FINAL Project Instructions

Date Submitted: February 17, 2017

Platform: NOAA Ship *Reuben Lasker*

Project Number: RL-17-02 (OMAO), 1704RL (SWFSC)

Project Title: Spring CPS Survey, Fisheries Resources Division

Project Dates: March 21, 2017 to April 22, 2017

Prepared by: _____ Dated: 2/15/2017
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I. Overview

A. Brief Summary and Project Period

Survey the distributions and abundances of coastal pelagic fish stocks, their prey, and their biotic and abiotic environments in the California Current between San Diego, California and Cape Mendocino, CA during March 21 to April 22, 2017.

The survey domain encompasses the anticipated distribution of the central sub-population of Northern anchovy (*Engraulis mordax*). The modeled distribution of Pacific sardine (*Sardinops sagax*) potential habitat, and any information recently gathered from other research projects (e.g. CalCOFI samples) or the fishing industry (e.g. sardine bycatch) will be used to determine whether the survey domain also encompassed the expected distribution of sardine. Acoustic transects will be conducted using the following sampling guidelines:

1. Depart San Diego, California and begin sampling along the transect located roughly 10 nautical miles (nmi) north of the sea buoy outside of San Diego Bay (see **Appendix A** and **Appendix B.1**).
2. Sample the compulsory transects, spaced 20-nmi apart, between San Diego, CA and the transect located approximately 40-nmi south of Cape Mendocino, CA, as time permits. The transects will be surveyed as close to shore as navigable, and as far offshore as necessary to map the western extent of CPS, based on the presence of CPS eggs in CUFES, CPS in echograms or trawl catches, or both.
3. In areas where the density of CPS eggs in CUFES exceeds 0.3 eggs min^{-1} for sardine or 1 egg min^{-1} for anchovy, where adult CPS are present in echograms or catches, or both, adaptively decrease the transect spacing to 10 nmi, as time permits. In the adaptive sampling areas, a minimum of five consecutive transects with 10-nmi spacing will be surveyed to comprise a stratum.

The goal is to sample all of the compulsory transects, with 20-nmi spacing, that are within the expected habitat range of the central subpopulation of Northern anchovy, adaptively decreasing to 10-nmi spacing in areas where CPS are abundant, as indicated above.

We request that the ship depart as early as possible (optimally at or before 0900) on the first day of each cruise leg, and maintain the flexibility to potentially return port later in the day on the final day of each cruise leg, if necessary and within the safety constraints of the ship (i.e., slack tide during daylight hours), to maximize the likelihood of collecting a cluster (at least three) of trawl samples on the evening prior to arrival that are essential for the accurate estimation of coastal pelagic species (CPS) biomass.

B. Days at Sea (DAS)

Of the 30 DAS scheduled for this project, 30 DAS are funded by a Line Office Allocation according to the Fleet Allocation Plan. This project is estimated to exhibit a high Operational Tempo.

C. Operating Area

The area covered during this survey will be from San Diego, CA to Cape Mendocino, CA and extend as far as 120-nmi offshore in the Southern CA Bight (SCB) and approximately 80-nmi offshore north of Pt. Conception (see **Appendices A** and **B.1**).

D. Summary of Objectives

The principal objectives are to estimate the distributions and abundances of pelagic fish stocks (particularly the central sub-population of northern anchovy and the northern sub-population of

Pacific sardine), their prey, and their biotic and abiotic environments in the California Current between San Diego and Cape Mendocino.

To achieve these goals, specific activities include:

1. Continuously sample multi-frequency acoustic backscatter using Simrad EK60 and ME70. At night-time during trawls, in areas where CPS are expected to be encountered, or both, opportunistically sample multi-frequency acoustic backscatter using the Simrad EK80 by multiplexing with the EK60s. These data will be used to estimate the distributions and abundances of CPS and krill. All echosounders will be synchronized *ca.* hourly to the ship's Symmetricon time server.
2. Continuously sample pelagic fish eggs using the Continuous Underway Fish Egg Sampler (CUFES). The data will be used to estimate the distributions of spawning hake, Northern anchovy, jack and Pacific mackerel, and Pacific sardine.
3. Opportunistically sample acoustic backscatter using the Simrad MS70 and SX90. The data will be used to indicate the presence and behaviors of CPS schools near the sea surface and in areas between the ends of acoustic transects and the shore.
4. Opportunistically conduct unmanned aircraft system (UAS) surveys using a SWFSC-owned hexacopter (APH-22, Aerial Imaging Solutions) (see **Appendix C**). Sampling will occur: 1) when surveying in areas where CPS schools are likely to occur or are visible in echograms, 2) when dolphins are in the vicinity of the ship, 3) when surveying in areas with unrestricted airspace, and 4) when environmental conditions permit. Such conditions will likely occur during the second half of Leg 2, north of Pt. Conception. UAS operations require support from the FSV's workboat. Imagery collected will be used to examine the presence and behaviors of near-surface CPS schools and dolphins in the vicinity of the ship and in areas between the transects and shore.
5. 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.
6. Continuously sample air temperature, barometric pressure, and wind speed and direction using an integrated weather station.
7. Sample profiles of seawater temperature and salinity using an underway CTD (UCTD) probe mounted on port side of the ship's stern.
8. Sample profiles of seawater temperature, salinity, oxygen and chlorophyll-a once during nighttime trawl sampling using the CTD rosette.
9. Sample plankton using a CalBOBL (CalCOFI Bongo Oblique) at prescribed and *ad hoc* stations. These data will be used to estimate the distributions and abundances of ichthyoplankton and zooplankton species, and contribute to the estimation of CPS spawning biomass using the daily egg production method (DEPM).
10. Sample the vertically integrated abundance of fish eggs using a Pairovet net at prescribed and *ad hoc* stations. Adaptive Pairovet samples will be collected if the density of CPS eggs in any CUFES exceeds the threshold of 0.3 eggs min^{-1} for sardine or 1 egg min^{-1} for anchovy. These data will be used to quantify the abundances and distributions of fish eggs using the DEPM.

11. Sample fish near the surface each night by conducting 2-5 surface trawls at stations or random sites selected each night by the Chief Scientist (CS). The data will be used to estimate the reproductive parameters, distributions, and demographics of sardine, anchovy and mackerels. Fish behavior inside trawls and the performance of the marine mammal excluder device (MMED) will be visually observed using cameras and lights mounted inside the net.
12. Monitor ambient sounds using the ship's hull-mounted hydrophones, recorded using scientist's instruments.
13. Sample profiles of currents using the RDI/Teledyne Acoustic Doppler Current Profiler (ADCP), only when conducting station work (which include side stations). The ADCP will be secured via circuit breaker(s) during daytime transiting due to interference with the EK60 and EK80 echosounders. It is requested that the ship's Survey Technician (ST) be responsible for ADCP operations.

E. Participating Institutions
    1. Southwest Fisheries Science Center (SWFSC)

F. Personnel/Science Party

Name (Last, First)	Title	Date Aboard	Date Disembark	Gender	Affiliation	Nationality
*Demer, David	Fishery Acoustician	3/21/2017	3/23/2017	M	SWFSC	US
*Renfree, Josiah	Fishery Acoustician	3/21/2017	3/23/2017	M	SWFSC	US
Griffith, Dave	Ship Operations	3/21/2017	4/7/2017	M	SWFSC	US
Human, Megan	Fishery Biologist	3/21/2017	4/7/2017	F	SWFSC	US
Macewicz, Beverly	Fishery Biologist	3/21/2017	4/7/2017	F	SWFSC	US
Manion, Sue	Ship Operations	3/21/2017	4/7/2017	F	SWFSC	US
Stierhoff, Kevin	Fishery Acoustician, Project Lead	3/21/2017	4/7/2017	M	SWFSC	US
Vasquez, Lanora	Ship Operations	3/21/2017	4/7/2017	F	SWFSC	US
Watson, William	Ship Operations	3/21/2017	4/7/2017	M	SWFSC	US
White, Phil	Chief Survey Technician	3/21/2017	4/7/2017	M	OMAO	US
Barbaro, Jake	UAS Pilot	4/11/2017	4/22/2017	M	SWFSC	US
Gardner, Emily	Ship Operations	4/11/2017	4/22/2017	F	SWFSC	US
Gilmore, Kelsey	Fishery Biologist	4/11/2017	4/22/2017	F	SWFSC	US
Macewicz, Beverly	Fishery Biologist	4/11/2017	4/22/2017	F	SWFSC	US
Manion, Sue	Ship Operations	4/11/2017	4/22/2017	F	SWFSC	US
Mau, Scott	Fishery Acoustician	4/11/2017	4/22/2017	M	SWFSC	US
McMinn, Virginia	Volunteer	4/11/2017	4/22/2017	F	SWFSC	US
Palance, Danial	Fishery Acoustician	4/11/2017	4/22/2017	M	SWFSC	US
Sandvik, Christie	Volunteer	4/11/2017	4/22/2017	F	SWFSC	US
Vasquez, Lanora	Ship Operations	4/11/2017	4/22/2017	F	SWFSC	US
Weber, Ed	Ship Operations	4/11/2017	4/22/2017	M	SWFSC	US

Note: Acoustic calibration staff shall be transferred ashore via small boat following completion of calibration efforts if calibrations are conducted in the bay.

***** Demer and Renfree will be put ashore on 23 March via small boat at the nearest point of land with small boat access, likely Dana Point Harbor near San Juan Capistrano, CA.

G. Administrative

1. Points of contact

   Cruise Leader: Kevin Stierhoff (858-546-7180); 8901 La Jolla Shores Drive, La Jolla, CA, 92037 (Kevin.Stierhoff@noaa.gov)

   Chief Scientist: David Demer (858-858-546-5603); 8901 La Jolla Shores Drive, La Jolla, CA, 92037 (David.Demer@noaa.gov)

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

2. Diplomatic Clearances

   None required.

3. Licenses and Permits

   This project will be conducted under the following permits and agreements:

   a) California Department of Fish and Wildlife (CDFW) on 02 April, 2015 (expires April 2018) NOAA-SWFSC-FRD-Cisco Werner (SC-12372)
   b) Marine Mammal Protection Act (MMPA) Letter of Authorization (LOA) for the CA Current (50 CFR Part 219, Subpart A) effective October 30, 2015 and is valid through October 29, 2020
   c) NMFS ESA consult (eulachon, salmon, sea turtles): NOAA Fisheries West Coast Region (WCR) Endangered Species Act (ESA) Consultation 2015-2455
   d) Office of National Marine Sanctuaries (ONMS) 304(d) consultation concurrence received by the SWFSC on April 14, 2015
   e) ESA Sec. 10 SRP 19320 issued to Dr. Steve Lindley, (SWFSC FED Director) Dec. 1, 2015 to Oct. 29, 2020
   f) Aircraft Operations Center (AOC) Airworthiness release (AWR NOAAAPH222015R l; 24 July 2015)
   g) NOAA Fisheries WCR Scientific Research Permit (SRP: 03-04/2017) as specified in 50 CFR 600.745
   h) Pending – Aircraft Operations Center (AOC) Operational Risk Management (ORM) Assessment
   i) Pending – NOAA ONMS Permit Application draft submitted to conduct CPS surveys in all 5 west coast sanctuaries (in review by Sean Hastings & Jackie Buhl at Channel Islands NMS)
   j) US Fish and Wildlife Service concurrence for UAS pilot project

   Note: UAS operations are suspended until all associated permits are acquired.

II. Operations

The CS is responsible for ensuring the scientific staff are trained in planned operations and are knowledgeable of project objectives and priorities. The CO is responsible for ensuring all operations conform to the ship's accepted practices and procedures.

A. Project Itinerary

Leg I: March 21: Depart San Diego, CA

April 7: Arrive San Francisco, CA.

Leg II: April 11: Depart San Francisco, CA

April 22: Arrive San Francisco, CA

B. Staging and De-staging

Staging: March 19-20, San Diego, CA, 10th Ave. Marine Terminal

De-staging: April 23, San Francisco, CA

C. Operations to be Conducted

1. Underway Operations

a) Scientific Computing System (SCS) Data Collection

The SCS will serve as the main data collection system throughout the survey. Copies of all SCS data will be provided to SWFSC personnel at the completion of the project on a provided hard disk drive (HDD). The following SCS data streams shall be provided by the Electronics Technician (ET) or ST:

(1) EAL/ZMUX Send SCS Message at 1-s interval
(2) CUFES Send SCS Message at 1-s interval
(3) MOA Continuous Event Logs at 30-s interval

b) 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.

c) Acoustics

Calibration of the Simrad EK60 and EK80 echosounders will be performed at the beginning of the project (requiring 6-8 hours). Attempt will be made to conduct the acoustic calibration while the ship is dockside. It is requested that that the transducer faces are cleaned of all barnacles or any other bio-fouling that will potentially hinder the calibration operations and degrade echosounder data, within one week prior to the calibration (tentative calibration date is **13 March 2017**). The EK60/80 transducer faces may be cleaned from the centerboard chest with the centerboard retracted to the "maintenance" position; the ME70 transducer must be cleaned by SCUBA divers. With the centerboard in the "maintenance" position, SWFSC engineers will install a plate with a sound velocity profiler (SVP) and a pan-tilt-zoom (PTZ) camera and conduct measurements of transducer impedance while the transducers are dry. The SVP and PTZ camera will be used to monitor the sound speed, temperature, and pressure at the transducer faces to improve calibration accuracy, and to observe the presence and behaviors of epipelagic animals, respectively. Data from the SVP will be input to the SCS and also logged with the Z-MUX software.

Immediately prior to calibration, a CTD will be cast to obtain measures of temperature and salinity versus depth, to calculate mean sound speeds and absorption coefficients. The centerboard will remain in the retracted position. Three motorized downriggers, 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 centerboard-mounted transducers. It is requested that the STs locate all calibration equipment (downriggers, cabling, and spheres) and participate in the calibration procedures for training purposes.

Throughout the project, EK60 and EK80 echosounders will be operated at 18, 38, 70, 120, 200 and 333 kHz and interfaced to a data acquisition system to estimate the biomasses of small pelagic fish and krill between 10 and 350 m depth. An "EK-MUX" multiplexer will be used to alternate transmissions from the EK60 and EK80 echosounders. The ST, with assistance from the acoustician, will verify the correct date and time on the echosounder computers and track total kilometers surveyed by EK60, EK80, ME70, MS70, and SX90 and submit respective distances to swfsc.ita@noaa.gov no later than 14 d following the conclusion of the project. These distances are required for environmental compliance as directed by SWFSC's Letter of Authorization for the California Current Research Area, (LOA CCRA -80 FR 58982) under the Marine Mammal Protection Act (valid until 29 October 2020).

Throughout the project, the ME70 multibeam sonar, configured to collect data to 500 m, will be operated synchronously with the EK60/80 echosounders.

Throughout the project, the MS70 quantitative multibeam sonar, configured to collect data to 250 m, will be operated synchronously with the EK60 and EK80 echosounders by the acoustic-system operator.

Occasionally, the SX90 omnidirectional fish finding sonar will be operated synchronously with the EK60 and EK80 echosounders by the acoustic-system operator.

An EK60/EK80 Adaptive Logging program (EAL) will be run continuously to detect the seabed depth and optimize the transmit interval and logging range while avoiding aliased seabed echoes ("false bottoms"). The EAL will provide a pseudo seabed depth telegram to the ship's K-Sync, to adaptively adjust the transmit intervals of the EK60, EK80, ME70, MS70, SX90, and the ADCP.

A "Z-MUX" multiplexer system will periodically measure the impedances of each of the EK60/80 transducers, ambient noise as measured by the EK60/80 echosounders, and the concomitant measurements of environmental conditions collected by the SCS.

Simrad TD50 four-dimensional imaging software will be loaded on a PC in the acoustics lab for real-time viewing of water column and seabed backscatter. This software will be used to visualize EK80, MS70, ME70, and SX90 in real-time, particularly in nearshore areas where the seabed is in range of all echosounders and the seabed depth is likely variable. Operation of the MS70 requires the centerboard to be extended to the “intermediate” position, at least. If possible, consider lowering the ship’s centerboard to the intermediate position while exiting San Diego Bay; else, we will attempt to collect these data soon after passing the sea buoy, at which point the centerboard is typically extended.

The most current versions of EK80, MS70, ME70, SX90, and TD50 will be provided to the ship’s ET for installation by approximately **1 March**.

An FTP program may be used in conjunction with the ship's VSAT system to telemeter raw and processed echosounder data ashore in quasi-real-time as bandwidth permits.

The instrumented centerboard will be extended to the "intermediate" position (ca. transducers at ~7 m below the surface) and the ship will maintain a speed of nominally 10 kn during all daytime survey operations (vessel speed may be increased to 12 kn during transits between acoustic transect). Any changes to this depth should be avoided, and reported to the acoustic-system operator(s). The acoustic-system operator(s) may request that the centerboard be fully extended (ca. transducers ~9 m below the surface) to reduce bubble-generated noise during heavy weather. The OOD or ST shall record changes in the centerboard position in the SCS (**Button labels: CB Flush, CB Intermediate, CB Extended**).

The vessel's Simrad ES60 depth sounder and Doppler velocity log (or comparable) may be used minimally at the discretion of the Commanding Officer (CO), but will normally remain off and secured via circuit breaker(s) while underway. The ship shall inform the CS and acoustic-system operator(s) of any use of the vessel's sounders, as it interferes with the signals received on the EK60/80, ME70, MS70, and SX90 echosounders that will be used continuously. The ER60/80 display on the bridge must be a video replicate of the ER60/80 running in the Acoustics Lab. A second instance of the ER60 will conflict with the EAL and cause the EAL, ER60/80, ME70, and MS70 to crash.

The UCTD (Teledyne Oceanscience UnderwayCTD, http://www.teledynemarine.com/underwayctd/) will be deployed approximately five times along each acoustic transect, during daytime, at locations indicated by the CS (**see Appendix B.2**). The vessel speed during UCTD casts shall be nominally 10 kn, but may be reduced at the request of the UCTD operator to achieve the desired cast depth. Two persons are required for UCTD sampling. The ST shall lead the preparation, deployment, recovery, and data download for each cast, with the assistance of the acoustician, or another member of the scientific party or ship's crew if the acoustician is unavailable. An underway stereo camera (UCAM), which interfaces with the UCTD, may be deployed opportunistically during the day to visually sample CPS and other potential acoustic scatterers.

The OOD or ST shall record the time that the UCTD is deployed and recovered in the SCS event logger (**Button labels: UCTD deployed, UCTD recovered**).

d) ADCP

The ship's ADCP should be activated only on station and be logged to a data acquisition system. Complete system settings will be provided by the oceanographer, but will include 5-min averaging of currents, AGC and 4 beam returns in 60 8-meter bins. The ADCP will be secured during daytime transits due to interference with the EK60 and EK80 echosounders.

e) CUFES

The egg pump will be mounted inside the ship's hull drawing water from a depth of 3 m. It is requested that the CUFES intake be cleared from all marine growth prior to departure.

During both legs, the pump will run continuously between stations to sample any pelagic fish eggs. Approximately 640 l min^{-1} is sent through a concentrator which filters all material larger than 505 µm. The sieved material is then collected and identified. All fish eggs are identified to the 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 be 30-min in duration whenever possible. If two consecutive samples have a concentration of Pacific sardine or northern anchovy eggs that exceed 0.3 eggs min^{-1} for sardine or 1 egg min^{-1} for anchovy, the ship will stop to conduct a Pairovet tow. Pairovet tows will continue at 4-nmi intervals until a concentration of less than 0.3

eggs min^{-1} for sardine or 1 egg min^{-1} for anchovy is observed in two consecutive CUFES samples. The CUFES pump shall be configured to report the flow rate in liters min^{-1} (not gallons min^{-1}).

f) UAS Sampling (UAS Ops suspended until all associated permits acquired)

A UAS will be deployed prescribed or *ad hoc* locations identified by the CS. For deployments while underway, the UAS will be launched from the bow of the ship, operated by a pilot and ground station operator, and remain within line-of-sight (LOS, ~0.5 nmi) at all times. For deployments near the inshore portion of acoustic transects, the UAS will be launched from the FSV's workboat by a pilot and co-pilot. The workboat will follow the UAS, maintaining LOS, until the UAS reaches the shore or the end of its mission, whichever comes first. The UAS will not be operated over land and will avoid pinniped haul-out areas. Detailed UAS procedures are located in **Appendix C**.

2. Station Daytime Station Sampling Operations

Each standard daytime station will include the following (if daytime station sampling is conducted):

a) CTD Sampling

CTD casts shall be conducted each evening prior to the first trawl sample. CTD casts shall also be conducted at the beginning and end of each leg, with all available UCTD probes attached, to collect data for inter-calibration and to examine potential drift in UCTD sensors during the survey. For each sample, the CTD/rosette shall be lowered to approximately 350 m (or to within ~10 m of the seabed when the seabed depth is < 350 m) at each station to measure temperature, salinity, oxygen, and chlorophyll-a.

The OOD or ST shall record the time that the CTD is deployed and recovered in the SCS event logger **(Button labels: CTD deployed, CTD recovered).**

b) CalBOBL (CalCOFI Bongo Oblique) Sampling

CalBOBL samples will be collected at 40-nmi spacing along compulsory acoustic transects. Each sample shall be a standard oblique plankton tow with 300 m of wire out, depth permitting, using paired 505 µm mesh nets with 71-cm diameter openings. The tow requires a descent wire rate of 50 m min-1 and an ascent wire rate of 20 m min^{-1}. All tows with ascending wire angles lower than 38° or higher than 51° in the final 100 m of wire will be repeated. Additionally, a 45° wire angle should be closely maintained during the ascent and descent of the net frame. The port side sample will be preserved in buffered ethanol at every station. An additional bongo tow will be taken at night in conjunction with the trawling operations, whether the ship is occupying a station or not.

The OOD or ST shall record shall record the time that the bongo is deployed and recovered in the SCS event logger **(Button labels: Bongo IN, Bongo OUT)**.

c) Pairovet Sampling

Pairovet samples will be collected at 20-nmi spacing along all compulsory and adaptive acoustic transects. For each sample, a Pairovet net will be fished from 70 m to the surface (depth permitting) using paired 25-cm diameter 150-µm mesh nets at all stations. The technical requirements for Pairovet tows are a descent rate of 70 m min^{-1}, a terminal depth time of 10 seconds, and an ascent rate of 70 m min^{-1}. All tows with wire angles exceeding 15° during the ascent will be repeated.

The OOD or ST shall record shall record the time that the Pairovet is deployed and recovered in the SCS event logger **(Button labels: Pairovet IN, Pairovet OUT).**

d) Weather observations

Routine weather observations will be made using the standard SWFSC procedure during every net tow and trawl event (i.e., at every “order occupied”).

3. Standard Nighttime Station Sampling Operations

Each standard nighttime station will include the following:

a) Surface trawls
b) Bongo net tow
c) CTD cast to 350 m

Two to five surface tows using a 264 Nordic Rope Trawl fitted with a MMED will be conducted during nighttime operations. The first set will be approximately one hour after sunset, and the last set will be concluded prior to sunrise. Trawls may or may not occur on predetermined stations. Trawl spacing will be determined based on CPS egg density, observed acoustic backscatter attributed to CPS observed during daytime, and other factors.

Each tow will be fished on the surface for a 45-min duration at a towing speed of approximately 3.5-4.5 kn. The duration of trawls shall be reduced only when necessary to avoid protected species or ensure the safety of the ship or its crew, in which cases a minimum duration of 30 min is preferred. In an attempt keep the footrope from sinking too deep during deployment, it is requested that once the tom weights are in the water, the ship's speed be increased to 3.0-3.5 kn. The trawl will be fitted with cameras and lights to observe the behaviors of target species and to assess the performance of the MMED. The catch from each tow will be processed according to the SFWSC mid-water trawl sampling protocol (See **Appendix D**). The acoustic trawl mensuration system (Simrad ITI) may be used to monitor the performance of the trawl net, but shall be secured when not in use to avoid interference with the scientific echosounders.

The OOD or ST shall record shall record the time of station arrival and departure in the SCS event logger (**Button labels: Arrive Station, Depart Station**) and the time that the trawl is deployed and recovered (**Button labels: Shoot Doors, Net in Water, Begin Fishing (EQ), Haul Back, Net on Deck)**.

It is requested that the OOD note the locations and times when the acoustic sampling starts and stops each day in the SCS event logger (**Button labels: Resume Transect, Break Transect**) and for each transect (**Button labels: Start Transect, End Transect**). After the last trawl of each night or 30 min prior to sunrise, the ship will return to the exact location where the acoustic sampling stopped the previous day, and resume acoustic sampling.

4. Other sampling gear

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.

5. Protected Species Watches

For the nighttime trawl operations, protected species (e.g. marine mammals and turtles) watches are now a standard part of conducting fisheries research activities, particularly those that use gear

(e.g., long-lines and mid-water trawls) known to interact with protected species or that we believe have a reasonable likelihood of doing so in the future.

a) 30-min pre-set protected species watches

Protected species watches (visual observation) will be initiated by a designated person/s no less than 30 min prior to deployment of gear for sampling in order to determine if any protected species are near the proposed trawl set location. This watch can occur during transit leading up to arrival at the sampling station. If stations are less than 5-nmi apart (or less than a 30-min transit time at typical transit speed) then pre-set watch should be conducted for duration of transit. Upon arrival at a sampling station trawl operations shall be conducted immediately except when it is necessary to conduct a bongo plankton tow or CTD deployment prior to deploying trawl gear. Protected species watches will be conducted using any binocular or monocular sighting instrument, with a means to estimate distance to protected species during daytime. During nighttime operations, visual observation shall be conducted using the naked eye and available vessel lighting.

b) Move-on rule

If marine mammals, sea turtles or other protected species are sighted within 1 nmi of the planned set location prior to setting the gear, the vessel will transit to a different section of the sampling area to maintain a minimum distance of 1 nmi between the set location and estimated location of sighted protected species. If, after moving on, protected species remain within the 1-nmi exclusion zone, the CS or watch leader may decide to move again or to skip the station, but in any case may not set while protected species are in the 1-nmi exclusion radius.

c) Monitoring during trawl deployment, fishing, and retrieval

In addition to the 30 min protected species watch, visual monitoring efforts for protected species are required throughout the entire period of time that trawl gear is in the water. These watches will occur from deployment through gear retrieval and will be conducted by the watch leader, CS, or other designated person/s. If protected species are sighted before the gear is fully retrieved, the most appropriate response to avoid incidental take will be determined by the professional judgment of the CS, watch leader and other experienced crew as necessary. This judgment will be based on his/her past experience operating gears around marine mammals and SWFSC training sessions that will facilitate dissemination of CS expertise that is used when operating in these situations (e.g., factors that contribute to marine mammal gear interactions and those that aid in successfully avoiding these events). These professional judgment decisions will be recorded in the provided visual monitoring watch logs. If trawling efforts have been suspended due to the presence of marine mammals, trawl operations may only resume when sighted protected species are estimated to be at least 1 nmi away from the trawl set location.

d) Data collection for visual watches

The visual monitoring watches (from 30 min prior to set through gear retrieval) and any data gathered during these watches will be recorded in the watch logs provided for each survey and in the SCS.

e) Marine mammal excluder device (MMED)

At all times Nordic 264 trawl nets must be fitted with a marine mammal excluder device to allow marine mammals caught during trawling operations an opportunity to escape.

f) Acoustic deterrent devices

Pingers must be deployed during all trawl operations and on all types of trawl nets. Two to four pingers (3 kHz @ 135 dB, 10 kHz @ 132 dB, and 70 kHz @ 145 dB) will be placed along the

footrope and/or headrope and will be tested regularly by the trawl team to ensure they are operating properly.

g) Other standard trawl survey protocols

The gear will be emptied as quickly as possible upon retrieval in order to determine whether or not protected species are present.

Care will be taken when emptying the trawl to avoid damage to protected species that may be caught in the gear but are not visible during retrieval.

h) Reporting, Data Collection, and Handling Procedures for Protected Species

All protected species (marine mammals, sea turtles, seabirds and fish) lethal and non-lethal interactions with fisheries research gear will be reported to Krista Catelani via the Incidental Take Authorization account: SWFSC.ITA@noaa.gov. These interactions will be immediately relayed to the SWFSC Director and recorded in the Protected Species Incidental Take Database within 48 hours of the event.

In addition, for take of marine mammals and sea turtles, the CS or watch leader will call Krista Catelani immediately at 707-293-3563 (cell – any time) or 858-546-7166 (work – daytime only) to provide a detailed report of the event. Catch of eulachon and salmon will only be reported to SWFSC.ITA@noaa.gov at the conclusion of every survey day; no call is necessary. Appropriate communications on all authorized takes will occur in a timely manner to allow Krista Catelani to report the event to the PSIT in the required 48 hours.

(1) Lethal take of marine mammal or sea turtle

If a lethal take of a marine mammal or sea turtle occurs, priority should be placed on removing the animal from the gear as quickly and safely as possible so photographs and measurements can be taken according to protocol (PSIT-002.02; **Appendix E**). After documentation and sampling, the animal(s) should be wrapped in bag(s) (trash bags or provided body bag) and placed in the scientific freezer. Concurrently, as stated above, Krista Catelani should be notified immediately.

(2) Non-lethal take of any protected species

Priority for any non-lethal take is to release the animal as quickly as possible according to (3) Protected Species Handling instructions (below) to maximize the chances of post-release survival. First and foremost, please take into consideration safety of all crew and staff. Concurrently, as stated above, Krista Catelani should be notified immediately.

(3) Protected Species Handling

In general, following a "common sense" approach to handling protected species will present the best chance of minimizing injury to the animal and of decreasing risks to scientists, officers and crew. There are inherent safety concerns associated with handling/disentangling protected species, so using good judgment and ensuring human safety is paramount. SWFSC researchers should refer to PSIT-004.02 (**Appendix E**), SWFSC Marine Mammal Handling Guidelines, and the Pacific Islands Region's Identification, Handling and Release of Protected Species (PSIT-005.01, **Appendix E**), and SWFSC's marine mammal and sea turtle sampling protocol (PSIT-002.01, **Appendix E**) for more specific guidance on protected species handling and sampling (e.g., species identification, safe removal of fishing gear, etc.).

For all marine mammal and sea turtle incidental interactions, SWFSC researchers will record interaction information using the Protected Species Incidental Take Form and the Marine Mammal and Sea Turtle Biological Sampling form. For any incidental takes of protected fish

species (salmon and eulachon) SWFSC researchers will fill out the Protected Fish Specimen Data form.

(4) Protected Species Sampling and Data Collection

SWFSC scientists are authorized under MMPA regulation 50 CFR 216.22 and encouraged to collect samples from authorized protected species **(**see **Appendix E**) incidentally captured or killed during fisheries research activities. For sampling, follow guidelines in PSIT-002.02, SWFSCs Detailed Sampling Protocol for Marine Mammal and Sea Turtle Incidental Takes (**Appendix E**) and fill out the Marine Mammal and Sea Turtle Biological Sampling form.

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 CO.

A dive is requested for clearing the CUFES intake of attached mussels prior to departure and the transducer faces (the ME70, in particular; the EK60/80 transducer faces may be cleaned with the centerboard in the "maintenance" position) of any marine biofouling prior to calibration.

E. Applicable Restrictions

In the event of poor weather conditions, we will work with the ship's officers on developing the best strategy the safe completion of all sampling. We have replacement gear for most operations; equipment failure should not impact our project.

III. Equipment

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

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

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

Starboard hydro winch with 0.375" cable for standard CTD casts

Starboard A-frame w/blocks to accommodate 0.375" cables

Port and starboard trawl winches with 1.0" diameter mechanical cable

Stern gantries with blocks to accommodate 1.0" cable

Access to the trawl ramp

Winch monitoring system

Knudsen 12 kHz depth recorder or comparable (EK60/80)

Acoustic Doppler Current Profiler

EK60 general-purpose transceivers (GPTs) with transducers (ES18-11, ES38B, ES70-7C, ES120-7C, ES200-7C, ES333-7C).

Calibration apparatus for EK60 echosounders, including motorized downriggers, control box, and standard spheres.

ME70 and MS70 multibeam echosounder systems.

SX90 omnidirectional echosounder system.

Symmetricon time server and clients installed on all echosounder and scientific computers

Navigation planning software installed in scientific spaces (e.g., Chemistry Lab, Acoustics Lab) with planned transects and sampling stations (Rose Point, OpenCPN, etc.).

Very Small Aperture Terminal (VSAT) high-bandwidth satellite communication system

Seabird SBE911+ CTD with calibrated temperature, conductivity, oxygen and fluorometer sensors.

Pump, collector and concentrator unit for CUFES water sampling.

(1) 75 lb. weight for bongo tows.

(1) 100 lb. weight for Pairovet tows.

Scientific Computing System (SCS).

Calibrated, motion-compensated balances for fish baskets, and calibration weights

-80 °C Freezer.

B. Equipment and Capabilities provided by the SWFSC (itemized)
EK80 wide-band transceivers (WBTs) (18-, 38-, 70-, 120-, 200-, and 333-kHz)

30-cc and 50-cc syringes

Canulas

(34) Pint, (15) quart, (5) gallon, (32) 4 oz., and (9) 8 oz. jar cases (350 lbs.)

(6) Cases of scintillation vials (120 lbs.)

Inside and outside labels

CalCOFI net tow data sheets

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

(6) 71-cm CalCOFI 505 µm mesh nets (10 lbs.)

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

(2) CalCOFI Pairovet frames (10 lbs.)

(12) 333 µm mesh codends (2 lbs.)

(6) Digital flowmeters (10 lbs.)

(1) 75-lb. Bongo weight

(1) 100-lb. hydro weight

(2) Standard CalCOFI tool boxes (50 lbs.)

Bucket thermometers and holders (SIO)

Hand held inclinometer for Pairovet and Bongo tows

Weather observation sheets

(2) Dissecting microscopes (50 lbs. w/case)

(2) NETS Nordic 264 midwater trawl (4000 lbs.)

(2) NETS 3.0 m X Lite trawl doors (2400 lbs.)

(2) Trawl rigging (1000 lbs.)

(4) Fish measuring boards (20 lbs.)

(4) Motion compensated scales (100 lbs.)

(2) Go-Pro trawl camera systems (60 lbs.)

(1) Impedance-measuring transducer-multiplexer system (Z-MUX) (20 lbs.)

(1) EK60/EK80 echosounder multiplexer (EK-MUX) (20 lbs.)

(2) Computer to run the EK60/80 Adaptive Logging (EAL) software (10 lbs.)

(1) Underway CTD – (UCTD, 2 probes, 1 winch (80 lbs.)

(3) Underway stereo camera (UCAM, SWFSC) (60 lbs.)

(2) APH-22 Unmanned aircraft system (UAS, Aerial Imaging Solutions) and supporting equipment (12 batteries, spares, and ground station) (200 lbs.)

(3) Experimental incubation bath systems (200 lbs.)

(14) Shipping containers (fish bins) (800 lbs.)

IV. Hazardous Materials

A. Policy and Compliance

The CS 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 procedures, 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 Individuals**	**Spill control**
Ethyl alcohol (95%)	20 gallons(in 5 gallon cans)	UN1170, Waste contained and disposed of by SWFSC at end of project, Stored in hazardous material room and cabinet under fume hood	Dave Griffith, Sue Manion	F
Ethyl alcohol (95%)	20 L (in 20 ml vials)	No waste. Stored in Chem Lab	Dave Griffith, Sue Manion	F
Buffered formalin (10%)	20 gallons in 4 oz. and 8 oz. jars.	Stored in wet lab, no waste	Dave Griffith, Sue Manion	F

Common Name of Material	Qty.	Notes	Trained Individuals	Spill control
Formaldehyde solution (37%)	5 gallons	No waste, Stored in wet lab fume hood	Dave Griffith, Sue Manion	F
Tris buffer	500ml	Stored in Chem Lab	Dave Griffith, Sue Manion	F
Sodium borate powder	500gr	Stored in Chem Lab	Dave Griffith, Sue Manion	D
Lithium Ion (LiPo) Batteries	6.9 kg	Stored in Acoustics Lab	Kevin Stierhoff, Scott Mau	L

C. Chemical safety and spill response procedures

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 SWFSC.

L: Lithium ion (LiPo) battery fire mitigation

- During flight operations, the Firewatch will be posted with a Class D fire extinguisher, a 3-5 gallon bucket filled with seawater, a bucket of sand to mount an immediate response should the unmanned aircraft ignite (the LiPo battery may ignite if substantially impacted and traditional fire extinguishers are ineffective on Lithium fires).
- The highest risk of UAS LiPo battery fires occurs during charging operations. At no point shall any UAS battery be on a charger without personnel trained in the charging procedures present. They will be placed in charging bags to suppress the possibility of a fire. A Class D fire extinguisher shall be available during battery charging operations to cool the battery in the event of a LiPo battery fire.

- LiPo batteries will be discharged to "storage voltage" (i.e., 70% charge) and placed in a metal storage container as required by shipping regulations (UN3481. P.I. 966) when being transported on and off the ship.

Inventory of Spill Kit Supplies

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

D. Radioactive Materials

No Radioactive Isotopes are planned for this project.

V. Additional Projects

A. Supplementary ("Piggyback") Projects

1. Shipboard egg rearing experiment(s)

SWFSC would like to try using sardine eggs incubated in a series of fixed temperature baths to determine temperature-dependent development rates. This will be an opportunistic experiment that will depend on getting one or more ripe male and female sardines from a trawl sample to obtain fertilized eggs of known age to rear in 3 temperature treatments. This experiment will run approximately 5-7 days and will require sampling of 2-3 eggs per treatment at 3-4 hour intervals through hatching (~2-4 days) and sampling 1-2 larvae once or twice daily after that through yolk absorption. It is desired that this project be configured in the constant environment room or the hydro lab.

2. Aerial surveys of CPS in Southern California

The SWFSC will coordinate with pilots who will be conducting aerial surveys of CPS for the California Department of Fish and Wildlife (CDFW) along planned acoustic transects in southern CA between 21 March and 31 March 2017. The objectives of the aerial survey are to estimate the biomass of CPS species 1) in offshore areas where the acoustic trawl survey operates, and 2) in shallow, inshore areas where the acoustic survey is unable to operate. All efforts will be made to conduct the aerial surveys coincident with acoustic sampling in the same area. Points of contact for the coordination of aerial and ship-based sampling are: Kirk Lynn (primary, Kirk.Lynn@wildlife.ca.gov), Dianna Porzio (Dianna.Porzio@wildlife.ca.gov), and Trung Nguyen (Trung.Nguyen@wildlife.ca.gov).

3. Deployment of educational sailboats in collaboration with Educational Passages

We will attempt to deploy several small sailboats provided by Educational Passages. The boats are approximately 5' in length, weigh approximately 30 lbs, and may be easily deployed over the rail of the FSVs using lines, or down the trawl ramp (after discussion with the Chief Boatswain Gomez aboard *Lasker*). The goal would be to deploy the boats near the shelf break during Leg 2 (but possibly Leg 1). There are no plans to recover the boats once deployed. The project will be coordinated by LTJG Dan Palance (NOAA Corps, SWFSC). More information about the project may be found at http://educationalpassages.com/.

B. NOAA Fleet Ancillary Projects

No NOAA Fleet Ancillary Project 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.

The CS will receive all original data related to the project from the ST. The CS will in turn furnish the CO 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 CS will be released to them, including supplementary data specimens and photos gathered by the scientific crew.

VII. Meetings, Vessel Familiarization, and Project Evaluations

A. Pre-Project Meeting

The CS and CO will convene 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 CS in arranging this meeting.

B. Vessel Familiarization Meeting

The CO 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 CO is responsible for convening a meeting no earlier than 24 hours before or 7 days after the completion of a project to discuss the overall successes 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 CS, and members of the scientific party and is normally arranged by the Operations Officer and CS.

D. Project Evaluation Report

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 https://sites.google.com/a/noaa.gov/omao-intranet-dev/operations/marine/customer-satisfaction-survey and provides a "Submit" button at the end of the form. It is also located at https://docs.google.com/a/noaa.gov/forms/d/1a5hCCkgIwaSII4DmrHPudAehQ9HqhRqY3J_FXqbJp9g/viewform. 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 CS. The CS and CO 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 CS 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 CS 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 CS will ensure that all non-NOAA or non-Federal scientists aboard also have proper orders. It is the responsibility of the CS 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 CO. 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: 02 JAN 2012) must be completed in advance by each participating scientist. The NHSQ can be obtained from the CS 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 CS 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 CS to ensure members of the scientific party report aboard with the proper attire.

D. Communications

A progress report on operations prepared by the CS may be relayed to the program office. Sometimes it is necessary for the CS to communicate with another vessel, aircraft, or shore facility. Through various means of communications, the ship can usually accommodate the CS. 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 128 kbs is shared by all vessels staff and the science team at no charge. Increased bandwidth in 30-d 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 d in advance.

E. IT Security

Any computer that will be connected to 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. Requirements include, but are not limited to:

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

Completion of the above requirements prior to boarding the ship is required.

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.

1. Responsibilities of the CS:
    a) Provide the CO 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.
    b) Escorts – The CS 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.
    c) 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.
    d) Export Control - Ensure that approved controls are in place for any technologies that are subject to Export Administration Regulations (EAR).

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

2. Responsibilities of the CO:
    a) Ensure only those foreign nationals with DOC/OSY clearance are granted access.
    b) 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.
    c) Ensure foreign national access is permitted only if unlicensed deemed export is not likely to occur.
    d) Ensure receipt from the CS or the DSN of the FNRS e-mail granting approval for the foreign national guest's visit.
    e) 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.
    f) Export Control - 8 weeks in advance of the project, provide the CS 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 CS of any OMAO-sponsored foreign nationals that will be onboard while program equipment is aboard so that the CS can take steps to prevent unlicensed export of Program controlled technology. The CO and the CS will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.
    g) 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.

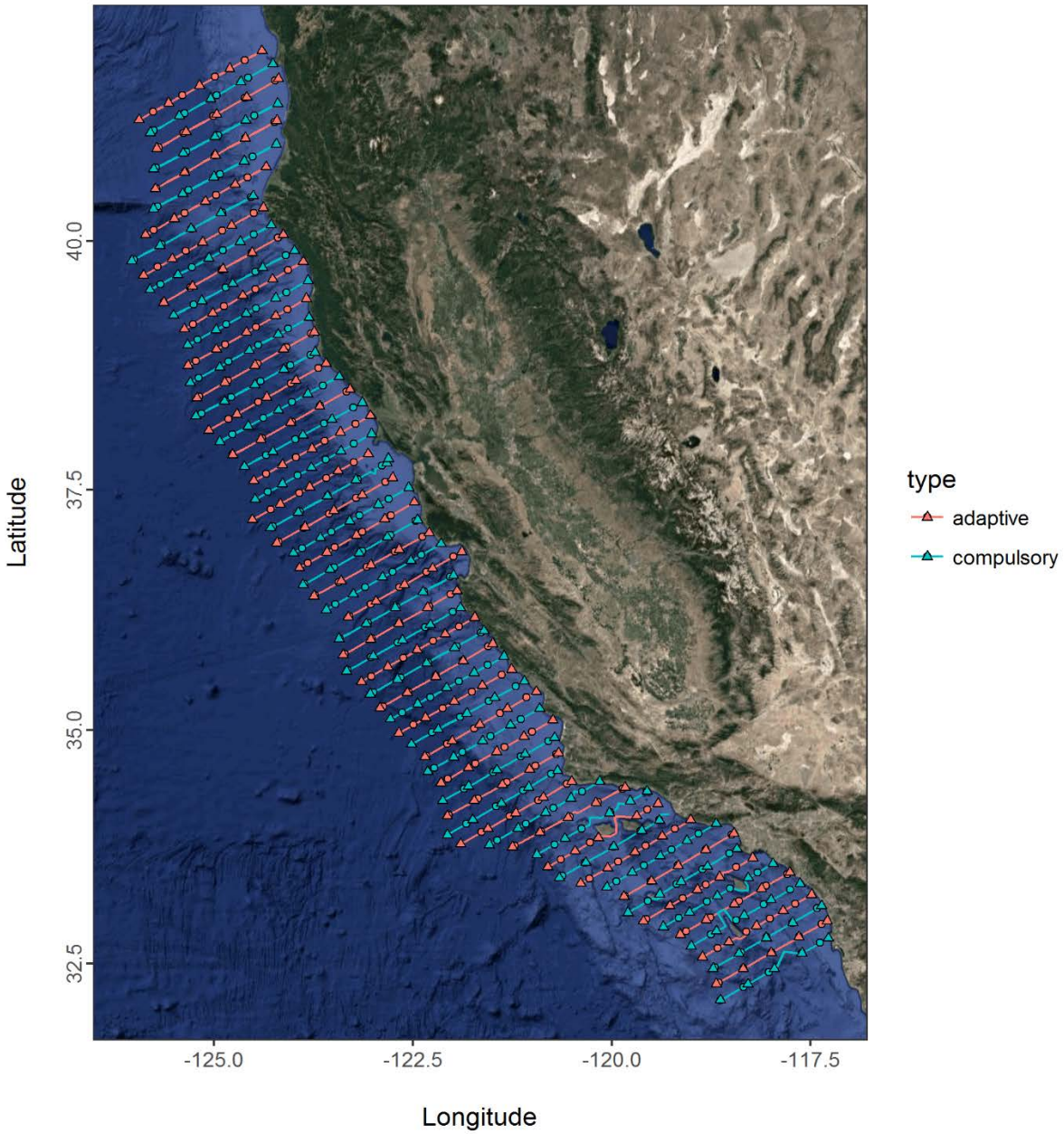
3. Responsibilities of the Foreign National Sponsor:
    a) Export Control - The foreign national's sponsor is responsible for obtaining any required export licenses and complying with any conditions of those licenses prior to the foreign national being provided access to the controlled technology onboard regardless of the technology's ownership.
    b) 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.
    c) Ensure completion and submission of NAO 207-12 Appendix C (Certification of Conditions and Responsibilities for a Foreign National

IX. Appendices

A. Survey Map

Planned compulsory (blue) and adaptive (pink) acoustic transects (lines), UCTD stations (circles), and Pairovet/bongo stations (triangles) for the Spring CPS Survey (1704RL). Compulsory transects are nominally 80-nmi long and spaced 20-nmi apart; adaptive transects reduce the transect spacing to 10 nmi. UCTD stations are spaced ca. 15-nmi apart, and Pairovet/bongo stations are spaced ca. 20-nmi apart. Waypoints for acoustic lines, UCTD stations, and Pairovet/bongo stations are provided in **Appendix B.1** and **B.2**. Waypoint files shall be provided to the ship in a variety of formats (Rose Point .NOB, .GPX, .CSV, etc.) upon request.

Point of Contact: Kevin Stierhoff (revised 1/20/2017)



B. Sampling waypoints

1. Acoustic Transects

Waypoints for acoustic transects mapped in **Appendix A**. Transect order proceeds from south to north. Transects begin at a water depth of ca. 30 m and extend ca. 80 nmi offshore along the same bearing as CalCOFI lines. Both compulsory and adaptive transects are provided. Preliminary edits have been made to avoid obstructions, hazards to navigation, and restricted areas.

Point of Contact: Kevin Stierhoff (revised 1/20/2017)

Order	Group/Line	Latitude	Longitude	Type
1	2_0	32.10232	-118.633	compulsory
2	2_0	32.45977	-117.924	compulsory
3	2_0	32.63082	-117.833	compulsory
4	2_0	32.60934	-117.62	compulsory
5	2_0	32.77686	-117.279	compulsory
7	2_1	33.12582	-117.365	compulsory
8	2_1	33.03599	-117.549	compulsory
9	2_1	32.44587	-118.728	compulsory
10	2_2	32.69012	-119.004	compulsory
11	2_2	32.90544	-118.568	compulsory
12	2_2	33.04577	-118.666	compulsory
13	2_2	33.07343	-118.634	compulsory
14	2_2	33.08582	-118.581	compulsory
15	2_2	32.95511	-118.469	compulsory
16	2_2	33.36427	-117.635	compulsory
18	2_3	33.58179	-117.974	compulsory
19	2_3	33.40104	-118.338	compulsory
20	2_3	33.3351	-118.285	compulsory
21	2_3	33.29031	-118.294	compulsory
22	2_3	33.28732	-118.33	compulsory
23	2_3	33.29359	-118.403	compulsory
24	2_3	33.32202	-118.498	compulsory
25	2_3	32.89705	-119.353	compulsory
26	2_4	33.05235	-119.796	compulsory
27	2_4	33.20599	-119.49	compulsory
28	2_4	33.19834	-119.438	compulsory
29	2_4	33.21865	-119.371	compulsory
30	2_4	33.26905	-119.364	compulsory
31	2_4	33.738	-118.426	compulsory
32	2_5	34.00977	-118.687	compulsory
33	2_5	33.32846	-120.062	compulsory
34	2_6	33.42802	-120.658	compulsory
35	2_6	33.9804	-119.536	compulsory

36	2_6	33.9872	-119.513	compulsory
37	2_6	33.99616	-119.504	compulsory
38	2_6	34.04532	-119.403	compulsory
39	2_6	34.10799	-119.382	compulsory
40	2_6	34.10706	-119.277	compulsory
41	2_7	34.35266	-119.558	compulsory
42	2_7	34.21561	-119.844	compulsory
43	2_7	34.2311	-119.912	compulsory
44	2_7	34.16793	-119.941	compulsory
45	2_7	34.06711	-120.146	compulsory
46	2_7	34.07905	-120.199	compulsory
47	2_7	34.0689	-120.28	compulsory
48	2_7	34.00382	-120.273	compulsory
49	2_7	33.67788	-120.941	compulsory
50	2_8	33.78312	-121.539	compulsory
51	2_8	34.2932	-120.492	compulsory
52	2_8	34.35662	-120.472	compulsory
53	2_8	34.34014	-120.397	compulsory
54	2_8	34.45768	-120.152	compulsory
58	2_9	34.57587	-120.682	compulsory
59	2_9	33.88971	-122.063	compulsory
60	2_10	34.25291	-122.123	compulsory
61	2_10	34.92275	-120.719	compulsory
62	2_11	35.22881	-120.906	compulsory
63	2_11	34.56374	-122.313	compulsory
64	2_12	34.85419	-122.516	compulsory
65	2_12	35.51562	-121.098	compulsory
67	2_13	35.77838	-121.354	compulsory
68	2_13	35.11958	-122.781	compulsory
69	2_14	35.38254	-123.034	compulsory
70	2_14	36.04316	-121.603	compulsory
71	2_15	36.28373	-121.903	compulsory
72	2_15	35.62341	-123.332	compulsory
73	2_16	35.96066	-123.428	compulsory
74	2_16	36.62231	-121.988	compulsory
75	2_17	36.9456	-122.147	compulsory
76	2_17	36.26497	-123.585	compulsory
77	2_18	36.52105	-123.88	compulsory
78	2_18	37.19196	-122.44	compulsory
79	2_19	37.52335	-122.552	compulsory
80	2_19	36.84974	-123.999	compulsory

81	2_20	37.11113	-124.284	compulsory
82	2_20	37.68563	-123.025	compulsory
83	2_20	37.66499	-122.984	compulsory
84	2_20	37.6707	-122.97	compulsory
85	2_20	37.70926	-122.972	compulsory
86	2_20	37.77606	-122.826	compulsory
87	2_20	37.81927	-122.805	compulsory
89	2_21	38.07117	-123.019	compulsory
90	2_21	37.40408	-124.479	compulsory
91	2_22	37.73791	-124.612	compulsory
92	2_22	38.3869	-123.133	compulsory
94	2_23	38.64996	-123.424	compulsory
95	2_23	37.99288	-124.924	compulsory
96	2_24	38.25067	-125.223	compulsory
97	2_24	38.89449	-123.728	compulsory
99	2_25	39.24226	-123.803	compulsory
100	2_25	38.58809	-125.296	compulsory
101	2_26	38.9686	-125.326	compulsory
102	2_26	39.61146	-123.814	compulsory
103	2_27	39.90633	-123.986	compulsory
104	2_27	39.26317	-125.504	compulsory
105	2_28	39.51946	-125.802	compulsory
106	2_28	40.16084	-124.279	compulsory
108	2_29	40.44643	-124.504	compulsory
109	2_29	39.80672	-126.031	compulsory
110	2_30	40.31964	-125.759	compulsory
111	2_30	40.95283	-124.213	compulsory
112	2_31	41.34607	-124.196	compulsory
113	2_31	40.70814	-125.756	compulsory
114	2_32	41.06467	-125.796	compulsory
115	2_32	41.72892	-124.257	compulsory
1	1_1	32.9637	-117.294	adaptive
2	1_1	32.2799	-118.687	adaptive
3	1_2	32.57184	-118.863	adaptive
4	1_2	32.78139	-118.439	adaptive
5	1_2	32.771	-118.387	adaptive
6	1_2	32.7963	-118.33	adaptive
7	1_2	32.83836	-118.317	adaptive
8	1_2	33.24829	-117.491	adaptive
9	1_3	33.48489	-117.763	adaptive
10	1_3	33.08664	-118.582	adaptive

11	1_3	33.0731	-118.634	adaptive
12	1_3	33.04583	-118.666	adaptive
13	1_3	32.81484	-119.141	adaptive
14	1_4	32.9614	-119.603	adaptive
15	1_4	33.45672	-118.604	adaptive
16	1_4	33.47979	-118.614	adaptive
17	1_4	33.48469	-118.601	adaptive
18	1_4	33.49634	-118.524	adaptive
19	1_4	33.64138	-118.229	adaptive
22	1_5	33.90281	-118.466	adaptive
23	1_5	33.22517	-119.846	adaptive
24	1_6	33.3667	-120.389	adaptive
25	1_6	34.04813	-119.01	adaptive
27	1_7	34.22308	-119.418	adaptive
28	1_7	34.07455	-119.722	adaptive
29	1_7	34.09031	-119.932	adaptive
30	1_7	34.07599	-119.972	adaptive
31	1_7	33.99003	-119.942	adaptive
32	1_7	33.91554	-119.939	adaptive
33	1_7	33.87289	-120.016	adaptive
34	1_7	33.87904	-120.121	adaptive
35	1_7	33.54469	-120.803	adaptive
36	1_8	33.76059	-121.248	adaptive
37	1_8	34.08228	-120.53	adaptive
38	1_8	34.10281	-120.533	adaptive
39	1_8	34.1379	-120.472	adaptive
40	1_8	34.12692	-120.429	adaptive
41	1_8	34.39417	-119.831	adaptive
43	1_9	34.45887	-120.505	adaptive
44	1_9	33.79116	-121.898	adaptive
45	1_10	34.09223	-122.066	adaptive
46	1_10	34.76101	-120.668	adaptive
48	1_11	35.10849	-120.741	adaptive
49	1_11	34.44446	-122.146	adaptive
50	1_12	34.72011	-122.345	adaptive
51	1_12	35.40743	-120.947	adaptive
53	1_13	35.64132	-121.259	adaptive
54	1_13	34.97289	-122.675	adaptive
55	1_14	35.23677	-122.911	adaptive
56	1_14	35.90936	-121.494	adaptive
58	1_15	36.18394	-121.722	adaptive

59	1_15	35.51318	-123.146	adaptive
60	1_16	35.7926	-123.373	adaptive
61	1_16	36.46011	-121.944	adaptive
64	1_17	36.86608	-121.884	adaptive
65	1_17	36.18837	-123.311	adaptive
66	1_18	36.40614	-123.743	adaptive
67	1_18	37.05836	-122.295	adaptive
69	1_19	37.37333	-122.481	adaptive
70	1_19	36.69973	-123.923	adaptive
71	1_20	36.95663	-124.207	adaptive
72	1_20	37.62312	-122.753	adaptive
74	1_21	37.86571	-123.06	adaptive
75	1_21	37.19571	-124.515	adaptive
76	1_22	37.59223	-124.496	adaptive
77	1_22	38.25656	-123.032	adaptive
79	1_23	38.5205	-123.288	adaptive
80	1_23	37.85787	-124.761	adaptive
81	1_24	38.10811	-125.061	adaptive
82	1_24	38.78142	-123.591	adaptive
85	1_25	39.09774	-123.737	adaptive
86	1_25	38.43436	-125.211	adaptive
87	1_26	38.76153	-125.322	adaptive
88	1_26	39.43039	-123.838	adaptive
89	1_27	39.7969	-123.877	adaptive
90	1_27	39.12734	-125.37	adaptive
91	1_28	39.39364	-125.626	adaptive
92	1_28	40.06471	-124.126	adaptive
94	1_29	40.33087	-124.377	adaptive
95	1_29	39.66163	-125.883	adaptive
96	1_30	40.06205	-125.855	adaptive
97	1_30	40.73159	-124.341	adaptive
98	1_31	41.18193	-124.208	adaptive
99	1_31	40.51535	-125.732	adaptive
100	1_32	40.90854	-125.716	adaptive
101	1_32	41.58537	-124.188	adaptive
102	1_33	41.85498	-124.396	adaptive
103	1_33	41.18749	-125.939	adaptive

2. UCTD Stations

Waypoints for planned underway CTD (UCTD) stations. Station locations are approximately spaced 15-nmi apart and staggered on adjacent lines to improve sampling coverage. If the waypoints provided do no occur precisely on the acoustic transect, the OOD shall choose a point on the transect perpendicular to the UCTD waypoint.

Point of Contact: Kevin Stierhoff (revised 1/20/2017)

Order	Latitude	Longitude	Type
1	32.10258	-118.633	compulsory
2	32.24513	-118.347	compulsory
3	32.40764	-118.023	compulsory
4	32.61386	-117.611	compulsory
5	32.72846	-117.383	compulsory
6	33.0996	-117.419	compulsory
7	32.94218	-117.732	compulsory
8	32.78407	-118.051	compulsory
9	32.62149	-118.375	compulsory
10	32.45783	-118.702	compulsory
11	32.8154	-118.751	compulsory
12	32.97013	-118.437	compulsory
13	33.14092	-118.089	compulsory
14	33.30422	-117.759	compulsory
15	33.48647	-118.165	compulsory
16	33.31392	-118.513	compulsory
17	33.16965	-118.805	compulsory
18	32.99485	-119.155	compulsory
19	33.17825	-119.545	compulsory
20	33.36058	-119.185	compulsory
21	33.52144	-118.858	compulsory
22	33.68998	-118.521	compulsory
23	33.89982	-118.91	compulsory
24	33.73169	-119.245	compulsory
25	33.56025	-119.595	compulsory
26	33.38996	-119.939	compulsory
27	33.44662	-120.618	compulsory
28	33.58807	-120.333	compulsory
29	33.7631	-119.978	compulsory
30	33.9328	-119.633	compulsory
31	34.04532	-119.403	compulsory
32	34.35266	-119.558	compulsory
33	34.13264	-120.015	compulsory
34	33.95257	-120.38	compulsory

35	33.78704	-120.717	compulsory
36	33.83312	-121.436	compulsory
37	34.0064	-121.08	compulsory
38	34.17633	-120.731	compulsory
39	34.35039	-120.374	compulsory
40	34.53742	-120.759	compulsory
41	34.36079	-121.112	compulsory
42	34.1942	-121.449	compulsory
43	34.00789	-121.825	compulsory
44	34.3837	-121.853	compulsory
45	34.55639	-121.488	compulsory
46	34.72224	-121.138	compulsory
47	34.8874	-120.793	compulsory
48	35.12034	-121.138	compulsory
49	34.93707	-121.524	compulsory
50	34.76982	-121.877	compulsory
51	34.60373	-122.227	compulsory
52	34.97733	-122.254	compulsory
53	35.14266	-121.901	compulsory
54	35.30765	-121.546	compulsory
55	35.46655	-121.203	compulsory
56	35.68542	-121.557	compulsory
57	35.51815	-121.919	compulsory
58	35.3515	-122.281	compulsory
59	35.18898	-122.632	compulsory
60	35.40206	-122.991	compulsory
61	35.55827	-122.654	compulsory
62	35.71855	-122.305	compulsory
63	35.88525	-121.946	compulsory
64	36.02646	-121.642	compulsory
65	36.24078	-121.997	compulsory
66	36.08181	-122.342	compulsory
67	35.9225	-122.688	compulsory
68	35.76736	-123.027	compulsory
69	35.63434	-123.313	compulsory
70	35.96422	-123.417	compulsory
71	36.13087	-123.06	compulsory
72	36.2942	-122.704	compulsory
73	36.45312	-122.358	compulsory
74	36.60465	-122.029	compulsory
75	36.83103	-122.39	compulsory

76	36.65874	-122.75	compulsory
77	36.49798	-123.095	compulsory
78	36.32046	-123.47	compulsory
79	36.53231	-123.857	compulsory
80	36.70513	-123.488	compulsory
81	36.87014	-123.131	compulsory
82	37.03426	-122.777	compulsory
83	37.18115	-122.464	compulsory
84	37.4081	-122.798	compulsory
85	37.23884	-123.168	compulsory
86	37.07069	-123.523	compulsory
87	36.90216	-123.89	compulsory
88	37.12728	-124.252	compulsory
89	37.27748	-123.919	compulsory
90	37.4422	-123.56	compulsory
91	37.61018	-123.19	compulsory
92	37.74769	-122.888	compulsory
93	37.97368	-123.235	compulsory
94	37.81169	-123.589	compulsory
95	37.64935	-123.946	compulsory
96	37.47918	-124.319	compulsory
97	37.85662	-124.34	compulsory
98	38.01735	-123.975	compulsory
99	38.17477	-123.615	compulsory
100	38.33748	-123.245	compulsory
101	38.56043	-123.629	compulsory
102	38.39269	-124.014	compulsory
103	38.23498	-124.377	compulsory
104	38.06349	-124.764	compulsory
105	38.27975	-125.156	compulsory
106	38.44205	-124.781	compulsory
107	38.60251	-124.409	compulsory
108	38.76112	-124.04	compulsory
109	38.87002	-123.783	compulsory
110	39.12909	-124.063	compulsory
111	38.96542	-124.439	compulsory
112	38.80137	-124.813	compulsory
113	38.63694	-125.185	compulsory
114	39.022	-125.204	compulsory
115	39.17366	-124.843	compulsory
116	39.33358	-124.466	compulsory

117	39.49421	-124.088	compulsory
118	39.86143	-124.091	compulsory
119	39.69832	-124.476	compulsory
120	39.53927	-124.851	compulsory
121	39.3724	-125.25	compulsory
122	39.57517	-125.668	compulsory
123	39.74332	-125.269	compulsory
124	39.90869	-124.882	compulsory
125	40.06892	-124.498	compulsory
126	40.43445	-124.534	compulsory
127	40.28418	-124.892	compulsory
128	40.12013	-125.281	compulsory
129	39.96766	-125.652	compulsory
130	39.82085	-126.002	compulsory
131	40.34224	-125.705	compulsory
132	40.50574	-125.312	compulsory
133	40.66144	-124.921	compulsory
134	40.83248	-124.507	compulsory
135	41.22785	-124.489	compulsory
136	41.03952	-124.942	compulsory
137	40.87746	-125.342	compulsory
138	40.72096	-125.727	compulsory
139	41.08703	-125.75	compulsory
140	41.25153	-125.364	compulsory
141	41.42716	-124.96	compulsory
142	41.59631	-124.567	compulsory
1	32.9307	-117.362	adaptive
2	32.7952	-117.642	adaptive
3	32.62212	-117.991	adaptive
4	32.4463	-118.342	adaptive
5	32.29452	-118.656	adaptive
6	32.66627	-118.671	adaptive
7	32.8434	-118.307	adaptive
8	32.99118	-118.009	adaptive
9	33.14917	-117.691	adaptive
10	33.46935	-117.794	adaptive
11	33.34025	-118.063	adaptive
12	33.17819	-118.4	adaptive
13	32.99949	-118.764	adaptive
14	32.85325	-119.063	adaptive
15	32.97991	-119.564	adaptive

16	33.20648	-119.109	adaptive
17	33.35306	-118.816	adaptive
18	33.54143	-118.432	adaptive
19	33.88904	-118.494	adaptive
20	33.73262	-118.815	adaptive
21	33.55867	-119.169	adaptive
22	33.39084	-119.511	adaptive
23	33.23068	-119.833	adaptive
24	33.42161	-120.28	adaptive
25	33.59972	-119.918	adaptive
26	33.76988	-119.57	adaptive
27	33.95227	-119.204	adaptive
28	34.15735	-119.551	adaptive
29	33.80559	-120.272	adaptive
30	33.62326	-120.642	adaptive
31	33.77506	-121.216	adaptive
32	33.92496	-120.885	adaptive
33	34.08228	-120.53	adaptive
34	34.24019	-120.174	adaptive
35	34.37839	-119.865	adaptive
36	34.4313	-120.563	adaptive
37	34.26031	-120.923	adaptive
38	34.08933	-121.28	adaptive
39	33.91914	-121.634	adaptive
40	34.10338	-122.043	adaptive
41	34.27826	-121.677	adaptive
42	34.45186	-121.316	adaptive
43	34.62543	-120.954	adaptive
44	34.74669	-120.699	adaptive
45	34.98565	-121.002	adaptive
46	34.82364	-121.347	adaptive
47	34.65055	-121.71	adaptive
48	34.48524	-122.06	adaptive
49	34.72833	-122.328	adaptive
50	34.85546	-122.069	adaptive
51	35.02266	-121.728	adaptive
52	35.18356	-121.402	adaptive
53	35.3471	-121.068	adaptive
54	35.58443	-121.382	adaptive
55	35.40641	-121.753	adaptive
56	35.23242	-122.121	adaptive

57	35.05964	-122.493	adaptive
58	35.25027	-122.875	adaptive
59	35.40675	-122.551	adaptive
60	35.57053	-122.209	adaptive
61	35.73155	-121.87	adaptive
62	35.88076	-121.547	adaptive
63	36.08918	-121.921	adaptive
64	35.93739	-122.243	adaptive
65	35.76142	-122.617	adaptive
66	35.57009	-123.02	adaptive
67	35.80127	-123.352	adaptive
68	35.96009	-123.013	adaptive
69	36.12485	-122.665	adaptive
70	36.29704	-122.295	adaptive
71	36.42445	-122.024	adaptive
72	36.81784	-121.987	adaptive
73	36.65503	-122.324	adaptive
74	36.49843	-122.668	adaptive
75	36.32472	-123.03	adaptive
76	36.19664	-123.292	adaptive
77	36.41243	-123.728	adaptive
78	36.54807	-123.427	adaptive
79	36.70633	-123.075	adaptive
80	36.86725	-122.723	adaptive
81	37.02015	-122.379	adaptive
82	37.24039	-122.769	adaptive
83	37.07008	-123.134	adaptive
84	36.91433	-123.478	adaptive
85	36.74942	-123.815	adaptive
86	36.96732	-124.185	adaptive
87	37.10823	-123.87	adaptive
88	37.25755	-123.546	adaptive
89	37.41567	-123.207	adaptive
90	37.58346	-122.842	adaptive
91	37.78382	-123.238	adaptive
92	37.62135	-123.586	adaptive
93	37.46675	-123.923	adaptive
94	37.30305	-124.285	adaptive
95	37.66294	-124.344	adaptive
96	37.83391	-123.968	adaptive
97	37.9975	-123.605	adaptive

98	38.174	-123.219	adaptive
99	38.49608	-123.333	adaptive
100	38.35487	-123.659	adaptive
101	38.19315	-124.014	adaptive
102	38.02816	-124.388	adaptive
103	37.85787	-124.761	adaptive
104	38.22205	-124.813	adaptive
105	38.39236	-124.435	adaptive
106	38.57986	-124.031	adaptive
107	38.73601	-123.686	adaptive
108	39.07978	-123.776	adaptive
109	38.94325	-124.082	adaptive
110	38.78263	-124.448	adaptive
111	38.61121	-124.822	adaptive
112	38.44685	-125.184	adaptive
113	38.80771	-125.221	adaptive
114	38.9709	-124.858	adaptive
115	39.14513	-124.466	adaptive
116	39.32462	-124.07	adaptive
117	39.7138	-124.062	adaptive
118	39.52634	-124.477	adaptive
119	39.35306	-124.869	adaptive
120	39.1765	-125.261	adaptive
121	39.39364	-125.626	adaptive
122	39.54003	-125.291	adaptive
123	39.71315	-124.902	adaptive
124	39.88521	-124.52	adaptive
125	40.03541	-124.189	adaptive
126	40.27788	-124.499	adaptive
127	40.10488	-124.894	adaptive
128	39.90436	-125.347	adaptive
129	39.7464	-125.701	adaptive
130	40.10919	-125.75	adaptive
131	40.28025	-125.366	adaptive
132	40.45798	-124.967	adaptive
133	40.62815	-124.573	adaptive
134	41.1683	-124.237	adaptive
135	41.01162	-124.6	adaptive
136	40.84076	-124.981	adaptive
137	40.67891	-125.354	adaptive
138	40.52233	-125.719	adaptive

139	40.92197	-125.69	adaptive
140	41.05861	-125.38	adaptive
141	41.22484	-125.002	adaptive
142	41.40046	-124.607	adaptive
143	41.56967	-124.226	adaptive
144	41.76261	-124.609	adaptive
145	41.60432	-124.984	adaptive
146	41.4243	-125.394	adaptive
147	41.26518	-125.763	adaptive

3. Pairovet/Bongo Stations

Waypoints for planned Pairovet and bongo (CalBOBL) stations. Station locations provided are spaced ca. 20-nmi apart along the compulsory and adaptive acoustic transects; however, Pairovet sampling will occur at 20-nmi spacing (nominally five samples per transect) along all compulsory and adaptive acoustic transects, and bongo sampling will occur at 40-nmi spacing (nominally three samples per transect) along compulsory acoustic transects only. If the waypoints provided do no occur precisely on the acoustic transect, the OOD shall choose a point on the transect perpendicular to the UCTD waypoint.

Point of Contact: Kevin Stierhoff (revised 1/20/2017)

Order	Latitude	Longitude	Type
1	32.10189	-118.634	compulsory
2	32.27479	-118.288	compulsory
3	32.44296	-117.958	compulsory
4	32.61314	-117.612	compulsory
5	32.77578	-117.28	compulsory
6	33.12582	-117.365	compulsory
7	32.94501	-117.727	compulsory
8	32.77836	-118.058	compulsory
9	32.60947	-118.401	compulsory
10	32.44587	-118.728	compulsory
11	32.69012	-119.004	compulsory
12	32.85311	-118.684	compulsory
13	33.02344	-118.337	compulsory
14	33.18962	-117.999	compulsory
15	33.36427	-117.635	compulsory
16	33.58179	-117.974	compulsory
17	33.42784	-118.287	compulsory
18	33.2335	-118.675	compulsory
19	33.05594	-119.025	compulsory
20	32.89705	-119.353	compulsory
21	33.05235	-119.796	compulsory
22	33.25257	-119.397	compulsory
23	33.38977	-119.129	compulsory
24	33.55145	-118.798	compulsory
25	33.738	-118.426	compulsory
26	34.00977	-118.687	compulsory
27	33.82883	-119.055	compulsory
28	33.66307	-119.39	compulsory
29	33.48551	-119.746	compulsory
30	33.32846	-120.062	compulsory
31	33.42802	-120.658	compulsory
32	33.59315	-120.327	compulsory

33	33.76385	-119.976	compulsory
34	33.93611	-119.625	compulsory
35	34.04532	-119.403	compulsory
36	34.35266	-119.558	compulsory
37	34.25101	-119.77	compulsory
38	34.12328	-120.031	compulsory
39	33.85193	-120.589	compulsory
40	33.67788	-120.941	compulsory
41	33.78312	-121.539	compulsory
42	33.95792	-121.179	compulsory
43	34.12854	-120.833	compulsory
44	34.28161	-120.516	compulsory
45	34.45768	-120.152	compulsory
46	34.57587	-120.682	compulsory
47	34.39622	-121.045	compulsory
48	34.22615	-121.386	compulsory
49	34.04807	-121.745	compulsory
50	33.88971	-122.063	compulsory
51	34.25291	-122.123	compulsory
52	34.40958	-121.801	compulsory
53	34.57928	-121.441	compulsory
54	34.75053	-121.089	compulsory
55	34.92275	-120.719	compulsory
56	35.22881	-120.906	compulsory
57	35.05643	-121.272	compulsory
58	34.88673	-121.622	compulsory
59	34.71668	-121.986	compulsory
60	34.56374	-122.313	compulsory
61	34.85419	-122.516	compulsory
62	35.00838	-122.182	compulsory
63	35.18054	-121.819	compulsory
64	35.3447	-121.47	compulsory
65	35.51562	-121.098	compulsory
66	35.77838	-121.354	compulsory
67	35.60613	-121.729	compulsory
68	35.44787	-122.074	compulsory
69	35.27782	-122.438	compulsory
70	35.11958	-122.781	compulsory
71	35.38254	-123.034	compulsory
72	35.53752	-122.692	compulsory
73	35.70702	-122.326	compulsory

74	35.86856	-121.976	compulsory
75	36.04316	-121.603	compulsory
76	36.28373	-121.903	compulsory
77	36.10632	-122.279	compulsory
78	35.94801	-122.629	compulsory
79	35.78173	-122.996	compulsory
80	35.62341	-123.332	compulsory
81	35.96066	-123.428	compulsory
82	36.11758	-123.084	compulsory
83	36.28766	-122.721	compulsory
84	36.44975	-122.372	compulsory
85	36.62231	-121.988	compulsory
86	36.9456	-122.147	compulsory
87	36.77257	-122.522	compulsory
88	36.60046	-122.879	compulsory
89	36.42605	-123.247	compulsory
90	36.26497	-123.585	compulsory
91	36.52105	-123.88	compulsory
92	36.68083	-123.539	compulsory
93	36.85085	-123.173	compulsory
94	37.01477	-122.819	compulsory
95	37.19196	-122.44	compulsory
96	37.52335	-122.552	compulsory
97	37.35068	-122.931	compulsory
98	37.18047	-123.293	compulsory
99	37.00795	-123.659	compulsory
100	36.84974	-123.999	compulsory
101	37.11113	-124.284	compulsory
102	37.268	-123.941	compulsory
103	37.43647	-123.574	compulsory
104	37.60074	-123.214	compulsory
105	37.77606	-122.826	compulsory
106	37.81927	-122.805	compulsory
107	38.07117	-123.019	compulsory
108	37.89399	-123.403	compulsory
109	37.72847	-123.773	compulsory
110	37.56257	-124.137	compulsory
111	37.40408	-124.479	compulsory
112	37.73791	-124.612	compulsory
113	37.89085	-124.257	compulsory
114	38.05664	-123.879	compulsory

115	38.21825	-123.515	compulsory
116	38.3869	-123.133	compulsory
117	38.64996	-123.424	compulsory
118	38.47416	-123.82	compulsory
119	38.31326	-124.188	compulsory
120	38.14816	-124.568	compulsory
121	37.99288	-124.924	compulsory
122	38.25067	-125.223	compulsory
123	38.40142	-124.865	compulsory
124	38.56594	-124.482	compulsory
125	38.72055	-124.12	compulsory
126	38.89449	-123.728	compulsory
127	39.24226	-123.803	compulsory
128	39.07301	-124.191	compulsory
129	38.91192	-124.555	compulsory
130	38.74277	-124.926	compulsory
131	38.58809	-125.296	compulsory
132	38.9686	-125.326	compulsory
133	39.11897	-124.97	compulsory
134	39.27958	-124.592	compulsory
135	39.43601	-124.22	compulsory
136	39.61146	-123.814	compulsory
137	39.90633	-123.986	compulsory
138	39.73888	-124.385	compulsory
139	39.58099	-124.762	compulsory
140	39.40937	-125.151	compulsory
141	39.26317	-125.504	compulsory
142	39.51946	-125.802	compulsory
143	39.66838	-125.449	compulsory
144	39.83279	-125.063	compulsory
145	39.9968	-124.667	compulsory
146	40.16084	-124.279	compulsory
147	40.44643	-124.504	compulsory
148	40.28002	-124.912	compulsory
149	40.1224	-125.283	compulsory
150	39.95869	-125.677	compulsory
151	39.80672	-126.031	compulsory
152	40.31964	-125.759	compulsory
153	40.46792	-125.39	compulsory
154	40.63096	-125	compulsory
155	40.78595	-124.618	compulsory

156	40.95283	-124.213	compulsory
157	41.34607	-124.196	compulsory
158	41.1848	-124.598	compulsory
159	41.02435	-124.984	compulsory
160	40.8635	-125.383	compulsory
161	40.70814	-125.756	compulsory
162	41.06467	-125.796	compulsory
163	41.22473	-125.432	compulsory
164	41.39276	-125.039	compulsory
165	41.55844	-124.659	compulsory
166	41.72892	-124.257	compulsory
1	32.9637	-117.294	adaptive
2	32.78716	-117.649	adaptive
3	32.61752	-117.997	adaptive
4	32.44395	-118.348	adaptive
5	32.2799	-118.687	adaptive
6	32.57184	-118.863	adaptive
7	32.73567	-118.53	adaptive
8	32.90894	-118.183	adaptive
9	33.07353	-117.846	adaptive
10	33.24829	-117.491	adaptive
11	33.48489	-117.763	adaptive
12	33.31118	-118.119	adaptive
13	33.14525	-118.462	adaptive
14	32.97542	-118.815	adaptive
15	32.81484	-119.141	adaptive
16	32.9614	-119.603	adaptive
17	33.12733	-119.271	adaptive
18	33.29925	-118.924	adaptive
19	33.43511	-118.647	adaptive
20	33.64138	-118.229	adaptive
21	33.90281	-118.466	adaptive
22	33.72759	-118.821	adaptive
23	33.55826	-119.164	adaptive
24	33.39098	-119.501	adaptive
25	33.22517	-119.846	adaptive
26	33.3667	-120.389	adaptive
27	33.53306	-120.05	adaptive
28	33.70269	-119.708	adaptive
29	33.87437	-119.365	adaptive
30	34.04813	-119.01	adaptive

31	34.22308	-119.418	adaptive
32	34.09143	-119.689	adaptive
33	33.85668	-120.169	adaptive
34	33.71456	-120.459	adaptive
35	33.54469	-120.803	adaptive
36	33.76059	-121.248	adaptive
37	33.9153	-120.903	adaptive
38	34.07385	-120.549	adaptive
39	34.23019	-120.199	adaptive
40	34.39417	-119.831	adaptive
41	34.45887	-120.505	adaptive
42	34.28949	-120.859	adaptive
43	34.12353	-121.206	adaptive
44	33.95627	-121.555	adaptive
45	33.79116	-121.898	adaptive
46	34.09223	-122.066	adaptive
47	34.25593	-121.73	adaptive
48	34.42314	-121.377	adaptive
49	34.58763	-121.032	adaptive
50	34.76101	-120.668	adaptive
51	35.10849	-120.741	adaptive
52	34.93496	-121.104	adaptive
53	34.77401	-121.448	adaptive
54	34.60556	-121.801	adaptive
55	34.44446	-122.146	adaptive
56	34.72011	-122.345	adaptive
57	34.88835	-122.003	adaptive
58	35.06041	-121.657	adaptive
59	35.23092	-121.313	adaptive
60	35.40743	-120.947	adaptive
61	35.64132	-121.259	adaptive
62	35.4722	-121.625	adaptive
63	35.30366	-121.978	adaptive
64	35.13328	-122.339	adaptive
65	34.97289	-122.675	adaptive
66	35.23677	-122.911	adaptive
67	35.39767	-122.57	adaptive
68	35.566	-122.211	adaptive
69	35.73101	-121.865	adaptive
70	35.90936	-121.494	adaptive
71	36.18394	-121.722	adaptive

72	36.01059	-122.093	adaptive
73	35.84665	-122.445	adaptive
74	35.6704	-122.811	adaptive
75	35.51318	-123.146	adaptive
76	35.7926	-123.373	adaptive
77	35.95697	-123.028	adaptive
78	36.12217	-122.674	adaptive
79	36.28701	-122.317	adaptive
80	36.46011	-121.944	adaptive
81	36.86608	-121.884	adaptive
82	36.69433	-122.251	adaptive
83	36.52487	-122.605	adaptive
84	36.35355	-122.962	adaptive
85	36.18837	-123.311	adaptive
86	36.40614	-123.743	adaptive
87	36.56346	-123.399	adaptive
88	36.72925	-123.027	adaptive
89	36.88873	-122.673	adaptive
90	37.05836	-122.295	adaptive
91	37.37333	-122.481	adaptive
92	37.20012	-122.851	adaptive
93	37.03491	-123.208	adaptive
94	36.86037	-123.578	adaptive
95	36.69973	-123.923	adaptive
96	36.95663	-124.207	adaptive
97	37.1198	-123.855	adaptive
98	37.28842	-123.491	adaptive
99	37.44923	-123.134	adaptive
100	37.62312	-122.753	adaptive
101	37.86571	-123.06	adaptive
102	37.69337	-123.439	adaptive
103	37.52838	-123.795	adaptive
104	37.35556	-124.165	adaptive
105	37.19571	-124.515	adaptive
106	37.59223	-124.496	adaptive
107	37.75507	-124.138	adaptive
108	37.92072	-123.767	adaptive
109	38.08599	-123.408	adaptive
110	38.25656	-123.032	adaptive
111	38.5205	-123.288	adaptive
112	38.35163	-123.669	adaptive

113	38.18467	-124.036	adaptive
114	38.01584	-124.41	adaptive
115	37.85787	-124.761	adaptive
116	38.10811	-125.061	adaptive
117	38.26924	-124.71	adaptive
118	38.44106	-124.335	adaptive
119	38.60949	-123.968	adaptive
120	38.78142	-123.591	adaptive
121	39.09774	-123.737	adaptive
122	38.92549	-124.124	adaptive
123	38.76299	-124.482	adaptive
124	38.59113	-124.861	adaptive
125	38.43436	-125.211	adaptive
126	38.76153	-125.322	adaptive
127	38.9236	-124.967	adaptive
128	39.09392	-124.59	adaptive
129	39.25788	-124.222	adaptive
130	39.43039	-123.838	adaptive
131	39.7969	-123.877	adaptive
132	39.62559	-124.262	adaptive
133	39.45971	-124.634	adaptive
134	39.28743	-125.013	adaptive
135	39.12734	-125.37	adaptive
136	39.39364	-125.626	adaptive
137	39.55391	-125.268	adaptive
138	39.72404	-124.885	adaptive
139	39.88779	-124.517	adaptive
140	40.06471	-124.126	adaptive
141	40.33087	-124.377	adaptive
142	40.15495	-124.777	adaptive
143	39.99074	-125.14	adaptive
144	39.82463	-125.521	adaptive
145	39.66163	-125.883	adaptive
146	40.06205	-125.855	adaptive
147	40.22316	-125.496	adaptive
148	40.39345	-125.106	adaptive
149	40.56033	-124.731	adaptive
150	40.73159	-124.341	adaptive
151	41.18193	-124.208	adaptive
152	41.01048	-124.602	adaptive
153	40.84498	-124.98	adaptive

154	40.67606	-125.365	adaptive
155	40.51535	-125.732	adaptive
156	40.90854	-125.716	adaptive
157	41.0711	-125.349	adaptive
158	41.243	-124.963	adaptive
159	41.407	-124.586	adaptive
160	41.58537	-124.188	adaptive
161	41.85498	-124.396	adaptive
162	41.68485	-124.799	adaptive
163	41.52007	-125.179	adaptive
164	41.35039	-125.569	adaptive
165	41.18749	-125.939	adaptive

C. Unmanned Aircraft System (UAS) Standard Operating Procedure
Point of Contact: Scott Mau (revised 2/7/2017)

NOAA Ship *Reuben Lasker*	OFFICE OF MARINE AND AVIATION OPERATIONS	DOCUMENT NO.	VERSION 1.0
		EFFECTIVE DATE April 11, 2017	
	AUTHORIZED BY: /s/ Kurt Dreflak CDR Kurt Dreflak Commanding Officer, NOAA Ship *Reuben Lasker*	REVIEW DATE April 11, 2017	
		RESPONSIBLE POSITION Commanding Officer, NOAA Ship *Reuben Lasker*	

Shipboard APH-22 Unmanned Aircraft System Operations

1. PURPOSE

1.1 To provide the minimum requirements for completing UAS Operations aboard the NOAA Ship *Reuben Lasker*

2. SCOPE

2.1 This procedure shall apply to performing APH-22 UAS Operations aboard the NOAA Ship *Reuben Lasker*

3. RESPONSIBILITIES AND PROCEDURES

3.1 All hands participating in UAS Operations should read and become familiar with this procedure.

UAS Operations are conducted at the discretion of the CO, OOD and UAS Pilot. The OOD, CO and UAS Pilot have the authority to cancel operations if he/she has any doubts regarding the safety of the operation.

3.2 **PRE PROJECT DEPARTURE PLANNING**

3.2.1 APPROVALS

- Flight will be conducted under the authority of the AOC Policy 220-1-5, 14 CFR 107.
- The Mission Commander bringing the UAS to the ship is responsible for obtaining all the required approvals/permits required of a UAS operation. Copies of the approvals/permits will be provided to the ship's Operations Officer.
- The ship's Operations Officer will verify with AOC that all required aviation related approvals have been obtained and that the permits/approvals match up with the operations specified in the Project Instructions. The Operations Officer will provide results and copies to the ship's CO.
- AOC Policy 220-1-5, Unmanned Aircraft Systems Operations, defines Pilot in Command (PIC), Ground station Operator (GSO), Visual Observer (VO), Project Manager (PM) and Mission Commander (MC) roles and requirements.

3.2.2 AIRWORTHINESS STATEMENT

- A statement of platform airworthiness is required for each mission. This is a memorandum provided by NOAA AOC specific for each UAS project. It specifies the criteria used to assess and approve the airworthiness of an aircraft and any restrictions or limitations to be abided by while conducting missions with that aircraft.
- The ship's Operation Officer will be provided with an airworthiness statement prior to any unmanned aircraft operations. The Operations Officer will provide this to the Commanding Officer.

3.2.3 OPERATIONAL RISK MANAGEMENT (ORM) ANALYSIS

- Completed prior to the commencement of any UAS project.
- The ORM will be led by the AOC according to their standard ORM procedures.
- The Mission Commander for the operation shall conduct the majority of the ORM analysis.
- The ORM team will consist of personnel at AOC, personnel from the appropriate MOC and personnel from the ship's command. Other ORM team members may be involved in the discussion if relevant.
- The Commanding Officer, AOC, and Commanding Officer, MOC, will be the final approving authority.
- The Commanding Officer, AOC will conduct a flight readiness review board prior to the operation and provide a Memorandum dictating how the UAS shall operate.

3.2.4 STAGING SPACE ABOARD THE VESSEL

- The flight team consists of a PIC who operates the Radio Control (RC) unit that sends commands to the aircraft and the GSO who, during flight, provides input to the PIC regarding aircraft status (altitude, battery level, distance from launch site, GPS quality) and what is appearing on the video feed from the camera. When the battery voltage reaches 14.5 volts the GSO will tell the PIC to commence the return of the aircraft to the ship. The GSO will be responsible for the hand launch and hand catch operations. The PIC and ground station will be in close proximity to each other during all operations.

4. UAS FACTS AND RESTRICTIONS (BASED ON THE APH-22)

- **Range:** Operations will be limited to daytime and line of sight, not to exceed 0.5 nautical miles.
- **Altitude:** The APH-22 will only operate below 400 ft for this mission.
- **Wind and Sea State:** The APH-22 should not be launched when wind speeds are greater than 15 knots and a sea state greater than 3-5 ft workboat and 4-6 ft from ship.
- **Clouds and Visibility:** Flight operation limitations for clouds and visibility will be set at the ORM Analysis for each mission. The APH-22 shall be operated within visual line of sight and under class E airspace weather minimums (3 statute miles flight visibility and 500 ft below any clouds).
- **Vessels, Rigs, Congested Areas:** The SP will consult with the OOD regarding surface contacts in the operations area and relay this information to the PIC. The PIC will not overfly their ship or other vessels.
- **Other Aircraft:** Specific procedures for aircraft deconfliction will be set by the ORM Analysis participants. Minimally, if another aircraft is sighted in the operations area the information will be passed to the PIC. The PIC will keep clear of any other aircraft. The VO will attempt to notify the encroaching aircraft of UAS operations via appropriate VHF aircraft monitoring frequency. Once the aircraft is clear of the operating area normal operations will resume. If applicable, "securite" calls shall be made via Aviation frequency notifying incoming traffic of the UAS operation.
- Only personnel with duties related to the UAS activity are allowed in the vicinity of a launch and recovery.
- When the APH-22 is operating in the immediate vicinity of the ship the PIC and SP will fly no lower than 150' Above Ground Level (AGL) until the approach for recovery.
- Incident and accident reporting procedures will be followed and AOC will investigate any accidents.

5. DAILY PLANNING

5.1 SAFETY BRIEFING

A morning safety briefing will be held including all parties involved. The following and any other issues affecting the safety and/or success of the operations will be discussed.

- ☐ Presence of other vessels, wildlife, fishing gear, navigational aids, land, etc.
- ☐ Equipment status
- ☐ Other operations that might be occurring simultaneously
- ☐ A review of the previous relevant UAS missions
- ☐ Safety concerns regarding the previous or upcoming UAS operation
- ☐ UAS status
- ☐ Mission objectives
- ☐ Weather forecast, winds and sea state
- ☐ Identification of roles
- ☐ Scheduled launch time
- ☐ Launch procedures
- ☐ Recovery procedures
- ☐ Limiting airspace factors
- ☐ Emergency procedures
- ☐ Coordination with any concurrent small boat operations

5.2 PERSONNEL

Name	**Role**
CDR Kurt Dreflak	CO
Jacob Barbaro	Pilot in Command (PIC)
Scott Mau	Ground Station Operator (GSO)
Dan Palance	VO
Scott Mau	PM
Chief Scientist	MC

Piloting rolls will be updated on a per survey basis and may be interchanged during cruise.

☐ **Commanding Officer (CO**) – Responsible for all operations on the ship.

☐ **UAS Pilot in Command (PIC**) – Manages the mission and tasked with the overall responsibility for the safe execution of the mission

- o Ensures all crew members understand and can properly perform their specific roles for the flight.
- o Provides and ensures all documentation, including pre- and post-flight briefs
- o Adheres to all SOPs and checklist requirements
- o Acts as the final authority to the safe operation of the aircraft.
- o Oversees aircraft system preparation, launch, airborne operations, landing, and preventative maintenance.
- o Updates waypoints, updates altitudes as needed, manages the aircraft's rally location in case of loss of link.

☐ **UAS Ground Station Operator (GSO)**–Implements the mission designed by the project PIC

- o Physically holds the aircraft during launch and catches the aircraft during recovery.
- o Acts as a liaison between the PIC and other personnel.
- o Communicates with the Officer of the Deck, conducts radio communications, and handles any other flight related issues that the PIC will be unable to attend to due to the heads down nature of controlling the UAS.

☐ **Visual Observer (VO):** The visual observer will be an external observer for "see and avoid"

purposes.

- Ensures that the operational area is clear for UAS operations
- Maintains situational awareness of the aircraft, surface and aerial contacts, developing weather observations, and conveys that information to the PIC via radio.
- Watches for birds, aircraft, and unauthorized personnel in the immediate area of flight for launch or recovery.

☐ **Project Manager (PM):** Shall be in charge of the overall operation while deployed

- Responsible for all aspect of the project and works closely with the ship, operational and scientific teams to ensure all project objectives are met.
- Approves any changes to definition or project scope and objectives.
- Ensures the involvement of all relevant stake holders during deployment.
- Ensures that all project deliverables are on-time, within scope and within budget.
- Monitors, tracks and reports progress to the UAS program manager when communications are available.
- Creates and maintains comprehensive project documentation.

☐ **Mission Commander (MC):** Shall be responsible for acting as the interface between Ship's command, scientific parties and APH-22 flight crew.

- Conducts the daily briefing in conjunction with the UAS PIC to all personnel regarding UAS operations and contingency plans.
- Provides SITREPS to both AOC and the UAS program manager.
- Coordinates between the approved aircraft traffic control authority.
- Briefs the approval authority of the APH-22 procedures.
- Ensures NOTAMs are filed appropriately if applicable.
- Communicates with any aircraft in the vicinity using the aircraft radio.

☐ **Officer on the Deck (OOD):** The OOD will assist the PIC in accomplishing the flight objectives while abiding by the Command's Standing Orders.

- Maneuvers for launch and recovery, sailing a planned route, holding station, or altering course and speed as requested.
- Provides situational updates to the PIC regarding radar or visual contacts, developing weather, course or speed changes, and anything else relevant to safe operation.
- Coordinates with the Chief Boatswain, or their designee, for small boat operations.

☐ **Operations Officer (OPS)**: The OPS will serve as a liaison between the PM/MC, or PIC as applicable, and the ship's departments to ensure the necessary resources for UAS operations are provided by the ship and its crew.

- Uploads flight data to the ship's network, and compiles mission data for reporting to the appropriate MOC with the help of the PM/MC.

☐ **Chief Boatswain (CB):** If the UAS is landed in the water, the CB is responsible for ensuring the small boat and small boat crew are prepared to recover it.

☐ **Fire-watch:** The Fire watch may also be the Visual Observer or a member of the Deck Department.

- The Firewatch will be posted with a class D fire extinguisher to mount an immediate response should the unmanned aircraft ignite (the lithium-ion battery may ignite if substantially impacted and traditional fire extinguishers are ineffective on Lithium fires).

☐ **NOTE:** Any member of the operation has the responsibility to stop an operation in the interest of safety and the operation will only resume when all parties are satisfied that the danger has been addressed.

5.3 COMMUNICATION

☐ OOD will coordinate with the MC.
☐ The VO will directly communicate with the PIC.
☐ VO/ MC will monitor aviation frequency and VHF.
☐ OOD will monitor VHF 16/13, applicable VTS frequencies, and VHF.

- ☐ The MC will coordinate with the Air Traffic Control Authority in order to file NOTAMS and be added to the appropriate flight schedule if applicable.
- ☐ The MC will communicate with the operations officer in order to schedule UAS operations aboard the ship.

5.4 OPERATIONS PLAN

NOAA's Southwest Fisheries Science Center (SWFSC)Advanced Survey Technology group (AST) conducts research on various Coastal Pelagic Species (CPS) along the west coast of north America. As part of these effort AST collects data on species abundance using shipboard acoustics and trawls.

The AST would like to evaluate several uses of the APH-22 Hexacopter UAS platform for ship-based and small boat based CPS detection. Specifically, to test the capability and utility of the APH-22 for obtaining photographs of CPS schools that may be used for nearshore confirmation of CPS schools and CPS reactions to the ship on transect.

While the APH-22 Hexacopter has previously flown from the NOAA Ship *Oscar Elton Sette* and small vessels this will be the first from the NOAA Fisheries Survey Vessel (FSV) *Reuben Lasker*. The initial goals of our 2017 survey will be to refine launch, recovery and communication protocols between the ship's command and the UAS pilots. This will also be an opportunity to evaluate CPS school detection in various weather conditions.

UAS missions will occur during the 2017 Spring CPS survey aboard FSV *Reuben Lasker* (RL-17-02) from 11 April through 22 April 2017. APH-22 flights may occur up to four times per day as adjustments are made to launch, recovery procedures and various weather conditions. Flights will typically occur from one mile before the landward end of the acoustic survey line to the shore. The APH-22 will not be flown over land or over marine mammal haul out sites. The APH-22 flights will be conducted on schools seen on sonar imagery to determine reactions to the vessel. This will allow for us to assess the operational limits of the Hexacopter in terms of imagery, and the coordination limits for operating the Hexacopter from the NOAA Ship *Reuben Lasker*. Flights will also occur from a small boat launched from the Lasker. Flights may occur 1-4 times per day, as suitable weather conditions and CPS observations allow. All missions will be flown under AOC Policy 220-1-5.

Launch/Recovery Procedure-
The APH-22 is hand launched and hand caught for each flight. All personnel involved will wear helmets and the hand catching personnel will also wear Kevlar lined gloves. All personnel involved will also were PFD's while piloting from the small boat.

Communication System Description –
The UAS flight crew will issue a NOTAM each day before operations. The flight crew will monitor the aircraft VHF for traffic and announce UAS operations to any aircraft in the vicinity.

Lost Link Procedure
If lose link, the aircraft will wait 10 seconds and then return to the current location of the ground station. The ground station has a beacon that sends out its position several times a second.

Emergency Procedures
Should the UAS encounter an emergency such as a system malfunction or engine failure the external pilot will take control of the UAS and attempt to guide it back to the ship. The UAS will be landed as soon as possible. If the aircraft has experienced a malfunction making a hand catch unsafe, the aircraft will be landed on the deck.

6. LAUNCH PROCEDURES

- OOD provides a 15 minute and 5 minute heads up to launch via VHF to all parties.
- The PIC and GSO will assemble the UAS on the launch deck. The VO may assist as needed.
- Following APH-22 assembly the PIC will return to the GCS and the GSO will remain on the launch deck with the aircraft.
- Deck Department: Prep the small boat completely and tied up at the hip with a coxswain standing by prior to UAS launch in the event of an emergency water landing.
- Aircraft Observer / Fire-watch: Standby ready to assist a class D fire extinguisher if the Lithium Ion battery should catch fire.
- The OOD will announce over the ship's all-call: **"Attention. All hands stay clear of the fantail/bow for UAS launch**."
- The PIC will conduct pre-flight checks at the GCS hand controller and the GSO handling the APH-22.
- Following successful completion of pre-flight checks the PIC will notify the OOD that the aircraft is ready for launch.
- The OOD will broadcast securite calls if necessary to notify nearby traffic of UAS operations on VHF channel 16/13 and any other appropriate frequency.
- The OOD will confirm the PIC, Deck Department, and the Visual Observer (VO) are ready for launch. If personnel are ready, and there are no other concerns, the OOD will notify PIC to proceed with launch.
- The PIC will power up the aircraft, and the GSO will hand launch the aircraft. The aircraft should begin to climb, gain speed, and begin its mission. The GSO will return to the GCS.

7. IN FLIGHT PROCEDURES

- The OOD will log the time and location of launch in the ship's log and click the appropriate event log button in SCS.
- The PIC and OOD will proceed with the UAS mission as planned.
- The OOD will announce over ship's all-call: **" Attention all hands APH-22 launch operations complete, the deck is open."**
- The Deck Department will stand by to deploy small boat in the event of an unplanned APH-22 landing.
- The OOD will alert the VO to the presence of any surface contacts in the vicinity of UAS operations and the VO will keep the OOD updated with location of the UAS.
- The OOD will maintain a 1 nm CPA with contacts, requesting course changes from traffic if possible.
- The aircraft observer will report any aircraft in the vicinity to the PIC/MC, if applicable. The VO/MC will attempt to contact the encroaching aircraft via 121.5 MHz VHF air traffic radio and will direct the PIC to stay clear.

- The VO will notify the Deck Department 5 minutes prior to any planned APH-22 landing.

- VO will continually monitor the UAS while in flight and inform PIC/MC of any other aircraft or concerns in the area.

8. RECOVERY PROCEDURES

******Our flights are typically shorter than 15 minutes. I think that having the team on the bow really helps with visual cues to the OOD as to what is going on.

- VO notify OOD 5 minutes prior to a planned capture.

- 10 minutes prior to flight operations the OOD will make a page over the 1MC that all flight decks are secured to only crew directly involved in the UAS operation.

- The PIC will request the OOD to put the wind on the stern if conditions require for capture.

- The OOD will notify the PIC when the ship is finished maneuvering.

- The PIC will then maneuver the aircraft for approach. The PIC will then request an approach from the OOD and the OOD will respond as necessary.

- With clearance from the OOD the PIC will then start the approach and land on the vessel.

- Once on deck the OOD will log the time and location of APH-22 landing in the ship's SCS system and will reposition the ship for small boat recovery if applicable.

- In the event of a missed landing or failed attempt the PIC will position the aircraft for another approach and inform the OOD that they would like another recovery attempt.

- In the event the APH-22 misses the deck and lands in the water, the OOD will notify the CB to deploy the small boat for recovery.

9. EMERGENCY RECOVERY:

- Failed Launch: The OOD will keep the ship clear of the downed UAS, mark the position, notify the CB to deploy the small boat for UAS recovery, and position the ship for small boat deployment. The small boat team will recover the UAS and return to the ship.

- UAS Unexpectedly Comes Down: OOD works with PIC to determine bearing and range, then steams to the general area of the UAS ensuring not to run it over. Call out numerous look outs. Once in sight notify the CB to deploy the small boat for UAS recovery, and position the ship for small boat deployment. The small boat team will recover the UAS and return to the ship.

- UAS Loses Contact with the RC Unit: If the APH-22 receives zero packets (bits of information) from the GCS for a period of ten seconds it initiates its loss of link procedure. The operator can program one of the following options in the event of loss of link:

    i. Go to Rally': The UAS flies to a previously specified altitude and rally point, proceeds to a landing waypoint and executes the auto-land function upon arrival at that landing waypoint. The rally/landing waypoint can be fixed or carried with the ship. This is the default setting when operated from a NOAA Ship and normally commands the aircraft to return to the designated rally waypoint at a specified distance and bearing from the GCS. As long as the APH-22 is receiving packets from the GCS the rally/landing waypoint will be continually updated based on the ship's position. If 'Go to Rally' (we call this "follow me" is initiated due to loss of link the APH-22 will return to the last received rally position. As the APH-22 approaches the rally point and ship, link should be reestablished and the PIC and SP can continue the mission if desired. **By far the most common cause of lost link is an obstruction. That is why we try to keep the aircraft well ahead of the ship's superstructure. If we did lose link because of the obstruction of the vessel, we could obtain control of the aircraft as soon as it was clear. We set the "come home" altitude to be higher than any of the ship's antennas.

    ii. It is the PIC's responsibility to inform the OOD when the APH-22 enters 'Loss of Link' mode and the OOD should mark the location on the ship's navigation software. From that position the APH-22's rally and landing waypoints can be determined. The OOD should hold station in the vicinity of these waypoints for recovery, but should stand off from the rally and landing waypoints by 300 yards. If the APH-22 returns to the rally location without re-establishing link it will automatically initiate a landing.

10. LITHIUM BATTERIES

- If the APH-22 strikes the deck or rigging the Li-ion battery may ignite. As with any metal fire, water or CO2 is ineffective at fighting the fire. A burning Li-ion battery should be put out with a class D fire extinguisher.
- In the event of a UAS related incident or accident, standard OMAO reporting procedures will be followed.

11. LOGS

11.1 OOD WILL RECORD A SCS EVENT WHEN:

- UAS security calls
- UAS launch time
- UAS recovery time
- Time and ship's position of lost link exceeding 20 seconds.
- An uncontrolled landing, low battery auto-land, loss of link landing, etc.
- Any Mishap involving the UAS
- The PIC and SP will maintain logs in accordance with AOC procedures.
- The OOD will also click the appropriate event in the SCS logger.

11.2 SHIP'S OPS OFFICER WILL:

- Transfer flight logs and files to the ship's network.
- Compile flight information for reports to MOC.

12. RECORDS AND REPORTS

Ship's Deck Log Daily
SITREP Flight Data Record

13. DEFINITIONS

CO	Commanding Officer
AOC	NOAA's Aircraft Operations Center
MOC	NOAA's Marine Operations Center
OOD	Officer of the Deck
NOTAM	A Notice to Airmen(NOTAM or NoTAM) is a notice filed with an aviation authority to alert aircraft pilots of potential hazards along a flight route or at a location that could affect the safety of the flight
AIS	Automated Identification System
RAM	Restricted In Ability to Maneuver
PIC	Pilot in Command
MC	Mission Commander
PM	Project Manager
SP	Supplemental Pilot
VO	Visual Observer
CB	Chief Bosun
OPS	Operations Officer

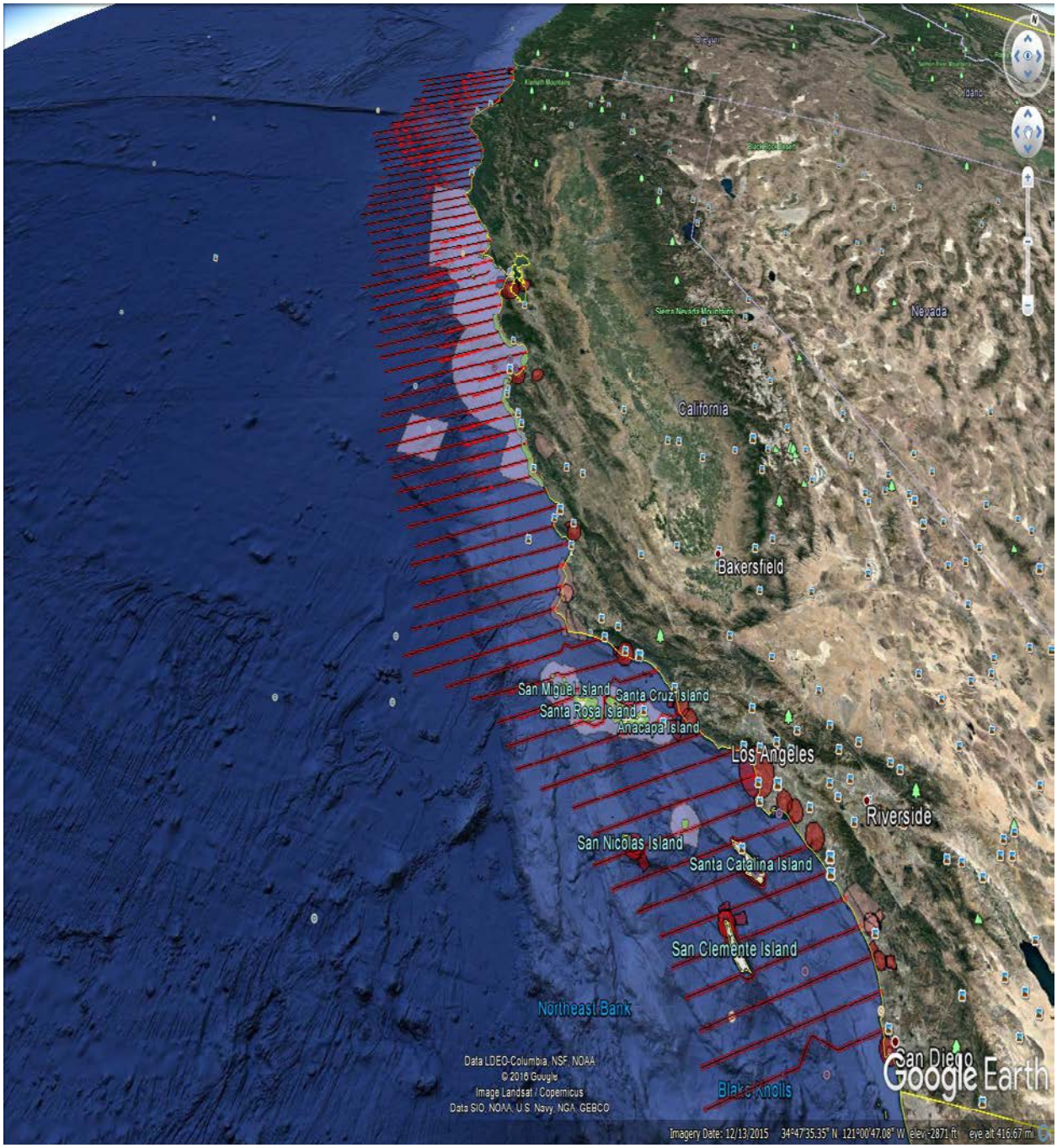


Figure C1: APH-22 missions will be launched and recovered from FSV Lasker or Workboat within the area between shore and the outer boundary defined by the red outline. Polygons indicate restricted airspace is (red), National marine sanctuary boundaries (purple), NMS no fly zones are in (orange), and NMSB restricted zone (green).

D. Trawl Processing

Point of Contact: Bev Macewicz (revised **2/15/2017**)

TRAWL CATCH PROTOCOL

Standard trawl duration is 45 minutes. Reduction of duration only approved for:

1) marine mammal sighted during tow (any duration)
2) presence of crab pots but not less than 30 minute and if safely possible.

I. During trawl net retrieval:

Only target CPS, mola, sharks, ESA/MMPA species, or Humboldt squid falling on the deck or caught in mesh forward of the MMED will be collected and included as part of the total catch. Process and Release quickly if alive.

Remove and keep any gilled CPS.

Toss any other species forward of the MMED.

II. Total Catch General Procedure

★ Always process any marine mammals/turtles (per SWFSC MMPA research permit)

A. Less Than about 5 baskets caught

If the catch does not fit in a basket or the large garbage can, then crane the codend to the outside sorting table and dump the catch onto the table for sorting!

1. All Target species remove, sort and process from entire catch:
   - Target CPS fish (sardine, anchovy, Pacific and jack mackerel)
   - ESA fish species (salmon and eulachon)
   - Minor target species (refer to attached list)
2. Non-target taxa (includes market squid) catch may be adaptively sampled:
   - Take a random composition sample and process
     a composition sample could be the whole amount or a random filled white tub
   - Record any remainder weight

B. Large total catch (> 5 baskets)

Place entire catch on the outside sorting table & push out the sliding door all samples into baskets

Only if a mechanical failure of the crane occurs, can the catch be grabbed from bins or from the codend & then put in baskets

ATM like surveys:

1. Remove, sort and process ESA fish species from the entire catch
2. Take a random 5 basket sample (used for sorting and estimation)
   - Sort and process CPS fish and minor target species CPS processing is reduced to number of fish in the 5 baskets. If more than 50 fish, process 50. If only 2 (i.e., sardine) are present in 5 baskets, do not sort/look for more, just process the 2 fish.
   - Take random white tub composition sample of non-target taxa (includes market squid) and process
   - Record remainder weight of non-target taxa
3. Weigh and record any unsorted baskets

DEPM surveys:

1. Remove, sort and process ESA fish species from the catch
2. If less than 100 anchovy or sardine is present in catch, remove (sort) species from whole catch and process; otherwise continue from step 3.
3. Take a random 5 basket sample (used for sorting and estimation)
    - Remove, sort and process CPS fish and minor target species
    - Take random composition sample of non-target taxa (includes market squid) and process
    - Record remainder weight of non-target taxa
3. Weigh and record any unsorted baskets

III. Processing CPS, sharks, and minor target (see list) species

- If a species catch is 50 individuals or less, process all specimens
- If a species catch is >50 individuals, take a 50 random subsample and process, record remainder weight of the species.

Refer to Target Species Biological Processing Chart and Bin Processing Chart for specific quantities needed.

IV. Processing ESA listed fish (salmon and eulachon):

Process adult salmon (>250mm FL) and eulachon quickly, release if alive

Note: Prepare and Send ITA report within 24 hours

Salmon (adults and juveniles):

- Identify to lowest taxon, including juveniles if possible
- Record Alive or Dead
- Measure fish (mm FL) and weight (g)
- Record presence/absence of adipose fin
- Take Fin clip on adults (for DNA)
- Freeze all juveniles(<250mm FL) individual bag/wrap with ID tick on fish

Eulachon:

- Measure length frequency (mm FL) and group weight(g) of random 50
- Obtain remainder weight(g) and calculate total number of fish
- Freeze 5 fish (California only): group bag

V. Processing Non-Target taxa

a composition sample could be the whole amount or a random filled white tub

a. Fish, Pyrosomes, Thetys, Crustaceans, Cephalopods (includes market squid):

- Separate into lowest taxon (combine myctophids and note species)
- Group weight(g) of random 20 per each taxon
- Measure FISH length frequency (mm FL), n=20 (except no measurements on myctophids and juveniles of rockfish, hake, or flatfishes).
- Obtain remainder weight(g) for each taxon

b. Gelatinous taxa, Krill, and Fish-Invertebrate larvae

- Group all and weigh (use itis-tsn code 202423 for Animalia)
- Take picture, record camera and number
- Identify presence to lowest taxon and record itis-tsn code for that taxon

Target Species Biological Processing Chart (every trawl but no larval stages) ATM

	Length Frequency	Group Weight (kg)	Length (mm)	Individual Weight (g)	Sex Maturity	Ovary Mature+Immat.	Otolith	DNA	Remainder Weight (kg)	Body Disposition
Pacific sardine* 161729	N/A	N/A	**50** SL	**50**	**25**	**10**	**25**	**25**	Yes	Discard
Northern anchovy* 161828	N/A	N/A	**50** SL	**50**	**25**	**10**	**25**	**25**	Yes	Discard
Pacific mackerel* 172412	N/A	N/A	**50** FL	**50**	**25**	**10**	**25**	**25**	Yes	Discard
Jack mackerel* 168586	N/A	N/A	**50** FL	**50**	**25***	**10**	**25**	**25**	Yes	Discard
Market squid ** 82371	N/A	N/A	**50** ML	**50**	N/A	N/A	N/A	N/A	Yes	##
Minor target***	**50**	**50**	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Discard

* see Bin charts below

** Market squid the 50 L&W should be a random mixture (both large and small sizes) of the catch

Market squid >75mm - individually bag and freeze 20 (>75mm) if available in the 50, discard the rest >75mm in the 50

Market squid <75mm - freeze group of 50 from the random sample or some may come from the remainder weight sample

*** Refer to Minor Target Species Chart (length frequency on fish only, except sharks do individual FL&W and take DNA)

Bin Processing Chart for Sardine and Anchovy

proportion **25** fish over the 12 bin sizes — Bin size 20 mm

Bin #	1	2	3	4	5	6	7	8	9	10	11	12
Bin start	40	51	71	91	111	131	151	171	191	211	231	>=251
Bin end	50	70	90	110	130	150	170	190	210	230	250	

- record sex and maturity, take otoliths and a DNA sample for the 25 bin selected fish
- up to 10 ovaries (any visual maturity code) will be removed from the 25 bin selected fish (max n = 10; if no females in 25 then # ovary saved = 0)

Bin Processing Chart for Mackerels

proportion **25** fish over the 12 bin sizes — Bin size 50 mm

Bin #	1	2	3	4	5	6	7	8	9	10	11	12
Bin start	31	51	101	151	201	251	301	351	401	451	501	> =551
Bin end	50	100	150	200	250	300	350	400	450	500	550	

- record sex and maturity, take otoliths and a DNA sample for the 25 bin selected fish
- up to 10 ovaries (any visual maturity code) will be removed from the 25 bin selected fish (max n = 10; if no females in 25 then # ovary saved = 0)

Target Species Biological Processing Chart (every trawl but no larval stages) DEPM

	Length Frequency	Group Weight (kg)	Length (mm)	Individual Weight (g)	Sex Maturity	Ovary Mature/Immat.	Otolith	DNA	Remainder Weight (kg)	Body Disposition
Pacific sardine* 161729	N/A	N/A	**50** SL	**50**	**50**	**25 / 2**	**25+**	**25+**	Yes	Discard
Northern anchovy* 161828	N/A	N/A	**50** SL	**50**	**50**	**25 / 2**	**25+**	**25+**	Yes	Discard
Pacific mackerel 172412	N/A	N/A	**50** FL	**50**	**25**	**10**	**25**	**25**	Yes	Discard
Jack mackerel 168586	N/A	N/A	**50** FL	**50**	**25**	**10**	**25**	**25**	Yes	Discard
Market squid** 82371	N/A	N/A	**50** ML	**50**	N/A	N/A	N/A	N/A	Yes	##
Minor target***	**50**	**50**	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Discard

* Sardine and Anchovy: if 25 mature ovaries are not sampled in the random 50, obtain more fish, cut open, and process any mature females (codes 2-4) until n=25; take 2 immature ovaries if present in random 50. All Females with Ovaries removed must have Otoliths removed & saved, this includes females not selected as a 'bin-fish'.

** Market squid: the 50 L&W should be a random mixture (both large and small sizes) of the catch

Market squid >75mm - individually bag and freeze 20 (>75mm) if available in the 50, discard the rest >75mm in the 50

Market squid <75mm - freeze group of 50 from the random sample or some may come from the remainder weight sample

*** Refer to Minor Target Species Chart (length frequency on fish only, except sharks do individual FL&W and take DNA)

Bin Processing Chart for Sardine and Anchovy (Otolith-DNA)

proportion **25** fish over the 12 bin sizes — Bin size 20 mm

Bin #	1	2	3	4	5	6	7	8	9	10	11	12
Bin start	40	51	71	91	111	131	151	171	191	211	231	>=251
Bin end	50	70	90	110	130	150	170	190	210	230	250	

Bin Processing Chart for Mackerels

proportion **25** fish over the 12 bin sizes — Bin size 50 mm

Bin #	1	2	3	4	5	6	7	8	9	10	11	12
Bin start	31	51	101	151	201	251	301	351	401	451	501	> =551
Bin end	50	100	150	200	250	300	350	400	450	500	550	

- record sex and maturity, take otoliths and a DNA sample for the 25 bin selected fish
- up to 10 ovaries (any visual maturity code) will be removed from the 25 bin selected fish (max n = 10; if no females in 25 then # ovary saved = 0)

Minor Target Species Chart

Scientific Name	Common Name	Itis tsn
FISH		
Alosa sapidissima	American shad	161702
Atherinopsis californiensis	jacksmelt	166012
Brama japonica	Pacific pomfret	170289
Clupea pallasii	Pacific herring	551209
Cololabis saira	Pacific saury	165609
Hypomesus pretiosus	surf smelt	162030
Mallotus villosus	capelin	162035
Merluccius productus (>110mm)	Pacific hake or whiting (>110mm)	164792
Mola mola	ocean sunfish	173414
Peprilus simillimus	Pacific butterfish or pompano	172565
Sarda chiliensis	Pacific bonito	172408
(identify species of adult rockfish)	(name) rockfish	code#
Sphyraena argentea	Pacific barracuda (CA barracuda)	170426
Thunnus alalunga	albacore	172419
INVERTEBRATES		
Phacellophora camtchatica	eggyolk jelly	51696
Aurelia	moon jellys unident	51700
Chrysoura	chrysoura jellyfish	51640
Dosidicus gigas	humbolt squid	82538
Onychoteuthis borealijaponicus	boreal clubhook squid	82442
SHARKS and RAYS		
Alopias vulpinus	thresher shark	159916
Prionace glauca	blue shark	160424
Squalus acanthias	spiny dogfish	160617
Torpedo californica	Pacific torpedo ray	160833
Dasyatis violacea	pelagic stingray	160950
Myliobatis california	bat ray	160981
Hydrolagus colliei	spotted ratfish	161015
ESA SPECIES Chart		
Oncorhynchus	Pacific salmon unidentified	161974
Oncorhynchus gorbuscha	pink salmon	161975
Oncorhynchus keta	chum salmon	161976
Oncorhynchus kisutch	Coho salmon	161977
Oncorhynchus nerka	sockeye salmon	161979
Oncorhynchus tshawytscha	chinook salmon (king salmon)	161980
Oncorhynchus mykiss	steelhead	161989
Thaleichthys pacificus	eulachon	162051

E. Marine Mammal and Sea Turtle Incidental Take and Sampling Documents
Point of Contact: Krista Catelani (revised **2/2/2017**)

All of the marine mammal sampling protocols are available for download by NOAA employees from the SWFSC EC/ITA Document Repository (https://drive.google.com/drive/folders/0BxKoDRm1QXQ5NVRMUjFBYVN0Tnc).

Specific documents mentioned in Section XX above:

PSIT-002.02 - Marine Mammal & Sea Turtle Sampling Protocol

(https://drive.google.com/a/noaa.gov/file/d/0BxKoDRm1QXQ5Unh0Q2o4eTJ3TmM/view?usp=sharing)

PSIT-004.02 SWFSC Marine Mammal Handling Protocol

(https://drive.google.com/a/noaa.gov/file/d/0BxKoDRm1QXQ5NXUxRVJYMEd2eWM/view?usp=sharing)

PSIT-005.01 PIRO Protected Species Handling Protocol

(https://drive.google.com/a/noaa.gov/file/d/0BxKoDRm1QXQ5VEJQZzlPOV9oTGM/view?usp=sharing)

List of Authorized Take Species for SWFSC Trawl Surveys

(https://drive.google.com/file/d/0BxKoDRm1QXQ5eDF2aEZfSHdOZzg/view)