

Abstract:

The “Search of the Lost Whaling Fleets of the Western Arctic” conducted systematic and comprehensive seabed mapping surveys of an area of the Chukchi Sea coast that was the site of the abandonment of 33 whaling ships caught in the sea ice in 1871. Before the mission, this nearshore area was largely unexplored and poorly mapped. The purpose of the cruise was to determine if any wreckage of these lost ships was present in the survey area after 144 years, and if so, to assess and document its status and condition. Consistent with the planned survey, approximately 50 sq. km. of seabed was mapped using side scan sonar and magnetometry, and three sites were identified and documented that contained wreckage from at least two of these whaling ships lost in during the period whaling was conducted in this area (around 1850 until the beginning of the 20th Century). In addition, magnetometry data suggests that wreckage may be buried in areas where magnetic anomalies were concentrated.

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Introduction:

The historical events surrounding whaling in the Western Arctic, conducted between 1848 and 1914, are of considerable historical significance in the maritime heritage of the United States, and perhaps globally (Barr and Delgado 2014). It was in this place that Yankee whaling, one of the United State’s first truly global industries that drove the early economy and diplomacy of this country, met its end, and the events of September, 1871, contributed to its demise (Allen 1973, Bockstoce 1986). Prior to this survey, the story of this event was well documented, but the fate of the wrecks of the 31 whaling ships lost that September was still largely unknown. Previous research conducted by others had documented wreckage on the beaches between Point Franklin and Wainwright Inlet (Beebe 2009). Two wreckage sites located in the adjacent nearshore waters were also identified in 1998 (Ota et al. 1999, USCG n.d.) but documentation of these apparent discoveries is limited. All told, around 60 whaling ships were lost in these waters, between 1850 and 1900, including the

32 abandoned in 1871 (Bureau of Ocean Energy Management 2011). The primary purpose of this project, therefore, was to systematically and comprehensively map the seabed of these nearshore waters and identify and document any wreckage that was present.

This survey was conducted under the oversight of the NOAA Office of National Marine Sanctuaries' Maritime Heritage Program, with the support of seabed mapping industry partners Edgetech Inc., HYPACK, Inc., and Applanix Inc., as well as the NOAA Office of Coast Survey, and the assistance of the Alaska Regional Office of the US Bureau of Ocean Energy Management. The survey was funded by the NOAA Office of Exploration and Research (Proposal # OE FY14-55).

The project team conducted a marine remote sensing survey from 8-26 August, 2015 on board the charter research vessel UKPIK out of Prudhoe Bay, Alaska. Approximately 50 km² was surveyed during the expedition, which was conducted in the nearshore waters of the Chukchi Sea between Wainwright, Alaska and Point Franklin, as depicted in Figure 1. The survey utilized two different sonar systems (Edgetech 6205 and Edgetech 4125), magnetometry (Marine Magnetics SeaSpy Magnetometers and Geometrics G-856AX base station). The mission was conducted in two cruise segments, collecting bathymetry, side scan sonar data (utilizing the Edgetech 6205), and magnetometry on the first leg, within the "Northern Survey Area" (approximately Point Belcher to Point Franklin). The second leg of the cruise (encompassing the waters off Wainwright to Point Belcher) collected side scan sonar data (using the Edgetech 4125) and magnetometry. This leg concluded with imaging located sonar targets with a drop camera system. The mission team for the survey was as follows:

NOAA/ONMS Maritime Heritage Program

Bradley W. Barr, Ph.D., Co-PI (Legs 1&2)

James P. Delgado, Ph.D., Co-PI (Legs 1&2)

Matthew Lawrence, Maritime Archaeologist (Leg 2)

Hans K. Van Tilburg, Ph.D., Maritime Archaeologist (Leg 2)

HYPACK, Inc.

Vitad Pradith, Seabed Mapping Specialist (Leg 1)

Edgetech, Inc.

Evan Martzial, Seabed Mapping Specialist (Leg 1)

This report will describe the research approach adopted for the mission, including a summary of project organization and data collected. Sections will also identify and describe permits and authorizations received for the project and summary of community engagement activities, an overview of archival and background research conducted, survey results and findings, as well as recommendations for preservation of the underwater cultural resources discovered during the survey. The report will also include sequential presentation of figures referenced in the text of the report and appendices of relevant documents mentioned.

Research Design and Approach:

Mission Objectives - The first objective of the mission was to comprehensively map the area where, in 1871, 31 whaling ships were lost, and where, throughout the 19th century, approximately 30 additional whaling ships have been lost, based on historical documentation. The second principal objective was to collect high-resolution bathymetric data for the survey area, recognizing NOAA's commitment to Integrated Coastal and Ocean Mapping (ICOM), which might be used by OCS in support of their efforts to more effectively and comprehensively update nautical charts for Arctic waters. The third primary objective was to identify potential shipwreck sites from the mapping data collected, and image those sites using the side scan sonar and drop camera systems.

Mission Approach - Because funding was only provided by OER to ONMS in January of 2015, and project was required to be completed by the end of September that year, the task of mounting an expedition of this complexity to such a remote and challenging place was considerable. Only with the help of many people was this possible, for which we are exceedingly grateful.

Most of the work between January and August was focused on getting the expedition organized and mobilized. Mapping systems and imaging systems were assembled and field-tested. Charter vessel services were secured. Considerable effort was needed to assemble, pack, and move nearly a ton of equipment to Prudhoe Bay, where the ORV UKPIK is homeported, and to get the mission team on-site and ready to conduct the survey. Fortunately, the project team's exertions paid off and the mobilization proceeded in time to depart as scheduled.

The seabed mapping was conducted with two systems, an Edgetech 6205 Multi-Phase Echo Sounder (loaned to the expedition by Edgetech), and an Edgetech 4125 Side Scan Sonar (on loan from the NOAA Office of Coast Survey). The project team had planned to investigate the survey area for magnetic anomalies using a Marine Magnetics SeaSPY horizontal gradiometer. Problems with the connectivity in the gradiometer tow cable forced the project to revert to a single towed SeaSPY magnetometer. Fortunately, the project team had brought a Geometrics G-856AX base station magnetometer (loaned by Thunder Bay NMS), which was then deployed on an adjacent barrier beach to record the diurnal variations in the Earth's magnetic field. The base station data was then used to correct the data collected by the towed magnetometer. A drop camera system, built for the mission, was also used to collect video documentation of any wreckage identified in the survey.

Once mobilized and underway, the mission was executed in a manner consistent with the cruise plan, notwithstanding weather delays encountered during the expedition. Mapping was systematically conducted, beginning on the first leg of the cruise with the "northern survey area" (approximately Point Belcher to Point

Franklin), using the Edgetech 6205 and magnetometer as the primary mapping systems. Bathymetry, side scan, and magnetometry data was collected during this phase of the mission using HYPACK survey software, collecting the data on the onboard integrated computer systems and archive storage. The second leg of the cruise was focused on the “southern survey area” (between Wainwright and Point Belcher) using the Edgetech 4125 and magnetometer, and concluded with a number of deployments of the drop camera system to document wreckage discovered during the survey operations.

Due to an advancing storm of some considerable intensity forecast for the survey area, we departed the survey area about a half-day earlier than anticipated, disembarked two of the mission team in Barrow en-route, and headed back rapidly to Prudhoe Bay. Upon arrival, the systems and equipment were repacked for shipment, and taken to the freight terminal in Deadhorse. The expedition was completed on the 26th of August, and work commenced, upon receipt of the equipment in Massachusetts, returning the systems to their owners, and continuing post-processing of the data collected.

Project Organization and Management – Mission personnel mentioned here are referenced to the list provided above in the introductory section. Co-PI Barr was responsible for overall planning and coordination of the expedition, with the assistance of ONMS Maritime Archaeologist Lawrence. As mentioned, the expedition was conducted in two parts, with the first leg of the cruise focused on seabed mapping in the “northern survey area.” Leg 1 team included Barr, Lawrence, Pradith and Martzial. Pradith and Martzial were critically important as they contributed their considerable seabed mapping expertise and experience. The second leg of the cruise was focused on not only continuing the seabed mapping operations, but also characterizing the maritime archaeology of the survey area. Mission personnel on this leg included Lawrence, Delgado, and Van Tilburg - in addition to Barr as mission coordinator - who provided this important maritime archaeological expertise and experience, particularly essential in identifying and documenting wreckage with the drop camera system discovered during the surveys.

While aboard the UKPIK, the captains (two were required because we were conducting seabed surveys taking advantage of the 24-hour daylight in the Arctic that time of year) were in charge of vessel operations, in consultation with the Chief Scientist on watch (either Barr or Lawrence). Mission personnel stood rotating 8-hour watches (except during weather delays) throughout the expedition. Protocols for this coordination were detailed in the expedition cruise plan, as was the general survey methodology, supplemented by the agreed-upon daily coordination between the watch captain and the watch chief scientist on specific survey tracks to be navigated. The sea-state during the mission was often 15-20 knot winds and 4-6 foot seas, testing the endurance of both the survey systems and mission personnel.

The coordination onboard between the vessel captains and the mission team was extraordinarily effective. The vessel proved very capable for the mission requirements, and the local knowledge possessed by the captains of the very shallow waters in which the expedition was operating was notable.

Data Organization, Processing, and Archive - All told, expedition collected more than a terabyte of data, including the bathymetry and side scan records, towed and base station magnetometer data, and video and still images from the drop camera system. All survey data collected during the mission, including the bathymetry, side scan sonar records, and magnetometry, was subjected to some preliminary post-processing, and archived on two 4TB RAID hard drives and one 5TB drive, the later used for video and image storage, onboard during the expedition. Preliminary mapping products have been developed from the data and the raw and processed data remains stored on these storage devices. When the post-processing has been completed, it is our intent to deliver the data and related metadata to the National Geophysical Data Center (NGDC) to make the information publically available. We have already shared preliminary data and products related to identified and potential wreckage locations with the Office of History and Archaeology, and will provide whatever additional data and/or products as requested, to be determined in discussions with OHA subsequent to the receipt of this report. The precise locations of the wreckage identified on the seabed will be kept as confidential non-public data by both NOAA and the State of Alaska to preserve the archaeological integrity of these wreck sites.

Permits and Authorizations:

A summary of the results from each coordination and consultation process is provided below:

National Environmental Policy Act (NEPA) –”, all proposed projects must be reviewed with respect to environmental consequences on the human environment. It was determined by NOAA, consistent with NOAA Administrative Order 216-6, “Environmental Review Procedures, that the activities funded through an Interagency Transfer of Funds executed in 2015 between the NOAA Office of Exploration and Research and the NOAA Office of National Marine Sanctuaries to conduct mapping and surveying activities qualified, under Section 6.03c.3(d) “Administrative or Routine Program Functions”, to be categorically excluded from further National Environmental Policy Act review. A memo to this effect, consistent with the guidance, was prepared and transmitted on 28 August 2015, which documented the “Categorical Exclusion” finding.

National Marine Fisheries Service - Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA) - Through written coordination or consultation with NMFS, it was their determination that the proposed action is not likely to adversely affect any species or designated critical habitat pursuant to the Endangered Species Act. With regard to MMPA, we consulted with Howard Goldstein of NMFS/OPR via e-mail and telephone, and after a call on 28 April,

2015, Mr. Goldstein determined that, having reviewed sufficient information provided about the project and its potential impacts, no further review would be required.

National Historic Preservation Act (NHPA) - Through written coordination and consultation with the State of Alaska Office of History and Archaeology (OHA), we received concurrence that no Section 106 review was needed for this project as there would be no potential disturbance of heritage resources as a result of the proposed mapping activities, and the larger benefit of identifying historical resources as a result of the mapping would enhance available information so that future proposed activities in this historically significant area that do have the potential to harm or disturb underwater cultural heritage resources can be more effectively assessed and evaluated. OHA issued a Field Archaeology Permit (File 3420-2015, Permit 2015-26) on 19 June, 2015, authorizing the conduct of the mapping activities within the submerged lands managed by the State of Alaska.

Department of the Interior Bureau of Land Management - As the magnetometry system utilized a land-based magnetometer as a base station to collect data on changes in the local magnetic field during the survey, a suitable location for the base station on the beach needed to be identified. The DOI Bureau of Land Management was identified as the land manager for an section of the adjacent beach central to the survey area, and a permit (FF097023) was issued by the BLM Alaska Field Office on 28 July, 2015, to coordinate this activity. The permit authorized the emplacement and periodic maintenance of the base station during the mission, as well as imposes some additional stipulations related to mitigating possible disturbance to wildlife, incorporating by reference the requirement to comply with the Summer 2015 ESA Section 7 Consultation with USFWS for this area. This Section 7 Consultation provides site-specific guidance to the BLM related to listed resources under their oversight, and includes both activities conducted by the BLM and any activities they may permit under their authority. Special reference was made in the BLM permit stipulations to those parts of this Section 7 Consultation regarding the Polar Bear Interaction Guidelines, and to avoidance of disturbance to eider aggregations during the mission. These stipulations were made part of the Cruise Plan for the mission.

North Slope Borough Coordination and Permitting

Pursuant to Title 19 of the NSB Municipal Code and the NSM Comprehensive Plan, the NSB has jurisdiction over any activity within waters and submerged lands adjacent to the Borough. The NSB Planning department reviewed the proposed activities and issued a permit (NSB 15-771) that expressed no objection to the proposed activity and finding it consistent with the NSB Municipal Code and Comprehensive Plan. An additional review was conducted by the NSB related to "Traditional Land Use", but it was determined (e-mail from Tommy Nageak, NSB Cultural Resource Specialist, dated 12 May, 2015) that no permit was required for the proposed mapping.

To insure that we were effectively coordinating with the local Iñupiat community, as required under Executive Order 13175, beyond the ongoing coordination with the communities through our consultation and permitting with the NSB, meetings were held in the villages of Wainwright (City Hall) and Barrow (Iñupiat Heritage Center) in June of 2015 to discuss the project with the local community members and especially those who are engaged in cultural subsistence activities. Advance announcement of these meetings was accomplished with flyers distributed around the villages, and announcements over VHF radio in each village in both English and Inuktitut. The meetings were lightly attended, but key individuals from each village attended. Participants did not express objections to the proposed mapping activities, and endorsed the proposed operational protocols for avoiding interference with subsistence activities. During the visit, a number of additional individual meetings were held with local community representatives where the project was discussed. All comments made regarding the project were supportive.

Through our coordination with the NSB, and directly with the communities, we believe we effectively met the requirements of E.O.13175. During the mission, we implemented the operational protocols incorporated into the Cruise Plan, continue to coordinate with local communities. A follow-up visit to Wainwright and Barrow to present the findings of the expedition to the local communities is planned in 2016.

Overview of Archival and Background Research Conducted:

The ONMS Maritime Heritage Program has been preparing for this mission for about a decade. As such, it has provided the foundation of our program's emphasis on whaling heritage, which involves many of the national marine sanctuary sites. We have, over the years since around 2005, collected data and information regarding the keystone events of whaling heritage in the Western Arctic and compiled this information on the ONMS web page. This compendium (<http://sanctuaries.noaa.gov/whalingfleet/>) includes detailed inventory and documentation on the whaling ships lost in 1871 and 1876, and to the Confederate Sea Raider SHENANDOAH, and descriptions of the key events related to 19th Century whaling in this part of the Arctic.

More recently, when we received funding from OER for the expedition, we supplemented this background, with the assistance of New Bedford Whaling Museum and Mystic Seaport staff, by reviewing and collecting available logbook information, particularly from the 1871 fleet and salvage efforts in 1872, very specifically looking for information on last known location of the abandoned vessels, and ice movement observations (to potentially assist in refining the survey area). While this research was very interesting, we found little information in the logbooks that enhanced our understanding of the events. We also conducted archival research to determine which of the abandoned ships were pushed ashore, which were burned, and which were holed and sunk offshore.

An Excel database was prepared from this research, and was used to refine the survey plan, and is available upon request.

Additionally, we spent a great deal of time coordinating with Randy Beebe, who, between 2005-2007, led a field team documenting the beach wreckage along the shore between Point Belcher and Point Franklin, as well as attempted some limited surveying offshore from a small inflatable boat. We highlighted the Beebe team's work on the expedition web page:

<http://oceanexplorer.noaa.gov/explorations/15lostwhalingfleets/background/survey/survey.html>

Mr. Beebe was invited to be a part of the mission team for a portion of the cruise, but he could not arrange to be there during the expedition. The information from Beebe's research was relied upon extensively to assist in refining the location of the survey area. We had requested a copy of the official report regarding this field research we had presumed was submitted to OHA in compliance with the permit issued to an archaeologist on Beebe's field team, but no such report could initially be found. According to Mr. Beebe, their OHA report was to be drafted by archaeologist Evgenia Anitchenko, who was apparently the archaeologist of record for the project, and the OHA permittee for this research, but if the report had been prepared, Mr. Beebe was not provided with a copy, nor was he in possession of any field notes or observations made by Anitchenko. Upon subsequent searching of the OHA files, a preliminary draft of this report from Beebe's 2007 field work was discovered by OHA staff, but we were unable to obtain a copy because the author, Ms. Anitchenko, has stated to OHA that she "regards the draft as too unfinished to be circulated" (Tom Gillispie, Personal Communication, 5 April 2016). However, Mr. Beebe was exceedingly generous with his time and shared all his data and information with us, and was apparently very pleased with the coordination with us as we prepared for our survey mission.

Beebe's (2009) Project Report provides additional background on some of the previous research conducted in the vicinity of our survey area. As summarized in that report, nearly all of this archaeological research was conducted on the adjacent shoreline areas and largely focused on historic Inupiat occupation and use. A team led by Dale Slaughter conducted excavations at the *Siraaagruk* site (OHA File 49-WAI-00095) near Point Belcher in 1979 -1980. These excavations targeted "the construction of Inupiat houses at this site", and reportedly "artifacts derived from the 1871 shipwrecks were found in the houses" during this archaeological investigation. However, this work remains unpublished (Tom Gillispie, Personal Communication, 5 April, 2016). We also acknowledge the pioneering work of Gregory Reinhardt of the University of Indianapolis and Anne Jensen of Point Barrow with the 1994-1996 Maritime Archaeology Project - *Pingasugruk*. This project conducted three seasons (20 weeks) of settlement pattern research, excavating, surveying, and mapping at Pingasugruk and other sites, between Wainwright and Point Franklin and documented Inupiat salvage and reuse of materials from shipwrecked whaling vessels. Additionally, we found

some limited documentation (Ota et al. 1999) from a project, also mentioned in Beebe's 2009 Project Report, within our survey area conducted in 1998 by students from Santa Clara University, in collaboration with NASA and with funding from the NOAA West Coast and Polar Regions Undersea Research Center. This report mentions that a remotely operated vehicle deployed during this cruise identified some possible wreckage at two locations, which was reported to have been confirmed by divers. Unfortunately, that report neither offered any description or characteristics of these discoveries, nor their locations. Beebe also shared a copy of a US Coast Guard report (n.d.) that provided some approximate coordinates for these sites, and offered additional information that apparently no final report was submitted to OHA for this project, as was presumably required under the terms of a permit issued for the research, clarifying why more widely available archaeological documentation is limited with regard to this project. Based on the coordinates provided in this USCG report, neither of these sites conform to the location of any wreckage identified on this expedition, nor are they apparent on the side scan data collected in our survey of the area. They do appear to be located within one of the magnetic anomaly concentration areas in the northern survey area, potentially providing additional support to the site formation theory that the anomaly concentrations represent buried wreckage.

While the "last chapter" of the epic story of 1871 was still a mystery before our expedition, the abandonment event that year is well documented in many sources, from Starbuck's *History of the American Whale Fishery* - originally published in 1878, just after the abandonments - and contemporary accounts of the disaster in newspapers like the *Whaleman's Shipping List* and the *New York Times*. Notably, the account assembled by Bockstoce (1986) in *Whales, Ice, and Men* was particularly detailed in its re-telling of this story. Throughout the past decade of research, all available accounts of this story were, at one time or another, read and analyzed for what they had to offer in understand the events of that fateful September of 1871. Each of these accounts are likely to have contributed some insight on those events, but their individual, specific contributions are impossible to illuminate here. It is a rich and extensive body of work, but we are confident that our background research missed very few, if any, sources in this literature.

Accomplishments and Findings:

With regard to the first objective, we comprehensively mapped more than 49 km² (14.2 nmi²) within the proposed survey area, using the 6205 and 4125 sonar systems and magnetometer. Given the alterations to the survey plan adopted during the mission, based on what was being encountered during the survey and the limitations on operations due to weather, it is challenging to precisely determine what percentage of the planned survey area was covered during the mission, but it appears that we collected side scan sonar and magnetometry data for more area than planned as a result of expanding the survey area to the south

late in the mission. Qualitatively, it can be reasonably concluded that we have met or exceeded this objective.

Figures 2 and 3 identify zones within the survey area where magnetic anomalies are concentrated. The Figure 2 identifies zones within the northern survey area where numerous magnetic anomalies were concentrated; however, no sonar targets were found within this area. The contoured magnetic gradient data revealed a broadly scattered field of individual ferrous objects that do not create the multicomponent magnetic signature of a concentrated wreck site. The gamma gradient symbolized in the map represents a change of between 1 and 10 gammas between readings. Yellow and orange represent the smallest changes, while green and red symbolize the greatest gamma changes. Figure 3 identifies magnetic concentration areas in the southern survey area, where wreckage was found. Given the extent of the magnetic anomalies in these areas it was initially surprising that only six sonar targets with shipwreck characteristics were located. However, the project team hypothesizes that the magnetic anomalies represent locations where several ships were broken apart and the resulting wreckage ground into small pieces and buried by deposition of sand eroded from nearshore and beach areas.

As mentioned above, the entire survey area was mapped using the sonar systems deployed during the expedition. It was closely monitored by onboard personnel as it was collected, but no wreckage was found on the surface of the seabed with the exception of the wreckage sites described below.

With regard to the second mission objective related to bathymetry, we collected data for approximately 25.6 km² (7.5 nmi²), or roughly around 86% coverage of the Northern Survey Area. It is uncertain whether this data will be of sufficient quality to potentially supplement NOAA's Arctic charting goals, given the malfunction of the Applanix POS/MV IMU after only about 18 hours of surveying. The image in Figure 4 is first-pass at the post processing of all bathymetric data collected, both with the higher resolution utilizing the POS/MV IMU and the backup IMU, which provided somewhat diminished resolution. However, we did learn a great deal about the challenges of conducting Integrated Ocean and Coastal Mapping (ICOM) onboard a vessel of opportunity like the UKPIK. There are many technical requirements for collecting "chart-quality" data, particularly acquiring the physical dimensions of the offsets (i.e. very precise measurements of distances between the various sensors). When these mapping systems have not been installed under highly controlled conditions (e.g. while the vessel is out of the water), imprecision in these critical measurements can add considerable uncertainty to the data collected. Perhaps our expectations with regard to ICOM (i.e. that vessels of opportunity should be collecting bathymetry that might be used to supplement data collected by our hydrographic fleet - "map once, use many times") may exceed the practical limitations imposed by our ability to meet these precise requirements.

With regard to the third objective, we identified six sections of wreckage with the side scan sonar and documented three of these sites with the drop camera system. All are presumed to be portions of 19th century whaling ships based on the size of the timbers and construction, the artifacts identified, and the historical record of the 1871 disaster. There is insufficient information from any of this wreckage to suggest the possible specific identity of the particular whaling ship from which this wreckage might have originated. Figure 5 presents a side scan sonar image for each target and its characteristics based on sonar and in some cases drop camera documentation.

Sonar targets WNS-1, WNS-2, and WNS-3 were revisited to collect imagery using the drop camera system. To the extent possible, given the inherent limitations of controlling drop camera system location with respect to the target being imaged, each site was systematically surveyed to reveal as much detail as possible regarding the site and any artifacts it might contain. Careful review of all video collected identified a number of artifacts in each location, including small anchors on two of the sites, anchor chain, various iron rigging elements, both stone and iron ballast, tryworks bricks, and what has been interpreted to be the iron support for a tryworks, where the whale blubber was rendered into oil. An underwater image of one wreck where artifacts were identified is provided in Figure 6. Additional video and still images of this wreckage can also be viewed at: <http://sanctuaries.noaa.gov/shipwrecks/lost-arctic-whaling-fleet/>.

We believe that one of the most remarkable findings of this expedition was simply that after 144 years of being subjected to ground ice, that any articulated wreckage along with associated features and diagnostic artifacts is still present on the surface of the seabed. This is not unprecedented, as wrecks documented in the Eastern Arctic (Delgado 2009) have similarly endured this yearly disturbance by ice. However, it was unexpected when we departed for the expedition, and therefore deserves special mention here.

Another particularly important finding is the results of the magnetometry survey. At least three relatively large areas were identified as having significant concentrations of magnetic anomalies (See Figures 2 & 3). Given the more than 60 whaling ships lost in the survey area in the last half of the 19th Century, even considering the amount of wreckage identified on the adjacent beaches by Beebe and his team in 2005-2007, it is highly likely that the source of these anomalies is from the ships that sunk just offshore. Throughout this period, the area was used by mostly sail (but also some steam-powered) whalers which were constructed using many iron parts, including, but not limited to, the standing rigging, the tryworks and its various components, anchors, steering gear, and other mechanical elements aboard. Therefore, we believe that these concentrations of magnetic anomalies potentially represent buried wreckage. The shorelines of the Western Arctic are known to be subject to significant coastal erosion, retreating sometimes as much as 15 meters per year. While this particular stretch of coast, from Point Franklin to Wainwright Inlet, has been

identified by the USGS, (Gibbs and Richmond 2015) in a survey of historic shorelines along the Arctic coast, as having moderate erosion, it is likely that this represents a significant source of material being deposited in the vicinity of these magnetic anomaly concentrations, some in water found too shallow for this survey's research vessel. The side scan records for this area show the seabed dominated by large areas of sand waves, suggesting it is an active and dynamic sedimentary environment. While we have no definitive proof of buried wreckage, the magnetometry suggests that it is likely.

We went to this historically-significant place to try to “write the final chapter” of the saga of the 1871 abandonments, which, while well documented, has elements of that story that remain a mystery. One of these mysteries is how, with the sea ice closing in on the shore that fateful September in 1871, the whaleboats carrying the 1219 survivors were able to successfully navigate to the ships near Icy Cape awaiting their arrival. Accounts of this escape in Everett S. Allen's (1973) book *Children of the Light*, mention an offshore bar running parallel to the shoreline, between the quickly approaching sea ice and the shore.

During the survey, we observed what might be remnants of that bar, and have identified other possible evidence of its existence in research subsequent to the expedition. Figure 7 is taken from Google Earth. It appears to show the presence of a bar just offshore in the area just south of Point Belcher. While we were unable to navigate close enough to the shore to map this area because of vessel and mapping system constraints, we observed other areas where this feature may have been moving offshore (e.g. shallow area shown on the bathymetric map, above, about midway between Point Belcher and Point Franklin. Why this may be important relates to theories of site formation regarding the possible buried wrecks we have tentatively identified from the results of the magnetometer data. If the ice was pushing the abandoned ships onto an offshore bar, and not the actual shoreline, it is possible that these ships remained just offshore, and were, over time, broken apart by the ice and deposited between the bar and the shore. Additionally, the bar would have isolated a narrow, possibly less ice-choked, channel along the shoreline that may have been the path to rescue.

Subsequent to the expedition, in consultation with John Harper, a coastal geomorphologist from British Columbia who has conducted shoreline surveys and research on the sediment dynamics in the areas included in this seabed mapping survey, this coastal feature has been identified as a “nearshore moat.” He also observed that this “nearshore bar (common on the entire Chukchi coast) does trigger ice pile-up.” (John Harper, personal communication, 10 March, 2016), and that this open water area is still commonly “used by locals in the spring ice melt (first part of sea ice to thaw).”

Two lithographs, reportedly drawn from first-person accounts, are provided which seem to support the idea that such a channel was likely present in 1871. The

first (Figure 9) is a lithograph is taken from the December 2nd, 1871 edition of *Harpers Weekly* included in an article about the abandonment. As seen from the land, there is open water between the sea ice and shore. The second (Figure 10) is another lithograph depicting the events, from the Ted and Ellie Congdon Collection at the Huntington Library, which also clearly shows the whaleboats navigating in the channel between the approaching ice and the shore, as seen from the perspective of someone aboard the abandoned ships. If these are accurate depictions of the events of 1871, they offer some historical evidence of the presence of an offshore obstruction that is keeping the ice, and the ships, from all grounding on the beach.

Clearly, all of this is somewhat speculative, but may shed some light on the remarkable outcome of this abandonment, where no lives were lost in their journey south to the waiting ships. It also provides some support for the theory, with regard to archaeological site formation, that the magnetometer data potentially suggests yet more wreckage buried in the seabed just offshore.

Considering the frequent bad weather encountered during the expedition, and the failure of some of the components of the mapping systems, we believe that this mission was very successful and accomplished most, if not all, of the project goals. In the proposal for this expedition, we suggested that one of the outcomes we hoped to achieve was to determine whether this was an “evocative landscape”, without any physical remains of the important historic events known to have occurred here, or whether this place possessed heritage resources that needed to be identified, documented, and preserved. We now know, with some certainty, that it is both.

Recommendations:

The ONMS does not have plans to return to this survey area, as the research objectives for this expedition have been met. We offer the following recommendations with regard to potential future research and preservation of the archaeological sites identified during our research cruise, and the possible wreckage and artifacts that might be present in the magnetic anomaly concentration areas identified. We have been contacted by other archaeologists working in Alaska, and are prepared to share the data from this project with the caveat expressed below about integrity of specific site locations. However, if OHA agrees, we can and would share locations with qualified archaeologists prepared to conduct follow-up research.

Protection of the wreckage found on the seabed – The precise locations of these wreckage sites are being held as confidential non-public data by NOAA, and we recommend a similar strategy be adopted by the State of Alaska to protect the archaeological integrity of these sites. We have already shared these geo-referenced locations with OHA after the expedition. While this is a remote location, and the artifacts identified may have little monetary value, withholding the precise locations from general public distribution in order to protect non-

renewable historic resources from potential damage or looting is an approach backed by established state and federal preservation law. We are aware that you have protocols in place at OHA to share this information when it is requested by qualified applicants, and this seems a reasonable accommodation as abandoned non-military sunken craft are property of the state.

We hope that other archaeologists will be interested in further documenting the wreckage sites using traditional non-invasive archaeological site documentation methodologies (e.g. photo documentation and baseline trilateration) using divers (as these sites are in quite shallow water). In particular, the site WNS-3 located off Wainwright holds great potential for further research. Its lower hull exhibit the most intact structure of the sites found and its proximity to Wainwright makes the logistical access to this site reasonable. .

These sites are very close to shore, and in extremely shallow water, putting them at risk for any adjacent development projects that might be proposed in the future. We would hope that appropriate consideration be given to preservation of these sites if such proposals come before the OHA. If the development activity can be designed to avoid direct disturbance, we believe this would be justified and warranted. Should avoidance of these areas not be possible for proposed development projects, detailed full site survey and excavation/ conservation should be carefully considered. This approach is consistent with established national and international standards in maritime archaeology and underwater cultural heritage. Additionally, if such development proposals are reviewed by your office, affecting the nearshore waters along this stretch of coast, we suggest that the proponent be asked to conduct independent surveys of the area being disturbed by the construction and use. While we are reasonably certain no other wreckage is present, based on our comprehensive survey of the area, there were some places close to the shore we were unable to survey (due to constraints imposed by the survey vessel and system we were deploying). Given the distribution of the magnetic signatures identified in this survey, and the shoreline distribution of wreckage, these nearshore un-surveyed areas have high potential for significant historic material.

With regard to the areas where concentrations of magnetic anomalies were found, we suggest that they be avoided if possible in any future development of the area. We did not determine how deep these anomalies may be buried, nor even what specifically they might represent; however, it is likely that they result from archaeological material. Again, should avoidance of these areas not be possible for proposed development projects, invasive techniques such as excavation and survey should be carefully planned and conducted to positively identify the exact nature of the magnetic signature, potentially leading to recovery and conservation of historic material. Such projects and associated costs are typically part of mitigation for potential impacts to cultural resources.

These sites, and what remains of the wreckage on the beaches identified by Beebe and his team, are the legacy of whaling heritage in this historically important place. We recommend that to the extent possible, this legacy continue to be protected by the State of Alaska.

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Figures:

Figure 1 – Location Map and Survey Area



Figure 2 – Magnetic Anomaly Concentration (Northern Survey Area)

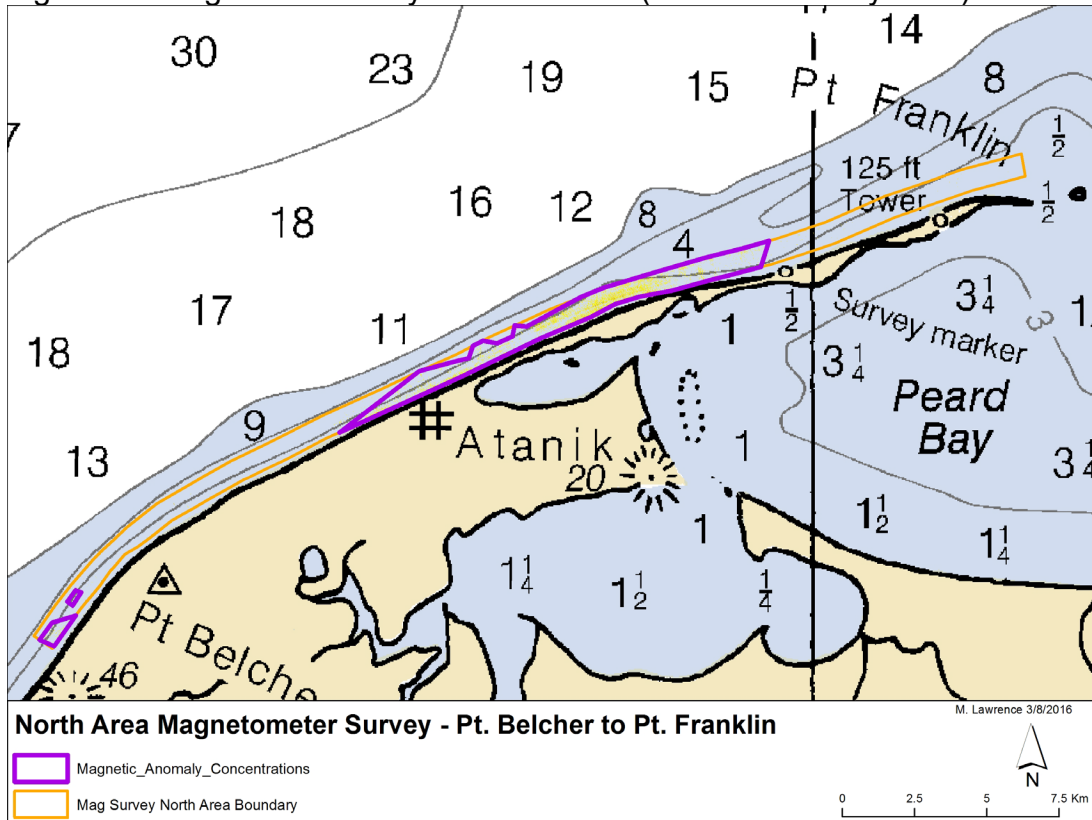


Figure 3 – Magnetic Anomaly Concentrations (Southern Survey Area)

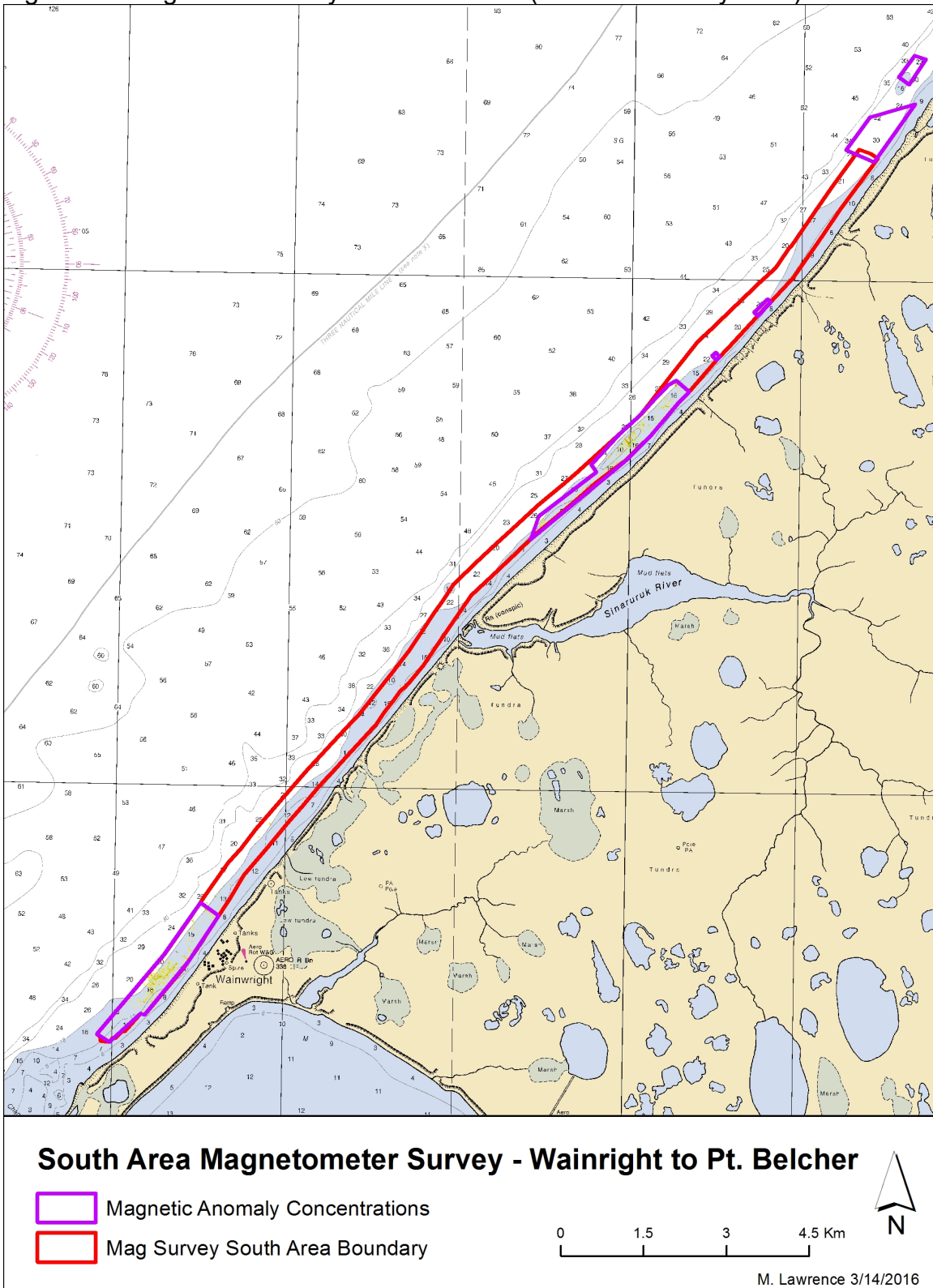


Figure 4 – Preliminary Bathymetry in the Northern Survey Area (Image: Pradith/HYPACK)

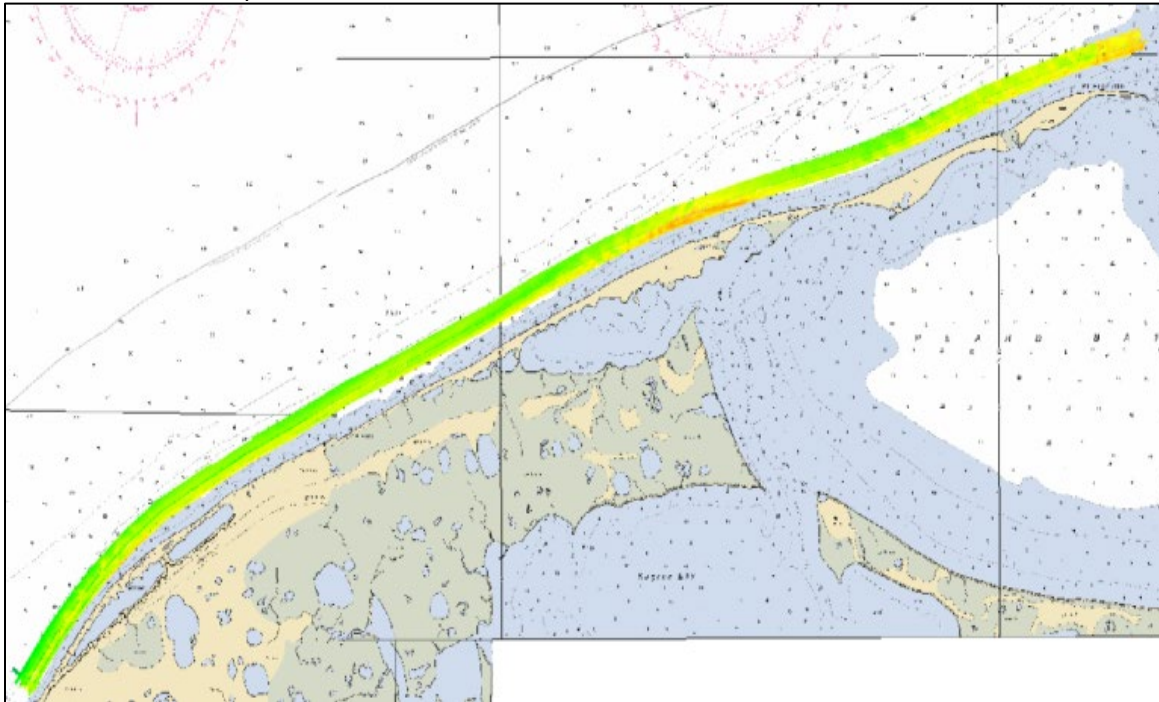
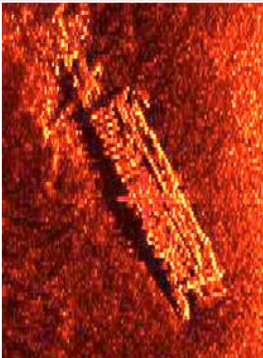
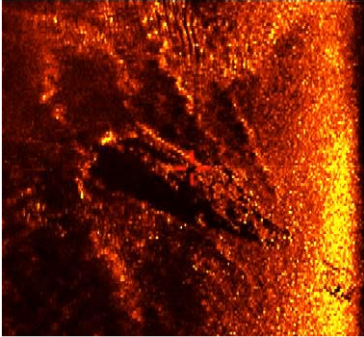


Figure 5 – Side Scan Sonar Images of Wreckage Identified in Survey

| Target ID | Side Scan Sonar Image | Characteristics |
|-----------|---|---|
| WNS-1 |  | 20 m max length 6 m max breadth Section of wooden hull with futtocks, inner and outer hull planking and longitudinal stringers. Both iron and copper-alloy fastenings present. |
| WNS-2 |  | 22 m max length 6 m max breadth Section of wooden lower hull including a keelson, floors, and bilge ceiling. Iron kentledge was present along with a small anchor, deadeye strop, and tryworks knee. Both iron and copper-alloy fastenings were present. |

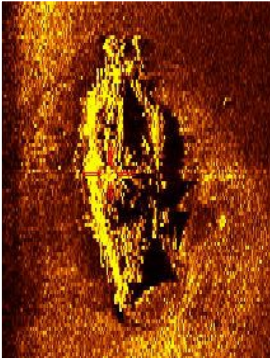
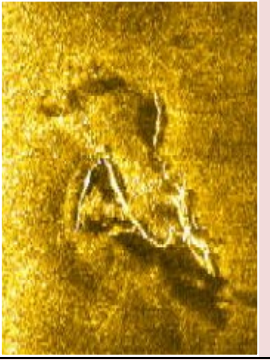
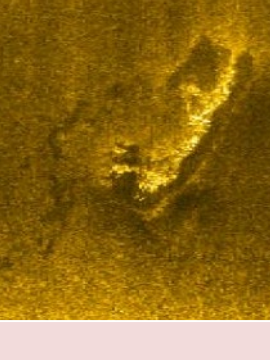
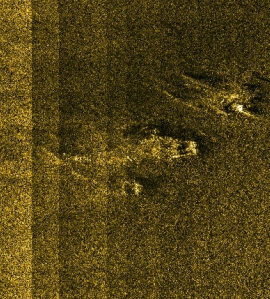
| | | |
|-------|---|--|
| WNS-3 |  | <p>23 m max length 8 m max breadth Lower hull of a wooden vessel with round rock ballast. Both iron and copper-alloy fastenings present.</p> |
| WNS-4 |  | <p>15 m max length 8 m max breadth Suspected to be wire rope rigging. Not investigated with the drop camera.</p> |
| WNS-5 |  | <p>14 m max length 7 m max breadth Linear feature not investigated with the drop camera. Adjacent to WNS-4.</p> |
| WNS-6 |  | <p>Three component target, 37 m length overall with a max breadth of 12 m. Not investigated with the drop camera.</p> |

Figure 6 – Underwater Photograph of WNS-2 Artifacts, including (L to R) anchor, deadeye strop, tryworks knee (Image: NOAA/ONMS/MHP).

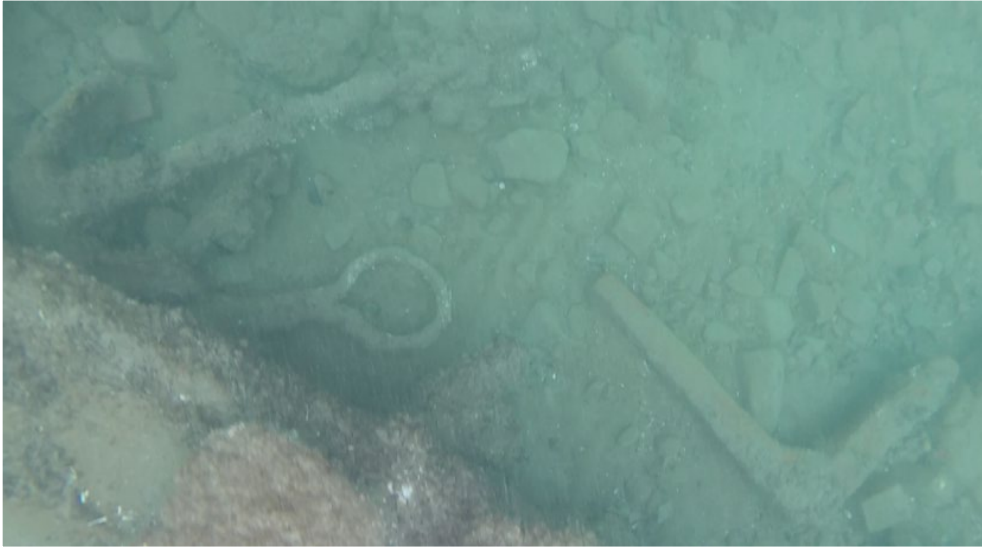


Figure 7 – Image from Google Earth, indicating sandbar just off shoreline around Pont Belcher.

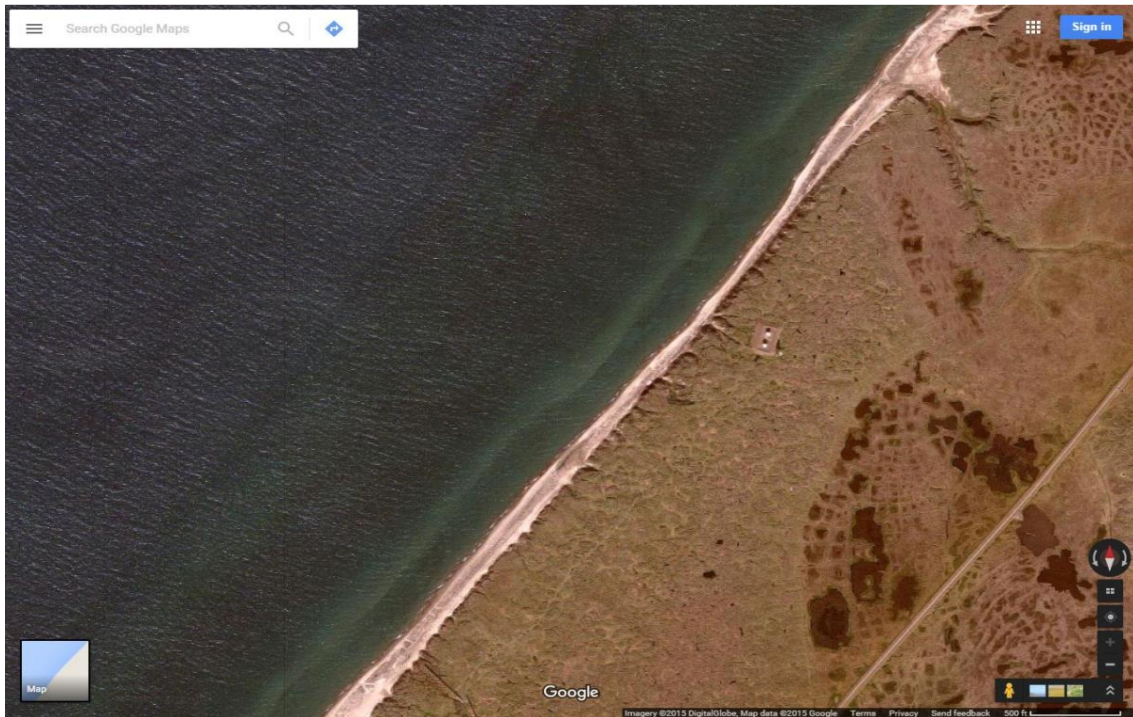


Figure 8 – Historic lithograph from 1871 *Harpers Weekly* showing open lead between ice and shore.



Figure 9 – Historic Lithograph from the Ted and Ellie Congdon Collection at the Huntington Library, Photo: Robert Schwemmer.

