May 1, 2007

MEMORANDUM TO: Eric Benner, Branch Chief
Environmental Branch A
Division of License Renewal
Office of Nuclear Reactor Regulation

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FROM: Nathan Goodman, General Scientist ***/RA/***
Environmental Branch A
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SUBJECT: TRIP REPORT FOR TRAVEL TO VERMONT, MASSACHUSETTS, AND NEW HAMPSHIRE

On November 14 – 17, 2006, Dr. Michael Masnik and Mr. Nathan Goodman of the NRC staff traveled to Turners Falls, MA, Westboro, MA, and Concord, NH. The purpose of this trip was to: 1) gain information about the upstream and downstream passage of fish, especially American shad and Atlantic salmon in the Connecticut River, specifically looking at Turners Falls dam; and 2) to speak with Federal, State, and local government officials on anadromous fish resources in the Connecticut River.

Meeting with Alex Haro of Conte Fish Lab

Dr. Alex Haro works at the Conte Fish Lab run by the U.S. Geological Survey. The Conte Fish Lab is in Turners Falls, MA, about a quarter mile above the Cabot hydroelectric dam along a power canal created for the dam.

NRC staff took a tour of the fish lab including the fabrication facility, as well as the experimental fishways set up when the fish are spawning.

Dr. Haro began by describing the different parts of Turners Falls and the location of all the fish ladders. There are three fish ladders at Turners Falls. These ladders are called cabot, spillway, and gatehouse. At the upstream end of Turners Falls, where the Turners Falls dam is located, there is an entrance to a canal on river left. On the far left of that canal is the gatehouse fish ladder, named because the fish ladder is in close proximity to the canal gatehouse. The gatehouse fish ladder allows fish to exit the Turners Falls canal from the Connecticut River. About 1/5 mile downstream of the mouth of the canal (located at the gatehouse) is the exit of the second fish ladder called spillway.

This fish ladder begins on the Connecticut River at the base of the spillway from Turners Falls dam and ends on the Turners Falls canal 1/5 mile downstream of the gatehouse. At the downstream end of the Turners Falls canal is the cabot hydroelectric dam, and the location of the third fish ladder, called cabot. This fish ladder runs from the bottom of the hydroelectric dam on the Connecticut River to the canal, just upstream of the hydroelectric dam.

Cabot fish ladder is the downstream fish ladder and the first attraction flow (a flow of water over a spillway providing fish an attraction to enter the fish ladder) encountered by fish moving upstream in the vicinity of Turners Falls, MA. It is the most common ladder for migrating fish including American shad (*Alosa sapidissima*) to use. Only 7-10% of the American shad that enter cabot fish ladder during upstream migration reach the top. Dr. Haro stated that the percentages could reach 25-30% by improving the ladder design. Of that 7-10% that ascend the cabot fish ladder, only 15-20% of those clear the gatehouse fish ladder, returning back to the Connecticut River above Turners Falls. Only 1.5-2% of all American shad that enter either cabot or spillway fish ladders clear gatehouse, returning to the Connecticut River above the falls. In order for a fish to be considered to have ascended Turners Falls, the fish must travel through the counting window at the gatehouse ladder. All three ladders have counting windows.

According to Dr. Haro, most American shad that enter the fish ladder at cabot fail to ascend the ladder. Many get impinged, others fail to ascend the ladder before tiring, and only a few that clear gatehouse spawn.

There is a design under consideration to install two fish elevators, one at cabot and one at gatehouse. The spillway fish ladder will not be modified since most of the fish use the cabot fish ladder.

There has been significant variability year to year, but the 1.5-2% passage success over Turners Falls is thought to remain relatively constant for American shad.

Initial estimates when the fish ladders and elevators were constructed on the Connecticut River were to have 2 million American shad annually, however Holyoke, the downstream most fish lift has never counted more than 600,000 individuals.

The majority of Connecticut River American shad in the ocean are found in the Bay of Fundy, Nova Scotia, Canada. There are currently no studies on population estimates of American shad in that bay.

Window counts are currently being done for American shad at Vernon Dam during the upstream migration period for American shad. The Conte laboratory has not investigated fish passage at Vernon dam. There are no fish counts done at night at Vernon dam because the gate is closed and research shows, according to Dr. Haro that American shad do travel upstream at night. The overall efficiency at Vernon dam is believed to be about 40-50 percent.

According to Dr. Haro, American shad passage could potentially improve with increases in ambient temperatures.

According to Dr. Haro, American shad that have been tagged and handled before returning to the ocean have shown very low mortality rates and the lab has experienced good returns from the ocean, showing that some handling of the fish during research does not necessarily increase mortality.

Conte Lab usually studies and tags about 1000 fish per season.

Meeting with Caleb Slator of Massachusetts State Fish and Wildlife

Mr. Caleb Slator works for the of Massachusetts Division of Fisheries and Wildlife. Mr. Slator is also a member of the Vermont Yankee Nuclear Power Plant Station (VYNPS) Technical Advisory Committee. Mr. Slator reviews annual ecological monitoring data and is reviewing the utilities request to raise the temperature one degree.

Unlike Dr. Haro, Mr. Slator believes that upstream movement of American shad decreases significantly at night.

Mr. Slator discussed the Connecticut River Atlantic Salmon Commission (CRASC) activities.

Mr. Slator reports that there are no American shad hatcheries on the Connecticut River watershed, so the American shad have returned to the river on their own.

Mr. Slator reports that the blueback herring (*Alosa aestivalis*) population has experienced a steep decline in numbers in the Connecticut River.

Mr. Slator believes that the American shad populations are decreasing throughout their range and particularly in the Connecticut River. He believes that the Connecticut River population is adversely affected by increase in striped bass (*Morone saxatilis*) in the Connecticut River which prey on the returning adult American shad. Work is ongoing at the Univeristy of Connecticut to determine the relationship, if any between the increase in striped bass in the lower Connecticut River and decreases in American shad by analyzing population trends of both species in the lower Connecticut River.

Connecticut River Atlantic Salmon Commission (CRASC) Meeting

NRC staff attended a periodic meeting of CRASC. CRASC is a Congressionally recognized interstate organization related to the restoration of Atlantic salmon (*Salmo salar*) in the Connecticut River. The meeting was held at 10:00 am at the Conte Fish Lab in Turners Falls, MA, on November 16, 2006.

During a discussion on genetic analysis, the members of the meeting concluded that genetic markers can be specific not only to the river of origin, but to the tributary of the river in which they were hatched.

The members reported that only four salmon cleared the fish ladder at Vernon dam during 2006.

When the members discussed fish passage during the 2006 migration season at Turners Falls, it was reported that improvements to the gateway fish ladder are still planned to increase efficiency. A fish elevator is still many years away.

The members stated that in the spring of 2006, 1600 adult American shad were collected from the Holyoke fish elevator and released upstream of Turners Falls, including Vernon pool past Turners Falls.

Mr. Slator stated that the number of salmon smolts and fry placed into the river do not correlate to the number of adult returns. He estimated that for every ¾ million fry released in the Connecticut River one adult returning Atlantic salmon is taken from the Holyoke fish elevator.

The members stated that in North American rivers, there is a slight upward trend for returns of Atlantic salmon over the past few years.

At the last meeting (February 2, 2006), it was concluded that there was a need for better Atlantic salmon habitat and a need for better fish passage through the dams.

The members concluded that all of the states that have a stake in the Connecticut River watershed have to act collectively to vie for resources to continue and expand the restoration effort.

Meeting with Don Traxler and Bob Stella of Northeast Utilities

NRC staff toured the Turners Falls facility including all three fish ladders, the gatehouse, the cabot hydroelectric dam, and the spillway at the Turners Falls dam. The staff also toured all three fish ladder counting stations, and most of the canal. The staff were told of all the different organizations that use water and have water rights to the canal including two hydroelectric power plants, the Conte Fish Lab, and one paper mill.

According to utility employees, the distance the fish must travel in order to complete the fish ladder passage) at the three fish ladders are as follows: cabot – 600 feet, spillway – 400 feet, gatehouse – 300 feet (estimated).

According to utility employees, 20 million dollars was spent to originally build the ladders.

Meeting with John Warner of the U.S. Fish and Wildlife Service (FWS) Stationed in New Hampshire

John Warner works for the FWS based out of Concord, NH, with an interest in anadromous fish species on the Connecticut River.

Mr. Warner stated that there are benefits for American shad to travel upstream as far as possible for more food, less crowding, and less predation. Atlantic Salmon have an internal desire to seek out new habitat.

Mr. Warner concluded that if the fish lifts and ladders were more “shad friendly,” there would be a lot more American shad traveling past Vernon dam and VYNPS.

Mr. Warner concluded that American shad do not really seem to like artificial fish passage because they are easily “spooked” and become disoriented in relation to the fish passage system for both fish elevators and fish ladders.

Mr. Warner stated that because such a high percentage of the fish that ascend Turners Falls also ascend Vernon dam ladder, it is unlikely that the heated discharge from Vermont Yankee is adversely affecting upstream migration of adult shad. Mr. Warner continued by stating that he does not feel American shad are a very temperature dependent fish. Mr. Warner stated however, that temperature increases could lead to early and accelerated spawning in American shad.

Mr. Warner expressed his opinion that it is highly unlikely that the VYNPS is the cause of the decline of American shad in the Connecticut River.

Mr. Warner also hypothesized that the increase in striped bass predation in the lower Connecticut River is likely causing a decrease in American shad. He also stated that there is a large striped bass population in Long Island Sound and during both the spawning migration and the migration of juveniles, American shad have to traverse Long Island Sound to get to the Atlantic Ocean. This could potentially be an explanation for the decline in American shad returns to the Connecticut River.

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