UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northwest Fisheries Science Center
Seattle, WA

Final Project Instructions

Date Submitted: May 31, 2016
Platform: NOAA Ship *Bell M. Shimada*
Project Number: SH - 16 - 09
Project Title: Rockfish Recruitment Survey
Project Dates: June 12 – June 26, 2016

Prepared by: Dated: 5/31/2016

Richard D. Brodeur
Project Leader
NOAA NMFS NWFSC FED

Approved by: Dated: 5/31/2016

Rich Zabel
Division Director
NOAA NMFS NWFSC FED

Approved by: Dated: 5/31/2016

Rich Zabel (Acting for John Stein)
Science and Research Director
NOAA NMFS NWFSC

Approved by: Digitally signed by BISHOP.JOE.C.1125064902 Date: 2016.06.10 10:23:22 -07'00' Dated: 6/10/2016

For Commander Brian W. Parker, NOAA
Commanding Officer
Marine Operations Center – Pacific

I. OVERVIEW

A. Brief Summary and Project Period – Project will conduct a pre-recruit survey for juvenile fish and ecosystem survey of the northern California Current.

Project Period: June 12 – June 26, 2016

B. Days at Sea (DAS)
Of the 15 DAS scheduled for this project, 0 DAS are funded by an OMAO allocation, 15 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 Medium Operational Tempo.

C. Operating Area: Brookings, OR to Grays Harbor, WA (see Appendix I and II for specifics)

D. Summary of Objectives

1. Sample for pelagic juvenile rockfish (*Sebastes* spp.) and other epi-pelagic micronekton.

2. Characterize prevailing ocean conditions and examine prominent hydrographic features.

3. Collect acoustic data for mapping distribution of fish and krill.

4. Observe seabird and marine mammal distribution and abundance.

5. Conduct depth-discrete plankton tows (MOCNESS).

6. Collect surface neuston plankton samples.

7. Collect samples for stable and radio isotope analyses.

8. Tow plankton video imaging system along the Oregon and Washington coasts.

9. Collect plankton and conduct CTD casts to characterize ocean conditions.

E. Participating Organizations

NOAA NMFS NWFSC FED
Oregon State University (OSU)
Pacific States Marine Fisheries Commission (PSMFC)
Ocean Associates (OA)
Cooperative Institute for Marine Resources Studies (CIMRS)

F. Personnel/Science Party:

Name (Last, First)	Title	Date Aboard	Date Disembark	Gender	Affiliation	Nationality
Brodeur, Richard	Chief Scientist	June 12	June 26	M	NMFS/NWFSC	USA
Roegner, Curtis	Fishery Biologist	June 12	June 26	M	NMFS/NWFSC	USA
Chittaro, Paul	Fishery Biologist	June 19	June 26	M	OA	USA
Auth, Toby	Fishery Biologist	June 12	June 26	M	PSMFC	USA
Phillips, Jason	Fishery Biologist	June 12	June 26	M	OA	USA
Fennie, Will	Fishery Biologist	June 12	June 26	M	OSU/HMSC	USA
Zeman, Sam	Biologist	June 12	June 26	F	CIMRS/HMSC	USA
Cowen, Robert	Professor	June 12	June 19	M	OSU/HMSC	USA
Robinson, Kelly	Postdoctoral Scholar	June 12	June 26	F	OSU/HMSC	USA
Luo, Jessica	Postdoctoral Scholar	June 12	June 19	F	OSU/HMSC	USA
Briseño-Avena, Christian	Postdoctoral Scholar	June 12	June 26	M	OSU/HMSC	Mexico
Ottmann, Daniel	Student	June 19	June 26	M	OSU/HMSC	Spain
Gladics, Amanda	Ornithologist	June 12	June 26	F	OSU/HMSC	USA
Porquez, Jessica	Ornithologist	June 12	June 26	F	OSU/HMSC	USA
Swieca, Kelsey	Student	June 12	June 26	F	OSU/HMSC	USA
Hann, Ashley	Student	June 12	June 19	F	NMFS/NWFSC	USA

G. Administrative

1. Points of Contacts:

Richard Brodeur, Fishery Biologist, Chief Scientist
NOAA NMFS NWFSC FED
Hatfield Marine Science Center
Newport, OR 97365

Phone: 541-867-0336
Email: rick.brodeur@noaa.gov

Curtis Roegner, Fishery Biologist, Alternate
NOAA NMFS NWFSC FED
Pt Adams Research Station
P.O. Box 155
520 Heceta Place
Hammond, OR 97121
Phone: 503-861-1818 ext 12
Email: Curtis.Roegner@noaa.gov

LT Timothy Sinquefield, Operations Officer
NOAA Ship *Bell M. Shimada*
Phone: 206-427-2374
Email: Ops.Bell.Shimada@noaa.gov

2. Diplomatic Clearances

None Required.

3. Licenses and Permits

The sampling will be conducted under an Oregon Department of Fish and Wildlife 2015 Scientific Taking Permit # 19527 and NOAA Scientific Research Permit (SRP-19). No sampling will take place in any sanctuaries so no permit is required.

If hook and line fishing is permitted, the fisher must be in compliance with all local/regional fishing regulations. While off OR and WA, you must have a valid state recreational fishing license in order to be allowed to retain any catch and all daily bag limits and prohibited closed area restrictions must be followed. No fish or invertebrates taken with scientific sampling gear may be sold, or bartered, although consumption of captured species aboard the vessel is allowed if regulations (area/species/bag limits) are followed.

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:

June 12-26

Embark scientists and depart MOC-P, Newport, OR, on June 12 and proceed to Brookings transect at maximum cruising speed. Beginning the first night and ending the morning of the last day, conduct nighttime mid-water trawls, CTD deployments, various oceanographic sampling, bongo tows, and neuston tows between Brookings, OR and Grays Harbor, WA. The transect plan is listed in Appendix I and is subject to change. There will be a transfer of scientific personnel (2-3 deboarding and boarding) just outside of the jetties off Newport using a small RHIB boat during the day on or before June 19, for a total transfer time of 1-2 hours. Arrive in port in Newport, OR, upon the completion of operations on June 26.

B. Staging and Destaging:

On June 9-10, the major scientific survey equipment from NOAA NMFS NWFSC FED will be loaded and secured aboard the ship while in port in Newport. Scientists traveling from out of town request the ability to stay aboard the ship the night of June 11 and during final inport on June 26. Frozen specimens will be offloaded and miscellaneous gear will be loaded and offloaded during each in-port. All scientists will be disembarked on June 26 and the gear will be demobilized on June 26 and 27. The modified Cobb midwater trawl will need to be rinsed/cleaned, removed from the net reel, and packed for storage. All associated cables and hardware should be cleaned and stowed.

C. Operations to be conducted:

1. Sample for pelagic juvenile rockfish and other epi-pelagic micronekton

Four midwater trawls of 15 minute duration will be conducted each night along the designated transects. A modified-Cobb midwater trawl with a 26 m (86') headrope and a 9.5 mm (3/8") codend liner will be used. Trawling operations will commence just after dusk and conclude just before dawn. Target headrope depth is 30 m except in areas with shallow bottom depths, in which case the target headrope depth is 10 m. We will start with 25 and 85 m of wire out, with adjustments made if target depth is not obtained, as determined from depth recordings collected from time-depth recorders (TDRs) and the ship's acoustic trawl net monitoring system. The TDR and acoustic sensors will be attached to the net during each tow. Ship speed during trawling should be ~2.0 knots. Ship's speed will be adjusted while trawling to maintain target headrope depth (using the acoustic trawl net monitoring system) while the amount of wire out will remain fixed. Two STM Products Dolphin Dissuasive Device (DDD 03) acoustic pingers will be attached to the trawl to mitigate encounters with marine mammals. Fish and select invertebrates from each trawl will be sorted, identified and enumerated. Length measurements will be taken on adult

northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), Pacific herring (*Clupea pallasi*), and Pacific whiting (*Merluccius productus*), as well as pelagic juvenile Pacific whiting, lingcod (*Ophiodon elongatus*), Pacific sanddab (*Citharichthys sordidus*), speckled sanddab (*Citharichthys stigmaeus*), and sablefish (*Anaplopoma fimbria*) and Humboldt squid, and market squid *(Doryteuthis opalescens*). Length measurements will also be taken on a subsample of mesopelagics, including: California headlightfish (*Diaphus theta*), *Nannobrachium* spp., California lanternfish (*Symbolophorus californiensis*), northern lampfish (*Stenobrachius leucopsarus*), blue lanternfish (*Tarletonbeania crenularis*), California smoothtongue (*Leuroglossus stilbius*), and blacksmelts (Bathylagidae). Size information will also be recorded for *Chrysaora* spp., *Aurelia* spp., *Pyrosoma* spp., *Thetys* spp., and *Carinaria* spp. All pelagic juvenile rockfish will be frozen for later laboratory analyses.

2. Characterize prevailing ocean conditions and examine prominent hydrographic features

CTD casts will be conducted throughout the day at pre-determined stations in the vicinity of the trawl transects and at each trawl station during the day. The scientific party may exclude some CTD casts during daytime and/or nighttime operations in order to complete the planned mid-water trawls. A Seabird Electronics CTD and water sampling system with conductivity, temperature, depth, fluorometer, and dissolved oxygen sensors will be used. The CTD will be lowered to a maximum depth of 500 meters, as bottom depth allows. Deployment rate: soak for 2 minutes at 10 meters depth, then beginning at the surface - 30 meters/minute on the first 200 m of the downcast, then 50 meters/minute from 200 to 500 meters depth, and 50 meters/minute for the upcast. Oceanographic data will also be collected while underway by a Turner Designs fluorometer and SeaBird thermosalinometer. High-resolution physical data collected by a suite of sensors (e.g., CTD, ECO fluorometer, photosynthetically active radiation, dissolved oxygen) that are part of the *In situ* Ichthyoplankton Imaging System (*IS*IIS – see Section 8) will also be made available.

3. Collect acoustic data for mapping distribution of fish and krill

A series of daytime transects will be run, during which the Simrad EK60 echosounder will be used to record and geo-reference the presence and abundance of fish and krill. We will run along the transects during daytime (when other operations are not ongoing) at a nominal speed of 11 kts. Data will also be collected in the transit between transects when seabird observations are going on. The Simrad EK60 echosounder will be used to acoustically characterize the distribution and abundance of macrozooplankton, micronekton, meroplankton, and zooplankton associated at prominent oceanographic features and locations.Acoustic data will be continuously collected using three frequencies on the EK60 (18, 38, 120 and 200 kHz) and the 75 kHz ADCP. All systems will be synchronized using the K-Sync. The vessel's ES-60 depth sounder may be used minimally at the discretion of the captain, but will normally remain off while underway.

4. Observe Seabird and marine mammal distribution and abundance

Ornithologists/marine mammal biologists from Oregon State University will visually survey and estimate abundance and distribution of seabirds and marine mammals from the ship's flying bridge during daylight hours while underway. In inclement weather, the ornithologist/marine mammal biologist may request to observe from the bridge, pending approval from the officer on duty. If species of particular interest are encountered, the ship may be asked to alter course accordingly if it does not affect other operations underway.

5. Conduct depth-discrete plankton tows (coupled MOCNESS)

A coupled asymmetrical Multiple Opening Closing Net Environmental Sampling System (coupled MOCNESS) will be deployed during daytime as time allows. One of two sampling designs will be implemented depending on the time allotted to support sampling needs of other scientific groups. One option is MOCNESS will be deployed at two cross-shelf stations along each of the 10 trawl transects, with one station located onshore and the other offshore. These two stations would be placed so that they bookend the *IS*IIS transect (see Section 8). A second option is MOCNESS will be deployed along two cross-shelf stations every other transect, with one station located more onshore and the second farther offshore.

MOCNESS samples will be used to validate images of plankton captured by the *In Situ* Ichthyoplankton Imaging System (see Section 8), and to collect pelagic rockfish larvae and their prey concurrently. The system consists of 5 MOCNESS-4 nets (7.5-m long × 4-m^2 mouth; 800-µm mesh), 5 MOCNESS-1 nets (3-m long × 1-m^2 mouth; 153-µm mesh), a drag net, a Sea-Bird 3S temperature sensor, a Sea-Bird 4 conductivity sensor, and an electronic flowmeter. A single underwater electronics unit controls net opening and closing via two separate toggle release systems actuated by two step motors. MOCNESS control and data acquisition software will be run off a desktop computer running Windows XP OS in the acoustic lab.

The system will be deployed for approximately 30 min from the aft A-frame and towed obliquely to a depth of 80 m. One net pair will sample the water column from surface to 80 m, and the remaining four net pairs will sequentially target depth intervals of 80-60 m, 60-40 m, 40-20 m, and 20-0 m with a tow time of 5 min per net pair. Upon system recovery, pelagic juvenile rockfish will be immediately removed the from cod-end contents and frozen separately for later gut content and isotope analysis. The remaining cod-end contents will be preserved in 95% ethanol. We anticipate a total operation time of 2 hrs per day, as MOCNESS deployment and recovery takes an estimate 30 min per tow.

Additional sampling offshore along the Newport Line and/or near the Columbia River plume may also occur if time allows.

6. Collect surface neuston samples

As time allows, surface neuston tows will be conducted from side of the vessel using a Manta net (1.0 × 0.4 m mouth; 300-µm mesh). Tows will be done at daylight stations (1,2,3,5,7) along each transect and at nighttime stations (1,3,5,7) as time allows. If time allows prior to nighttime leg of transect, conduct tows at ~hourly intervals during dusk at final daylight station (1 or 7). If ship arrives at inshore station prior to beginning of night trawls, conduct time series tows during dusk (all at inner-most station trawl station). Ship's survey techs will be responsible for deployment but scientists will assist as needed and directed by the crew. Tows will be for 5 min at 2 knots (through water), depending on jellyfish concentrations.

7. Collections for stable isotope analysis

We will collect samples of zooplankton, krill and other micronekton to provide baseline samples at multiple trophic levels to explore the potential for developing an "isoscape" analysis of the California Current. This will include saving samples (frozen) from one cod-end for each of the bongo tows (ideally with 333-µm mesh) conducted and tissue samples from krill, market squid (ideally in 50- 100 mm size range, with larger preferred over smaller), adult northern anchovy, Pacific sardine, adult (age 1+) Pacific hake, adult (age 1+) shortbelly rockfish, adult (age 1+) Pacific sand dab, adult northern lampfish, and adult California headlightfish. Tissue samples should also be collected from a small number of opportunistic samples from jellyfish (*Chrysaora* spp.) and salps (*Thetys* spp.) several times over the course of the survey. For larger fish, samples can be taken from muscle tissue and combined in a single bag (as five individual pieces), smaller individuals can simply be frozen whole. We will develop a spreadsheet with stations and species listed with the ability to "check" when a given sample has been collected to track collections. Tissue from pelagic juvenile rockfish species will be sampled during routine analysis of those specimens following completion of the project. While underway if not impacting other operations during the daylight hours, attempts will be made to catch albacore for OSU radioecology work. Ideal vessel speed is 6 knots with SST over 15^{o} C. Hand lines will be deployed by scientists and/or crew with a valid sport fishing license. Any albacore captured will be euthanized by an IACUC designated person (Jason Phillips) with training under ACUP4547.

8. Tow plankton video imaging system along the Oregon and Washington Coast

The *In Situ* Ichthyoplankton Imaging System (*IS*IIS) will be deployed during the daytime along station lines as time allows to examine the cross-shelf, fine-scale distribution of key ichthyoplankton, mesozooplankton, and microzooplankton. One of two sampling designs will be implemented depending on the time needed to support the sampling needs of other scientific groups. One option is *IS*IIS tows will be conducted for 4 to 6 hrs on each of the 10 transects used for nighttime trawl sampling (See Appendix I.II). A second design is ISIIS will be towed along a cross-shelf transect for 4 to 6 hrs every other trawl transect, for five transects in total.

Plankton imagery data will be captured with a large camera (50 cm depth of field × 13 cm field of view, 135 L s^{-1}) and a small camera (9 cm depth of field × 4 cm field of view, 9.8 L s^{-1}). The *IS*IIS will be towed at 5 knots either in a tow-yo pattern (surface to a maximum of 100 m) or at a fixed depth (to be determined). The system will synchronously sample environmental conditions using a suite of sensors, including: CTD, ECO fluorometer, photosynthetically active radiation (PAR) sensor (Biospherical), dissolved oxygen Sensor, and mini Doppler velocity log. Physical data (e.g., temperature, salinity, density) will be plotted in real-time via the topside computer.

The *IS*IIS's approximate foot print for deck storage is 8' W × 7' L × 5' H. Weight in air is ~ 1000 lbs. *IS*IIS requires a minimum of 2 ft clearance on each side of the A-frame for safe deployment. A fiber optic winch and block will be provided to deploy ISIIS from the aft A-frame. *IS*IIS deployment requires a winch driver, an A-frame operator, and (preferably) three deck hands – two for tag lines, and one directing deployment operations. Deployment and recovery typically takes 15-20 min each. Data acquisition is controlled by a large box (3' × 3' × 2') housing a Windows OS-based computer, a power modulator, and modems that is connected to the vehicle via a fiber optic cable. Data are saved to 12-TB RAID data arrays during each deployment. Each array has a footprint of 20 × 12 × 16 cm and four arrays are typically brought on a project (2 for the small camera and 2 for the large camera).

Additional sampling offshore along the Newport Line and/or near the Columbia River plume may also occur if time allows.

9. Collect plankton and conduct CTD casts to characterize ocean conditions

As part of the long-term monitoring of the Newport Hydroline, we will be doing a CTD, bongo and short vertical plankton tow at two stations on our way out of Newport. These should each take about an hour. The coordinates for NH-5 are 44.652 N 124.175 W and for NH-25 are 44.652 N 124.650 W. Three bongos will be conducted at night at three of the four locations where night trawling occurs. Plankton samples will be collected using a bongo net with a 60-cm diameter mouth opening and 333-μm mesh nets. The bongo will be fished as a continuous oblique tow from ~100 m (or within 5 m of the bottom at stations <100 m) to the surface at a retrieval rate of 33 m min^{-1} and a ship speed of 1.0-1.5 m s^{-1}. A depth recorder and flowmeter will be placed in the net during each tow to determine tow depth and volume of water filtered. Special collections of near surface jellyfish will be made using long-handled dip nets to examine their diets off Oregon and Washington. These collections will be accompanied by plankton collections with a bongo net. These will be made at the CTD stations or some other locations at the discretion of the day watch chief.

D. Dive Plan

Dives are not planned for this project.

E. Applicable Restrictions

Conditions which preclude normal operations:

1. **Mitigating interaction with marine mammals**

The scientists will visually scan the area for marine mammals for a period of no less than 10 minutes before setting the trawl gear. If marine mammals are observed within one nautical mile of the planned set location during the initial visual scan and determined to be at risk of interaction, then the vessel will relocate to a distance one nautical mile away and another visual scan will be conducted at the new location. If marine mammals are still observed after the vessel has moved two times from the original station location, then trawl operations for that particular station will be cancelled and the vessel will proceed to the next planned trawl station.

Whenever the trawl is in the water, the project leader and/or scientists will continue to monitor the waters around the vessel and maintain a lookout for marine mammal presence as far away as environmental conditions allow. The chief scientist/project leader should be notified if any marine mammals are observed by the captain, deckhands, and scientists. If the midwater trawl is deployed (but not yet fishing) after an "all clear" visual scan and marine mammals are then observed by the captain, deckhands, or scientists during the trawl deployment, then the gear will immediately be retrieved to avoid further interaction with the animals. The vessel will relocate to a distance one nautical mile away and follow the visual scanning protocols noted in the previous paragraph. If the midwater trawl is fishing and marine mammals are observed, then the appropriate action should be taken based upon the individual circumstances with consultation between the scientists and captain (in some cases the net will be immediately retrieved, while in others it may be kept at depth to avoid marine mammals at the surface).

Every effort should be made to deploy and retrieve the trawl net as quickly as possible (following all safety measures) to avoid possible interactions with marine mammals, which tend to aggregate at the surface.

If a marine mammal is inadvertently captured in the trawl net, it will be of the highest priority to release the animal back into the water as soon as is safely possible. The chief scientist/project leader will be responsible for recording the event in the data books, noting the status of the animal (e.g., healthy and alive, injured slightly, etc.), the species, and if possible other details such as sex and relative size. If a marine mammal is captured in the midwater trawl net, the chief scientist/project leader should immediately notify the CO of the ship and a NOAA NMFS NWFSC representative on shore via telephone or email and convey all the pertinent information regarding the event.

A further measure to mitigate marine mammal encounters is to install acoustic pingers on the midwater trawl net. Two STM Products Dolphin Dissuasive Device (DDD 03) acoustic pingers will be attached to the trawl net whenever it is deployed to mitigate marine mammal encounters.

See Appendix 3 for NWFSC Standard Operating Procedures to minimize Marine Mammal interactions

2. **Adverse weather conditions**

Operations will be suspended under adverse weather conditions. High winds (e.g. greater than 35 knots) and seas (e.g. greater than 4 m) can negatively impact the scientific sampling and could potentially pose a safety issue for personnel.

3. Equipment failure

Operations may be suspended/altered if the scientific gear is damaged. If the midwater trawl is damaged, the Chief Scientist requests that the ship's crew assist in repairs. However, if the damage is deemed too extensive, the spare midwater trawl will be used in lieu of repairing the damaged net.

4. Unforeseen circumstances

The Chief Scientists can alter the scientific portion of this project with the concurrence of the CO, provided that the proposed changes will not: (1) jeopardize the safety of personnel or the ship; (2) exceed the time allotted for the project; (3) result in undue additional expense; or (4) change the general intent of the project

.

III. EQUIPMENT

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

Trawl winches, and gantries with trawl blocks

Net reel for modified-Cobb mid-water trawl net

Cowbells for securing codend of trawl net

Winch and conductive cable for CTD deployments

Feed for conducting cable into the lab space

Winch for bongo tows

Multifrequency transducers providing 38, 70, 120, 200 kHz frequencies for the EK-60

75 kHZ ADCP with K-sync to operate while using other acoustics

Regular freezer, –80^{o}C freezer, and refrigerator space for water and organism samples

GPS feeds into lab spaces

Acoustic trawl (FS70) net sounder system with display monitor

Chair on the flying bridge for ornithologists/marine mammal biologists

Constant temperature room set at 22°C ± 1°C (71.5°F ± 2°F)

Seabird CTD interfaced with deck units and PC

Inclinometer for bongo tows

Turner 10-AU fluorometer and flow through seawater system

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

Modified-Cobb mid-water trawl nets (2)

1.5 m x 2.1 m (5’ x 7') steel V-doors, mounted (1 pair)

12.7 mm (1/2") x 55 m (180’) midwater trawl bridle cables (4)

Transfer cables, door legs, and rigging hardware for midwater trawl net

STM Products DDD 03 acoustic pingers

Bongo net frame, nets, and codends

Bongo weights (75 lbs)

Half-meter frame, net and codend

Flowmeters

Long-handled dipnet for jellyfish

Specimen sorting, enumeration, and preservation equipment

Simrad EK-60 GPTs and software

TDRs

PC laptop computers running Windows OS

Microscopes, dissecting equipment, and field guides

Nekton sorting and enumeration equipment

Large coolers

Foul weather gear

Quart and gallon jars

MSDS sheets for all chemicals

Manta neuston net - (1.0 × 0.4 m mouth) with flow meters

5-gallon buckets and lids

Large square sieve

Bucket with holes

Squeeze bottles for seawater

Long-handled dip-nets for jellyfish

Go-Pro video cameras and housings

In situ Ichthyoplankton Imaging System (*IS*IIS) + fiber optic winch from OSU ship operations (1) deck footprint – (7' x 8' x 5')

*IS*IIS toolboxes (2)

*IS*IIS fiber optic spool

*IS*IIS computer – footprint (3' x 3' x 2') housing a power modulator, modems, and computer (1)

12-TB RAID data arrays with e-SATA cables (4)

*IS*IIS data backup accoutrements (e.g., hard drives, docking stations, surge protectors, etc.)

Desktop computer with MOCNESS data acquisition software (1)

Computer monitors 20-24" (4)

12-TB RAID data arrays - footprint (20 x 12 x 16 cm) (4)

Coupled MOCNESS system (4.5m x 4m)

MOCNESS 4-m^2 nets (10) + cod-ends (10)

MOCNESS 1-m^2 nets (10) + cod-ends (10)

MOCNESS deck box – footprint (10"x 10"x 3") (1)

MOCNESS battery chargers (1)

5-gallon buckets (10)

Brass sieves (3)

MOCNESS sampling accoutrements (e.g., zip ties, duct tape, forceps, squirt bottles, etc.)

1-L plastic jars with screw-top lids (200)

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**
Buffered Formaldehyde solution (37%)	3 x 1L	Alkalinity, Stored in ship chem. locker	Toby Auth	F/E
Ethanol (95%)	20 gal	Stored in ship chem. locker	Toby Auth	F/E

C. Chemical safety and spill response procedures

F/E: Formalin/Formaldehyde/Ethanol

- 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 sawdust.

Inventory of Spill Kit supplies

Product Name	Amount	Chemicals it is useful against	Amount it can clean up
Form. Solidifier	2 - L	Formaldehyde	50 gal.
Neutralizer Pads	50	Formaldehyde	50 gal.

D. Radioactive Materials

No Radioactive Isotopes are planned for this project.

V. ADDITIONAL PROJECTS

A. Supplementary ("Piggyback") Projects

As timing and schedule allows, we will work with the chartered vessel R/V Ocean Starr doing paired trawling and gear comparison work for 1-2 days off the mouth of the Columbia River.

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.

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 conducting a meeting no earlier than 24 hours before or seven 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 http://www.omao.noaa.gov/fleeteval.html and provides a "Submit" button at the end of the form. 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 ship, 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 three 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 (e.g., a variety of sandwich items, cheeses, fruit, milk, juices, etc.) 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 one business day of your approval. The 'Send Tab" function will be accessible for 30 days.

Contact information:

Regional Director of Health Services
Marine Operations Center – Pacific
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 three days of embarking.

F. Foreign Nationals

All foreign national access to the vessel shall be in accordance with NAO 207-12 and RADM De Bow's March 16, 2006 memo (http://deemedexports.noaa.gov). National Marine Fisheries Service personnel will use the Foreign National Registration System (FNRS) to submit requests for access to NOAA facilities and ships. The Departmental Sponsor/NOAA (DSN) is responsible for obtaining clearances and export licenses and for providing escorts required by the NAO. DSNs should consult with their designated Line Office Deemed Export point of contact to assist with the process.

Foreign National access must be sought not only for access to the ship involved in the project but also for any Federal Facility access (NOAA Marine Operations Centers, NOAA port offices, USCG Bases) that foreign nationals might have to traverse to gain access to and from the ship. The following are basic requirements.

Full compliance with NAO 207-12 is required.

Responsibilities of the Chief Scientist:

1. Provide the Commanding Officer with the email generated by the Servicing Security Office granting approval for the foreign national guest's visit. (For NMFS-sponsored guests, this email will be transmitted by FNRS.) This email will identify the guest's DSN and will serve as evidence that the requirements of NAO 207-12 have been complied with.

2. Escorts – The Chief Scientist is responsible to provide escorts to comply with NAO 207-12 Section 5.10, or as required by the vessel's DOC/OSY Regional Security Officer.

3. Ensure all non-foreign national members of the scientific party receive the briefing on Espionage Indicators (NAO 207-12 Appendix A) at least annually or as required by the Servicing Security Office.

4. Export Control - Ensure that approved controls are in place for any technologies that are subject to Export Administration Regulations (EAR).

The Commanding Officer and the Chief Scientist will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.

Responsibilities of the Commanding Officer:

1. Ensure only those foreign nationals with DOC/OSY clearance are granted access.

2. Deny access to OMAO platforms and facilities by foreign nationals from countries controlled for anti-terrorism (AT) reasons and individuals from Cuba or Iran without written approval from the Director of the Office of Marine and Aviation Operations and compliance with export and sanction regulations.

3. Ensure foreign national access is permitted only if unlicensed deemed export is not likely to occur.

4. Ensure receipt from the Chief Scientist or the DSN of the FNRS or Servicing Security Office email granting approval for the foreign national guest's visit.

5. Ensure Foreign Port Officials, e.g., Pilots, immigration officials, receive escorted access in accordance with maritime custom to facilitate the vessel's visit to foreign ports.

6. Export Control - 8 weeks in advance of the project, provide the Chief Scientist with a current inventory of OMAO controlled technology onboard the vessel and a copy of the vessel Technology Access Control Plan (TACP). Also notify the Chief Scientist of any OMAO-sponsored foreign nationals that will be onboard while program equipment is aboard so that the Chief Scientist can take steps to prevent unlicensed export of Program controlled technology. The Commanding Officer and the Chief Scientist will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.

7. Ensure all OMAO personnel onboard receive the briefing on Espionage Indicators (NAO 207-12 Appendix A) at least annually or as required by the Servicing Security Office.

Responsibilities of the Foreign National Sponsor:

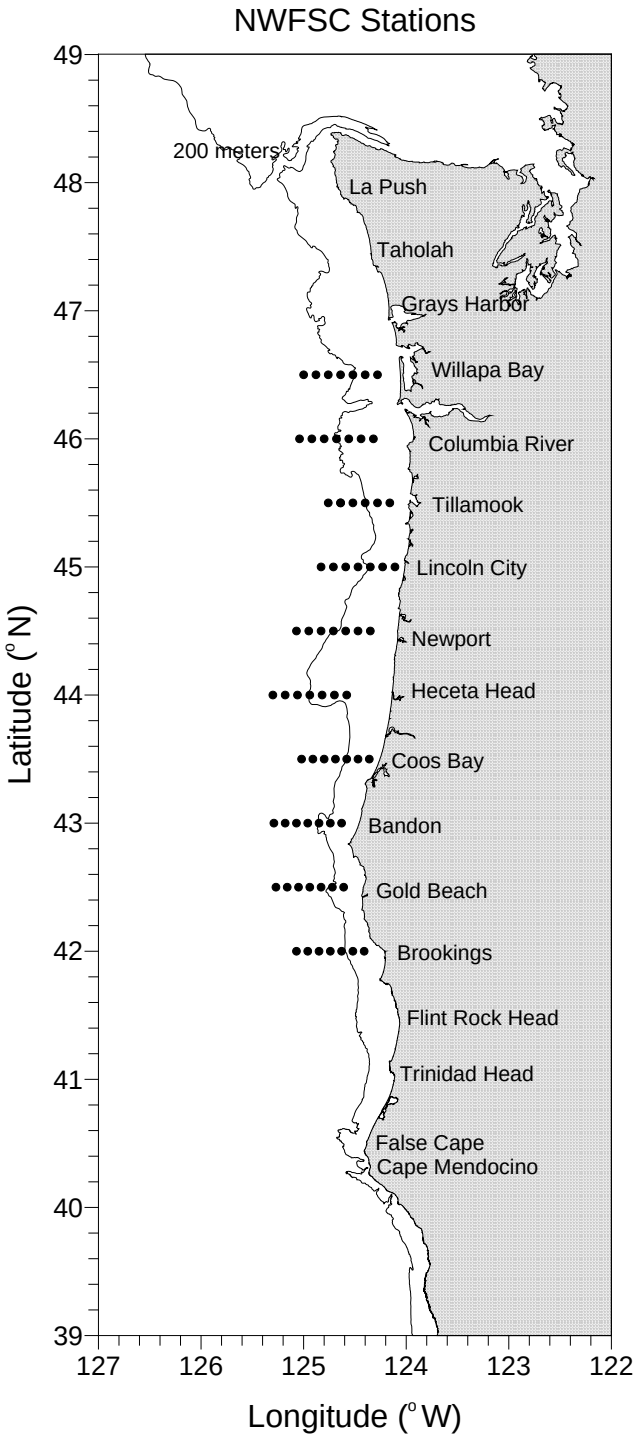
1. Export Control - The foreign national's sponsor is responsible for obtaining any required export licenses and complying with any conditions of those licenses prior to the foreign national being provided access to the controlled technology onboard regardless of the technology's ownership.

2. The DSN of the foreign national shall assign an on-board Program individual, who will be responsible for the foreign national while on board. The identified individual must be a U.S. citizen and a NOAA or DOC employee. According to DOC/OSY, this requirement cannot be altered.

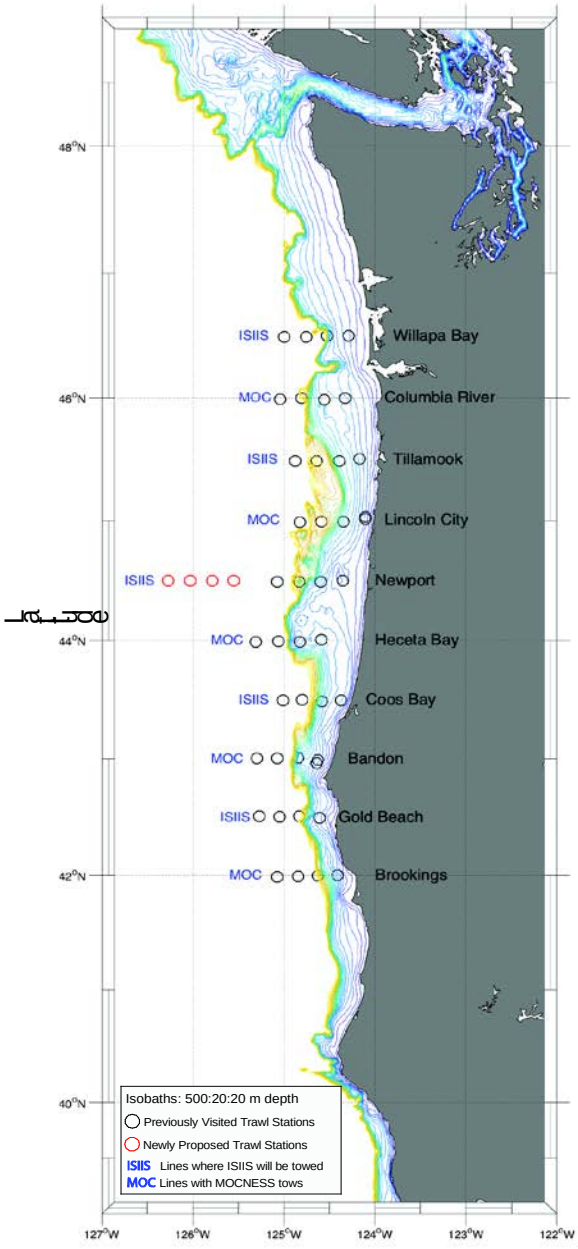
3. Ensure completion and submission of Appendix C (Certification of Conditions and Responsibilities for a Foreign National

VIII. APPENDICES

APPENDIX I.I: MAP OF MIDWATER TRAWL AND CTD STATION LOCATIONS



APPENDIX I.II MAP OF MIDWATER TRAWL STATIONS AND TRANSECTS FOR MOCNESS (MOC) AND ISIIS; Isobaths are in increments of 20 m from 500 m depth.



APPENDIX II: MIDWATER TRAWL AND CTD STATION LOCATIONS

BROOKINGS

Latitude		Longitude	
42°	0’	124°	24.6’
42°	0’	124°	31.2’
42°	0’	124°	37.8’
42°	0’	124°	44.4’
42°	0’	124°	51’
42°	0’	124°	57.6’
42°	0’	125°	4.2’

GOLD BEACH

Latitude		Longitude	
42°	30’	124°	36.6’
42°	30’	124°	43.2’
42°	30’	124°	49.8’
42°	30’	124°	56.4’
42°	30’	125°	3’
42°	30’	125°	9.6’
42°	30’	125°	16.2’

BANDON

Latitude		Longitude	
43°	0’	124°	37.8’
43°	0’	124°	44.4’
43°	0’	124°	51’
43°	0’	124°	57.6’
43°	0	125°	4.2’
43°	0	125°	10.8’
43°	0	125°	17.4’

COOS BAY

Latitude		Longitude	
43°	30	124°	21.6’
43°	30	124°	28.2’
43°	30	124°	34.8’
43°	30’	124°	41.4’
43°	30’	124°	48’
43°	30’	124°	54.6’
43°	30’	125°	1.2’

HECETA HEAD

Latitude		Longitude	
44°	0’	124°	34.8’
44°	0’	124°	42’
44°	0’	124°	49.2’
44°	0’	124°	56.4’
44°	0’	125°	3.6’
44°	0’	125°	10.8’
44°	0’	125°	18’

NEWPORT

Latitude		Longitude	
44°	30’	124°	21’
44°	30’	124°	28.2’
44°	30’	124°	35.4’
44°	30’	124°	42.6’
44°	30’	124°	49.8’
44°	30’	124°	57’
44°	30’	125°	4.2’
44°	30’	125°	11.4’
44°	30’	125°	18.6’
44°	30’	125°	25.8’
44°	30’	125°	33’
44°	30’	125°	40.2’
44°	30’	125°	47.4’
44°	30’	125°	54.6’
44°	30’	126°	01.8’
44°	30’	126°	09’
44°	30’	126°	16.2’
44°	30’	126°	23.4’

LINCOLN CITY

Latitude		Longitude	
45°	0’	124°	6.6’
45°	0’	124°	13.8’
45°	0’	124°	21’
45°	0’	124°	28.2’
45°	0’	124°	35.4’
45°	0’	124°	42.6’
45°	0’	124°	49.8’

TILLAMOOK

Latitude		Longitude	
45°	30’	124°	9.6’

45°	30’	124°	16.8’
45°	30’	124°	24’
45°	30’	124°	31.2’
45°	30’	124°	38.4’
45°	30’	124°	45.6’
45°	30’	124°	52.8’

COLUMBIA RIVER

Latitude		Longitude	
46°	0’	124°	19.2’
46°	0’	124°	26.4’
46°	0’	124°	33.6’
46°	0’	124°	40.8’
46°	0’	124°	48’
46°	0’	124°	55.2’
46°	0’	125°	2.4’

WILLAPA BAY

Latitude		Longitude	
46°	30’	124°	16.8’
46°	30’	124°	24’
46°	30’	124°	31.2’
46°	30’	124°	38.4’
46°	30’	124°	45.6’
46°	30’	124°	52.8’
46°	30’	125°	0’

TAHOLAH

Latitude		Longitude	
47°	0’	124°	35.4’
47°	0’	124°	42.6’
47°	0’	124°	49.8’
47°	0’	124°	57’
47°	0’	125°	4.2’
47°	0’	125°	11.4’

GRAYS HARBOR

Latitude		Longitude	
47°	30’	124°	42.6’
47°	30’	124°	49.8’
47°	30’	124°	57’
47°	30’	125°	4.2’
47°	30’	125°	11.4’
47°	30’	125°	18.6’

Appendix III. NWFSC Marine Mammal Mitigation Procedures

The following suite of mitigation measures will be employed by the NWFSC during fisheries research. These procedures are the same whether the survey is conducted on board a NOAA vessel or charter vessel. The procedures described are based on protocols used during previous research surveys and/or best practices developed for commercial fisheries using similar gear. The NWFSC continually reviews its procedures and investigates options for incorporating new mitigation measures and equipment into its on-going survey programs. Evaluations of new mitigation measures include assessments of their effectiveness in reducing risk to marine mammals but any such measures must also pass safety considerations and allow survey results to remain consistent with previous data sets. Additional mitigation measures that are being proposed for further development and implementation by the NWFSC during the five-year life of the authorization are detailed in Section 11.2.

1.1 Mitigation Measures for Marine Mammals during Research with Trawl Gear

The following protocols apply to all NWFSC surveys and research projects using surface trawl gear (Nordic 264 Trawl), mid-water trawl gear (Modified Cobb Midwater Trawl, Aleutian Wing Midwater Trawl, and commercial trawl gear), and bottom trawl gear (commercial-sized bottom trawls, double rigged shrimp trawl, Poly Nor'easter bottom trawl, modified Aberdeen bottom trawl, and 2-meter beam trawl). However, the great majority of marine mammals taken in NWFSC research gear in the past have been caught in surface trawl gear. While these mitigation measures have been in place for all trawl surveys since 2009, surveys using surface trawl gear have implemented monitoring and avoidance of marine mammal practices for many years prior to 2009 and have a strong culture of marine mammal mitigation as part of their survey operations. Where differences between implementation of these measures exist between surface trawl surveys and all other trawl surveys, they are noted below.These measures are relevant to all protected species, including sea turtles, but in actual practice they apply primarily to marine mammals because sea turtles are rarely seen during NWFSC surveys and have never been caught in NWFSC research gear. Note that the NWFSC conducts joint projects with the SWFSC (i.e., the joint hake-sardine integrated acoustics-trawl survey). During joint surveys, the mitigation measures related to gear deployment for sardine sampling (conducted at night) are the responsibility of the SWFSC scientific team under SWFSC marine mammal protocols, and the mitigation measures related to gear deployment for hake (generally conducted during the day) are the responsibility of the NWFSC scientific team using the marine mammal protocols described below.

1.1.1 Monitoring methods

- The Captain and bridge crew monitor for marine mammals during transit and, on surface trawl surveys, are joined by designated members of the scientific party assigned to watch for marine mammals as part of the pre-set protocols as the vessel approaches a station. Detection of marine mammals is by visual observation with the aid of bridge binoculars as necessary. In general, average effective observation distance is about 500 meters from the vessel. A number of factors influence the ability of observers to detect marine mammals, including, but not limited to; the species, size, and numbers of animals present, their distance from the vessel and behavior, lighting conditions, weather conditions, sea state, and the specific vessel being used.

- For trawl operations at night, deck lights are used when crew are present but only illuminate the immediate area around the vessel; potential detection distances of marine mammals are small.
- For midwater trawl surveys, the period of marine mammal monitoring begins about 10 minutes before the vessel is on station and extends continuously until the net has been retrieved. There is always a minimum of three and up to eight observers assigned to monitor for marine mammals, including crew on the bridge, depending on the numbers of marine mammals that have been seen during the station approach or are expected at that particular place and season. Any indication of marine mammal presence and risk elicits the assignment of additional crew to stand watch in different locations around the ship, with the goal of providing 360 degree monitoring coverage around the vessel.
- For mid-water trawls, the Chief Scientist must confirm with the Captain or the bridge that no marine mammals have been seen within 500 meters of the ship or appear to be approaching the ship during a 10-minute period prior to the deployment of any trawl gear. The 10-minute observation period is conducted by the Captain and bridge crew and typically occurs during transit prior to arrival at the sampling station, but may also include time on station if other types of gear or equipment (e.g., bongo nets) are deployed before the trawl.
- During standard trawl operations, at least some of the trackline to be towed is typically traversed prior to setting gear in order to check for hazards along the transect or, in the case of bottom trawls, to scan the bottom with echosounders to see if it is trawlable. On surface trawl surveys, CTD casts and plankton/bongo net hauls are made prior to setting the trawl. These activities can take 25-35 minutes after the vessel arrives on station, depending on water depth, and monitoring for marine mammals continues throughout these activities. Mid-water trawls and bottom trawls may not deploy other gears before deploying their trawl gear but reconnaissance of the trawl line often takes 10-15 minutes after arriving on station. In addition, once the decision is made to deploy the trawl gear, monitoring continues while the net is unspooled, which may take about 10 minutes. Before the trawl doors are deployed, the net floats on the surface behind the vessel but it is closed and actions can be taken if marine mammals are sighted near the ship (see operational procedures below). Thus, the monitoring period for marine mammals begins before the vessel arrives on station and extends continuously through gear deployment, typically for over 30 minutes on all trawl types.
- Monitoring for marine mammals continues after the trawl doors are deployed with a minimum of two observers, including members of the science party. Care is taken to provide some rest periods for observers to avoid observer fatigue. Lookouts divide up the area around the boat to ensure at least one person is looking at each sector around the vessel. At least two pairs of binoculars are on board and available for observers to verify a potential sighting. Lookouts search for any surface sign of marine mammal (e.g. blow, splash, dorsal fin) between the times when the trawl mouth is first deployed in the water until the time the trawl mouth is recovered on deck. Lookouts immediately alert the Captain and Chief Scientist as to their best estimate of the following information, relative to the ship's position, about any marine mammal or suspected marine mammal:
    - Distance
    - Bearing

- Type/species
- Number of individuals
- Direction of travel or behavior

- For surface trawls, monitoring all around the ship continues until the trawl retrieval begins, at which point the focus is on the stern and the trawl itself. For mid-water and bottom trawls, once the trawl doors are deployed the net sinks to the intended depth. Based on the lack of historical interactions with these gear types and marine mammals during this period, the risk of interactions appears to be very low and monitoring efforts are reduced to the bridge crew while crew attend to other duties.
- In the case of surveys conducted aboard smaller research or chartered fishing vessels, the number of individuals and the amount of their time that may be devoted to serving as marine mammals lookouts may be limited. Under these circumstances more reliance may be placed on the Chief Scientist to maintain a watch.

1.1.2 Operational procedures

- "Move-On" Rule. If any marine mammals are sighted within 1 NM of the vessel and are considered at risk of interacting with the vessel or research gear, or appear to be approaching the vessel and are considered at risk of interactions, the vessel has several options depending on the circumstances of the sighting. First, the set can be delayed while the vessel remains on site for some time period, usually at least 10 minutes, to see if they move off. If the marine mammals move off, the monitoring crew will conduct another 10-minute watch after the animals leave and, if no additional sightings are made, the trawl gear may be deployed. Second, the vessel may be moved away from the animals to a different section of the sampling area if the animals appear to be at risk of interaction with the gear. After the vessel is moved, monitoring protocols continue as reconnaissance of the new location is conducted and any other scientific gear is deployed (CTDs, bongos, etc.), a period of at least 10 minutes since moving to the new location. If no marine mammals are sighted that are considered at risk of interacting with the vessel or research gear, the trawl gear may be deployed.
- After moving on, if marine mammals are still visible from the vessel and appear to be at risk, the officer on watch, in consultation with the Chief Scientist, may decide to move again or to skip the station. The officer on watch will consult with the Chief Scientist or other designated scientist (identified prior to the voyage and noted on the project plan) and other experienced crew as necessary to determine the best strategy to avoid potential takes of marine mammals. Strategies are based on the species encountered, their numbers and behavior, their position and vector relative to the vessel, and other factors. For instance, a whale transiting through the area and heading away from the vessel may not require any move, may require a short delay before the gear is set, or may require only a short move from the initial sampling site, while a pod of dolphins gathered around the vessel may require a longer move from the initial sampling site or possibly cancellation of the station if the dolphins follow the vessel. Trawl gear is not deployed if marine mammals have been sighted within 500 meters of the ship unless those animals do not appear to be in danger of interactions with the trawl, as determined by the judgment of the Chief Scientist or officer on watch.

- During trawl operations, the most appropriate response to avoid incidental take is determined by the professional judgment of the officer on watch, in consultation with the Chief Scientist or other designated scientist and other experienced ship's crew and science crew as necessary. In general, the critical distance for deciding to retrieve the net early is an observation of a marine mammal within 500 meters of the ship or marine mammals sighted at a greater distance but clearly closing on the vessel. These judgments take into consideration the species, numbers, and behavior of the animals, type of net being used, the status of the trawl net operation (net opening, depth, and distance from the stern), the time it would take to retrieve the net, and safety considerations for changing speed or course. Because the surface trawl is more prone to capturing marine mammals, based on the historical experience of the NWFSC, decisions on what course of action to follow may be different than for a mid-water or bottom trawl. In some situations, such as whale sightings, the risk of adverse interactions may be diminished by continuing to trawl until the marine mammals have left the area before beginning haul-back operations. In other situations, swift retrieval of the net may be the best course of action. If the Chief Scientist is not on watch during a trawl, any member of the scientific party has the authority to halt trawling operations if a marine mammal is observed in the vicinity and considered to be at risk. The Chief Scientist does not have to be notified before action is taken.
- All monitoring periods are documented in a logbook or on data sheets maintained by scientific party. Pertinent information includes: 1) Confirmation that the marine mammal monitoring protocol was completed prior to deployment of gear, 2) Records of any stations dropped because of the presence of marine mammals, and 3) Species or types of marine mammals observed (if possible) within 500 meters of the ship that cause an adjustment in our set protocols (e.g., extending of observation period).
- Logbooks from surface trawling operations indicate that, from 2008 through 2012, the NWFSC shortened 9.2% of tows and had to skip (not set at all) 0.9% of surface tows (out of a possible 694 tows). For comparison, 4 tows (0.6%) of the 694 conducted caught marine mammals. Shortened or skipped tows may also occur due to masses of jellyfish or gear complications but most of these incidents were because of the presence of marine mammals. The logbook data do not include the numbers of delays or moves caused by the presence of marine mammals but the move-on rule is implemented on a regular basis, especially during May and June when migratory marine mammals are in the area.
- Care is taken when emptying the trawl, including opening the cod end as close as possible to the deck of the checker (or sorting table) in order to avoid damage to marine mammals that may be caught in the gear but are not visible upon retrieval. The gear is emptied as quickly as possible after retrieval in order to determine whether or not marine mammals are present.

1.1.3 Tow duration

- Standard tow durations are typically 30 minutes or less at the targeted depth, excluding deployment and retrieval time, to reduce the likelihood of attracting and incidentally taking marine mammals. Note that retrieval and deployment times can exceed trawling time, depending on the gear. These tow durations decrease the opportunity for curious marine mammals to find the vessel and investigate. The resulting tow distances are typically 1 to 2 nautical miles, depending

on the survey and trawl speed. Additionally, although the NWFSC has never caught sea turtles in trawl gear, short tow times reduce the likelihood that incidentally captured sea turtles would drown.

1.1.4 Acoustic pinger devices

- For all trawls, two pairs of acoustic signaling devices known as "pingers" are installed near the net opening, one on either side. Acoustic pingers, when submerged, emit an underwater pulse of sound, or "ping". The intent of these devices is to discourage marine mammals from entering the net (see Appendix A in the accompanying EA).
- Pingers are manufactured by a number of companies but two brands typically used by the NWFSC include the Aquatec Subsea Limited, model AQUAmark, and Fumunda Marine, models F10 and F70. Pingers remain operational at depths between 10 m and 200 m. Tones range from 200 to 400 microseconds in duration, repeated every 5 or 6 seconds, with variable frequency of 10-160 kHz. The pingers generate a maximum sound pressure level of 145 decibels (dB) root mean square referenced to 1 micropascal at one meter.

1.1.5 Vessel Strike Avoidance

- When research vessels are actively sampling, vessel speeds are less than four knots, a speed at which the probability of collision with large whales and other marine mammals is negligible. When transiting between sampling stations, NWFSC research vessels cruise at 6-14 knots, but average about ten knots. This is slower than marine mammals can swim so the risk of collisions and serious injury or mortality is still very low. In addition, NWFSC research vessel captains and crew watch for marine mammals while underway during daylight hours and take necessary actions to avoid them. There are currently no Marine Mammal Observers (MMOs) aboard the vessels dedicated to watching for marine mammals to minimize the risk of collisions, although the large NOAA vessels operated by the NOAA Corps (e.g., R/V *Bell M. Shimada*) include one bridge crew dedicated to watching for obstacles at all times, including marine mammals. When research vessels are operating in areas and times when many marine mammals have been seen, additional crew may be brought up to the bridge to monitor for whales and captains may also reduce speed to improve the chances of observing whales and avoiding them. At any time during a survey or in transit, any bridge personnel that sights marine mammals that may intersect with the vessel course immediately communicates their presence to the helm for appropriate course alteration or speed reduction as possible to avoid incidental collisions, particularly with large whales.