Project Instructions

Date Submitted: October 13, 2016

Platform: NOAA Ship *Bell M. Shimada*

Project Number: SH-17-01 (OMAO)

Project Title: 2017 Spawning Hake Stock Acoustic-Trawl Survey

Project Dates: January 11, 2017 to February 12, 2017

Prepared by: PARKER-STETTER.SANDRA.LEE.1501012510 Digitally signed by PARKER-STETTER.SANDRA.LEE.1501012510 Date: 2016.12.19 08:36:58 -08'00' Dated: _____

Sandra Parker-Stetter
Survey Lead and Research Fishery Biologist
Northwest Fisheries Science Center (NWFSC)/Fishery Resource Analysis and Monitoring (FRAM) Division/Fisheries Engineering and Acoustic Technologies (FEAT)

Approved by: HUFNAGLE.LAWRENCE.CJR.1365818246 Digitally signed by HUFNAGLE.LAWRENCE.CJR.1365818246 Date: 2016.12.16 08:58:55 -08'00' Dated: 12/16/16

Lawrence Hufnagle
Team Lead
NWFSC/FRAM Division/FEAT

Approved by: MCCLURE.MICHELLE.M.1365819889 Digitally signed by MCCLURE.MICHELLE.M.1365819889 Date: 2016.12.16 11:54:07 -08'00' Dated: _____

Michelle McClure
Division Director
NWFSC/FRAM Division

Approved by: STEIN.JOHN.E.1365884540 Digitally signed by STEIN.JOHN.E.1365884540 Date: 2016.12.16 13:20:49 -08'00' Dated: _____

John Stein
Science and Research Director
NWFSC

Approved by: Digitally signed by PARKER.BRIAN.W.1076514042 Date: 2016.12.28 11:47:25 -08'00' Dated: _____

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

I. Overview

A. Brief Summary and Project Period

2017 Spawning Hake (*Merluccius productus*) Stock Acoustic-Trawl Survey (hereafter "Winter Survey") will (1) characterize the winter distribution of Pacific Hake (hereafter "hake"), hake aggregations, and the fish within those aggregations, to support evaluation of the feasibility/design of a winter hake biomass survey and (2) increase our understanding of the winter ecology and biology of hake in the CCE. This is a research survey. The survey period is January 11 through February 12, 2017.

B. Days at Sea (DAS)

Of the 30 DAS scheduled for this project, 0 DAS are funded by an OMAO allocation, 30 DAS are funded by a Line Office allocation and 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 2017 winter survey will span the west coast of the U.S. from approximately latitude 31.6°N (south of San Diego, CA along U.S. EEZ) to approximately latitude 44.6°N (Newport, OR) (**Appendix 1**, **Figure 1**; waypoints are listed in **Appendix 2**, **Table 1**). Eastern and western extents will ordinarily range from the ≥30 m isobath to either the 3,000 or 4,500 m isobaths, but not to exceed the 6,000 m isobath. Remaining time, if any, at the end of the planned transects will be used to survey north of Newport before the end of the survey.

D. Summary of Objectives

The primary goals of the survey are to characterize the winter distribution of hake, the hake aggregations, and the fish within those aggregations in order to support an evaluation of the feasibility of a future winter hake biomass survey. The project will use data from an integrated acoustic and trawl survey off the west coast of the U.S. from approximately south of San Diego, CA (latitude 31.6°N along the U.S. EEZ) to approximately Newport, OR (latitude 44.6°N). Our objectives are to:

- Conduct 24-hour acoustic, trawl, oceanographic, and zooplankton operations.
- Continuously sample multi-frequency acoustic backscatter data using the ship's Simrad EK60 scientific echosounders (18, 38, and 120 kHz) system. Simrad EK80 broadband echosounders will operate at 70 and 200 kHz. Collectively, the acoustic data will be used to characterize the distribution of hake and describe hake aggregations.

    - Collect acoustic data along pre-planned diagonal transects along the coast (hereafter “transects”).

    - Collect acoustic data over hake aggregations, where the design will be determined based on the observed aggregation (hereafter “adaptive transects”).

- Collect stationary acoustic data 1 hour before sunrise/sunset to 1 hour after sunrise/sunset to evaluate migration (vertical and/or horizontal) of hake aggregations.

- Conduct daytime and nighttime trawling (**Appendices 3** and **4**) to verify hake aggregations and obtain specimens for biological data (length, sex, maturity, age, ovaries, diet, genetics, etc.).

    - Multiple trawl samples may be taken on a single hake aggregation to evaluate heterogeneity in sex, maturity, etc.

    - Record data from shipboard net mensuration gear to evaluate trawl performance

- Use a portable x-ray system (**Appendices 5** and **6**) to take radiographic images of fish swimbladders

- Optically verify the presence of non-hake scatterers during trawling using a video camera and light(s) attached to the upper panel of the midwater trawl approximately 20-30 meters forward of the codend.

- Conduct vertical casts with the ship’s CTD rosette, outfitted with a dissolved oxygen sensor and Niskin bottles, at pre-planned stations along transects and/or at trawl locations (**Appendix 2**, **Table 2**, **Table 4**, and **Table 5**). These data will be used to describe the vertical and horizontal distributions of hake relative to oceanographic conditions. Niskin water collections will be filtered for evaluation of environmental DNA (eDNA).

- Conduct underway CTD (uCTD) casts at pre-planned stations along transects (**Appendix 2**, **Table 6**). These data will be used to supplement oceanographic information obtained from the CTD rosettes and will be used to describe the distribution of hake relative to ocean conditions

- Continuously collect Acoustic Doppler Current Profiler (ADCP) data along transects. These data will be used to describe the distribution of spawning hake relative to currents.

- Conduct vertical ring net zooplankton tows at pre-planned stations along transects (**Appendix 1**, **Figure 1**; stations are listed in **Appendix 2**, **Table 2**) and bongo net tows (**Appendix 1**, **Figure 1**; stations are listed in **Appendix 2**, **Table 3**). These data will be used to describe the winter distribution of zooplankton species.

- Continuously sample sea-surface temperature, salinity, and chlorophyll-a using the ship's thermosalinograph and fluorometer. These data will be used to estimate the physical oceanographic habitats for spawning hake.
- Continuously sample air temperature, barometric pressure, and wind speed and direction using the ship's integrated weather station.
- Collect broadband acoustic data with EK80 echosounders operating at central frequencies of 70 and 200 kHz. The use of the EK80s will require temporary modification to the ship's EK60 set-up.

E. Participating Institutions:

NOAA/NMFS/NWFSC, 2725 Montlake Blvd. E, Seattle, WA 98112

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

Leg I: 1/11/2017 to 1/26/2017

Name (Last, First)	**Title**	**Date Aboard**	**Date Disembark**	**Gender**	**Affiliation**	**Nationality**
Parker-Stetter, Sandy	Acoustician/Chief Scientist (CS)	1/8/17		F	NWFSC	U.S.
de Blois, Steve	Acoustician/Field Party Chief (FPC)	1/8/17		M	NWFSC	U.S.
Thomas, Rebecca	Acoustician	1/8/17	1/27/17	F	NWFSC	U.S.
Snow, Ben	Acoustician	1/10/17	1/27/17	M	DFO	Canada
Chappell, Aaron	Lead Biologist	1/11/17	1/27/17	M	NWFSC	U.S.
Simon, Victor	Lead Biologist	1/10/17	1/27/17	M	NWFSC	U.S.
Donovan, Cassandra	Biologist	1/10/17	1/27/17	F	NWFSC	U.S.
Tolimieri, Nick	Biologist	1/10/17	1/27/17	M	NWFSC	U.S.
Bash, Jeff	Biologist	1/10/17	1/27/17	M	NWFSC	U.S.
Bair, Brittney	Biologist	1/10/17	1/27/17	F	OSU	U.S.
Manning, Rachel	eDNA Scientist & Biologist	1/10/17	1/27/17	F	UW	U.S.

Leg II: 1/30/2017 to 2/12/2017

Name (Last, First)	Title	Date Aboard	Date Disembark	Gender	Affiliation	Nationality
Parker-Stetter, Sandy	Acoustician/Chief Scientist (CS)		2/14/17	F	NWFSC	U.S.
de Blois, Steve	Acoustician/Field Party Chief (FPC)		2/14/17	M	NWFSC	U.S.
Chu, Dezhang	Acoustician		2/14/17	M	NWFSC	U.S.
Stanley, Chelsea	Acoustician	1/29/17	2/13/17	F	DFO	Canada
Draper, Doug	Lead Biologist	1/29/17	2/12/17	M	NWFSC	U.S.
Johnson, Melanie	Lead Biologist	1/29/17	2/12/17	F	NWFSC	U.S.
Detering, Jackie	Biologist	1/29/17	2/13/17	F	DFO	Canada
Kamikawa, Dan	Biologist	1/29/17	2/12/17	M	NWFSC	U.S.
McVeigh, Jon	Biologist	1/29/17	2/13/17	M	NWFSC	U.S.
Rubio, Uriel	Biologist	1/29/17	2/13/17	M	Centro Interdisciplinario en Ciencias Marinas	Mexico
Wells, Abigail	eDNA Scientist	1/29/17	2/13/17	F	NWFSC	U.S.

Note, if approved by the Chief Scientist and the Commanding Officer, personnel transfers via a chartered small craft, to be arranged by the Northwest Fisheries Science Center, may occur during any or all of the project legs.

G. Administrative

1. Points of Contacts:

NWFSC

Sandra Parker-Stetter, Survey Lead and Chief Scientist, 2725 Montlake Boulevard E, Seattle, WA 98112, (206) 861-1250, sandy.parker-stetter@noaa.gov

Alternate: Larry Hufnagle, 2725 Montlake Boulevard E, Seattle, WA 98112, (206) 860-3346, lawrence.c.hufnagle@noaa.gov

Alternate: Alicia Billings, 2032 Marine Science Drive, Newport, OR 97365, (541) 867-0507, alicia.billings@noaa.gov

Ops Officer *Bell M. Shimada*

LT Sara Sheehan, 2002 SE Marine Science Drive, Newport, OR 97365, (541) 867-8775, ops.bell.shimada@noaa.gov

2. Diplomatic Clearances:

None needed as all work will occur in U.S. waters.

3. Licenses and Permits:

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

a. NMFS/WCR on January X, 2017 to Larry Hufnagle (SRP XX-2017) (in process, to be provided upon receipt)

b. NOAA/ONMS, January 2017 to Larry Hufnagle (MULTI-2017-00X) (in process, to be provided upon receipt)

c. CDFW, January 2017 to Michelle McClure (SC-XXXXX) (in process, to be provided upon receipt)

d. ODFW on XXX, 2017 to Larry Hufnagle (STP #XXXXX) (in process, to be provided upon receipt)

e. NMFS/NWR to the NWFSC. (Incidental Take Statement, #16337-3R, providing coverage for the take of ESA-listed fish)

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 Winter Survey will be conducted January 11, 2017 through February 12, 2017, aboard the NOAA Ship *Bell M. Shimada*. The survey will collect data that will be used to evaluate the feasibility of a future winter biomass survey of Pacific hake and to increase understanding of the winter ecology and biology of hake in the CCE.

Due to a potential loss of survey days should weather and sea state deteriorate, and because where/when hake will be found is unknown, the survey design is modular, with components that can be done in alternate orders. At-sea planning decisions will be made jointly by the Chief Scientist, Field Party Chief,

Operations Officer, and the Commanding Officer. Presented below is an optimal survey sequence.

Leg I of the project will start in Newport, OR where the ship will commence running the transects (**Appendix 1**, **Figure 1**; stations are listed in **Appendix 2**, **Table 1)** and conducting pre-planned CTD casts, (**Appendix 1**, **Figure 1**; stations are listed in **Appendix 2**, **Table 2**, **Table 4**, and **Table 5**), zooplankton vertical net tows (**Appendix 2**, **Table 2**), bongo net tows (**Appendix 2**, **Table 3**), and uCTD casts (**Appendix 2**, **Table 6**). If weather conditions are optimal, we may choose to conduct a drifting calibration outside of Newport.

When a potential hake aggregation is observed on the EK60 and/or EK80 echosounders, the ship will break transect and perform a midwater trawl to verify the composition of the aggregation. At the discretion of the Chief Scientist and/or Field Party Chief, additional adaptive transects to determine aggregation size and/or additional midwater trawls may be conducted on the aggregation. If the sampled aggregation is between planned CTD stations, a CTD cast may be conducted. As we will be collecting water for eDNA analysis, CTD casts will be completed at the end of the trawl path, if fish are still present, or adjacent to the trawl path. Upon completion of sampling, the ship will resume running the transects, and subsequent hake aggregations may be sampled in the manner described. If hake are observed at the western end of transects, the Chief Scientist and/or Field Party Chief, in consultation with the Office on Duty, may extend those transects offshore to a bottom depth not to exceed 6,000 m or a distance not to exceed the U.S. EEZ.

A calibration of the EK60 and EK80 echosounders are planned to occur during Leg 2, but may be conducted during Leg 1 if optimal weather and sea state conditions occur. The calibration may occur in Monterey Bay or near the Channel Islands (information from SWFSC on this location will be obtained by NWFSC prior to sailing), or drifting outside of Newport. The decision on calibration timing and location will be made jointly by the Chief Scientist, Commanding Officer, and the Operations Officer.

Leg II of the project will start in San Francisco, CA where the ship will resume running the transects and conducting pre-planned CTD casts, uCTD casts, and zooplankton vertical net tows at the Leg I break point. The same procedure for identifying hake aggregation with trawls and/or conducting adaptive transects to determine size, as described above, applies to Leg II operations.

If the planned operations will be completed ahead of scheduled, due to unused weather days and/or low catches of hake, the Chief Science and/or Field Party Chief may request that nearshore and/or offshore diagonals be added to the design or that the ship return to the northern portion of the survey area and adds transects to the north. CTD casts, uCTD casts, and midwater trawling would also occur if weather permits. All additions or modifications will be made in consultation with the Commanding Offer and Operations Officer.

Leg	Mission	Days	Date start	Date end
Staging	Staging in Newport, OR		1/8/17	1/11/17
I	Begin transects and planned operations at Newport, OR, plus 4 weather days		1/11/17	1/26/17
Inport	San Francisco, CA		1/26/17	1/30/17
II	Resume transects and planned operations at San Francisco, CA, plus 4 weather days		1/30/17	2/12/17
Inport	Newport, OR		2/12/17	
Destaging	Newport, OR		2/12/17	2/14/17

B. Staging and Destaging

Given the ship's schedule departure on January 11, 2017 (Wednesday), staging will begin in Newport, OR on either the morning of January 6, 2017 (Friday) or afternoon of January 8, 2017 (Sunday). We request that all science spaces be clean and ready for the Science Party by January 8, 2017. We also request that crane support be available to us on January 8, 2017 so that the Science Party has two full days for set-up prior to sailing on January 11, 2017. Support from the ship's ET will be required the morning of January 9, 2017 to allow set-up and testing of electronic and computer gear. As the Shimada is scheduled for a Fleet Inspection immediately prior to SH-17-01, we will coordinate staging operations and delivery of NWFSC/FEAT trawl nets with the Operations Officer to ensure these operations do not interfere.

Destaging will be in Newport, OR on February 12-14, 2017.

C. Operations

The following list of survey priorities includes detailed descriptions of the planned activities.

Priorities:

1. Daytime and nighttime: EK60/EK80 acoustic transects, adaptive transects when hake aggregations are observed, midwater trawling to sample observed aggregations, CTD rosette casts, uCTD casts, vertical zooplankton tows, bongo net tows, and ADCP data collection.

2. Crepuscular periods (± 1 hour from sunrise and sunset) when no hake aggregation is observed: EK60/EK80 acoustic transects, CTD rosette casts, vertical zooplankton tows, ADCP data collection, and EK80 data collection.

3. Crepuscular periods (± 1 hour from sunrise and sunset) when hake aggregation is observed: stationary EK60/EK80 data collection.

Planned activities:

a. Acoustic data collection

The EK60 and EK80 echosounder data collections and calibrations take priority over all other operations. Acoustic backscatter data will be collected with EK60s operating at 18, 38, and 120 kHz. EK80s will operate at 70 and 200 kHz.

The split-beam transducers are mounted on the ship's retractable centerboard. During the survey, the centerboard will be extended to lowered depth, which extends the transducers to ~9.15 m below the surface, to reduce interference from bubbles. Any changes to the centerboard depth will be reported to the Chief Scientist and recorded in the SCS.

The ADCP will be run continuously on all transects. CTDs will occur at planned stations along transects and, if conditions and time permit, at the location of each midwater trawl deployment. Zooplankton and bongo nets will be deployed at pre-planned stations on transects.

i. *Transducer inspection & cleaning:* Prior to the start of Leg I, the transducers must be visually inspected and cleaned, if necessary, by the Survey Technicians. The transducers must also be visually inspected and cleaned, if necessary, prior to the start of Leg II operations.

ii. *Ship's sounders:* The ship's echosounders and Doppler velocity log (DVL) should be secured as much as possible throughout the survey. When their use is necessary, the crew shall inform the Chief Scientist of any use of the vessel's sounders or DVL. They interfere with the signals received on the EK60s.

iii. *Calibration*: A calibration of the EK60 and EK80 echosounders will occur during Leg 2. If ideal conditions occur, the calibration may alternatively occur during Leg 1. The calibration will occur in Monterey Bay, near the Channel Islands, or drifting ooutside of Newport. Prior to the calibration, if conditions allow, the transducers will be inspected and cleaned, if necessary. CTD casts will be required before and after the calibration to determine local sound speed and absorption values. During the calibration, unless

the calibration is done drifting, the vessel should be anchored from the bow, and the water beneath the ship should be preferably 20-40 m deep and devoid of fish and other marine life. A tungsten carbide sphere with a known backscattering cross section will be positioned below the transducers and the acoustic returns will be measured.

iv. *Transects*: The survey design is modular to allow flexibility if weather conditions are unfavorable and to allow planning around where/when hake are found. The survey will occur between Newport, OR and south of San Diego, CA, with diagonal transects (**Appendix 1**, **Figure 1**) that extend from ≥30 m to 3,000 or 4,500 m bottom depth. Some shorter diagonals may extend from the ≥30 m contour to ~2,000 m contour (**Appendix 1**, **Figure 1**). Acoustic data will be collected along the transects 24 hours per day. Vessel speed will be standard survey speed as weather allows. If hake aggregations are detected acoustically at the offshore end of a transect, that line will be extended farther offshore until the ship reaches the end of the aggregations, plus an additional 0.5 nmi, with bottom depth not to exceed 6,000 m and distance not to exceed the U.S. EEZ. Additional modifications, based on the observed distribution of hake, may also occur in the field. All modifications will be made by the Chief Scientist and/or Field Party Chief in consultation with the Officer on Duty.

If weather days have been unused, or hake have not been located, transects may be extended further offshore during Leg I or II and/or additional diagonals may be added to the design. The Chief Scientist and/or Field Party Chief, in consultation with the Commanding Officer, may also choose to return to the northernmost point of the transects and survey additional transects northward.

If poor weather compromises completion of the survey at the planned time, or if modifications are necessary as hake have not been observed, provisions will be made by the Chief Scientist and/or Field Party Chief to adapt the remaining portion of the survey, by removing transects, increasing transect spacing, or by adjusting transect placement. These changes will be made in consultation with the Commanding Officer and Operations Officer. Planned waypoints defining the transects (listed in **Appendix 2**, **Table 1**) will be provided to the ship in Nobeltec format prior to sailing.

v. *Adaptive transects*: When a hake aggregation is confirmed by midwater trawling (see Biological data collection below), the Chief Scientist and/or Field Party Chief may choose to conduct a short series of adaptive transects designed in consultation with the

Officer on Duty. These transects will be used to determine the spatial extent and size of the hake aggregation. Upon completion of the adaptive transects, and any biological data collection associated with the hake aggregation, the ship shall resume surveying along the transects.

vi. *Acoustic data collection*: The Kongsberg Simrad KSync unit will be used to synchronize the pulse sequence from our instruments. The following acoustic instruments will be run and their data collected:

ADCP: Data from the ship's ADCP will be recorded continuously during the project. Operation of the ADCP should be synchronized with the trigger pulse from the Simrad EK60. Assistance of a Survey Tech will be needed for daytime and nighttime operations of the ADCP.

Simrad EK60: The EK60s will operate, using the ship's equipment, at 18, 38, and 120 kHz.

Simard EK80: The EK80s, with central frequencies of 70 and 200 kHz, will run continuously throughout the survey. Assistance from the ET will be needed to install the EK80 WBT boxes near the EK60 GPT boxes before the start of Leg I.

b. Biological data collection

A single type of biological sampling method will be used during both daytime and nighttime operations.

i. *Trawl sampling*: Trawl samples will provide the primary information for interpreting the acoustic data. During the day and night, four to six times over a 24-hour period, midwater and near-bottom sound scatterers will be sampled using an Aleutian Wing Trawl 24/20 (AWT). Trawl gear performance will be monitored for depth, net opening, and other parameters with a Simrad FS70 third-wire trawl sonar attached to the headrope and a Simrad ITI temperature-depth sensor. We request that the Survey Technicians FS70 be recorded for our later review. A temperature-depth recorder (Sea-Bird SBE 39) will also be deployed. The AWT will be deployed with a digital video camera system mounted in the net 20-30 meters forward of the codend on the top panel of the intermediate.

All fish and many invertebrates in each catch will be sorted to species, if possible, and the catch weighed on NWFSC provided scales. Individuals of certain species will be randomly selected for biological sampling (length, individual weight, sex, otolith

collection, ovary, etc.) or kept to complete special sampling requests. Some specimens, such as ovaries, will be preserved in 10% formalin. Others, such as otoliths, will be preserved in 50% ethanol and still others, such as fin clips, preserved in 95% ethanol. A list of current protocols is available upon request.

Large catches: For large catches, the catch will be randomly subsampled. The total catch weight will be determined by either weighing the entire catch in multiple dumps into the hopper using a NWFSC provided scale, using a NWFSC provided crane scale and creating multiple sample 'sections' using cinching straps, or other methods to be determined by the Wet Lab lead and the Chief Scientist.

ii. *X-ray images*: A portable x-ray machine will be used to take radiographic images of fish collected in the trawls. The Science Party will use the Constant Environment room for this purpose.

iii. *Marine mammal protocols*: Before deploying gear/nets that have a potential to cause a marine mammal "take", the Chief Scientist or Field Party Chief must determine whether any marine mammals are within 500 m of the planned deployment site. To accomplish, designated scientists should make observations for a minimum of 10 min prior to a deployment noting any mammals in the vicinity of the ship or moving towards the deployment site.

If there are marine mammals in the vicinity, the vessel will remain on site for a minimum of 10 minutes to see if they leave the vicinity (stand-down period). If the marine mammals leave, another 10-minute watch will be conducted (restarting the clock at the end of the stand-down period). If no additional marine mammals are sighted, the gear/nets may be deployed. If the marine mammals do not leave the vicinity or if they reappear during the second 10-minute watch, the site may be abandoned and the vessel may proceed to an alternate site, unless the Chief Scientist and/or Field Party Chief chooses to conduct an additional 10-minute watch.

A log documenting the marine mammal watches is required to be maintained by the Chief Scientist and Field Party Chief. The log should contain: 1) Confirmation that the watch was completed prior to deployment of gear; 2) A record of any stations dropped because of the presence of marine mammals; 3) Species or types of marine mammals observed (if any); 4) Wait times; and 5) Initials of person conducting the watch.

In the event a marine mammal is taken by the sampling gear, all trawling operations will immediately stop. The Chief Scientist or

Field Party Chief will notify NMFS shore-side contacts as soon as possible, following guidelines from the "Acoustic Trawl Survey Marine Mammal Protocols" document. This document will be available for Ship's review prior to sailing. A decision on whether to continue trawling operations will be made by NMFS Western Regional Office leadership. If authorized to use, a marine mammal excluder device (MMED), attached to a spare codend, will be present on board as a back-up mitigation device.

iv. *Vertical ring net (zooplankton net)*: This plankton net is a 0.5-m 202 um single ring net. It is towed vertically while the vessel holds station to a target depth of 100 m when the water column is deeper than 100 m, or 2–5 meters off the bottom at nearshore stations. The wire rates for descent and ascent are 50 and 30 m/min, respectively, with the goal of keeping the wire as vertical as possible during the tow, especially during the descent. If the wire angle is greater than 10–15 degrees, more hydro wire will need to be deployed to achieve a depth of 100 m. The Science Party will process the samples upon retrieval in the CTD garage and fume hood area.

v. *Bongo net*: This is a 333 um double-ringed 0.5 m net. We will follow CalCOFI standards for the deployment and retrieval of this net, using a 20 m/min payout/retrieval rate. Once at depth (either 200 m or 15 m off bottom, whichever is less), the net will remain at depth for 30 seconds prior to retrieval. The ship speed should be 1-2 kt and a wire angle of ~45˚ be maintained. A brief table of wire-out is below. The Science Party will process samples from both net in the Chemistry Lab and/or the CTD garage and fume hood area.

Station depth (m)	Wire out (m)	Tow depth (m)	Approx tow time (min)
150	190	135	14
500	300	210	20
1500	300	210	20
2000+	300	210	20

c. <u>Oceanographic data collection</u>

i. *ADCP*: Data from the ship's ADCP will be recorded continuously throughout the survey and during all trawl operations. Operation of the ADCP will be synchronized with the trigger pulse from the

Simrad EK60, which will be accomplished using the Simrad KSync. Assistance of a Survey Technician will be needed for daytime and nighttime operations of the ADCP. Assistance from the ET may be needed to troubleshoot synchronization of instruments.

ii. *CTD rosette deployments*: The ship's CTD rosette will be cast at stations during day or night operations and will be used to collect water at up to 8 discrete depths. The ship's Survey Technician is needed to install the oxygen sensor and Niskin bottles and assist with the operation/maintenance of this equipment. The ship's Survey Technician may be needed to assist with obtaining water from the Niskin bottles and to assist with stowing the water to allow the eDNA scientist to fill bottles, filter, etc. off the oceanographic side deck.

If the eDNA scientist is off shift, the Chief Scientist and/or Field Party Chief may request that the Survey Technician save water from Niskin bottles and store it in the refrigerator in the Chemistry Lab or leave it secured on the oceanographic side deck if temperature is appropriate.

iii. *eDNA collections*: Water from the CTD rosette's Niskin bottles will be filtered, using a vacuum filtration system, in the Chemistry Lab. The ship's Survey Technician may be needed to troubleshoot the filtration set-up if problems occur. The resulting filters will be stored in the -80 freezer.

iv. *Underway CTD deployments (uCTD)*: A uCTD will be deployed day or night at pre-planned locations, weather permitting. The uCTD requires a vessel speed less than or equal to 10 kts. The ship's Survey Technician is needed to assist with the operation and maintenance of this equipment.

v. *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) provided. The ship's station and position information (MOA log) will also be copied to this HDD. During the pre-project meeting, parameters to include in the MOA will be specified, as well as how the bridge and survey departments wish to number stations and transects.

D. Dive Plan

All dives are to be conducted in accordance with the requirements and regulations of the NOAA Diving Program (http://www.ndc.noaa.gov/dr.html) and require the approval of the ship's Commanding Officer.

No dives are planned during this survey.

E. Applicable Restrictions

Conditions which preclude normal operations: If sea conditions and vessel ride deteriorate to a point where the quality of collected acoustic data is compromised, the vessel may need to break from running acoustic transects and jog or seek shelter until conditions improve enough for satisfactory collection of acoustic data.

III. Equipment

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

Item #	Item name
1	CTD (main unit plus spare), rosette, carousel, Niskin water sampling bottles, computer/deck unit, hydrographic winch
2	ADCP computer/deck unit
3	Underway sensors (SCS) and computer/deck unit
4	FSCS computer system (Three touchscreen monitors and at least 3 working computers)
5	Trawl winch, net mensuration (e.g., Simrad third wire)
6	Ship's computer network (at least 4 static IP addresses on SH)
7	Centerboard-mounted transducers (ADCP, ES60, ITI)
8	Spaces: Fish Processing Lab, Chemistry Lab, Acoustics Lab, Dry Lab, Constant Environment Room, and Preservation Alcove
9	Email, telephones, intercom system, handheld radios
10	VHF Radios with NOAA F-Channels
11	Simrad EK60: 18-, 38-, 70-, 120-, and 200-kHz GPTs
12	Simrad KSync
13	Simrad ITI temperature-depth sounder
14	FS70 third-wire trawl sounder
15	Applanix POS MV position and attitude sensor system
16	Freezers (-20, -80˚C)
17	Fishbuster trawl doors
18	Wet lab conveyer belt and hopper on back-deck
19	Fume hoods for sampling processing (Chem Lab and Preservation Alcove)

B. Equipment and Capabilities provided by NWFSC (itemized)

Item #	Item name
1	Computer and networking gear (8 laptops, 2 8-port Netgear switches, a number of assorted 1-4TB external drives with cables, various software media, and possibly an NAS system). Assistance from ET will be needed to set up
2	Simrad EK80 WBTs, with center frequency of 70 and 200 kHz. Assistance from the ET will be needed to install the WBT boxes
3	Trawl gear (2 midwater [AWT] nets, 1 sets of Fishbuster 4-m^2 doors, 750-lb tom

	weights, spare components)
4	0.5 m vertical net, flowmeter
5	Underwater video camera (components to be determined)
6	Temperature and depth recorders (3 Sea-Bird SBE 39s)
7	Biological sampling gear (~20 fish baskets and 12 tubs, crane scale, 4 Scantrol fish measuring boards, 2 large and 3 small Marel motion-compensating scales, and various other gear [knives, gloves, raingear, etc.] for working in the Wet Lab)
8	Calibration gear (4 downriggers [with clamps] and 4 battery packs, calibration spheres, ultrasonic cleaner, etc.)
9	Backup Marine Mammal Excluder Device (MMED) attached to a spare codend
10	EK60 GPTs (Spares for 18, 38, 70, and 200 kHz)
11	Personal locator beacons (PLBs), personal flotation devices (PFDs), and immersion suits for scientific party. Current maintenance logs and inventory will be provided to the ship before departure
12	Hobo light logger to be deployed on forward rail
13	Dissolved oxygen sensor to be installed by Survey Tech onto CTD rosette
14	X-ray machine (PXP-40HF Portable X-Ray with stand)
15	X-ray digital recording system (FujiFilm D-EVO P-Series DR-Flex System w/ one 14"x17" Wireless GadOx Detector & FDX Laptop)
16	X-ray safety equipment (Lead apron, 2 dosimeters)
17	Underway CTD and mount (mount currently stored in CTD garage aboard the Shimada)
18	202 um zooplankton vertical net
19	333 um bongo net

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 the anticipated quantity brought aboard, SDS, 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, butters, 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 SDS 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, if requested. The CO's designee will maintain a log to track scientific party hazardous materials. SDS 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	**Quantity**	**Notes**	**Trained Individual**	**Spill control**
Formaldehyde solution (4% and 37%)	5 liters in plastic bottles of 37% formaldehyde (100% formalin); 5-gallon bucket(s), 2.5-gallon carboy, and/or small sample containers of 4% formaldehyde (10% formalin)	Bottle of 37% is stored in the Chemistry Lab under fume hood and in the Preservation Alcove under the fume hood and will be diluted to 4% using seawater into buckets, carboys, (stored in the fish sampling lab) and/or sample containers (stored	Steve de Blois	F

Common Name of Material	Quantity	Notes	Trained Individual	Spill control
		under fume hood)		
Ethanol (50% and 95%)	5 gallons of 95%, small squirt bottle of 50%	5-gallon carboy of 95%, stored in appropriate chemical locker, small squirt bottle of 50% stored in fish processing lab	Steve de Blois	E

C. Chemical safety and spill response procedures

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 sawdust.

E: 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. Absorb spill with inert material, then place in suitable container.

Inventory of Spill Kit supplies

Product Name	Amount	Chemicals it is useful against	Amount it can clean up
Spill-X-FP	12 lb	Formalin/formaldehyde	13.6 gallons
Absorbent pads	5	Formalin/formaldehyde/ethanol	10x its weight

Other supplies include saline solution for rinsing eyes, safety goggles, trash bags, hazardous waste labels, and SDS for all chemicals

D. Radioactive Materials

No Radioactive Isotopes are planned for this project.

V. Additional Projects

A. Supplementary ("Piggyback") Projects

No Supplementary Projects are planned

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.

In addition to the standard welcome aboard meeting, the Science Party requests that a tour of the ship's muster locations and safety equipment be conducted for interested Science Party members.

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. Quantity and quality of food for the night shift must be maintained throughout the survey. The Chief Scientist will alert the Commanding Officer and Operations Officer of the Scientific Party watch schedule before departure. 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 Operations 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 (3-16)) 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 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-P 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:

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 Commanding Officer, 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 128 kbs is shared by all vessels staff and the Science Party 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

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:

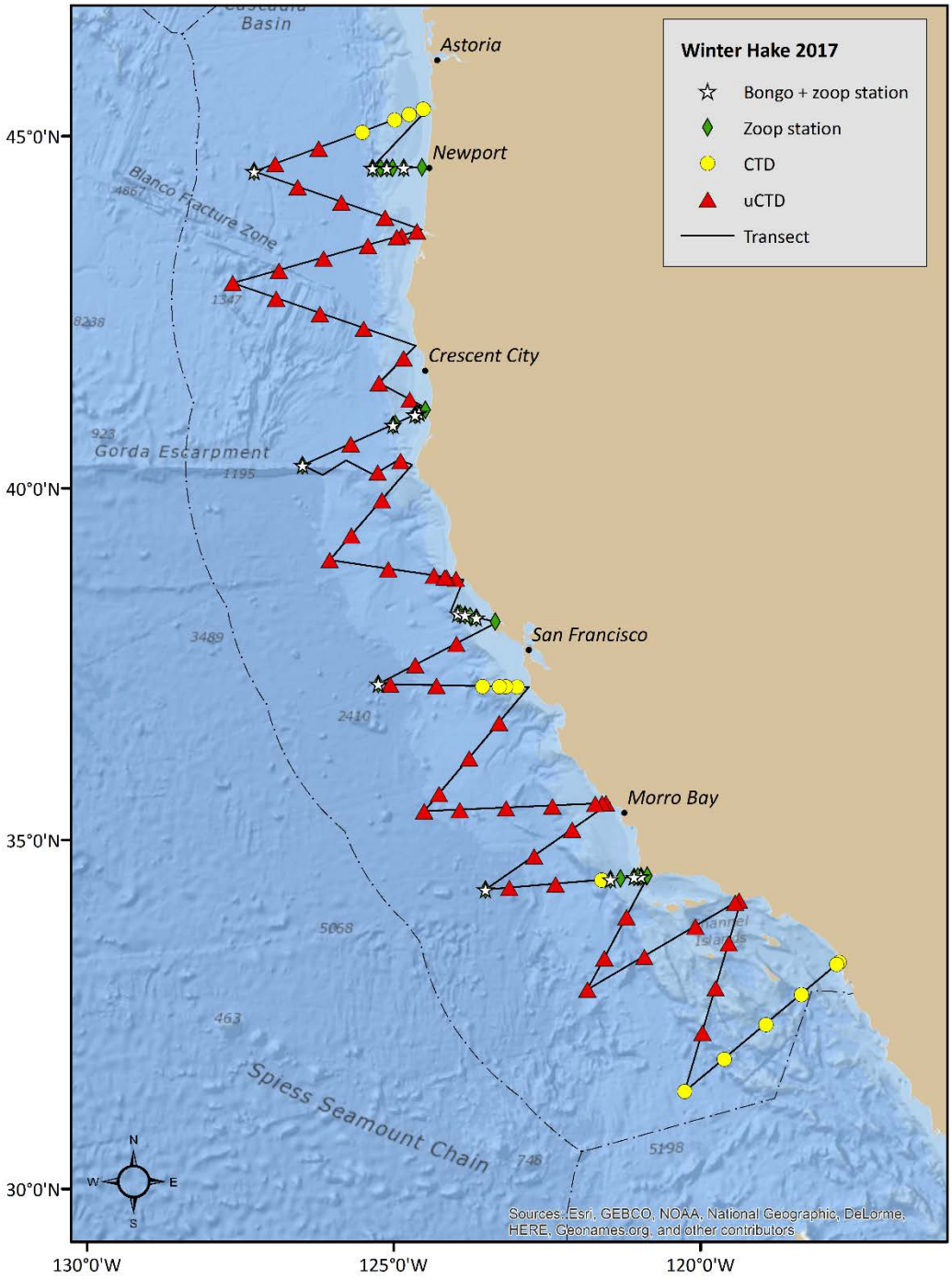
1. Export Control - The foreign national's sponsor is responsible for obtaining any required export licenses and complying with any conditions of those licenses prior to the foreign national being provided access to the controlled technology onboard regardless of the technology's ownership.

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.

Appendix 1. Survey overview (Figures, maps, tables, images, etc.)

Figure 1. Survey transect and station design for the 2017 Spawning Hake Stock Acoustic-Trawl Survey aboard the NOAA Ship *Bell M. Shimada*.



Appendix 2. Station/Waypoint List (coordinates in Latitude, Longitude)

Table 1. Transect waypoints for the 2017 Spawning Hake Stock Acoustic-Trawl Survey aboard the NOAA Ship *Bell M. Shimada*.

Waypoint	Latitude	Longitude
1	44.6517	-124.1028
2	44.6517	-125.2062
3	45.5158	-123.9983
4	44.6	-127.5833
5	43.7667	-124.2132
6	43.0067	-127.9667
7	42.119	-124.3787
8	41.5968	-125.1003
9	41.217	-124.1673
10	40.43	-126.5667
10.1	40.2917	-126.1825
10.2	40.4997	-125.74
10.3	40.2917	-125.2178
10.4	40.4997	-124.7418
11	40.43	-124.4867
12	39.0833	-126.05
13	38.78	-123.5717
14	38.325	-123.8233
15	38.1623	-122.969
16	37.3188	-125.1667
17	37.2227	-122.4387
18	35.4967	-124.375

19	35.5188	-121.0837
20	34.355	-123.3325
21	34.4475	-120.489
22	32.87	-121.6417
23	34.0257	-118.8938
24	31.3267	-120.0992
25	33.0057	-117.2983

Table 2. Coordinates for zooplankton vertical net (202 um) stations (with CTD rosette) during the 2017 Spawning Hake Stock Acoustic-Trawl Survey aboard the NOAA Ship *Bell M. Shimada*. Please note that completion of the "end" stations will be determined in the field based on time and/or weather.

Station	Location key	Latitude	Longitude
zoop 1.60	NH60	44.6517	-124.1820
zoop 1.150	NH150	44.6517	-124.5540
zoop 1.300	NH300	44.6517	-124.7832
zoop 1.500	NH500	44.6517	-124.8977
zoop 1.1000	NH1000	44.6517	-125.0207
zoop 1.1500	NH1500	44.6517	-125.1837
zoop 3.end	NHend	44.6000	-127.5833
zoop 9.60	TH60	41.2027	-124.2112
zoop 9.150	TH150	41.1625	-124.3343
zoop 9.300	TH300	41.1462	-124.3844
zoop 9.500	TH500	41.1365	-124.4139
zoop 9.1000	TH1000	41.0123	-124.7940
zoop 9.1500	TH1500	40.9970	-124.8408
zoop 9.end	THend	40.4300	-126.5667
zoop 14.60	BB60	38.1695	-123.0067
zoop 14.150	BB150	38.2353	-123.3523
zoop 14.300	BB300	38.2565	-123.4632
zoop 14.500	BB500	38.2746	-123.5583
zoop 14.1000	BB1000	38.2916	-123.6476
zoop 14.1500	BB1500	38.2993	-123.6879
zoop 15.end	BBend	37.3188	-125.1667
zoop 20.60	PC60	34.4470	-120.5042

zoop 20.150	PC150	34.4435	-120.6103
zoop 20.300	PC300	34.4416	-120.6683
zoop 20.500	PC500	34.4395	-120.7323
zoop 20.1000	PC1000	34.4318	-120.9718
zoop 20.1500	PC1500	34.4260	-121.1468
zoop 19.end	PCend	34.3550	-123.3325

Table 3. Proposed coordinates for bongo tow (333 um) stations during the 2017 Spawning Hake Stock Acoustic-Trawl Survey aboard the NOAA Ship *Bell M. Shimada*. Please note that completion of the "end" stations and those stations on BB and TH will be determined in the field based on time and/or weather.

Station	Location key	Latitude	Longitude
bongo 1.150	NH150	44.6517	-124.5540
bongo 1.500	NH500	44.6517	-124.8977
bongo 1.1500	NH1500	44.6517	-125.1837
bongo 3.end	NHend	44.6000	-127.5833
bongo 9.150	BB150	41.1625	-124.3343
bongo 9.500	BB500	41.1365	-124.4139
bongo 9.1500	BB1500	40.9970	-124.8408
bongo 9.end	BBend	40.4300	-126.5667
bongo 14.150	TH150	38.2353	-123.3523
bongo 14.500	TH500	38.2746	-123.5583
bongo 14.1500	TH1500	38.2993	-123.6879
bongo 15.end	THend	37.3188	-125.1667
bongo 20.150	PC150	34.4435	-120.6103
bongo 20.500	PC500	34.4395	-120.7323
bongo 20.1500	PC1500	34.4260	-121.1468
bongo 19.end	PCend	34.3550	-123.3325

Table 4. Coordinates for CTD rosette stations during the 2017 Spawning Hake Stock Acoustic-Trawl Survey aboard the NOAA Ship *Bell M. Shimada*. Please note that CTD rosette casts will also be conducted at zooplankton and/or bongo stations.

Station	Latitude	Longitude
CTD 3.100	45.4803	-124.1386
CTD 3.2000	45.1618	-125.3909
CTD 3.300	45.4070	-124.4273
CTD 3.500	45.3318	-124.7234
CTD 16.100	37.2302	-122.6531
CTD 16.2000	37.2522	-123.2757
CTD 16.300	37.2374	-122.8583
CTD 16.500	37.2415	-122.9729
CTD 20.2000	34.4210	-121.3020
CTD 23.end	31.3267	-120.0992
CTD 24.100	32.9945	-117.3171
CTD 24.2000	31.7501	-119.3977
CTD 24.500	32.9682	-117.3614
CTD 24.500+40	32.5829	-118.0085
CTD 24.500+80	32.1976	-118.6528

Table 5. Coordinates for CalCOFI liner 67 CTD rosette stations during the 2017 Spawning Hake Stock Acoustic-Trawl Survey aboard the NOAA Ship *Bell M. Shimada*. Please note that the completion of these stations will be determined in the field during Leg 2 based on time.

Station	Latitude	Longitude
67-50	36.786	-122.056
67-55	36.620	-122.415
67-60	36.453	-122.772
67-65	36.286	-123.129
67-70	36.120	-123.485
67-75	35.953	-123.841
67-80	35.786	-124.195
67-85	35.620	-124.549

Table 6. Proposed coordinates for underway CTD (uCTD) casts during the 2017 Spawning Hake Stock Acoustic-Trawl Survey aboard the NOAA Ship *Bell M. Shimada*. Please note that uCTD station locations may be modified and/or dropped during the survey due to weather, time, and/or proximity to other station.

Station	Latitude	Longitude
uCTD 3.2000+40	44.9351	-126.2783
uCTD 3.2000+80	44.7083	-127.1622
uCTD 4.+120	43.9481	-124.9426
uCTD 4.+40	44.3827	-126.6998
uCTD 4.+80	44.1653	-125.8196
uCTD 5.100	43.7474	-124.3088
uCTD 5.2000	43.5491	-125.2923
uCTD 5.2000+40	43.3702	-126.1771
uCTD 5.2000+80	43.1913	-127.0593
uCTD 5.300	43.6850	-124.6189
uCTD 5.500	43.6658	-124.7137
uCTD 5.end	43.0067	-127.9667
uCTD 6.+120	42.3698	-125.3874
uCTD 6.+40	42.7944	-127.1040
uCTD 6.+80	42.5821	-126.2442
uCTD 7.500	41.9464	-124.6178
uCTD 7.end	41.5968	-125.1003
uCTD 8.500	41.3561	-124.5084
uCTD 9.1500+40	40.7318	-125.6497
uCTD 10.3.1500	40.3261	-125.1390
uCTD 10.4.1500	40.4887	-124.7017
uCTD 11.+40	39.9326	-125.0677

uCTD 11.+80	39.4352	-125.6444
uCTD 11.end	39.0833	-126.0500
uCTD 12.100	38.7966	-123.7073
uCTD 12.2000	38.8467	-124.1158
uCTD 12.2000+40	38.9503	-124.9620
uCTD 12.300	38.8178	-123.8805
uCTD 12.500	38.8219	-123.9139
uCTD 15.+40	37.8712	-123.7303
uCTD 15.+80	37.5801	-124.4885
uCTD 16.2000+40	37.2817	-124.1126
uCTD 16.2000+80	37.3112	-124.9498
uCTD 17.+120	35.7386	-124.1061
uCTD 17.+40	36.7280	-122.9981
uCTD 17.+80	36.2333	-123.5539
uCTD 17.end	35.4967	-124.3750
uCTD 18.100	35.5183	-121.1573
uCTD 18.2000	35.5119	-122.1055
uCTD 18.2000+40	35.5064	-122.9245
uCTD 18.2000+80	35.5009	-123.7434
uCTD 18.300	35.5178	-121.2243
uCTD 18.500	35.5170	-121.3446
uCTD 19.+40	35.1630	-121.7748
uCTD 19.+80	34.8070	-122.4628
uCTD 20.2000+40	34.3947	-122.1094
uCTD 20.2000+80	34.3685	-122.9166
uCTD 21.+40	33.8779	-120.9076

uCTD 21.+80	33.3083	-121.3235
uCTD 21.end	32.8700	-121.6417
uCTD 22.100	34.0057	-118.9417
uCTD 22.2000	33.2937	-120.6383
uCTD 22.500	33.9771	-119.0099
uCTD 22.500+40	33.6770	-119.7266
uCTD 23.+120	32.1536	-119.7337
uCTD 23.+40	33.4016	-119.1758
uCTD 23.+80	32.7776	-119.4558

Appendices 3 and 4 to be provided to the ship when the Science Party comes aboard.

Appendix 3. Trawl net specifications

Figure 1. Diagram of the NWFSC/FEAT Aleutian Wing Trawl configuration that will be used during the 2017 Spawning Hake Stock Acoustic-Trawl Survey aboard the NOAA Ship *Bell M. Shimada*.

Table 1. Hardware specifications and breaking strengths for the NWFSC/FEAT Aleutian Wing Trawl configuration that will be used during the 2017 Spawning Hake Stock Acoustic-Trawl Survey aboard the NOAA Ship *Bell M. Shimada*.

Appendix 4. NWFSC/FEAT AWT safety standards checklist

Appendix 5. X-ray specifications

Specifications for a portable x-ray system that will be used during the 2017 Spawning Hake Stock Acoustic-Trawl Survey aboard the NOAA Ship *Bell M. Shimada.*

a. Source: PXP-40HF
   Operation settings:
   i. Millampere Seconds (mAs): 4.0–8.0
   ii. Kilovolt Peak (kVp): 40–70
   iii. Distance to objects (fish): 40 inches
b. Digital Detector: FujiFilm D-EVO P-Series DR-Flex System
   i. A 14" x 17" flat digital recording panel
   ii. A Wireless GadOx Detector
   iii. An FDX laptop

Appendix 6. X-ray safety protocols

Safety measures for operating x-ray machine that will be used during the 2017 Spawning Hake Stock Acoustic-Trawl Survey aboard the NOAA Ship *Bell M. Shimada.*

To assure the safety of operating the x-ray machine, specific setup and operation protocols will be followed.

I. Setup for safety operation:
   1. The x-ray machine will be mounted on a stand and securely tied down in the Constant Environmental Room (CER) (see Figure 1).
   2. An extension telephone cord will be used to allow the operator outside the CER and not directly in the line of sight of the x-ray.
   3. A lead sheet (1/8”) will be placed on the floor beneath the plywood base to shield the direct radiation of the x-ray to the engine room down below.
   4. A lead apron will be available for the operator.
   5. Two registered dosimeters are available to monitor the accumulative exposure level.

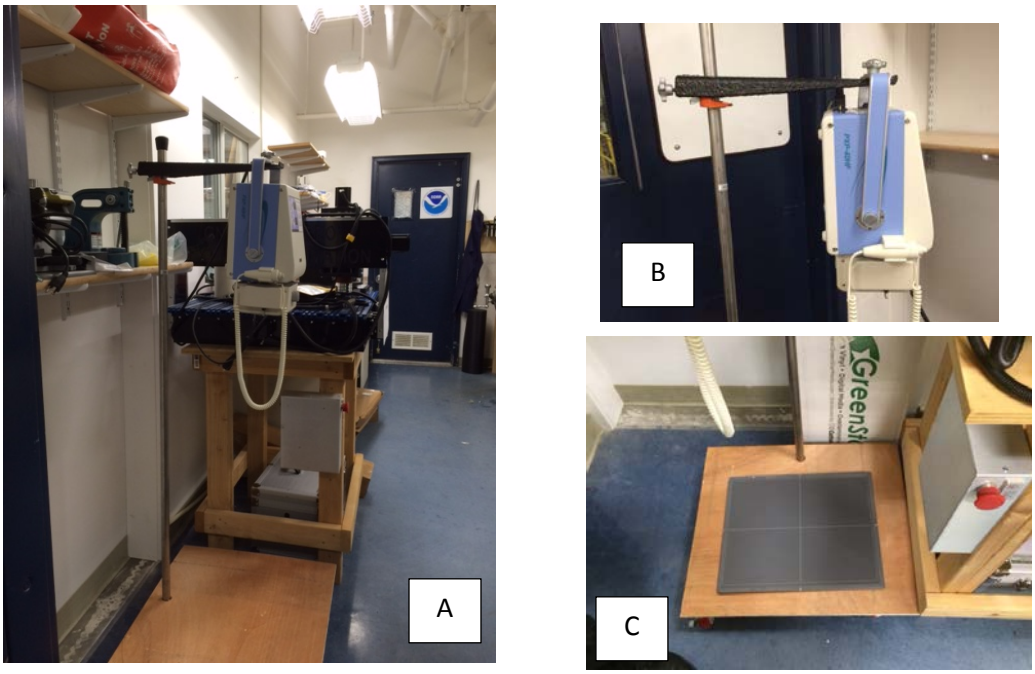


Figure 1. Photo of the x-ray machine (PXP-40HF) on an adjustable stand (A). The foot print of the base (plywood) is 2’ x 2’. The distance between the source and the base will be about 40”. The x-ray machine with the stand will be placed in the constant environment room (likely on the inboard side of the room). The four wheels on the bottom of the stand will be locked and the stand will also be tied down to ensure its stability during the cruise. The x-ray machine will be securely fastened to the horizontal bar of the stand with a 4-point knob screw (B). The 14” x 17” digital receiver (flat panel) will be placed on top of the plywood board (C).

II. Operation protocols:

1. Before x-ray operation:
   a. “X-ray in Use” signs will be put (1) in the hall way next to the door entering the Wet Lab the hallway, (2) on the wall in the Wet Lab, and (3) on the wall in the Chemistry Lab before x-ray is operated
   b. The operator will don the lead apron
   c. The operator will clip the dosimeter (registered to them) onto the outside of the lead apron
   d. The x-ray machine can then be turned on

2. During x-ray operation:
   a. The door of the CER will be ajar and the operator will stand away from the opening
   b. There will be no people in the line-of-sight of the x-ray and within 6’ of the CER
   c. The operator will announce the x-ray operation just before taking the x-ray each time

3. After x-ray operation:
   a. Turn off the power of the x-ray machine
   b. Take down the “X-ray in Use” signs
   c. Take off the lead apron and dosimeter and place them at proper places
   d. Check dosimeter readings about every 10 exposures and make sure the accumulative exposure level is below the level of concern. According to the estimate by the professionals from the Swedish Hospital, the estimated accumulative level of 10 exposures of our x-ray machine is about 0.3% of the level of concern received at 6” from the x-ray without the metal wall of the CER.