

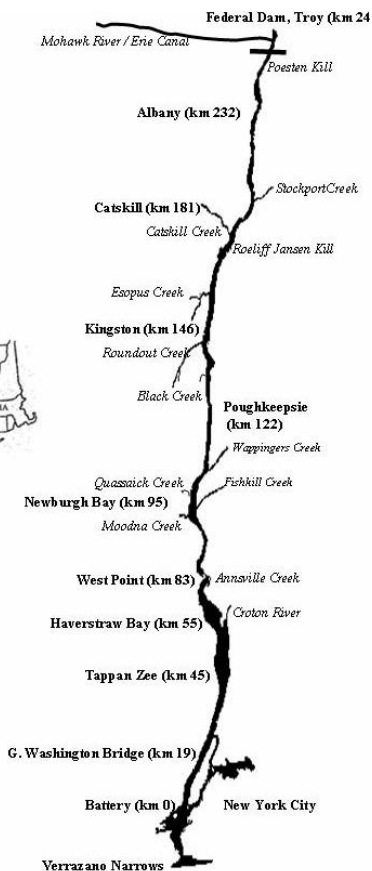


## Status of New York River Herring Stocks

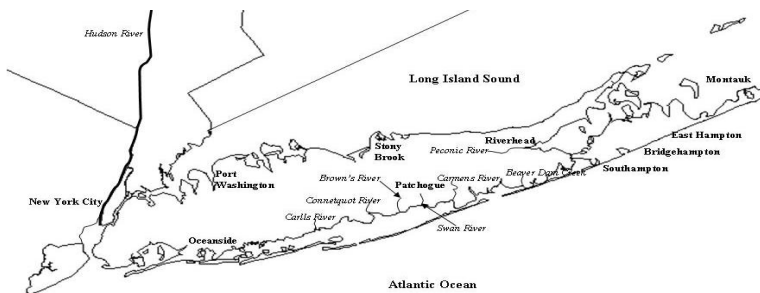
K. Hattala, M. DuFour, R. Adams and A. Kahnle  
Hudson River Fisheries Unit, Bureau of Marine Resources  
New York Department of Environmental Conservation

**Distribution, Biology and Management:** The fisheries that existed back in colonial days in the Hudson Valley of New York undoubtedly included river herring among the many species harvested. River herring, comprised of both alewife (*Alosa pseudoharengus*), and blueback herring (*Alosa aestivalis*) were among the fish mentioned by early explorers and colonists – the French Jesuits, Dutch and English. Archaeological digs of Native American middens indicated the fish provided an important food source to them. The present fishery, which includes both commercial and recreational harvesters, exploits the spawning migration; the primary use of herring is for bait.

Two management units exist for New York. They are the Hudson, and all its tributaries, including the Mohawk River. The Hudson is tidal for 247 km to the first impassable barrier, with numerous (>50) smaller tributaries used by herring for spawning. Blueback herring began colonizing the Mohawk River in the 1970s; increased through the 1990s, but have declined since 2000. River herring spawn in fresh water of the Hudson, most all of the tidal portion tributaries and the Mohawk.



Numerous Long Island streams have runs of primarily alewife. Most are freshwater tidal streams that empty from head ponds and kettle lakes. Little biological data are available from these runs.

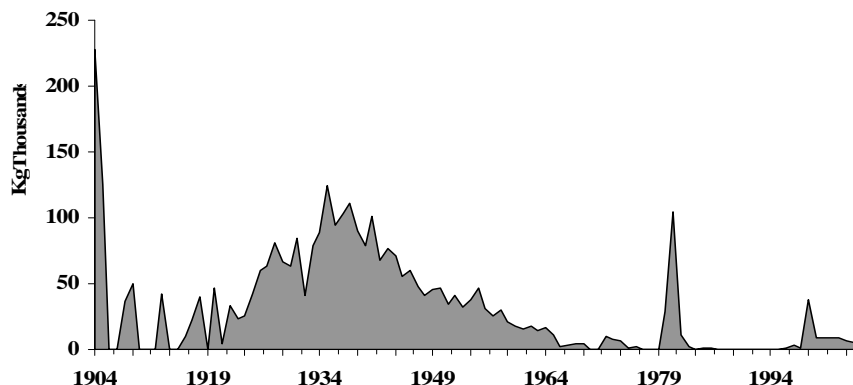


Females return to spawn from age four through six, males ages three through five. After annual spawning they return to ocean waters. Their coastal migratory range extends from the Bay of Fundy, Nova Scotia south to coastal waters off North Carolina. Observed data indicate river herring can reach age ten, and can spawn up to seven times during its life. The maximum age is not known.

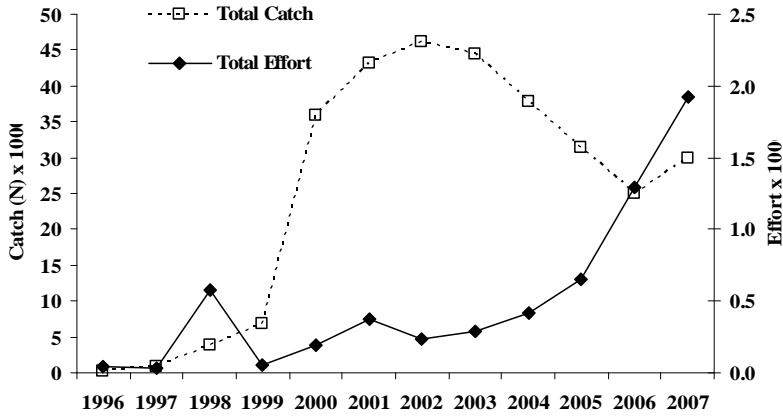
Current management is through a cooperative interstate fishery management plan coordinated through the Atlantic States Marine Fisheries Commission.

**The Commercial Fishery:** Several peaks occur in the total river herring landings for New York. The first peak occurred in the early 1900s followed by a lull (with some gaps) until the period prior to, during, and after World War II when landings peaked a second time. By the 1950s, landings were in a serious decline. Landings remained low through the 1980s through 1995. A small peak in herring landings occurred in 2000, but landings have declined since then. Reported Hudson River landings were approximately 6,300 kg (14,000 pounds) in 2007.

New York river herring landings

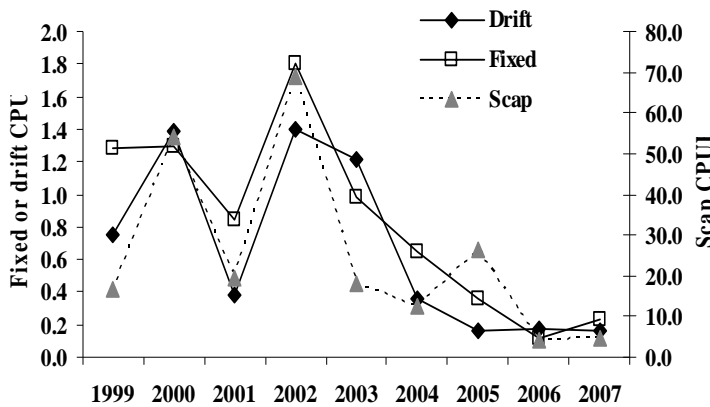


Hudson River commercial fishery

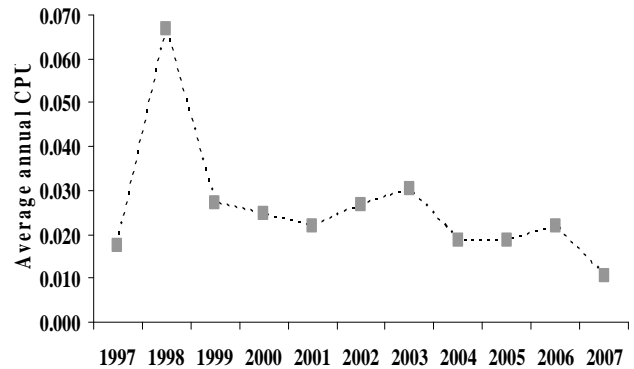


**Adult Abundance:** Since 2002, total catch (in number of fish) declined while effort rose. Three major gears used to catch fish are fixed and drift gill nets and scap/lift nets. CPUE of these gears have all declined (CPUE: catch-per-unit-effort = number of fish/net-hour, calculated from commercial mandatory reports for these gears).

Mandatory reports



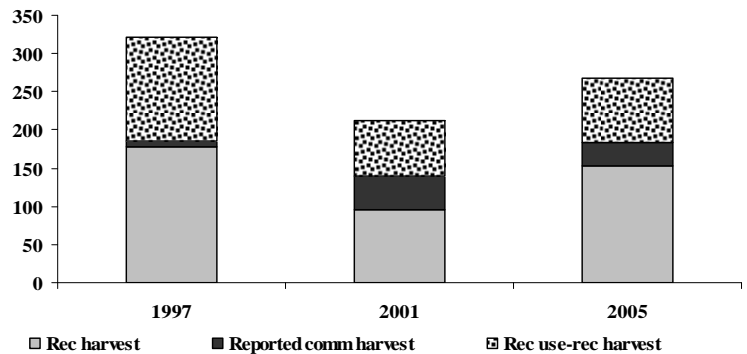
Commercial monitoring- fixed gill nets



In DEC's Hudson River commercial monitoring program, technicians observe commercial fishing operations. We use the data from the passive fixed gear gill-net fishery in the lower Hudson as an annual index of adult abundance. Fixed gill nets in the lower river most accurately monitor river herring abundance as they migrate through the lower river to upriver spawning areas. Although sample size is relatively small, the same declining trend is evident.

**The Recreational Fishery:** River herring are extremely popular as bait during the spring fishery for striped bass. Many recreational striped bass anglers catch their own bait prior to, or while, fishing for striped bass. In New York, angling and some net gears are allowed to catch bait (scap/lift, dip and cast nets) under an inland fishing license. Many fishers are quite successful jigging for herring using Sabiki rigs. A number of recreational fishers also purchase marine commercial permits to catch herring for their own use and/or to sell.

Total river herring used compared to known harvest

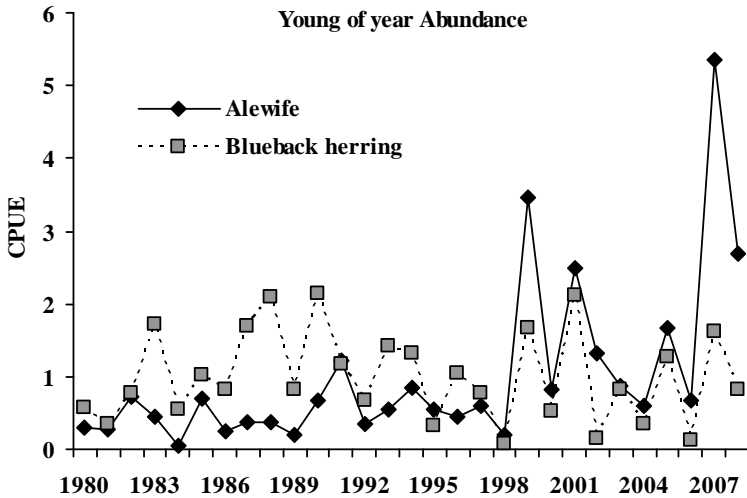
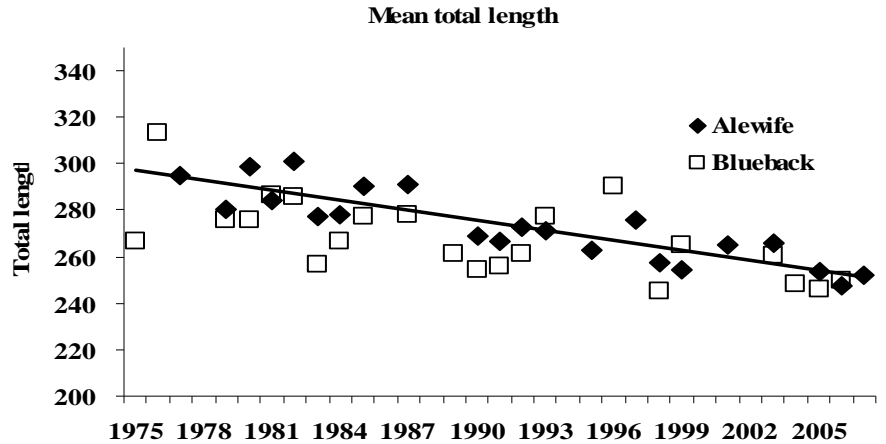


From creel survey and angler diary data, we estimated the total number of herring used in the 2005 striped bass fishery to be 236,000 fish (the number of herring per trip (3.65) times the 64,500 trips using bait for striped bass). This includes herring both caught and bought by recreational fishers.

The same creel survey reported recreational harvest by anglers to be 152,000 herring. Only 32,000 fish were reported harvested by commercial gear (and available for sale), leaving 84,000 fish used, but unaccounted for in harvest records.

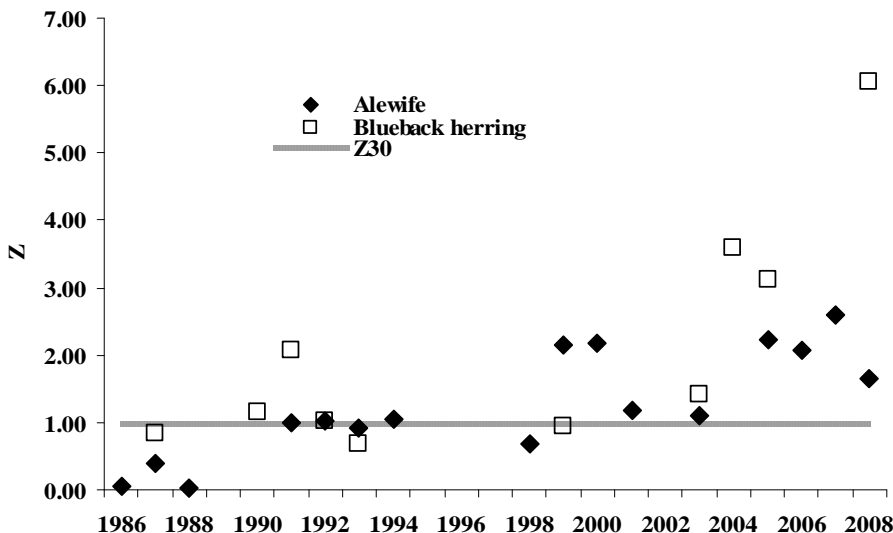
Overall the recreational fishery harvest is greater than harvest by commercial gear. It is clear that the reporting rate is low for commercial fishers. However, many recreational fishers obtain commercial permits that allow them to take and sell herring, which blurs the line between the users of this resource.

**Adult Size:** A decline in fish size occurred from the late 1970s through the present, concurrent with declining CPUE and landings. Samples from the fishery and the independent spawning stock survey indicated fish size has dropped. The same decline is occurred in both alewife and blueback herring.



**Young of year Abundance:** The NYSDEC collects data on young of year, or juvenile, fish. The annual abundance indices are quite variable for both alewife and blueback herring. The erratic see-saw pattern of indices may be the direct result of zebra mussels which have depleted much of the food supply of early life stages of these species.

Over 80% of the river's phytoplankton (microscopic plant food) has been consumed by zebra mussels. This has caused a 50% decrease in the abundance of zooplankton, which young fish first begin to feed on.



**Mortality Rates**

We calculated acceptable rates of total mortality ( $Z_{30}$ ) for river herring from a Thompson-Bell biomass-per-recruit model (BPR) using Hudson River inputs for weight, maturity, vulnerability-at-age, and natural mortality ( $M$ )=0.42, based on the maximum age of 10 observed in the stock. The resulting  $Z_{30}$ , also called a reference point, was equal to 0.97.

Total mortality estimates ( $Z$ ), calculated for the spawning stock show that  $Z$  for the

Hudson River stock was stable in the late 1980s through the 1990s, then began to climb after 2000. Mortality rates have been over the acceptable rate since 2004.

**Habitat loss and degradation:** From the late 1890s through the 1950s, much spawning and nursery habitat (approximately 4,500 acres north of Hudson NY) was lost in the upper half of the tidal Hudson because of dredge and fill operations to maintain the river’s shipping channel. Spawning was likely affected, much like the impacts on their larger cousin, American shad. New York City and Albany, as well as other major towns along the Hudson, added their share of pollution to the river. It was so prevalent that the Hudson was often referred to as an open sewer. Biological demand caused by sewage created oxygen blocks that occurred seasonally in some sections of the river. The best-known blocks occurred from the 1960s to 70s near Albany, the other occurred in the 1980s in New York harbor. These oxygen blocks cleared up after implementation of the Clean Water Act and when secondary treatment plants came on-line. The introduction of zebra mussels in the Hudson in 1991, and their subsequent explosive growth in the river, quickly caused major changes in the phytoplankton (80% drop) and micro and macro-zooplankton (76% and 50% drop, respectively). These massive changes resulted in a decrease in observed growth rate and abundance of YOY fishes. It is not yet clear how if this constraint affects annual survival and recruitment. However, distribution changed – young of year fish are now using shallow waters more, perhaps in an effort to find food.

**Other losses:** Striped bass predation on adults is a well-known fact. Herring are used extensively for bait for the popular spring recreational striped bass fishery. We collected and examined the gut contents of 1,859 mature striped bass from the Hudson River from 1990 through 2006. Most fish were collected in spring. Most striped bass stomachs were empty (84%). Of those that contained food, unidentified fish and river herring were the most common diet items. Two power generating companies located within the spawning area use closed cycle cooling. The remaining power generating stations with once-through cooling occur from Newburgh Bay south. Total entrainment and impingement losses, due to once-through cooling water intakes at these power generating stations averaged about 24% in most years, from 1974 through 1997.

**Summary:** Current trends in the Hudson’s river herring stock are not encouraging. Most all of the indicators (CPUE, mean size) indicate a decreasing trend. This coincided with a rise in adult mortality, which is now above acceptable levels. Recent patterns of change in the young-of-year index are of concern. River herring are also vulnerable to a host of fisheries on the Atlantic coast during the entire duration of their ocean residency. Total ocean bycatch estimates remain unknown.

Fishery dependent & independent sampling data trends for river herring in the Hudson River **Bold = significant**

Source data	Year Range	Slope	R-Square	P	Trend
Fishery dependent					
CPUE – commercial drift gill net	2000-2007	<b>-0.17</b>	<b>0.52</b>	<b>0.042</b>	<b>Decreasing</b>
CPUE – commercial fixed gill net	2000-2007	<b>-0.19</b>	<b>0.64</b>	<b>0.017</b>	<b>Decreasing</b>
CPUE – commercial scap/lift net	2000-2007	-6.62	0.48	0.058	Decreasing
Mean TL - alewife - all	2001-2007	-4.27	0.42	0.334	Decreasing
Mean Wt - alewife - all	2001-2007	-4.69	0.58	0.163	Decreasing
Mean TL - blueback herring- all	2001-2007	-1.62	0.89	0.056	Decreasing
Mean Wt - blueback herring- all	2001-2007	-4.67	0.90	0.235	Decreasing
Fishery independent					
Mean TL – alewife	1975-2007	<b>-1.44</b>	<b>0.77</b>	<b>&lt; 0.001</b>	<b>Decreasing</b>
Mean Wt – adult alewife	1975-2007	<b>-4.04</b>	<b>0.68</b>	<b>&lt; 0.001</b>	<b>Decreasing</b>
Mean TL – adult blueback herring	1975-2007	<b>-1.10</b>	<b>0.40</b>	<b>0.002</b>	<b>Decreasing</b>
Mean Wt – adult blueback herring	1975-2007	<b>-1.95</b>	<b>0.25</b>	<b>0.026</b>	<b>Decreasing</b>
Total mortality- alewife	1986-2008	<b>0.05</b>	<b>0.68</b>	<b>&lt; 0.001</b>	<b>Increasing</b>
Total mortality-blueback herring	1987-2008	<b>0.09</b>	<b>0.56</b>	<b>0.012</b>	<b>Increasing</b>
NYSDEC YOY abundance alewife	1980-2007	<b>0.06</b>	<b>0.03</b>	<b>0.003</b>	<b>Increasing</b>
NYSDEC YOY abundance b.herring	1980-2007	0.01	<.001	0.960	No trend