

Field Operations QAPP – July 2006

Alaska Aleutian Island Coastal EMAP Quality Assurance Project Plan For 2006 and 2007 Field Sampling



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For the
Alaska Monitoring and Assessment Program
An Alaska Department of Environmental Conservation (DEC) and University of
Alaska Institute of Marine Science Implementation of the US EPA National Coastal
Assessment Program in Alaska

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Management Approvals:

Signature indicates that the Research Plan and QAPP is approved and will be implemented in conducting the research of the project.

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Introduction

The Environmental Monitoring and Assessment Program (EMAP) is a national research program led by EPA's Office of Research and Development (EPA-ORD). It is intended to develop the scientific tools and agency partnerships needed to broadly assess the status and trends of significant ecological systems. The goal of EMAP is "to monitor the condition of the Nation's ecological resources to evaluate the cumulative success of current policies and programs and to identify emerging problems before they become widespread or irreversible" (U.S. EPA, 1997).

The Alaska Coastal EMAP is providing information on over 50% of the nation's coastline to the EPA the National Coastal Assessment (NCA) project, which reports on the condition of the Nation's coastal resources. As a part of the overall EMAP, the NCA is supported by an effort to monitor and assess the status and trends of significant estuarine and coastal resources to create an integrated and comprehensive coastal monitoring program among the coastal states.

The core set of parameters that are included in the EMAP that ensures the consistency and comparability of data from all coastal states includes several oceanographic and water quality parameters, sediment toxicity analyses, sediment chemistry, tissue chemistry, fish pathology, benthic community analyses, and fish community analyses. This QAPP is for implementing the Aleutian Island Province Alaska EMAP Coastal Survey.

Aleutian Background

From the Alaska Peninsula, the Aleutian Islands extend westward from Unimak Island to Attu Island over a distance of more than 1,900 km (Figure 1). Over 200 Aleutian Islands totaling about 1.1 million hectares form an arc that separates the North Pacific Ocean from the Bering Sea (Banks et al., 2000). Four main island groups comprise the Aleutian Islands: Fox Islands, closest to the Alaska Peninsula, consist of Unimak, Unalaska, and Akutan; Andreanof Islands, includes Adak, Atka, Kanaga and Tanaga; Rat Islands, includes Amchitka, Semisopochnoi, and Kiska; and the Near Islands, which include Agattu and Attu. A smaller island group of the Semichi Islands, which includes Shemya, is close to the Near Island group. Further to the west of the Near Islands, the Kommandor Islands, Russia, continue the island arc and are biologically linked to the Kamchatka shelf and coast. On the southern edge of this submerged mountain range, of which the Aleutian Islands are the exposed peaks, is a curving submarine trench as deep as 7,600 meters extending across the North Pacific for 3,200 km from the Gulf of Alaska to Kamchatka Peninsula (Merritt et al., 1977).

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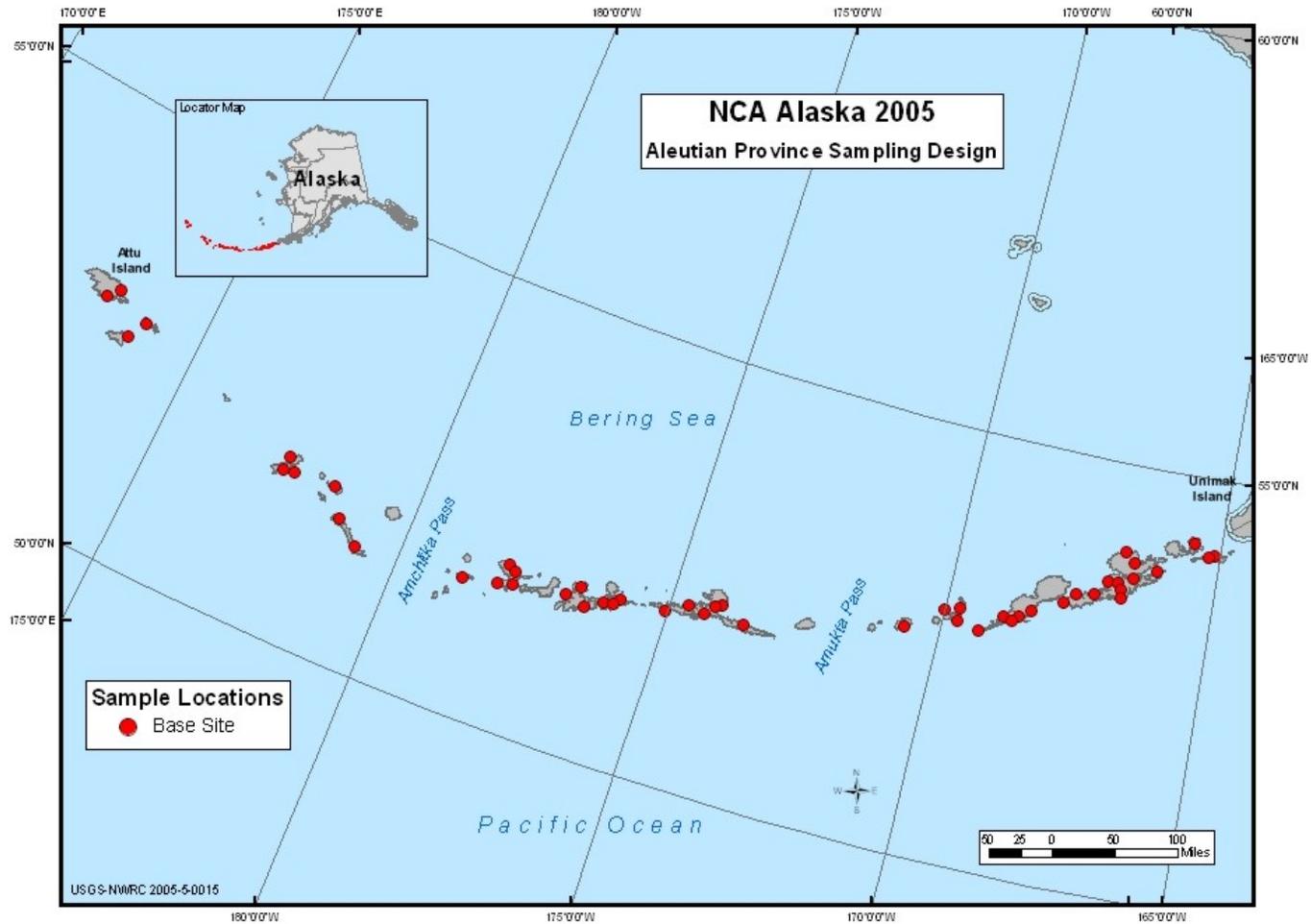


Figure 1 – Aleutian Islands with Primary EMAP Sampling Sites

Some of the most productive and biologically diverse marine ecosystems in the world occur within the marine zones around the Aleutian Islands. Significant upwelling occurs in this region bringing nutrients to the surface creating a “green belt” region of high levels of primary and secondary production along the Aleutian Arc (Springer et al., 1996). Numerous species of fish, mollusks and crustaceans, birds and marine mammals live in this region (NOAA, 1998).

Overall Goals and Objectives

Two overarching goals of the 2005 – 2007 Aleutian EMAP are 1) to assess the spatial extent of ecological conditions based on several measured indicators of marine environmental quality and 2) establish baseline measurements to evaluate future changes in environmental quality or condition. In doing so, specific questions can be further evaluated and potentially answered. For example:

What proportions of the Aleutian Islands’ coastal marine measured indicators have contaminant levels that indicate potential ecotoxicological impacts?

What is the prevalence of chemical contaminant loads in fish tissues that indicate exposure to contaminant sources?

What proportions of the Aleutian Islands’ marine coastal waters have levels of nutrients, dissolved oxygen, or other tested water quality parameters that indicate poor water quality for resident benthic fish and invertebrates?

Alaskan participation in the Western Coastal EMAP Program provides both direct and indirect benefits to ADEC and the State of Alaska, including:

- Integrating water quality and habitat assessments to assist the State in evaluating its water body needs and priorities and for implementation of the Alaska Clean Waters Action Policy.
- Helping to establish specific ecological indicators for use in ADEC ambient water quality monitoring program designs.
- Improving methods and procedures for sharing and managing comparable data sets and forms incorporated into a distributed data management system.
- Establish environmental baselines for Alaska’s waters that will help resource managers to implement adaptive management strategies.

Alaska’s Aleutian coastal environmental concerns include the following (not prioritized):

- Introduction of non-indigenous aquatic nuisance species.
- Effect of localized inputs from contaminated sites on the marine environment.
- A better understanding global contaminants inputs to the Aleutian Islands.
- Dredging and other sediment-related issues.
- Direct and indirect effects of harvesting fish, shellfish, plants or algae.
- Development of appropriate mixing zones for point source discharges,
- Short and long-term effects of oils spill on the Aleutian coastal ecosystems.
- Developing a better understanding of ecosystem shifts.

- Leakage of radionuclides from the former Amchitka Underground Nuclear Test Site.

EMAP coastal assessment data will help to evaluate several of these coastal environmental concerns by providing background or context data (*e.g.* toxic contaminants, benthic habitat), by providing specific data (*e.g.* benthic invertebrates for possible non-indigenous species or to extend geographic ranges of species), or by providing a sampling platform for other projects assessing the status of the ecosystems in this region.

PROGRAM FRAMEWORK

The Aleutian EMAP survey is based on the principles used for national EMAP programs with a monitoring design that features multi-tiered, integrated monitoring of selected environmental indicators. Data will be integrated from multiple media, including water quality data, sediment data, biological, physical and chemical parameters. This will provide a more complete evaluation and assessment of ecosystem “health” or condition than more traditional monitoring, which typically emphasizes single media and a stand-alone approach.

Critical to the EMAP assessment process is the sampling design utilizing a probabilistic, stratified-random approach. This approach enables interpretation of the general ecological health of large areas, such as the Aleutian Islands, to be assessed with a relatively small number of sampling sites.

The Aleutian EMAP survey will take a two tiered approach. First, the EPA’s national protocol, parameters to be sampled, analytical laboratory requirements, data QA/QC, data storage, data analysis and reporting methods will be followed, whenever possible. For more information on this the reader is referred to the EPA EMAP web site <http://www.epa.gov/emap>. Secondly, the rocky benthic habitat will require modification in the EMAP methodology, specifically by dropping the sediment sampling component and benthic trawl. This statement of work describes the methods under consideration for alternate techniques to assess rocky benthic habitat. Several additional parameters to be sampled have also been added and are described later in this document.

Context for EMAP Aleutian Study

The ADEC, with various collaborative partners, will conduct ecological monitoring around the coasts of the Aleutian Islands during the summer of 2006 and 2007. This sampling program is part of the NCA, U.S. EPA’s nationwide EMAP sampling program designed to assess the health of U.S. coastal waters.

The Aleutian Island chain consists of volcanic oceanic islands delineating the North Pacific Ocean from the Bering Sea. Shorelines around these islands are exposed to high-energy wave surges and strong currents. The littoral and sub-littoral zones often consist of rocky substrate with lush macroalage growth, but seldom do fine grain sediment environments occur. A multi-tiered sediment triad approach focused only on fine grain sediments cannot characterize the status of the coastal ecological resources in this province. Adopting methodology similar to that

utilized in the EMAP NCA program in Guam and Hawaii, with some modifications, will be done to assess the rocky benthic habitats in this Aleutian EMAP effort.

On a gross scale the Aleutian Islands are usually considered one biogeographical region. Yet on the local scale biologist hypothesize that biogeographical breaks may occur at several sites along the Aleutian Island Chain, such as Amchitka Pass (Iken and Konar, 2003). In assessing the EMAP results this potential variation will have to be considered.

National Coastal Assessment 2001-2004 – Adoption of Sections

Section Adoptions of Group A Measurement/Data Acquisitions

Sections A1-A8

By reference, the Alaska QAPP adopts these sections in the NCA QAPP 2001-2004. The problem definition/background, project description, data quality objectives for measurement data (including representativeness, completeness, comparability, accuracy and precision) are as defined in the NCA QAPP 2001-2004 except as noted below:

The NCA QAPP 2001-2004 (Table 1) Target Method Detection Limits (MDLs) for laboratory analyses is modified to include of analysis of macroalgae for trace metals, water column samples for tritium, and PBDE in fish tissue. The MDLs for macroalgae trace metals are those recommended for sediments, 2 pCi/L for tritium, and 0.1 pg/g wet weight for PBDE in fish tissue.

Table A7-3 lists the quality assurance sample types, frequency of use, and types of data generated for EMAP-Coastal 2000 Monitoring. The Alaska EMAP 2006 program adopts these criteria by Sediment Toxicity Tests, Benthic Species Composition, Sediment Grain Size, Total Organic Carbon, Nutrients, Chlorophyll *a*, Total Suspended Solids.

Water quality parameters will be collected in situ using a Seabird 25 Sealogger CTD, with a backup Seabird 19 provided. Dissolved oxygen, salinity, temperature, depth, pH, photosynthetically active radiation (PAR), and fluorometry sensors were calibrated at Seabird in June 2006 for the Sealogger 25. The fluorometry sensor data will provide additional in situ information beyond that measured for discrete water sample analyses for chlorophyll *a*. The Seabird 19, set-up just for conductivity, temperature and pressure was also calibrated by Seabird in June 2006.

During the approximately 35-day field sampling program in Alaska, there will be no access to a laboratory to conduct monthly calibration checks. Daily field QC checks will be made by comparison with DO, pH, and conductivity checks on water samples collected from the wireline Niskin bottles at discrete depths [surface ~ 1 meter, mid-depth, and bottom (1 meter off bottom) or surface and bottom if depth is $\leq 7M$] for comparison with the CTD cast. Daily comparisons of DO will be conducted on the discrete Niskin water samples using the Winkler titration method with accuracy ± 0.5 mg/L. Salinity will be checked daily using discrete water sample measured with a refractometer with accuracy ± 1.0 ‰. Salinity will also be collected from the Niskin sample bottles for later comparison with CTD cast, when these samples will be analyzed on the

salinometer at the University of Alaska Fairbanks Seward Marine Center facility. Bottom depth will be checked against the depth recorded by the handheld depth finder used on the small boats or from the ship, depending upon sampling platform. These checks are considered field validation checks and not calibration verifications. In the event field QC checks are in obvious disagreement with the CTD an immediate assessment of the CTD for obvious signs of malfunction will be initiated. All problems will be documented and data flagged as appropriate.

At the end of the cruise the SBE 25, and SBE19 if used, will be placed in the UAF Seward Marine Center seawater test tank and water samples will be taken for DO, pH, conductivity, temperature, depth and salinity and compared to the CTD reading.

Measurement quality objectives (MQOs) for accuracy of CTD units, based on the National Coastal Assessment Quality Assurance Project Plan 2001-2004, for comparison against reference standards or instruments are:

| | | |
|------------------|-----|---------------|
| Dissolved Oxygen | +/- | 0.5 mg/L |
| Salinity | +/- | 1.0 ppt |
| pH | +/- | 0.3 units |
| Temperature | +/- | 1.0 C |
| Depth | +/- | 0.5 m (~2 ft) |

If field and UAF test tank validation checks for DO, salinity, pH, temperature and depth are within the above MQOs the CTD will be placed in proper dry storage and recalibrated on an annual basis, with the next calibration scheduled for May 2007. In the event the MQOs are not met and it is not a minor problem, such as a loose connection, the CTD will be returned to the Seabird for recalibration. All calibration and recalibration information will be provided to EPA and kept by DEC as part of the sampling record.

As calibration was just conducted in June 2006 and both CTD's calibrated, we are confident that the Seabird calibration and the University calibration checks are sufficient to ensure the accuracy and precision of the instruments.

In the event that the SBE19 must be used the differences in response and resolution will be noted to the field sampling logs to allow for comparison of basic temperature, conductivity and depth between the SBE19 and SBE25. The information used to do this comes from the Seabird instrument specifications and the Seabird 2006 calibration data package.

Section A9 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

The field crew that will be conducting the Alaskan Aleutian Island EMAP work consists of personnel from a range of agencies and organizations. Appendix A provides C.V.s for each of the main field personnel. These members represent a core group that will be consistently sampling throughout the entire 35 day period at sea. All personnel will be trained together at the beginning of the field program and will be onboard the vessel at all times, with the exception of Dixon Landers, who will leave the vessel in Dutch Harbor, Alaska after the first week of sampling.

Currently, the core field sampling crew are:

| Core Crew | Organization | Field Responsibilities |
|------------------|----------------------------------|---|
| Douglas Dasher | ADEC | Cruise/Lead Scientist/All aspects of program. |
| Terri Lomax | ADEC | Sediments, Water Quality & fish sampling. |
| James Gendron | ADEC | Sediments, Water Quality & fish sampling. QC/QC officer. |
| Mandy Lindberg | NOAA | Macroalgae Taxonomic Expert & Assistance with water quality & fish sampling. |
| Stephen Jewett | UAF IMS | Lead Scientific Diver |
| Max Hoberg | UAF IMS | Scientific Diver |
| Shawn Harper | UAF IMS | Scientific Diver |
| Heloise Chenelot | UAF IMS | Scientific Diver |
| Reid Brewer | UAF IMS | Scientific Diver |
| Roger Clark | Contractor/Taxonomic Specialists | Scientific Diver |
| Dixon Landers | EPA | EPA Project Officer QA/QC. On board for part of the cruise to conduct initial EPA QA/QC review of sampling efforts. |

The field personnel will demonstrate individual and team proficiency during the training and QAPP evaluation procedures during the first several days of the start of field operations. The dive team members have demonstrated competency as scientific divers and have experience in working in the Aleutian Island near shore marine environment and in identifying most common species. One dive team member, Roger Clark, has acted as a NOAA Aleutian region invertebrate specialist. Mandy Lindberg, with NOAA Auke Bay Laboratory, has specific expertise in the collection and identification of macroalgae. Other core members have experience conducting water quality and sediment quality sampling in Alaskan environment.

Section A10 DOCUMENTATION AND RECORDS

Each data generating activity, both field measurements and laboratory analyses, will be thoroughly documented in accord with the guidelines that are presented in the NCA QAPP 2001-2004.

Section Adoptions of Group B Measurement/Data Acquisitions

Section B1 Sampling Process Design (Experimental Design)

The Alaska QAPP adopts this section of the NCA QAPP 2001-2004 by reference, with the following modifications. Sample locations are based on a probabilistic sampling scheme based on a target population of waters ≤ 20 meters deep around the Aleutian Islands. The target population was broken into two strata; (1) Estuary waters ≤ 20 meters and (2) Open marine waters ≤ 20 meters. Estuary sites comprise 60% of the total selected sites. Hexagon grids of equal sized cells were

used. Fifty base sites were selected with an additional (100% over sample) 50 alternate sites. Metadata and a complete listing of sample sites are provided in Appendix A. Additional information on the sampling statistical design can be found at <http://www.epa.gov/nheerl/arm/>.

Note that for this study estuary is defined as any water body that is tidally influenced, saline, and has less than 50% of its perimeter adjacent to the ocean (EPA, 2001). Open marine waters, the second target population stratum, are waters that do not meet the estuary definition. Wetlands and littoral zones, regions exposed to the atmosphere during low tides, are not part of the targeted population. A review of the sites selected indicate the preponderance of sites encompass rocky benthic habitat common to the Aleutian Islands.

Field Collection of Environmental Data

The Alaska QAPP adopts the NCA QAPP 2001-2004 by reference. The vessel and scientific crew will make their best efforts to locate each site and hold the vessel and gear on station within the 0.02 nautical mile radius.

The entire geographic linear range across the study area is more than 1,900 km. The sites in the Aleutian Islands extremely weather dependent, for both sampling and transiting. Thus, there is the potential that there will be many days when no sampling is possible as the boat waits for weather or tides or is transiting a long distance. It is estimated that 1 site per day will be sampled.

At each station, the core field data/samples will include:

- Instantaneous water column profiles (DO, pH, salinity, temperature, depth, transmittance, PAR and fluorometry) with a CTD and associated sensors. In addition, water clarity will also be measured with a secchi disk.
- Water quality parameters (nutrient loads-phosphates, nitrates/nitrites, ammonium, chlorophyll *a*, Total Suspended Solids, tritium, and CTD validation check pH, DO and conductivity) will be collected from discrete water samples at surface, mid-depth, and bottom. At depths ≤ 7 meters discrete water samples will be taken only at only surface and bottom.
- Surficial sediments, when encountered within the transect quadrant, will have the top ~ 5 cm sampled for chemical contaminants (organics, trace metals), sediment toxicity, total organic carbon, sediment grain size and radionuclides.
- Macroalgae, epifauna or infauna, dependent upon habitat encountered in the quadrant, will be sampled within three (3) randomly placed quadrants, with each quadrant composed of a 1x1 meter, with nested 0.5x0.5 meter and 0.25x.25 meter, placed along the off-shore side of the 25 meter transect line. In the case of sediment sampling for contaminants, TOC, sediment toxicity, grain size and radionuclides a duplicated quadrant will be placed on the in-shore side of the transect tape to be sampled.
- In environments where sediments are present at over 50% of the transect sampling of Benthic macroinvertebrate communities (taxonomy and abundance; richness) will take place.
- Fish (length; weight; sex and age), external pathological examination assessment of fish; fish tissue contaminants [whole fish] will be taken for (organics and trace metals)

- Habitat (general habitat information as described in NCA QAPP 2001-2004)

Samples collected in the field will be stored onboard the R/V Norseman until return to Seward, Alaska, at which time they will be appropriately packed and shipped to respective laboratories. We will leave and return to Seward, Alaska and will have no opportunity to allow more frequent sample shipment. The vessel specifications, however, provide for adequate freezer and refrigerator space to meet the guidelines outlined in Table B-1, allowing us to side-step the “field holding” and store samples onboard in a manner equivalent to “lab storage.” Thus, Table B1-1 in the NCA QAPP 2001-2004 is revised for the Alaska QAPP as follows:

| Sample Type | Container | Field Holding | Lab Storage | Max. Holding |
|--------------------------------------|---|---|---|---|
| <i>Water Quality</i> | | | | |
| Chlorophyll <i>a</i> | 25 mm GF/F in HDPE snap-tube (foil wrapped) | Freezer (-20°C) | Freezer (-20°C) | 6 months |
| Nutrients | 60 ml Nalgene bottle | Freezer (-20°C) | Freezer (-20°C) | 6 months |
| Total Suspended Solids (TSS) | 47 mm pre-weighted GF/F in petri dish | Freezer (-20°C) | Freezer (-20°C) | 3 months |
| Tritium | 500 ml narrow mouth glass bottle black phenolic polyseal cap. | Unrefrigerated in a cool dark location. | Unrefrigerated in a cool dark location. | 6 months |
| <i>Sediments</i> | | | | |
| Organic Contaminants | 500 ml Pre-cleaned I-Chem jars | Freezer (-20°C) | Freezer (-20°C) | 1 year |
| Inorganic Contaminants | 125 ml or 250 ml Pre-cleaned I-Chem jars | Freezer (-20°C) | Freezer (-20°C) | 1 year* |
| Total Organic Carbon | 60 ml Nalgene jar | Freezer (-20°C) | Freezer (-20°C) | 1 year |
| Grain Size | Zip loc™ Bag or Nalgene bottle filled with approx. 125 ml sediment. | Refrigerator (4°C) | Refrigerator (4°C) | 1 year |
| Toxicity | 1000 ml HDPE jar | Refrigerator (4°C) | Refrigerator (4°C) | 28-days |
| Radionuclides | Zip loc™ Bag – or small Nalgene bottle approximately 125 ml sediment. | Unrefrigerated in a cool dark location. | Unrefrigerated in a cool dark location. | Dependent upon radionuclide of interest |
| <i>Macroalgae</i> | | | | |
| Inorganic Contaminants | 125 ml or 250 ml Pre-cleaned I-Chem jars | Freezer (-20°C) | Freezer (-20°C) | 1 year* |
| Radionuclides | Zip loc™ bags | Freezer (-20°C) | Freezer (-20°C) | 1 year |
| <i>Biota</i> | | | | |
| Epifauna and Benthos (1.0 mm sieved) | 100-1000 ml wide-mouth Nalgene | 10% buffered formalin | Transfer to isopropyl alcohol | Indefinitely |
| Fish Contaminants | Individuals wrapped in foil and plastic sealed pouch. | Freezer (-20°C) | Freezer (-20°C) | 1 year* |

*Except for Hg, which has a recommended maximum recommended holding time before laboratory analyses of 28 days.

Laboratory Analyses of Samples

National Laboratories/In-State Laboratory Analyses

The following laboratories will be contracted to do the analyses:

| | |
|--|--|
| Institute for Integrated Research in Materials, Environments & Society (Tentative) | Sediment PAHs, Fish Tissue Organics, Tri-butyl tins, PDBE, and lipids |
| Alaska Department of Environmental Conservation Environmental Health Laboratory | Sediment, fish and algae Inorganics; Processing fish samples for organic and lipid analysis. Also, removal of otholits for determining fish age. |
| Northwestern Aquatic Science | Sediment Toxicity |
| University of Alaska School of Fisheries and Ocean Science | Nutrients, Chlorophyll <i>a</i> , Total Suspended Solids, grain-size analysis. |
| University of Alaska's School of Fisheries and Ocean Sciences | Benthic Invertebrate Taxonomy and Abundance |
| University of Alaska's School of Fisheries and Ocean Sciences | TOC |
| Washington Department of Ecology | QA/QC checking of the UAF SFOS taxonomy |
| Alaska Department of Fish and Game | Fish age |

Alaska Department of Environmental Conservation Environmental Health Laboratory has participated in the under the ADEC Quality Assurance Project Plan for Fish Tissue Monitoring Program [Copy is included in Appendix B], including removal of otholiths for aging and homogenization of fish samples for trace metal and further organic chemical analysis. Exact methods for homogenization remain to be worked out, in consultation with the EPA project manager, once a contract laboratory is chosen for the fish tissue organic, tri-butyl tins, PDBE and lipid analysis.

Northwestern Aquatic Sciences, a private consulting firm, conducted the toxicity testing for the Oregon State Coastal 2000 sampling, and the Alaska Southcentral 2002 sampling.

The University of Alaska Fairbanks School of Fisheries and Ocean Science (UAF SFOS) has conducted benthic invertebrate sorting for the Southcentral and Southeast Alaska Coastal EMAP program. The QA/QC checking of the UAF SFOS sorting and taxonomy will be conducted by the Washington Department of Ecology, which has provided QA/QC for all West Coast benthic invertebrate sorting and taxonomy.

All analytical methods and processes pertaining to the EMAP samples will be conducted by the individual laboratories according to EMAP protocols and the NCA QAPP 2001-2004

Section B2 Sampling Methods Requirements

The Alaska program will make all attempts to ensure that their EMAP sampling methods follow approved EMAP protocols as defined in the NCA QAPP 2001-2004. We will work to ensure that any modifications in the field sampling procedures meet the general guidelines of these established protocols and adhere to the spirit of the QA/QC established for the EMAP so that the

resultant data remain comparable to that collected by standard procedures. Given the remote location of most sites in the Alaska sampling region, and the high cost of accessing these sites, very few sites could be field “reconnoitered.” Through this type of evaluation, several sites are known ahead of time to be unsampleable and will be replaced by back-up or replacement sites as described in a previous section.

If safe, the Norseman will navigate to within 0.02 nautical miles (+/- 37 meters) of the given coordinates; otherwise the crew makes their best efforts to position the vessel within a 0.1 nautical mile radius or nearest safe water depths to the given coordinates.

In the event the Norseman cannot navigate safely within 0.02 nautical miles, a small boat will be used to navigate to the given coordinates GPS and Portable Depth Detector. Once on location the site will be marked by a surface buoy and anchor, which will remain for the dive team transect starting point.

If the given sites are to remain fixed, but if a sample site is in freshwater, dense kelp beds, located on land or in the inter-tidal zone due to mapping inaccuracies or otherwise presents a hazard to the sampling team, program protocols allow the site to be moved up to 500 m from the original location in a random direction. The random direction is pre-determined as either to the right or left of a person facing parallel to shore. The random direction is included under transect direction in Appendix B. If the sample site is deeper than 20 meters the sampling team will move directly towards shore, in a straight a line as possible, until reaching a randomly selected depth of ≤ 20 meters. See Appendix B for this depth. At that point the new site will be marked.

If, with the move, the sample site still remains in an inappropriate location, the site will be dropped. Any movement of a sample site will be recorded including the new latitude and longitude as determined by GPS and the rationale for the move and/or its deletion will be noted.

The vessel will be out of cell phone range often for days or weeks at a time and satellite phone communications remain unreliable. Opportunities to have discussions with the EPA Project Officer will not be feasible for much of the field program. The field team, which will include the State Team Coordinator, will follow the above protocols before dropping any site. ANY relocation greater than 0.02 nm will be documented in detail in the field record.

Alternate Sample Site Procedures

Fifty (50) alternate sites have been randomly selected from the target population to provide back-up locations in the event that a site has to be dropped. The NCA QAPP 2001-2004 (USEPA, 2001) requires that each of the remaining alternate sites be used sequentially, thus, when say site 1 is dropped then alternate site 51 is added. Only sites that are originally selected from the target population will be sampled.

A tight sampling budget and the length of the sampling area, over 1,900-km, limit our ability to realistically utilize the next sequential alternate site once a base site has been dropped. While at times, selection of a sequential alternate site may be located near-by, it is just as likely to be hundreds of miles away. The following method will be used to select the alternate site.

First, if time permits, alternate sites especially the first ten (10), will be sampled to provide the ideal sequential selection for primary site replacement. As these alternate sites are spread out over 1,900 km, logistics and weather conditions may not allow us to be able to consistently take this approach. Thus, the following approach will also be utilized, to select alternate sites.

The alternate or replacement sample site will be selected by drawing a radius in increments of 4 nautical miles [4, 8, 12, etc.] from the non-sampleable site until an alternate site is encountered. If more than one site is encountered the one with the lowest alternate site number will be sampled. The sector of the circle used for the alternate site selection must be in the direction of primary ship travel.

Water Measurements

After a basic evaluation of a site's location relative to navigational hazards, etc...the first sampling activity conducted on site will be the collection of water column measurements and the collection of discrete water samples.

Water grab samples will be collected from the surface, mid-water, and at depth (approximately 1 meter off of the bottom) using Niskin sample bottles "on-the-wire". Once the Niskin bottles are back at the surface water samples will be collected in appropriate containers, each pre-rinsed with the sample water, for nutrient analyses (orthophosphate, total dissolved phosphorus, nitrate+nitrite nitrogen, ammonia nitrogen, total dissolved nitrogen, chlorophyll-*a*, pH, ³H, and Total Suspended Solids (TSS). These samples will be processed and stored as prescribed in the NCA QAPP 2001-2004 (U.S. EPA, 2001).

Hydrographic Profile

Water column profiles will be performed at each site to measure the following basic water quality parameters:

- Dissolved oxygen (DO)
- Conductivity (Salinity)
- Temperature
- pH
- Pressure (depth)
- Fluorometry
- PAR
- Secchi depth

All above measurements, except for the secchi disk profile, will be obtained using a SeaBird25 CTD with sensors. Sensors include Seabird temperature, pressure, conductivity, and SBE 43 dissolved oxygen sensors; a Biospherical PAR sensor, and a Turner Fluorometer. The sampler will be programmed to sample every 0.125 seconds and can be averaged at other intervals in the post-processing software. Real-time data can be collected through a SeaBird cable from which the unit will be hand lowered and raised, but depending on field considerations the data may be logged remotely and checked later. The instrument will be allowed two to three minutes of

warm-up while at the surface and will be lowered at a rate of approximately one meter per second or less during the down-cast and up-cast. For reference surface PAR measurement will be made before and after the casts a surface. After approximately 30 seconds holding at the bottom of the cast the up cast will begin for recovery of the CTD. While the results of the downcast will be the one ultimately recorded for the EMAP program, results will be compared with the downcast for QA/QC purposes to determine if there are any obvious disagreements.

Water Quality Indicators

At each of the sample stations individual five-liter Niskin bottles will be mounted either individually or in series on a wire line to collect grab samples at 1 meter, mid-depth and 1 meter off the bottom. If the depth is ≤ 7 meters we will only sample at 1 meter and 1 meter off the bottom. Once the bottle(s) are at depth the operator will move the wire line up and down about 1 meter and wait about 30 seconds after resetting the bottles to approximately 1 meter above the bottom and then send the messenger down to trip the bottles.

After recovery, the water samples in the Niskin bottles will be recovered and transported in a container back to the Norseman, if sampling from the smaller boats, and placed in a Niskin holder rack. From each Niskin bottle we will collect, in pre-labeled containers pre-rinsed two times with 30 to 50 ml sample water, one (1) liter sample [TSS] (cubic container), one (1) liter sample [chlorophyll a and nutrients], one (1) 500ml samples [tritium] in glass bottles, and one 60 ml sample [field pH, Temperature and salinity]. From the bottom sample one dissolved oxygen sample will also be taken. The water sampling sequence will start with the DO sample and then the other samples. No tritium watches are to be worn by the person taking or handling the water samples.

Once samples are taken from the Niskin bottles they will be transported directly to the field lab and processed.

1) Chlorophyll a:

Chlorophyll *a* samples will be filtered no more than four hours after collection to minimize possible cell lysis. Sample bottles will be shielded from light while processing in the laboratory as much as practical. A vacuum manifold accepting the GF/F 25 mm filters will be used to filter the samples, with vacuum pressure not allowed to exceed 12 psi. The volume of water filtered will be measured in a graduated cylinder and recorded on each data sheet and processed filter container. Depending on suspended sediment load, up to 200 ml of sample water will be filtered for each chlorophyll *a* sample. The filter will be removed carefully using filter forceps, folded with the pigment side on the inside of the fold, and then placed into a pre-labeled, disposable polypropylene centrifuge tube. The tube will be wrapped in aluminum foil and labeled with the station and sample name. After filtering the sample the filter housing will be rinsed in distilled water and stored in a clean appropriate manner between sampling events.

2) Dissolved Nutrients

Up to 50-ml (no less than 40-ml) of sample from the container that contained the chlorophyll *a* sample will be gently poured into a 60 ml syringe, pre-rinsed in the sample water before fitting

with the syringe filter, and then pushed through a 0.45 μM syringe filter and collected into a pre-labeled, pre-rinsed in sample water clean 60-ml Nalgene screw-capped bottle. Adequate headspace for expansion of the sample when it is frozen must be maintained in all bottles. The sample bottles will be, placed inside Zip Loc™ bags stored in a -20°C freezer. The salinity (\pm 2 ‰) of each sample will be recorded on the outside of each water sample bottle.

3) Total Suspended Solids

Up to one liter of seawater will be collected for TSS at each water sampling depth. These samples can be held up to 7 days at 4°C before they must be processed (filtered and frozen). This SOP recognizes changes made to the NCA 2002 field protocols in March 2002 that recommends processing the samples in the field instead of shipping large volumes of water to the contract laboratory. For each sample, a pre-weighed, numbered 47mm GF/F filter will be placed on a filter assembly and vacuum will be applied. A sufficient amount of the sample will be filtered (measured in a graduated cylinder) until the filter is almost clogged. A good rule of thumb is at 50 mg/L TSS, approximately 1000 ml is appropriate. After filtration, the filter will be removed with forceps and stored in a flat petri-type dish. All pre-weighed filters information is to be recorded in the sample log and the pre-weighed filter containers kept until QA/QC is completed. The filter containers are pre-numbered and correlate to the known weights of each filter, so extra care will be taken to absolutely ensure that each filter is placed in its appropriate container. The filter apparatus will be rinsed with distilled water between samples.

4) pH

An Orion Model 250A pH meter will be used to measure pH at the surface, mid-depth, and bottom using the discrete water samples. A water sample will be collected into a polypropylene jar. The pH will be determined using a pH meter within two hours of sampling. Before each set of measurements, the instrument will be manually calibrated with at least two buffer solutions and the field calibration information recorded in the lab pH calibration log book.

Benthic Sampling

The Aleutian Islands EMAP study is designed to sample and assess both soft and hard (rocky) bottom habitats. The decision has been made to use dive teams to sample both habitats to maximize efficiency of sampling techniques and project logistics. This also provided consistency with the Hawaii and Guam EMAP work. All diving will adhere to no-decompression diving protocol, therefore, diving will mainly be at ≤ 20 m depths. The following indicators will be assessed, in order, by scuba:

- Benthic habitat description (macroinvertebrate assessments, submerged aquatic vegetation, marine debris, wave impact, threatened/endangered species).
- Sediment samples (benthic infaunal community, sediment physical characteristics, sediment contaminant analyses, sediment toxicity).
- Fish collection and tissue contaminant analyses.

Sampling Transect

Divers will descend the site buoy line, attach a 25-m tape with a 5-m rope lead to the anchor (proximal end of transect) and swim into the current if present, otherwise swim right or left relative to a person facing and parallel to shore (randomly selected – see site spreadsheet in Appendix B) laying out the tape to the distal end of the meter transect along the depth contour (± 2 m). See Figure 2. The first 5 meter of the rope nearest the anchor will not be surveyed due to potential disturbance by the anchor. Each 1-m² quadrat will be placed on the offshore side of the transect regardless of substrate composition.

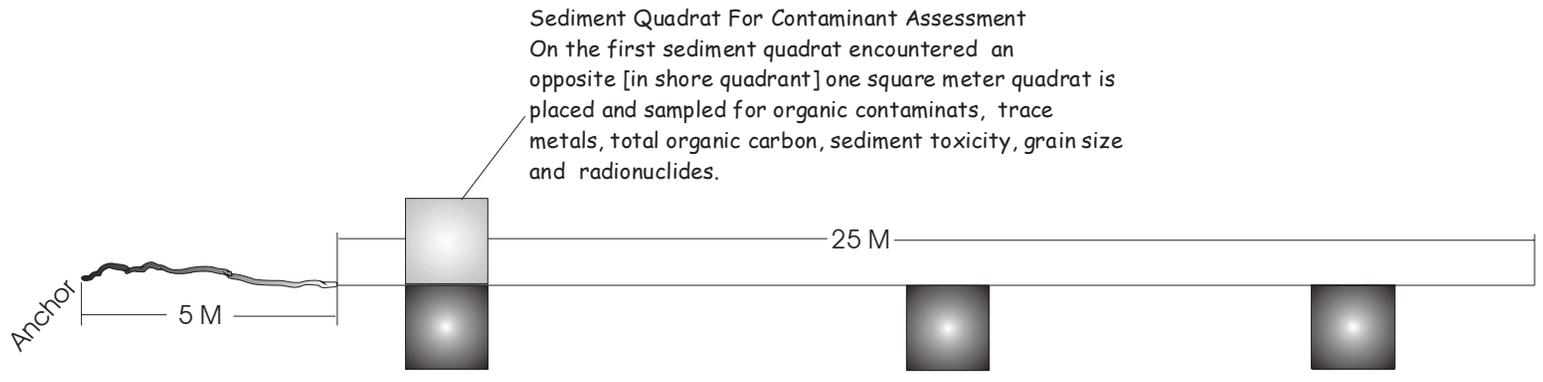
Benthic Habitat Description

Once the transect tape is laid out a diver swims from the anchor to the end of tape, 1-2 m over the center of the tape, video recording the habitat, associated macroinvertebrates (large epifauna), vegetation, marine debris, and threatened/endangered species. Video footage from the transects will be analyzed to provide qualitative information on habitat characteristics and distribution and abundance of major epibenthic taxa. Another diver collects two or three representatives of mature kelp and macrofauna, if present, from 1 m either side of the transect. These collections should not occur within the 3 random 1-m² quadrats. Target organisms, to be collected qualitatively, for habitat description include the brown kelps (*Alaria*, *Laminaria*, *Agarum*, and *Cymathere*), and the invertebrates giant Pacific chiton (*Cryptochiton stelleri*), sea urchin (*Strongylocentrotus polyacanthus*), horse mussel (*Modiolus modiolus*), blue mussel (*Mytilus trossulus*), rock jingle (*Pododesmus macroschisma*), sand dollar (*Echinarachnius parma*), giant octopus (*Enteroctopus dofleini*), and Oregon triton (*Fusitriton oregonensis*). Other species may be added once on site. All samples are placed in a mesh bag at depth. At the surface the samples are held in a tray until returned to the main vessel, where they will be processed, sorted and either stored in the 5% buffered formalin solution, frozen or disposed of overboard.

Soft Sediments

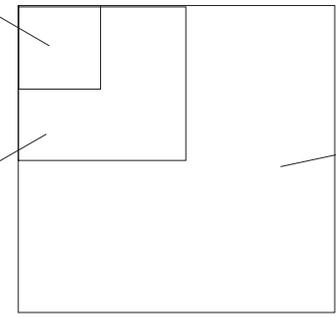
In the event that soft or sandy sediments are encountered within the 1-m² transect quadrats the divers collect infauna and sediment samples for the parameters listed in Tables 3 and 4 of the Statement of Work. Procedures have been adopted, with some modifications, from the EMAP programs in Hawaii and Guam (Brock, 2001; Guam Environmental Protection Agency, 2004).

This first potential soft substrate sampling point along the transect is a random point within 0-15 m. Points two and three are each placed 5 m apart from the first randomly selected point. For example, if the random start is at 11 m, the second and third points are 16 and 21, respectfully. The transect tape can be premarked at these points prior to the dive, to eliminate time-consuming point selection at depth. Any transect point on soft substrate must be sufficiently large so that 1-m² quadrat frames can be placed on the inshore as well as the offshore sides of the transect. At each random point along the transect a 1 x 1 m quadrat is placed so that the left leg is at the transect sampling point. Infauna is collected from the offshore quadrat and sediment is collected from the inshore quadrat.



0.0625 Square meter quadrat
 Within the frame all flat horizontal sections are scraped of flora and fauna. Material greater than 1 mm is collected with a air lift system and material greater than 1 mm collected in the mesh bag.

0.5 square meter quadrat
 A photographic image record is made immediately prior to and after sampling. All macroalgae is removed, except for the 0.0625 square meter area.



One Square Meter Quadrat
 A photographic record is made of the quadrat, with the 0.25 and 0.0625 square meter transects set within the left [diver facing from inshore position] legs against the meter square quadrat. All macrophytes and conspicuous macrofauna (> 2cm in length) are identified in situ and either counted or and estimated percent cover made. Counts are made of solitary macroflora and macrofauna, while per cent cover is used for those species whose individuals

Figure 2 – Transect and Quadrat

Sediment Infaunal Sampling

Within the 1-m² offshore quadrat a 0.0625-m² quadrat is placed for infauna sampling. The smaller quadrat is placed so that the left leg is at the transect sampling point. The entire 0.0625-m² is removed by a diver-operated airlift with a 1-mm mesh bag to a substrate depth of 10 cm. This is approximately 0.00625 cubic meters of material sampled. The retained portion of the airlift, mainly live biological material, is preserved in 5% buffered formalin and labeled.

Sediment Sampling

Sediment samples are taken within the 1-m² inshore quadrat for inorganic (INO) and organic (ORG) contaminants, total organic carbon (TOC), grain size (GRN), sediment bioassay (BIO) and radionuclide (RAD). Pre-cleaned 250 ml I-Chem jars™ are used for collecting INO; 500 ml jars will be used for collecting ORG. For TOC collection a 60 ml Nalgene™ bottle will be used. GRN and RAD will be collected in a 250 ml bottle with the sample split after the dive. For BIO, two 2-L containers will be used. All sediment samples are taken to a sediment depth of 5 cm and from an undisturbed portion of the 1-m² quadrat. All samples are placed in a mesh bag at depth. At the surface the samples are held in a tray until returned to the main vessel, where they are processed and refrigerated at 4° C or frozen at -20° C.

Rocky Benthic Habitat

For consistency in the Aleutian EMAP sampling the procedures for rocky benthic habitat incorporates components of the Hawaii and Guam EMAP program (Brock, 2001; Guam Environmental Protection Agency, 2004) with some modifications. Survey methods from the international Natural Geography in Shore Areas (NaGISA) biodiversity survey (Census for Marine Life, 2001); marine biodiversity methods utilized by the Ecological Monitoring and Assessment Network of Environment Canada (Phole, et al., unspecified); and the video photography methods utilized in a New Zealand Ministry of Fisheries and Research McMurdo Sound ecological survey (Norkko, et al., 2002) were consulted in drafting these proposed field techniques. The following summarizes the techniques that are to be used in 2006.

In the event that rocky substrate (gravel, cobble, boulder, rock) bottom are encountered within the transect divers collect biota from three quadrat sizes at up to three random transect points. Sampling occurs up to three points along the offshore side of the transect. This first point is a randomly selected point within the 0-15 m section. Points two and three are each placed 5 m apart from the first randomly selected point. For example, if the random start is at 11 m, the second and third points are 16 and 21, respectfully. The transect tape can be premarked at these points prior to the dive, to eliminate time-consuming point selection at depth. At each transect point three different quadrat sizes are placed: 1 x 1 m (1 m²), 50 x 50 cm (0.5 m²), and 25 x 25 cm (0.25 m²).

Within each 1 x 1 m quadrat, a photographic image record (digital) is made immediately prior to sampling. If conditions do not permit such a photographic record to be made (e.g., poor visibility) then a hand-drawn map should be constructed as an alternative. All macrophytes and conspicuous macrofauna (>2 cm length) with the 1 x 1 quadrat are identified *in situ*, and either

counted or an estimate of percent cover made using a standard technique. Counts are made of solitary macroflora and macrofauna while percent cover is used for species whose individual cannot be differentiated (e.g., colonial).

Within the 1 x 1 m quadrat, a 50 x 50 cm quadrat is placed with the left leg of the quadrat at the transect point. Within each 50 x 50 cm quadrat, a 25 x 25 cm quadrat is placed (always the same position within the larger sample). In each 50 x 50 cm quadrat, a photographic image record (digital) is made immediately prior to and after sampling. Within the 50 x 50 cm quadrat all macroalgae are completely removed, except for the 25 x 25 cm area. This 50 x 50 cm sample is taken in order to ensure sufficient algal reference material to support the *in situ* observation.

All macrophytes and fauna within the 25 x 25 cm quadrat are carefully removed using knife or hand scraper and an airlift system with 1 mm mesh bags. In each 25 x 25 cm quadrat, a photographic image record (digital) is made immediately prior to and after sampling. The digital still photography of the 1 x 1 m, 50 x 50 cm, and 25 x 25 cm quadrats may be used to enable a more detailed analysis of the habitat-diversity associations. All portions of the sample should be separately fixed and preserved 5% buffered formalin. All macrophytes are sorted for species and a wet weight biomass determinate is made.

Organism Sampling for Contaminants

Targeted demersal fish species for EMAP contaminant analysis will be collected by hook and line and/or spears. Within the given time constraint given to do each site the goal will be to collect five each of at least two, if not more, of the targeted demersal fish species will be collected. Targeted fish will be those that are typically sedentary bottom fishes that occupy the near shore benthic environment.

Fish from each site will be sorted and identified to genus and species, or to the lowest taxonomic group possible. The fish will be measured, weighted, sexed and visually checked for pathology. Our objective is to analyze one, preferably two if funding allows individual fish for accumulation of targeted contaminants from each site. Otolith will be removed at the land-based laboratory so that the individual fish may be aged. The fish will be wrapped in aluminum foil and frozen on board for subsequent fish tissue analysis per the Aleutian EMAP QAPP.

Based on research through NMFS data, as well as data from other sources (Merritt, et al., 1977; Dr. Stephen Jewett, personal communications), the potential target species will include Kelp greenling (*Hexagrammos decagrammus*), Rock greenling (*Hexagrammos lagocephalus*), Red Irish Lord (*Hemilepidotus hemilepidotus*), Yellow Irish Lord (*Hemilepidotus jordani*), Rockfish (Family *Scorpaenidae*) and Rock sole (*Lepidopsetta bilineata*). There are other species typically found in the shallow waters around the Amchitka Islands that may also be collected.

As was done during the previous Alaska coastal EMAP field programs, we will sample up to five species per station to the extent possible within the time constraints imposed by diving to ensure that we have the opportunity to analyze similar species across the geographic range of the province. Sufficient freezer space will be available on board to process and hold samples, which require freezing.

B3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Field Data

Field data will be written on water resistant field data forms as the data are collected and information needs to be recorded on deck or in the wheelhouse. Field sheets used for this project are based on those provided by the regional QA and IM personnel and by the Washington Department of Ecology. These data sheets will ultimately be transcribed into an electronic format and submitted in the required standardized format for the West Coast National Coastal Assessment EMAP program.

Field Data Forms

Alaska 2006 EMAP field personnel will record most of their raw field data or collection records on hardcopy data sheets.

Site/Sample Identity Codes

Unique site codes were provided by EPA's ORD. The site codes are configured in a series specific to Alaska and to a field program in 2006 and 2007. Each code includes a two character abbreviation for Alaska (AK), a two code number for the year (06), and sequential numerical series to differentiate the individual sites (up to 50 for Alaska's 2006 EMAP program). Alaska's site identity codes for primary sites are AKALE[sample year]-0001 through AKALE[sample year]-0050 and alternate sites AKALE[sample year]-ALT0051 through AKALE[sample year]-ALT0100.

Sample jars will be labeled prior to arriving at each station and the labels sealed with clear tape to minimize water damage to the labels. The labels have been pre-printed with all pertinent information for analysis type.

Data Transfer

The Alaska EMAP 2006 cannot wait until returning from the field to do data entry as it precludes the opportunity to catch mistakes or missing information while the field personnel can still remember and/or reconstruct what took place on site. Thus, we will be entering data onboard the vessel, but will wait to transfer the electronic files to EPA until fall 2006. The saved files are backed up to disk daily.

Sample Transfer

All samples collected will be documented through chain-of-custody forms. The Alaska EMAP 2006 field team does not have a land-based support team. They will not have access to ports for shipping until return to Seward, Alaska, at the end of the cruise. On return to Seward, Alaska, the sampling team will prepare samples for shipping, complete chain-of-custody forms, and make hardcopies of all data sheets from the stations. This will be done at the Seward Marine Center. Once samples are properly processed they will be shipped to the appropriate laboratory for processing. All chemistry samples (sediment and tissue) will be shipped from port by

overnight mail or air cargo. The designated laboratories will be notified that the packed coolers will be arriving to ensure that they are expecting the shipment. All other recommendations and requirements of the NCA QAPP 2001-2004 for sample transfer will be followed.

B4 Analytical Methods Requirements

The Alaska EMAP 2006 program has successfully sought the analytical services of several of the laboratories that have already participated in the analyses of west coast EMAP NCA samples. All analytical methods and processes pertaining to the EMAP samples will be conducted by the individual laboratories according to EMAP protocols and the NCA QAPP 2001-2004

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Appendix A
Site Locations and Metadata

Aleutian Frame - Metadata File

Identification_Information:

Originator: USGS/NWRC/GBPO

Publication_Date: 2005

Title: ak-aleutian2005-gis-design-file-v01

Geospatial_Data_Presentation_Form: tabular digital data

Online_Linkage: \designs\GISdesignfiles\yr2005\ak-aleutian2005-gis-design-file-v01.dbf

Title: Survey Design for NCA - Alaska, Aleutian Province 2005 **Date of Request:** 01/01/05 **Original Requestor:** Kevin Summers, Virginia Engle **Client:** EPA **Objective:** Sample sites to be used in estimating condition of waters in the Aleutian Province of Alaska

Design Requirements : Target Population: waters that have been delineated to be less than 60 feet deep

Strata: 1. Estuary waters in the less than 60 feet deep range 2. Marine waters in the less than 60 feet deep range

Number of sites: 30 sites in the estuary stratum 20 sites in the marine stratum

Oversample: 100% oversample; completely random samples 30 sites in the estuary stratum 20 sites in the marine stratum

Design: Systematic random sample with 2 strata using hexagon grid with equal size cells

Purpose: To developed a Survey Design for EPA's NCA Program - Alaska 2005-09

Supplemental_Information: Hex grid and random point sample coverages are in:
/gisdata\designs\NCA\alaska2005_09\aleutian

Calendar_Date: 2005

Currentness_Reference: ground condition

Progress: Complete

Maintenance_and_Update_Frequency: None planned

Bounding_Coordinates:

West_Bounding_Coordinate: -178.842950

East_Bounding_Coordinate: 179.220960

North_Bounding_Coordinate: 54.239890

South_Bounding_Coordinate: 51.431140

Theme_Keyword_Thesaurus:

REQUIRED: Reference to a formally registered thesaurus or a similar authoritative source of theme keywords.

Theme_Keyword: 2005

Theme_Keyword: Design

Theme_Keyword: NCA

Place_Keyword: Alaska - Aleutian Province

Access_Constraints:

It is strongly recommended that this data is directly acquired from the distributor described above or from another USGS Biological Resources Division server and not indirectly through other sources which may have changed the data in some way. The distributor makes no claims as to the data's suitability for other purposes.

Use_Constraints:

Acknowledgement of the National Wetlands Research Center / Gulf Breeze Project Office (NWRC/GBPO) as a data source would be appreciated in products developed from these data, and such acknowledgment as is standard for citation and legal practices for data source is expected by users of this data. Sharing new data layers developed directly from these data would also be appreciated by NWRC/GBPO staff. Users should be aware that comparison with other data sets for the same area from other time periods may be inaccurate due to inconsistencies resulting from changes in mapping conventions, data collection, and computer processes over time. The distributor shall not be liable for improper or incorrect use of this data, based on the description of appropriate/inappropriate uses described in this metadata document. These data are not legal documents and are not to be used as such.

Contact_Person: Pete Bourgeois

Contact_Organization: USGS

Contact_Position: Geographer

Address_Type: mailing and physical address

Address: 1 Sabine Island Dr

City: Gulf Breeze

State_or_Province: Florida

Postal_Code: 32561

Country: USA

Contact_Voice_Telephone: 850-934-9280

Contact_Facsimile_Telephone: 850-934-2495

Contact_Electronic_Mail_Address: pete_bourgeois@usgs.gov

Data_Set_Credit: The NWRC/GBPO would like to acknowledge the following for the use of data sources - USGS DLGs. The actual random sample locations were derived using software routines developed by the NWRC/GBPO.

Native_Data_Set_Environment: Microsoft Windows 2000 Version 5.1 (Build 2600) Service Pack 1; ESRI ArcCatalog 8.3.0.800

Originator: USGS/ NWRC/ GBPO

Title: Survey Design for NCA Program - Alaska, Aleutian Province 2005

Data_Quality_Information:

Originator: U.S Geological Survey, National Mapping Division

Publication_Date: 1983

Title: USGS 1:100,000 Digital Line Graph

Geospatial_Data_Presentation_Form: vector digital data

Publication_Information:

Publication_Place: Rolla, MO

Publisher: U.S. Geological Survey, National Mapping Division

Source_Scale_Denominator: 100,000

Type_of_Source_Media: Digital database file

Source_Time_Period_of_Content:

Time_Period_Information:

Range_of_Dates/Times:

Beginning_Date: 1983

Ending_Date: 1995

Source_Currentness_Reference: Date of publication

Source_Citation_Abbreviation: DLG

Source_Contribution: Primary source for estuary boundaries

Originator: USGS/NWRC/GBPO

Title: Random Sample Generator

Geospatial_Data_Presentation_Form: vector digital data

Type_of_Source_Media: software routines

Source_Citation_Abbreviation: RSG

Source_Contribution: software routines used to create hexagons and random point sample locations

Title: USGS Quadrangle

Source_Scale_Denominator: 250,000

Type_of_Source_Media: Digital database file

Source_Citation_Abbreviation: USGS Quadrangle

Source_Contribution: Source used to delineate the 10 fathom contour line. This was used as the cut-off depth limit for the sampling resource.

Title: NOAA Navigation Chart

Source_Scale_Denominator: 300,000 and 100,000

Type_of_Source_Media: Digital database file

Source_Citation_Abbreviation: NOAA Navigation Chart

Source_Contribution: Source used to delineate the 10 fathom contour line. This was used as the cut-off depth limit for the sampling resource.

Process_Step:

Process_Description:

The estuary/marine coverage was originally created by NWRC/GBPO staff using USGS 1:100,000 DLG datasets. Staff from EPA's PCEB group utilized USGS Quadrangle maps and NOAA Navigation Charts to delineate the 10 fathom depth contour which was intersected with the original estuary/marine polygons. Select water bodies needed in the sample population. Create hexagon coverage. Create random sample locations from the previously created hexagons.

Compile appropriate GIS design file in DBF.

Process_Description: Import metadata.

Process_Description: Metadata imported.

Source_Used_Citation_Abbreviation: F:\TEMP\xml7E.tmp

Spatial_Data_Organization_Information:

Direct_Spatial_Reference_Method: Point

Spatial_Reference_Information:

Horizontal_Coordinate_System_Definition:

Geographic:

Geographic_Coordinate_Units: Decimal degrees

Geodetic_Model:

Horizontal_Datum_Name: North American Datum of 1983

Ellipsoid_Name: Geodetic Reference System 80

Entity_and_Attribute_Information:

Detailed_Description:

Entity_Type:

Entity_Type_Label: ak-aleutian2005-gis-design-file-v01

Attribute_Label: OID

Attribute_Definition: Internal feature number.

Attribute_Definition_Source: ESRI

Unrepresentable_Domain: Sequential unique whole numbers that are automatically generated.

Attribute_Label: EMAP_ID

Attribute_Definition: Station moniker and #

Attribute_Domain_Values:

Attribute_Label: STRATA_ID

Attribute_Definition: Strata Number

Attribute_Label: FRAME_SQKM

Attribute_Definition: Frame Size in Sq.Kilometers - total potential population size

Attribute_Label: HEXSIZE

Attribute_Definition: Hexsize in Sq.Kilometers

Attribute_Label: RANXCOORD

Attribute_Definition: Random X coordinate value

Attribute_Label: RANYCOORD

Attribute_Definition: Random Y coordinate value

Attribute_Label: RANLONDD

Attribute_Definition: Random longitude in decimal degrees

Attribute_Label: RANLATDD

Attribute_Definition: Random latitude in decimal degrees

Attribute_Label: RANLONG

Attribute_Definition: Random longitude in DMS

Attribute_Label: RANLAT

Attribute_Definition: Random latitude in DMS

Attribute_Label: SAMPLE_TYP

Attribute_Definition: Base or alternate sample

Attribute_Label: ESTUARY

Attribute_Definition: Estuary Name

Attribute_Label: STATE_NAME

Attribute_Definition: 2 letter abbreviation for the state name

Attribute_Label: SQ_KM

Attribute_Definition: Estuary size in Sq.Kilometers for the polygon associated with the sample site

Attribute_Label: PROVINCE

Attribute_Definition: Epa Bio-Geographic Province

Attribute_Label: SQKM_EST

Attribute_Definition: Total estuary size in Sq.Kilometers - some may have more than one polygon

Attribute_Label: CLASS2

Attribute_Definition: Estuary or Marine

Overview_Description:

Distribution_Information:

Resource_Description: Upon Request

Distribution_Liability: NWRC Standard Data Liability Disclaimer (April 1997): Although these data have been processed successfully on a computer system at the National Wetlands Research Center/GBPO, no warranty expressed or implied is made regarding the accuracy or utility of the data on any other system or for general or scientific purposes, nor shall the act of distribution constitute any such warranty. This disclaimer applies both to individual use of the data and aggregate use with other data. It is strongly recommended that these data are directly acquired from a Biological Resources Division server, and not indirectly through other sources which may have changed the data in some way. It is also strongly recommended that careful attention be paid to the contents of the metadata file associated with these data. NWRC/GBPO shall not be held liable for improper or incorrect use of the data described and/or contained herein. So, these data are provided "as is" and without any express or implied warranties, including, without limitation, the implied warranties or merchantability and fitness for a particular purpose. Also, use of trade names or commercial products in this metadata is solely for the purpose of providing specific information, and does not imply recommendation or endorsement by the US Government. Any downloading and use of these data signifies a user's agreement to comprehension and compliance of the NWRC Standard Disclaimer. Insure all portions of metadata are read and clearly understood before using these data in order to protect both user and NWRC interests.

Format_Name: table in DBF

Transfer_Size: 0.006

Fees: None, if available on-line. There may be a fee involved in shipping data.

Custom_Order_Process: None

Metadata_Reference_Information:

Metadata_Date: 20050120

Contact_Organization_Primary:

Contact_Organization: USGS/NWRC/GBPO

Contact_Person: Pete Bourgeois

Contact_Position: Geographer

Contact_Address:

Address_Type: mailing and physical address

Address: 1 Sabine Island Dr.

City: Gulf Breeze

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Country: USA

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Contact_Electronic_Mail_Address: pete_bourgeois@usgs.gov

Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata

Metadata_Standard_Version: FGDC-STD-001-1998

Metadata_Time_Convention: local time

Metadata_Extensions:

Online_Linkage: <<http://www.esri.com/metadata/esriprof80.html>>

Profile_Name: ESRI Metadata Profile

Metadata_Extensions:

Online_Linkage: <<http://www.esri.com/metadata/esriprof80.html>>

Profile_Name: ESRI Metadata Profile

Generated by mp version 2.7.33 on Thu Jan 20 08:57:33 2005

| Map ID | EMAP_ID | Longitude, DD ¹ | Latitude, DD ¹ | Estuary | Island |
|--------|--------------|----------------------------|---------------------------|------------------|---------------|
| 1 | AKALE05-0001 | -175.86955 | 51.94934 | Igitkin Pass | Chugul |
| 2 | AKALE05-0002 | -165.53826 | 54.23989 | Akun Bay | Akun |
| 3 | AKALE05-0003 | -177.81956 | 51.70905 | Kanaga Pass | Tanaga |
| 4 | AKALE05-0004 | 173.07243 | 52.79588 | Temnac bay | Attu |
| 5 | AKALE05-0005 | -176.84241 | 51.81803 | Bay of Islands | Adak |
| 6 | AKALE05-0006 | 178.75975 | 51.65105 | Ogala Pass | Amchitka |
| 7 | AKALE05-0007 | -166.85244 | 53.63858 | Naginak Cove | Unalaska |
| 8 | AKALE05-0008 | -174.16208 | 52.22364 | Nazan Bay | Atka |
| 9 | AKALE05-0009 | -178.10143 | 51.66542 | Tanaga Pass | Tanaga |
| 10 | AKALE05-0010 | -169.70877 | 52.80481 | Samalga Pass | Chuginadak |
| 11 | AKALE05-0011 | -169.99550 | 52.89955 | Carlisle Pass | Carlisle |
| 12 | AKALE05-0012 | -167.27813 | 53.45518 | Kismaliuk Bay | Unalaska |
| 13 | AKALE05-0013 | -175.97131 | 51.89041 | Umak Bight | Umak |
| 14 | AKALE05-0014 | -176.63150 | 51.94731 | Andrew Lake | Adak |
| 15 | AKALE05-0015 | -166.16736 | 53.84377 | Beaver Inlet | Unalaska |
| 16 | AKALE05-0016 | 179.22096 | 51.43114 | Kirilof Bay | Amchitka |
| 17 | AKALE05-0017 | 177.44775 | 51.91448 | Vega Bay | Kiska |
| 18 | AKALE05-0018 | -176.15393 | 51.86570 | Umak Pass | Little Tanaga |
| 19 | AKALE05-0019 | 173.25486 | 52.93110 | Chichagof Harbor | Attu |
| 20 | AKALE05-0020 | -167.06391 | 53.62500 | Skan Bay | Unalaska |
| 21 | AKALE05-0021 | -166.61181 | 53.89150 | Unalaska Bay | Unalaska |
| 22 | AKALE05-0022 | 173.96152 | 52.71435 | Agattu Strait | Nizki |
| 23 | AKALE05-0023 | -166.75717 | 53.45413 | Usof Bay | Unalaska |

| Map ID | EMAP_ID | Longitude, DD ¹ | Latitude, DD ¹ | Estuary | Island |
|--------|--------------|----------------------------|---------------------------|---------------------|---------------|
| 24 | AKALE05-0024 | -169.71340 | 52.95207 | Kagamil Pass | Kaganmill |
| 25 | AKALE05-0025 | -168.69244 | 52.95152 | Traders Cove | Umnak |
| 26 | AKALE05-0026 | -165.21138 | 54.10655 | Avatanak Strait | Tigalda |
| 27 | AKALE05-0027 | -167.61286 | 53.40078 | Umnak Pass | Unalaska |
| 28 | AKALE05-0028 | -166.78065 | 53.55783 | Usof Bay | Unalaska |
| 29 | AKALE05-0029 | -168.87360 | 52.98298 | Nikolski Bay | Unmak |
| 30 | AKALE05-0030 | -166.58552 | 53.71224 | Kisselen Bay | Unalaska |
| 31 | AKALE05-0031 | -174.61721 | 52.14344 | Bering Sea | Atka |
| 32 | AKALE05-0032 | -174.30408 | 52.11020 | North Pacific Ocean | Atka |
| 33 | AKALE05-0033 | -174.02676 | 52.26640 | Bering Sea | Atka |
| 34 | AKALE05-0034 | 173.76540 | 52.49173 | North Pacific Ocean | Agattu |
| 35 | AKALE05-0035 | -173.54128 | 52.11957 | Bering Sea | Amlia |
| 36 | AKALE05-0036 | -178.73450 | 51.56642 | Bering Sea | Kavalga |
| 37 | AKALE05-0037 | -170.63741 | 52.59340 | North Pacific Ocean | Yunaska |
| 38 | AKALE05-0038 | -175.01534 | 52.00356 | North Pacific Ocean | Atka |
| 39 | AKALE05-0039 | -165.11076 | 54.12488 | Bering Sea | Tigalda |
| 40 | AKALE05-0040 | 177.48633 | 52.07517 | Bering Sea | Kiska |
| 41 | AKALE05-0041 | -168.39016 | 53.11723 | North Pacific Ocean | Umnak |
| 42 | AKALE05-0042 | -178.00240 | 51.91068 | Bering Sea | Tanaga |
| 43 | AKALE05-0043 | -168.59911 | 53.01724 | North Pacific Ocean | Unmak |
| 44 | AKALE05-0044 | -166.81870 | 53.99563 | Bering Sea | Unalaska |
| 45 | AKALE05-0045 | 178.45303 | 51.97072 | Bering Sea | Little Sitkin |

| Map ID | EMAP_ID | Longitude, DD ¹ | Latitude, DD ¹ | Estuary | Island |
|--------|-----------------|----------------------------|---------------------------|----------------------|---------------|
| 46 | AKALE05-0046 | 177.66703 | 51.94037 | North Pacific Ocean | Kiska |
| 47 | AKALE05-0047 | -176.45454 | 51.73557 | Bering Sea | Adak |
| 48 | AKALE05-0048 | -169.28391 | 52.75605 | North Pacific Ocean | Samalga |
| 49 | AKALE05-0049 | -167.80973 | 53.28830 | North Pacific Ocean | Unalaska |
| 50 | AKALE05-0050 | -177.85319 | 51.84580 | Bering Sea | Tanaga |
| 51 | AKALE05-ALT0001 | -166.34928 | 53.85534 | Beaver Inlet | Unalaska |
| 52 | AKALE05-ALT0002 | -166.30089 | 53.97056 | Kalekta Bay | Unalaska |
| 53 | AKALE05-ALT0003 | 178.61487 | 51.64276 | Ogala Pass | Amchitka |
| 54 | AKALE05-ALT0004 | 173.61062 | 52.39499 | Otkriti Bay | Agattu |
| 55 | AKALE05-ALT0005 | -176.14990 | 51.82669 | Chisak Bay | Little Tanaga |
| 56 | AKALE05-ALT0006 | -166.92365 | 53.46633 | Eagle Bay | Unalaska |
| 57 | AKALE05-ALT0007 | -168.99396 | 52.88363 | Samalga Pass | Umnak |
| 58 | AKALE05-ALT0008 | -170.69074 | 52.59618 | South Anchorage | Yunaska |
| 59 | AKALE05-ALT0009 | -166.14088 | 53.95129 | Unalga Pass | Unalga |
| 60 | AKALE05-ALT0010 | -168.98619 | 52.91905 | Samalga Pass | Umnak |
| 61 | AKALE05-ALT0011 | -169.69324 | 52.80834 | Samalga Pass | Chuginadak |
| 62 | AKALE05-ALT0012 | -167.05070 | 53.44829 | Kuliliak Bay | Unalaska |
| 63 | AKALE05-ALT0013 | 179.06997 | 51.52499 | Ogala Pass | Amchitka |
| 64 | AKALE05-ALT0014 | -176.60633 | 51.87532 | Kuluk Bay | Adak |
| 65 | AKALE05-ALT0015 | 173.31149 | 52.80674 | Agattu Strait | Attu |
| 66 | AKALE05-ALT0016 | -178.12187 | 51.82140 | Tanaga Pass | Tanaga |
| 67 | AKALE05-ALT0017 | -167.84266 | 53.44116 | Otter Bight | Umnak |
| 68 | AKALE05-ALT0018 | -167.40816 | 53.42600 | Aspid Bay | Unalaska |
| 69 | AKALE05-ALT0019 | -176.29008 | 51.79373 | Little Tanaga Strait | Kagalaska |

| Map ID | EMAP_ID | Longitude, DD ¹ | Latitude, DD ¹ | Estuary | Island |
|--------|-----------------|----------------------------|---------------------------|---------------------|----------|
| 70 | AKALE05-ALT0020 | 178.88604 | 51.62252 | Ogala Pass | Amchitka |
| 71 | AKALE05-ALT0021 | -176.42386 | 51.75274 | Kagalaska Strait | Adak |
| 72 | AKALE05-ALT0022 | -166.35331 | 53.99633 | Kalekta Bay | Unalaska |
| 73 | AKALE05-ALT0023 | 178.86200 | 51.62555 | Ogala Pass | Amchitka |
| 74 | AKALE05-ALT0024 | -166.66406 | 53.59668 | Three Island Bay | Unalaska |
| 75 | AKALE05-ALT0025 | -166.51722 | 53.59973 | Staraya Bay | Unalaska |
| 76 | AKALE05-ALT0026 | 173.31662 | 52.81998 | Agattu Strait | Attu |
| 77 | AKALE05-ALT0027 | 172.75106 | 52.83491 | Abraham Bay | Kanaga |
| 78 | AKALE05-ALT0028 | -177.20455 | 51.88120 | Kanaga Sound | Kanaga |
| 79 | AKALE05-ALT0029 | -169.73558 | 53.05370 | Uliaga Pass | Uliaga |
| 80 | AKALE05-ALT0030 | -176.75761 | 51.78763 | Bay of Islands | Unalaska |
| 81 | AKALE05-ALT0031 | 178.27793 | 51.82657 | Bering Sea | Rat |
| 82 | AKALE05-ALT0032 | -169.21559 | 52.76439 | North Pacific Ocean | Samalga |
| 83 | AKALE05-ALT0033 | -174.73041 | 52.12184 | Bering Sea | Atka |
| 84 | AKALE05-ALT0034 | -168.79753 | 52.91191 | North Pacific Ocean | Umnak |
| 85 | AKALE05-ALT0035 | -167.95431 | 53.54715 | Bering Sea | Umnak |
| 86 | AKALE05-ALT0036 | -173.99564 | 52.12316 | Bering Sea | Amlia |
| 87 | AKALE05-ALT0037 | -168.48403 | 53.04634 | North Pacific Ocean | Umnak |
| 88 | AKALE05-ALT0038 | -166.07764 | 53.86357 | North Pacific Ocean | Egg |
| 89 | AKALE05-ALT0039 | -167.71280 | 53.26918 | North Pacific Ocean | Unalaska |
| 90 | AKALE05-ALT0040 | -169.08668 | 52.83018 | North Pacific Ocean | Umnak |
| 91 | AKALE05-ALT0041 | -177.45172 | 51.71772 | Bering Sea | Kanaga |

| Map ID | EMAP_ID | Longitude, DD ¹ | Latitude, DD ¹ | Estuary | Island |
|--------|-----------------|----------------------------|---------------------------|---------------------|---------|
| 92 | AKALE05-ALT0042 | -173.43836 | 52.11847 | Bering Sea | Amlia |
| 93 | AKALE05-ALT0043 | -168.43459 | 53.09011 | North Pacific Ocean | Umnak |
| 94 | AKALE05-ALT0044 | 178.20331 | 51.83294 | Bering Sea | Tanaga |
| 95 | AKALE05-ALT0045 | 177.60643 | 51.92006 | North Pacific Ocean | Kiska |
| 96 | AKALE05-ALT0046 | 173.70131 | 52.42649 | North Pacific Ocean | Agattu |
| 97 | AKALE05-ALT0047 | 173.70458 | 52.46193 | North Pacific Ocean | Agattu |
| 98 | AKALE05-ALT0048 | 177.66999 | 52.07795 | Bering Sea | Kiska |
| 99 | AKALE05-ALT0049 | -178.84295 | 51.56792 | Bering Sea | Kavalga |
| 100 | AKALE05-ALT0050 | -171.31659 | 52.49037 | Bering Sea | Amukta |

-
- Horizontal Datum: North American Datum of 1983

Appendix B
Site Quadrat Locations, Depths and Transect Direction

Random Q Meters

| EMAP_ID | 1 | 2 | 3 | Transect Direction | Random Depth, M |
|--------------|----|----|----|-----------------------|--------------------|
| AKALE05-0001 | 13 | 18 | 23 | 1 | 19 |
| AKALE05-0002 | 3 | 8 | 13 | 2 | 9 |
| AKALE05-0003 | 11 | 16 | 21 | 2 | 15 |
| AKALE05-0004 | 15 | 20 | 25 | 1 | 15 |
| AKALE05-0005 | 1 | 6 | 11 | 2 | 13 |
| AKALE05-0006 | 14 | 19 | 24 | 1 | 14 |
| AKALE05-0007 | 10 | 15 | 20 | 2 | 14 |
| AKALE05-0008 | 9 | 14 | 19 | 1 | 7 |
| AKALE05-0009 | 7 | 12 | 17 | 1 | 8 |
| AKALE05-0010 | 1 | 6 | 11 | 2 | 8 |
| AKALE05-0011 | 7 | 12 | 17 | 1 | 20 |
| AKALE05-0012 | 0 | 5 | 10 | 1 | 5 |
| AKALE05-0013 | 10 | 15 | 20 | 2 | 6 |
| AKALE05-0014 | 7 | 12 | 17 | 2 | 18 |
| AKALE05-0015 | 7 | 12 | 17 | 2 | 7 |
| AKALE05-0016 | 15 | 20 | 25 | 1 | 10 |
| AKALE05-0017 | 7 | 12 | 17 | 2 | 5 |
| AKALE05-0018 | 4 | 9 | 14 | 2 | 19 |
| AKALE05-0019 | 8 | 13 | 18 | 2 | 18 |
| AKALE05-0020 | 3 | 8 | 13 | 1 | 20 |
| AKALE05-0021 | 0 | 5 | 10 | 1 | 16 |
| AKALE05-0022 | 11 | 16 | 21 | 2 | 18 |
| AKALE05-0023 | 10 | 15 | 20 | 1 | 17 |
| AKALE05-0024 | 14 | 19 | 24 | 1 | 10 |
| AKALE05-0025 | 1 | 6 | 11 | 2 | 20 |
| AKALE05-0026 | 13 | 18 | 23 | 2 | 13 |
| AKALE05-0027 | 10 | 15 | 20 | 1 | 4 |
| AKALE05-0028 | 14 | 19 | 24 | 2 | 16 |
| AKALE05-0029 | 10 | 15 | 20 | 2 | 6 |
| AKALE05-0030 | 2 | 7 | 12 | 1 | 18 |
| AKALE05-0031 | 8 | 13 | 18 | 1 | 8 |
| AKALE05-0032 | 2 | 7 | 12 | 2 | 19 |
| AKALE05-0033 | 14 | 19 | 24 | 2 | 13 |
| AKALE05-0034 | 9 | 14 | 19 | 2 | 6 |
| AKALE05-0035 | 1 | 6 | 11 | 1 | 15 |
| AKALE05-0036 | 5 | 10 | 15 | 2 | 17 |
| AKALE05-0037 | 6 | 11 | 16 | 2 | 8 |
| AKALE05-0038 | 10 | 15 | 20 | 1 | 15 |
| AKALE05-0039 | 12 | 17 | 22 | 2 | 18 |
| AKALE05-0040 | 5 | 10 | 15 | 1 | 3 |
| AKALE05-0041 | 14 | 19 | 24 | 1 | 15 |
| AKALE05-0042 | 5 | 10 | 15 | 2 | 4 |
| AKALE05-0043 | 9 | 14 | 19 | 2 | 8 |
| AKALE05-0044 | 4 | 9 | 14 | 2 | 15 |

| | | | | | |
|-----------------|----|----|----|---|----|
| AKALE05-0045 | 3 | 8 | 13 | 2 | 14 |
| AKALE05-0046 | 2 | 7 | 12 | 1 | 10 |
| AKALE05-0047 | 13 | 18 | 23 | 1 | 5 |
| AKALE05-0048 | 15 | 20 | 25 | 2 | 7 |
| AKALE05-0049 | 6 | 11 | 16 | 2 | 14 |
| AKALE05-0050 | 10 | 15 | 20 | 1 | 7 |
| AKALE05-ALT0001 | 10 | 15 | 20 | 2 | 15 |
| AKALE05-ALT0002 | 9 | 14 | 19 | 2 | 5 |
| AKALE05-ALT0003 | 8 | 13 | 18 | 1 | 5 |
| AKALE05-ALT0004 | 15 | 20 | 25 | 1 | 7 |
| AKALE05-ALT0005 | 13 | 18 | 23 | 2 | 3 |
| AKALE05-ALT0006 | 5 | 10 | 15 | 1 | 5 |
| AKALE05-ALT0007 | 15 | 20 | 25 | 1 | 17 |
| AKALE05-ALT0008 | 3 | 8 | 13 | 2 | 15 |
| AKALE05-ALT0009 | 4 | 9 | 14 | 1 | 14 |
| AKALE05-ALT0010 | 12 | 17 | 22 | 2 | 17 |
| AKALE05-ALT0011 | 11 | 16 | 21 | 1 | 15 |
| AKALE05-ALT0012 | 4 | 9 | 14 | 2 | 4 |
| AKALE05-ALT0013 | 0 | 5 | 10 | 2 | 20 |
| AKALE05-ALT0014 | 5 | 10 | 15 | 2 | 10 |
| AKALE05-ALT0015 | 8 | 13 | 18 | 2 | 4 |
| AKALE05-ALT0016 | 11 | 16 | 21 | 1 | 19 |
| AKALE05-ALT0017 | 2 | 7 | 12 | 1 | 18 |
| AKALE05-ALT0018 | 0 | 5 | 10 | 2 | 19 |
| AKALE05-ALT0019 | 2 | 7 | 12 | 1 | 8 |
| AKALE05-ALT0020 | 10 | 15 | 20 | 1 | 9 |
| AKALE05-ALT0021 | 15 | 20 | 25 | 2 | 3 |
| AKALE05-ALT0022 | 13 | 18 | 23 | 2 | 15 |
| AKALE05-ALT0023 | 5 | 10 | 15 | 2 | 19 |
| AKALE05-ALT0024 | 5 | 10 | 15 | 1 | 1 |
| AKALE05-ALT0025 | 7 | 12 | 17 | 1 | 11 |
| AKALE05-ALT0026 | 8 | 13 | 18 | 1 | 13 |
| AKALE05-ALT0027 | 9 | 14 | 19 | 1 | 18 |
| AKALE05-ALT0028 | 11 | 16 | 21 | 1 | 8 |
| AKALE05-ALT0029 | 9 | 14 | 19 | 2 | 15 |
| AKALE05-ALT0030 | 14 | 19 | 24 | 2 | 11 |
| AKALE05-ALT0031 | 1 | 6 | 11 | 1 | 7 |
| AKALE05-ALT0032 | 1 | 6 | 11 | 1 | 6 |
| AKALE05-ALT0033 | 8 | 13 | 18 | 1 | 11 |
| AKALE05-ALT0034 | 8 | 13 | 18 | 2 | 11 |
| AKALE05-ALT0035 | 4 | 9 | 14 | 1 | 20 |
| AKALE05-ALT0036 | 12 | 17 | 22 | 2 | 15 |
| AKALE05-ALT0037 | 13 | 18 | 23 | 2 | 15 |
| AKALE05-ALT0038 | 11 | 16 | 21 | 1 | 12 |
| AKALE05-ALT0039 | 8 | 13 | 18 | 1 | 9 |
| AKALE05-ALT0040 | 12 | 17 | 22 | 1 | 16 |
| AKALE05-ALT0041 | 11 | 16 | 21 | 2 | 4 |
| AKALE05-ALT0042 | 5 | 10 | 15 | 2 | 19 |
| AKALE05-ALT0043 | 9 | 14 | 19 | 1 | 20 |

| | | | | | |
|-----------------|----|----|----|---|----|
| AKALE05-ALT0044 | 11 | 16 | 21 | 2 | 4 |
| AKALE05-ALT0045 | 12 | 17 | 22 | 2 | 5 |
| AKALE05-ALT0046 | 5 | 10 | 15 | 2 | 12 |
| AKALE05-ALT0047 | 0 | 5 | 10 | 1 | 5 |
| AKALE05-ALT0048 | 15 | 20 | 25 | 2 | 18 |
| AKALE05-ALT0049 | 11 | 16 | 21 | 2 | 12 |
| AKALE05-ALT0050 | 13 | 18 | 23 | 1 | 6 |

Person parallel and
facing
shore
1= Right
2=Left

Appendix C
ADEC Fish Quality Project Plan for Processing Fish Tissue
(Whole rather than fillets will be processed.)

| | | |
|---|---|---|
|  | Alaska Department of Environmental Conservation Environmental Health Laboratory Standard Operating Procedure | |
| SOP Title: | Fish Tissue Processing for Fish Tissue Testing program | Revision Date: November 17, 2005 |
| Method No: | NA | SOP Revision No: 001 |
| Page No: | 43 of 10 | Supersedes: NA |
| Reference: | EPA 823-B-00-007 (U.S. EPA 2000) | |

Signature and Title

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Periodic Review:

Signature

Title

Date

This is a controlled document with the most recent updated revision. This SOP should be reviewed on an annual basis. If the SOP is found adequate, the SOP cover page is signed and dated for documenting the review. If major revisions are needed, a new revision will be released with a new signature page. The above signatures reflect periodic review of the Standard Operating Procedure.

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1.0. OBJECTIVE:

This procedure describes the laboratory fish tissue processing procedures for the assessment of contaminant levels in a variety of marine and freshwater fishes of Alaska. Fish tissue samples are prepared in accordance with U.S. Environmental Protection Agency (EPA) guidance (U.S. EPA 2000). Sample processing and homogenization of tissues are performed at the DEC Environmental Health (EH) Lab. The Project Coordinator oversees fish sample processing activities.

2.0. SCOPE AND APPLICATION:

Processing for most fish samples consists of removal of both fillets from each fish, removal of the skin from both fillets, homogenization of the entire amount of tissue from both fillets, and apportionment of the homogenized tissue from each fish into four pre-cleaned 8 oz. glass sample jars. One exception to this is for species such as Pacific halibut (*Hippoglossus stenolepis*), where a roast removed from one fillet of a fish has been received from the field sampler. In this case the skin is removed along with a layer from each side of the roast. The roast is then homogenized following the same procedures used for fillets.

3.0. INTERFERENCES:

3.1. Stainless steel knives, blades and blenders are used to minimize contamination of the samples.

4.0. HEALTH AND SAFETY:

4.1. Before performing this SOP, the pertinent MSDS for each chemical is read.

4.2. Gloves, eye protection glasses and lab coat are worn at all times while performing this analysis.

4.3. Knives are kept sharp and cuts are made following the procedures outlined in section 8.0. Whenever possible, cuts are made away from the body. A Kevlar glove is worn to protect the non-knife hand.

5.0. SAMPLE COLLECTION, PRESERVATION, AND STORAGE:

5.1. Biologists from IPHC, ADF&G, NOAA, other agencies, and commercial and native fishermen have collected whole fish or roast samples from predetermined locations.

5.2. Fish samples are stored at $\leq -20^{\circ}\text{C}$ until they are ready to be thawed for processing.

- 5.3. Fish samples are thawed at 4°C. Fish are thawed only to the point at which it becomes possible to safely make the necessary incisions into the flesh (U.S. EPA 1990).
- 5.4. Processed fish tissue samples are returned to the freezer and stored in wide mouth jars at $\leq -20^{\circ}\text{C}$ until time of analysis.

6.0. EQUIPMENT AND SUPPLIES:

- 6.1. Analytical balance for use in weighing samples.
- 6.2. Laboratory dishwasher.
- 6.3. Blender.
- 6.4. Commercial tissue grinder.
- 6.5. Fume hood.
- 6.6. Kevlar glove.
- 6.7. Chemical waste storage containers.
- 6.8. Labware:
 - 6.8.1. Glassware – 8 oz wide mouth jars with lids.
 - 6.8.2. Cutting board.
 - 6.8.3. Foil.
 - 6.8.4. Teflon spatula.
 - 6.8.5. Filet knife.
 - 6.8.6. Marked Teflon squeeze bottles for DI water, acetone, cyclohexane, and methylene chloride.

7.0 REAGENTS AND STANDARDS:

- 7.1 Acetone.
- 7.2 Cyclohexane.
- 7.3 Methylene chloride.
- 7.4 DI Water (RO filtered).

8.0 PROCEDURE

8.1. Inspection:

- 8.1.1. Individual fish received are unwrapped and carefully inspected to ensure that they have not been compromised in any way e.g. decomposed, not properly preserved during shipment, too small for individual processing, arrived with incomplete or missing Field Data Collection form.
- 8.1.2. Any specimen deemed unsuitable for further processing and analysis should be discarded and identified on the sample processing sheet.
- 8.1.3. All fish are inspected for lesions or other indications that they are not healthy.
- 8.1.4. The fish processing Technician immediately informs the Project Coordinator of any unsuitable or unhealthy samples. Lesions and indications found are documented on the sample processing sheet.

8.2. Sample Weighing:

- 8.2.1. **Prior to processing each fish, the Technician washes their hands with soap and rinses thoroughly in tap water, followed by a distilled water rinse (U.S. EPA 1990).**
- 8.2.2. **Fresh gloves are worn for each fish processed. Gloves are talc- and dust-free, and of non-contaminating materials. For safety, a Kevlar glove is worn under the glove of the non-knife hand.**
- 8.2.3. **A wet weight is determined for each fish in the processing laboratory.**
- 8.2.4. **Samples are weighed on a properly calibrated balance with adequate accuracy and precision (± 1 gram).**
- 8.2.5. **Fish are weighed directly on a foil-lined balance tray. To prevent cross contamination between individual fish, the foil lining is replaced after each weighing.**
- 8.2.6. **All weights are recorded to the nearest gram on the sample processing sheet.**

8.3. Sex Determination:

- 8.3.1. **To determine the sex of a fish, an incision is made on the ventral surface of the body from a point immediately anterior to the anus toward the head to a point immediately posterior to the isthmus.**

- 8.3.2. **If necessary, a second incision is made on the left side of the fish from the initial point of the first incision toward the dorsal fin. The resulting flap is folded back to more easily observe identifiable reproductive tissue.**
- 8.3.3. **The sample identification number and sex of each fish is recorded on the sample processing sheet.**
- 8.3.4. **If unsure of the sex of any sample, the Project Coordinator is contacted for verification before further processing of the fish.**
- 8.3.5. **If the fillet tissue becomes contaminated by puncture of the internal organs during resection, alternatively, the fillet tissue may be rinsed in contaminant-free, de-ionized distilled water and air dried or the fillet tissue may be eliminated as a sample. The Project Coordinator will decide which procedure is appropriate. A notation is made describing the event and its severity on the sample processing sheet.**

8.4. Filleting:

- 8.4.1. **Filleting is conducted under guidance of the Project Coordinator or other experienced biologist.**
- 8.4.2. **Fish are filleted on a plastic cutting board that is properly cleaned and decontaminated between fish (see below for cleaning procedure).**
- 8.4.3. **Care is taken to avoid contaminating fillet tissues with material released from inadvertent puncture of internal organs.**
- 8.4.4. **Clean, decontaminated, high-quality stainless steel utensils are used to remove both fillets from each fish, as necessary.**
- 8.4.5. **A shallow cut is made through the skin, on either side of and along the dorsal fin, from the base of the skull to the base of the tail.**
- 8.4.6. **Vertical cuts are made behind the gill cover through the skin and flesh to the spine. The length of the cut is from the dorsal to ventral surface of the fish.**
- 8.4.7. **The fillet is then removed by cutting along the spine and over the ribs from front to back.**
- 8.4.8. **The belly flap is included with each fillet, but the pelvic fins, if present, are removed.**
- 8.4.9. **When the fillet remains connected to the fish only at the tail, the fillet is removed from the skin, leaving the skin attached to the fish carcass.**

- 8.4.10. **Bones still present in the tissue after filleting are removed carefully (U.S. EPA 1990).**
- 8.4.11. **Both fillets are removed from a fish.**
- 8.4.12. **Both fillets from a fish, with belly flesh attached, are homogenized as a sample.**
- 8.4.13. **Roast samples are processed by removing the skin, if present, and cutting away the outer layer of tissue from all sides of the roast. This is done to remove any tissue that may have come into contact with contaminants. The roast is then treated the same as the pair of fillets from other fish species.**
- 8.5. **Preparation of Individual Homogenates:**
 - 8.5.1. **To ensure even distribution of contaminants throughout tissue samples, fillets are ground and homogenized prior to analyses.**
 - 8.5.2. **Fillets are ground in a tissue homogenizer. Either a commercial tissue grinder or a laboratory blender are used. The grinder is made of aluminum, with stainless steel blades. The blender has all stainless steel parts. As grinding and homogenization of biological tissue is easier when the tissue is partially frozen (Stober 1991), samples are homogenized immediately after removal from the carcass.**
 - 8.5.3. **Chilling the grinder/homogenizer briefly with a few chips of dry ice, as available, reduces the tendency of the tissue to stick to the grinder.**
 - 8.5.4. **The grinder is run for at least 5 minutes.**
 - 8.5.5. **A Teflon spatula is used to ensure that all tissue is continually being run through the grinder blades.**
 - 8.5.6. **If the tissue is not uniform and finely ground after five minutes, the grinding/ homogenizing is repeated.**
 - 8.5.7. **Homogenization of each individual fish is noted on the sample processing sheet.**
 - 8.5.8. **Homogenates from each fish are apportioned into two to four pre-cleaned labeled 8 oz. jars, depending on needs for analysis, frozen and stored at $\leq -20^{\circ}\text{C}$. Analysis decisions are made by the Program Manager.**
 - 8.5.9. **Each homogenate portion size is roughly two to three ounces. The jar will not be completely filled.**

8.6. Decontamination Procedures Between Samples:

- 8.6.1. The cleaning and preparation of all equipment prior to processing fish tissue ensures no cross contamination between samples.**
- 8.6.2. All knives, cutting boards and grinder parts are rinsed in the lab sink with de-ionized water and then washed in an approved laboratory dishwasher with a detergent, followed by a mild acid rinse, and a de-ionized water rinse.**
- 8.6.3. All equipment is then triple-rinsed with each of the following: acetone, cyclohexane, and methylene chloride. All parts are then air dried.**
- 8.6.4. Organic (acetone and cyclohexane) and chlorinated (methylene chloride) chemical waste is disposed of in separate secondary hazardous waste containers under the fume hood.**

9.0 QUALITY CONTROL:

9.1 In order to maintain high quality homogenates, the following will be maintained:

- 9.1.1 The Technician is properly trained in knife handling and filleting, to protect the quality of the tissue during removal.**
- 9.1.2 All data is immediately entered onto the fish processing sheets as it is collected.**
- 9.1.3 To ensure that there is no contamination of the solvents, squeeze bottles are filled one type at a time. Solvents are never returned to their original container after being placed in the squeeze bottles.**

10.0 DATA HANDLING:

10.1 Data is entered into the SQL Server by the Technician. The Project Coordinator checks all data entered and maintains records of all data quality checks.

11.0 INSTRUMENTATION MAINTENANCE:

11.1 The scale is calibrated before initiating the processing and is re-calibrated annually.

12.0 REFERENCES

- 12.1 Stober, Q. J. 1991. Guidelines for Fish Sampling and Tissue Preparation for Bioaccumulative Contaminants. Environmental Services Division, Region 4, U.S. Environmental Protection Agency, Athens, GA.
- 12.2 Texas Water Commission. 1990. Texas Tissue Sampling Guidelines. Texas Water Commission, Austin, TX.
- 12.3 U.S. EPA. 2000. Guidance for assessing chemical contaminant data for use in fish advisories, Volume 1 - Fish sampling and analysis. Third Edition. EPA 823-B-00-007. U.S. Environmental Protection Agency, Office of Water, Washington, DC.