National Park Service
U.S. Department of the Interior

Rocky Mountain National Park
Continental Divide Research Learning Center

Fish Effects on Zooplankton

The Question: Assess the impacts of past fish introductions on zooplankton communities.

A cyclopoid copepod zooplankton species found in high-elevation lates at RMNP. The large size of copepods encourages high predation by trout species.

The introduction of fish into alpine lakes can have dramatic effects on alpine lake ecosystems particularly because fish, as a new top predator, influence the size, abundance, and kinds of zooplankton present. Lakes above timberline in Rocky Mountain National Park were historically fishless until stocking began in the late 19th century. While all stocking ceased in 1968, many high altitude lakes in the park presently still maintain populations of Greenback cutthroat and non-native fishes such as Rainbow trout.

Different zooplankton species have very different ecological roles in the lake, thus changes in zooplankton community structure impact how the aquatic system functions. The primary goal of this study was to establish a baseline understanding of zooplankton communities in the park and to assess the effects of fish stocking and removal. Assessments of the effects of fish introductions and removal are necessary to understand and restore natural ecological processes in alpine lakes.

The Project: Survey peak summer zooplankton populations and other lake parameters at as many lakes as possible.

Plankton tow used to collect zooplankton.

Tobin Lafrancois of the St. Croix Watershed Research Station sampled 34 lakes at different elevations and in different drainages on the park's east side in 10 days during July 2005. They chose lakes based on a number of criteria including their importance to fish management and importance to visitors. The question of whether and to what extent zooplankton communities respond to fish removal was addressed by comparing lakes with fish, lakes that have never had fish, and lakes that were stocked but fish have naturally died out since stocking ended. The investigators sampled zooplankton with a plankton tow net then identified and counted them on a microscope. They analyzed zooplankton data in terms of abundance, biomass, and biodiversity. Because elevation, temperature, conductivity, and productivity are also key determinants of zooplankton community structure, these parameters were measured to separate the effects of fish presence from the effects of other lake variables.

The Results: Fish introductions negatively impacted zooplankton community structure.

An exotic fish at RMNP, the Rainbow trout.

The research findings indicate that fish presence drives zooplankton biomass down and changes species composition but does not significantly affect overall zooplankton diversity or mean numbers of individuals. Lakes with fish tend to have a diverse population of smaller rotifers and lower numbers of larger zooplankton (e.g., cladocerans or copepods). On the other hand lakes without fish support a greater diversity, abundance, and biomass of cladocerans and copepods. Bluebird Lake with an impressive natural barrier to fish movement maintains the biggest zooplankton population found in the survey. Two lakes, Bear and Pear, stood out as having very diverse and somewhat larger zooplankton populations than other lakes with fish possibly due to the lower elevations of these lakes.

In general zooplankton communities in lakes recovering from stocking more closely resembled communities in naturally fishless lakes than those in lakes with fish. These results indicate that addition of fish to naturally fishless lakes impacts the zooplankton community but once fish are no longer present park lakes return to more natural ecological conditions.

This summary is based on published, peer-reviewed and/or unpublished reports available at the time of writing. It is not intended as a statement of park policy or as a definitive account of research results.
For more information on the park's research program, see www.nps.gov/romo Written by: Colleen Flanagan Date: March 2006 Updated: January 2008
Top two photos courtesy of Toben Lafrancois, St. Croix Watershed Research Station, Science Museum of Minnesota Fish photo: NPS-RMNP