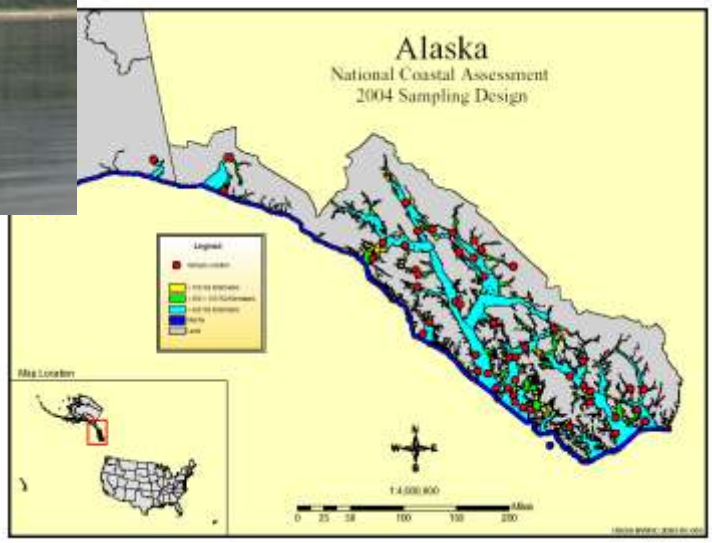
Alaska Department of Environmental Conservation

2004 Southeast Alaska Coastal Survey Environmental Status



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Acknowledgements

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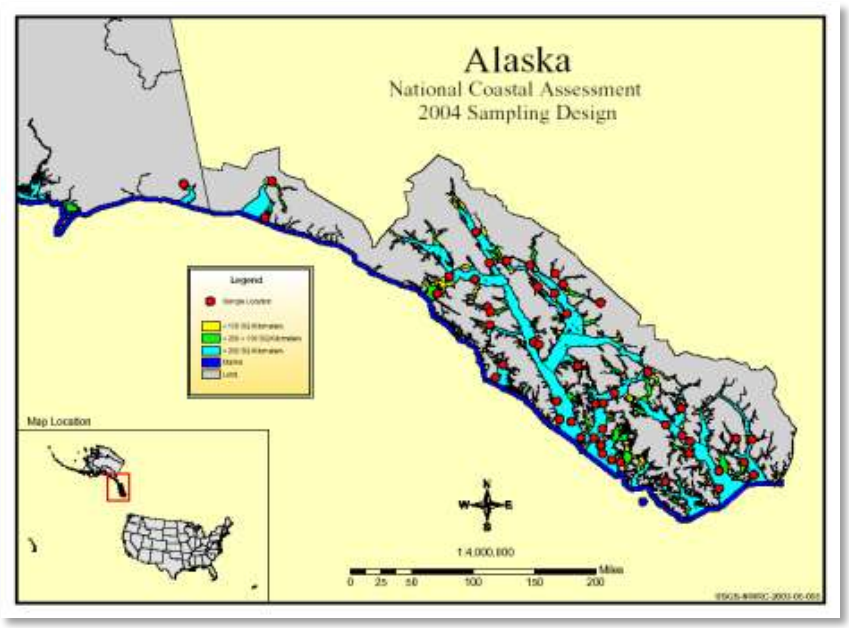
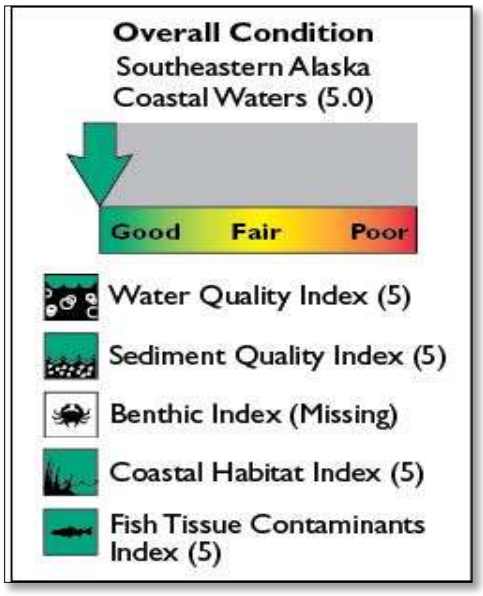
In 2004, the Alaska Department of Environmental Conservation (ADEC), as part of the US Environmental Protection Agency (EPA) Western States Coastal Environmental Monitoring and Assessment Program, surveyed Alaska's Sutheast province. This survey (Figure 1-1) was part of a larger National Coastal Assessment (NCA) on-going assessment of the aquatic resource status of the nations' coastline. The first coastal survey was carried out in Alaska's Southcentral province in 2002 (Saupe et al., 2005). DEC established, within the Division of Water Quality and Restoration Program, the Alaska Monitoring and Assessment Program (AKMAP) to adapt and implement regional aquatic resource surveys.

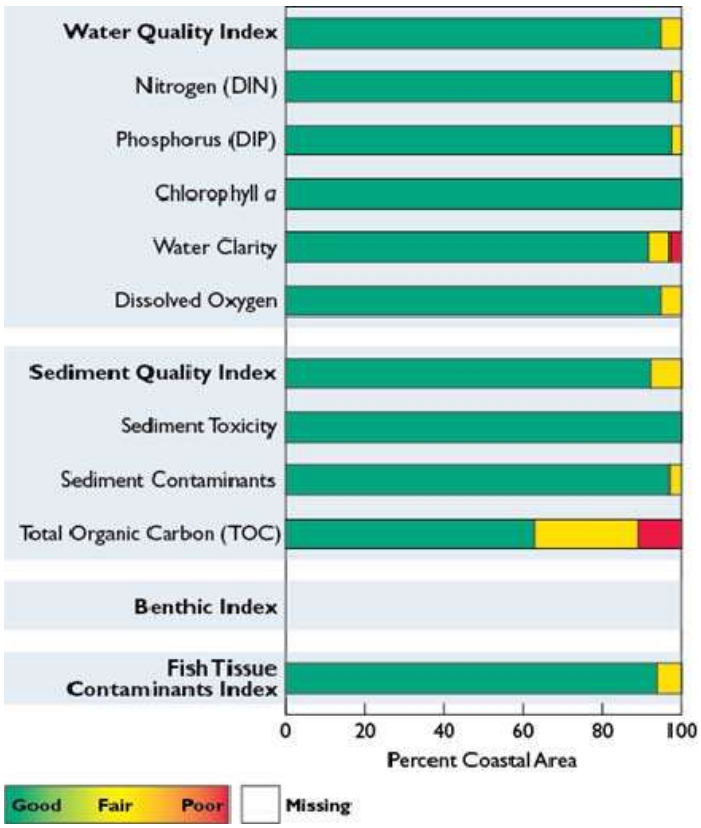


1-1: Southeast Alaska Coastal Survey Design Base Sites

As shown in Figure 1-2, the overall condition of Southeastern Alaska's coastal waters is rated good, with an overall condition score of 5.0. Appendix D provides information on the indices used for Alaska, which are part of the current working draft of the National Coastal Condition Report IV and potentially subject to change. Figure 1-3, provides a summary of the percentage of Southeastern Alaska coastal area in good, fair, poor, or missing categories for each index and component indicator The water quality, sediment quality, and fish tissue contaminants are rated good, and the benthic index for this region could not be evaluated. This assessment is based on environmental stressor and response data collected from 42 locations (three samples for water quality and sediments were lost, resulting in only 39 sample sets used in ranking water quality and sediments) along Southeastern Alaska's coastline in 2004. This is an initial status survey and cannot be used to infer changes or trends, as can the repeated surveys conducted as part of the contiguous United States EPA National Coastal Condition surveys. Please refer to Chapter 2, 3, and Appendix D for information about how these assessments were made, what cut points were used to develop the rating for each index and component indicator, and limitations of the available data.



1-2: Overall condition for Southeast Alaska Coastal Waters

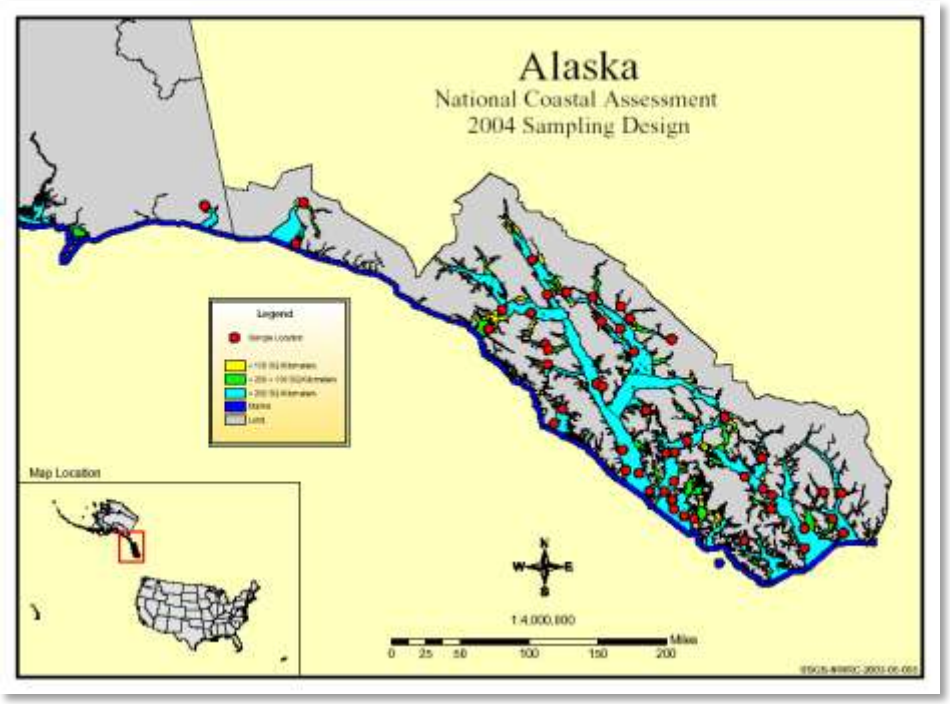


1-3: Southeast Alaska Results for Various Indicies

Chapter-2: Alaska Monitoring and Assessment Program Southeast Alaska 2004 Coastal Survey Background

Introduction

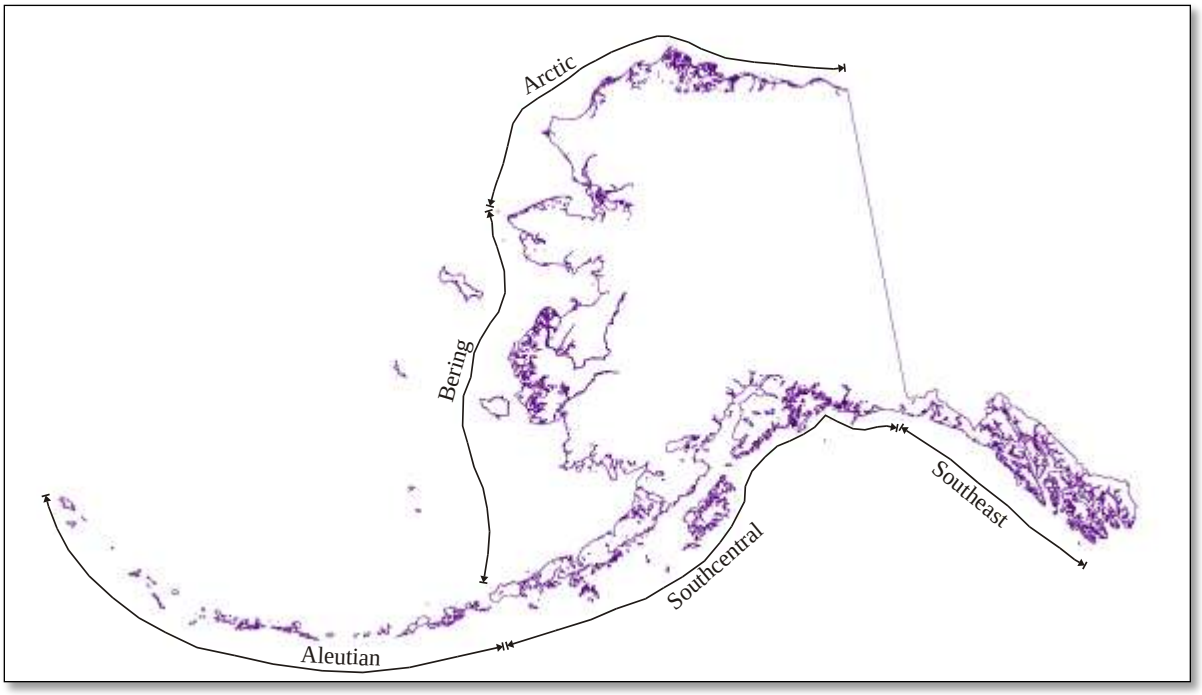
In 2004, the Alaska Department of Environmental Conservation (ADEC), as part of the US Environmental Protection Agency (EPA) Western States Coastal Environmental Monitoring and Assessment Program, surveyed Alaska's Southeast province. This survey (Figure 1) was part of a larger National Coastal Assessment (NCA) on-going assessment of the aquatic resource status of the nations' coastline. EPA categorized Alaska's coastline into 5 biogeographical strata or provinces (Figure 2). The first coastal survey was carried out in Alaska's Southcentral province in 2002 (Saupe et al., 2005). DEC established, within the Division of Water Quality and Restoration Program, the Alaska Monitoring and Assessment Program (AKMAP) to adapt and implement regional aquatic resource surveys. Statuses of the coastal marine and freshwater regional assessments are show in Figure 2-3.



2-1: Southeast Alaska Survey Design Base Sites

Background

The Environmental Monitoring and Assessment Program (EMAP), a predecessor to the current EPA National Aquatic Resource Surveys (NARS), of which NCA is a component, was a national research program led by EPA's Office of Research and Development (EPA-ORD). EMAP's purpose was to develop the scientific tools and agency partnerships needed to broadly assess the status and trends of significant ecological systems. The goal of EMAP and the current programs 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" (EPA 1997).

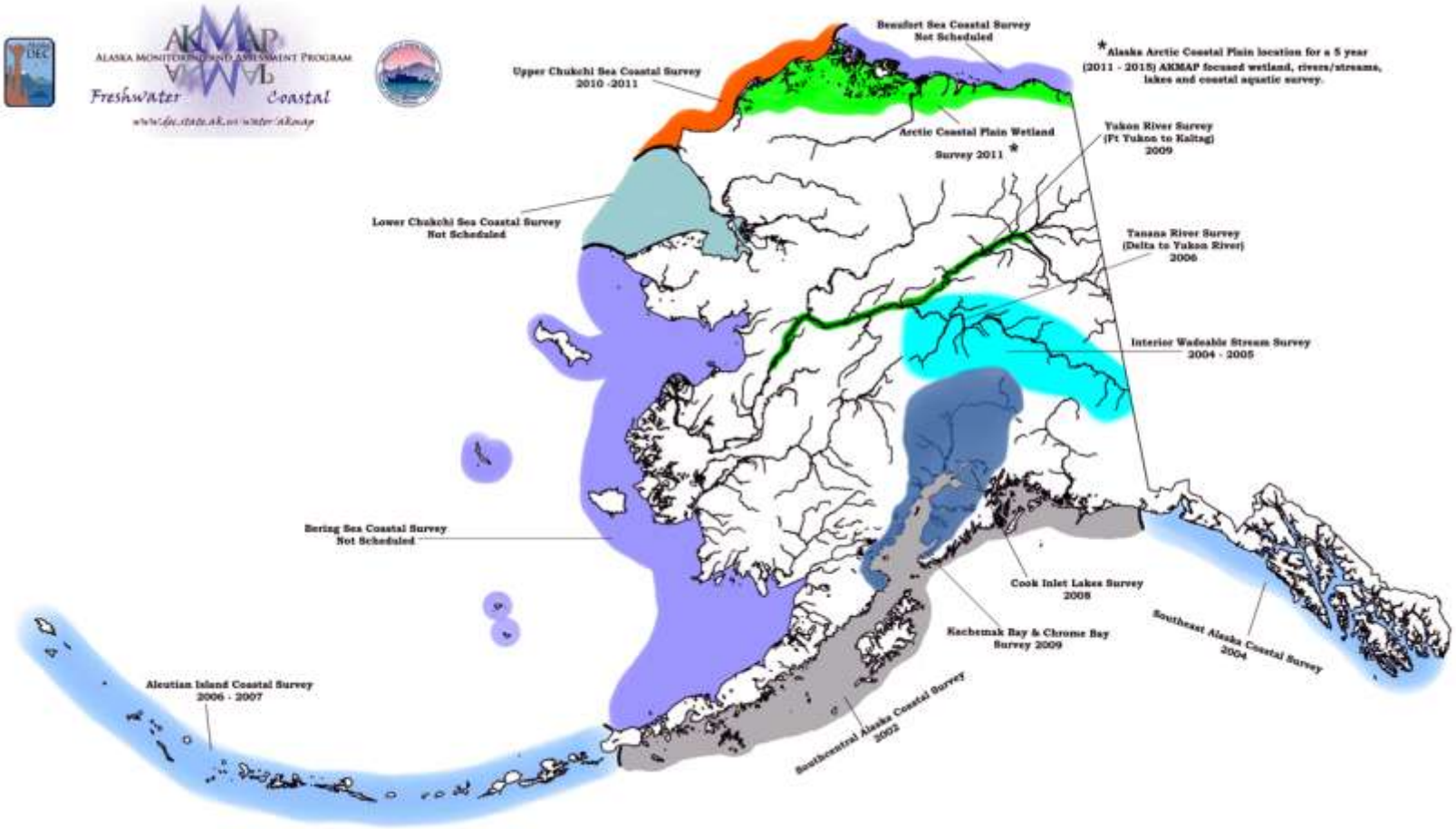


2-2: Alaska Coastal Provinces

Problem Statement

Alaska has the longest coastline of all the U.S. states, with approximately 45,000 miles of marine water shoreline, which constitutes over 50% of the total U.S. coastline. In addition, much of the southeast Alaskan coast is very convoluted, a result of the hundreds of bays, estuaries, coves, fjords, and other water bodies. As a result of Alaska's expansive coastline and associated monitoring costs, historical coastal assessments in Alaska have been targeted for specific areas to assess impacts from specific activities, such as oil exploration and production, fish processing, and municipal discharges. Section 305(b) of the Clean Water Act requires states to report on conditions of their waters biennially with a scope that provides a description of the water quality of *all* navigable waters, accounting for seasonal, tidal and other variations. an analysis of the extent to which *all* navigable waters provide for the protection and prorogation of a balanced population of shellfish, fish and wildlife, and allow for recreational activities on land and waters.

There have been many assessments of water quality in Alaska over the years by various federal, state and local agencies, including non-governmental entities, most have been targeted surveys to address specific issues (DEC, 2005a; 2005b). Targeted assessments are by their design focused to address specific environmental issues, but cannot be used to make inferences about populations (all waters) distributed over space. Understanding large-scale environmental concerns, e.g. coastal sediment distribution changes due to climate change, requires measures characterizing the population of concern (Long et al., 1996; Cox et al., 1997; Stevens and Olsen, 2004). Survey sampling provides a scientifically rigorous methodology to sample a subset of the ecological resource of interest, e.g. coastal estuaries, to provide estimate of the condition or status of the estuaries with a statement about uncertainty surrounding that estimate. The EMAP program developed a statistically-valid basis for determining this status.



2-3: Status of Alaska Monitoring and Assessments Program Marine and Coastal Surveys 2009

Southeast Alaska is a relatively unpopulated area of the state. However, southeast waterways are used extensively by the cruise ship industry and it is estimated that a population equivalent to the entire state of Alaska traverses these waters each summer. Concerns for potential environmental impacts associated with black- and gray-water discharges from the cruise ship industry, as well as several violations associated with these discharges, led to the state of Alaska to promulgate cruise ship discharge regulations prohibiting these discharges into state waters. However, there are locations within Southeast Alaskan inshore waters that are outside of state authority where there may be cumulative impacts from the numerous ships discharging into these relatively small volumes of water. Thus, ADEC's Cruise Ships Program partnered with the Southeast Alaska survey to collect additional data to help evaluate potential impacts and best manage the industry's compliance.

Additional water and sediment quality concerns are associated with southeast Alaska's fishing and mining industry. Water and sediment quality data AKMAP collected throughout Southeast Alaska coastal marine waters provides a context to assist resource managers in quantifying potential effects of these industries waste on the marine environment in specific areas.

Anticipated Benefits

The primary goal of the Southcentral Alaska EMAP 2004 program was to assess the aquatic resource condition based on measured indicators of marine environmental quality (using a modified Sediment Quality Triad approach) and establish baseline measurements to evaluate future changes in the environmental quality or condition. In doing so, specific questions as presented below can be answered. For example:

> *What proportion of southeast Alaska's coastal marine sediments has chemical contaminant levels that indicate poor sediment quality?*
>
> *What is the prevalence of chemical contaminant loads in fish tissues that indicate exposure to contaminated sediments or food and how well do fish tissue and sediment contaminant data correlate?*
>
> *What proportion of southeastern Alaska's marine waters has depleted dissolved oxygen that indicates poor water quality for resident benthic fish and invertebrates?*

Results of the AKMAP Southeast Alaska survey provide direct and indirect benefits to the State of Alaska, including:

- Provides information to assist the state in implementing the Alaska Clean Waters Action Policy, which integrates water quality, quantity, and habitat in the evaluation of waterbody needs, and priorities.
- Resulting ecological indicators and monitoring design can help DEC to refine the survey strategy for Alaska arctic and sub-arctic conditions where appropriate. Methods, indicators, and quality indices developed for contiguous lower 48 states are not necessarily relevant to assessing the status of Alaska aquatic resources.

The Southeast Alaska survey information can be used to assist in evaluating issues of coastal environmental concerns by providing background or context data (*e.g.* DO concentrations, toxic contaminants, benthic habitat), by providing specific data (*e.g.* benthic invertebrates for possible non-indigenous species or to extend geographic ranges of species.

Study Design

Setting

Southeast Alaska has numerous freshwater inputs from the surrounding watershed that includes creeks and rivers, local precipitation, snowmelt, and continual glacial melting. These massive freshwater inputs contribute significantly to the Alaska Coastal Current that moves counterclockwise along the coastal Gulf of Alaska. In addition to the salinity variability in southeastern Alaskan water, there are large tidal fluctuations, high localized sedimentation, and multiple potential sources of contamination; all of which contribute to this area's complex oceanography.

Sample Design

Southeast Alaska's AKMAP coastal survey was based on the principals used for EPA NAR surveys, with a monitoring design that features multi-tiered, integrated monitoring of selected environmental indicators. Data is integrated from multiple media, following a modified-Sediment Quality Triad (SQT) design. Integrating data water quality, sediment chemistry, sediment toxicity, and biotic parameters provides a more thorough evaluation and assessment of ecosystem "health" or status than more traditional monitoring, which typically emphasizes single media and a stand-alone approach.

The AKMAP Southeast Alaska survey relied on a probabilistic, stratified-random sampling design with the sample locations distributed across pre-selected strata and sample sites randomly selected within each stratum. This design enabled the assessment of the general ecological health of Southeast Alaska's coastline with a relatively small number of sampling sites.

AKMAP surveyed 42 randomly selected sites, but three water quality and sediment samples were lost, resulting in 39 sites being used for ranking water and sediment quality. In case a base site could not be sampled due to access, weather or other issues alternate or back-up sites are also provided. Actual sampled sites are show in Figure 2-4. The site design metadata is shown in Appendix A and the list of sites actually sampled is presented in Appendix B. Sample design followed the national EMAP monitoring protocols and associated Quality Assurance (QA) procedures as described for the national program (USEPA 2001).

Field Sampling

Primary parameters/indicators were sampled and analyzed as per the requirements of the National EMAP requirements (USEPA, 2001). Table 1 summarizes the list of parameters assessed at each of the sample sites. Specific analytes are listed in Appendix C. All sampling, collection and analyses were done in accordance with the NCA QAPP 2001-2004 (USEPA 2001). Following is a brief description of the methods used in the southeast Alaska 2004 EMAP.

Two vessels were used to accomplish the sampling; (1) a large vessel that provided housing for the field team, transit throughout the study area, and acted as sampling platform for deeper sites (typically >50 feet depth with appropriate room for maneuvering) and (2) a smaller vessel for sampling shallower waters. Each vessel had the ability to deploy a SeaBird 19 Plus Conductivity Temperature Depth (CTD), Van Veen sediment grab sampler, and a trawl, although the trawl net size differed between the vessels. Given the large transit distances between sites and that the sampling depths vary randomly along the entire 600 mile study area, the smaller vessel, or skiff, was carried onboard or towed behind the larger vessel between sites. Each boat was equipped with Geographic Positioning Systems (GPS), and the main vessel possessed sufficient hydraulic equipment to conduct deep-water sampling, and berth space for 6 scientists in addition to the crew's quarters. The R/V *Ocean Cape* supported the AKMAP Southeast Coastal survey.

Table 2-1: AKMAP Southeast Alaska Core Environmental Indicators

Parameter	Sampling Location on Site	Generalized Method
Water Quality Parameters		
Pressure (depth)	Water column profile	Seabird 19plus Instrument
Temperature	Water column profile	Seabird 19plus Instrument
Salinity	Water column profile	Seabird 19plus Instrument
Nutrients (nitrate+nitrite/ammonium, phosphate, silicate)	Discrete samples at (minimum of) surface, mid-water, and at depth	Filtered seawater frozen and analyzed later at contract lab.
Chlorophyll-*a*	Discrete samples at (minimum of) surface, mid-water, and at depth	Filtrate from filtered seawater frozen and analyzed later at contract lab.
Total suspended solids	Discrete samples at (minimum of) surface, mid-water, and at depth	Filtrate from filtered seawater frozen and analyzed later at contract lab.
Dissolved Oxygen	Water column profile	DO sensor attached to CTD
pH	Water column profile if can fit additional sensor to CTD. Otherwise, discrete samples from surface, mid-water, and at depth	Either pH sensor attached to CTD or discrete water samples measured with probe.
Photosynthetically Active Radiation (PAR)	Water column profile	PAR sensor attached to CTD
Transmissivity (measure of suspended solids)	Water column profile	Transmissivity sensor attached to CTD
Flurorometry (used as a measure of relative phytoplankton abundance)	Water column profile	Flurometry sensor attached to CTD
Secchi depth (measure of water clarity)	Discrete depth measured	Secchi Disk used at side of ship
Sediment Quality Parameters		
Sediment Grain Size (including % silt-clay)	Surface Benthic Sediments	Van Veen Grab; Sediments refrigerated and shipped to contract laboratory for analyses.

Table 2. Continued		
Parameter	**Sampling Location on Site**	**Generalized Method**
Sediment % Total Organic Carbon (TOC)	Surface Benthic Sediments	Van Veen Grab; Sediments frozen and shipped to contract laboratory for analyses.
Sediment Contaminants (15 Trace metals, 4 butyltins, 26 n-Alkanes, 37 PAHs, 21 PCB congeners, 6 DDT and metabolites, 14 Pesticides)	Surface Benthic Sediments	Van Veen Grab; Sediments frozen and shipped to contract laboratory for analyses.
Sediment Toxicity	Surface Benthic Sediments	Van Veen Grab; Sediments refrigerated and shipped to contract laboratory for *Ampelisca abdita* 10-day solid-phase test.
Biotic Parameters		
Infaunal species composition	(richness, diversity, abundance (>1.0 mm)	Van Veen Grab, sediment sieved in stacked 0.5 and 1.0 mm sieves. Samples preserved and shipped to contract laboratory analyses. For this program, only the >1.0 mm fraction were sorted and identified.
Fish Tissue Contaminants (13 metals, 6 DDT and metabolites, 21 PCB congeners, 14 pesticides, % lipids)	At least one benthic "Target Species"	Benthic Trawl; whole fish measured and frozen, shipped to laboratory for analyses.
Demersal species composition	Benthic fishes and invertebrates for abundance, richness, diversity, and other community-level analyses, as well as potential identification of non-indigenous or cryptogenic species.	Benthic Trawl sorted, speciated, counted; up to 30 of each species measured for length and fish checked for external pathology and parasites.
Infaunal species composition (richness, diversity, abundance (>1.0 mm)		

Given the remote location of most sites in the Southeast Coastal Province, and the high cost of accessing these sites, no sites were field "reconnoitered." The locations of all sites were plotted on various charts prior to the field program to identify potentially difficult sampling locations. From past experience in the Southcentral AKMAP sampling program, and from other studies conducted in southeastern Alaska (Columbian Province), it was clear that sampling difficulties would be encountered throughout the area. For example, there was significant rocky benthic habitat at many of the randomly selected sites in Southcentral Alaska limited sediment sampling and benthic trawling. Bottom habitat with waters less than 70 m depth commonly found in adjacent small areas at the sides of deep fjords damaged

trawl gear. However, given the paucity of fish assemblage data for near shore waters in southeastern Alaska, every effort was made to safely conduct trawls at all of the survey sites.

The scientific field crew consisted of 4-6 individuals from ADEC and partnering agencies. ADEC's water QA officer coordinated with the EPA QA/QC officer to ensure that appropriate QA/QC checks are conducted. The field crew consisted of personnel from a range of agencies and organizations. Each site survey lasted 4-6 hours resulting in 1-2 sampling locations worked each day. Field sampling protocol consisted of first locating the pre-selected sampling site using the boat's GPS. Once at the site Secchi depth reading was taken and the CTD deployed to collect water column data. The CTD was programmed to sample every 0.5 seconds, with post-processing of the raw data into averaged depth intervals. The instrument was allowed two to three minutes of warm-up while at the surface and then was lowered at a rate of one meter per second or less during the down-cast and up-cast. Data was downloaded after each cast to ensure that the instrument's sensors collected data during the cast. The CTD measurements were taken with a Seabird 19plus instrument with additional sensors for measuring Dissolved Oxygen, fluorometry, and Photosynthetically Active Radiation (PAR). The CTD and sensors underwent a pre-cruise calibration at the Seabird offices in Bellevue, WA.

In addition to water column profile data, water grab samples were collected from the surface, mid-water, and at depth (approximately 1 meter off of the bottom) using Niskin sample bottles either "on-the-wire" or using a Seabird Auto-fire module. Problems were experience with auto-fire module and many samples were collected by wire line. Once the Niskin bottles were back at the surface, water was drawn from each bottle for nutrient analyses, chlorophyll a analyses, pH, and Total Suspended Solids (TSS). These samples were processed and stored as prescribed in the NCA QAPP 2001-2004 (USEPA 2001) and described in the QAPP for Southcentral Alaska EMAP (ADEC 2002.

After completing the water quality sampling, benthic sediment sampling took place for sediment chemical analyses, sediment toxicity and identification of benthic invertebrates. Sediments were collected using either a single (skiff) or double (larger vessel) utilizing a 0.1 m^2 stainless steel Van Veen grab sampler. Multiple grabs were conducted to ensure an appropriate volume of sediment, using only the top 2-3 cm of each grab that passes QC (non-washed and sufficient volume and depth). One full grab was used for sieving for benthic invertebrates using a stacked set of 0.5 mm and 1.0 mm screens.

The final sampling procedure at each site was the benthic trawl. Depending on conditions such as bottom type, shoreline geomorphology, and bathymetry, trawling was conducted from either the larger vessel or from the skiff. The larger vessel will trawl using a commercial size Eastern 400 Research Trawl (NET Systems, Inc.; 70 ft. headrope, 4" body mesh, and 3.5" cod end) with a rubber cookie footrope and high lift doors. The skiff used a Mid-size modified-SQWRRP research trawl with a 34-foot headrope, 1.5" body mesh, and 1.25" cod-end. As for the Southcentral EMAP, trawl time was minimized to reduce the mortality of the catch with a typical tow lasting 5 minutes on the bottom.

Fish from each trawl were sorted and identified to genus and species, or to the lowest taxonomic group possible. Vouchers were collected for unknown species. Up to thirty individuals per species were measured and lengths and counts by species were recorded. All fish not retained for histopathology or chemistry was returned to the estuary. Invertebrates were identified and counted. Each of the fish measured was also checked for pathology and tissue taken if unusual pathology was observed.

Five each of the target bottom species were wrapped in tin foil and frozen for subsequent fish tissue analyses. Based on research through NMFS data, as well as data from other sources, target species included Rex sole (*Glyptocephalus zachirus*), Flathead sole (*Hippoglossoides elassodon*), Capelin (*Mallotus villosus*), Rock sole (*Lepidopsetta bilineata*), Walleye pollock (*Theragra chalcogramma*), Slender sole (*Lyopsetta exilis*), and Dover sole (*Microstomus pacificus*). There are other species typically

found in a "shallow-water" flatfish assemblage in the Gulf of Alaska, in waters typically less than 150 mm, occurred in the trawls. These include Starry flounder (*Platichthys stellatus*), butter sole (*Pleuronectes isolepsis*), English sole (*Pleuronectes vetulus*), Alaska plaice (*Pleuronectes quadrituberculatus*), and Sand sole (*Psettichthys melanostictus*). As was done during the soutchentral Alaska EMAP field program in 2002, we sampled up to five species per site to ensure that we analyzed similar species across the geographic range of the province. Sufficient freezer space was available on board to process and hold samples, which required freezing.

Samples collected in the field were stored onboard the vessel between ports, at which time they were appropriately packed and shipped to respective laboratories. The vessel specifications, however, provide for adequate freezer and refrigerator space to meet the guidelines outlined in the NCA QAPP 2001-2004 (USEPA 2001), allowing us to side-step the "field holding" and store samples onboard in a manner equivalent to "lab storage."

Sample Analyses

Water, sediment and fish samples were prepared in the field and sent to the contract laboratories for further analysis. Based on our EMAP experience and through discussions with other Western EMAP states, ADEC is convinced that regional knowledge and demonstrated experience are very valuable to collecting comparable and valid data. This is especially true for benthic invertebrates and fish where many species are at their northern or southern geographical limits and may be unique to the Alaskan provinces. Sediment benthic invertebrates were identified at the University of Alaska Fairbanks laboratory and NOAA National Marine Fisheries Laboratory in Seattle, Washington, conducted the fish voucher identification and pathology work. EPA contract laboratories conducted the remaining chemistry analysis of sediments, water samples and fish tissue. Benthic sediment invertebrate taxonomy QA was conducted by a group established within the Western EMAP project.

Quality Assurance/Quality Control

Project QA/QC

The Southeast Alaska MAP program followed field sampling and quality assurance procedures specified in the NCA QAPP 2001-2004 (USEPA 2001). Field data was recorded on data sheets that are compatible to the data required for the national EMAP program. A field QA/QC check was conducted by the EPA project QA/QC officer establishing the field methods were properly followed by the field sampling team. This review consisted of a post-analysis review of the NCA QAPP chemical data quality objectives of the sediment and tissue chemistry analysis. For sediment chemistry a sub-set of the metals, PAHs, PCBs and Pesticides analytes did not meet the DQO and were flagged. Similarly, for tissues a sub-set of metal, PCBs, and Pesticides did not meet the DQO and were flagged.

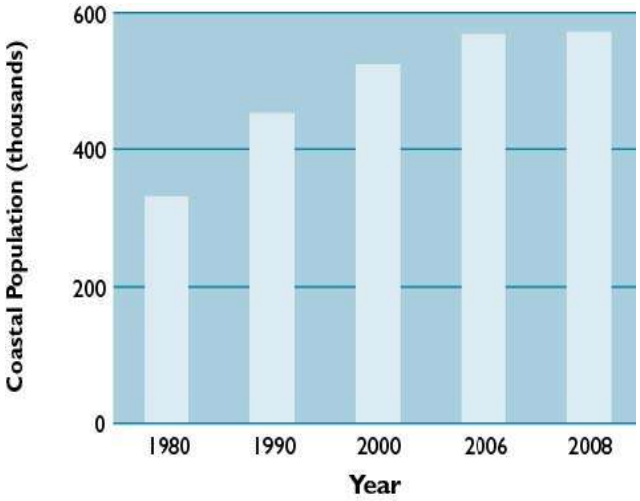
Chapter-3: Summary of Environmental Conditions Observed in 2004 for AKMAP Southeast Alaska Assessment (Section taken from working draft of Alaska Section National Coastal Condition IV Report, 2011)

Introduction

The sheer scale and geographic complexity of Alaska's shoreline dictate that comprehensive assessments of its coastal resources are inherently difficult. Alaska's marine shoreline of approximately 45,000 miles nstitutes more than 50% of total U.S. coastline miles, and the state's coastal bays and estuaries have a total surface area of 33,211 square miles. Much of southeastern coast of Alaska is very convoluted containing hundreds of bays, estuaries, coves, fjords, and other coastal features. It is estimated to contain approximately 63% of the total Alaskan coastline (Sharma, 1979). Five marine ecosystems, Eastern Gulf of Alaska Slope, Prince of Wales Shelf and Inside Waters, Chichagof Shelf and Inside Waters, Northern Gulf of Alaska Slope, and Northern Gulf of Alaska Shelf, are delineated for this region (Piatt and Springer, 2007). Southeastern Alaska, also known as the Alaskan panhandle, encompasses several national parks and monuments as well as the largest national forest in the U.S., the Tongass National Forest. The region is ecologically unique, a lush temperate rain forest with a coastline that is buffered from the open ocean by an extensive chain of islands. It is home to a vast array of terrestrial and marine wildlife, including black and brown bears, mink, waterfowl, several salmon species, and various marine mammal species. Alaska's coastal resources are not subject to population and development pressures to the same extent as the rest of the U.S. coastline, due to the state's low population density, the distance between most of its coastline and major urban or industrial areas, and limited agriculture activities. Consequently, some contaminant concentrations have been measured as having levels significantly lower than those in the rest of the coastal United States, though localized sources of trace metal and organic contaminants such as PCPs and mercury exist in Alaska (AMAP, 2010; Landers et al., 2010). Indeed the principal input of organic contaminants is from global sources; however, concentrations of trace metals and organic contaminants in marine fish from Alaska are low and not a public health concern according to studies conducted by Alaskan authorities (Alaska H&SS, 2010).

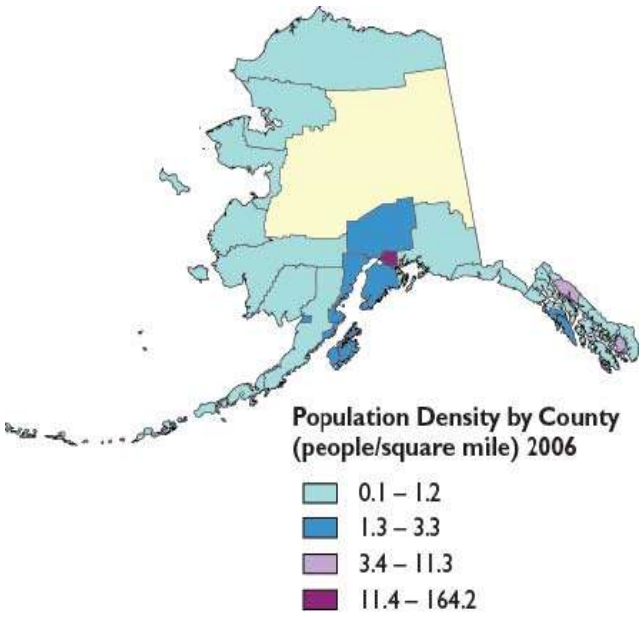
Nevertheless, Southeastern Alaska includes several population centers, as well as the state's capital city of Juneau, and the port city of Ketchikan, which is a popular destination for cruise ships. Large-scale timber and fishery industries also inflict pressures on the coastal resources of this area. Between 1980 and 2006, the population of coastal counties along the Alaskan Coast increased 72% from 331,000 to 569,000 people, and the area experienced the second largest rate of population increase of any coastal region in the entire United States (Figure 3-1). However, as a result of the large coastal area, the population density is low and the Alaskan Coast is home to less than 1% of the total U.S. coastal population. Population density has increased from approximately 0.9 persons per square mile in 1980 to 1.5 persons per square mile in 2006 (Figure 3-2) (NOEP, 2010).

The scenario for Alaska's coastal aquatic resources is not one of existing degradation from agricultural, industrialization, and urbanization pollution drivers, but one of possible large-scale changes due to climate change and future resource development (AMAP, 2010; AMAP, 2009; State of Alaska, 2010). Ocean acidification refers to the decrease in ocean pH due to the uptake of excess carbon dioxide, which results primarily from burning of fossil fuels and other human activities, such as cement production and deforestation. Global fossil fuel CO_2 emissions contribute about 30.8 billion tons of carbon dioxide to the atmosphere globally (Global Carbon Project, 2010). Monitoring for ocean acidification has not been a component of the NCA in Alaska's coastal oceans, where the effects of ocean acidification may be occurring more rapidly than in other regions (Bates et al., 2009; Fabry et al., 2009; Feely et al., 2010).



3-1: Alaska population increas along coastline 1980 – 2008 (NOEP, 2010)

The sampling conducted in the EPA NCA survey has been designed to estimate the percent of coastal area (nationally or in a region) in varying conditions and is displayed as pie diagrams. Many of the figures in this report illustrate environmental measurements made at specific locations (colored dots on maps); however, these dots (color) represent the value of the index specifically at the time of sampling. Additional sampling would be required to define temporal variability and to confirm environmental condition at specific locations.



3-2: Alaska population density(NOEP, 2010)

Large-scale resource development of Alaska's oil, gas, and mineral reserves is likely to occur in the future as world resources grow scarcer. A recent USGS Report placed Arctic Alaska as the second-

ranked province likely to contain major deposits of undiscovered oil, gas, and natural gas liquids (Bird et al., 2008). Alaska's coastal regions also contain potentially significant metallic-non-metallic mineral resources, such as chromium, coal, copper, "oil-shale", silver, and zinc (Alaska DNR, 2010).

It is crucial that future Alaska NCCA designs take into account the overall focus for Alaska waters. This focus includes developing a current status for much of Alaska's "pristine" aquatic resources for future reference. Understanding the primary drivers for the region's potential aquatic resource degradation, which differ from the contiguous populated United States, is also important in order to apply the correct indicators to assess condition and trends resulting from climate change and future large-scale resource development.

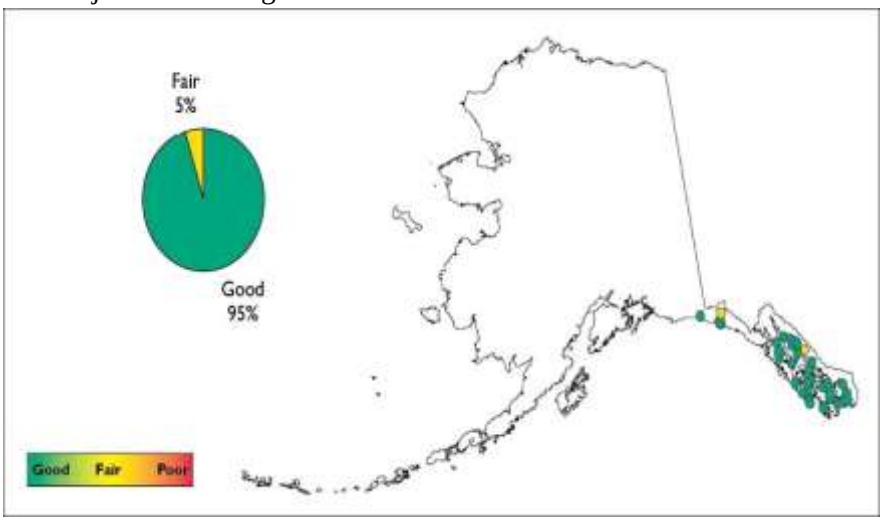
Coastal Monitoring Data—Status of Coastal Condition

The geographic expanse of Alaska, the reduced sampling window in the Arctic regions, and the unique fiscal and logistical challenges of sampling the state's coastal resources (which are mostly inaccessible by road) necessitated a comprehensive federal-state sampling design. In 2001, under the NCA program the Alaska DEC and EPA Region 10 developed a design to assess all of the state's coastal resources by monitoring 250 sites throughout the state during five phases—Southcentral Alaska, Southeastern Alaska, the Aleutian Islands, the Bering Sea, and the Beaufort Sea. As of 2010, the Southcentral Alaska, Southeastern Alaska, and the Aleutian Islands phases have been surveyed, and the plan has been modified to split the Arctic coastal phase into lower and upper Chukchi Sea and Beaufort Sea (see Figure 2-3). The ability to complete the remaining phases and begin a repeat sampling for long-term trend analysis remains uncertain due to funding constraints. Before this collaboration between Alaska's resource agencies and EPA, the Alaska DEC routinely assessed only about 1% of the state's coastal resources, focusing its efforts on water bodies known or suspected to be impaired (Alaska DEC, 1999). In June 2005, the Alaska DEC released its *Water Quality Monitoring and Assessment Strategy* and *Environmental Monitoring & Assessment Program Implementation Strategy* to guide its stewardship of Alaska's marine and freshwater resources (Alaska DEC, 2005b; 2005a).

In 2004, Alaska's southeastern coast (Alaskan Province) was the second portion of the state to be assessed by the NCA because of the importance of this area's major estuarine resources, high cruise ship use, and importance to local and state economies. Due to the long distances between sites and the area that needed to covered, the surveys were conducted using a large (100-foot), ocean-going research vessel equipped with a powered skiff for shallow-water work. Depths ranged from approximately 60 to 1,500 feet for the 39 sites used to calculate this report's water quality and sediment indices. A discussion of the cut points used in developing these indices is provided in Appendix D.

Water Quality Index

The water quality index for the coastal waters of Southeastern Alaska is rated good. This index was developed based on measurement of five component indicators: DIN, DIP, chlorophyll *a*, water clarity, and dissolved oxygen. Most (95%) of the coastal area was rated good, with the remainder of the area rated fair (Figure3-3). Fair conditions were largely due to low water clarity measurements or low dissolved oxygen concentrations, which are most likely the result of naturally occurring conditions and not human influences. Low water clarity measurements are associated with glacial silt input by nearby glaciers or river systems draining glaciated watersheds and low dissolved oxygen levels are associated with deeper waters of fjords in this region.



3-3: Water quality index data for Southeast Alaska coastal waters (U.S. EPA/NCA IV Draft, 2011)

Nutrients: Nitrogen and Phosphorus

Southeastern Alaska coastal waters are rated good for DIN and DIP concentrations, with 97% of the coastal area rated good and 3% rated fair for both indicators. These rating were based on the NCA DIN and DIP cutpoints for the western United States (Appendix D). Although these cutpoints have been adjusted for regional coastal upwelling events, further work is needed to determine if these or other cutpoint values are more applicable to Southeastern Alaska coastal waters. The 3% of the area rated fair likely appears to reflect natural conditions rather than human influences.

Chlorophyll a

Chlorophyll *a* concentrations in Southeastern Alaska's coastal waters are rated good, with 100% of the coastal area rated good for this component indicator.

Water Clarity

Water clarity in the coastal waters of the Southeastern Alaska region is rated good, with 5% and 3% of the coastal area respectively rated fair and poor for this component indicator. Water clarity was rated poor at a sampling site if light penetration at 1 meter was less than 10% of surface illumination.

Dissolved Oxygen

Dissolved oxygen conditions in the coastal waters of Southeastern Alaska are rated good, with 95% of the coastal area rated good and 5% rated fair for this component indicator. Although conditions in the Southeastern Alaska region appear to be generally good for dissolved oxygen, the measured values reflect surface conditions and do not include natural hypoxic conditions in the deep fjords sampled.

Sediment Quality Index

The sediment quality index for the coastal waters of Southeastern Alaska is rated good, with 8% of the coastal area rated fair (Figure 3-4). The sediment quality index was calculated based on measurements of three component indicators: sediment toxicity, sediment contaminants, and sediment TOC.

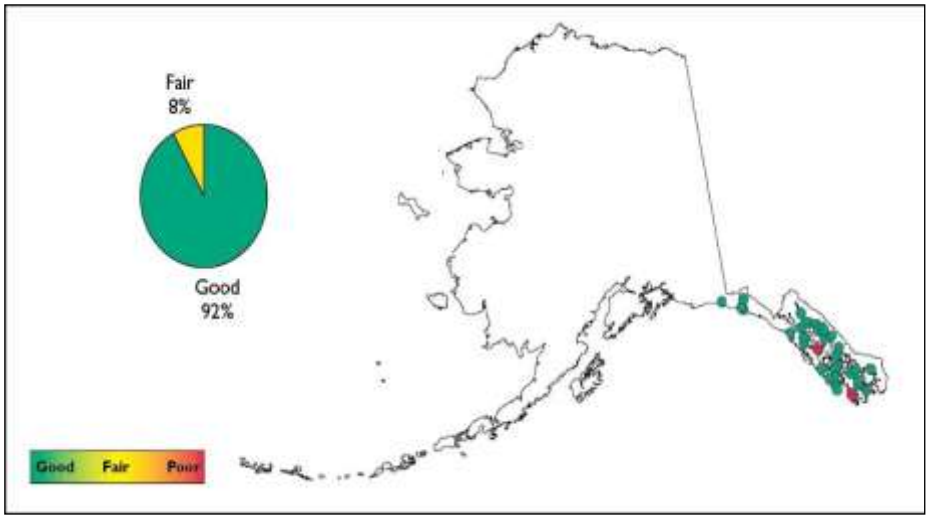
Sediment Toxicity

Sediment toxicity for Southeastern Alaska coastal waters is rated good, with 0% of the coastal area rated poor. Sediment toxicity was determined using a static, 10-day acute toxicity test with the amphipod *Ampelisca abdita*. Although use of *Ampelisca* standardizes the sediment toxicity test within the EMAP/NCA process, this test may or may not reflect the actual response of the specific benthic organisms indigenous to Southeastern Alaska. The State of Alaska has yet to select specific benthic species for use in sediment toxicity studies, but considers the NCA work important in supporting future efforts to develop a sediment toxicity test for Alaska.

Guidelines for Assessing Sediment Contamination (Long et al., 1995)

ERM (Effects Range Median)— Determined for each chemical as the 50th percentile (median) in a database of ascending concentrations associated with adverse biological effects.

ERL (Effects Range Low)—Determined values for each chemical as the 10th percentile in a database of ascending concentrations associated with adverse biological effects.



3-43: Sediment quality index for Southeast Alaska coastal waters (U.S. EPA/NCR IV Draft, 2011)

Sediment Contaminants

The coastal waters of Southeastern Alaska are rated good for the sediment contaminants component indicator, with approximately 2% of the coastal area rated poor and approximately 3% of the area rated fair. It should be noted that this evaluation of sediment contamination excluded nickel because the ERM value for this metal has a low reliability for areas of the West Coast, where high natural crustal concentrations of nickel exist (Long et al., 1995). A study of metal concentrations in cores collected along the West Coast determined the range of historic background concentrations of nickel to be 35–70 ppm (Lauenstein et al., 2000), which brackets the value of the ERM (51.6 ppm). Some researchers have also suggested that West Coast crustal concentrations for mercury may be naturally elevated; however, no conclusive evidence is available to support this suggestion. Therefore, mercury data were not excluded from this assessment of Southeastern Alaska's coastal waters. In addition, only one exceedance was counted if a site exceeded the ERL for low molecular weight PAHs, high molecular weight PAHs, and/or total PAHs to ensure that the analysis was not biased by PAHs.

Sediment TOC

The coastal waters of Southeastern Alaska are rated good for the sediment TOC component indicator, with 11% of the area rated poor, 26% rated fair and 63% rated good.

Benthic Index

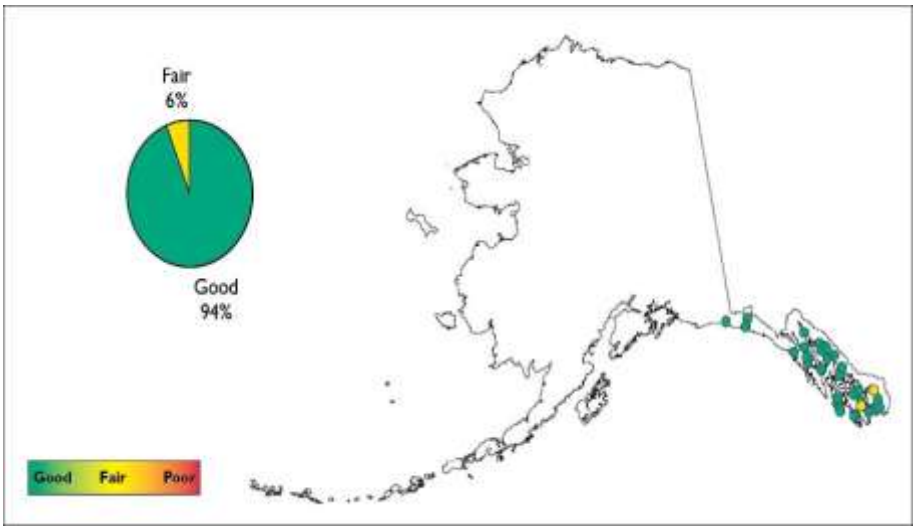
The benthic index for the coastal waters of Southeastern Alaska could not be evaluated. Although several efforts are underway and indices of benthic community condition have been developed for some regions of the West Coast (e.g., Smith et al., 1998), there is currently no benthic community index applicable for Southeastern Alaska. In lieu of a benthic index for Southeastern Alaska, the deviation of species richness from an estimate of expected species richness was used as an approximate indicator of the condition of the benthic community. This approach requires that species richness be predicted from salinity, and, in the case of the Southeastern Alaska survey data, the regression was not significant.

Coastal Habitat Index

The coastal habitat index for Alaska is rated good. Although estimates of habitat loss are available for Alaska as a whole, data were not available to correspond with the geographic region sampled by the NCA survey (i.e., southeastern Alaska); therefore, overall trends for the whole state are presented. The Alaska coast region experienced a loss of 900 acres (0.04%) of coastal wetlands from 1990 to 2000 (Dahl, 2010), and the long-term, average decadal wetlands loss rate is 0.01%.

Fish Tissue Contaminants Index

The fish tissue contaminants index for the coastal waters of Southeastern Alaska is rated good, with 6% of the stations where fish were caught rated fair and none of the stations rate poor (Figure 3-5).



3-5: Fish tissue contaminants index for Southeast Alaska coastal waters (U.S. EPA/NCA IV Draft, 2011)

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Appendices

Appendix A – Design Metadata

NCA Survey Design for Alaska 2004

Metadata:

Identification_Information:
Citation:
Citation_Information:
Originator: USGS/NWRC/GBPO
Publication_Date: 1999
Title: ak2004est
Geospatial_Data_Presentation_Form: vector digital data
Online_Linkage:
Description:
Abstract:
Title: Sample Frame Dataset used in NCA Survey Design for Alaska 2004 Date of Request: Original Requestor: Kevin Summers EPA Client: EPA Objective: Estimate condition of waters in Alaska, Columbian Province
Design Requirements
Target Population: Estuaries in Columbian Province, AK
Purpose: To develop an NCA Survey Design for Alaska 2004
Supplemental_Information:
Hex grid and random point sample coverages are in: D:\Mack1\us_estuary\ak\columbian\
Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: 2004
Currentness_Reference: ground condition
Status:
Progress: Complete
Maintenance_and_Update_Frequency: None planned
Spatial_Domain:
Bounding_Coordinates:
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East_Bounding_Coordinate: -129.744764
North_Bounding_Coordinate: 63.063648
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Keywords:
Theme:
Theme_Keyword_Thesaurus:

REQUIRED: Reference to a formally registered thesaurus or a similar authoritative source of theme keywords.
Theme_Keyword: 2004
Theme_Keyword: Design
Theme_Keyword: NCA
Theme_Keyword: Columbian
Theme_Keyword: Province
Theme_Keyword: Alaska
Place:
Place_Keyword: Columbian Province, AK
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.
Point_of_Contact:
Contact_Information:
Contact_Person_Primary:
Contact_Person: Matt Nesta
Contact_Organization: USGS
Contact_Position: Geographer
Contact_Address:
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: 850-934-2492
Contact_Facsimile_Telephone: 850-934-2495
Contact_Electronic_Mail_Address: mnesta@usgs.gov
Data_Set_Credit:
The NWRC/GBPO would like to acknowledge the following for the use of data sources - USGS DLGs.
Native_Data_Set_Environment:
Microsoft Windows XP Version 5.1 (Build 2600) Service Pack 2; ESRI ArcCatalog 9.2.2.1350
Cross_Reference:
Citation_Information:
Originator: USGS/ NWRC/ GBPO
Title: Sample Frame Dataset used in NCA Survey Design for Alaska 2004

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Lineage:
Source_Information:
Source_Citation:
Citation_Information:
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Publication_Date: 1983
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Publication_Information:
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Time_Period_Information:
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Ending_Date: 1995
Source_Currentness_Reference: Date of publication
Source_Citation_Abbreviation: DLG
Source_Contribution: Primary source for estuary boundaries
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Process_Description:
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SDTS_Terms_Description:
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Point_and_Vector_Object_Count: 713

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Attribute_Definition: Size of estuary
Attribute:
Attribute_Label: FID
Attribute_Definition: Internal feature number.
Attribute_Definition_Source: ESRI
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Sequential unique whole numbers that are automatically generated.
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Attribute_Label: PROVINCE
Attribute_Definition: Geographic sub-region
Attribute:
Attribute_Label: Shape
Attribute_Definition: Feature geometry.
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Attribute_Label: AREA
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Attribute:

Attribute_Label: CLASS
Attribute_Definition: Sample Frame Dataset used in NCA Survey Design for Alaska 2004
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 commerical 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.
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Metadata_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: USGS/NWRC/GBPO
Contact_Person: Matt Nesta
Contact_Position: Geographer
Contact_Address:
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: 850-934-2492
Contact_Facsimile_Telephone: 850-934-2495

Contact_Electronic_Mail_Address: mnesta@usgs.gov
Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata
Metadata_Standard_Version: FGDC-STD-001-1998
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Generated by mp version 2.8.6 on Thu Sep 13 14:24:36 2007

Appendix B – Actual Southeast Alaska Sample Stations

StationID	SampleDepth, Meters	Latitude	Longitude	Estuary Name
AK04-0001	212	55.8473	-133.98243	Iphigenia Bay
AK04-0002	130	55.41048	-132.24731	Kasaan Bay
AK04-0003	147	58.15653	-136.35525	Port Althorp
AK04-0004	80	58.32101	-134.67158	Favorite Channel
AK04-0005	500	56.49475	-134.59058	Chatham Strait
AK04-0006	57	57.23606	-134.58826	Whitewater Bay
AK04-0007	21	59.54463	-139.77208	Monti Bay
AK04-0008	127	57.78361	-135.35046	Tenakee Inlet
AK04-0009	65	55.17225	-132.90698	Tlevak Strait
AK04-0010	126	57.61776	-135.4632	Peril Strait
AK04-0011	295	58.76885	-135.14995	Lynn Canal
AK04-0013	425	55.94206	-132.55828	Clarence Strait
AK04-0014	432	55.55413	-132.18476	Clarence Strait
AK04-0015	91	55.09165	-131.28583	Felice Strait
AK04-0016	294	55.3686	-130.90058	Clarence Strait
AK04-0017	221	59.93498	-139.60161	Clarence Strait
AK04-0018	118	58.21065	-135.48326	Felice Strait
AK04-0019	168	57.83575	-135.42148	Tenakee Inlet
AK04-0020	339	56.372	-133.36585	Sumner Strait
AK04-0022	407	55.05543	-131.82743	Clarence Strait
AK04-0023	202	58.18898	-134.15215	Stephens Passage
AK04-0024	106	55.62513	-133.94876	Iphigenia Bay
AK04-0025	74	56.32916	-133.63593	Port Protection
AK04-0027	312	57.77881	-133.82433	Stephens Passage
AK04-0028	6	57.91456	-134.18538	Seymour Canal
AK04-0029	158	58.00493	-133.7321	Port Snettisham
AK04-0030	383	55.99143	-132.1194	Ernest Sound
AK04-0032	48	59.99371	-141.43313	Icy Bay
AK04-0033	328	57.55676	-133.13498	Endicott Arm
AK04-0034	334	56.01521	-133.8107	Sumner Strait
AK04-0035	273	57.49268	-133.84591	Stephens Passage
AK04-0036	466	58.37018	-135.01896	Lynn Canal
AK04-0037	245	57.85935	-133.63123	Williams Cove
AK04-0040	123	56.02181	-134.27843	Chatham Strait
AK04-0051	128	59.6183	-139.94011	Yukutat Bay
AK04-0062	324	55.77665	-131.02686	Behm Canal - East
AK04-0099	284	55.11008	-132.95618	Tlevak Strait
AK04-0116	140	59.61441	-139.81	Yukutat Bay
AK04-0139	250	55.07808	-130.98243	Revillagigedo Channel
AK04-0143	5	56.77581	-133.26591	Duncan Canal
AK04-0157	81	57.02316	-132.88641	Thomas Bay
AK04-0201	89	55.4942	-133.90898	Iphigenia Bay

Appendix C – List of Chemical Analytes for Sediments and Tissues

List of Chemical Analytes for Sediments and Tissues

54 Polynuclear Aromatic Hydrocarbon (PAHs) Analytes		**21 PCB Congeners**	
		PCB No.	**Compound Name**
1,1'-Biphenyl	*C2-Chrysenes*	8	2,4'-dichlorobiphenyl
1,6,7-Trimethylnaphthalene*	*C2-Dibenzothiophenes*	18	2,2',5-trichlorobiphenyl
1-Methylnaphthalene	*C2-Fluorenes*	28	2,4,4'-trichlorobiphenyl
1-Methylphenanthrene	*C2-Phenanthrenes/Anthracenes*	44	2,2',3,5'-tetrachlorobiphenyl
2,6-Dimethylnaphthalene	*C3 –Naphthalenes*	52	2,2',5,5'-tetrachlorobiphenyl
2-Chloronaphthalene	*C3-Chrysenes*	66	2,3',4,4'-tetrachlorobiphenyl
2-Methylfluoranthene	*C3-Dibenzothiophenes*	101	2,2',4,5,5'-pentachlorobiphenyl
2-Methylnaphthalene	*C3-Fluorenes*	105	2,3,3',4,4'-pentachlorobiphenyl
2-Methylphenanthrene	*C3-Phenanthrenes/Anthracenes*	110/77	2,3,3',4',6-pentachlorobiphenyl
4,6-Dimethyldibenzothiophene	*C4 –Naphthalenes*		3,3',4,4'-tetrachlorobiphenyl
9H-Fluorene, 1-methyl-	*C4-Chrysenes*	118	2,3,4,4',5-pentachlorobiphenyl
Acenaphthene	*C4-Phenanthrenes/Anthracenes*	126	3,3,4,4',5-pentachlorobiphenyl
Acenaphthylene	Carbazole	128	2,2',3,3',4,4'-hexachlorobiphenyl
Anthracene	Chrysene	138	2,2',3,4,4',5'-hexachlorobiphenyl
Benzo(a)anthracene	Chrysene, 5-methyl-	153	2,2',4,4',5,5'-hexachlorobiphenyl
Benzo(a)pyrene	Dibenzo(a,h)anthracene	170	2,2'3,3',4,4',5-heptachlorobiphenyl
Benzo(b)fluoranthene	Dibenzofuran	180	2,2',3,4,4',5,5'-heptachlorobiphenyl
Benzo(ghi)perylene	Dibenzothiophene	187	2,2',3,4',5,5',6-heptachlorobiphenyl
Benzo(k)fluoranthene	Fluoranthene	195	2,2',3,3',4,4',5,6-octachlorobiphenyl
Benzo[e]pyrene	Fluorene	206	2,2',3,3',4,4',5,5',6-nonachlorobiphenyl
C1-Chrysenes	Indeno(1,2,3-cd)pyrene	209	2,2',3,3',4,4',5,5',6,6'-decachlorobiphenyl
C1-Dibenzothiophenes	Naphthalene		
C1-Fluoranthene/Pyrene	Perylene		
C1-Fluorenes	Phenanthrene		
C1-Naphthalenes	Phenanthrene, 3,6-dimethyl-		
C1-Phenanthrenes/Anthracenes	Pyrene		
C2 -Naphthalenes	Retene		

List of Chemical Analytes for Sediment and Tissues - Continued

DDT and its metabolites	**Other Chlorinated Pesticides**	**Trace Metals**
		Aluminum
2,4'-DDD	Aldrin	Antimony (sediment only)

List of Chemical Analytes for Sediments and Tissues - Continued

	Other Chlorinated Pesticides	**Trace Metals**
DDT and its metabolites		
4,4'-DDD	Alpha-Chlordane	Arsenic
2,4'-DDE	Dieldrin	CadniumCopper
4,4'-DDE	Endosulfan I	ChromiumIron
2,4'-DDT	Endosulfan II	Lead
4,4'-DDT	Endosulfan sulfate	Manganese (sediment only)
	Endrin	Mercury
	Heptachlor	Nickel
	Heptachlor epoxide	Selenium
	Hexachlorobenzene	Silover
	Lindane (gamma-BHC)	Tin
	Mirex	
	Toxaphene	
	Trans-Nonachlor	

Appendix D – DRAFT National Coastal Condition Report IV Chapter 1– Indices Summary Section Only

Water Clarity

Ecological Condition by Site	Ranking by Region
Good: Amount of light at 1 meter is greater than 10% (coastal waters with high turbidity), 20% (coastal waters with normal turbidity), or 40% (coastal waters that support SAV) of surface illumination.	**Good:** Less than 10% of the coastal area is in poor condition, and more than 50% of the coastal area is in good condition.
Fair: Amount of light at 1 meter is 5–10% (coastal waters with high turbidity), 10–20% (coastal waters with normal turbidity), or 20–40% (coastal waters that support SAV) of surface illumination	**Fair:** 10% to 25% of the coastal area is in poor condition, or 50% or less of the coastal area is in combined fair and poor condition.
Poor: Amount of light at 1 meter is less than 5% (coastal waters with high turbidity), 10% (coastal waters with normal turbidity), or 20% (coastal waters that support SAV) of surface illumination.	**Poor:** More than 25% of the coastal area is in poor condition.

Dissolved Oxygen

Ecological Condition by Site	Ranking by Region
Good: Bottom-water concentrations (or surface-water concentrations in Alaska) are greater than 5 mg/L.	**Good:** Less than 5% of the coastal area is in poor condition, and more than 50% of the coastal area is in good condition.
Fair: Bottom-water concentrations (or surface-water concentrations in Alaska) are between 2 mg/L and 5 mg/L.	**Fair:** 5% to 15% of the coastal area is in poor condition, or 50% or less of the coastal area is in good condition.
Poor: Bottom-water concentrations (or surface-water concentrations in Alaska) are less than 2 mg/L.	**Poor:** More than 15% of the coastal area is in poor condition.

* Nutrients in Guam were assessed using nitrate-nitrogen rather than DIN.

**Tropical ecosystems include Hawaii, Puerto Rico, U.S. Virgin Islands, and Florida Bay sites.

Table 1-26. NCA Cutpoints for the Three Component Indicators Used in the Sediment Quality Index to Assess Coastal Condition

Sediment Toxicity is evaluated as part of the sediment quality index using a 10-day static toxicity test with the organism *Ampelisca abdita*.

Ecological Condition by Site	Ranking by Region
Good: Mortality* is less than or equal to 20%.	**Good:** Less than 5% of the coastal area is in poor condition.
Poor: Mortality is greater than 20%.	**Poor:** 5% or more of the coastal area is in poor condition.

Sediment Contamination is evaluated as part of the sediment quality index using ERM and ERL values.

Ecological Condition by Site	Ranking by Region
Good: No contaminant concentrations exceeded the ERM, and fewer than five contaminant concentrations exceeded ERL values.	**Good:** Less than 5% of the coastal area is in poor condition.
Fair: No contaminant concentrations exceeded the ERM, and five or more contaminant concentrations exceeded ERL values.	**Fair:** 5% to 15% of the coastal area is in poor condition.
Poor: One or more contaminant concentrations exceeded the ERM.	**Poor:** More than 15% of the coastal area is in poor condition.

Table 1-25. NCA Cutpoints for the Five Component Indicators Used in the Water Quality Index to Assess Coastal Condition

Dissolved Inorganic Nitrogen (DIN)

Ecological Condition by Site	Ranking by Region
Good: Surface concentrations are less than 0.1 mg/L (Northeast, Southeast, Gulf, Guam*), 0.35 mg/L (West, Alaska, American Samoa), or 0.05 mg/L (tropical**).	**Good:** Less than 10% of the coastal area is in poor condition, and more than 50% of the coastal area is in good condition.
Fair: Surface concentrations are 0.1–0.5 mg/L (Northeast, Southeast, Gulf, Guam), 0.35–0.5 mg/L (West, Alaska, American Samoa), or 0.05 –0.1 mg/L (tropical).	**Fair:** 10% to 25% of the coastal area is in poor condition, or 50% or less of the coastal area is in good condition.
Poor: Surface concentrations are greater than 0.5 mg/L (Northeast, Southeast, Gulf, Guam, West, Alaska, American Samoa) or 0.1 mg/L (tropical).	**Poor:** More than 25% of the coastal area is in poor condition.

Dissolved Inorganic Phosphorus (DIP)

Ecological Condition by Site	Ranking by Region
Good: Surface concentrations are less than 0.01 mg/L (Northeast, Southeast, Gulf), 0.025mg/L (Guam), 0.07 mg/L (West, Alaska, American Samoa), or 0.005 mg/L (tropical).	**Good:** Less than 10% of the coastal area is in poor condition, and more than 50% of the coastal area is in good condition.
Fair: Surface concentrations are 0.01–0.05 mg/L (Northeast, Southeast, Gulf), 0.025-0.1 mg/L (Guam), 0.07–0.1 mg/L (West, Alaska, American Samoa), or 0.005–0.01 mg/L (tropical).	**Fair:** 10% to 25% of the coastal area is in poor condition, or 50% or less of the coastal area is in good condition.
Poor: Surface concentrations are greater than 0.05 mg/L (Northeast, Southeast, Gulf), 0.1 mg/L (Guam, West, Alaska, American Samoa), or 0.01 mg/L (tropical).	**Poor:** More than 25% of the coastal area is in poor condition.

Chlorophyll *a*

Ecological Condition by Site	Ranking by Region
Good: Surface concentrations are less than 5 µg/L (less than 0.5 µg/L for American Samoa, Guam, tropical ecosystems).	**Good:** Less than 10% of the coastal area is in poor condition, and more than 50% of the coastal area is in good condition.
Fair: Surface concentrations are between 5 µg/L and 20 µg/L (between 0.5 µg/L and 1 µg/L for American Samoa, Guam, tropical ecosystems).	**Fair:** 10% to 20% of the coastal area is in poor condition, or 50% or less of the coastal area is in good condition.
Poor: Surface concentrations are greater than 20 µg/L (greater than 1 µg/L for American Samoa, Guam, tropical ecosystems).	**Poor:** More than 20% of the coastal area is in poor condition.

Table 1-24. NCA Indices Used to Assess Coastal Condition

Water Quality Index	**Water Quality Index** – This index is based on measurements of five water quality component indicators (DIN, DIP, chlorophyll *a*, water clarity, and dissolved oxygen).			
	Ecological Condition by Site		**Ranking by Region**	
	Good:	No component indicators are rated poor, and a maximum of one is rated fair.	**Good:**	Less than 10% of the coastal area is in poor condition, and more than 50% of the coastal area is in good condition.
	Fair:	One component indicator is rated poor, or two or more component indicators are rated fair.	**Fair:**	Between 10% and 20% of the coastal area is in poor condition, or 50% or less of the coastal area is in good condition.
	Poor:	Two or more component indicators are rated poor.	**Poor:**	More than 20% of the coastal area is in poor condition.
Sediment Quality Index	**Sediment Quality Index** – This index is based on measurements of three sediment quality component indicators (sediment toxicity, sediment contaminants, and sediment TOC).			
	Ecological Condition by Site		**Ranking by Region**	
	Good:	No component indicators are rated poor, and the sediment contaminants indicator is rated good.	**Good:**	Less than 5% of the coastal area is in poor condition, and more than 50% of the coastal area is in good condition.
	Fair:	No component indicators are rated poor, and the sediment contaminants indicator is rated fair.	**Fair:**	Between 5% and 15% of the coastal area is in poor condition, or 50% or less of the coastal area is in good condition.
	Poor:	One or more component indicators are rated poor.	**Poor:**	More than 15% of the coastal area is in poor condition.
Benthic Index	**Benthic Index** (or a surrogate measure) – This index indicates the condition of the benthic community (organisms living in coastal sediments) and can include measures of benthic community diversity, the presence and abundance of pollution-tolerant species, and the presence and abundance of pollution-sensitive species.			
	Ecological Condition by Site		**Ranking by Region**	
	Good, **fair**, and **poor** and were determined using regionally dependent benthic index scores (see Table 1-19)		**Good:**	Less than 10% of the coastal area is in poor condition, and more than 50% of the coastal area is in good condition.
			Fair:	Between 10% and 20% of the coastal area is in poor condition, or 50% or less of the coastal area is in good condition.
			Poor:	More than 20% of the coastal area is in poor condition.
Coastal Habitat Index	**Coastal Habitat Index** – This index is based on historic (1780–1980) and recent (1990–2000) data on estuarine intertidal wetland acreage for all coastal states (except American Samoa, Guam, and Puerto Rico).			
	Ecological Condition by Site		**Ranking by Region**	
	The average of the mean long-term, decadal wetland loss rate (1780–1990) and the present decadal wetland loss rate (1990–2000) was determined for each region of the United States to create a coastal habitat index value.		**Good:**	The coastal habitat index value is less than 1.0.
			Fair:	The coastal habitat index value is between 1.0 and 1.25.
			Poor:	The coastal habitat index value is greater than 1.25.
Fish Tissue Contaminants Index	**Fish Tissue Contaminants Index** – This index indicates the level of chemical contamination in target fish/shellfish species.			
	Ecological Condition by Site		**Ranking by Region**	
	Good:	For all chemical contaminants listed in Table 1-21, the measured concentrations in tissue fall below the range of the EPA Advisory Guidance* values for risk-based consumption associated with four 8-ounce meals per month.	**Good:**	Less than 10% of the monitoring stations where fish were caught are in poor condition, and more than 50% of the monitoring stations where fish were caught are in good condition.
	Fair:	For at least one chemical contaminant listed in Table 1-21, the measured concentration in tissue falls within the range of the EPA Advisory Guidance values for risk-based consumption associated with four 8-ounce meals per month.	**Fair:**	10% to 20% of the monitoring stations where fish were caught are in poor condition, or 50% or less of the monitoring stations where fish were caught are good condition.

Sediment Total Organic Carbon (TOC)

Ecological Condition by Site	Ranking by Region
Good: The TOC concentration is less than 2%.	**Good:** Less than 20% of the coastal area is in poor condition.
Fair: The TOC concentration is between 2% and 5%.	**Fair:** 20% to 30% of the coastal area is in poor condition.
Poor: The TOC concentration is greater than 5%.	**Poor:** More than 30% of the coastal area is in poor condition.

* Test mortality is adjusted for control mortality.

How the Indices Are Summarized

Overall condition for each region was calculated by summing the scores for the available indices and dividing by the number of available indices (i.e., equally weighted), where good = 5; good to fair = 4; fair = 3; fair to poor = 2; and poor = 1. In calculating the overall condition score for a region, the indices are weighted equally because of the lack of a defendable, more-than-conceptual rationale for uneven weighting. The Southeast Coast region, for example, received the following scores:

Indices	Score
Water Quality Index	3
Sediment Quality Index	2
Benthic Index	5
Coastal Habitat Index	3
Fish Tissue Contaminants Index	5
Total Score Divided by 5 = Overall Score	18/5 = 3.6

The overall condition and index scores for the nation are calculated based on an areally weighted average of the regional scores for each index. The national ratings for overall condition and each index are then assigned based on these calculated scores, rather than on the percentage of area in good, fair, or poor condition. The indices were weighted based on the coastal area contributed by each geographic area. For example, the weighted average for the water quality index was calculated by summing the products of the regional water quality index scores and the proportional area contributed by each region (Figure 1-4). These weighting factors were used for all indices except the coastal habitat index, which used the geographic distribution of total area of coastal wetlands (Figure 1-5). The national overall condition score was then calculated by summing each national index score and dividing by five.