FINAL Project Instruction

Date Submitted: June 1, 2012

Platform: NOAA Ship *R/V Oscar Dyson*

Project Number: DY-12-08, Legs 1, 2, 3 (OMAO)

Project Title: BASIS

Project Dates: August 16, 2012 to October 14, 2012

Prepared by: ____________________ Dated: __________________
Jim Murphy
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Approved by: ____________________ Dated: __________________
Edward V. Farley, Jr.
Program Manager
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Approved by: ____________________ Dated: __________________
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Director
Auke Bay Laboratories

Approved by: ________________________ Dated: ______________________
Captain Wade J. Blake, NOAA
Commanding Officer
Marine Operations Center - Pacific

I. Overview

A. Brief Summary and Project Period

Project Period: August 16 – October 15, 2012

This research area is focused on improving and reducing uncertainty in stock assessment models of important commercial fish species in the Bering Sea through the collection of fisheries oceanographic indices. Data from the survey will be used to test the hypothesis:

H_0: In the eastern Bering Sea YOY condition scaled by abundance is an accurate and precise predictor of walleye pollock recruitment and can be used for stock assessment purposes.

B. Service Level Agreements

Of the 51 DAS scheduled for this project, 51 DAS are funded by the program. This project is estimated to exhibit a ____ Operational Tempo.

Operational Tempo Rate (Low, Medium or High) is used for budgetary projections and will be completed by the ship or MOC A/P. Transit DAS to the Project's ports are to be included here as well and addressed throughout this document as a leg, though it (they) can be referred to as "Transit(s)" if no science is being collected during them.

C. Operating Area (include optional map/figure showing op area)

Southeastern Bering Sea (see Figure 1)

D. Summary of Objectives

Summary of Objectives: Fisheries (surface and midwater trawl) and oceanographic survey to:

(1) Describe the community structure, biomass, energetic status, diets, and biological composition of epi-pelagic nekton including Pacific salmon, Pacific cod, age-0 pollock, jellyfish, herring, capelin and sand lance;

(2) Collect target strength data and multi-frequency acoustic echo integration data using centerboard mounted transducers for use in estimates of relative abundance of epipelagic nekton.

(3) Compare and contrast pelagic and epi-pelagic fish communities and food web structure in the southeastern Bering Sea using surface and mid-water trawls;

(4) Collect electronic oceanographic data including CTD (Conductivity-temperature-depth) vertical profiles of temperature, salinity, light transmission, chlorophyll a fluorescence, dissolved oxygen, possibly pH, photosynthetic available radiation (PAR) and possibly nitrate concentration (Satlantic ISUS nitrate analyzer). Continuously (along-track) collect sea surface temperature, salinity, chlorophyll a fluorescence data and possibly nitrate concentration (Satlantic ISUS nitrate analyzer) and above surface PAR (Hobo PAR sensor and data logger);

(5) Collect biological oceanographic samples (water and plankton) at trawl stations; i.e. zoo- and ichthyoplankton data using a 20 and 65 cm bongo samplers (oblique tow with 150 µm and 505/335 µm nets, respectively to near bottom or 200 m), 25 cm Juday net (vertical tow with 150 micron net to near bottom or 100 m), nutrients, chl-a, dissolved oxygen, salinity, particulate organic carbon and possibly

alkalinity samples using Niskin bottles attached to the carousel housing the CTD. These samples are collected to yield environmental indices of the current status and trends in the Bering Sea ecosystem.

(6) Conduct beam trawls during nighttime hours for age 0 and age 1 flat- and demersal fishes. Conduct benthic sampling at each beam trawl station with a Van Veen benthic grab to characterize associated sediments and infaunal assemblages. Night operations also may include midwater trawls for target strength estimations.

(7) Bering Sea mooring (M2) may be retrieved during the end of Leg 3.

(8) PMEL and AFSC will conduct oceanographic sampling along the standard 70 m isobath transect, including the boxes in and around the 4 moorings (M2, M4, M5, M8) during Leg 2 of the survey

E. Participating Institutions

AFSC - Alaska Fisheries Science Center, Juneau, AK and Seattle, WA;

PMEL - Pacific Marine Environmental Laboratory, Seattle, WA

TINRO Center, Vladivostok, Russia;

UAF – University of Alaska Fairbanks

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

Sort the completed table by common name (in WORD: Click in the table, select Tab "Layout", select "Sort" (upper right), select "Date Aboard" and ensure "has header row" is checked .

Name (Last, First)	**Title**	**Date Aboard**	**Date Disembark**	**Gender**	**Affiliation**	**Nationality**
Murphy, Jim	Chief Scientist	8/16	9/2	M	AFSC	USA
Duffy-Anderson, Janet	Fish Res Biol	8/16	9/2	F	AFSC	USA
Cooper, Dan	Fish Res Biol	8/16	9/2	M	AFSC	USA
Proctor, Peter	Oceanographer	8/16	9/2	M	PMEL	USA
McKeever, Scott	Oceanographer	8/16	9/26	M	PMEL	USA
VanTulder, Florence	Oceanographer	8/16	9/2	F	AFSC	USA
McKelvey, Denise	Acoustician	8/16	9/2	F	AFSC	USA
Volkov, Anatoly	Fish Res Biol	8/16	9/25	M	TINRO	Russia
Kuznetsova, Natalia	Fish Res Biol	8/16	9/25	F	TINRO	Russia
HAMC Contract 1	Fish Res Biol	8/16	9/2		AFSC	USA
Moses, Aaron	UAF Intern	8/16	9/2	M	UAF	USA
HAMC Contract 2	Fish Res Biol	9/7	9/25		AFSC	USA
Eiler, John	Chief Scientist	9/7	9/25	M	AFSC	USA
Eisner, Lisa	Oceanographer	9/7	9/25	F	AFSC	USA
Wilson, Matt	Fish Res Biol	9/7	9/25	M	AFSC	USA
Jones, Darin	Acoustician	9/7	9/25	M	AFSC	USA
Harpold, Colleen	Oceanographer	9/7	9/25	F	AFSC	USA
Mordy, Calvin or Weissgarver	Nutrient chemist	9/7	9/25	M	PMEL	USA

Dewitt, Carol	Oceanographer	9/7	10/14	F or M	PMEL	USA
Gann, Jeanette	Chief Scientists	10/1	10/14	F	AFSC	USA
Jump, Chrissy	Fish Res Biol	10/1	10/14	F	AFSC	USA
Clark, Jay	Fish Res Biol	10/1	10/14	M	AFSC	USA
Floering, Bill	Oceanographer	10/1	10/14	M	PMEL	USA
Proctor, Peter	Oceanographer	10/1	10/14	M	PMEL	USA
Kondzela, Chris	Fish Res Biol	10/1	10/14	F	AFSC	USA
HAMC Contract 3		10/1	10/14		AFSC	USA
Auborn-Cook, Mary	Fish Res Biol	10/1	10/14	F		USA
TBD	Acoustician	10/1	10/14		AFSC	USA
Mullen, Shari	Fish Res Biol	10/1	10/14	F	AFSC	USA
Mordy, Calvin or Weissgarver	Nutrient chemist	10/1	10/14	M	PMEL	USA

G. Administrative

1. Points of Contacts:

Jim Murphy (Chief Scientist), 17109 Point Lena Loop Road, Juneau, AK, 99801, 907-789-6651, jim.murphy@noaa.gov

Janet Duffy-Anderson (Alternate), AFSC, 7600 Sand Point Way NE, Bldg 4, Seattle WA 98115, ph: 206-526-6465, Janet.Duffy-Anderson@noaa.gov

Jeff Napp, AFSC, 7600 Sand Point Way NE, Bldg 4, Seattle WA 98115, ph: 206-526-4148, Jeff.Napp@noaa.gov

Phyllis Stabeno, PMEL, 7600 Sand Point Way NE, Bldg 3, Seattle WA 98115, ph: 206-526-6453, Phyllis.Stabeno@noaa.gov

Chris Wilson, AFSC, 7600 Sand Point Way NE, Bldg 4, Seattle, WA 98115, ph:206-526-6435, chris.wilson@noaa.gov

2. Diplomatic Clearances

This project involves Marine Scientific Research in waters under the jurisdiction of _____. Diplomatic clearance has been requested.

3. Licenses and Permits

This project will be conducted under the Scientific Research Permit (U.S.) AND/OR Marine Mammal License (U.S.) AND/OR Foreign Fishing Vessel License (Canada) AND/OR Species at Risk Act permit (Canada) issued by ___________ (U.S. AND/OR foreign agency) on ______ (date) to ___________ State the name of the license holder--often but not always the Chief Scientist. There could be multiple permits/licenses. The Chief Scientist is responsible for obtaining and listing all permits as well as any identification numbers they contain.

This project will be conducted under a Scientific Research Permit issued by the Alaska Regional Office, National Marine Fisheries Service (Permit number ####-###), and a Fish Resource Permit issued by the State of Alaska (Permit number CF-##-###). The Chief Scientists will be included as an authorized participant on both permits.

II. Operations

A. Project Itinerary

Leg 1	
Aug 14	Embark scientists in Dutch Harbor, AK
Aug 15	Load Gear
Aug 16	Depart Dutch Harbor, AK at 10:00 for SE Bering Sea
Aug 17- Sep 1	Fish/Ocean survey in the SE Bering Sea
Sep 2	Arrive Dutch Harbor, AK at 09:00; disembark scientific party
Leg 2	
Sep 6	Embark scientists in Dutch Harbor, AK
Sep 7	Depart Dutch Harbor, AK at 09:00
Sep 8-24	Fish/Ocean survey in the SE Bering Sea
Sep 25	Arrive Dutch Harbor, AK at 09:00; disembark scientific party
Leg 3	
Sep 30	Embark scientists in Dutch Harbor, AK
Oct 1	Depart Dutch Harbor, AK at 09:00
Oct 2-11	Fish/Ocean survey in the SE Bering Sea
Oct 14	Arrive Kodiak, AK at 09:00; disembark scientific party
Oct 15	Scientists depart Kodiak, AK

B. Staging and Destaging

Scientific gear will be loaded onto the vessel in Dutch Harbor, AK. Scientific gear is located at OSI in Captains Bay. **Request DY to dock near OSI to expedite loading of scientific gear** on Aug 16. Most scientific gear will unloaded in Kodiak, AK. **Request DY carry one or more research nets to Seattle for annual maintenance as well as the AFSC FOCI equipment and biological samples..**

C. Operations to be Conducted

1. Underway Operations:

1A. Primary survey operations will be conducted during hours of 06:00 to 21:00; secondary operations (FOCI Night ops) will be conducted during night time (21:00 to 06:00). Therefore, we request 24 hour operations, with sufficient deck and survey support for all operations. Stations will be sampled using a systematic grid design with stations spaced every 30 minutes of Latitude and 1 degree of Longitude. The survey will cover the area from 160° W to 173° W at locations with water depths of at least 25 meters (Figure 1).

1B. Operations require that a Cantrawl rope trawl be loaded onto the net reel and second Cantrawl will be stored on board the vessel as backup gear. A pair of NETS five-meter alloy doors and spectra bridals will be used with the trawl. A second pair of NETS doors will be stored on board the vessel as backup gear. We request that the Chief Boatswain keep a trawl gear logbook to record all modifications made to trawl gear during the cruise. Stations within the eastern Bering Sea are at depths of ~ 25 m and greater. An average of 3 surface trawl hauls and 1or more mid-water trawl hauls per 20 hrs is anticipated. Surface trawl haul duration will be 30 minutes, beginning when the doors are fully deployed to ensure an adequate sample. Due to ship location of the Simrad FS-20 3rd wire net sounder, and past complications in using this sounder to successful surface trawl operations, the net sounder will **not** be used to document net dimensions (width and depth) during the 30 minute surface trawl. In place of the Simrad FS-20, an ITI sensor will be placed on the headrope and footrope of the surface trawl to collect data on net spread (vertical) and location in the water column. Mid-water trawl haul duration will vary depending on estimated abundance from acoustic echo signatures. The Simrad FS-20 net sounder **will** be used to document trawl dimensions during mid-water trawl operations. Biological data collected from each haul will include species composition by weight and number, sex composition, length frequencies, whole fish weight, maturities, salmon scales, and otoliths.

1C. Acoustic data will be collected during the entire survey to provide biomass estimates of age-0 and 1 pollock, Pacific cod, other forage fish, and euphausiids. Acoustic data will be collected continuously with a Simrad ER60 echo integration system incorporating centerboard-mounted transducers at 18, 38, 70, 120, and 200 kHz. The vessel must not operate other echo sounders or acoustic equipment that interferes with collection of scientific acoustic data. The bow thrusters, Doppler speed log and bridge Furuno depth sounder should all be secured, as they degrade the quality of acoustic data.

1D. At each surface trawl station, small fishes and zooplankton will be sampled using fine-mesh nets: 60 cm diameter bongo nets (oblique tow) with 505 (Net 1) and 335 (Net 2) micron nets, a 20 cm bongo array with 153 micron nets, a Juday net (vertical tow, multiple depth ranges) with a 168 micron net, and a CalVET net (vertical tow) with 53 µm nets. Zooplankton net tows will occur during daylight hours **but may also be requested during night time hours to assess euphausiid biomass and energetics.** The bongo and Juday net will be deployed on one of the oceanographic winches with conducting wire (using real time CTD data collected with an SBE19 or SBE 49). Plankton samples will be preserved in 5% buffered formalin. 60Bon Net 1 (505 mesh) will be preserved for zoo- and icthyoplankton and 60Bon Net 2 will be preserved for zooplankton at selected stations. 20 Bon Net 1 will be preserved for zooplankton, 20 Bon Net 2 will be discarded. Zooplankton tows will be to near-bottom (5-10 m from bottom) or 200 m (if bottom depths are > 200 m). CalVET nets are towed vertically from 60 m to the surface. Both nets of the CalVET are preserved and placed in the same jar. Note that the SBE 49 (SeaBird FastCat) is on order and may not arrive until Leg 2. Once it arrives, it should be used in place of the older SeaCat (SBE 19).

1E. CTD casts will be conducted at each surface trawl station and *ad-hoc* casts may be necessary to document changes in oceanographic characteristics during the survey. For each cast, instruments and 5 or 10 L Niskin bottles will be added to the ship's CTD carousel. Instruments added to the ship's SBE 911+ CTD include secondary TC sensors, a PAR spherical sensor (Biospherical Instruments QSP 2300), chl-a fluorometer with turbidity sensor (Wet Labs ECO FL-NTU), possibly an ISUS nitrate sensor with battery pack (Satlantic ISUS v3), beam transmissometer (Wet Labs C-star), two dissolved oxygen sensors (SBE 43), and possibly a pH meter. See fact sheets for all instruments. CTD casts will be to near-bottom (5-10 m from bottom) or 200 m (if bottom depths are > 200 m).

1F. We will collect along-track surface measurements of temperature, salinity, chlorophyll a fluorescence and possibly nitrate concentration with the ship's thermosalinograph (TSG) system (SBE-45, Wet Labs WetStar fluorometer) and an ISUS nitrate sensor.

1G. Water samples collected with Niskin bottles attached to the CTD will be sampled for chlorophyll a, nutrients, salinity, oxygen, particulate organic carbon and possibly alkalinity.

1H. Above surface PAR data will be continually recorded with a HoBo PAR sensor and data logger.

1I. We plan to begin primary operations at 06:30 each day unless otherwise agreed upon by the CO and chief scientist. Standard station activities include:

- CTD cast with Niskin water sample collection.
- Vertical Juday tow.
- Oblique bongo net tow (FOCI set-up, 20 & 60 cm bongo).
- Surface trawl (30 minutes once doors are fully deployed.)
- Mid-water trawl (1 or more net tows each day; location and duration determined at sea).

We expect activities and travel between stations to take 6 to 8 hours, depending on schedule for the mid-water trawl. Thus the following would be an example of a daily schedule. This schedule may be adjusted depending on time of sunrise and sunset:

Station	Time
1	06:30
2	13:00 or 15:00
3	21:00

One or more mid-water trawls will occur each day sometime after the first trawl station.

We plan for 2 scientific teams with 12 hour shifts each. It is likely that the first shift will begin on or around 06:00 am and end at 18:00 (BASIS DAY SHIFT) and the second shift will begin around 12:00 and end around 24:00 am (BASIS NIGHT SHIFT).

1J. FOCI NIGHT OPERATIONS (21:00 to 6:00)

Benthic grab

Sediment and soft-bottom benthic macroinvertebrates will be sampled using a van Veen benthic grab at selected stations within the path of the beam trawled area between the hours of 22:00 and 6:00 each night. The first grab will be collected at the last station occupied during the BASIS regular grid survey each day, and a second grab will occur at the next BASIS grid station prior to the commencement of regular BASIS operations each morning.

The grab is constructed of stainless steel and has a sampling capacity of 20 liters. Total weight without lead weights is 111 lbs, and is 198 lbs with 4 removable lead weights attached to the grab device, and 2 removable lead weights (30 lbs each) attached to the arms. Sampling depth can be 15-16 cm into the seafloor, depending on sediment properties. Some assistance in determining the best method of deployment and retrieval is requested from the ship (Bridge, Deck, Survey). On other ships, the grab is attached to a hydrowire and allowed to "free-fall" (60 m/minute) toward the seafloor. It is attached to the hydrowire using a shackle ball-bearing swivel. For safety, the hydrowire, swivel, and all shackles have a load capacity at least 3 times greater than the weight of a full sampler. The grab typically is allowed to "free-fall" toward the seafloor, but impacts the sediment at no more than 80 m/min (1.33 m/sec or 4.4 ft/sec). Upon impact with and penetration of the seafloor, the hydrowire slacks, the jaws close, and the sample is collected. The grab is then retrieved at a constant speed. After the sediment and macroinvertebrate samples have been collected, the grab should be thoroughly rinsed so that the next sample is not contaminated.

A MOA mark should be made when the grab hits the seafloor (At depth).

3-m Beam Trawl

Immediately after each benthic grab, a beam trawl will be conducted. A modified plumb-staff, 3-m beam trawl will be deployed to collect juvenile flatfishes and demersal gadids from the seafloor between the hours of 22:00 and 6:00 each night. The first beam trawl will be collected at the last station occupied during the BASIS regular grid survey each day, and a second beam trawl will occur at the next BASIS grid station prior to the commencement of regular BASIS operations each morning. Additional stations may be occupied dependent on time and approval of the CO.

We request assistance from the Bridge, Survey, and Deck Dept with deployment, fishing/monitoring, and retrieval of beam trawls. We will use the ITI (trawl eye) system to monitor depth of the trawl in real time. Assistance from the Bridge and Deck department with ITI (trawl eye) is requested. A back-up Scanmar system may be brought by the scientific party.

Marks should be made at Surface (in), EQ, HB, and Surface (out).

Details for how the catch is to be processed: flatfishes, Pacific cod and walleye pollock are the priority for catch processing, other fishes will be sorted to the finest taxonomic level practical and then will be enumerated and weighed and the discarded (but see Special Projects).

Upon retrieval of trawl to the deck, contents will be emptied into the small plastic swimming pool and photographed for associated benthic fauna and substrata. Flatfish juveniles, walleye pollock, and Pacific cod are to be sorted to species, and then counted, weighed, and lengthed. Other species will be sorted into broader taxonomic categories, enumerated, and weighed. If catch of any one target species is very high (more than 50 individuals of one species), a subsample may be taken for counting and weighing, and the remainder of the sample may be weighed and frozen or discarded. After counting and weighing, the fish (age-0 walleye pollock, age-0 Pacific cod, age-0 and age-1 yellowfin sole, and age-0 individuals of all other flatfish species) will be put into individual freezer bags (1 bag per species) and put in the -80 C freezer in the rough lab. After 24 hours, bags of frozen fish may be transferred to the (-20 F, slime lab freezer).

On occasion, additional stations may be added requiring participation of the deck crew. These may occur between the hours of 21:00 and 06:00. These will include collection of target strength data, additional trawling (midwater trawl hauls), and other **requested special scientific projects.**

1K. The Scientific Computing System (SCS) will be configured to log data from a large array of sensors during the cruise including data from the thermosalinograph, CTD casts, weather data (particularly above surface PAR or other light measurements) and wind speed and direction), etc.

1.L. 70-m isobath and mooring stations (end of Leg 2). This portion of the cruise will serve to continue a long-term time series of observations describing the physical and biological properties of the Bering Sea shelf. Information will be collected through, CTD casts and water sampling, underway shipboard measurements and plankton tows along the 70m isobath and at stations around the moorings. Activities: CTD - 70 m isobaths (chlor 0,10,20,30,40,50 m; nut 0,10,20,30,40,50,60 m). Stations are from N to S. A CTD cast will be the first operation at each station. At every other station along the isobath, a bongo tow will occur. When at the stations around or at each mooring, both a CTD and bongo will be done and when at the mooring stations triplicate CalVET tows will be completed as the last operation.

1.M. Mooring Operations (Leg 3). Prior to the recovery of the mooring, calibration CTDs with nutrient and chlorophyll samples will be completed approximately 0.5 miles from the mooring site. At site BS-2, we will recover 1 subsurface and 1 surface mooring.

D. Dive Plan

Dive plans can be displayed here or a reference such as the following can be used.
The Dive Plans encompassing all legs of ##-##-## are presented in Appendix #.

E. Applicable Restrictions

Conditions which preclude normal operations: (list restrictions such as poor weather conditions, equipment failure, safety concerns, unforeseen circumstances, as well as mitigation strategies that might be used).

III. Equipment (Hazardous materials are not to be listed here. They should be included in Hazardous Materials Section.)

A. Equipment and Capabilities Provided by the Ship (itemized)

1. Acoustic Equipment
    - GPS with NEMA 183 to ER60 (2)
    - 50/200 kHz ES60 Bridge sounder
    - Furuno FE-700 fathometer
    - Acoustic echosounders (5)
2. Trawling Equipment
    - 3rd wire FS-70 net sonar with winch and accessories (2)
    - Simrad ITI net mensuration system (2)
    - Furuno CN24-40 headrope transducer
    - Stern trawl capabilities for can and beam trawls
3. Oceanographic Equipment
    - Both starboard oceanographic winches with conducting cable, slip rings and blocks. Forward winch terminated for CTD/rosette; aft winch terminated for SeaCat/FastCat.
    - Seabird SBE 911+CTD System
    - Seabird SBE19+CTD and PDIM for real time data on zooplankton tows
    - SBE45 Thermosalinograph with fluorometer
    - Power source for ISUS
    - Wire speed indicators and readout for both hydrographic winches visible in Dry Lab or where SEACAT operations occur
    - Weather instr. For above surface PAR, wind speed/direction
    - Ship's crane and A-frame for recovering moorings
4. Biological Sampling Equipment
    - Fish lab conveyor system
    - Catch sorting and weighing table
    - Marrel M60 60kg scale (2)
    - Marrel M60 6kg scale (2)
    - Elect. Fish meas. Board (2)
5. Computing equipment
    - Scientific Computing System
    - Fisheries Scientific Computer System
6. Sample storage equipment
    - Supercold freezer (-80C)
    - Walk in freezer (-10C)
    - Stand up freezer (-20C)
    - Hazmat storage cabinets

7. Laboratory and exterior working space

- Use of Pentium PC in Dry and/or Computer Lab for data analysis,
- Scientific Computer System (SCS)
- Video monitors in Dry, Chemistry, and Wet labs for viewing SCS and Electronic MOA output
- Laboratory space with exhaust hood, sink, lab tables, and storage space
- Sea-water hoses and spray nozzles to wash nets (quarterdeck and aft deck),
- Adequate deck lighting for night-time operations,
- Navigational equipment including GPS and radar,
- Safety harnesses for working on starboard sampling station/hero platform and fantail
- Ship's crane(s) used for loading and/or deploying gear and supplies

B. Equipment and Capabilities Provided by the Scientists (itemized)

1. Acoustic Equipment (500lbs)
2. Trawling Equipment (11,000lbs)
    - Cantrawl mid water trawl w/accessories (e.g., 2.0cm mesh liners,) (2); 7,000lbs
    - Spectra bridles (60 m); 300lbs
    - NETS 5.0m doors with accessories (2 sets); 3,000lbs
    - Spare webbing & twine
    - Spare hardware
    - Three 3-m beam trawls,
    - All accessories to make trawls fishable and spare web if available

3. Oceanographic Equipment (1,500lbs)
    - Biospherical !SP2300 PAR sensor
    - Wet labs ECO Fluorometer and turbidity sensor (FL-NTU)
    - Wet labs C-start Transmissometer
    - SBE 43 dissolved oxygen sensor (2)
    - pH sensor
    - Secondary TC sensors for SBE 911+
    - SBE 19Plus SeaCat (all Legs)
    - SBE 49 FastCat (Legs 2 & 3)
    - Niskin Bottles 10 L (need 10 total+ spares)
    - Satlantic ISUS Nitrate Analyzer w/battery, cabling, power source (backup)
    - Filter racks and pumps (3)
    - Nutrient auto-analyzer and associated equipment (to be set up on center island in chem. lab for on-board nutrient analysis)
    - Turner 700 fluorometer, sonicator, centrifuge (for on-board chla analysis)
    - Microscopes (compound, dissecting) (3)
    - 20 & 60 cm Bongo frames, 505/335/153 mesh nets, cod ends, weights, and flowmeters
    - CalVET frame and 53 µm mesh nets, cod ends, and flow meters
    - Juday net
    - van Veen Benthic Grab with bucket and arm weights
    - Two wire-angle indicators

- Biological supplies (misc.) *

4. Biological Sampling Equipment (500lbs)
    - Dynamometer
    - Marel M60 60 kg scale (2)
    - Marel M60 6 kg scale (2)
    - Mechanical platform scale (2)
    - Fish baskets (30)
5. Miscellaneous scientific sampling and processing equipment
    - Fish baskets (12, MACE),
    - Dishpans (10, MACE),
    - 5-gal buckets (5),
    - Wading pools (small and large),
    - Two length board and strips for adult fish,
    - Three length boards for small fish,
    - SBE-39 temperature and depth sensor (MACE) for beam trawl
    - Triple-beam balance for small fish weights,
    - 1000 Zip-loc bags (12"),
    - Sieves, jar holder, funnels, squirt bottles,
    - 30 cases of 32-oz jars, closures, and labels,
    - 10 flowmeters, calibration data, hardware for attaching and maintaining them,
    - Preservative-dispenser equipment,
    - Hazardous materials spill kit, and
    - Spare wire angle indicator
6. Computing equipment (50lbs)
    - IBM compatibles w/XP Op.System*
    - Printers*
    - Laptops
    - Cruise Operations Database (COD) software and forms
7. Chemical supplies
    - Ethanol Liter (L) (2)- this was for fish, do we still need this?
    - Formalin (5L) (4 containers)
    - Undenatured ethanol (500ml) (4)-this was for fish, do we still need this?
    - Acetone (250ml)
    - HCl (1 N, <10%) (L)
    - Formalin spill kit
    - Sodium borate (borax) (L)
    - Chemicals for nutrient analysis (**need info from Cal Mordy**)
    - Chemicals for dissolved oxygen fixation and possibly analysis (**need info from Cal Mordy**)
    - Chemicals for alkalinity sample fixation

IV. Hazardous Materials

A. Policy and Compliance

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

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

- A list of hazardous materials by name and anticipated quantity
- A list of neutralizing agents, buffers, and/or absorbents required for these hazardous materials, if they are spilled
- A chemical hygiene plan.

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

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

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

Chemical	CAS Number	Respondee	Org.	Qty	H	F	R	Storage Color Code	Hazard Class	Packing Group Number	UN	Reportable Quantity
Formaldehyde 37%	50-00-0	Chief Scientist	AFSC	3, 20-L	3	2	2	Flammable	3 & 8	III	1198	100 LBS
Ethyl Alcohol 100% Genetic Grade	64-17-5	Chief Scientist	AFSC	2, 4-L	2	3	1	Flammable	3	II, III	1170	2L
Sodium Borate Solution, Saturated	mix	Chief Scientist	AFSC	20-L	1	0	0	General	Not regulated	N/A		

B. Radioactive Isotopes

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

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

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

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

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

C. Inventory (itemized)

Sort the completed table by common name (in WORD: Click in the table, select Tab “Layout”, select “Sort” (upper right), select “Common Name”and ensure “has header row” is checked .

Common Name	**Concentration**	**Amount**	**Notes**

V. Additional Projects

A. Supplementary (“Piggyback”) Projects

1. Nutrient and dissolved oxygen sample analysis will be conducted on-board ship by scientists from P MEL (e.g. Calvin Mordy).

Chemical	CAS Number	Respondee	Org.	Qty	H	F	R	Storage Color Code	Hazard Class	Packing Group Number	UN	Reportable Quantity
Ammonium Chloride	12125-02-9	Calvin Mordy or Peter Proctor	PMEL/FOCI	3	1	0	0	Orange	9	III	3077	2270 kg
Ammonium molybdate(VI) tetrahydrate	12054-85-2	Calvin Mordy or Peter Proctor	PMEL/FOCI	291.6	2	0	0	Gray	---	---	---	
Ammonium molybdate(VI) tetrahydrate	12054-85-2	Calvin Mordy or Peter Proctor	PMEL/FOCI	270	2	0	0	Gray	---	---	---	
Brij-35, 21% solution	009002-92-0	Calvin Mordy or Peter Proctor	PMEL/FOCI	125	1	0	0		---	---	---	
Cadmium	7440-43-9	Calvin Mordy or Peter Proctor	PMEL/FOCI	30	2	0	0		---	---	---	4.54 kg
Clorox regular-bleach	7681-52-9	Calvin Mordy or Peter Proctor	PMEL/FOCI	1000								45.4 kg
Copper (II) Sulfate Anhydrous	7758-98-7	Calvin Mordy or Peter Proctor	PMEL/FOCI	15	2	0	0	Blue	6.1	III	3288	
Dodecyl Sodium Salt	151-21-3	Calvin Mordy or Peter Proctor	PMEL/FOCI	30	2	3	0	Red	4.1	III	1325	
DOWFAX 2A1 Solution Surfactant	119345-04-09 7757-82-6	Calvin Mordy or Peter Proctor	PMEL/FOCI	125	2	1	0		9		3082	
FL-70 Detergent, Biodegradable	64-02-8	Calvin Mordy or Peter Proctor	PMEL/FOCI	60	2	1	0	Gray	N/R	N/R	N/R	
Hydrazine hemisulfate salt	13464-80-7	Calvin Mordy or Peter Proctor	PMEL/FOCI	96	4	0	0		8 (6.1)	III	2923	4.54 kg
Hydrochloric acid 33-40% solution	7647-01-0	Calvin Mordy or Peter Proctor	PMEL/FOCI	500	3	0	1	White	8	II	1789	2270 kg
Imidazole	288-32-4	Calvin Mordy or Peter Proctor	PMEL/FOCI	272	3	0	0		8 (6.1)	III	2923	
L-(+)-Tartaric acid	87-69-4	Calvin Mordy or Peter Proctor	PMEL/FOCI	3000	2	1	0		N/R	N/R	N/R	
N-(1-Naphthyl)ethylenediamine dihydrochloride monomethanolate	1465-25-4	Calvin Mordy or Peter Proctor	PMEL/FOCI	20					N/R	N/R	N/R	
Phenol Liquid	108-95-2	Calvin Mordy or Peter Proctor	PMEL/FOCI	200	4	2	0		6.1	II	1671	454 kg
Potassium Nitrate	7757-79-1	Calvin Mordy or Peter Proctor	PMEL/FOCI	3				Yellow	5.1	III	1486	
Potassium phosphate monobasic	7778-	Calvin	PME	3	0	0	0	Gray	N/R	N/R	N/R	

	77-0	Mordy or Peter Proctor	L/FO CI									
Sodium Citrate Dihydrate	6132-04-3	Calvin Mordy or Peter Proctor	PME L/FO CI	3360	1	0	0	Gray	N/R	N/R	N/R	
Sodium Hydroxide Solution 10 N	1310-73-2	Calvin Mordy or Peter Proctor	PME L/FO CI	120	3	0	1	White	8	II	182 4	454 kg
Sodium Nitrite	7632-00-0	Calvin Mordy or Peter Proctor	PME L/FO CI	3	2	0	1		5.1(6. 1)	III	150 0	45.4 kg
Sodium Nitroferricyanide Dihydrate (Crystalline/Certified ACS)	13755 -38-9	Calvin Mordy or Peter Proctor	PME L/FO CI	3.5	3	1	1		6.1	II	158 8	
Sodium silicofluoride	16893 -85-9	Calvin Mordy or Peter Proctor	PME L/FO CI	6.5	2	0	0		6.1	III	267 4	
Sulfanilimide	64-73-1	Calvin Mordy or Peter Proctor	PME L/FO CI	230	2	0	0		N/R	N/R	N/R	
Sulfuric Acid 90-98%	7664-93-9	Calvin Mordy or Peter Proctor	PME L/FO CI	500	2	0	2	White	8	II	183 0	454 kg
Tin(II) chloride dihydrate	10025 -69-1	Calvin Mordy or Peter Proctor	PME L/FO CI	300	3	0	1		8	III	175 9	

Oxygen Measurements

The procedure is based on that of Carpenter. Winkler titrations will be conducted according to WOCE/CLIVAR protocols, and described in detail in GO_SHIP Repeat Hydrography Manual, Report number 14, ICPO Publication Series No. 134, Version 1, 2010. On each cast, the number of samples and the depths sampled will depend on the oxygen profile from the CTD. In deep water, samples will be collected at every depth below 100 m. On the shelf, samples will usually be collected in the upper layer on one station and in the bottom layer on the next station. End point determinations of the Winker titration will be determined by an amperometric method. Thiosulfate will be standardized for each batch of sample titrations, and blanks will be measured periodically during the cruise. Side by side comparison of this method with the photometric method show differences 0.06% or +/- 0.15 umol/kg. The automated amperometric titrator was designed by Chris Langdon at RSMAS in Miami.

Chemical	CAS Number	Respondee	Org.	Qty	H	F	R	Storage Color Code	Hazard Class	Packing Group Number	UN	Reportable Quantity
Manganese(II) Chloride tetrahydrate	13446-34-9	Calvin Mordy or Peter Proctor	PMEL/ FOCI	500	2	1	1		N/R	N/R	N/R	
Sodium Iodide, Anhydrous	7681-82-5	Calvin Mordy or Peter Proctor	PMEL/ FOCI	500	1	0	1		N/R	N/R	N/R	
Sodium	10102-	Calvin Mordy	PMEL/	500	3	0	1		N/R	N/R	N/R	

Thiosulfate pentahydrate	17-7	or Peter Proctor	FOCI									
Potassium Iodate 0.1N solution	64-02-8	Calvin Mordy or Peter Proctor	PMEL/ FOCI	500	1	0	0		N/R	N/R	N/R	

B. NOAA Fleet Ancillary Projects

VI. Disposition of Data and Reports

A. Data Responsibilities

B. Pre and Post Project Meeting

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

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

C. Ship Operation Evaluation Report

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

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

VII. Miscellaneous

A. Meals and Berthing

Meals and berthing are required for up to 14 scientists. Meals will be served 3 times daily beginning one hour before scheduled departure, extending throughout the project, and ending two hours after the termination of the project. Since the watch schedule is split between day and night, the night watch may often miss daytime meals and will require adequate food and beverages (for example a variety of sandwich items, cheeses, fruit, milk, juices) during what are not typically meal hours. Special dietary requirements for scientific participants will be made available to the ship's command at least seven days prior to the survey.

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

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

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

B. Medical Forms and Emergency Contacts

The NOAA Health Services Questionnaire (NHSQ, Revised: 02 JAN 2012) must be completed in advance by each participating scientist. The NHSQ can be obtained from the Chief Scientist or the NOAA website http://www.corporateservices.noaa.gov/~noaaforms/eforms/nf57-10-01.pdf. The completed form should be sent to the Regional Director of Health Services at Marine Operations Center. The participant can mail, fax, or scan the form into an email using the contact information below. The NHSQ should reach the Health Services Office no later than 4 weeks prior to the cruise to allow time for the participant to obtain and submit additional information that health services might require before clearance to sail can be granted. Please contact MOC Health Services with any questions regarding eligibility or completion of the NHSQ. Be sure to include proof of tuberculosis (TB) testing, sign and date the form, and indicate the ship or ships the participant will be sailing on. The participant will receive an email notice when medically cleared to sail if a legible email address is provided on the NHSQ.

Contact information: Include only the Pacific OR Atlantic Office as applicable.

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

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

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

C. Shipboard Safety

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

The ship does not provide steel-toed boots. Hard hats are also required when working with suspended loads. Work vests are required when working near open railings and during small boat launch and recovery operations. Hard hats and work vests will be provided by the ship when required.

D. Communications

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

E. IT Security

Any computer that will be hooked into the ship's network must comply with the *NMAO Fleet IT Security Policy* 1.1 (November 4, 2005) prior to establishing a direct connection to the NOAA WAN. Requirements include, but are not limited to:

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

Completion of these requirements prior to boarding the ship is 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 (FRNS) to submit requests for access to NOAA facilities and ships. The Departmental Sponsor/NOAA (DSN) is responsible for obtaining clearances and export licenses and for providing escorts required by the NAO. DSNs should consult with their designated NMFS Deemed Exports point of contact to assist with the process.

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

Responsibilities of the Chief Scientist:

1. Provide the Commanding Officer with the e-mail generated by the FRNS granting approval for the foreign national guest's visit. This e-mail will identify the guest's DSN and will serve as evidence that the requirements of NAO 207-12 have been complied with.

2. Escorts – The Chief Scientist is responsible to provide escorts to comply with NAO 207-12 Section 5.10, or as required by the vessel's DOC/OSY Regional Security Officer.
3. Ensure all non-foreign national members of the scientific party receive the briefing on Espionage Indicators (NAO 207-12 Appendix A) at least annually or as required by the servicing Regional Security Officer.
4. Export Control - *The NEFSC currently neither possesses nor utilizes technologies that are subject to Export Administration Regulations (EAR).*

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

Responsibilities of the Commanding Officer:

1. Ensure only those foreign nationals with DOC/OSY clearance are granted access.
2. Deny access to OMAO platforms and facilities by foreign nationals from countries controlled for anti-terrorism (AT) reasons and individuals from Cuba or Iran without written NMAO approval and compliance with export and sanction regulations.
3. Ensure foreign national access is permitted only if unlicensed deemed export is not likely to occur.
4. Ensure receipt from the Chief Scientist or the DSN of the FRNS e-mail granting approval for the foreign national guest's visit.
5. Ensure Foreign Port Officials, e.g., Pilots, immigration officials, receive escorted access in accordance with maritime custom to facilitate the vessel's visit to foreign ports.
6. Export Control - 8 weeks in advance of the cruise, provide the Chief Scientist with a current inventory of OMAO controlled technology onboard the vessel and a copy of the vessel Technology Access Control Plan (TACP). Also notify the Chief Scientist of any OMAO-sponsored foreign nationals that will be onboard while program equipment is aboard so that the Chief Scientist can take steps to prevent unlicensed export of Program controlled technology. The Commanding Officer and the Chief Scientist will work together to implement any access controls necessary to ensure no unlicensed export occurs of any controlled technology onboard regardless of ownership.
7. Ensure all OMAO personnel onboard receive the briefing on Espionage Indicators (NAO 207-12 Appendix A) at least annually or as required by the servicing Regional Security Officer.

Responsibilities of the Foreign National Sponsor:

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

Appendices (all that apply)

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

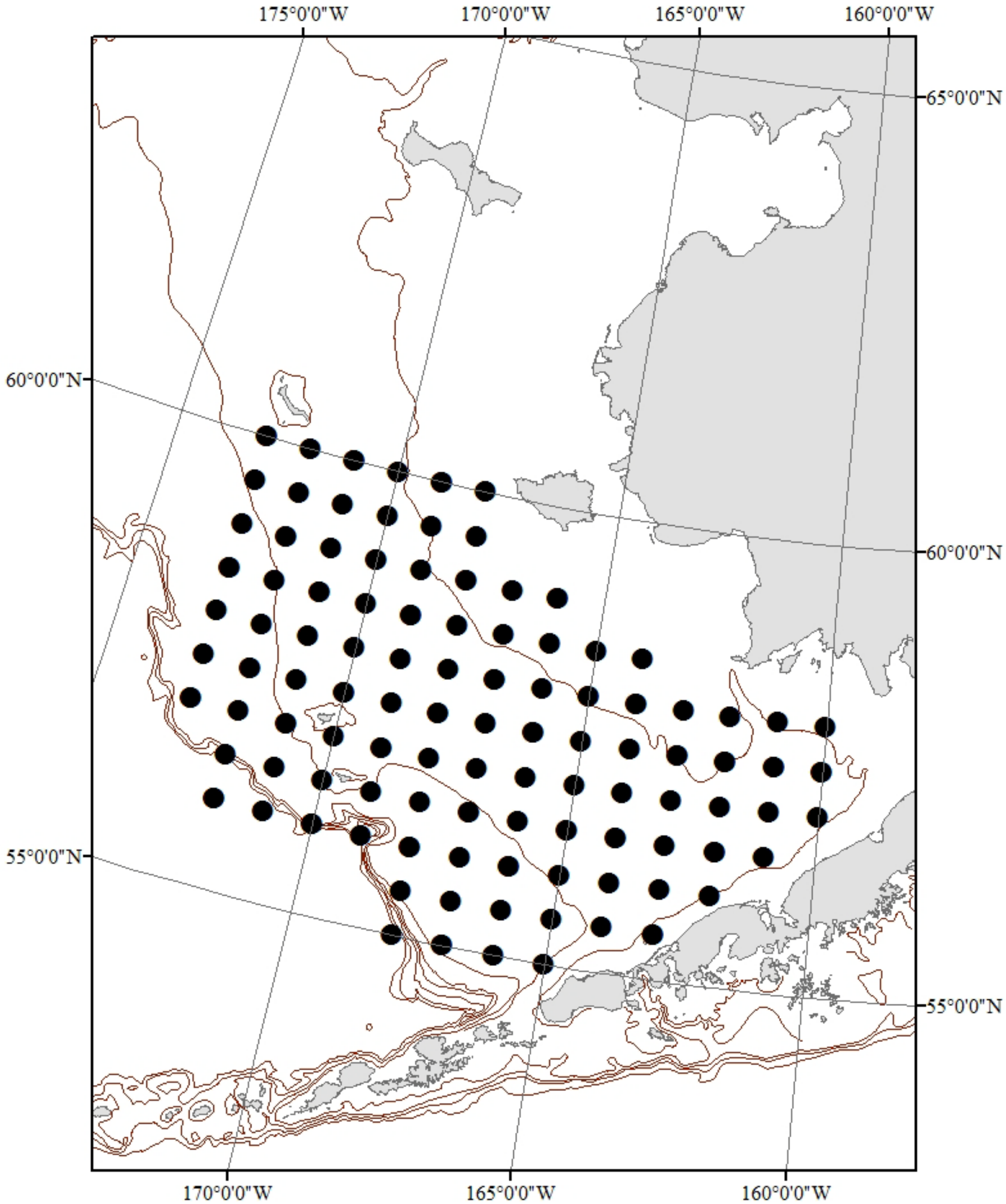

Figure 1. Proposed survey stations (east of black line) for the BASIS research cruise along the eastern Bering Sea, August 16 to October 14, 2012 on board the R/V *Oscar Dyson*.

2. Table 1. Station/Waypoint List (coordinates in Latitude, Longitude: degree-minutes) for BASIS along with effective (Eff.) days at sea (those that actually apply to sampling, excludes transit).

Leg 1

Latitude	Longitude	Station ID	Date	Eff. Days at Sea
55	-165	1	17-Aug	1
55.5	-165	2	17-Aug	
55.5	-164	3	17-Aug	
55.5	-163	4	18-Aug	2
56	-163	5	18-Aug	
56	-162	6	18-Aug	
56.5	-162	7	19-Aug	3
56.5	-161	8	19-Aug	
57	-161	9	19-Aug	
57	-160	10	20-Aug	4
57.5	-160	11	20-Aug	
58	-160	12	20-Aug	
57.5	-161	13	21-Aug	5
58	-161	14	21-Aug	
57	-162	15	21-Aug	
57.5	-162	16	22-Aug	6
58	-162	17	22-Aug	
58	-163	18	22-Aug	
57.5	-163	19	23-Aug	7
57	-163	20	23-Aug	
56.5	-163	21	23-Aug	

Latitude	Longitude	Station ID	Date	Eff. Days at Sea
56	-164	22	24-Aug	8
56.5	-164	23	24-Aug	
57	-164	24	24-Aug	
57.5	-164	25	25-Aug	9
58	-164	26	25-Aug	
58.5	-164	27	25-Aug	
58.5	-165	28	26-Aug	10
58	-165	29	26-Aug	
57.5	-165	30	26-Aug	
57	-165	31	27-Aug	11
56.5	-165	32	27-Aug	
56	-165	33	27-Aug	
55	-166	34	28-Aug	12
55.5	-166	35	28-Aug	
56	-166	36	28-Aug	
56.5	-166	37	29-Aug	13
57	-166	38	29-Aug	
57.5	-166	39	29-Aug	
58	-166	40	30-Aug	14
58.5	-166	41	30-Aug	
59	-166	42	30-Aug	
59	-167	43	31-Aug	15
58.5	-167	44	31-Aug	
58	-167	45	31-Aug	

Latitude	Longitude	Station ID	Date	Eff. Days at Sea
57.5	-167	46	1-Sep	16
57	-167	47	1-Sep	
56.5	-167	48	1-Sep	

Leg 2

Latitude	Longitude	Station ID	Date	Eff. Days at Sea
55	-167	49	8-Sep	1
55.5	-167	50	8-Sep	
56	-167	51	8-Sep	
55	-168	52	9-Sep	2
55.5	-168	53	9-Sep	
56	-168	54	9-Sep	
56.5	-168	55	10-Sep	3
57	-168	56	10-Sep	
57.5	-168	57	10-Sep	
58	-168	58	11-Sep	4
58.5	-168	59	11-Sep	
59	-168	60	11-Sep	
59.5	-168	61	12-Sep	5
60	-168	62	12-Sep	
60	-169	63	12-Sep	
59.5	-169	64	13-Sep	6
59	-169	65	13-Sep	
58.5	-169	66	13-Sep	

Latitude	Longitude	Station ID	Date	Eff. Days at Sea
58	-169	67	14-Sep	7
57.5	-169	68	14-Sep	
57	-169	69	14-Sep	
56.5	-169	70	15-Sep	8
56	-169	71	15-Sep	
56	-170	72	15-Sep	
56.5	-170	73	16-Sep	9
57	-170	74	16-Sep	
57.5	-170	75	16-Sep	
58	-170	76	17-Sep	10
58.5	-170	77	17-Sep	
59	-170	78	17-Sep	
59.5	-170	79	18-Sep	11
60	-170	80	18-Sep	
60	-171	81	18-Sep	
59.5	-171	82	19-Sep	12
59	-171	83	19-Sep	
58.5	-171	84	19-Sep	
58	-171	85	20-Sep	13
57.5	-171	86	20-Sep	
57	-171	87	20-Sep	

Leg 3

Latitude	Longitude	Station ID	Date	Eff. Days at Sea
56.5	-171	88	2-Oct	1
56	-171	89	2-Oct	
56	-172	100	2-Oct	
56.5	-172	101	3-Oct	2
57	-172	102	3-Oct	
57.5	-172	103	3-Oct	
58	-172	104	4-Oct	3
58.5	-172	105	4-Oct	
59	-172	106	4-Oct	
59.5	-172	107	5-Oct	4
60	-172	108	5-Oct	
60	-173	109	5-Oct	
59.5	-173	110	6-Oct	5
59	-173	111	6-Oct	
58.5	-173	112	6-Oct	
58	-173	113	7-Oct	6
57.5	-173	114	7-Oct	
57	-173	115	7-Oct	

Table 2. Latitude and Longitude for 70-m isobath oceanographic transect.

Station	Operation	Latitude			Longitude		
		Deg	Min		Deg	Min	
M8-N	CTD/BON	62	25.300	N	174	42.000	W
M8-W	CTD/BON	62	12.000	N	175	12.000	W
M8	CTD/BON	62	12.000	N	174	45.000	W
M8	3 CalVETs	62	12.000	N	174	45.000	W
M8-E/SL12a	CTD/BON	62	12.000	N	174	18.000	W
M8-S	CTD/BON	61	58.500	N	174	37.020	W
70M56	CTD	62	1.590	N	174	39.520	W
70M55	CTD/BON	61	56.600	N	174	21.850	W
70M54	CTD	61	51.730	N	174	5.656	W
70M53	CTD/BON	61	43.640	N	173	51.280	W
70M52	CTD	61	33.610	N	173	42.730	W
70M51	CTD/BON	61	24.640	N	173	44.170	W
70M50	CTD	61	14.990	N	173	44.450	W
70M49	CTD/BON	61	3.940	N	173	49.760	W
70M48	CTD	60	54.440	N	173	49.480	W
70M47	CTD/BON	60	44.330	N	173	38.880	W
70M46	CTD	60	34.310	N	173	38.370	W
70M45	CTD/BON	60	25.500	N	173	35.500	W
70M44	CTD	60	15.100	N	173	31.300	W
70M43	CTD/BON	60	6.030	N	173	19.000	W
70M42	CTD	60	2.230	N	173	0.390	W
70M41	CTD/BON	59	58.690	N	172	44.770	W
70M40	CTD	59	54.690	N	172	26.110	W
M5-N	CTD/BON	60	4.500	N	172	0.000	W
M5-W	CTD/BON	59	53.880	N	172	10.000	W
70m38M5	CTD/BON	59	54.580	N	171	42.460	W
70m38/M5	3 CalVETs	59	53.500	N	171	42.660	W
M5-E	CTD/BON	59	53.880	N	171	15.500	W
M5-S	CTD/BON	59	42.000	N	171	30.000	W
70M37	CTD	59	46.620	N	171	26.980	W
70M36	CTD/BON	59	42.930	N	171	8.390	W
70M35	CTD	59	35.700	N	170	55.370	W
70M34	CTD/BON	59	26.140	N	170	54.360	W
70M33	CTD	59	20.120	N	170	39.350	W
70M32	CTD/BON	59	14.820	N	170	24.730	W
70M31	CTD	59	6.410	N	170	14.810	W
70M30	CTD/BON	58	56.900	N	170	19.640	W
70M29	CTD	58	46.460	N	170	17.620	W

70M28	CTD/BON	58	37.020	N	170	16.530	W
70M27	CTD	58	26.770	N	170	11.140	W
70M26	CTD/BON	58	16.920	N	170	5.680	W
70M25	CTD	58	8.830	N	169	55.090	W
70M24	CTD/BON	58	2.530	N	169	40.350	W
70M23	CTD	57	54.420	N	169	30.000	W
M4-N	CTD/BON	57	55.000	N	169	0.000	W
M4-W	CTD/BON	57	50.00	N	169	12.00	W
70M21/M4	CTD/BON	57	50.000	N	168	53.201	W
70M21/M4	3 CalVETs	57	50.000	N	168	53.201	W
M4-E	CTD/BON	57	46.000	N	168	40.000	W
M4-S	CTD/BON	57	36.000	N	168	42.000	W
70M18	CTD	57	31.440	N	168	36.810	W
70M17	CTD/BON	57	31.210	N	168	18.240	W
70M16	CTD	57	30.040	N	167	59.170	W
70M15	CTD/BON	57	30.070	N	167	39.910	W
70M14	CTD	57	29.960	N	167	20.650	W
70M13	CTD/BON	57	31.340	N	167	2.290	W
70M12	CTD	57	25.720	N	166	48.720	W
70M11	CTD/BON	57	26.280	N	166	30.750	W
70M10	CTD	57	19.340	N	166	19.580	W
70M9	CTD/BON	57	19.260	N	166	0.670	W
70M8	CTD	57	15.730	N	165	44.830	W
70M7	CTD/BON	57	6.400	N	165	36.800	W
70M6	CTD	56	59.610	N	165	22.650	W
70M5	CTD/BON	56	51.540	N	165	7.370	W
70M4	CTD	56	54.560	N	164	49.650	W
70M3	CTD/BON	56	48.500	N	164	35.000	W
M2-N	CTD/BON	57	1.000	N	164	13.000	W
M2-W	CTD/BON	56	46.000	N	164	20.000	W
70M2/M2	CTD/BON	56	54.000	N	164	3.200	W
70M2/M2	3 CalVETs	56	54.000	N	164	3.200	W
M2-E	CTD/BON	56	56.500	N	163	50.010	W
M2-S	CTD/BON	56	40.000	N	163	52.000	W