



ACADIA NP • APPALACHIAN NST • BOSTON HARBOR ISLANDS NRA • MARSH-BILLINGS-ROCKEFELLER NHP • MINUTE MAN NHP
MORRISTOWN NHP • ROOSEVELT-VANDERBILT NHS • SAINT-GAUDENS NHS • SAUGUS IRON WORKS NHS • SARATOGA NHP • WEIR FARM NHS

Looking at What the Tide Brought In

The Northeast Temperate Network’s Rocky Intertidal Monitoring Program

Background

Rocky intertidal habitat lies between the high and low tide marks, and is regularly covered and exposed by the advance and retreat of the tides. Because they are repeatedly subjected to air and tossed to-and-fro by the incessant action of waves when they are underwater, the plants and animals that call this zone home must be hardy and adaptable. Even with the challenges rocky intertidal habitats propose, they are teeming with a high biodiversity of organisms, many of them at the edge of their physical and ecological tolerances, that have adapted to unique niche zones. These species are important food for birds and mammals that forage along the shoreline. Rocky intertidal communities provide important economic, scientific, educational, and recreational value for humans, but are also highly susceptible to human impacts including climate change, invasive species, pollution, and trampling.

Purpose and Scope

Monitoring intertidal ecosystems helps the National Park Service determine the level of negative impacts to rocky shorelines that are popular with park visitors in Acadia and the Boston Harbor Islands. These parks also contain several stretches of relatively untouched intertidal habitat that will be useful to monitor as a baseline and to track more indirect anthropogenic impacts (e.g. climate change). There have also been discussions about installing a liquefied natural gas (LNG) facility on the outer islands of Boston Harbor Islands. Long-term monitoring data is crucial for documenting the importance of habitats that development projects like this and others could impact.

Monitoring

The monitoring methods of the rocky intertidal program are comparable to the standard, or “core,” procedures of the Multi-Agency Rocky Intertidal Network (MARINe) that currently surveys target species at 80 Pacific coast sites including six national parks. This will facilitate the ability of managers and scientists to make comparisons and predictions across coasts. Following the recommendations of MARINe, the monitoring program focuses on target species (also called key or indicator species) that dominate particular zones, or living assemblages of organisms in rocky intertidal habitats. Focusing on these dominant, structure forming species is



Quadrat sampling for snails in Acadia National Park. NPS photo.

advantageous because most other members of the community rely on these species in some way. The nine target species and species groups are:

Knotted wrack seaweed
Barnacles
Echinoderms (esp. Forbes’ sea star, common sea star, and the green sea urchin)
<i>Fucus</i> spp. (e.g. bladder wrack seaweed)
Common periwinkles
Smooth periwinkles
Mussels (e.g. blue mussel)
Dog whelks
Red algae (especially Irish moss and carragheen)

Monitoring intertidal habitats in Acadia National Park, Boston Harbor Islands National Recreation Area, and the Maine Coast Islands National Wildlife Refuge (through a partnership with the U.S. Fish and Wildlife Service) allows NETN to determine whether changes are occurring across broad scales (hundreds of kilometers) and to measure a gradient of human visitation and management practices. The program monitors rocky shores across multiple scales (biological, ecological, and landscape) and across relevant disciplines (marine ecology, physical oceanography, and the study of climate change). This long-term, regional, interdisciplinary approach to monitoring

will vastly improve the NPS's ability to manage these resources.

Field Methods

Field methods for monitoring rocky intertidal zones include using **photoquadrats** to monitor the surface cover of permanently attached target species like seaweeds and barnacles. The monitoring crew takes photographs in the field and interprets them afterwards in the lab. **Point-intercept transects** extend from the low to the high intertidal zone (length varies by site) and are used to monitor changes in the range of species with respect to intertidal height. **Tide pool band transects** are used to monitor the number and size of sea stars and sea urchins within 2 meter by 10 meter areas. **Motile invertebrates** (those capable of moving around), including snails and limpets, are counted in every photoquadrat, and the recruitment of barnacles is also monitored at each site. **Water temperature** is measured once every hour using three "tidbit" temperature sensors that are deployed in the low intertidal (i.e. red algae) zone at each site. A series of overlapping photos, or **overview photographs**, are taken of each fixed plot, shot from the same location each time to place changes occurring within the plots into a broader spatial context. Information about the site-wide abiotic and biotic conditions is then recorded in a field log.



Tide pool transect searching for sea stars and urchins. NPS photo.



Species Spotlight:

Dog Whelk

Found in rocky, sandy, or shallow intertidal areas, dog whelks are small (1-inch long, 1/2-inch wide) snails distinguishable by their pointed spiral shells that can be fairly smooth or somewhat rough with raised beads along the ridges. Their shell color ranges from white to yellowish grey to dark reddish brown, and occasionally has brown spiral stripes.

Rarely solitary animals, whelks are most often found in groups of many individuals. Scavengers as well as predators, whelks will feed on dead fish but are also capable of drilling small holes in the hard shells of bivalves using what is essentially a tooth-covered drill - an organ called the radula. After drilling the hole, the whelk can feed upon the soft flesh of its prey by releasing digestive enzymes into it, liquidizing it, and then sucking up the "soup" with a mouth that is on an extensible proboscis. The blue mussel *Mytilus edulis*, found on rocky shores of New England, can fight back by attaching byssal threads (strong, silky fibers made from proteins and usually used to attach to rocks) to the snail which traps and exposes them to crab predation. When feeding on barnacles, the whelk will pry open the top plates rather than drill a hole.

The color and shape of dog whelks differ depending on the geographical location and the prey consumed. Those that eat mussels are predominately dark reddish brown, while whelks that consume barnacles are white to light yellowish-brown. Dog whelks living in high-energy environments, such as beaches, have smaller ridges than those living in marshes and inlets.

The dog whelk has been seriously impacted by the use of tributyltin (TBT) as a so-called antifouling paint on boats. The chemical can cause infertility and local extinctions of whelks. Stricter regulations in many countries have led to local recoveries, and recolonization and recovery of genetic diversity have been fairly rapid due to the animals planktonic larvae, which can travel considerable distances in ocean currents.



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More Information

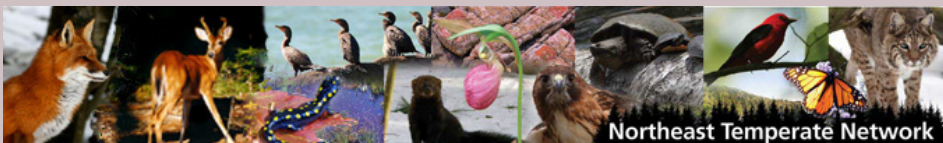
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Draft Protocol online at:
<http://science.nature.nps.gov/im/units/NETN/monitor/monitor.cfm>



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