FOCI CRUISE INSTRUCTIONS

R/V *THOMAS G. THOMPSON*
April 11 –May 13, 2006
Chief Scientist – Dr. Nancy B. Kachel, PMEL/NOAA

1.0 FOCI CRUISE INSTRUCTIONS

1.1 Cruise Title – Fisheries-Oceanography Coordinated Investigations (FOCI) Ice Cruise.

1.2 Cruise Numbers

1.2.1 Cruise Number – TN193

1.2.2 FOCI Number – 1TT06

1.3 Cruise Dates

1.3.1 Mobilization – April 11, 2006 in Kodiak, AK. A van with our equipment will be on the dock prior to the arrival of the ship. Antifreeze will be put into the ADCP well by ship's personnel. Two (or three) 50-gal drums of gasoline will be acquired in Kodiak by NMFS personnel to load aboard for small boat operations for marine mammals.

1.3.2 Cruise TN193 Legs 1 and 2

1.3.2.1 Departure – Depart Kodiak, AK, 1900 PDT on Wednesday, April 12, 2006.

1.3.2.2 Joint Operations with NOAA Ship *Miller Freeman* – Joint ship operations from April 22-27 or 28. At the end of this time (2) Scientists from *Miller Freeman* will join *Thompson* for the steam to St. Paul Island.

1.3.2.3 Touch-and-Go –Disembark some scientists, and embark other scientists in St. Paul Island, Alaska, Saturday morning, April 29, 2006 via a small boat operation. Begin Leg 2.

1.3.2.4 Arrival – Arrive in Seward Alaska, at ~2000 local time on Friday May 12, 2006.

1.3.3 Demobilize – Some gear, including all hazmat) will be offloaded in Seward, AK, May 13, 2006. We are negotiating with the Chief Scientists for the subsequent two cruises to give us written permission to keep our equipment aboard until R/V *Thomas G. Thompson* returns to Seattle on June 19, 2006.

1.4 Operating Areas – Eastern Bering Sea shelf, primarily in the vicinity of the ice edge.

2.0 CRUISE OVERVIEW –

Cruise Objectives – Ecosystems & Fisheries-Oceanography Coordinated Investigations (Eco-FOCI) is an effort by National Oceanic and Atmospheric Administration (NOAA) and associated academic scientists. Eco-FOCI's goal is to understand the effects of abiotic and biotic variability on ecosystems of the North Pacific Ocean and Bering Sea This cruise is in support of research sponsored by NOAA's North Pacific Climate Regimes & Ecosystem Productivity Program, the North Pacific Research Board (NPRB), the Alaskan Ocean Observing System (AOOS), and PMEL/AFSC base. The cruise is also a new collaboration between Eco-FOCI and two programs at the Alaska Fisheries Science Center: the National Marine Mammal Laboratory (NMML) and the Marine Assessment & Conservation Engineering Program (MACE) in the RACE Division. These two groups are supported during this cruise by base funds. This cruise is also, in part, a pilot study for the Bering Ecosystem Study (BEST) anticipated to be funded by the National Science Foundation for the field years of 2007, 2008, and 2009.

The primary purpose of this cruise is: to observe the ice-edge ecosystem of the eastern Bering Sea. This includes sampling water properties (T, S, nutrients) and structure of the water across the zone of the ice-edge, to sampling physical properties of the ice and the epontic algae and metazoan communities, sampling water column algae and zooplankton communities that are utilizing the phytoplankton bloom associated with the presence of the ice, and observing the distribution of birds and mammals that utilize the ice floes in the spring. Ribbon seals, in particular, are the focus of the marine mammal component. Tagging of ribbon seals with ARGOS transmitters will permit NMFS/ NMML personnel to track the movements of these little-known animals after the ice melts. Finally, during the two-ship operations, personnel on *Miller Freeman* will use acoustics to map the distribution of fish at and behind the ice edge. In addition, divers from *Miller Freeman* will attempt to sample planktonic organisms attached or congregating underneath individual ice floes.

Operations will include: hydrographic measurements (with samples for chlorophyll, nutrients, salinity and phytoplankton identification); zooplankton sampling using MARMAP bongo tows, vertical net-tows; and Tucker trawls, ice coring to sample chlorophyll and phytoplankton species in the ice; drill holes to sample ice and pore water properties; make bird and mammal observations; and tag of ribbon seals via small boat operations. On-deck incubation experiment to measure phytoplankton growth and shipboard incubations to estimate zooplankton egg production rates are planned.

Transects consisting of Conductivity, Temperature, and Depth (CTD) profiler casts and Marine Assessment, Monitoring, and Prediction (MARMAP) Bongo, and CalVET tows, and Tucker trawls will extend across the ice- edge zone, perpendicular to the ice edge. Transects along the ice edge will primarily be done during daylight hours to allow observations of sea birds and mammals.

Incubations experiments for phytoplankton productivity will be done in one deck incubator. Zooplankton egg production experiments will be done in a chiller in the walk-in refrigerator.

From April 22-28 we plan joint operations with NOAA Ship *Miller Freeman*. During the times of joint operations, *Freeman* will be conducting hydroacoustic surveys in our area of operations. There may also be a need to transfer frozen nutrient samples from *Freeman* to *Thompson* via a small boat operation. The transfer of frozen samples will permit their analysis

aboard *Thompson*, which will improve the quality of the nutrient measurements compared to a delayed analysis of frozen samples after return to Seattle.

Two Alaskan Natives will participate by assisting the NMML personnel in tagging seals. An environmental film maker, Soames Summerhays will come on the second leg.

2.1 Participating Organizations

NOAA – Pacific Marine Environmental Laboratory (PMEL)
7600 Sand Point Way N.E.
Seattle, Washington 98115-6439

NOAA – Alaska Fisheries Science Center (AFSC)
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Seattle, Washington 98195

2.2 Personnel

2.2.1 Chief Scientist

Name	Gender	Nationality	Affiliation	E-mail Address
Dr. Nancy B. Kachel (206) 526-6746	Female	USA	PMEL	Nancy.Kachel@noaa.gov

2.2.2 Participating Scientists

2.2.2.1 Leg 1 April 12-29, 2006

Name	Gender	Nationality	Affiliation	E-mail Address
Dr. Nancy B. Kachel	Female	USA	PMEL	Nancy.Kachel@noaa.gov
Dr. Phyllis J. Stabeno	Female	USA	PMEL	Phyllis.Stabeno@noaa.gov
Dr. Calvin Mordy	Male	USA	PMEL	Calvin.W.Mordy@noaa.gov
Dr. George Hunt, Jr.	Male	USA	UW	geohunt2@u.washington.edu
Dr. Edward Cokelet	Male	USA	PMEL	Edward.D.Cokelet@noaa.gov
Dr. David Hyrenbach	Male	Spain	UW/Duke	khyrenba@duke.edu
Dr. Lisa Eisner	Female	USA	AFSC	Lisa.Eisner@noaa.gov
David G. Kachel	Male	USA	PMEL	Dave.Kachel@noaa.gov
Margaret Sullivan	Female	USA	PMEL	Peggy.Sullivan@noaa.gov
Rachael Cartwright	Female	USA	AFSC	Rachael.Cartwright@noaa.gov
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Carolina Parada	Female	Chile	AFSC	Carolina.Parada@noaa.gov
Kathy Mier	Female	USA	AFSC	Kathy.Mier@noaa.gov

Name	Gender	Nationality	Affiliation	E-mail Address
Elizabeth Logerwell	Female	USA	AFSC	Libby.Logerwell@noaa.gov
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Shawn Dahle	Male	USA	NMML	shawn.dahle@noaa.gov
Robert Montgomery	Male	USA	NMML	robert.montgomery@noaa.gov
Elizabeth Jenkinson	Female	USA	NMML	Beth.Jenkinson@noaa.gov
Charlie Saccheus	Male	USA	AK Native	mSaccheus@yahoo.com
John Goodwin Sr.	Male	USA	AK Native	jgoodwin@otz.net
Evgeniy Mamaev	Male	Russia	NMML	emamaev@lionsea.kirov.ru

2.2.2.2 Personnel joining *Thompson* from *Miller Freeman* April 28,2006

Name	Gender	Nationality	Affiliation	E-mail Address
Alex DeRobertis	Male	USA	NMML	Alex.DeRobertis@noaa.gov
Chris Wilson	Male	USA	NMML	Chris.Wilson@noaa.gov

2.2.2.3 Leg 2 April 29- May 12, 2006

Name	Gender	Nationality	Affiliation	E-mail Address
Dr. Jeffrey Napp	Male	USA	AFSC	Jeff.Napp@noaa.gov
Dr. Nancy B. Kachel	Female	USA	PMEL	Nancy.Kachel@noaa.gov
Dr. Calvin Mordy	Male	USA	PMEL	Calvin.W.Mordy@noaa.gov
Dr. George Hunt, Jr.	Male	USA	UW	geohunt2@u.washington.edu
Dr. David Hyrenbach	Male	Spain	UW/Duke	khyrenba@duke.edu
Dr. Carol Ladd	Female	USA	PMEL	Carol.Ladd@noaa.gov
Dr. Edward Cokelet	Male	USA	PMEL	Edward.D.Cokelet@noaa.gov
Dr. John Bengtson	Male	USA	NMML	John.Bengtson@noaa.gov
Dr. Lisa Eisner	Female	USA	AFSC	Lisa.Eisner@noaa.gov
David G. Kachel	Male	USA	PMEL	Dave.Kachel@noaa.gov
Margaret Sullivan	Female	USA	PMEL	Peggy.Sullivan@noaa.gov
Rachael Cartwright	Female	USA	AFSC	Rachael.Cartwright@noaa.gov
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Michael Cameron	Male	USA	NMML	Michael.Cameron@noaa.gov
Shawn Dahle	Male	USA	NMML	Shawn.Dahle@noaa.gov
Robert Montgomery	Male	USA	NMML	Robert.Montgomery@noaa.gov
Elizabeth Jenkinson	Female	USA	NMML	Beth.Jenkinson@noaa.gov
Charlie Saccheus	Male	USA	AK Native	mSaccheus@yahoo.com
John Goodwin Sr.	Male	USA	AK Native	jgoodwin@otz.net
Soames Summerhays	Male	UK	Summerhays Films	jgsoames@aol.com

2.3 Administrative

2.3.1 Ship Operations

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School of Oceanography
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2.3.2 Scientific Operations

Dr. Phyllis J. Stabeno, NOAA/PMEL
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E-mail: Jeff.Napp@noaa.gov

3.0 OPERATIONS

3.1 Responsibilities

3.1.1 **Master** – The ship's Master shall be in sole command of the vessel and shall be responsible for the welfare of all personnel on board. The Master shall be the final authority in matters relating to the safety, proper navigation, stability, and sailing condition of the vessel and shall execute each voyage with the utmost dispatch.

The Master shall inform the Chief Scientist as soon as possible of any changes in the program necessitated by events. In the case of emergency, nothing in these instructions shall be construed as preventing the Master from taking the most effective action, which in the Master's judgment, will rectify the situation causing the emergency, and; thereby, safeguard life, property, and the ship.

The Master will have the authority to abort operations temporarily on the basis of clear and present danger to life and property at sea, and will inform the Chief Scientist as soon as safe conditions permit. Full details of the action taken, rationale, and recommendations will be provided at the earliest opportunity. Under normal operating conditions, the Master shall not take any mission-aborting action without consultation with the Chief Scientist.

3.1.2 **Chief Scientist** – The Chief Scientist is responsible for executing the technical portion of the scientific mission specified by these instructions. Responsibilities also include:

1. Comportment of visiting scientists and technicians,
2. Disposition of data, feedback on data quality, and archiving of data and specimens collected,

3. Administration and physical handling of all scientific party hazardous materials,
4. Assignment of berthing for the scientific party,
5. Cleanliness of all berthing, laboratory, and storage spaces used by the scientific party,
6. Delivery of medical and emergency contact forms for the scientific party, and
7. With the Master, safe, efficient, and economical use of shipboard resources to support the embarked mission.

The Chief Scientist has the authority to revise or alter the technical portion of the instructions as work progresses provided that after consultation with the Master, it is ascertained that the proposed changes will not:

1. Jeopardize the safety of personnel or the ship,
2. Exceed the overall time allotted for the project,
3. Resulting undue additional expenses, or
4. Alter the general intent of these project instructions.

3.1.3 **Scheduling** – Scheduling of individual activities will depend upon weather conditions, the position of the ice edge, and progress of scientific work. Therefore, firm advance scheduling of events will not be possible, and a continual dialogue between scientific and ship's personnel will be important.

3.2 **Data To Be Collected** – The Chief Scientist is responsible for the disposition, feedback on data quality, and archiving of data and specimens collected on board the ship for the primary project. The Chief Scientist will be considered the representative of the Directors of PMEL and AFSC for purpose of data disposition. A single copy of all data gathered by the vessel shall be delivered to the Chief Scientist for forwarding to the Center and Laboratory Directors. The Chief Scientist will be responsible for distribution of data to other investigators desiring copies.

3.2.1 **Data Logging** – If the ship has a computer system that operates throughout the cruise acquiring and logging data from navigation, meteorological, and flow-through oceanographic sensors, it is requested that we receive a copy of the data at the end of the cruise. It is requested that position, water depth, Photosynthetically Available Radiation (PAR), air temperature and wind speed and direction be recorded in addition to the sea surface temperature (SST), salinity, and chlorophyll fluorescence from the sea chest – underway system, if possible.

The ship's computer manager will ensure data quality. During the cruise, the scientific party may require the assistance of the ship's computer manager to determine if all sensors are functioning properly and to monitor some of the collected data in real time to make sampling strategy decisions (e.g. underwater PAR).

The scientists should be able to access data acquired by the ship’s systems as close to real-time as possible.

3.3 **Staging Plan** – Loading of scientific equipment is planned to occur in Kodiak AK on April 11, or a date to be assigned by the ship’s personnel. Equipment from PMEL and AFSC will be shipped to Kodiak via a cargo van, and then brought to the ship’s dock before the time set for mobilization. See Section 8.1 Cruise TN193 Equipment Inventory for an equipment list.

During staging Thompson personnel will add anti-freeze to the well holding the ADCP, according the specifications of RDI Instruments. The purpose of the antifreeze is to prevent the water filling the well from freezing in the -1.7°C seawater conditions we anticipate encountering. Water freezing in the well seriously degrades the data acquired from the ADCP.

3.4 De-staging Plan – Equipment will be off-loaded in Seward, AK, on May 12-13, 2006 in coordination with the ships' operations officer. The scientific party will be responsible for arranging for a van to ship their equipment back to Seattle.

3.5 Cruise Plan

1) Cruise TN193 begins with a test CTD cast on the first morning. We request that this be in waters shallower than 200 m, at a site to be agreed upon between the Chief Scientist and the Captain.

2) We plan then to transit through Unimak Pass and into the Bering Sea. If, perchance, there are a large number of seabirds and mammals present in Unimak Pass, we plan to spend ~4 hours on CTD/Bongo operations and observations.

3) See Section 8.5 Cruise TN193 Itinerary for station locations and tentative itinerary and Section 8.4 Cruise TN193 Chartlets for a figure of the prospective cruise track line based on the position of the ice edge in 2005. Final positions depend on the location of the ice edge during the cruise. It is planned that, throughout the cruise, we will have a scientist ashore sending us updates on analyses of the satellite observations of the sea ice in our area of operations.

4) Our first sample stations will be at and around FOCI's mooring site M2. Five CTD/MARMAP bongo tows will be accomplished. One of the five stations will also have a CTD cast to obtain water for productivity measurements.

5) We then plan to go to the southeastern end of the ice edge (near Nunivak Isl.) in ~ 30m water depth to begin our ice sampling. We will begin by taking a small boat to a sufficiently large ice floe to make drill holes and take ice cores. We anticipate that the auguring/coring/sampling process will take 3-5 hours at each site. At each site we plan to sample 2-3 floes on as many days. After the ice-coring operation, if any seals are present we will deploy 3 small boats belonging to NMML. Their purpose is to tag seals with satellite transmitters. If possible, while the marine mammal boats are in the water, we may take individual CTD and productivity casts or make vertical net tows, if deemed to be safe by the captain. Upon return of the small boats to the ship, we will begin a bird and mammal observing transit out of the ice during daylight hours. This operation will proceed outward into open water. After dark we will conduct CTD/Bongo stations, ending back at the ice by light the next morning. At some stations, we will double the CTD casts, with the first being taken without bottles. The purpose is to conduct a cast with a capsule filter on the intake to an AC-9 attached to the CTD followed by a cast without a filter (to separate the dissolved and particulate components of the absorption and beam attenuation spectra). We plan to be back at the ice edge the next morning.

6) Between ice sampling areas we plan to transit during daylight along the ice edge to permit bird and mammal observations to take place.

7) Next, we plan 5 CTD/Bongo stations and 1 CTD productivity cast around FOCI's mooring site M4 (named "The Big Valley" in honor of the ship that sank), before steaming to the second sea–ice station.

8) We plan to sample a total of 3 ice stations along the southern end of the ice edge during Leg 1: one on the inner shelf, discussed above, one on the middle shelf (~70m depth), and one on the outer shelf.

9) We plan 6 days of ice station work in coordination with NOAA Ship *Miller Freeman* from April 22-28 at two Ice Stations. *Miller Freeman* will conduct operations with divers to sample under the ice, hydroacoustic surveys, trawls, and towed vehicle operations to make detailed measurements of hydrographic structure in the vicinity of the ice edge. Scientists from *Thomas G. Thompson* will continue with ice sampling, mammal tagging, CTD/bongo/CalVET operations/Tucker trawl, and bird observations. It is anticipated that frozen nutrient samples will be transferred from *Miller Freeman* to *Thomas G. Thompson* for analysis at this time. By making the transfer, less time will elapse between their collection and analysis. This greatly improves the quality of the resulting data, compared with that from a delay until analysis can be done back in Seattle.

10) Two scientists from *Miller Freeman* plan to transfer to *Thomas G. Thompson* for the steam to St. Paul. We also plan a transfer of nutrient and salinity samples collected by the *Freeman*, to the *Thompson* for onboard analysis.

11) On April 29, 2006 we plan a small boat operation(s) just outside the harbor at St. Paul Island to disembark/embark science personnel.

12) After leaving *Miller Freeman*, we plan to continue operations in a similar manner along the northwest side of the ice edge, as far north as St. Lawrence Island, if conditions permit (We deem this to be unlikely). At each site chosen along the ice edge we will spend 2-3 days sampling on and between the ice in the manners discussed in #2-5, and #7.

13) As we begin our return to Seward at the end of the cruise, we plan to spend ~24 hours (plus transit time) sampling along the 70 m isobath, including at the front between the ice-influenced portion of the Bering shelf, and the thermally stratified southerly portion. The position of the front will be relayed to us by scientists aboard NOAA Ship *Miller Freeman*. Operations at the stations include CTD/ MARMAP bongo tows, and occasional CTD/productivity casts.

14) At the end of the cruise we will transit back through Unimak Pass and end at Seward, AK on May 12, 2006. We will spend a portion of May 13 unloading the ship. At that time the ship has requested time to drain the well holding the ADCP to remove the water-antifreeze mixture, and to refill it with fresh water.

3.6 **Sampling Strategy** – CTD casts will be done throughout the cruise. The CTD will be equipped with dual temperature and conductivity sensors, as well as two SBE-43 oxygen sensors (one provided by PMEL), a WetLabs Fluorometer and transmissometer, a Photosynthetically Available Radiation (PAR) sensor and AC-9 fluorometer. The Uncontaminated Scientific Seawater System (USSW) with thermosalinograph and a fluorometer will be used throughout the entire cruise. A PMEL provided Nitrate meter will be

attached to the underway system. We anticipate locating it at the sink in the ship's wet lab. Throughout the cruise, samples will be drawn from the underway system for ground-truth measurements of chlorophyll and nutrients.

Salinity and nutrient samples will be taken at up to 12 depths at most CTD stations. Salt samples will be analyzed aboard ship by a member of the science party trained to use the salinometer (**It is requested that *Thomas G. Thompson* bring an autosalinometer so that salinities may be analyzed on board the ship.)**.

Some nutrient samples may need to be frozen in a -20° Celsius freezer. It is planned to analyze all of the samples on board. In case it becomes necessary to freeze nutrient samples for analysis back in Seattle, Washington, FOCI requests the capability of freezing nutrient samples from both our legs of the cruise. If possible, it is best to flash freeze the nutrient samples in an -80° Celsius freezer, then move them to the -20° Celsius freezer. Approximately two cubic feet are necessary in the -80°C freezer and 16 cubic feet in the -20°C freezer.

Chlorophyll and plant pigments will be sampled at five or six depths with the Niskin bottles and from sea ice samples (size fractionated and total). Seawater will be filtered immediately after sampling (or thawing) using equipment supplied by the scientists. Filters will be frozen and stored at -80° Celsius using the ship's ultracold freezer. Samples will be transported back to Seattle after the cruise for analysis.

Samples will be taken for analysis of DIC (dissolved inorganic carbon) and alkalinity. These samples will be sent to a colleague in Sweden for analysis. Other alkalinity samples from the ice cores will be analyzed in conjunction with the productivity studies aboard.

We will be collecting seawater for phytoplankton and microzooplankton species identification and enumeration from the water column and bottom 2 cm of the sea ice. Samples will be preserved in Lugols and/ or buffered formalin and fixed on slides using glutaraldehyde and DAPI. Slides need to be stored frozen. Other samples need to be stored unfrozen in the dark.

Estimates of primary production will be obtained by incubating phytoplankton (water column and sea ice) with stable isotopes (13C and 15N) on the deck in clear polycarbonate bottles placed in tanks cooled by running surface seawater (4 – 12 hr). A small number of experiments may also be conducted by hanging the bottles in the ocean using a line tethered to an ice floe (4 hr). Collection of phytoplankton requires Niskin bottles with silicon O-rings and external closure mechanisms. Insides of the Niskin bottles must be without any metal or black rubber. At the end of the experiments, the contents of the bottles are filtered and the filters stored in the –20°C freezer.

We plan to deploy 4 Advanced Research and Global Observation Satellite (ARGOS) satellite-tracked drifter buoys during the cruise.

Several different types of nets will be used to collect micro- and mesozooplankton for identification and enumeration. MARMAP bongo nets will be used to collect zooplankton at most hydrographic stations. The AFSC uses a combination of two bongo net frames, a 20 cm frame on top, and a 60 cm frame underneath towed from a conducting oceanographic cable. Above the 20 cm frame is an SBE 19 to measure salinity, temperature, and telemeter the depth of the nets. Below the 60 cm frame is a 70 kg lead weight. Instructions for towing the nets are given in Section 3.8.5 thru Section 3.8.7. Two other types of nets will be used on an

infrequent basis. The CalVET net is a small dual mouth net that is towed vertically (with the ship hove-to) and the $1m^2$ Tucker trawl is a multiple net (mechanical)system that is towed either horizontally or obliquely through the water column.

CalVET nets will be taken to collect zooplankton eggs. Some Tucker tows will be taken. Samples will be put in jars and preserved with formalin.

Zooplankton for rate measurement experiments will be collected using simple ring nets and large volume cod ends. The captured animals will be quickly sorted in the laboratory under a microscope and then incubated in the climate controlled room (walk in refrigerator set at 3°C) for 24 hr. To conduct experiments at –1.7°C, it will be necessary to place small laboratory chillers inside the climate controlled room. The electric chillers require 110V current for operation, and will pump a mixture of water and antifreeze (ethylene glycol) through tubing into aluminum chiller blocks.

We will conduct seabird observations from the bridge in a location that has unobstructed visibility, but does not interfere with ships operations. Seabird observations are logged on a portable computer, requiring access to electrical power (110V), but no GPS line feed. Easy access to displays of ship's position, and water depth, wind speed, ship's speed and course are also needed. In previous cruises, we have extracted these data from a GPS "repeater" screen and a computer display of the ship's underway data logging system.

Small Boat Operations

All small boat operations around the ice will include a bridge watch for polar bears, particularly when the ship is north of St. Matthew Isl. The Bridge will notify scientists on the ice via VHF radio if they spot a bear. The Bridge will provide the bear's distance from the work area and its direction of travel. Scientists will quickly abandon the work site if a bear comes within 1 mile from the site, leaving their scientific equipment behind, if necessary. Scientists from NMML are discussing the matter of firearms on the ship with Bill Martin (UW). If fire-arms will be permitted, then each work group will also include an armed person trained in the safe use of firearms.

Non-seal, ice flow operations will consist of a group of 3-4 scientists, 1 boat operator, and 1 polar bear lookout using a Zodiac to approach a suitably large ice flow. All personnel will have full Mustang-style float suits and the boats will carry at least one VHF handheld radio. Once on the ice, the team will perform 2 types of operations. First they will use an augur to drill several holes to various depths in the ice. They will then allow time for water to seep into these holes. Later, they will take water samples from the holes, using a slurp gun. While the holes are filling, the scientists will use a gas-powered ice-cored to obtain ice-cores. The cores will be briefly measured and described, then placed in sections into an ice locker for transport back to the ship. The returned cores will be slowly thawed in the walk-in refrigerator, in the dark, before they are filtered, frozen or preserved.

Scientists from the National Marine Mammals Laboratory (NMML) will deploy 2-3 Zodiac boats using NMML personnel as the boat operators. Scientists will bring with them copies of all necessary permits for their work. All personnel will have full Mustang-style float suits and the boats will carry at least one VHF handheld radio. They will approach an ice floe with a targeted animal from 2-3 directions at once. This confounds the animal, causing it to hesitate, taking evasive action until too late. The animals will be captured with a throw net. After capture scientists will attach to the animal a satellite transmitter. These animals proved to be

docile last year. The NMML scientists remove the net and leave.

3.7 Station Locations – Stations locations will be determined by the dynamic position of the ice edge. Based on the position of the ice in May 2005 (Section 8.3.2 – Ice Edge, April-May 2005), we have laid out an imaginary cruise track, for the purpose of scheduling times on and between stations. (Section 8.5 – Cruise TN193 Itineraries). This is displayed in the chartlet in Section 8.4 – Cruise TN193 Chartlets.

3.8 Station Operation Procedures – The following are the standard operation procedures at PMEL and AFSC for the proposed operations on this cruise:

3.8.1 Ice Floe Operations – We will visit 5 or 6 ice stations (areas, e.g. Ice-A, Ice-B, etc.) along the ice edge from approximately Nunivak Island westward across the shelf. Each ice station will encompass sampling at 2 or 3 Ice Floes. At each of the ice stations, we will record surface temperature and solar radiation (PAR), then select 2-3 floes that are >50 cm thick and level (no ridging, away from the floe edge) for sampling. The area surrounding each ice station will be characterized (total ice coverage, type of ice, size of floes, extent of ridging, and weather conditions).

At each floe within an Ice Station, we will sample ice cores (Austin/Kovacs Mark 2 9cm corer), brine sacks and under-ice irradiance. Each flow will be characterized (size, ice thickness, ice freeboard, snow depth) prior to sampling. To measure under-ice irradiance, a portion of the floe (southern if possible) should not be disturbed. If measuring for POC/PON (Bio 1), NO WOOL ALLOWED.

3.8.1.1 The types of ice cores and order of importance:

- Chlorophyll/HPLC (Bio 1, includes POC, PON) – core, cut in 10-cm sections
- Salinity/nutrients – core, cut in 10-cm sections
- Phytoplankton and metazoan species (Bio 2) – core, cut in 10-cm sections
- Temperature - T measured while on ice, core discarded
- Primary production – May be combined with the temperature core

3.8.1.2 Overall hints for operating the ice corer, to prevent freezing up:

- Attempt to keep corer vertical.
- Lift up on the corer approximately every 10 seconds or so based on slow-down feel of corer/motor. This removes slush.
- Take special care as the corer approaches the brine, the most likely time for a freeze-up. Push hard downwards as the corer approaches brine interface to maintain momentum of corer.
- If freeze-up occurs, return to the ship and obtain ~20 gallons of HOT water to pour down the hole to dislodge and discard core. Corer is driven by a gas drill which is uni-directional, i.e. not reversible.

3.8.1.3 Sequence of operations on an ice flow – GENERAL INFORMATION:
Disembark personnel and equipment. Include a rescue line with ice gear. Post one person on lookout for polar bears. A polar bear at a distance of one mile is the trigger to return to the ship (ship also on polar bear watch). One crew member stays in boat/zodiac. Use 3-4 people for coring, equipment

handling, documentation, etc. Keep to one end of floe (north if possible) leaving undisturbed site for PAR reading (preferably south).

3.8.1.4 Sequence of operations on an ice flow – ORDER of SAMPLING:

1) **Photography.** Upon landing on the floe, take photographs before disturbing it.
2) **Temperature Core** – Drill the first core. Keep the area around the hole and towards the sun as pristine as possible. Immediately remove the core, place on a plastic sheet (away form the hole) and measure the overall length. Temperature profile measurements are taken beginning at the deepest core end. Drill a ~2" hole in the core 5 cm from the bottom, using a battery-powered drill. Insert a temperature probe, and record the temperature. Continue measuring temperature up the core at 5-10 cm spacing. Discard the core.
3) **Under-ice and above-ice Irradiance** – 2 PAR sensors are needed. A 2 PI PAR sensor is situated on the ice and a 4 PI PAR sensor is inserted into one of the core holes to record underwater light levels. Once inserted into the hole, an opaque object or snow is used to cover the hole. The sensor is positioned so that it is under the ice and not directly below the auger hole. Record surface and under-ice readings. Measure ice-freeboard from this hole. Whenever possible, make under ice measurements with and without snow on the surface of the ice. This reading is to better understand variability of under-ice irradiance under a variety of conditions.
4) **Brine Sacks –for Salinity and Nutrient Samples**– Using the ice auger, drill a series of holes about 1 m apart that increase in depth by about 20 cm each hole (e.g. hole 1 = 20cm, hole 2 = 40cm, etc). Leave these auger holes to fill while taking the rest of the cores and sampling. After finishing ice-cores, sample the brine in these holes with a slurp-gun; place each sample into doubled plastic bags placing a label inside the outer bag (TBD adhesive labels or no). Place bagged samples into the cooler. Once on the ship, sub-sample the brine for salinity and nutrients.
5) **Chlorophyll Core- Biology Core #1 (chlorophyll and POC/PON)** – Place core on a plastic sheet (to observe the extent of brine loss), measure the total length, give a brief description (i.e. location of algal bands, depth of mush at the bottom), and section into 10 cm sections using a SS pruning knife. With clean gloves, place each section into a labeled bag (double bag) and into a cooler. Once on the ship, add 100 ml of GF/F filtered seawater (FSW) for each centimeter of core (1000 ml for 10 cm). The FSW should be close in temperature to the temperature in the climate controlled room. Melting occurs in the dark over about 24 hr. Check the samples every 2 hr. or so. Once all the ice has melted, first measure the total volume of each melted section. Aliquots for chlorophyll ((200-500 ml) and POC/PON (500 – 1500 ml) are filtered recording the exact amount filtered.
6) **Salinity/nutrient Core** – Wearing plastic or rubber gloves, immediately remove the core, place on a plastic sheet (to observe the extent of brine loss), measure the total length, give a brief description (i.e. location of algal bands, depth of mush at the bottom), section into 10 cm sections using a stainless steel pruning saw. Place each section into a labeled bag

(double bag) and into a cooler. Once on the ship, these samples can be thawed in the dark in the bags or in wide-mouth jars. Once melted, the total volume of the melted section should be measured. Each section should be sub-sampled for nutrients, and then salinity. For each section we will measure the melt volume, conductivity, and nutrients, determine salinity (Baker, 1987), and calculate brine salinity (Assur, 1958) and brine volume (Cox and Weeks, 1983).

7) **Biology Core #2 for speciation**– Immediately remove the core, place on a plastic sheet (to observe the extent of brine loss), measure the total length, give a brief description (i.e. location of algal bands, depth of mush at the bottom), and section into 10 cm sections using a stainless steel pruning saw. Place each section into a labeled Ziploc bag (double bag) and into a cooler. Once on the ship, these samples should be placed into wide mouth jars. A measured amount of 0.7 micron FSW at sample temperature is added. The FSW should be kept cold, and at a minimum, the volume added should be 100 ml per cm of ice, but 1.5-2 liters would be fine. These ice sections should be thawed in the dark for 12–24 hours Care should be taken to process the samples immediately upon thaw. Measure the total volume of each melted section, gently mix then sub-sample a known volume to be preserved (Lugols & 2% buffered formalin) phytoplankton and microzooplankton species Sieve the remaining water through a 20 micron piece of plankton netting for metazoa. Preserve the metazoa in 5% buffered formalin.
8) **Ice Structure Core**- Photograph and briefly describe core. Place into a plastic tube/sleeve, and into a plastic tube bag. Place in -20^{o} freezer.

3.8.2 **Pinniped surveys** – During daylight hours and whenever *Thompson* is underway and within sight of ice, up to two observers from the NMML will be stationed on the bridge with binoculars and inclinometers to record the presence of any pinnipeds in the area, their distance from the ship, and nearby sea ice characteristics (i.e., concentration, ridging, age/thickness).

3.8.2.1 **Pinniped capture and handling operations** – During daylight hours and whenever a seal is seen hauled out onto the ice, NMML researchers will, in conjunction with the Chief Scientist, decide whether or not to request that the ship be stopped to allow for the seal's capture. In these instances, *Thompson's* deck crew and crane operators will lower three inflatable rafts into the water for seal capture and handing operations. Using ladders hung over the side of *Thompson*, members of the capture party will climb down into the rafts (at least two people for each raft). All personnel will be wearing personal flotation devices and each raft will be equipped with at least one VHF radio and one hand-held GPS. After each raft has established radio communications with: 1) the bridge, 2) the NMML spotter stationed on the bridge, and 3) the other rafts, the capture team will motor towards the target seal's ice floe. The three rafts will split up and take positions to surround the floe at a distance of about 1/3 mile. The rafts will then close in on the target seal. If the ice is determined to be safe, a researcher with a hoop net will jump onto the floe to capture the seal. Upon capture, the researchers will physically restrain the animal and glue a satellite transmitter onto its fur using a quick setting epoxy. The seal's measurements (e.g., length and girth) will be taken, and a small sample of skin will be cut from

the inter-digital webbing of one of the hind flippers for DNA analyses). Up to 50cc's of blood may also be drawn, before releasing the animal back into the water.

With the permission of the bridge, NMML researchers may choose to remain in the pack ice to continue to hunt for additional seals to capture. This often includes frequent radio calls to the NMML spotter positioned on the bridge. Occasionally, it may also be necessary for a team member to exit their raft and climb on top of an iceberg to get a better view of the ice field. If the bridge determines that conditions are unsafe, or for any other reason requires that researchers return to *Thompson*, the field party will immediately, return to the ship. Once all rafts and team members are aboard the team leader will notify the bridge that the pinniped capture and handling operations are complete.

3.8.2.2 Precautions for dealing with polar bears – Polar bears are extremely rare in the southern Bering Sea, particularly in offshore areas where *Thompson* is expected to spend most of its time. Nevertheless, the potential for an encounter with a polar bears exists for personnel that spend time on or within the pack ice (e.g., for collecting ice core samples, or for capturing seals). Naturally, all personnel working in the sea ice should remain vigilant with respect to polar bears, as well as to weather conditions and other hazards. To further reduce the danger to personnel working off of the ship, the following guidelines will be followed: 1) Personnel will not be allowed off of the ship when a bear has been sighted in the area. 2) Whenever personnel are away from the ship a dedicated spotter will be positioned on the bridge to serve as a lookout for polar bears. 3) In areas of highly ridged or jumbled ice, personnel will be particularly vigilant about their surroundings. 4) Continuous monitoring of VHF radio by ice party must be maintained.

NMML researchers will make two short handled, marine coated, shotguns and ammunition available to qualified members of the science parties who wish to have them while they are conducting field operations. In the unlikely event that a polar bear is spotted, either by an observer on *Thompson* or by members of the field party, all field operations will cease and all personnel will return to the ship until the polar bear is deemed to no longer be a threat. In the extremely rare case of a polar bear surprising a field party, such that they can not escape the encounter in time, the field party should make noise and to attempt to stall or scare the bear away. If available, qualified users may use the shotguns to fire two slugs into the ice in front of the bear to startle it. If the bear continues to make advances towards the party, the bear may be shot with the intent to kill.

All firearms used by the ice parties shall be unloaded before returning to *Thompson* and the firearms and ammunition will be turned over to the Master to be locked into the ship's weapons locker.

3.8.3 Bird observations – We would like to conduct our observations from indoors, so a high visibility location on the bridge would be ideal. We will need an electricity outlet to power our field computer, but no GPS line feed. However, we will need access to displays of the location of the vessel, and environmental and cruising

information (depth, wind speed, sailing speed and course). In previous cruises, we have extracted this information from a GPS "repeater" screen and a computer display of the ship's underway data logging system.

3.8.4 **CTD/Water Sample Operations** – A Sea-Bird Electronics' SBE 911*plus* Conductivity, Temperature, and Depth (CTD) profiler with dual temperature and conductivity sensors will be the primary system. It is requested that the vessel provide the primary 911*plus* CTD system. If the ship is unable to provide a Photosynthetically Active Radiation (PAR) sensor and fluorometer, then FOCI will provide the fluorometer and PAR light meter to be mounted on the CTD stand for all casts. However, these instruments cannot exceed the following depths:

- WETLabs' WETStar fluorometer cannot exceed 600 meters, and
- Biospherical Instruments' QSP-200L4S light meter cannot exceed 1000 meters.

Samples will be collected using the 5-liter or 10-liter "clean technique" Niskin bottles.

Once the CTD has been deployed, it should be lowered to 10 meters, and then the deck unit should be turned on. After 45 seconds, the CTD can be returned to just below the surface. Then the data acquisition program should then be started. The CTD should descend at a rate of 30 meters per minute for the first 200 meters and 45-50 meters per minute below that. The ascent rate should be 50 meters per minute. An entry in the Marine Observation Abstract (MOA) should be made for each CTD cast at the maximum cast depth. Daytime productivity casts require a short time between descent and ascent to calculate light depths.

Scientists will keep the ***CTD Cast Information/Rosette Log***. Pressure, primary salinity, secondary salinity, primary temperature, secondary temperature, fluorescence, and light levels will be recorded on the ***CTD Cast Information/Rosette Log*** for all water bottle samples.

3.8.4.1 **CTD Calibration** – Salinity samples will be taken on every other cast, or as specified by the Chief Scientist. The CTD systems will be equipped with dual temperature and conductivity sensors. **It is requested that the ship bring an autosalinometer so that salinities may be analyzed aboard ship.**

3.8.5 **MARMAP Bongo Tows** – A 60-cm aluminum Bongo frame with 0.333-mm mesh and a 20-cm aluminum Bongo frame with 153-micron mesh, both with hard plastic cod-ends, and a 70-kg lead weight for a depressor will be used in standard Marine Assessment Monitoring and Prediction (MARMAP) Bongo tows. **The nets will be deployed while the ship is steaming at 1.5 to 2.5 kts with the wind (and waves, whenever possible) on the starboard quarter**. After the bridge gives permission, ship's personnel and one or two scientists will deploy the Bongo array. **It is important that the wire angle during both deployment and recovery is not less than 40 degrees and not greater than 50 degrees**. The ship's speed should be adjusted to **maintain the wire angle within these specifications** during the entire tow. This is accomplished, in part, by relaying wire angles from the starboard sampling station to the bridge by radio, so that the bridge personnel can speed up or slow down the vessel's speed to increase or reduce the towing angle. **The net frames are lowered at a constant wire speed of 40meters per minute to a**

maximum depth of 300 meters, or 5-meters off bottom in shallower waters. A scientist will monitor the depth of the Bongo nets using SeaCat software and inform the ship's winch operator when the desired gear depth is reached. Afterwards, the winch operator will be instructed by the scientist to **retrieve the nets at a wire speed of 20 meters per minute**. A Sea-Bird Electronics SBE 19 SEACAT Profiler will be attached to the wire above the top bongo frame to provide real-time instrument depth.

When the nets reach the surface, the SeaCat, and nets will be recovered. After the nets are brought aboard, they are washed with saltwater from a nearby deck hose to move the sample into the cod-end. In some cases, fish larvae are sorted and separately preserved. Flow meters in the nets record the amount of water filtered, and the SBE 19 SEACAT records the depth history of the tow. The scientists on watch are responsible for recording times, maximum depth, wire-out, and flow meter counts on the Cruise Operations Database (COD) forms. Tows not meeting specifications) may be repeated at the discretion of the scientific watch (i.e. hit bottom, wire angles less than 40 or more than 50 degrees, nets tangled, etc.).

3.8.6 **CalVET Net Tows –** California Cooperative Oceanic Fisheries Investigation (CalCOFI) Vertical Egg Tow (CalVET) collects microzooplankton and free-floating copepod eggs. These net tows will be conducted by themselves or in conjunction with Conductivity, Temperature, and Depth (CTD) profiler and Niskin water bottle casts. Scientists will require the assistance of the ship's marine technician for deploying and recovering the CalVET net. A "book clamp" is placed on the wire where the cod-ends hang to keep the net taut. When used with a Sea-Bird Electronic SBE 19 SEACAT, the SEACAT is placed below the cod-ends.

The ship is requested to maintain a near constant vertical wire angle during the entire cast. After descent to the desired depth (usually 60 meters) at 60 meters per minute, the net is then retrieved at a rate not to exceed 60 meters per minute. The samples are washed into the cod-ends, and then preserved in 32-ounce jars with Formalin for later analysis.

3.8.7 **Tucker Trawls** – The Tucker trawl will be used occasionally around the ice edge over the middle shelf domain to capture snow crab larvae from multiple depths. The Tucker will be equipped with 0.333-mm mesh netting and be towed in a smooth oblique fashion with one net open. When used for discrete depth sampling, a Sea-Bird Electronics SBE 19 SEACAT or a SBE 39 Temperature and Pressure Recorder will be attached on the main cable above the bridle (whenever possible) The messenger release is positioned on the cable above the SEACAT.

The trawl will be deployed (40 m/min) while the ship is steaming at 1.5 to 2.5 kts with the wind (and waves, whenever possible) on the starboard quarter. After the bridge gives permission, ship's personnel and one or two scientists will deploy the Tucker. As with the bongo **it is important that the wire angle during both deployment and recover is not less than 40 degrees and not greater than 50 degrees**. The ship's speed should be adjusted to **maintain the wire angle within these specifications** during the entire tow. This is accomplished, in part, by relaying wire angles from the starboard sampling station to the bridge by radio, so that the bridge personnel can speed up or slow down the vessel's speed to increase or reduce the towing angle.

A scientist will be stationed in the ship's CTD lab to monitor the SEACAT depth and to inform the scientists and winch operator when each desired gear depth is reached. When the maximum desired depth is reached, the winch operator will stop the winch and scientists will send the first messenger, closing the drogue net and opening the first net. The winch then begins to retrieve the trawl (20 m / min) until the next desired depth is reached. At that point the winch is stopped again, and a second messenger is sent, closing the first net and opening the second. The winch is again started and the net is hauled to the surface.

When the nets reach the surface, they are brought aboard and hosed with saltwater to wash the sample into the cod-end. The sample is preserved as specified in the FOCI Field Manual or sample collection request forms. Flow meters in the nets record the amount of water filtered, and the SBE 19 SEACAT, or SBE 39, records the depth history of the tow. The scientists on watch are responsible for recording times, maximum depth, wire outs, and flow meter counts on the Cruise Operations Database (COD) forms. Tows not meeting specifications (i.e., hit bottom, poor wire angles, nets tangled, etc.) may be repeated at the discretion of the scientific watch.

3.8.8 **Chlorophyll/Nutrient Sampling Operations** – Chlorophyll samples will be collected simultaneously with Conductivity, Temperature, and Depth (CTD) profiler casts from the 10-liter Niskin bottles. The scientists will be responsible for collection, filtration, and preservation of samples. Sampling depths depend on the fluorescence profile. A typical strategy would be samples at 0, 10, 20, 30, 40, and 50 or 60 meters, depending upon which of the last couple of depths is closest to the fluorescence maximum. If the maximum is deeper than 60 meters, sampling should be moved deeper with fewer samples in the mixed layer.

Nutrient samples will be collected from all Niskin bottles, both near surface and from depth. It is desirable to flash-freeze nutrient samples in an -80° Celsius freezer, if available, if they are not to be analyzed with 24 hours. The -80° Celsius freezer is required for sample storage of the chlorophyll & HPLC filters. The -20° C freezer will be used to store frozen nutrient samples.

3.8.9 **ARGOS Satellite-Tracked Drifter Buoy Deployments** – Two to three working days before deployment, the Chief Scientist, or designee, will secure the drifter on the back deck. The drifter buoy is then turned on, usually by removing the magnet, and an e-mail message is sent by the Chief Scientist, or designee, to Dr. Phyllis Stabeno at Phyllis.Stabeno@noaa.gov, stating the serial number that is stamped on the drifter and the time that it was turned on. This lead-time is necessary to ensure that telemetry from the buoy is being received and transmitted by the Advanced Research and Global Observation Satellite (ARGOS). The method of deployment of the drifter is dependent upon the particular make of drifter and is to be directed by the Chief Scientist, or designee.

3.9 **Underway Operations** – Underway operations that will be performed during this cruise include thermosalinograph, fluorometer, nitrate meter, bathymetry, and meteorological data.

3.10 **Data Logging** – The ship's data logger, shall operate throughout the cruise, acquiring, and logging data from navigation, meteorological, oceanographic, and bathymetric sensors. If a method for observing data acquisition is available, please provide project scientists with the capability of monitoring sensor acquisition via text and graphic displays. A data processing

node should be made available to project scientists throughout the cruise for the above-mentioned purpose.

At regular intervals, not to exceed every five days, the ship's computer manager will archive data from disk files to a suitable medium, such as CD or DVD, for delivery to the project representative at the end of the cruise. Additional recording of processed data may be requested of the ship's computer manager. The ship's computer manager will ensure data quality. During the cruise, the scientific party may require the assistance of the ship's computer manager to determine if all sensors are functioning properly and to monitor some of the collected data in real time to make sampling strategy decisions.

3.11 **Sea chest and Uncontaminated Seawater** – Sea surface temperature, conductivity, and fluorometry will be continuously monitored. Uncontaminated seawater from the Uncontaminated Scientific Seawater System (USSS) will be continuously pumped through the thermosalinograph, fluorometer, and nitrate monitor – provided by PMEL. Data from these instruments should be sent to the data logger, if possible. Approximately two square feet of bench space will be required near a sink with uncontaminated seawater to install the underway nitrate monitor.

The ship's complement will be responsible for inspecting, and when required, cleaning the sea chest and conductivity cells. The scientists will be responsible for regularly cleaning the cuvette, inside the fluorometer, and obtaining and processing the calibration samples for fluorescence and nitrate. Calibration samples will be taken twice per day, throughout the cruise

During the cruise, the ship's personnel will be responsible for ensuring that the data logger correctly logs data streams from the instruments, and checking the logger status display once per watch to determine that the instruments are functioning.

The scientists also request that the fluorometer be interfaced to the ship's data logger, if possible, and the data logger should be configured to log one-minute data throughout each FOCI cruise, including:

- GPS Time,
- GPS Latitude,
- GPS Longitude,
- Water Depth, in meters,
- PAR from the superstructure, if available,
- Seawater (sea chest) Temperature,
- Seawater (sea chest) Salinity,
- Laboratory Fluorometer voltage, and
- Flow-Through Nitrate voltage, if we are able to wire it in.

3.12 **Small Boat Operations** – The ship's small boat will be needed for transferring scientific personnel in St. Paul, Alaska on April 29, 2006. Additionally, scientists plan on deploying their own small boats for the purpose of the tagging of ribbon seals and ice coring operations by FOCI. These operations are described separately. In addition personnel and samples will come from *Miller Freeman* to *Thompson* using *Freeman*'s small boat.

4.0 FACILITIES

4.1 Equipment and Capabilities Provided by Ship

- Oceanographic winch with 0.322" electro-mechanical cable with slip rings terminated for CTD operations and MARMAP bongo tows with an attached SeaBird 25 SEACAT
- Winch with minimum of 1,000 meters of 9/16” wire,
- A-Frame,
- Shipboard ADCP,
- Ability to connect a PAR, fluorometer, oxygen, and transmissometer, provided by the ship, or by PMEL, to the CTD,
- Provide termination kits and ship support personnel to do the terminations,
- A device to allow the signal from the sea cable to be split, so it can be fed into the deck units for the CTD and SeaCat (SBE-19),
- Wire speed indicators and readout for winches,
- Meter block for MARMAP plankton tows, 0.322” electro-mechanical cable is essential. Ability to switch the cable between the CTD and MARMAP bongos,
- Electrical connection between winch and Deck computer systems,
- Sea-Bird Electronics’ SBE 911*plus* CTD system with dual sensors, 12 bottle rosette, stand, deck unit, and weights, X clean technique Niskin bottles,
- Refrigerator and freezer space for storage of biological and chemical samples, +4° C (4-cu ft) for nutrients and -20°C (~12-16-cu ft) for frozen nutrients, respectively, plus a –80°C freezer for chlorophyll, HPLC, and lipid samples,
- Walk-in refrigerator for thawing and sampling ice cores, and for zooplankton egg production experiments,
- For meteorological observations: Anemometers, calibrated air thermometer – wet-and dry-bulb – and a calibrated barometer and/or barograph, interfaced to the data logger, if possible,
- A salinometer for analysis of salinity samples,
- Bench space for PCs, monitors, and printers,
- Exhaust hoods,
- Laboratory space with exhaust hood, sink, lab tables, and storage space,
- Sea-water deck hoses and nozzles to wash nets and recovered mooring equipment,
- Sea-water hoses to circulate water through an incubator located on the 01-Deck (preferred location, to avoid interfering with small boat operations
- Adequate deck lighting for night-time operations,
- Navigational equipment including GPS and radar,
- Depth sounder good to at least 3,000 meters,
- Safety harnesses for working on quarterdeck and fantail,
- Ship’s crane(s) used for loading and/or deploying and small boat ops,
- Hand-held radios for shipboard scientific/winch/bridge communications and for communicating with scientists on ice floes and small boats,
- VHF radio with external antenna at CTD computer station,
- Thermosalinograph and fluorometer interfaced with the data logger,
- Continuous uncontaminated seawater sampling system with debubbler piped from bow into labs,
- MilliQ de-ionized water source – projected use of <50-L/day for, and
- Capability to transfer ship’s data to CD-ROM or DVD disks,

- Quick release/overboard ejection racks for (33) 55-gal. drums of gasoline.

4.2 Equipment and Capabilities Provided by Scientists – See Section 8.1 Cruise TN193 Equipment Inventory for weights:

- Sea-Bird Electronics' SBE 911*plus* CTD system with dual sensors, 12 bottle rosette, stand, deck unit, and weights – to be available as backup for the ship's system, (this will remain aboard from the CLIVAR cruise),
- Photosynthetically Active Radiation (PAR) and fluorometer to be mounted on CTD,
- Portable Photosynthetically Active Radiation (PAR) sensor, to measure PAR down the ice core,
- CTD carousel sampler,
- (12) 5-liter sample bottles,
- Lanyard material and nicropress sleeves,
- 144 salinity sample bottles,
- Fluorometer (spare) to be mounted to the Uncontaminated Scientific Seawater System (USSS),
- Debubbler for the fluorometer,
- (2) Sea-Bird Electronics' SBE-19 SEACAT systems,
- 60-cm MARMAP Bongo sampling arrays,
- 20-cm MARMAP Bongo arrays,
- Spare wire angle indicator,
- Filtration rig for chlorophyll samples,
- Tucker trawl, with nets,
- (8) ARGOS satellite tracked drifter buoys,
- Iridium phone,
- (2) Hand-held radios for scientific/winch/bridge communications,
- Miscellaneous scientific sampling and processing equipment,
- Cruise Operations Database (COD) and forms,
- Marine Observation Abstract (MOA) log,
- PMEL CTD Weather Observation Logs,
- CTD Cast Information/Rosette Log,
- 5 Zodiac boats or small boat operations,
- Deck incubator,
- Nutrient analysis equipment and chemicals,
- Winkler Oxygen titration equipment and chemicals
- Spill kits for scientists' HazMat,
- Miscellaneous laboratory and sampling equipment (NMFS),
- Miscellaneous laboratory and sampling equipment (NMFS-Auk Bay), and
- Miscellaneous laboratory and sampling equipment (FOCI).
- Float coats, mustang suits, rubber gloves (lined and unlined)

Supplies for Ice Sampling:

- Mustang suits
- Insulated rubber boots
- Regular boots
- Work gloves with liners
- Sampling gloves

- Log sheets designed for ice sampling
- Ice auger for deploying PAR sensor and making brine holes
- Surface PAR sensor with digital display or data logger
- On Ice and Under-ice PAR sensors with deployment stick and digital display
- Ice corer (Mark II?) and motor
- Temperature Probe (and spare)
- Tape measures (6)
- Cordless drills (2), extra battery, charger, drill bits
- Hacksaw or Fiskers stainless steel pruning saw
- Hand-held Refractometer for coarse salinity measurements
- Labels (Date, Ice station, core type (sal, bio 1, bio 2), section)
- 1-gallon freezer bags (~80 per floe) for double bagging samples—We can re-use the outer ones
- Large-mouth jars
- Graduated cylinders (1 liter, 500 ml, 250 ml, 100 ml)
- Jugs for filtered sea water
- Cartridge filters (1 nm or 0.2 nm?) for FSW through our large volume filter
- Baked GFF for POC/PON
- (4) Slurp Gun for sampling brine sacks_ alternatively, syringes and Tygon tubing
- Coolers for keeping ice sections in the dark while on the ice
- Action Packers for gear
- Digital cameras
- Movie camera equipment

5.0 DISPOSITION OF DATA AND REPORTS

5.1 **Ship Provided Data Products** – The following data products will be provided by the ship and included in the data package at the end of the cruise:

- Calibration Sheets for all ship's instruments used,
- Files from data logger,
- Marine Operations Abstracts (MOA), and
- PMEL CTD Weather Observation Logs.

5.2 **Scientific Party Provided Data Products** – The following data products will be completed by the scientific party:

- CTD Cast Information/Rosette Log,
- Cruise Operations Database (COD) log sheets, and
- Mooring logs.

5.3 **Pre-cruise Meeting** – A pre-cruise meeting between the ship's representative and the Chief Scientist will be held before the start of the cruise. Its purpose is to identify the day-to-day requirements of the project in order to best utilize shipboard personnel resources and to identify overtime requirements. A brief meeting of all scientific personnel, the ship's officers, deck and marine tech departments, and other relevant ship's personnel should be held before the vessel reaches the operations area for the purposes of:

1. Introducing scientific personnel to ship's procedures, proper channels, etc.,

2. Discuss operating procedures for deploying various pieces of sampling equipment, and
3. Coordinating scientific watch assignments.

6.0 HAZARDOUS MATERIALS

6.1 Definition – Hazardous scientific materials are any substance, which because of its chemical properties can cause the deterioration of the materials or injury to living organisms. Rules for the stowage, labeling, and protection of flammables and other hazardous scientific stores on inspected vessels are given in ***Subchapter U, Title 46 CFR, Part 194***.

6.2 Standards

6.2.1 Storage Containers – Storage containers should be marked, labeled, and stored in a ventilated and protected area under the supervision of the Chief Scientist with the knowledge and approval of the Master. Consideration should be given to transporting and storing hazardous materials, normally shipped in glass containers, in special, non-breakable containers.

6.2.2 Working Quantities – Working quantities only should be stored in the laboratory. A reasonable working quantity would be a one-day supply, considering the hazard posed by the material. Containers should be marked with the material's chemical and common names, type, and classification, and person responsible.

6.2.3 Storerooms – Storerooms for chemicals and flammables, where practicable, should be protected by fixed CO_2 or Halon systems, and used for no other purpose. Where it is not practical to provide such a storeroom, consideration should be given to a hazardous material locker appropriate for the type and quantity of material being stored.

6.2.4 Incompatible Materials – Because of the limited shipboard storage for hazardous materials, particular attention must be made to avoid storing incompatible materials together. A close review of the Material Safety Data Sheets (MSDS) will show if two chemicals are incompatible.

6.3 Transportation and Disposal – The Chief Scientist is responsible for the proper transportation, shipping, and disposal of hazardous materials, including empty containers, associated with their project. Transportation and disposal must be carried out in accordance with Federal, State, and Local regulations. In no case will this responsibility be passed to the ship's crew or operating institution unless specifically arranged in advance.

6.4 Chemical Spill Response – The scientific party is responsible for supplying neutralizing agents, buffers, and/or absorbents in the amounts adequate to address spills of a size equal to the amount of any chemicals brought aboard. This spill response material must accompany the chemicals when they come aboard.

6.5 HAZMAT Inventory – The Hazmat for Calvin Mordy's nutrient analyses will remain aboard R/V *Thomas G. Thompson* from the two CLIVAR cruises (Richard Feely, Chief Scientist) earlier. Bill Martin (personal communication) has agreed to be responsible for the inventoried Hazmat that stays aboard during the MURI cruise (B. Plant, Chief Scientist), while no

scientist from PMEL is aboard. Lists of Hazmat will come from 4 groups, Mordy, Napp, Cameron, and Eisner. (See Section 8.6 Cruise TN193 HAZMAT Inventory)

6.6 Material Data Safety Sheets (MSDS) – All hazardous materials brought onboard will have accompanying MSDSs.

7.0 MISCELLANEOUS

7.1 Communications – For scientific projects, the Chief Scientist, or designated representative, may have access to the ship's communications systems on a cost reimbursable basis.

7.2 Satellite Communications – INMARSAT (voice and facsimile) communications are available aboard ship and may be used for personal or business related calls. Arrangements to pay for the calls must be made before calling. Credit card calls are the preferred method of payment. INMARSAT calls can be extremely expensive and the exact cost may not be known until you receive your bill.

7.3 Electronic Mail (E-mail) – FOCI requests that **R/V *THOMAS G. THOMPSON*** transmit e-mail as frequently as possible. We understand that, when the Hi SEAS Network is functioning, this means that email is available in real-time, most of the time. Each embarked personnel will have an e-mail account and address established in their name by the ship.

7.4 Internet - The scientists will have use of the internet access at times during the cruise for the purpose of accessing near real-time data to assists us in locating the oceanographic features of interest, and for transmitting figures and data between ship and shore.

7.5 Use of Radio Transceivers – Because it will be necessary for the scientific staff to communicate with other research vessels, especially during joint operations, and shore based NOAA facilities, the Chief Scientist or designee may request the use of radio transceivers aboard the vessel. Use of handheld receivers to communicate with the personnel in small boats and on the ice floes will be necessary.

7.6 Important Telephone and Facsimile Numbers and E-mail Addresses

7.6.1 Pacific Marine Environmental Laboratory (PMEL)

FOCI – Ocean Environmental Research Division (OERD2):
- (206) 526-4700 (voice)
- (206) 526-6485 (fax)

Administration:
- (206) 526-6810 (voice)
- (206) 526-6815 (fax)

7.6.2 Alaska Fisheries Science Center (AFSC)

FOCI – Resource Assessment and Conservation Engineering (RACE):
- (206) 526-4171 (voice)
- (206) 526-6723 (fax)

7.6.3 R/V *THOMAS G. THOMPSON*

Cellular- Master

- (206) 409-4046

INMARSAT B

- 011-872-33-663-4510 (Voice)
- 011-872-33-663-4511 (Facsimile – on the bridge)
- 011-872-33-663-4512 (Facsimile – in the main lab)

8.0 Appendices

8.1 Cruise TN193 Equipment Inventory – PMEL (N.Kachel)

ITEM	QTY	WEIGHT	TOTAL WEIGHT
CTD Equipment			
CTD Rosette	1		
CTD Cage	1		
SBE 911*plus*			
Bottles, Niskin, 5-l	12		
Stand, Reel	1	25 lbs	25 lbs
NMFS-FOCI			
Supplies, Miscellaneous, G1	1	25 lbs	25 lbs
Coats, Float and Gloves, B2	1	20 lbs	20 lbs
Mustang suits	5-6	10 lbs	60 lbs
Kit, Response, Spill	1	15 lbs	15 lbs
Box, Clear Plastic, Large	1	35 lbs	35 lbs
Deck Unit, SeaCat	1	30 lbs	30 lbs
Buckets		5 lbs	5 lbs
SBE-39	1	10 lbs	10 lbs
Frame, Bongo, 60-cm	1	40 lbs	40 lbs
Frame, Bongo, 20-cm	1	15 lbs	15 lbs
Weight, Depressor, Bongo	1	50 lbs	50 lbs
Filtering rig w/supplies		70 lbs	70 lbs
Bottles, Sample, Nutrient			
Box, SeaCat	1	40 lbs	40 lbs
Box, SeaCat	1	40 lbs	40 lbs
Frame and nets for Tucker Trawl			75 lbs
Frame and nets for CalVET			20 lbs
Chiller for incubating zooplankton in cold room			60 lbs
Deck Incubator			50 lbs
Chlorophyll Analysis Equipment			80 lbs
Slurp guns	4		5 lbs
ICE SAMPLING SUPPLIES-FOCI			
Gas Powered Coring device			60 lbs
Augurs			20 lbs
Ice Chests	8		50 lbs
Miscellaneous Supplies			100 lbs
PAR sensors			

ITEM	QTY	WEIGHT	TOTAL WEIGHT
Glass bottles			40 lbs
Ziploc bags 2 cases?		10 lbs	
MISCELLANEOUS			
Box, Drifter, ARGOS	2	69 lbs	138 lbs
Box, Wooden, Large	1	795 lbs	795 lbs
CTD	1	900 lbs	900 lbs
Cameras			
Assorted laptop computers			<100 lbs
Nutrient Analysis-IOS			
Equipment and Supplies			350 lbs
Salt and Analysis			
Salinity Bottles			80 lbs
Chemicals (See hazmat inventory)			
		Total	**~3403 lbs**

8.2 Equipment Inventory – NMML (Cameron)

Estimate of cargo container volume needed for shipping field gear to Kodiak - NMML, Polar Ecosystems Program

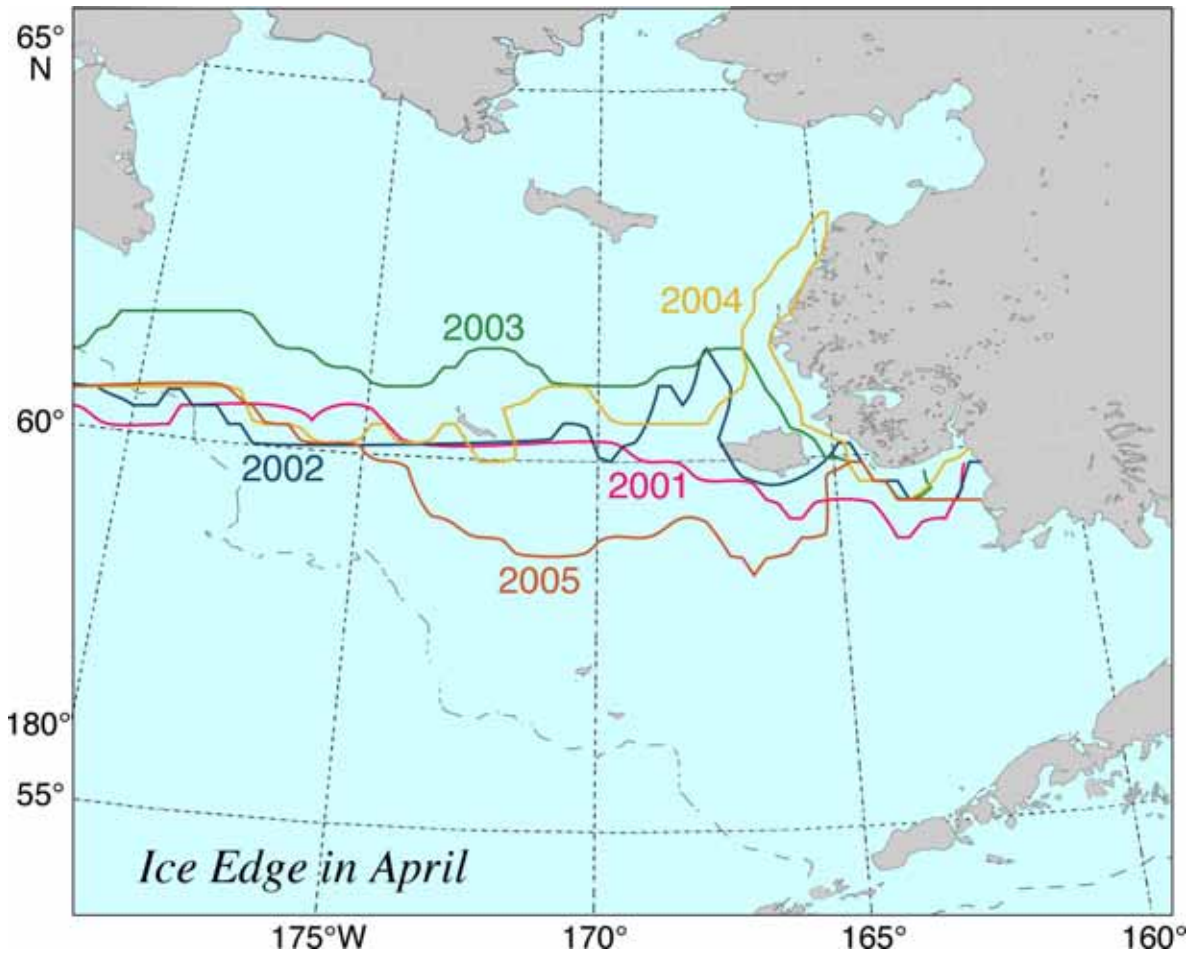
Container	L	W	H	Volume (Cubic Inches)	Volume (Cubic Feet)	Number	Total Volume (Cubic Feet)	Expected Contents
Engine box (2-stroke)	60	24	37	53,280	31	1	31	Evinrude outboard motor, 2 "mixed" gas cans and hoses
Engine boxes (4-stroke)	64	30	38	72,960	42	3	127	Mostly empty to Kodiak (will hold Honda motors on return)
Sm. white clamshells	32	24	29	22,272	13	3	39	Field gear
Deflated Zodiacs	60	24	37	53,280	31	2	62	boats and floorboards
Lg. grey clamshell	48	36	26	44,928	26	2	52	Field gear and clothing
					GRAND TOTAL (Cubic Feet) =		**310**	

Estimate of additional cargo container volume for leaving gear on Thompson or shipping back to Seattle after cruise - NMML, Polar Ecosystems Program

Super Lg. grey clamshell	58	28	36	58,464	34	1	34	Field gear (might be able to fit one of the Zodiacs in here).
Deflated Zodiacs	60	24	37	53,280	31	1	31	boats and floorboards
					GRAND TOTAL incl. above (Cubic Feet) =		**375**	

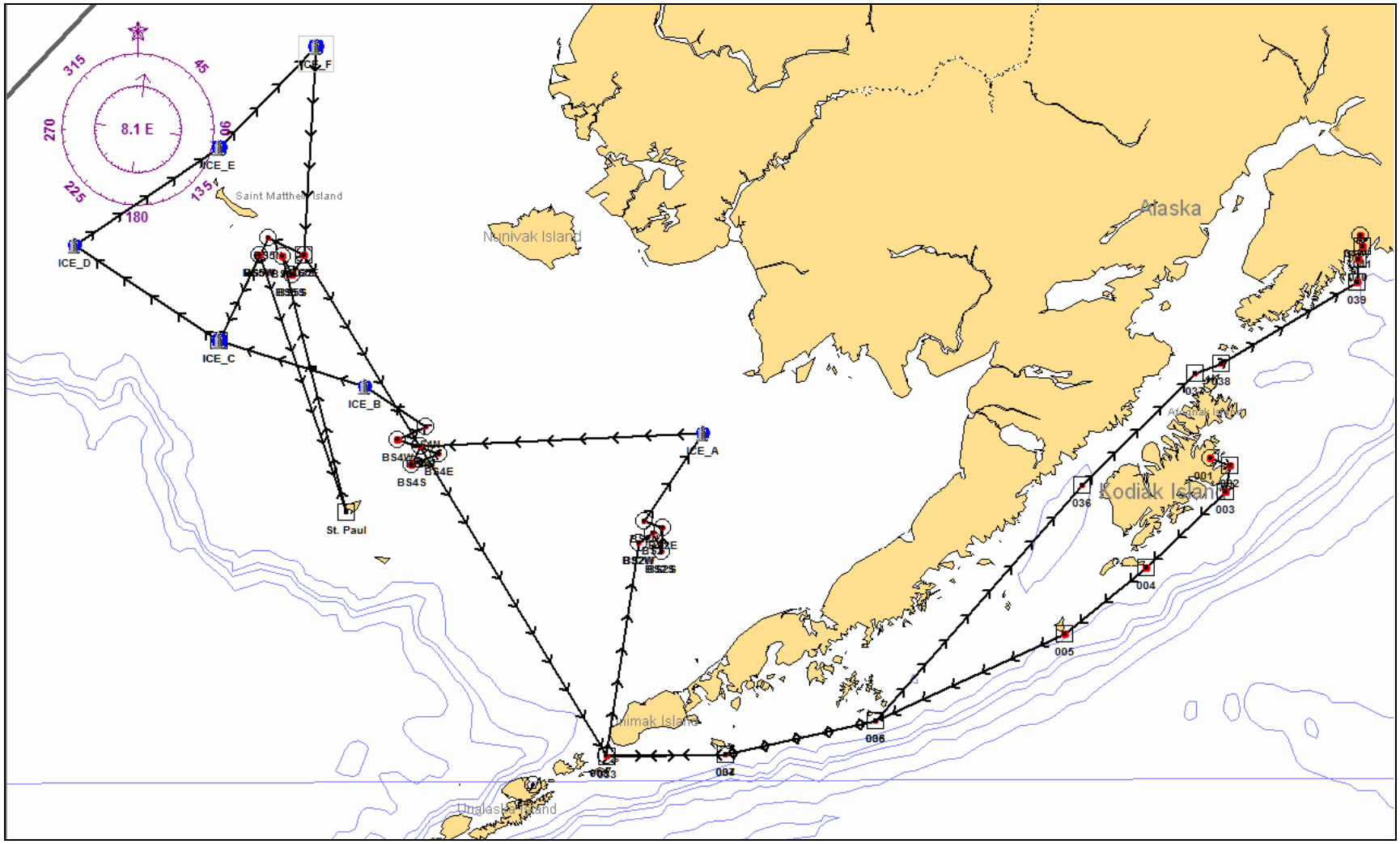
8.3 Cruise TN193 Figures

8.3.1 Ice edge Extent in late April – Satellite data was used to define the position of the Bering Sea Ice edge in late April, 2001-2005.



8.3.2 **<u>Ice Edge, April-May 2005</u>** – Ice edge retreat during April and May of 2005, and the Stations occupied by FOCI on the TN179 cruise between May 14 and 28, 2005.

8.4 **Cruise TN193 Chartlets-** This cruise track is based on a hypothetical position for the sea ice. The stations in blue are hypothetical positions for ice stations. We plan to rendezvous with NOAA Ship *Miller Freeman* for visits to ice near Stations B and C.



8.5 **Cruise TN193 Itineraries** – Station locations for Leg 1 and Leg 2 included in these instructions may change. The Chief Scientists will work closing with the command to ensure that the latest locations are provided.

Station ID	Activity	Latitude			Longitude			Dist. (nm)	Spd (kts)	Transit (hrs)	z (fm)	Water Depth (m)	CTD Depth (m)	CTD/net Time (min)	Other time	Arrive Local Date/Time	Depart Local Date/Time
Kodiak Is	DEPART	57	43.43	N	152	31.53	W										04/12/06 19:00
Unimak Pass	on Transit	54	16.00	N	165	00.00	W	466.2	12	38.9					650	04/14/06 09:51	04/14/06 20:41
site 2/west	CTD	56	46.00	N	164	20.00	W	151.7	12	12.6		75	70			04/15/06 09:19	04/15/06 09:19
site 2/west	bongo	56	46.00	N	164	20.00	W	0.0	12	0.0		75	70	20		04/15/06 09:19	04/15/06 09:39
site 2	CTD	56	52.50	N	164	03.00	W	11.3	12	0.9		72	67			04/15/06 10:36	04/15/06 10:36
site 2	CalVET (3)	56	52.50	N	164	03.00	W	0.0	12	0.0		72	67	15		04/15/06 10:36	04/15/06 10:51
site 2	bongo	56	52.50	N	164	03.00	W	0.0	12	0.0		72	67	20		04/15/06 10:51	04/15/06 11:11
site 2 south	CTD	56	40.00	N	163	52.00	W	13.9	12	1.2		75	70			04/15/06 12:20	04/15/06 12:20
site 2-south	bongo	56	40.00	N	163	52.00	W	0.0	12	0.0		75	70	20		04/15/06 12:20	04/15/06 12:40
site 2-east	CTD	56	56.50	N	163	50.01	W	16.5	12	1.4		69	64			04/15/06 14:03	04/15/06 14:03
site 2-east	bongo	56	56.50	N	163	50.01	W	0.0	12	0.0		69	64	20		04/15/06 14:03	04/15/06 14:23
site 2 north	CTD	57	01.00	N	164	13.00	W	13.3	12	1.1		69	64			04/15/06 15:29	04/15/06 15:29
site 2 north	bongo	57	01.00	N	164	13.00	W	0.0	12	0.0		69	64	20		04/15/06 15:29	04/15/06 15:49
Eastern Ice edge-Ice.Sta.A	CTD/ bongos/ ICE FLOE	58	00.00	N	163	00.00	W	70.8	12	5.9		35	30		3000	04/15/06 21:44	04/17/06 23:44
site 4	CTD	57	51.00	N	168	51.25	W	186.7	12	15.6		72	67			04/18/06 15:17	04/18/06 15:17
site 4	bongo	57	51.00	N	168	51.25	W	0.0	12	0.0		72	67	20		04/18/06 15:17	04/18/06 15:37
site 4 south	CTD	57	39.20	N	169	01.20	W	12.9	12	1.1		71	66			04/18/06 16:42	04/18/06 16:42
site 4 south	bongo	57	39.20	N	169	01.20	W	0.0	12	0.0		71	66	20		04/18/06 16:42	04/18/06 17:02
site 4 west	CTD	57	55.60	N	169	19.30	W	19.0	12	1.6		71	66			04/18/06 18:37	04/18/06 18:37
site 4 west	bongo	57	55.60	N	169	19.30	W	19.0	12	1.6		71	66	20		04/18/06 20:12	04/18/06 20:32
site 4 east	CTD	57	46.00	N	168	28.00	W	28.9	12	2.4		71	66			04/18/06 22:57	04/18/06 22:57
site 4 east	bongo	57	46.00	N	168	28.00	W	28.9	12	2.4		71	66	20		04/19/06 01:21	04/19/06 01:41
site 4 north	CTD	58	04.00	N	168	43.80	W	19.9	12	1.7		71	66			04/19/06 03:21	04/19/06 03:21
site 4 north	bongo	58	04.00	N	168	43.80	W	19.9	12	1.7		71	66	20		04/19/06 05:00	04/19/06 05:20

Station ID	Activity	Latitude			Longitude			Dist. (nm)	Spd (kts)	Transit (hrs)	z (fm)	Water Depth (m)	CTD Depth (m)	CTD/net Time (min)	Other time	Arrive Local Date/Time	Depart Local Date/Time
Mid-Shelf Ice Sta.B	CTD/ bongos/ ICE FLOE/mammals	58	30.00	N	170	00.00	W	47.8	11	4.3	70	70	65	24	3100	04/19/06 09:41	04/21/06 13:45
outer Ice Sta C	CTD/ bongos/ ICE FLOE-mammals Join Thompson	59	00.00	N	173	00.00	W	145.5	12	12	120	120	115	28	3600	04/22/06 04:23	04/24/06 18:30
site 5 west	CTD/ bongos/ ICE FLOE-mammals Join Thompson	59	53.88	N	172	10.00	W	107.1	12	8.9	70	70	65		4800	04/25/06 03:26	04/28/06 11:26
St Paul	Small boat personnel exchange	57	07.00	N	170	22.00	W	191.6	12	16.0					240	04/29/06 03:24	04/29/06 07:24
site 5 west	CTD	59	53.88	N	172	10.00	W	0.0	10	0.0	70	70	65			04/29/06 07:24	04/29/06 07:24
site 5 west	bongo	59	53.88	N	172	10.00	W	0.0	10	0.0	70	70	65	20		04/29/06 07:24	04/29/06 07:44
site 5	CTD	59	53.50	N	171	41.50	W	14.3	10	1.4	72	70	65			04/29/06 09:09	04/29/06 09:09
site 5	bongo	59	53.50	N	171	41.50	W	0.0	10	0.0	72	70	65	20		04/29/06 09:09	04/29/06 09:29
site 5	CalVET (3)	59	53.50	N	171	41.50	W	0.0	10	0.0	72	70	65	15	45	04/29/06 09:29	04/29/06 10:29
site 5 south	CTD	59	42.00	N	171	30.00	W	12.9	10	1.3	70	70	65			04/29/06 11:47	04/29/06 11:47
site 5 south	bongo	59	42.00	N	171	30.00	W	0.0	10	0.0	70	70	65	20		04/29/06 11:47	04/29/06 12:07
site 5 east	CTD	59	53.88	N	171	15.50	W	13.9	10	1.4	70	70	65			04/29/06 13:30	04/29/06 13:30
site 5 east	bongo	59	53.88	N	171	15.50	W	0.0	10	0.0	70	70	65	20		04/29/06 13:30	04/29/06 13:50
site 5 north	CTD	60	04.50	N	172	00.00	W	24.7	10	2.5	70	70	65			04/29/06 16:18	04/29/06 16:18
site 5 north	bongo	60	04.50	N	172	00.00	W	0.0	10	0.0	70	70	65	20		04/29/06 16:18	04/29/06 16:38

Station ID	Activity	Latitude			Longitude			Dist. (nm)	Spd (kts)	Transit (hrs)	z (fm)	Water Depth (m)	CTD Depth (m)	CTD/net Time (min)	Other time	Arrive Local Date/Time	Depart Local Date/Time
outer Ice Sta D	CTD/ bongos/ ICE FLOE-mammals	60	00.00	N	176	00.00	W	119.9	10	12.0	70	70	65		3600	04/30/06 04:38	05/02/06 16:38
outer Ice Sta E	CTD/ bongos/ ICE FLOE-mammals	61	00.00	N	173	00.00	W	107.0	10	10.7	70	70	65		3600	05/03/06 03:20	05/05/06 15:20
outer Ice Sta F	CTD/ bongos/ ICE FLOE-mammals	62	00.00	N	171	00.00	W	104	10	10.5	70	70	65		3000	05/05/06 15:20	05/08/06 03:20
site 5 east	CTD/ bongos	59	53.88	N	171	15.50	W	83.8	10	8.4	70	70	65		600	05/08/06 11:43	05/08/06 21:43
ctds on transit	on Transit	54	16.00	N	165	00.00	W	394.3	12	32.9	70	70	65		600	05/10/06 06:35	05/10/06 16:35
Unimak Pass	on Transit	54	16.00	N	165	00.00	W	0.0	12	0.0	70	70	65			05/10/06 16:35	05/10/06 16:35
Arrive Seward, AK		60	06.30	N	149	25.27	W	613.5	12	51.1						05/12/06 19:42	

8.6 Cruise TN193 HAZMAT Inventory

- **8.6.1 Hazmat – Eisner**
- **8.6.2 Hazmat – Napp**
- **8.6.3 Hazmat – Mordy**
- **8.6.4 Hazmat – Cameron**

8.6.1 Hazmat – Eisner

User: Lisa Eisner **Cruise # TN193** **Cruise Dates: 11April-12May 2006**

Container Information								Spill Response Materials		Shipboard Use			Degree of Hazard			
Common Name of Material	**Chemical Composition**	**UN Identification Number**	**Type**	**Size**	**Qty**	**MSDS ?**	**Storage Hazard**	**Type**	**Qty Loaded**	**Stored Location**	**Used**	**Amount Offloaded**	**Health**	**Flammability**	**Reactivity**	**Special**
Ammonium Chloride (15 N), working solution, 0.011 g/L	$^{15}NH_4Cl$		plastic bottle	125 ml	1	yes	Not regulated	absorbent material					1	0	0	
Sodium Bicarbonate (13C), working solution, 2 g/L	$NaH^{13}CO_3$		plastic bottle	100 ml	3	yes	Not regulated	absorbent material					1	0	0	
Potassium Nitrate (15N), working solution, 0.1025g/L	$K^{15}NO_3$	1486	plastic bottle	100 ml	2	yes	Oxidizer, Class 5.1	absorbent material					1	0	0	
4',6-diamidino-2-phenylindole, dihydrochloride (**DAPI**), primary stock, 200 ug /ml in freezer	$C_{16}H_{17}Cl_2N_5$		plastic bottle	40 ml	1	yes	Not regulated	absorbent material					1	0	1	
4',6-diamidino-2-phenylindole, dihydrochloride (**DAPI**), primary stock, 200 ug /ml in freezer	$C_{16}H_{17}Cl_2N_5$		cryovial	2 ml	4	yes	Not regulated						1	0	1	
4',6-diamidino-2-phenylindole, dihydrochloride (**DAPI**), primary stock, 10 ug /ml in refrigerator	$C_{16}H_{17}Cl_2N_5$		plastic bottle	40 ml	1	yes	Not regulated						1	0	1	
Gluteraldehyde (10%)	$OHCCH_2CH_2CH_2CHO$	2927, 2810	glass safety coated bottle with dispenser	500 ml	1	yes	Corrosive, Class 6.16.1	spill kit	1				3	1	1	
Gluteraldehyde (10%)	$OHCCH_2CH_2CH_2CHO$	2927, 2810	glass safety coated bottle	2 L	1	yes	Corrosive, Class 6.16.1						3	1	1	
Hydrochloric acid solution, dilute (0.01N, 1/1200 of full strength)	HCl	1789	plastic bottle	1L	3	yes	Corrosive, Class 8	absorbent material					3	0	1	

8.6.2 Hazmat – Napp

User: Jeff Napp **Cruise #** TN193 **Cruise Dates:** Apr 11- May 13, 2006

			Container Information					Spill Response Materials		Shipboard Use			Degree of Hazard			
Common Name of Material	**Chemical Composition**	**UN Identification Number**	**Type**	**Size**	**Qty**	**MSDS ?**	**Storage Hazard**	**Type**	**Qty Loaded**	**Stored Location**	**Used**	**Amount Offloaded**	**Health**	**Flammability**	**Reactivity**	**Special**
37% Formaldehyde	HCHO and CH3OH in water	1198	poly	4 L	4	yes	flammable, corrosive	Fan-Pads, Formalex	1 roll, 1L				3	2	2	
37% Formaldehyde	HCHO and CH3OH in water	1198	poly cube	8 L	1	yes	flammable, corrosive	Fan-Pads, Formalex	1 roll, 1L				3	2	2	
* plankton/sea water in 1.8 % formaldehyde		not regulated	glass jars	1 L	400	no	none						3	0	0	
Sodium Borate (solution)	Na2B4O7.10H20 in water	not regulated	poly	250 g	1	yes	none						2	0	1	
Ethylene Glycol	CH2OHCH2OH	not regulated	glass	4 L	2	yes	no acids or oxidizers	3M spill pads	3 meters				2	1	1	
Methanol	CH3OH	1230	glass vial	30 ml	5	yes	flammable	3M spill pads	3 meters				3	3	1	
Lugol's Solution	** see solution recipe below	not regulated	glass	L	1	yes	oxidizer, corrosive	baking soda					2	0	1	
*** Liquid Nitrogen	N2-L	1977	dewar	20 L	1	yes							3	0	0	

* Estimated accumulation of plankton samples for duration of FOCI cruises. All plankton samples will be removed from Thompson in Seward for shipment to Seattle.

** 100 g potassium iodide, 1 liter distilled water, 50 g iodine, 100 ml glacial acetic acid.

*** Liquid nitrogen will be delivered to the dock in Seward for transfer to dry-shipper dewar on Thompson. Both dewars will then be removed from the Thompson for shipment to Seattle.

8.6.3 Hazmat – Mordy

User: Mordy **Cruise #** TN193 **Cruise Dates:** 12Apr-12May

			Container Information					Spill Response Materials		Shipboard Use			Degree of Hazard			
Common Name of Material	**Chemical Composition**	**UN Identification Number**	**Type**	**Size**	**Qty**	**MSDS ?**	**Storage Hazard**	**Type**	**Qty Loaded**	**Stored Location**	**Used**	**Amount Offloaded**	**Health**	**Flammability**	**Reactivity**	**Special**
Sodium Citrate	Trisodium citrate dihydrate	not regulated	plastic	140 g	25	yes			3500 g				1	0	0	
Brij	Brij 35	not regulated	plastic	125 ml	2	yes			250 ml				1	0	0	
Phenol	Phenol, H2O, Oxalic acid, dihydrate	2821	glass	500 ml	1	yes			500 ml				4	2	0	
nitroprusside	Sodium nitroferricyanide dihydrate	1588	plastic	0.5 g	10	yes			5 g				2	0	1	
Sodium Hydroxide	H2O, NaOH	1824	plastic	1 liter	1	yes			1 liter				3	0	1	
Sodium Hydroxide	H2O, NaOH	1824	plastic	0.5 liter	1	yes			0.5 liter				3	0	1	
Imidazole	C3H4N2	3263	plastic	13.6 g	10	yes			135 g				3	1	0	
Imidazole	C3H4N2	3263	plastic	27.2	8	yes			217.6				3	1	0	
Hydrochloric Acid	HCl	1789	glass	500 ml	6	yes			3 liters				3	0	1	W
Ammonium Chloride	NH4Cl	3077	plastic	14 g	8	yes			112 g				2	0	0	
Ammonium Chloride	NH4Cl	3077	plastic	0.20 g	5	yes			1.0 g				2	0	0	
Sulfuric Acid, 90-98%	H2SO4	1830	glass	500 ml	1	yes			500 ml				3	0	2	W
Acetone	C3H6O	1090	plastic	2.5 liters	1	yes			2.5 liters				1	3	0	
Ethyl Alcohol, denatured	CH3CH2OH	1170	plastic	1 liter	1	yes			1 liter				2	3	0	
NEDA	N-(1-Naphthyl) ethylenediamine dihydrochloride), 98%, ACS Reagent	not regulated	plastic	1 g	6	yes			4 g				2	0	1	
Sulfanilamide	Sulfanilamide	not regulated	plastic	10 g	6	yes			40 g				1	1	0	G

8.6.4 Hazmat – Cameron

User: Cameron **Cruise #** TN193 **Cruise Dates:** 10 April- 13 May, 2006

			Container Information					Spill Response Materials		Shipboard Use			Degree of Hazard			
Common Name of Material	**Chemical Composition**	**UN Identification Number**	**Type**	**Size**	**Qty**	**MSDS ?**	**Storage Hazard**	**Type**	**Qty Loaded**	**Stored Location**	**Used**	**Amount Offloaded**	**Health**	**Flammability**	**Reactivity**	**Special**
Acetone	(CH3)2CO	UN1090	glass	-	1L.	Yes	Flammable Liquid	3M spill pads	3 meters				2	3	0	
Ethanol (Ethyl Alcohol)	C_2H_6O	UN1170	glass	-	1L.	Yes	Flammable liquid	3M spill pads					2	3	0	
Cartridges for weapons, inert projectile (12G. Shotgun cartridges)	n/a	UN0328		-	100 ea.	Yes	Explosive 1.2	n/a	n/a				1	0	0	