I. Coastal Stream Systems in the North Atlantic Coast Ecoregion

This plan addresses small coastal streams and tidal creeks entirely within the North Atlantic Coast ecoregion. For information on the larger stream and river portfolio within the North Atlantic Coast, please see the Lower New England Ecoregional Plan 2003 as the larger streams were assessed as part of watershed systems which crossed both LNE and NAC before reaching the coast.

Team Leader: Arlene Olivero

TNC Reviewers: Mark Carabetta-CTFO; Andrew Manus-DEFO; Alison Bowden-MAFO; Nancy Sferra-MEFO; Doug Bechtel-NHFO; Jay Odell-NHFO; Marianna Upmeyer-NJFO; Marilyn Jordan – NYFO-LI; Becky Shirer-NYFO-ENY; Julie Lundgren-RIFO

Overview

Target Name: Coastal Size 1 Stream System

Variants: Coastal Tidal Stream (or Tidal Creek), Coastal Non-tidal Stream

Target Definition**:** System of connected size 1 (0-30 sq.mi. drainage area) streams that empty directly to the ocean or the tidal section of a river/ river estuary.

Coastal streams and creeks are widespread and abundant ecosystems in the North Atlantic Coast Ecoregion (NAC). They are defined as continuously flooded systems of small streams that drain directly to the ocean or a large tidal river estuary. Most examples are tidal at the lower reach, typically entering into brackish and/or salt marsh ecosystems (the coastal tidal stream type). The upper sections beyond the influence of tidal action, exhibit freshwater ecosystems (the coastal non-tidal stream type). Less commonly, a coastal stream flows directly into the bay or ocean at a higher gradient, so as to have little or no tidal influence at the mouth of the stream.

Coastal streams support a rich diversity of plant and animals, serve as the primary nursery area for many fishes and represent a uniquely integrated ecosystem continuum connecting upland habitats to the ocean. Although their ecological importance has historically been undervalued, recent research is showing these small systems have distinctly diverse hydrological, watershed, and biotic characteristics and that their collective influence on the estuarine ecosystem function may equal or exceed that of larger river dominated estuaries in certain geographies (Mallin 2004).

Review was specifically focused on those streams and tidal creeks connecting directly downstream to the ocean, rather than to a larger tidal river, because these systems were not nested within a larger watershed that would have received review during the previous stream portfolio assessment of the Lower New England region.

Characteristics

Salinity: In the tidal creek reaches, the water level fluctuates with the tides and salinity ranges between 0.5 and 30 ppt. Although salinity will vary with the tides, in general tidal creeks can be divided into those that are dominantly high-saline (polyhaline to marine), moderate-salinity (mesohaline to polyhaline) or low-salinity (fresh to oligohaline) systems. High saline creeks have strong tidal influence throughout and are characterized by salt marsh vegetation throughout. Moderate-salinity creeks are also strongly tidally influenced, but drain larger continental upland areas and their streamside vegetation ranges from wooded uplands in the headwaters to salt marsh vegetation in the lower reaches. Low salinity coastal creek/stream systems are less strongly influenced by tides, have wooded headwaters and the lower reaches may be vegetated by oligohaline marsh or riparian swamp forest.

Acidity: Water chemistry in the upper freshwater stream sections can vary from calcareous to acidic due to the influence of local geology, although calcareous tidal creeks are extremely rare in the North Atlantic Coast region. The pH of seawater in the tidally influenced zone is generally slightly basic.

Depth: The depth of tidal creeks rarely exceeds 3m at high tide. Although some tidal creeks may drain completely at low tide, others will contain a few centimeters to a third of a meter or more of water, even at low tide. The smaller creeks that stop flowing at low tide (discontinuous) tend to have higher nutrient and particulate concentrations than deeper, more continuous creeks. It is suggested that these discontinuous creeks act to trap nutrients and particulates in the ebbing tide and return them to the marsh surface which acts to accelerate the development of the marsh in their vicinity. The non-tidal reaches vary considerably in depth, often with scattered deep pools.

Substrate/Form: Most tidal creeks have moderately firm, sandy, channel bottom and banks that are exposed at low tide. Although the vertical banks of the creek are regularly eroded and slump into the creek bottom, the position of the creek bed in the marsh is fairly stable and oxbows are rare. The sinuous meanders of tidal creeks are not formed by recent erosion of the marsh, rather they are thought to be relicts of the drainage channels that were active in the tidal flats when the salt marsh grasses first became established. Some tidal creeks are associated with broad intertidal sand or mud flats instead of marsh in the lower reaches. The non-tidal reaches also have relatively stable channels, but may run through sand, gravel, or fine sediments.

Biodiversity

The salinity zonation in **tidal creeks** and adjacent waters leads to the creation of vegetative ecotones such as Spartina dominated salt marshes which blend into rush (*Juncus* and *Scirpus* spp.) dominated fresh and brackish marshes. The lower tidally influenced sections of coastal tidal streams are utilized as nursery areas, refuges, and important food sources for a variety of crabs, fish, and other coastal/marine animals. Characteristic plants in the tidal section include widgeon-grass (*Ruppia maritime*) and several cyanobacteria including *Hydrocoleum lyngbaceum*, *Anabaena torulosa*, and *Agmenellum quadruplicatum*. The most abundant fishes of tidal creeks are the Common Mummichog, Striped Killifish, the Sheepshead Minnow and the Atlantic Silverside. Several fishes that are resident in tidal creeks at low tide also use the low salt marsh when it is flooded by high tide. Fishes that have this distribution pattern include Atlantic Silverside, Mummichog, Sheepshead Minnow, Fourspine Stickleback, Threespine Stickleback, and American Eel. Young-of-the-year Winter Flounder may also be found in tidal creeks. Higher salinity creeks often contain productive shellfish beds.

Biota in the **freshwater sections of coastal streams** represent common freshwater communities found in other small freshwater streams of similar size, gradient, and chemistry in the coastal region. A key distinction is found between the medium-high gradient streams and low gradient streams. For example, in higher gradient tributaries, the higher dissolved oxygen levels, more abundant riffle habitat, and gravel substrates support brook trout, brook-trout slimy sculpin fish communities. At lower gradients the poorer aeration, fine mucky substrate, and low velocity lead to communities instead dominated more by Fallfish, Longnose Dace, Creek Chub, Longnose and White Sucker, Common Shiner, Fathead and Bluntnose Minnow. Brook lamprey appear to be indicators of very high quality waters in coastal stream systems in Massachusetts. Sea-run brook trout are also found in some coastal streams and are thought to indicate high integrity systems. Diadromous fish that utilize the tidal and non-tidal reaches of coastal size 1 ecosystems include Alewife, American Shad, Rainbow Smelt, Blueback Herring, and American Eel.

Target Mapping

Size 1 rivers (< 30 sq.mi. drainage area) and their watersheds were mapped using 1:100,000k EPA Rf3 stream reach data and USGS National Elevation Dataset Digital Elevation Model (Anderson and Olivero 2003). The tidally influenced elevation zone in the North Atlantic Coast includes areas of < 20 ft. (Anderson and Ferree, 2004) and stream systems intersecting this zone were automatically included in the tidal-creek analysis. Additional small coastal streams that were too small to meet the 1:100,000 scale minimum mapping unit resolution in the EPA Rf3 100,000k stream layer were added to the NAC coastal size 1 stream dataset on a case by case basis after state level expert review and portfolio recommendation.

Target Stratification

Tidal streams were stratified into nine different types based on salinity on watershed size (Table 26). Additional geographic stratification for goals occurred using Ecological Drainage Unit watershed groups according to standard freshwater ecoregional planning (Anderson and Olivero, 2003). Details on this process are found in the Appendices. The most common of the nine primary types were the small (< 2 sq.mi.) >75% tidally influenced systems, making up 33% of all tidal creek watersheds and 40% of all tidal creeks directly connected to the ocean. The second most common type was the medium 2<10 sq.mi. > 75% tidally influenced system for watershed directly connected to the ocean. The size 1 coastal-tidal watershed type differed between the total set and the set directly connected to the ocean. This difference reflected the stronger tidal influence on the examples directly connected to the ocean. The second most common type in the non-direct to ocean set (e.g. those that connect directly downstream to large tidal river mainstems) was the small < 2 sq.mi. < 25% tidal watersheds.

Although the number of small <2 sq.mi. watershed occurrences was high (924, 55% of all watershed occurrences), considering the total area covered by all coastal-tidal size 1 watersheds, the less common larger size 1 watershed occurrences account for the majority of the aerial coverage of the coastal-tidal size 1 creek system watershed ecosystem type (Table 25).

Table 25. Nine Primary Size 1 Coastal-Tidal Watershed Types, Based on Salinity Class and Watershed Class

Type	% Tidal	Size Class	% All Size 1 Coastal Watersheds	% Area Covered by All Size 1 Coastal Watersheds	% of All Size 1 Coastal Directly Ocean Connected Watersheds	% of Area Covered by All Size 1 Coastal Directly Ocean Connected Watersheds
1	< 25%	< 2 sq.mi.	13	3	9	2
2	< 25%	2<10 sq.mi.	12	12	8	10
3	< 25%	10<30 sq.mi.	9	40	5	24
4	25<75%	< 2 sq.mi.	9	2	9	2
5	25<75%	2<10 sq.mi.	8	8	9	11
6	25<75%	10<30 sq.mi.	4	17	5	22
7	75+%	< 2 sq.mi.	33	4	40	6
8	75+%	2<10 sq.mi.	10	9	13	13
9	75+%	10<30 sq.mi.	2	6	2	9

Target Viability

Ecological Integrity (or viability) was based on Key Ecological Attributes (KEAs) that sustain the conservation target and maintain its composition, structure, and function. Key ecological attributes for coastal size 1 systems included measures of hydrologic regime, water chemistry, watershed % natural cover, stream buffer % natural cover, in-stream connectivity, connectivity to upland habitat, invertebrate community structure, vertebrate community structure, and plant community structure. There were also related attributes of the integral riparian wetlands and salt marsh communities that these systems are linked to. Although an effort was made by the team to define indicators for each key attribute (see Appendices), comprehensive data on all key attributes was not available across the region for the size 1 coastal streams. The condition and viability assessment thus relied on a 1) GIS data analysis of proxy variables related to key attributes which could be mapped and assessed across all occurrences and 2) an expert interview process to validate and gather additional information.

Screening Criteria

An initial GIS based Condition Screening evaluated each watershed in terms of:

- Land Use/Impervious surface impacts;
- Connectivity/Dam Impacts;
- Point Source Impact.

Data including watershed and riparian land cover, conservation lands, dams, road crossings, and rare species were analyzed to rank each watershed on each of the above relatively uncorrelated primary axes. Additional variables were also calculated to highlight watersheds meeting special criteria such as presence of rare species, large amount of managed areas, or connected to the existing riverine portfolio.

The data on land use rank, connectivity rank, point source rank, and special qualifier were used to assign an estimated portfolio class of “Yes” (Y), “Maybe” (MY), or “No” (N) to each watershed. TNC state scientists used expert interviews in their state to gather additional information, not represented in this GIS analysis, to verify initial portfolio recommendations. See Appendices for a more detailed summary of the condition analysis.