Draft Project Instructions

Date Submitted: March 4, 2014

Platform: R/V *Ocean Starr*

Project Number: 1404OS

Project Title: CalCOFI/ATM/DEPM Survey, Fisheries Resources Division.

Project Dates: March 28, 2014 to April 26, 2014

Prepared by: _____ Dated: March 4, 2014
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Approved by: _____ Dated: 3/10/14
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I. Overview

A. Brief Summary and Project Period

Survey the distributions and abundances of pelagic fish stocks, their prey, and their biotic and abiotic environments in the area of the California Current between San Diego, California and San Francisco, California during the period of March 28 to April 26, 2014.

B. Operating Area

From San Diego, CA to San Francisco, CA and out 300 nautical miles. Please refer to appendix 1.b.

C. Summary of Objectives

Survey the distributions and abundances of pelagic fish stocks, their prey, and their biotic and abiotic environments in the area of the California Current between San Diego, California and San Francisco, California.

I.C.1. Continuously sample pelagic fish eggs using the Continuous Underway Fish Egg Sampler (CUFES). The data will be used to estimate the distributions and abundances of spawning hake, anchovy, mackerel, and spawning Pacific sardine. (Legs I & II)

I.C.2. Continuously sample multi-frequency acoustic backscatter using the Simrad EK60. The data will be used to estimate the distributions and abundances of coastal pelagic fishes (e.g., sardine, anchovy, and mackerel), and krill species. (Legs I & II)

I.C.3. Continuously sample sea-surface temperature, salinity, and chlorophyll-a using a thermosalinometer. These data will be used to estimate the physical oceanographic habitats for target species. (Legs I & II)

I.C.4. Continuously sample air temperature, barometric pressure, and wind speed and direction using an integrated weather station. (Legs I & II)

I.C.5. Sample profiles of seawater temperature, salinity, chlorophyll-a, nutrients, and phytoplankton using a CTD with water-sampling rosette and other instruments at prescribed stations. Measurements of extracted chlorophyll and phaeophytin will be obtained with a fluorometer. Primary production will be measured as C^{14} uptake in a six hour in situ incubation. Nutrients will be measured with an auto-analyzer. These data will be used to estimate primary productivity and the biotic and abiotic habitats for target species. (Leg II will not have water-sampling rosette, CTD profile only)

I.C.6. Sample the light intensity in the photic zone using a standard secchi disk once per day in conjunction with a daytime CTD station. These data will be used to interpret the measurements of primary production. (Leg I only)

I.C.7. Sample plankton using a CalBOBL (CalCOFI Bongo Oblique) at prescribed stations. These data will be used to estimate the distributions and abundances of ichthyoplankton and zooplankton species. (Legs I & II)

I.C.8. Sample plankton using a Manta (neuston) net at prescribed stations. These data will be used to estimate the distributions and abundances of ichthyoplankton species. (Leg I only)

I.C.9. Sample the vertically integrated abundance of fish eggs using a Pairovet net at prescribed stations. These data will be used to quantify the abundances and distributions of fish eggs. (Legs I & II)

I.C.10. Sample plankton using a PRPOOS (Planktonic Rate Processes in Oligotrophic Ocean Systems net) at all prescribed CalCOFI stations on lines 90.0, 86.7, 83.3 and 80.0 only. These data will be used in analyses by the LTER (Long Term Ecological Research) project. (Leg I only)

I.C.11. Continuously observe, during daylight hours, seabirds and mammals. These data will be used to estimate the distributions and abundances of seabirds and marine mammals. (Leg I only)

I.C.12. Within the Southern California Bight and possibly north of Point Conception, sample fish near the surface at nighttime by conducting 2-5 surface trawls at stations (Appendix 1.b.) or at random sites each night. The data will be used to estimate the reproductive parameters, distributions and demographics of sardine, anchovy and mackerel. (Leg II only)

D. Participating Institutions

I.D.1 Southwest Fisheries Science Center (SWFSC)

I.D.2 Scripps Institution of Oceanography (SIO)

I.D.3 Farallon Institute Advanced Ecosystem Research (FIAER)

I.D.4 California Wetfish Producers Association(CWPA)

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

Name (Last, First)	**Title**	**Date Aboard**	**Date Disembark**	**Gender**	**Affiliation**	**Nationality**
Scott Mau	Fishery Acoustician	March 28, 2014	March 28, 2014	M	SWFSC	US
Juan Zwolinski	Fishery Acoustician	March 28, 2014	March 28, 2014	M	SWFSC	Portugal
Kevin Stierhoff	Fishery Acoustician	March 28, 2014	March 28, 2014	M	SWFSC	US
Amy Hays	Cruise Leader	March 28, 2014	April 26, 2014	F	SWFSC	US
Sue Manion	Fishery Biologist	March 28, 2014	April 26, 2014	F	SWFSC	US
Bryan Overcash	Fishery Biologist	March 28, 2014	April 26, 2014	M	SWFSC	US
TBD	Volunteer	March 28, 2014	April 15, 2014	?	SWFSC	US

James Wilkinson	Oceanographer	March 28, 2014	April 15, 2014	M	SIO	US
Dave Wolgast	Oceanographer	March 28, 2014	April 15, 2014	M	SIO	US
Jennifer Rodgers-Wolgast	Oceanographer	March 28, 2014	April 15, 2014	F	SIO	US
Dave Faber	Oceanographer	March 28, 2014	April 15, 2014	M	SIO	US
Lindsey Ekern	Chemist	March 28, 2014	April 15, 2014	F	SIO	US
Megan Roadman	LTER	March 28, 2014	April 15, 2014	F	SIO	US
Brian Snouffer	LTER	March 28, 2014	April 15, 2014	M	SIO	US
Kelsey Gilmore	LTER	March 28, 2014	April 15, 2014	F	SIO	US
Dawn Breese	Bird Observer	March 28, 2014	April 15, 2014	F	FIAER	US
Katherine Whitaker	Marine Mammal Observer	March 28, 2014	April 15, 2014	F	SIO	US
Amanda Debich	Marine Mammal Acoustician/Observer	March 28, 2014	April 15, 2014	F	SIO	US
David Murfin	Fishery Acoustician	March 28, 2014	April 15, 2014	M	SWFSC	US
Scott Mau	Fishery Acoustician	April 15, 2014	April 26, 2014	M	SWFSC	US
Emily Gardner	Fishery Biologist	April 15, 2014	April 26, 2014	F	SWFSC	US
Erin Reed	Fishery Biologist	April 15, 2014	April 26, 2014	F	SWFSC	US
Ed Weber	Fishery Biologist	April 15, 2014	April 26, 2014	M	SWFSC	US
Joel Van Noord	Biologist	April 15, 2014	April 26, 2014	M	CWPA	US
Heather Colley	Volunteer	April 25, 2014	April 26, 2014	F	SWFSC	US

***Note: Acoustic Calibration staff to be transferred ashore via small boat following completion of calibration efforts.*

F. Administrative

1. Points of Contacts:

Chief Scientist/alternate: Sam McClatchie/ Amy Hays (858-546-7083/ 858-546-7130); 8901 La Jolla Shores Drive, La Jolla, CA, 92037 (Sam.McClatchie@noaa.gov/ Amy.Hays@noaa.gov)

Project Operation Lead: Sam McClatchie (858-546-7183); 8901 La Jolla Shores Drive, La Jolla, CA, 92037 (Sam.McClatchie@noaa.gov)

2. Diplomatic Clearances

N/A

3. Licenses and Permits

All marine mammal work is covered under a federal research permit NMFS Permit 727-1915 issued to Dr. John Hildebrand of SIO. All ichthyoplankton collections are covered under an MOU (Memo of Understanding) between the California Department of Fish and Game, the Southwest Region, National Marine Fisheries Service, NOAA and the Southwest Fisheries Science Center, National Marine Fisheries Service, NOAA.

II. Operations

A. Project Itinerary

	March 25: Arrive San Diego, CA
	March 28: Calibration in San Diego Bay, CA (see attached Appendix 1.c.)
Leg I:	March 28: Depart San Diego, CA - CalCOFI
	April 15: Arrive San Diego, CA
Leg II:	April 17: Depart San Diego, CA – ATM/ DEPM
	April 26: Arrive San Francisco, CA

Staging and De-staging

Staging for CalCOFI requires two full days. Final de-staging will be conducted in San Francisco, CA (pier TBD).

We request 1 laboratory van to be craned onto the afterdeck and secured in San Diego prior to Leg I departure. The dimension of the van is approximately 8x10x8 feet weighing 5800 lbs. Power requirement is 110V.

We request 1 electric winch to be craned onto the afterdeck and secured in San Diego prior to Leg I departure. The dimension of the winch is 4.5x4.5 feet. Power requirement is 440V 3-phase.

B. Operations to be Conducted

II.B.1. Underway Operations

II.B.1.a. Thermosalinometer sampling - The SWFSC will provide and maintain a thermosalinometer (TSG), which is calibrated and in working order, for continuous measurement of surface water temperature and salinity

II.B.1.b. Acoustics: Calibration of the Simrad EK60 echosounders will be performed at the beginning of the cruise (requiring 6 hours). The ship will sail at 0800 on March 28, 2014 and anchor in San Diego Bay, San Diego (see Appendix 1.c.), and calibrate. Three motorized down-riggers, two on one side of the vessel and one on the other, will be used to swing a 38.1 mm diameter tungsten carbide sphere beneath the hull-mounted transducers.

Throughout the cruise, the EK60 echosounders will be operated at 38, 70, 120 and 200 kHz and interfaced to a data acquisition system to estimate small pelagic fish and krill biomasses between 10 and 750 m. An EK60 Adaptive Logging program (EAL) will be run continuously to detect the seabed depth and optimize the logging range while avoiding aliased seabed echoes ("false bottoms"). The vessel's depth sounder and Doppler current meter may be used minimally at the discretion of the Captain, but will normally remain off while underway. During daytime transit between stations, the ship will maintain a desired speed of 10 knots. The ship shall inform the Cruise Leader of any use of the vessel's sounders, as it interferes with the signals received on the EK60s that will be used continuously.

II.B.1.c. CUFES: The egg pump will be mounted inside the ship's hull drawing water from a depth of three meters. During legs I and II, the pump will run continuously between stations to sample any pelagic fish eggs. Approximately 640 liters/minute is sent through a concentrator which filters all material larger than 505µm. The sieved material is then collected and identified. All fish eggs are identified to lowest taxa, counted and entered into the data acquisition software. Each sample entry is coupled with sea surface temperature, geographical position, date and time, and surface salinity. Sampling intervals will vary in length, depending on the number of fish eggs seen, from five to 60 minutes. If two consecutive samples have a concentration of Pacific sardine eggs equal to or greater than 1 egg per minute, the ship will stop to conduct a Pairovet tow. Pairovet tows will continue at four mile intervals until a concentration of less than one egg per minute is observed in two consecutive samples.

It is requested that prior to departure from Ballard, WA that the CUFES intake be cleared from all marine growth.

It is requested that prior to departure from Ballard, WA that the hull be cleaned of all barnacles and other bio-fouling organisms that will impede the acoustic calibration operations.

II.B.1.d. Bird Observations: During daylight hours a bird observer will be posted on the flying bridge to identify and count birds while the ship is underway during cruise transects. (Leg I only)

II.B.1.e. Acoustic hydrophone: During transit between most daylight stations, an acoustic hydrophone array will be towed from the stern at a distance of 300 meters with a deck loaded winch to record sounds from marine mammals. The winch is 440V 3-phase with a deck pattern of 4.5 by 4.5 feet. Upon approaching a station, a sonobuoy will be

deployed one nautical mile prior to stopping for station work. (Leg I only)

II.B.2. Station Operations

Each standard station will include the following:

II.B.2.a. CTD/Rosette consisting of 24 10-liter hydrographic bottles will be lowered to approximately 500 meters (depth permitting) at each station to measure physical parameters and collect water at discrete depths for analysis of: salinity, nutrients, oxygen, chlorophyll, etc. For leg II, a smaller CTD will be used and sent down to 200 meters. It is requested that the hydraulic hoist on the port side trolley way be installed and operational.

NOTE: SIO will provide their own CTD sensor and 24 bottle (10 liter) rosette for use on leg I. The SWFSC will provide the CTD for leg II.

II.B.2.b. CalBOBL (CalCOFI Bongo Oblique): standard oblique plankton tow with 300 meters of wire out, depth permitting, using paired 505 μm mesh nets with 71 cm diameter openings. The technical requirements for this tow are: Descent wire rate of 50 meters per minute and an ascent wire rate of 20 meters per minute. All tows with ascending wire angles lower than 38° or higher than 51° in the final 100 meters of wire will be repeated. Additionally, a 45° wire angle should be closely maintained during the ascent and descent of the net frame. A self-contained LOPC (Laser Optical Particle Counter) will be mounted in the port side opening during each tow. The port side sample will be preserved in buffered ethanol at every station.

II.B.2.c. Manta net (neuston) tow: using a 505 μm mesh net on a frame with a mouth area of 0.1333 m². Tows are 15 minutes in duration at towing speed of approximately 1.5 - 2.0 knots. Wire angles should be kept between 15° and 25°. Manta operations will be discontinued after completion of line 76.7. (Leg I only)

II.B.2.d. Pairovet net: will be fished from 70 meters to the surface (depth permitting) using paired 25 cm diameter 150 μm mesh nets at all stations out to and including station 100.0. The technical requirements for Pairovet tows are: Descent rate of 70 meters per minute, a terminal depth time of 10 seconds and an ascent rate of 70 meters per minute. All tows with wire angles exceeding 15° during the ascent will be repeated.

II.B.2.e. A PRPOOS (Planktonic Rate Processes in Oligotrophic Ocean Systems) net will be taken on specific stations on line 90.0, 86.7, 83.3, and 80.0 during leg I. These stations are occupied as part of the LTER (Long Term Ecological Research) project. The mesh of the PRPOOS net is 202 μm and the tow is a vertical cast up from 210 meters. The technical requirements for the PRPOOS tows are: Decent rate of 40 meters per minute, a terminal depth time of 20 seconds and an ascent rate of 50 meters per minute. (Leg I only)

II.B.2.f. Primary productivity: at about 1100 hours on each day of leg I a primary productivity CTD cast consisting of six 10-liter hydrographic bottles (mounted on CTD

frame) will be carried out. The cast arrangement will be determined by a Secchi disc observation. This cast will be in conjunction with an already scheduled station. The purpose of the cast is to collect water from six discrete depths for daily *in situ* productivity experiments. Measurements of extracted chlorophyll and phaeophytin will be obtained with a fluorometer. Primary production will be measured as C^{14} uptake in a six hour *in situ* incubation. Nutrients will be measured with an auto-analyzer. All radioisotope work areas will be given a wipe test before the departure of the SIO technical staff. (Leg I only)

II.B.2.g. A light meter (Secchi disk) will be used to measure the light intensity in the euphotic zone once a day with the primary productivity cast and all daytime stations. (Leg I only)

II.B.2.h. Weather observations.

II.B.3.a. Order of Operations for each standard station:

1) CTD to 515 meters with 24 bottle rosette (depth permitting). Leg II will have a CTD depth of 200 meters with no bottles.

2) Secchi disk (daylight stations only, Secchi will be first prior to CTD on Primary Productivity station of the day which is typically 0900-1100). (Leg I only)

3) PRPOOS net tow (lines 90.0, 86.7, 83.3 and 80.0 only). (Leg I only)

4) Pairovet net tow (on all lines out to station 100.0 but not to include near shore SCCOOS). (Leg I and out to station 80 on leg II)

5) Manta net tow (on all stations except for near shore SCCOOS and stations after line 76.7). (Leg I only)

6) Bongo net tow (on all stations). (Legs I & II)

7) After the completion of the six primary CalCOFI lines, the *Ocean Starr* will return to San Diego to reconfigure for trawling. Work will continue south to north up to Point Conception performing surface trawls between sunset and sunrise, and bongo, CTD and pairovet tows at fixed stations during the day as well as with a night trawl.

   A surface tow using a 264 Nordic Rope Trawl fitted with a marine mammal exclusion device (MMED) will be conducted during nighttime operations. Each tow will be fished on the surface for a 30 minute duration at a towing speed of approximately 3.5-4.0 knots. The catch of each tow will be processed in the following manner: Sardines collected in each trawl will be randomly subsampled. Standard length and body weight will be measured, otoliths will be collected, and ovaries preserved in buffered formalin. These fish are assigned a maturity code based on a four stage system developed during a previous Trinational Sardine Forum.

   Please record the locations and times when the acoustic data collection starts and stops each day. After the last trawl of each night, 30 minutes prior to sunrise, the ship

will return to the exact location where the acoustic sampling stopped the previous day, and resume acoustic sampling.

There will be three to five trawls per night. The first set will be approximately one hour after sunset. Trawls may or may not occur on predetermined stations. Trawl spacing will be determined based on sardine egg density, the acoustic backscatter observed during daytime, and other factors.

II.B.4.a. Plankton Nets, Oceanographic Sampling Devices, Video Camera and ROV Deployments: The SWFSC deploys a wide variety of gear to sample the marine environment during all of their research cruises. These types of gear are not considered to pose any risk to protected species and are therefore not subject to specific mitigation measures. However, the OOD and crew monitor for any unusual circumstances that may arise at a sampling site and use their professional judgment and discretion to avoid any potential risks to protected species during deployment of all research equipment.

II.B.4.b. The mate on watch, Chief Scientist (or other designated member of the Scientific Party), and crew standing watch on the bridge visually scan for marine mammals, sea turtles, and other ESA listed species (protected species) during all daytime operations. 7X bridge binoculars are used as necessary to survey the area as far as environmental conditions (lighting, sea state, precipitation, fog, etc.) will allow. A member of the crew designated to stand watch for protected species (dedicated to that function) visually scans the waters surrounding the vessel at least 30 minutes before the trawl net is to be put into the water. This typically occurs during transit prior to arrival at the sampling station, but may also include time on station if other types of gear or equipment (e.g., bongo nets) are deployed before the trawl.

"Move-On" Rule. If any marine mammals or sea turtles are sighted anywhere around the vessel in the 30 minutes before setting the gear, the vessel may be moved away from the animals to a different section of the sampling area if the animals appear to be at risk of interaction with the gear at the discretion of the officer on watch. Small moves within the sampling area can be accomplished without leaving the sample station. After moving on, if marine mammals or sea turtles are still visible from the vessel and appear to be at risk, the officer on watch may decide to move again or to skip the station. The officer on watch will consult with the Chief Scientist or other designated scientist (identified prior to the voyage and noted on the cruise plan) and other experienced crew as necessary to determine the best strategy to avoid potential takes of these species. Strategies are based on the species encountered, their numbers and behavior, their position and vector relative to the vessel, and other factors. For instance, a whale transiting through the area and heading away from the vessel may not require any move, or may require only a short move from the initial sampling site, while a pod of dolphins gathered around the vessel may require a longer move from the initial sampling site or possibly cancellation of the station if the dolphins follow the vessel. In most cases, trawl gear is not deployed if marine mammals have been sighted from the ship in the previous 30 minutes unless those animals do not appear to be in danger of interactions with the trawl, as determined by the judgment of the Chief Scientist or officer on watch. The efficacy of the "move-on" rule is limited during night time or other periods of limited visibility; research gear is deployed as necessary when visibility is poor, although operational lighting from the vessel illuminates the water in the immediate vicinity of the vessel during gear setting and retrieval.

Trawl operations are usually the first activity undertaken upon arrival at a new station in order to reduce the opportunity to attract marine mammals and other protected species to the vessel. However, in some cases, bongo or vertical nets may be deployed before the trawl in order to check for high densities of jellyfish and salps that may compromise the integrity of the trawl gear. Other exceptions include instances where trawls can only be conducted after night has fully fallen, but CTD's, bongo nets or other samples can be conducted during the crepuscular period (e.g., the juvenile rockfish survey). The order of gear deployment is determined on a case-by-case basis by the Chief Scientist based on environmental conditions and sonar information at the sampling site. Other activities, such as water sampling and most plankton tows, are conducted in conjunction with, or upon completion of, trawl activities.

Once the trawl net is in the water, the officer on watch, Chief Scientist, or other designated scientist, and/or crew standing watch continue to monitor the waters around the vessel and maintain a lookout for marine mammal and sea turtle presence as far away as environmental conditions allow (as noted previously, visibility can be limited for various reasons). If these species are sighted before the gear is fully retrieved, the most appropriate response to avoid incidental take is determined by the professional judgment of the officer on watch, in consultation with the Chief Scientist or other designated scientist and other experienced crew as necessary. These judgments take into consideration the species, numbers, and behavior of the animals, the status of the trawl net operation (net opening, depth, and distance from the stern), the time it would take to retrieve the net, and safety considerations for changing speed or course. Consideration is also given to the increase in likelihood of marine mammal interactions during retrieval of the net, especially when the trawl doors have been retrieved and the net is near the surface and no longer under tension. Acoustic pingers and excluder devices are not operational under these conditions. In some situations, risk of adverse interactions may be diminished by continuing to trawl with the net at depth until the marine mammals and/or sea turtles have left the area before beginning haul-back operations. In other situations, swift retrieval of the net may be the best course of action. The appropriate course of action to minimize the risk of incidental take of protected species is determined by the professional judgment of the officer on watch and appropriate crew based on all situation variables, even if the choices compromise the value of the data collected at the station.

If trawling operations have been delayed because of the presence of marine mammals or sea turtles, the vessel resumes trawl operations (when practical) only when these species have not been sighted within 30 minutes or else otherwise determined to no longer be at risk. This decision is at the discretion of the officer on watch and is situation-dependent.

Care is taken when emptying the trawl, including opening the cod end as close to the deck as possible in order to avoid damage to protected species that may be caught in the gear but are not visible upon retrieval. The gear is emptied as quickly as possible after retrieval in order to determine whether or not protected species are present.

II.B.4.c. Standard tow durations have been reduced to 30 minutes or less at targeted depth, excluding deployment and retrieval time, to reduce the likelihood of attracting and incidentally taking protected species. These short tow durations decrease the opportunity for curious marine mammals to find the vessel and investigate. The resulting tow

distances are typically 1 to 2 nautical miles, depending on the survey and trawl speed. Additionally, short tow times reduce the likelihood that captured sea turtles would drown.

II.B.4.d. The SWFSC uses several different types of trawl nets for different surveys. The two types that have taken marine mammals in the past are the Nordic 264 and the Modified Cobb trawl. Currently, all Nordic 264 nets are outfitted with marine mammal excluder devices (MMEDs) developed for the SWFSC. These excluder devices enable fish to pass through a grid and into the codend while preventing the passage of marine mammals, which bump into the slanted grid and slide out through an escape opening or swim back out of the mouth of the net .

While this excluder device was designed to minimize small cetacean and pinniped mortalities in trawl gear, the design is an adaptation of turtle excluder devices used in trawl gears in the Atlantic and Gulf of Mexico. The SWFSC believes that due to its similar configuration to turtle excluder devices, the excluder device may also be effective at reducing sea turtle capture and mortality in mid-water trawls. To date, SWFSC has had no known interactions with sea turtles when using mid-water trawl gear with an excluder device in place, so further testing is needed to validate this hypothesis.

II.B.4.e. Vessel speeds are restricted on research cruises in part to reduce the risk of ship strikes with marine mammals. Transit speeds vary from 8-11 knots, but average 10 knots. The vessel's speed during active sampling is typically 2-4 knots due to sampling design. Thus, these much slower speeds essentially eliminate the risk of ship strikes.

At any time during a survey or in transit, any crew member that sights marine mammals that may intersect with the vessel course immediately communicates their presence to the bridge for appropriate course alteration or speed reduction as possible to avoid incidental collisions, particularly with large whales (e.g., blue whales).

While underway on leg I:

We will have a bird observer on the flying bridge during all daylight transects.

We will have 2 marine mammal observers on the flying bridge during all daylight transects.

We will have a marine mammal acoustician with a towed hydrophone. The hydrophone will be towed off the stern at a distance of 300 meters between daylight stations. The hydrophone will be deployed at a ship speed of 5 knots while leaving a station. Once deployed, ship can travel at full speed. The hydrophone can be retrieved at ship's full speed.

At 1 mile prior to each daylight station marine mammal observers will deploy 2 sonobuoys. The hydrophone will be retrieved at this time.

Communication will be open to bridge during all hydrophone deployments and retrievals.

C. Dive Plan

N/A

D. Applicable Restrictions

Conditions which preclude normal operations:

In the event of poor weather conditions, we will work with the ship's officers on developing the best strategy for completion of all stations safely.

We have replacement gear for most operations. Equipment failure should not impact our project.

III. Equipment

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

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.

Starboard hydro winch with ¼" cable for standard Bongo, Pairovet and Manta tows

Port oceo winch with 0.434" EM cable for standard CTD casts

Port J-frame w/blocks to accommodate 0.434" cable

Port and starboard trawl winches with ⅝" diameter mechanical cable

Stern gantries with blocks to accommodate ⅝" cable

Constant temperature room set at 22^{o}C ± 1^{o}C (71.5^{o}F ± 2^{o}F)

Winch monitoring systems

Knudsen 12 kHz depth recorder or comparable

Multifrequency EK60 transducers (ES38B, ES70-7C, ES120-7C, ES200-7C)

Pump, collector and concentrator unit for CUFES water sampling

GPS feed to flying bridge for use by bird observers

GPS feed to main labs for use by scientists

110V power to science van on main deck

440V power to science winch on main deck

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

37% Formalin (SWFSC)

Ethanol (SWFSC)

Tris buffer (SWFSC)

Sodium borate (SWFSC)

30 cc and 50 cc syringes (SWFSC)

Canulas (SWFSC)

Pint, quart and gallon jars (SWFSC)

Inside and outside labels (SWFSC)

CalCOFI net tow data sheets (SWFSC)

71 cm CalCOFI Bongo frames (SWFSC)

71 cm CalCOFI 505 μm mesh nets (SWFSC)

CalCOFI 150 μm Pairovet nets and codends (SWFSC)

CalCOFI Pairovet frames (SWFSC)

333 μm mesh codends (SWFSC)

Digital flowmeters (SWFSC)

PRPOOS frames (SIO)

170 lb PRPOOS weight (SIO)

202 μm mesh PRPOOS nets and codends (SIO)

75 lb Bongo weight (SWFSC)

100 lb hydro weight (SWFSC)

CalCOFI Manta net frames (SWFSC)

60 cm CalCOFI 505 μm mesh Manta nets (SWFSC)

Standard CalCOFI tool boxes (SWFSC)

Bucket thermometers and holders (SIO)

Hand held inclinometer for Pairovet and Bongo tows (SWFSC)

Oxygen auto-titration rig with reagents (SIO)

Oxygen flasks (SIO)

Guildline Portasal (SIO)

Salinity bottles (SIO)

Standard sea water (SIO)

Data sheets for scheduled hydrographic work (SIO)

Weather observation sheets (SIO)

Primary productivity incubation rack (SIO)

C^{14} and other chemicals for primary productivity work (SIO)

24 niskin bottles (10 liter) for rosette (SIO)

SBE911+ CTD unit with necessary sensors (SIO)

Turner fluorometer (SIO)

90% acetone and all supplies for chlorophyll extraction (SIO)

Nutrient auto analyzer (SIO)

Chemicals for all nutrient analyses (SIO)

EK60 Echosounders (GPTs), Ethernet switch, and logging computer (SWFSC)

Laptop computer running Matlab / EAL EK60 Adaptive Logging software (SWFSC)

EK60 calibration apparatus (SWFSC)

LOPC (SIO)

Isotope van (SIO)

Winch for acoustic array (SIO)

Dissecting microscopes (SWFSC)

Sonobuoys (SIO)

NETS Nordic 264 midwater trawl (SWFSC)

NETS 3.0 m X Lite trawl doors (SWFSC)

Trawl rigging (SWFSC)

Fish measuring boards (SWFSC)

Motion compensated scales (SWFSC)

IV. Hazardous Materials

A. Policy and Compliance

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

Per FEC 07, the scientific party will include with their project instructions and provide to the CO of the respective ship 60 to 90 days before departure:

- A list of hazardous materials by name and anticipated quantity
- Include a chemical spill plan the addresses all of the chemicals the program is bringing aboard. This shall include:
  - Procedures on how the spilled chemicals will be contained and cleaned up.
  - A complete inventory (including volumes/amounts) of the chemical spill supplies and equipment brought aboard by the program. This must be sufficient to clean and neutralize all of the chemicals brought aboard by the program.
  - A list of the trained personnel that will be accompanying the project and the training they've completed.

Common Name of Material	**Qty**	**Notes**	**Trained Individual**	**Spill control**
Ethyl alcohol (95%)	20 gallons (in 5 gallon cans)	UN1170, Waste contained and disposed of by SIO at end of project.	Amy Hays	F
Buffered Ethyl alcohol (95%)	20 L (in 20 ml vials)	No waste. Stored in Chem lab	Amy Hays	F
Buffered formalin (10%)	20 gallons in 4 oz. and 8 oz. jars.	Stored in wet lab, no waste	Amy Hays	F
Formaldehyde solution (37%)	5 gallons	No waste, stored in flammable cabinet in wet lab	Amy Hays	F
Tris buffer	500ml	Stored in wet	Amy Hays	F

Common Name of Material	Qty	Notes	Trained Individual	Spill control
		lab		
Sodium borate powder	500gr	Stored in wet lab	Amy Hays	F
HCL (1.2N)	4L	UN1789, No waste, Stored in Radiation van on aft deck	David Wolgast	A
Sulfuric acid (10 Normal)	4L	Stored in Chem lab, waste neutralized by base in assay	David Wolgast	A
Acetone (90%)	7L	UN1090, Waste contained and disposed of by SIO at end of project, Stored in Rad van	David Wolgast	F
Mangannous Chloride	4L	No waste, stored in main lab	David Wolgast	A
Sodium Hydroxide/Sodium Iodide	4L	UN1824, Waste neutralized by acid in assay, Stored in main lab	David Wolgast	A
Ethanol (95%)	1L	UN1170, No waste, Stored in Constant environment room	David Wolgast	F
Ecolume Scintillation Fluid	2.5L	No waste, Stored in Rad van	David Wolgast	F
14C Sodium Bicarbonate (5.0mCi)	20ml	Waste contained and disposed of by SIO at end of project, UCSD EH&S, Stored in Rad van	David Wolgast	Waste remains in Rad van vacuum jugs in secondary containment
HCL (12N)	150ml	No waste, Stored in wet lab/Dropper bottles with secondary containment	Megan Roadman	A

Common Name of Material	Qty	Notes	Trained Individual	Spill control
Isopropyl Alcohol (91%)	30ml	No waste, Stored in wet lab/Dropper bottles with secondary containment	Megan Roadman	A
Liquid Nitrogen	50L Dewar	No waste, Stored wet lab	Megan Roadman	A
Acetone (90%)	7L	No waste, Stored in wet lab and freezer with secondary containment	Megan Roadman	F
HCL (1N)	400ml	No waste, Stored in wet lab/Dropper bottles with secondary containment	Megan Roadman	A
0.01 mg/ml DAPI 4',6-Diamidino-2-Phenylindole,Dihydrochloride	4x1-ml aliquots	Stored in Chem lab. Concentrated DAPI in freezer with secondary containment	Megan Roadman	A
Buffered Formalin (10%)	2L	Stored in Chem lab fume hood with secondary containment	Megan Roadman	F
Alkaline Lugol's fixative (100%)	250ml	Stored in Chem lab refer with secondary containment	Megan Roadman	F
Paraformaldehyde (10%)	.5L	Stored in Chem lab refer with secondary containment	Megan Roadman	F
Proflavin (0.033%)	250ml	Stored in Chem lab refer with secondary containment	Megan Roadman	F
Sodium Thiosulfate (0.190M)	250ml	Stored in Chem lab refer with secondary containment	Megan Roadman	F

Common Name of Material	Qty	Notes	Trained Individual	Spill control
Basic Lugol's fixative (100%)	500ml	Stored in Chem lab with secondary containment	Megan Roadman	F
Ammonium Molybdate (po4)	108g	No waste, Stored in Chem lab	Lindsey Ekern	
Dihydrazine Sulfate	25.6g	No waste, Stored in Chem lab	Lindsey Ekern	
Sulfanilamide	50g	No waste, Stored in Chem lab	Lindsey Ekern	
N-1-N	5g	No waste, Stored in Chem lab	Lindsey Ekern	
Imidazole	68g	No waste, Stored in Chem lab	Lindsey Ekern	
Copper Sulfate	2g	No waste, Stored in Chem lab	Lindsey Ekern	
Ammonium Chloride	250g	No waste, Stored in Chem lab	Lindsey Ekern	
Cadmium Columns	30g	No waste, Stored in Chem lab	Lindsey Ekern	
Ammonium Molybdate	129.6g	No waste, Stored in Chem lab	Lindsey Ekern	
Tartaric Acid	1000g	No waste, Stored in Chem lab	Lindsey Ekern	A
SnCl2	80g	No waste, Stored in Chem lab	Lindsey Ekern	
Potassium Phosphate	3.4g	No waste, Stored in Chem lab	Lindsey Ekern	
Potassium Nitrate	6.16g	No waste, Stored in Chem lab	Lindsey Ekern	
Sodium Nitrite	1.4g	No waste, Stored in Chem lab	Lindsey Ekern	

Common Name of Material	Qty	Notes	Trained Individual	Spill control
Sodium Hexafluorosilicate	2.12g	No waste, Stored in Chem lab	Lindsey Ekern	
Phenol	12g	No waste, Stored in Chem lab	Lindsey Ekern	
Sodium Citrate	560g	No waste, Stored in Chem lab	Lindsey Ekern	
Sodium Nitroprusside	1L	No waste, Stored in Chem lab	Lindsey Ekern	A
Sodium Hydroxide	400g	No waste, Stored in Chem lab	Lindsey Ekern	A
Ammonia Sulphate	0.8g	No waste, Stored in Chem lab	Lindsey Ekern	A
Tetraborate	360g	No waste, Stored in Chem lab	Lindsey Ekern	
Sulfite	2.4g	No waste, Stored in Chem lab	Lindsey Ekern	
o-phthalaldehyde	24g	No waste, Stored in Chem lab	Lindsey Ekern	
Ethanol	1500ml	No waste, Stored in Chem lab	Lindsey Ekern	F
HCL (dilute 1.2N)	2.5L	No waste, Stored in Chem lab	Lindsey Ekern	A
HCL (conc. 12N)	4L	No waste, Stored in Chem lab	Lindsey Ekern	A

SPILL CONTROL

A: ACID/Bases

- Wear appropriate protective equipment and clothing during clean-up. Keep upwind. Keep out of low areas.
- Ventilate closed spaces before entering them.
- Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.
- **Large Spills**: Dike far ahead of spill for later disposal. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal.
- **Small Spills**: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.
- Never return spills in original containers for re-use.

- Neutralize spill area and washings with soda ash or lime. Collect in a non-combustible container for prompt disposal.
- J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this product.

F: Formalin/Formaldehyde/Ethanol/Acetone

- Ventilate area of leak or spill. Remove all sources of ignition.
- Wear appropriate personal protective equipment.
- Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible.
- Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container.
- Do not use combustible materials, such as saw dust.

Inventory of Spill Kit supplies

Product Name	Amount	Chemicals it is useful against	Amount it can clean up
Chemical Spill pads	100	Formaldehyde, Alcohols	29 gallons
Formaldehyde Eater	5 gal	Formaldehyde	10 gallons

**Note: Please see attached Appendix 1.a. detailing spill control efforts for Scripps Institution of Oceanography.

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

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

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

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

B. Radioactive Isotopes

The Chief Scientist is responsible for complying with OMAO 0701-10 Radioactive Material aboard NOAA Ships. Documentation regarding those requirements will be provided by the Chief of Operations, Marine Operations Center, upon request.

At least three months in advance of a domestic project and eight months in advance of a foreign project start date the shall submit required documentation to MOC-CO, including:

1. NOAA Form 57-07-02, Request to Use Radioactive Material aboard a NOAA Ship
2. Draft Project Instructions
3. Nuclear Regulatory Commission (NRC) Materials License (NRC Form 374) or a state license for each state the ship will operate in with RAM on board the ship.
4. Report of Proposed Activities in Non-Agreement States, Areas of Exclusive Federal Jurisdiction, or Offshore Waters (NRC Form 241), if only state license(s) are submitted).
5. MSDS
6. Experiment or usage protocols, including spill cleanup procedures.

Scientific parties will follow responsibilities as outlined in the procedure, including requirements for storage and use, routine wipe tests, signage, and material disposal as outline in OMAO 0701-10.

All radioisotope work will be conducted by NRC or State licensed investigators only, and copies of these licenses shall be provided per OMAO 0701-10 at least three months prior to the start date of domestic projects and eight months in advance of foreign project start dates.

C. Inventory (itemized) of Radioactive Materials

Common Name Radioactive Material	**Concentration**	**Amount**	**Notes**
14C Sodium Bicarbonate	5.0mCi	20ml	To be used and stored in Science provided Rad van on main deck of ship. All waste contained and offloaded on or about April 15 by UCSD,EH&S

V. Additional Projects

A. Supplementary ("Piggyback") Projects

If time permits, the SWFSC's fishery acousticians will test recently constructed submersible video cameras to be placed on the interior surface of the Nordic 264 trawl. The cameras will be placed in order to watch fish behavior as well as to determine effects and efficiency of the marine mammal excluder device. (Leg II only)

B. NOAA Fleet Ancillary Projects

N/A

VI. Disposition of Data and Reports

A. Data Responsibilities

The Chief Scientist will receive all original data related to the project. The Chief Scientist will in turn furnish the Captain with a complete inventory listing of all data gathered by the scientific party, detailing types of operations and quantities of data prior to departing the ship. All data gathered by the vessel's personnel that are desired by the Chief Scientist will be released to him, including supplementary data specimens and photos gathered by the scientific crew.

B. Pre and Post Project Meeting

Prior to departure, the Chief Scientist will conduct a meeting of the scientific party to train them in sample collection and inform them of project objectives. Some vessel protocols, e.g., meals, watches, etiquette, etc. will be presented by the ship's Operations Officer.

VII. Miscellaneous

A. Meals and Berthing

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

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

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

B. Shipboard Safety

Wearing open-toed footwear or shoes that do not completely enclose the foot (such as sandals or clogs) outside of private berthing areas is not permitted. Steel-toed shoes are required to participate in any work dealing with suspended loads, including CTD deployments and recovery. The ship does not provide steel-toed boots. Hard hats are also required when working with

suspended loads. Work vests are required when working near open railings and during small boat launch and recovery operations. Hard hats and work vests will be provided by the ship when required.

C. Communications

A progress report on operations prepared by the Chief Scientist may be relayed to the program office. Sometimes it is necessary for the Chief Scientist to communicate with another vessel, aircraft, or shore facility. Through various means of communications, the ship can usually accommodate the Chief Scientist. Special radio voice communications requirements should be listed in the project instructions. The ship's primary means of communication with the SWFSC is via e-mail and the Very Small Aperture Terminal (VSAT) link. Standard VSAT bandwidth at 128kbs is shared by all vessels staff and the science team at no charge. Increased bandwidth in 30 day increments is available on the VSAT systems at increased cost to the scientific party. If increased bandwidth is being considered, program accounting is required it must be arranged at least 30 days in advance.

Appendices

1. Figures, maps, tables, images, etc.

Appendix 1.a. Detailed list of Scripp's Oceanography Chemicals and spill control plan.

Scripps Oceanography, CalCOFI Chemical Spill Kit List, *Ocean Starr* March 2014

The main concern here is the 10 normal Sulfuric Acid which is secured to the bench in wooden box to prevent spill. We bring a 13.5 lbs bag of Baking soda to neutralize acid in the event of a spill.

Our Radiation van has a spill kit that consists of 2 x 1/2 gallon of Safety Sorbent, the spill kits listed below were just ordered along with additional baking soda.

In addition to the spill kit in the Rad van we bring 6 x 1/2gallon additional cartons of Safety Sorbent

http://wyksorbents.com/anti-slip-safety-sorbent/

Safety Sorbent 8 x 1/2 gallon (http://wyksorbents.com/anti-slip-safety-sorbent/)

Sodium Bicarbonate (Arm & Hammer baking soda) 2 x 13.5 lbs bag for Acid Spills

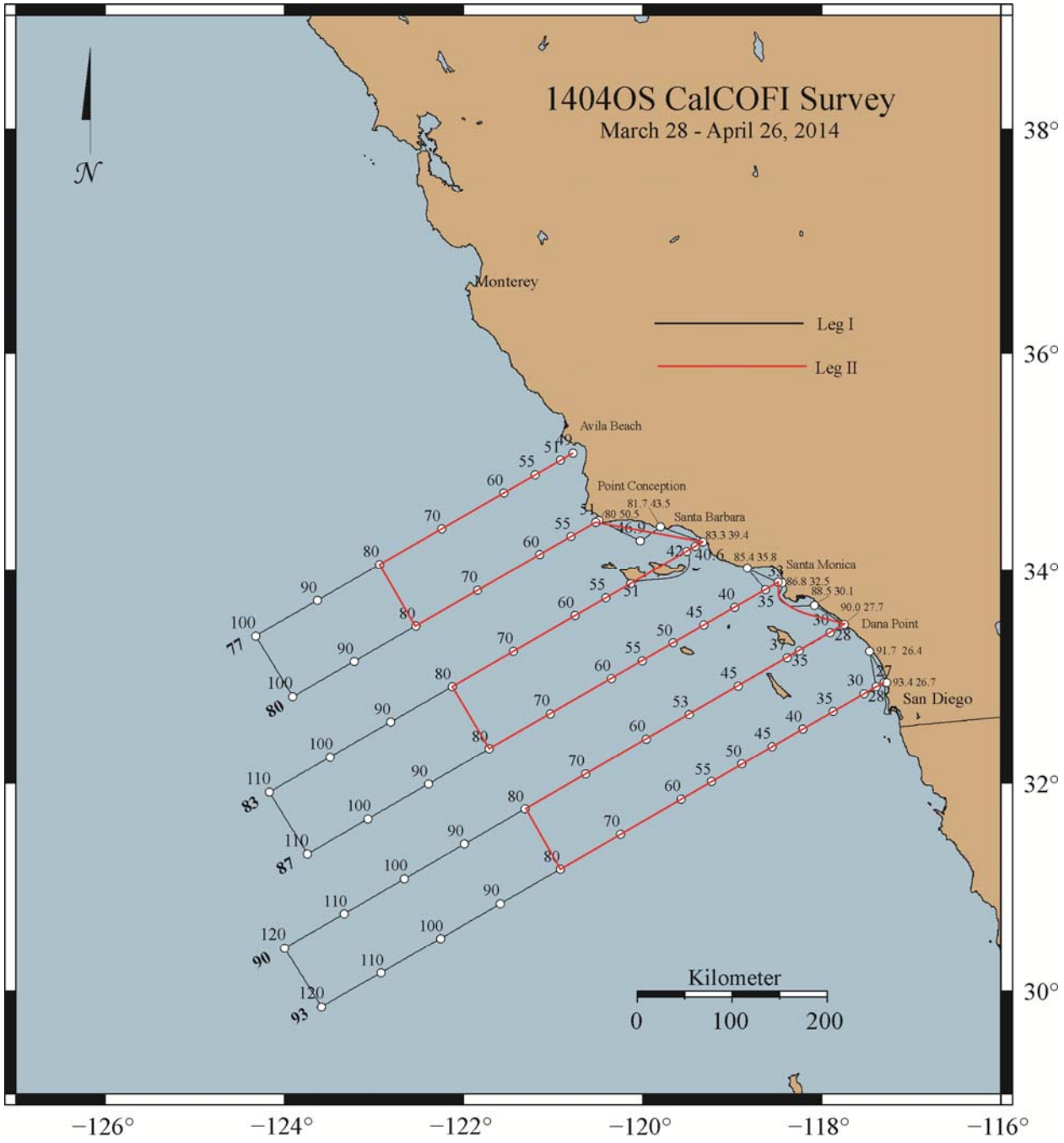
Portable Allwik Economy Spill Kit in Yellow Bag x2
(http://www.fastenal.com/web/products/detail.ex?sku=1007705)

Vinyl gloves 20+ boxes (50-100) count

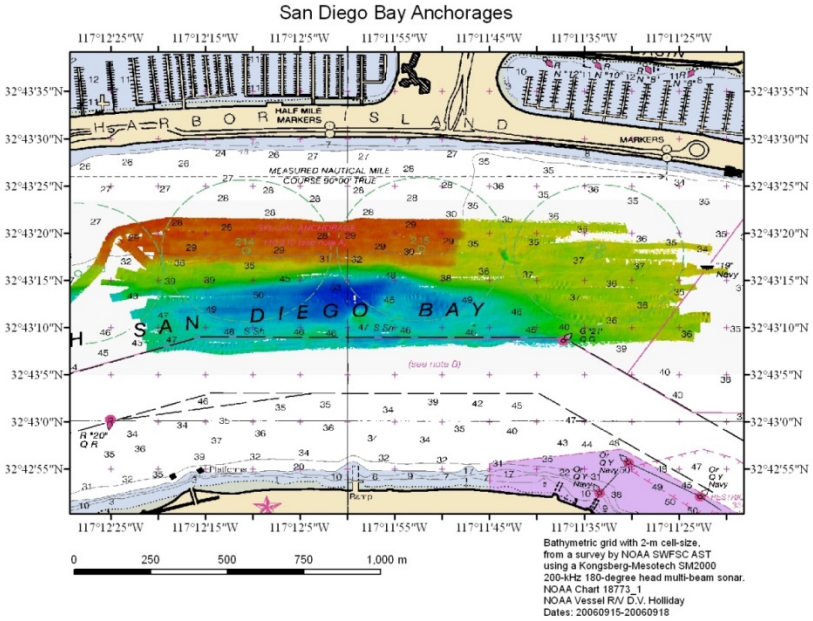
Containment bags 3 rolls of 50 each

Roll paper towels 12 each.

Appendix 1.b. Requested cruise track and station location.



Appendix 1.c. Bathymetry of the special anchorages off Shelter Island, San Diego Bay (red is shallowest, dark blue is deepest). The echo sounder calibrations will be conducted here (32° 43.20' N, 117° 12.0' W) on April 6, 2013. The ship will anchor in the deepest possible water, outside of the channel.



2. Station/Waypoint List (coordinates in Latitude, Longitude: degree-minutes)

Schedule_Order	Line	Station	Dlatitude	Dlongitude
1	93.3	26.7	32.95637243	117.3053809
2	93.4	26.4	32.94905192	117.2735654
3	91.7	26.4	33.24350056	117.4654169
4	93.3	28	32.91303909	117.3943818
5	93.3	30	32.84637243	117.5312206
6	93.3	35	32.67970576	117.8728643
7	93.3	40	32.51303909	118.2138649
8	93.3	45	32.34637243	118.5542278
9	93.3	50	32.17970576	118.8939582
10	93.3	55	32.01303909	119.2330612
11	93.3	60	31.84637243	119.5715421
12	93.3	70	31.51303909	120.2466579
13	93.3	80	31.17970576	120.9193461
14	93.3	90	30.84637243	121.5896467
15	93.3	100	30.51303909	122.2575992
16	93.3	110	30.17970576	122.9232422
17	93.3	120	29.84637243	123.5866142
18	90	120	30.41794919	123.9989326
19	90	110	30.75128253	123.3316429
20	90	100	31.08461586	122.6620162
21	90	90	31.41794919	121.9900131
22	90	80	31.75128253	121.3155939
23	90	70	32.08461586	120.6387183
24	90	60	32.41794919	119.9593451
25	90	53	32.65128253	119.4822756
26	90	45	32.91794919	118.9355113
27	90	37	33.18461586	118.3870812
28	90	35	33.25128253	118.2497109
29	90	30	33.41794919	117.9058212
30	90	28	33.48461586	117.7680788
31	90	27.7	33.49461586	117.7474083
32	88.5	30.1	33.67442348	118.0836933
33	86.8	32.5	33.88887212	118.4442347
34	86.7	33	33.88952596	118.4903339
35	86.7	35	33.82285929	118.6287319
36	85.4	35.8	34.02135923	118.8341306
37	86.7	40	33.65619263	118.9742516
38	86.7	45	33.48952596	119.3190964
39	86.7	50	33.32285929	119.6632718

40	86.7	55	33.15619263	120.0067835
41	86.7	60	32.98952596	120.3496367
42	86.7	70	32.65619263	121.0333897
43	86.7	80	32.32285929	121.7145734
44	86.7	90	31.98952596	122.3932299
45	86.7	100	31.65619263	123.0694006
46	86.7	110	31.32285929	123.7431265
47	83.3	110	31.91175657	124.1703953
48	83.3	100	32.2450899	123.4923224
49	83.3	90	32.57842323	122.8117321
50	83.3	80	32.91175657	122.1285823
51	83.3	70	33.2450899	121.4428307
52	83.3	60	33.57842323	120.7544339
53	83.3	55	33.7450899	120.4092298
54	83.3	51	33.87842323	120.1325788
55	83.3	42	34.17842323	119.5085132
56	83.3	40.6	34.2250899	119.4112355
57	83.3	39.4	34.2650899	119.3278113
58	81.7	43.5	34.40555136	119.80037
59	81.8	46.9	34.27489752	120.0252367
60	80	50.5	34.46666667	120.4890554
61	80	51	34.45	120.5239048
62	80	55	34.31666667	120.802448
63	80	60	34.15	121.15
64	80	70	33.81666667	121.8430351
65	80	80	33.48333333	122.5333494
66	80	90	33.15	123.2209872
67	80	100	32.81666667	123.9059922
68	76.7	100	33.38824343	124.3228913
69	76.7	90	33.72157677	123.633345
70	76.7	80	34.0549101	122.9410906
71	76.7	70	34.38824343	122.2460832
72	76.7	60	34.72157677	121.5482772
73	76.7	55	34.88824343	121.1983102
74	76.7	51	35.02157677	120.9178206
75	76.7	49	35.08824343	120.7774028
76	93.3	30	32.84637243	117.5312206
77	93.3	40	32.51303909	118.2138649
78	93.3	50	32.17970576	118.8939582
79	93.3	60	31.84637243	119.5715421
80	93.3	70	31.51303909	120.2466579

81	93.3	80	31.17970576	120.9193461
82	90	80	31.75128253	121.3155939
83	90	70	32.08461586	120.6387183
84	90	60	32.41794919	119.9593451
85	90	50	32.75128253	119.2774328
86	90	40	33.08461586	118.5929391
87	90	30	33.41794919	117.9058212
88	86.7	33	33.88952596	118.4903339
89	86.7	40	33.65619263	118.9742516
90	86.7	50	33.32285929	119.6632718
91	86.7	60	32.98952596	120.3496367
92	86.7	70	32.65619263	121.0333897
93	86.7	80	32.32285929	121.7145734
94	83.3	80	32.91175657	122.1285823
95	83.3	70	33.2450899	121.4428307
96	83.3	60	33.57842323	120.7544339
97	83.3	52	33.8450899	120.2017824
98	83.3	40.6	34.2250899	119.4112355
99	80	51	34.45	120.5239048
100	80	60	34.15	121.15
101	80	70	33.81666667	121.8430351
102	80	80	33.48333333	122.5333494
103	76.7	80	34.0549101	122.9410906
104	76.7	70	34.38824343	122.2460832
105	76.7	60	34.72157677	121.5482772
106	76.7	49	35.08824343	120.7774028