The Great Bay Ecosystem

Scientists have long described an ecosystem as all the interacting parts of the physical and biological worlds. The Great Bay Ecosystem, Great and Little Bays and the Piscataqua River, has a number of unique physical and biological components that combine to create a dynamic estuary.

Key Physical Features:

1. Drainage confluence of 7 major rivers which are the; Squamscott, Winnicut, Lamprey, Oyster, Bellamy, Salmon Falls, and Cocheco Rivers. Great Bay alone is the drainage confluence for the Squamscott, Winnicut, and Lamprey Rivers and for the Crommet and Lubberland Creeks.

2. Deglaciation of the area over 14,500 years ago left a depression in the land that flooded with both tidal and fresh waters, creating the “drowned river valley” of the Great Bay Estuary.

3. Towns surrounding the Estuary system are; Dover, Durham, Newmarket, Stratham, Greenland, Newington, Portsmouth, Eliot, ME and South Berwick, ME.

4. Strong tidal influence along with wind driven currents control the circulation of intruding salt and fresh waters within the Estuary, this leaves little vertical stratification (“salt wedge”) within the waters of this area. Salt and fresh waters are typically well mixed.

5. Tidal change is dramatic within Great Bay. Average depth of the embayment is 2.7 m with channels extending to 17.7 m. The water surface of Great Bay covers 8.9 square miles at high tide and 4.2 square miles at low tide, leaving greater than 50% of the bottom of the Bay exposed at low tide.

6. Salinities in Great Bay range from .20 ppt (almost fresh water) to 35 ppt (seawater), usually greater than 20ppt (parts per thousand). Salinity within Great Bay correlates directly with the amount of fresh water runoff draining into the Estuary.
7. The Great Bay Estuary extends inland a distance of 15 miles, from the mouth of the Piscataqua River to Great Bay proper. Great Bay begins “upstream” of Furber Strait and is one of the most recessed estuaries in the U.S.

8. Approximately one half of the annual precipitation in the Great Bay Estuary watershed enters the Estuary as stream flow. Total drainage area of the Great Bay Estuary watershed is 2334 square kilometers (approx. 930 square miles).

Key Biological Features:

Producers

1. Estuarine primary production, the assimilation of the energy of light by green plants for the synthesis of organic compounds, is the major source of organic matter within the estuary.

2. Phytoplankton, these microscopic aquatic plant species are a major component of primary production within the estuary.

3. Eelgrass (Zostera marina) is a submerged marine flowering plant that is rooted within the sediments of the Great Bay estuarine system, this plant species plays an important role in the life cycle of scallops, crabs, finfish, geese, and ducks in Great Bay. Eelgrass covers almost half the area of bottom in Great Bay alone and in some bay areas it is exposed at low tide.

4. Seaweed; a wide diversity of seaweed species exits within the Great Bay Estuary. Dominant species are the intertidal populations of the brown algae Knotted Wrack (Ascophyllum nodosum) and Rockweed (Fucus vesiculosus). Approximately 7 acres of these species grow within Great Bay alone, growing on the shingle cobble and granite outcrops.

5. Salt marshes are meadows and fringing areas around the shoreline, approximately 1.6 square miles of 1000 acres of salt marsh surround Great Bay. Salt marshes are dominated by the plant species Cord Grass (Spartina alterniflora) and Salt Hay (Spartina patens).

6. Other important primary producers within the Estuary are the species of benthic (bottom dwelling) microalgae. Diatoms, and other microscopic algae, occur within the mudflats and serve a very important role in the reduction of sediment resuspension.

7. Upland plant species serve as a valuable buffer that protects the estuarine environment in several ways. A buffer zone of numerous trees and herbaceous plants maintain water quality, provide significant wildlife value, offer aesthetic beauty and promote estuarine health by trapping nutrients and
sediments that would otherwise wash into the Estuary contributing to a reduction in water quality.

8. Zooplankton: the Estuary serves as a nursery and feeding area for a number of marine and estuarine animal species including the larval stage of a number of benthic marine species such as barnacles, soft-shell clam, and oyster larvae. A total of 32 zooplankton species have been collected within the Great Bay Estuary.

9. Fishes: the estuary today supports 52 species of finfish with populations of commercially and recreationally important resident and migratory species. These include; smelt (*Osmerus mordax*), winter flounder (*Pseudopleuronectes americanus*), smooth flounder (*Liopsetta putnami*), and striped bass (*Morone saxatilis*). Important forage species include; Atlantic silversides (*Menidia menidia*), alewives (*Alosa pseudoharengus*), Blueback herring (*Alosa aestivalis*), and the Common Mummichog (*Fundulus heteroclitus*).

10. Benthic invertebrates: 91 intertidal and 114 subtidal bottom dwelling species have been collected throughout the Great Bay Estuary. 45% of these were marine worms, 25% were various crustaceans, 15% were bivalves, and 11% were gastropods.

11. Birds: 110 species (excluding upland birds) are known to use the estuary. The highest number of species occurs during April and September, coincident with spring and fall migrations. The most common species include; herring gulls, American black ducks, double-crested cormorants, great blue herons, and American crows. Abundant overwintering migrants include: Canada geese, great scapaus, buffleheads, common goldeneyes, mallards, and red-breasted mergansers. A rare but regular winter resident is the American bald eagle.

12. Mammals: Harbor seals occur in the estuary in the fall, winter and spring. Terrestrial mammals known to utilize the Great Bay Estuary include raccoons, white-tailed deer, red fox, woodchuck, muskrats, chipmunks, grey squirrels, cottontail rabbits, mink, otter, coyote, and beaver. Small mammals such as meadow voles inhabit the salt marsh areas and are a primary food source for larger predators.

**Detritivores**

13. Dead Organic matter, detritus, is “decomposed” by a number of plant and animal species within the estuary. These “garbage processors” of the ecosystem include larger animal species such as crabs but the majority of the decomposition work falls on bacteria and fungi. The role of detritivores is to break down organic remains that would otherwise accumulate with in the
ecosystem, and for releasing their nutrients so they can be used again by plants.