UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center
8901 La Jolla Shores Drive
La Jolla, CA 92037-1508

Cruise Instructions

Date Submitted: July 17, 2014

Platform: R/V *Ocean Starr* - Stabbert Maritime

Project Number: SWFSC MMTD Cruise No. 1647

Project Title: California Current Cetacean and Ecosystem Assessment Survey: CalCurCEAS

Project Dates: August 1, 2014 to December 10, 2014

Prepared by: _____ Dated: _____
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Approved by: _____ Dated: _____

I. Overview

Objectives

The 2014 California Current Cetacean and Ecosystem Assessment Survey (CalCurCEAS) is a marine mammal assessment survey of the U.S. West Coast waters. The primary objectives of the CalCurCEAS are to estimate the abundance and to understand factors that affect the distribution of dolphins and whales that are commonly found off 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.

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. A map of the survey area and gridlines is shown in the Appendix, Figure 1.

Itinerary

Staging and ship set up: 1-4 August, San Diego, CA

Leg 1: 5-27 August, 23 DAS, San Diego, CA to Newport, OR
Leg 2: 30 August – 22 September, 24 DAS, Newport OR to San Francisco, CA
Leg 3: 25 September – 18 October, 24 DAS, San Francisco, CA to San Diego, CA
Leg 4: 22 October – 14 November, 24 DAS, San Diego, CA to San Francisco, CA
Leg 5: 17 November – 10 December, 24 DAS, San Francisco, CA to San Diego, CA

October San Diego In Port: Additional sonobuoy pallets will be loaded during San Diego port call; ship's force is needed to crane sonobuoys aboard the ship.

Points of Contacts

Primary Point of Contact (POC)
Annette Henry, Survey Coordinator, SWFSC
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Licenses and Permits

This project will be conducted under the National Marine Fisheries Service Permit No. 14097 issued to Southwest Fisheries Science Center, for research activities on marine mammals and sea turtles and National Marine Sanctuary Permit Multi-2013-009 issued to Southwest Fisheries Science Center to conduct activities within West Coast National Marine Sanctuaries (sanctuaries) for research purposes. Permits to salvage and import marine mammal parts and birds will be present on the vessel.

II. Operations

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.

At the beginning of each day search effort should start on the trackline. The ship 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.

Biopsy Sampling

Samples for genetic analyses of cetaceans will be collected on an opportunistic basis. 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 80 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 Captain concurs that operating conditions are safe. The small boat will remain within sight and radio contact at all times while conducting scientific missions.

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. 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 Captain concurs that operating conditions are safe. Unless the Captain allows otherwise, the small boat will remain within sight and radio contact at all times while deployed.

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. 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.

Passive Acoustics

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. Acousticians will be responsible for maintaining equipment, recording input, and monitoring automatic detection programs. Real-time monitoring of the array, and recording sounds made by cetaceans to localize their positions will also be conducted.

The array will be retrieved at the end of visual effort or 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 Captain to assess the maneuvering limits of the ship for this array (typically, vessel speed must be within 3 and 10 kts, turning must not exceed 180˚, and rudder angle limits will be determined during Leg 1). The acoustics team must be informed of potential hazards with the maximum lead-time. Trolling or rod and reel fishing cannot occur when the array is deployed.

Sonobuoys: Sonobuoys will be deployed periodically from either the ship or small boat on an opportunistic basis at the discretion of the Cruise Leader. The acoustics personnel will contact the bridge to ask permission to deploy the sonobuoy before deployment. Generally, we expect to deploy two sonobuoys before each nightly CTD station.

DASBR Buoys: Drifting Autonomous Spar Buoy Recorders (DASBRs) consist of a large white spar buoy attached to a cable with hydrophones, drogue, and weight at 100m depth. The spar buoy will be attached to a secondary buoy using a 10-m floating line to aid in detection and retrieval. Five DASBRs will be deployed and retrieved during the survey by a member of the acoustics team and a member of the ship's crew either from the stern of the vessel (when

stationary) or from a small boat. Deployment must occur at vessel speed no greater than 1.5 knots, and buoy will be deployed such that it drifts away from the vessel. This will require communication with the bridge immediately prior to deployment to discuss expected drift and preferred location of deployment. Buoys will be retrieved after 1-3 months either from the ship during a later leg or from a chartered vessel (TBD). Buoys will be tracked with two satellite geolocators and at close range (<5 nm) will be re-located with VHF radio tracking equipment and the assistance of observers on big-eye binoculars. The DASBRs and buoys include a ring of reflective tape at the top, and the ship's spotlight may be used to help locate a buoy at night, but nighttime retrievals are not anticipated. Retrieval from the small boat is preferred; however, a grappling hook from the ship can be used to hook the floating line between the DASBR and the float. Deployment and retrieval (once buoys are located) should each require approximately 30 minutes.

Seafloor Hydrophone: One seafloor hydrophone will be deployed during the cruise, likely in mid-October. The equipment will be picked up in Newport, Oregon for deployment south of Santa Cruz Island in Southern California. The deployment will be in about 3000m water depth. There are approximately 400m of line between the anchor and float. Because the ship has an experienced crew, it is safe to estimate 45-90 minutes deployment time for a 3000m mooring.

Deployment order of operations, alternate lifting, and deployment methods based on ship setup, and ship speed during deployment are detailed in Appendix 1. General deployment operations: after the float is deployed, ship speed should start out at 2.5 to 3 kts and should be deployed under tension to eliminate potential tangling of the mooring line with itself. The deployment should be as fast as can be done safely, with a maximum speed of 5 kts. The ship deployment speed at is subject to modification in the field. At the correct location, the ship's crane will lift the skid plate on which the anchor (railroad wheel) sits to *encourage* it to leave the ship.

Oceanography:

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. 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. XBTs will be conducted primarily by the scientific party while underway during the day; a handwritten log will be completed for each drop (e.g., date, time, latitude, longitude, comments on the drop, etc.). The completed log needs to be given to the Chief Scientist at the end of the survey.

Thermosalinograph Sampling: SWFSC will provide and maintain a thermosalinograph (TSG) for continuous measurement of surface water temperature and salinity. The TSG will continuously collect surface water temperature and salinity from the ship's clean seawater system.

Active Acoustics: The Simrad EK60 Scientific Echo Sounder will be operated continuously at 38, 70, 120, and 200 kHz. The vessel's navigational depth sounder may be used at the discretion of the Captain, but will normally remain off while underway in deep waters. The navigational depth sounder aboard vessels has been 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 may be on when the ship is inshore

in depths of 30 fathoms or less. The Captain will inform the Cruise Leader any time the navigational depth sounders are used. The EK60 will be interfaced to a data acquisition system to estimate micronekton biomass between 0 and 700 m. The data will be copied to each of two SWFSC external hard drives at the end of each leg.

Bongo Tow: Approximately two hours after sunset, an oblique bongo tow will be conducted for 15 minutes from a depth of 200m (wire out 300m on winch). Two cod ends will be used on the bongo tow. 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. The bongo tow will be conducted by the scientific party with the assistance of the deck department. The schedule for these tows may vary by leg and may need to be modified by the Cruise Leader.

Collection of Fish: Fish will be collected on an opportunistic basis at the discretion of the Cruise Leader. 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. While underway, trolling gear will be used when conditions permit. While stationary, hook-and-line gear may be used. Trolling or rod and reel fishing cannot occur when the hydrophone array is deployed.

El Niño Sampling:

Typically, there will be a six-hour window for El Niño sampling operations most nights. The order of operations will be as follows. The ship will proceed to a predetermined location/waypoint or simply conduct sampling at its current position. First, a CTD cast will be conducted, followed by a vertical plankton net cast (protocols described below). It is anticipated this will take between 1-2 hr depending on depth, weather, and experience. If time permits, several rods will be used for hook and line sampling by deck and scientific personnel to attempt collection of Humboldt squid. This will continue for up to one hour or as time permits. Upon recovery of the plankton net or conclusion of fishing activities, the ship will then move along any course required by the marine mammal survey, or if no transit is required, a waypoint (station) will be generated for the ship, with an estimated transit of 1-2 hr at a speed of 5-9 kt. At the new depending upon weather and time spent at the previous station, and then repeat sampling protocol in the same order- CTD, followed by vertical plankton net, and then hook and line sampling with a goal of completing all operations within the six hour window (or whatever time window is available that night).

CTD: A Sea-Bird CTD (SBE 19 profiler) will be used for hydrographic sampling. The ships winch operator will lower the CTD to 10m depth and hold for 2 min, then raise it to just below the surface and again lower the unit at a constant rate of 30m/min for the downcast to a depth about 5m above the bottom or to a maximum depth of 200m at stations deeper than 200m. The operator will hold the unit at max depth for 3 sec, then retrieve at a constant rate of 60m/min for the upcast. Additional sampling instruments, including a PAR sensor, fluorometer, oxygen sensor, and transmissometer, may be attached to the CTD.

Vertical net: A 0.5m diameter, 200um ring net will be used to collect zooplankton. While the boat is stopped, the weighted net will be lowered vertically to a point about 5m, above the bottom or to a maximum depth of 100m at stations deeper than 100m, and held there for 10 seconds. The net will be retrieved at a constant rate of 30m/min. Once on deck, net contents will

be rinsed down with a seawater deck hose into the codend and transferred to a storage jar with 5% buffered formalin preservative.

Hook and Line Squid Sampling: Sampling will be conducted opportunistically for squid using rod-n-reel and glow-in-the-dark squid jigs. Jigging will be conducted opportunistically, as transit time permits at nighttime stations where CTD and vertical net sampling are conducted, either before or after those samples are collected. Any squid collected will need to be gaffed and pulled on board over the rail for sampling in the wetlab.

End of Operations (Transit at Night)
When scientific operations are complete for the night, the ship may 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.

III. Equipment

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

1. Insulated cable running from location site for CPUs (SIC or Chief Scientist stateroom and acoustics laboratories) to the flying bridge consoles (minimum two connections).
2. Power and ship's GPS 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 – there will be six computers in the dry lab that will require GPS connections)
3. Canopy on flying bridge
4. Small boat (RHIB), including spare parts, for biopsy sampling, photography, seabird collection and marine turtle research
5. Freezer space for biological samples (standard freezer -20^{o} C and -80^{o} C freezer)
6. Hydrographic winch with minimum 2500m cable (3/8" minimum diameter) for net tows
7. Bottom depth checking during all net tows in depths less than 2000m.
8. Fume hood (located in chem lab, aft counter, inboard bulkhead)
9. Small refrigerator for cell culture (chem lab)
10. 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 2 boxes
11. Deck space for two bongo net frames (primary with nets attached and one spare frame)
12. Deck hose with water supply to rinse nets as needed
13. Hydraulic power unit for passive acoustic winch
14. Hansen Coupling Division female LL6-HKP/LL8-HKP ends to quick connect style connectors on hose from hydraulic power supply for acoustic winch
15. Space of the aft deck for the acoustic winch (6' x 6' footprint)
16. Four (4) ship's GPS connections to the acoustics lab for computers
17. Two (2) ship's GPS connections to the SIC room for two computers
18. Exterior storage space for three (3) pallets of sonobuoys
19. Deck space for 2 fish boxes for acoustics equipment
20. Dry storage space for bongo tow sample jars – minimum 5' x 5'x 3'
21. Space on flying bridge for 4 fish boxes of mammal equipment
22. Grappling hook and line

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

1. Nine 7x50 hand-held binoculars
2. Four 25x150 binoculars and stands
3. One 20x60 hand-held gyro-stabilized binoculars
4. Video camera and tapes
5. Three digital cameras, lenses, and accessories
6. Three handheld radios
7. Three laptop computers for Cruise Leader, photo-ID team, and backup unit
8. Two desktop computers, one mounted in the acoustics room and one mounted in Chief Scientist stateroom with CAT6 KVM extension units at CPUs and at remote console units on the flying bridge
9. Portable GPS component
10. Crossbows, biopsy darts and tips, sample vials and storage solution (Ethanol) with SDS
11. Two liquid nitrogen tanks (one 70 l and one 34 l) for biopsy sample preservation with SDS
12. One notebook computer for biopsy data entry and two printers: a small deskjet and a thermal label printer
13. Two long-handled dip nets and sample containers
23. Simrad EK60 scientific echo sounder with 38, 70, 120, 200, and 333 kHz transducers plus PC with EK60 data logging software and input cables
14. Sippican XBT launcher (prefer aft deck location) and connection to Sippican software
15. XBT probes (Deep Blues) - 38 cases to be stored in 2 fish boxes (18 boxes) and lab spaces (20 boxes)
16. Oceanographic data logs and log books
17. 2 fish boxes for on deck XBT storage
18. Jars for bongo tow sample preservation in formalin with SDS
19. Computer data storage media (diskettes, CDs, etc.)
20. Three pallets of sonobuoys (5'x5'x5', 1200 lbs when full); additional sonobuoy pallets will be loaded during San Diego port call (19-21 October)
21. Sonobuoy receivers with rack-mounted recording system
22. Hydrophone arrays and directional hydrophones
23. Aluminum hydraulic winch for hydrophone array, 6'x6' footprint, ~1200 lbs
24. Hansen Coupling Division male LL6-HKP/LL8-HKP ends to quick connect style connectors on 21' hose to hydraulic power supply for acoustic winch
25. Acoustics recording equipment, including mixer and recording rack, laptop computers (3), desktop computers (2), and accessory equipment.
26. Two fish boxes for deck storage of backup acoustic equipment
27. Two external hard drives for EK60 data storage
28. Five DASBR buoy systems
29. Seafloor hydrophone
30. Skid to deploy seafloor hydrophone
31. Installation of sonobuoy antenna and coax cable to the acoustic lab
32. zPermits for specimen collection
33. Printer/copy machine

IV. Hazardous Materials

Inventory

Common Name of Material	**Qty**	**Notes**	**Spill control**
Formalin (10%)	5 gallons	Alkalinity; stored in ship's chemical locker	Corrosive
Nitrogen	105 liters	Stored in dewar	Cryogenic
Ethanol			Flammable
Bleach			Corrosive

V. Scientific Personnel

Leg 1. San Diego to Newport

Position	Name
Cruise Leader/Chief Scientist	Jay Barlow
Sr. Mammal Observer	Juan Carlos Salinas
Sr. Mammal Observer	Paula Olson
Mammal Observer	Suzanne Yin
Mammal Observer	Adam Ü
Mammal Observer	Morgane Lauf
Mammal Observer	Jeff Moore
Independent Observer	Bennie Johnson
Independent Observer	Yaiyr Astudillo-Scalia
Sr. Seabird Observer	Michael Force
Seabird Observer	Dawn Breese
Acoustician	Susannah Calderan
Acoustician	Emily Griffiths
Acoustician	Eiren Jacobson
Oceanographic Technician	Annette Henry

Leg 2. Newport to San Francisco

Position	Name
Cruise Leader	Eric Archer
Sr. Mammal Observer	Juan Carlos Salinas
Sr. Mammal Observer	Paula Olson
Mammal Observer	Suzanne Yin
Mammal Observer	Adam Ü
Mammal Observer	Jim Gilpatrick
Mammal Observer	Jim Carretta
Independent Observer	Bennie Johnson
Independent Observer	Elanor Miller
Sr. Seabird Observer	Michael Force
Seabird Observer	Dawn Breese
Acoustician	Brian Miller
Acoustician	Emily Griffiths
Acoustician	Kym Collins
Oceanographic Technician	Elan Portner
Oceanographic Technician	Gina Lonati

Leg 3. San Francisco to San Diego

Position	Name
Cruise Leader	Lisa Ballance
Sr. Mammal Observer	Juan Carlos Salinas
Sr. Mammal Observer	Paula Olson
Mammal Observer	Suzanne Yin
Mammal Observer	Adam Ü
Mammal Observer	Robert Pitman
Mammal Observer	Jim Gilpatrick
Independent Observer	Mridula Srinivasan
Independent Observer	Charlotte Boyd
Sr. Seabird Observer	Michael Force
Seabird Observer	Dawn Breese
Acoustician	Michelle Wierathmueller
Acoustician	Emily Griffiths
Acoustician	Amy VanCise
Oceanographic Technician	Jacob Youssefzadah
Oceanographic Technician	Morgan Martin

Leg 4. San Diego to San Francisco

Position	Name
Cruise Leader	Barb Taylor
Sr. Mammal Observer	Juan Carlos Salinas
Sr. Mammal Observer	Paula Olson
Mammal Observer	Suzanne Yin
Mammal Observer	Adam Ü
Mammal Observer	Jim Gilpatrick
Mammal Observer	Lilian Carswell
Independent Observer	Sarah Mesnick
Independent Observer	Brittany Hancock-Hanser
Sr. Seabird Observer	Michael Force
Seabird Observer	Dawn Breese
Acoustician	Jennifer Keating
Acoustician	Emily Griffiths
Acoustician	Eric Keen
Oceanographic Technician	Alex McHuron
Oceanographic Technician	Megan Stoltzfus

Leg 5. San Francisco to San Diego

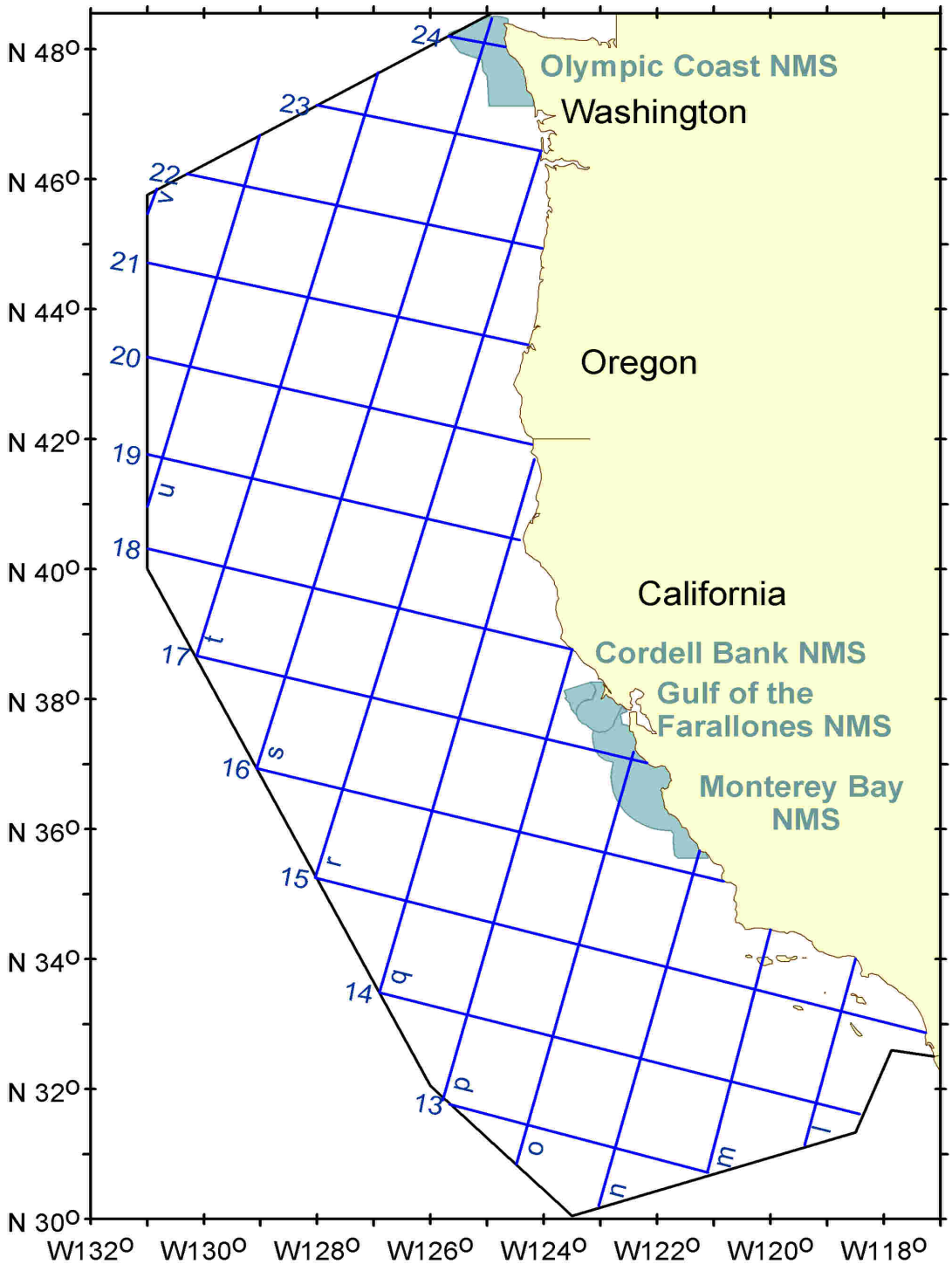
Position	Name
Cruise Leader	Karin Forney
Sr. Mammal Observer	Juan Carlos Salinas
Sr. Mammal Observer	Paula Olson
Mammal Observer	Suzanne Yin
Mammal Observer	Morgane Lauf
Mammal Observer	Scott Benson
Mammal Observer	Jim Gilpatrick
Independent Observer	Morgan Ritchie
Independent Observer	Lori Beraha
Sr. Seabird Observer	Michael Force
Seabird Observer	Dawn Breese
Acoustician	Arial Brewer
Acoustician	Jennifer Keating
Acoustic Technician	Nicky Beaulieu
Oceanographic Technician	Morgan Arrington
Visiting Scientist	Camilo Saavedra

VI. Appendices

Appendix 1
Tracklines and Station/Waypoint List (coordinates in Latitude, Longitude: degree-minutes)

Appendix 2
Seafloor Hydrophone Diagram and Deployment Instructions

Appendix 1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Olympic Coast NMS
Washington
Oregon
California
Cordell Bank NMS
Gulf of the Farallones NMS
Monterey Bay NMS

Appendix 2

Mooring Deployment Procedures

Ship position for deployment;
Deployment strategy

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

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

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

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

Mooring Set-up
(refer to mooring diagram included)

Pre-deployment
The mooring can be treated as two moorings, the top and the bottom, and can be built independently of each other. If possible get the anchor moved into position on the fantail, beneath the A-frame before

operations begin. This eliminates having to use the crane during the deployment operation and allows the tech to begin building the bottom of the mooring while the 3000-4200m mooring line is being deployed.

Building the top of the mooring

On the top loop of the float, splice the 10m polyolifin line and attach a 5/8" shackle to the top of the float (not the line), this will be used as the attachment point for the quick release used to deploy the float.

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

Attach 40m piece of ¾" nylon with a thimble bushing, to the bottom of the 1/2m chain using another 5/8" shackle. The pin goes through the nylon not the chain.

Flake the 40m piece of line out on the deck so it can go overboard without tangling.

When the ship is within 20 minutes of beginning the deployment, bring the hydrophone out of the lab and attach the 40m ¾" nylon to the top of the hydrophone. This attachment is done using a 5/8" shackle connected to the nylon, with a thimble bushing, hooked with a ½" shackle to the top of the hydrophone.

Inspect all nylon isolator bushings and shackles and verify they are in place.

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

Preparing to deploy

When using an A-frame, capstain/winch configuration

If the ship only has one method of lifting the mooring, and or only one block in the A-frame, you will need to do a "double pick-up."
This involves feeding the ship's lifting line through the block and attaching it to the float via a quick release. While the ship is at all stop, lower the float into the water and release it. While the 40m ¾" nylon line is slowly going overboard, feed the jacketed vectron through the block and attack it to the bottom of the hydrophone using a ½" shackle attached to a 5/8" sling link, or"pear-ring", and another ½" shackle to the 'phone. The 5/8" sling link is critical for stopping off the mooring on the subsequent recovery operation.

Lift the hydrophone off the deck with the Vectron line through the block on the A-frame

Have the bridge bring the ship up to deployment speed, start at 2kt, as the ship accelerates, the 40m nylon line will begin paying off the deck into the water as it is pulled off by the drag from the float. When the line is pulled tight, begin paying out the jacketed Vectron and the 'phone will go into the water as smoothly as possible.

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

Lift the float with the lifting line, then lift the hydrophone with the Vectron attached to the bottom of the hydrophone. Then lower the float into the water, release it, allow the 40m ¾" nylon to deploy and when the line comes under tension, lower the 'phone into the water.

After lifting the float over the side and booming out ~5-6m the mooring can be deployed through a snatch block on the crane. This method requires the capstain to provide the lifting while the crane is used similar to the a-frame or as a support for the block the line is going through. This method is preferred when working on the R/V Atlantis, since the A-frame is dedicated to Alvin no mooring work is allowed to use the A-frame.

If the capstain is unavailable, NOAA/PMEL has a portable 440v windlass we can mount so we can utilize the crane for over the side mooring deployments.

The mooring deployment procedure is the same as above except we use the crane/capstain rather than the A-frame/capstain combo.

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

Building the bottom of the mooring

Preparing the Acoustic Release for deployment.

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

Benthos 865a; Attach the detachable link and ARM the release. If not armed it won't release next year…

Attach a 2m chain to the 800lb anchor using a 5/8" shackle.

Attach a 5/8" shackle to the middle of the 2m chain, this is where you will attach the quick release to for lifting the anchor into the water.

Attach the upper end of the 2m chain to the detachable link on the acoustic release using a 5/8" shackle.

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

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

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

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

The lifting line must be strong enough to support all dynamic forces generated by the 800 lb anchor, 80 lb release and tension on the line.

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

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

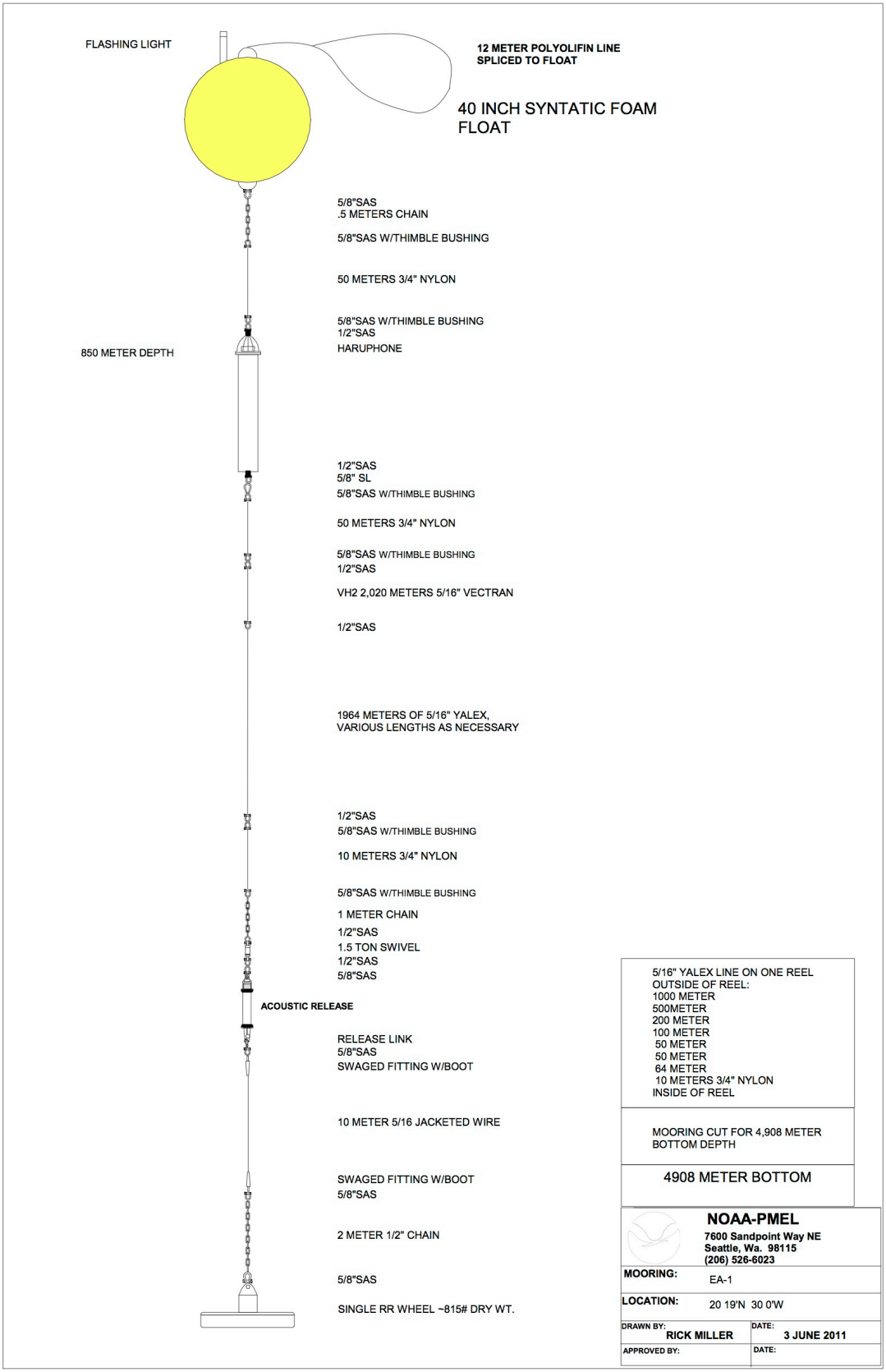
As you deploy the last of the mooring line, the 10m ¾" nylon, you will observe the drop line hanging free from the 1m chain, After the drop line has passed through the block on the A-frame, stop the deployment. Haul the line back in until you can grab the drop line while standing on the fantail. Use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

Attach the m chain to the swivel using a ½" shackle

Detach the lifting line from the 1m chain and transfer it to the quick release attached to the 5/8" shackle, mid way on the 2m chain between the anchor and the release. This is your pick-up point.

Take up the strain on the lifting line, check with the bridge, and tow the mooring until you get to the anchor drop point.

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


FLASHING LIGHT
12 METER POLYOLIFIN LINE
SPLICED TO FLOAT
40 INCH SYNTATIC FOAM
FLOAT
5/8"SAS
.5 METERS CHAIN
5/8"SAS W/THIMBLE BUSHING
50 METERS 3/4" NYLON
5/8"SAS W/THIMBLE BUSHING
1/2"SAS
HARUPHONE
850 METER DEPTH
1/2"SAS
5/8" SL
5/8"SAS W/THIMBLE BUSHING
50 METERS 3/4" NYLON
5/8"SAS W/THIMBLE BUSHING
1/2"SAS
VH2 2,020 METERS 5/16" VECTRAN
1/2"SAS
1964 METERS OF 5/16" YALEX,
VARIOUS LENGTHS AS NECESSARY
1/2"SAS
5/8"SAS W/THIMBLE BUSHING
10 METERS 3/4" NYLON
5/8"SAS W/THIMBLE BUSHING
1 METER CHAIN
1/2"SAS
1.5 TON SWIVEL
1/2"SAS
5/8"SAS
ACOUSTIC RELEASE
RELEASE LINK
5/8"SAS
SWAGED FITTING W/BOOT
10 METER 5/16 JACKETED WIRE
SWAGED FITTING W/BOOT
5/8"SAS
2 METER 1/2" CHAIN
5/8"SAS
SINGLE RR WHEEL ~815# DRY WT.
5/16" YALEX LINE ON ONE REEL
OUTSIDE OF REEL:
1000 METER
500METER
200 METER
100 METER
50 METER
50 METER
64 METER
10 METERS 3/4" NYLON
INSIDE OF REEL
MOORING CUT FOR 4,908 METER
BOTTOM DEPTH
4908 METER BOTTOM
NOAA-PMEL
7600 Sandpoint Way NE
Seattle, Wa. 98115
(206) 526-6023
MOORING: EA-1
LOCATION: 20 19'N 30 0'W
DRAWN BY: RICK MILLER
DATE: 3 JUNE 2011
APPROVED BY:
DATE: