

# Archaeology Guidelines Supplement

## Submerged Archaeological Resources Guidelines for Investigations and Report Standards



State Historic Preservation Office

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# Submerged Archaeological Resources Guidelines for Investigations and Report Standards

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# Submerged Archaeological Resources

## Guidelines for Investigations and Report Standards

### I. Introduction

The following guidelines are intended to help developers and cultural resource practitioners identify when archaeological surveys may be required within the jurisdictional state waters of Ohio, and how to meet the requirements for regulatory compliance during investigations of submerged archaeological resources (e.g. shipwrecks, inundated terrestrial archaeological resources, etc.). The Ohio History Connection (OHC) houses the State Historic Preservation Office (SHPO). OHC recognizes that each project is unique, and conditions may require deviation from these guidelines. OHC recommends early and frequent consultation with their office to determine project-specific survey requirements. The following sections in this Appendix provide guidance on personnel qualifications, survey methods, and report contents. Additional resources are provided in Section V of this Appendix that describe best practices, including the [UNESCO 2001 Convention on the Protection of the Underwater Cultural Heritage Annex Rules](#).

### Statutory Authority

Federal undertakings that occur within the submerged lands of Ohio must adhere to the regulations in [36 CFR Part 800 "Protection of Historic Properties"](#). The Guidelines included in this Appendix are meant to facilitate adherence to the regulations outlined in 36 CFR Part 800.

Submerged archaeological resources may also be subject to additional federal and/or state legislation. For example, title to abandoned shipwrecks in or on the submerged lands of Ohio are transferred from the federal government to the state through the [Abandoned Shipwreck Act of 1987](#). The State of Ohio reaffirms ownership of submerged abandoned property in Lake Erie through [Ohio Revised Code Title \[15\] XV Chapter 1506.30 and 1506.33](#) and expands the definition of abandoned property to include submerged materials resulting from Native American activities. All United States military craft, including shipwrecks and downed aircraft, regardless of their age, are protected under the [Sunken Military Craft Act of 2004](#); protections may also be extended to foreign military vessels. Human remains or funerary items from submerged contexts identified during survey or excavation, or encountered during the undertaking, may be subject to the [Native American Graves Protection and Repatriation Act of 1990](#). [Human remains](#) and associated burial objects are referenced in these Archaeology Guidelines; whether identified in a terrestrial or submerged context, there is no difference in statutory authority over these materials.

## Jurisdiction

As stated in these guidelines the SHPO coordinates state participation in the implementation of the [National Historic Preservation Act \(NHPA\)](#). This includes all federal undertakings with planned ground disturbance in submerged lands, be they coastal waters, inland rivers, inundated reservoirs, etc. Project applicants should anticipate that a submerged archaeological resources survey will be required; however, all decisions regarding survey requirements are at the discretion of the SHPO. Early and frequent coordination with the SHPO is recommended.

The [Submerged Lands Act, 43 U.S.C. § 1301 et seq.](#), defines coastal waters for states bordering the Great Lakes, including Ohio, as extending from shore to the international maritime boundary with Canada. This definition is reaffirmed in the [Ohio Revised Code, Title \[15\] XV, Conservation of Natural Resources, Chapter 1506.01 and 1506.10](#). The waters of the Ohio River along the state's southern border are not Ohio state waters, following the U.S. Supreme Court decision regarding the matter of [OHIO v. KENTUCKY \(1980\)](#), which upheld Kentucky's claim that their northern border extended to the low-water line along the northern bank of the Ohio River as it existed in 1792.

## Submerged Archaeological Contexts

The State of Ohio retains title to abandoned property, including post-contact vessels and materials associated with Native American activity. Ohio's northern border includes over 310 miles of shoreline along Lake Erie and the coastal islands, with approximately 600 shipwrecks estimated to have been lost within Ohio waters. While shipwrecks are the most commonly recognized type of submerged archaeological resource, they are not the only resource anticipated from submerged contexts, nor is Lake Erie the only location with the potential to contain submerged archaeological resources. The SHPO recognizes the wide diversity of submerged archaeological resources that can occur in state waters, which span the entirety of human occupation in the state. Additional resource types and locations are described below but do not represent an exhaustive list of Ohio submerged archaeological resources.

Navigable waterways, including streams, rivers, lakes, canals, reservoirs, and quarries may all contain evidence of past human activity. Archaeological resources may also be identified within wetlands, streambanks, and along eroding shorelines. Recommended survey methods are outlined below in Section III. The Ohio SHPO recommends that all potential survey areas be assessed with a view towards their cultural context; for example, sites may be discussed in terms of their place within the broader maritime cultural landscape (e.g., Ford 2011; NPS 2015).

Sites in transitional zones, such as shorelines and streambanks, can present unique challenges for archaeological survey but may still contain in situ archaeological deposits. Shoreline and streambank development are the outcome of complex geomorphological processes. Shorelines developed as a result of lowering and rising lake levels, isostatic rebound, and climatic conditions. Raising and lowering of lake levels also had a direct impact on tributary rivers of the Great Lakes and rates of [alluviation](#) (Monaghan and Lovis 2005). Similarly, streambank development was a result of various processes that include climatic conditions, lateral and vertical sediment accretion, and erosion. The discipline of geomorphology is significant in understanding landscape and landform development, and [taphonomic](#) processes that are responsible for the burial of archaeological resources.

Pre-contact archaeological resources that can be found in shoreline or streambank environments can include, but are not limited to ephemeral campsites, well-developed villages, watercraft (e.g., canoes), and isolated features. [Buried pre-contact sites](#) can represent a single occupation or component, or they can be stratified and multicomponent. Post-contact archaeological sites can include, but are not limited to, remnants of wharves, harbors, piers, bridges, canal features, associated structures, and watercraft.

Previous [buried site](#) models have identified geomorphological evidence for episodic periods of floodplain stability and flooding that contribute to site preservation potential (Monaghan and Lovis 2005). During periods of climate stability, floodplain surfaces underwent extended periods of weathering which led to greater pedogenesis. This contributed to longer periods for human occupation and site development, resulting in higher visibility of archaeological materials (Monaghan and Lewis 2005:162). Periods of dynamic flooding caused accelerated rates of [alluviation](#), and the more rapid burial of archaeological materials reduces the visibility of archaeological sites that represent shorter-term or possibly one-time occupations (Monaghan and Lovis 2005:162-164).

Previous investigations have demonstrated the importance of surveying shoreline and streambank areas in Ohio for archaeological resources. Extensive geomorphological investigations conducted by Commonwealth Cultural Resources Group at the William H. Zimmer Generating Station in Clermont County, indicated a high probability for the identification of buried archaeological resources at the Ohio riverbank and overlying levee (Roper and Lepper 1991:354); buried archaeological materials dating to the Paleoindian, Early Archaic, and Late Archaic periods were identified within the riverbank. Geomorphological investigations conducted by Gray & Pape, Inc. at the Greenlee Tract along the Ohio River in Adams County identified multiple landforms with variable potential for buried deposits including archaeological materials dating to the terminal Middle Archaic and Late Archaic periods (Purtill 2012).

## Permit Requirements

Proposed activities directed at historic properties that include collection and/or removal of artifacts, or sediment removal from a submerged context, must first obtain a [permit from the Ohio Department of Natural Resources \(ODNR\)](#). ODNR consults with the SHPO prior to the issuance of such permits, pursuant to [Section 1506.32 of the Ohio Revised Code](#), and as defined in these Archaeology Guidelines.

## Summary

Final decisions regarding survey requirements and/or accepted methods are at the discretion of the SHPO. The SHPO encourages early coordination to confirm that a survey will be required. Depending on the type of environment to be surveyed, alternate methods from those presented in these Guidelines may be necessary and should be developed in consultation with the SHPO.

## II. Qualifications

### Principal Investigator

Projects require at least one experienced Principal Investigator (PI) responsible for maintaining proper archaeological standards, field methods, data quality, reporting procedures, and [safety protocols](#). The PI must meet or exceed the minimum standards for archaeology as outlined in the Department of the Interior's (DOI) Standards and Guidelines for Archeology and Historic Preservation ([36 CFR Part 61, Appendix A - Professional Qualifications Standards](#)). The PI should be professionally qualified for their supervisory role(s) and able to conduct submerged archaeological resource surveys with a proven record of archaeological training, experience, and competence relative to the project's particular scope of work and permitting requirements, especially for submerged archaeological contexts.

### Project Personnel

Project crew chiefs, underwater archaeologists, and other personnel with primary roles should also meet or exceed the minimum DOI standards and be appropriately skilled for their individual responsibilities related to the scope of work. Dive safety officers (DSO) and support divers should be amply qualified for their respective duties.

### Health, Safety, and Environment (HSE)

The SHPO may request that cultural resources consultants planning on conducting submerged archaeological resources investigations provide proof of [appropriate](#)

[safety plans](#) prior to the start of operations. Working on the water and/or breathing compressed air require additional safety measures and, where applicable, insurance requirements. Dive operations in support of regulatory compliance should meet standards for safety accepted by OSHA for scientific diving as presented in [Standard 1910, Subpart T, Appendix B](#). Field personnel should consult available resources, such as NOAA Tides and Currents for projected on-water conditions prior to the start of operations.

## SHPO Consultant List

[The Ohio SHPO maintains a directory of qualified archaeological consultants](#), and a list of those with specific expertise in submerged archaeological survey can be provided by the SHPO upon request.

### III. Recommended Survey Methods

Efforts should always be made to use appropriate nondestructive survey methods to fulfill the specified research aims. Where conditions prohibit adherence to these recommended survey methods, SHPO encourages coordination with their office to identify reasonable alternatives.

#### Phase I: Shoreline/Streambank Survey

Before starting any archaeological fieldwork, it is important to consider the potential for [buried archaeological resources](#) in shoreline and streambank environments. The SHPO encourages early coordination with archaeological consultants to determine if potential archaeological resources are likely to be located within the proposed area of potential effect (APE). It is imperative to conduct detailed [background research](#) in past environmental, climatic, geological, pedological, archaeological, and geomorphological studies to evaluate the potential for buried landforms and archaeological resources in the proposed APE. Recommended sources of information include historic USGS topographic maps, navigational charts, and aerial photographs. These resources can document post-contact period impacts to the APE, such as erosion, sediment deposition, and land-altering activities that would impact site preservation potential. Consultants will need to identify the potential impacts of a given undertaking on the APE, assess if there is a higher potential for pre-contact sites or post-contact period sites, and identify how the landscape of the APE has changed over time (e.g., has the APE always been underwater, or was it dry land at a previous point in time).

Several archaeological methods for identifying landforms that have a potential for site burial are available and include geophysical survey, hand augering, solid core retrieval, and backhoe trenching. Phase I surveys of streambanks and shorelines

should attempt to adhere, to the extent possible, to the recommended guidelines for Phase I terrestrial surveys as presented in these Guidelines.

## Phase I Survey: Remote-Sensing Investigation

When the APE includes submerged lands, a remote-sensing survey should be conducted to detect the presence or absence of potential archaeological resources. The methods described below are consistent with those recommended by other state and federal regulatory agencies and represent “best practice” using commonly available tools and techniques. If potential resources are identified, consultation with SHPO is required to determine the most appropriate course of action. In areas where water depths are too shallow to allow safe operation by boat, the SHPO should be consulted to determine appropriate alternative strategies for meeting compliance requirements.

### 1. Survey Design

- a) The survey must include all submerged lands included within the APE where any activity, whether permanent or temporary, would impact the bottom. This includes anchoring of vessels.
- b) The survey should address the potential for post-contact shipwrecks as well as the potential for pre-contact paleolandscapes or inundated (formerly terrestrial) archaeological sites.
- c) The survey should achieve a minimum of 200% bottom coverage with the sonar.
- d) Surveys for linear projects, such as transmission cables or pipelines, should include a centerline based on the projected path of the feature to be installed, and offsets to either side. The use of a centerline is intended to allow for collection of data directly along the area to be impacted by operations.
- e) The vessel should travel at a speed appropriate for all sensors during data acquisition (typically 4-5 knots).

### 2. Survey Line Spacing

- a) Primary survey line spacing should not exceed 30 meters [100 feet].
- b) Perpendicular tie-line spacing should not exceed 500 meters [1650 feet].
- c) A minimum of three (3) equidistant tie-lines should be surveyed, which may require that tie-lines be planned at smaller intervals.



- i. As discussed in Evans et al. 2020, wooden shipwrecks in the shallow waters of Lake Erie may be extremely difficult to discern. If the APE has a high probability for the occurrence of shipwrecks, additional tie-lines may be desired so as to maximize the chances of identifying a wooden shipwreck.

### 3. Sensors and Specifications

#### a) Navigation

- i. A differentially-corrected global positioning system (DGPS) receiver or system of equal or greater accuracy should continuously log the surface position of the vessel.
- ii. Layback corrections should be applied to the navigation data for each sensor.

#### b) Bathymetry

- i. Digital singlebeam bathymetry data should be collected along all lines.

#### c) Side Scan Sonar

- i. Digital sonar data should be recorded along all survey lines, with the range adjusted to provide a minimum 200% coverage of the bottom.
- ii. The side scan sonar should be towed above the bottom at an altitude that is between 10 and 20 percent of the range of the instrument.
- iii. A sonar system capable of 400 kHz frequency or greater is recommended.

#### d) Magnetometer

- i. The magnetometer should record the magnetic environment at 1-second intervals or less.
- ii. The towfish altitude should not exceed 6 meters [20 feet].

#### e) Subbottom Profiler

- i. A subbottom profiling system should be used for mapping

buried horizons.

## Phase II and III Submerged Archaeological Resources Investigations

If the results of a Phase I survey indicate the presence of a potential archaeological resource, and the resource cannot be avoided by the proposed undertaking, the SHPO may require a Phase II Evaluation or Phase III Data Recovery and Mitigation project. Archaeological consultants will need to coordinate with the SHPO to determine appropriate methodologies to achieve specific objectives on a case-by-case basis.

## IV. Reporting Requirements

Survey report [submission requirements](#) are summarized by the SHPO for all archaeological projects. These requirements specify the deliverables, including items such as GIS data and maps, and are generally applicable to submerged archaeological resources survey reports; however, report content criteria, as listed in these Guidelines are specific to terrestrial site investigations, and do not adequately address the specific categories of information required to report on submerged archaeological resources investigations. The reporting guidelines given below should be used for submerged archaeological resources reports.

### Deliverables and Submission

All projects permitted by ODNR (through the SHPO) or submitted directly to the SHPO for compliance review must include electronic geospatial data and should be submitted in standard Geographic Information Systems (GIS) formats organized within an ESRI ArcGIS geodatabase. Other GIS formats are also acceptable provided they are usable with standard, commercially-available software. Consultants should contact the SHPO if they have questions about acceptable formats.

Digital data submissions must clearly define the project geodetic datum.

### Phase I Report Outline

1. Front Matter, including the cover, abstract, table of contents, and lists of tables, figures, and/or appendices.
  - a. The title page should include: the report title, including project name, township, and county; author(s), principal investigator, address, and phone number; client for whom the report was prepared, address, and phone number; lead public agency, if applicable; and date of report.

- b. The abstract should summarize the APE location and size, scope of work, permit information (if applicable), survey personnel, methods, findings and recommendations, and provide a list of any/all inventory forms completed as part of the project. [Ohio Shipwreck Inventory](#) or [Ohio Archaeological Inventory Forms](#) (new or updated) should be included as a separate appendix to the report, where applicable.

## 2. Introduction

- a. This section should discuss the purpose and circumstances of the contracted services including location of project, description of proposed undertaking, project administration, organization, constraints, and acknowledgements. This chapter should be illustrated with maps/graphics as needed.

## 3. Environmental and Cultural Context

- a. This chapter should provide environmental and geologic background information relevant to identifying site preservation potential within the project area. For example, the chapter should include a discussion of documentary research on lake/reservoir formation, stream/channel incision or development, shoreline changes, sedimentation, and landscape alterations. Historic USGS topographic maps, nautical charts, harbor maps, and all relevant maritime documents should be referenced. Background information should also address environmental conditions that would have supported local populations, including available and/or exploited resources.
- b. The cultural portion of this chapter should present a review of relevant cultural histories, known Ohio Archaeological Inventory and [Ohio Shipwreck Inventory](#) sites in proximity to the APE, any [National Register](#) sites in the area, ship traffic and navigation history, known or reported vessel or aircraft losses in the area, and changes within the built environment that would impact submerged sites. The cultural discussion should also address, to the extent possible, known Tribes with traditional or ancestral ties to the project area. This section should also address any previous surveys or investigations that overlap or are in the vicinity of the current project area.

## 4. Field and Processing Methodology

- a. This chapter should first identify the types of resources most likely to be encountered in the project area, and present the basic assumptions, methods and techniques used to design the survey strategy. If the pre-plotted survey lines could not be run as planned in

the field, a discussion should be included that addresses why the survey design was changed and how the survey was modified so as to maintain compliance with these Guidelines.

- b. The chapter should identify all project personnel and their role(s), equipment specifications and settings used in the survey, field and operating conditions, survey procedures, data quality, discussion of any data acquisition issues/problems that impact quality or interpretation, and post-processing procedures (including software used and workflows followed).
- c. Magnetometer contours should be prepared to illustrate the report and should supplement the presentation of individual anomalies. The methodology should include a discussion of data processing, including any corrections (e.g., IGRF or diurnal) applied to the data, and gridding and contouring parameters used.
- d. Authors will need to describe their criteria for defining sonar targets and magnetic anomalies as well as their rationale for interpreting specific targets and/or anomalies as potential archaeological resources.

## 5. Results and Interpretation

- a. This chapter should include a discussion of the results of the bathymetry, sonar, magnetometer, and subbottom data sets independently followed by a discussion of the interpretation of the cumulative data. Maps to accompany the text should illustrate the following:
  - i. A navigation pre-plot showing the planned survey lines and the actual as-run survey lines.
  - ii. Bathymetry contours.
  - iii. Locations of interpreted features, such as individual sonar targets, individual magnetic anomalies, and/or subbottom features.
  - iv. Magnetometer contours.
  - v. Sonar mosaic.
  - vi. Where possible, subbottom data should be used to prepare an isopach map of buried sediment horizons.

## 6. Conclusions and Recommendations

- a. This chapter should present a management summary that includes a brief discussion of the proposed undertaking, the location of the project area, methods used for data acquisition and analysis, and the findings.

- b. Authors should also include an evaluation of the presented findings, to include the potential significance of each site or feature in terms of its scientific (archaeological), historical, and/or cultural value, possible impacts to the site or feature that may occur as a result of the proposed undertaking, and possible mitigation measures.
- c. When sufficient data are available, each site is to be evaluated in terms of its potential eligibility for listing to the National Register of Historic Places, the State Registry of Archaeological Landmarks, and the State Registry of Historic Landmarks, as applicable.

## 7. References Cited

- a. Reports need to include complete citations as appropriate for all works referenced.

## 8. Appendices

- a) Sonar target table detailing, at minimum, dimensions for each target (length, width, and height), coordinates, description, and recommended avoidances (where applicable). If the target is associated with other targets or anomalies, this should be detailed in the description field.
- b) Sonar target image report, providing an annotated image of each interpreted sonar target. Care should be taken so that annotations do not cover or obscure the target being illustrated.
- c) Magnetic anomaly table detailing, at minimum, intensity, duration, signature, and coordinates for each interpreted anomaly, and recommended avoidances (where applicable). If the anomaly is associated with other anomalies or a sonar target, this should be noted in the avoidance field.
- d) Ohio Shipwreck Inventory form(s)
  - i. For wrecks already listed on the Ohio Shipwreck Inventory (OSI):
    - (1) Include a side scan sonar image of the wreck(s);
    - (2) Record the GPS data (latitude and longitude) from the center point of the shipwreck;

- (3) Provide the geodetic datum used (e.g., NAD83, State Plane, or WGS84 UTM; meters or feet); and.
    - (4) Document this and any additional information on the Ohio Historic Preservation Office's 'Continuation sheet.'
  - ii. This information will update the existing OSI Form. For new, unrecorded wrecks:
    - (1) Download the Ohio Shipwreck Inventory Microsoft Access database form to document shipwreck specifics.
    - (2) Prepare and include the information requested in steps 1-3 above.
    - (3) If the vessel's name is known or has been identified it can be included on the form. When submitting new, unidentified, unrecorded shipwreck information, the finder's name is incorporated into the placeholder site name. For example, John Doe 2019-1, John Doe 2019-2.
    - (4) In the description field, provide a summary of observations regarding the vessel and the site;
- e) Ohio Archaeological Inventory form(s)
  - i. Non-shipwreck archaeological sites should be documented using the Ohio Archaeological Inventory form following the instructions presented in the OAI instruction manual.
  - ii. Information related to submerged, or partially inundated archaeological sites may not fit completely within the pre-defined OAI form and can be provided on a "Continuation Section." If additional guidance is needed, consultants are directed to contact the SHPO.

## Phase II & III Reporting Requirements

In the event that a Phase II Evaluation or Phase III Data Recovery and Mitigation

project for submerged archaeological resources is requested, SHPO will work with the archaeological consultant to determine the specific reporting requirements necessary. Conservation of any recovered materials and long-term curation must be included in the [research design](#). Archaeology consultants should review and make sure that all conservation and curation plans adhere to the [UNESCO 2001 Convention on the Protection of the Underwater Cultural Heritage Annex Rules](#).



## V. Further Reading

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New York. Catsambis, Alexis, and Ben Ford

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National Park Service, State Submerged Cultural Resources Laws

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2008 *Underwater Archaeology: The NAS Guide to Principles and Practice*, (2<sup>nd</sup> edition). Wiley-Blackwell, Hoboken.

Ohio History Connection, Ohio Shipwreck Inventory website

UNESCO 2001 Convention of the Protection of the Underwater Cultural Heritage, Annex Rules website

United States Naval History and Heritage Command website

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2015 Proceedings of the Maritime Cultural Landscape Symposium, Volume I: Presentation Papers. October 14-15, 2015. University of Wisconsin-Madison. <https://www.nps.gov/nr/publications/guidance/NRLI/presentations/MCLS-Proceedings-vol1-final.pdf>

Purtill, Matthew P. (editor)

2012 *A Persistent Place: A Landscape Approach to the Prehistoric Archaeology of the Greenlee Tract in Southern Ohio*. Published by Gray & Pape, Inc., Cincinnati, Ohio.

Roper, Donna C., and Bradley T. Lepper

1991 Archaeological Data Recovery from Four Sites at the William H. Zimmer Generating Station. Report prepared for the American Electric Power Service Corporation, Columbus, Ohio. Report prepared by Commonwealth Cultural Resources Group, Jackson, Michigan.

Trimble

2020 Differential GPS: DGPS Advanced Concepts. Electronic resource.

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2005 Sound Images of the Ocean in Research and Monitoring. Springer-Verlag, Berlin.

## VII. Glossary

***Bathymetry***: refers to the depth of a given water body relative to a specific datum (e.g., sea-level) but can also refer to the study of water bottom features and topography. For more information see NOAA 2018.

***Differential Global Positioning System (DGPS)***: a positioning system that incorporates a stationary receiver with roving satellites to make position measurements, where the incorporation of the stationary receiver increases the accuracy of calculated positions. For more information see Trimble 2020.

***Diurnal magnetic variation***: the daily variation in the Earth's ambient magnetic field.

***Dive Safety Officer (DSO)***: person whose responsibilities include developing and/or maintaining all dive safety protocols for an organization and who should function independently of the scientific Principal Investigator. For more information see American Academy of Underwater Science Diving Standards.

***International Geomagnetic Reference Field (IGRF)***: a mathematical equation used to calculate the Earth's expected magnetic field developed and maintained by the International Association of Geomagnetism and Aeronomy (IAGA). Using the time and coordinates of a given data set the IGRF algorithm is used to calculate the expected value of the ambient magnetic field, which is used to normalize the raw data in post-processing.

***Isopach***: a contour line on a map connecting equal data points that may depict the thickness or depth of a given stratigraphic unit.

***Layback***: the horizontal distance between the positioning antennae and the remote sensing sensor being deployed via cable from the survey vessel. Layback may also be referred to as 'cable out' or 'setback'.

***Magnetic Anomaly***: a deviation above and/or below the Earth's ambient magnetic field that exceeds a pre-defined intensity and duration; can appear as monopolar, dipolar, or complex feature typically attributed to ferrous material on or below the sediment surface.

***Magnetometer***: an instrument used to measure the Earth's magnetic field strength; it can be deployed behind a survey vessel to collect data along survey lines. For more information see Marine Magnetometer, Woods Hole Oceanographic Institution.

***Side Scan Sonar.*** an instrument that emits and receives acoustic signals of varying frequencies where the speed and strength of the returned signal is used to generate a 2D image of the bottom. For more information see Wille 2005.

***Singlebeam echosounder.*** a remote sensing tool that records bathymetry data using a single downward-facing acoustic beam; singlebeam echosounders are commonly found on recreational boats (e.g., fish-finders) as well as larger commercial vessels (after Blondel 2009).

***Sonar Target.*** an object or feature observed in sonar imagery; where overlapping coverage is available the target will appear consistently in the same location but the overall appearance may change due to its acoustic reflection. Targets may be natural or anthropogenic in origin. For more information see Blondel 2009:77-83.

***Subbottom Profiler.*** a downward-facing echosounding device used to record stratigraphy below the sediment surface. For more information see Wille 2005.

***Towfish:*** a housing for remote sensing equipment designed to be towed in the water behind a survey vessel and connected to the topside processing computer by a data cable.