

Cape Cod National Seashore and Northeast National Parks and National Historical Sites

Patterns and processes for freshwater fish distribution in northeastern National Parks: inventory, monitoring, and a model of governing processes

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Project Overview

Project Justification. Freshwater fish provide recreation for both anglers and non-anglers. In addition, freshwater fish act as key predators in many aquatic food webs. However, hydrologic alterations, acid rain, nutrient loading from adjacent development, exotic fish introductions, and recreational fishing pressure in both freshwater and estuarine habitats complicate the management of these resources. Furthermore, comprehensive and current fish inventories for North Atlantic Region parks are lacking.

Project Goal. Thus, an urgent need exists for park-wide inventories to form the basis for long-term monitoring programs, to describe present trophic structure in aquatic habitats, and to identify problems facing the sustainability of the ecosystems that support freshwater fish communities.

1999 Field Season Goals. Because of the scope and complexity of the project, a preliminary field reconnaissance was required in 1999. With this first field season completed, the final sampling design for the project can be implemented in the 2000 field season. Below we discuss our progress in the 1999 field season.

The main objectives for the 1999 field season were to:

- Compile existing fish, biological, and abiotic information at all sites
- Identify effective freshwater fish sampling gear
- Conduct a preliminary physical and fish survey of aquatic systems at all 7 park sites (Cape Cod National Seashore, Roosevelt-Vanderbilt, Saratoga, Morristown, Marsh-Billings-Rockefeller, St-Gaudens, Weir Farm)

- Explore methods for quantifying differences in abiotic and biotic variables across systems that might influence fish community structure

Methods

(A) Compile existing fish, abiotic, and biotic information at all sites

- The 20 kettle ponds at Cape Cod National Seashore were chosen as the primary site to develop sampling methods and explore mechanisms for fish community structure.

(B) Identify effective sampling gear for freshwater fish

- The literature on freshwater fish sampling was reviewed.

(C) Conduct a preliminary physical and fish survey of aquatic systems at all 7 park sites

Cape Cod National Seashore

- In May, the kettle ponds were visited several times and the perimeters walked to increase familiarity with the systems.
- Starting in June 1999, all 20 kettle ponds were sampled in a standardized 2.5 d sampling plan using with all 6 gears described below.
- Because using all gear in all ponds required sampling over 50+ d, at two intervals we initiated another "snapshot" sampling scheme in which all ponds were sampled with a single gear, (beach seine) over 5 d. This allowed us to assess if seasonal effects occurred within the sampling period.

Roosevelt-Vanderbilt NHS, Saratoga, Morristown, Marsh-Billings-Rockefeller, St-Gaudens, Weir Farm)

- A 2-d visit was made to each NHS in October 1999.

(D) Explore methods for quantifying abiotic and biotic differences across systems

- Water quality data (temperature, pH, dissolved oxygen), and invertebrate prey (zooplankton, benthic invertebrates) were collected at all 20 kettle ponds in summer 1999.
- Depth profiles were taken in several ponds. These profiles were integrated into Arc-View 3-D analyst to view kettle pond morphometry.

Results

(A) Compile existing fish, abiotic, and biotic information at all sites

- Mike Carey, a MS student, and Alicia Norris, a technician have been hired to work on the project through the University of Massachusetts at Amherst.
- The 20 kettle ponds at Cape Cod National Seashore were visited several times in the winter/early spring of 1999. UMASS project personnel viewed sites. Access, previous water use, background on fish communities, and available water quality data were reviewed with park personnel. Prior NPS park reports were acquired for UMASS project files.
- UMASS project personnel met with Steve Hurley of the Massachusetts Division of Fisheries and Wildlife, Southeastern District several times in the winter/spring of 1999. Previous stocking and assessment reports were reviewed. A summary report was compiled that synthesized what we know about previous fish stocking and sampling.
- MASS GIS files were reviewed to assess if existent data coverages could be useful to this project.
- Based on these data (1-4), a plan for the first (1999) field season was compiled. The goal of the first field season was to conduct preliminary sampling of freshwater fish communities. These summary data was included in a field season proposal talk given to park personnel both at Cape Cod National Seashore and at University of Massachusetts in the spring of 1999.
- Existing reports from all NHS are being compiled.

(B) Identify effective sampling gear for freshwater fish

- Based on the literature review, we decided to use 6 gears to sample freshwater fish communities. This range of gear should cover all sizes of active and stationary fish in all habitats.
 - Fyke net: Fixed net that targets medium and large fish actively swimming in the littoral (inshore) zone (1 net set for 4-8 h in each of the kettle ponds and ponds at other NHS)
 - Minnow trap: Fixed gear that targets actively swimming small fish in the littoral (inshore) zone (2 traps set for 4-8 h in each of the kettle ponds and ponds at other NHS)
 - Beach seine: Active gear that targets swimming and stationary small, medium, and large fish in the littoral (inshore) zone (3 33 m beach seines undertaken in

each kettle pond twice during the summer of 1999 and at most other NHS)

Snorkel: Active gear that targets swimming and stationary small, medium, and large fish in the littoral (inshore) zone (1 33 m transect swum in each kettle pond)

Trammel net: Fixed net that targets medium and large fish actively swimming in the transitional zone between the littoral and pelagic littoral (1 net set for 4-8 h once in each of the kettle ponds and ponds at other NHS)

Vertical gill nets: Fixed net that targets medium and large fish actively swimming in the pelagic (5 nets of variable mesh set for 4-6 h in each kettle pond)

(C) Conduct a preliminary physical and fish survey of aquatic systems at all 7 park sites

Cape Cod National Seashore

- Major habitat types were identified and mapped.
- Fourteen fish species were collected (brown trout, rainbow trout, American eel, river herring, grass pickerel, smallmouth bass, white sucker, white perch, golden shiner, largemouth bass, brown bullhead, pumpkinseed sunfish, banded killifish, yellow perch; Table 1). The relative abundance and size distribution differed across ponds and across gear within and across lakes. These data are now being analyzed to understand patterns of fish abundance and determine how best to sample fish in the upcoming field season.
- A fish key is being compiled to aid identification of fish species at all NHS. UMASS personnel will use this key. Subsequently, it will be modified for use by park personnel and, if appropriate, for public interpretation.
- Preliminary sampling protocols have been prepared.

Roosevelt-Vanderbilt NHS, Saratoga, Morristown, Marsh-Billings-Rockefeller, St-Gaudens, Weir Farm)

During our 2 d visit to each site, we

- Discussed our approach with the natural resource specialist at each park
- Viewed all of the aquatic resources at each park
- Conducted preliminary physical and fish sampling
- Discussed a potential inventory, monitoring plan product with park personnel
- Reviewed upcoming anthropogenic and natural changes/disturbances that should be considered in any fish

monitoring plan (changes in vegetation, beaver, deer, dam renovations, etc)

- Based on our visit, we identified the following types of habitats that require habitat-specific sampling.

Habitat: Small-moderate streams
Sampling method: Stream electrofishing
NHS: Roosevelt-Vanderbilt, Saratoga, Morristown, and St-Gaudens

Habitat: Impoundments - low/no flow
Sampling method: Fyke, minnow, seine
NHS: Saratoga, Marsh-Billings-Rockefeller, Valkill (ROVA), St. Gaudens, Weir Farm

Habitat: Impoundments - higher flow
Sampling method: Fyke, minnow, seine
NHS: Roosevelt-Vanderbilt (FDR, Vanderbilt)

Habitat: Natural ponds (kettle/farm)
Sampling method: Fyke, minnow, seine
NHS: Cape Cod National Seashore, Saratoga, St. Gaudens

- For the Cape Cod National Seashore, in 2000, we propose to again sample the littoral fish community in all ponds using the above-described methods. In addition, we are investigating the possibility of sampling more intensively to assess (a) factors related to across-system variability in yellow perch populations, (b) variation in timing of ontogenetic niche of young-of-year largemouth bass across systems, (c) sources of variability in pumpkinseed size-specific growth across systems, and/or (d) influence of different prey communities on largemouth bass growth. Sampling plans for these intensive sampling plans are being developed and will be presented to and evaluated by UMASS and park personnel for scientific rigor and practical application.
- For the other NHS, in 2000, we plan to (a) physically map all habitats, (b) classify habitats into functional groups, (c) sample a representative group of all habitats to produce a habitat-specific inventory, (d) discuss the sampling protocols and results with park personnel, and (e) modify the monitoring plan to incorporate natural resource managers comments on feasibility and usefulness.

(D) Explore methods for quantifying abiotic and biotic differences across systems

- Water quality data (temperature, pH, dissolved oxygen), invertebrate prey (zooplankton, benthic invertebrates) was collected at all 20 kettle ponds.
- Depth profiles were taken in several ponds. These profiles were integrated into Arc-View 3-D analyst to view the morphometry of the kettle ponds.
- In 2000, this information will again be collected and related to fish community structure.

Volunteer Involvement and Partnerships

- Several park volunteers helped with fish and other aquatic data collection.
- Sampling plans were discussed with the Gull Lake Association.

Partnerships

- Massachusetts Cooperative Fish and Wildlife Research Unit (USGS-BRD, University of Massachusetts-Amherst-Department of Natural Resource Conservation, Massachusetts Division of Fisheries and Wildlife, Massachusetts Division of Marine Fisheries, Wildlife Management Institute).

Educational and Interpretive Products

- Interpretive tools related to fish identification and habitat use will be developed.

Public Information Products

Articles

- Article in the Cape Codder

Scientific Publication Plans

- Based on the data we plan to collect and analyze in 2000, a number of peer review papers will be prepared for scientific journals and presented at scientific meetings.