



**The Goodwin-Niering Center for Conservation Biology and
Environmental Studies, Connecticut College**

**Summary of paper presented at the conference:
Saving Biological Diversity:
Weighing the Protection of Endangered Species vs. Entire Ecosystems
April 6 – 7, 2007**

Restoring the Atlantic Salmon (*Salmo salar*) to New England

Presented by Stephen Gephard

Summary by Sarah Ayres 09

Stephen Gephard spoke at the conference about the Connecticut River Fisheries Program. As the overseer of the DEP Inland Fisheries Division's Diadromous Fish Program, he is an expert on the life cycle of *Salmo salar*, or the Atlantic salmon. Gephard has spent over 28 years studying diadromous fish species, a term that refers to fish that migrate from salt water to fresh water in order to spawn. His talk focused on Atlantic Salmon restoration research being conducted on the Connecticut River and specifically at the Rainbow Fishway on the Farmington River.

Gephard opened with an overview on the life cycle of a typical salmon. They emerge from the gravel as fry, which generally stay on the breeding grounds except to find food. As parr, the juvenile salmon spend their last moments in freshwater, preparing for the Atlantic Ocean. When parr develop into smolt, they begin their journey to the Atlantic; this is known as the migratory phase. A salmon typically spends between one to four years in the ocean. Sometime between October and November an adult salmon will make its way back to the breeding grounds.

Historically, Connecticut has supported fish runs (the annual migration) in several rivers, including the Housatonic and the Connecticut Rivers. Now however, many of

these runs are closed because Dams block the salmon from its habitat. Without these critical migratory routes, the Atlantic salmon is not able to spawn. In the early 1800's, the Atlantic salmon in Connecticut went extinct. In the past, there have been efforts to re-introduce the salmon to the Connecticut River, but they have experienced little to no success. The Connecticut River Atlantic Salmon Commission was formed in 1983, and has successfully restored salmon to the Connecticut River. It has tried to address the needs of Atlantic salmon migration through tributary restoration, raising salmon in hatcheries, genetic management, and fry stocking.

Next, Gephard discussed research and restoration projects at dams around Connecticut. Dams are a major impediment to Atlantic Salmon migrations. Because a dam crosses a river, it can block the only route for salmon to reach certain breeding areas. When a dam is built, the Connecticut River Atlantic Salmon Commission have to try to find an alternative path for the salmon. One common solution is to build a fishway, or fish passage. This is a ladder-like path on the side of the dam, made out of steps the salmon can leap from into the water on the other side. Eventually the salmon make their way up the ladder and past the dam and are able to proceed to their breeding grounds. A dam was built on the Farmington River in Windsor, blocking the migration of the salmon back to their historic spawning grounds. The Rainbow fishway cuts through the dam, and creates a sort of ladder that the fish can climb, eventually making their way past the dam and to their breeding grounds. Fishways are a major part of the Atlantic salmon restoration project because if the salmon do not reach their breeding grounds, they do not spawn, and then the Atlantic salmon population does not grow.

Every salmon that passes through Rainbow Fishway in Windsor is trapped and spawned. The salmon are not allowed to spawn naturally because there is no way to ensure that every salmon successfully spawns. Because of predators or disease there is a high chance that the salmon may die before they reach the breeding ground. In addition, if they successfully reach the grounds, they may not be able to find a salmon of the opposite sex. At a time when population numbers are very low, artificially spawning is an appropriate way to ensure a healthy future for the salmon.

The research Gephard and others are conducting has led them to become experts on genetics. Genetics are paramount to salmon restoration efforts. Salmon always return to the same breeding grounds and this makes the salmon run on different rivers reproductively isolated from one another. This results in the development of distinctly adapted genetic strains, unique to certain rivers. When a run is blocked by the creation of a dam or some other human barrier, it could be disastrous for that strain. The loss of just one of these individual salmon strains is a serious blow to conservation biology efforts. A good deal of the Connecticut River Atlantic Salmon Commission's efforts for salmon restoration of the salmon runs has been focused around the re-creation of original strains. One way of doing this would be to breed only the biggest, healthiest, best salmon in an attempt to create the *ultimate* salmon, but that would not produce natural salmon, which is the ultimate goal of the Commission. Instead, they take a fish with a strain containing lots of genetic variability and breed it with a fish with similar traits. Then natural selection takes over. Genotyping has been developed as a method of breeding the returning fish year after year. Each salmon that comes through the Rainbow Fishway for example, receives an electronic tag. This identifies the fish, and its genetic strain, so that

the next time it comes through, hatchery managers can record its survival. This technology lets the scientists know which strains are the most successful, and which are not. With this information, it is easy for the managers to find the mates who will likely produce healthy offspring. By predicting the genetics of their offspring, hatchery managers are able to identify which new salmon came from which parents. By recording the number of returns from a specific set of strains, scientists evaluate which tributaries produce the most effective families. It also allows the hatchery managers to maximize genetic diversity by recording which strains have already been mated with other strains in the past. Once hatchery managers spawn the salmon coming through a fishway, they typically raise the eggs until they become fry. At that point, volunteers from all over the area take the fry and release them in rivers according to their genetic strain. This is one of the Connecticut River Atlantic Salmons Commission's restoration efforts called fry stocking.

Fry stocking is a region-wide effort to release salmon fry into the wild. The hope is that the salmon will live in the rivers where they are released for two years until they become smolt and make their way to the ocean. Then, when it is time, they will return to the very spot they were released to spawn. The best place for fry stocking is shallow, clear, cold water with a moderate current and lots of gravel or cobble. The Farmington River, a tributary of the Connecticut River, has this type of environment and is therefore an important place for salmon to spawn. Fry stocking is something that everyone can participate in, if you are interested in volunteering go to

<http://www.fws.gov/R5CRc/Help/fry.html> for more information.

From this research, and efforts to restore the Atlantic salmon to the Connecticut River, Gephard has learned much about biodiversity and the conservation of a species. He explained that although the Connecticut River Atlantic Salmon Commission had put in a great deal of time and effort, there were still years with unexplained declines in numbers. It has not been enough to only protect and monitor the salmon while they are in the rivers. Because they are a diadromous fish, they spend their life in two separate habitats, and both need to be protected. Gephard argued that The North Atlantic Conservation Organization needed to become involved in restoration efforts as well in order for them to be successful. Because the Atlantic Salmon is a migratory species, conservation needs to be at multiple scales. Gephard reminded us that these conservation efforts do not produce results over night; this takes time. Recreating a genetic strain is a slow process which takes time and patience. The most important lesson about species restoration that Gephard mentioned was that it cannot focus on one species alone. In order to preserve one species it is necessary to consider all other species and environments it will come in contact with during its life cycle. It is an effort that needs to be considered from an ecosystem conservation point of view in order to be successful.

Online Source: U.S. Fish & Wildlife Services, Connecticut River Coordinator's Office
<http://www.fws.gov/R5CRC/index.htm>