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National Marine Fisheries Service
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August 28, 2017

Project Instructions

Date Submitted: August 28, 2017

Platform: NOAA Ship *Bell M. Shimada*

Project Number: SH-17-08

Project Title: Pacific Northwest Harmful Algal Bloom Survey

Project Dates: September 18, 2017 to September 29, 2017

Prepared by: ADAMS.NICOLAUS.G.1365883846 Digitally signed by ADAMS.NICOLAUS.G.1365883846 Date: 2017.08.29 10:11:56 -07'00' Dated: _____
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Chief Scientist
Marine Biotoxin Team-Northwest Fisheries Science Center

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Acting EFS Division Director
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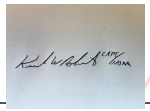
Approved by:  Digitally signed by ROBERTS.KEITH.W.1042165537 Date: 2017.09.15 07:45:28 -07'00' Dated: _____
Captain Keith W. Roberts, NOAA
Commanding Officer
Marine Operations Center – Pacific

I. Overview

A. Brief Summary and Project Period: The 2017 Pacific Northwest Harmful Algal Bloom survey (PNW HAB survey) will primarily collect data to aid in understanding the oceanographic conditions that promote and transport toxic blooms of the domoic acid (DA)-producing diatom *Pseudo-nitzschia* to coastal areas where shellfish and baitfish can accumulate the toxin and act as vectors for toxin transfer up the food web. Analyses for other harmful algal species will also be conducted (e.g *Alexandrium, Dinophysis* and *Azadinium* spp.). Additionally, two to three surface drifting buoys will be deployed as well as up to six subsurface moorings. The survey period is 18-29 September 2017.

B. Days at Sea (DAS)

Of the **_12_** DAS scheduled for this project, _12_ DAS are funded by an OMAO allocation, _0_ DAS are funded by a Line Office Allocation, _0_ DAS are Program Funded, and _0_ DAS are Other Agency funded. This project is estimated to exhibit a High Operational Tempo.

C. Operating Area: The PNW HAB survey will operate in Puget Sound and the Strait of Juan de Fuca, as well as the waters off of Vancouver Island, Canada, Washington State, and Oregon. Our offshore station grid is bounded by the following coordinates: 44° 00.00' N, 48° 50.00' N, 124° 0.00' W, 127° 0.00' W. Maps of the operation areas and stations coordinates are shown in Appendices A (station maps) and B (station coordinates).

D. Summary of Objectives: The primary goal of the survey is to collect and analyze water samples for the presence of harmful algal species and their toxins in Pacific Northwest waters. In addition we will collect associated oceanographic data (physical, biological, and chemical) to relate to the presence of harmful algal species as well as to support the development of predictive models for harmful algal blooms. Specific objectives include:

- perform a CTD survey and collect discrete water samples in the Strait of Juan de Fuca and Puget Sound for marine toxin, nutrient, dissolved oxygen, dissolved inorganic carbon, and phytoplankton assemblage analyses
- deploy drifting buoys at 2 locations (station LAB06, in the Juan de Fuca eddy and station HH05 on Heceta Bank)
- Deploy a subsurface Noise Reference Station (NRS) mooring
- Deploy up to five subsurface acoustic recording moorings for the NWFSC Marine Mammal team
- perform CTD casts and collect discrete water samples at survey grid stations for marine toxin, nutrient, dissolved oxygen, dissolved inorganic carbon, and phytoplankton assemblage analyses
- if high concentration of *Pseudo-nitzschia* are observed an additional drifting buoy will be deployed to track that watermass
- continuously sample sea-surface temperature, salinity, and fluorescence using the ship's thermosalinograph and fluorometer.

- continuously sample air temperature, barometric pressure, and wind speed and direction using the ship's integrated weather station.
- continuously log data from the ship's ADCP
- perform on-board analyses of particulate domoic acid, chlorophyll, dissolved macronutrients, dissolved oxygen, and phytoplankton assemblage.
- perform on-board processing and plotting of CTD data as well as data generated from onboard analyses.
- collect samples from the scientific seawater supply when the vessel is in the vicinity of a PMEL wave glider

E. Participating Institutions

NOAA-Northwest Fisheries Science Center
University of Washington-Olympic Natural Resource Center
University of Washington-School of Oceanography
Grays Harbor College
San Francisco State University
NOAA Teacher-at-Sea program
Quileute Tribe
UW-Applied Physics Laboratory
NOAA-Pacific Marine Environmental Laboratory

F. Personnel/Science Party: name, title, gender, affiliation, and nationality

Name (Last, First)	Title	Date Aboard	Date Disembark	Gender	Affiliation	Nationality
Adams, Nicolaus	Chief Scientist	9/17/17	9/30/17	M	NWFSC	USA
Bill, Brian	Oceanographer	9/17/17	9/30/17	M	NWFSC	USA
Cox, Daniel	Scientist	9/17/17	9/30/17	M	SFSU	USA
Ikeda, Chris	Oceanographer	9/17/17	9/30/17	M	SFSU	USA
Scamman, Lynne	Research Associate	9/17/17	9/30/17	F	Grays Harbor College	USA
Loizeaux, Martha	Teacher at Sea	9/17/17	9/29/17	F	Ocean Studies Charter School	USA
Gallagher, Michael	Oceanographer	9/17/17	9/30/17	M	NOAA S/T	USA
Odell, Anthony	Oceanographer	9/17/17	9/30/17	M	UW/ONRC	USA
Hagen, Jennifer	Scientist	9/17/17	9/30/17	F	Quileute tribe	USA
Barry, Tracie	Research Associate	9/17/17	9/30/17	F	UW-Tacoma	USA
Claassen, Lindsey	Scientist	9/17/17	9/30/17	F	WA Sea Grant	USA
Cosca, Cathy	Oceanographer	9/17/17	9/30/17	F	PMEL	USA
Lebrec, Marine	Oceanographer	9/17/17	9/30/17	F	UW-APL	USA

G. Administrative

1. Points of Contacts:

Primary Point of Contact (POC)

Nick Adams, 206-860-6787 or 206-356-3734 (cell)
Northwest Fisheries Science Center
Marine Biotoxin Program
2725 Montlake Blvd. E.
Seattle, WA 98112

Alternative land based POC

Vera Trainer, 206-860-6788
Northwest Fisheries Science Center
Marine Biotoxin Program
2725 Montlake Blvd. E.
Seattle, WA 98112

2. Diplomatic Clearances

This project involves Marine Scientific Research in waters under the jurisdiction of CANADA. Diplomatic clearance has been requested.

3. Licenses and Permits

This project will be conducted under the Scientific Research Permit (U.S.) issued by:

a. The Olympic Coast National Marine Sanctuary #OCNMS-2010-006-A1 to Nicolaus Adams (expiration December 29, 2019)
b. The Olympic Coast National Marine Sanctuary #XXXXXXX to Brad Hanson (expiration……)—Permit is under review at OCNMS

II. Operations

The Chief Scientist is responsible for ensuring the scientific staff are trained in planned operations and are knowledgeable of project objectives and priorities. The Commanding Officer is responsible for ensuring all operations conform to the ship's accepted practices and procedures.

A. Project Itinerary

The 2017 Pacific Northwest Harmful Algal Bloom survey will be conducted from September 18, 2017 through September 29, 2017, aboard NOAA Ship *Bell M. Shimada*. The survey will provide essential data on the distribution of harmful algal species and their toxins.

The project will start in Seattle, WA. After departing Seattle, we will conduct a CTD transect through Puget Sound and the Strait of Juan de Fuca (Fig. 1, Table 1). After completion of station PRISM120, we will transit to the WJDF mooring location and deploy a subsurface acoustic recording mooring.

We will then transit to station LBC01 and begin sampling the survey grid (Fig. 2, Table 2) in a systematic fashion from North to South. As time allows, selected transect lines may be re-sampled.

Drifting buoys will be deployed at two pre-defined locations (Fig. 3, Table 3) and another drifter may be deployed if high concentrations of *Pseudo-nitzschia* cells are observed.

At times during the survey, we will break off to deploy moorings (Fig3, Table 4). It is preferable to finish a survey line prior to breaking to deploy moorings. If it is necessary to break from a survey line to deploy a mooring, we will return and re-sample the last sampled station on that line and continue to complete the line.

At the end of the project the ship will transit to Newport, OR.

B. Staging and De-staging

We would like to conduct staging operations in Seattle, WA on 9/15/17 to load "hand-carry" items onto the ship and begin setting up equipment in the lab spaces. On 9/17/17, we will need assistance with the ship's crane to load some of the heavier/bulky items (e.g. mooring equipment). Some personnel may come to the ship on 9/16/17 and 9/17/17 to complete any outstanding equipment setup. We also request permission for individuals to stay on board the vessel the night of 9/17/17.

De-staging will be in Newport, OR on 9/29/17 (depending on arrival time) and/or 9/30/17. We request that scientific personnel be allowed to stay on board the vessel the nigh of 9/29/17. We will be driving from Newport to Seattle with our gear on 9/30/17.

C. Operations to be conducted:

We will conduct 24 hour operations with a highly adaptive sampling plan that is organized around a grid of stations (Figure 2). The primary objectives of this cruise are to: (1) perform a CTD survey of the Strait of Juan de Fuca and Puget Sound for marine toxin, nutrient, dissolved oxygen, dissolved inorganic carbon, and phytoplankton assemblage analyses, (2) deploy two surface drifting buoys at pre-defined locations, and (3) perform CTD casts and collect discrete water samples at survey grid stations for marine toxin, nutrient, dissolved oxygen, dissolved inorganic carbon, and phytoplankton assemblage analyses.

The nature of this work may require spur-of-the-moment changes to the cruise plan depending on the presence or absence of *Pseudo-nitzschia* cells in particular areas. For

example, if while sampling the survey grid high numbers of *Pseudo-nitzschia* are observed, a drifting buoy will be deployed. All changes to the cruise plan will be made in consultation with the Operations Officer and the Commanding Officer so that the changes will not (1) jeopardize the safety of personnel or the ship; (2) exceed the time allotted for the cruise; (3) result in undue additional expense; or (4) change the general intent of the project.

Discharges from holding tanks must be secured 20 minutes before arriving on station to avoid contaminating surface water samples. The bridge must inform the Ship's engineers in advance when discharges are to be secured.

A noise reference station mooring will be recovered and re-deployed and up to five moorings with acoustic recording devices will be performed. Net reels should be empty and available for use in the mooring operations.

Survey Lines NM and GR are designed to pass by existing moored arrays (UW-APL Cha'Ba/NEMO and NSF/IOOS, respectively) at a safe distance. Coordinates of these moorings will be provided to the ship and survey stations may be adjusted as necessary.

On-Station Operations

CTD profiles

CTD profiles will be conducted at all transect stations through Puget Sound/Strait of Juan de Fuca, at drifting buoy and mooring deployments, and at survey grid stations. CTD casts will be made to a depth of 500 meters or to 10 meters above the bottom when the water depth is less than 500 meters. The CTD will be lowered at a speed of 30 meters/minute for the first 100 meters and then at 50 meters/minute for the remainder of the cast. The CTD will be raised at 50 meters/minute unless otherwise specified by the chief scientist or a designated watch stander. The time, depth, and position of the CTD are to be recorded by bridge watch personnel when the package enters and leaves the water. GPS positions at the highest accuracy available will be recorded by the SCS. Positions at the beginning and end of all operations and as required elsewhere in these instructions are to be recorded. The Science party will provide a Satlantic ISUS nitrate sensor/battery pack that will be integrated with the CTD system prior to sailing. Assistance from the Survey department with installation of these instruments will be required.

At stations NH85 and NH125 we request that the CTD be lowered to 10 m above the bottom using the winch speeds noted above. These will be deep CTD casts to ~2800-3000m depending on water depth.

The CTD rosette should be outfitted with a full complement of 10L Niskin bottles. Discrete water samples (subject to change) will be collected at 0, 5, 10, 15, chl-max, 30, 50, 100, 150, 200, 300 and 500 meters depending on water depth (chl-max=chlorophyll maximum). At stations where the depth is less than 1000 m, as

many of these depths as possible will be collected in addition to a sample 10 meters from the bottom.

Hand deployed phytoplankton net

At each CTD station a surface plankton net sample will be collected. After obtaining permission from the bridge, the net (20cm diameter, 2 meters long) will be deployed over the side of the vessel and pulled through the water by hand for ~0.5 minutes or until color is seen in the net. Typically, this operation is conducted while the CTD is in the water so that the net sample can be analyzed prior to collecting samples from Niskin bottles after the CTD package is back on deck.

Water sampling from Niskin bottles

The usual order for drawing seawater samples on deck will be: dissolved oxygen, dissolved inorganic carbon, nutrients, domoic acid (pDA and dDA), chlorophyll, phytoplankton enumeration, DNA, and salinity. Water collection from the Niskin bottles will be done by scientific personnel. Samples will be collected for salinity from selected bottles at selected stations.

Samples will be collected for nutrients, phytoplankton enumeration, pDA, dDA, and chlorophyll from bottles fired between the surface and 30 meters at all stations on lines LAB, KB, GR, and NH. At all other stations, these samples will be collected only from the surface bottle and, if present, at the chlorophyll maximum unless high concentrations of *Pseudo-nitzschia* are observed in the net tow sample. DNA samples will be collected from surface bottles only. If high concentrations of *Pseudo-nitzschia* are observed in the net tow at other stations, bottles will be fired between the surface and 30 meters (0, 5, 10, 15, chl-max, and 30 meters).

Drifting buoy deployments

Positions for drifting buoy deployments are noted in Appendix 2 (Stations LAB06 and HH05). At each deployment location we will perform a CTD cast. At drifter CTD stations, seawater will be collected at 0, 5, 10, 15, 30 meters and chl-max. Samples will be collected for nutrients, phytoplankton enumeration, pDA, dDA, and chlorophyll at all depths. Drifters will be deployed by tossing them over the stern of the vessel while the vessel makes ~1 knot (i.e. just enough headway that the drifter and the vessel can gain some distance from each other but not so fast that the force of the impact of the drifter hitting the water causes it to break apart).

Sampling near PMEL Wave Glider location

Access to the application that tracks PMEL's wave glider will be provided to the ship. When the ship is in the vicinity of the wave glider, samples will be collected from the scientific seawater supply for DIC, Total Alkalinity, Dissolved oxygen and nutrients. Temperature and salinity will be recorded.

Underway operations

Thermosalinograph and meteorological sensors: TSG and SCS data will be recorded continuously during the survey. These data will be logged to the ship's computers, and copied to media hard disk drive (HDD) that we provide. The ship's station and position information (MOA log) will also be copied to this HDD. During the pre-project meeting, we will specify what to include in the MOA and how the bridge and survey departments wish to number stations and transects. An ISUS nitrate sensor with flow through capability will be integrated with the flow-through system but the science party will supply a laptop computer for stand-alone data acquisition. Water samples will be collected from the flow-through seawater system during transits between survey lines and for calibration of the ISUS nitrate sensor and fluorometer.

Onboard analyses

During the survey we will be conducting on board analyses of particulate domoic acid, ammonia, dissolved oxygen, and chlorophyll-a. Additionally we will be determining phytoplankton community composition using light microscopy.

Mooring Deployments

Acoustic recorder mooring deployments

Moorings consisting of a subsurface float cabled to the acoustic recorder, acoustic release, and a chain anchor will be deployed off the aft deck at five sites off the Washington Coast (Fig. 3).

This task will require that two of the bottom-anchored moorings be deployed within OCNMS waters. Brad Hanson of the NWFSC Marine Mammal Team will secure the necessary permits for mooring deployments in the OCNMS and these permits will be provided to the ship. If the OCNMS permit is not available at the scheduled time of deployment, the moorings located in the OCNMS will not be deployed. The same sites and recoverable anchor system that have been used since 2005 in the OCMNS will continue to be used. All moorings will utilize an acoustic release, allowing the recorder, release cable and floats to be recovered at a later date.

For each mooring there will be a tote labeled with the specific location with the lines, shackles, etc. and a mooring diagram. Each mooring sans anchor will fit in a standard fish tote. The anchor is about 700lb, lines, etc. about 50 lb, release about 50lb, recorder about 50lb, and float(s) about 50lb, approximately 900lb total for each mooring. Each recorder is labeled for a specific location. The acoustic releases are interchangeable between mooring locations. Anchors are usually tagged for the mooring location as is the float(s). Following assembly all shackles should be wired down. For each assembled mooring the recorder number needs to be recorded as well as the serial number of the acoustic release and its release code, as well as the enable and disable codes. The line should be flaked out on the deck to allow for the

line to feed smoothly off the aft deck once the deployment is begun. With the anchor attached to a quick release from the A frame, the ship should line up on an into-the-swell course that allows for the entire mooring to be completely fed out float first so that when the ship goes over the mooring location the quick release can be tripped to drop the anchor. The date, time, and depth in which the mooring was deployed should be recorded.

Noise Reference Station mooring recovery and re-deployment

Michael Gallagher of NOAA-S&T will be aboard to conduct the recovery and re-deployment of the Noise Reference Station Mooring. A detailed description of the procedure for recovery and deployment of this mooring can be found in Appendix 3. Briefly, for existing mooring recovery the ship will maneuver to a location approximately ½ km from the mooring location. The acoustic release will be triggered and the mooring will surface almost directly over the surveyed anchor point, but will begin to drift upon reaching the surface. The float will be brought aboard first, followed by the rest of the mooring following the instructions in Appendix 3. Once the mooring is aboard and secured, a new mooring will be deployed. The anchor for the new mooring will weigh ~2500 lbs and two boxes of mooring hardware will have a combined weight of ~1600 lbs.

D. Dive Plan

Dives are not planned for this project.

E. Applicable Restrictions

Conditions which preclude normal operations: If sea conditions and vessel ride deteriorate to a point where it is impossible to safely perform CTD casts, the vessel may need to break from running HAB survey transects and seek shelter until conditions improve enough for satisfactory sample and data collection.

III. Equipment (Hazardous materials are not to be listed here. They should be included in Hazardous Materials Section.)

A. Equipment and Capabilities provided by the ship (itemized)

#	Item Name
1	CTD (main unit plus spare), rosette, carousel, water sampling bottles, computer/deck unit, hydrographic winch
2	Seabird 9/11 CTD system with operational/calibrated altimeter, duplicate temperature, conductivity and oxygen sensors (SBE-43) and Wetlabs

#	Item Name
	fluorometer, and rosette with 12 - 10 Liter Niskin bottles.
3	ADCP computer/deck unit
4	Underway sensors (SCS) and computer/deck unit
5	Ship's computer network
6	Centerboard-mounted transducers
7	Spaces needed: Fish Processing Lab, Chem Lab, Dry Lab, Hydro Lab, Constant Environment Room, and Preservation Alcove
8	Email, telephones, intercom system, handheld radios
9	VHF Radios with NOAA F-Channels
10	Refrigerator as well as -20 °C and -80 °C freezer space for sample storage
11	SCS display in the Dry Lab, Chem Lab and Wet Lab
12	Access to continuous flow scientific seawater supply for underway sampling
13	Use of net reel and A-frame for mooring deployments

B. Equipment and Capabilities provided by the scientists (itemized)

#	Category	Brand & Quantity
1	Computers	• 4 laptops (various)
2	External hard drives	• 1-TB Seagate Expansion drive
3	Electronics	• Satlantic ISUS Nitrate sensor/battery pack (dimensions: Sensor-23"x4.5", Battery-33"x4.5") for integration with CTD system • Satlantic ISUS Nitrate sensor/power supply and Turner 10-AU fluorometer for integration with flow-thru scientific seawater system

#	Category	Brand & Quantity
4	Laboratory equipment	• Oven for laboratory incubations – 14” x 14” x 24 “, 20 lbs • 10-AU Fluorometer for chlorophyll - 24" x 12" x 12"; 40 lbs • Trilogy Fluorometer for ammonium - 12" x 12" x 10"; 10 lbs • Versamax Plate Reader for nutrients and DA ELISA - 24" x 18" x 12"; 35 lbs • Zeiss Upright microscope for phytoplankton ID - 8" x 18" x 18"; 25 lbs • Inverted microscope in for phyto ID and isolations - 8" x 20" x 18"; 25 lbs • one small Percival incubator (32" x 32" x 24"; 150 lbs) • Vacuum pumps (2) • Filtration manifolds (3) • Filters: 0.45 µm-47mm (1500), 3.0 µm-47mm (600), GF/F-25mm (600) • Various containers for sample collection: 1.5 mL tubes (600), 2.0 mL tubes (600), 15 mL tubes (1200), 20 mL scintillation vials (1500), 50 ml tubes (1200)
5	Drifting buoys	• 3 - Davis-type drifters, 1 meter tall x 8 cm diameter, 25 lbs each
6	Mooring hardware	• 5 fish totes plus chain anchors for acoustic recorder moorings (900 lbs each) • Anchor for NRS mooring (~2500 lbs) • Hardware for NRS mooring (2 boxes, ~1600 lbs)

#	Category	Brand & Quantity
7	Dissolved Oxygen Analyses	• Laboratory supplies (pipettes, tips, squirt bottles) • Dosimat • stir bars, magnet • DI squirt bottle • DI water/carboy • waste beaker • cups for reagents • empty H2SO4 bottle • tupperware • Kim wipes • diapers/absorbant pads • dosimat • stirrer and stand (book) • lamp • light bulbs • clipboard • bag for stopper bags • waste bucket • sampling tubes • deck box • 0.5L reagant bottles, empty • re-pipettors/bottle-top dispensers • DO bottles • extra beakers • bag of extras (stir bars, cups, sample tube, etc)

#	Category	Brand & Quantity
8	Dissolved Inorganic Carbon Sampling	• 24 cases of 20 bottles, 24" x 20" x 12" high (25 lbs each) • pipette • pipette tips • sampling tube • bucket • collars • rubber bands • electrical tape • duct tape • red lab tape • painters tape/masking tape • channelock pliers • zip ties • paint pen • grease • grease syringes • beakers • tupperware • spill kit • waste bags • gloves (M, L) • goggles

#	Category	Brand & Quantity
9	APL/PMEL Chlorophyll analysis	• sample bottles (12 each: 125mL, 250mL) • GF/F filters (25mm and 47mm) • plastic chla tubes • Styrofoam tube holders • forceps • FSW squeeze bottle • DI squeeze bottle • repipettor/bottletop dispenser • extra repipettor/bottletop dispenser • 90% acetone bottle • volumetric cylinder • graduated cylinder • spare graduated cylinder • foil • filtration rack • resevior/carboy • tubes • filters • pump • extra pump • stand alone filter • SW carboy • FWS carboy • tupperware • Kim wipes • diapers/absorbant pads • parafilm • funnels
10	APL/PMEL Nutrient sampling	• sample bottles • syringes • filters • extra flat

IV. Hazardous Materials

A. Policy and Compliance

The Chief Scientist is responsible for complying with FEC 07 Hazardous Materials and Hazardous Waste Management Requirements for Visiting Scientific Parties (or the OMAO procedure that supersedes it). By Federal regulations and NOAA Marine and Aviation Operations policy, the ship may not sail without a complete inventory of all hazardous materials by name and quantity, MSDS, appropriate spill cleanup materials (neutralizing agents, buffers, or absorbents) in amounts adequate to address spills of a size equal to the amount of chemical brought aboard, and chemical safety and spill response procedures. Documentation regarding those requirements will be provided by the Chief of Operations, Marine Operations Center, upon request.

Per OMAO procedure, the scientific party will include with their project instructions and provide to the CO of the respective ship 30 days before departure:

- List of chemicals by name with anticipated quantity
- List of spill response materials, including neutralizing agents, buffers, and absorbents
- Chemical safety and spill response procedures, such as excerpts of the program's Chemical Hygiene Plan or SOPs relevant for shipboard laboratories
- For bulk quantities of chemicals in excess of 50 gallons total or in containers larger than 10 gallons each, notify ship's Operations Officer regarding quantity, packaging and chemical to verify safe stowage is available as soon as chemical quantities are known.

Upon embarkation and prior to loading hazardous materials aboard the vessel, the scientific party will provide to the CO or their designee:

- An inventory list showing actual amount of hazardous material brought aboard
- An MSDS for each material
- Confirmation that neutralizing agents and spill equipment were brought aboard sufficient to contain and cleanup all of the hazardous material brought aboard by the program
- Confirmation that chemical safety and spill response procedures were brought aboard

Upon departure from the ship, scientific parties will provide the CO or their designee an inventory showing that all chemicals were removed from the vessel. The CO's designee will maintain a log to track scientific party hazardous materials. MSDS will be made available to the ship's complement, in compliance with Hazard Communication Laws.

Scientific parties are expected to manage and respond to spills of scientific hazardous materials. Overboard discharge of hazardous materials is not permitted aboard NOAA ships.

B. Inventory

Common Name of Material	**Qty**	**Notes**	**Trained Individual**	**Spill control**
Formaldehyde solution (20%)	3L	Alkalinity, Corrosive, Toxic	Brian Bill	F
Ethanol	100 mL	Flammable	Nick Adams	T

Common Name of Material	Qty	Notes	Trained Individual	Spill control
Oxalic Acid (3%)	250 mL	Irritant	Nick Adams	A
Acetone (90%): chlorophyll analysis	16 L	Flammable	Brian Bill	T
Hydrochloric acid (10%)	2 L	Corrosive, Toxic	Brian Bill	A
Mercuric Chloride, Saturated Solution: DIC samples	2 x 25ml	DIC sampling supplies	Cathy Cosca	M2
Apiezon M Grease (non-hazardous): DIC samples	1 x 25g	DIC sampling supplies	Cathy Cosca	G
Ammonia analysis working reagent: Ammonia analysis	4L	0.1 M Sodium Tetraborate, 15 mM Ortho-Phthaldialdehyde (OPA), 0.3 mM Sodium Sulfite, 5% Ethanol in water	Brian Bill	G
Manganese Choride tetrahydrate (3M): O2 analysis	2 L	Irritant, permeator	Marine Lebrec	G
Potassium iodate (0.01M): O2 analysis	2 L	Irritant	Marine Lebrec	O
Sodium hydroxide (8M): O2 analysis	2 L	Corrosive, irritant, permeator	Marine Lebrec	C
Sodium iodide (8M): O2 analysis	2 L	Irritant, permeator	Marine Lebrec	G
Sulfuric acid (10N, pH 4.4): O2 analysis	2 L	Corrosive, irritant, permeator	Marine Lebrec	A
Sodium Thiosulfate (0.01M): O2 analysis	2 L	Irritant	Marine Lebrec	G

(OR See attached Appendix #)

C. Chemical safety and spill response procedures

A: ACID

- Wear appropriate protective equipment and clothing during clean-up. Keep upwind. Keep out of low areas.
- Ventilate closed spaces before entering them.

- Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.
- Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.
- **Large Spills**: Dike far ahead of spill for later disposal. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal.
- **Small Spills**: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.
- Never return spills in original containers for re-use.
- Neutralize spill area and washings with soda ash or lime. Collect in a non-combustible container for prompt disposal.
- J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this product.

T: Acetone

- Flammable liquid.
- Keep away from heat.
- Keep away from sources of ignition.
- Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material.
- place in a chemical waste container

F: Formalin/Formaldehyde

- Ventilate area of leak or spill. Remove all sources of ignition.
- Wear appropriate personal protective equipment.
- Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible.
- Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container.
- Do not use combustible materials, such as saw dust.

C: Caustics:

- Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust.
- Residues from spills can be diluted with water, neutralized with dilute acetic acid.

O: Potassium iodate

- **Small spill**: Use appropriate ppp and tools to put the spilled solid in a convenient waste container
- **Large Spill**: Oxidizing material
- Stop leak if without risk
- Avoid contact with a combustible material (wood, paper, oil, clothing, etc.)
- Keep substance damp using water spray
- Do not touch spilled material.
- Prevent entry into sewers, basements, or confined areas; dike if needed

M2: Saturated Solution, Mercuric Chloride

- Wear appropriate ppp and use paper towel orother absorbent material to soak up spill.
- Place absorbent material in ziplock bag inside another ziplock.
- Label "spilled Mercuric Chloride Solution".
- Place with other supplies returning to PMEL and hand off to PMEL Chemical Hygiene Officer.

G: General Spill

- Wear appropriate personal protective equipment.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- If dry, sweep up, if wet, soak up with absorbent material.
- Either one, containerize for reclamation or disposal.
- Vacuuming or wet sweeping may be used to avoid dust dispersal.
- Following product recovery, wipe or flush area with water.

X: Virtually Harmless

- Small Quantities of less than 5 gallons/pounds should be collected in a ziplock or bucket and marked as "used".

Inventory of Spill Kit supplies

Product Name	Amount	Chemicals it is useful against	Amount it can clean up
Polyform F	96 oz	Formalin	3L
Nitrile gloves, Absorbent material, Ziploc bags		Reagents for DIC/O2 analysis	Enough for quantities that are brought aboard

(OR See attached Appendix #

D. Radioactive Materials

No Radioactive Isotopes are planned for this project.

E. Inventory (itemized) of Radioactive Materials

V. Additional Projects

A. Supplementary ("Piggyback") Projects

1. Description: Swap-out of a "Noise Reference Station" mooring

See Appendix 3.

2. Description: Deploy subsurface acoustic recording moorings

See above description (section II-C).

B. NOAA Fleet Ancillary Projects

No NOAA Fleet Ancillary Projects are planned.

VI. Disposition of Data and Reports

Disposition of data gathered aboard NOAA ships will conform to NAO 216-101 *Ocean Data Acquisitions* and NAO 212-15 *Management of Environmental Data and Information.* To guide the implementation of these NAOs, NOAA's Environmental Data Management Committee (EDMC) provides the *NOAA Data Documentation Procedural Directive* (data documentation) and *NOAA Data Management Planning Procedural Directive* (preparation of Data Management Plans). OMAO is developing procedures and allocating resources to manage OMAO data and Programs are encouraged to do the same for their Project data.

A. Data Classifications: *Under Development*

a. OMAO Data

b. Program Data

B. Responsibilities: *Under Development*

VII. Meetings, Vessel Familiarization, and Project Evaluations

A. Pre-Project Meeting: The Chief Scientist and Commanding Officer will conduct a meeting of pertinent members of the scientific party and ship's crew to discuss required equipment, planned operations, concerns, and establish mitigation strategies for all concerns. This meeting shall be conducted before the beginning of the project with sufficient time to allow for preparation of the ship and project personnel. The ship's Operations Officer usually is delegated to assist the Chief Scientist in arranging this meeting.

B. Vessel Familiarization Meeting: The Commanding Officer is responsible for ensuring scientific personnel are familiarized with applicable sections of the standing orders and vessel protocols, e.g., meals, watches, etiquette, drills, etc. A vessel familiarization

meeting shall be conducted in the first 24 hours of the project's start and is normally presented by the ship's Operations Officer.

C. Post-Project Meeting: The Commanding Officer is responsible for conducted a meeting no earlier than 24 hrs before or 7 days after the completion of a project to discuss the overall success and short comings of the project. Concerns regarding safety, efficiency, and suggestions for future improvements shall be discussed and mitigations for future projects will be documented for future use. This meeting shall be attended by the ship's officers, applicable crew, the Chief Scientist, and members of the scientific party and is normally arranged by the Operations Officer and Chief Scientist.

D. Project Evaluation Report

Within seven days of the completion of the project, a Customer Satisfaction Survey is to be completed by the Chief Scientist. The form is available at https://sites.google.com/a/noaa.gov/omao-intranet-dev/operations/marine/customer-satisfaction-survey and provides a "Submit" button at the end of the form. It is also located at https://docs.google.com/a/noaa.gov/forms/d/1a5hCCkgIwaSII4DmrHPudAehQ9HqhRqY3J_FXqbJp9g/viewform. Submitted form data is deposited into a spreadsheet used by OMAO management to analyze the information. Though the complete form is not shared with the ships, specific concerns and praises are followed up on while not divulging the identity of the evaluator.

VIII. Miscellaneous

A. Meals and Berthing

The ship will provide meals for the scientists listed above. Meals will be served 3 times daily beginning one hour before scheduled departure, extending throughout the project, and ending two hours after the termination of the project. Since the watch schedule is split between day and night, the night watch may often miss daytime meals and will require adequate food and beverages (for example a variety of sandwich items, cheeses, fruit, milk, juices) during what are not typically meal hours. Special dietary requirements for scientific participants will be made available to the ship's command at least seven days prior to the project.

Berthing requirements, including number and gender of the scientific party, will be provided to the ship by the Chief Scientist. The Chief Scientist and Commanding Officer will work together on a detailed berthing plan to accommodate the gender mix of the scientific party taking into consideration the current make-up of the ship's complement. The Chief Scientist is responsible for ensuring the scientific berthing spaces are left in the condition in which they were received; for stripping bedding and linen return; and for the return of any room keys which were issued. The Chief Scientist is also responsible for the cleanliness of the laboratory spaces and the storage areas utilized by the scientific party, both during the project and at its conclusion prior to departing the ship.

All NOAA scientists will have proper travel orders when assigned to any NOAA ship. The Chief Scientist will ensure that all non NOAA or non Federal scientists aboard also have proper orders.

It is the responsibility of the Chief Scientist to ensure that the entire scientific party has a mechanism in place to provide lodging and food and to be reimbursed for these costs in the event that the ship becomes uninhabitable and/or the galley is closed during any part of the scheduled project.

All persons boarding NOAA vessels give implied consent to comply with all safety and security policies and regulations which are administered by the Commanding Officer. All spaces and equipment on the vessel are subject to inspection or search at any time. All personnel must comply with OMAO's Drug and Alcohol Policy dated May 17, 2000 which forbids the possession and/or use of illegal drugs and alcohol aboard NOAA Vessels.

B. Medical Forms and Emergency Contacts

The NOAA Health Services Questionnaire (NHSQ, NF 57-10-01 (3-14)) must be completed in advance by each participating scientist. The NHSQ can be obtained from the Chief Scientist or the NOAA website http://www.corporateservices.noaa.gov/noaaforms/eforms/nf57-10-01.pdf.

All NHSQs submitted after March 1, 2014 must be accompanied by NOAA Form (NF) 57-10-02 - Tuberculosis Screening Document in compliance with OMAO Policy 1008 (Tuberculosis Protection Program).

The completed forms should be sent to the Regional Director of Health Services at the applicable Marine Operations Center. The NHSQ and Tuberculosis Screening Document should reach the Health Services Office no later than 4 weeks prior to the start of the project to allow time for the participant to obtain and submit additional information should health services require it, before clearance to sail can be granted. Please contact MOC Health Services with any questions regarding eligibility or completion of either form. Ensure to fully complete each form and indicate the ship or ships the participant will be sailing on. The participant will receive an email notice when medically cleared to sail if a legible email address is provided on the NHSQ.

The participant can mail, fax, or email the forms to the contact information below. Participants should take precautions to protect their Personally Identifiable Information (PII) and medical information and ensure all correspondence adheres to DOC guidance (http://ocio.os.doc.gov/ITPolicyandPrograms/IT_Privacy/PROD01_008240).

The only secure email process approved by NOAA is Accellion Secure File Transfer which requires the sender to setup an account. Accellion's Web Users Guide is a valuable aid in using this service, however to reduce cost the DOC contract doesn't provide for automatically issuing full functioning accounts. To receive access to a "Send Tab", after your Accellion account has been established send an email from the associated email account to accellionAlerts@doc.gov requesting access to the "Send Tab" function. They will notify you via email usually within 1 business day of your approval. The 'Send Tab" function will be accessible for 30 days.

Contact information: Include only the Pacific OR Atlantic Office as applicable.

Regional Director of Health Services
Marine Operations Center – Atlantic

Regional Director of Health Services
Marine Operations Center – Pacific

439 W. York Street
Norfolk, VA 23510
Telephone 757-441-6320
Fax 757-441-3760
Email MOA.Health.Services@noaa.gov

2002 SE Marine Science Dr.
Newport, OR 97365
Telephone 541-867-8822
Fax 541-867-8856
Email MOP.Health-Services@noaa.gov

Prior to departure, the Chief Scientist must provide an electronic listing of emergency contacts to the Executive Officer for all members of the scientific party, with the following information: contact name, address, relationship to member, and telephone number.

C. Shipboard Safety

Hard hats are required when working with suspended loads. Work vests are required when working near open railings and during small boat launch and recovery operations. Hard hats and work vests will be provided by the ship when required.

Wearing open-toed footwear or shoes that do not completely enclose the foot (such as sandals or clogs) outside of private berthing areas is not permitted. At the discretion of the ship CO, safety shoes (i.e. steel or composite toe protection) may be required to participate in any work dealing with suspended loads, including CTD deployment and recovery. The ship does not provide safety-toed shoes/boots. The ship's Operations Officer should be consulted by the Chief Scientist to ensure members of the scientific party report aboard with the proper attire.

D. Communications

A progress report on operations prepared by the Chief Scientist may be relayed to the program office. Sometimes it is necessary for the Chief Scientist to communicate with another vessel, aircraft, or shore facility. Through various means of communications, the ship can usually accommodate the Chief Scientist. Special radio voice communications requirements should be listed in the project instructions. The ship's primary means of communication with the Marine Operations Center is via email and the Very Small Aperture Terminal (VSAT) link. Standard VSAT bandwidth at 128kbs is shared by all vessels staff and the science team at no charge. Increased bandwidth in 30 day increments is available on the VSAT systems at increased cost to the scientific party. If increased bandwidth is being considered, program accounting is required and it must be arranged through the ship's Commanding Officer at least 30 days in advance.

E. IT Security

Any computer that will be hooked into the ship's network must comply with the *OMAO Fleet IT Security Policy* 1.1 (November 4, 2005) prior to establishing a direct connection to the NOAA WAN. Requirements include, but are not limited to:

(1) Installation of the latest virus definition (.DAT) file on all systems and performance of a virus scan on each system.
(2) Installation of the latest critical operating system security patches.
(3) No external public Internet Service Provider (ISP) connections.

Completion of the above requirements prior to boarding the ship is required.

Non-NOAA personnel using the ship's computers or connecting their own computers to the ship's network must complete NOAA's IT Security Awareness Course within 3 days of embarking.

F. Foreign National Guests Access to OMAO Facilities and Platforms

Foreign National access to the NOAA ship or Federal Facilities is not required for this project.

VIII. Appendices (all that apply)

Appendix 1. Figures, maps, tables, images, etc.

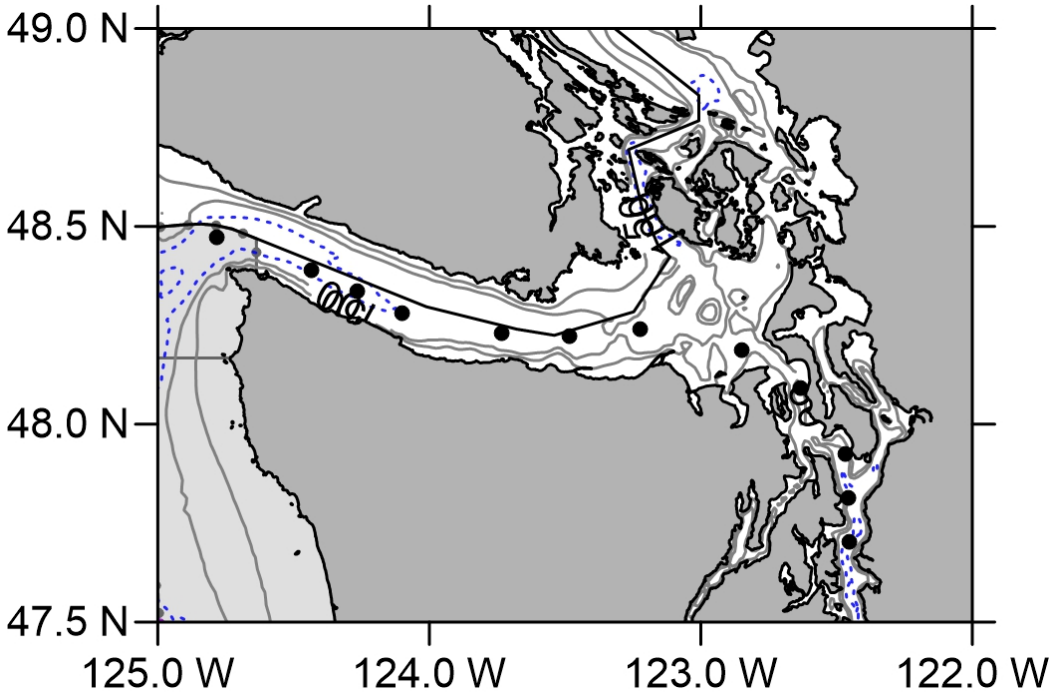


Figure 1. Puget Sound and Strait of Juan de Fuca stations (black circles)

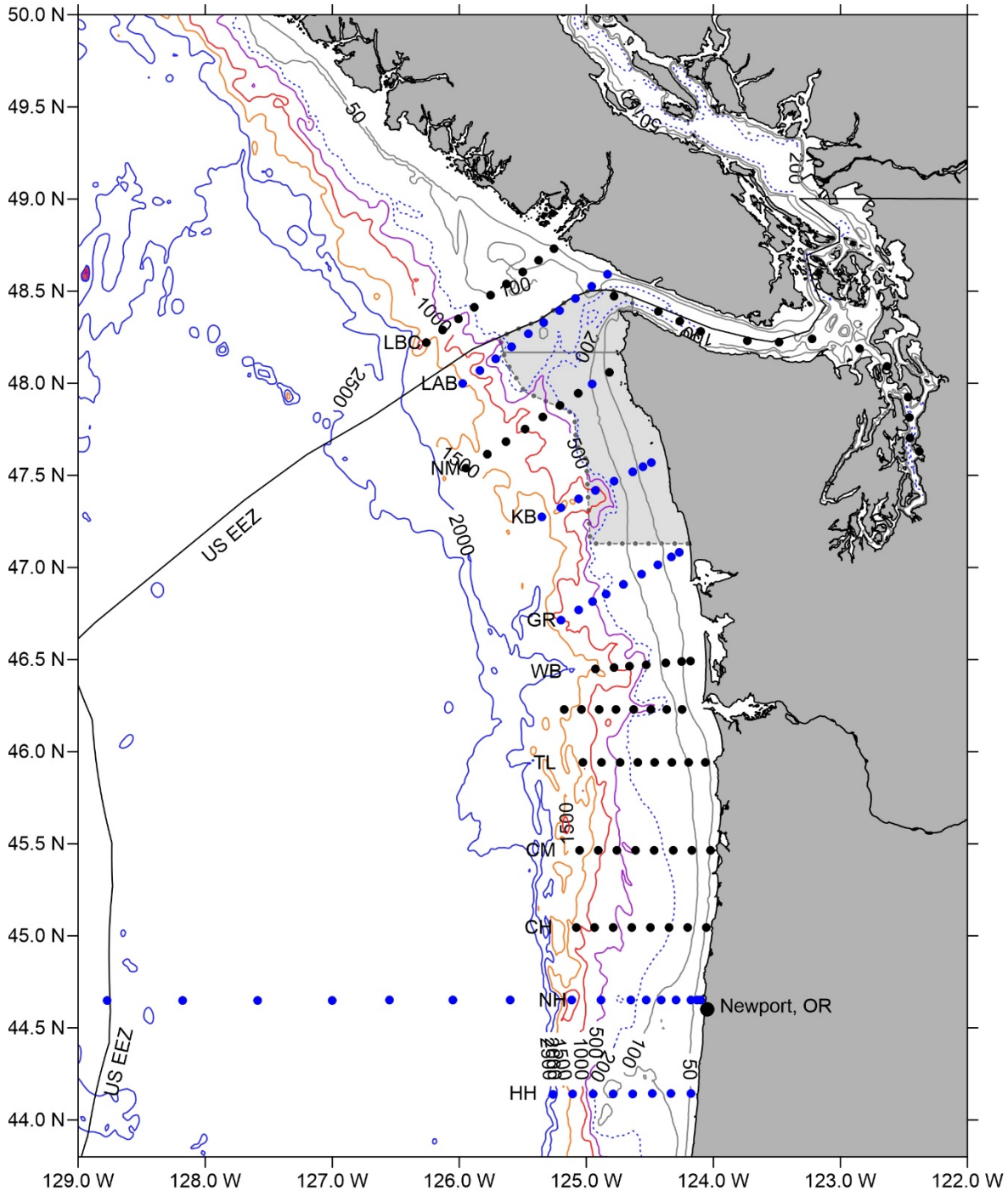


Figure 2. HAB survey grid stations, including Puget Sound and Strait of Juan de Fuca stations. Blue circles indicate priority transects, where water samples will be collected at various depths. Black circles indicate transects where samples will be collected only at the surface and the chlorophyll maximum. CTD casts will be performed at all stations.

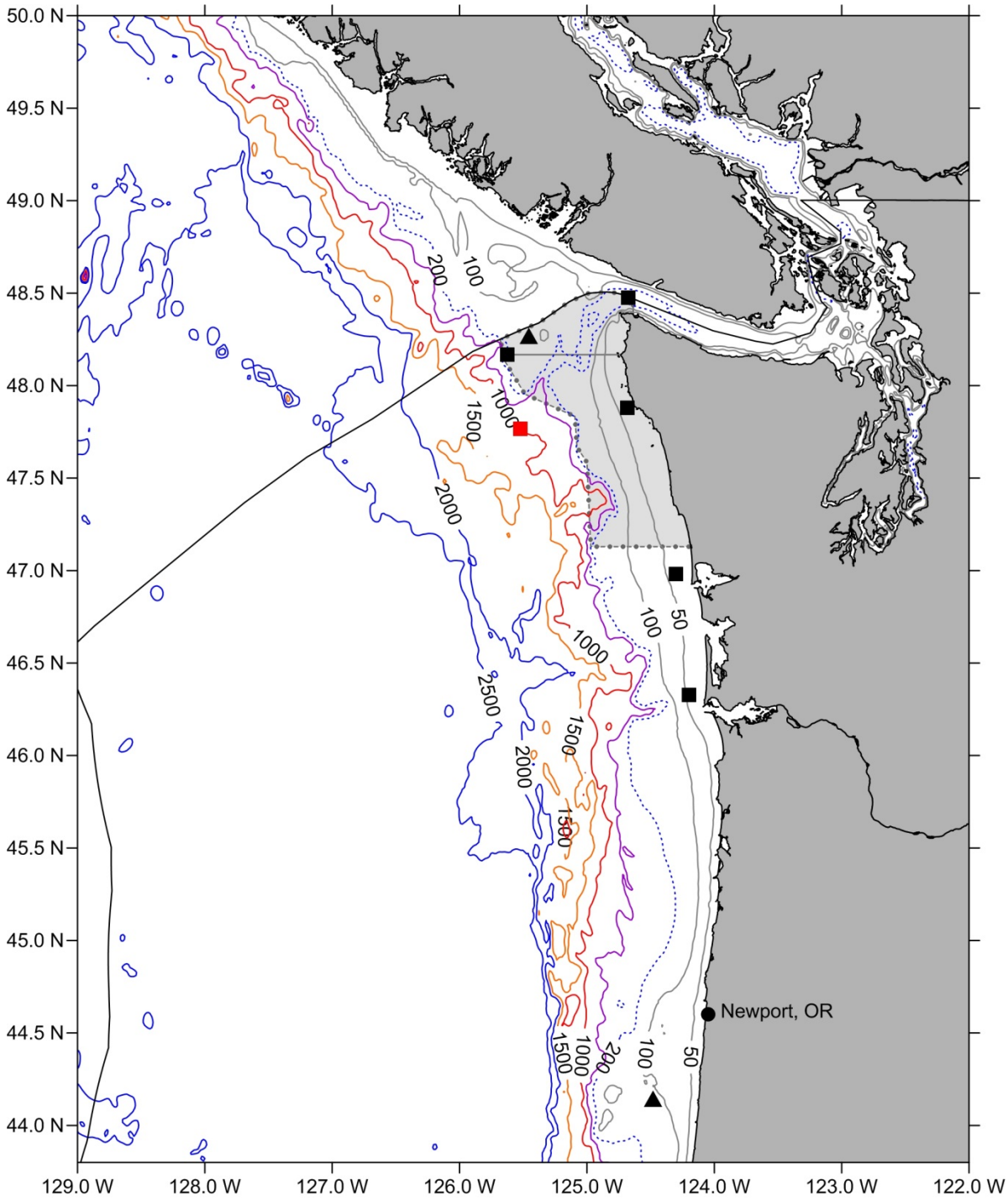


Figure 3. Mooring and drifting buoy deployment locations. Black squares are locations of acoustic recording devices that will be deployed for the NWFSC Marine Mammal team. The Red square is the location of the Noise Reference station mooring. Black triangles indicate drifting buoy deployment locations.

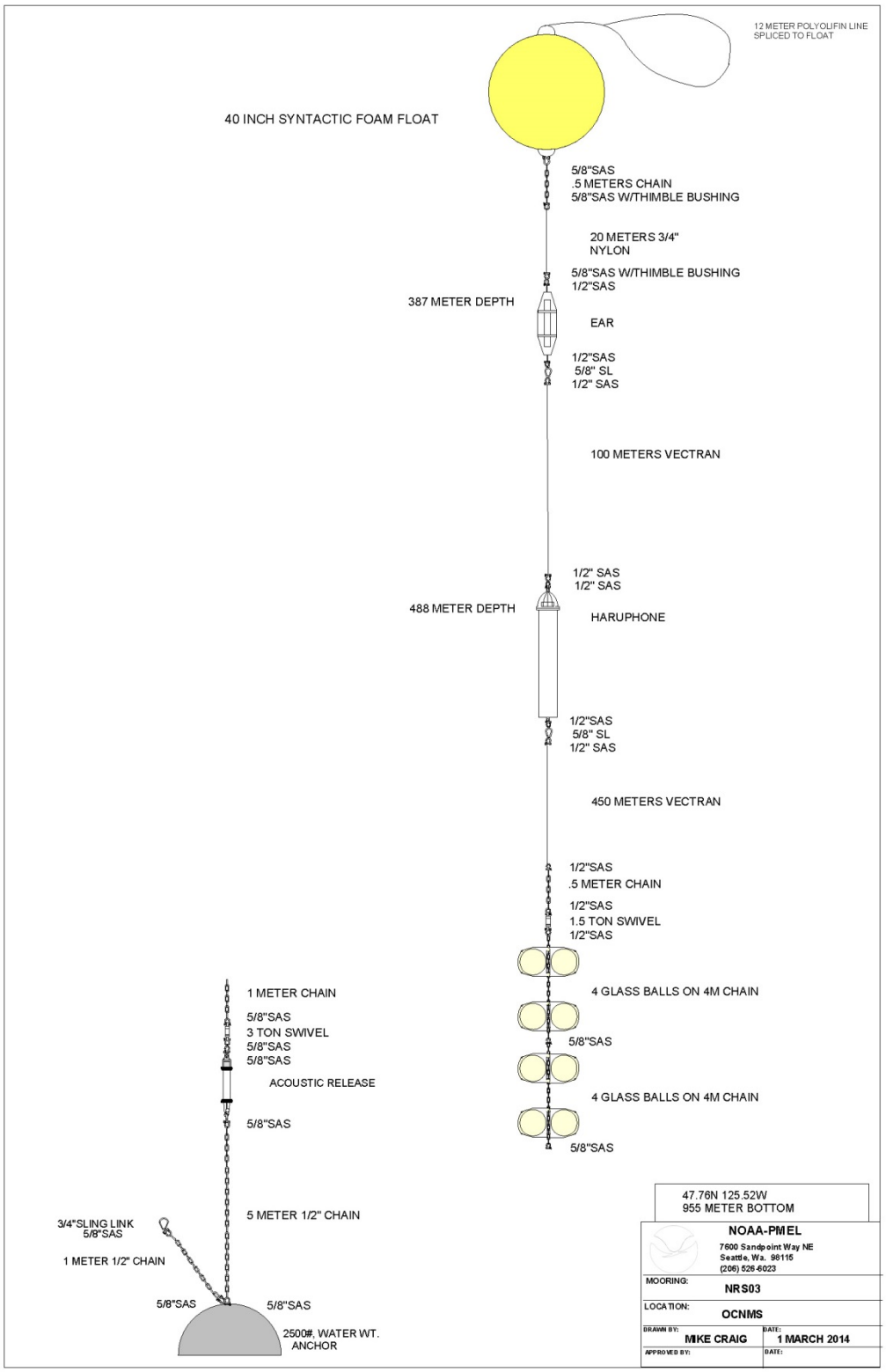


Figure 4. Noise Reference Station Mooring schematic

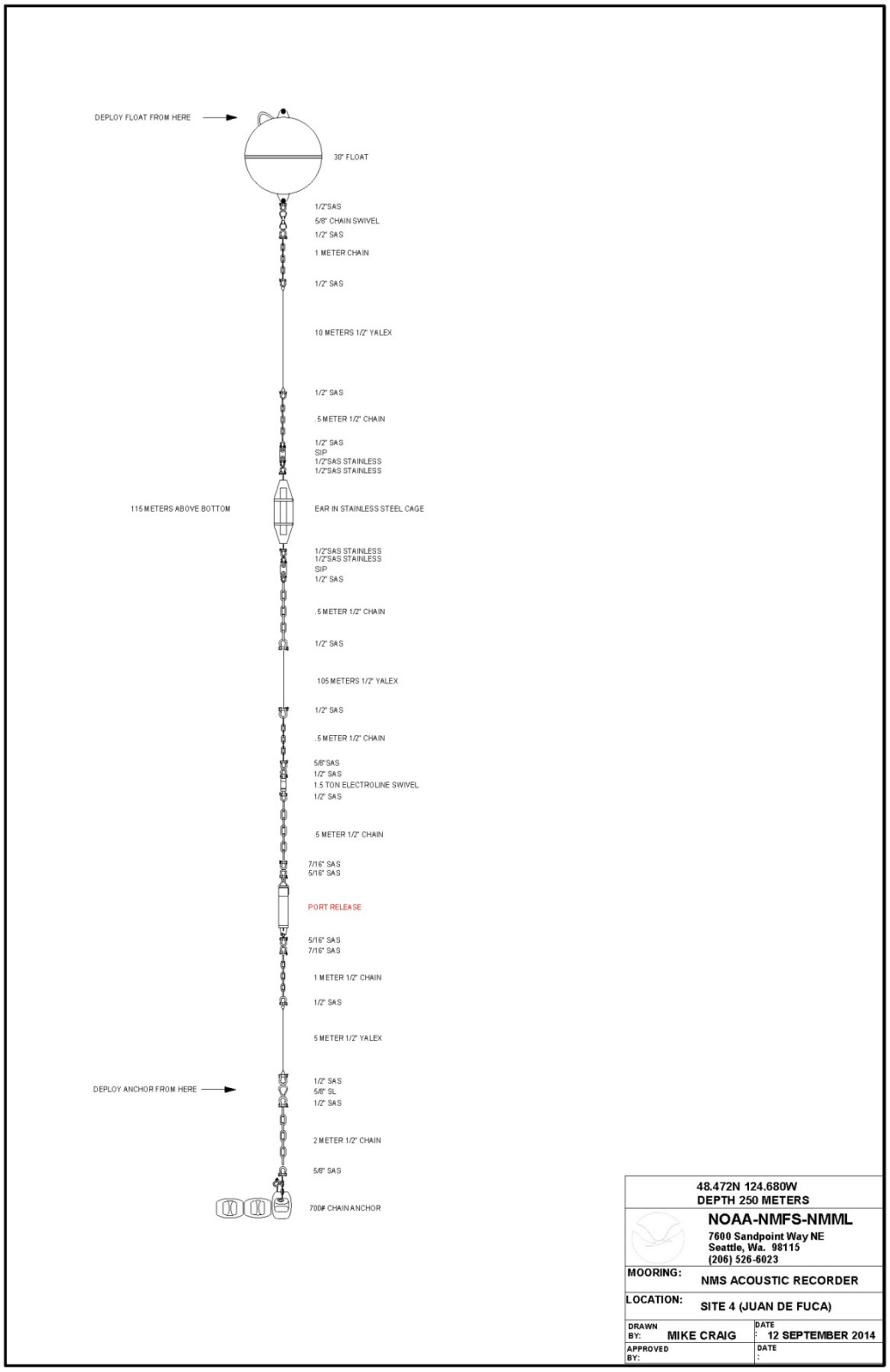


Figure 5. Subsurface Acoustic Recording Mooring schematic

Appendix 2. Station/Waypoint List (coordinates in Latitude, Longitude: degree-minutes)

Table 1. List of Puget Sound and Strait of Juan de Fuca proposed station coordinates

ID	Lat_deg	Lat_min	H	Lon_deg	Lon_min	H
PRISM28 (North of West Point)	47	42.18	N	122	27.24	W
PRISM27 (Apple Cove Point)	47	48.78	N	122	27.3	W
PRISM6 (Useless Bay)	47	55.5	N	122	28.08	W
PRISM19 (Lagoon Point)	48	5.46	N	122	37.86	W
PRISM21 (Buoy SA)	48	11.28	N	122	51	W
PRISM23 (Off Sequim)	48	14.46	N	123	13.44	W
PRISM136 (Strait of Juan de Fuca 11)	48	13.38	N	123	28.98	W
PRISM133 (Strait of Juan de Fuca 10)	48	13.8	N	123	43.98	W
PRISM131 (Strait of Juan de Fuca 8)	48	16.86	N	124	6.0	W
PRISM128 (Strait of Juan de Fuca 7)	48	20.16	N	124	15.96	W
PRISM123 (Strait of Juan de Fuca 6)	48	23.4	N	124	25.98	W
PRISM120 (Strait of Juan de Fuca 4)	48	28.38	N	124	46.98	W

Table 2. List of Offshore HAB survey grid proposed station coordinates

ID	Lat_deg	Lat_min	H	Lon_deg	Lon_min	H
LBC01	48	43.82	N	125	15.24	W
LBC02	48	40.05	N	125	22.65	W
LBC03	48	36.2	N	125	30.01	W
LBC04	48	32.36	N	125	37.81	W
LBC05	48	28.65	N	125	45.32	W
LBC06	48	24.78	N	125	52.82	W
LBC07	48	20.97	N	126	0.32	W
LBC08	48	17.25	N	126	7.96	W
LBC09	48	13.21	N	126	15.54	W
LAB10	47	59.94	N	125	58.32	W
LAB09	48	4.181	N	125	50.244	W
LAB08	48	7.994	N	125	42.908	W
LAB07	48	11.81	N	125	35.33	W
LAB06	48	16.043	N	125	27.381	W
LAB05	48	19.81	N	125	20.24	W
LAB04	48	23.63	N	125	12.72	W
LAB03	48	27.573	N	125	5.193	W
LAB02	48	31.56	N	124	57.54	W
LAB01	48	35.56	N	124	49.95	W
NM01	48	3.48	N	124	49.02	W
NM02	47	59.7	N	124	57.24	W
NM03	47	56.7	N	125	3.84	W

ID	Lat_deg	Lat_min	H	Lon_deg	Lon_min	H
NM04	47	52.8	N	125	12.36	W
NM05	47	49.02	N	125	20.52	W
NM06	47	45.12	N	125	29.04	W
NM07	47	41.04	N	125	37.98	W
NM08	47	36.9	N	125	46.68	W
NM09	47	32.28	N	125	56.94	W
KB07	47	16.45	N	125	21.001	W
KB06	47	19.531	N	125	12.031	W
KB05	47	22.383	N	125	3.718	W
KB04	47	25.104	N	124	55.747	W
KB03	47	28.136	N	124	46.922	W
KB02	47	31.09	N	124	38.04	W
KB01.5	47	32.808	N	124	33.296	W
KB01	47	34.2	N	124	29.34	W
GR01	47	4.92	N	124	16.02	W
GR02	47	3.36	N	124	19.8	W
GR03	47	0.9	N	124	26.22	W
GR04	46	57.78	N	124	34.02	W
GR05	46	54.48	N	124	42.48	W
GR06	46	51.24	N	124	50.64	W
GR07	46	48.84	N	124	57.06	W
GR08	46	46.14	N	125	3.66	W
GR09	46	42.84	N	125	12	W
WB07	46	26.94	N	124	55.8	W
WB06	46	27.379	N	124	46.998	W
WB05	46	27.78	N	124	39.72	W
WB04	46	28.25	N	124	31.8	W
WB03	46	28.82	N	124	22.44	W
WB02	46	29.29	N	124	14.94	W
WB01.5	46	29.46	N	124	10.74	W
CR01	46	13.715	N	124	14.671	W
CR02	46	13.715	N	124	21.974	W
CR03	46	13.715	N	124	29.619	W
CR04	46	13.715	N	124	37.72	W
CR05	46	13.715	N	124	45.936	W
CR06	46	13.715	N	124	54.037	W
CR07	46	13.715	N	125	2.252	W
CR08	46	13.715	N	125	10.467	W
TL08	45	56.406	N	125	1.681	W
TL07	45	56.406	N	124	52.896	W
TL06	45	56.406	N	124	43.996	W

ID	Lat_deg	Lat_min	H	Lon_deg	Lon_min	H
TL05	45	56.406	N	124	35.78	W
TL04	45	56.406	N	124	27.679	W
TL03	45	56.406	N	124	19.578	W
TL02	45	56.406	N	124	11.591	W
TL01	45	56.406	N	124	3.832	W
CM01	45	27.9	N	124	1.44	W
CM02	45	27.9	N	124	10.2	W
CM03	45	27.9	N	124	19.02	W
CM04	45	27.9	N	124	27.9	W
CM05	45	27.9	N	124	36.72	W
CM06	45	27.9	N	124	45.54	W
CM07	45	27.9	N	124	54.3	W
CM08	45	27.9	N	125	3.12	W
CH08	45	2.76	N	125	4.8	W
CH07	45	2.76	N	124	56.04	W
CH06	45	2.76	N	124	47.28	W
CH05	45	2.76	N	124	38.52	W
CH04	45	2.76	N	124	29.7	W
CH03	45	2.76	N	124	20.94	W
CH02	45	2.76	N	124	12.18	W
CH01	45	2.76	N	124	3.42	W
NH01	44	39.06	N	124	6	W
NH03	44	39.06	N	124	7.8	W
NH05	44	39.06	N	124	10.5	W
NH10	44	39.06	N	124	17.64	W
NH15	44	39.06	N	124	24.66	W
NH20	44	39.06	N	124	31.68	W
NH25	44	39.06	N	124	39	W
NH35	44	39.06	N	124	52.98	W
NH45	44	39.06	N	125	6.96	W
NH65	44	39.06	N	125	36	W
NH85	44	39.06	N	126	3	W
NH105	44	39.06	N	126	33	W
NH125	44	38.94	N	126	59.94	W
NH150	44	39	N	127	35.34	W
NH175	44	39	N	128	10.62	W
NH200	44	38.94	N	128	46.32	W
HH08	44	8.34	N	125	15.78	W
HH07	44	8.52	N	125	6.6	W
HH06	44	8.52	N	124	56.76	W
HH05	44	8.52	N	124	47.4	W

ID	Lat_deg	Lat_min	H	Lon_deg	Lon_min	H
HH04	44	8.52	N	124	38.1	W
HH03	44	8.64	N	124	28.92	W
HH02	44	8.58	N	124	20.04	W
HH01	44	8.64	N	124	10.68	W

Table 3. List of drifter deployment locations

ID	lat deg	lat min	H	lon deg	lon min	H
Drifter1	48	16.043	N	125	27.381	W
Drifter2	44	8.64	N	124	28.92	W

Table 4. List of mooring deployment locations

ID	lat deg	lat min	H	lon deg	lon min	H
WJDF mooring	48	28.588	N	124	40.484	W
CF Offshore mooring	48	9.985	N	125	37.43	W
NRS03	47	45.9	N	125	31.32	W
LaPush mooring	47	52.818	N	124	40.856	W
Westport mooring	46	58.83	N	124	18.034	W
CR North mooring	46	19.61	N	124	11.86	W

Appendix 3. Detailed recovery and deployment procedures for Noise Reference Station Mooring

HYDROPHONE MOORING TURNAROUND INSTRUCTIONS

RECOVERY PROCEDURES:

Prep:

- foams/boxes for recovered hydrophone and release
- something to lower/secure float onto
- tools for removing cotter pins and shackles
- wrapping for hardware if going on to winch or net reel
- handheld GPS, mooring diagram, log sheets

Release

Maneuver ship to a location approximately ½ km from the mooring location. The mooring technician will then lower the transducer and enable and range to the acoustic release. Once enabled, signal the acoustic release to drop the anchor, releasing the mooring from the seafloor. The float ascends at 200m/min and typically surfaces within 5 minutes of release. The mooring is a low drag design with a small cross section, so it is not strongly affected by the currents while it is surfacing. It will surface almost directly over the surveyed anchor point. The mooring will however begin to drift almost immediately upon reaching the surface.

Capture of the Float

Fairlead a line of suitable strength to lift 2500kg (order of magnitude safety margin - the heaviest piece of the mooring is the float at 250 kg) through a block with a sheave capable of accepting a 5/8" shackle or larger attached to the a-frame. The float at the top of the mooring (1m syntactic foam sphere) has a 10m floating line spliced into a loop attached to the top of the float. The loop is used to attach a lifting line to, either by maneuvering the ship close enough to throw a grappling hook, or by using a small boat to take a lifting line out to the float and manually attach it.

Recovery

Refer to the mooring diagram to get familiar with the components of the mooring. Begin the recovery by bringing the float aboard. Lift the float up to the A-frame and bring the A-frame inboard. Lower the float onto the deck and secure it to the deck. Transfer the lifting line to the 50m ¾" nylon line attached to the bottom of the float and recover the 50m piece directly onto the deck or empty spool (this section of line will need to be moved to the other end of the mooring for redeployment). The hydrophone is located at the bottom of the 50m line. When the phone is recovered, secure it to the deck and transfer the lifting line from the top of the ¾" nylon line to the sling link on the bottom of the hydrophone. Recover the following yalex or vectran segments using net reel, winch, or capstan and spools; wrap hardware to protect line if recovering with winch or net reel. At the bottom of the final section of yalex/vectran are the 10m ¾" nylon line

and the acoustic release. Bring these on board, disconnect, and secure all recovered mooring equipment.

DEPLOYMENT PROCEDURES:

Anchor Drop Point

When deploying a hydrophone mooring, you must first determine the approximate location where you want the final anchor position to be. After determining where the target anchor location is, you must then determine the approximate anchor drop point. Due to the design of the mooring, we deploy the float first and stream the mooring out behind the ship. Since the floatation has more drag than the anchor has, when the anchor is dropped, it does not descend straight down to the bottom. Instead, the anchor swings back toward the float while the float is heading (at ~ 5kts) toward the anchor. This results in the anchor landing on the bottom quite a ways behind where it was dropped. This "fall back" of the anchor follows a predictable rate. The anchor will end up ~1/7 the mooring line length behind the drop point. So if you have a mooring with 4200m of line on it, you need to drop the anchor 600m PAST the target anchor position. The anchor will swing back to the target location. The amount of "fallback" is not purely a function of line length, line tension is a factor as well. If the ship is approaching the drop point slowly with the line slack or with little tension, the fallback will be less than if the line is under moderate tension. The amount of fallback is generally between $1/7^{th}$ and $1/10^{th}$ of the mooring line length.

Starting position of the ship

With an experienced crew (one that has done at least one hydrophone mooring) it is safe to estimate 45-90 minutes deployment time for at 3000m to 4200m mooring. For the first deployment estimate 90-120 minutes deployment time.

The speed the ship deploys at is subject to modification in the field, however, start out at 2.5-3 kts after deploying the float. The speed of deployment is important for a couple of reasons. It allows you to estimate how far down range to begin the deployment, since you know the duration of the deployment, speed of the ship, and the anchor drop point. Another important aspect of the deployment speed translates to the distance over ground covered during the deployment (crucial to avoid missing your drop point). Our mooring is designed to be low drag to reduce strumming noise; the drawback to this design is that without some drag, the mooring line does not deploy swiftly and smoothly unless the ship is going fast enough. This is counter-intuitive, but the faster the ship deploys at (speed through water) the shorter the distance both through the water and over the ground covered during the deployment. The reason for this is simple though not necessarily obvious, since the mooring has little drag, at slow deployment speeds, the float simply follows along after the ship. The difference is dramatic, if you deploy a 4000m mooring at < 2kts it will take ~2 to 2.5 hours and the distance over ground may be as much as 5 NM or more. If you deploy the same 4000m mooring at 4-5 kts, the deployment time will be ~ 45 minutes (or less) and the cover 3 to 4 NM (or less) over ground.

There are other considerations to mooring speed, however it is important the mooring be deployed under tension to eliminate potential tangling of the mooring line with itself. As a general rule of thumb, deploy as fast as can be done safely, with a maximum speed of 5 kts.

Mooring Set-up (refer to mooring diagram included)

Deck Prep:
- test, cock, and disable new release in lab
- bring release and hydrophone out to deck
- new hardware and cotter pins
- tools for shackles and cotter pins

Pre-deployment

The mooring can be treated as two moorings, the top and the bottom, and can be built independently of each other. If possible get the anchor moved into position on the fantail, beneath the A-frame before operations begin. This eliminates having to use the crane during the deployment operation and allows the tech to begin building the bottom of the mooring while the mooring line is being deployed.

Building the top of the mooring

The float can either be deployed right side up with a quick release attached to a 5/8" shackle (can be an old/reused shackle), or upside down by lifting it with the 50m ¾" nylon through the block.

On the bottom loop of the float, attach a 1/2m section of chain using a 5/8" shackle (pin through the chain, not the float).

Attach 50m piece of ¾" nylon with a thimble bushing, to the bottom of the 1/2m chain using another 5/8" shackle. The pin goes through the nylon not the chain.

Flake the 50m piece of line out on the deck so it can go overboard without tangling.

Attach the 50m ¾" nylon to the top of the hydrophone. This attachment is done using a 5/8" shackle connected to the nylon, with a thimble bushing, hooked with a ½" shackle to the top of the hydrophone.

Inspect all nylon isolator bushings (wrap with tape) and shackles and verify they are in place.

Insert cotter pins to all shackles (use new cotter pins, never re-use the pins that come in the shackle, they are cheap galvanized and need to be replaced with stainless steel pins).

Preparing to deploy

When using an A-frame, capstan/winch configuration

If the ship only has one method of lifting the mooring, and or only one block in the A-frame, you will need to do a "double pick-up".
This involves feeding the ship's lifting line through the block and attaching it to the float via a quick release. While the ship is at all stop, lower the float into the water and release it. While the 50m ¾" nylon line is slowly going overboard, feed the yalex/vectran through the block and attack it to the bottom of the hydrophone using a ½" shackle attached to a 5/8" sling link and another ½" shackle to the hydrophone. The 5/8" sling link is critical for stopping off the mooring on the subsequent recovery operation.

Lift the hydrophone off the deck with the yalex/vectran line through the block on the A-frame

Have the bridge bring the ship up to deployment speed, start at 2 kt, as the ship accelerates, the 50m nylon line will begin paying off the deck into the water as it is pulled off by the drag from the float. When the line is pulled tight, begin paying out the line and the hydrophone will go into the water as smoothly as possible. After the hydrophone is deployed, ship can speed up to 5 knots. Stop off and replace hardware and cotter pins at all connections.

If the ship has two methods of lifting and two blocks attached to the A-frame, set-up similar to previously described.
Run the yalex/vectran line through one block and attach it to the bottom of the hydrophone. Run the ship's "lifting line" through the other block to the quick release attached to the top of the float. This is the preferred method since the mooring is attached to the ship at all times during the deployment and there is no transferal of lines under strain to deal with.

Lift the float with the lifting line, then lift the hydrophone with the line attached to the bottom of the hydrophone. Then lower the float into the water, release it, allow the 50m ¾" nylon to deploy and when the line comes under tension, lower the hydrophone into the water. After the hydrophone is deployed, ship can speed up to 5 knots. Stop off and replace hardware and cotter pins at all connections.

If the ship has a crane/snatchblock and a capstan the mooring can easily be deployed over the side. After lifting the float over the side and booming out ~5-6m the mooring can be deployed through a snatch block on the crane. This method requires the capstan to provide the lifting while the crane is used similar to the a-frame or as a support for the block the line is going through. This method is preferred when working on the R/V Atlantis, since the A-frame is dedicated to Alvin no mooring work is allowed to use the A-frame.
The mooring deployment procedure is the same as above except we use the crane/capstan rather than the A-frame/capstan combo.

While the mooring line is being deployed by the deck force/assistant build the bottom of the mooring.

Building the bottom of the mooring

Preparing the Acoustic Release for deployment.

EG&G/Edgetech 8242; Attach the detachable link, cock the release using the cocking tool included with the release

Attach a 2m chain to the anchor using a 5/8" shackle.

Attach a 5/8" shackle (old/reused shackle ok here) to the middle of the 2m chain; this is where you will attach the quick release to for lifting the anchor into the water.

For NRS04, next attach 10m wire and 0.5m chain here.

Attach the upper end of the chain to the detachable link on the acoustic release using a 5/8" shackle.

Attach a 5/8" shackle to the top of the acoustic release looped through a ½" shackle attached to the 1 1/2 ton swivel, (writing on the side of the swivel should be upright after the mooring is deployed).

Lay another ½" shackle near the top of the swivel it will be used to make the final connection between the bottom of the mooring line and the top of the swivel.

When you are nearing the end of the last piece of yalex/vectran mooring line going into the water, attach the 10m ¾" nylon piece, with thimble bushings, to the bottom of the yalex/vectran line using a 5/8" / ½" shackle combination.

Attach the 1m chain to the bottom of the 10m ¾" nylon using a 5/8" shackle, attach the other end of the chain to the ship's "lifting line".

The lifting line must be strong enough to support all dynamic forces generated by the anchor, 80 lb release and tension on the line.

At this point have the ship slow to 2 kts through the water.

Attach a drop line/strap to the 1m chain. The drop line must be long enough to reach the deck from the A-frame block the mooring line is being deployed through with enough left over to grab onto and haul in on. 8-12m is probably sufficient.

As you deploy the last of the mooring line, the 10m ¾" nylon, you will observe the drop line hanging free from the 1m chain, After the drop line has passed through the block on the A-frame, stop the deployment. Haul the line back in until you can grab the drop line while standing on the fantail. Use the drop line in conjunction with the release of a little additional line to get the 1m chain down to the deck and stop it off to the deck. Transfer the tension from the lifting line to the deck. Detach the lifting line from the 1m chain and attach the 1m chain to the swivel using a ½" shackle.

Attach the lifting line to the quick release attached to the 5/8" shackle, mid way on the 2m chain between the anchor and the release. This is your pick-up point. Tow the mooring until you get to the anchor drop point.

When you are approaching 5 minutes from the drop point, detach the 1m chain from the deck and lower the release into the water. Lift the anchor off the deck, go out on the A-frame, lower the anchor to the water's edge and wait for the bridge to give the order to drop the anchor.