

# Salt Marshes of the Gulf of Maine

Long-term Monitoring to Assess Human Impacts and Ecological Condition

## Salt marshes

are extremely productive ecosystems that perform many services valued by society. They naturally filter pollutants from coastal waters, provide fish and wildlife habitat, and protect uplands from storm erosion and flooding. ✧ During the past four hundred years, many salt marshes on the Gulf of Maine's coast from Massachusetts to Nova Scotia were degraded or destroyed. Salt marshes were filled and drained, and tidal flooding was blocked by roads, railroads, and dikes. Loss of intact salt marshes impairs the health of the Gulf of Maine ecosystem and the economic activities that depend on it. ✧ As awareness of salt marshes' importance has increased, efforts to protect and restore salt marsh habitats have expanded. Yet much of the information needed for effective management does not exist. In particular, the effects of human impacts and natural disturbances on salt marshes are far-reaching but poorly understood. Ecological monitoring provides information on marsh extent and health that is essential for improved management, conservation, and habitat restoration. ✧ Therefore, the Gulf of Maine Council on the Marine Environment has established a framework to expand and enhance salt marsh monitoring in the Gulf of Maine. The Council is seeking additional partners in Massachusetts, New Hampshire, Maine, New Brunswick, and Nova Scotia to implement a monitoring network for the region's salt marshes.

Kennebunk, Maine photo: Ethan Nedeau

# What are salt marshes?

Salt marshes are coastal wetlands dominated by grasses and flooded by the tides. Their character is strongly influenced by tidal flooding and freshwater input. Tidal marshes range in salinity from salt marsh to brackish and fresh marshes farther inland. Within a salt marsh, elevation increases from bay or creek edge to upland. Low portions of the salt marsh, dominated by smooth cordgrass (*Spartina alterniflora*), receive daily tidal flooding. Higher portions of marsh flood less often and support many plant species. Salt marshes develop in protected bays over decades to millenia, varying in form from narrow shoreline fringes to vast meadows.



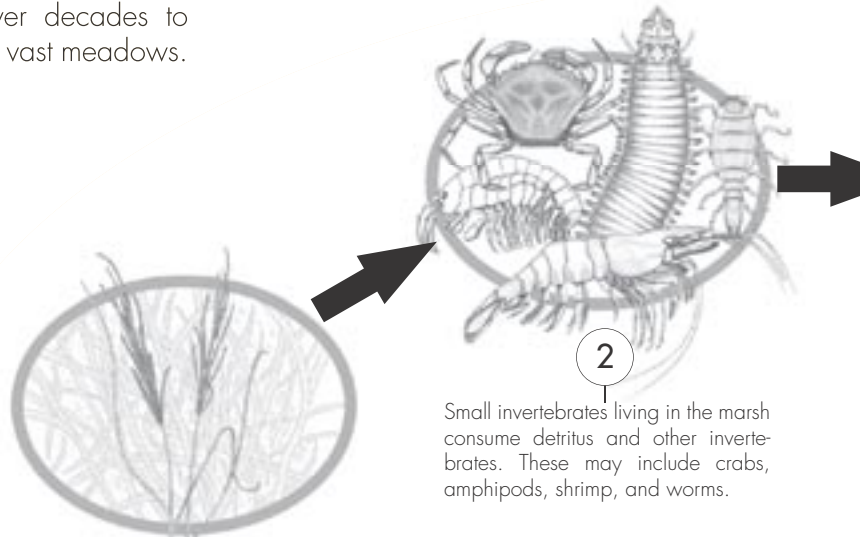
Snowy egret, Mark McCollough



Saltmarsh sharp-tailed sparrows reside in salt marshes and are threatened by habitat loss. photo: Greg Shriver

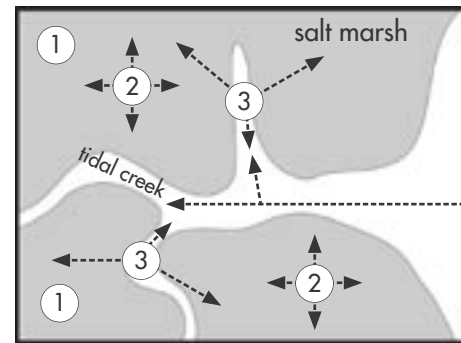


Productivity of salt marshes supports fish such as striped bass. photo: Michele Dionne

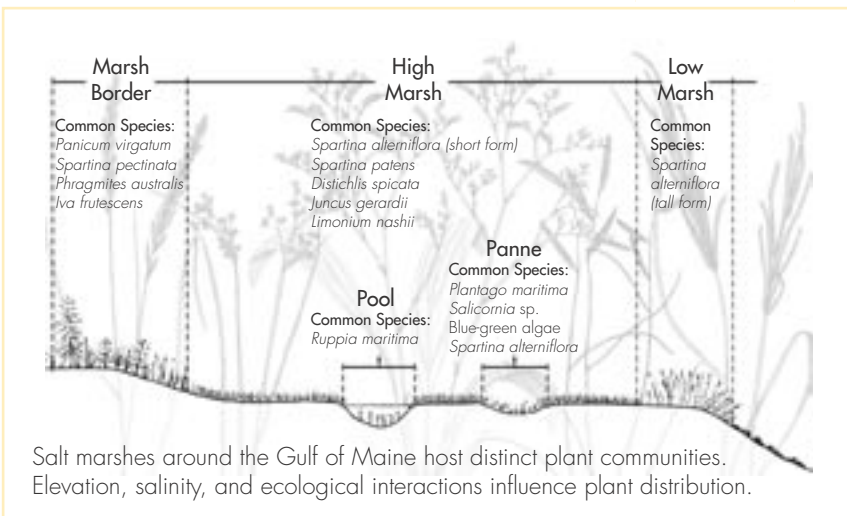


Small invertebrates living in the marsh consume detritus and other invertebrates. These may include crabs, amphipods, shrimp, and worms.

1 On the marsh surface, dead plant matter is colonized by bacteria, fungi, and protozoans, making a rich food called detritus.



## Salt Marsh Aquatic



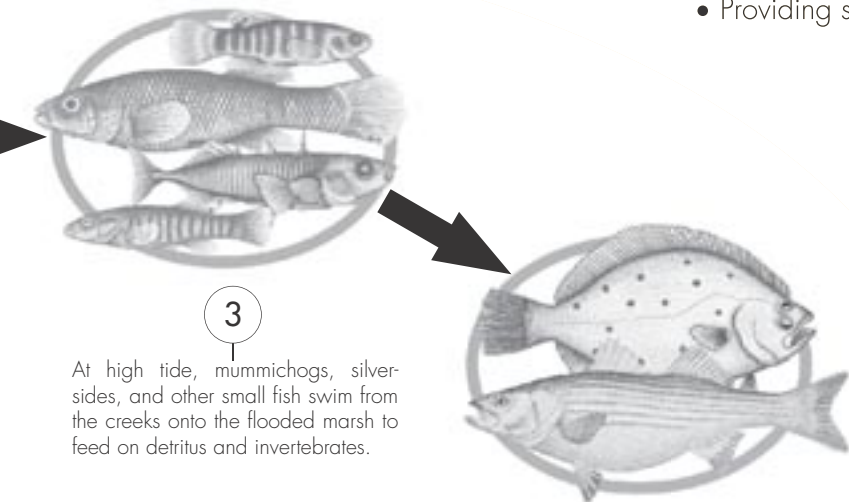
Salt marshes around the Gulf of Maine host distinct plant communities. Elevation, salinity, and ecological interactions influence plant distribution.

## Functions and values of salt marshes

- High primary productivity fuels food webs within and beyond marshes; acre for acre, salt marshes can produce as much plant material as intensively farmed cropland
- Source of food for shellfish and finfish, including commercially important species
- Nurseries for young fish, including commercially important species
- Filtering of sediments, nutrients, and contaminants
- Peat accumulates as sea level rises, building marsh elevations and storing carbon; this mitigates effects of climate change
- Habitat for birds, mammals, reptiles, and invertebrates
- Protecting upland property from storm erosion and flooding
- Popular for recreation, the arts, and environmental education
- Providing scenic vistas and open space

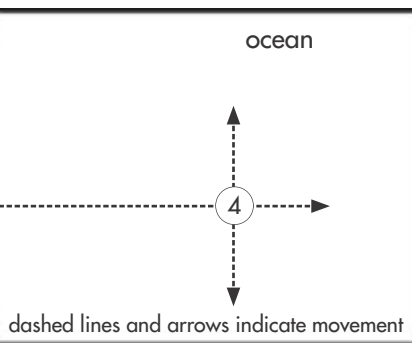


Wells, Maine photo: Peter Taylor



At high tide, mummichogs, silver-sides, and other small fish swim from the creeks onto the flooded marsh to feed on detritus and invertebrates.

Fished species such as striped bass and winter flounder eat small fish and invertebrates in the marsh and then leave the marsh, bringing nutrients to offshore food webs.



Small culverts (top) can be replaced with large culverts (bottom) to restore tidal flow to salt marshes.

photos: Massachusetts Wetlands Restoration Program (top), Jon Kochmar (bottom)

## Food Web Relay



Kennebunk, Maine photo: Ethan Nedeau

## Major human impacts and threats

- Restriction of tidal flooding with roads, railroad embankments, and undersized culverts
- Filling with dredge or other material
- Drainage of surface water by ditching
- Invasion by exotic forms of common reed (*Phragmites australis*)
- Increased freshwater runoff and pollution
- Conversion of diked marsh to upland pasture
- Development along upland edge of marsh and loss of vegetated buffer
- Climate change and rising sea level

# Monitoring salt marshes is essential for management

Resource managers and other coastal decision-makers around the Gulf of Maine need information on salt marsh condition and changes over time. Long-term change analysis is necessary to detect threats to coastal habitats, identify sources of problems, and develop management solutions. By their nature, salt marshes are dynamic places that change with the tides, weather, seasons, climate, and sea level. In addition, human impacts such as tidal restrictions, fill, and coastal development cause long-lasting disturbance. Long-term monitoring of salt marshes provides critical information about changes in marsh extent, distribution, and ecological condition; human impacts at the ecosystem level; outcomes of habitat restoration and other management actions; and early warning of new threats.

## Standardized monitoring protocol

Scientists from government agencies, academia, and non-government organizations have established a standardized protocol for monitoring salt marshes. The Gulf of Maine Salt Marsh Monitoring Protocol to assess habitat restoration efforts was designed in 1999 and refined in 2004. Its use has expanded beyond restoration projects to encompass all salt marshes. The protocol includes prioritized ecological indicators and data-collection methods to characterize geographic attributes, hydrology, soils, plants, and animal use.

## Role in habitat restoration

Evaluation is an essential part of any salt marsh restoration project. Monitoring for a minimum of one year prior to restoration activity provides a baseline of pre-existing conditions. After restoration, marshes should be monitored for five years or longer to assess changes. Pre- and post-restoration monitoring measures the effectiveness of restoration efforts and allows monitoring results to guide future management actions. Simultaneous monitoring of unimpacted marshes helps distinguish responses to restoration from natural change and provides information on the ecological condition of the region's salt marshes. In 2004, analysis of monitoring data from 36 restoration projects in the Gulf of Maine showed that the ecology of impacted salt marshes differed markedly from unimpacted sites and that habitat restoration can set degraded



Scientists are adopting a standardized protocol for monitoring salt marshes around the Gulf of Maine. photo: Ethan Nedeau

marshes on a trajectory toward recovery. These data provide a platform for launching an expanded regional monitoring program to evaluate the success of salt marsh restoration and provide information to manage and protect natural systems.

## Next steps: Regional network for monitoring salt marshes

The Gulf of Maine Council on the Marine Environment has developed standard methods for regional salt marsh monitoring that offer the potential for a cohesive, comprehensive view of salt marsh conditions. Adoption of these standards by existing monitoring programs around the Gulf of Maine could provide the basis for an extensive regional monitoring network. A regional monitoring program will facilitate effective management of salt marshes, healthier coastal waters, and sustainable economic uses of the Gulf of Maine.

*For more information about using the Gulf of Maine Salt Marsh Monitoring Protocol or joining the regional monitoring network, visit:*

[www.gulfofmaine.org/habitatmonitoring](http://www.gulfofmaine.org/habitatmonitoring)



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