FINAL Project Instructions

Date Submitted: January 09, 2015

Platform: NOAA Ship *Bell M. Shimada*

Project Number: SH-15-01 (NWFSC)

Project Title: Northern California Current Ecosystem Survey

Project Dates: **JAN 28, 2015 TO FEB 06, 2015**

Prepared by: _____ Dated: 12 JAN 2015
Jay C. Peterson
Chief Scientist
Cooperative Institute for Marine Resources Studies/Oregon State University

Approved by: _____ Dated: 1/21/2015
Richard Zabel
Division Director-Fisheries Ecology Division
NMFS/NWFSC/FED

Approved by: _____ Dated: 1/21/15
John Stein
Center Director
Northwest Fisheries Science Center

Approved by: _____ Dated: 22 Jan 2015
Captain Douglas Baird, NOAA
Commanding Officer
Marine Operations Center – Pacific

Template Date: 14JAN2014

I. Overview

A. **Brief Summary and Project Period.** This project continues long-term studies of the Northern California Current (NCC) pelagic ecosystem and includes study of broad-scale patterns of hydrography, plankton and ocean acidification/hypoxia in the NCC Large Marine Ecosystem off Oregon and Washington. Ecosystem studies were initiated in 1996, and studies of ocean acidification/hypoxia were initiated in 2010.

B. Days at Sea (DAS)

Of the 10 DAS scheduled for this project, 10 DAS are funded by a Line Office Allocation. This project is estimated to exhibit a medium Operational Tempo.

C. Operating Area. Transect sampling in continental shelf and slope waters from Eureka, CA to La Push, Washington, including a long transect line out to 150 miles from shore off Crescent City, CA, and 200 miles off Newport, OR.

D. Summary of Objectives. Our routine ecosystem survey will make hydrographic measurements with a CTD, collect water samples for chemical analyses with a Niskin bottle rosette, and collect zooplankton samples with towed plankton nets at an array of stations along transect lines extending across the Oregon, Washington and northern California coast.

E. Participating Institutions. Scientists are from NOAA/NMFS/NWFSC, NOAA/NMFS/SWFSC, Oregon State University, and Pacific States Marine Fisheries Commission.

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

Name (Last, First)	Title	Role	Gender	Affiliation	Nationality
Peterson, Jay	Dr.	Chief Sci.	M	Oregon State Univ.	U.S.
Auth, Toby	Mr.	Scientist	M	PSMFC	U.S.
Bjorkstedt, Eric	Dr.	Scientist	M	NMFS/SWFSC	U.S.
Carpenter, Josh	Mr.	Scientist	M	Oregon State Univ	U.S.
Honisch, Brittney	Ms.	Scientist	F	Oregon State Univ	U.S.
Kelley, Breeze	Ms	Grad. Student	F	Oregon State Univ	U.S.
Throckmorton, Ian	Mr.	Scientist	M	Oregon State Univ.	U.S.

G. Administrative

1. Points of Contacts: (1) William Peterson, NOAA/NWFSC, Hatfield Marine Science Center, Newport Oregon. Contact Info: 541 867 0201 (o), 541 961 2972 (mobile), bill.peterson@noaa.gov (2) Jay Peterson, Oregon State University, Hatfield Marine Science Center, Newport Oregon 541 867 0424 (o), jay.peterson@noaa.gov

Ops Officer: LT Zachary Cress (206-427-2374) NOAA Ship *Bell M. Shimada* (OPS.Bell.Shimada@noaa.gov)

2. Diplomatic Clearances

None Required.

3. Licenses and Permits

None Required

II. Operations

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

A. Project Itinerary: We will conduct standard CTD casts and plankton net tows along six transect lines. Station locations are listed at the end of this project plan;

28 Jan	Leave the MOC-P dock. Steam to first station (NH01).
	Arrive at NH01 and survey NH Line
30 Jan	Finish sampling NH line; steam to CC Line
	Arrive at CC150 and start sampling the line.
31 Jan	Finish CC Line
	Steam to TH Line (TH01)
	Arrive at TH01 and begin sampling
01 Feb	Finish sampling TH Line; steam north to RR Line
	Arrive at RR07 and begin sampling
02 Feb	Finish RR Line and steam to FM Line
	Arrive at FM01 and begin sampling
	Finish FM Line and steam north to HH07
	Finish HH Line and steam north to CM
03 Feb	Arrive at CM03 and begin sampling
	Finish CM Line and steam north to CR Line
	Arrive CR30 Line and begin sampling
04 Feb	Finish CR Line and steam north to GH Line.
	Arrive at GH Line and being sampling
05 Feb	Finish GH Line and head back to port.
06 Feb	Arrive at MOC-P

B. Staging and Destaging:

Will be done at MOC-P in Newport. Loading will preferably take place on 27 January and unloading on 06 February, or whenever is deemed appropriate by the ship's crew.

C. Operations to be conducted:

The following operations will occur throughout the day (i.e. 24 hr. operations).

Make CTD casts and collect water samples from 10 Liter Niskin bottles on the CTD Rosette. Maximum depth for CTD operations will be 1000 m in deep water stations although the majority will be only to 500 m. In shallow waters, CTD casts should be within 5 m of the bottom, weather permitting.

Take zooplankton samples with a plankton net (0.5 m VertNet) towed vertically from 100 m to the surface, and with a bongo net towed obliquely from 100 m to the surface. In water less than 100m depth, the tows will be from within 5m of the bottom to the surface. Sampling will be at standard hydrographic stations (list of stations given at the end of this report). On the NH Line, we will do 'shallow' bongo net tows, sampling just the upper 30 m at the shelf stations (NH01 – NH25). If we are able to sample the NH Line twice (see station locations/sampling order below), we will likely do the regular (deeper) bongo tows at the shelf stations.

Bird and mammal observations during daylight hours.

D. Dive Plan

Dives are <u>not</u> planned for this project.

E. Applicable Restrictions

Conditions which preclude normal operations: We expect to encounter poor weather conditions and will adjust our work accordingly. We understand that there may be equipment failures and other unforeseen circumstances that may lead to loss of opportunities to complete our work at sea. This is the nature of our business. All weather related decisions will be made in consult with the Commanding Officer. The Commanding Officer may require stations to be moved or delayed to maintain his/her comfort margin for safety. As the ship nears each station, the operation will be evaluated, along with prevailing weather, functionality of ship's systems, vessel traffic, and proximity to hazards. The Chief Scientist will be notified of all changes.

III. Equipment

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

1. Hydrographic winch with conducting cable, with CTD attached.
2. Seabird 9/11 CTD system with oxygen sensor (SBE-43) and Wetlabs fluorometer, and rosette with 10 Liter Niskin bottles. We would like to have 12 bottles mounted on the rosette if possible.
3. Hydrographic winch with bare wire operated over starboard side for vertical plankton net tows and Bongo tows.

4. Continuous underway measurements of conductivity, temperature and fluorescence using the ship's flow-through system.
5. Freezer space for storage of small plastic bottles (125 ml) frozen for later analysis of nutrient concentration in sea water and for storage of chlorophyll samples and other water samples. We will need access to the -80°C freezer as well as the regular -20°C freezer.
6. Access to the walk-in Constant Temperature room with temperature set at 10°C. This room will be used for experimental work on copepods, krill and pteropods.
7. Saltwater hose with spray nozzle that will be used to wash down plankton nets.
8. Scientific Computing System for logging of all operations.
9. We would like the Simrad EK60 acoustics system and ADCP to be operational and to have all data logged.

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

1. Plankton sampling nets (vertical net, Bongo net), sampling jars, microscopes.

2. All plastic-ware needed to conduct experiments on living zooplankton (copepods, krill and pteropods).

3. Large plastic fish box (dimensions are approximately 1m x 1m x 1m), placed on the back deck. The box is for storage of sample jars that will contain plankton preserved with 5% formalin solution.

4. Formalin, ethanol and Lugol's solution for preservation of plankton samples.

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 quantity, MSDS, appropriate spill cleanup materials (neutralizing agents, buffers, or absorbents) in amounts adequate to address spills of a size equal to the amount of chemical brought aboard, and chemical safety and spill response procedures. . Documentation regarding those requirements will be provided by the Chief of Operations, Marine Operations Center, upon request.

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

- List of chemicals by name with anticipated quantity
- List of spill response materials, including neutralizing agents, buffers, and absorbents

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

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

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

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

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

B. Inventory. We will be bringing approximately three gallons of full-strength formalin (37% formaldehyde) that will be used to preserve plankton samples; a few mls of this solution are added to jars containing plankton samples for a diluted strength of 5-10% formalin solution in seawater. All formalin will be in the fume hood, near the area where the plankton tows are conducted. Some organisms will be preserved in ethanol.

Common Name of Material	**Qty**	**Notes**	**Trained Individual**	**Spill control**
Formaldehyde solution (37%)	12 x 900ml squeeze bottles	For preserving plankton samples	Jay Peterson	**F**
Ethanol	1 liter	Located in chem lab	Jay Peterson	**EL**
Lugol's Solution	1 liter	Plankton preservation	Jay Peterson	**EL**

C. Chemical safety and spill response procedures

F: Formalin/Formaldehyde

- 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 using "PIG Pillows".
- Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with vermiculite and place in a chemical waste container.

- We will use "Spilfyter 480001" absorbant material to contain the spill.

EL: Ethanol and Lugol's

- Ventilate area. There is no "kit"; small spills (a few ml) may be wiped up with paper towels then towels placed in chemical hood until dry after which they can be disposed. Larger spill can be handled similarly except that we will also have an absorbant pillow or vermiculite that can be used to absorb the ethanol.

Inventory of Spill Kit supplies

Product Name	Amount	Chemicals it is useful against	Amount it can clean up
Spilfyter 480001	3 x 2 lb bottles	Formaldehyde	> 12 liters
Respirators	2	Formaldehyde	
Gloves	2 pair	Formaldehyde, alcohol, acids	
Plastic bags	6	Storage and disposal of used absorbent materials	

D. Radioactive Materials

No Radioactive Isotopes are planned for this project.

E. Inventory (itemized) of Radioactive Materials.

No Radioactive Isotopes are planned for this project.

V. Additional Projects

A. Supplementary ("Piggyback") Projects

No Supplementary Projects are planned

C. NOAA Fleet Ancillary Projects. No NOAA Fleet Ancillary Projects are planned.

VI. Disposition of Data and Reports

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

A. Data Classifications: *Under Development*

a. OMAO Data

b. Program Data

B. Responsibilities: *Under Development*

VII. Meetings, Vessel Familiarization, and Project Evaluations

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

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

C. Post-Project Meeting: The Commanding Officer is responsible for conducted a meeting no earlier than 24 hrs before or 7 days after the completion of a project to discuss the overall success and short comings of the project. Concerns regarding safety, efficiency, and suggestions for future improvements shall be discussed and mitigations for future projects will be documented for future use. This meeting shall be attended by the ship's officers, applicable crew, the Chief Scientist, and members of the scientific party and is normally arranged by the Operations Officer and Chief Scientist.

D. Project Evaluation Report: Within seven days of the completion of the project, a Customer Satisfaction Survey is to be completed by the Chief Scientist. The form is available at http://www.omao.noaa.gov/fleeteval.html and provides a "Submit" button at the end. 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 project.

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

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

All persons boarding NOAA vessels give implied consent to comply with all safety and security policies and regulations which are administered by the Commanding Officer. All spaces and equipment on the vessel are subject to inspection or search at any time. All personnel must comply with OMAO's Drug and Alcohol Policy dated May 17, 2000 which forbids the possession and/or use of illegal drugs and alcohol aboard NOAA Vessels.

B. Medical Forms and Emergency Contacts

The NOAA Health Services Questionnaire (NHSQ, NF 57-10-01 (3-14)) must be completed in advance by each participating scientist. The NHSQ can be obtained from the Chief Scientist or the NOAA website http://www.corporateservices.noaa.gov/~noaaforms/eforms/nf57-10-01.pdf. All NHSQs submitted after March 1, 2014 must be accompanied by NOAA Form (NF) 57-10-02 - Tuberculosis Screening Document in compliance with OMAO Policy 1008 (Tuberculosis Protection Program).

The completed forms should be sent to the Regional Director of Health Services at the applicable Marine Operations Center. The NHSQ and Tuberculosis Screening Document should reach the Health Services Office no later than 4 weeks prior to the start of the project to allow time for the participant to obtain and submit additional information should health services require it, before clearance to sail can be granted. Please contact MOC Health Services with any questions regarding eligibility or completion of either form. Ensure to fully complete each form and

indicate the ship or ships the participant will be sailing on. The participant will receive an email notice when medically cleared to sail if a legible email address is provided on the NHSQ.

The participant can mail, fax, or email the forms to the contact information below. Participants should take precautions to protect their Personally Identifiable Information (PII) and medical information and ensure all correspondence adheres to DOC guidance (http://ocio.os.doc.gov/ITPolicyandPrograms/IT_Privacy/PROD01_008240).

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

Contact information:.

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

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

C. Shipboard Safety

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

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

D. Communications

A progress report on operations prepared by the Chief Scientist may be relayed to the program office. Sometimes it is necessary for the Chief Scientist to communicate with another vessel,

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

Foreign National access to the NOAA ship or Federal Facilities is not required for this project.

VIII. Appendices

1. List of station locations

Station	Depth	Decimal Latitude	Decimal Longitude	Degree Latitude	Minute Latitude	Degree Longitude	Minute Longitude
NH01	30	44.652	-124.100	44	39.102	-124	6.0
NH03	48	44.652	-124.130	44	39.102	-124	7.8
NH05	60	44.652	-124.175	44	39.102	-124	10.5
NH10	80	44.652	-124.295	44	39.102	-124	17.7
NH15	90	44.652	-124.412	44	39.102	-124	24.7
NH20	140	44.652	-124.528	44	39.102	-124	31.7
NH25	296	44.652	-124.650	44	39.102	-124	39.0
NH35	435	44.652	-124.883	44	39.102	-124	53.0
NH45	670	44.652	-125.117	44	39.102	-125	7.0
NH65	1600	44.652	-125.600	44	39.102	-125	36.0
NH85	2850	44.652	-126.050	44	39.102	-126	3.0
NH105	2900	44.652	-126.551	44	39.102	-126	33.0
NH125	2900	44.652	-127.000	44	39.102	-126	60.0
NH150	3000	44.652	-127.590	44	39.102	-127	35.4
NH175	2889	44.652	-128.178	44	39.102	-128	10.7
NH200	2889	44.652	-128.772	44	39.102	-128	46.3
CC150	*3000*	41.900	-126.999	41	53.972	-126	59.9
CC125	3259	41.900	-126.505	41	53.972	-126	30.3
CC11	3400	41.900	-125.999	41	53.972	-125	59.9
CC10	2948	41.900	-125.666	41	53.972	-125	39.9
CC08	2745	41.900	-125.197	41	53.972	-125	11.8
CC07	852	41.900	-125.000	41	53.972	-125	0.0
CC06	687	41.900	-124.801	41	53.972	-124	48.0
CC05	645	41.900	-124.701	41	53.972	-124	42.1
CC04	495	41.900	-124.607	41	53.972	-124	36.4
CC03	117	41.900	-124.502	41	53.972	-124	30.1
CC02	63	41.900	-124.392	41	53.972	-124	23.5
CC01	39	41.900	-124.301	41	53.972	-124	18.0
TH01	35	41.058	-124.204	41	3.48	-124	12.3
TH02	75	41.058	-124.267	41	3.48	-124	16.0
TH03	140	41.058	-124.342	41	3.48	-124	20.5
TH04	410	41.058	-124.433	41	3.48	-124	26.0
TH05	780	41.058	-124.583	41	3.48	-124	35.0
TH06	910	41.058	-124.75	41	3.48	-124	45.0
RR07	3013	42.500	-125.203	42	29.997	-125	12.2
RR06	1866	42.500	-125.000	42	29.997	-124	60.0
RR05	1000	42.500	-124.900	42	29.997	-124	54.0
RR04	550	42.500	-124.800	42	29.997	-124	48.0
RR03	160	42.500	-124.699	42	30.01	-124	41.9

RR02	88	42.500	-124.601	42	30.021	-124	36.1
RR01	38	42.500	-124.499	42	29.997	-124	30.0
FM01	36	43.221	-124.432	43	13.234	-124	25.9
FM03	60	43.220	-124.498	43	13.207	-124	29.9
FM04	84	43.225	-124.590	43	13.481	-124	35.4
FM05	158	43.221	-124.670	43	13.248	-124	40.2
FM06	310	43.212	-124.745	43	12.717	-124	44.7
HH07	1600	44.0	-125.198	44	0	-125	11.9
HH05	950	44.0	-125.001	44	0	-125	0.1
HH04	100	44.0	-124.798	44	0	-124	47.9
HH03	150	44.0	-124.604	44	0	-124	36.2
HH02	115	44.0	-124.399	44	0	-124	23.9
HH01	52	44.0	-124.199	44	0	-124	11.9
NH25	296	44.652	-124.650	44	39.102	-124	39.0
NH20	140	44.652	-124.528	44	39.102	-124	31.7
NH15	90	44.652	-124.412	44	39.102	-124	24.7
NH10	80	44.652	-124.295	44	39.102	-124	17.7
NH05	60	44.652	-124.175	44	39.102	-124	10.5
NH03	48	44.652	-124.130	44	39.102	-124	7.8
NH01	30	44.652	-124.100	44	39.102	-124	6.0
CM03	30	45.480	-124.030	45	28.8	-124	1.8
CM05	44	45.480	-124.090	45	28.8	-124	5.4
CM10	74	45.480	-124.200	45	28.8	-124	12.0
CM15	98	45.480	-124.320	45	28.8	-124	19.2
CM20	130	45.480	-124.440	45	28.8	-124	26.4
CM25	250	45.480	-124.560	45	28.8	-124	33.6
CR30	591	46.170	-124.670	46	10.2	-124	40.2
CR25	146	46.170	-124.550	46	10.2	-124	33.0
CR20	132	46.170	-124.450	46	10.2	-124	27.0
CR15	110	46.170	-124.330	46	10.2	-124	19.8
CR10	82	46.170	-124.210	46	10.2	-124	12.6
CR07	55	46.170	-124.150	46	10.2	-124	9.0
CR04	27	46.170	-124.070	46	10.2	-124	4.2
GH06	38	47.000	-124.320	47	0	-124	19.2
GH10	55	47.000	-124.410	47	0	-124	24.6
GH16	82	47.000	-124.550	47	0	-124	33.0
GH21	110	47.000	-124.690	47	0	-124	41.4
GH26	165	47.000	-124.810	47	0	-124	48.6
GH31	176	47.000	-124.940	47	0	-124	56.4
GH36	732	47.000	-125.060	47	0	-125	3.6
GH40	480	47.000	-125.149	47	0	-125	8.9
GH60	1888	47.000	-125.649	47	0	-125	38.9

2. Rudimentary map