

Dedicated to the Memory of Commissioner Enoch S. "Inky" Moore Jr.



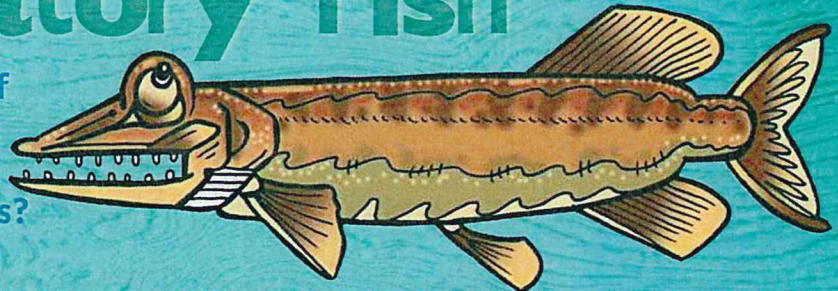
PIYAY

SUMMER
2005

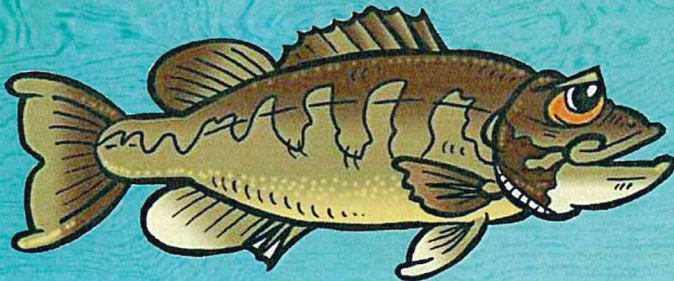
Pennsylvania • League • of • Angling • Youth

PA's Most Mighty Migratory Fish *by Walt Dietz*

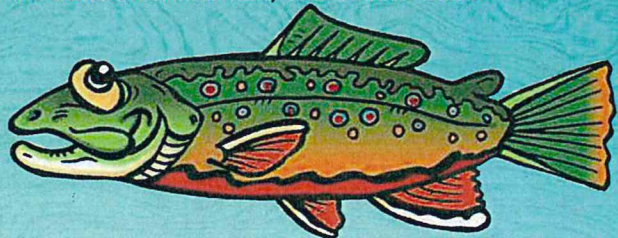
Which fish would you think of if you were asked to imagine one of Pennsylvania's most important and interesting fishes?



Maybe even the mighty muskellunge? What about the state's official fish, the brook trout?



Would the popular smallmouth bass come to mind?



Here's a hint: This fish once had a significant effect on our state and nation's economy. It still does. And it's had its share of obstacles over the years. How about the **American shad**?

The American shad is one of our state's most important fishes. It was once caught and eaten by Native Americans. Later, an entire fishing industry thrived around it and it fed many people. Is there any wonder why its scientific name is *Alosa sapidissima*, which is Latin for "shad, good to eat"? It's also important in the ecosystem as predator and prey. Today it serves as a great sportfish for many anglers. And it's even good for our state's outdoor recreation economy.

The American shad may not have been your first guess to the question about Pennsylvania's most important and interesting fishes. But you might change your mind once you take a closer look at this great fish. Read on to learn more about the story of the American shad!

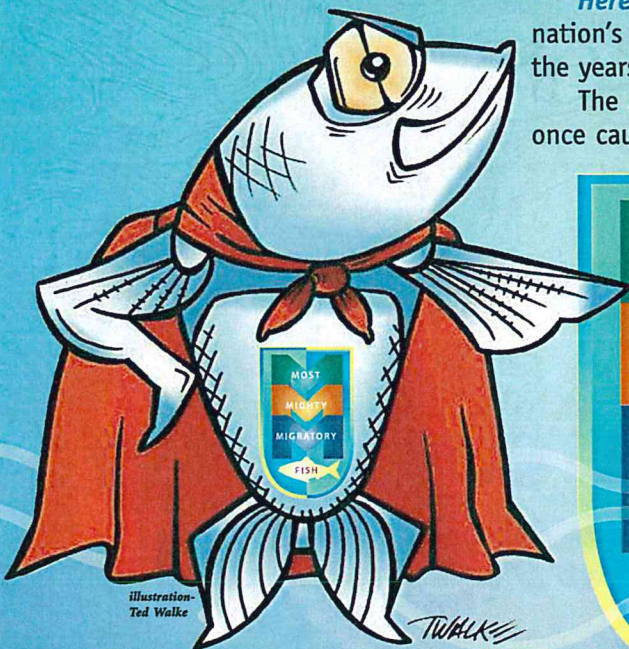
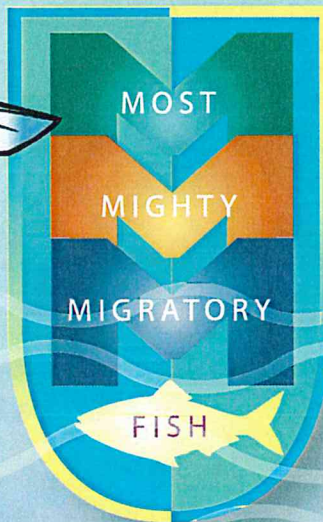


illustration
Ted Walke

TWALKE



www.fish.state.pa.us

The Life Cycle of the American Shad

PA's Most Mighty Migratory Fish



The **American shad** belongs to the herring family (Genus: *Alosa*). It is the largest herring in North America and can grow up to about 24 inches and 6 pounds. It ranges along the Atlantic Coast from Florida all the way to Canada. It likes to eat zooplankton, microcrustaceans and small fish.

This fish is quite a traveler and has a very interesting life cycle. It is anadromous (a-nad-dro-mus), which in Greek means "up-running." In other words, the "anadromous" shad migrates upstream from salt water to fresh water to spawn. The shad enters two rivers in our state by way of the Chesapeake Bay or Delaware Bay. Can you guess which two rivers? See the map of the shad's migration route to find your answer.

Shad make their journey to the rivers in late spring. They spawn at night in shallow areas where the water is moving. One shad can release up to 300,000 eggs! Most shad die after spawning, but some may survive to spawn another day.

After hatching, the little shad fry live in their river nurseries until the next fall, when they start their journey back to the Atlantic Ocean. Check out the life cycle of the shad, **if you think you can keep up!**



SPRING:

Adults migrate to freshwater rivers to spawn, then return to the ocean.

SPRING

SUMMER:
Juveniles use rivers and estuarine waters as nursery areas.

SUMMER

WINTER:

Juveniles stay in near-shore ocean waters until sexual maturity at 3-6 years.

WINTER

FALL

FALL: Juveniles move out to the ocean, joining adults.

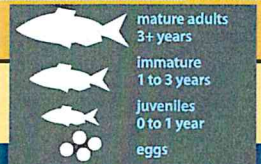
SHAD/HERRING LIFE CYCLE

SPAWNING AREA

FRESHWATER: 0 ppt (parts per thousand) salinity

ESTUARY: 0-30 ppt

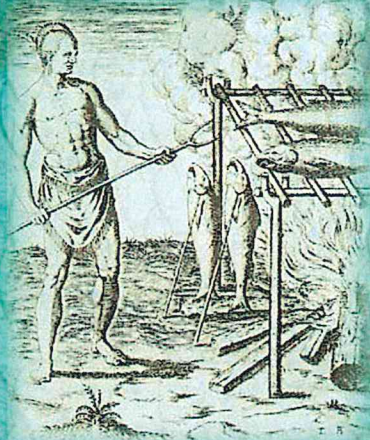
OCEAN: 30-35 ppt





PA's
Most
Mighty
Migratory
Fish

Where Have ALL the Fish GONE?



American shad and other migratory fishes have had their share of obstacles over the years. These fish were once plentiful in our waterways.

The Native Americans relied on them as a food source. Fish later became an important food source for European settlers who came to America. Our taste for their meat and caviar (eggs) led to over-fishing, which led to population declines.



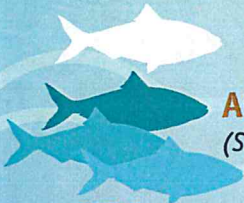
Susquehanna Flats, MD 1900

archival photos courtesy of U.S. Fish & Wildlife Service

Our waterways also became polluted as our nation grew. Sewage, industrial discharges, pollution from cities, runoff from timber harvesting and siltation from farms made it hard for migratory fish to survive their journey.



American Shad Timeline (Susquehanna and Delaware Rivers)



1820

Small mill dams eliminate shad runs on the Susquehanna to Binghamton, NY.

1830- 1835

Construction of canal feeder dams on Susquehanna River at Columbia, Nanticoke, Shamokin, Clarks Ferry and Duncan's Island.

1866

PA's first commissioner of fisheries appointed. Regulations require fish passage at all dams. Start of five fishways constructed at Columbia with no success at passing fish.

1873

First shad hatcheries established.

1874

Poor shad harvest results on the Susquehanna and even worse on the Delaware.

1878

Construction of Columbia Dam on Susquehanna River.

1885

2.5 million pounds of shad commercially caught on Susquehanna River Flats (below dams).



PA's Most Mighty Migratory Fish



One of the biggest obstacles to migratory fish was building dams. Dams once provided the power to run mills. Today, they are used to make hydro-electricity or provide recreation.

Conowingo Dam on the Susquehanna River, 6 miles below the Pennsylvania/Maryland border.

Dams serve an important purpose in our lives, but they also block migratory fish from reaching their spawning grounds.

Dams such as the Conowingo Dam have constructed permanent fish passage facilities to aid these migratory fish.



Conowingo Dam photos-PECO Energy

WHICH WAY DO I GO?



Make sure you check out the 2004 Fall PLAY issue on **Fishing & History** to learn about how Native Americans and early settlers caught migratory fish.



illustration-Ted Walke; photo-Vic Attardo

1889

Fish baskets and weirs eliminated from Delaware River.

1891

Shad catches on Delaware show some recovery.

1904

Construction of York Haven Dam on Susquehanna.

1910

Construction of Holtwood Dam on Susquehanna (fishways included with no success at passing shad).

1915

Last commercial harvest of American shad on Susquehanna.

1926

Construction of Conowingo Dam on Susquehanna.

1932

Construction of Safe Harbor Dam on Susquehanna.

1947-1963

Restoration studies began.

1970

PA Fish Commission, electric utilities and federal government agree on restoration plan.





PA's Most Mighty Migratory Fish

a SUCCESSFUL SHAD TORY



Shad fry

photo-Russ Gettig

UP



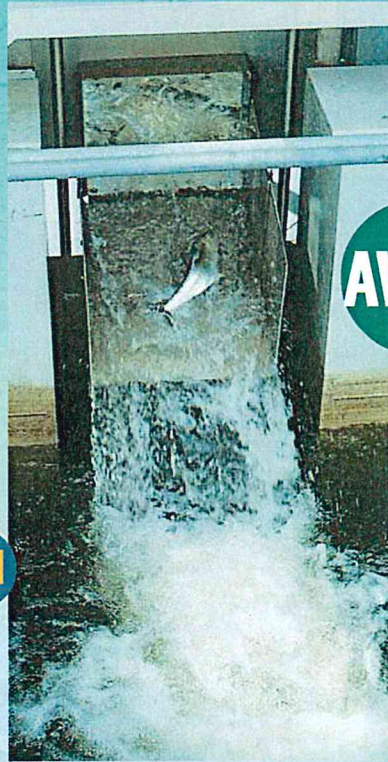
UP



UP



and



AWAY

The fish lift at Safe Harbor Dam began operation in 1997. This fish lift, like Conowingo Dam's lift, passes migrating fish directly into the pool above the dam.



Viewing window

At left, water from above the dam attracts fish into the fish lift. A gate closes and crowds the fish over a bucket, which lifts the fish, in water, and releases them into the channel at a level above the dam.

Safe Harbor Dam photos-Ted Walke

American Shad Timeline

(Susquehanna and Delaware Rivers) *continued*

1972

Construction of Conowingo fish lift completed.

1971-1974

124 million shad eggs transplanted.

1976

Susquehanna River Anadromous Fish Restoration Committee (SRAFR) formed.

1972-1980

7 million shad fry stocked in Juniata River.

1980

Shad fishing closed on all Maryland waters of the Chesapeake Bay.

1981

750 American shad counted at Conowingo Dam.

1985-1994

150,000 adult shad released to spawn above dams on Susquehanna. 100,000 shad fry released into Susquehanna.

PA's Most Mighty Migratory Fish

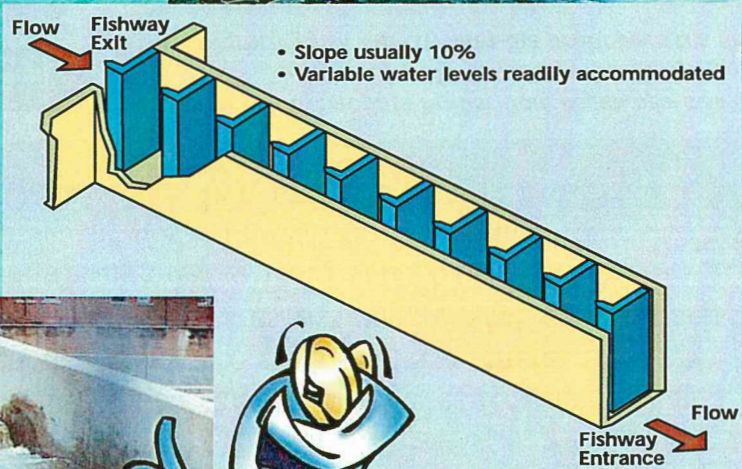


photo-Mike Hendricks

Fish & Boat Commission personnel release 21-day-old inch-long shad fry into the Juniata River at Millerstown, Perry County. The Commission raises 10 million to 20 million shad fry annually for stocking. Raising shad and stocking them above block-ages is currently a major part of restoration.

Regulations also require utilities (the dam owners) to provide fish passage at each dam that cannot be removed. These utilities have built fishways, elevators or lifts that help transport fish over the dam so they can continue their upstream migration. All four of the big hydroelectric dams on the lower Susquehanna River have fish elevators or lifts.

Finally, the Commission restocks fry and migrating adults to areas above the dams so that they can reach their spawning areas. The shad fry come from eggs that are taken from adult shad and raised in a hatchery.



Fishways constructed on barriers (see graphic) are called ladders. Migrating fish swim up the ladders at their own pace to reach upstream spawning habitat.

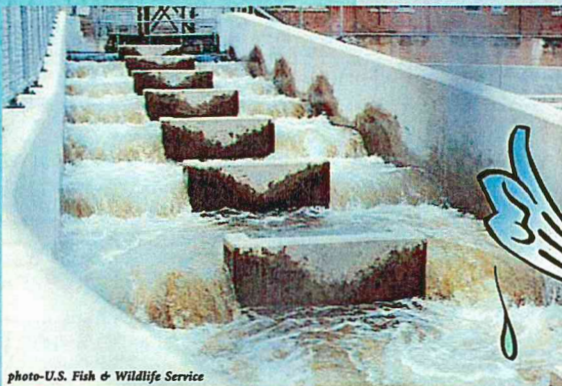
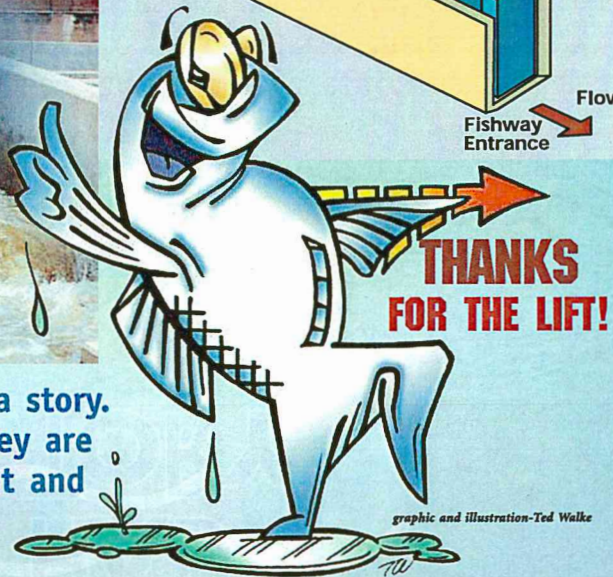


photo-U.S. Fish & Wildlife Service



THANKS FOR THE LIFT!

graphic and illustration-Ted Walke

American shad have quite a story. Now you might agree that they are Pennsylvania's most important and interesting fishes.



1990
15,000 American shad counted at Conowingo Dam.

1995
Holtwood fish passage completed.

1997
Safe Harbor fish passage completed.

2000
York Haven fish passage completed.

2001
193,574 American shad counted at Conowingo dam, a new record!



2001
DCNR agrees to provide fish passage at inflatable dam in Sunbury.

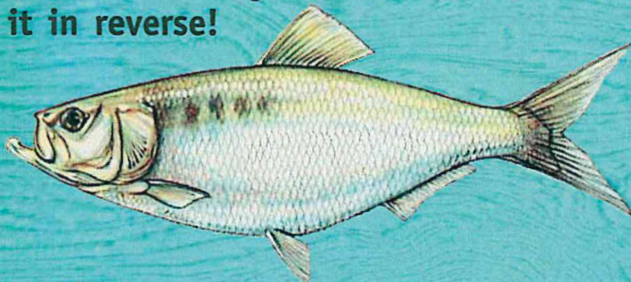
2003
125,135 American shad counted at Conowingo dam.



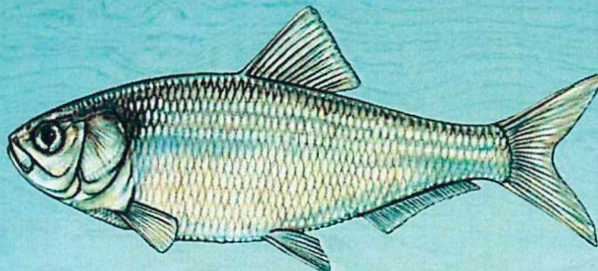
PA's
Most
Mighty
Migratory
Fish

Many More Migratory Fish

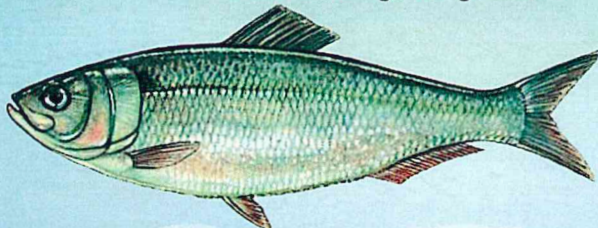
American shad aren't the only fish that migrate up and down Pennsylvania's waterways. You might be surprised to learn how many fish move between the Atlantic Ocean and our state's waterways. One fish even does it in reverse!



Hickory shad (*Alosa mediocris*). This endangered shad is slightly smaller than the American shad, reaching lengths of around 15 inches. This shad prefers to eat small fish.

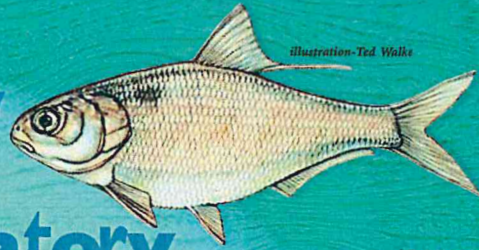


Alewife (*Alosa pseudoharengus*). This shad prefers to spawn in smaller tributaries and slack water. A "landlocked" form of the alewife has been stocked into lakes across the state as forage for gamefish.



Blueback herring (*Alosa aestivalis*). This herring looks like the alewife, but it's slightly bigger. It migrates to the lower Delaware River and Delaware estuary.

Paddlefish (*Polyodon spatula*). This bizarre-looking critter migrates up and down the Allegheny and Ohio rivers in search of plankton to eat.



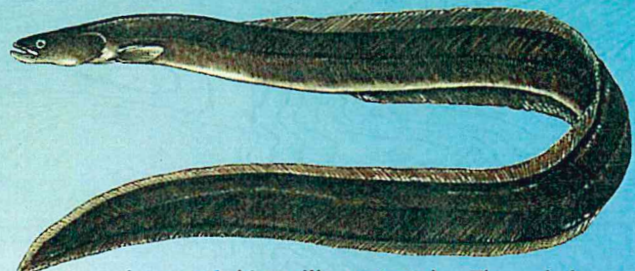
Gizzard shad (*Dorosoma cepedianum*). This herring is a bit different from the others. It has a muscular gizzardlike stomach to process plankton and plant food that it strains from the water.



Striped bass (*Morone saxatilis*). This fish can live up to 30 years and reach sizes of 4 feet long and 50 pounds! It spawns near tidal tributaries. Small stripers may move up rivers to feed during the summer. Landlocked stripers can be found in some of our state's bigger lakes.



Atlantic sturgeon (*Acipenser oxyrinchus*). This prehistoric fish is endangered. It can reach huge sizes up to 14 feet long! It migrates to the lower reaches of the Delaware River to spawn.



American eel (*Anguilla rostrata*). The eel does things in reverse. It is catadromous (cat-'tad-dromus), which means "down-running." It spends most of its life in fresh water and then migrates to the Atlantic Ocean's Sargasso Sea to spawn.

