Build It and They Will Come

Fritz Rohde
2000 Trinity Avenue,Wilmington, NC 28411
fritz.rohde@gmail.com

Yes, it is a cheesy title ripped straight from the movie "Field of Dreams" and no, this story isn't about baseball or Iowa, but rather about the tenacity and perseverance of the American Eel (*Anguilla rostrata*).

Many studies have indicated that American Eel populations are declining with fishing pressure and habitat loss implicated as contributing factors (Greene et al. 2009). Among the habitat threats are blockage of stream access, particularly by large hydroelectric dams on main-stem rivers such as the Roanoke Rapids Dam located near the Fall Line at river mile 138 on the Roanoke River in northeastern North Carolina (Figure1). This dam was built between 1953 and 1955 on the site of a much older dam that was constructed circa 1891-1901 which partially blocked migration of diadromous fishes during low flow years. The current dam measures 3,050 feet in length and a height of 72 feet (Figure 2) thus totally blocking fish from any upstream movement. Historically, the American Eel occurred up into the headwaters of the Roanoke River, but gradually disappeared from those areas after the series of main-stem dams were constructed (Jenkins and Burkhead 1994).

Brief history

By 1900 dam building for hydropower had become a very important topic for Congress and industrialists of the time. President Teddy Roosevelt was a strong proponent of hydropower development, but at the same time insisted that the rivers, fisheries, and environment should be held in trust for the public. He insisted that hydropower projects be licensed by the government for a definite period of time

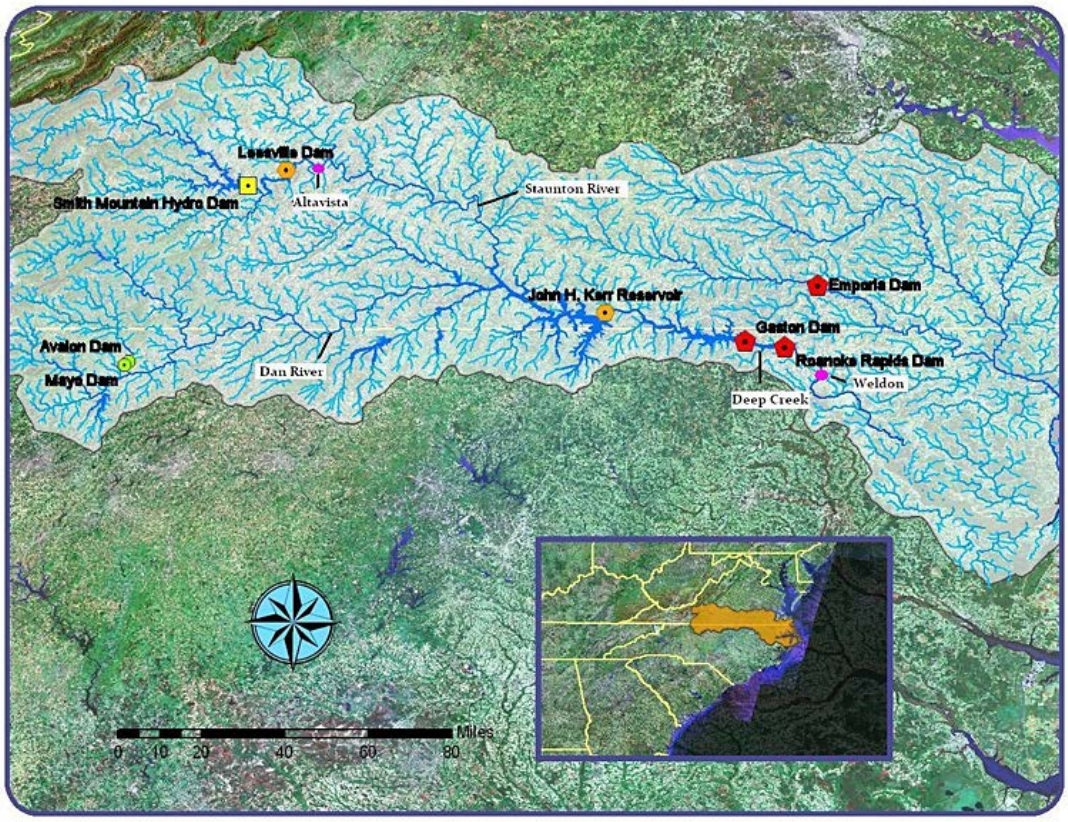


Fig. 1.
River Basin, North Carolina and Virginia.

Fig. 2.
Roanoke Rapids Dam, Roanoke River Halifax County, NC. Tailrace is in foreground.

(usually 30 to 50 years), allowing for changes in the public interest and that fish passage must be provided. The Federal Power Commission was created in 1920 through the Federal Power Water Act, the precursor of the Federal Energy Regulatory Commission (FERC), which was created in 1977. In 1992, Congress passed the Energy Policy Act, which reaffirmed that mandatory fish passage can be prescribed by either the Department of Interior (Fish and Wildlife Service) or Department of Commerce (National Marine Fisheries Service). All non-federal hydroelectric projects must be licensed by FERC. Part 1 of the Federal Power Act, Section 18 states: "The Commission shall require the construction, maintenance, and operation by a licensee at its own expense of such fishways, as may be prescribed by the Secretary of Commerce or the Interior."

Back Almost to the Present

The license for Roanoke Rapids Dam and its sister, upstream dam, Gaston Dam, expired in 2001. The owners, Dominion Generation (Dominion) filed an application for relicensing in late 1999. After several years of negotiations a settlement was reached to help restore diadromous fish in the Roanoke River Basin. Although nine fishes are targeted, the initial management objectives are focused on the American Eel and American Shad, the two species that historically ascended highest up in the basin. Efforts to restore the shad will be discussed in a future article.

The first four years (2005-2008), biologists from Dominion surveyed the distribution of elvers and yellow eels downstream of Roanoke Rapids Dam. Nine eel traps (Figure 3) were operated weekly or biweekly along the edge of the dam in the bypass section of the river; one trap was in the tailrace. The bypass normally receives between 325 to 500 cfs of water. Most of the river exits through the powerhouse and tailrace. Eels were measured, fin clipped, and released back into the river. A total of 17,206 eels was caught in the bypass traps in 2008 with only 3 recaptures. In 2009, 11,682 eels were collected; of these, a significant portion died when an unexpectedly high run coincided with warm conditions in early August and the eels became crowded in the collecting buckets. A total of 1,212 of the surviving 3,225 eels was implanted with coded wire tags. As part of the agreement reached between Dominion and the resource agencies, the eels trapped in 2009 were transported and released in Deep Creek, a tributary of Roanoke Rapids Lake, to look at dispersion, carrying capacity, etc.

Fig. 3.
Eel trap similar to those set along base of the dam.

Build It

One of the settlement agreements required Dominion to build an operational eelway by 2009 but because of unavoidable problems, they were not able to construct and install it until 2010. One of the reasons for using nine traps along the base of the dam in the early years was to determine the optimal location(s) for the eelways. Based on their studies, it was decided to build two eelways – a 99-ft long one on the north side of the dam (Figure 4) and a 27- ft long one on the south adjacent to the tailrace (Figure 5). They both have a 45° incline and the eels fall into a container after ascending the eelway (Figure 6, 7). The containers are generally sampled three times a week with the eels transported upstream – half to Deep Creek and half to Roanoke Rapids Lake. There is an attractant flow at the mouth of the eelway. A material especially designed for eels was placed in the bottom.

And They Will Come (and Come)

So do they work? Everyone who has been involved with this project is stunned in how successful these eelways have worked. Based on the previous study with the nine traps along the base of the dam, we anticipated seeing upwards maybe to 100,000 eels. Were we ever wrong! The south side eelway was operational on March 1 2010 and

Fig. 4.
North side eelway – white arrow points to entrance. Attraction flow is around 38 gpm.

Fig. 5.
South side eelway – white arrows point at entrance and capture barrel.

Fig. 6.
Night photo of eels starting their trek up the eelway.

the north side on April 15 and to be operated through November, with the capture barrels examined every three days. No eels were collected until late March when the water temperatures had increased to 50° F. Numbers started gradually increasing until mid-April when on the 19th, almost 79,000 eels were found in the buckets, many suffocated by the sheer number of them. So the buckets were then checked more frequently until the numbers decreased (Figure 8). Catches were low through the summer and early fall but a late season surge took us by surprise when over 42,000 eels ascended during the last week of

Fig. 7.
Upper end of eelway showing the climbing substrate and attractant spray before they fall into the capture bucket.

November (Figures 9, 10). Changes in operations of the capture buckets, now rectangular boxes, ensured that all survived. Finally water temperatures dropped significantly and the eelways were shut down on December 7. An estimated total of 399,240 eels were captured, and 369,632 of these were transported and released in 2010: 89% ascended the shorter, southern eelway (Figure 11).

Fig. 8.
Dipping eels from the buckets.

Fig. 9.
42,000 plus American Eeels in late November.

Why are there so many more eels than we anticipated? One theory is that we're seeing not only this year's crop of elvers (the pigmented stage after glass eels) but holdovers from previous years who had no where to go. This is somewhat reflected in the larger sizes of eels that traveled up the eelways versus the smaller eels observed in the traps in the earlier years. It will be interersting to see what transpires in 2011; if the high numbers will continue or if we will see a drop off.

Fig. 9.
Late season surge.

Literature Cited

Greene, K.E., J.L. Zimmerman, R.W. Laney, and J.C. Thomas-Blate. 2009. Atlantic coast diadromous fish habitat: A review of utilization, threats, recommendations for conservation, and research needs. Atlantic States Marine Fisheries Commission Habitat Management Series No. 9, Washington, D.C.

Jenkins, R.E., and N.M. Burkhead. 1994. Freshwater fishes of Virginia. American Fisheries Society, Bethesda, Maryland.

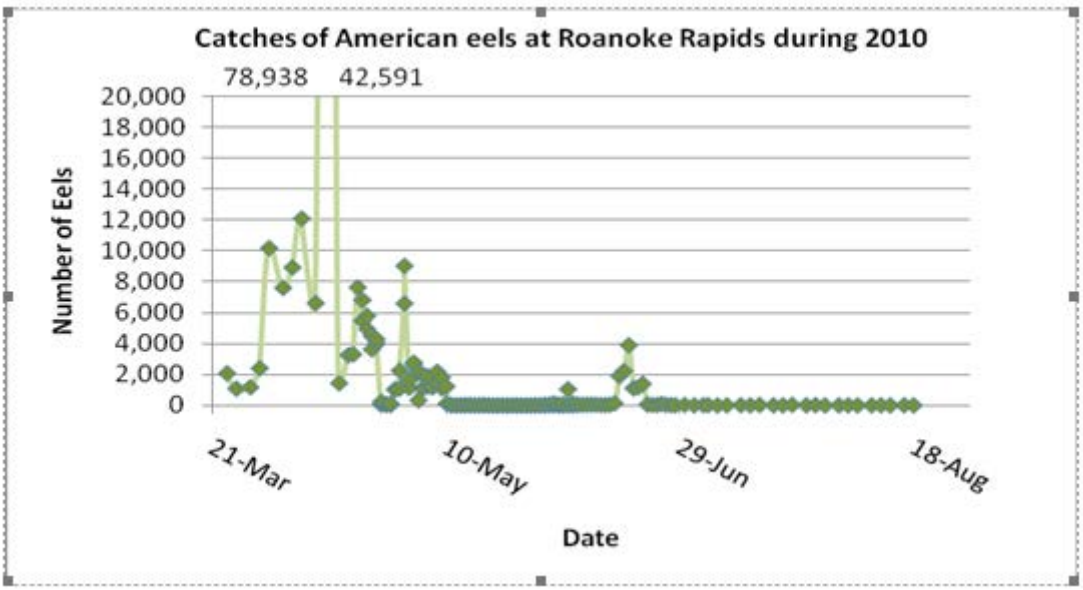


Fig. 11.
Number of American Eels collected at Roanoke Rapids upstream passage facilities during 2010. Data provided by Dominion.

Petition to list the American Eel as Threatened

The following was excerpted from the announcement in the Federal Register Vol. 76 No. 189, p. 60431-60444

The American Eel may need federal protection as a threatened or endangered species, the U.S. Fish and Wildlife Service (Service) announced, following an initial review of a petition seeking to protect the species under the Endangered Species Act (ESA).

The decision, commonly known as a 90-day finding, is based on scientific information about the eel provided in a 2010 petition from the Council for Endangered Species Act Reliability and in the Service's files.

The Service will begin an extensive status review for the American Eel to determine if adding the species to the Federal List of Endangered and Threatened Wildlife is warranted. A previous status review was conducted in 2007, finding that federal protection under the ESA was not warranted. The 2010 petition includes some information that became available after the 2007 review.

The American Eel, found in freshwater, estuarine and marine habitats from Greenland to South America, has been extirpated from portions of its historical freshwater habitat during the last 100 years, mostly resulting from dams built through the 1960s. Habitat loss and degradation, harvest, and turbine mortality have also contributed to some local population declines.

The species' unique life cycle, including its breeding phase in the Sargasso Sea, presents challenges to understanding and assessing biological and environmental processes that influence eels. New information indicates that changes in ocean conditions may be negatively impacting the eel's reproduction rates.

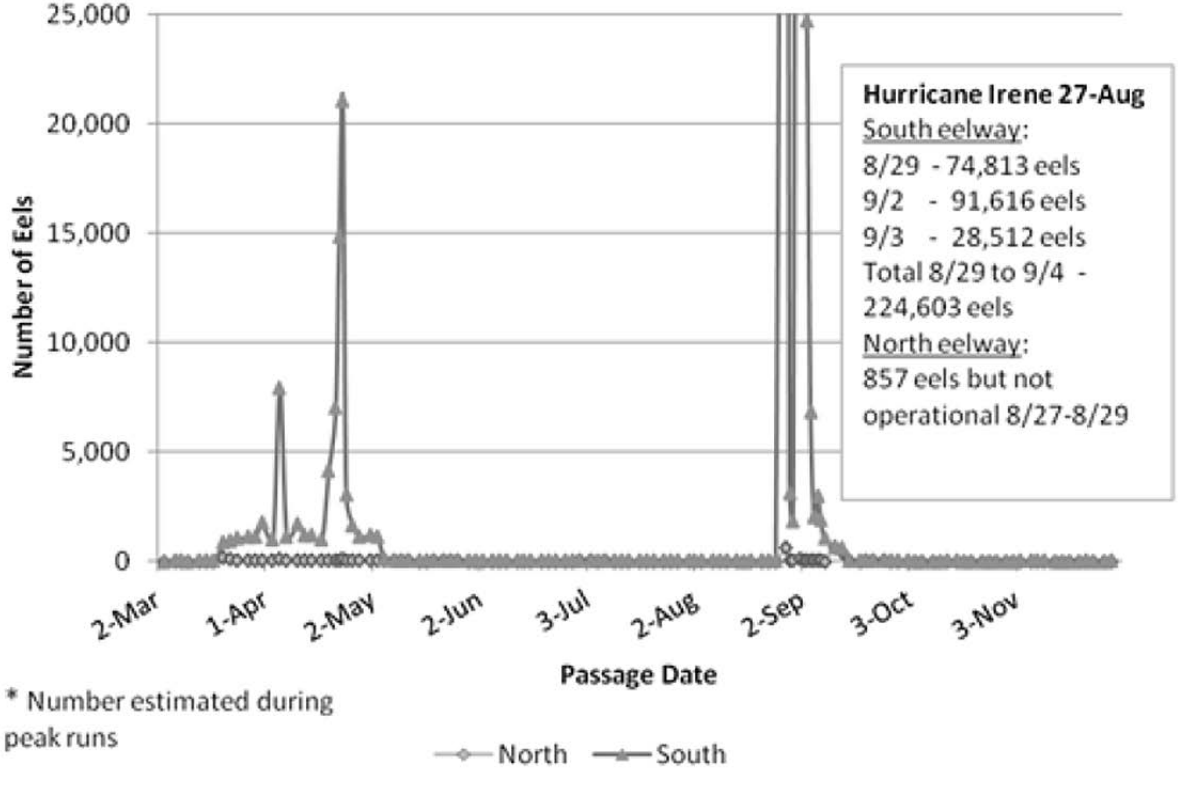
The Service is particularly seeking the following types of new information not known at the time of the 2007 status review: species' population structure (panmixia); range-wide analysis of impacts from the parasitic nematode *Anguillicola crassus*; statistically significant long-term glass eel recruitment declines; and the correlation of climate change and glass eel recruitment.

Update: Build It and They Will Come

Fritz Rohde

In *American Currents* Vol. 37 (1), I reported on the successful first year of eel passage in 2010 at Roanoke Rapids Dam, NC, where an estimated 399,240 eels ascended the eelways, by far the largest number passed anywhere on the East Coast. One question after it was all over: was the number so high because the eels have been in a "holding" pattern for a number of years and there were multiple age groups present or did it represent a single cohort of elvers migrating in from the ocean. I think we got our answer in 2011 when an estimated 322,109 eels travelled up the eelways. The large surge (an estimated 240,885 eels) in late August early September was in response to increased flows caused by the passage of Hurricane Irene.

Figure 1. Number of American eels trapped at North and South eelways during 2011.*



A juvenile American Eel (Anguilla rostrata) captured on the Kennebec River near Waterville, Maine. Photo by Nate Tessler.