






**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
**NATIONAL MARINE FISHERIES SERVICE**  
Northwest Fisheries Science Center  
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Seattle, WA 98112-2097

**Final Project Instructions for *Bell M. Shimada***

**Date submitted:** 5 February 2016  
**Platform:** NOAA Ship *Bell M. Shimada*  
**Project Number:** SH-16-03  
**Project Title:** Pacific Orcinus Distribution Survey 2016  
**Project Dates:** 20 February – 11 March 2016

Prepared by:  Dated: 5 January 2016  
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## I. Overview

### A. Brief Summary and Project period

The objective of Pacific Orcinus Distribution survey (PODs 2016) is to conduct a survey for marine mammals, primarily killer whales, with the goal of locating and following endangered southern resident killer whales in order to obtain information on their occurrence, movement patterns, habitat use, and habitat features. The project period is 20 February – 11 March.

### B. Days at Sea (DAS):

. Of the 21 DAS scheduled for this project, 0 DAS are funded by an OMAO allocation, 21 DAS are funded by a Line Office Allocation, 0 DAS are Program Funded, and 0DAS are Other Agency funded.

### C. Operating Area (include optional map/figure showing op area)

The operating area will include the coastal waters of the continental United States from northern Washington to potentially as far south as central California (37 degrees North) and in Canada on the continental shelf waters of Vancouver Island north to the Brooks Peninsula (50 degrees north) as well as the inland waters as far north as the northern Strait of Georgia (Figures 1-2).

### D. Summary of Objectives

NWFSC will conduct acoustic and visual surveys of marine mammals and seabird from 20 February – 11 March 2015 along the Washington, Oregon, California, and Canadian coasts in order to determine Critical Habitat in the coastal portion of the range of Southern Resident killer whales.

While aboard *Bell M. Shimada* we will work on established track lines using both visual and acoustic means to locate killer whales. Upon a potential or confirmed detection of whales of interest, the ship will break from the track line to the location of the whales and follow the pod. If conditions permit we will launch one of the small boats to collect photo-IDs, biopsy samples, predation and fecal samples, and deploy satellite tags. If the whales are southern resident killer whales we will continue to follow them until we lose visual and acoustic contact. At that time a search plan will be devised and executed, we will recommence surveying, or we will return to port, depending on weather conditions, current location and remaining duration of the project.

The mission is successful if we are able to locate and track any of the southern resident killer pods. The collection of predation, fecal, and biopsy samples will be of significant additional value. Secondary objectives include locating and documenting other cetacean species, in particular the collection of photographs and audio recordings of other killer whale pods, as well as sea bird counts and oceanographic data by CTD, TSG, surface water samples, XBT, and bongo tows.

Participating Institutions

NWFSC  
Biowaves, Inc.  
Cascadia Research Collective  
DFO

E. Personnel (Science Party)

<b>Name (Last, First)</b>	<b>Title</b>	<b>Date Aboard</b>	<b>Date Disembark</b>	<b>Gender</b>	<b>Affiliation</b>	<b>Nationality</b>
Brad Hanson	Chief Scientist	18 Feb 2015	12 March 2015	M	NWFSC	U.S.
Candice Emmons	Mammal Observer	18 Feb 2015	12 March 2015	F	NWFSC	U.S.
Dawn Breese	Mammal Observer	18 Feb 2015	12 March 2015	F	Biowaves	U.S.
Jeff Foster	Mammal Observer	18 Feb 2015	12 March 2015	M	Cascadia	U.S.
Cory HomWeaver	Acoustics Team	18 Feb 2015	12 March 2015	F	Biowaves	U.S.
Shannon Coates	Acoustics Team	18 Feb 2015	12 March 2015	F	Biowaves	U.S.
Kerry Dunleavy	Acoustics Team	18 Feb 2015	12 March 2015	M	Biowaves	U.S.
Arial Brewer	Acoustics Team	18 Feb 2015	12 March 2015	F	Cascadia	U.S.
Robert Hunt	Acoustics Team	18 Feb 2015	12 March 2015	M	Cascadia	U.S.
Peggy Foreman	Acoustics Team	18 Feb 2015	12 March 2015	F	Cascadia	U.S.
Rachel Mayer	Oceanographer	18 Feb 2015	12 March 2015	F	Cascadia	U.S.

G. Administrative

1. Points of Contact: Chief Scientist/alternate

a. Primary Point of Contact (POC):

Brad Hanson (206) 860-3220 [brad.hanson@noaa.gov](mailto:brad.hanson@noaa.gov)

b. Alternative land-based POC

Mike Ford (206) 860-5612 [mike.ford@noaa.gov](mailto:mike.ford@noaa.gov)

c. Ops Officer:

LT Timothy Sinquefield (541-867-8923) NOAA Ship *Bell M. Shimada*  
(OPS.Bell.Shimada@noaa.gov)

## 2. Diplomatic Clearances

This project involves Marine Scientific Research in waters under the jurisdiction of Canada. Diplomatic clearance has been requested and will be provided upon approval.

## 3. Licenses and Permits

This project will be conducted under the Scientific Research Permits:

U.S. NMFS Marine Mammal License No. 16163-01 issued to Dr. Brad Hanson, expires on June 6, 2017.

U.S. NOS National Marine Sanctuaries Research permit No. MULTI-2013-00, expires February 22, 2018

Canadian DFO Marine Mammal and SARA License No. XMMS 8 2014, Valid: 18-Dec 2014 to 31-Dec-2017

CITIES Multiple-Use Export Permit Number: 16CA00021FONHQ

## 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

18 February – Begin on-load equipment

20 February - Depart Newport, OR subject to tides and weather

Morning - Familiarization and Safety briefing

Mid-day – XBT/Surface water sample

Mid Afternoon– XBT/Surface water sample

Evening – End visual and acoustic surveys, Surface water sample (and XBT if CTD is cancelled)

Evening – CTD cast

Evening – Bongo tows

21 February – 10 March

Morning – Surface water sample

Morning – Begin visual survey

Morning – Safety Meeting

Morning – XBT/Surface water sample  
Mid-day – XBT/Surface water sample  
Mid Afternoon – XBT/Surface water sample  
Evening – End visual and acoustic surveys, Surface water sample (and XBT if CTD is cancelled)  
Evening – CTD cast  
Evening – Bongo tows

11 March

Arrive Newport –  
Afternoon – Begin off load equipment

B. Operations to be conducted

Staging:

Staging: 19 February - STBD deck crane to load winches, sonobuoy totes, work boat, and other gear.

Destaging: 11 March - Aft STBD deck crane to unload small boat winches and sonobuoy totes and other gear

*Execution: We will conduct 24 hour operations by maintaining an acoustics listening watch in the dry lab. During day light hours observers will use Big Eye binoculars located at stations on the flying bridge. Observers will be on the flying bridge from sunrise to sunset. After sunset we will conduct CTD casts not to exceed 1000m or 10 m above charted depth at the time of the cast and bongo tows.*

- 1.1. Cetacean Survey - Line-transect survey methods will be used to collect sighting data. At the beginning of each day (sunrise) search effort will begin on the track line that had been continued on from the previous evening. *Shimada* should travel at 9-10 knots (through the water) along the designated trackline. While on search effort, if the ship's speed through the water should deviate from this by more than one knot due to a ship-based request, the bridge personnel will notify the mammal team on watch or the Chief Scientist no matter time of day. A daily watch for marine mammals will be maintained during daylight hours by scientific observers on the flying bridge (approximately 0700 to 1800), except when the ship has stopped to conduct other sampling operations, or when precluded by weather. A team of three observers will search with 25x150 binoculars, 7X binoculars, and unaided eye on the flying bridge. The flying bridge will need to be in VHF radio contact with the bridge and acoustics (dry lab). If weather conditions (rain, fog, wind) preclude use of the 25x binos, a one or two observer monitoring effort will be maintained with 7x50 binos or unaided eye on the bridge with the permission of the OOD. Sighting conditions, watch effort, sightings, and other required information will

be entered into a computer, hooked up to the ship's GPS (for course, speed and position information). Draft waypoints are shown in Figures 1-3. Final waypoints will be provided as a Nobeltec compatible file at the pre-project meeting. Route and waypoint selection will be subject to recent killer whale sighting reports and weather conditions and adjusted relative to these circumstances and time remaining in the project. Points near the coast are approximate, but the actual survey tracklines will end at the 20-fathom isobath or at the shallowest safe navigation depth as determined by the Commanding Officer. Tracklines into and out of ports are not shown. It is not intended that the entire grid of tracklines be covered during the course of the 21 day survey, but the order in which they are covered will be determined by weather and other contingencies. If weather precludes survey, the Chief Scientist may decide to wait at that position for better weather or may request the ship be moved to another location on the transect based on weather forecasts. The Chief Scientist will be responsible for working with the Command to ensure that the vessel arrives at designated ports at designated times. The Chief Scientist will be responsible for ensuring that the entire survey area is adequately covered. The Chief Scientist may adjust the scientific activities and length of the nighttime travel to meet scientific and scheduling objectives.

- 1.1.1. Logging of data - A log of observation conditions, watch effort, sightings and other required information will be entered into a computer, connected to the ship's GPS (for course, speed and position information) and SCS (for weather and heading information). Please note that it is very important that all science computers be connected to the same ship's GPS. We also need a file with the ship's track while underway (not just during ops).
- 1.1.2. Breaking Trackline - On sighting a marine mammal or other feature of biological interest, the Chief Scientist or marine mammal observer team on watch will request that the vessel be maneuvered to approach the school or feature for investigation. When the ship approaches a group of marine mammals, the observers will make independent estimates of group size. Behavioral data collection and photographic operations may commence from the bow, based on directions from the Chief Scientist or identification specialists. In some instances, the Chief Scientist will request the deployment of a small boat for biopsy, behavioral data collection, prey remains and fecal sample collection, and photographic or other operations (see 1.1.6). It may occasionally be necessary to divert the ship's course from the established trackline during regular effort due to glare or adverse sea conditions. Under these circumstances, the ship may divert up to 30 degrees from the established course. This deviation may continue until the ship is 8 nm from the trackline, at which point the ship should turn back toward the trackline.
- 1.1.3. Resuming Effort - When the observers have completed scientific operations for the sighting, the ship will resume the same course and speed as prior to the sighting. If the pursuit of the sighting has taken the ship more than 5 nm from the trackline, the observers should be notified. The Chief Scientist or identification specialists may request that, rather than proceed directly toward the next waypoint, the ship take a heading of 20 degrees back toward the trackline.

1.2. Southern Resident killer whale studies – In the event that any members of the pods of southern resident killer whale population, or other whales of interest, are located, every effort will be made to remain with these animals for the duration of the project. Visual sightings as well as acoustic data from the towed acoustic array or sonobuoys will be used to track the whales. Behavioral data will be collected during visual observations. Weather permitting, small boat operations will commence in order collect, behavioral data, predation event remains, and photographs.

### 1.3. Acoustics

1.3.1. Towed Array – One or both acoustic arrays will be deployed for continuous monitoring during all hours the ship is underway on the survey tracklines except during the CTD and extreme inclement weather. One array (two-element is typically deployed) both day and night while the larger array (five element) is typically deployed at night. The vessel will slow from survey speed to approximately 3 knots at the midpoint and end of each line in order to provide improved acoustic monitoring conditions. It is requested that turns not exceed 30 degrees of course change and inshore turns will be initiated if water depth is less than 30 fathoms. It is requested that the ship slow to 2-3kt for night-time bongo deployments. The arrays will be wound onto a ship-powered hydraulic winches supplied by the NWFSC. Hook-ups will be required for each winch to the ship's hydraulic power system which is located on the port side of the trawl deck. This array will be towed at a distance of 200 or 300 m behind the ship depending on conditions (including obstacles such as crab pots and the amount of ship noise that *Shimada* generates). The deployment depth of this array can vary from 5 to 65 m depending on ship speed. For example, the deployment depth will be between 40-65 m at 3 knots while the depth will be between 5-15 m at 10 kts. A second towed array on a separate hydro-electric powered winch also may be deployed to more efficiently track marine mammals, especially at night. This array will be towed at a distance of 660 m behind the ship. The deployment depth of this array can vary from 3 to 45 m depending on ship speed. For example, the deployment depth will be between 10-25 m at 3 knots while the depth will be between 5-10 m at 10 kts. While both arrays will be towed simultaneously, power to each winch can be provided sequentially for deployment. A team of 3 or 4 acousticians will monitor the array, record sound made by cetaceans, and localize their positions.

1.3.2. Sonobuoys - Sonobuoys may be deployed on an opportunistic basis and subject to certain conditions, at the discretion of the Chief Scientist or Acoustics team. For example, if we cannot have the arrays out because of weather or location (shallow water, crab pots), we may deploy sonobuoys for passive acoustic operations instead. Sonobuoys are typically deployed manually off the stern of the ship. A VHF antenna mounted at a high point on the ship and cabled to the acoustics lab will be used to monitor these. All other necessary equipment will be supplied and operated by scientists.

1.3.3. Depth Sounder - The scientific ME-70 depth sounder will be operated continuously, at between 70 and 120KHz and will be interfaced to a data acquisition system to estimate micronekton biomass between 0 and 500 m. The vessel's navigational depth sounder may be used at the discretion of the Commanding Officer, but will normally remain off while underway in deep waters.

1.3.4. Acoustic Echosounder - EK60 echosounder data at 18, 38, 70, 120, and 200 kHz data will be recorded to monitor the winter distribution of some important fish species off the US west coast, such as Pacific hake, sardine, myctophids, etc. The EK60 transducers are mounted on the vessel centerboard and all necessary software has been installed on the ship computer and used by the Acoustics Team of the NWFSC for the 2011 Joint US and Canada integrated acoustic and trawl hake survey. The recording will be depth will be from 0 to 750 m. If any of the ship's navigational depth sounders are found to interfere with the EK-60 scientific sounder, the command will inform the Chief Scientist at any time those navigational depth sounders are used.

1.4. Seabird Survey - Visual surveys of seabirds will be conducted from the flying bridge during daylight hours by two seabird observers. A log of sighting conditions, effort, sightings and other required information will be entered into a computer interfaced with the ship's GPS (for course, speed and position information) and SCS (for weather and heading information). Again, it is very important that all science computers be connected to the same ship's GPS. Seabird observers will use handheld and 25x150 binoculars.

1.5. Small Boat Work - STBD crane will be needed for deployment of small boat during mammal small boat ops. Three deck crew and Small Boat OIC will be needed for small boat ops. A 22' Zodiac 630 with 104 gallon fuel capacity (gasoline, no additional fuel will be brought) will be used for biopsy sampling, behavioral data collection, predation and fecal sampling, satellite tag deployment and photography. Deployment will be requested by the Chief Scientist on an opportunistic basis, providing the Commanding Officer concurs that operating conditions are safe. The small boat will remain within radar range and radio contact at all times while deployed.

1.5.1. Biopsy Sampling - Biopsies for genetic analyses of killer whales will be collected on an opportunistic basis. Necessary permits will be aboard the vessel. The animals sampled will be approached by a small boat. Samples will be collected from animals within 10m of the small boat using a dart fired from a crossbow or a dart rifle. The small boat and its requisite safety equipment will be supplied by the scientific party. The ship will provide a freezer for samples.

1.5.2. Behavioral Observations – Behavioral observations of marine mammals will be taken on an opportunistic basis. Necessary permits will be present on the vessel. The animals to be observed will either be approached by the research vessel during normal survey operations, will approach the vessel on their own, or will be approached by a small boat.



- 1.5.3. Prey remains collection – Collection of prey remains from predation events of marine mammals will be collected on an opportunistic basis. Necessary permits will be present on the vessel. The animals to be followed will be approached by the small boat.
- 1.5.4. Satellite tag deployments – Satellite-linked transmitter tags will be deployed on killer whales on an opportunistic basis to track their movements. Necessary permits will be aboard the vessel. The animals to be tagged will be approached by a small boat. Animals will be approached within 6m with the small boat and the tag deployed using a pneumatic tag projector. The small boat and its requisite safety equipment will be supplied by the scientific party.
- 1.5.5. Photography - Photographs of marine mammals will be taken on an opportunistic basis. Necessary permits will be present on the vessel. The animals to be photographed will either be approached by the research vessel during normal survey operations, will approach the vessel on their own, or will be approached by a small boat.
- 1.6. Conditions Which Preclude Normal Operations – At times during the project visual survey operations will not be possible due to high winds, seas, or fog. Usually, survey operations are suspended at Beaufort Sea State 6 or higher. Also, if fog makes the visibility one nautical mile or less, visual observations are suspended until visibility increases. During these times, the Chief Scientist will decide which task to pursue, if any other operations are possible. The weather conditions that would prevent regular survey operations vary somewhat so the Chief Scientist will inform the bridge when survey effort is suspended. The Chief Scientist will work in conjunction with the Commanding Officer when adverse conditions are encountered.
- 1.7. Collection of Marine Mammals - Marine mammal body parts may be collected on an opportunistic basis at the discretion of the Chief Scientist. This includes whale and dolphin ivory and carcasses. In the event that this occurs, scientific freezer space will be needed to store the mammal body parts. Permits to collect and import marine mammal parts will be present on the vessel. All marine mammal ivory collected will be stored at the NWFSC but may be released on extended loan to recognized research institutions according to existing guidelines.
- 1.8. Oceanography - Oceanographic sampling will be done by the oceanographer and other designated scientists while underway during the day.
  - 1.8.1. Oceanographic Records – A chronological record of oceanographic stations will be kept by SCS with dates and times in GMT. The ship will provide a digital copy of SCS data including weather to the NWFSC oceanographer at the completion of the project. The main CTD system will be provided by the ship and operated by the survey department. The collection of oceanographic data, samples, and their processing will be conducted by the scientific party. The oceanographer will maintain a log book which lists the dates and times that samples were taken,

sampling locations (longitude and latitude), which samples were taken (salinity, temperature, nutrients, chlorophyll a, plankton, etc.), and how the samples were taken (bucket, CTD, XBT, thermosalinograph, and/or dip net).

- 1.8.2. XBT Drops - There will be 3 XBT drops per day at 0900, 1200 and 1500 hours local ship time, or at the discretion of the Chief Scientist. Survey technician will be needed at 0900, 1200 and 1500 for XBT launches. If a CTD cast is cancelled, a survey technician will be needed at 1800 for an XBT launch. If the vessel is stopped, the drop will be done when the vessel is again underway. If the vessel is not going to move within half an hour, the scientist performing the drop should be notified and the drop will be delayed or canceled, at the discretion of the Chief Scientist. If a CTD cast (described below) is cancelled due to inclement weather or because the ship is tracking killer whales, an XBT will be launched at 1800 hours when the surface water sample (see below) is collected.
- 1.8.3. Surface Water Samples - A surface water sample for chlorophyll a analysis and sea surface temperature will be taken at 0600, 0900, 1200, 1500, and 1800 hours local ship time daily. Surface water samples will also be taken every hour when in the presence of Southern Resident killer whales. Permission to conduct bucket/surface sampling will be requested by the sampler to the OOD on the bridge prior to any sampling.
  - 1.8.3.1. Chlorophyll a analysis – immediately following bucket sampling, a 50 ml sample of the bucket water will be filtered onto GF/F filters following the chlorophyll a analysis protocol. Using forceps, the filter will be folded in half (particulate matter on the inside), placed in a glass culture tube that is labeled with the date, time of sample, and GPS location of sample), and stored frozen in a tube rack within a box until the sample is analyzed for chlorophyll a analysis.
  - 1.8.3.2. Temperature – the temperature and salinity reading from the ship’s thermosalinograph, the date, the time of sample, and the GPS location will be recorded by the oceanographer in the oceanography log book at the time of surface water collection.
- 1.8.4. Thermosalinograph Sampling - The ship will provide and maintain a thermosalinograph (TSG), which is calibrated and in working order, for continuous measurement of surface water temperature and salinity. The ship's Scientific Computing System (SCS) shall collect this information from the TSG and a GPS. The oceanographer will provide the ship's Operations Officer and Electronics Technician with detailed acquisition information before departure. All SCS data will be provided to the NWFSC oceanographer following the project.
  - 1.8.4.1. Thermosalinograph samples – thermosalinograph data will be recorded with date, time, and GPS location throughout the project at all times.

#### 1.8.4.2. SeaBird Ecology Team flow-thru system for temperature and salinity.

The following system requirements for set up are totally independent of ship's SCS system:

- 1) unaltered seawater via a garden-hose type connector, which comes from same source as sampled by ship's sensors; as close to the ocean source as possible in order minimize heating occurs in the pipes before reaching the instrument
- 2) ability to set up laptop, GPS, and NMEA box (3 items) in a dry lab within 50-100 ft of the sampling instrument which will require bulk-head pass-thru for data, GPS cables
- 3) outdoor location for mounting GPS antenna, close enough that GPS antenna wire can get to GPS unit
- 4) location to put the flow-thru instrument - two choices: (1) indoor w/sink for an outflow for our newer, more compact instrument that fits into a cooler; or (2) on deck protected location for the old-style instrument in the water bath.

## 2.0 NIGHT OPERATIONS

A chronological record of oceanographic stations will be kept by the ship (Electronic Marine Operations Log) with dates and times in GMT. The ship will provide a digital copy of the electronic marine operations log and project weather log to the NWFSC oceanographer at the completion of the project. The main SeaBird CTD system will be operated by the scientific party. The collection of oceanographic data, samples, and their processing will be conducted by the scientific party. The crew of the vessel will operate all deck equipment and be responsible for the proper termination (and any necessary re-terminations) of the CTD cable pigtail to the conducting cable of the winch. The ship shall provide a complete system, consisting of frame with weights, 12-place rosette and deck unit, and SeaBird 9/11+ CTD with conductivity and temperature sensors. All instruments, their spares and spare parts provided by the ship must be maintained in working order and, if applicable, have current calibrations (within previous 12 months).

2.1. CTD Stations - STBD hydrographic Winch will be needed for CTD casts. One CTD (conductivity-temperature-depth) station will be occupied each evening after sunset. Cast times are subject to change since sunset will vary during the project. Additional CTD stations may be requested by the Chief Scientist in areas of special interest. CTD data and seawater samples will be collected using a SeaBird 9/11+ CTD with rosette and Niskin bottles fitted with silicone tubing and o-rings. All casts are to 1000m (depth permitting) with the descent rate at 30m/min. for the first 100m of the cast, then 60m/min after that, including the upcast between bottles.

2.1. a. CTD Samples - The evening cast (1000 m or to within 10 m of the bottom) will begin approximately one hour after sunset. This exact starting time will be determined in advance, by the Ops Officer. The Survey tech and two deck crew will be needed for CTD cast.

Niskin bottle water samples will be collected at 12 standard depths (0, 10, 20, 30, 40, 50, 75, 100, 150, 200, 500, 1000) between the surface and 1000 meters, or to within 10 m of the bottom. From each cast, chlorophyll samples (to 200 m) and salinity samples (100, 500, and 1000 m or bottom) will be collected and processed on board. Additional salt samples will be collected every other day (3 depths < 500m), so that the depths sampled are 30 m, 100m, 150m, 200 m, 500 m, and 1000 m.

2.1. a1. salinity samples – samples of water from 100m, 500 m and 1000 m (or bottom) on each day as well as 3 additional depths (30 m, 150 m, and 200 m) on every other day will be stored in salinity bottles that have been pre-rinsed 3X or more with the water collected at the same depth as the sample.

2.1. a2. chlorophyll a samples – 50 ml of water from each of the 10 depths up to 200 m will be filtered onto GF/F filters following the chlorophyll a analysis protocol. The filter will be folded in half (particulate matter on the inside), placed in a glass culture tube that is labeled with the date, time of sample, and GPS location of sample), and stored frozen in a tube rack within a box until the sample is analyzed for chlorophyll a analysis.

2.1. a3. Nutrient samples – approximately 40 ml of water from each of the 11 depths up to 500 m will be collected, frozen, and stored in upright pre-rinsed (10% HCl) vials that have been rinsed 3X with the water collected at the same depth as the sample. The vials are to be labeled with the date, depth of sample, time of sample, and GPS location of sample.

2.1b. Bongo tows - Perform approximately 1 bongo tow/ night at opportunistic locations in concert with the CTD. Second hydrographic winch will be needed for Bongo Tows. A Survey tech and a winch operator (AB) will be needed for night time Bongo deployments. Towards the end of each day a "plan of work" for that evening and station locations will be provided

1.9. Dive Plan – Dives are not planned for this project.

1.10. Applicable Restrictions – Conditions which preclude normal operations: Poor weather conditions may preclude conduct of survey in coastal waters. Ship may be moved to the Strait of Juan de Fuca or Port Angeles depending on severity of conditions.

## II. Equipment

### A. Equipment and capabilities provided by the ship

We request the following systems and their associated support services, sufficient consumables, back-up units, and on-site spares. All measurement instruments are assumed to have current calibrations and we request that all pertinent calibration information be included in the data package.

1. 3 insulated CAT5 cables running from location site for CPUs to the flying bridge consoles

2. Power, ship's GPS, and ship's SCS connections to CPU running the flying bridge consoles
3. Space inside for CPUs, keyboards, and monitors referred to in Item #2
4. Three handheld radios (as spares)
5. Freezer space for water and biological samples (chest)
6. Bottom depth checking during CTD casts (consult charts)
7. CTD system (including rosette with Niskin bottles (10L, 12 ea.)
8. Oceanographic winch with 3/8" conducting wire, terminated to CTD
9. Micro thermosalinograph (SBE45) and connection
10. Sippican MK21w/ XBT launcher
11. Storage space in wet lab for 8 boxes of XBTs
12. Scientific Computing System for data collection
13. Hook-up (CTD) and counter space for NWFSC-supplied oceanographic computer
14. Marine Operations and Deck Log/Weather Observation sheets, filled out by Deck Officers if SCS is down for an extended period.
15. Installation of NWFSC-supplied sonobuoy antenna and coax cable
16. Deck space storage space for 2 fish boxes of sonobuoys
17. Ship's GPS connection to dry lab for acoustics computers
18. Deck space, Power hookup, and installation of winches for acoustics
19. Designated work space in drylab for 1-3 scientists
20. Copy Machine
21. Small standard freezer (-80 not required) for storage of chlorophyll samples
22. Connection of Micro thermosalinograph to the SBE interface box, including GPS input (append to data string with raw temp, conductivity, and calculated salinity). LAN connection to main lab (4) and 1 to flying bridge (to be used for time server
23. 40 degree Cold room for live animal culture

**B. Equipment and capabilities provided by the scientists**

1. Three 7x50 hand-held binoculars
2. Two 25x150 binoculars and stands
3. Two 14x45 hand-held stabilized binoculars
4. Two observer chairs for flying bridge
5. Video camera and tapes
6. Three digital Canon EOS D series cameras with lenses and extra batteries
7. Three handheld radios
8. Laptop computers (1-2) for scientific party email, digital photo management
9. Portable GPS component as backup to ship's system
10. Rifles, biopsy darts and tips, sample vials and storage solution
11. Predation event sampling nets
12. Desktop PC with RJ45 KVM extender for remote set up in SIC room
13. Monitor and keyboard for flying bridge to be used in conjunction with SIC remote PC
14. XBT probes (Deep Blues) – 5 cases
15. Oceanographic data logs and log books
16. Computers for environmental and acoustic (ADA) data acquisition
17. Fluorometer for discrete chlorophyll a analysis
18. Lab apparatus, logs and supplies for discrete chlorophyll a analysis

19. Wormley standard seawater vials for salinometer calibration (6 vials)
20. Salinity sample bottles (96 bottles), caps, and thimble inserts
21. Bucket for surface water sampling
22. Nutrient sample vials
23. Oceanographic sample nets – bongo nets
24. Safety sheets (MSDS's) and clean up materials for all chemicals
25. Acoustics recording equipment, including: mixer and recording equipment, laptop computers, CDs, accessory equipment
26. 2 Fish boxes of sonobouys
27. Two sonobuoy receivers
28. DAT recorder for sonobuoys
29. 2 hydrophone arrays
30. 2 Aluminum Hydraulic winches for hydrophone arrays, 3x4 foot print, approx. 400 lbs ea
31. Hansen Coupling Division male LL6-HKP/LL8-HKP ends to quick connect style connectors on 50' hose to hydraulic power supply for acoustic winch
32. Computer data storage media (CDs, etc.)
33. Permits for specimen collection and foreign research (copies will be provided to Commanding Officer)
34. 10 reams of paper
35. 2 8x50 hand-held binoculars
36. 1 waterproof laptop with power supply
37. 1 non-waterproof laptop with power supply
38. 1 Back-up GPS unit and antenna in the event of ship GPS feed failure
39. 2-4 hand-help FRS type radios
40. 1 marine VHF hand-held radio
41. One Canon EOS D10, cameras with lenses and extra batteries
42. Digital video camera and tapes
43. Batteries and power supply cords
44. Outdoor extension cords
45. Waterproof tables
46. Anti -fatigue matting for observers
47. Bongo net frame
48. Crate of nets
49. 6 crates of sample jars
50. Microscope
51. 3 crates of misc. supplies
52. 2 coolers
53. 22' Zodiac 630 and trailer for biopsy sampling, satellite tag deployment, biological sampling, photography
54. fluorometer
55. sonicator
56. plate mixer
57. plate reader
58. vortex mixer
59. mini -80 freezer
60. 3 acoustic recorder moorings

3.2.a Include a breakdown of weight by item-include L x W x H and weight of each item. The ship requires these calculations for stability purposes.

Item	Length (ft)	Width (ft)	Height (ft)	Total Weight (lbs)
Two 25x150 binoculars and cases	4.0	2.0	1.5	160
Two binoculars stands and yolks	2.0	2.0	5.0	140
Three 7x50 hand-held binoculars in Pelican case	2.5	1.5	1.0	25
Two 15x45 hand-held stabilized binoculars in Pelican case	2.0	1.5	1.0	20
Two observer chairs for flying bridge	2.65	2.5	3.0	75
Water proof housing for monitor and keyboard for flying bridge to be used in conjunction with SIC remote PC	2.0	2.0	2.0	30
Wooden table for flybridge monitor box	2.0	2.0	4.0	20
Desktop PC and monitor with RJ45 KVM extender for remote set up in SIC room	2.0	1.0	2.0	
3 Laptop computers and cases for survey, digital photo management	2.0	1.5	0.5	60
Portable GPS component as backup to ship's system	0.5	0.5	0.5	10
Four digital Canon EOS D series cameras with lenses and extra batteries in 2 Pelican cases	2.0	1.5	1.0	50
Video camera and tapes in Pelican case	2.0	1.5	1.0	25
4 Predation event sampling nets and handles	8.0	2.0	0.5	20
2 - Biopsy rifles in Pelican cases	4.0	2.0	0.5	60
Biopsy darts and tips, sample vials and storage solution	2.0	1.5	1.5	20
Three handheld radios				
Small Aluminum Hydraulic with towed array	4.0	4.0	3.0	400
Large Aluminum Hydraulic with towed array	4.0	4.0	4.5	684
Acoustics recording equipment case, including: mixer and recording equipment	3.0	3.0	4.0	60
3 laptop computers	2.0	1.5	0.5	45
Acoustics accessory equipment (5 Bins)	1.0	2.5	2.0	80
4 hard drives	1.5	1.0	1.0	30
Two sonobuoy receivers	0.5	0.5	0.1	10

Tool Box	1	0.5	1.5	30
2 Fish boxes of sonobouys	4.0	4.0	3.0	1840
Permits for specimen collection and foreign research (copies will be provided to Commanding Officer)				
10 reams of paper	2.0	1.5	1.5	40
XBT probes (Deep Blues) – 5 cases	2.0	2.0	2.0	180
Vacuum Pumps (2)	1.0	1.0	1.0	20
Fluorometer for discrete chlorophyll a analysis	3.0	2.0	1.75	50
Lab apparatus, logs and supplies for discrete chlorophyll a analysis ( 6 Totes)	2	1.25	1.25	120
3 Plastic carboys for water (2 L)	1.0	1.0	1.0	24
2 crates of salinity sample bottles (96 bottles), caps, and thimble inserts	1.5	1.5	1.5	30
SeaBird flow thru CTD recorder	0.42	0.42	1.67	15
PVC pipe for CTD water bath	0.75	0.75	2.92	10
Tote for CTD hoses, GPS, manuals...etc	1.25	1.83	1.08	<75
Observer chair w/ pedestal	2.17	1.83	3.33	25
Tote with 3 laptop computers, GPS, and associated electronic equipment, manuals	1.25	1.83	1.08	<75
Tote with hardware and tools for securing equipment	1.25	1.83	1.08	<75
Tote for small binoculars, camera, radios, survey manuals, office equipment	1.25	1.83	1.08	<75
Bongo net frame	5	.5	1.5	75
Crate of nets	1.5	1.08	.90	20
6 crates sample jars – after filling with sea water	1.5	3.24	1.8	180
One microscope – in crate	1.5	1.08	.9	30
3 crates of miscellaneous supplies	1.5	3.24	.9	100
Two coolers	2	3	1.5	10
22ft work boat and trailer	24	9	8	5000
3 Autonomous acoustic moorings	4	4	4	2400



### **III. Hazardous Materials**

#### **A. HAZMAT – Policy and Compliance**

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

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

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

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

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

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

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

## B. Inventory

Common Name of Material	Qty	Notes	Trained Individual	Spill control
Formaldehyde solution (37%)	1 L	Alkalinity, Stored in ship chem. lkr	Brad Hanson	F

## 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 saw dust.

### Inventory of Spill Kit supplies

Product Name	Amount	Chemicals it is useful against	Amount it can clean up
FSC 1 (Formalin Spill Control).	11 oz.	Formalin	1L

## D. Radioactive Materials

No Radioactive Isotopes are planned for this project.

## IV. Additional Projects

- A. Supplementary ("Piggyback") Projects – Acoustic recorder mooring deployment – Three moorings consisting of a subsurface float cabled to the acoustic recorder, acoustic release, and a railroad car wheel or chain anchor will be deployed off the aft deck at three sites to be determined off the Washington Coast.
- B. NOAA Fleet Ancillary Projects - None

## 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*

## V. Meetings, Vessel Familiarization, and Project Evaluations

- A. Pre-Project Meeting: The Chief Scientist and Commanding Officer will conduct a meeting of pertinent members of the scientific party and ship's crew to discuss required equipment, planned operations, concerns, and establish mitigation strategies for all concerns. This meeting shall be conducted before the beginning of the project with sufficient time to allow for preparation of the ship and project personnel. The ship's Operations Officer usually is delegated to assist the Chief Scientist in arranging this meeting.
- B. Vessel Familiarization Meeting: The Commanding Officer is responsible for ensuring scientific personnel are familiarized with applicable sections of the standing orders and vessel protocols, e.g., meals, watches, etiquette, drills, etc. A vessel familiarization meeting shall be conducted in the first 24 hours of the project's start and is normally presented by the ship's Operations Officer.
- C. Post-Project Meeting: The Commanding Officer is responsible for conducted a meeting no earlier than 24 hrs before or 7 days after the completion of a project to discuss the overall success and short comings of the project. Concerns regarding safety, efficiency, and suggestions for future improvements shall be discussed and mitigations for future projects will be documented for future use. This meeting shall be attended by the ship's officers, applicable crew, the Chief Scientist, and members of the scientific party and is normally arranged by the Operations Officer and Chief Scientist.
- D. Project Evaluation Report  
Within seven days of the completion of the project, a Customer Satisfaction Survey is to be completed by the Chief Scientist. The form is available at <http://www.omaο.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 ships', specific concerns and praises are followed up on while not divulging the identity of the evaluator.

## VIII. Miscellaneous

#### A. Meals and Berthing

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

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

All NOAA scientists will have proper travel orders when assigned to any NOAA ship. The Chief Scientist will ensure that all non NOAA or non-Federal scientists aboard also have proper orders. It is the responsibility of the Chief Scientist to ensure that the entire scientific party has a mechanism in place to provide lodging and food and to be reimbursed for these costs in the event that the ship becomes uninhabitable and/or the galley is closed during any part of the scheduled project.

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

#### C. Medical Forms and Emergency Contacts

The NOAA Health Services Questionnaire (NHSQ, Revised: 02 JAN 2012) 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](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](mailto: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](mailto: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.

#### **D. 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.

#### **E. 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 e-mail 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 at least 30 days in advance.

#### **F. 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.

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

#### **VIII. Appendices**

1. Figures, maps, tables, images, etc.
2. Station/Waypoint List (coordinates in Latitude, Longitude: degree-minutes)

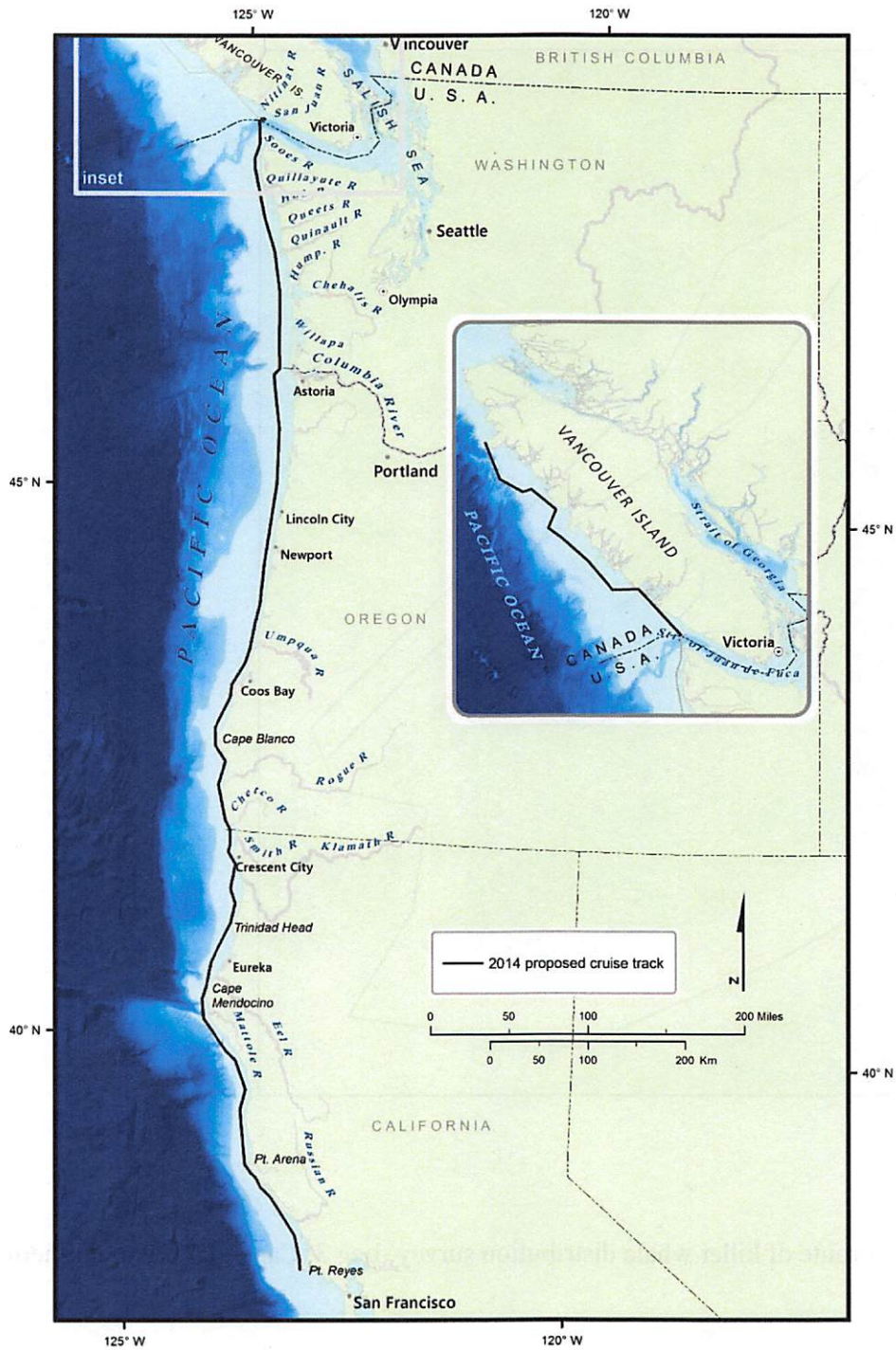


Figure 1. Generalized killer whale distribution survey, Leg 1, Cape Flattery to central California and generalized route of killer whale distribution survey (inset), Leg 2, Cape Flattery to Brooks Peninsula.

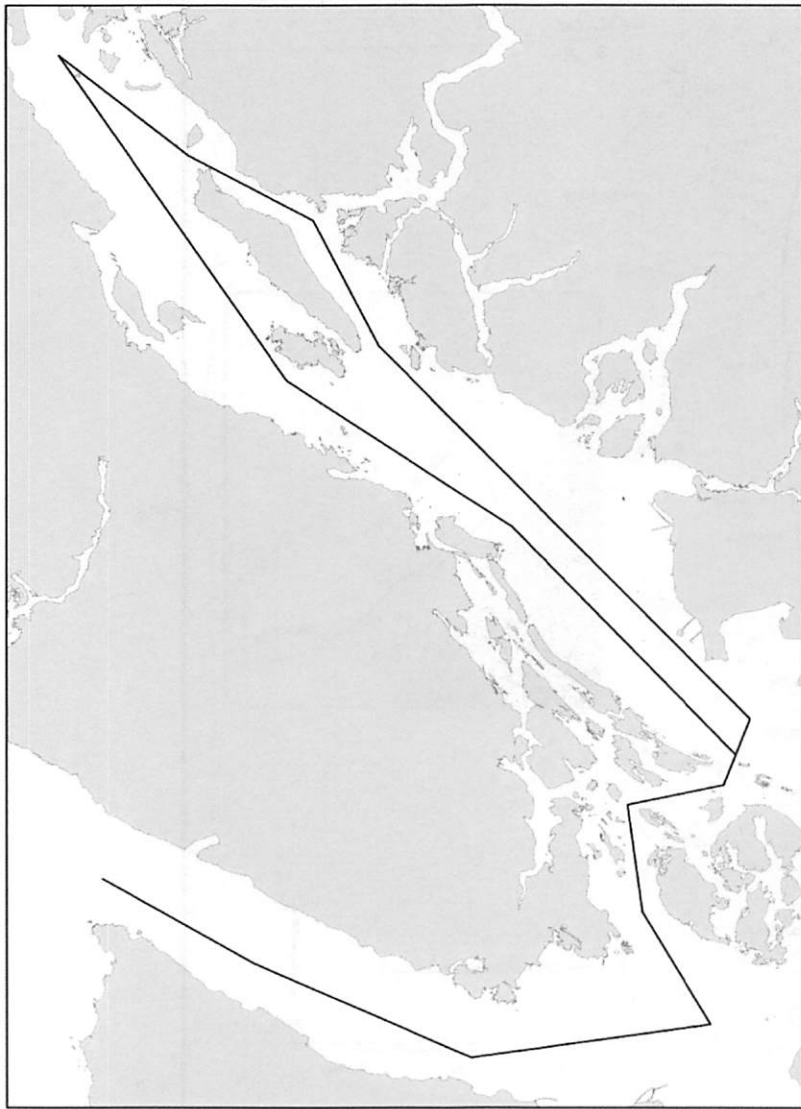


Figure 2. Generalized route of killer whale distribution survey, Leg 3, Cape Flattery to northern Strait of Georgia.



Station/Waypoint List for Figure 1 - Coordinates in Latitude, Longitude: degree-minutes for Leg 1 (U.S. coastal waters) and Leg 2 (Canadian coastal waters)

Ordered from SOUTH to NORTH			
Location	POINT_ID	X_COORD (long.)	Y_COORD (lat.)
USA	1	-123.05172	37.99958
USA	2	-123.06261	38.09046
USA	3	-123.14073	38.30959
USA	4	-123.45694	38.65275
USA	5	-123.58014	38.73779
USA	6	-123.64339	38.82210
USA	7	-123.70797	38.86320
USA	8	-123.78326	38.93643
USA	9	-123.89321	39.43683
USA	10	-123.84806	39.62748
USA	11	-123.99416	39.88884
USA	12	-124.11869	39.96976
USA	13	-124.42032	40.24828
USA	14	-124.44489	40.36159
USA	15	-124.45982	40.42375
USA	16	-124.42445	40.53986
USA	17	-124.39159	40.76953
USA	18	-124.19571	41.14520
USA	19	-124.15977	41.32614
USA	20	-124.23478	41.45965
USA	21	-124.20191	41.68675
USA	22	-124.30209	41.79757
USA	23	-124.28470	41.86169
USA	24	-124.29069	41.91096
USA	25	-124.29559	41.95127
USA	26	-124.30132	41.99830
USA	27	-124.37555	42.08580
USA	28	-124.49834	42.40129
USA	29	-124.43799	42.62438
USA	30	-124.58168	42.76028
USA	31	-124.60339	42.92548
USA	32	-124.45213	43.20993
USA	33	-124.44562	43.32885
USA	34	-124.30749	43.53429
USA	35	-124.26156	43.67596

USA	36	-124.22769	43.90358
USA	37	-124.18797	44.08644
USA	38	-124.17744	44.46492
USA	39	-124.10552	45.20118
USA	40	-124.14175	45.71116
USA	41	-124.25447	46.10947
USA	42	-124.26789	46.19984
USA	43	-124.20629	46.25098
USA	44	-124.23835	46.47194
USA	45	-124.28217	46.82957
USA	46	-124.30175	46.96462
USA	47	-124.41574	47.32018
USA	48	-124.59232	47.62334
USA	49	-124.78727	48.06274
USA	50	-124.79375	48.10742
USA	51	-124.80391	48.15411
USA	52	-124.75319	48.29270
USA	53	-124.79089	48.51694
USA	54	-124.72032	48.52148
CANADA	55	-124.79089	48.51694
CANADA	56	-125.14361	48.72405
CANADA	57	-125.46528	48.90781
CANADA	58	-125.83540	48.87232
CANADA	59	-126.24106	49.12090
CANADA	60	-126.65834	49.30993
CANADA	61	-126.87185	49.38692
CANADA	62	-126.79009	49.56953
CANADA	63	-127.18525	49.73475
CANADA	64	-127.30195	49.69920
CANADA	65	-127.66134	49.79012
CANADA	66	-127.94431	50.11519

Station/Waypoint List for Figure 2 - Coordinates in Latitude, Longitude: degree-minutes for Leg 3 (Canadian inland waters)

Point ID	X_COORD	Y_COORD
1	-124.6675700	48.4599700
2	-124.2745400	48.3449800
3	-123.6480900	48.2059600
4	-122.9958900	48.3020700
5	-123.2087100	48.4994400
6	-123.2705000	48.6745100
7	-123.0096200	48.7448700

8	-122.9495500	48.8701600
9	-124.0771600	49.5052000
10	-124.2934200	49.7248800
11	-124.6658500	49.8227100
12	-125.0554500	49.9840400
13	-124.3277400	49.4245300
14	-123.6566700	49.1911100
15	-123.0336500	48.8324100