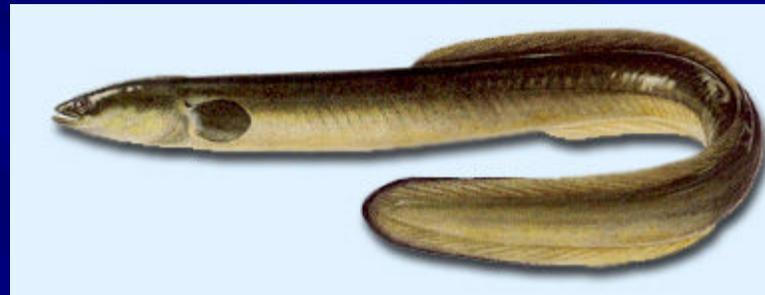


American Eels

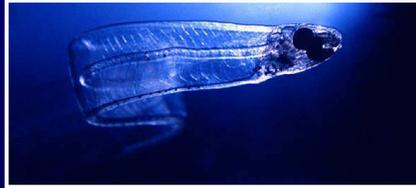
Do Everything Backwards; American Eel Restoration in the Susquehanna River Basin



Steve Minkkinen
U.S. Fish & Wildlife Service
Maryland Fishery Resources Office
Annapolis, MD

American Eel Life Cycle

- **Spawn in Sargasso Sea**



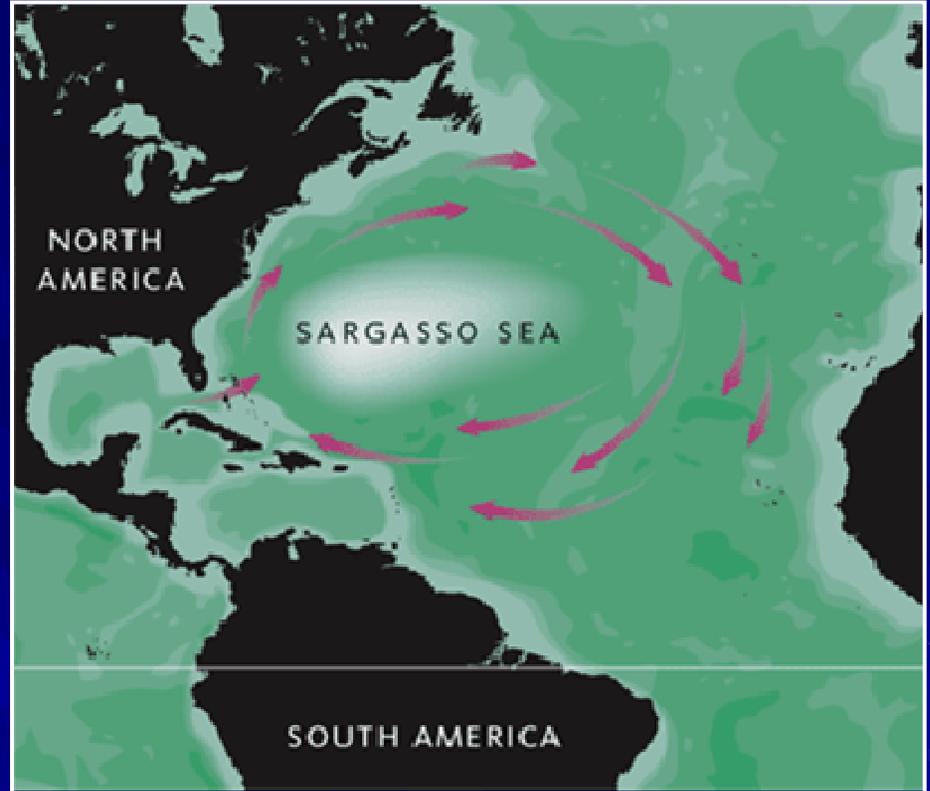
- **Larvae carried by gulf stream**



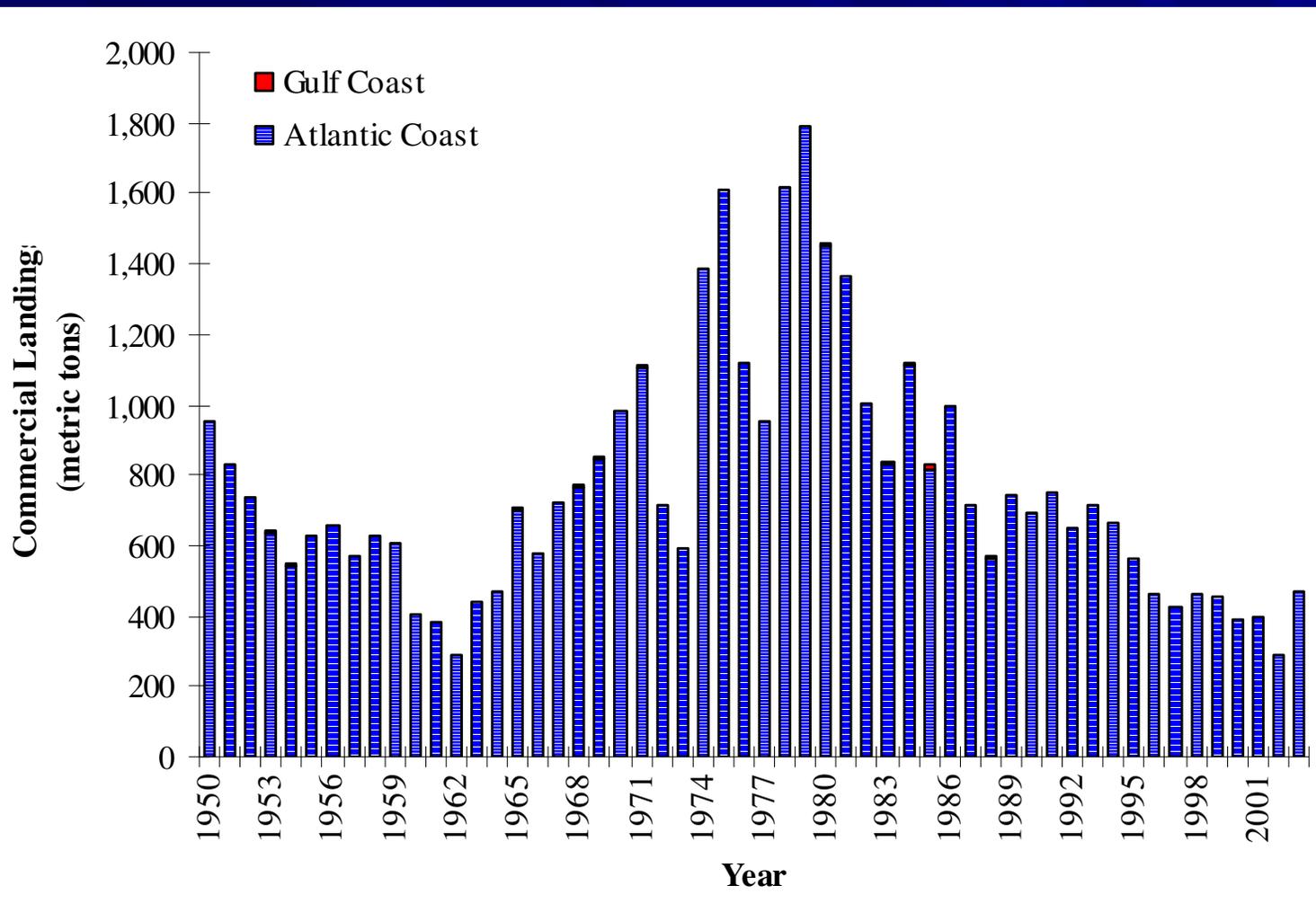
- **Live in estuaries, rivers and streams**

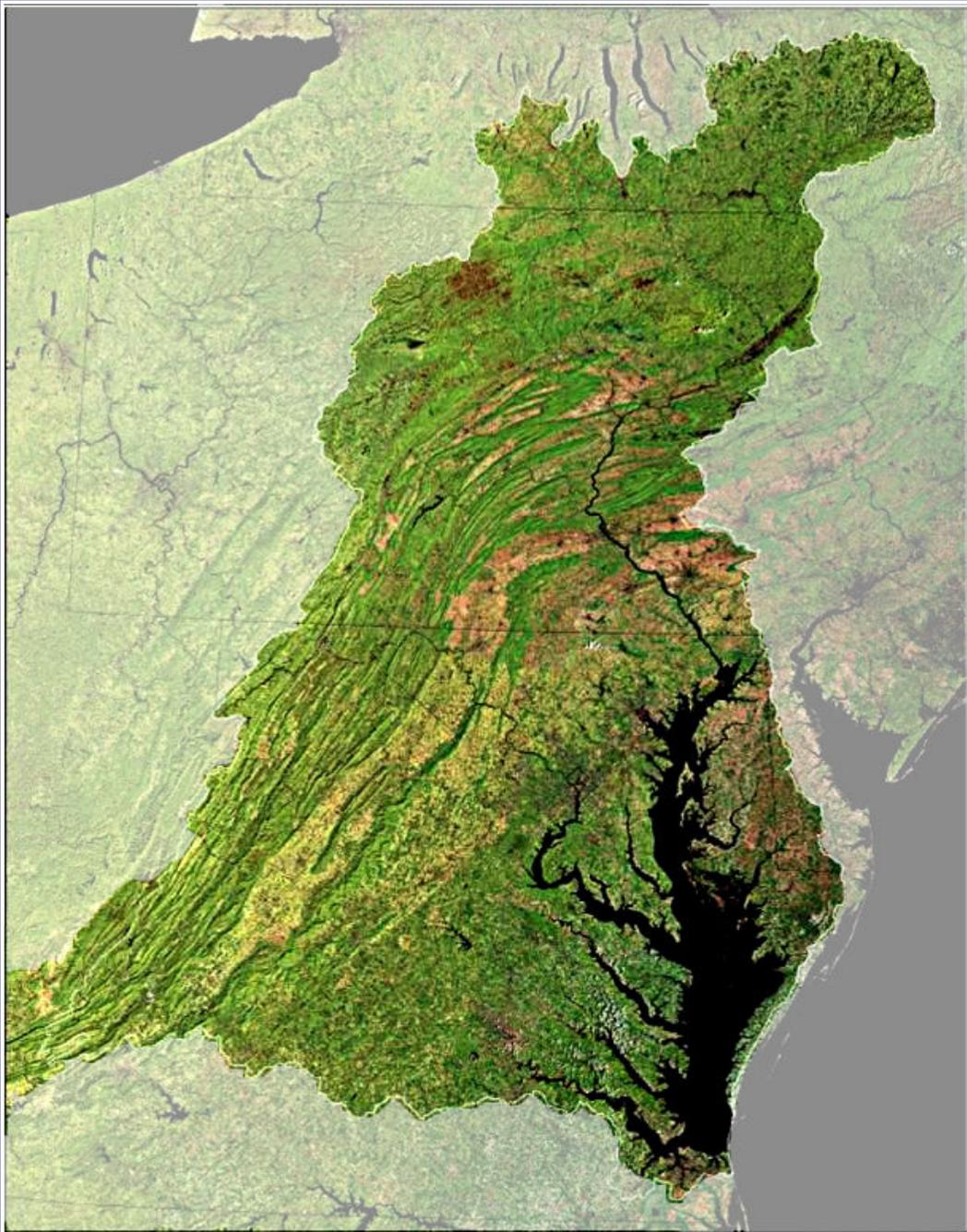


- **Migrate back to Sargasso Sea to spawn**



Coastwide Commercial Eel Landings 1950-2003

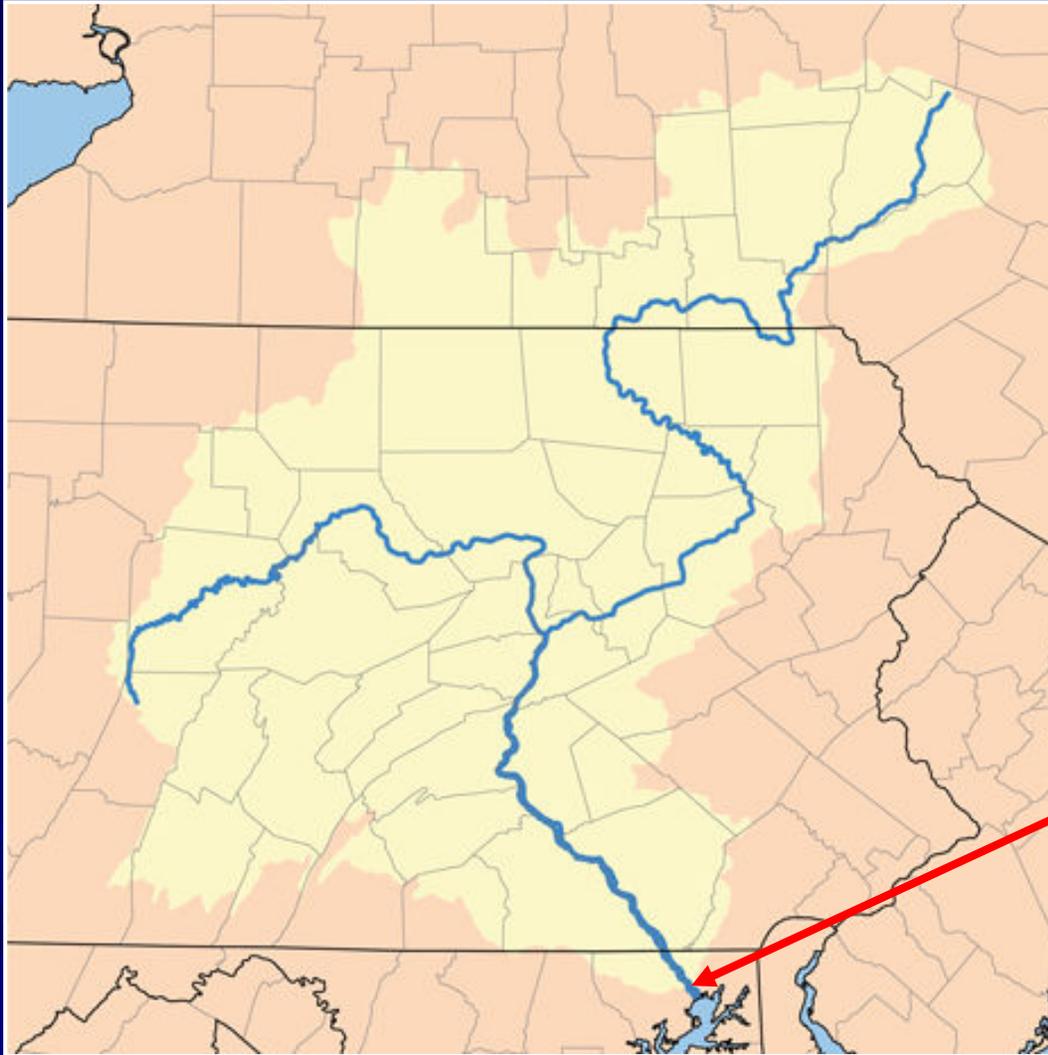




Petition To List

- **November 2004 -
Petition filed to
USFWS and NMFS**
- **February 2007 -
USFWS announced
completion of status
review**
- **Listing not
warranted**
- **Chesapeake Bay -
50% decline in
yellow eels from
1994-2004**

Susquehanna River Watershed

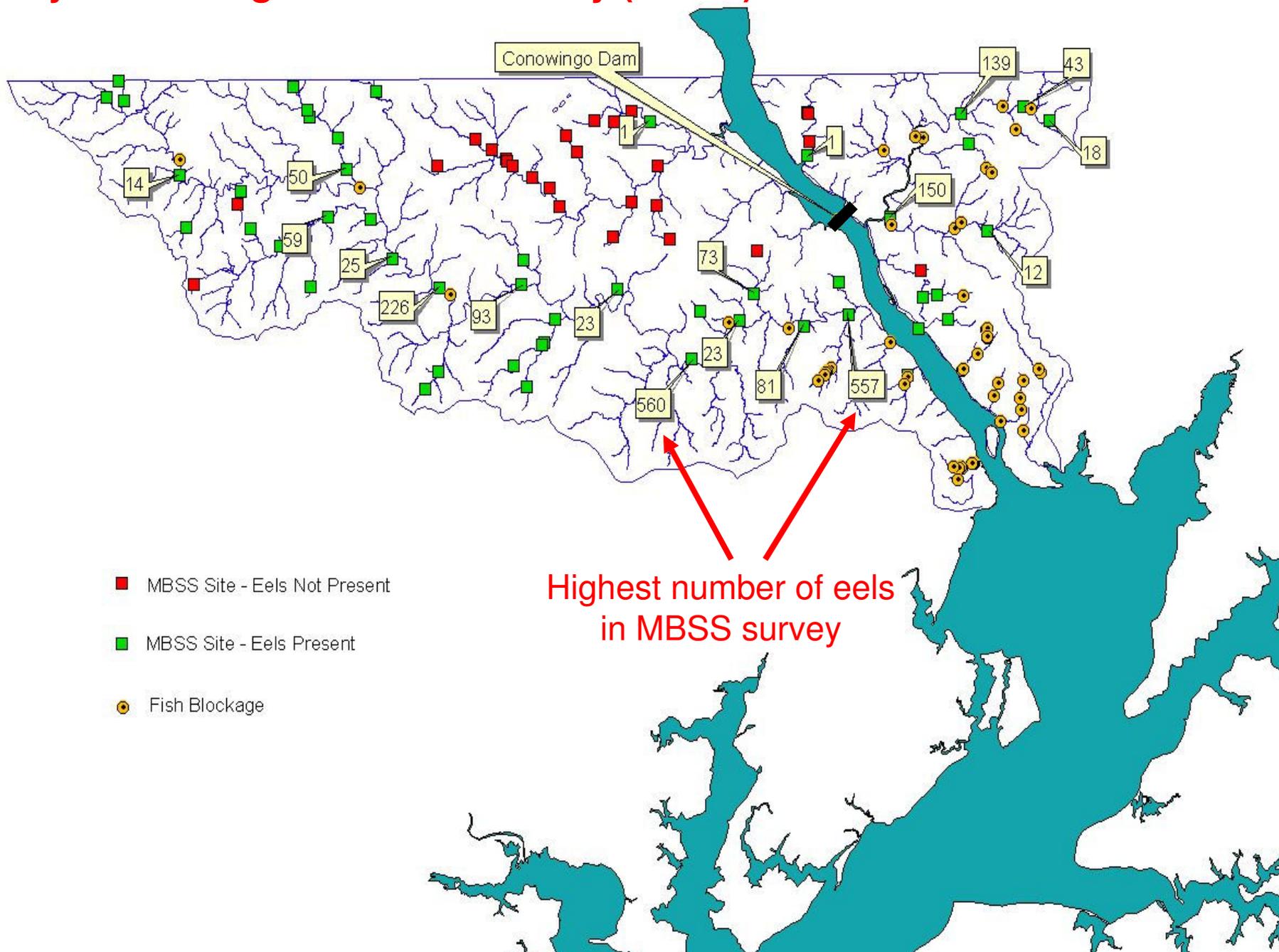


- **43% of Chesapeake Bay watershed**
- **444 miles long**
- **27,500 square miles**
- **Conowingo Dam
River Mile 10**



Conowingo Dam

Maryland Biological Stream Survey (MBSS)



Fish Passage on Susquehanna River

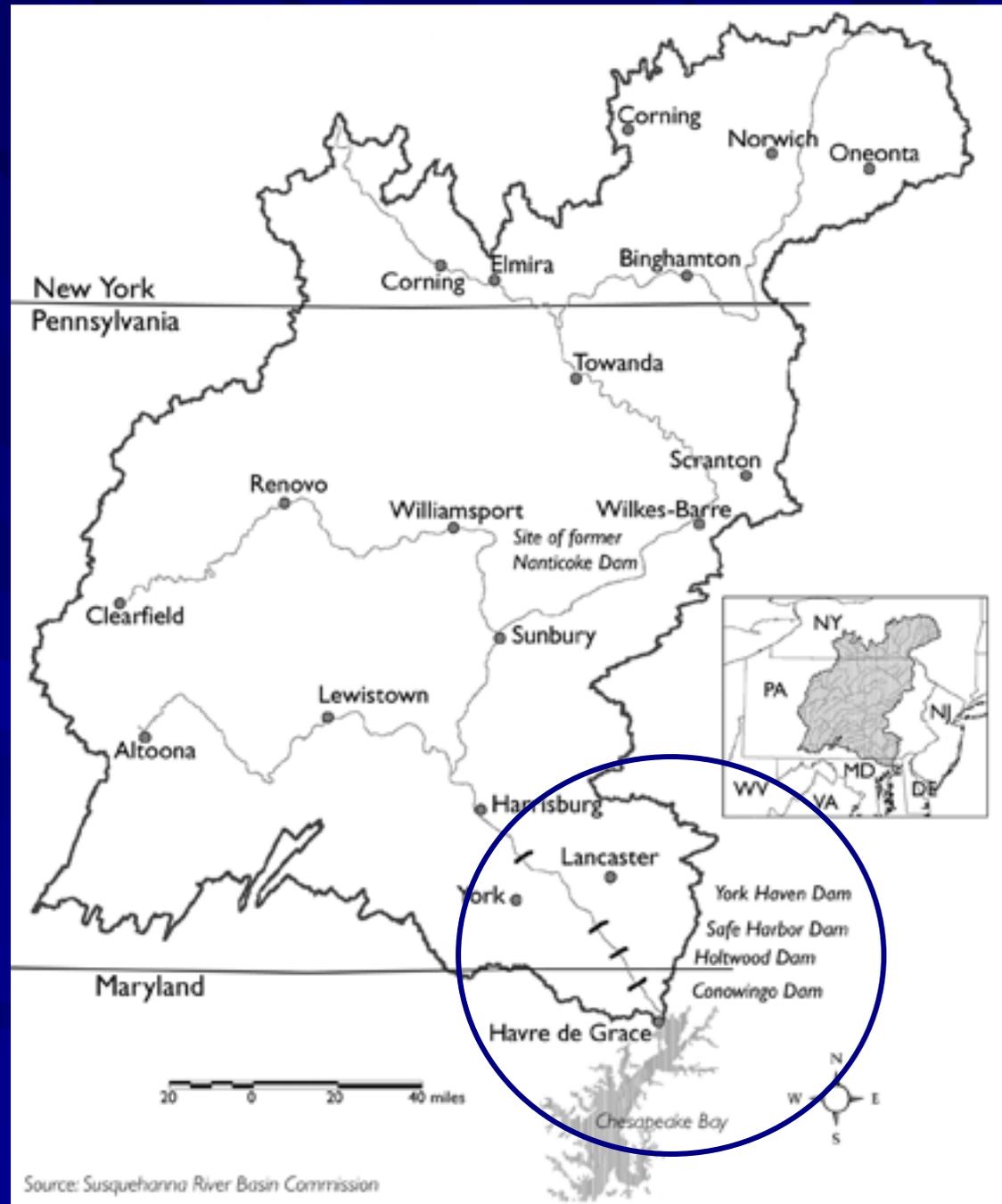
- **Provided at 4 dams**
- **Designed for anadromous species**
 - **Shad/River Herring**
 - **Move upstream as adults**
 - **Prefer high flows**
 - **Daytime migration**
- **Ineffective at passing juvenile American eels**



Conowingo Fish Lift

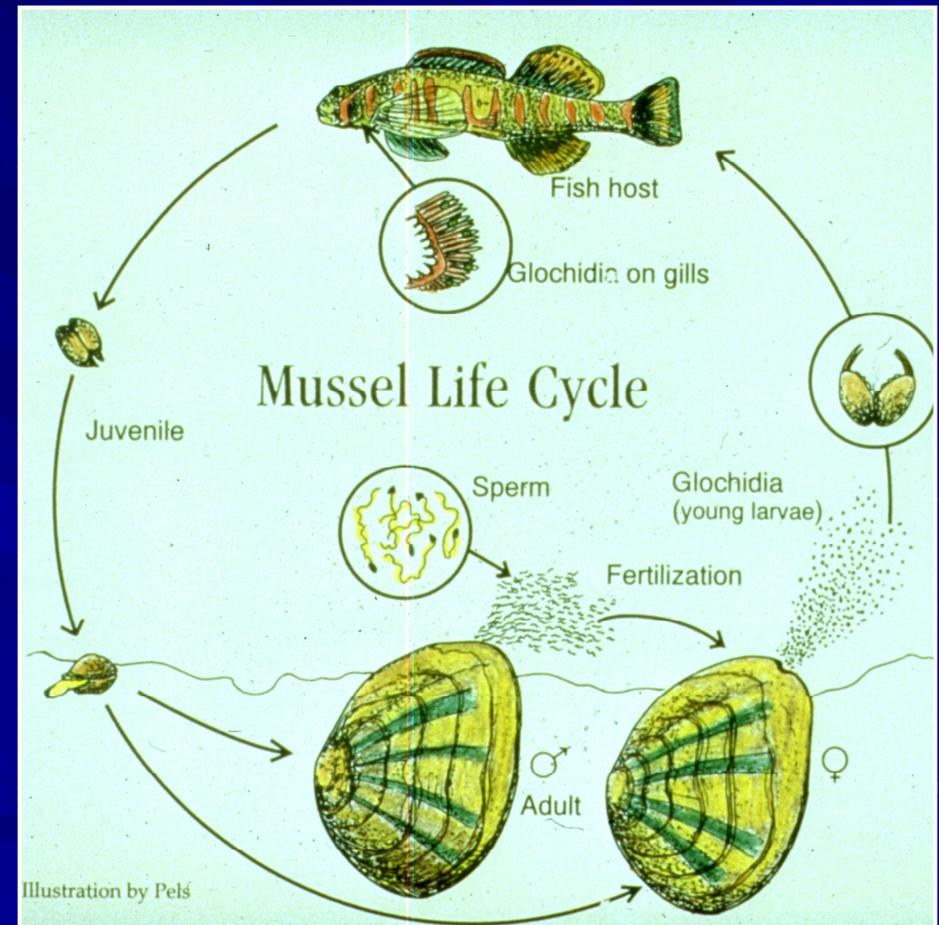
FERC relicensing

- 3 dams and a pumping station scheduled for relicensing over the next 5 years
- Eel passage an important issue
- What is the ecological significance of eels?



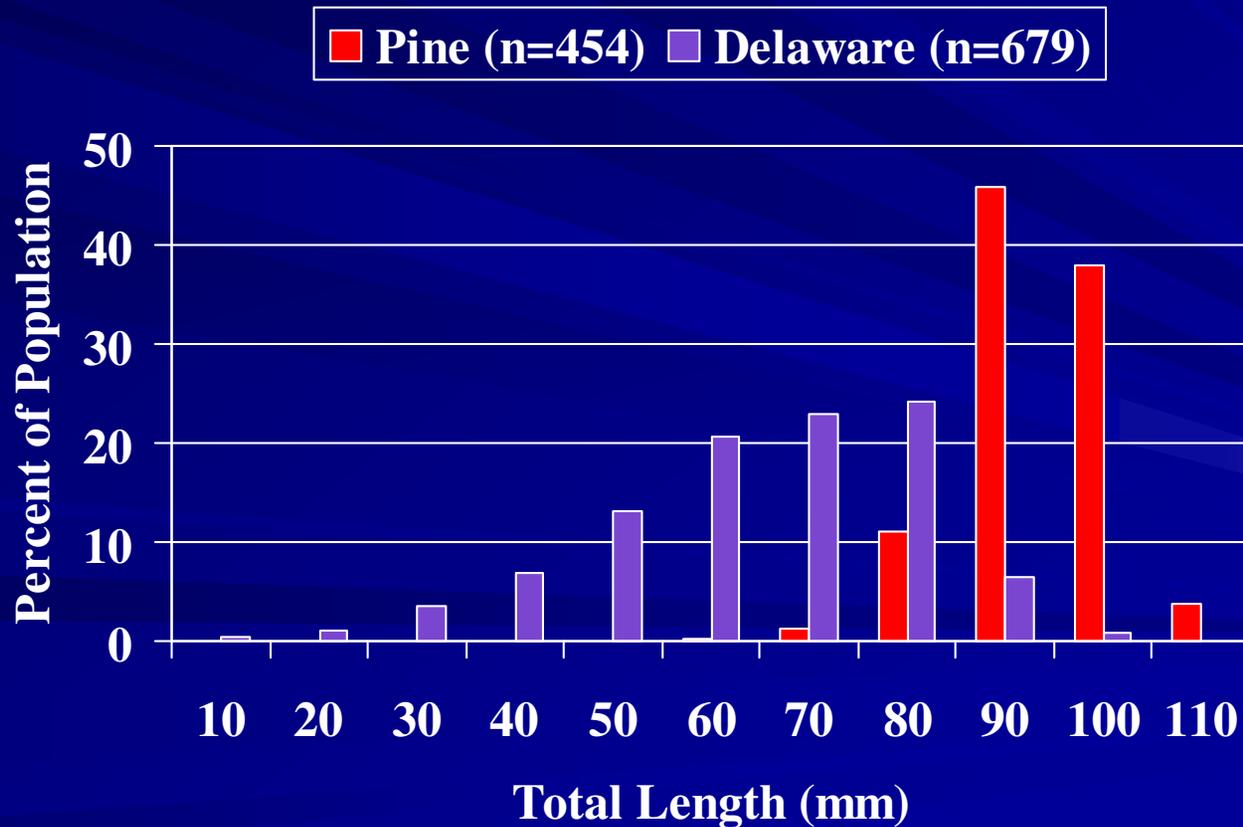
Importance to Ecosystem

- 25% of fish biomass in undammed streams
- Various life stages eat every available prey item
- Used by freshwater mussels (eastern elliptio) to complete life cycle



Eels and Mussels

- Eastern elliptio common in adjacent free flowing watersheds
- Lack of eels above dams may be limiting mussel populations
- Mussels can improve water quality by filtering nutrients/sediments



USFWS Objectives



- **Sample eel population below Conowingo Dam**
 - Elvers - migration patterns
 - Yellow eels - population size
- **Learn more about eel / mussel relationship in the Susquehanna River**
- **Experimental eel introductions in tributaries to the Susquehanna River**
 - Where do eels go?
 - Effects on freshwater mussel reproduction?

Conowingo Dam Elver Collection

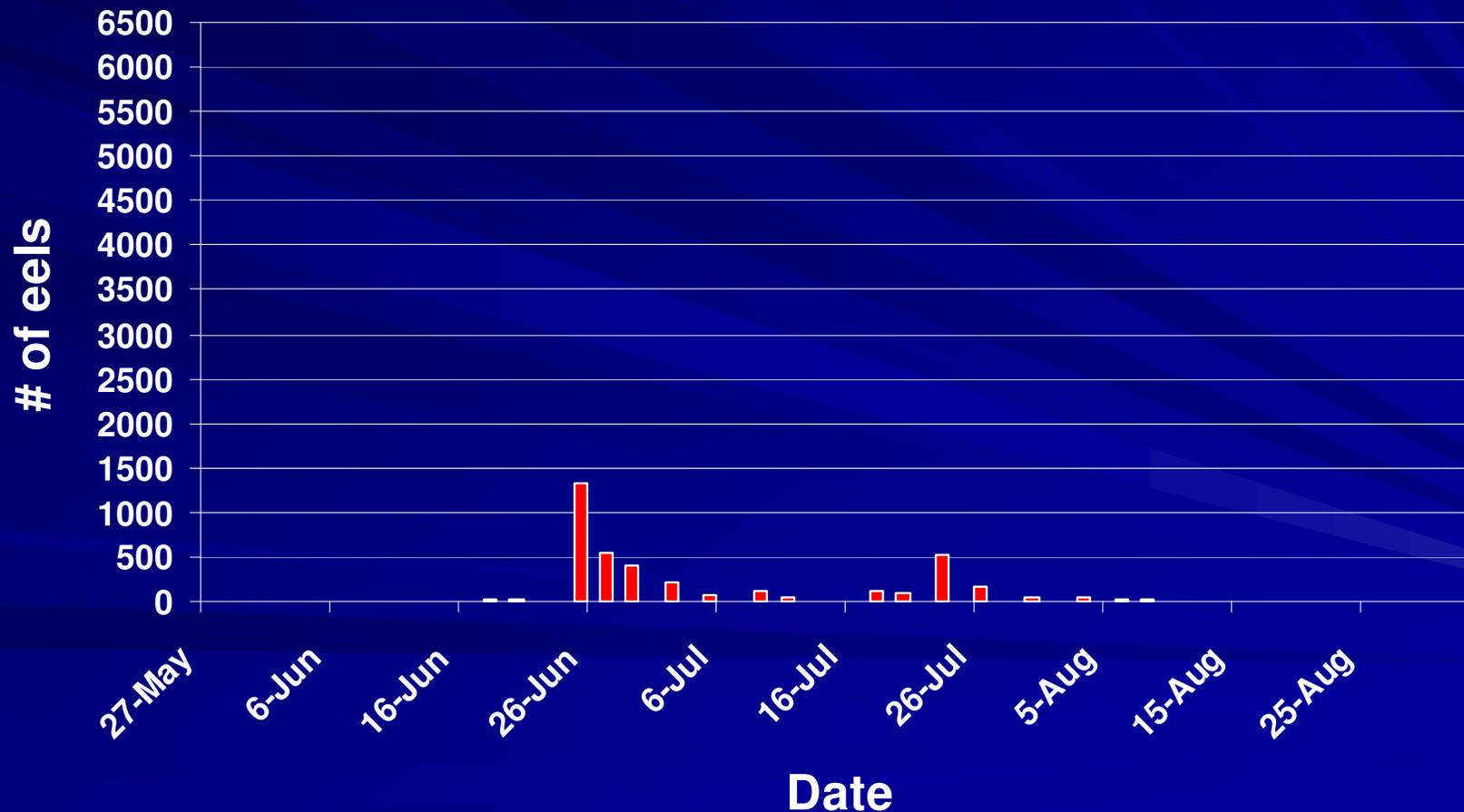


Year	# of elvers
2005	42
2006	19
2007	3837
2008	42059
2009	17437



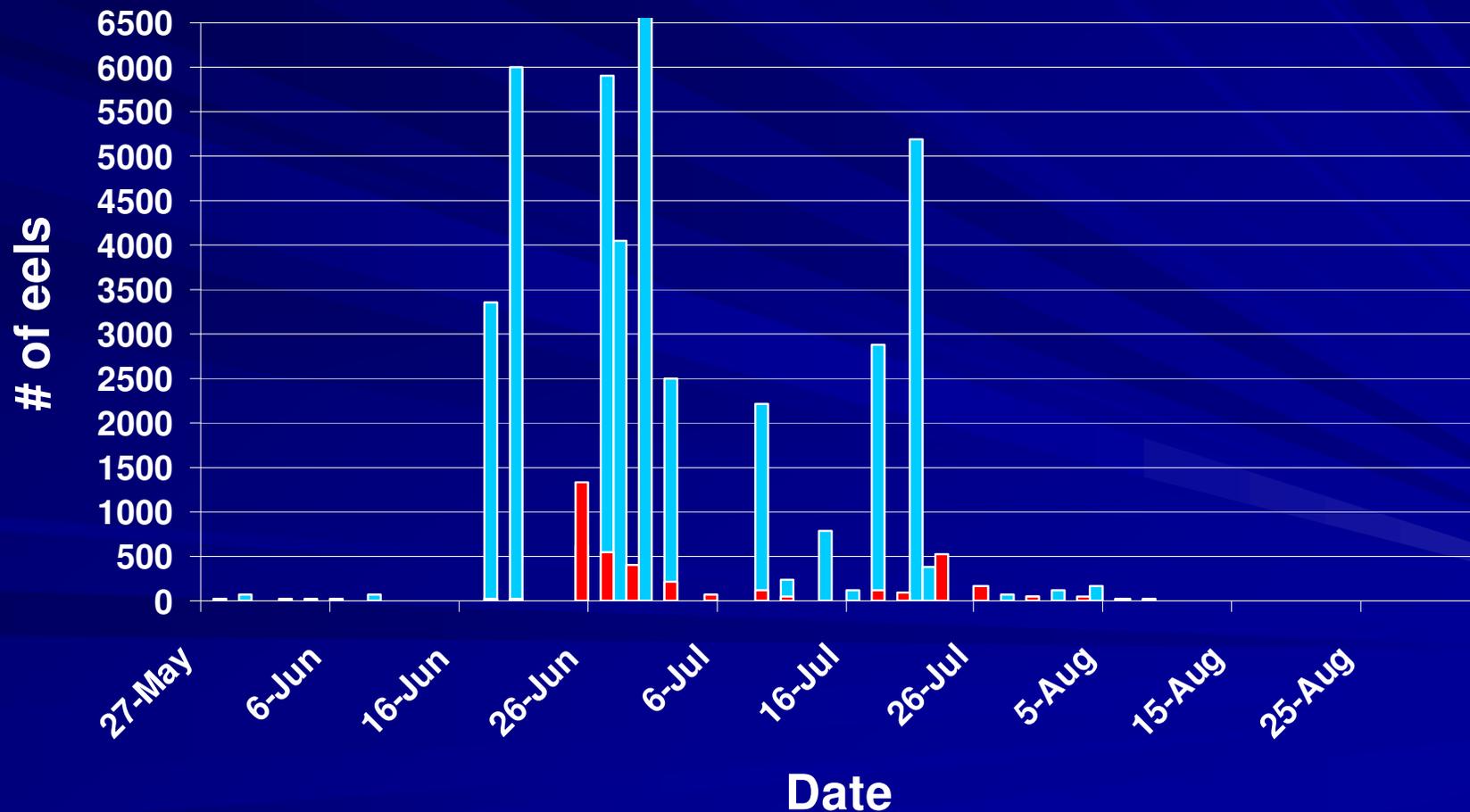
Timing of Elver Collection

■ 2007 (n = 3837)



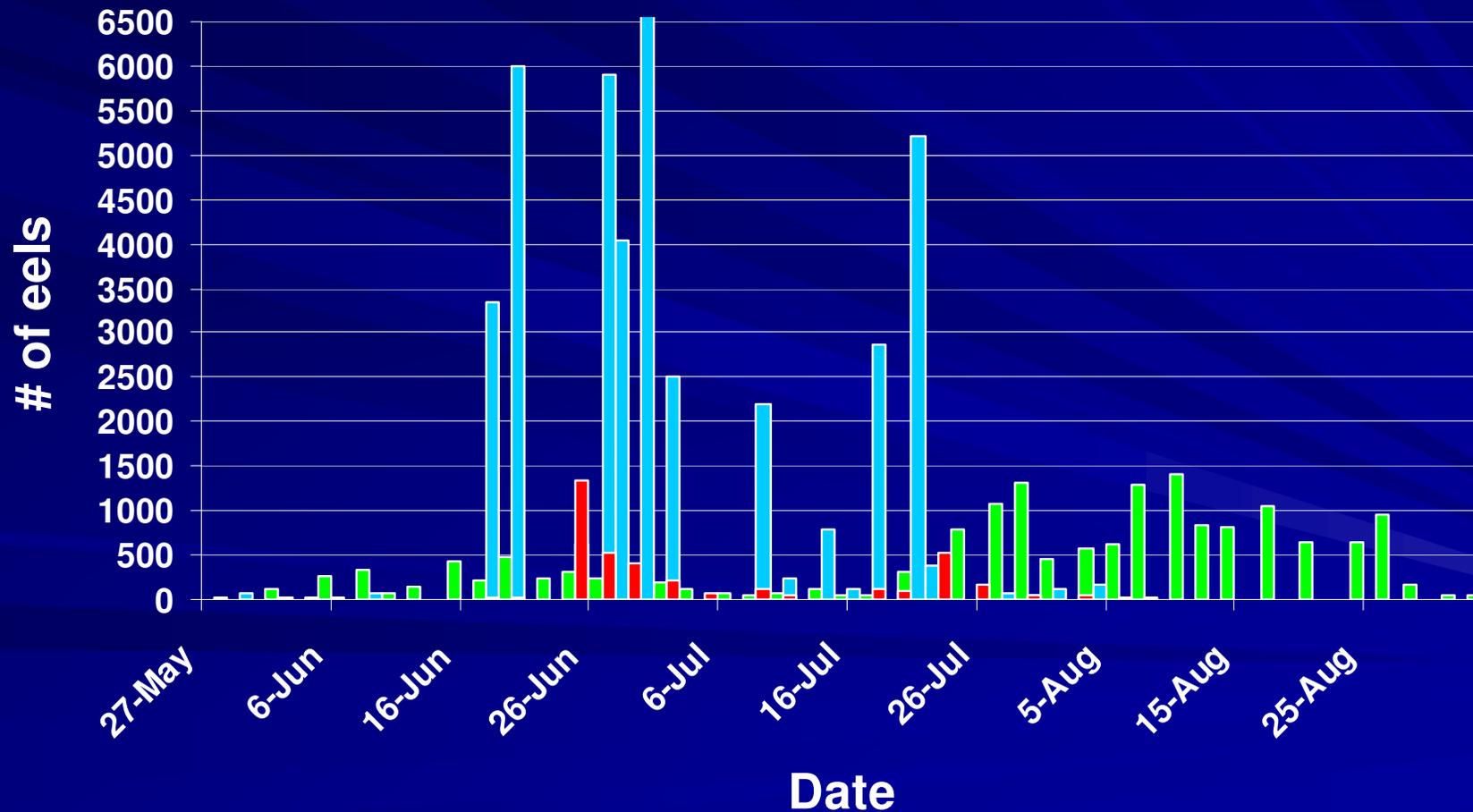
Timing of Elver Collection

■ 2008 (n = 42059) ■ 2007 (n = 3837)

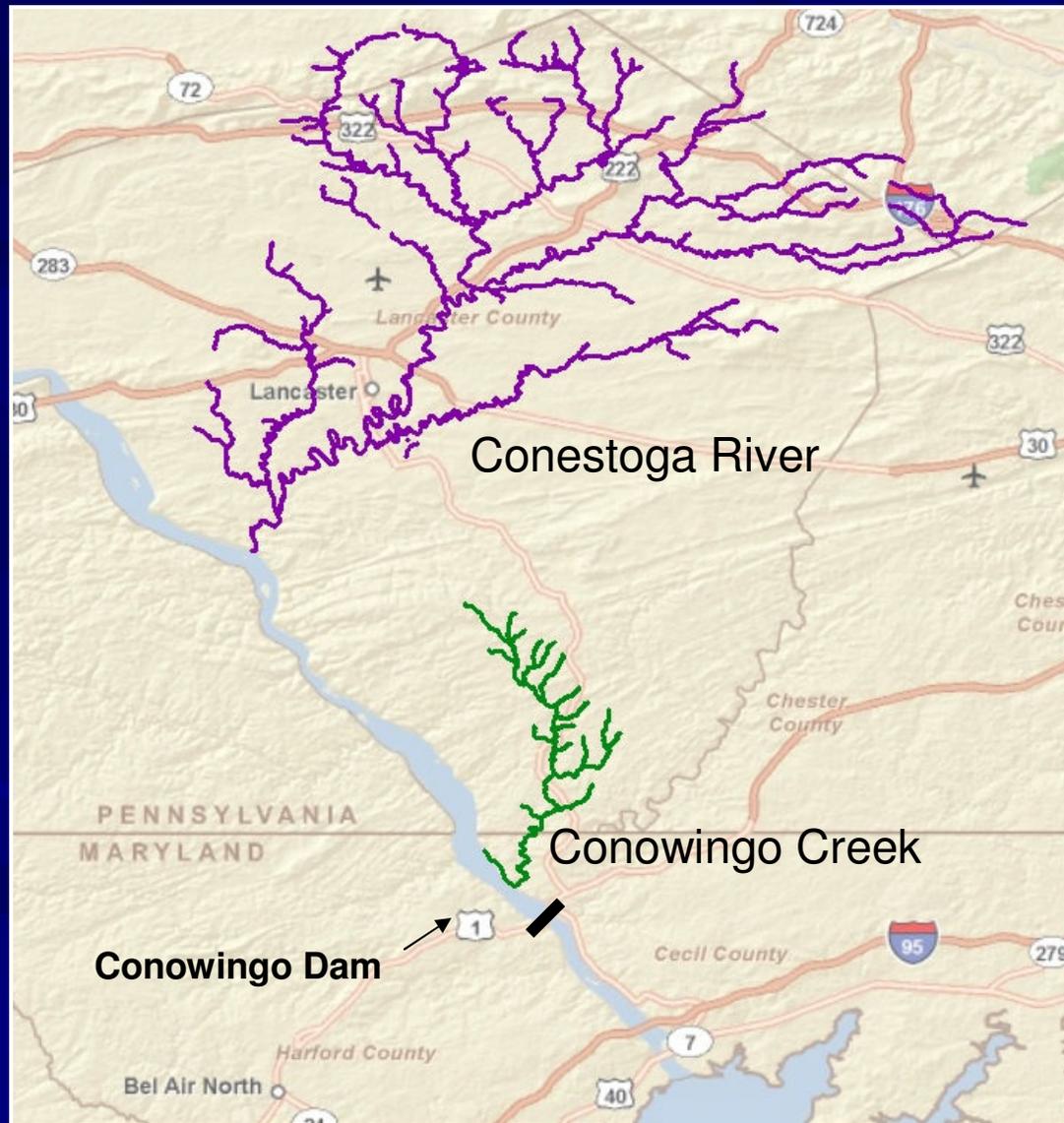


Timing of Elver Collection

■ 2009 (n = 17437) ■ 2008 (n = 42059) ■ 2007 (n = 3837)



Upstream elver introductions



- 2008 – 17,504 elvers stocked in Conestoga River
- 2009 – 15,316 elvers stocked in Conowingo Creek
- Elvers recaptured in Conowingo Creek



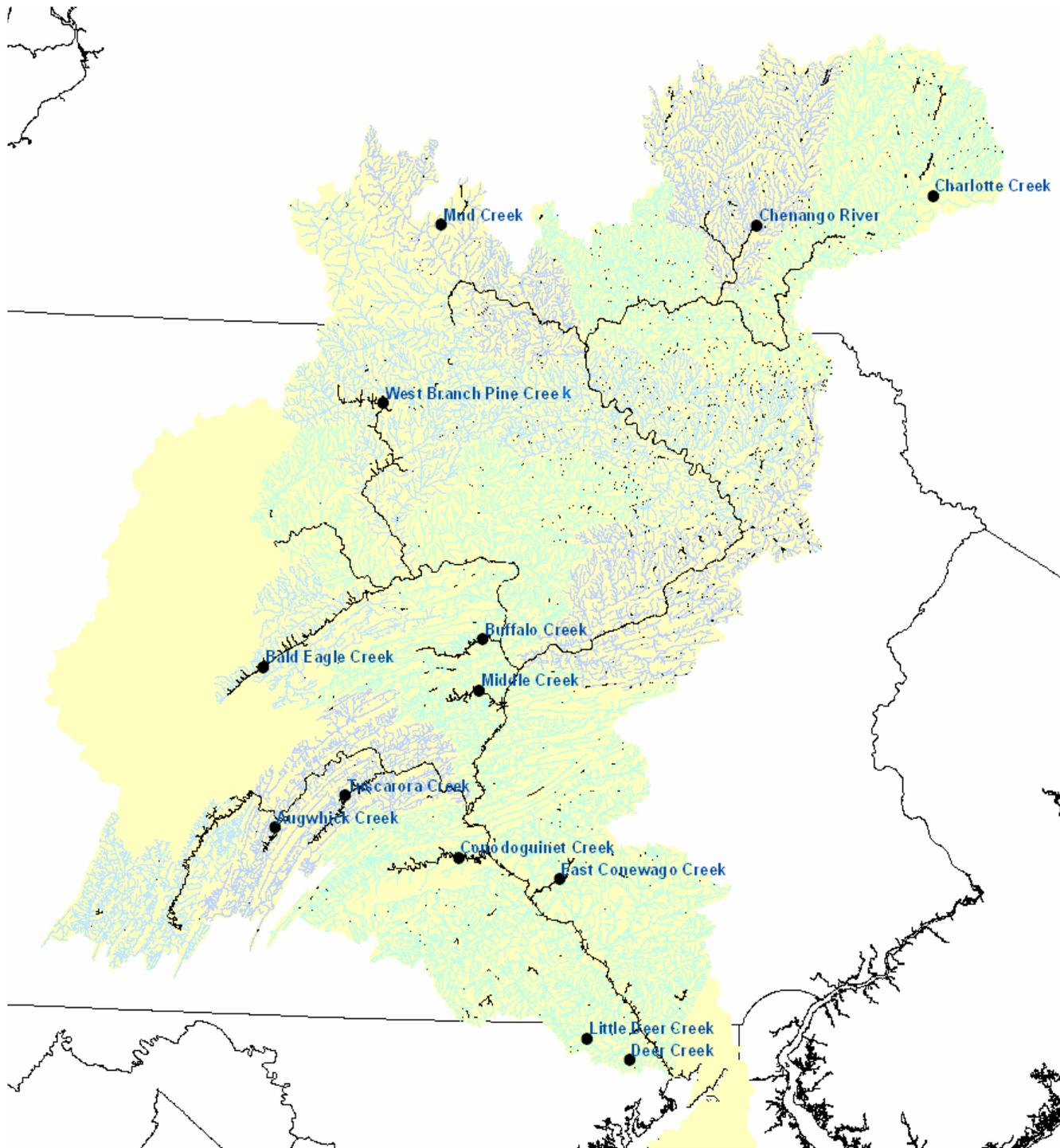
Eels / Mussel study in the Susquehanna River



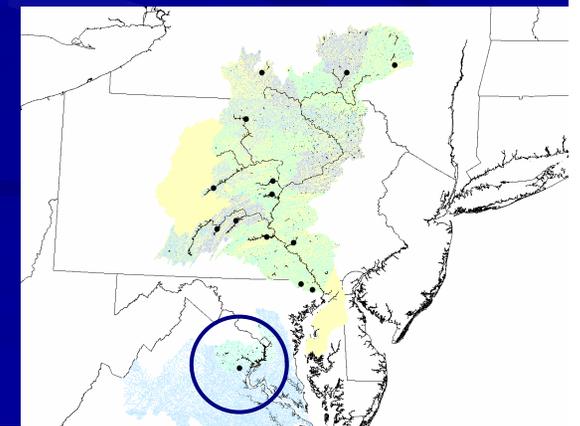
Goal: Assess the importance of American eels to freshwater mussels in the Susquehanna River

Objectives:

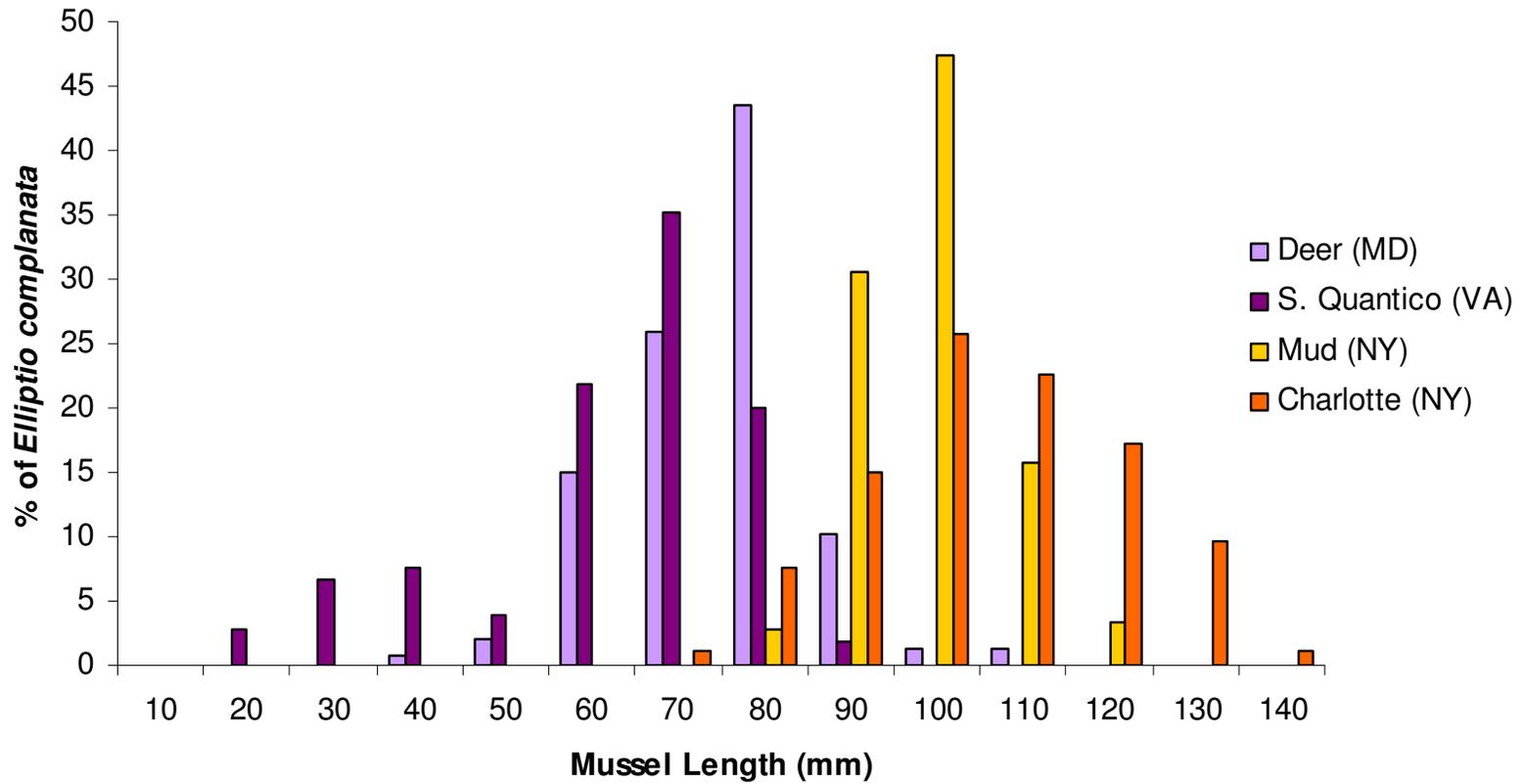
- Confirm American eels as primary host for eastern elliptio
- Do American eels serve as the host fish for other freshwater mussel species
- **Determine recruitment status of *Elliptio complanata* within the Susquehanna drainage**



- All sample sites in Susquehanna drainage except 1 in Potomac drainage
- Qualitative and quantitative surveys
- Mussels found in quantitative survey were id'd and measured



Results



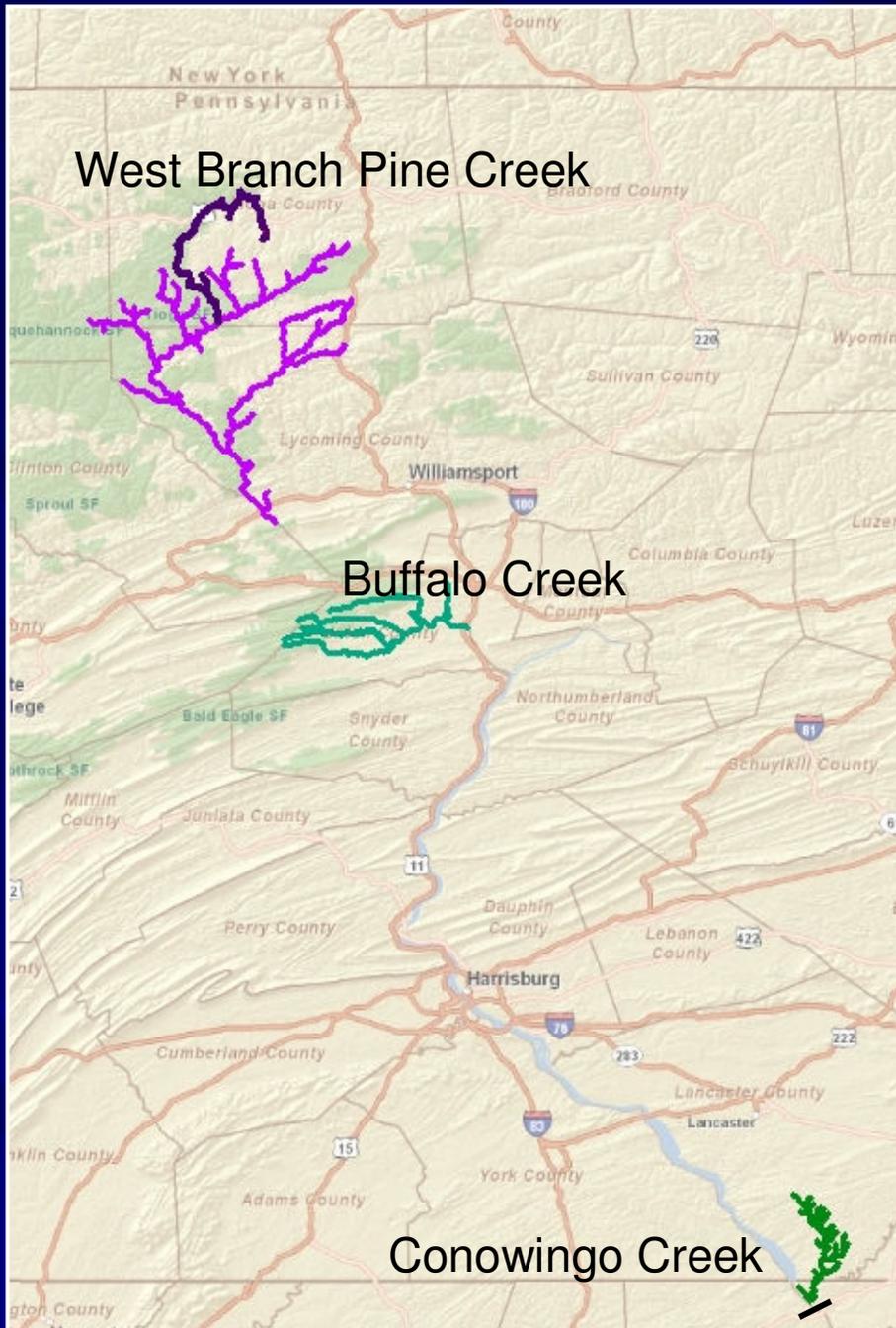
Conclusion: Eels are important to eastern elliptio reproduction



- **Eastern elliptio less abundant in Susquehanna River**
 - **70% of sites in Delaware had over 50 elliptio found in an hour (USGS)**
 - **Only 5% of sites in Susquehanna had over 50 elliptio found in an hour (Art Bogan and Dave Strayer)**
- **40 fish species tested, 5 worked, American eels most successful**
- **No juvenile eastern elliptio found in upstream tributaries**

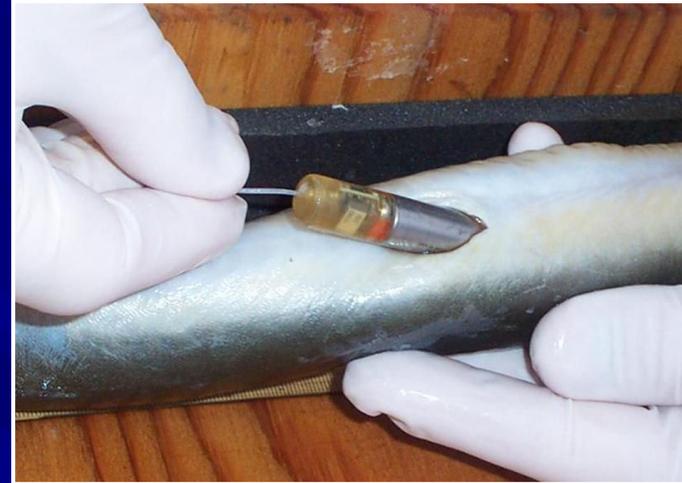
Testing the mussel eel hypothesis

- Introduce eels where there is currently no recruitment
 - Buffalo Creek
 - West Branch Pine Creek
- Stock eels infected with freshwater mussel larvae
- Continue stocking Conowingo Creek
- Monitor mussel populations
- Monitor fish populations using MBSS protocols



Downstream passage

- **Downstream passage project on the Shenandoah**
 - **30% mortality at each dam**
 - **Downstream movement throughout the year**
 - **Determine methods for reducing downstream mortality**
- **Need research to assess downstream passage on Susquehanna**



Credit: Doug Watts



Future Studies

- **Increase elver captures below Conowingo Dam**
- **Stock eels in upstream tributaries**
- **Determine if eels can move through Conowingo Pool**
- **Determine optimal size of eels for freshwater mussel host**
- **Downstream Passage**

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Mussels could be up a creek without migratory eels

Thousands of eels have been trucked beyond Conowingo Dam in effort to jump-start their population as well as that of a mollusc that depends on the fish

By Karl Blankenship

After swimming more than 1,000 miles from the Sargasso Sea and up the Chesapeake Bay, eels reaching the Susquehanna River seem undaunted by the Conowingo Dam.

Rather than stop at the foot of the 100-foot dam, they are willing to follow a dribble of water up a long pile of concrete rip-rap.

For the first time in decades, their efforts are being rewarded. Biologists this summer have been collecting the eels, then giving them a ride around the dam.

It's the second year that humans have intervened to help the eels fulfill their migratory impulse. Last year, 20,000 eels were moved upstream; by early August this year, more than 10,000 had made the trip.

"They have great desire to move upstream," said Steve Minkinen, who heads the U.S. Fish and Wildlife Service's Maryland Fisheries Resource Office. "That dam, unfortunately, is too much for them to get around."

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