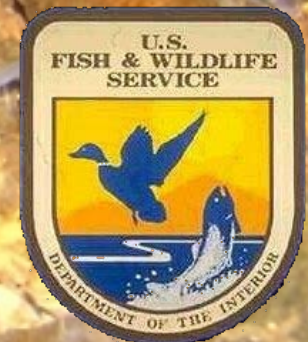


A photograph of numerous American eel larvae (Ammocetes) in a stream. The larvae are translucent with a yellowish-brown hue and are swimming in shallow, clear water over a rocky substrate. The background shows a large, mossy rock overhang.

# *2015 finding on the American eel Endangered Species Act petition*

**Steven Shepard**  
U.S. Fish and Wildlife Service  
Maine Field Office

American Eel  
Symposium  
23-25 Oct. 2015  
Portland, Maine



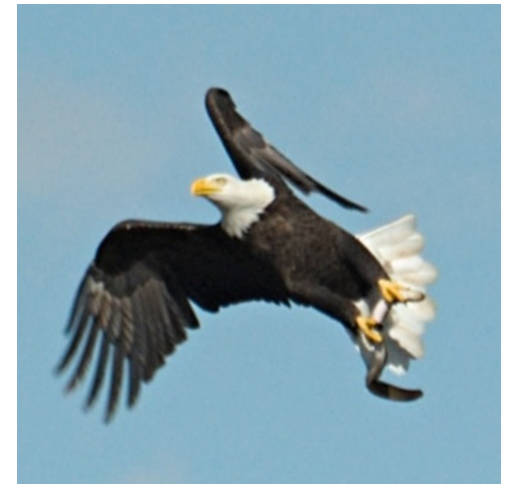
# So...listing is not warranted

Notice of the FWS response to the American eel petition from the Center for Environmental Science Accuracy and Reliability was published in:

**Federal Register of 10/8/2015 (80 FR 60834)**

## The Finding and supporting information:

- 1) The 12-month not warranted finding
- 2) The Biological Species Report (peer-reviewed source document)
- 3) And...baseline information in the FWS response to the 2004 petition to list American eel.

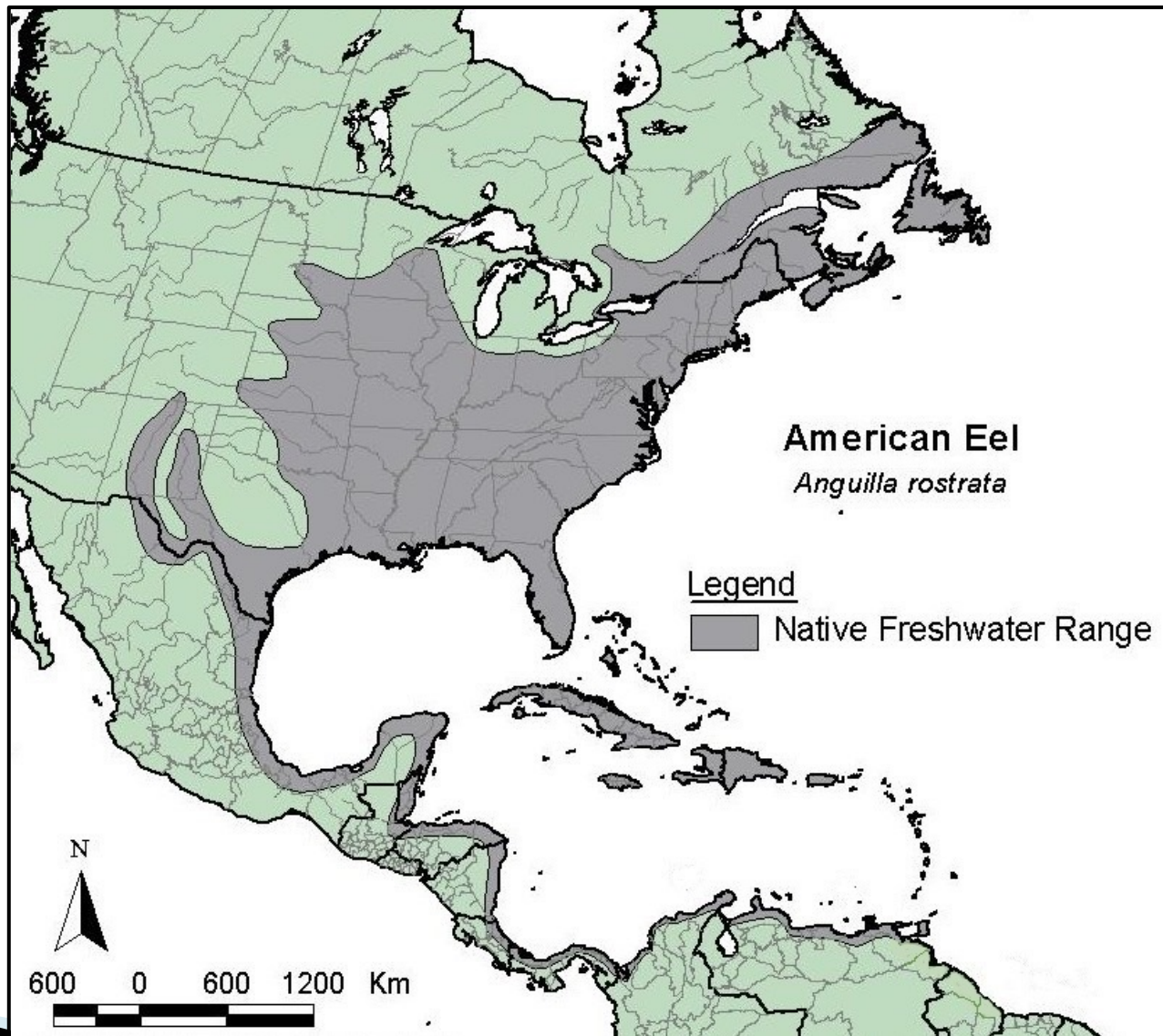


The documents can be found on-line at:

<http://www.fws.gov/northeast/americaneel/>



# Native range of American eel

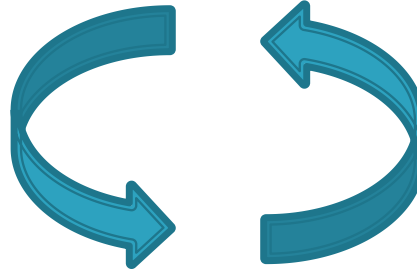


(updated from NatureServe, 2006)

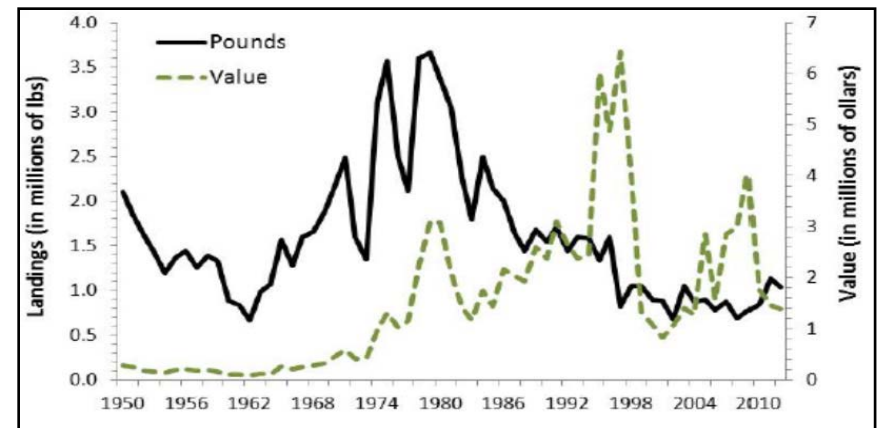
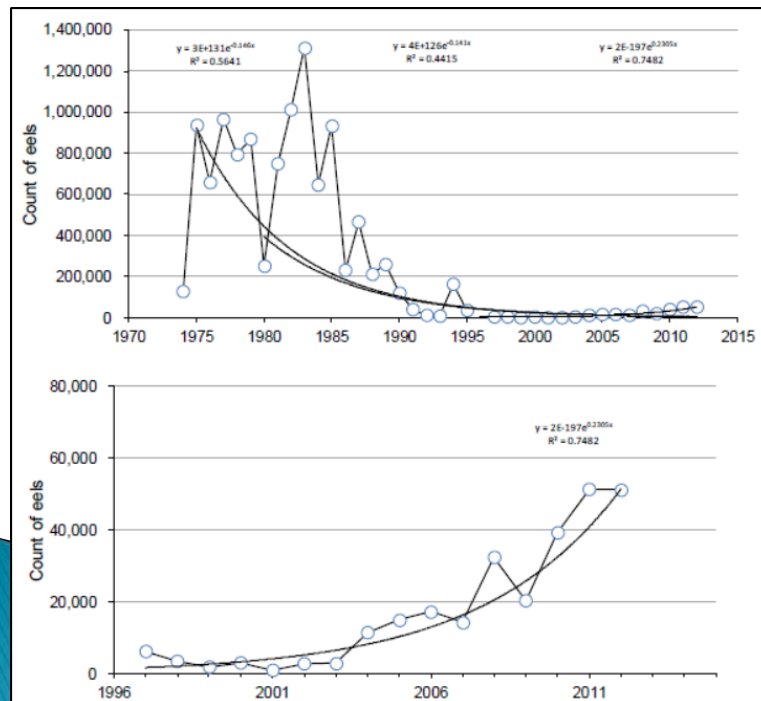


# What was considered in our finding?

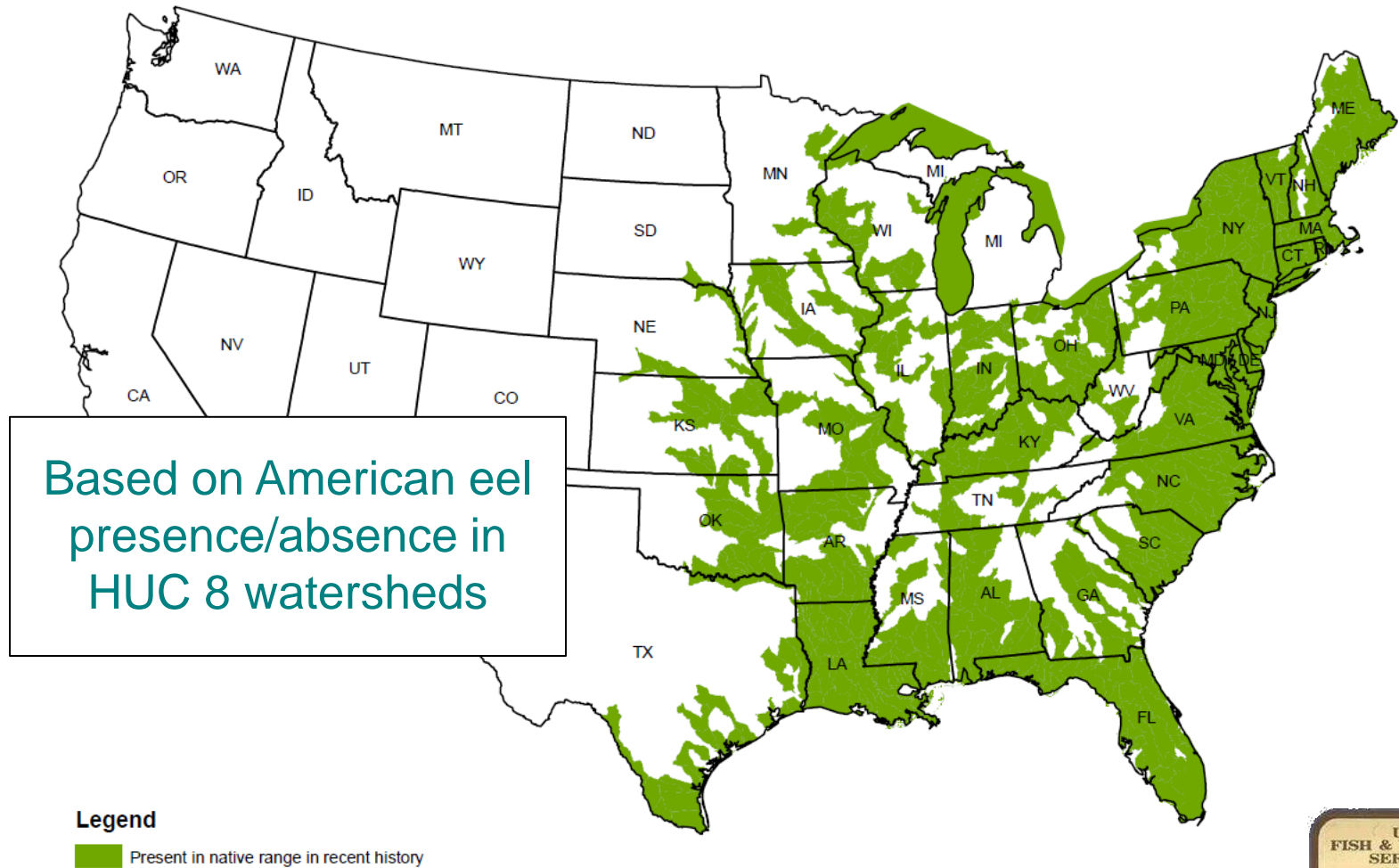
Abundance  
&  
Trends



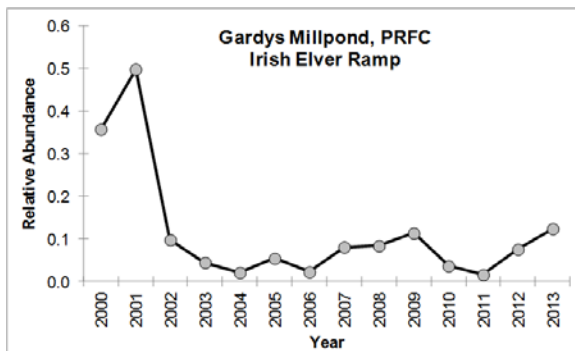
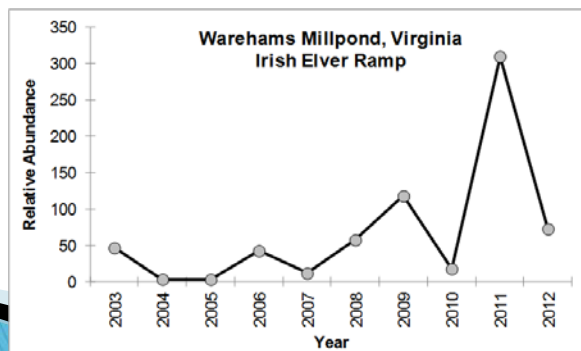
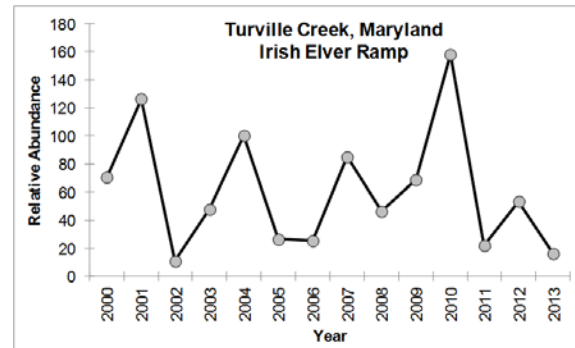
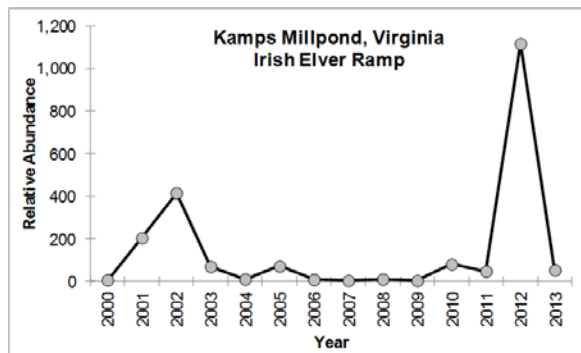
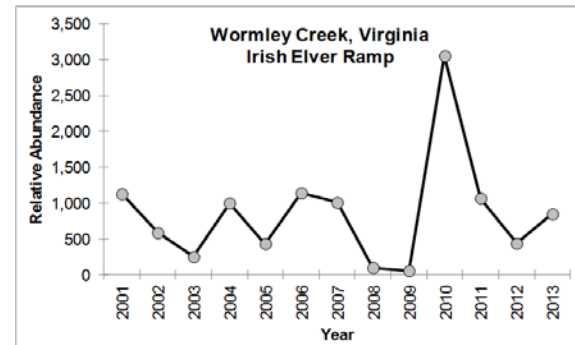
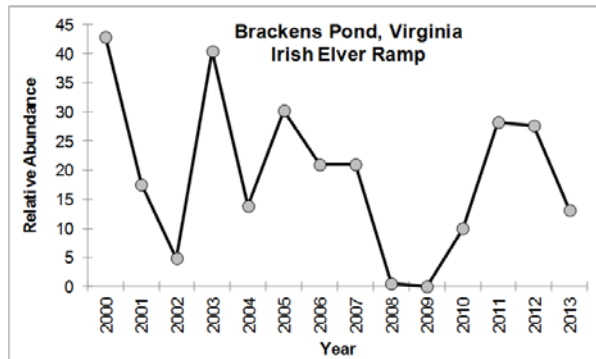
Threats  
&  
Extinction



# Distribution of American eel in the U.S.

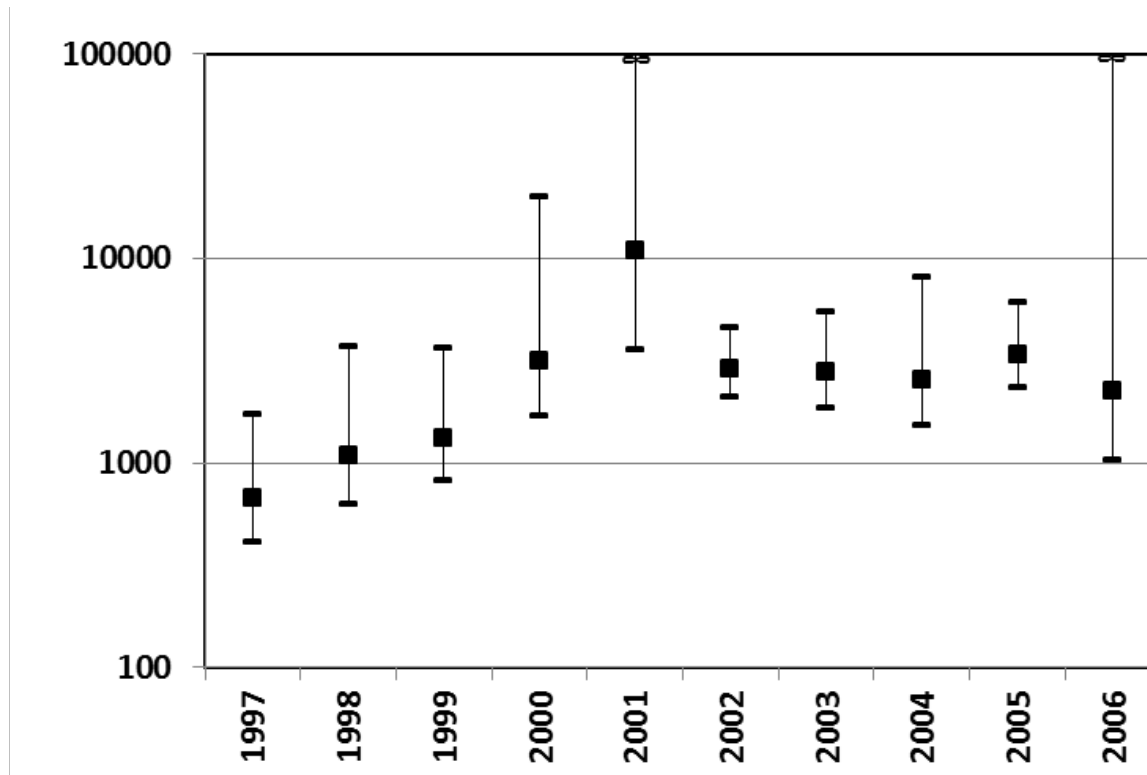


# Elver Abundance Trend Examples



# Breeders per Cohort ( $N_b$ )

An index of the number of breeding eels contributing to each cohort

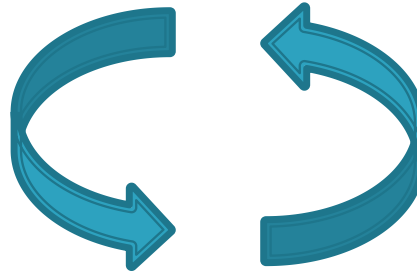


Data from: Côté, C., P. Gagnaire, V. Bourret, G. Verreault, M. Castonguay and L. Bernatchez. 2013. Population genetics of the American eel (*Anguilla rostrata*):  $F_{ST} = 0$  and North Atlantic Oscillation effects on demographic fluctuations of a panmictic species. *Molecular Ecology* 22:1763–1776.



# What was considered in our finding?

Abundance  
&  
Trends



Threats  
&  
Extinction





# Stressors (~~Threats~~)

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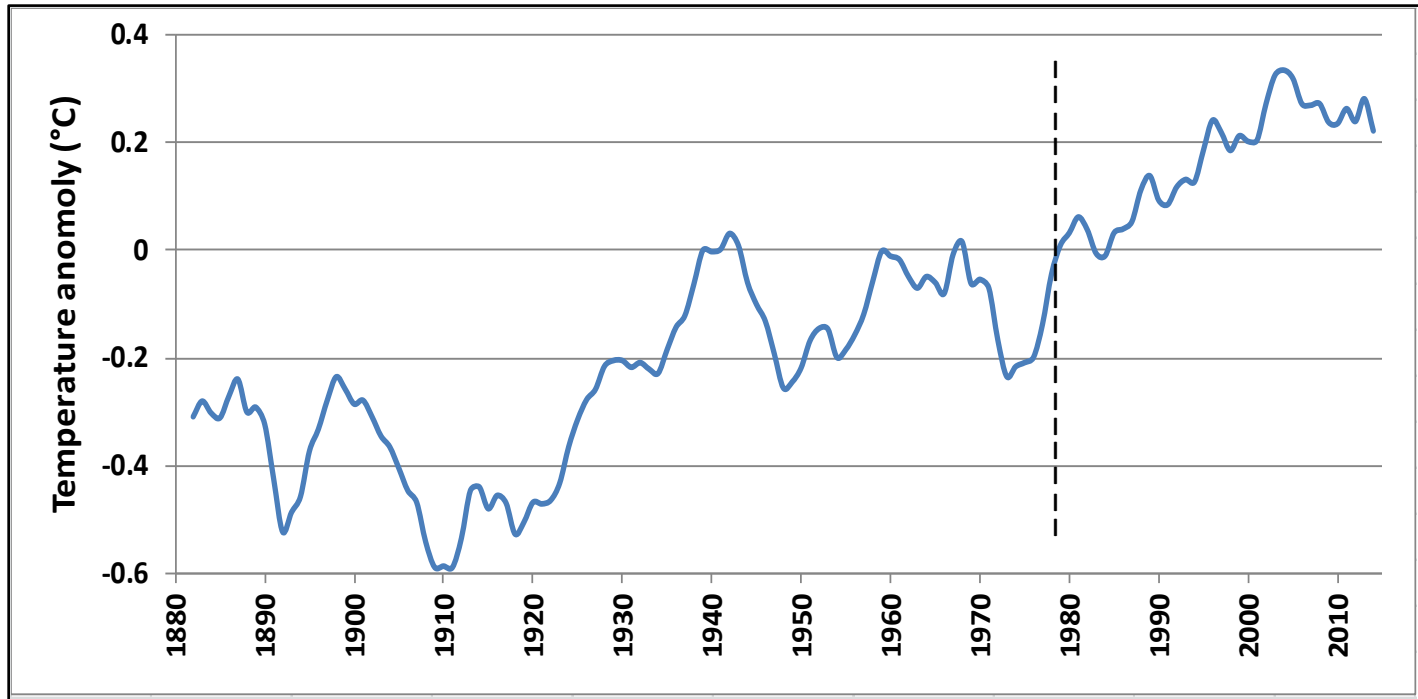
Seven stressors are described in the Biological Report:

1. Climate change
2. Parasites
3. Predation
4. Habitat loss and fragmentation
5. Migratory impacts from dams
6. Commercial harvests
7. Contaminants

(These stressors may rise to the level of Threats to the species.)



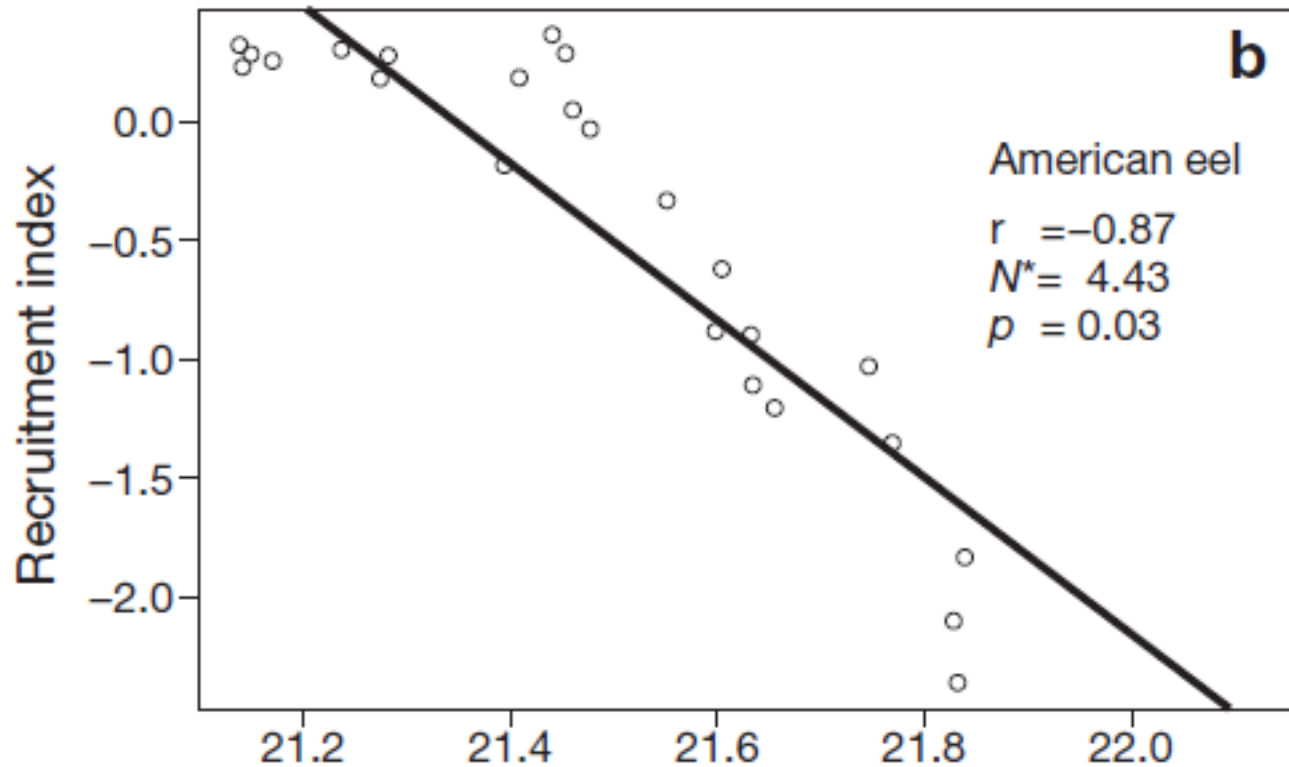
# Climate Change



**FIGURE 22**—Average Atlantic Ocean sea surface temperature anomaly from 1880-2014 at 0°N to 30°N (data from noaa.gov).



# Climate Change—Ocean Temperature

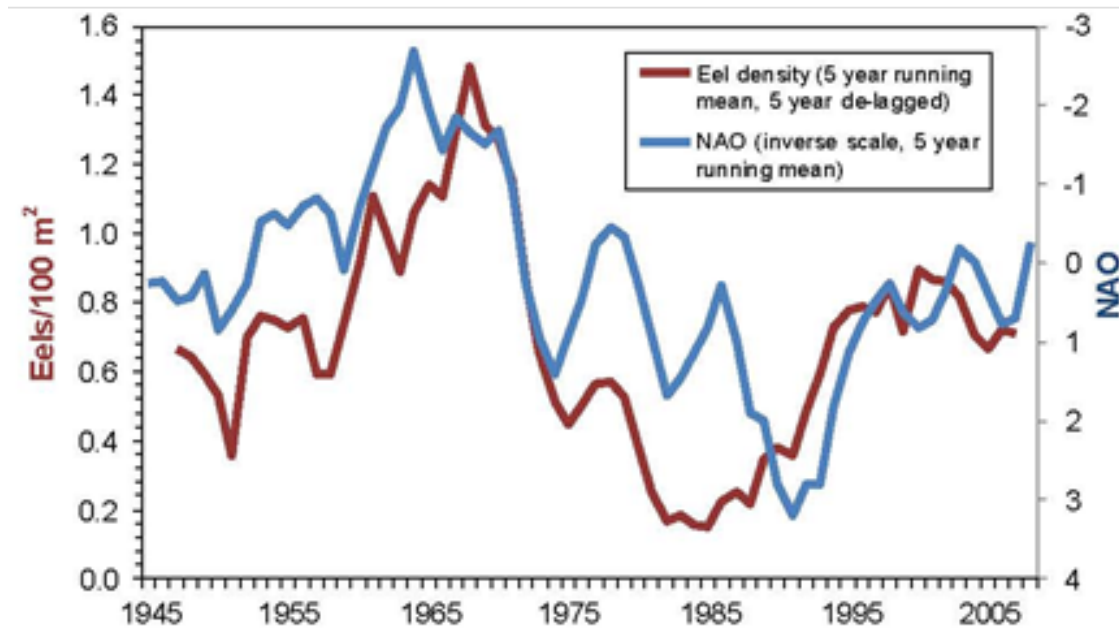


**FIGURE 23**—American eel recruitment index versus Sargasso Sea surface temperature (from Bonhommeau *et al.* 2008, p. 76).



# Climate Change and the NAO

The North Atlantic Oscillation (NAO) is inversely correlated with the abundance of young American eels.



**FIGURE 24**—The inverse relationship between juvenile eel density and the NAO (from Cairns *et al.* 2014 p. 92).



# Climate Change—NAO

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Researchers have speculated on specific NAO mechanisms that may affect eel. For example:

- The NAO affects currents that carry larvae to continental rearing areas.
- It changes ocean productivity, which affects larval food availability (e.g., marine snow).
- The NAO changes the characteristics of ocean front spawning sites far to the south in the Sargasso Sea.

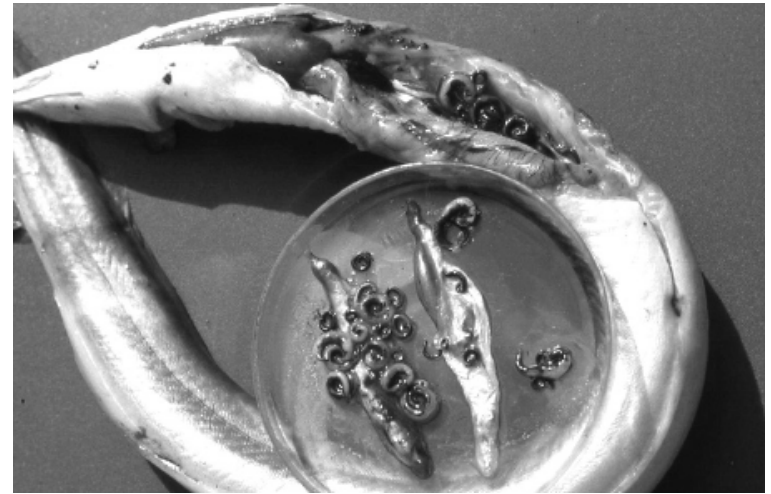
And...there are similar correlations for the NAO and European eel abundance.



# Parasites—*Anguillicoloides crassus*

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- exotic parasitic nematode from Asia
  - adult worms infest the swimbladder
  - requires warmer waters
  - does not survive in full salinity
  - has many intermediate hosts
  - causes little or no mortality, but
  - may have chronic sub-lethal effects
- 



## History of introduction in North America:

- 1995, first described in Texas and S. Carolina
- 1998, found in mid-Atlantic states and the Hudson River
- by 2005, widespread in eastern U.S., not in Canada
- 2007, documented in Cape Breton, Nova Scotia
- Not documented in the Mississippi River basin



# Predation

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Recent research in Europe and N. America using satellite pop-off transmitters has documented some new sources of predation.

- Temperature and depth data document predation by “warm-blooded” fish species.
- Behavior and temperature indicate predation by porbeagle shark.
- Possibly some predation by thresher shark and tuna.
- However, the large transmitter size casts some doubt on the study results and conclusions.



# Stressors

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These stressors have been updated where new information has become available since the 2007 Status Review:

1. Climate change
2. Parasites
3. Predation
4. Habitat loss and fragmentation
5. Migratory impacts from dams
6. Commercial harvests
7. Contaminants





# Hydroelectric Dam Impacts

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- Some dams are complete barriers (habitat loss),
- Ineffective upstream passage fragments habitat,
- Mortality due to downstream passage



# Eel Upstream Fishways

- Simple
- Cheap
- Effective...with the right design, siting and operation



Alex Haro, USGS



# Eel Upstream Fishways

Eel Pass - Roanoke Rapids Dam  
Roanoke River, North Carolina



The Roanoke fishways  
are passing about  
800,000 eels per year



# Eel Downstream Passage

- Not so simple
- Not so cheap
- Not so effective

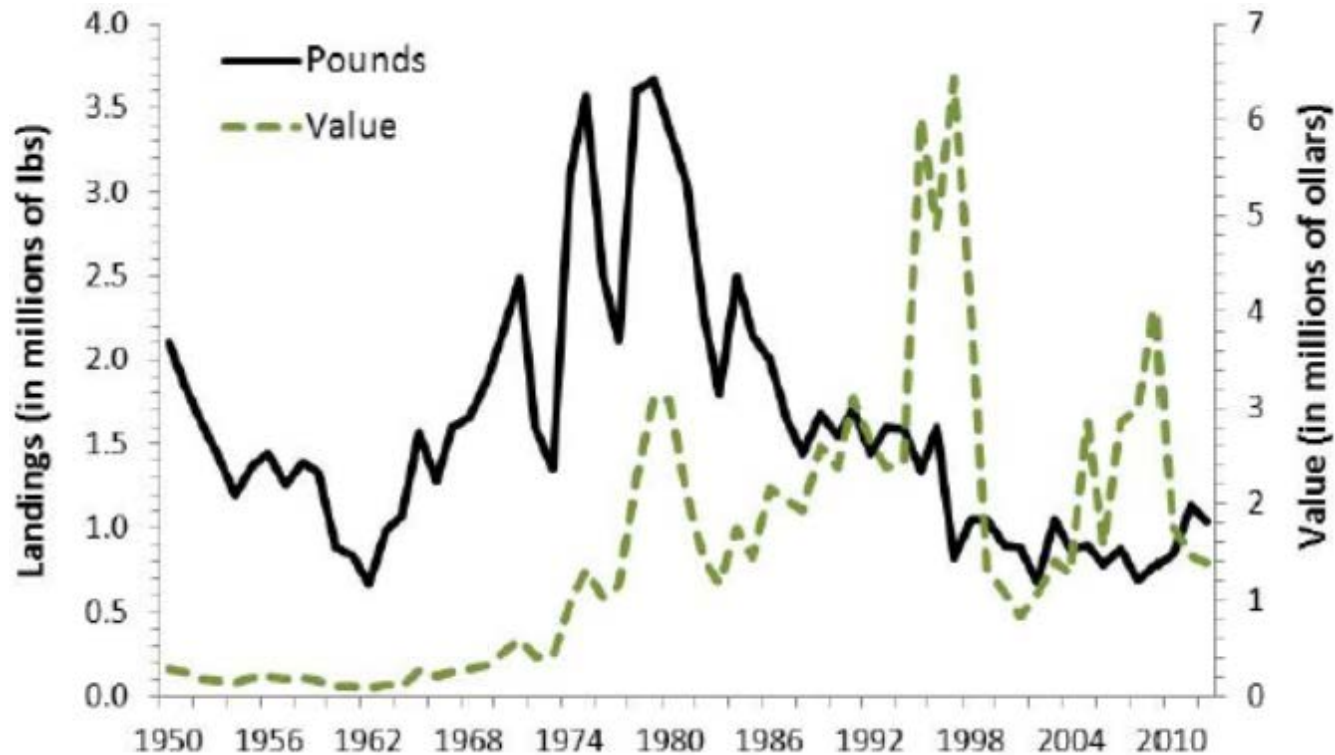
Entrained eels experience a high rate of mortality



Courtesy A. Haro, USGS



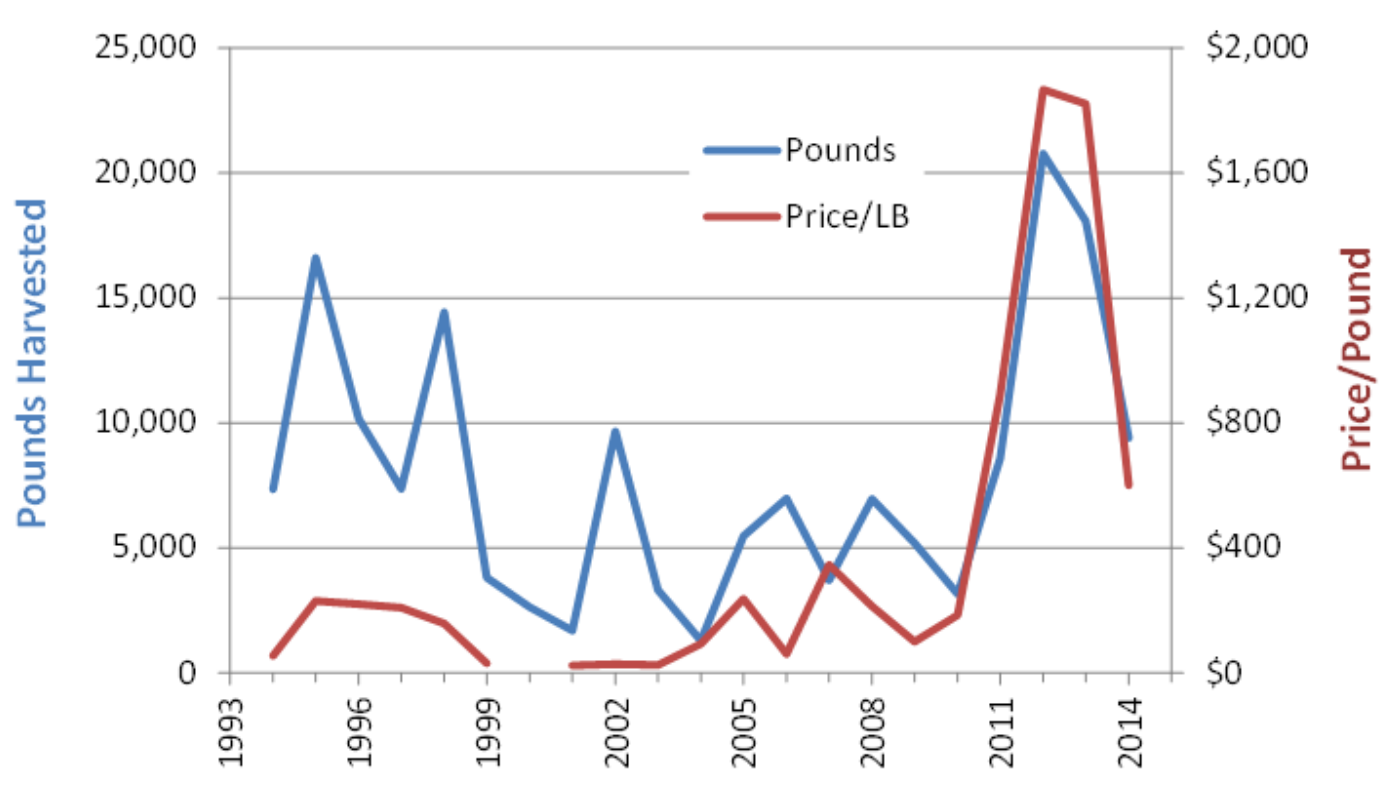
# U.S. harvest of yellow eels



**FIGURE 25**—Total U.S. commercial landings and value of yellow eels from 1950 to 2010 (ASMFC 2014b, p. 9).



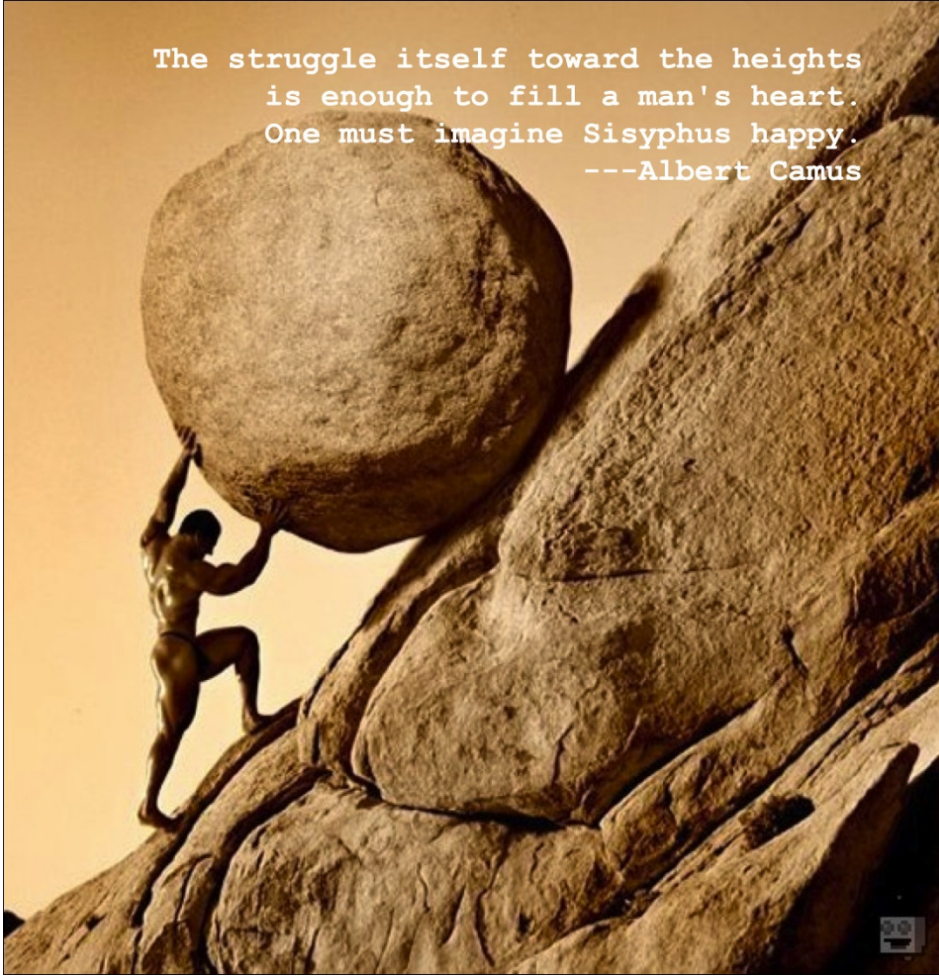
# Maine harvest of glass eels



**FIGURE 26**—Maine glass eel landings and price paid to harvesters from 1994 to 2014 (data from MDMR 2014).



The struggle itself toward the heights  
is enough to fill a man's heart.  
One must imagine Sisyphus happy.  
---Albert Camus



Questions...

