

### ***Introduction***

It is Department of the Navy policy to preserve, protect, and manage its underwater archaeological resources for scientific research, interpretation, and public education. Such resources include shipwrecks, aircraft crash sites, and submerged land sites, among others. The following fieldwork guidelines provide recommendations on effective methods for conducting research on submerged cultural resources, meet professional and ethical standards for undertaking underwater archaeological field investigations, and promote responsible heritage stewardship. They draw from existing federal historic preservation statutes and regulations, as well as technical manuals and references applicable to underwater archaeology. To the extent there are any questions or divergence between the following and applicable laws and regulations, the latter are controlling. For intrusive work on Navy sunken military craft, a permit under 32 CFR 767 is required. The Navy conducts or supports a series of investigations in the underwater environment for purposes other than archaeological; the lead Navy Command involved in any such investigation would be best positioned to ascertain whether these recommended methods and guidelines, or parts thereof, would be applicable in each instance.

The following guidelines issued by the Naval History and Heritage Command are meant to inform and provide a framework for developing and executing research plans for underwater archaeological field projects, conservation and curation of collected artifacts and data, report generation, and dissemination of the results of research.

### ***Guiding Principles for Underwater Archaeological Field Studies***

- I. Project supervision should be done under an experienced underwater archaeologist who meets the qualification standards in the Department of the Interior's Standards and Guidelines for Archeology and Historic Preservation. The principal investigator should be suitably qualified as evidenced by training, education, and/or experience, and possess demonstrable competence in archaeological theory and method, and in collecting, handling, analyzing, evaluating, and reporting archaeological data, relative to the type and scope of the work proposed.
- II. A research design should be developed in advance of fieldwork which clearly defines research objectives and sets forth field methods and techniques to be followed.
- III. Documentation efforts should follow a statement of objectives and field methods that responds to needs identified in the research design.
- IV. To the extent feasible, chosen methodologies and techniques should consider the possibility that future researchers will need to use the collected data to address problems not recognized during the original fieldwork.
- V. An assessment of the environmental characteristics of a site, to include site formation process, should be undertaken to aid research into the effectiveness of long-term in-situ preservation of the site as well as interpretation of the archaeological record.
- VI. Destructive methods on archaeological sites should be avoided when nondestructive methods are practical and can achieve the stated data recovery objectives. The focus on stated research objectives should be maintained throughout the process of study and documentation. In the case of imminent destruction or disturbance, it may be practical to gather the required data in the most direct manner, which may involve the use of destructive techniques. Often,

- destructive techniques are required to answer research questions, but such techniques should be limited to the gathering of necessary information to answer stated questions. If sampling a site through test excavations will meet the objectives, such minimal disturbance may be deemed sufficient.
- VII. Conservation begins from the moment of exposure of an artifact or feature, and is part and parcel with archaeology—without it archaeological information can be lost or left unexploited.
  - VIII. Field conservation and first-aid conservation (which refers to immediate care of an object upon recovery) procedures are vital for retaining as much information within an artifact until it can be transported to a suitable laboratory for full documentation and treatment.
  - IX. Archaeological excavation is a destructive process, and archaeological context is preserved only in the documentation that is collected in the process such as notes, drawings, measurements, and photographs. Conservation is an extension of the fieldwork and has the potential to recover vastly more data than that recovered solely in the field.
  - X. Archaeological documentation is not completed with field work; analysis of collected information is an integral part of the documentation activity, and should be planned for in the research design.
  - XI. Data recovery efforts should be planned and funded in accordance with long-term preservation standards and, particularly with federal collections, comply with 36 CFR 79 (Curation of Federally-Owned and Administered Archaeological Collections) to ensure the responsible care and stewardship of, and access to, recovered material culture. Planning should include protocol for possible encounter or inadvertent discovery of human remains, and should follow appropriate guidance and policy of federal agency, if applicable (i.e., Navy policy for sunken military craft casualties, NAGPRA for Native American sites on federal land)
  - XII. The results of the fieldwork data analyses are integrated into the body of current knowledge, and are reported and made available to the public.

### ***Research Design***

- I. The research design, developed in advance of field operations, should have the following minimum contents:
  - a. Discussion of research objectives
  - b. Historical overview of the project and area of study
  - c. Previous research conducted on the proposed study
  - d. Maps of study area
  - e. Description of the geology and/or geomorphology of study area
  - f. Discussion of methodologies and techniques used to gather required data
  - g. Description of all required equipment and project survey vessel(s)
  - h. Discussion of any possible environmental hazards, required site remediation, and site management strategies. Identify required permits and authorizations received prior to fieldwork. When required, complete environmental assessment or impact statement based on planned activities.
  - i. Detailed field conservation and laboratory conservation plans (as applicable)

- j. Dive planning and emergency planning (as applicable)
  - k. Long-term curation planning (as applicable)
  - l. Expected outcomes of research initiative
  - m. Plans for public outreach and educational initiatives
  - n. Budget and funding
  - o. Qualified personnel, project partners, and stakeholders
- II. Guidance for background research in preparing research design includes:
- a. Conducting intensive background information gathering to include: identification of previous archaeological work and inspection of archaeological collections; relevant geological, geomorphological, environmental, and biological data (and other related disciplines); archival research; informant interviews, recording of oral tradition, etc.
  - b. Conducting research to identify potential archaeological resources, assist in generating research questions used in the research design, and predict the costs of fieldwork, analysis, and curation.
  - c. If research will take place on federal or tribal lands, the provisions of the Archaeological Resources Protection Act (ARPA) may apply. This may also hold for parts of the Outer Continental Shelf outside of state waters. Further, if a federal agency is supporting such work, or the work is subject to a federal permit, license, or approval, Section 106 of the National Historic Preservation Act may apply.
- III. Field Methods, Logistics, and Techniques:
- a. Should be based on the research design so it is known in advance of fieldwork what kinds of information are needed for analysis; record-keeping techniques should focus on these data. Field records should be maintained in a manner that permits independent interpretation in so far as possible. Recordkeeping should be standardized in format and level of detail. Explicit descriptive statements of and justification for field study techniques are important to provide a means of justifying the selected level of intrusiveness, as well as evaluating results and cost effectiveness relative to other potential choices.
  - b. Should be flexible enough to accommodate the discovery of new or unexpected data classes or properties, or changing field conditions. In some cases, a phased approach may be necessary to gather sufficient data to calculate the necessary sample size for a statistically valid sample.
  - c. Should encapsulate full, clear, and accurate recording of all field operations and observations, including excavation and documentation techniques and stratigraphic or inter-site relationships.
  - d. Logistics in the field should consider site significance, anticipated location of most important data, potential time limitations, possibility of encountering human remains, possible adverse environmental conditions, and cost effectiveness.
  - e. Should incorporate the documentation of all uncollected, significant artifacts using drawings, measurements, and photographs. Record a provenience of all collected and uncollected significant specimens using appropriate methods and levels of accuracy defined in the research design. Note the provenience of collected materials on site map.

- IV. Archaeological data recovery projects on federal property result in a collection that must be curated in accordance with 36 CFR 79. Secure curation capacity based on the estimated volume and kind of archaeological materials that will be collected and the estimated linear feet of associated records, prior to the start of a project.

### *Surveying*

- I. General Operational Guidelines
- a. Use survey equipment appropriate for the survey objectives and environmental conditions. For example, towed side scan sonar systems to cover large areas in search of objects or features expected to exhibit relief above the seafloor, lake bed, or river bed; magnetometer or gradiometer to conduct searches of buried objects with substantial ferrous cores; multibeam echosounder to gather useful bathymetric data to detect seafloor features, to complement side scan sonar data, or to collect site-specific data; sub-bottom profiler to investigate individual anomalies or features buried under the seafloor; Autonomous Underwater Vehicle (AUV) systems to search large swaths or collect high-resolution data over specific sites; Remotely Operated Vehicle (ROV) systems to investigate deep-water archaeological sites or those in hazardous environments; or, a combination of these resources, if available.
  - b. Surveyor should use an accurate navigation system that can continuously determine the surface position of the survey vessel and data collection sensors. Calibrate precision of the navigation system and frequently log position fixes digitally along the vessel track to allow for the generation of a post-survey plot. Where possible, and particularly for shallow wrecks, the use of ellipsoidally-referenced GNSS survey positioning will offer the most stable and accurate data.
  - c. Coordinate system, geographical zone, base station information, diurnal variation, and any other local information should be fully recorded and organized for post-processing, interpretation, and use in Geographic Information System (GIS) applications.
  - d. To ensure full coverage for the development of complete site maps and to fully analyze wreck sites and associated debris fields, surveyor should space parallel survey lanes to allow for 100% overlap (200% coverage) of survey area (while ensuring nadir overlap in SSS), depending on the selected sensor. For intensive work, consider conducting two corridor search patterns at 90 degrees, or three at 60 degrees. For less intensive work, more expedient approaches may be used, though full coverage is required to rule out existence of resources in any one area.
  - e. Decisions regarding line spacing and direction will depend on the type of equipment deployed and nature of the seabed and environmental factors, such as surface sensors.
  - f. Consider proximity of shallows and obstructions, navigation buoys and fishing floats, shipping channels, the activities of other sea-users, the direction and strength of winds and currents, and variation in current direction and strength during tidal cycles.
  - g. Surveyor should log survey procedure and major events throughout survey, noting any direction changes, adverse weather conditions, equipment malfunctions, or other factors

that would affect data interpretation. Log and annotate start of the line (SOL) and end of the line (EOL) times.

- h. Appropriate processing software should be used to adequately process and interpret acquired data, and incorporate data into a GIS to provide analytical capabilities, map making abilities, and for report generation.

II. Magnetometer Operational Guidelines

- a. For towed devices, magnetometer towfish should be pulled behind the vessel at a distance of at least three times the length of the craft, or as appropriate based on hull material to eliminate vessel interference.
- b. Tow as close to the bottom as possible, but not higher than 6 m (20 ft) in a way that minimizes interference from the vessel hull and other survey instruments
- c. Parallel survey lanes should typically be between 15 and 20 m (50-65 ft) apart, but never more than 30 m (98 ft). Exact distances should be determined by equipment, environment, and water depth.
- d. Surveyor should annotate each survey line with the tow sensor height off the seafloor (if possible) and with the start of the line (SOL) and end of the line (EOL) times. Magnetometer sensitivity should not exceed one gamma ( $\gamma$ ) or one nanoTesla (nT), and the data sampling rate should not exceed one second. Background noise level should not exceed a total of 3 gammas ( $\gamma$ ) peak to peak.
- e. Magnetometer data should be recorded on a digital medium in such a way that it can be linked to navigational data so as to ensure positional accuracy, and vessel speed should be annotated as required.

III. Sidescan Sonar Operational Guidelines

- a. When possible, use a towed, dual-channel, dual-frequency sidescan sonar system to obtain continuous planimetric images of the seafloor, lakebed, or riverbed
- b. Side scan sonar frequency should be appropriate for type of search and range – typically low frequency (100–400 kHz) for broad, lower-resolution surveys and high frequency (600–1600 kHz) for narrow, high-resolution surveys.
- c. For cultural resource surveys run at a spacing of 50 m (164 ft), a system that operates in the 300–500 kHz range is recommended. Line spacing should be selected to ensure 100% overlap (200% coverage) of survey area, making sure to account for full overlap of nadir. Spacing is dependent on depth and frequency.
- d. The lane spacing and display range should be appropriate for the water depth. Lane spacing should be less than the sonar swath, thereby allowing for overlap between lanes
- e. In general, tow the unit at an altitude that is 10% to 20% of the range of the instrument, as shown below:

Height Above Seafloor	Range at 10% of Fish Altitude	Range at 20% of Fish Altitude
5 m	50 m/channel	25 m/channel
10 m	100 m/channel	50 m/channel
15 m	150 m/channel	75 m/channel
20 m	200 m/channel	100 m/channel

- IV. Sub-bottom Profiler Operational Guidelines
- a. When possible, use a high-frequency CHIRP (Compressed High-Intensity Radiated Pulse) sub-bottom acoustic profiler operating within the 1.5 to 4.5 kHz bandwidth to provide continuous and high resolution information of near surface and buried geological features.
  - b. System should be capable of achieving a resolution of vertical bed separation of at least 30 cm (1 ft) in the uppermost 15 m (50 ft) below the mudline.
  - c. The data should be recorded digitally to allow signal processing to improve data quality further and allow export to a workstation for integrated interpretation and mapping of data.
  - d. Surveyor should tow as close to the seabed as possible (5-10 m; 16-33 ft).
- V. Echosounder Operational Guidelines
- a. When possible, use a vessel- or vehicle- mounted, high-frequency echosounder to obtain bathymetric data.
  - b. Raw data should be displayed on graphic recorder and logged digitally and continuously.
  - c. A system should be devised to record with a sweep appropriate to the range of water depths expected in the survey area. A heave compensator should be used in conjunction with the echosounder system to remove the effects of vessel movement from the data.
  - d. Surveyor should account for and record relative height of sonar head, roll, heave, pitch, yaw, and speed over ground.
  - e. Especially in deep water, calibrate water column sound velocity at the start and end of the survey (minimally) by using a conductivity temperature depth (CTD) sensor or velocity probe capable of recording in the maximum water depth expected in the survey area.
- VI. Autonomous Underwater Vehicle Operational Guidelines
- a. AUVs operate independently of support vessels and can conduct pre-determined survey patterns to gather remote-sensing data. They can typically be fitted with multiple sensors and tools including side scan sonar, echosounder, HD video camera, 3D scanning devices, and marine magnetometer.
  - b. As above, side scan sonar frequency should be appropriate for type of search and range—typically low frequency (100 – 400 kHz) for broad, lower-resolution surveys and high frequency (600-1600 kHz) for narrow, high-resolution surveys.
  - c. Range should be adjusted for search type, depth, and frequency, following side scan sonar recommendations above.
  - d. Altitude should be approximately 10% of the depth of the water column for area surveys, and within a few meters of the highest point of relief on an archaeological site/feature for site surveys.
  - e. Downward-looking cameras and sufficient and well-positioned lighting should be used for photomosaics to create planimetric view and reduce shadows; images are typically collected at altitudes between 2.5 m and 5 m (8 ft and 16 ft) depending on water clarity, with overlaps of at least 50% in both directions.

- f. Ideal survey patterns depend on target area and objective, but can vary from star patterns (for multi-angle side scan coverage of a specific target) to conventional grid layouts (for broad searches).
- VII. ROV Operational Guidelines
- a. Work-class ROVs with powerful propulsion systems capable of excavation or other light duties should be equipped with Ultra Short Base Line (USBL) positioning to allow for accurate recording of feature locations and maneuvering around archaeological sites/features. A timed sequence of X-Y-Z points should be taken so that it will be possible to reproduce a post-plot of ROV movement.
  - b. Smaller inspection-class ROVs should maintain sufficient positioning via sector scanning or other controls (e.g., HD cameras) to allow for accurate maneuvering around archaeological sites.
  - c. ROV investigations over archaeological sites should only be conducted by trained, experienced, and competent ROV pilots to avoid inadvertent damage to underwater resources.
  - d. A professional underwater archaeologist should be present or be able to communicate in real time with the ROV pilot in order to direct the investigation and data gathering.
  - e. All data including video, sonar, and navigation should be recorded digitally and made available for later review.
  - f. Weather, tides, current, and continual positioning of survey vessel should all be taken into consideration during mission planning to avoid unanticipated complications.
  - g. Tethering systems and thrusters should not disturb underwater archaeological sites, including associated debris fields. If depositing of a ballast system is required, it should be dropped well away from the furthest known extents of the site and a USBL fix of the location should be recorded and incorporated into the final report.
  - h. Any sample collection should be done with extreme care to avoid disturbance of surrounding site features, artifacts, or material or human remains. Site documentation should precede any form of disturbance, and any unanticipated or accidental impacts should be thoroughly documented. Artifact recoveries should follow the same proveniencing, analyses, conservation, and curation requirements as described above and elsewhere.
  - i. Sediment removal should be done in a manner that does not negatively impact the preservation potential of the site or artifacts remaining in situ.
  - j. Once the surrounding environment has been evaluated for potential hazards, navigation should take the form of a constant and consistent circuit around a site to enable development of a site map. This will also allow for the systematic analysis of features along specific sections of the sunken craft, illuminating significant details such as battle or other forms of damage, construction features, or the presence of personal effects or human remains. Attempts should be made to maintain a forward or downward looking viewpoint while navigating, avoiding abrupt and frequent changes in camera angle to prevent disorientation during later viewing and analysis. Record USBL position fixes (waypoints) at key and recognizable portions of the site (e.g., bow, stern, amidships, paddlewheel, gun turret, main mast, nose, wings, tail).

- k. In cases where seafloor impact is significant, such as when a steel-hulled vessel drives into the bottom at great depths and creates craters or damage to geological features, the ROV should attempt to capture the environment immediately surrounding the site to document the impact. All sites, however, should be inspected for potential debris field.
- l. For acquisition of photomosaic video data, ROVs should be guided slowly over the top of the archaeological site at a sufficient altitude to prevent disturbance and ensure adequate lighting and visibility, attempting to stay approximately the same height above the site with downward facing cameras. ROVs should conduct as many equally-spaced gridded lanes along the length of a site as necessary to ensure full coverage and adequate overlap.
- m. Additional basic recommendations for collection of **photogrammetric** video data:
  - i. Conduct slow and steady sweeps at approximately the same distance from the periphery of the site (e.g., 2-5 m [6.5-16.4 ft], determined by visibility, current, etc.) along its length, starting near the lowest portion of the site, and continue around the known extents to complete a circuit around the site. Conduct a second pass following the same pattern at a higher level, ensuring overlap with the pass beneath, and maintain a forward, or slightly downward-facing camera angle. Repeat for a third or fourth pass depending on height of relief above the seafloor, ensuring overlap with the previous pass. Conduct final pass directly over the top of the site, in several gridded lanes as required for appropriate coverage and overlap, with the camera facing directly down.
  - ii. Conduct the survey at a slow speed that is conducive to collecting unblurred video stills for importation into photogrammetry software applications.
  - iii. To tie photogrammetric reference points together, it is often advisable to pause in the middle of a circuit, pass over the top of the feature to the other side, then go back to the original position to continue the circuit. This may assist photogrammetry software programs in better recognizing reference points.
  - iv. For larger underwater sites, it may be more practical to divide the site into two or three sections for ease of data gathering and post processing, ensuring there is sufficient overlap and site references to later join the sections together.
  - v. Maintain a forward or downward-looking camera angle during passes, and avoid panning as much as possible; this will maximize probability of reference point recognition in software applications.
  - vi. Remain at a sufficient altitude throughout data collection to prevent bottom disturbance, which could affect visibility and negatively impact the site.
  - vii. Ensure there is sufficient lighting and proper depth of field to capture as much focused detail over the site as possible, eliminating shadow to the extent feasible to increase the quality of the processed photogrammetric model.
  - viii. Confirm that on-screen ROV data, such as altitude, depth, coordinates, compass, date, and file name are removed from the screen during recording, as this will severely hinder the pattern recognition function of photogrammetry software.
  - ix. If possible, carefully place a few scale bars of appropriate size (proportional to magnitude of site) next to key features in different areas to later create an accurate scale within photogrammetry software. This will enable accurate measurements to be taken from within the final wreck site model.

- x. Maintain record of USBL position fixes at key and recognizable locations on the site (see above examples) to aid in model generation and to geo-rectify the processed model for incorporation into GIS applications.

VIII. Anomaly Groundtruthing Guidelines

a. Using divers

- i. In shallow waters, marker buoys should be dropped at the precise location of the anomaly
- ii. Send qualified diving personnel to investigate individual targets
- iii. Diver(s) should perform a series of 10 radial search sweeps around the positioned marker buoy in 1.5-m (5-ft) increments out to a radius of 15 m (50 ft), which provides a 30-m (100-ft) diameter circle of investigation around the anomaly. The radial increment is dependent on visibility, and may be expanded moderately in clear water.
- iv. Alternate search patterns such as linear grids and jackstay searches may be employed if better suited to the search environment and ensures full coverage
- v. For magnetic anomalies, each search should be conducted with a hand-held metal detector or magnetometer
- vi. Basic notes, sketches, measurements, and photography/video recording should accompany each discovered anomaly for the purposes of assessment and identification.

b. Using ROVs (in addition to ROV guidance above)

- i. USBL fixes (waypoints) should be taken near the location of the object to provide information on the size and shape of the anomaly.
- ii. If determined to be a shipwreck, USBL fixes should minimally be taken at both extremities, amidships, port, and starboard sides during initial assessments. For an aircraft discovery, fixes should also minimally be taken at wing extremities.
- iii. If surveying a shipwreck or sunken aircraft, investigate the surrounding area to determine the size of the debris field and gather data on the immediate environment and resident biological communities.
- iv. If equipped, high-definition video and sector sonar scans should be recorded.
- v. Surveyor should log ROV location and activities and annotate orientation and cardinal direction in which cameras are facing.

***Documentation, Excavation, Data Collection***

I. General

- a. All actual field methods used and observations made should be documented. Original and backup copies of field journals, notebooks, diving records, artifact record forms, field sketches, photographs, logs, feature and artifact drawings, field maps, soil profiles, and all raw and processed remote sensing data should be retained. All materials used in

collecting, processing, and analyzing specimens and material samples should also be documented.

- b. Archaeological documentation should be conducted under the supervision of qualified professionals in the disciplines appropriate to the data that are to be recovered. When the general public is directly involved in archaeological documentation activities, provision should be made for training and supervision by qualified professionals.
- c. Apply a documentation system according to specific site and circumstances, and ensure baselines and control points, if applicable, are selected prior to fieldwork, as outlined in research design.
- d. Thorough documentation should precede any form of site disturbance including recovery.
- e. Document the environmental and/or burial characteristics of a site, to include bottom type, salinity, currents, turbidity, U/V rays, marine communities, and, if possible and relevant to informing about site or artifact conservation, CTD casts and sediment cores.
- f. Maintain principles of archaeological survey: use of traditional methods (e.g., offsets, trilateration, direct measurements) should be complemented with new technology such as positioning systems, photogrammetry, and 3D scanning and modeling when available. In some cases, particularly with deep-water sites, the new technology may be the primary methods with traditional methods used to complement digital data.
- g. Record context: structures, hulls, cuts, fills, and layers. Each layer of infilling material should be designated as context, as each represents a specific episode in the history of the site. Stratigraphy can be complex due to movement of tides, scour, human intervention, and the attention of local fauna and flora. Most layers are recognizable because the material is different in texture or color, as shown in a Munsell color chart. All variables that make up distinctive character of a context should be recorded to the extent possible for each context encountered on a site, with the acknowledgement that some site environments will be more conducive to this type of recording than others.
- h. A simple labeling system that is easy to log and is flexible for new finds and disarticulated finds should be applied. Select labels that are durable both in the field and temporary storage solution prior to conservation or laboratory inspection.
- i. General guidance for plans and sections: 1:1 for small objects with diagnostic features; 1:2 or 1:4 for larger finds; and up to 1:10 for most site plans. Drawings should include site name, plan number, subject, recorder, draughtsperson, date, scale, position, orientation.
- j. If there is a reasonable chance that the activity may find or disturb human remains, a plan for stopping work, securing the remains, and notifying the proper authorities should be developed. If human remains are encountered on federal or tribal lands, and the remains or grave goods are Native American or Native Hawai'ian, the provisions of the Native American Graves Protection and Repatriation Act may apply. If human remains are encountered on state or private lands, it should be noted that each state will have its own requirements for securing the remains and reporting the find—in some states, the initial point of contact may be the state archaeologist, in others, it may be the coroner or sheriff. For sunken and terrestrial military craft, also notify Naval History and Heritage Command.

- k. To the extent possible, screen excavated soil from all units, regardless of unit size, through no larger than 1/4 –inch (65mm) mesh. Smaller mesh sizes may be appropriate depending on research design and material to be screened.
  - l. Excavation should be conducted as a controlled dismantling of the contexts that form a site—sediments, surfaces, structures, objects, and materials relating to past human existence—in order to understand their temporal, spatial, and social relationships. These principles are the same as on terrestrial archaeological sites, and movement of sediment should be controlled using appropriate tools for the task. Care should be taken in defining contexts and the nature of stratification. Layers should be removed in reverse order of deposition. If strata are unclear, excavate in 5 or 10 cm increments recording each section until a distinct layer is reached. Artifacts should not be pulled from surrounding sediments until fully excavated to avoid risk of breakage, risk of damaging surrounding artifacts as yet unexposed, failure to record nearby associations, and failure to recognize which archaeological context it is associated with. Sediment removal by induction dredge or airlift should be controlled and discharged through a screen so that an archaeologist can inspect discharged materials.
  - m. Sampling in the form of artifact recovery should only be conducted if: 1) there is evidence that the sample will contain valuable information concerning the past; 2) there is sound reason and research questions to be answered; 3) there is a clear prospect the material will be studied; 4) there is adequate conservation planning and funding in place to stabilize and curate the artifacts.
  - n. Retention of Field Notes: field notes are primary records and the basis for verifying the accuracy of your drawings. They should be simple, neat, and broken down into appropriate levels of detail with annotations as necessary. State in the field notes and measured drawings the field methods and instruments used, and the accuracy of their results. Identify an appropriate repository or archive for generated field notes.
- II. Specific to Wooden Shipwrecks:
- The guidelines in section II were designed for wooden sailing vessels, and will not necessarily be applicable to steel ships, scattered submerged archaeological sites, submerged shoreline infrastructure, submerged aircraft, or other resources.
- a. Method of recording should be controlled and consistent
  - b. Should be planned so that records are compatible with research and reconstruction techniques, and excavation data can be theoretically reevaluated, even after a site has been abandoned, reburied, or removed. Each site has its own combination of features that affect recording, and no two sites are quite the same, which means a single “best” system of hull documentation cannot be recommended. Recording conventions such as those noted below, however, apply across documentation systems.
  - c. Recording conventions
    - i. Widest part of ship, if distinguishable, is designated midship frame
    - ii. Frames forward of this point are lettered consecutively, those aft numbered
    - iii. Structural elements are given a prefix before the number, such as F12 for the 12<sup>th</sup> frame aft of the midship frame; and, typically a capital letter in order of excavation if there are multiple pieces, such as KB for the second keel section

- iv. For unknown fragments, the master prefix is UM (unidentified member), followed by the grid letter and number, and the number of the sequence it was excavated.
  - v. No matter how sparse or complex the wreck, consider the following:
    - 1. Keep the system as simple as possible to serve the demands of the conservation, research, and reconstruction processes that follow.
    - 2. Design the system to serve ship reconstruction and ship terminology; segregate hull members from general tagging systems applied to other forms of artifacts.
    - 3. Avoid confusion; for instance, use “N” for knee, because a keel is more commonly designated with a “K”.
  - vi. If bow and stern are indistinguishable, or midship frame cannot be identified, develop a system of labeling the timbers in the field so that members can be identified after disassembly or during lab work. For example, affixing durable tags that indicate direction of bow/stern, designation of port/starboard, or otherwise sequentially labeling the timbers from one end of the wreck to another to avoid confusion.
- d. Recommended contents of a hull catalog for final reports, to be considered during hull documentation efforts:
- i. Pertinent background information, such as age and hull type if known
  - ii. Pertinent excavation information
  - iii. Relevant cargo and artifact information, including distribution over site
  - iv. Photomosaics, general site photography, site plans, wreck drawings
  - v. Hull lines
  - vi. Drawings, photographs, and verbal descriptions
  - vii. Results of laboratory analyses
  - viii. Account of the disposition of the timbers
  - ix. Pertinent conservation information
  - x. Post conservation recording
  - xi. Reassembly recording
- e. Recommended minimum timber documentation: length of survival; general statement of condition; individual recording to include following categories: 1. Drawings; 2. Photos; 3. Maximum length remaining; 4. Description; 5. Sided (upper surface); 6. Molded; 7. Fastenings; 8. Frame impressions; 9. Rabbits or bevels; 10 Curvatures; 11. Tool marks; 12. Surface coverings; 13. Other features; 14. Wood identification; 15. Wood characteristics; 16. Comments.
- f. Plans and Drawings:
- i. Drawings are the most vital part of the catalog; without them, ships cannot be reconstructed. **Wreck plans** illustrate the distribution of hull timbers and related artifacts. Unlike photographic records, they can be produced in a precise scale, so that measurements may be taken directly from them.
  - ii. They should reveal framing plans, planking seams, visible scarfs and butts, scattered fragments, and other structural information. If the hull is to be

- dismantled, separate drawings of interior and exterior construction should be produced. These can be produced from stereo-photogrammetric recording.
- iii. No matter how many wreck plans are produced, they should be made to the same scale; 1:10 is usually a convenient wreck plan scale, although 1:20 may be more practical for large vessels. Whatever scale is chosen, it must be large enough for accuracy, small enough for convenience, and consistent for all phases of the work. Like all catalog and reconstruction drawings, wreck plans should include site name, plan number, subject, recorder, draughtsperson, date, scale, position, orientation
  - iv. **Timber and fragment drawings** provide visible details on hull features typically not shown on wreck plans, which can only supply general information about the hull's construction. Drawings also provide details not readily evident from photographs, such as fastener holes, tool marks, and position of sapwood, which often can only be observed during close inspection and recording.

### *Field Conservation*

- I. As archaeology and conservation can both be destructive processes, data should be preserved in field and laboratory records prior to recovery, after recovery, during conservation, and after conservation to ensure maximum retention of data.
- II. Basic conservation principles include:
  - a. Respect for the integrity of the artifact under treatment.
  - b. Ensure competent facilities and qualified professionals are available.
  - c. Keep all materials collected from a submerged environment stored wet until they can be transported to a conservation facility for treatment.
  - d. All archaeological materials should be treated with the same standard with regard to data recovery and suitable stabilization treatments.
  - e. Treatment should be appropriate for the material at hand and to ensure long-term preservation and maximum data recovery.
  - f. All treatments should be theoretically reversible.
  - g. There should be limits on aesthetic reintegration to preserve archaeological integrity. Reconstructed elements should be distinguishable from original material.
  - h. Qualified auxiliary personnel should be secured prior to an undertaking.
- III. Basic conservation precepts for field archaeologist:
  - a. Materials are likely to have survived if they have reached physical and chemical equilibrium with their immediate environment.
  - b. Removal is likely to speed up process of corrosion and decay due to environmental exposure
  - c. Treatment is based on material and condition of object, research objectives, and advantages and disadvantages of various treatment methods available
  - d. First aid for artifacts is crucial upon recovery
  - e. Conservation advice should be sought early

- f. Plan ahead and take into account approaches to lifting, storage prior to treatment, and full conservation measures
  - g. Do not remove any corrosion layers in the field as these often contain valuable archaeological data
- IV. Conservation considerations prior to excavation:
- a. Anticipate the scale of the project
    - i. Determine early on whether the objective is basic data collection for identification or general site survey, or major excavation for full study and analysis. This will in turn guide the research design, budget, and conservation efforts.
    - ii. Understand the burial environment and expected effects on artifacts contained therein.
    - iii. Determine necessary expertise, facilities, field conservator qualifications, and long-term planning for artifacts
  - b. Funding
    - i. Short term, to include field laboratory, supplies, staff, and transportation
    - ii. Long term, to include conservation laboratory, dedicated staff, supplies and equipment, storage facilities, curation, study and exhibit
  - c. Awareness of material degradation
    - i. Understand material types: organic, metal, stone, ceramic, glass, bone, textile
    - ii. Identify agents of deterioration, both physical and chemical
    - iii. Study environment to understand soil types, salinity, depth, alkalinity, oxygen, light, temperature, marine organisms, soluble salts, and concretions, among others
  - d. Field conservator duties
    - i. Visit site in preparation for fieldwork planning
    - ii. Assist with logistical planning and budgeting
    - iii. Assist with excavation and train field personnel where necessary
    - iv. Ensure first-aid procedures are given to recovered objects
    - v. Assist with packing, documentation, and transportation of sensitive materials
  - e. Field supplies: ensure necessary equipment is available, including storage containers, tools and brushes, calipers/rules, personal protective equipment, labeling materials, documentation materials, packing materials, refrigeration, workspace, and a water source.
  - f. Arrange permanent conservation facility with the necessary ventilation, floor drain, sink, access, climate control, electrical, deionized water, chemical storage, work-space, and personnel.
- V. First aid conservation should account for:
- a. Controlling the post-excavation environment
  - b. Labeling
  - c. Effects of relative humidity
  - d. Keeping all objects:
    - i. Waterlogged

- ii. Chilled
- iii. Out of the light
- iv. Separated according to material type
- v. In inert containers
- e. Maintaining field notes and records
- f. Storage and package for transportation

### ***Analysis/Interpretation and Reporting***

- I. Analytical techniques should be selected that are relevant to the objectives of the investigation
- II. Appropriate forms of analysis, depending on the type of data recovered and research objectives, include but are not limited to: studying artifact types and distribution; radiometric and other means of age determination; dendrochronology; wood identification; studies of soil stratigraphy; studies of organic matter such as human remains, pollen, animal bones, shells and seeds; study of the composition of the soils and study of the natural environment in which the site appears. As technologies and analytical methods are improved, such improvements should be incorporated into current studies and modes of analysis.
- III. Conservation is an integral component of underwater archaeological excavation and documentation, much of which continues in the laboratory while cleaning, removing encrustations, and revealing surface features not visible during initial documentation or recovery efforts. Thorough documentation during the conservation treatment is vital.
- IV. Final reports should include:
  - a. Results of desk-based research, including a site history and a contextual history relating the site to the general history and maritime landscape (as applicable) of the region
  - b. A master site map and feature maps of any recovered artifacts showing their positions within the site
  - c. Interpreted survey data and associated maps
  - d. Photographs of significant site features and significant artifacts both in situ and after removal (as permitted by visibility and other environmental conditions)
  - e. Geographical and environmental information on the site's location
  - f. If applicable, a section that includes an inventory of recovered artifacts, description of conserved artifacts, laboratory conservation records, documentation of analyses undertaken, photographs of recovered artifacts before and after conservation treatment, and recommended curation conditions
  - g. Relationships between artifacts and the site
  - h. Drawings of both artifacts and site
  - i. Hull catalog (as applicable)
  - j. A written section describing the site's discovery, environment, past and current archaeological fieldwork, results, and analysis

- k. A summary of the survey and/or excavation process including methods and techniques employed, an account of operational phases, copies of applicable logs, as well as thorough analysis of the recovered data
  - l. An evaluation of the completed permitted activity that includes an assessment of the project's degree of success compared to the goals specified in the research design
  - m. Recommendations for future activities and site management, if applicable
  - n. Recommendations on continued studies.
  - o. An account of how public interpretation or dissemination plan described in the research design has been or is being carried out. Additionally, identification of any sensitive information such as specific location data and information about the cargo of a sunken or terrestrial military craft, the existence of armaments, munitions and other hazardous materials, or the presence of, or potential presence of, human remains.
  - p. Citations for all sources used
  - q. Copies of any required permits
- V. Publications & Outreach Considerations
- a. Prior to fieldwork, determine scholarly journals in which to publish and and popular media with which to engage, if applicable
  - b. Consider sensitivity of information and appropriateness of publication; for example, if naval vessel or aircraft contains human remains or confidential data or location. Section 304 of the NHPA and Section 9 of ARPA provide for the withholding from general release of certain kinds of information about historic properties and archaeological sites. The ACHP has guidance about the use of Section 304 and how it relates to ARPA at: <https://www.achp.gov/digital-library-section-106-landing/frequently-asked-questions-protecting-sensitive-information>.
  - c. Incorporate timeline for publications into project deadlines that will be adhered to.
  - d. Where appropriate, identify relevant public affairs personnel, whether public or private, and coordinate with regard to the release of sensitive data

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