

Project Instructions


Date Submitted: February 1, 2018

Platform: NOAA Ship *Reuben Lasker*

Project Number: RL-19-01 (OMAO), 1902RL (SWFSC)

Project Title: Winter CalCOFI, Fisheries Resources Division.

Project Dates: February 6, 2019 to February 13, 2019

Prepared by:  _____ Dated: January 31, 2019
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Approved by: _____ Dated: _____
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Approved by: _____ Dated: _____
Kristen Koch,
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Approved by: _____ Dated: _____
Captain Keith Roberts, NOAA
Commanding Officer
Marine Operations Center - Pacific

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 Francisco, California and San Diego, California during the period of February 6 to February 13, 2019.

B. Days at Sea (DAS)

Of the 8 DAS scheduled for this project, 8 are funded by a Line Office Allocation. This project is estimated to exhibit a High Operational Tempo.

C. Operating Area

The area covered during this survey will be from San Diego to Point Conception and extend approximately 200 miles offshore (please see appendix section).

D. 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 Point Conception, California and San Diego, California.

The following are specific objectives for the winter CalCOFI.

I.D.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 early spawning Pacific sardine.

I.D.2. Continuously sample multi-frequency acoustic backscatter using the Simrad EK60/80 and the Simrad ME80. The data will be used to estimate the distributions and abundances of coastal pelagic fishes (e.g., sardine, anchovy, and mackerel), and krill species (please see appendix section).

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

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

I.D.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.

I.D.6. Sample the light intensity in the photic zone using a standard secchi disk in conjunction with a daytime CTD station. These data will be used to interpret the measurements of primary production.

I.D.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.D.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.D.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.D.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 and station 81.8 46.9. These data will be used in analyses by the LTER (Long Term Ecological Research) project.

I.D.11. Continuously sample profiles of currents using the RDI/Teledyne Acoustic Doppler Current Profiler. This will be dependent on the ability to sync the ADCP's output with the EK60 and ME70. The EK60 and ME70 will hold priority over the ADCP (please see appendix section).

I.D.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.

E. Participating Institutions

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

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

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

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

Name (Last, First)	Title	Date Aboard	Date Disembark	Gender	Affiliation	Nationality
Bryan Overcash	Chief Scientist	February 6, 2019	February 13, 2019	M	SWFSC	US
Amy Hays	Biologist	February 6, 2019	February 13, 2019	F	SWFSC	US
Lanora Vasquez Del Mercado	Biologist	February 6, 2019	February 13, 2019	F	SWFSC	US
Emily Gardner	Biologist	February 6, 2019	February 13, 2019	F	SWFSC	US
James Wilkinson	Oceanographer	February 6, 2019	February 13, 2019	M	SIO	US
Megan Roadman	Oceanographer	February 6, 2019	February 13, 2019	F	SIO	US

David Faber	Oceanographer	February 6, 2019	February 13, 2019	M	SIO	US
Dan Schuller	Chemist	February 6, 2019	February 13, 2019	M	SIO	US
Shonna Dovel	LTER	February 6, 2019	February 13, 2019	F	SIO	US
Angela Klemmedson	Oceanographer	February 6, 2019	February 13, 2019	F	SIO	US
Ann Schulberg	Oceanographer	February 6, 2019	February 13, 2019	F	SIO	US
Dafna Bimstein	Volunteer	February 6, 2019	February 13, 2019	F	SIO	US
Emily Griffiths	Marine Mammal Observer	February 6, 2019	February 13, 2019	F	SIO	US
Katherine Whitaker	Marine Mammal Observer	February 6, 2019	February 13, 2019	F	SIO	US
Brian Hoover	Bird Observer	February 6, 2019	February 13, 2019	M	FIAER	US

G. Administrative

1. Points of Contacts:

Chief Scientist/alternate: Bryan Overcash/Amy Hays (858-546-7126/858-546-7130); 8901 La Jolla Shores Drive, La Jolla, CA, 92037
Bryan.Overcash@noaa.gov/Amy.Hays@noaa.gov

Project Operation Lead: Ed Weber (858-546-5676); 8901 La Jolla Shores Drive, La Jolla, CA, 92037 (Ed.weber@noaa.gov)

Ops Officer: David Wang (619-230-0331) NOAA Ship *Reuben Lasker* (OPS.Reuben.Lasker@noaa.gov)

2. Diplomatic Clearances

None Required.

3. Licenses and Permits

I.3.G.a. All marine mammal work is covered under a federal research permit NMFS Permit 17312 issued to Dr. John Hildebrand of SIO.

I.3.G.b. CDFW on March 30, 2015 (expires March 2021) NOAA-SWFSC-FRD-Kristen Koch (SC-013886)

II. Operations

A. Project Itinerary

February 6: Depart San Diego, CA – CalCOFI

February 13: Arrive San Diego, CA

B. Staging and Destaging

Staging and destaging will be conducted at the NOAA facility at the Tenth Avenue Marine Terminal in San Diego, CA.

We request one laboratory van to be craned onto the afterdeck and secured in San Diego prior to departure. The dimension of the van is approximately 8x8x10 feet weighing 6500 lbs. Power requirement is 110V.

We request one SWFSC MMTD Acoustic Hydraulic Winch to be craned onto the afterdeck and secured in San Diego prior to departure. Please see Appendix 3a *Marine Mammal Acoustics Lasker Shakedown Report* document for additional details. Specifications are as follows:

- Custom winch on 48" drum, 72" rim, approx 30-" wide
- Winch is attached to a larger steel based that can be bolted to the deck. Screw spacing for larger steel space is 48" (square) with the screw size of 1 5/8"
- Footprint for entire unit approximately 6'x6'
- Approximate weight (with cable): 1200 lbs
- Current motor: Sauer Danfoss DH-200 (hydraulics are engaged only when winch is actively being used (releases to neutral)
- Hansen-style quick disconnects
- PSI 1500

We request the ship to load its portable HPU unit that is currently stored in the warehouse. The portable HPU unit will be installed, as per appendix 3a

- 12 GPM (gals per minute of oil flow)
- 1200lb Pressure
- 440V Power, to be installed/operated inside the wetlab
- Water cooling system installation.
- Hydraulic hoses will be installed at the beginning of the project, and not disconnected until the end of the project. This best management practice will mitigate the leaking of hydraulic oil through the hoses.

- Efforts will be coordinated between the ship and the scientific compliment to ensure proper measures are in place to reduce environmental impacts in the event of a spill casualty.

C. Operations to be Conducted

II.C.1. Underway Operations

II.C.1.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 project. 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 project.

II.C.1.b. 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. If synchronization of the ADCP is not achievable, the ADCP will only be active during night hours and while on station.

II.C.1.c. CUFES: 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 505 μ m. 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.

It is requested that prior to departure on February 6 that the CUFES intake be cleared from all marine growth.

II.C.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 project transects.

II.C.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. Upon

approaching a station, two sonobuoy will be deployed one nautical mile prior to stopping for station work.

II.C.2. Station Operations

Each standard station will include the following:

II.C.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. Three tag lines will be used for every deployment and retrieval of the CTD/Rosette.

NOTE: SIO will provide their own CTD sensor and 24 bottle (10 liter) rosette unit. Please record CTD deployed, CTD at depth and CTD recovered for SCS.

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. The starboard side sample will be preserved in 5% buffered formalin and the port side sample will be preserved in buffered ethanol at every station.

Please record Bongo deployed and Bongo recovered for SCS.

II.C.2.c. Manta net (neuston) tow: 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. 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 stations on line 90.0 and 80.0 as well as stations out to and including station 60.0 on lines 86.7 and 83.3 and station 81.8 46.9. 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.

Please record PRPOOS deployed and PRPOOS recovered for SCS.

II.C.2.f. Primary productivity: at about 1100 hours on each day 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 C¹⁴ 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. Primary productivity after line 76.7 will not be measured.

II.C.2.g. A light meter (Secchi disk) will be used to measure the light intensity in the euphotic at 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:

- 1) CTD to 515 meters with 24 bottle rosette (depth permitting).
- 2) PRPOOS net tow [lines 90.0 and 80(out to station 100), 86.7 (out to station 60), 83.3 (out to station 60); station 81.8 46.9]. Total of 31 stations).
- 3) Pairovet net tow (on lines 90 and 80 out to station 70.0, and out to station 60 on lines 86.7 and 83.3).
- 4) Manta net tow (on all stations except for near shore SCCOOS).
- 5) Bongo net tow (on all stations).

II.C.3.b. 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 projects. 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.

Marine mammal watches are now a standard part of conducting fisheries research activities, particularly those that use gear (e.g., longlines and mid-water trawls) known to interact with marine mammals or that we believe have a reasonable likelihood of doing so in the future. Marine mammal watches are conducted in two ways. First, watches are conducted by lookouts (those navigating the vessel and other crew) at all times when the vessel is being operated. Second, marine mammal watches and monitoring occur for 30 minutes prior to deployment of gear, and they continue until gear is brought back on board, for longlines and mid-water trawl gear. Watches in the first category are not done by dedicated staff; these personnel primary duties as lookout according to the Rules of the Road are “maintaining a

proper lookout by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.” Watches in the second category are done by dedicated scientists with no other responsibilities during the watch period. If marine mammals are sighted within 1 nm of the planned set location then the sampling station is either moved or canceled. Watch-standers record the estimated species and number of animals present and their behaviors. This information can be valuable in understanding whether some species may be attracted to vessels or gear. While underway:

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.

D. Dive Plan

All dives are to be conducted in accordance with the requirements and regulations of the NOAA Diving Program (<http://www.ndc.noaa.gov/dr.html>) and require the approval of the ship’s Commanding Officer.

A dive is requested for clearing the CUFES intake of attached mussels.

E. 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 all operations. Equipment failure should not impact our project.

III. Equipment

A. Equipment and Capabilities provided by the ship

We request the following measurement 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. Measurement instruments include all sensors

associated with the CTD package, underway systems such as the thermosalinometers and fluorometers, and atmospheric sensors such as barometers, thermometers and wind indicators.

Starboard hydro winch with 0.375" cable for standard Bongo, Pairovet and Manta tows

Starboard oceo winch with 0.375" electro-mechanical cable for standard CTD casts

A-frame w/blocks to accommodate 0.375" cables

Constant temperature room set at $22^{\circ}\text{C} \pm 1^{\circ}\text{C}$ ($71.5^{\circ}\text{F} \pm 2^{\circ}\text{F}$)

Winch monitoring system

Knudsen 12 kHz depth recorder or comparable to measure bottom depth to 4000+ meters (EK60)

Acoustic Doppler Current Profiler

Multifrequency EK60 GPTs and transducers (ES18-11, ES38B, ES120-7C, ES200-7C, ES333)

Broad bandwidth ME70 echosounder

Scientific computing system

Applanix PosMV position and motion sensor

24-bottle rosette frame capable of carrying 10-liter niskin bottles, fitted with SBE911+ CTD unit (spare only to be used in case of equipment loss or failure)

Pump, collector and concentrator unit for CUFES water sampling

GPS feed to flying bridge for use by bird observers

-80°C Freezer

Thermo Scientific filtration system

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

30 cc and 50 cc syringes (SWFSC)

Canulas (SWFSC)

(30) Pint jar cases (SWFSC) (120 lbs.)

(15) Quart jar cases (SWFSC) (60 lbs.)

(4) Gallon jar cases (SWFSC) (16 lbs.)

(8) Scintillation vial flats (SWFSC) (10 lbs.)

Inside and outside labels (SWFSC)

CalCOFI net tow data sheets (SWFSC)

(2) 71 cm CalCOFI Bongo frames (SWFSC) (40 lbs.)

(5) 71 cm CalCOFI 505 μm mesh nets (SWFSC) (10 lbs.)

(5) CalCOFI 150 μm Pairovet nets and codends (SWFSC) (10 lbs.)

(2) CalCOFI Pairovet frames (SWFSC) (10 lbs.)

333 μm mesh codends (SWFSC)

(6) Digital flowmeters (SWFSC)

(2) PRPOOS frames (SIO) (10 lbs.)

(1) 170 lb PRPOOS weight (SIO)

202 μm mesh PRPOOS nets and codends (SIO) (10 lbs.)

(2) 75 lb Bongo weight (SWFSC)

(2) 100 lb hydro weight (SWFSC)

(2) CalCOFI Manta net frames (SWFSC) (60 lbs.)

(5) 60 cm CalCOFI 505 μm mesh Manta nets (SWFSC) (10 lbs.)

(4) Standard CalCOFI tool boxes (SWFSC) (80 lbs.)

Bucket thermometers and holders (SIO)

Hand held inclinometer for Pairovet and Bongo tows (SWFSC)

(2) Oxygen auto-titration rig (SIO) (75 lbs.)

(5) Oxygen flask cases (SIO) (80 lbs.)

(2) Guildline Portasal (SIO) (80 lbs.)

(8) Salinity bottles (SIO) (100 lbs.)

(2) Standard sea water (SIO) (160 lbs.)

Data sheets for scheduled hydrographic work (SIO)

Weather observation sheets (SIO)

(1) Primary productivity incubation rack (SIO) (120 lbs.)

24 Niskin bottles (10 liter) for rosette (SIO) (150 lbs.)

(1) SBE911+ CTD unit with necessary sensors (SIO) (1000 lbs.)

(2) Turner fluorometer (SIO) (60 lbs.)

(1) Nutrient auto analyzer (SIO) (75 lbs.)

(1) Isotope van (SIO) – 6500 pounds

(1) Winch for acoustic array (SIO) – 3800 pounds

(2) Dissecting microscopes (SWFSC) (50 lbs.)

(150) Sonobuoys (SIO) (1500 lbs.)

Sound speed sensor and pan-tilt-zoom camera on centerboard plate (SWFSC)

EK80 adaptive logger software (SWFSC)

EK80 software (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 OMAO procedure, the scientific party will include with their project instructions and provide to the CO of the respective ship 30 days before departure:

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

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

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

- Confirmation that chemical safety and spill response procedures were brought aboard

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

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

B. Inventory

Common Name of Material	Qty	Notes	Trained Individual	Spill control
Ethyl alcohol (95%)	80L (in 20L cans)	UN1170, Waste contained and disposed of by SWFSC at end of project. Stored in fume hood	Bryan Overcash, Amy Hays	F
Formaldehyde solution (37%)	20L	No waste. Stored in fume hood	Bryan Overcash, Amy Hays	F
Tris buffer	500ml	Stored in Chem lab	Bryan Overcash, Amy Hays	F
Sodium borate powder	500gr	Stored in Chem lab	Bryan Overcash, Amy Hays	F
HCL (1.2N)	4L	UN1789, No waste. Stored in chem lab.	Dan Schuller	A
Sulfuric acid (10 Normal)	4L	Stored in Chem lab, waste neutralized by base in assay	Dan Schuller	A
Acetone (90%)	7L	UN1090, Waste contained and disposed of by SIO at end of project. Stored chem locker.	Dan Schuller	F

Common Name of Material	Qty	Notes	Trained Individual	Spill control
Mangannous Chloride	4L	No waste. stored in chem locker	Dan Schuller	A
Sodium Hydroxide/Sodium Iodide	4L	UN1824, Waste neutralized by acid in assay. Stored in chem locker	Dan Schuller	A
Ethanol (95%)	1L	UN1170, No waste. Stored in Constant environment room	Dan Schuller	F
Ecolume Scintillation Fluid	2.5L	No waste. Stored chem locker.	Dan Schuller	F
¹⁴ C Sodium Bicarbonate (5.0mCi)	20ml	Waste contained and disposed of by SIO at end of project by UCSD EH&S. Stored in Rad van	Dan Schuller	Waste remains in Rad van vacuum jugs in secondary containment
HCL (12N)	150ml	No waste. Stored in wet lab/Dropper bottles with secondary containment	Shonna Dovel	A
Isopropyl Alcohol (91%)	30ml	No waste. Stored in wet lab/Dropper bottles with secondary containment	Shonna Dovel	A
Liquid Nitrogen	50L Dewar	No waste. Stored wet lab	Shonna Dovel	A
Acetone (90%)	7L	No waste. Stored in wet lab and -80 freezer with secondary containment	Shonna Dovel	F
HCL (1N)	400ml	No waste. Stored in wet lab/Dropper bottles with secondary containment	Shonna Dovel	A

Common Name of Material	Qty	Notes	Trained Individual	Spill control
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	Shonna Dovel	A
Buffered Formalin (10%)	2L	Stored in Chem lab fume hood with secondary containment	Shonna Dovel	F
Alkaline Lugol's fixative (100%)	250ml	Stored in Chem lab refer with secondary containment	Shonna Dovel	F
Paraformaldehyde (10%)	.5L	Stored in Chem lab refer with secondary containment	Shonna Dovel	F
Proflavin (0.033%)	250ml	Stored in Chem lab refer with secondary containment	Shonna Dovel	F
Sodium Thiosulfate (0.190M)	250ml	Stored in Chem lab refer with secondary containment	Shonna Dovel	F
Basic Lugol's fixative (100%)	500ml	Stored in Chem lab fume hood with secondary containment	Shonna Dovel	F
Ammonium Molybdate	75g	No waste. Stored in Chem lab	Dan Schuller	D
Ammonium Sulfate	0.1322g	No waste. Stored in Chem lab	Dan Schuller	D
Ascorbic acid	46g	No waste. Stored in Chem lab	Dan Schuller	D
Brij-35 (15%)	15g	No waste. Stored in Chem lab	Dan Schuller	D

Common Name of Material	Qty	Notes	Trained Individual	Spill control
Imidazole	8g	No waste. Stored in Chem lab	Dan Schuller	D
Copper Sulfate	2g	No waste. Stored in Chem lab	Dan Schuller	D
N-(1-naphthyl) ethylenediamine dihydrochl	2g	No waste. Stored in Chem lab	Dan Schuller	D
Cadmium Coil	3g	No waste. Stored in Chem lab	Dan Schuller	D
Oxalic acid	100g	No waste. Stored in Chem lab	Dan Schuller	D
Sodium dodecyl sulfate	24g	No waste. Stored in Chem lab	Dan Schuller	A
Potassium antimony tartrate	0.34g	No waste. Stored in Chem lab	Dan Schuller	D
Potassium Phosphate	0.8g	No waste. Stored in Chem lab	Dan Schuller	D
Sodium chloride	850g	No waste. Stored in Chem lab	Dan Schuller	D
Sodium Nitrite	1.4g	No waste. Stored in Chem lab	Dan Schuller	D
Sodium hydrogen carbonate	15g	No waste. Stored in Chem lab	Dan Schuller	D
Sodium Hydroxide	10g	No waste. Stored in Chem lab	Dan Schuller	D
Sodium Hydroxide	0.1L	No waste. Stored in Chem lab	Dan Schuller	A
Ammonia Sulphate	1L	No waste. Stored in Chem lab	Dan Schuller	A
Sodium sulfite	2.4g	No waste. Stored in Chem lab	Dan Schuller	D
Sulfanilamide	20g	No waste. Stored in Chem lab	Dan Schuller	D
O-phthalaldehyde	4g	No waste. Stored in Chem lab	Dan Schuller	D

Common Name of Material	Qty	Notes	Trained Individual	Spill control
Ethanol	1500ml	No waste. Stored in Chem lab	Dan Schuller	F
HCL (dilute 1.2N)	2.5L	No waste. Stored in Chem lab	Dan Schuller	A
HCL (conc. 12N)	4L	No waste. Stored in Chem lab	Dan Schuller	A

C. Chemical safety and spill response procedures

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.

D: Powdered and granular chemicals

- Wear appropriate protective equipment and clothing during clean-up. Keep upwind. Keep out of low areas.
- Sweep up dry chemical and place in a doubled zip lock bag.
- If contact with water occurs, use proper neutralizing agent prior to cleanup.
- Store in sealed container to be returned and disposed by UCSD EH&S.

Product Name	Amount	Chemicals it is useful against	Amount it can clean up
Chemical Spill pads	100	Formaldehyde, Alcohols	110L
Uni-Safe spill binder	14 kg	Formaldehyde, alcohols, acids	120L

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

D. Radioactive Materials

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.

E. Inventory (itemized) of Radioactive Materials

Common Name Radioactive Material	Concentration	Amount	Notes
¹⁴ C 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 Jan. 29 by UCSD,EH&S
¹⁴ C Sodium Bicarbonate	100mCi	20ml	To be used and stored in Science provided Rad van

			on main deck of ship. All waste contained and offloaded on Jan. 29 by UCSD,EH&S
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V. Additional Projects

A. Supplementary (“Piggyback”) Projects

Supplementary Projects are planned and details will be added in a later draft.

B. NOAA Fleet Ancillary Projects

No NOAA Fleet Ancillary Projects are planned.

VI. Disposition of Data and Reports

Disposition of data gathered aboard NOAA ships will conform to NAO 216-101 *Ocean Data Acquisitions* and NAO 212-15 *Management of Environmental Data and Information*. To guide the implementation of these NAOs, NOAA’s Environmental Data Management Committee (EDMC) provides the *NOAA Data Documentation Procedural Directive* (data documentation) and *NOAA Data Management Planning Procedural Directive* (preparation of Data Management Plans). OMAO is developing procedures and allocating resources to manage OMAO data and Programs are encouraged to do the same for their Project data.

A. Data Classifications: *Under Development*

- a. OMAO Data
- b. Program Data

B. Responsibilities: *Under Development*

VII. Meetings, Vessel Familiarization, and Project Evaluations

A. Pre-Project Meeting: The Chief Scientist and Commanding Officer will conduct a meeting of pertinent members of the scientific party and ship’s crew to discuss required equipment, planned operations, concerns, and establish mitigation strategies for all concerns. This meeting shall be conducted before the beginning of the project with sufficient time to allow for preparation of the ship and project personnel. The ship’s Operations Officer usually is delegated to assist the Chief Scientist in arranging this meeting.

B. Vessel Familiarization Meeting: The Commanding Officer is responsible for ensuring scientific personnel are familiarized with applicable sections of the standing orders and vessel protocols, e.g., meals, watches, etiquette, drills, etc. A vessel familiarization meeting shall be conducted in the first 24 hours of the project’s start and is normally presented by the ship’s Operations Officer.

- C. Post-Project Meeting: The Commanding Officer is responsible for conducted a meeting no earlier than 24 hrs before or 7 days after the completion of a project to discuss the overall success and short comings of the project. Concerns regarding safety, efficiency, and suggestions for future improvements shall be discussed and mitigations for future projects will be documented for future use. This meeting shall be attended by the ship's officers, applicable crew, the Chief Scientist, and members of the scientific party and is normally arranged by the Operations Officer and Chief Scientist.
- D. Project Evaluation Report
- E. Within seven days of the completion of the project, a Customer Satisfaction Survey is to be completed by the Chief Scientist. The form is available at <http://www.oma.noaa.gov/fleeteval.html> and provides a "Submit" button at the end of the form. Submitted form data is deposited into a spreadsheet used by OMAO management to analyze the information. Though the complete form is not shared with the ships', specific concerns and praises are followed up on while not divulging the identity of the evaluator.

VIII. Miscellaneous

A. Meals and Berthing

The ship will provide meals for the scientists listed above. Meals will be served 3 times daily beginning one hour before scheduled departure, extending throughout the project, and ending two hours after the termination of the project. Since the watch schedule is split between day and night, the night watch may often miss daytime meals and will require adequate food and beverages (for example a variety of sandwich items, cheeses, fruit, milk, juices) during what are not typically meal hours. Special dietary requirements for scientific participants will be made available to the ship's command at least seven days prior to the 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 Commanding Officer will work together on a detailed berthing plan to accommodate the gender mix of the scientific party taking into consideration the current make-up of the ship's complement. The Chief Scientist is responsible for ensuring the scientific berthing spaces are left in the condition in which they were received; for stripping bedding and linen return; and for the return of any room keys which were issued. The Chief Scientist is also responsible for the cleanliness of the laboratory spaces and the storage areas utilized by the scientific party, both during the project and at its conclusion prior to departing the ship.

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

All persons boarding NOAA vessels give implied consent to comply with all safety and security policies and regulations which are administered by the Commanding Officer. All spaces and equipment on the vessel are subject to inspection or search at any time. All personnel must comply with OMAO's Drug and Alcohol Policy dated May 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, NF 57-10-01 (3-14)) must be completed in advance by each participating scientist. The NHSQ can be obtained from the Chief Scientist or the NOAA website

<http://www.corporateservices.noaa.gov/noaaforms/eforms/nf57-10-01.pdf>.

All NHSQs submitted after March 1, 2014 must be accompanied by [NOAA Form \(NF\) 57-10-02](#) - Tuberculosis Screening Document in compliance with [OMAO Policy 1008](#) (Tuberculosis Protection Program).

The completed 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 project 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.

The participant can mail, fax, or email the forms to the contact information below. Participants should take precautions to protect their Personally Identifiable Information (PII) and medical information and ensure all correspondence adheres to DOC guidance

http://ocio.os.doc.gov/ITPolicyandPrograms/IT_Privacy/PROD01_008240).

The only secure email process approved by NOAA is [Accellion Secure File Transfer](#) which requires the sender to setup an account. [Accellion's Web Users Guide](#) is a valuable aid in using this service, however to reduce cost the DOC contract doesn't provide for automatically issuing full functioning accounts. To receive access to a "Send Tab", after your Accellion account has been established send an email from the associated email account to accellionAlerts@doc.gov requesting access to the "Send Tab" function. They will notify you via email usually within 1 business day of your approval. The "Send Tab" function will be accessible for 30 days.

Contact information:

Regional Director of Health Services

Marine Operations Center – Pacific
2002 SE Marine Science Dr.
Newport, OR 97365
Telephone 541-867-8822
Fax 541-867-8856
Email MOP.Health-Services@noaa.gov

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

C. Shipboard Safety

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

Wearing open-toed footwear or shoes that do not completely enclose the foot (such as sandals or clogs) outside of private berthing areas is not permitted. At the discretion of the ship CO, safety shoes (i.e. steel or composite toe protection) may be required to participate in any work dealing with suspended loads, including CTD deployment and recovery. The ship does not provide safety-toed shoes/boots. The ship's Operations Officer should be consulted by the Chief Scientist to ensure members of the scientific party report aboard with the proper attire.

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 means of communications, the ship can usually accommodate the Chief Scientist. Special radio voice communications requirements should be listed in the project instructions. The ship's primary means of communication with the Marine Operations Center is via e-mail and the Very Small Aperture Terminal (VSAT) link. Standard VSAT bandwidth at 128kbs is shared by all vessels staff and the science team at no charge. Increased bandwidth in 30 day increments is available on the VSAT systems at increased cost to the scientific party. If increased bandwidth is being considered, program accounting is required it must be arranged at least 30 days in advance.

E. IT Security

Any computer that will be hooked into the ship's network must comply with the *NMAO Fleet IT Security Policy* 1.1 (November 4, 2005) prior to establishing a direct connection to the NOAA WAN. Completion of these requirements prior to boarding the ship is required. 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.

(4) Any computer or device connected through the Government network and internet is subject to NOAA IT shore based monitoring.

(5) For connections to the ship's Public Network, personnel are limited to one personal device. No phones will be allowed on the ship's Network.

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 (<http://deemedexports.noaa.gov>). National Marine Fisheries Service personnel will use the Foreign National Registration System (FNRS) 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.

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 FNRS 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 - Ensure that approved controls are in place for any 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 FNRS 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 project, 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

IX. Appendices

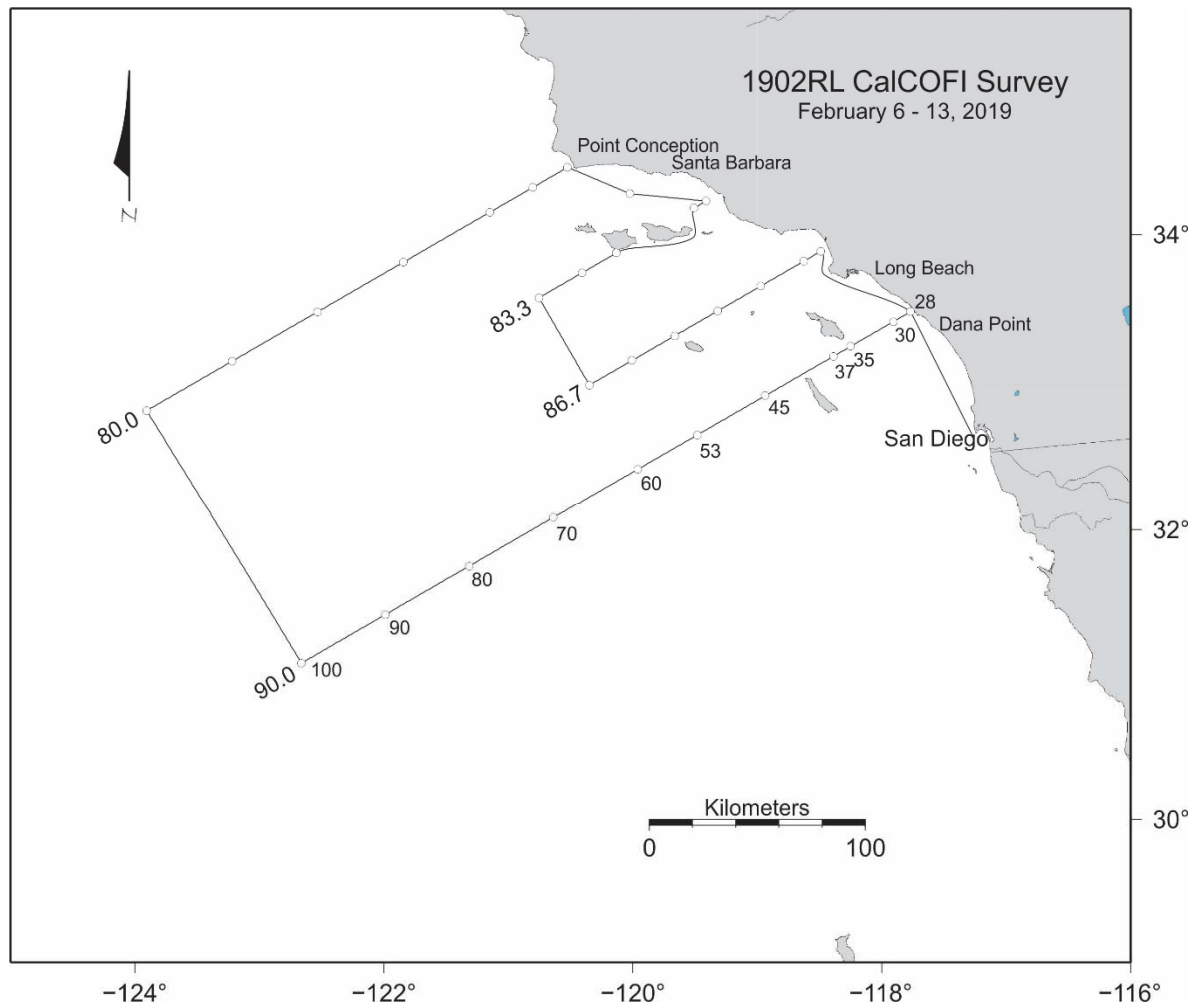
Appendix 1.a. Detailed list of Scripps Oceanography Chemicals and spill control plan.

Scripps Oceanography, CalCOFI Chemical Spill Kit List, Reuben Lasker February 2019

All spill clean-ups are performed while wearing safety glasses and protective gloves.

The main concern here is the 10Normal 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.

Appendix 2.a. Projected project track and station locations for the winter CalCOFI survey.



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

Schedule Order	Line	Station	Deg Lat	Min Lat	Deg Lon	Min Lon
1	90	28	33	29.04	117	46.08
2	90	30	33	25.02	117	54.3
3	90	35	33	15.06	118	14.94
4	90	37	33	11.04	118	23.22
5	90	45	32	55.02	118	56.1
6	90	53	32	39.06	119	28.92
7	90	60	32	25.02	119	57.54
8	90	70	32	5.04	120	38.28
9	90	80	31	45.06	121	18.9
10	90	90	31	25.02	121	59.4
11	90	100	31	5.04	122	39.72
12	80	100	32	48.96	123	54.3
13	80	90	33	9	123	13.2
14	80	80	33	28.98	122	31.98
15	80	70	33	48.96	121	50.58
16	80	60	34	9	121	9
17	80	55	34	18.96	120	48.12
18	80	51	34	27	120	31.38
19	81.8	46.9	34	16.44	120	1.5
20	83.3	40.6	34	13.5	119	24.66
21	83.3	42	34	10.68	119	30.48
22	83.3	51	33	52.68	120	7.92
23	83.3	55	33	44.7	120	24.54
24	83.3	60	33	34.68	120	45.24
25	86.7	60	32	59.34	120	20.94
26	86.7	55	33	9.36	120	0.36
27	86.7	50	33	19.32	119	39.78
28	86.7	45	33	29.34	119	19.14
29	86.7	40	33	39.36	118	58.44
30	86.7	35	33	49.32	118	37.68
31	86.7	33	33	53.34	118	29.4

Appendix 3a. Summary of passive acoustic monitoring

Reuben Lasker Shakedown Cruise: Summary of Passive Acoustic Monitoring

Shannon Rankin

May 23, 2014

Objective: Testing of all systems related to the passive acoustic monitoring (PAM) of cetaceans from the Reuben Lasker to prepare for shipboard marine mammal surveys. Systems tested include: hydraulic winch and power systems, deployment and retrieval of towed hydrophone arrays, maneuvering of vessel with towed hydrophone array deployed, acoustic lab setup, testing of noise on towed array system, detection and tracking of marine mammals using towed hydrophone array, testing of volumetric towed hydrophone arrays, deployment and retrieval of Drifting Autonomous Spar Buoy Recorders (DASBR), deployment of sonobuoys, and reception range of sonobuoy signals. A summary of observations and results, suggested modifications, and necessary improvements and repairs will be discussed.

Hydraulic Winch and Power System: The hydraulic power system (HPU, provided by the vessel) provides ~1200 lbs pressure to the hydraulic winch for the towed hydrophone array (owned by SWFSC).

The HPU is housed in the wet lab, and the hoses run through the roll-up door (Fig. 1). The HPU power is located at the side sampling station, and there is a water cooling system to prevent overheating. The acousticians have permission to run the HPU independent of ships' crew; however, if the unit fails to function, they should report to the bridge and/or the engineer on watch immediately. They should not attempt to test or repair it themselves (the HPU runs on 440 v and it is not intended for outdoor use). Prior to using the HPU, the HPU hoses must be connected to the winch hoses. These quick-disconnect hoses release a reasonable amount of hydraulic oil when used, and so ideally these should remain connected for the entirety of the survey. If the quick-disconnects are difficult to connect, move the handle on the winch to release pressure. To use the HPU, the power to the water cooling system should be initiated (Fig. 2), then the power to the HPU. The pressure should read ~ 1200lbs.

Figure 1a. Photo from fantail of aft entrances to wet lab. The HPU hoses are currently run out of the roll-up door. The green arrow points to the bulkhead opening which would be the preferred route for the HPU hoses.



Figure 1b. Photo of HPU (with roll-up door behind it). The black button is the START, the red button is the STOP. The green arrow points to the pressure gauge. The red arrow points to the temperature gauge for the hydraulic fluid.

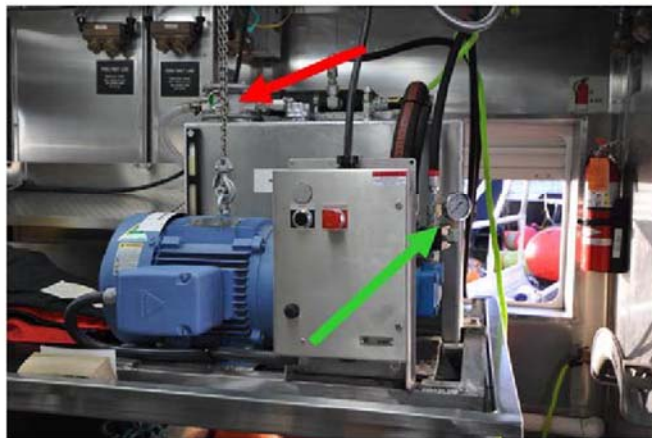
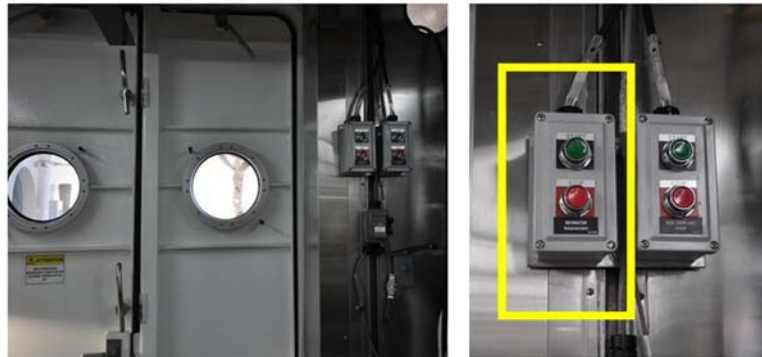


Figure 2. On/off for HPU seawater washdown is located in the wet lab near the doors to the side-sampling station.



The hydraulic winch will be located on the grate on the fantail. The structure will be chained to the grate itself, and the hoses should be run to connect to the HPU. The hydraulic winch was recently serviced and runs slightly slower than in previous years, although it is less sensitive to movements and will be less 'jerky'. On the top of the hydraulic valve component, there is a screw that allows the speed of the unit to be increased/decreased. This component was not serviced and must be repaired. The dial at the top broke on first use, and when the screw was turned counter-clockwise to increase the speed, hydraulic oil began to seep from this part.

Figure 3. Photo of Winch Speed Adjuster (prior to failure) and close up of poor screw condition and leak.



Suggestions: If the hydraulic hoses are long enough, they should be run through the bulkhead hole (where the deck cable runs) and remain attached to the winch hoses for the entirety of the survey. The HPU should be repaired so that it does not seep hydraulic fluid when the screw is moved.

Deployment and Retrieval of Towed Arrays: Two acousticians are required to deploy the towed arrays: one to run the winch, the other to work with the cable. The winch/HPU worked well with the exception of the noted leak requiring maintenance. The speed of the winch was sufficient to deploy/retrieve in reasonable time (< 15 min). Ships' speed for retrieval should be no greater than 5 knots; while deployment was only tested at 5 knots, previous experience suggests that deployment speeds of up to 8 knots would be safe when needed. 'Jerking' of the winch was dampened, which allows for minimal training of personnel to run the winch (during the shakedown I showed someone how to run it in 30 seconds and felt safe enough to deploy with 1 experienced and 1 new person). The deck crew modified a roller to fit on the aft stanchion to facilitate deployment/retrieval (Fig. 4). This is the easiest and safest device we have used to date; however, the rollers do not meet the minimum bend radius of our tow cable. Ideally, we would like to modify the roller so that it meets the bend radius for our tow cable. When using a linear array, the entire array can be deployed/retrieved from this device (with the exception of the initial toss). The roller can be removed by lifting (very heavy, requires 2 people).

Figure 4. Roller to aid in deployment/retrieval of array from aft deck. Roller can be removed by lifting (requires 2 people).



Deployment of volumetric arrays (torpedo and x-array) was simple and required no additional assistance.

Cable distance out was measured at three points: 300m, 250m, and 200m. Three white stripes of electrical tape denote 300m, two stripes of white electrical tape denote 200m, and one stripe of electrical tape denote 250m out. We found that 250m was an ideal distance and we suggest this distance for the fall survey. The Reuben Lasker is an extremely quite vessel, and vessel speed was reasonable at all three distances.

With no weight attached to the tow cable, the array averaged 3-4m depth at 200m cable out and 5-6 m depth at 300m out. Five pounds of weight was added to the cable, which gave 6m depth at 200m cable out. I would suggest adding an additional 5 lbs of lead weight to the cable to increase the depth an additional few meters. I believe this will improve our detection distance of dolphin schools, and with the use of the roller it will not impact ease of deployment/retrieval. This will be necessary if the X-Array is deployed, as it maintained a more shallow depth.

Suggestions: Add an additional 5 lbs lead weight to tow cable, forward of the existing section of lead weight. Modify roller to meet minimum bend radius of tow cable (minimum 12").

Vessel Maneuvering: A maneuvering test was performed to identify the maximum turning point to minimize excessive tension/stress on the cable. At speeds above 10 knots, a maximum of 3° rudder angle is suggested. At speeds less than 8 knots, a rudder angle of 4° did not lead to excessive stress on the cable. As vessel speed decreases, the tension drops dramatically and there are no issues with rudder angle; however, to keep instructions simple we will only request a maximum of 3° rudder angle for speeds greater than 8 knots and a maximum rudder angle of 4° for speeds less than 8 knots. In discussion with the C.O., it can be slow to initiate a turn at these low rudder angles. He suggested starting a turn at a high rudder angle (well outside of our acceptable range) to initiate a turn and then dropping to our requested angles once the vessel has begun to turn. I think this type of maneuvering would greatly improve our ability to respond to sightings with little or no impact on the cable tension.

Maneuvering tests were not performed using either of the volumetric arrays. It is expected that there will be increased tension using these arrays, and this may lead to a required decrease in the turning radius. If a volumetric array is used, a maneuvering test should be repeated.

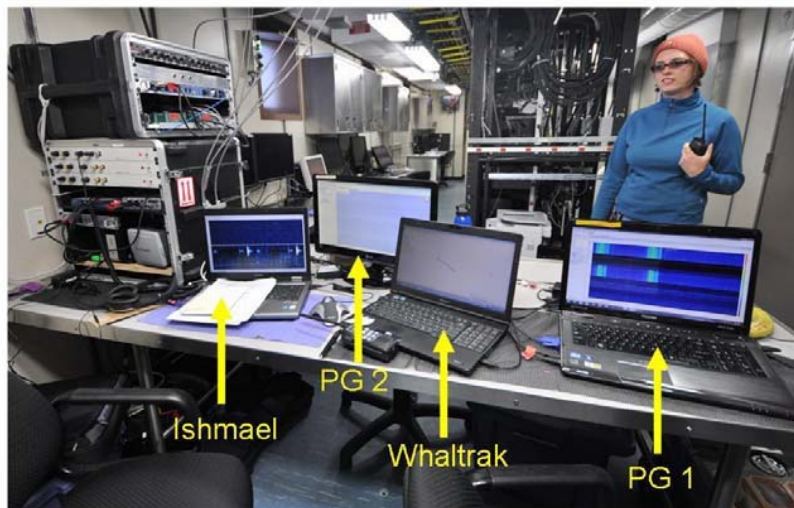
At full speed the towed hydrophone array trails behind the vessel at 250m. As the vessel speed decreases, the array sinks. If the vessel was to remain at all-stop for an extended period of time, the array would hang vertically from the stern, creating a potential hazard (could interfere with the propeller). A slow-speed test was performed to identify the

slowest ‘safe’ speed the vessel could maintain without concern. At 3 knots there was absolutely no concern, and at speeds of 1-2 knots the array sank *very* slowly. For security, any time the vessel slows to speeds less than 3 knots, an acoustician should be posted on the fantail to keep an eye on the array angle. If the array angle should sink less than 40° from the vertical, the acoustician should call the bridge and request the vessel increase speed. This increase in speed need only be temporary, and the acoustician can keep in close contact with the bridge to maintain a safe lower speed. In my experience this is a very safe method to allow for slow-speed maneuvering without retrieving the array. This should allow for maneuvering to pick up items in the water, including biopsy darts, the small boat, etc. If there is ever a concern due to miscommunication, etc, the acousticians can begin to retrieve the array immediately. As the array is retrieved, this effectively increases the ship’s speed (from the perspective of the array), eliminating any problem with regards to the array going under the vessel.

Suggestions: At the beginning of the fall survey, I suggest a brief discussion with all crew regarding the limits of vessel maneuvering to make sure that everyone is on the same page. This includes the high initial turning radius suggested by the C.O. as well as the fact that they can turn more sharply at very low speeds. These values are ONLY valid for a linear array. If a volumetric array is used, then these tests must be repeated and, if necessary, new limitations defined. Any time the vessel speed drops below 3 knots, an acoustician must be posted on the fantail to ensure that the array continues to flow BEHIND the vessel. If the array angle drops below 40°, the bridge should be notified to increase the speed temporarily for safety. If for any reason this is insufficient, the acousticians can begin to retrieve the array immediately, which would alleviate any issues related to slow vessel speed.

Acoustic Lab Setup: The acoustics lab will be setup in the computer lab, on the peninsula table. The deck cable is run to this location, and there are 4 SES serial outputs for GPS available. The two rack systems will be mounted against the bulkhead (with the sonobuoy rack on top). There are eyes mounted to the wall for tie-down. Thick nonskid should be used under both racks. The towed array monitoring station will be setup as shown in Fig. 5.

Figure 5. Acoustic Lab Setup. Rack systems are secured to bulkhead. Computers for real-time PAM are closest to rack systems, Pamguard recorder is at the far end with an extra rear monitor for the Pamguard click-detector and logger forms.



All computers were run off an Isobar surge protector from shipboard power. The hydrophone array and rack system was run off battery power. The sonobuoy system was run off ships power. The GPS input were from the SES cables (hanging from above). This setup is sufficiently close to the observer computer (to allow for the wincruz-panguard connection). This setup worked reasonable well; however some modifications are suggested to minimize electrical noise input to the system and to improve access to computers/components. We plan to construct a simple wooden structure (5'x 5"x 5") to run along the center of the table to house cables and AC adaptors, as well as to mount the PG 2 monitor. We need to install an under-table keyboard/mouse tray below the Ishmael computer, so that the panguard computer can be accessed by the primary acoustician while they are working with the real-time localization using Ishmael/Whaltrak. The raised metal lip of the lab tables leads to bruising, so keyboard cushions should be purchased for the extended survey.

Batteries to run the array rack system were manually charged during the sea trial; however, a more secure and automated battery bank (of 2-3 new batteries) should be built for the fall cruise. Chief ET Kim Belveal approved the location of the battery bank, as long as they were housed in a box in the rare case of a spill. The battery bank will be housed below the rack-system (against the bulkhead) and the size will be either 1'x3' OR 18" x 18".

The rack-system itself will be re-built at the lab prior to the fall survey. The 3rd Magrec appears to have increased gain on the 2nd channel. The thru-voltage for all components should be checked. All cables should be isolated to the greatest extent possible, and the depth gauge should be both isolated and protected.

We will need to a dedicated handheld radio, programmed to NOAA frequencies, for the duration of the cruise (cannot be VHF). This will need to be kept in the acoustics lab for acoustics personnel. The acoustics team has one set of UHF handheld radios, and these should be used for communications between the 1^o and 2^o acousticians (or, during sonobuoy ops). A radio w/ mounted antenna is located directly behind the acoustics station and can be accessed when needed to communicate with the small boat (or, to monitor small boat communications).

The sonobuoy computer and monitoring will be on the other side of the peninsula, and a single computer will be used for recording and monitoring.

Suggestions: Build wooden housing for cables to run along center of table. Install under-table keyboard/mouse tray. Build battery bank to fit in space below rack-system (on floor against bulkhead). Purchase 3-4 keyboard wrist cushions. Obtain a dedicated handheld radio tuned to NOAA frequencies.

Noise Tests: Noise tests include radiated ship noise and electrical noise picked up by the cable and hardware in the acoustics lab.

The Reuben Lasker is a very, very, very quiet ship. There is absolutely no concern whatsoever about radiated ship noise. In fact, we may consider changing the high-pass filters on the inline pre-amps and the Magrec to consider detection of baleen whales from this platform.

Electrical noise, although less of a problem than on most vessels, does remain a problem. The deck cable was run along a path to minimize potential interference from other cables (including moving it above fluorescent lights when possible). We will need to wrap bubble wrap around any sections touching other cables or metal (per Kim's suggestion). The lab-end of the deck cable needs to be rebuilt again (there appear to be bad wires on HP 2, 5). Shannon Rankin will arrange with the vessel during their port repairs to spend a day in the lab repairing this section of the deck cable. Insulative caps should be made for the connectors at the lab-end of the deck cable to minimize noise interference.

Care should be taken to make sure NO part of our system touches any metal on the ship, as this introduces noise. The tables in the lab are edged with metal. The wide sections of metal on the tables should be covered with non-skid.

The computers could be run off ships power when used with an ISOBAR. The cables were run along the center of the peninsula table, and movement of cables near metal or noisy devices introduced noise. We will build a wooden structure to house cables and AC adaptors. These can be arranged to minimize noise, and the housing will prevent movement of the cables which may inadvertently introduce noise. The PG 2 monitor can be mounted to the top of this wooden structure.

The GPS inputs were routed through the SES. Because these are actually serial port outputs from a computer (and not directly from the GPS), they are low- or no- noise. We did not test our independent GPS as the SES input was found to be sufficient. The optically isolated USB to Serial port connectors were extremely quiet and are suggested for ALL USB to Serial port connections.

Different noise bands showed up at different times, and on different hydrophones. After the suggested changes noted in this report and implemented, we will need to conduct more noise tests to eliminate any remaining noise bands. It was suggested that we consider using electro-static matting for our lab equipment to minimize noise.

The active acoustics are run on an EK-60 and include 18kHz, 38kHz, 70kHz, 120kHz, 200kHz, and 333kHz frequencies. These can be turned on/off by the acoustician using the computers directly behind the acoustics station. The 18 and 38 kHz pingers directly interfere with passive acoustic detection, although they are helpful when testing and troubleshooting. We should test detection of the 70 kHz pinger. The cruise will likely develop standard requirements for if/when the frequencies will be used, although we strongly request that the 18 and 38 kHz be off when the array is in the water.

Suggestions: Request permission to work on the Lasker for 1 day during port repairs in June to rebuild lab-end of deck cable, and cushion deck cable with bubble wrap. Build wooden housing for cables on table. Cap ends of connectors on medusa (lab end of deck cable).

Detection and Tracking: Limited detection and tracking tests were conducted. In general, the systems appeared to perform well. Both the Ishmael and the Pamguard computers could benefit from trackball mouse. Pamguard computer was limited by USB inputs and we need to find a low-noise USB multiplier to allow for all the required inputs. This may require a docking station. An under-table keyboard tray will be necessary to use both the real-time tracking computers as well as the pamguard/data logging computers.

Suggestions: Install under-table keyboard. PG computer requires either a docking station or a low-noise USB multiplier.

Volumetric Arrays: Both the Torpedo (TT) and the X-Array (XT) were briefly tested during the shakedown cruise. Deployment and retrieval of both arrays were simple and required no additional precautions. The Torpedo array was mis-wired at HP4 and should be re-wired if it will be used with the big tow cable. The X-Array requires modification due to noise and then further testing. A thorough report on the X Array is in the works.

DASBRs: The Drifting Autonomous Spar Buoy Recorders were deployed from the Lasker and retrieved the following day from the small boat. There were a large number of problems with this deployment and therefore a large number of suggested changes.

The DASBRs were deployed while the Lasker was going downwind at 2-3 knots speed. There was a misunderstanding regarding the deployment speed, and all future deployments should be conducted at less than 1 knot speed or else deployed from the small boat. Deployment should occur at the centerline of the aft deck, on the grating, to provide more space for equipment and personnel.

Several changes should be made to the DASBR to allow for deployment/retrieval from the Lasker. A length of 5m buoyant line with a large float should be attached to the DASBR. This would allow for slow lowering of the spar buoy to the water (the Lasker has a high freeboard), and this would also allow for use of a grapple to retrieve the device. The float should be large to improve visual detection. The MOB poles failed, and alternative fishing poles should be considered.

Suggestions: Modify DASBRs to improve success of deployment/retrieval from Lasker. Ship speed should be less than 1 knot for deployment. Deployment should occur from centerline of aft deck (on grating).

Sonobuoys: Sonobuoys were not tested on this survey, as the VHF antenna cable was not yet ready. This system is relatively simple and a test can be completed during the first day of the fall survey.

The sonobuoy antenna cable will be run through the mast during the June repair period. We suggest that a pre-amp be connected inline, preferable in a location that is accessible in the event of repairs (Kim suggested the bridge). Because we were unable to test the range of detection, and because modifications cannot be performed at sea, we will need a pre-amplifier in the sonobuoy cable. We have provided the sonobuoy antenna, and the ship will provide the sonobuoy cable (low loss). We have received word that the ship will supply the pre-amp as long as it stays on the ship (which is fine with us). If this changes, we hope to be notified, as a pre-amp is necessary for the fall cruise.

Suggestions: Run cable from lab up mast to sonobuoy antenna, with a pre-amplifier (preferably in a location with easy access).

Conclusions: The Reuben Lasker will be an ideal platform for passive acoustic monitoring using a towed hydrophone array. I am particularly interested in the possibility for monitoring baleen whales using a towed hydrophone array. Relatively few modifications are required to allow for successful implementation of these methods during the fall survey. We will need to re-examine the cruise instructions to make sure that they are thorough.

Most tests were completed during the shakedown survey. Exceptions include: sonobuoy deployment and detection, test of 70 kHz pingers (and higher frequencies). Some tests will need to be repeated during the first week of the fall survey after improvements have been made. These include: maneuvering tests using volumetric arrays, maneuvering tests, testing the wincruz-pamguard connection, test electronic noise.

