fay, Joseph S.**	Bulk Freighter	Wood	1871	1905	215	Stranded	Iron Ore	Presque Isle	17	C
11	**Franz, W.C.**	Bulk Freighter	Steel	1901	1934	346	Collision	Light	Alcona	230	C
12	**Gilbert, W.H.**	Bulk Freighter	Steel	1892	1914	328	Collision		Alcona	255	C
13	**Greenbush Wreck**	?	Wood						Alcona	10	C
14	**Handy, Augustus**	Schooner	Wood	1855	1861	126	Stranded	Wheat	Mackinaw		C
15	**Hayes, Kate**	Schooner	Wood	1856	1856	130	Stranded	Wheat	Mackinaw		C
16	**Jewett, John**	Schooner	Wood	1866	1898	91	Stranded		Presque Isle	10	C

	Vessel Name	Vessel Type	Hull	Built	Lost	Length	Loss Type	Cargo	County	Depth	Alternative
17	**Johnson, Henry J.**	Bulk Freighter	Wood	1888	1902	260	Collision	Iron Ore	Presque Isle	160	C
18	**Jones, Chester B.**	Schooner	Wood	1873	1924	167	Abandoned	Light	Presque Isle	16	C
19	**Marine City**	Paddle Wheeler	Wood	1866	1880	192	Burned	Shingles, Fish	Alcona	5	C
20	**Mason, W.G.**	Tug	Wood	1898	1924	84	Abandoned	Light	Presque Isle	13	C
21	**Merrick, M.F.**	Schooner	Wood	1863	1889	137	Collision	Furnace Sand	Presque Isle	300	C
22	**Messenger**	Steam Barge	Wood	1866	1890	136	Burned	Cedar	Presque Isle	194	C
23	**Monrovia**	Ocean Vessel	Steel	1943	1959	447	Collision	Steel	Alpena	140	C
24	**New York**	Package Freighter	Wood	1879	1910	268	Foundered	Freight	Alcona	90	C
25	**Nightingale**	Schooner	Wood	1856	1869	138	Stranded	Iron Ore	Mackinaw	70	C
26	**North Bay Wreck**	Schooner	Wood						Presque Isle		C
27	**Northern Light**	Barge	Wood	1858	1880	210	Stranded		Alcona	2	C
28	**Northwestern**	Brig	Wood	1847	1850	110	Collision	Salt	Presque Isle	135	C
29	**Persian**	schooner	Wood	1855	1868	115	Collision	Wheat	Presque Isle	172	C
30	**Shaw, John L.**	Schooner	Wood	1885	1894	205	Foundered	Coal	Alcona	128	C
31	**Smith, Anna**	Bulk Freighter	Wood	1873	1889	178	Stranded		Cheboygan		C
32	**Spangler, Kyle**	Brig	Wood	1856	1860	130	Foundered	Corn	Presque Isle	185	C

Additional Maritime Heritage Sites and the Cultural Landscape

The consequences under Alternative C are similar to Alternative B, but would include Rogers City, the 40 Mile Point Lighthouse, the Presque Isle County Historical Museum, the Great Lakes Lore Maritime Museum, and Spectacle Reef Light.

Tourism

There would be no negative consequences for tourism. Anticipated positive consequences are summarized in the *Consequences Common to all Boundary Alternatives* section.

Shipping

There would be no impact on shipping.

Fishing
Commercial and recreational fishing would not be impacted.

Physical and biological environment
A minor increase in charter boats catering to tourist activities may occur as a result of boundary expansion. Given that sewage discharges from vessels are not permitted in the Great Lakes and that a handful of additional charter boats is a negligible increase when compared to the numerous recreational fishing boats, NOAA does not expect any negative impacts on the physical or biological environment as a result of increased tourism. In addition, since the designation of the sanctuary in 2000, the main increase in tourism has been seen on land rather than in the sanctuary. Anticipated positive consequences are summarized in the *Consequences Common to all Boundary Alternatives* section.

Cumulative Impacts
Activities to manage the sanctuary as proposed in the boundary expansion analysis generally result in beneficial effects to the maritime heritage resources and cultural landscape environment. No adverse effects of the action have been identified. However, the positive effects would provide for incremental additional resource protection to known and suspected shipwrecks. The past, present, and reasonably foreseeable actions that were considered in conjunction with the proposed sanctuary expansion include:

- State laws relating to maritime heritage resources (Part 761 of the Natural Resources and Environmental Protection Act, 1994 PA 451, MCL 324.76101 *et seq*). These laws impact maritime heritage resources by prohibiting resource disturbance or artifact recovery without a permit. The cumulative effects of these laws, when considered with the proposed action, are to protect maritime heritage resources from disturbance and destruction. Public awareness about state laws related to maritime heritage resources is also expected to increase as a result of the proposed action, further reinforcing this effect.

- The Lake Huron Binational Partnership effort focuses on pollution reduction activities in areas of obvious importance, such as Areas of Concern (AOCs), and directly pursues on-the-ground activities to protect areas of high-quality habitat within the Lake Huron basin. Existing stakeholder and agency forums are used as much as possible to support the goals of the Partnership. The Partnership maintains a close association with the Remedial Action Plan efforts in AOCs, the Great Lakes Fishery Commission's Lake Huron and Lake Huron Technical Committees, the State of the Lakes Ecosystem Conference (SOLEC), and domestic efforts that support the Partnership. The Thunder Bay Final Management Plan of 2009, which would apply to the larger area considered for expansion, contains an activity to partner with multidisciplinary researchers to study Lake Huron. This proposed action, if

implemented, may benefit this project in a small way by extending the area over which the state and federal agencies and sanctuary staff may partner. The proposed action would not have significant impacts on the natural environment of Lake Huron being protected and restored.

Beneficial effects considered together with the many natural and human-induced stressors may somewhat lower the beneficial effects of implementing the proposed action. Such stressors include human threats and natural processes. Human threats include looting sanctuary shipwreck sites, disturbing artifacts or the wreck itself, and damaging sites by anchoring. The expansion of sanctuary boundaries to include an additional 47 known historic shipwrecks would have a non-significant, but beneficial, impact on the resources by reducing the occurrence of these human threats. Natural processes include the impacts of wind , waves, storms and ice, as well as the impact of invasive species such as zebra and quagga mussels that today cover most of Lake Huron's shipwrecks. The outcome of these external stressors is not expected to be altered by the implementation of the proposed action. This is because, no single activity, when taken in consideration with others, would have significant beneficial or negative impacts on any individual or combined resource. Therefore, cumulative impacts of this action are not considered significant under NEPA. Based on this analysis, the proposed expansion of TBNMS, reviewed in conjunction with other actions taking place in the Thunder Bay region, is not expected to result in significant cumulative impacts on sanctuary resources or the environment.

VI. Appendices

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Note: For data on each shipwreck in NOAA's Preferred Alternative see Tables 4 (p. 57), 5 (p. 63) and 6 (p. 69).

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