



**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
Alaska Fisheries Science Center  
Resource Assessment and Conservation Engineering  
7600 Sand Point Way NE  
Seattle, WA 98115

## Final Cruise Instructions

**Date Submitted:** April 2012  
**Platform:** NOAA Ship *Oscar Dyson*  
**Cruise Number:** DY-12-05/06  
**Project Title:** FOCI Spring Ichthyoplankton and Larval Walleye Pollock  
Assessment Survey – Bering Sea  
**Cruise Dates:** May 15 – June 1, 2012

Prepared by: \_\_\_\_\_  
Chief Scientist Name  
Title  
Affiliation

Dated: April 30, 2012  
Daniel Cooper  
Research Fishery Biologist  
NOAA/AFSC

Approved by: \_\_\_\_\_  
Program Director Name  
Title  
Affiliation (Program or Lab)

Dated: \_\_\_\_\_  
Guy Fleischer  
Deputy Division Director  
AFSC/RACE Division

Approved by: \_\_\_\_\_  
Science Center Director  
Title  
Affiliation

Dated: \_\_\_\_\_  
Dr. Douglas P. DeMaster,  
Science and Research Director  
Alaska Fisheries Science Center

Approved by: \_\_\_\_\_  
Captain Wade Blake, NOAA  
Commanding Officer  
Marine Operations Center – Pacific

Dated: \_\_\_\_\_



**I. Cruise Overview**

**A. Departure:** Depart Dutch Harbor, Alaska, at 1500 hours on Monday, May 15, 2012.

**Arrival:** Arrive Dutch Harbor, Alaska, at 0800 hours on Saturday, June 1, 2012.

**B. Operating Area:** Eastern Bering Sea

**C. Summary of Objectives:**

The primary objective is to conduct an assessment of eggs and larvae of walleye pollock (*Theragra chalcogramma*) over the eastern Bering Sea shelf. We will also examine the interactions among climate, weather, and ichthyoplankton distribution and abundance. This work is needed to describe larval fish assemblages and determine how physical and biological factors affect the transport and survival of fish larvae. The cruise is a collaboration between two AFSC Programs, The Fisheries Oceanography Coordinated Investigations Program (FOCI) and the Ecosystem Monitoring and Assessment Program (EMA).

**D. Participating Institutions:**

NOAA – Alaska Fisheries Science Center (AFSC)

7600 Sand Point Way N.E.

Seattle, Washington 98115-6349

**E. Personnel (Science Party):**

Name	Gender	Affiliation	Title	Citizenship
Dan Cooper	Male	AFSC	Chief Scientist	USA
Kathryn Mier	Female	AFSC	Fisheries Biologist	USA
Melanie Paquin	Female	AFSC	Fisheries Biologist	USA
Annette Dougherty	Female	AFSC	Fisheries Biologist	USA
Deborah Blood	Female	AFSC	Fisheries Biologist	USA
Adam Spear	Male	AFSC	Biological Oceanographer	USA
Willaim Floering	Male	AFSC	Biological oceanographer	USA

**F. Administrative**

**1. Points of Contacts:**

**Chief Scientist**

Dan Cooper

NOAA – Fisheries, Alaska Fisheries Science Center

7600 Sand Point Way NE

Seattle, WA 98115

(206) 526-4330 (Ph.); (206) 526-6723 (FAX)

[Dan.Cooper@noaa.gov](mailto:Dan.Cooper@noaa.gov)

**Field Operations Officer**

Matt Davis

NOAA Ship Oscar Dyson

(206) 295-0550 (Cell)

**2. Diplomatic Clearances:** N/A

**3. Licenses and Permits:**

**DOC/NOAA/Scientific Research Permit #2012-3**

State of Alaska, Fisheries Research Permit

**II. Operations**

**A. Cruise Plan/Itinerary**

Date	Activity
May 12	Embark Cooper and Dougherty in Dutch Harbor, Alaska
May 13	Load scientific gear. Embark 4 scientists in Dutch Harbor, Alaska
May 13-14	Assemble equipment
May 14	Depart Dutch Harbor 1500 hrs, and proceed to first station
May 14 - June 1	Conduct survey in eastern Bering Sea
June 1	Arrive Dutch Harbor 0800 hrs; disembark equipment, samples, and 4 scientists
June 2	Disembark Cooper and Dougherty

**B. Staging and Destaging:**

1. **Staging Plan** – The equipment necessary for the cruise will be shipped to Dutch Harbor and loaded onto **NOAA Ship OSCAR DYSON** prior to departure from Dutch Harbor. Assistance with craning is requested on May 13, 2012. We will require dedicated use of the chemistry, hydrographic, wet, dry, and fish processing labs for sample and equipment preparation and request as much counter and cabinet space as possible. We will use the Dry lab for SEACAT operations.

2. **De-staging Plan** – Samples and gear will be offloaded on June 1, 2012 in Dutch Harbor, AK. Assistance with craning is requested.

**C. Operations to be Conducted:** We will conduct operations 24/7.

1. **Underway Operations** --- The ship's Scientific Computer System (SCS) shall operate throughout the cruise, acquiring and logging data from navigation, meteorological, and oceanographic sensors. See FOCI Standard Operating Instructions (**SOI 5.2** and **SOI 5.3**) for specific requirements.

2. **Station Operations** – The cruise will begin upon departure from Dutch Harbor, Alaska at 15:00 ADT on Monday, 14 May 2012. Sampling will occur at pre-determined stations in a grid array (15 nmi apart) encompassing the Unimak island and Alaska Peninsula vicinity, the outer continental shelf at least as far as the Pribilof Islands and potentially farther (time and ice permitting) (Figure 1, Table 1). At each grid location, walleye

pollock will be sampled using 20.60 cm diameter bongo array equipped with a seacat data recorder (T, S, depth). Grid station bongo tows will be to a depth of 300 meters, or to 10 meters off bottom, whichever is shallowest. CUFES may be run between stations on an ad hoc basis. If ice is present over the shelf, sampling may be relocated over the adjacent basin (tow depth = 300 m).

Bongo net

The 20/60-cm Bongo net (SOI 3.2.2) will be deployed to a depth of 300 meters, or 10 meters off the bottom, whichever is shallowest. Net mesh will be 0.505 mm as Net 1 and 0.333 mm as Net 2. The sample collected in Net 1 will be used to quantify ichthyoplankton population density; it will be preserved in a 5% formalin-seawater solution buffered with sodium borate (2%). The sample collected in Net 2 will be used to quantify zooplankton population density; it will be preserved in a 5% formalin-seawater solution buffered with sodium borate (2%). The sample from Net 2 may be sorted for larval fish taxa of interest. Special interest taxa will be preserved in 95% EtOH in scintillation vials. The Sea-Cat profiler will be used to position the net in real time and to obtain profiles of water temperature and salinity. Three MOA buttons are needed to mark:

- 1) Surface (deploy),
- 2) At depth, and
- 3) Surface (retrieve).

ARGOS Satellite-Tracked Drifter Buoy Deployments

- a) At each of five locations, there will be two drifter deployments. One of the two drifters will be drogued at 20 m and the other drifter will be drogued at 40 m.

Mooring Operations: A secondary objective of this cruise will be mooring operations – including recoveries, deployments and searches in the Bering Sea. Depending on ice conditions, the following mooring operations will be conducted on this cruise

OPERATIONS	SITE	LATITUDE	LONGITUDE
Recover/Deploy	Mooring 2	56° 51.80' N	164° 03.10' W
Recover/Deploy	Mooring 4	57° 51.70' N	168° 52.68' W
Recover/Deploy	Mooring 5	59° 54.76' N	171° 42.12' W

- a) **FOCI Bering Sea Site 2** – Depending on arrival timing, we will either proceed with mooring operations or with the CTD “box”. Prior to mooring operations, calibration CTDs (with nutrient and chlorophyll samples) will be completed. Mooring operations will consist of recovering two subsurface moorings and deploying one surface and one subsurface mooring. After the completion of all mooring operations, a CTD, with nutrient and chlorophyll samples, a MARMAP Bongo tow with 20 and 60 cm bongos and triplicate CalVET tows will be completed approximately 0.5 mile from the mooring site. At the four stations surrounding Site 2, a CTD and 20/60 bongo tow will be completed.
- b) **FOCI Bering Sea Site 4** – If ice conditions allow mooring operations at site 4 – but

prohibit the ship from getting to FOCI Bering Sea Site 5, the ship will transit from site 2 – while completing the 70 m isobath CTDs - to site 4. If ice conditions allow the ship to proceed to site 5, we will cancel the site 4 mooring operations, and the ship will transit from site 2 – while completing the 70 m isobath CTDs - to site 5. We will then deploy the “site 4 moorings” at site 5.

Depending on arrival time at site 4, we will either proceed with mooring operations or with the CTD “box”. Prior to mooring operations, a calibration CTD (with nutrient and chlorophyll samples) will be completed. Mooring operations will consist of recovering two subsurface moorings and deploying two subsurface moorings. After the completion of all mooring operations, a CTD, with nutrient and chlorophyll samples, a MARMAP Bongo tow with 20 and 60 cm bongos and triplicate CalVET tows will be completed approximately 0.5 mile from the mooring site. At the four stations surrounding Site 4, a CTD and 20/60 bongo tow will be completed.

- c) **FOCI Bering Sea Site 5** – If ice conditions allow, the ship will transit from FOCI Bering Sea Site 2 to FOCI Bering Sea Site 5. Depending on arrival timing, we will either proceed with mooring operations or with the CTD “box”. Prior to mooring operations, a calibration CTD (with nutrient and chlorophyll samples), a MARMAP Bongo tow with 20 and 60 cm bongos and triplicate CalVET tows will be completed. Mooring operations will consist of recovering and redeploying two subsurface moorings. After the completion of all mooring operations, a CTD will be completed. A CTD, with nutrient and chlorophyll samples and a 20/60 Bongo tow will be completed at the four stations surrounding Site 5.

**D. Dive Plan** -- N/A

**E. Applicable Restrictions** -- None known

### **III. Facilities**

#### **A. Equipment and Capabilities Provided by the Ship:**

- Sorting table in slime lab
- Hydrographic winch with slip rings and 3-conductor cable terminated for the SBE-19 + SEACAT, for bongo net tow operations,
- Sea-Bird Electronics’ SBE-19+ SEACAT system,
- Wire speed indicators and readout for both hydrographic winches visible in Dry Lab or where SEACAT operations occur,
- For meteorological observations: 2 anemometers (one R. M. Young system interfaced to the SCS), calibrated air thermometer (wet-and dry-bulb) and a calibrated barometer and/or barograph,
- Freezer space (approx. 4x4x4 feet) at -20° C and -80° C,
- SIMRAD ES-60 and SIMRAD EK-60 echosounders,
- 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, and
- Ship's crane(s) used for loading and/or deploying gear and supplies.

**B. Equipment and Capabilities Provided by the Scientists:**

- Plankton sampling gear:
  - One 60-cm bongo sampling array (505 and 333-micron mesh net and all necessary accessories),
  - Two wire-angle indicators
- Cruise Operations Database (COD) software and forms
- Surface mooring (FOCI biophysical platforms),
- Subsurface moorings
- Miscellaneous scientific sampling and processing equipment
  - 5-gal buckets (5),
  - 1000 Zip-loc bags (12"),
  - Sieves, jar holder, funnels, squirt bottles,
  - 11 cases of 32-oz jars, closures, and labels,
  - 6 flowmeters, calibration data, hardware for attaching and maintaining them,
  - Preservative-dispenser equipment,
  - Hazardous materials spill kit, and
  - Spare wire angle indicator

**IV. Hazardous Materials**

**A. Policy and Compliance:**

The Chief Scientist is responsible for complying with MOCDOC 15, Fleet Environmental Compliance #07, Hazardous Material and Hazardous Waste Management Requirements for Visiting Scientists, released July 2002. Documentation regarding those requirements will be provided by the Chief of Operations, Marine Operations Center, upon request.

By Federal regulations and NOAA Marine and Aviation Operations policy, the ship may not sail without a complete inventory of all hazardous materials by name and the anticipated quantity brought aboard, MSDS and appropriate neutralizing agents, buffers, and/or absorbents in amounts adequate to address spills of a size equal to the amount of chemical brought aboard. The amount of hazardous material arriving and leaving the vessel shall be accounted for by the Chief Scientist.

**B. Radioactive Isotopes: N/A**

**C. HazMat Inventory:**

Chemical	CAS Number	Respondee	Org.	Qty	H	F	R	Storage Color Code	Hazard Class	Packing Group Number	UN	Reportable Quantity
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Formaldehyde 37%	50-00-0	Cooper	AFSC	3, 20- L	3	2	2	Flammable	3 & 8	III	1198	100 LBS
Ethyl Alcohol 100% Genetic Grade	64-17-5	Cooper	AFSC	2, 4-L	2	3	1	Flammable	3	II, III	1170	
Sodium Borate Solution, Saturated	mix	Cooper	AFSC	20- L	1	0	0	General	Not regulated	N/A		
Battery, Lithium	mixture	Floering	PMEL	*	2	2	3	General	9	II	3090	
Tributyltin Oxide	56-35-9	Floering	PMEL	6 oz.	3	1	0	Poison	N. R.			1

## V. Additional Projects

### A. Supplementary (“Piggyback”) Projects: N/A

Collections of larval walleye pollock (as available) for R. Heintz (AFSC) to characterize larval growth and energy content.

Collections of larval walleye pollock (as available) for S. Porter. CalVET tows will be conducted (NTE 25) at selected locations where pollock larvae are found at the discretion of the CO and Chief Scientist.

### B. NOAA Fleet Ancillary Projects: N/A

## VI. Disposition of Data and Reports

**A. Data Responsibilities:** The following data products will be supplied by the vessel and included in the cruise data package:

NOAA Form 77-13d – *Deck Log – Weather Observation Sheets*,  
Electronic Marine Operations Abstracts,  
SCS backup – recordable compact diskette (CD-RW),  
Calibration Sheets for all ship's and scientific instruments used,  
PMEL CTD weather observation log  
CTD Cast Information/Rosette Log,  
Scientific Freezer Temperature Daily Log, and  
Controlled Environmental Room Temperature Log.

### C. Pre and Post Cruise Meeting:

Cruise meetings may be held in accordance with *FOCI Standard Operating Instructions* (SOI 5.5).

Pre-Cruise Meeting: Prior to departure, the Chief Scientist will conduct a meeting of the

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

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

### **C. Ship Operation Evaluation Report:**

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

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

## **VII. Miscellaneous**

### **A. Miscellaneous – Meals and Berthing:**

Meals and berthing are required for up to 7 scientists. Meals will be served 3 times daily beginning one hour before scheduled departure, extending throughout the cruise, and ending two hours after the termination of the cruise. 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. Miscellaneous – Medical Forms and Emergency Contacts:**

The NOAA Health Services Questionnaire (NHSQ, Revised: 08/08) must be completed in advance by each participating scientist. The NHSQ can be obtained from the Chief Scientist or the NOAA website at [http://www.oma.noaa.gov/medical/NHSQ\\_Final\\_wi\\_Instructions\\_fill.pdf](http://www.oma.noaa.gov/medical/NHSQ_Final_wi_Instructions_fill.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:

Regional Director of Health Services  
Marine Operations Center – Atlantic  
439 W. York Street  
Norfolk, VA 23510  
Telephone 757.441.6320  
Fax 757.441.3760

Regional Director of Health Services  
Marine Operations Center - Pacific  
1801 Fairview Avenue East  
Seattle, WA 98102  
Telephone 206.553.8704  
Fax 206.553.1112

E-mail [MOA.Health.Services@noaa.gov](mailto:MOA.Health.Services@noaa.gov)

Email [MOP.Health-Services@noaa.gov](mailto:MOP.Health-Services@noaa.gov)

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

#### **C. Miscellaneous – 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. Miscellaneous – Communications**

A progress report on operations prepared by the Chief Scientist may be relayed to the program office. Sometimes it is necessary for the Chief Scientist to communicate with another vessel, aircraft, or shore facility. Through various modes of communication, the ship is able to maintain contact with the Marine Operations Center on an as needed basis. These methods will be made available to the Chief Scientist upon request, in order to conduct official business. Due to a new directive from Marine Operations Center, the ship must charge the science party for all calls made on the cell or sky-cell telephone. INMARSAT, Sky Cell and cellular communication costs shall be reimbursed to the ship for telephone calls made by all scientific personnel. Currently, Sky Cell

and cellular telephone services are about \$0.89 per minute and INMARSAT MiniM is around \$1.68 per minute for voice. These charges will be assessed against the program after the ship receives the bill. There is generally a three month delay receiving the bill for review. The Chief Scientist will be required to keep a log of all calls made by the science party.

**NOAA Ship OSCAR DYSON** – Telephone methods listed in order of increasing expense.

**IN PORT**

Home Port (Kodiak, AK):

•907-486-0460

•907-486-0326

Cellular:

• (206) 271-4475, -8843 (CO)

• (206) 295-0775 (XO)

• (206) 295-0550 (OPS)

• (206) 295-0670 (CME)

Wavetalk

• 1-800-668-4950-toll free

**INMARSAT B:**

• 011-872-336-995-910 (voice line 1)

• 011-872-336-995-920 (voice line 2)

• 011-872-336-995-911 (fax)

**Iridium:**

011-8816-7631-0050

808-659-0050

E-Mail: [NOAA.Ship.Oscar.Dyson@noaa.gov](mailto:NOAA.Ship.Oscar.Dyson@noaa.gov) (mention the person's name in SUBJECT field.)

**MOC-P Newport, OR**

(541) 867-8790, 9791, 8792

(541) 867-8793 (FAX)

E-Mail: [FirstName.LastName@noaa.gov](mailto:FirstName.LastName@noaa.gov)

**E. Miscellaneous – IT Security**

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

(1) Installation of the latest virus definition (.DAT) file on all systems and performance of a virus scan on each system.

(2) Installation of the latest critical operating system security patches.

(3) No external public Internet Service Provider (ISP) connections.

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

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

**F. Foreign National Guests Access to OMAO Facilities and Platforms: N/A**

## Appendices

Figure 1. Sampling locations for DY-12-04 in the eastern Bering Sea. Some stations locations may shift dependent on spatial extent of sea ice.

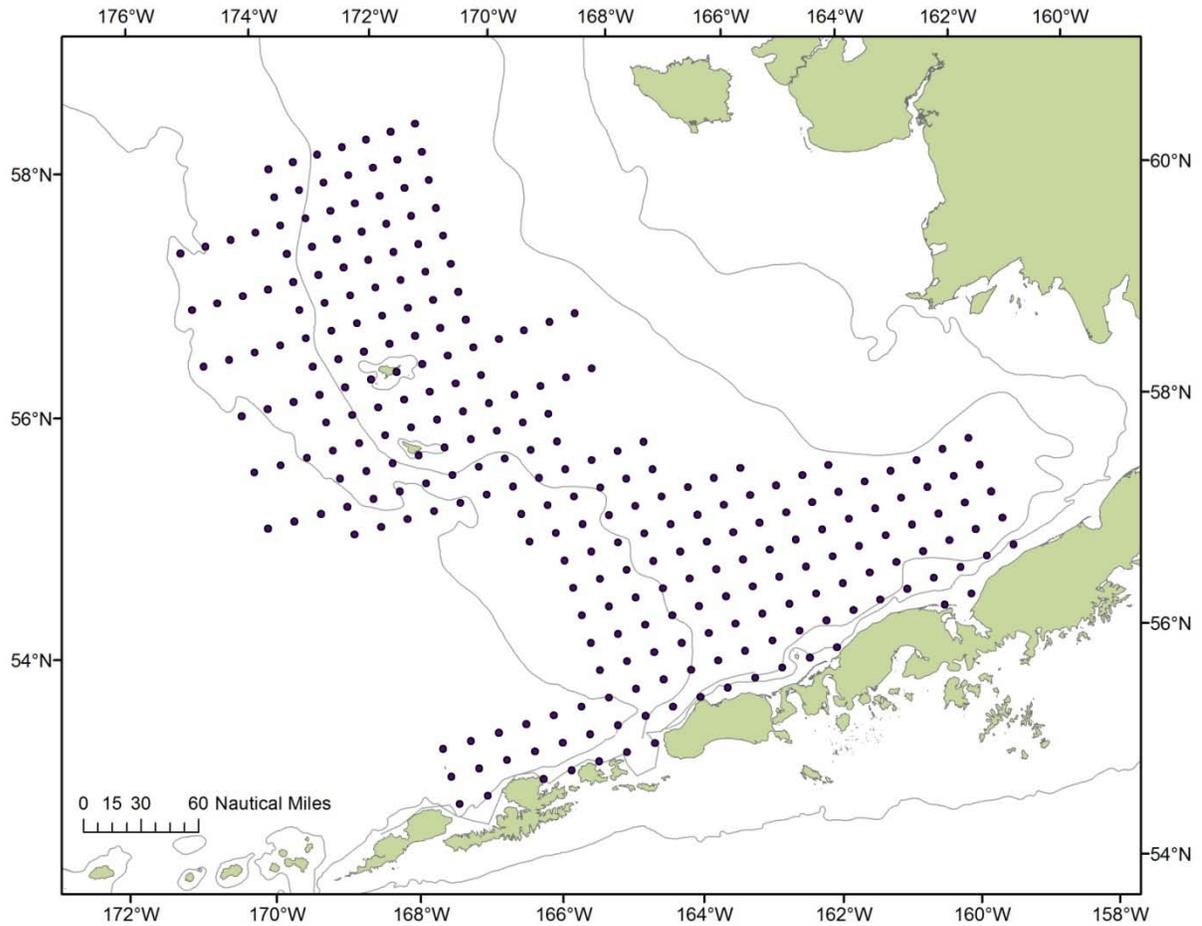


Table 1. Bongo sampling locations that will be occupied during DY-12-04, sea ice extent and time permitting.

SN_grid	EW_grid	LatDD	LonDD	lat_deg	lat_min	lon_deg	lon_min
K	7	56.59896	-160.006	56	35.9376	160	0.384
K	10	56.81878	-160.224	56	49.1268	160	13.428
K	13	57.03859	-160.443	57	2.3154	160	26.556
K	16	57.25841	-160.663	57	15.5046	160	39.756
K	19	57.47823	-160.884	57	28.6938	160	53.034
N	7	56.47961	-160.405	56	28.7766	160	24.306
N	10	56.69942	-160.622	56	41.9652	160	37.308
N	13	56.91924	-160.84	56	55.1544	160	50.394
N	16	57.13906	-161.059	57	8.3436	161	3.552
N	19	57.35888	-161.28	57	21.5328	161	16.788
Q	4	56.14044	-160.588	56	8.4264	160	35.262
Q	7	56.36026	-160.803	56	21.6156	160	48.15
Q	10	56.58007	-161.019	56	34.8042	161	1.116
Q	13	56.79989	-161.236	56	47.9934	161	14.154
Q	16	57.01971	-161.455	57	1.1826	161	27.27
Q	19	57.23953	-161.674	57	14.3718	161	40.464
T	4	56.02109	-160.985	56	1.2654	160	59.07
T	7	56.24091	-161.199	56	14.4546	161	11.922
T	10	56.46072	-161.414	56	27.6432	161	24.846
T	13	56.68054	-161.631	56	40.8324	161	37.842
T	16	56.90036	-161.849	56	54.0216	161	50.916
T	19	57.12018	-162.068	57	7.2108	162	4.068
W	7	56.12156	-161.594	56	7.2936	161	35.622
W	10	56.34137	-161.808	56	20.4822	161	48.504
W	13	56.56119	-162.024	56	33.6714	162	1.458
W	16	56.78101	-162.242	56	46.8606	162	14.496
W	19	57.00083	-162.46	57	0.0498	162	27.606
Z	7	56.0022	-161.987	56	0.132	161	59.244
Z	10	56.22202	-162.201	56	13.3212	162	12.084
Z	13	56.44184	-162.417	56	26.5104	162	25.002
Z	16	56.66166	-162.633	56	39.6996	162	37.998
Z	19	56.88148	-162.851	56	52.8888	162	51.066
Z	22	57.1013	-163.07	57	6.078	163	4.206
AC	7	55.88285	-162.38	55	52.971	162	22.794
AC	10	56.10267	-162.593	56	6.1602	162	35.598
AC	13	56.32249	-162.808	56	19.3494	162	48.474
AC	16	56.54231	-163.024	56	32.5386	163	1.428
AC	19	56.76213	-163.241	56	45.7278	163	14.454
AC	22	56.98195	-163.459	56	58.917	163	27.558

AF	4	55.54369	-162.56	55	32.6214	162	33.582
AF	7	55.7635	-162.771	55	45.81	162	46.272
AF	10	55.98332	-162.984	55	58.9992	162	59.034
AF	13	56.20314	-163.198	56	12.1884	163	11.874
AF	16	56.42296	-163.413	56	25.3776	163	24.786
AF	19	56.64278	-163.63	56	38.5668	163	37.77
AF	22	56.86259	-163.847	56	51.7554	163	50.832
AI	4	55.42434	-162.95	55	25.4604	162	57.024
AI	7	55.64415	-163.161	55	38.649	163	9.678
AI	10	55.86397	-163.373	55	51.8382	163	22.404
AI	13	56.08379	-163.587	56	5.0274	163	35.202
AI	16	56.30361	-163.801	56	18.2166	163	48.072
AI	19	56.52343	-164.017	56	31.4058	164	1.02
AI	22	56.74324	-164.234	56	44.5944	164	14.04
AI	25	56.96306	-164.452	56	57.7836	164	27.132
AL	4	55.30499	-163.34	55	18.2994	163	20.4
AL	7	55.5248	-163.55	55	31.488	163	33.018
AL	10	55.74462	-163.762	55	44.6772	163	45.702
AL	13	55.96444	-163.974	55	57.8664	163	58.458
AL	16	56.18426	-164.188	56	11.0556	164	11.292
AL	19	56.40408	-164.403	56	24.2448	164	24.198
AL	22	56.62389	-164.62	56	37.4334	164	37.176
AL	25	56.84371	-164.837	56	50.6226	164	50.232
AO	4	55.18563	-163.728	55	11.1378	163	43.704
AO	7	55.40545	-163.938	55	24.327	163	56.28
AO	10	55.62527	-164.149	55	37.5162	164	8.928
AO	13	55.84509	-164.361	55	50.7054	164	21.648
AO	16	56.06491	-164.574	56	3.8946	164	34.44
AO	19	56.28473	-164.788	56	17.0838	164	47.304
AO	22	56.50454	-165.004	56	30.2724	165	0.24
AO	25	56.72436	-165.221	56	43.4616	165	13.254
AR	4	55.06628	-164.116	55	3.9768	164	6.936
AR	7	55.2861	-164.325	55	17.166	164	19.476
AR	10	55.50592	-164.535	55	30.3552	164	32.088
AR	13	55.72574	-164.746	55	43.5444	164	44.766
AR	16	55.94556	-164.959	55	56.7336	164	57.516
AR	19	56.16537	-165.172	56	9.9222	165	10.344
AR	22	56.38519	-165.387	56	23.1114	165	23.238
AR	25	56.60501	-165.604	56	36.3006	165	36.21
AR	28	56.82483	-165.821	56	49.4898	165	49.26
AR	31	57.04465	-166.04	57	2.679	166	2.388
AU	4	54.94693	-164.502	54	56.8158	164	30.096
AU	7	55.16675	-164.71	55	10.005	164	42.6

AU	10	55.38657	-164.92	55	23.1942	164	55.176
AU	13	55.60639	-165.13	55	36.3834	165	7.812
AU	16	55.82621	-165.342	55	49.5726	165	20.526
AU	19	56.04602	-165.555	56	2.7612	165	33.312
AU	22	56.26584	-165.77	56	15.9504	165	46.17
AU	25	56.48566	-165.985	56	29.1396	165	59.1
AU	28	56.70548	-166.202	56	42.3288	166	12.108
AU	31	56.9253	-166.42	56	55.518	166	25.194
AU	40	57.58475	-167.082	57	35.085	167	4.914
AU	46	58.02439	-167.53	58	1.4634	167	31.794
AX	4	54.82758	-164.887	54	49.6548	164	53.19
AX	7	55.0474	-165.094	55	2.844	165	5.658
AX	10	55.26722	-165.303	55	16.0332	165	18.192
AX	13	55.48704	-165.513	55	29.2224	165	30.798
AX	16	55.70686	-165.725	55	42.4116	165	43.47
AX	19	55.92667	-165.937	55	55.6002	165	56.214
AX	22	56.14649	-166.151	56	8.7894	166	9.036
AX	25	56.36631	-166.365	56	21.9786	166	21.924
AX	28	56.58613	-166.582	56	35.1678	166	34.89
AX	31	56.80595	-166.799	56	48.357	166	47.934
AX	40	57.4654	-167.459	57	27.924	167	27.522
AX	46	57.90504	-167.905	57	54.3024	167	54.318
BA	1	54.48841	-165.064	54	29.3046	165	3.852
BA	4	54.70823	-165.27	54	42.4938	165	16.218
BA	7	54.92805	-165.477	54	55.683	165	28.644
BA	10	55.14787	-165.686	55	8.8722	165	41.142
BA	13	55.36769	-165.895	55	22.0614	165	53.706
BA	16	55.58751	-166.106	55	35.2506	166	6.342
BA	19	55.80732	-166.318	55	48.4392	166	19.05
BA	22	56.02714	-166.531	56	1.6284	166	31.83
BA	25	56.24696	-166.745	56	14.8176	166	44.682
BA	28	56.46678	-166.96	56	28.0068	166	57.606
BA	31	56.6866	-167.177	56	41.196	167	10.608
BA	34	56.90641	-167.395	56	54.3846	167	23.682
BA	37	57.12623	-167.614	57	7.5738	167	36.834
BA	40	57.34605	-167.835	57	20.763	167	50.07
BA	46	57.78569	-168.28	57	47.1414	168	16.77
BD	1	54.36906	-165.447	54	22.1436	165	26.844
BD	4	54.58888	-165.653	54	35.3328	165	39.174
BD	7	54.8087	-165.859	54	48.522	165	51.564
BD	10	55.02852	-166.067	55	1.7112	166	4.02
BD	13	55.24834	-166.276	55	14.9004	166	16.548
BD	16	55.46815	-166.486	55	28.089	166	29.148

BD	19	55.68797	-166.697	55	41.2782	166	41.814
BD	22	55.90779	-166.909	55	54.4674	166	54.558
BD	25	56.12761	-167.123	56	7.6566	167	7.368
BD	28	56.34743	-167.338	56	20.8458	167	20.256
BD	31	56.56725	-167.554	56	34.035	167	33.216
BD	34	56.78706	-167.771	56	47.2236	167	46.248
BD	37	57.00688	-167.989	57	0.4128	167	59.358
BD	40	57.2267	-168.209	57	13.602	168	12.552
BD	46	57.66634	-168.653	57	39.9804	168	39.168
BG	1	54.24971	-165.83	54	14.9826	165	49.77
BG	4	54.46953	-166.034	54	28.1718	166	2.058
BG	7	54.68935	-166.24	54	41.361	166	14.412
BG	25	56.00826	-167.5	56	0.4956	167	29.994
BG	28	56.22808	-167.714	56	13.6848	167	42.84
BG	31	56.4479	-167.929	56	26.874	167	55.758
BG	34	56.66771	-168.146	56	40.0626	168	8.748
BG	37	56.88753	-168.364	56	53.2518	168	21.822
BG	40	57.10735	-168.583	57	6.441	168	34.968
BG	43	57.32717	-168.803	57	19.6302	168	48.192
BG	46	57.54699	-169.025	57	32.8194	169	1.5
BG	49	57.7668	-169.248	57	46.008	169	14.886
BG	52	57.98662	-169.473	57	59.1972	169	28.35
BG	55	58.20644	-169.698	58	12.3864	169	41.904
BG	58	58.42626	-169.926	58	25.5756	169	55.536
BG	61	58.64608	-170.154	58	38.7648	170	9.258
BG	64	58.86589	-170.384	58	51.9534	170	23.064
BG	67	59.08571	-170.616	59	5.1426	170	36.954
BG	70	59.30553	-170.849	59	18.3318	170	50.94
BJ	1	54.13036	-166.21	54	7.8216	166	12.624
BJ	4	54.35018	-166.415	54	21.0108	166	24.882
BJ	7	54.57	-166.62	54	34.2	166	37.2
BJ	31	56.32854	-168.304	56	19.7124	168	18.234
BJ	34	56.54836	-168.52	56	32.9016	168	31.188
BJ	37	56.76818	-168.737	56	46.0908	168	44.214
BJ	40	56.988	-168.955	56	59.28	168	57.324
BJ	43	57.20782	-169.175	57	12.4692	169	10.506
BJ	46	57.42764	-169.396	57	25.6584	169	23.766
BJ	49	57.64745	-169.619	57	38.847	169	37.11
BJ	52	57.86727	-169.842	57	52.0362	169	50.532
BJ	55	58.08709	-170.067	58	5.2254	170	4.032
BJ	58	58.30691	-170.294	58	18.4146	170	17.622
BJ	61	58.52673	-170.522	58	31.6038	170	31.296
BJ	64	58.74654	-170.751	58	44.7924	170	45.054

BJ	67	58.96636	-170.982	58	57.9816	170	58.902
BJ	70	59.18618	-171.214	59	11.1708	171	12.84
BM	1	54.01101	-166.59	54	0.6606	166	35.418
BM	4	54.23083	-166.794	54	13.8498	166	47.634
BM	7	54.45065	-166.999	54	27.039	166	59.916
BM	31	56.20919	-168.678	56	12.5514	168	40.65
BM	34	56.42901	-168.893	56	25.7406	168	53.562
BM	37	56.64883	-169.109	56	38.9298	169	6.546
BM	40	56.86865	-169.327	56	52.119	169	19.614
BM	43	57.08847	-169.546	57	5.3082	169	32.754
BM	46	57.30828	-169.766	57	18.4968	169	45.972
BM	49	57.5281	-169.988	57	31.686	169	59.268
BM	52	57.74792	-170.211	57	44.8752	170	12.648
BM	55	57.96774	-170.435	57	58.0644	170	26.106
BM	58	58.18756	-170.661	58	11.2536	170	39.648
BM	61	58.40738	-170.888	58	24.4428	170	53.28
BM	64	58.62719	-171.117	58	37.6314	171	6.99
BM	67	58.84701	-171.347	58	50.8206	171	20.79
BM	70	59.06683	-171.578	59	4.0098	171	34.674
BP	4	54.11148	-167.172	54	6.6888	167	10.32
BP	7	54.3313	-167.376	54	19.878	167	22.572
BP	31	56.08984	-169.05	56	5.3904	169	3
BP	34	56.30966	-169.265	56	18.5796	169	15.87
BP	37	56.52948	-169.48	56	31.7688	169	28.818
BP	40	56.7493	-169.697	56	44.958	169	41.838
BP	43	56.96912	-169.916	56	58.1472	169	54.936
BP	46	57.18893	-170.135	57	11.3358	170	8.112
BP	49	57.40875	-170.356	57	24.525	170	21.372
BP	52	57.62857	-170.578	57	37.7142	170	34.704
BP	55	57.84839	-170.802	57	50.9034	170	48.12
BP	58	58.06821	-171.027	58	4.0926	171	1.614
BP	61	58.28802	-171.253	58	17.2812	171	15.198
BP	64	58.50784	-171.481	58	30.4704	171	28.866
BP	67	58.72766	-171.71	58	43.6596	171	42.618
BP	70	58.94748	-171.941	58	56.8488	171	56.454
BS	1	53.77231	-167.347	53	46.3386	167	20.796
BS	4	53.99213	-167.549	53	59.5278	167	32.94
BS	7	54.21195	-167.753	54	12.717	167	45.156
BS	31	55.97049	-169.421	55	58.2294	169	25.284
BS	34	56.19031	-169.635	56	11.4186	169	38.118
BS	37	56.41013	-169.85	56	24.6078	169	51.024
BS	40	56.62995	-170.067	56	37.797	170	4.002
BS	43	56.84977	-170.284	56	50.9862	170	17.058

BS	46	57.06958	-170.503	57	4.1748	170	30.192
BS	49	57.2894	-170.723	57	17.364	170	43.404
BS	52	57.50922	-170.945	57	30.5532	170	56.7
BS	55	57.72904	-171.168	57	43.7424	171	10.068
BS	58	57.94886	-171.392	57	56.9316	171	23.52
BS	61	58.16867	-171.618	58	10.1202	171	37.056
BS	64	58.38849	-171.845	58	23.3094	171	50.676
BS	67	58.60831	-172.073	58	36.4986	172	4.38
BS	70	58.82813	-172.303	58	49.6878	172	18.174
BV	1	53.65296	-167.723	53	39.1776	167	43.386
BV	4	53.87278	-167.925	53	52.3668	167	55.5
BV	7	54.0926	-168.128	54	5.556	168	7.674
BV	31	55.85114	-169.792	55	51.0684	169	47.508
BV	34	56.07096	-170.005	56	4.2576	170	0.3
BV	37	56.29078	-170.219	56	17.4468	170	13.164
BV	40	56.5106	-170.435	56	30.636	170	26.106
BV	43	56.73042	-170.652	56	43.8252	170	39.126
BV	46	56.95023	-170.87	56	57.0138	170	52.218
BV	49	57.17005	-171.09	57	10.203	171	5.388
BV	52	57.38987	-171.311	57	23.3922	171	18.636
BV	55	57.60969	-171.533	57	36.5814	171	31.962
BV	58	57.82951	-171.756	57	49.7706	171	45.372
BV	61	58.04932	-171.981	58	2.9592	171	58.86
BV	64	58.26914	-172.207	58	16.1484	172	12.432
BV	67	58.48896	-172.435	58	29.3376	172	26.094
BV	70	58.70878	-172.664	58	42.5268	172	39.84
BY	31	55.73179	-170.161	55	43.9074	170	9.666
BY	34	55.95161	-170.374	55	57.0966	170	22.422
BY	37	56.17143	-170.587	56	10.2858	170	35.244
BY	40	56.39125	-170.802	56	23.475	170	48.144
BY	43	56.61106	-171.019	56	36.6636	171	1.122
BY	46	56.83088	-171.236	56	49.8528	171	14.172
BY	49	57.0507	-171.455	57	3.042	171	27.3
BY	52	57.27052	-171.675	57	16.2312	171	40.506
BY	55	57.49034	-171.897	57	29.4204	171	53.79
BY	58	57.71016	-172.119	57	42.6096	172	7.152
BY	61	57.92997	-172.343	57	55.7982	172	20.598
BY	64	58.14979	-172.569	58	8.9874	172	34.128
BY	67	58.36961	-172.796	58	22.1766	172	47.742
BY	70	58.58943	-173.024	58	35.3658	173	1.44
CB	34	55.83226	-170.741	55	49.9356	170	44.478
CB	40	56.2719	-171.169	56	16.314	171	10.128
CB	46	56.71153	-171.601	56	42.6918	171	36.072

CB	52	57.15117	-172.039	57	9.0702	172	2.322
CB	58	57.59081	-172.481	57	35.4486	172	28.884
CB	64	58.03044	-172.929	58	1.8264	172	55.764
CE	34	55.71291	-171.108	55	42.7746	171	6.48
CE	40	56.15255	-171.534	56	9.153	171	32.046
CE	46	56.59218	-171.965	56	35.5308	171	57.912
CE	52	57.03182	-172.401	57	1.9092	172	24.072
CE	58	57.47145	-172.843	57	28.287	172	50.55
CE	64	57.91109	-173.289	57	54.6654	173	17.346
CH	34	55.59356	-171.474	55	35.6136	171	28.416
CH	40	56.0332	-171.898	56	1.992	171	53.904
CH	46	56.47283	-172.328	56	28.3698	172	19.686
CH	52	56.91247	-172.763	56	54.7482	172	45.768
CH	58	57.3521	-173.203	57	21.126	173	12.162
CH	64	57.79174	-173.648	57	47.5044	173	38.868
CK	52	56.79312	-173.123	56	47.5872	173	7.404
CK	58	57.23275	-173.562	57	13.965	173	33.708
CK	64	57.67239	-174.006	57	40.3434	174	0.33

Drifter Deployment, time and sea ice permitting:

Drifter deployment, 40 m	55°	57.31	165°	4.81	
Drifter deployment, 20 m	55°	57.69	165°	4.13	
Drifter deployment, 40 m	56°	2.69	165°	4.82	
Drifter deployment, 20 m	56°	3.07	165°	4.14	
Drifter deployment, 40 m	56°	3.09	164°	54.50	
Drifter deployment, 20 m	56°	2.69	164°	55.18	
Drifter deployment, 40 m	56°	0.38	164°	59.32	
Drifter deployment, 20 m	56°	0.00	165°	0.00	
Drifter deployment, 40 m	55°	57.69	164°	54.51	
Drifter deployment, 20 m	55°	57.31	164°	55.19	

Moorings, time and sea ice permitting:

Recover 11BS-2C	56°	51.797	164°	03.095	72
Site 2/south	56	40.00	163	52.00	72
Site 2/east	56	56.50	163	50.01	69
Site 2/north	57	01.00	164	13.00	69
Site 2/west	56	46.00	164	20.00	75

Recover 11BS-4A	57°	51.703	168°	52.679	72
Site 4/south	57°	39.200	169°	1.200	71
Site 4/east	57°	46.000	168°	28.000	71
Site 4/north	58°	4.000	168°	43.800	71
Site 4/west	57°	55.600	169°	19.300	71

Site 5/south	59°	42.000	171°	30.000	71
Site 5/east	59°	53.880	171°	15.500	71
Site 5/north	60°	4.500	172°	0.000	71
Site 5/west	59°	53.880	172°	10.000	71
Recover 11BS-5B	59°	54.760	171°	42.120	72

Table 2. Biomass Removal Estimates:

Estimation of Fish Removal

Projected removal of fish biomass per sample:

Sample	# Hauls	Arrowtooth fl.	Rock sole	Walleye pollock	Pacific cod	Yellowfin sole
Bongo net	<300	<0.1 kg	<0.1 kg	<0.1 kg	<0.1 kg	<0.1 kg
CUFES	<300	<0.1 kg	<0.1 kg	<0.1 kg	<0.1 kg	<0.1 kg