

## Shad Research

### *Background*

- For background and big picture, review Brandywine Shad document.
  - Also take a look at the Atlantic States Marine Fisheries Commission website - <http://www.asmfc.org/>. Go to the Shad and River Herring Plan. Also, there's a table in the back of Addendum 1 that summarizes where there are shad restoration and management efforts going on in all the East Coast states.
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### *Research Questions and Contacts*

- Research alternatives to dams for diverting water for water supply purposes (i.e., such as we see occurring with both Newark and Wilmington on the White Clay and Brandywine). (Dam #2 on Brandywine concern)
  - What are the alternatives to simply throwing up a fish ladder at water supply dams.
    - Chuck Barscz mentioned one alternative a colleague of his knows of – a 'J' hook. Robert emailed him (Jim MacCartney from Concord, NH) and has not heard anything back yet.
    - A lot of alternative options may depend on specific designs and flows.
  - There are concerns about the effectiveness of fish ladders at passing shad. It would be good to research statistics on the effectiveness of fish ladders (though any statistics would be set against the background of dropping shad numbers overall). Specifically on projects in the Northeast and specifically related to shad.
  - Contact: Sara Dueling from American Rivers 717.763.0741
  - Contact: PWD about Fairmount Fish Ladder (\$2.7 million investment)
  - Contact: Charles Miller, he has experience with Fish Ladders and River Herring in Delaware and New Jersey.
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### *Product*

- Summary report of findings
- Hopefully have the beginning of an update at the meeting on the 11<sup>th</sup>.

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## *Additional Information*

### ***Emails***

Original Email from Robert Lonsdorf:

I am writing to ask you what your experience is in the effectiveness of fish ladders at passing shad and other herring species. Dick Quinn seems to think they're fine, and that you should get some 85% of the fish to get through the ladder, whereas Mark Pennell of URS and Craig Shirey of DNREC have privately expressed much more concern about their use to me. I know there may be as many as four fish ladders soon on the Schuylkill, so presumably PFBC and DEP and the Phila. Water Dept. think they're fine. URS has even proposed that they would like to do a critical review of their effectiveness. Both parties are concerned that on the Brandywine we are talking about trying to fund and construct a fish ladder on the City of Wilmington's dam #2 and that that dam is awfully low down on the system to construct something that may not be very effective at passing the target fish.

### **Response #1**

Robert,

Generally speaking, the best fishway, is to not need one (i.e., no dam-open river). However, in some case, like where there is a dam that can not be removed for whatever reason, fishways are your only choice. All fishways (ladders, lifts, ramps) have problems, and none are as effective or efficient in allowing fish (or other aquatic organisms) to move upstream or downstream, as an open river channel would be. Aside from installation costs, all fishways require some form of continuing maintenance and operation costs \$\$\$ (including nature-like fishways or ramps at dams).

Fish ladders if properly designed, installed, operated, and maintained can provide effective passage for shad and river herring. They usually have a river flow effective operating range though (high flow and low flow), and when river flows are outside of this range they do not work that well (but then again in an open river during a 100 year flood event you will not have much upstream movement of fish, the same is true for an extreme drought flow). In New England on small rivers with low head dams fish ladders have been effective in passing target numbers of fish, and on rivers with strong runs the design capacity of the fishways is sometimes exceeded. The large number of fish returning, literally push and squeeze the fish in front of them through the fishway.

The problem is on rivers with multiple passage barriers (like the Brandywine) where the inefficiencies of fishways are compounded (i.e., on a river with five dams and an 85% average fishway passage efficiency, you would pass only 44% of the fish that migrate up to the first dam, through the last upstream dam). SO the more dams you eliminate through dam removal the more fish you are likely to get upstream.



When your goal is to restore an extirpated fishery, every fish that returns in the spawning run is important. So you want your efficiency for upstream passage to quality spawning habitat to be as high as possible, because its through these fish that your restoration progresses.

In my opinion, (and it is now standard practice for fishways installed at federally licensed FERC hydroelectric dams), all installed fishways should have effectiveness studies, and the first dam on a river should have a long term fish run monitoring plan.

I hope this helps.

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Larry Miller  
U.S. Fish and Wildlife Service  
Mid-Atlantic Fishery Resources Office

## **Response #2**

Dick Quinn has much more experience than I in regard to fish ladders. However, I suspect that more of Dick's attention has been focused on design and building the ladders and less on evaluating their effectiveness. He is an engineer afterall. No question though, Dick is the expert. Our state-level experience has been mostly with the Alaska steep-pass ladders that we have in place to pass river herring. All but two of these units were built by contractors working for Public Service Enterprise Group, the owners of Salem Nuclear Plant. These units are too small for shad, even if we had shad in the waterways where these have been installed. Unfortunately river herring populations have declined so steeply that we are not getting enough adults to the ladders to pass. The Denil fish ladders that were installed on the Brandywine in the late 60s were ineffective for a number of reasons, including general neglect, and a lack of American shad. They also had some design limitations that were frustrating because they were so easily damaged by each storm event. The folks that built those ladders have long since retired or passed on. Even they underestimated the flood damage potential of the Brandywine

-Roy Miller

## **Response #3**

FYI, Martha, a response from Bill Weihbrecht, engineer with URS who is designing the rock ramp at Wilmington's dam #1.

Robert

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**From:** Bill\_Weihbrecht@URSCorp.com [mailto:Bill\_Weihbrecht@URSCorp.com]  
**Sent:** Wednesday, January 02, 2008 10:46 PM  
**To:** Robert Lonsdorf  
**Cc:** mark\_pennell@urscorp.com  
**Subject:** Re: Fish ladders

Robert,

I may not have all the facts but it was my understanding that that the ladders are not very efficient at passing shad and herring. There were fish ladders at dam #2 and #4 which were never functional. Although there is the issue of passage at dam #1, I thought that the ladder at #2 was removed due to maintenance issues (debris removal etc.). I hear that the PFBC is also looking at the ladders on the Lehigh due to the disappointing results. I would suggest getting data from other ladders along the East Coast to determine whether we should consider proceeding with the existing engineered ladders for these target species. This information should be available. I know they work for other species but I honestly haven't heard anything good about shad passage with ladders. I had asked Dave Kristine (PFBC) about the efficiency of shad passage at existing ladders and he did not know of any. In my mind this is an important step before anyone proceeds with shad passage on any river system.

Bill Weihbrecht  
URS Corporation  
Senior Stream Restoration Specialist  
4507 North Front Street, Suite 200  
Harrisburg, PA 17110  
office 717-635-7901  
cell 717-645-1526

#### **Response #4**

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**From:** Shirey Craig (DNREC) [mailto:Craig.Shirey@state.de.us]  
**Sent:** Thursday, January 03, 2008 9:01 AM  
**To:** Robert Lonsdorf  
**Cc:** Miller Roy W. (DNREC)  
**Subject:** RE: Fish ladders

Robert – Roy is correct in that nearly all of our experience has been with river herring and relatively small fish ladders that were aimed at passing only herring. It may be too much of a leap to compare our experiences with these ladders to what might be expected with shad. Dam two will be the hinge-pin on the success of shad restoration in the Brandywine however. If a ladder at dam 2 works well, we could have shad all the way up to the Hagley # 7 dam assuming that someday dam 4 will be removed and the others. If on the other hand serious problems with fish passage occur at dam 2 the whole thing will suffer or possibly never get off the ground at all. We can only look at other systems outside the Brandywine to see what our chances might be with today's fish ladder technology and hope for the best because I'm not sure we have any other option at dam 2. As you know the City is not flexible and isn't going to entertain anything other than a fish ladder. I think we do have an opportunity to have a review of the fish ladder plans by experts from throughout the North East region if that is something that the partnership wants to pursue

#### **Response #5**



Craig and Roy, thanks for your responses. Craig, I am intently interested in sponsoring some kind of 'review of the fish ladder plans by experts from throughout the North East region' (I'd probably include down to Virginia). I would welcome your thoughts on how to set that up. That's approximately what Martha Corrozi of UDE's Water Resources Agency has agreed to take on, with student research help and oversight.

I hear you about the City being pretty inflexible, but I'm not ready to assume that there's no hope for an alternative to a fish ladder – especially if we have a reasonable non-experimental alternative. I'm trying to look into something called a 'J' hook, for example. To complicate matters however, they not only divert water into the mill race there, they pump it from the Compton Mills pump a few hundred yards upstream, and on the opposite bank of the diversion.

Dam 2 is ultra-sensitive to them since it's so related to their drinking water source – obviously they can't chance any disruptions.

We may be able to get the ear of the Mayor if we're proposing something particularly unusual or important there. Also, this is one reason why I put so much importance on public outreach in Wilmington – to build political support for the project and put appropriate pressures on the Public Works people to stay actively engaged in the project and to take 'ownership' of it – something they have yet to fully do.

I hope we can continue this discussion prior to and at next Friday's Partnership meeting, along with an update on dam #4 progress and fish stocking possibilities. Draft agenda coming tomorrow.

Thanks,  
Robert