

Post-Secondary Research Opportunities on Brook Trout (*Salvelinus fontinalis*) at the Black Rock Forest

Background

Brook trout (*Salvelinus fontinalis*) are a native char found throughout the Northeast including the streams of Black Rock Forest. Over the past several decades this important local species has come under threat from human-induced landscape changes which have caused populations in our area to become greatly diminished. In a survey conducted by Trout Unlimited in 2005 it was found that brook trout are now found in less than 50% of the streams which contained them prior to European settlement.

Several factors have led to the decline of brook trout over the past several decades. The most significant in our region are habitat loss/fragmentation caused by agricultural expansion and urban development (e.g., addition of impassable culverts), and competition with non-native trout species (brown (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*)). This decline in population size and abundance along with the desire to increase educational opportunities at the Black Rock Forest has led our Forest Manager, John Brady, to institute a brook trout release program with elementary school children.

Efforts are currently underway at the Forest to better understand brook trout habitat requirements, and the current status of brook trout in our own streams. This allows for a variety of opportunities for both undergraduate and graduate students to conduct sound scientific research in the fields of restoration ecology and conservation biology. The most relevant questions we are hoping to address within the next year include: What is the genetic make-up of BRF brook trout and surrounding areas? Is the introduction of hatchery fish increasing or decreasing genetic diversity? What is the success of our introduction efforts to the streams? What is the population structure of the BRF population? What areas in BRF are the best areas for brook trout? Which areas are best for focusing restoration efforts? Which areas in the entire region (i.e., including Harriman State Park, Palisades State Park, and West Point) are best for brook trout and in which areas should we focus restoration efforts?

Population Genetic Structure

Recent genetic work has shown brook trout to be incredibly genetically diverse, with even geographically close populations showing highly distinct genetic structure (King 200?). Our current efforts in brook trout restoration include the release of hatchery-raised fish through a long-term education program here at the Forest. In order to ascertain the effectiveness of this program, we need to know the genetic structure of both the native population and the introduced fish. The introduction of non-native strains can be harmful to native populations; however, there is also the possibility that with such low numbers introductions could also be supplying greater genetic diversity.

These questions need to be addressed in order for us to more accurately assess the Black Rock Forest brook trout population.

Students performing this work would accompany researchers performing population assessment surveys during the spring in order to collect samples for genetic analysis. Students interested in this project should consider applying to our small grants program for funding of genetic research (applications for small grants are due Feb. 1, 2010).

Population Viability, Age structure and Survivorship

As stated above, through a long-term education program (Brookies at Black Rock and Trout in the Classroom), Black Rock Forest staff has been stocking our rivers with young brook trout during the spring and summer months. However, to date we have no record of survival rates of these introductions. We know approximately how many fish are released at each site, and the fall survey work conducted in 2009 gives a secondary number for fish survival. However, it is important to know the overwinter survival rate of these fish as well. Therefore, we will need several students to help us perform spring (pre-release) fish surveys during the 2010 field season. This will be a great opportunity for students to learn electrofishing and seine netting techniques along with fish identification. The data gained from this work will be used to generate introduction survivorship and could also be used to generate life-tables for age structure and population viability analyses or other ecological concepts. This data coupled with genetic data could also provide a more in-depth understanding of how the introduced and native strains are surviving in our streams. This work could be performed by 2-3 undergraduate or graduate students for thesis projects. Most of the data would be collected during the spring; however, work could also be done in an additional fall assessment as well.

Habitat Assessment and Priority Setting

A crucial component to restoration is understanding how suitable an area is for the species of interest. Looking across the landscape at a large scale will allow us to identify areas of conservation concern (areas with high suitability and high threat) and areas in which to focus restoration effort (areas with low threat and moderate suitability). This work will involve on the ground assessments of stream water quality and riparian area (stream banks) habitat quality. Students will be traveling throughout the Hudson Valley region taking measurements such as stream flow, water temperature, air temperature, turbidity, pH, stream bed composition, riparian buffer width, riparian species composition and many more. All of this data can then be compiled and, using the Fish and Wildlife Service's Habitat Suitability Index for Brook Trout (Raleigh 1982), students will determine the degree of suitability for different areas in the region. This information could then also be integrated into a GIS database in order to visualize the data and assess areas for concern and restoration efforts.

We are looking for approximately 2-3 students to work on this project. Students performing this work will be afforded lodging at the Black Rock Forest during the approximately 2 months it would take to complete these surveys. They would also be awarded a stipend of \$400/week for compensation. Students with access to a car are preferred as this position will require a great deal of travel around the region. This is a great opportunity for either an undergraduate or master's thesis project and will allow students to gain experience in a variety of environmental measurements and techniques and complex data analysis.