Cape Cod National Seashore
Resource Brief

National Park Service
U.S. Department of the Interior

Natural Resource Program Center
Office of Inventory, Monitoring & Evaluation

Monitoring Pond Breeding Amphibians

Background

Cape Cod National Seashore contains an abundance and diversity of freshwater wetlands which support significant populations of amphibians, some of which are regionally rare. However, although all but one of the seashore's amphibians reproduce in wetlands, most species are terrestrial outside of the breeding season and live in upland habitats. Amphibians are ecologically important, often accounting for a large portion of vertebrate biomass and energy flow via predator-prey relations. Moreover, because most of the seashore's amphibian species have an aquatic larval stage followed by a terrestrial adult stage, they facilitate the flow of energy and nutrients between wetland and upland habitats, and affect the structure of animal communities in both. As awareness of the ecological role of amphibians is increasing, they face a variety of human threats in our region. These include loss of uplands to development, wetland draining and filling, pesticide toxicity, acid rain, road mortality, diseases, and introduced competitors and predators. The sensitivity of amphibians to these stressors makes them excellent indicators of environmental quality and natural landscape integrity.

To better understand the condition of amphibian populations and use that information to evaluate the integrity of the Seashore's freshwater and terrestrial habitats, monitoring of pond-breeding amphibians began in 2002. The program has two components: vernal pond egg mass counts and anuran (frog and toad) calling surveys.

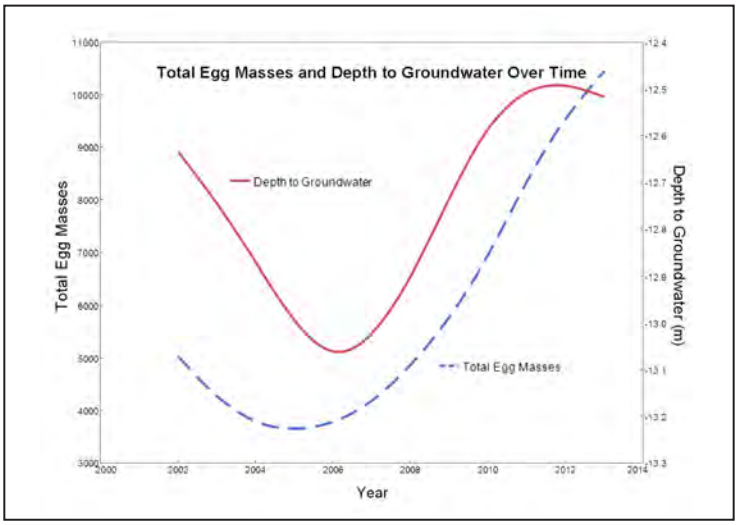

Figure 1. Total number of spotted salamander egg masses at 14 ponds from 2002 through 2013, and mean depth to groundwater in late summer 4-7 years previously. Late summer pond drying affects reproductive success in spotted salamanders and because spotted salamanders take about 5 years to reach sexual maturity, the size of the breeding population in a given year is influenced by previous years' groundwater levels.

Spadefoot toads breed in spring following heavy rains, and many are killed on local roads. photo: Brad Timm

Methods, Status, and Trends

Vernal Ponds Egg Mass Counts

Vernal ponds are small ponds that can go dry. Because of this they lack fish, and many species such as the spotted salamander and wood frog have evolved to take advantage of this. National Park Service (NPS) staff monitor the abundance of these two species by counting their egg masses in 40 vernal ponds each spring and collecting data on pond water quality and the landscape surrounding each pond. Results so far show that wood frogs are limited geographically to Eastham and South Wellfleet, and are uncommon compared to spotted salamanders. The lack of extensive forested wetlands, an important summer habitat for wood frogs, is likely the reason they are uncommon here. In contrast, spotted salamanders are more widespread and abundant. Their egg mass counts have increased significantly during the 2002 to 2013 period. Annual variation in the groundwater table and its effect on pond hydro-period appears to be the environmental factor driving spotted salamander trends (Figure 1).

Anuran Calling Surveys

Anuran calling surveys monitor the relative abundance, distribution, and habitat associations of breeding frogs and toads each spring and summer at a range of wetland types in the park. During these nighttime surveys, NPS staff listen for calling frogs and toads, and score how loud their choruses are. These data are used to generate an estimate of occupancy, i.e. the percentage of sites at which each species is likely present . Results so far provide a baseline of species distribution, abundance, and habitat associations.

continued

For example, spring peepers are widespread both geographically and among all habitat types, whereas pickerel frogs have only been recorded from kettle pond lakes, which occur near the Wellfleet-Truro town line. Ten seasons of data show modest year-to-year variation but, in general, each species' occupancy rate has remained relatively constant (Figure 2).

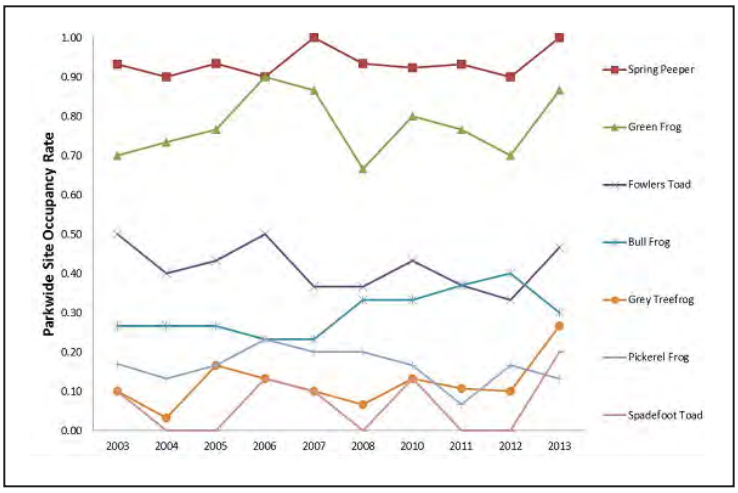

Figure 2. Annual variation in anuran site occupancy rates. Spring peepers are widespread, occurring in over 90% of CACO wetlands sampled, whereas spadefoot toads are estimated to occur in less than 20%.

Applications

This program has helped identify regionally significant amphibian populations in the Seashore, and the habitats that support them. For example, the eastern spadefoot toad, a sandy landscape specialist, has declined dramatically throughout the Northeast due to habitat loss and is a "Threatened" species in Massachusetts.

Cape Cod National Seashore is one of the few places left in the Northeast where it is still common. As the largest protected natural area on the Northeast coastal sandplain, the seashore's vast landscape of sand dunes and temporary wetlands is unparalled and plays a key role in preserving spadefoot toads in the region. This has lead to specific management actions, such as closing Province Lands road on rainy nights to minimize road kill.

Similarly, when compared to many other areas in the Northeast, the seashore's vernal ponds support more and larger spotted salamander populations. Numerous studies (e.g. Clark et al. 2008, Egan and Paton 2008) have shown that spotted salamander populations decline as urbanization, habitat fragmention, roads and traffic increase, and forest habitat and wetlands decrease.

Spotted salamanders are long-lived forest-dwelling amphibians that live most of their lives in underground burrows in well-drained soils. Because they still require aquatic habitats for reproduction, they migrate in early spring on rainy nights to vernal ponds . Some migrate up to 500+ meters, and on landscapes fragmented by roads, many are run over. NPS photo: Robert Cook

Thus, the abundance of spotted salamanders at the seashore suggests that the integrity of its forested landscapes and freshwater wetlands is relatively intact, and amphibian populations here appear to be tolerating the current level of development in and adjacent to the park.

Information on the seashore's amphibians has also been incorporated into many aspects of park planning, management, and environmental impact analysis and mitigation. Over the longer term, the data will be used to determine if there are changes in the abundance, distribution, and/or structure of amphibian populations and communities, and if so, what the likely causes are. Ultimately, given that an important reason for creating Cape Cod National Seashore was to help preserve Cape Cod's native wildlife, data on pond breeding amphibians will help in assessing our success in meeting that goal

Literature Cited.

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Egan, R.S. and P.W.C. Paton. 2008. Multiple scale habitat characteristics of pond-breeding amphibians across a rural-urban gradient. In R.E. Jung and J.C. Mitchell (eds.), Urban Herpetology, pp. 53-65. Herpetological Conservation #3, Society for the Study of Amphibians and Reptiles. Salt Lake City, UT.

Contact

Robert Cook
Wildlife Ecologist

Cape Cod National Seashore
99 Marconi Site Rd
Wellfleet MA 02667

ph: (508) 487-3262 ext. 0503
email: Robert_Cook@nps.gov