**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
National Marine Fisheries Service
Southwest Fisheries Science Center
8604 La Jolla Shores Drive
La Jolla, CA 92037

# Cover Page

**Date submitted:** 28 June 2008

**Platform:** NOAA Ship McARTHUR II

**Cruise number:** M2-08-08 **SWFSC Cruise Number:** 1635

**Project Title:** Oregon, California, Washington Line-transect and Ecosystem (ORCAWALE) Survey

**Cruise Dates:** 28 July through 01 December 2008

**Signatures:**

Prepared by: _____ Dated: 30 June 08
Annette Henry
Survey Coordinator, SWFSC

_____ Dated: 6/24/08
Dr. Jay Barlow
Chief Scientist, SWFSC

Approved by: R. P. Merrett for Dated: 6/30/08
Dr. Norman W. Bartoo
Acting Director, F/SWR

Approved by: _____ Dated: _____
Captain Michelle Bullock
Commanding Officer, Marine Operations Center - Pacific

## 1.0 Mission

1.1 Mission Statement: The ORCAWALE 2008 survey cruise is a marine mammal assessment survey of the U.S. West Coast waters out to a distance of approximately 300 nautical miles. The primary objectives of the ORCAWALE cruise are to estimate the abundance and to understand the distribution of dolphins and whales which are commonly found off of the west coast. A secondary objective is to characterize the pelagic ecosystem within the study area, through the collection of underway and station-based physical and biological oceanographic sampling, studies of mid-trophic level organisms (using net sampling and acoustic backscatter methods) and research on non-protected apex predators (seabirds). A final objective is to conduct biopsy sampling and photo-identification studies of cetacean species of special interest.

1.2 Operating Area: The principal study area includes the U.S. West Coast Exclusive Economic Zone (EEZ) – Washington, Oregon, and California coastal waters out to a distance of approximately 300 nautical miles. The survey is planned to be a grid of predetermined tracklines to cover uniformly this offshore area.

1.3 Participating Institutions: Protected Resources Division, Southwest Fisheries Science Center, (NMFS, NOAA Fisheries).

1.4 Personnel: Personnel sailing on ORCAWALE 2008 are listed in Table 1. Personnel may need to be modified prior to or during the cruise due to extenuating circumstances. All modifications will be sent to the Operations Officer as soon as possible.

1.4a. Emergency contact information for personnel: Emergency contact information for scientific personnel sailing on ORCAWALE 2008 is located in Table 2.

1.4b Meals, dietary restrictions: Dietary preferences, restrictions, and allergies for scientific personnel sailing on ORCAWALE 2008 are listed in Table 3.

The Chief Scientist is responsible for the cleanliness of the laboratory spaces and storage areas used by the science party, both during the cruise and at its conclusion prior to departing the ship.

In accordance with NC Instruction 5255.0, Controlled Substances aboard NOAA Vessels, dated 06 August 1985, all persons boarding NOAA vessels give implied consent to conform to 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.

1.5 Administrative

*Primary Point of Contact (POC)*

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2.0 Operations: We will execute operations 24 hours each day as permitted by weather.

2.1 Mobilization: SWFSC will stage the cruise starting 23 July and continue through 27 July. The ship will be docked at Sand Point, Seattle, WA.

Equipment will arrive at Sand Point by 22 July. Craning operations will take place on 23 July. Pier-side crane services will be contracted by SWFSC in order to transport scientific equipment up to the flying bridge. All other equipment needing to be craned will require the use of the ship's crane. Scientists are responsible for setting up their equipment. Ship support from the Chief Boatswain, Survey Tech, and Chief Electronics Technician will be necessary during setup for installation of computers onto ships network, integration of SWFSC oceanographic equipment with ship's oceanographic equipment, and connection of acoustic winch hydraulic lines; SWFSC will provide welder to attach acoustic winch to the fantail.

2.2 Demobilization: Demobilization will take place at the Port of San Diego 10th Avenue Terminal on 01 December 2008. The scientific party will offload their equipment as soon as the ship has been cleared by the US Fish and Wildlife Service (USFWS). Because a substantial quantity of samples are expected to be collected during the survey, the US Fish and Wildlife Service (USFWS) inspection may take several hours. During this time, officers, crew, and scientists will be required to remain aboard the ship until the USFWS allows departures.

Pier-side crane services will be contracted by SWFSC in order to transport scientific equipment down from the flying bridge. All other equipment needing to be craned will require the use of the ship's crane.

2.3 Cruise plan: The itinerary for ORCAWALE 2008 follows:
Pre-cruise meeting: 11 June, at 1300 aboard NOAA Ship McArthur II, Seattle, WA
Staging ship: 23-27 July, Seattle, WA
[redacted]
Demobilization and EK60 acoustic calibration: 01-02 San Diego, CA

Daily safety meetings will take place at 0750 in a location set by the Operation's Officer. Daily operations meetings will take place at 1500 in a location set by the Operation's Officer. The Cruise Leader is required to attend the meetings.

Final Cruise Instructions will be submitted to MOC-Pacific no later than 27 June for signatures. A courtesy copy will be provided to the ship, via the Operations Officer, pending signatures.

2.4 Scientific Operations: A timeline of daily operations is displayed in Table 4. Daily operations may need to be modified prior to or during the cruise due to weather or other considerations. The Chief Scientist or Cruise Leader will notify the Operations Officer about changes in a timely manner.

2.4.1 Visual Surveys: Line-transect survey methods will be used to collect cetacean abundance data. A daily watch for cetaceans will be maintained on the flying bridge during daylight hours (approximately 0600 to 1900) by six (6) mammal observers. Each observer will work in 2-hour rotations, manning each of the following three stations on the flying bridge for 40 minutes: a port side 25x150 binocular station, a center-line data recorder position, and a starboard 25x150 binocular station. An "independent observer" may keep a separate watch of animals sighted during the cetacean survey operations, to be compared later with the observer team's data.

Visual surveys of seabirds will be conducted from the flying bridge during daylight hours by two seabird observers. Seabird observers will use handheld and 25x150 binoculars.

Ship Speed, Order of Operations: At the beginning of each day search effort should start on the trackline. The *McArthur II* should travel at 10kt (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 1kt, the bridge personnel will notify the mammal team on watch or the Cruise Leader.

On sighting a marine mammal school or other feature of biological interest, the Cruise Leader or marine mammal observer team on watch may request that the vessel be maneuvered to approach the school or feature for investigation. When the ship approaches a school of dolphins, the observers will make independent estimates of school size. Biopsy and photography operations may commence from the bow, based on directions from the Cruise Leader or Senior Marine Mammal Observers. In some instances, the Cruise Leader will request the deployment of a small boat for biopsy, photography, or other operations.

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 5nm from the trackline, at which point the ship should turn back toward the trackline.

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 5nm from the trackline, the observers should be notified. The Cruise Leader or Senior Marine Mammal Observers may request that, rather than proceed directly toward the next waypoint, the ship take a heading of 20 degrees back toward the trackline or return to the position at which the ship diverted before resuming effort.

Ship Equipment Required: Observation computers (mammal and seabirds) will be hooked up to the ship's GPS (for course, speed and position information) and SCS (for weather and heading information). If the SCS goes down for any reason, the ship’s Electronics Technician must manually restart the WINDACS_MAC event (in addition to the other events). A log of observation conditions, watch effort, sightings and other required information will be entered into a computer which needs to be linked 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 GPS.

Ship Personnel Requirements: Weather permitting, visual watches for marine mammals and seabirds will be conducted by observer teams on the flying bridge during all daylight hours (from sunrise to sunset). The Commanding Officer shall ensure that the flying bridge work area is smoke-free at all times when marine mammal or seabird observers are on watch.

2.4.2 Biopsy Sampling: Samples for genetic analyses of cetaceans will be collected on an opportunistic basis. Necessary permits will be present on the vessel.

Ship Speed, Order of Operations: The animals to be sampled will 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. Samples will be collected, from animals within 10 m to 30 m of the bow of the vessel, using a dart fired from a crossbow or rifle. Small boat deployment will be requested by the Cruise Leader on an opportunistic basis during all daylight hours, possibly multiple times in a single day, providing the Commanding Officer concurs that operating conditions are safe. Unless the Commanding Officer allows otherwise, the small boat will remain within sight and radio contact at all times while deployed.

Ship Equipment Required: With the exception of the small boat and safety gear, all necessary gear will be furnished and operated by the scientific party.

Ship Personnel Requirements: Ship personnel are required for launching and piloting small boat.

2.4.3 Photography: Photographs of marine mammals will be taken on an opportunistic basis. These will be used to study social behavior and movement patterns of identified individuals, and to study geographic variation. Necessary permits will be present on the vessel.

Ship Speed, Order of Operations: The animals to be sampled will 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. Small boat deployment will be requested by the Cruise Leader on an opportunistic basis during all daylight hours, possibly multiple times in a single day, providing the Commanding Officer concurs that operating conditions are safe. Unless the Commanding Officer allows otherwise, the small boat will remain within sight and radio contact at all times while deployed.

Ship Equipment Required: With the exception of the small boat and safety gear, all necessary gear will be furnished and operated by the scientific party.

Ship Personnel Requirements: Ship personnel are required for launching and piloting small boat.

2.4.4 Salvage of Marine Mammals and Birds: Marine mammal body parts and/or birds may be salvaged on an opportunistic basis at the discretion of the Cruise Leader. This includes whale and dolphin ivory and carcasses, and whole bird specimens. In the event that this occurs, scientific freezer space will be used to store the salvaged material. Permits to salvage and import marine mammal parts and birds will be present on the vessel. All marine mammal specimens obtained will be archived at the SWFSC but may be released on extended loan to recognized research institutions according to existing guidelines. All bird specimens will be donated to the San Diego Natural History Museum.

2.4.5 Passive Acoustics

2.4.5.1 Towed Hydrophone Array: A towed hydrophone array will be deployed approximately 300m behind the vessel during daylight hours on all legs, weather permitting. The array will be deployed by the acoustics personnel prior to the start of visual observations, and will be retrieved each evening after search effort ends. During Legs 1-4, one acoustics technician will be responsible for maintaining equipment, recording input, and monitoring automatic detection programs. During Leg 5, two acoustics personnel will monitor the array, record sounds made by cetaceans, and localize their positions.

Ship Speed, Order of Operations: The array will be retrieved 1) at the end of visual effort, 2) after the first IKMT trawl, or 3) at other times as requested. To retrieve the array, the ship will first slow down to 5kt and maintain its current heading. During array retrieval and deployment, the ships' course and speed must be maintained. During Leg 1, the cruise leader and acoustic team will work with the Commanding Officer to assess the maneuvering limits of the ship for this array (typically, vessel speed must be within 3 and 10 kt, turning must not exceed 180˚, and rudder angle must not exceed 3˚). The acoustics team must be informed of potential hazards, such as fishing gear, with the maximum lead time.

Ship Equipment Required: The array will be wound onto a hydraulic-powered winch supplied by the SWFSC. The winch and hoses will be provided by SWFSC; hydraulic power and connectors will be provided by the ship. Hookup to a ship-powered hydraulic system will be required. With the exception of the hydraulic winch hookups and safety apparel, all of the necessary equipment will be supplied and operated by scientific personnel.

Ship Personnel Requirements: Ship personnel are needed to secure the acoustic winch to the deck using ship steel plates and then hook-up the winch to ship-powered hydraulic system; SWFSC will provide welder if needed.

2.4.5.2 Sonobuoys: Sonobuoys may be deployed periodically from either the *McArthur II* or a small boat on an opportunistic basis at the discretion of the Cruise Leader.

Ship Speed, Order of Operations: The acoustics personnel will contact the bridge to ask permission to deploy the sonobuoy prior to deployment.

Ship Equipment Required: With the exception of the small boat and safety apparel, all of the necessary equipment will be supplied and operated by scientific personnel.
Ship Personnel Requirements: N/A

2.4.5.3 Hull Hydrophone: A hull-mounted hydrophone will be tested and monitored by the acoustics technician during all legs.

Ship Speed, Order of Operations: N/A

Ship Equipment Required: With the exception of the transmitting cable to the dry lab, all of the necessary equipment will be supplied and operated by scientific personnel.

Ship Personnel Requirements: The Chief ET may be needed to assist with transmitting cable connections.

2.4.6 Oceanography:

Ship Speed, Order of Operations: A chronological record of oceanographic and net tow stations will be kept by the ship (Marine Operations Log) with dates and times in GMT. The ship will provide a copy of the electronic marine operations log (with the cruise Weather Log and SCS data) to the SWFSC oceanographer at the completion of the cruise.

Ship Personnel Requirements: The collection of oceanographic samples and their processing will be conducted by the oceanographer, ship's Survey Technician, and other designated scientists with assistance from the Deck Department as required.

2.4.6.1 XBT Drops: There will be a minimum of three XBT drops per day. These drops will be conducted primarily at 0900, 1200 and 1500 local ship time, or as requested by the Cruise Leader. XBTs may also be dropped more frequently in pre-determined locations to sample fine scale thermal structure.

Ship Speed, Order of Operations: If the vessel is stopped at the scheduled launch time, the drop will be delayed until the ship is again underway. If the vessel is not going to move within half an hour, the individual performing the drop should be notified and the drop will be delayed or canceled, at the discretion of the Cruise Leader.

Ship Equipment Required: XBTs will be provided by the Southwest Fisheries Science Center, the Sippican MK-21 system will provided by the SWFSC and maintained by the ship, and the launcher and computer will be provided by the ship.

Ship Personnel Requirements: XBTs will be conducted by the oceanographer, ship's Survey Technician, and other designated scientists, while underway during the day.

2.4.6.2 Surface Water Samples: A minimum of three surface water samples will be taken each day, primarily at 0900, 1200, and 1500 hours local ship time daily. The samples will be analyzed for chlorophyll *a* and filtered samples will be stored for analysis of phycotoxin, phytopigment, QPCR, and nutrients. Surface water samples may also be collected more frequently in pre-determined locations to sample fine scale structure.

Ship Speed, Order of Operations: N/A

Ship Equipment Required: N/A

Ship Personnel Requirements: Oceanographic sampling will be done by the oceanographer, ship's Survey Technician, and other designated scientists, while underway during the day.

2.4.6.3 Phosphate Limitations in Plankton. Water samples (2-8 liters) will be collected 4-8 times daily to examine phosphate limitation in phytoplankton. These samples will be filtered and refrigerated in cryovials containing ethanol. Incubation experiments will also be conducted using a cooler connected to the seawater intake on the fantail. These samples will be analyzed using a pulse amplitude modulated fluorometer.

Ship Speed, Order of Operations: N/A

Ship Equipment Required: N/A

Ship Personnel Requirements: N/A

2.4.6.4 Thermosalinograph Sampling: The ship's TSG will continuously collect surface water temperature and salinity.

Ship Speed, Order of Operations: N/A

Ship Equipment Required: 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 TSG needs to be cleaned between each leg of cruise to prevent inaccurate salinity measurements. The Scientific Computing System (SCS) will serve as the main data collection system.

Ship Personnel Requirements: The oceanographer will provide the ship's Operations Officer and Electronics Technician with detailed SCS acquisition information before departure. The SCS data acquisition will be stopped and restarted weekly so the data files can be backed up and checked for errors. All SCS data will be provided to the SWFSC oceanographer following each leg of the cruise. Ship personnel will be responsible for cleaning the TSG between each leg of the cruise.

2.4.6.5 CTD Sampling:

2.4.6.5.1 Deck Pressure Tests for Each Leg: A deck pressure test is required at the beginning of each leg (five times throughout cruise).

Ship Speed, Order of Operations: The test takes approximately 30 minutes to complete.

Ship Equipment Required: see section 2.4.6.4.3

Ship Personnel Requirements: The test should be conducted by the Oceanographer and the ship's Survey Technician before leaving the dock; the CTD should be in its normal at-sea position on the ship.

2.4.6.5.2 CTD Bottle-test Cast for Each Leg: An additional CTD cast is needed on the first evening of oceanographic operations for each leg of the cruise. This cast will be used to test the agreement among salinity samples collected from all CTD bottles.

Ship Speed, Order of Operations: The bottle-test will occur prior to first CTD cast on each leg of the cruise. For this cast, a maximum depth of 700m is needed; at this depth, all bottles will be fired. The rate of CTD ascent and descent for this cast can be 60m per minute. The oceanographer will need time to take salinity samples from all bottles before the regular CTD cast can be conducted. The total amount of time needed for this cast is expected to be one hour: 30 minutes for the cast, 15 minutes for the sampling, and 15 minutes to prepare the CTD for the regular evening cast.

Ship Equipment Required: See section 2.4.6.4.3

Ship Personnel Requirements: Sampling will be done by the oceanographer, ship's Survey Technician, and other designated scientists.

2.4.6.5.3 CTD Stations: Weather permitting, between one and two CTD stations will be occupied each night: a pre-dawn cast (if the ship moved more than 10 nm after the end of effort the previous day) and an evening cast after the end of effort. 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 (supplied by the scientific party). SeaBird Electronics temperature, conductivity, pressure, and oxygen sensors will also be used to collect data from each cast.

Niskin bottle samples will be collected from 12 standard depths on all stations; the depths will be supplied by the oceanographer. Samples for chlorophyll will be collected from all depths ≤ 250m and processed onboard. The 265ml chlorophyll samples will be filtered onto GF/F filters, placed in 10ml of 90% acetone, refrigerated for 24 hours, and then analyzed on a Turner Designs model 10AU field fluorometer.

Salinity samples will be taken from bottles selected by the oceanographer. Analysis will be done by the oceanographer.

Samples for analysis of phycotoxin, phytopigment, QPCR, and nutrients will also be collected from depths provided by the oceanographer. For phycotoxin, phytopigment, and QPCR sampling, six samples of 250mL of water will be filtered onto 0.7μm GF/F filters; the filters will be placed in 2mL cryovials and stored in the -80C freezer. The water filtered for the phycotoxin

sampling will be stored in a plastic scintillation vial and stored in the -20C freezer for post-cruise nutrient (N, P, Si) analyses.

Ship Speed, Order of Operations: All casts are to 1000m, where bottom depths permit. When bottom depths are too shallow for the 1000m cast, the oceanographer and ship's survey technician will determine a safe depth for the cast and notify the bridge prior to operations. Casts descent rate will be at 30m/min for the first 100m of the cast, then 60m/min after that, including the upcast between bottles. An evening CTD cast will be conducted no sooner than one hour after sunset. The exact time will be determined by the Deck Officer (by 1800 local ship time that day). A morning cast will begin approximately one and one-half hours prior to sunrise, if the ship moved more than 10 nm after the end of effort the previous day. The exact starting time will be determined the evening before, by the Operations Officer or Deck Officer. Cast times are subject to change since sunrise and sunset will vary during the cruise and the schedule may be modified by the Oceanographer. Additional CTD stations may be requested by the Cruise Leader in areas of special interest.

Ship Equipment Required: The main SeaBird CTD system will be provided, maintained, and operated by the ship's Survey Technician. Scientific personnel will be trained to operate the A-frame; the crew of the vessel will operate winch and other deck equipment, and will be responsible for the termination (and any necessary reterminations) of the CTD cable pigtail to the conducting cable of the winch. All instruments, their spares, and spare parts provided by the ship must be maintained in working order and, if applicable, have current calibrations (within the previous 12 months). The SWFSC will provide a second set of sensors to be used on all casts; conducting CTD casts with two temperature and salinity sensors provides immediate feedback about the performance of the sensors and the validity of the data. SWFSC will also provide an oxygen sensor. To ensure longevity of the CTD and bottles, the CTD must be rinsed completely with fresh water after every cast, and the CTD and rosette must then be covered and secured.

Ship Personnel Requirements: The ship's Survey Technician and the SWFSC Oceanographer will participate in daily evening CTD sample collection and morning CTD sample collection when they are scheduled. The Deck Department will provide two people to assist with deployment.

2.4.6.6 Prey Fishes and Squids

2.4.6.6.1 Acoustics - The scientific EK60 depth sounder will be operated continuously at 38, 120, and 200 KHz.

Ship Speed, Order of Operations: 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. The navigational depth sounder aboard NOAA Ship *McArthur II* is known to interfere with the EK60 scientific sounder. Since synchronization is not possible, the navigational sounder should remain off when not in shallow water. The ship's navigational depth sounders will be on

when the ship is inshore in depths of 30 fathoms or less. The command will inform the Cruise Leader at any time the navigational depth sounders are used.

Ship Equipment Required: The EK60 will be interfaced to a data acquisition system to estimate micronekton biomass between 0 and 500 m.

Ship Personnel Requirements: N/A

2.4.6.6.2 Net Sampling - Net tows will be conducted by the scientific party as assigned by the cruise leader, with the assistance of a winch operator from the vessel. The schedule for these tows may vary by leg and may need to be modified by the Cruise Leader.

2.4.6.6.2.1 Isaacs-Kidd Midwater Trawl (IKMT) Tow: IKMT tows will be conducted after the evening bongo tow. After the evening bongo net tow, the ship will transit back along the trackline completed to conduct one or two additional oblique IKMT trawls before transiting to the start position for the next day (in consultation with the scientific party's net sampling team, the Cruise Leader will determine the number of and location of additional IKMT trawls, considering distance from the next day's start position, time available for a second CTD cast, etc.). After each tow, the net and cod end will be rinsed with a deck hose to be provided by the ship. The scientific party will attempt to rough-sort samples at sea (with exact duties to be determined by the Cruise Leader as needed), and material that cannot be worked up at sea will be preserved in formalin, alcohol or frozen, labeled, and stored in containers provided by the SWFSC until the vessel returns to San Diego. Sample material that is not retained will be disposed of at sea.

Ship Speed, Order of Operations: The first evening IKMT net tow, where bottom depths permit, will be conducted to 500m depth. Where the bottom is less than or equal to 500m depth, the tow will be conducted to a maximum depth of 30m off the bottom. Bottom depth will be determined by the ship, and depth of the tow will be determined from equipment provided by the SWFSC (a depth-encoded acoustic pinger, a hydrophone, and a depth-calibrated acoustic receiver). The scientific party will communicate the depth of the net to the winch operator. When the IKMT reaches its maximum tow depth, the net will be allowed to settle for approximately 30 seconds, and then the winch operator will retrieve the net. The IKMT will be towed at 2-4 knots (with the speed to be determined by the Cruise Leader) and wire will be payed out at 26m/min and retrieved at 20 m/min. The second evening IKMT tow will be to a maximum of 150m depth, and if a third evening IKMT tow is conducted its maximum depth will be determined by the Cruise Leader (in consultation with the scientific party's net sampling team) but be no greater than 350m. As with the first tow, the maximum depths of the second and third IKMT tows must be adjusted to account for bottom depth and must not be deeper than 30m off the bottom. Winch speeds for the second and third tows will be the same as those for the first. The geographic positions of the second and third evening IKMT net tows will be determined by the Cruise Leader on the basis of information gathered during the day and considering the requirements for a possible second CTD cast and starting visual observations the next morning.

Ship Equipment Required: The IKMT will be deployed from the starboard J-frame, and it will be attached to the wire on the starboard winch. The IKMT will be attached to the winch cable with a shackle or other component that allows it to be swapped with the bongo net which is intended to be deployed on the same wire. The IKMT will be provided by the SWFSC.

Ship Personnel Requirements: Net tows will require one winch operator in addition to the oceanographer and other designated scientists.

2.4.6.6.2.2 Bongo Tow: An oblique bongo tow will be conducted immediately following the evening CTD station. The bongo has 505-micron mesh on the starboard side, and 333-micron mesh on the port side. The samples will be preserved in formalin or frozen, labeled, and stored in containers provided by the SWFSC until the vessel returns to San Diego. Two cod ends will be used on the bongo tow.

Ship Speed, Order of Operations: An oblique bongo tow (45 minute station time) will be conducted for fifteen minutes immediately following the evening CTD station, to a depth of 200m (wire out 300m on starboard hydro winch). If no evening CTD is conducted, the tow will begin a minimum of one-hour after sunset.

Ship Equipment Required: J-frame and winch

Ship Personnel Requirements: Winch operator

2.4.6.6.2.3 Hand tow: A small hand net of 20µm mesh will be deployed vertically to collect a concentrated phytoplankton sample, which will be preserved for post-cruise analysis of *Pseudo-nitzschia* morphologies by scanning electron microscopy (SEM). The contents of the cod end will be placed in a glass scintillation vial and preserved with acid-Lugol. The vials will be stored in a cool, dark location.

Ship Speed, Order of Operations: The hand tow net will be deployed during the evening CTD station.

Ship Equipment Required: N/A

Ship Personnel Requirements: Sampling will be done by the oceanographer and other designated scientists.

2.4.6.6.3 Collection of Squid: Concurrent with the evening CTD station, jigging for squid will take place using attracting lights, fishing lines, and handline jigs. Small to medium-size squid would be recovered from the mid-water trawl. Juvenile squid swimming at the surface will be collected with dipnets. Specimens smaller than 30 cm mantle length(ML) should be frozen intact as soon as possible in plastic bags and properly labeled for further

identification, morphometric analysis and tissue collection at the NMFS SWFSC labs. Large squid (larger than 30 cm ML) will be weighed, sexed, maturity stage noted, and mantle lengths measured aboard the ship by the visiting scientist in charge of squid sampling. Gill, gladius or pen, the complete buccal mass (beak and muscle), stomachs, and heads (with arms removed) would be saved for processing later. Gill samples will be stored in 95% ethanol in 1.5 ml plastic vials; muscle tissue, gladius, and buccal mass samples will be bagged and frozen separate from the stomachs and heads, which will be bagged together and frozen as well. Frozen samples will be kept at -20°C. Although multiple squid species specimens are sought, the primary target species is jumbo squid (Dosidicus gigas). Species ID should be part of the normal routine if there is any question whether the animals are Dosidicus or something else. All samples should be labeled with latitude, longitude, bottom depth, date, time of capture, mantle length, sex, and maturity stage.

Ship Speed, Order of Operations: Squid jigging will be concurrent with the evening CTD station

Ship Equipment Required: Attracting lights

Ship Personnel Requirements: N/A

2.4.6.6.4Collection of Fish: Fish will be collected on an opportunistic basis at the discretion of the Cruise Leader. While underway, trolling gear will be used when conditions permit. While stationary, hook-and-line gear may be used. Fish will be measured, sexed, and stomach contents will be examined and recorded by scientific personnel. The Cruise Leader will be responsible for the disposition of the catch, in accordance with NOAA Administrative Order 202-735B, dated January 9, 1989.

Ship Speed, Order of Operations: N/A

Ship Equipment Required: N/A

Ship Personnel Requirements: When the hydrophone is being towed, all fishing lines must be manned by a fisherman within 10 feet of the attachment and must be retrieved immediately whenever the ship begins to turn.

2.4.6.7 Underway pCO2 System: The Pacific Marine Environmental Laboratory's underway pCO2 system will measure the partial pressure of CO2 in the air and surface water while the ship is underway. The pCO2 values, along with wind data, temperature, and salinity are used to calculate the flux of CO2 at the air-sea interface.

Ship Speed, Order of Operations: N/A (continuous operations)

Ship Equipment Required: The system requires 3 liters of seawater per minute and determined CO2 content with a Licor infrared detector.

Ship Personnel Requirements: Equipment maintenance, including: daily verification that the system is operating correctly, e-mail transmission of CO2 data to PMEL, and replacement of magnesium perchlorate desiccant every 3 days is the responsibility of the ship's Survey Technician.

2.4.6.8 Argo Buoy Deployments: Up to four Argo buoys will be deployed by scientific personnel to improve coverage in the Pacific Ocean; Argo is a major contributor to the WCRPs Climate Variability and Predictability Experiment (CLIVAR) and to the Global Ocean Data Assimilation Experiment (GODAE). The Argo array is part of the Global Climate Observing System/Global Ocean Observing System GCOS/GOOS.

Ship Speed, Order of Operations: The times and locations of the deployments will be determined by the Cruise Leader in consultation with the Command. Buoys will be deployed by a member of the scientific party after notifying the Deck Officer. The buoys will be loaded in Seattle and secured in a weather-protected area and stored horizontally at all times.

Ship Equipment Required: N/A

Ship Personnel Required: N/A

2.4.6.9 End of Operations (Transit at Night): When scientific operations are complete for the night, the ship will resume course along the trackline, at a speed determined by the Cruise Leader, until it is necessary to stop for the pre-dawn CTD station. It is estimated that the ship will need to transit between 10 and 50 nm per night. The Cruise Leader will determine the nightly transit length on a daily basis.

2.5 Waypoints: Waypoints will be provided to the ship no less than 30 days prior to sailing (Figure 1. Trackline grid for study area).

3.0 Facilities:

3.1 Equipment and capabilities required of 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. Insulated cable running from location site for CPUs (CSCI stateroom) to the flying bridge consoles; cabling should have been replaced during winter inport
2. Power, ship's GPS, and ship's SCS connections to CPUs running the flying bridge consoles (Please note that it is very important that all science computers be connected to the same ship's GPS)
3. Canopy on flying bridge

4. Three handheld radios (as spares)
5. Small boat, including spare parts, for biopsy sampling, photography, seabird collection and marine turtle research
6. Freezer space for biological samples (2-45 cu. ft./standard chest freezer and 3 cu. Ft. - 80$^{o}$ freezer)
7. Seabird 9/11+ CTD system including rosette with Niskin bottles (2.5L, 12 each)
8. Oceanographic winch with minimum 500m of .375" conducting wire, terminated to CTD
9. Hydrographic winch with minimum 2500m cable (3/8" minimum diameter) for net tows
10. Bottom depth checking during CTD casts and all net tows in depths less than 2000m.
11. SeaBird thermosalinograph (SBE45) and connection to SCS
12. Connection of SBE38 to SCS (secondary temperature sensor for TSG)
13. Sippican XBT launcher (prefer aft deck location) and connection to Sippican software
14. Fume Hood (located in aft lab, aft counter, left side)
15. Small refrigerator for chlorophyll sample extraction (aft lab)
16. Storage space on aft deck for 18 boxes of XBTs in 2 fish boxes (48" x 44" x 30") and inside the ship (main or aft laboratories) for 23 boxes
17. Scientific Computing System for data collection
18. Simrad EK60 scientific echo sounder with 38, 120, and 200kHz transducers plus PC with EK60 data logging software and input cables
19. Autosal salinometer (model 8400) to use as spare (must be operational/tested prior to departure)
20. Counter space for SWFSC-supplied oceanographic computers and connections to network
21. Deck space for two bongo net frames (primary with nets attached and one spare frame)
22. Deck space for two IKMT rigs (one rig is a spare)
23. Deck hose with water supply to rinse nets as needed
24. Marine Operations and Deck Log (electronic)/Weather Observation sheets, filled out by Deck Officers
25. Connection of Micro thermosalinograph to the SBE interface box, including GPS input (append to data string with raw temp, conductivity, and calculated salinity)
26. Installation of SWFSC-supplied sonobuoy antenna and coax cable to the dry lab
27. Copy Machine
28. Additional email computer for scientific email use in dry Lab
29. Network access to a printer for biopsy sampling computer
30. Space in dry lab area for -80º freezer (36" x 48" footprint)
31. Hansen Coupling Division female LL6-HKP/LL8-HKP ends to quick connect style connectors on hose from hydraulic power supply for acoustic winch
32. Space of the aft deck for the acoustic winch (5' x 6' footprint)
33. Installation of SWFSC-supplied hull hydrophone cable to the dry lab
34. Two (2) ship's GPS connection to the dry lab for acoustics computers (Please note that it is very important that all science computers be connected to the same ship's GPS.)
35. Exterior storage space for three (3) pallets of sonobuoys (see item in the Equipment Supplied by SWFSC section)

36. Deck space for 2 fish boxes for acoustics equipment
37. Dry storage space for IKMT sample jars – minimum 5' x 5'x 5'
38. Saltwater hookup on fantail for cooler (where aquarium usually stays)
39. Space for fluorometer near cooler on fantail

3.2 Equipment and capabilities provided by science party: A break down by item including weight and dimensions will be provided to the ship no less than 30 days prior to sailing.

40. Nine 7x50 hand-held binoculars
41. Four 25x150 binoculars and stands
42. One 20x60 hand-held gyro-stabilized binoculars
43. Three observer chairs for flying bridge
44. Video camera and tapes
45. Two Digital SLR cameras, and one 35mm camera with lenses and 35mm film
46. Three handheld radios
47. Three laptop computers for scientific party e-mail use, one laptop for the Cruise Leader, and one laptop for the photo-ID team
48. Two desktop computers mounted in the SIC room with CAT5 KVM extension units at CPUs and at remote console units on the flying bridge
49. Portable GPS component
50. Crossbows, biopsy darts and tips, sample vials and storage solution (EtOH) with MSDS
51. Two liquid nitrogen tanks (one 70 l and one 34 l) for biopsy sample preservation with MSDS
52. Rifles, 9mm and .22 caliber blank charges
53. One notebook computer for biopsy data entry and two printers: a small deskjet and a thermal label printer
54. Two long-handled dip nets and sample containers
55. 2 gimbaled 20 gal aquarium tanks (for inside use)
56. 2 50-gallon aquarium tanks (for outside use)
57. Formalin and sodium borate
58. Bongo frame and nets (including spare frame and nets)
59. Three 20µm or 35µm mesh phytoplankton nets with cod ends and lines
60. Glass sample containers with lids for net tow samples, pint (22 boxes), quart (2 boxes) and gallon (1 box/4ea)
61. XBT probes (Deep Blues) - 41 cases to be stored in 2 fish boxes and lab spaces
62. Three computers for oceanographic data processing and 1 spare
63. Fluorometer (TD10AU) and one backup (TD10) for discrete chlorophyll *a* analysis
64. Lab apparatus, logs and supplies for discrete chlorophyll *a* analysis
65. Water filtration equipment and supplies: pressure/vacuum pump; 10L carboy with tabulation, fittings; GF/F filters and holder; graduated container to measure filtered water
66. Wormley standard seawater vials for salinometer calibration (55 vials)
67. SBE38, remote temperature sensor (already installed)
68. Salinometer (Portasal 8410) to use as primary salinometer

69. Salinity sample bottles, square w/plastic insert beneath screw cap (100 ea. -4 cases of 24 plus 4 spares)
70. Chemicals: Acetone, Hydrochloric acid, and Triton x-100 and respective MSDS; a complete inventory of chemicals will be provided to the ship prior to sailing.
71. Phycotoxin, phytopigment, QPCR, and nutrients sample vials
72. Bucket thermometer holder and thermometer (and 2 spares)
73. Oceanographic data logs and log books
74. Fish boxes, ten for storage including two for XBTs
75. Permits for specimen collection
76. Computer data storage media (diskettes, CDs, etc.)
77. 5 reams of paper
78. Keel-mounted hydrophone
79. -80º freezer (36" x 48" footprint)
80. "RESEARCH" Banner for prominent display in the State Waters of Washington - SWFSC to provide placement information to the ship no less than 48 hours prior to sail.
81. Two complete IKMT rigs (one rig is a spare and each rig consists of a bridle assembly, spreader bar, depressor vane, net, and cod end)
82. Two flowmeters for use on IKMT frames (one is a spare)
83. Acoustic pinger (and spare) and receiver to determine fishing depth of the IKMT
84. Three Pallets of sonobuoys (5'x5'x5', 1200 lbs when full)
85. One sonobuoy receiver
86. DAT recorder and laptop PC for sonobuoys
87. Hydrophone arrays and directional hydrophones
88. Aluminum hydraulic winch for hydrophone array, 6'x6' footprint, approx. 1200 lbs
89. Hansen Coupling Division male LL6-HKP/LL8-HKP ends to quick connect style connectors on 50' hose to hydraulic power supply for acoustic winch
90. Acoustics recording equipment, including mixer and recording rack, laptop computers (3), desktop computers (2), accessory equipment.
91. Two fishboxes for deck storage of backup acoustic equipment
92. IKMT collection equipment: 50 L formalin, 105 L Ethanol, storage jars (5' x 5' x 5' space)
93. Squid jigging rods, reels, and jigs.
94. Two external hard drives for EK60 data storage
95. Fluorometer for Plankton Phosphate Limitation project
96. Cooler for incubation of Plankton

## 4.0 Data and Reports:

4.1 Data Responsibilities: Ship data responsibilities include a chronological record of oceanographic and net tow stations kept by the ship (Marine Operations Log) with dates and times in GMT. The ship will provide a copy of the electronic marine operations log (with the cruise Weather Log and SCS data) to the SWFSC oceanographer at the completion of the cruise.

4.2 Ship operation evaluation report: An evaluation report required by MOC will be submitted within 30 days after the cruise ends with a copy to the ship.

5.0 Policies:

5.1 Policy/compliance: All NOAA ships will operate in full compliance with all NOAA hazardous materials.

5.1.1 (HAZMAT) requirements: The Cruise Leader shall be responsible for complying with MOCDOC 15, Fleet Environmental Compliance #07, Hazardous Material and Hazardous Waste Management Requirements for Visiting Scientists, released July 2002. All hazardous materials and substances needed to carry out the objectives of the embarked science mission, including ancillary tasks, are the direct responsibility of the embarked designated Chief Scientist, whether or not that Chief Scientist is using them directly. The ship's Environmental Compliance Officer will work with the Chief Scientist to ensure that this management policy is properly executed. Material Safety Data Sheet: All hazardous materials require a Material Safety Data Sheet (MSDS). Copies of all MSDSs shall be forwarded to the ship at least two weeks prior to sailing. The Chief Scientist shall have copies of each MSDS available when the hazardous materials are loaded aboard. HAZMAT for which the MSDS is not provided will not be loaded aboard.

The Chief Scientist will provide the Commanding Officer with an inventory indicating the amount of each hazardous material brought onboard, and for which the Chief Scientist is responsible. This inventory shall be updated at departure, accounting for the amount of material being removed, as well as the amount consumed in science operations and the amount being removed in the form of waste.

All HAZMAT, except small amounts for ready use, must be stored in the ship’s HAZMAT Locker. If science party requirements exceed ship's storage capacity, excess HAZMAT must be stored in dedicated lockers meeting OSHA/NFPA standards to be provided by the science party.

The scientific party, under supervision of the Chief Scientist, shall be prepared to respond fully to emergencies involving spills of any mission HAZMAT. This includes providing properly trained personnel for response, as well as the necessary neutralizing chemicals and clean-up materials. Ship's personnel are not first responders and will act in a support role in the event of a spill. The Chief Scientist shall provide a list of science party members that are properly trained to respond in the event of HAZMAT spills.

The Chief Scientist is directly responsible for the handling, both administrative and physical, of all scientific party hazardous wastes:

- No liquid wastes shall be introduced into the ship's drainage system
- No solid waste material shall be placed in the ship's garbage

- The embarking Chief Scientist will work with the departing Chief Scientist and the ship's Environmental Compliance Officer (ECO) to ensure proper tracking of inherited hazardous materials.

5.2 Inventory of Hazardous Materials: As previously mentioned, all hazardous materials require a Material Safety Data Sheet (MSDS). Copies of all MSDSs shall be forwarded to the ship at least two weeks prior to sailing. The Chief Scientist shall have copies of each MSDS available when the hazardous materials are loaded aboard. HAZMAT for which the MSDS is not provided will not be loaded aboard.

6.0 Radioactive Isotopes: N/A

7.0 Foreign National Access and Deemed Export Controls: 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). The foreign national's sponsor is responsible for obtaining clearances and export licenses required and for providing for required escorts by the NAO. Programs sponsoring foreign nationals should consult with their designated line office personnel to assist with the process (http://deemedexports.noaa.gov/contacts.html).

The following are basic requirements; full compliance with NAO 207-12 is required.

7.1: Responsibilities of the Chief Scientist: The Chief Scientist is responsible for ensuring the following is provided to the Commanding Officer before any foreign national will be allowed on board for any reason:

1. Written notification identifying the NOAA Program individual who is responsible for ensuring compliance with NOAA and export regulations for the foreign national (see Foreign National Sponsor responsibilities below).
2. A copy of the DOC/OSY clearance authorization for access by the foreign national.
3. A copy of Appendix B of NAO 207-12 with NOAA Chief Administrative Officer concurrence endorsement.
4. Written notification that the foreign national has been cleared against the State, Commerce and Treasury departments' Lists to Check (http://www.bis.doc.gov/ComplianceAndEnforcement/ListsToCheck.htm)
5. Provide the NOAA Foreign National List spreadsheet for each foreign national in the scientific party.

7.1.1 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. 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 Regional Security Officer.

7.1.2 Export Control: The Chief Scientist is responsible for complying with NAO 207-12

and the development of Technology Access Control Plans for items they bring aboard. The Chief Scientist must notify the Commanding Officer of any export controlled items they bring aboard and any access restrictions associated with these items. 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.

7.2 Responsibilities of the Commanding Officer: Ensure only those foreign nationals with DOC/OSY clearance are granted access. 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 NMAO approval and compliance with export and sanction regulations. Ensure foreign national access is permitted only if unlicensed deemed export is not likely to occur. Ensure receipt from the Chief Scientist of the NOAA Foreign National List spreadsheet for each foreign national in the scientific party. 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.

7.2.1 Export Control: Eight weeks in advance of the cruise, 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.

7.2.2 Espionage Indicators: 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 Regional Security Officer.

7.3 Responsibilities of the Foreign National Sponsor:

7.3.1 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.

7.3.2 FN Escort: The Departmental Sponsor/NOAA 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, NOAA (or DOC) employee. According to DOC/OSY, this requirement cannot be altered.

7.3.3 Forms: Ensure completion and submission of Appendix C (Certification of

Conditions and Responsibilities for a Foreign National Guest) as required by NAO 207-12 Section 5.03.h.

## 8.0 Miscellaneous

8.1 Shipboard Safety: The Chief Scientist will ensure all members of the scientific party wear closed-toed/closed-heeled shoes, and, when appropriate, work vests, hard hats, etc. Scientific staff will follow all shipboard safety measures including participation in all required safety emergency drills; abiding to rules prohibiting the use of alcohol and illegal drugs onboard the ship, or to possession of firearms and other weapons without prior written approval of the XO; abiding to specified smoking restrictions; wearing proper footwear at all times; and adhering to other specified safety regulations when working on deck, such as the proper use of life vests, safety belts, and hard hats when handling equipment on deck or deploying it over the side, or riding in launches. Ship's equipment also is to be operated only by qualified members of the ship's complement. Scientific equipment is to be operated only by qualified scientific staff as well.

8.2 Communications: Large file attachments should be sent to only one (1) person shore side with instructions to forward on if necessary.

8.3 Port Agent services and billing: Applicable port agent/billing procedures will be followed.

8.4 Wage Marine Working Hours and Rest Periods: Chief Scientist shall be cognizant of the reduced capability of the ship operating crew to support 24-hour mission activities with a high tempo of deck operations at all hours. Wage marine employees are subject to negotiated work rules contained in the applicable collective bargaining agreement. Dayworkers' hours of duty are a continuous eight-hour period, beginning no earlier than 0600 and ending no later than 1800. It is not permissible to separate such an employee's workday into several short work periods with interspersed nonwork periods. Dayworkers called out to work between the hours of 0000 and 0600 are entitled to a rest period of one hour for each such hour worked. Such rest periods begin at 0800 and will result in no dayworkers being available to support science operations until the rest period has been observed. Under no circumstances will any wage marine work in excess of 12 hours during a 24 hour period.

All wage marine employees are supervised and assigned work only by the Commanding Officer or designee. Accordingly, the Chief Scientist and the Commanding Officer shall consult regularly to ensure that the shipboard resources available to support the embarked mission are utilized safely, efficiently and with due economy.

9.0 Tables, Figures, and Memorandum:

Figure 1. Study Area Gridlines for ORCAWALE 2008
Table 1: Waypoints for Leg 1 and Leg 2.
Table 2: Scientific personnel including affiliation and nationality
Table 3: Emergency contact information for scientific personnel
Table 4: Dietary preferences, restrictions and allergies for scientific personnel
Table 5: A timeline of daily operations
Memorandum of Small Boat Risk

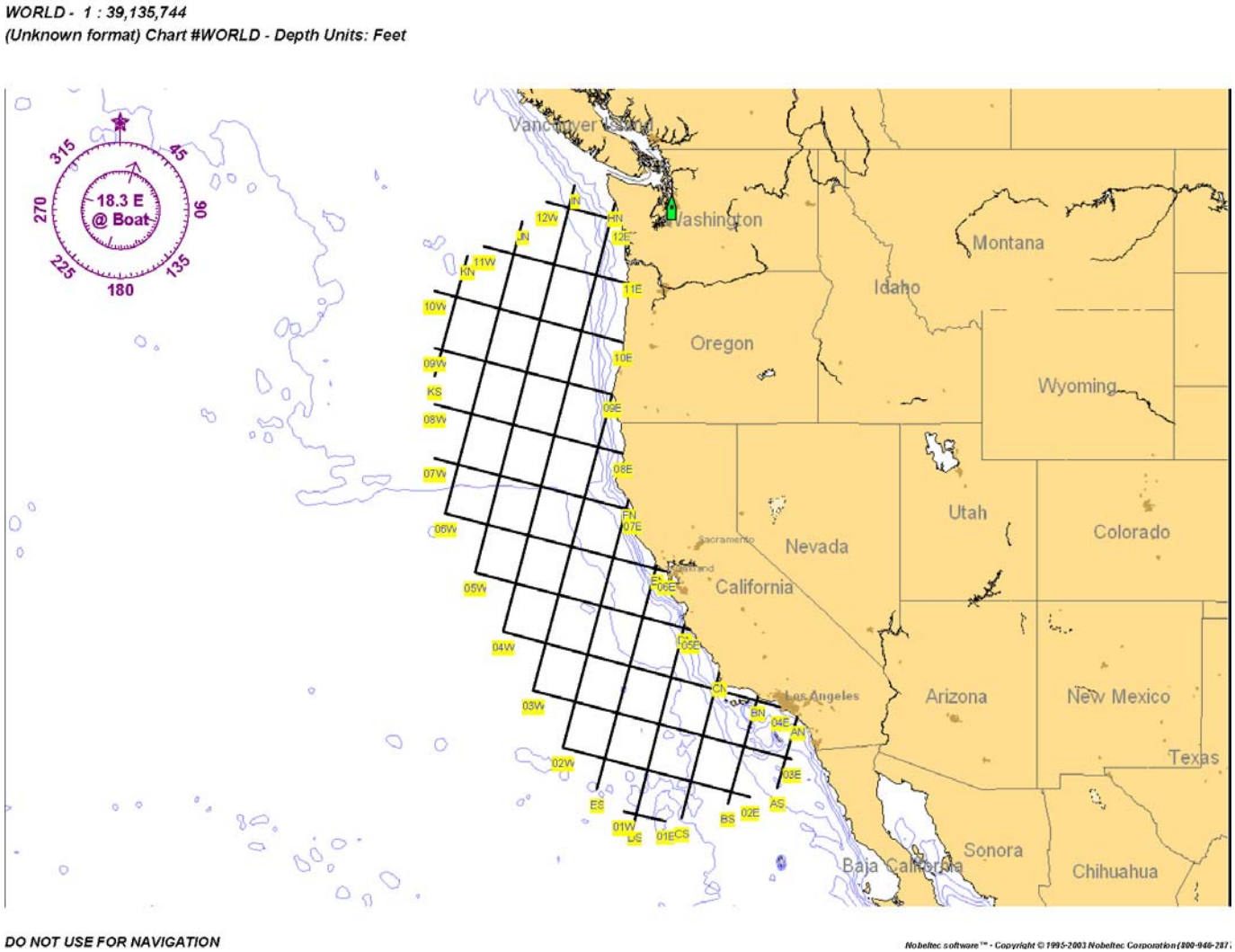


Figure 1A. Grid of tracklines to be achieved on ORCAWALE 2008.

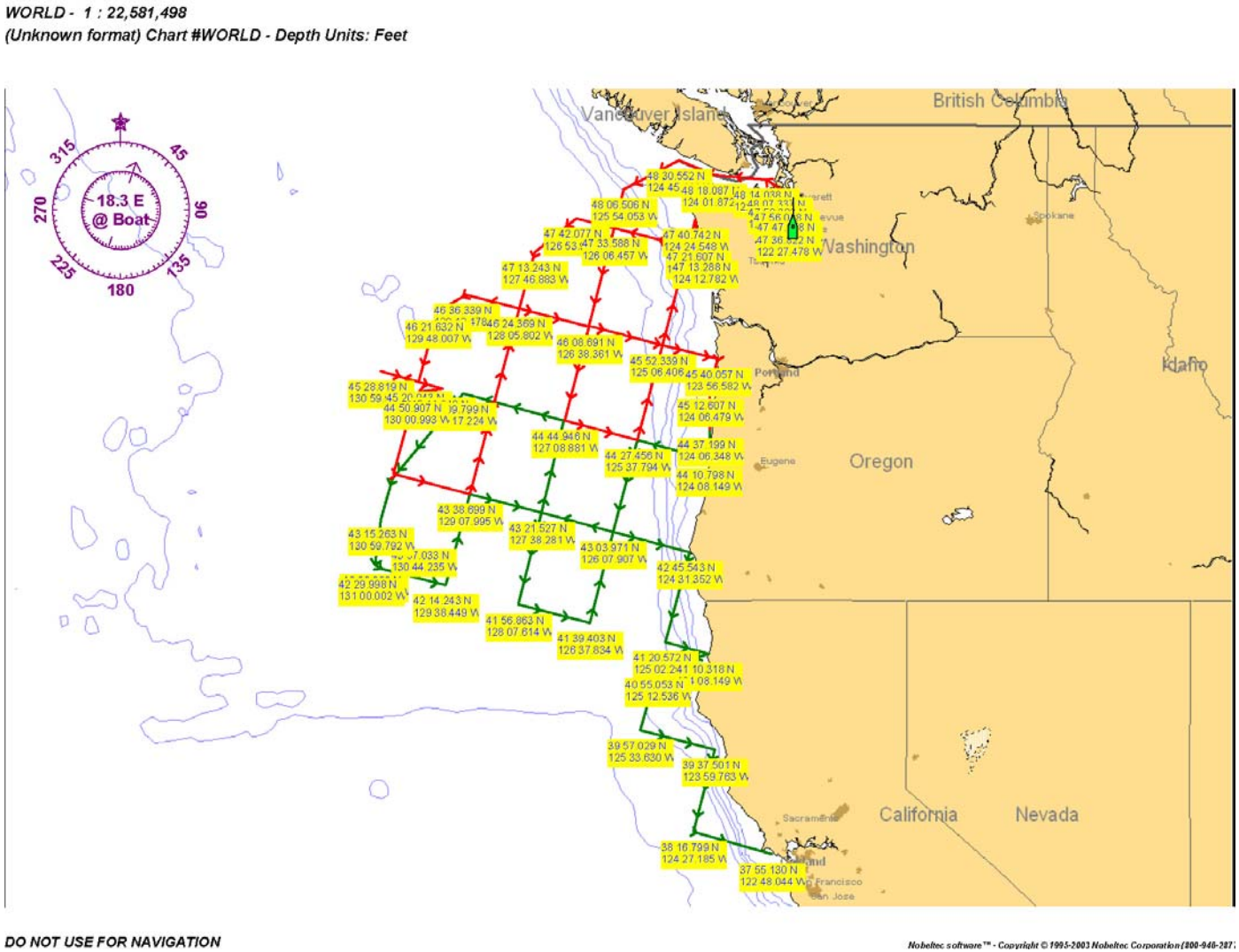


Figure 1B. Tracklines to be completed on Leg 1 (red) and Leg 2 (green).

Table 1. Table of waypoints for Legs 1 and 2; waypoints provided electronically to ship.

| Leg | Waypoint | Latitude | Longitude | Distance |
|---|---|---|---|---|
| 1 | WP1 | 47 36.822 N | 122 27.478 W | N/A |
| 1 | WP2 | 47 47.678 N | 122 26.159 W | 10.894 nm |
| 1 | WP3 | 47 56.018 N | 122 29.587 W | 8.651 nm |
| 1 | WP4 | 47 59.383 N | 122 36.970 W | 5.981 nm |
| 1 | WP5 | 48 07.337 N | 122 39.079 W | 8.079 nm |
| 1 | WP6 | 48 14.038 N | 122 55.954 W | 13.097 nm |
| 1 | WP7 | 48 18.087 N | 124 01.872 W | 44.065 nm |
| 1 | WP8 | 48 30.552 N | 124 45.114 W | 31.296 nm |
| 1 | WP9 | 48 06.506 N | 125 54.053 W | 51.776 nm |
| 1 | WP10 | 47 33.588 N | 126 06.457 W | 33.955 nm |
| 1 | WP11 | 46 08.828 N | 126 38.131 W | 87.484 nm |
| 1 | WP12 | 45 52.431 N | 125 05.944 W | 66.093 nm |
| 1 | WP13 | 47 40.742 N | 124 24.548 W | 111.960 nm |
| 1 | WP14 | 47 21.607 N | 124 21.351 W | 19.256 nm |
| 1 | WP15 | 47 13.288 N | 124 12.782 W | 10.149 nm |
| 1 | WP16 | 47 42.077 N | 126 53.951 W | 112.704 nm |
| 1 | WP17 | 47 13.243 N | 127 46.883 W | 45.958 nm |
| 1 | WP18 | 46 24.369 N | 128 05.802 W | 50.561 nm |
| 1 | WP19 | 46 36.339 N | 129 12.478 W | 47.428 nm |
| 1 | WP20 | 46 21.632 N | 129 48.007 W | 28.546 nm |
| 1 | WP21 | 45 20.043 N | 130 12.595 W | 63.926 nm |
| 1 | WP22 | 45 28.819 N | 130 59.990 W | 34.413 nm |
| 1 | WP23 | 45 14.040 N | 129 41.877 W | 56.844 nm |
| 1 | WP24 | 45 10.545 N | 130 16.023 W | 24.311 nm |
| 1 | WP25 | 43 57.033 N | 130 44.235 W | 76.211 nm |
| 1 | WP26 | 43 38.699 N | 129 07.732 W | 72.028 nm |
| 1 | WP27 | 46 24.369 N | 128 05.900 W | 171.338 nm |
| 1 | WP28 | 46 08.691 N | 126 38.361 W | 62.505 nm |
| 1 | WP29 | 44 44.946 N | 127 08.881 W | 86.439 nm |
| 1 | WP30 | 44 27.475 N | 125 37.849 W | 67.128 nm |
| 1 | WP31 | 45 52.339 N | 125 06.406 W | 87.712 nm |
| 1 | WP32 | 45 40.057 N | 123 56.582 W | 50.230 nm |
| 1 | WP33 | 45 12.607 N | 124 06.479 W | 28.315 nm |
| 1 | WP34 | 44 37.199 N | 124 06.348 W | 35.409 nm |

| Leg | Waypoint | Latitude | Longitude | Distance |
|---|---|---|---|---|
| 2 | WP35 | 44 37.262 N | 124 06.567 W | N/A |
| 2 | WP36 | 44 10.798 N | 124 08.149 W | 26.489 nm |
| 2 | WP37 | 44 27.456 N | 125 37.794 W | 66.266 nm |
| 2 | WP38 | 43 04.068 N | 126 07.776 W | 86.154 nm |
| 2 | WP39 | 43 21.527 N | 127 38.281 W | 68.233 nm |
| 2 | WP40 | 44 45.162 N | 127 09.544 W | 86.148 nm |
| 2 | WP41 | 45 09.799 N | 129 17.224 W | 93.649 nm |
| 2 | WP42 | 43 53.221 N | 130 46.081 W | 99.386 nm |
| 2 | WP43 | 43 15.263 N | 130 59.792 W | 39.237 nm |
| 2 | WP44 | 42 33.283 N | 131 08.022 W | 42.411 nm |
| 2 | WP45 | 42 29.998 N | 131 00.002 W | 6.763 nm |
| 2 | WP46 | 42 14.243 N | 129 38.449 W | 62.279 nm |
| 2 | WP47 | 43 38.699 N | 129 07.995 W | 87.349 nm |
| 2 | WP48 | 43 21.527 N | 127 38.281 W | 67.302 nm |
| 2 | WP49 | 41 56.863 N | 128 07.614 W | 87.370 nm |
| 2 | WP50 | 41 39.403 N | 126 37.834 W | 69.167 nm |
| 2 | WP51 | 43 03.971 N | 126 07.907 W | 87.412 nm |
| 2 | WP52 | 42 45.543 N | 124 31.352 W | 73.079 nm |
| 2 | WP53 | 41 20.572 N | 125 02.253 W | 88.016 nm |
| 2 | WP54 | 41 10.318 N | 124 08.149 W | 41.946 nm |
| 2 | WP55 | 40 55.053 N | 125 12.536 W | 50.904 nm |
| 2 | WP56 | 39 57.029 N | 125 33.630 W | 60.205 nm |
| 2 | WP57 | 39 37.501 N | 123 59.763 W | 74.727 nm |
| 2 | WP58 | 38 16.799 N | 124 27.185 W | 83.473 nm |
| 2 | WP59 | 37 55.130 N | 122 48.044 W | 80.972 nm |

Table 2. Scientific personnel roster.

Leg 1. Astoria to Newport

| **Position** | **Name** | **Nationality** |
|---|---|---|
| Cruise Leader/Chief Scientist | Jay Barlow | United States |
| Sr. Mammal Observer | Jim Cotton | United States |
| Sr. Mammal Observer | Richard Rowlett | United States |
| Sr. Mammal Observer | Jim Gilpatrick | United States |
| Mammal Observer | Suzanne Yin | United States |
| Mammal Observer | Chris Cutler | United States |
| Mammal Observer | Allan Ligon | United States |
| Sr. Seabird Observer | Michael Force | Canada |
| Seabird Observer | Sophie Webb | United States |
| Oceanographer | Ryan Driscoll | United States |
| Mesopelagic Assistant | Jared Cox | United States |
| Acoustic technician | Tina Yack | United States |
| Mesopelagic technician | Pete Davidson | United States |
| Teacher-at-sea | Heather Judkins | United States |
| Oceanographic Assistant | Misty Blakely | United States |

Leg 2: Newport to San Francisco

| **Position** | **Name** | **Nationality** |
|---|---|---|
| Cruise Leader | Lisa Ballance | United States |
| Sr. Mammal Observer | Jim Cotton | United States |
| Sr. Mammal Observer | Richard Rowlett | United States |
| Sr. Mammal Observer | Mark Deakos | Canada / Permanent US Resident |
| Mammal Observer | Suzanne Yin | United States |
| Mammal Observer | Chris Cutler | United States |
| Mammal Observer | Allan Ligon | United States |
| Sr. Seabird Observer | Michael Force | Canada |
| Seabird Observer | Sophie Webb | United States |
| Oceanographer | Ryan Driscoll | United States |
| Visiting scientist | Karla Garcia | United States |
| Acoustic technician | Tina Yack | United States |
| Mesopelagic technician | Pete Davidson | United States |
| Visiting scientist | Ioana Ionescu | United States |
| Mesopelagic Assistant | R. Iliana Ruiz | Mexico / Permanent US Resident |

Table 2 continued.

Leg 3: San Francisco to San Diego.

| **Position** | **Name** | **Nationality** |
|---|---|---|
| Cruise Leader | Jim Carretta | United States |
| Sr. Mammal Observer | Jim Cotton | United States |
| Sr. Mammal Observer | Richard Rowlett | United States |
| Sr. Mammal Observer | Rich Pagen | United States |
| Mammal Observer | Suzanne Yin | United States |
| Mammal Observer | Chris Cutler | United States |
| Mammal Observer | Allan Ligon | United States |
| Sr. Seabird Observer | Michael Force | Canada |
| Seabird Observer | Sophie Webb | United States |
| Oceanographer | Ryan Driscoll | United States |
| Mesopelagic Assistant | Shannon Lyday | United States |
| Acoustic technician | Tina Yack | United States |
| Mesopelagic technician | Andrey Suntsov | Russia |
| Visiting Scientist | Jeremy Rusin | United States |
| Visiting scientist | Alyson Fleming | United States |

Leg 4: San Diego to San Francisco.

| **Position** | **Name** | **Nationality** |
|---|---|---|
| Cruise Leader | Karin Forney | United States |
| Sr. Mammal Observer | Jim Cotton | United States |
| Sr. Mammal Observer | Richard Rowlett | United States |
| Sr. Mammal Observer | Rich Pagen | United States |
| Mammal Observer | Suzanne Yin | United States |
| Mammal Observer | Chris Cutler | United States |
| Mammal Observer | Allan Ligon | United States |
| Sr. Seabird Observer | Michael Force | Canada |
| Seabird Observer | Sophie Webb | United States |
| Oceanographer | Ryan Driscoll | United States |
| Visiting scientist | Elizabeth Becker | United States |
| Acoustic technician | Tina Yack | United States |
| Mesopelagic technician | Andrey Suntsov | Russia |
| Mesopelagic Assistant | Jason Blackburn | United States |
| Visiting scientist | Justin Garver | United States |

Table 2 continued.

Leg 5: San Francisco to San Diego.

| Last | First | Middle |
|---|---|---|
| Cruise Leader | Megan Ferguson | United States |
| Sr. Mammal Observer | Jim Cotton | United States |
| Sr. Mammal Observer | Richard Rowlett | United States |
| Sr. Mammal Observer | Rich Pagen | United States |
| Mammal Observer | Suzanne Yin | United States |
| Mammal Observer | Chris Cutler | United States |
| Mammal Observer | Allan Ligon | United States |
| Sr. Seabird Observer | Michael Force | Canada |
| Seabird Observer | Sophie Webb | United States |
| Oceanographer | Ryan Driscoll | United States |
| Acoustician | Shannon Rankin | United States |
| Acoustic technician | Tina Yack | United States |
| Acoustic technician | Zachery Schakner | United States |
| Mesopelagic technician | Pete Davidson | United States |
| Mesopelagic Assistant | Lilian  Carswell | United States |

Table 5. Operations timeline. Note: All operations are dependent on sunrise and sunset. The timetable is based on sunrise at 0600 and sunset at 1900.

| Time | Acoustic Towed Array | Cetacean Operations | Seabird Surveys | XBT | Surface Water samples | CTD | Squid Jigging | IKMT | Hand Tow | Bongo Tow | TSG | EK60 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5:45 | X | | | | | | | | | | X | X |
| 6:00 | X | X | X | | | | | | | | X | X |
| 6:30 | X | X | X | | | | | | | | X | X |
| 7:00 | X | X | X | | | | | | | | X | X |
| 7:30 | X | X | X | | | | | | | | X | X |
| 8:00 | X | X | X | | | | | | | | X | X |
| 8:30 | X | X | X | | | | | | | | X | X |
| 9:00 | X | X | X | X | X | | | | | | X | X |
| 9:30 | X | X | X | | | | | | | | X | X |
| 10:00 | X | X | X | | | | | | | | X | X |
| 10:30 | X | X | X | | | | | | | | X | X |
| 11:00 | X | X | X | | | | | | | | X | X |
| 11:30 | X | X | X | | | | | | | | X | X |
| 12:00 | X | X | X | X | X | | | | | | X | X |
| 12:30 | X | X | X | | | | | | | | X | X |
| 13:00 | X | X | X | | | | | | | | X | X |
| 13:30 | X | X | X | | | | | | | | X | X |
| 14:00 | X | X | X | | | | | | | | X | X |
| 14:30 | X | X | X | | | | | | | | X | X |
| 15:00 | X | X | X | | | | | | | | X | X |
| 15:30 | X | X | X | X | X | | | | | | X | X |
| 16:00 | X | X | X | | | | | | | | X | X |
| 16:30 | X | X | X | | | | | | | | X | X |
| 17:00 | X | X | X | | | | | | | | X | X |
| 17:30 | X | X | X | | | | | | | | X | X |
| 18:00 | X | X | X | | | | | | | | X | X |
| 18:30 | X | X | X | | | | | | | | X | X |
| 19:00 | X | | | | | | | | | | X | X |
| 19:45 | | | | | | | | | | | X | X |
| 19:30 | | | | | | | | | | | X | X |
| 20:00 | | | | | | X | X | | X | | X | X |
| 20:30 | | | | | | X | X | | X | | X | X |
| 21:00 | | | | | | | | | | X | X | X |
| 21:30 | | | | | | | | X | | | X | X |
| 22:00 | | | | | | | | X | | | X | X |
| 22:30 | | | | | | | | X | | | X | X |
| 23:00 | | | | | | | | X | | | X | X |
| 23:30 | | | | | | | | X | | | X | X |
| 0:00 | | | | | | | | X | | | X | X |
| 0:30 | | | | | | | | X | | | X | X |
| 1:00 | | | | | | | | X | | | X | X |
| 1:30 | | | | | | | | X | | | X | X |
| 2:00 | | | | | | | | X | | | X | X |
| 2:30 | | | | | | | | X | | | X | X |

| Time | Acoustic Towed Array | Cetacean Operations | Seabird Surveys | XBT | Surface Water samples | CTD | Squid Jigging | IKMT | Hand Tow | Bongo Tow | TSG | EK60 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3:00 | | | | | | | | X | | | X | X |
| 3:30 | | | | | | | | | | | X | X |
| 4:00 | | | | | | | | | | | X | X |
| 4:30 | | | | | | X | X | | | | X | X |
| 5:00 | | | | | | X | X | | | | X | X |
| 5:30 | | | | | | | | | | | X | X |
| 5:45 | | | | | | | | | | | X | X |

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Fisheries Center
8604 La Jolla Shores Drive
La Jolla, California 92038

28 April 2008

MEMORANDUM FOR: Commanding Officer, NOAA Ship *McArthur II*

FROM: Annette E. Henry
Survey Coordinator, SWFSC

THROUGH: Jay Barlow
Chief Scientist, ORCAWALE 2008

SUBJECT: Statement of Intent to Use Small Boats, and Assessment of Risk for small boat missions during the ORegon, CAlifornia, WAshington Line-transect and Ecosystem (ORCAWALE) Survey aboard NOAA Ship *McArthur II*

During ORCAWALE 2008, small boats will be necessary for the biopsy sampling and photography research projects while at sea. There are no island stops or surf zone landings planned for this cruise.

Assessment of Risk:

In addition to the general risks inherent in all small boat operations at sea, the greatest risks with small boat operations on this survey are likely to be:

1) Cold water operations
   - ORCAWALE 2008 will include the waters off the coasts of California, Oregon and Washington, where water temperatures are cold. To increase the safety of those deploying in the small boats, the scientific party will provide Mustang suits to scientific crew, to be used at the discretion of the Command.

2) Launch and retrieval
   - The greatest risks are likely to be during launching and retrieval. To mitigate this risk we are taking extensive time before the cruise to drill crew and scientists on safe launching and retrieval techniques.

3) Operations around large whales
    - Although no whale researchers have been harmed by baleen whales, they are powerful animals and their potential to cause damage should not be ignored. To mitigate this risk we are hiring a scientist with extensive experience handling small boats around large whales and he is available to work with ship's crew to determine safe methods for approaching large whales.

4) Cross-bow/firearm use
    - Crossbows and rifle-powered dart guns will be used to biopsy whales. To mitigate this risk, we have hired one of the most experienced whale biopsy experts in the world to be the primary biopsy biologist. He will train others on safe use of these instruments.

5) Falls within the small boat
    - Falls are generally caused by an unexpected movement of the boat caused by wave action or by a sudden acceleration or deceleration by the coxswain. To mitigate this risk, we will require the coxswain to notify all occupants prior to a rapid change in course or speed. Prior to accelerating from a stop, the coxswain will ask all occupants if they are ready and will wait for a reply before proceeding. The coxswain will also be responsible for watching for rogue waves and for notifying occupants if the vessel is expected to take a sudden lurch.