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

March 5, 2012

Project Instructions 12-04-SH (SH12-02)

I. Project Overview

I.A. Project Period
I.A.1. 17 March 2012 – 29 April 2012

I.B. Operating Area

I.B.1. San Francisco, CA to US/Mexican border with variable transect lengths (please refer to Appendix 1 for detailed plot).

I.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 Francisco, California and San Diego, California.

The following are specific objectives for leg I (Spring CalCOFI) and leg II (Daily Egg Production Method, DEPM).

Leg I (Spring CalCOFI):

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 sardine, anchovy and mackerel.

I.C.2. Continuously sample multi-frequency acoustic backscatter using the Simrad EK60 and the Simrad ME70 echosounders. The data will be used to estimate the distributions and abundances of coastal pelagic fishes (e.g., sardine, anchovy, and mackerel), and krill species. Transit between both daytime and nighttime stations at 14 knots (NOTE: This is different

from leg 2 where daytime will be transit at 9 knots.) Throughout the survey, the raw data from the EK60 and ME70 echosounders will be transmitted from the ship to the SWFSC in real-time via the ship's VSAT.

I.C.3. Continuously sample sea-surface temperature, salinity, and chlorophyll-a using a thermosalinograph and fluorometer. These data will be used to estimate the physical oceanographic habitats for target species.

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

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.

I.C.6. Sample the light intensity in the photic zone once per day in conjunction with a daytime CTD station. These data will be used to interpret the measurements of primary production.

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.

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.

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.

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 and 80.0 as well as stations out to and including station 70.0 on lines 86.7 and 83.3. These data will be used in analyses by the LTER (Long Term Ecological Research) project.

I.C.11. If it does not interfere with the EK60 and ME70 and degrade their data qualities, continuously sample profiles of currents using the RDI/Teledyne Acoustic Doppler Current Profiler.

I.C.12. 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 II (CPS):

I.C.13. Continuously sample pelagic fish eggs using the Continuous Underway Fish Egg Sampler (CUFES). The data of Pacific sardine eggs will be used to allocate additional Pairovet samples to estimate the daily egg production of Pacific sardine. The Pairovet samples will be also taken at predetermined stations. Both samples from CUFES and Pairovet will be used to estimate the distributions and abundances of spawning sardine, anchovy and mackerel and other species.

I.C.14. Continuously sample multi-frequency acoustic backscatter using the Simrad EK60 and the Simrad ME70 echosounders. The data will be used to estimate the distributions and abundances of coastal pelagic fishes (e.g., sardine, anchovy, and mackerel) and krill species. Transit between daytime stations at 9 knots. Throughout the survey, the raw data from the EK60 and ME70 echosounders will be transmitted from the ship to the SWFSC in real-time via the ship's VSAT.

I.C.15. Sample selected aggregations of fish and zooplankton which have been observed acoustically during daylight hours with surface trawls conducted at night. These data will be used to identify the sound scattering species and their sizes.

I.C.16. Sample fish near the surface at nighttime by conducting 1 trawl between 30 - 60 minutes after the start of each night (defined as 30 minutes after sunset).

Add one trawl prior to each of the next two nighttime stations, before deployment of the pairovet/ bongo/ manta net tows. Transit between nighttime stations at 14 knots.

The trawl data will be used to estimate the reproductive parameters, distributions and demographics of sardine, anchovy and mackerel. The trawl data will also be used to obtain species composition and size structure for partitioning acoustic backscatter attributed to fish.

No trawling at stations will be done during daylight.

After the grid is complete, all extra days will be used to fill gaps in the daytime acoustic transects and do more nighttime trawling in areas of high Coastal Pelagic Species abundance, and to conduct some directed trawls during daytime.

I.C.17. If it does not interfere with the EK60 and ME70 and degrade their data qualities, cContinuously sample profiles of currents using the RDI/Teledyne Acoustic Doppler Current Profiler.

I.C.18. Continuously sample sea-surface temperature, salinity, and chlorophyll-a using a thermosalinograph and fluorometer. These data will

be used to estimate the physical oceanographic habitats for target species.

I.C.19. Continuously sample air temperature, barometric pressure, and wind speed and direction using an integrated weather station.

I.C.20. Sample profiles of seawater temperature and salinity using a CTD with water-sampling rosette and other instruments at prescribed stations.

I.C.21. Sample plankton using a CalBOBL (CalCOFI Bongo) at prescribed stations. These data will be used to estimate the distributions and abundances of ichthyoplankton and zooplankton species.

I.C.22. Sample plankton using a Manta (neuston) net at prescribed stations. These data will be used to estimate the distributions and abundances of ichthyoplankton species.

I.C.23. 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.

I.C.24. Continuously observe, during daylight hours, seabirds and marine mammals. These data will be used to estimate the distributions and abundances of seabirds and marine mammals.

I.D. Participating Institutions

I.D.1. Southwest Fisheries Science Center, Fisheries Resources Division.

I.D.2. Scripps Institution of Oceanography, Integrative Oceanography Division.

I.E. Personnel (ScienceParty)(15 science berths)

Acoustic calibration staff 17 MAR San Diego, California

Position	Name, Gender	Affiliation	Citizenship
Acoustics	Juan Zwolinski	SWFSC	Portugal
Acoustics	Josiah Renfree	SWFSC	USA
Acoustics	Randy Cutter	SWFSC	USA
Acoustics	David Demer	SWFSC	USA

Shimada Leg I (Spring CalCOFI):
17 MAR – Dep. San Diego April 2 – Arr. San Diego, 17 DAS

Position	Name, Gender	Affiliation	Citizenship
Cruise Leader	Amy Hays, F	SWFSC	USA
Fishery Biologist	Noelle Bowlin, F	SWFSC	USA
Acoustician	Juan Zwolinski, M	SWFSC	Portugal

Oceanographer	James Wilkinson, M	SIO	USA
Oceanographer	David Wolgast, M	SIO	USA
Oceanographer	Jennifer Wolgast, F	SIO	USA
Oceanographer	David Faber, M	SIO	USA
Oceanographer	Megan Roadman, F	SIO	USA
LTER	Shonna Dovel, F	SIO	USA
Mar. Mammal obs.	Katherine Whittaker, F	SIO	USA
Mar. Mammal obs.	Melody Baran, F	SIO	USA
Mar. Mammal Acou.	Elizabeth Vu, F	SIO	USA
Bird obs.	Dawn Breese, F	SIO	USA
Volunteer	Lindsay Hennes,F	SIO	USA
Oceanographer	TBD	SIO	USA

Shimada Leg II (DEPM):
San Diego to San Francisco
7 APR – Dep. San Diego 29 APR – Arr. San Francisco, 23 DAS

Position	**Name, Gender**	**Affiliation**	**Citizenship**
Cruise Leader	Amy Hays, F	SWFSC	USA
Fishery Biologist	William Watson, M	SWFSC	USA
Fishery Biologist	Beverly Macewicz, F	SWFSC	USA
Fishery Biologist	Sharon Charter, F	SWFSC	USA
Fishery Biologist	Edward Weber, M	SWFSC	USA
Fishery Biologist	Annette Henry, F	SWFSC	USA
Bird Obs.	Scott Mills, M	volunteer	USA
Acoustician	Kyle Byers, F	SWFSC	USA
Acoustician	DaeJae Lee, M	SWFSC	Korea
Mar. Mammal Obs.	TBD	SWFSC	USA

I.F. Administrative

I.F.1. Points of Contacts:

Chief Scientist/alternate: Sam McClatchie/David Griffith (858-752-8495/ 858-546-7155; 8604 La Jolla Shores Drive, La Jolla, CA, 92037; Sam.McClatchie@noaa.gov/Dave.Griffith@noaa.gov),
Ops Officer: LT Andrew Colegrove (OPS.Bell.Shimada@noaa.gov)
Ship cell phone (206) 427-2374
Ship Iridium phone (808) 684-5457 code: 8816 5145 2194

Agent if needed: N/A

I.F.2. Diplomatic Clearances: N/A

I.F.3. Licenses and Permits: N/A

II. Operations

II.A. Itinerary

Acoustic

Calibration:	17 MAR – San Diego, California
Leg 1:	17 MAR Dep. San Diego 02 APR Arr. San Diego
Leg 2:	7 APR Dep. San Diego 29 APR Arr. San Francisco

Total 40 DAS

II.B. Staging and Destaging

Staging to be conducted in San Diego. We will require a crane operator.

We request 1 laboratory van to be craned onto the afterdeck and secured in San Diego prior to CalCOFI leg I. The dimensions of the van are approximately 8x8x10 feet and it weighs 5800 lbs. Power requirement is 110V.

De-staging at the completion of leg II to be conducted in San Francisco. Ship tie up is TBD.

II.C. Operations to be Conducted

II.C.1. Underway Operations

II.C.2.a. Thermosalinometer sampling - The ship will provide and maintain a thermosalinometer (TSG), which is calibrated and in working order, for continuous measurement of surface water temperature and salinity. A backup unit (calibrated and in working order) will also be provided by the vessel and remain aboard during the cruise. The Scientific Computing System (SCS) will serve as the main data collection system. All SCS data will be provided to SWFSC personnel at the completion of the cruise.
NOTE: The vessel has no constant temperature room. The salinometer room can't be considered temperature controlled.

II.C.2.b. Acoustics: Calibration of the Simrad EK60 echosounders will be performed at the beginning of the cruise (requiring 6-12 hours). The ship will sail at 1200 on 17 March, anchor in San Diego Bay, San Diego, and calibrate. The keel will remain in the retracted position. 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 keel-mounted transducers. The instrumented keel will be retracted, flush with the hull, during calibrations.

The EK60 echosounder will be operated at 18, 38, 70, 120 and 200 kHz and interfaced to a data acquisition system to estimate small pelagic fish and krill biomasses between 10 and 250 m. The instrumented keel will be extended to mid-depth (ca. transducers at 7.5 m), during all survey operations. Any changes to this depth should be avoided, and reported to the acoustic-system operator(s). The vessel's Simrad ES60 depth sounder and Doppler current meter may be used minimally at the discretion of the Commanding Officer, but will normally remain off while underway. 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.

Daytime leg 1 (between 30 minutes before sunrise to 30 minutes after sunset): collect acoustic data while transiting at a speed of 14 knots. (note this speed is higher than during leg 2). The eastern ends of all transects should be run as close to the shore as navigable.

Nighttime leg 1: collect acoustic data while transiting at 14 knots.

Daytime leg 2 (between 30 minutes before sunrise to 30 minutes after sunset): collect acoustic data while transiting at a speed of 9 knots. (note: this speed is slower than during leg 1).

Nighttime leg 2: collect acoustic data while transiting at 14 knots.

II.C.2.c. ADCP: The ship's ADCP should run continuously and be logged to a data acquisition system. Complete system settings will be provided by the oceanographer, but will include 5-minute averaging of currents, AGC and 4 beam returns in 60 8-meter bins. The ADCP transmissions will be triggered by, and thereby synchronized with, the EK60s to avoid cross talk.

II.C.2.d. CUFES: The egg pump will be mounted inside the ship's hull drawing water from a depth of three meters. During the legs I, II and III, 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, wind speed and direction, date and time, and surface salinity. Sampling intervals will vary in length, depending on the number of fish eggs seen, from five to 30 minutes. At any time during legs I and II when the CUFES detects sardine egg concentrations of one egg per minute or higher in two consecutive samples, the ship will begin conducting pairovet tows at four mile intervals until the egg concentration falls below a density of one egg per minute in two consecutive samples. This information will be relayed to the bridge by scientists monitoring the CUFES system.

II.C.2.e. Surface trawling: During leg II, a Nordic 264 surface trawl will be deployed between the hours of approximately 1800 and 0600 PST between San Diego and San Francisco at positions indicated in Appendix 2. The positions may be changed at the discretion of the Chief Scientist or Cruise Leader depending on information gained and occurrence of sardines. The trawl has been modified with a marine mammal excluder device (MMED) to reduce possibility of catching marine mammals.

Additional trawls on leg II may be set in areas with acoustic targets as time and opportunity permit.

No trawling will be conducted during leg I.

A marine mammal watch will be initiated 30 minutes before trawling. Trawling will be the first activity on arrival at a trawling station, or will be located away from a previously occupied station to avoid any mammals that may have been attracted to the vessel. The trawl is fitted with a marine mammal excluding device (MMED) to avoid any take of cetaceans or pinnipeds. If any mammals are detected, the trawl position will be moved to a new area and the mammal watch reinitiated. Any mammal capture will trigger telephone contact to the

Division Director of FRD (Russ Vetter), SWFSC who will take immediate action.

Any adult salmon caught in the trawl will be immediately returned to the sea and assumed to have survived. Any juvenile salmon caught incidentally will be frozen and turned over to Bob Emmett at NWFSC for further study.

Each trawl will be fished for 30 minutes in duration at a towing speed of approximately 3.5 knots. The catch of each tow will be processed in the following manner: The fish will be sorted to species, if possible, and the catch weighed. Sardines collected in each trawl will be randomly subsampled. Standard length and body weight will be measured, fish sexed and maturity graded, otoliths will be collected, ovaries preserved in buffered formalin and tails preserved in ethanol vials for genetics. Standard length and body weight will also be measured for Northern anchovy, Jack and Pacific mackerels, hake and other species as time permits.

II.C.2.f. Bird Observations: For both legs, 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.

II.C.g. Acoustic hydrophone: During transit between most daylight stations on leg I (Spring CalCOFI), 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.

II.C.h. Shimada position at sunrise and sunset of each day to be recorded by bridge watch and logged as events in the SCS.

II.C.2. Station Operations -

During leg I standard CalCOFI stations will be sampled.

During leg II, nominal stations actually occupied will be determined by (1) the distribution of eggs observed with CUFES, (2) the presence of acoustic marks identified as small pelagic fish during leg I, and (3) the results of the sardine spawning habitat model. The goal is to place the station sampling in areas where there is a high probability of finding small pelagic fish.

Each standard station will include the following:

II.C.2.a. CTD/Rosette consisting of 12 10-liter hydrographic bottles will be lowered to 500 meters (depth permitting) at each station to measure physical parameters and collect water at discrete depths for analysis of: salinity, nutrients and chlorophyll. Casts conducted on line 66.7 will be to a depth of 1000 meters. NOTE: SIO will provide their own CTD sensor and 24 bottle (10 liter) rosette unit for use on leg I. Please record CTD deployed, CTD at depth and CTD Recovered for SCS.

The CTD/ Rosette will not be deployed during leg II in the areas sampled by leg I to reduce redundancy of effort.

II.C.2.b. CalBOBL (CalCOFI Bongo): 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 only during leg I (CalCOFI stations). The port side sample will be preserved in buffered ethanol at every station.
Please record Bongo deployed and Bongo recovered for SCS.

Additional bongo tows may be added during leg II in the areas sampled by leg I if sardine eggs are found in the core CalCOFI area. These tows would be necessary if eggs are present in the area sampled by leg I in order to estimate mortality of sardine larvae in the appropriate time frame for the DEPM.

II.C.2.c. Manta net (neuston) tow: using a 505 μm mesh net on a frame with a mouth area of 0.1333 m^2. 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°.
Please record Manta deployed and Manta recovered in SCS.

II.C.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. If sardine eggs are present beyond station 80 we will continue Pairovet sampling at each station on both the CalCOFI leg I and DEPM leg II as long as more than one egg per sample is counted (or to the end of the line). 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.
Please record Pairovet deployed and Pairovet recovered for SCS.

II.C.2.e. PRPOOS (Planktonic Rate Processes in Oligotrophic Ocean Systems net will be taken at all Leg I (CalCOFI) stations on line 90.0 and 80.0 as well as stations out to and including station 70.0 on lines 86.7 and 83.3. 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. Please record PRPOOS deployed and PRPOOS recovered for SCS.

No PRPOOS net deployment on leg II.

II.C.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 will be carried out. The cast arrangement will be determined by a Secchi disc observation. 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.

II.C.2.g. A light meter will be used to measure the light intensity in the euphotic zone once a day with the primary productivity cast and all daytime stations. Please record Secchi deployed and Secchi recovered for SCS.

II.C.2.h. Weather observations.

II.C.3.a Order of Operations for each standard station on Leg I CalCOFI:

CTD to 515 meters with 24 bottle rosette (depth permitting).

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

PRPOOS net tow (lines 90.0,86.7,83.3,80.0 only, total of 35 stations).

Pairovet net tow (on all lines out to station 100.0).

Manta net tow (on all stations except for near shore SCCOOS).

Bongo net tow (on all stations).

While Underway on Leg I CalCOFI:
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 1 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. Once deployed, ship can travel at full speed.

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

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

II.C.b.3 Order of Operations for Leg II CPS:

Daytime Operations to include:

CTD (ship provided) to 515 meters on all stations north of Leg I station grid. We will not require bottles, just a CTD profile.

Pairovet net tow (north of Leg I station grid)

Manta net tow (north of Leg I station grid)

Bongo net tow (north of Leg I station grid)

If we encounter high sardine egg density with the CUFES system, additional Pairovet/Bongo tows will be performed throughout the entire Leg II pattern to include area covered on Leg I. Pairovets would be spaced every four nautical miles until sardine egg density decreased. Bongos would be added sporadically depending on sardine egg density and/or acoustic targets.

Please mark location of when day time acoustics data collection stops for the day. We will return to this exact location 30 minutes prior to sunrise of the following day to resume day time acoustics collection after the last trawl of the night.

We will have a bird and possibly marine mammal observer on the flying bridge during all day time transects.

Nighttime operations to include:

3 trawls per night, first set approximately 1 hour after sunset. Trawls may or may not occur on predetermined stations. Trawl spacing will be determined based on sardine egg density and other factors.

We will post a night time marine mammal watch just prior to each trawl set to ensure the least amount of interaction.

At the end of the last trawl we will request to go to the marked location from the end of acoustics collection of the previous day. Line transects will resume from this location at 9 knots.

Ship may travel at 14 knots during night time operations.

II.D. Dive Plan: N/A

II.E. Applicable Restrictions: N/A

III. Equipment

III.A. Equipment and Capabilities Provided by the Ship:

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

Starboard hydro winch with ¼" cable for standard Bongo, Pairovet and Manta tows
NOTE: .375 electro-mechanical wire rather than ¼" cable is acceptable.
Starboard winch with 0.375" conductive cable
Port and starboard trawl winch with 1 1/8" trawl cable
Port and starboard gantries with trawl blocks for 1 1/8" trawl cable
J-frame w/blocks to accommodate 0.375" cable
Constant temperature room set at 22°C ± 1°C (71.5°F ± 2°F)
NOTE: The vessel has no constant temperature room. The salinometer room can't be considered temperature controlled.
Winch monitoring system
Seabird thermosalinometer
Knudsen 12 kHz depth recorder or comparable
Acoustic Doppler Current Profiler
Multifrequency EK60 transducers (ES18-11, ES38B, ES120-7C, ES200-7C).
12-bottle rosette frame capable of carrying 10-liter niskin bottles, fitted with SBE911+ CTD unit. SIO to provide complete CTD for leg I.
Pump and concentrator unit for CUFES water sampling.
Fish splitting bin and sorting table.
GPS feed to flying bridge for use by bird observers.
-80°C Freezer

III.B. Equipment and Capabilities Provided by the Scientists

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)
Jars for ovaries (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)
Inclinometer for bongo tows (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 weights (SWFSC)
CalCOFI Manta net frames (SWFSC)
60 cm CalCOFI 505 μm mesh Manta nets (SWFSC)
Standard CalCOFI tool boxes (SWFSC)
Bucket thermometers and holders (SWFSC)

Hand held inclinometer for Pairovet tows(SWFSC)
Oxygen auto-titration rig with reagents (SIO)
Oxygen flasks (SIO)
Guildline Portasal (SWFSC, 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 vials (SIO)
EK60 calibration apparatus
LOPC (SIO)
Isotope van (SIO)
Dissecting microscopes (SWFSC)
Nordic 264 rope trawl fitted with Marine Mammal Excluder Device (SWFSC)
Trawl rigging (SWFSC)
3.0 m^2 XL-Lite foam core trawl doors (SWFSC)
Motion compensated balances (SWFSC)
Fish measuring boards (SWFSC)
Dissection equipment (SWFSC)
Sonobuoy (SIO)

IV. Hazardous Materials

HAZMAT list and amounts will be provided to the Environmental Compliance Officer, the Operations Officer and the Commanding Officer upon arrival and departure.

A. Policy and Compliance

A. The Chief Scientist is responsible for complying with ENV 01-09 (or the OMAO procedure that supercedes them). Documentation regarding those requirements will be provided by the Chief of Operations, Marine Operations Center - Pacific, upon request.

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, and/or absorbents in amounts adequate to address spills of a size equal to the amount of chemical brought aboard. The amount of hazardous material arriving and leaving the vessel shall be accounted for by the Chief Scientist.

B. Radioactive Isotopes

Each scientist working with these materials will be required to wear a lab coat and disposable booties to reduce the likelihood of tracking the substance out of the specified working area.

It will be the responsibility of the investigator to conduct pre-cruise (for background) and post-cruise wipe tests (regardless of whether a spill occurred or not). Wipe tests should also be conducted in the event of a spill, as well as periodically while underway.

A detailed procedural methodology describing the use of these materials should be provided to the Environmental Compliance Officer (ECO) for review at least one month prior to bringing them aboard. A spill contingency plan should also be provided at the same time. Please note that ship's personnel are not first responders in the event of a spill.

A log detailing the type and amount of materials brought aboard and removed from of the ship shall be maintained, along with a record of any spills that occurred.

All radioisotope work will be conducted by NRC or State licensed investigators only, and copies of these licenses shall be provided to the ECO at least one month prior to bringing any materials on board.

Hazardous Communication training will be conducted for all personnel aboard regarding the hazards of radioactive material. This training will take place prior to the commencement of leg I.

C. Inventory

V. Additional Projects

A. No additional projects
B. No NOAA Fleet Ancillary Projects

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 Commanding Officer 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 Cruise Meeting

Pre-Cruise 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 cruise objectives.

Some vessel protocols, e.g., meals, watches, etiquette, etc. will be presented by the ship's Operations Officer.

Post-Cruise Meeting: Upon completion of the cruise, a meeting will normally be held at 0830 (unless prior alternate arrangements are made) and attended by the ship's officers, the Chief Scientist and members of the scientific party, the Vessel Coordinator and the Port Captain to review the cruise. Concerns regarding safety, efficiency, and suggestions for improvements for future cruises should be discussed. Minutes of the post-cruise meeting will be distributed to all participants by email, and to the Commanding Officer and Chief of Operations, Marine Operations Center.

C. Ship Operation Evaluation Report

Within seven days of the completion of the cruise, a Ship Operation Evaluation form is to be completed by the Chief Scientist. The preferred method of transmittal of this form is via email to OMAO.Customer.Satisfation@noaa.gov. If email is not an option, a hard copy may be forwarded to:

Director, NOAA Marine and Aviation Operations
NOAA Office of Marine and Aviation Operations
8403 Colesville Road, Suite 500
Silver Spring, MD 20910

VII. Miscellaneous

A. Meals and Berthing

Meals and berthing are required for 15 scientists. Meals will be served 3 times daily beginning one hour before scheduled departure, extending throughout the cruise, and ending two hours after the termination of the cruise. Galley will be closed for dinner during inports.

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. We request night lunches for science crew on legs I and II.

Special dietary requirements for scientific participants will be made available to the ship's command at least seven days prior to the survey (e.g., Chief Scientist is allergic to fin fish).

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

for the cleanliness of the laboratory spaces and the storage areas utilized by the scientific party, both during the cruise and at its conclusion prior to departing the ship.

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

All persons boarding NOAA vessels give implied consent to comply with all safety and security policies and regulations which are administered by the Commanding Officer. All spaces and equipment on the vessel are subject to inspection or search at any time. All personnel must comply with OMAO's Drug and Alcohol Policy dated May 7, 1999 which forbids the possession and/or use of illegal drugs and alcohol aboard NOAA Vessels.

B. Medical Forms and Emergency Contacts

The NOAA Health Services Questionnaire (NHSQ, Revised: 08/08) must be completed in advance by each participating scientist. The NHSQ can be obtained from the Chief Scientist or the NOAA website http://www.moc.noaa.gov/all_ships/medical.html . The completed form should be sent to the Regional Director of Health Services at Marine Operations Center. The participant can mail, fax, or scan the form into an email using the contact information below. The NHSQ should reach the Health Services Office no later than 4 weeks prior to the cruise to allow time for the participant to obtain and submit additional information that health services might require before clearance to sail can be granted. Please contact MOC Health Services with any questions regarding eligibility or completion of the NHSQ. Be sure to include proof of tuberculosis (TB) testing, sign and date the form, and indicate the ship or ships the participant will be sailing on. The participant will receive an email notice when medically cleared to sail if a legible email address is provided on the NHSQ.

Contact information:

Regional Director of Health Services
Marine Operations Center – Atlantic
439 W. York Street
Norfolk, VA 23510
Telephone 757.441.6320
Fax 757.441.3760
E-mail:
MOA.Health.Services@noaa.gov

Regional Director of Health Services
Marine Operations Center - Pacific
2002 SE Marine Science Drive
Newport, OR 97365
Telephone 541-867-8820
Fax 541-867-8856
Email: MOP.Health-Services@noaa.gov

Prior to departure, the Chief Scientist must provide a listing of emergency contacts to the Executive Officer for all members of the scientific party, with the following information: name, address, relationship to member, and telephone number.

C. 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 and hard hats are required when participating in or operating near any operation including and especially the side station as well as when working near any railings or open decks and during small boat launch and recovery operations. Hard hats and work vests will be provided by the ship when required.

D. Communications

A progress report on operations prepared by the Chief Scientist may be relayed to the program office. Sometimes it is necessary for the Chief Scientist to communicate with another vessel, aircraft, or shore facility. Through various modes of communication, the ship is able to maintain contact with the Marine Operations Center on an as needed basis. These methods will be made available to the Chief Scientist upon request, in order to conduct official business. Due to a new directive from Marine Operations Center, the ship must charge the science party for all calls made on the cell or sky-cell telephone. INMARSAT, Sky Cell and cellular communication costs shall be reimbursed to the ship for telephone calls made by all scientific personnel. Currently, Sky Cell and cellular telephone services are about $0.89 per minute and INMARSAT Mini M is around $1.68 per minute for voice. These charges will be assessed against the program after the ship receives the bill. There is generally a three month delay receiving the bill for review. The Chief Scientist will be required to keep a log of all calls made by the science party.

E. IT Security

Any computer that will be hooked into the ship's network must comply with the NMAO Fleet IT Security Policy prior to establishing a direct connection to the NOAA WAN. Requirements include, but are not limited to:

1. Installation of the latest virus definition (.DAT) file on all systems and performance of a virus scan on each system.
2. Installation of the latest critical operating system security patches.
3. No external public Internet Service Provider (ISP) connections.

Completion of these requirements prior to boarding the ship is preferable.

Non-NOAA personnel using the ship's computers or connecting their own computers to the ship's network must complete NOAA’s IT Security Awareness Course within 3 days of embarking.

F. Foreign National Guests Access to OMAO Facilities and Platforms

All foreign national access to the vessel shall be in accordance with NAO 207-12 and RADM De Bow's March 16, 2006 memo. National Marine Fisheries Service personnel will use the Foreign National Registration System (FRNS) to submit requests for access to NOAA facilities and ships. The Departmental Sponsor/NOAA (DSN) is responsible for obtaining clearances and export licenses and for providing escorts required by the NAO. DSNs should consult with their designated NMFS Deemed Exports point of contact to assist with the process.

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

Responsibilities of the Chief Scientist:

1. Provide the Commanding Officer with the e-mail generated by the FRNS granting approval for the foreign national guest's visit. This e-mail will identify the guest's DSN and will serve as evidence that the requirements of NAO 207-12 have been complied with.
2. Escorts – The Chief Scientist is responsible to provide escorts to comply with NAO 207-12 Section 5.10, or as required by the vessel's DOC/OSY Regional Security Officer.
3. Ensure all non-foreign national members of the scientific party receive the briefing on Espionage Indicators (NAO 207-12 Appendix A) at least annually or as required by the servicing Regional Security Officer.
4. Export Control - The NEFSC currently neither possesses nor utilizes technologies that are subject to Export Administration Regulations (EAR).

The Commanding Officer and the Chief Scientist will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.

Responsibilities of the Commanding Officer:

1. Ensure only those foreign nationals with DOC/OSY clearance are granted access.
2. Deny access to OMAO platforms and facilities by foreign nationals from countries controlled for anti-terrorism (AT) reasons and individuals from Cuba or Iran without written NMAO approval and compliance with export and sanction regulations.
3. Ensure foreign national access is permitted only if unlicensed deemed export is not likely to occur.
4. Ensure receipt from the Chief Scientist or the DSN of the FRNS e-mail granting approval for the foreign national guest's visit.
5. Ensure Foreign Port Officials, e.g., Pilots, immigration officials, receive escorted access in accordance with maritime custom to facilitate the vessel's visit to foreign ports.
6. Export Control - 8 weeks in advance of the 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

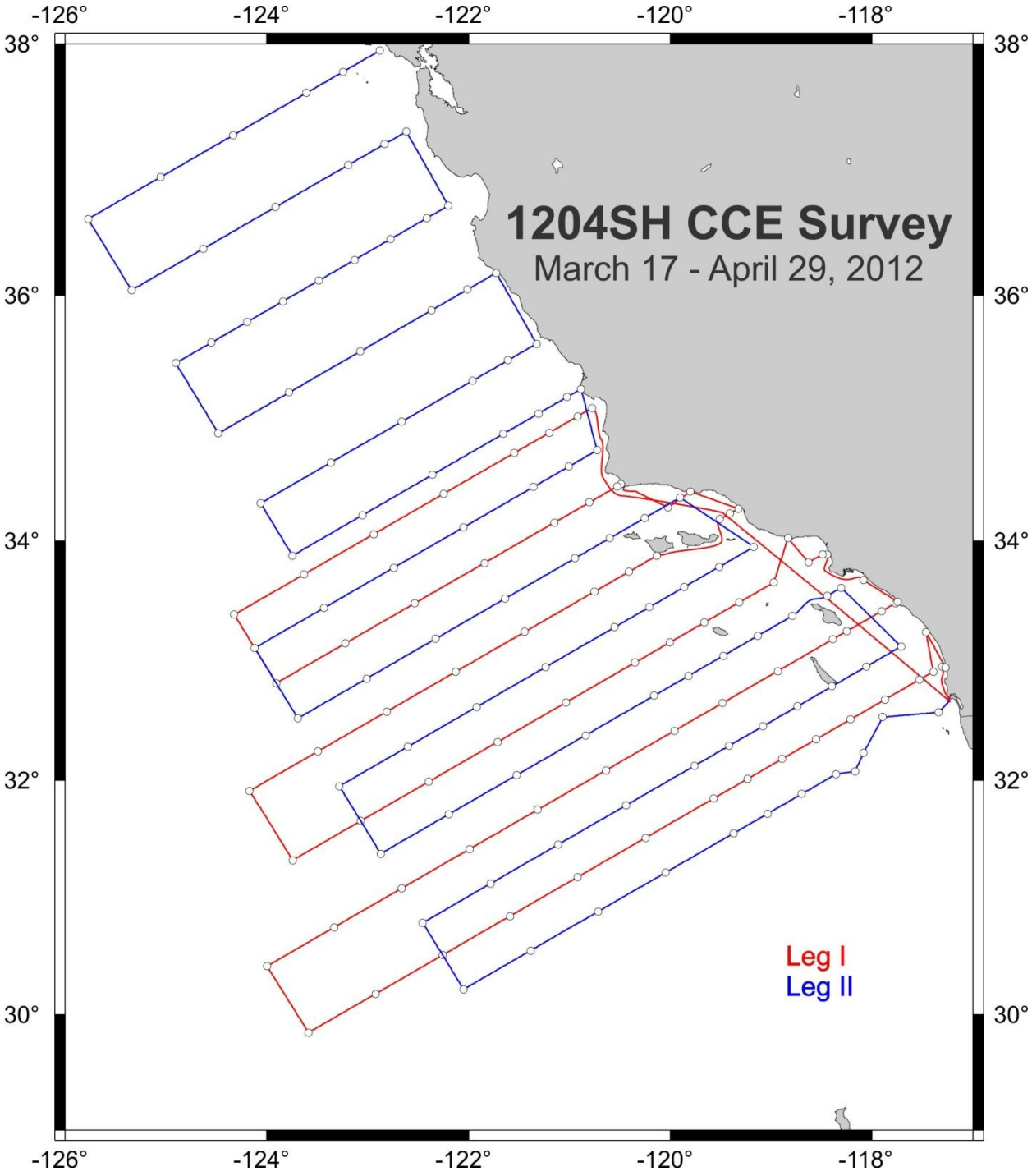
prevent unlicensed export of Program controlled technology. The Commanding Officer and the Chief Scientist will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.

7. 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.

Responsibilities of the Foreign National Sponsor:

1. Export Control - The foreign national's sponsor is responsible for obtaining any required export licenses and complying with any conditions of those licenses prior to the foreign national being provided access to the controlled technology onboard regardless of the technology's ownership.
2. The DSN of the foreign national shall assign an on-board Program individual, who will be responsible for the foreign national while on board. The identified individual must be a U.S. citizen, NOAA (or DOC) employee. According to DOC/OSY, this requirement cannot be altered.
3. Ensure completion and submission of Appendix C (Certification of Conditions and Responsibilities for a Foreign National Guest) as required by NAO 207-12 Section 5.03.h.

Appendix I. Cruise track and proposed station position for SH12-04 legs I and II. Stations listed in Appendix II.



Appendix II. Station positions for SH12-04.

Legs I & II (leg I ends at Schedule Order 76)

Schedule_Order	Line	Station	Dlatitude	Dlongitude
1	94.72297167	27.98719507	32.667	117.2329967
2	93.3	26.7	32.95637243	117.3053809
3	93.4	26.4	32.94905192	117.2735654
4	91.7	26.4	33.24350056	117.4654169
5	93.3	28	32.91303909	117.3943818
6	93.3	30	32.84637243	117.5312206
7	93.3	35	32.67970576	117.8728643
8	93.3	40	32.51303909	118.2138649
9	93.3	45	32.34637243	118.5542278
10	93.3	50	32.17970576	118.8939582
11	93.3	55	32.01303909	119.2330612
12	93.3	60	31.84637243	119.5715421
13	93.3	70	31.51303909	120.2466579
14	93.3	80	31.17970576	120.9193461
15	93.3	90	30.84637243	121.5896467
16	93.3	100	30.51303909	122.2575992
17	93.3	110	30.17970576	122.9232422
18	93.3	120	29.84637243	123.5866142
19	90	120	30.41794919	123.9989326
20	90	110	30.75128253	123.3316429
21	90	100	31.08461586	122.6620162
22	90	90	31.41794919	121.9900131
23	90	80	31.75128253	121.3155939
24	90	70	32.08461586	120.6387183
25	90	60	32.41794919	119.9593451
26	90	53	32.65128253	119.4822756
27	90	45	32.91794919	118.9355113
28	90	37	33.18461586	118.3870812
29	90	35	33.25128253	118.2497109
30	90	30	33.41794919	117.9058212
31	90	28	33.48461586	117.7680788
32	90	27.7	33.49461586	117.7474083
33	88.5	30.1	33.67442348	118.0836933
34	86.8	32.5	33.88887212	118.4442347
35	86.7	33	33.88952596	118.4903339
36	86.7	35	33.82285929	118.6287319
37	85.4	35.8	34.02135923	118.8341306
38	86.7	40	33.65619263	118.9742516
39	86.7	45	33.48952596	119.3190964
40	86.7	50	33.32285929	119.6632718
41	86.7	55	33.15619263	120.0067835
42	86.7	60	32.98952596	120.3496367

43	86.7	70	32.65619263	121.0333897	
44	86.7	80	32.32285929	121.7145734	
45	86.7	90	31.98952596	122.3932299	
46	86.7	100	31.65619263	123.0694006	
47	86.7	110	31.32285929	123.7431265	
48	83.3	110	31.91175657	124.1703953	
49	83.3	100	32.2450899	123.4923224	
50	83.3	90	32.57842323	122.8117321	
51	83.3	80	32.91175657	122.1285823	
52	83.3	70	33.2450899	121.4428307	
53	83.3	60	33.57842323	120.7544339	
54	83.3	55	33.7450899	120.4092298	
55	83.3	51	33.87842323	120.1325788	
56	83.3	42	34.17842323	119.5085132	
57	83.3	40.6	34.2250899	119.4112355	
58	83.3	39.4	34.2650899	119.3278113	
59	81.7	43.5	34.40555136	119.80037	
60	81.8	46.9	34.27489752	120.0252367	
61	80	50.5	34.46666667	120.4890554	
62	80	51	34.45	120.5239048	
63	80	55	34.31666667	120.802448	
64	80	60	34.15	121.15	
65	80	70	33.81666667	121.8430351	
66	80	80	33.48333333	122.5333494	
67	80	90	33.15	123.2209872	
68	80	100	32.81666667	123.9059922	
69	76.7	100	33.38824343	124.3228913	
70	76.7	90	33.72157677	123.633345	
71	76.7	80	34.0549101	122.9410906	
72	76.7	70	34.38824343	122.2460832	
73	76.7	60	34.72157677	121.5482772	
74	76.7	55	34.88824343	121.1983102	
75	76.7	51	35.02157677	120.9178206	
76	76.7	49	35.08824343	120.7774028	
77	94.72297167	27.98719507	32.667	117.2329967	San Diego
78	94.9	29.9	32.57257763	117.3435197	
79	93.9	36.3	32.53244938	117.8931935	
80	94.8	40.6	32.23323147	118.0830399	
81	95.3	42.7	32.07662893	118.1683523	
82	95	45	32.05192379	118.358686	
83	95	50	31.88525712	118.6973116	
84	95	55	31.71859046	119.035319	
85	95	60	31.55192379	119.3727132	
86	95	70	31.21859046	120.0456826	
87	95	80	30.88525712	120.7162597	

88	95	90	30.55192379	121.384484
89	91.7	90	31.12350056	121.7834128
90	91.7	80	31.45683389	121.1111299
91	91.7	70	31.79016722	120.4364263
92	91.7	60	32.12350056	119.7592614
93	91.7	55	32.29016722	119.4197432
94	91.7	50	32.45683389	119.0795942
95	91.7	45	32.62350056	118.7388092
96	91.7	40	32.79016722	118.397383
97	91.7	35	32.95683389	118.0553101
98	91.7	30	33.12350056	117.7125854
99	88.3	33	33.61239783	118.3067408
100	88.3	35	33.54573116	118.4446887
101	88.3	40	33.3790645	118.7890892
102	88.3	45	33.21239783	119.1328241
103	88.3	50	33.04573116	119.4758988
104	88.3	55	32.8790645	119.8183187
105	88.3	60	32.71239783	120.1600892
106	88.3	70	32.3790645	120.8417031
107	88.3	80	32.04573116	121.5207828
108	88.3	90	31.71239783	122.1973698
109	85	90	32.2839746	122.6020864
110	85	80	32.61730793	121.9211997
111	85	70	32.95064126	121.2377486
112	85	60	33.2839746	120.5516906
113	85	55	33.45064126	120.2076705
114	85	50	33.61730793	119.8629824
115	85	45	33.7839746	119.5176207
116	85	40	33.95064126	119.1715799
117	81.7	45	34.35555136	119.9048202
118	81.7	50	34.1888847	120.2525343
119	81.7	55	34.02221803	120.5995556
120	81.7	60	33.85555136	120.9458897
121	81.7	70	33.52221803	121.6365191
122	81.7	80	33.1888847	122.3244669
123	81.7	90	32.85555136	123.0097768
124	78.3	90	33.44444864	123.433021
125	78.3	80	33.77778197	122.7430212
126	78.3	70	34.1111153	122.0503058
127	78.3	60	34.44444864	121.3548297
128	78.3	55	34.6111153	121.0060421
129	78.3	51	34.74444864	120.7265031
130	75.8	49	35.24412801	120.885022
131	75.8	51	35.17746134	121.0257114
132	75.8	55	35.04412801	121.3067414

133	75.8	60	34.87746134	121.6573789
134	75.8	70	34.54412801	122.3565096
135	75.8	80	34.21079467	123.05282
136	75.8	90	33.87746134	123.7463563
137	73.3	90	34.31047404	124.0615369
138	73.3	80	34.64380737	123.3643879
139	73.3	70	34.97714071	122.6644048
140	73.3	60	35.31047404	121.9615407
141	73.3	55	35.47714071	121.6090134
142	73.3	51	35.61047404	121.3264603
143	70	51	36.18205081	121.7258644
144	70	55	36.04871747	122.0104783
145	70	60	35.88205081	122.3655627
146	70	70	35.54871747	123.0734784
147	70	80	35.21538414	123.7784308
148	70	90	34.88205081	124.4804682
149	66.7	90	35.45362757	124.9027779
150	66.7	85	35.62029424	124.5496169
151	66.7	80	35.78696091	124.1957124
152	66.7	75	35.95362757	123.8410585
153	66.7	70	36.12029424	123.4856487
154	66.7	65	36.28696091	123.1294771
155	66.7	60	36.45362757	122.7725371
156	66.7	55	36.62029424	122.4148226
157	66.7	52	36.72029424	122.1998195
158	63.3	52	37.30919152	122.6178311
159	63.3	55	37.20919152	122.8345184
160	63.3	60	37.04252485	123.1950214
161	63.3	70	36.70919152	123.9136417
162	63.3	80	36.37585818	124.6291242
163	63.3	90	36.04252485	125.3415203
164	60	90	36.61410162	125.7709893
165	60	80	36.94743495	125.0532694
166	60	70	37.28076828	124.3323747
167	60	60	37.61410162	123.6082525
168	60	55	37.78076828	123.2449644
169	60	50	37.94743495	122.8808493

Appendix III. 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 17 March, 2012. The ship will anchor in the deepest possible water, outside of the channel.