

# National Coastal Condition Assessment 2015 Great Lakes Survey Design

The National Coastal Condition Assessment 2015 (NCCA 2015) survey design includes two main survey design components: the Near Shore survey design and the Embayment survey design. The Near Shore design includes a United States survey design and a Canadian survey design. The Embayment design only includes embayments within the United States. The Near Shore design also includes sites from the National Park Service design in 2010 which would only be incorporated into a 2015 survey design of parks if it occurs.

## Description of Near Shore Survey Design

**Target population:** Near shore waters of the Great Lakes of the United States and Canada. Near shore zone is defined as region from shoreline to 30m depth constrained to a maximum of 5 km from shoreline. Great Lakes include Lake Superior, Lake Michigan, Lake Huron, Lake Erie, and Lake Ontario. The NARS Great Lakes assessment will be restricted to the United States portion.

**Sample Frame:** The sample frame was obtained from Jack Kelly.

**Survey Design:** The survey design consists of two independent designs. One design re-samples sites sampled during NCCA 2010 Great Lakes assessment. The other design selects new sites using the same survey design used for NCCA 2010. Both designs use a Generalized Random Tessellation Stratified (GRTS) survey design for an area resource.

**Stratification:** Both designs are stratified by Great Lake and country.

**Multi-density categories:** Both designs use unequal probability categories where the categories are based on states or province within each Great Lake and the expected sample size is proportional to state shoreline length within each stratum.

**Panels:** The combined designs have the following panels:

1. Base10\_RVT2\_FT: Sites from NCCA 2010 that will be re-sampled twice in 2015 and once for Fish Tissue study
2. Base10\_FT: Sites from NCCA 2010 that will be re-sampled once in 2015 and for Fish Tissue study
3. Base10: Sites from NCCA 2010 that will be re-sampled once in 2015 and not for Fish Tissue study
4. Base15\_RVT2: New sites in Canadian portion of the design that will be sampled twice in 2015
5. Base15\_FT: New sites that will be sampled once in 2015 and for Fish Tissue study
6. Base15: New sites that will be sampled once in 2015 and not for Fish Tissue study

7. Base10\_OverSamp: Sites from NCCA 210 that are over sample sites that will only be used if any Base10\_RVT2 or Base10 sites cannot be sampled in 2015
8. Base15\_OverSamp: New sites that are over sample sites that will only be used if any Base15 site cannot be sampled in 2015

**Expected sample size:** For the United States the expected sample size is 225 Near Shore sites with 45 sites in each of the five Great Lakes. Five sites in each Great Lake will be sampled twice in 2015 for a total of 250 site visits. All sites that will be sampled twice in 2015 are sites that were sampled in 2010 and in most cases were sampled twice in 2010. Sample sizes were allocated proportional to shoreline length by state within each Great Lake. Approximately 50% of the sites are sites from NCCA 2010 to be re-sampled in 2015 and 50% are new sites.

**Site Use:** When a “base” site cannot be sampled for any reason, the site must be replaced using the following rules:

1. Base10\_RVT2\_FT: When a site in this category cannot be sampled it should be replaced by the next available site in the Base10\_OverSamp list within the same Great Lake and state (where sites are in SITEID\_15 order within the Great Lake and state) and the replacement site should be sampled twice in 2015. The over sample site should be sampled for the fish tissue study.
2. Base10\_FT: When a site in this category cannot be sampled it should be replaced by the next available site in the Base10\_OverSamp list within the same Great Lake and state (where sites are in SITEID\_15 order within the Great Lake and state). The over sample site should be sampled for the fish tissue study
3. Base10: When a site in this category cannot be sampled it should be replaced by the next available site in the Base10\_OverSamp list within the same Great Lake and state (where sites are in SITEID\_15 order within the Great Lake and state).
4. Base15\_RVT2: When a site in this category cannot be sampled it should be replaced by the next available site in the Base10\_OverSamp list within the same Great Lake (where sites are in SITEID\_15 order within the Great Lake)
5. Base15\_FT: When a site in this category cannot be sampled it should be replaced by the next available site in the Base15\_OverSamp list within the same Great Lake and state (where sites are in SITEID\_15 order within the Great Lake and state). The over sample site should be sampled for the fish tissue study
6. Base15: When a site in this category cannot be sampled it should be replaced by the next available site in the Base15\_OverSamp list within the same Great Lake and state (where sites are in SITEID\_15 order within the Great Lake and state)

## **Description of Embayment Survey Design**

**Target population:** Embayments within the near shore waters of the Great Lakes of the United States.

**Sample Frame:** The sample frame was obtained from Jack Kelly.

**Survey Design:** The survey design consists of two independent designs. One design re-samples sites sampled during NCCA 2010 Great Lakes embayment assessment. The other design selects new sites using the same survey design used for NCCA 2010. Both designs use a Generalized Random Tessellation Stratified (GRTS) survey design for an area resource.

**Stratification:** A single Great Lake embayment stratum is used.

**Multi-density categories:** Both designs use unequal probability categories. Three unequal probability categories are based on area of embayments. For 2010 the categories are (0,50], (50,75] and (75,100] where the area is in square kilometers. For 2015 the categories are (0,20], (20,30] and (30,40] where the area is in square miles and were selected to match the 2010 categories approximately. The latter two categories identify two large embayments while the first category includes the remaining embayments.

**Panels:** The combined designs have the following panels:

1. Base10\_RVT2: Sites from NCCA 2010 that will be re-sampled twice in 2015
2. Base10: Sites from NCCA 2010 that will be re-sampled once in 2015
3. Base15: New sites that will be sampled once in 2015
4. Base10\_OverSamp: Sites from NCCA 210 that are over sample sites that will only be used if any Base10\_RVT2 or Base10 sites cannot be sampled in 2015
5. Base15\_OverSamp: New sites that are over sample sites that will only be used if any Base15 site cannot be sampled in 2015

**Expected sample size:** The Embayment design expected sample size is 150 sites. Fourteen (14) sites from 2010 Embayment assessment will be sampled twice in 2015. Fifty-four (54) sites from 2010 Embayment assessment will be sampled once in 2015. Sixty-eight (68) new sites will be sampled in 2015. This results in 136 unique sites.

**Site Use:** When a “base” site cannot be sampled for any reason, the site must be replaced using the following rules:

1. Base10\_RVT2: When a site in this category cannot be sampled it should be replaced by the next available site in the Base10\_OverSamp list (where sites are in SITEID\_15 order) and the replacement site should be sampled twice in 2015.
2. Base10: When a site in this category cannot be sampled it should be replaced by the next available site in the Base10\_OverSamp list (where sites are in SITEID\_15 order).
3. Base15: When a site in this category cannot be sampled it should be replaced by the next available site in the Base15\_OverSamp list (where sites are in SITEID\_15 order)

## Sample Frame Summary

Summary of Near Shore sample frame by Great Lake and State/Province (square miles)

	IL	IN	MI	MN	NY	OH	ON	PA	WI	Sum
Lake_Erie_NS_USA	0.0	0.0	106.3	0.0	209.0	639.3	0.0	152.4	0.0	1107.0
Lake_Huron_NS_USA	0.0	0.0	1331.5	0.0	0.0	0.0	0.0	0.0	0.0	1331.5
Lake_Michigan_NS_USA	179.3	126.7	1724.2	0.0	0.0	0.0	0.0	0.0	1009.1	3039.2

Lake_Ontario_NS_USA	0.0	0.0	0.0	0.0	531.5	0.0	0.0	0.0	0.0	531.5
Lake_Superior_NS_USA	0.0	0.0	894.6	108.6	0.0	0.0	0.0	0.0	287.3	1290.6
Lake_Erie_NS_CAN	0.0	0.0	0.0	0.0	0.0	0.0	971.3	0.0	0.0	971.3
Lake_Huron_NS_CAN	0.0	0.0	0.0	0.0	0.0	0.0	1779.8	0.0	0.0	1779.8
Lake_Ontario_NS_CAN	0.0	0.0	0.0	0.0	0.6	0.0	814.3	0.0	0.0	814.9
Lake_Superior_NS_CAN	0.0	0.0	0.0	0.0	0.0	0.0	807.4	0.0	0.0	807.5
Lake_Michigan_NS_Islands	0.0	0.0	9.1	0.0	0.0	0.0	0.0	0.0	0.0	9.1
Lake_Superior_NS_Islands	0.0	0.0	71.6	0.0	0.0	0.0	0.0	0.0	28.3	99.9
Sum	179.3	126.7	4137.2	108.7	741.1	639.3	4372.8	152.4	1324.7	11782.1

Note that the near shore region includes embayment area.

**Summary of Embayment sample frame by State/Province (square miles)**

	IL	IN	MI	MN	NY	OH	ON	PA	WI	Sum
Embayments	1.3	5.8	219.1	13.1	38.5	14.7	0.0	8.8	48.5	349.8
Embayments_Harbor	1.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4
Total	2.4	6.1	219.1	13.1	38.5	14.7	0.0	8.8	48.5	351.2

**Site Selection Summary**

Number of sites by state/province for base sample:

NearShore

	Base10_RVT2	Base10	Base15_RVT2	Base15	Base10_OverSamp	Base15_OverSamp	Sum
IL	0	0	0	0	0	1	1
IN	0	1	0	2	3	1	7
MI	11	45	0	55	52	52	215
MN	2	1	0	3	4	5	15
NY	7	21	0	28	27	29	112
OH	2	10	0	14	13	13	52
PA	0	1	0	2	3	1	7
WI	3	6	0	11	21	13	54
ON	0	0	20	160	0	0	180
Sum	25	85	20	275	123	115	643

Embayments

	Base10_RVT2	Base10	Base15_RVT2	Base15	Base10_OverSamp	Base15_OverSamp	Sum
IL	0	0	0	1	1	0	2
IN	0	1	0	1	3	1	6
MI	10	33	0	39	48	42	172
MN	0	2	0	3	0	2	7
NY	1	7	0	7	11	9	35
OH	0	2	0	3	2	4	11
PA	1	1	0	2	3	1	8
WI	2	8	0	12	15	9	46
Sum	14	54	0	68	83	68	287

Special

	Base10_RVT2	Base10	Base15_RVT2	Base15	Base10_OverSamp	Base15_OverSamp	Sum
IL	0	0	0	0	3	0	3
IN	0	0	0	0	1	0	1
MI	0	0	0	0	41	0	41
WI	0	0	0	0	8	0	8
Sum	0	0	0	0	53	0	53

**Description of Sample Design Output:**

The output is provided as a shapefile for the sites. Note that the “.dbf” file may be read in Excel. The attributes are as follows:

Variable Name	Description
ORDER	Variable that orders sites by type of design, Great Lake, state, and site number (DSGN_TYPE, NCA_NM, PSTL_CODE, and SITEID_15) to facilitate identification of

	site use by a state
SITEID_15	Unique site identification (character)
LON_DD	Longitude in decimal degrees using North American 1983 datum (see below)
LAT_DD	Latitude in decimal degrees using North American 1983 datum (see below)
ALBERS_X	Albers x-coordinate from map projection (see below)
ALBERS_Y	Albers y-coordinate from map projection (see below)
DSGN_TYPE	Identifies if site is associated from Near Shore design, Embayment design, or special design (NPS and Illinois state design)
NCA_NM	Name of Great Lake
PSTL_CODE	State and province two letter code
PANEL_15	Panel assignment for site for NCCA 2015. See above for values
DESIGN	Identifies the specific survey design used to select the sites in either NCCA 2010 for sites to be resampled in 2015 or NCCA 2015 for new sites
WGT_DSGN15	Design weight (in square miles), inverse of inclusion probability, to be used in statistical analyses
STRATUM_15	Strata used in the survey design
MDCAT_15	Multi-density categories used for unequal probability selection
SITEID_10	NCCA 2010 SITE ID
RSRC_CLASS	Resource class in which the site is located. Possible values are Great_Lakes_Embayments, Great_Lakes_Embayments_Harbors, Great_Lakes_Near_Shore_NotBays, Great_Lakes_Near_Shore_NotBays_Harbors, Great_Lakes_Near_Shore_Islands
COUNTRY	Location of site in USA or Canada
NCA_REGION	NCCA region: Great Lakes
PROVINCE	Biogeographical province
NCA_EST_NM	Name of Great Lake
NPS_PARK	Four letter abbreviation of the name of National Park Service park

### Projection Information

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PARAMETER["False_Northing",0.0],
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Created by Tony Olsen

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PARAMETER["Standard_Parallel_1",29.5],  
PARAMETER["Standard_Parallel_2",45.5],  
PARAMETER["Latitude_Of_Origin",37.5],  
UNIT["Meter",1.0]]
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