

Appendix A. Technical Information on Spatial Sampling Designs.

The following sections describe the GIS coverages and methods used to generate the spatial designs for each of the North Atlantic Coastal Parks. All derived and original-source GIS coverages used for this protocol are available from the Data Coordinator for the NPS NCBN.

Sampling schemes were created in Workstation ArcInfo 8.3 using a custom script (PROCNP.S.AML) developed at the U.S. EPA, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Atlantic Ecology Division. This same script is used for the EPA National Coastal Assessment and requires seed values for the hexagon cell size, minimum and maximum x & y tics for the tessellation scheme, minimum and maximum x & y bounding coordinates for random point generation, and a number of random points to generate.

Acadia National Park (ACAD)

Somes Sound (SS)

Estuarine boundaries were derived from the coverage “coast” (polygon), 1:24,000 coastline data obtained from Maine Office of Geographic Information Systems (MEGIS, <http://apollo.ogis.state.me.us/>). Somes Sound is a fjord-like estuary, so the mouth of the estuary was closed off at its shallow sill. This was accomplished using the 30-foot isobath from the file gom15ctr.shp (Digital Bathymetry Contours of the Gulf of Maine) obtained from USGS (<http://pubs.usgs.gov/of/of98-801/bathy/data.htm>). The spatial domain was closed off at the U.S. Route 102 and 198 bridges using the MEGIS coverage “roads” (line).

Seed values for the PROCNP.S.AML algorithm, which was used to generate the tessellated hexagon design and the random sampling stations, were as follows:

- Hex scheme initial tics: x-min = -20000, x-max = +20000, y-min = -20000, y-max = +20000
- Hex Scheme initial cell size: 1422
- Hex scheme initial number of random points: 700,000
- Random Points bounding coordinates: x-min = 552,594, x-max = 556,068, y-min = 4,905,037, y-max = 4,913,359.
- Hawth's Tools used to generate 30 random points in each hexagon.
- Trend stations for this stratum are assigned to hexagon numbers 18, 23, and 27.

Bass Harbor Marsh Estuary (BHM)

Estuarine boundaries were derived from the coverage “coast” (polygon), 1:24,000 coastline data obtained from MEGIS. The spatial domain was closed off at the two U.S. Route 102 bridges using the MEGIS coverage “roads” (line). The northern extend of the spatial domain was closed off at a point upstream of Buttermilk Brook, defined by the point where the park boundary leaves the estuary toward the east. The GIS park boundary coverage “legbnd2002” (poly), was obtained from ACAD for this purpose.

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Seed values for the PROCNPS.AML algorithm were as follows:

- Hex scheme initial tics: x-min = -20000, x-max = +20000, y-min = -20000, y-max = +20000
- Hex Scheme initial cell size: 286
- Hex scheme initial number of random points: 900,000
- Random Points bounding coordinates: x-min = 550,940, x-max = 552,970, y-min = 4,889,400, y-max = 4,902,535.
- Trend stations for this stratum are assigned to hexagon numbers 34, 39, and 44.

Northeast Creek Estuary (NEC)

The shoreline coverage used for the previous two strata was inadequate for delineating this estuary. Instead, the shoreline was based upon the shapefile “roman_shoreline.shp” which was created as part of a vegetation mapping project by Charles Roman (NPS North Atlantic Coast Cooperative Ecosystem Studies Unit at the University of Rhode Island). The downstream extent of the estuary was terminated at the U.S. Route 3 bridge using the coverage “roads” (line) from MEGIS. The upstream extent was terminated at the confluence of Aunt Betsy’s Brook using the MEGIS coverage “hydro” (poly).

Seed values for the PROCNPS.AML algorithm were as follows:

- Hex scheme initial tics: x-min = -1000, x-max = +1000, y-min = -1000, y-max = +1000
- Hex Scheme initial cell size: 179
- Hex scheme initial number of random points: 500,000
- Random Points bounding coordinates: x-min = 553,500, x-max = 554,710, y-min = 4,918,500, y-max = 4,919,360.
- Trend stations for this stratum are assigned to hexagon numbers 1, 6, and 13.

Assateague Island National Seashore (ASIS)

Estuarine boundaries were derived from the coverage “mdvabays” (polygon), which is a concatenation of a Maryland and a Virginia shoreline coverages created by Luke Cole at the University of Rhode Island. The Maryland shoreline comes from a 2001 shoreline coverage from the Maryland Department of Natural Resources (“DNR_Wetlands” www.MSGIC.state.md.us), and the Virginia portion is from a 2003 edition of the Geographic Data Technology, Inc. U.S. Block Groups coverage produced for the U.S. Department of Commerce, Census Bureau.

Seed values for the PROCNPS.AML algorithm were as follows:

- Hex scheme initial tics: x-min = -20000, x-max = +20000, y-min = -20000, y-max = +20000
- Hex Scheme initial cell size: 6100
- Hex scheme initial number of random points: 1,000,000
- Random Points bounding coordinates: x-min = 454,910, x-max = 493,000, y-min = 4,190,100, y-max = 4,244,000.

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Boston Harbor Island National Park Area (BOHA)

Estuarine boundaries were derived from the coverage Boston Harbor Islands Intertidal and Terrestrial Area, “coast” (polygon), obtained from the NPS. The buffered area was saved as a shapefile and combined with the coastline dataset using the ESRI Geoprocessing Wizard, and all upland and intertidal areas were removed from the sampling area using the Edit functions in ArcMap. The GIS coverage “roads” (line) was obtained from the Massachusetts Office of GIS (<http://www.state.ma.us/mgis>) and was used to crop the spatial domain at Washington Boulevard and at U.S. Route 1.

Seed values for the PROCNPS.AML algorithm were as follows:

- Hex scheme initial tics: x-min = -20000, x-max = +20000, y-min = -20000, y-max = +20000
- Hex Scheme initial cell size: 3000
- Hex scheme initial number of random points: 80,000
- Random Points bounding coordinates: x-min = 326300, x-max = 351100, y-min = 4676000, y-max = 4695000.

Cape Cod National Seashore (CACO)

Estuarine boundaries were derived from the shapefile “shoreline01” (line), coastline data obtained from NCBN. Boundaries for Pilgrim Lake were derived from the dataset “wetdep_capea1.shp” obtained from MassGIS (<http://www.mass.gov/mgis/wetdep.htm>). Salt Pond and Mill Pond kettle-holes were cropped from the NH spatial domain using 1:5,000 Elevation data obtained from Massachusetts Office of GIS to select break lines. Kettle-hole ponds were cropped from the PB stratum by hand so that associated shallow channels remain part of the kettle hole stratum.

Nauset Harbor (NH)

Estuarine boundaries were derived from the shapefile “shoreline01” (line), coastline data obtained from NCBN. Salt Pond and Mill Pond kettle-holes were cropped from the NH spatial domain using 1:5,000 Elevation data obtained from Massachusetts Office of GIS to select break lines.

Seed values for the PROCNPS.AML algorithm were as follows:

- Hex scheme initial tics: x-min = -20000, x-max = +20000, y-min = -20000, y-max = +20000
- Hex Scheme initial cell size: 1440
- Hex scheme initial number of random points: 900,000
- Random Points bounding coordinates: x-min = 417,678, x-max = 422,039, y-min = 4,626,320, y-max = 4,633,032.
- Trend stations for this stratum are assigned to hexagon numbers 18, 23, and 28.

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Pleasant Bay (PB)

Estuarine boundaries were derived from the shapefile “shoreline01” (line), coastline data obtained from NCBN. Kettle-hole ponds were cropped from the PB stratum by hand so that associated shallow channels remain part of the kettle hole stratum.

Seed values for the PROCNPS.AML algorithm were as follows:

- Hex scheme initial tics: x-min = -20000, x-max = +20000, y-min = -20000, y-max = +20000
- Hex Scheme initial cell size: 2486
- Hex scheme initial number of random points: 900,000
- Random Points bounding coordinates: x-min = 416,503, x-max = 423,153, y-min = 4,613,887, y-max = 4,626,259.
- Trend stations for this stratum are assigned to hexagon numbers 3, 7, and 11.

Estuarine Kettle Holes (KH)

No grid of tessellated hexagons are required for this stratum. Each estuarine kettle hole pond is identified as a spatial unit (lettered A-L) based upon bathymetry and random station locations created for each.

Colonial National Historic Park (COLO)

Tidal Creek Stratum

The area of NPS ownership is very small at each location where Colonial Parkway overpasses a tidal creek, and tidal creeks that drain NPS lands are smaller still. Exhaustive sampling of these discrete small areas is prescribed for this stratum. Because of their small size, any location within each location can reasonably be considered representative, so constraints related to accessibility and water depth for sampling instruments are allowed to dictate specific locations. As a general approach for locations where estuaries cross beneath Colonial Parkway, sampling is done from the bridge at mid channel. For estuarine tidal creeks draining NPS lands, the single sampling station is located at the creek mouth.

Jamestown Island Stratum

The Jamestown Island stratum was created using the shoreline coverage “hydrology ln” (line) and park boundary coverage “colo boundary” (shape) obtained directly from COLO. Cutoffs were identified i) as a continuation of the park boundary across Powhatan Creek where it first intersects park property, ii) at the roadway/bridge between Sandy Bay and the James River, and iii) between Black Point and a pier on the mainland NNE across the Thorofare.

- Hex scheme initial tics: x-min = -2013, x-max = +2013, y-min = -2013, y-max = +2013.
- Hex Scheme initial cell size: 500
- Used Hawth's Tools extension (<http://www.spatialecology.com/htools/>) in ArcGIS 9.1 to generate 30 random points in each hexagon.

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Fire Island National Seashore (FIIS)

The RTS design for FIIS was created by the U.S. EPA, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Atlantic Ecology Division. The spatial domain was created using the following GIS coverages and procedures. Estuarine boundaries were derived from the coverage “park_boundary” (polygon) and the shoreline coverage “poly_island” (polygon), both obtained directly from FIIS. The original hex scheme tic marks and cell size are unavailable, but the PROCNPS.AML script was modified to generate additional random sampling points for the original hex scheme as follows:

- Hex scheme initial number of random points: 500,000
- Random Points bounding coordinates: x-min = 339900, x-max = 351300, y-min = 4115300, y-max = 4122600.
- Trend stations for this park are assigned to hexagon numbers 5, 10, 15, 20, 25, & 30.

Gateway National Recreation Area (GATE)

The spatial domain for GATE was first created by the U.S. EPA, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Atlantic Ecology Division. Following the 2003 feasibility study, and in consultation with the park, the spatial domain has since been modified to include several previously excluded tributaries. This required a revision of the RTS design as well.

Seed values for the revised PROCNPS.AML algorithm were as follows:

- Hex scheme initial tics: x-min = -19400, x-max = +20000, y-min = -19500, y-max = +20000
- Hex Scheme initial cell size: 2550
- Hex scheme initial number of random points: 100,000
- Random Points bounding coordinates: x-min = 584730, x-max = 611470, y-min = 4487300, y-max = 4506020.

George Washington Birthplace National Monument (GEWA)

The RTS design for the GEWA was created using the following GIS coverages and procedures. Estuarine boundaries were derived from the coverage “gewastrm” (polygon), George Washington Birthplace NM Hydrography, 1:24,000 hydrology data developed by NCSU. The Maryland-Virginia border was used to close the spatial domain, using the coverage “esri_states” obtained from Environmental Systems Research Institute, Inc.

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Seed values for the PROCNPS.AML algorithm were as follows:

- Hex scheme initial ties: x-min = -20000, x-max = +20000, y-min = -20000, y-max = +20000
- Hex Scheme initial cell size: 336
- Hex scheme initial number of random points: 100,000
- Random Points bounding coordinates: x-min = 330000, x-max = 334000, y-min = 4226000, y-max = 4230000.
- Trend stations for this park have been assigned to hexagon numbers 1, 6, 13, 18, 23, & 25.

Sagamore Hill National Historical Site (SAHI)

No spatial sampling design was created for SAHI.