

Alaska Monitoring and Assessment Program 2015 National Petroleum Reserve Alaska Estuaries Survey Design

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Description of Sample Design

Target population: The estuary target population includes any water body that is tidally influenced, is saline (3-5% salinity (PSU)), and has less than 50% of its perimeter adjacent to the ocean. The estuary sample frame was created in ArcGIS 10.1 using the best available spatial data as of June 2013 to match the target population definition. Estuaries were mapped by starting with NOAA's Environmental Sensitivity Index (ESI) coastline file for the North Slope (published in 2005, overflights conducted in 1997). The ESI shoreline files were used as the inner boundary for the estuaries and, where barrier islands were present, also as the outer boundary. For estuaries where barrier islands were not present, the estuary outer boundary was closed by connecting the two outermost ends of the inner boundary.

The ESI dataset has dangles where shoreline mapping ended along river shorelines. These dangles were connected by drawing a straight line across the river to make a continuous inner boundary for the estuaries. In some inland areas, the ESI dataset ended abruptly along an interior bay or Lake Shoreline. (This may have been due to missing imagery at the time of mapping because the endpoints align vertically along orthophoto tiles). Estuary boundaries were extended in these areas to include the entire inner boundary of the bay or lake. Islands mapped in the ESI dataset and located within the estuaries were erased from the estuary dataset to avoid placing sample points on land.

The ESI shoreline mapping was compared to 2010 SPOT satellite orthophotos, which are included in the Statewide Digital Mapping Initiative and accessed through the Alaska Mapped WMS. Due to high rates of annual coastal erosion in the arctic, some shorelines have eroded hundreds of meters from their locations in the ESI dataset. In these areas, estuary boundaries were reshaped to match the 2010 coastline.

Sample Frame: The sample frame consists of the GIS shape file for NPRA estuaries. The sample frame has some areas that may not meet the target population definition since salinity

data were not available. Salinity measurements must be made at each station in the field potentially with an approximate salinity line being developed if salinities of less than 3 PSU are encountered. In addition, some under coverage may exist due to the rapid rates of coastline erosion in the arctic. The sampling design will include oversample points that can be used when sampling sites accessed in the field do not match the target population definition.

Survey Design: A Generalized Random Tessellation Stratified (GRTS) survey design for an area resource was used. The GRTS design includes reverse hierarchical ordering of the selected sites and is stratified with unequal probability of selection based on area within each stratum.

Multi-density categories: Unequal probability category was created based on area of polygons (estuaries) within each stratum.

Stratification: Stratification is based on location being in either a Chukchi or Beaufort estuary stratum.

Panels: Design includes two panels. (1) Base: identifies stations to be sampled. (2) Over: identifies stations available for any necessary base station replacement.

Expected sample size: Chukchi stratum 20 stations, with an expected sample size for Kasegaluk Lagoon of 5, Kuk River of 6, and Peard Bay of 9. Beaufort stratum 20 stations, with an expected sample for Elson Lagoon of 8, Smith Bay of 7, and Harrison Bay of 5.

Oversample: Eighty (80) sites total with 40 in each stratum.

Site Use: The base survey design has 40 stations total, with 20 in each stratum. Base and oversample stations are listed in siteID order for each stratum. All base sites must be sampled or reasons documented why that site was not used. If a base site cannot be sampled the next sequential numbered oversample site in the sampled estuary should be utilized.

Sample Frame Summary

The total estuarine area is 2,970.78 km²

Estuary Area	Base Sites	Oversample Sites	Total Area (km ²)
Chukchi Stratum			
Kasegaluk Lagoon	5		231.30
Wainwright Inlet	5		269.67
Peard	10		324.65
Total	20	40	825.62
Beaufort Stratum			
Elson Lagoon	8		1079.61
Smith Bay	6		364.37
Harrison Bay	6		701.18
Total	20	40	2145.16

Description of Sample Design Output

The sites are provided as a shapefile that can be read directly by ArcMap, which can be read by Excel. It is also provided in an Excel file workbookformat.

Variable Name	Description
Dbf file has the following variable definitions.	
SiteID	Unique site identification (character)
arcid	Internal identification number
x	Albers x-coordinate
y	Albers y-coordinate
mdcaty	Multi-density categories used for unequal probability selection
weight	Weight (in meters), inverse of inclusion probability, to be used in statistical analyses
stratum	Strata used in the survey design
panel	Identifies base sample by panel name and Oversample by OverSamp
auxiliary variables	Remaining columns are from the sample frame provided
Variable Name	Description
Excel file has the following variable definitions.	
SiteID	Unique site identification (character)
arcid	Internal identification number
x	Albers x-coordinate
y	Albers y-coordinate
mdcaty	Multi-density categories used for unequal probability selection
weight	Weight (in meters), inverse of inclusion probability, to be used in statistical analyses
stratum	Strata used in the survey design
panel	Identifies base sample by panel name and Oversample by OverSamp
auxiliary variables	Remaining columns are from the sample frame provided
LatDD	Station latitude in decimal degrees. Datum NAD 83 see projection information.
LongDD	Station longitude in decimal degrees. Datum NAD 83 see projection information.

Projection Information

Projected Coordinate System: NAD_1983_Alaska_Albers
 Projection: Albers
 False_Easting: 0.00000000
 False_Northing: 0.00000000
 Central_Meridian: -154.00000000
 Standard_Parallel_1: 55.00000000
 Standard_Parallel_2: 65.00000000
 Latitude_Of_Origin: 50.00000000
 Linear Unit: Meter

Geographic Coordinate System: GCS_North_American_1983
 Datum: D_North_American_1983
 Prime Meridian: Greenwich
 Angular Unit: Degree

Evaluation Process

The survey design weights that are given in the design file assume that the survey design is implemented as designed. That is, only the sites that are in the base sample (not in the over sample) are used, and all of the base sites are used. This may not occur due to (1) sites not being a member of the target population, (2) landowners deny access to a site, (3) a site is physically inaccessible (safety reasons), or (4) site not sampled for other reasons. Typically, users prefer to replace sites that cannot be sampled with other sites to achieve the sample size planned. The site replacement process is described above.

As a general rule when sites are replaced, the survey design weights are no longer correct and must be adjusted during the data analysis. The weight adjustment requires knowing what happened to each site in the base design and the over sample sites. EvalStatus is initially set to “NotEval” to indicate that the site has yet to be evaluated for sampling. When a site is evaluated for sampling, then the EvalStatus for the site must be changed. Recommended codes are:

EvalStatus Code	Name	Meaning
TS	Target Sampled	Site is a member of the target population and was sampled.
SD	Subsistence Denial	Subsistence user priority encountered did not sample.
PB	Physical Barrier	Physical barrier prevented access to the site i.e., sand bar or station too shallow.
MM	Marine Mammal	Due to presence of an endangered marine mammal site was dropped.
MB	Marine Bird	Due to presence of endangered marine bird the site was dropped.
PHB	Physical Habitat Barrier	Applies to the case where sediment due to grain size or density is not able to be sampled with sediment grab samplers.
O	Other	Field team provides description of why it was not possible to sample the station.

Statistical Analysis

Any statistical analysis of data must incorporate information about the monitoring survey design. In particular, when estimates of characteristics for the entire target population are computed, the statistical analysis must account for any stratification or unequal probability selection in the design. Procedures for doing this are available from the Aquatic Resource Monitoring web page given in the bibliography. A statistical analysis library of functions is available from the web page to do common population estimates in the statistical software environment R.

For further information on survey design:

Web Page: <http://www.epa.gov/nheerl/arm>