http://www.cqs.washington.edu/~hinrich/foundation.html ISSN 1099-4990

HUDSON RIVER ISSUE

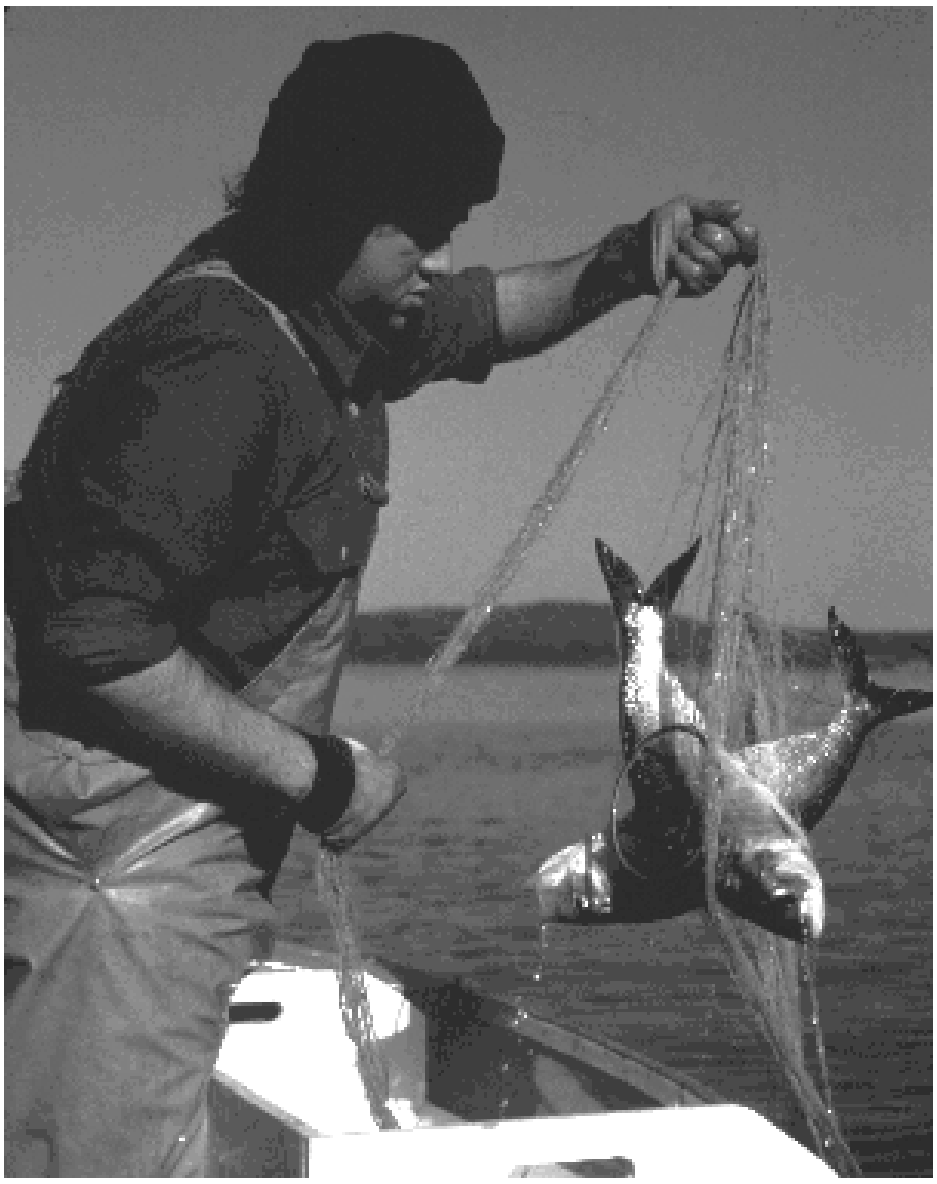
■ THE SHAD FOUNDATION'S ■

# SHAD JOURNAL

*"For the study, protection, and celebration of shad around the world"*

## *"Uppie, downie": commercial stake gill netting on the Hudson Stock identification, management, and fishing*

VOLUME 2, NUMBER 3, SUMMER 1997



TOM LAKE

**A COMMERCIAL FISHERMAN in the Hudson River lands a pair of American shad. Their capture in the Hudson indicates they almost certainly are from the Hudson River stock; if the same fish were captured in the coastal intercept fishery, only sophisticated stock identification techniques could determine their stock affinities and those of their cohorts. To learn more about these techniques, please turn to page 12.**

***President's Note:***

This issue features five articles on the Hudson River shad and their fisheries. Each of the five authors has a unique perspective on the Hudson's shad; together they sketch a picture that spans biology and human culture. The articles by Kathryn Hattala, John Waldman, and Karin Limburg span topics from shad life history, management, genetics, and the biology juveniles. Those of John Harmon and Richard Joseph give us the commercial fisherman's point of view. The fisherman's struggle has been the shad's—staying alive under a history of a changing river and wide swings in human attitudes and management practices.

I came away from this issue with great optimism because of the passion and concern for the Hudson that changed the river from an overworked, open sewer, to a relatively clean river. It demonstrates the remarkable power of a river to clean itself once pollution is cut back. The resolve of biologists and fishermen to see stocks rebuilt is an inspiration.

The *Shad Journal* welcomes a larger editorial board which now includes nine members: John Waldman of the Hudson

*Continued on page 3*

**INSIDE**

# SHAD FORUM

*This new "Shad Forum" department of the Shad Journal publishes letters and comments on issues surrounding shad and their fisheries. Your contributions are welcome.*

### Shad in Australian Waters?

Concerning the map on page 3 of the February issue, I was surprised to see no shad listed for Australia. According to Tim Berra's "An Atlas of Distribution of Freshwater Fish Families of the World," clupeids occur across eastern Australia. Do you have any knowledge of this?

*JOHN WALDMAN*
*HUDSON RIVER FOUNDATION*
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***Hinrichsen's reply:***

Although clupeids occur over a wide range of Australian freshwaters, apparently no shad can be counted among them. According to G.R. Allan (1989), there are only two Australian herrings that require freshwater for their life cycle: the bony bream (*Nematalosa erebi)* and the freshwater herring (*Potamalosa richmondia*). P.J.P. Whitehead's "Clupeoid Fishes of the World" does not include these among the shad (Alosinae).

See:

FRESHWATER FISHES OF AUSTRALIA. G.R. Allan. Neptune City, New Jersey, USA: TFH Publications, Inc., pages 26-28; 1989.

AN ATLAS OF DISTRIBUTION OF FRESHWATER FISH FAMILIES OF THE WORLD. Tim M. Berra. Lincoln, Nebraska, USA: University of Nebraska Press, page 21; 1981.

### Dadswell on Invasions and Competition

***From the Editors:***

We asked Dr. Dadswell, a noted biologist and member, about the effect of shad on the native species of the West Coast and whether American shad, as Spencer Baird predicted before the turn of the century, might invade the great rivers of Asia.

***Dadswell's reply:***

The dispersal of American shad into a region where there are already other shad species (i.e., Asia) may occur since in many parts of the world there are two or more Alosid types in a river system. For example, in the southeast United States, there are up to five species in a single river. The demise of many West Coast salmon populations may be because they are unable to compete with the large American shad populations. The juvenile life history of shad and chum salmon is similar.

*MIKE DADSWELL*
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### Pfeiffer's Revised Shad Fishing Book

I am working on a new revised edition of my book "Shad Fishing." It will be based on the old, but with an emphasis on fly fishing for shad, fly patterns, techniques, places, methods, tackle, etc. Thus, if anyone has any ideas, fly patterns, special techniques, photos that they can loan, etc., I would definitely like to hear from them.

The book will be published by Abenaki Publishers (publishers of four fly fishing magazines), but I am just starting, so publication date has not yet been decided and will probably be sometime next year.

A copy of the old edition is available from me for $10.00 (U.S.) plus $2.50 shipping and handling—$12.50 total. I will be happy to autograph the book for anyone interested and can personalize it with a name and message. Many book dealers are selling the book for more than I am.

*C. BOYD PFEIFFER*
*14303 ROBCASTE ROAD*
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### Penobscot Indian Nation Plan Shad Restoration

I am the fisheries manager for the Penobscot Indian Nation, a river tribe with a reservation that lies within the Penobscot River Basin, and a people with a long-standing tradition of seasonal subsistence fisheries for shad and other anadromous clupeids. The Penobscot River was once one of the greatest American shad rivers in the Northeast, until actions of European settlers rapidly overwhelmed their complicated and delicate life history in the early 1800s, spelling their doom for over a century and a half.

Today, we have an opportunity, through the commitment and dedication of a few professionals, to restore this great species [American shad] to much of its former range in the Penobscot. A small working group that includes me, representatives of the U.S. Fish & Wildlife Service, Maine Dept. of Natural Resources, and

**THE SHAD JOURNAL** ®

**Editor-in-Chief***:* Richard Hinrichsen

**Board of Editors**: John Waldman, Greg Garman, Curtis Ebbesmeyer, Catherine Hinrichsen, Jim Norris, Joseph Smith, Miran Aprahamian, Charles Paulsen.

*The Shad Journal* is published quarterly in association with the Shad Foundation, P.O. Box 21748, Seattle, Washington 98111-3748. Direct phone inquiries to (206) 616-7449 and e-mail to hinrich@cqs.washington.edu. 

**Subscriptions**. The annual membership/subscription rate is $15.00 through December, 1997. Make checks or money orders payable to:

**THE SHAD FOUNDATION**
P.O. Box 21748
Seattle, WA 98111-3748

*The Shad Foundation* is a Washington State non-profit corporation that was established in 1996 to promote a greater understanding of shad for the purpose of restoration where depleted, or their responsible use where sufficiently abundant.

**Trustees:** Richard A. Hinrichsen, *University of Washington, Seattle, Washington;* Curtis Ebbesmeyer, *Evans-Hamilton, Inc., Seattle, Washington*; Richard St. Pierre, *U.S. Fish & Wildlife Service, Harrisburg, Pennsylvania*.

**Submissions.** The editors welcome submission of articles on any aspect of shad. The Journal publishes letters, commentaries, histories, scientific articles, interviews, reviews, and philosophical and methodological items related to shad the world over. (See instructions on back cover.)

ISSN 1094-4990

Maine Dept. of Inland Fish & Wildlife is preparing a shad restoration plan. This group and its efforts result from a 1995 Co-operative Planning Agreement with these agencies, which the Penobscot Nation took the lead role in starting and developing. Our restoration goals for the next 20 years are ambitious, and the obstacles—biological, legal, and social—are great. To develop the public support to proceed, we need to educate the public in our region about the tremendous benefits and value of shad restoration.

*CLEM FAY*
*FISHERIES MANAGER*
*PENOBSCOT INDIAN NATION*

**President's letter**
*Continued from page 1*

River Foundation; Joseph Smith of the U.S. National Marine Fisheries Service Beaufort Laboratory; Jim Norris of the University of Washington School of Fisheries (and a commercial fisherman); Miran Aprahamian of U.K.'s Environment Agency; and Charles Paulsen of Paulsen Environmental Research, Ltd.

Our new official status as a federally recognized nonprofit 501(c)(3) organization brings many benefits. First of all, the Shad Foundation is tax-exempt and your contributions are deductible from your income tax. Secondly, we are able to receive donations from other granting institutions that require non-profit status.

But there are some strings attached. (1) We are a publicly supported charity, which means that most of our contributions must come directly from the public, and from other publicly-supported charities—not from particular individuals and private organizations. (2) Our political actions are also severely restricted.

These restrictions help ensure the scientific and educational nature of our organization, and help maintain balance in the views expressed.

*-R. Hinrichsen*

## NEW CHARTER MEMBERS OF THE SHAD FOUNDATION

The Shad Foundation welcomes its new individual and corporate members and invites you to become a charter member*.

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*Maryland Department of Natural Resources*, Annapolis, Maryland, USA
*Clyde Roberts*, Port Penn, Delaware, USA
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# "Uppie, Downie"

## *Commercial shad fishing on the Hudson*

by John Harmon

Commercial shad fishing on the Hudson has experienced tremendous ups and downs over the decades. In this century the annual catch along the river has varied from 3-5 million pounds in a year to as low as 40,000 pounds. It is clear that the business of shad fishing is subject to some pretty serious financial fluctuations for a fisherman. "Uppie, downie" is what shad fishermen on the Hudson used to chant as they drove the net poles into the mud of the river bottom and it is also what has happened to commercial shad fishing on the Hudson.

Today there are fewer than a dozen people who fish commercially for shad during the brief spring season and only one row of shad nets. In the late 1950s there were 55 rows of nets along the lower Hudson and more than 1,000 fishermen who tended them 24 hours a day. Though the shad run goes up and down, commercial shad fishing on the river seems to have one direction— down.

This article is a look at commercial gill net shad fishing on the Hudson and a comparison of the peak days with the precarious situation of today. The material for the 1940s comes primarily from a few magazine articles and a wonderful piece reprinted from *The New Yorker* of April 4, 1959 that really caught the flavor of what it was like to be a shad fisherman in the late 1950s.

In between then and today, the persistence of this old form of fishing seemed to fascinate journalists, who would periodically discover the "lone holdout" who "sets his nets." I "rediscovered" him also— Ron Ingold. He and his son Scott, his grandson Eric, friends Tom Rambone and Louis Lasher and a chef who mends the nets for Ingold in exchange for fish, are the only team keeping commercial stake gill net shad fishing alive on the Hudson.

### The Far Past

All commentators on the American shad remark on the size and reliability of the runs in the early period of European settlement of this country. The huge quantities of fish that ran up the rivers of the Atlantic seaboard provided food and fertilizer to the early agricultural colonists, as they had to the native Americans who had speared the fish before them. With simple technology, no dams to break the spawning runs, and clean water, many of the shad got through to spawn, and future runs were ensured. This changed.

As fishermen got more efficient at getting the maximum harvest during the brief season, fewer fish returned to breed. Then the upstream tributaries were isolated by power dams on the mainstem rivers and the runs got even smaller. The Hudson River was fortunate in that the flow is tidal where the shad run and not appropriate to dam for power. So while other rivers in the populous Northeast, like the Connecticut, saw huge declines in their shad runs, the Hudson remained a little more stable, and commercial fishing has been continuous to the present day.

### The Peak—1940s and 1950s

The peak period was in the 1940s and commercial shad fishing continued to be vigorous into the 1950s. At this time there were two distinct stretches of fishing grounds along the Hudson. The first was the lower river, from the Battery to about the village of Alpine, New York. The 55 shad rows in this section extended every 1,500 feet from about 79th Street in Manhattan to the state line and were in New Jersey because the ship channel is in the New York side of the Hudson; deep-draft ships

JOHN HARMON

**RON INGOLD keeps state gill net commercial shad fishing alive on the Hudson River.**

and shad nets are not good company.

This was also the best shad fishing area on the river because, as all commercial shad fishermen know, the fish are better if you get them early in the spawning run. The less time they spend in the river water, the better they taste.

Time affects the quality of shad roe as well. As one shad fisherman in the lower Connecticut River put it, "You wouldn't want to eat an egg that the hen's been setting on for three days, would you?"

Above the boundary line shift at Alpine, the fishing was not as good and done differently. While there were some gill nets, the shad were also caught in seine nets.

The New Jersey rows were regulated and apportioned by the Army Corps of Engineers and the state board of fisheries. The Corps, responsible for maintaining the shipping channel on the river, determined where the rows could be and the state board allocated the rows.

Commercial shad fishing has been regulated in New Jersey since 1799, but current regulations came about sometime in the early 20th century, partly to make sure that shad fishing did not disrupt shipping, but mostly because of concern for declining runs of shad. The New Jersey catch in 1896 was 675,595 pounds; by 1916, it was down to 40,000 pounds.

### Orange Hats Against the Skyline

These rows were up to 1,200 feet long but some were shorter. Today the two rows still fished are only 300 feet long.

This year even this shortened row was struck three times by tugs and barges and Ingold would have set another hundred feet of net except for that problem. To keep the poles visible to radar, the state suggested he cap them with those international orange plastic highway hazard cones. The poles make an odd site poking up out of the river with their orange hats and the Manhattan skyline behind.

The poles that support the nets were, and are, the key to successful commercial shad fishing in the Hudson. Shagbark hickory poles, 6 to 9 inches in diameter and 50-70 feet long, are stuck into the bottom and the nets are tied to the poles. Shagbark is preferred because of its density; at 52 pounds to the cubic foot it barely floats. Without the poles you cannot have lower Hudson River shad fishing.

Harry Lyons, one of the better-known shad fishermen of the 1930s and 40s, spoke with some experience of the importance of these poles to the enterprise and how you went about getting them.

JOHN HARMON

**A ROW OF HICKORY POLES, rising from the Hudson, supports Ron Ingold's gill nets.**

"You don't just pick up the phone and order a shad pole from a lumberyard. You have to hunt all over everywhere and find a farmer who has some full-grown hickory trees in his woods and is willing to sell some, and even then he might not have any that are tall enough and straight enough and limber enough. I get mine from a farmer who owns some deep woods in Pennsylvania. When I need some new ones, I go out there—in the dead of winter usually, a couple of months before shad season starts—and spend the whole day tramping around in his woods looking at his hickories. And I don't just look at a tree—I study it from all sides and try to imagine how it would take the strain if it was one of a row of poles staked in the Hudson River holding up a shad net and the net was already heavy with fish and a full-moon tide was pushing against the net and bellying it out and adding more fish to it all the time."

After you had the poles you had to make sure that they were absolutely smooth so they would not snag the nets. Add that to what you would pay the woodlot owner and the trucker and, as Harry Lyons put it, "In other words, the damned things run into money." With spares it took perhaps up to 60 poles a row. Between seasons the poles were left in the river mud, becoming coated in a preserving green slime; a dry pole loses its strength, but a damp pole stays strong and supple.

### The Labor Situation —Then and Now

Sometime in the second half of March the shad fishermen would share their labor and help each other set their poles by taking them out of their river bottom storage and loading them on double-boats, 40-foot scows connected with a narrow space between them. They would stand up the poles in the space between the two boats, lash a crosspiece to the pole and have two men jump up and down on it to drive the pole into the mud. At deeper spots they would have to lash two poles together. With a spacing of 25 to 30 feet, a row would have from 41 to 49 poles—a tremendous amount of work. Technology has simplified things a lot, though, and now the poles are winched into the mud. Today's fishermen have a recollection of setting the poles this way, but with labor as scarce as it is today, it is essential to set the poles with the winch, and no one seems particularly nostalgic about the elimination of this part of the work.

By this time in the season most of the labor had assembled for the six to eight weeks of the run. Tending a 1,200-foot row of nets takes a lot of labor and it has to be nearby for the entire season.

The shad fishermen of the early to middle part of this century were mostly Scandinavian and Portuguese itinerant labor who moved north and timed their arrival in New York to make the beginning of the shad season. These fishermen were the "utility infielders" of commercial fishing on the Atlantic coast, "seining off Atlantic City, scalloping out of New Bedford, trawl fishing off Hampton, Virginia, tilefishing in the Gulf Stream south of Ambrose and pound fishing off the Jersey coast," said Harry Lyons. He put the labor situation like this:

"A shadfisherman generally hires two to five of them for each row he fishes and pays them a hundred or so a week and bunk and board. Most of them are Norwe-

gians or Swedes… They know how to do almost any kind of commercial fishing—and if they don't they can pick it up between breakfast and lunch and do it better by supper than the ones who taught them."

These men were the core of the shad fishing labor force and were well rewarded for their labor of 18-hours days, six days a week in 1947. There was a period in the 1970s when the few commercial captains left would rely on the unemployed college students on break and the occasional environmentalist wanting to get a feel for real fishing. They made only $850 plus keep for a month's work.

Today the last gill net fisherman on the river has his son to help with the lifts and the help of two friends who just enjoy being on the river with him. There are a couple of other fishermen he can call on for heavy lifts, but clearly, shad fishing is not capturing the top of the labor market anymore.

JOHN HARMON

**LOUIS LASHER, a friend of Ingold, mends gill nets meant to capture American shad. The nets require frequent repair since large numbers of heavy, armor-plated striped bass often fill and tear them.**

### The Run

After the poles were set, the fishermen would set up trial nets and wait for the run to begin. Timing is critical to success in any kind of fishing and there are several markers in the landscape to let a fisherman know the status of the shad run—the blooming of the forsythia at the beginning, the shadbush during the major part of the run. It ends with the lilac run, which can go into early June. There is also a local saying, "When the buds on the trees are as big as a mouse's ear, the shad are in the river." The best clue, however, is a shad in the trial nets.

Once the full set of nets had been set for the first time the real season of fishing would begin, completely driven by the tide. An incoming tide drives the fish into the gill nets and an outgoing tide lets them out; that rather neatly brackets the twice-a-day cycle. They would put the nets on the poles at low water slack tide, leaving five feet clearance at the top and bottom and the nets were weighted by iron rings.

The nets were light-weight gill nets with 5.5-inch or six-inch openings and required a lot of mending. Just at the time the tide was switching, the nets would have to be emptied. Wait too long, and the fish get driven out of the nets; go out too soon and you don't get enough fish. The bottom of the river switches about a half hour before the top of the river, and judging exactly when to go out to retrieve the catch is key to making money.

Emptying the nets was a job for teams in large rowboats with three to four people to a team. Two would purse the net, pull up the bottom and dump the fish into the boat and the third and sometimes fourth would row, keeping the boat steady in the same place against the tide.

Today the fishermen keep only the roe shad; live bucks are returned to the river. When shad was in greater demand both the roes and bucks were kept, but the roes were packed separately because they brought a higher price. On the beach they would grab the net, place it in the net box and carry it to the racks where one team member would remove the river trash and mend the net for its next setting. The rest would sort, weight and pack the fish a hundred pounds to a box. A good "lift" could bring as many as 1,000 pounds of fish and really large ones ran over 8,000 pounds.

Ingold tells of one 10,000-pound lift they made that left only three inches of freeboard on the boat.

### Not Just Shad

"Lifting a shad net is like shooting dice—you never get tired of seeing what comes up… And shad aren't the only fish that turn up in a shad net. We may find a dozen big catfish lying in the belly of the net, or a couple of wall-eyed pike or some other freshwater fish… Or we may find some fish that strayed in from the ocean on a strong tide—bluefish or blackfish or fluke or mossbunkers or goosefish, or a dozen other kinds." (Harry Lyons)

Very occasionally they would even find a large hole in the net caused by a sturgeon moving upstream. This year Ingold reported lots of gizzard shad, sea trout (known in the Northeast as weakfish), fluke, only a couple of blue fish and lots of striped bass.

Ingold's relationship with the striped bass is a complex one. The striped bass is a highly regulated gamefish. In New Jersey, where Ingold fishes, no commercial harvest is allowed and taking of bass in the New York Hudson is still prohibited due to polychlorinated biphenyl (PCB) contamination. The striped bass is today at historic highs but the striped bass regulations make life difficult for the shad fishermen. Ingold regards the fish as "about as endangered as the cockroach."

Today there are increasing numbers of the gamefish showing up in the nets instead of shad and they must be returned to the river. On the day I was on the river, late in the shad run, more striped bass than shad ended up in the nets and had to be thrown back. According to Ingold, the number of striped bass showing up in the nets is one of the key factors driving people out of gill net fishing on the Hudson, "You can't get them out of the net —can't mend the nets fast enough. The striped

bass is a lot heavier and with their armor-like plate on the bottom, they really tear the nets up." While the nylon nets are stronger than the old linen ones, there is still a lot of mending between lifts.

Because shad spend most of their lives in the ocean, they have been exempt from the commercial fishing ban on the Hudson caused by increasing levels of PCBs in the river. This is one of the factors that is keeping commercial shad fishing alive—at least a little bit—on the river.

**To Market**

Once the fish were iced and boxed they would have to get to market. The fish caught on this section of the Hudson have always been marketed at lower Manhattan's Fulton Street Market. Even into the late 1940s one or two shad fishermen would sail their catch around the tip of Manhattan and take it directly to the market, but most were using trucks by then, as they do today.

By the 1940s shad was coming to Fulton Street from many different locations, up to a dozen states. The Hudson River shad catch has been only a portion—a declining one at that—of the total volume of shad wholesaled through New York City's fish market. Western rivers compete for the Eastern shad market as well. The Sacramento River was stocked as early as 1871 and with high prices for shad and good transportation, some of the shad sold in the New York market, even in the 1940s, was from western rivers.

JOHN HARMON

**RON AND SCOTT INGOLD pull up the nets in a 40-year-old shad boat built by former shad ambassador Floyd Clayton.**

Today a very large percentage of the shad at the market is coming from offshore fishermen who are catching the shad before they get to the river. Ingold put it this way: "With other species getting played out, guys with mortgages on their boats are turning to shad, intercepting them as they come north. The result is we are seeing fewer shad in the river."

There are lots of reasons that commercial shad fishing along the Hudson will go up and down. The water, the weather, the labor supply of shad fishermen and people who are proficient at removing the more than 700 bones in a shad, what people want to eat (fillet or roe), the length and timing of Lent, shad fishing in the West and on the Delaware—all of these factors move prices up and down.

For all the labor, technical and environmental problems that have plagued the commercial shad fishing industry on the Hudson, it is the market that rules. And with shad being a "spring" fish, people want it early; the late shad run on the Hudson catches a market that has already been eating Delaware River shad for some time.

There still must be enough money for the remaining commercial fishermen, though. In the 1980 season Ingold claimed to have spent $5,000 up front before setting a single net. But he also pulled in one lift with 5,000 pounds of roe and 500 pounds of buck which, at the prices in the Fulton Street market he quoted, meant between $1,000 and $2,000 for that single lift. Commercial fishermen are reluctant to talk about the money they make (bad luck), but it wouldn't take too many lifts like that to break even, and over a six-week season there are about 70 lifts. Ingold's income, though, is not from shad alone.

Once the shad season is over, Ingold sets a smaller net on the poles and catches a whole season's worth of crab bait, which he uses for crabbing during the summer season. Combined with a little lobstering in the winter, he manages to be fishing year-round.

**The End?**

Finding Ingold was not all that difficult. The earlier writers have been very clear about being able to see the rows from the George Washington Bridge (not really possible today), and with enough clues like that an interested person should be able to find Ingold pretty quickly. He gets a lot of media attention and doesn't give out his telephone number, though. The fishing is conducted from a dock and a shack made up completely of scavenged material that the river has provided; Ingold lives there during most of the shad season. From the water it looks like a small piece of Maine transplanted to the Palisades.

JOHN HARMON

**FISHING SHACK AND DOCK made completely of scavenged material.**

***For all the labor, technical and environmental problems that have plagued the commercial shad fishing industry on the Hudson, it is the market that rules.***

On a beautiful, sunny late Spring day, I went out with Ron, Scott, Eric, Tom, Louis and a photojournalist working on a

book on commercial fishing in the New York region. It was his last lift for shad this season and he said he wouldn't have been doing it if we weren't coming down to watch. Ingold takes his role as the "ambassador of shad" seriously. At the end of the season only the night runs are worth pulling up and the lift they made that afternoon yielded only 60 pounds of roe shad. They got a lot of striped bass and, because it was so late in the season, back runners that had already spawned and were too thin to market.

Even after reading about it several times it was an odd experience to be in a 40-year-old shad boat that had been built by Floyd Clayton, a former ambassador of shad, watching Ingold and his son pull up the nets while Lou kept the boat headed upriver. They were fishing almost exactly as they would have 150 years ago; the nets are nylon, not linen, and there is a 35 horsepower Evinrude instead of someone on the oars but everything else was the same. Right down to the skyline of Manhattan behind the boat.

Commercial shad fishing on the lower Hudson today is a quite different matter from its peak in the 1940s. Today commercial shad fishing is just barely hanging on, down to one row from 55 and the rows are only 300 feet instead of 1,200. It has been hanging on like this for quite a while.

Partly due to his location but also to his personality, journalists rediscover the "last" shad fisherman every five years or so. Of course, Ingold is not the last one, just the leader of the last team engaged in staked gill net shad fishing on the river. A 1980 article was titled "A Lone Holdout Sets his Nets" but in 1985 that same holdout was still shadding and bringing his son along. In 1997 a New Jersey journalist wrote an article under the headline of "Last Shad Fisherman on the Hudson Works Hard to Practice Lost Art." Today his son is still with him and it looks like his grandson is bitten with the bug to fish, too.

JOHN HARMON

**INGOLD'S GRANDSON ERIC was bitten by the family fish bug.**

With the dramatic declines in the shad run in 1994 and 1995 it is hard to tell whether there is a future at all for commercial shad fishing on the lower river but it is possible it could revive. Ingold called this year's run "pretty good" but also admitted that he's just "bungling along." There are as many as 40-50 commercial shad fishermen left on the entire river left; the rest are further up and use anchor, drift and seine nets. Ingold has been the last holdout for staked gill net fishing for 20 years. "It kind of gets in your blood. When the season is over every year you swear up and down you're not going to fish again, but then in a couple of months…"

What the East Coast market wants to eat is what people will seine, gill net, bottom haul and somehow get out of the water. If there were only a few cod and people really wanted it, you could probably make a tough living hand-fishing for cod. The market for shad is down; it takes a lot of work to get a roe shad out of the river, to the market, filleted, cooked and on a plate. When people in the New York region will pay enough so a fisherman can make a living, people will go out into the Hudson and get the shad for them. But if we miss a generation of shad fishermen who know how to do this job, commercial shad fishing will disappear from the Hudson.

Fifty years ago a *National Geographic* writer called it a "pleasant anachronism." For the writer it was somehow reassuring that there were fishermen there "in the shadow of skyscrapers" who were pursuing their trade in the same way it was done 150 years ago. A few are still there and the anachronism is no less pleasant.

## *The Author*

JOHN HARMON is a professor of geography at Central Connecticut State University and lives in West Hartford, Connecticut. He studies popular culture in North America and became aware of American shad while looking into the geographical distribution of shad bakes as community events. His focus is on culture and how shad are used as "festival food." For further information, please contact the author at harmonj@ccsua.ctstateu.edu.

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# Managing Hudson River American Shad

## *A biologist's perspective on the shad's ups and downs*

by Kathryn A. Hattala

Many times I sat in his boat and ticked off the marks on the page, as the fish fell from the net. It was springtime April 1986, that crystal-cool time, with a hint of warmer days to come. I was there to count the catch, working for New York State's Hudson River Fisheries Unit. My job was to "get a ride" (observe and collect data) on a small commercial shad fishing boat on the Hudson and observe.

### Beginnings of a Partnership

Frank Parslow sure knew how to catch shad. "No shadbush in bloom yet—more to come, ahh—yeah," he'd say in his knowing tone. I was full of questions, running through the routine—how much net? (three, four, six, eight shad—the bunch came in over the side), what's the twine? (two shad—was that a buck?), what's the hang?

He politely and patiently answered. I was a rookie, but he made me feel at ease, asking just as many questions of me. "What do you do with all those numbers? You remind me of a few years back—Gerry, yeah that was his name—he got me to do that." My curiosity roused, I asked, "Oh yeah? Mind if I take a look?" "Sure," he replied.

Out came his diaries of years past. Over a plate of smoked shad, we leafed through pages and he reminisced about the last 40 years of his fishing life. Little did we both know then where it would lead.

Fast forward to eight springs later, another clear April morning, same crystal-clear sky, forsythia budding, no shadbush buds in sight. "Hey Frank," I asked, "you ready to fish?" "The boat's in the water, boss," he replied. Our relationship took time to build—it took a lot of tides and a lot of water down the river. But now we, a fisherman and a biologist, were working as partners on a new study of the Hudson's shad population.

### Home of American Shad

The Hudson River origins lie in the Adirondack Mountains at Lake Tear of the Clouds. From there the river flows south for nearly 300 miles to the Atlantic Ocean. The lower Hudson, south of the Federal Dam at Troy, New York, however, is a different kind of river. [For convenience in identifying location, the upriver distance is defined by river miles. River mile 0 is at Battery in New York Harbor and river mile 152 is at Troy Dam.]

Geologically, the lower Hudson lies in a drowned river valley. The "river" is at sea level the entire length from Troy to New York; it is an "arm of the sea," so to speak, with tides creating a river that flows both ways. From Troy Dam to the Hudson's mouth, the river is known as the Hudson River Estuary.

Salt water intrudes into the estuary on a seasonal basis. The salt front is generally near New York harbor in early spring, during the period of snow melt from the Adirondack and Catskill mountains. During the summer months, salt water reaches further inland as far as Newburgh Bay (river mile 60), but can reach as far north as Poughkeepsie (river mile 75) in drought years.

The Estuary plays an exceptional role as spawning and nursery habitat for numerous fish species, especially anadromous fish. The Hudson supports among the largest stocks of striped bass (the Chesapeake's is larger), Atlantic sturgeon, and American shad.

For American shad, the upper half of the Estuary provides spawning habitat—wide shoals and numerous small bays in the region from Kingston to Albany. The nursery area encompasses this area and also extends down to Newburgh Bay, the southern extent of freshwater. It's here that young shad spend the first summer of their life before venturing out to the "Big Pond," hopefully to return home five to six years later to spawn.

### A Stock in Jeopardy

The Hudson's shad stock was once one of the largest runs of the Atlantic coast. Its history was like that of many other East Coast shad stocks—cycles of boom and bust. Except now the booms were less high and the busts, a bit more drawn out with a longer recovery time until the next "boom." The fishery in the Hudson began back in colonial days—some say it goes back to the late 1600s when the Dutch settled New York and up the Hudson valley.

The existing record of fish catch, however, only goes back as far as the late 1800s. Fishing played a major role in the behavior of the stocks. Many other sources contributed to the declines the first part of this century: habitat loss was high. The Hudson luckily escaped the building of dams with no passage (for anadromous fish this is a necessity—adults and young need to return to the sea) unlike most New England rivers. The Troy Dam cuts off only a relatively small portion of the original spawning and nursery habitat.

The Hudson was not able to escape other signs of human progress up the valley. The upper half of the Hudson, once littered with many small islands was "straightened out" by dredge and fill operations to the benefit of the shipping industry developing near Albany. Seth Green's hatchery cove was one casualty [see "Oceanography of the Pacific Shad Invasion," by Curtis C. Ebbesmeyer and Richard A. Hinrichsen; SHAD JOURNAL, February 1997]. The cove no longer exists; Shad Island became part of the western shore.

Pollution also took its toll; sewage dumping led to reaches of little or no oxygen in the Albany pool and elsewhere along the river. The river gained a reputation as an open sewer. In spite of it all the shad stock persisted and the fishing industry hung on. The shad stock afforded a cheap and abundant food source to the valley's growing population.

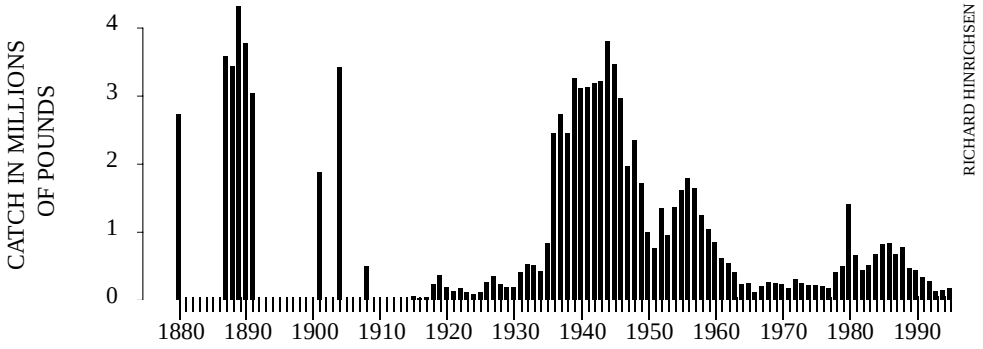
By the mid-1940s, the Hudson's landings peaked at about 3.8 million pounds, almost recovering to the same level of shad landed in the late 1890s. Landings at this level occurred for a period of about 10 years when, following World War II, the stock collapsed. Many other coastal shad stocks repeated the Hudson's dramatic decline, causing the newly formed Atlantic States Marine Fisheries Commission (ASMFC) great concern.

Coastal shad landings, as a whole, had experienced a six-fold decline from 50 million pounds in the 1890s to just under 10 million pounds in the mid 1950s. Several studies were conducted in several Atlantic coast rivers under the joint leadership of ASMFC and U.S. Fish & Wildlife Service. G. Talbot's study of the Hudson in the 1950s was classic in the sense that it thoroughly examined a variety of factors that could have produced the Hudson's collapse, including fishing, water flow and temperature, shipping, channel dredging, and pollution.

His study followed the standard tagging protocol of the day. Shad were captured and tagged in lower New York Harbor, downstream of the New Jersey stake netters, and released. The numerous commercial fishermen would serve as the recapture mechanism. The first gauntlet of nets was New Jersey's 40 or so stake gill netters, lining the west shore of the Hudson just north of New York harbor. The fish that escaped those nets were then subject to capture by some 300 New York gill netters.

Talbot and his sampling crew released approximately 250 tagged fish the first year and 525 the second. They then surveyed, in both years, as many fishermen as possible to recover the tags and get estimates of their catch. The number of tag returns were then compared to the total catch versus how many tagged fish were released. This proportion resulted in an estimate in time of the size of the Hudson Run—about 1.5 to 1.6 million shad. The percent of tag returns was high in both years, about 50 percent. This meant that of the total run, only about half (or 850,000) escaped the fishery to spawn.

Unfortunately for the fishermen, however, Talbot's conclusion was simple—over-fishing was the primary factor of the Hudson's decline. The large harvest during the years following WWII was greater than the population could withstand, so the stock size began to drop. Other problems




*DATA SOURCES: National Marine Fisheries Service, U.S. Fish & Wildlife Service, New York State Department of Environmental Conservation*

**THE CATCH of Hudson River Shad from 1880 to 1995 shows the effects of over-harvesting—long cycles of boom and bust. The gaps indicate periods of no data.**

such as habitat loss and pollution were also present, but they just made things worse.

So here we are, almost 50 years later; habitat issues are being addressed and coastal rivers like the Hudson are not open sewers anymore. Yet, current Atlantic coast American shad landings have again experienced another six-fold drop. Coastwide landings are now at an all-time low of approximately 1.5 million pounds—a sixth of the catch of 1950. The Hudson's shad run has dropped a bit more—down to less than 200,000 pounds from a million in the 1950s. All along the coast one question is being asked—is history repeating itself?

The past sizes of commercial landings illustrate the Hudson's potential to produce fish. But landings are dead fish. Though they are a food source gained, they are also spawning potential lost. The historical landings give managers insight on the ability of the stock to grow—what the stock was capable of doing in the past, it may be able to do in the future. Only one thing remains—you have to know where the stock level is before you can begin recovery.

### New Era for Management

Beginning in 1979, New York State's Department of Environmental Conservation took resource management to a new level. The Hudson River Fisheries Unit was established to study the anadromous fish populations, primarily American shad and striped bass.

The Unit's focus is stock assessment—to collect data characterizing the river fish stocks and to provide advice for resource management. This task is not a small one. Anadromous fish give biologists a limited opportunity to study them; a short eight-to-10 week window is all we get, but we make the most of this time.

The partnership that developed between biologists and the Hudson's commercial shad fishermen took time and patience. The Unit's monitoring program sends technicians out with fishermen who effectively sample the fish population. Technicians are out with fishermen for the duration of the fishing season, April through the middle of May. Anchor gill netters are the first to catch shad in the lower "bays" (Tappan Zee and Haverstraw Bay), then the drifters (drift gill netters) as the shad move upriver above Newburgh to Catskill. This program allows us to monitor how many are caught for the effort expended in the fishery, fish size and age.

***But landings are dead fish. Though they are a food source gained, they are also spawning potential lost.***

In addition to the commercial monitoring, we also look at what survives the fishery to spawn by fishing with our own gear—the old-fashioned way. During the month of May into early June, we sample the shad on the spawning ground with a 500- or 1,000-foot haul seine with an eight- to 10-person crew. With this gear, however, we capture all sizes of fish, big and small alike. Knowing the spawning fish sizes, sex composition, and especially the ages, lends insight into what fish produce the spawn and how fast the fish are

disappearing over time (mortality rates).

We also sample young shad throughout the summer months to estimate future spawners to come. These various data, from 1980 to the present, produce nearly a complete picture of the stock's current character.

We, both biologists and shad fishermen, noticed changes occurring, subtle at first, but more worrisome as time went by. Fishermen would say, "Where are the larger fish? What's going on? I can't get as many as before." All the data supported their observations. Catch rates were dropping off, an indication that not as many shad were coming back to the river. Fish were getting smaller. A close look showed that the older, larger fish that should have been there weren't.

The fishermen in the Hudson valley are much fewer now, estimates run from 30 to 50 compared to the hundreds of years past. Shad fishing was not just limited to the rivers anymore. Markets for Hudson fishermen were filled prior to shad returning to the river. Valley fishermen talked of growing ocean fisheries. They asked me what was happening. The question kept coming to me—could all the combined catch produce the declines of the past?

There was one additional piece of data that could help. In 1994 and 1995, the Hudson River Foundation, followed by New York state funds in 1996, gave me and some fellow researchers the opportunity and the means we had been waiting for. Dr. Roman Jesien from the University of Maryland, my co-worker, Andrew Kahnle, and I wanted to repeat a tagging study similar to Gerry Talbot's so many years ago, but with a few innovations. Our objectives were to measure exploitation and survival rates and, we hoped, population size.

We have learned a lot since Talbot's time. The earliest shad enter the river in late March, but some are already leaving as the last of the shad are still arriving in late May and early June. Tagging would need to continue over the entire run. The commercial fishery, our intended primary recapture mechanism, ends partway through the spring run as the shad come into spawning condition. So to have "fishing" ongoing throughout the run, we enlisted the help of those who know the fish best—Hudson River valley commercial fishermen.

Our fishing crews came with lots of experience, totaling nearly 200 years. The "old-timers" (their ages ranged from 55 to over 80) tried to outdo each other not only in catching fish, but also in providing insights. Frank Parslow and son lent their expertise and talent in net design and building. The three tag-and-release locations—spread throughout the river—were interspersed with the fishery. Each sampling location was different. The crew's knowledge of these river reaches—where the currents were best, where to avoid hangs—added to sample regime. These unique research crews not only fished to catch, tag and release shad, but they also served as the recapture crew, "fishing" once the actual fishery slowed down.

Shad movement in the river during the spring was not well understood. By tagging some shad with high-tech radio or sonic transmitters, Dr. Jesien and his graduate student, Valerie Whalon, would discover how shad used each river section. They found shad spread out through the entire upper half of the river, slowing down in some river reaches, but never stopping, always moving with the tide. Some fish moved to areas where they were less vulnerable to commercial fishing operations. This movement out of an area violates assumptions of a model used to estimate population sizes. This increases the uncertainty in model estimates.

As we got the word out, and they began to see the benefits of our program, more commercial fishermen began to support it and participate. Over the past three years, nearly 5,000 shad were tagged and released. Tag returns were relatively low for the river, about 50 each year. Reporting rate was found to be relatively high, so the low tag return was real. The low returns comported with the general complaint that fewer and fewer fish were coming back each year.

Once the shad leave the river, however, shad fishing does not end. Tag returns have come in from all over the Atlantic coast: from New England and Canadian Maritimes in summer and fall and then in very early spring as far south as Virginia.

The tagging studies allowed us to calculate annual survival rates. As suspected, it was low—about 23 percent per year for spawning age fish. A report should be available by late fall 1997. But in the meantime, biologists from all the Atlantic coast states are taking a hard look at what is happening. The Hudson is not the only shad stock affected.

Unregulated fishing is mostly a thing of the past, yet it is still the present rule for shad in ocean waters along the coast. Hudson fishermen have had regulations in place for years, providing the shad some protection when they return to spawn. In all, any resource user feels it is not "their fault," and it isn't, alone. My role as a biologist is to complete the picture, let resource users know their effect as a whole. I provide advice, and where we are now is an uncomfortable place to be—there is little room for error.

Hudson River Valley commercial fishermen are deeply concerned for the shad stock. Their fishing effort is beginning to drop off as shad are becoming increasingly scarce, making fishing a non-profitable venture. Still, they hang on. They want to keep their traditions alive.

So we all have a decision to make in a forum in which we can all work together: the Atlantic State Marine Fisheries Commission (ASFMC). Their work continues, giving us the means as coastal states to come together. ASFMC is also us: biologists, fishermen, manager. We will decide together which way we, and the shad, will go.

## *The Author*

Kathryn A. Hattala is a Fisheries Scientist with the Hudson River Fisheries Unit, Bureau of Marine Resources, New York State Department of Environmental Conservation, located in New Paltz, NY. Her primary focus is stock assessment of anadromous fish populations of the Hudson River, (American shad, river herring, striped bass and Atlantic sturgeon). She and co-worker Andrew Kahnle are developing a comprehensive stock assessment on Hudson River American shad, describing the present condition of the stock and the reasons for its recent decline.

## *Further Reading*

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# Who's Who

## *Stock identification of Hudson River shad and other East Coast populations*

by John Waldman

American shad stocks occur in rivers from the St. Lawrence in Quebec to the St. John's in Florida. Mark-recapture studies have shown that individuals from these stocks mix in the Atlantic Ocean across much of this range. Allocation of anadromous fish stocks between fisheries in their natal rivers and "intercept" fisheries that harvest them on their way to these rivers has long been a difficult issue, and is largely why the Atlantic States Marine Fisheries Commission exists. Traditionally, American shad were caught almost completely in riverine fisheries, but in recent decades, controversial intercept fisheries, located primarily in Virginia to New Jersey, have taken much of the total harvest, approximately 42 percent in 1992 for example.

Over the past two decades, there has been considerable concern over whether the offshore "intercept" fisheries for American shad are responsible for declining catches of shad in the Hudson River. One step in answering this question is to examine the stock composition of these fisheries.

Fish stock identification is a murky subdiscipline of fisheries, located at the interesting junction of population and evolutionary biology. Stocks are the fundamental management units of fisheries. Many stocks, particularly stocks of anadromous species such as American shad, cooccur in coastal "mixed-stock" fisheries. These fisheries usually are managed to protect the weaker of the stocks that contribute to the fishery; and this requires information on the stock composition of the mixed-stock fishery. However, identifying the correct stock of origin of an individual caught in a mixed-stock fishery is a formidable task.

Stock identification is utterly dependent on variation; if all American shad individuals were morphologically and genetically identical, it would be impossible to perform. Not only must there be variation among individuals, but a component of the total variation must be partitioned across stocks—the more so, the better. The degree of this among-stock variation reflects the evolutionary history of the populations that comprise the species. That is, prolonged isolation, strong reproductive homing fidelity, and localized natural selection promote differentiation among stocks; whereas, reproductive contact among populations, through natural straying or stocking of nonnative fish, erodes stock differences.

***Fish stock identification is a murky subdiscipline of fisheries, located at the interesting junction of population and evolutionary biology.***

A great many characteristics have been used as "markers" to distinguish fish stocks, for example, meristic features such as scale and fin ray counts; measurements of body and scale shape; parasite burdens; proteins; and DNA sequences. In the case of American shad, some such tool was needed to perform stock identification on mixed-stock fisheries and to estimate stock composition. Studies have focused on mitochondrial DNA (mtDNA), a rapidly evolving, largely maternally inherited molecule that has proved enormously useful in population studies of vertebrates.

In the approach used, various restriction enzymes recognize particular four-, five-, or six-base pair sequences of mtDNA and cleave the molecule at those locations. This results in mtDNA fragments of certain length classes that can be visualized through electrophoresis and radiography, with the fragment profiles corresponding to different genotypes. Beginning in the late 1980s, three large-scale mtDNA surveys of American shad have been performed by a group led by Kathleen Nolan, at that time a Ph.D. candidate at the City University of New York; then by Paul Bentzen, a Ph.D. candidate at the University of Montreal; and finally by a group led by Bonnie Brown, a professor at Virginia Commonwealth University.

Stock identification—the delineation of differences among stocks, using "known" specimens—is the necessary precursor to stock composition analysis. The problem is that one can never know with absolute certainty what the stock affinity of an individual wild fish is. To maximize the probability that the "known" specimens analyzed actually represented the populations included, in all three studies, specimens for stock identification were obtained on the spawning grounds during spawning season. These collections served as "reference" samples and were used to characterize the mtDNA genotype frequencies for each stock.

There were great similarities among the findings of the three studies. In comparison with mtDNA surveys of other anadromous fishes, American shad showed very high overall variability—among the most for any fish species studied to date—but only weak to moderate differentiation among stocks. High genetic variability across populations is probably related to the relatively short generation times (age to maturity) and the great total abundance of the species. That is, high turnover of generations and a large number of individuals favors the generation of new mutations (genotypes).

But why are shad populations not more strongly differentiated from each other? Two observations help explain this. One is that there are many more populations of American shad (at least 23) than of some other anadromous fishes, such as striped bass and Atlantic sturgeon, that spawn only in large rivers. This means that overall genetic diversity is partitioned across more populations, allowing less opportunity for "uniqueness" of genotypes.

A second factor is that there is evi-

dence that American shad don't show as high a degree of homing fidelity to their rivers of origin as do non-shads. A team of Canadian researchers led by Gary Melvin tagged 5,074 adult American shad in the Annapolis River, Nova Scotia, during the 1981 and 1982 spawning runs. They estimated a homing fidelity rate of 97 percent, based on their obtainment in subsequent years of 56 recaptures from the Annapolis River and two from other rivers. If straying rates are actually on the order of 3 percent, theoretically, population differentiation should not occur. However, occurrences of straying do not necessarily mean that all such strays reproduce successfully. Indeed, the genetic data suggest that reproductively effective straying rates for shad are less than 3 percent, but are greater than for striped bass and Atlantic sturgeon.

***…there is evidence that American shad don't show as high a degree of homing fidelity to their rivers of origin as do non-shads.***

The three mtDNA surveys of American shad took place across a period in which molecular analysis became substantially easier. Technological advances allowed use of preserved rather than fresh tissues, and they allowed mtDNA to be isolated using simple chemical procedures instead of lengthy ultracentrifugation. Thus, whereas the Nolan study examined a little more than 100 specimens from four rivers, Bentzen surveyed almost 250 fish from 14 rivers, and Brown and her colleagues analyzed just under 1000 fish from 15 rivers.

The first two studies demonstrated that there was a substrate of variation that could be used for stock composition analysis—an analysis included in Brown's study. Her study team included statistical researchers at Rutgers University Center for Theoretical and Applied Genetics, Peter Smouse and Carol Kobak. Smouse and Kobak helped pose and address lingering questions concerning mtDNA data and stock composition analysis, and they provided the analytical framework—a computer program called SHADRACQ.

Mitochondrial DNA analysis classifies individual fish to a particular genotype, but typically, none or few of the prevalent genotypes are found to be restricted to only one population. So then how can these data be used to perform stock composition analysis? SHADRACQ and other similar programs for stock composition analysis are based on maximum-likelihood approaches in which stock composition estimates are not just the sum of the classification of individuals to stocks. Rather, they are based on the genotype frequency data of the reference samples and the mixed-stock samples. The estimates of the mixed-stock samples reflect the most likely proportions of the reference samples given the genotypic frequency distributions of each.

For example, if there were people from only two towns (two "reference stocks") assembled at one place (a "mixed-stock"), with 50 percent of them having red hair, and in one of these towns 75 percent of the population had red hair and in the other town, 25 percent, then it would be most likely that the proportion of people in the assemblage from each town would be 50 percent (the "stock" composition estimate). However, if the frequencies of other hair colors or additional features such as eye color were known, the precision of the estimate would increase. Only rarely would the origin of an individual be known for certain, but the estimate of each town's contribution to the assemblage might be estimated with high confidence.

Simulations by the Rutgers group with mtDNA data showed that as a rule, there should be at least 100 fish in the mixed-stock sample and 100 in the reference samples from each stock. Also, there should be no annual shifts in the genotypic frequencies of each reference stock. Such temporal instability, often ignored, destabilizes stock composition analyses.

The sheer scale of the Brown study combined with the natural variability of American shad resulted in the identification of 116 genotypes among 998 individuals. However, the most thorough laboratory analyses—those using the greatest number of restriction enzymes used, up to 14—did not result in the most useful data for stock composition analysis because it tended to generate singletons (individual fish with a unique genotype). In fact, there was little benefit to using more than the six most informative restriction enzymes—a finding that decreases the cost of future studies of this kind.

So what was the estimated contribution of the Hudson River stock of American shad to coastal intercept fisheries? Analysis of approximately 500 fish each in 1994 and 1995 caught in New Jersey waters indicated Hudson contributions of 21.2 percent and 22.1 percent, respectively. Given that New Jersey's total 1994 coastal shad harvest was about 144,000 pounds, this amounts to approximately 30,000 pounds of shad destined for the Hudson River, or more than 8,000 individuals. When the 1994 sample was divided into southern and northern coastal New Jersey components, the Hudson stock was estimated to comprise 6 percent of the southern sample and 36 percent of the northern sample. This is consistent with the notion that near spawning time, the Hudson River shad are funneling to the area at the mouth of their natal river and therefore represent a higher proportion of all shad at that location.

Total coastal commercial landings of American shad from 1990 to 1993 ranged between 450 and 675 metric tons, or as much as 375,000 individuals. No doubt these catches represent an amalgam of American shad stocks, and they may be contributing to declines in shad runs observed in many rivers.

Future stock identification work on American shad may include additional mtDNA analysis (direct sequencing for example) and a new approach that performed well in a pilot study involving the Hudson, Connecticut, and Delaware rivers—the analysis of the elements found in shad otoliths [see "Juvenile Alosids: Ecological


*The Author*

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# Juvenile Alosids: Ecological Movers and Shakers?

## *The big players in the Hudson's estuarine ecosystem are revealed*

by Karin Limburg

Springtime in the Hudson River Valley. The scent of shadbush wafts on the first vernal breezes as the few remaining shad fishermen set their stake-nets south of Haverstraw, or drift gill nets on the flood tides in the river's freshwater reaches. Most of us think of springtime as Shad Time in our rivers and estuaries, for that is when the adults return from the sea to spawn, to be caught, and to be feted at shad festivals. And yet that is only the beginning, or in some cases the end, of a complex life cycle for shad and river herrings (members of the herring subfamily Alosinae, or alosids).

The Hudson River supports four species in the genus *Alosa*: the best known is American shad (*A. sapidissima*), but alewife (*A. pseudoharengus*) and blueback herring (*A. aestivalis*) are important denizens as well. The lesser-known hickory shad (*A. mediocris*) rounds out the complement. Atlantic menhaden (*Brevoortia tyrannus*) is another important alosid that uses the brackish part of the estuary as a summer feeding ground.

Although most of us think about the adults, it is really the young stages—the eggs, larvae, and juveniles—that are the big players in estuarine ecosystems. Eggs and the delicate, translucent larvae are highly vulnerable to predation, of course, and many of them become meals for a number of predators—everything from eels to white perch, and perhaps even small fish like spottail shiners. However, the sheer numbers of larvae, especially of blueback herring, help to assure that some will survive the gauntlet of predation or adverse climatic effects. I once estimated the June abundances of blueback herring larvae to exceed *85 billion* individuals. American shad larvae "top out" at a paltry 168 million individuals. Because *Alosa* spp. larvae are concentrated in the upper tidal reaches of the Hudson, they represent, potentially, an important regulatory force on populations of zooplankton, the microscopic crustacean organisms that compose most of their diet. And, since many other fish eat them, young-of-year alosids form a critical link between the lower and upper parts of the Hudson's food web, as they do in many other estuaries.

***Although most of us think about the adults, it is really the young stages—the eggs, larvae, and juveniles—that are the big players in estuarine ecosystems.***

Those larvae that survive transform into juveniles, and continue to feed and grow. Shad make a switch at about 40-60 millimeters [1.5-2.3 inches] from zooplankton food to a diet consisting mostly of insect larvae, or even insects on the wing that come close to the water's surface. Walk down to the river's edge any summer evening, and you are likely to see young shad "dimpling" the water as they pluck emerging midges from the surface. On one evening, I seined up a 2.5-inch shad and found its gut filled with flying ants. The amount of food in this fish, relative to its size, would have been the human equivalent to a full Thanksgiving dinner with all the trimmings—turkey and all!

All good things must come to an end, and American shad juveniles must of necessity leave their natal rivers before the onset of winter. But when is the best time to go? Experiments have shown that juvenile shad cannot survive at water temperatures colder than about 4 degrees Celsius [about 39 degrees Fahrenheit], and the Hudson drops below this critical temperature in winter. For a long time it was thought that shad and their conspecifics migrated *en masse* in the fall (October), a veritable piscine pulse that was cued by falling water temperatures. However, close examination of some monitoring studies in the Hudson, which kept track of both the relative abundance of fish as well as their size and location at capture, revealed that larger individuals showed up south of the areas where they had been spawned relatively early in the summer (July). But had they really moved there from upriver?

### Juvenile Migration Study

I conducted an intensive study of a single year-class of American shad in 1990, in order to trace the out-migration process and to determine if it was keyed on temperature or on body size. Juvenile shad are too small to tag, and besides they are too delicate to be handled much. But fortunately I was able to use a natural tagging device carried by all teleost fish: the otolith, or literally, ear-stone.

Otoliths are part of the hearing and balance system in fishes, and are located just under the brain case. They are actually tiny calcified concretions, built by a process that precipitates calcium carbonate (in the crystalline form of aragonite) onto a matrix of protein. This process occurs in a daily, circadian rhythm, and keeps pace more or less in proportion to body growth. Thus it is possible to extract the otolith, prepare a thin section, and view increments with the aid of a microscope. These increments are analogous to tree rings, only they represent *days*, not years.

I was able to collect large samples of juvenile fish up and down the Hudson throughout the course of a growing season, and by counting and measuring the daily rings, I could track the growth rates and movements of different age-groups called "cohorts." And in fact, I found that older, larger juveniles showed up in the lower Hudson in advance of smaller, younger

ones, and that within a given age-group, larger individuals showed up downstream earlier than did the runts.

This movement occurred well ahead of autumnal drops in water temperature, and could not be explained solely by the fish drifting downstream with ebb tides. Fish had to have migrated actively to have gotten to where they did, when they did. Body size does seem to matter: bigger is better for migration, at least before the threat of winter draws near.

Staring through the microscope, I discovered another curiosity. I found a few fish whose early growth patterns, as mirrored in their otoliths, looked nothing like the hundreds of other fish I'd examined. It was hard for me to believe that they had come from the same river, so different were the patterns. I made inquiries with various scientists to see if there might be some independent way for me to check this out – perhaps using some chemical markers in the fish. I eventually found myself speaking with David Secor of the University of Maryland.

He had been studying the movements of striped bass, another migratory species, in the Chesapeake Bay, and had been able to show that when fish were exposed to different salinities, this was reflected by the amount of a trace element, strontium, getting entrained into the otolith. Strontium is a close chemical relative of calcium, and so can substitute for calcium in the aragonite crystal. Furthermore, strontium varies in proportion to salinity in the eastern U.S., so it appeared to be a good candidate to trace movements of fish across salinity gradients.

By using a special instrument called a microprobe, point measurements can be made along a transect of the otolith (at tiny distances, on the order of millionths of an inch) through the daily rings, and strontium concentrations can be measured.

***…some juveniles migrate out to sea after the first growing season, but then return in the spring with adult spawners, migrating over 100 miles to the spawning grounds.***

Strontium levels in "normal" fish (those I had good reason to believe had resided in freshwater their entire, short lives) were extremely low—almost undetectable. However, in the "suspected migrant" fish, strontium was low at first, as one would expect of fish born in fresh water, but then suddenly jumped to levels 4-6 times higher—typical of what happens when a fish moves from fresh water to seawater.

This suggested that these fish had been spawned in another river, had emigrated early, then wandered into the Hudson. When I matched up the high strontium points with the days on which they occurred, I found that some juvenile shad had migrated from fresh water as early as late June, some of these only six weeks old.

**Strange Migrations**

Since then, I have conducted more work with chemical markers in Hudson River alosids. I have found that some juveniles (shad, blueback herring, and alewife) migrate out to sea after the first growing season, but then return in the spring with the adult spawners, migrating over 100 miles [160 kilometers] to the spawning grounds.

Even more interesting, some blueback herring and alewife juveniles appear to overwinter somewhere in the Hudson drainage, for they do not show any evidence of a marine residence period. This is consistent with the observation that alewife and blueback can become "landlocked" in lakes, but shad do not.

Although we don't know what proportion of the populations of these species engage in these anomalous migrations, it may be a manifestation of the straying behavior described by John Waldman [see "Stock Identification of Hudson River Shad and Other East Coast Populations," page 12 of this issue], or it may be a gregarious behavior that allows the species to explore and colonize new habitats [see "Oceanography of the Pacific Shad Invasion," by Curtis C. Ebbesmeyer and Richard A. Hinrichsen, SHAD JOURNAL, February 1997].

I am also following up on the size aspects of out-migration, by measuring strontium levels in the otoliths of adult shad and looking at how old they were, and how large they were, as juveniles when they migrated from fresh to salt water. Then I will be able to test whether relatively larger fish are the more successful migrants that ultimately recruit to the spawning population. But that is a future story.

Young-of-year alosids play a major role in the Hudson River estuary by virtue of their abundance and their position in the food web. By moving out of the River, they contribute production derived from rivers to the offshore coastal ecosystem. Ecological detective work using otoliths and other techniques, helps us understand their ecological role.

## *The Author*

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## *Further Reading*

MODELING THE ECOLOGICAL CONSTRAINTS ON GROWTH AND MOVEMENT OF JUVENILE AMERICAN SHAD, ALOSA SAPIDISSIMA, IN THE HUDSON RIVER ESTUARY. Karin E. Limburg in *Estuaries* Vol. 19, pages 794-813; 1996.

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OTOLITH STRONTIUM TRACES MIGRATORY HISTORIES OF JUVENILE AMERICAN SHAD, ALOSA SAPIDISSIMA. Karin E. Limburg in *Marine Ecology Progress Series* Vol. 119, pages 25-35; 1995.

Anomalous migrations of anadromous herrings revealed with natural chemical tracers. Karin E. Limburg in *Canadian Journal of Fisheries and Aquatic Sciences* (in press).

# Shad Fishing on the Hudson Half a Century Ago

## *Tales of a family fishery on the Hudson*

by Richard Joseph

My dad worked on the New York Central Railroad, but in the spring he was a fisherman. He would take his vacation and we would go fishing. I started fishing with my father around 1945 when I was just a little boy. We would go out on the river and do commercial fishing, with a boat and nets, and it was very exciting.

### Preparing the Gear

In spring we had to get the nets, the corks, the rings, the boats, the lamps, the oars, the motors—all the equipment that we needed—ready to go fishing by April. The first thing my father did was to order the material for the nets from either the A. M. Starr Net Company or the Linden Net Company, both of which were located in Connecticut. Sometime in February we would receive a big package, and it would be the mesh that we used to make the nets.

When we started fishing in the 1940s, the nets were made of cotton, and cotton didn't hold up very well, so we soaked our nets in linseed oil in a galvanized tub. Then we hung the nets on poles and let them dry. The linseed oil preserved the cotton cord.

Near the end of the 1940s, nylon nets came out. Oh boy, did that make a difference in catching fish! We could catch twice as many fish in a nylon net. With the cotton nets, the linseed oil would stiffen the cord, and the net would become coarse. When the fish swam up and hit it, they would feel it and back away real quick. But we didn't need to soak the nylon net in linseed oil, so it would stay very soft and flexible, so when the fish hit the net, they would get caught. By the time they realized it was a net, it would be too late. We used nylon up to the time we quit fishing.

The mesh we used on the net was four inches square, but of course when the net was hanging in the water with the rings pulling it down, the mesh was about eight inches from top to bottom. With this size mesh, most of the bucks (the male shad) and other fish we didn't want could swim right through it. But the roes, with all their eggs, were bigger around than the bucks and would get caught.

But to get back to my story, with either cotton or nylon nets the first thing that had to be done was to put on the top and bottom sim lines. The top sim line was a cotton or nylon cord about as thick as a pencil that ran along the top of the net. We tied the cork lines to it. The bottom sim line was the same kind of cord, and we would tie the bottom of the net to it, along with the rings that weighted down the bottom of the net.

To make the net, we would tie one end of the sim lines to the banister at the head of the stairs in our house and the other end to a two-by-four my father had rigged up at the far end of the bedroom, about 15 to 20 feet away. We would walk along the lines (we did the top and bottom sim lines together), and every six feet we would dip a finger into a bottle of red ink and rub the cords back and forth between our fingers. The mark on the top sim line was where our cork line would go, and the mark on the bottom sim line was where we would sew the rings on later.

Next we would sew the net to the top and bottom sim lines. We would hook the top of the net with a plastic net needle that had nylon cord wound on it, count five loops, and then hook the needle to the top sim line and tie the net to it. We would keep going from the banister all the way to the other end of the bedroom. When we reached that point, we would take the net down from the banister and drag it across the floor to the two-by-four. Then we would put up more top and bottom sim lines and keep on tying on the net. It would take weeks to do all this, but we finally got it done.

I was pretty fast at sewing the net, so lots of times I got to stay home from school to work on the nets. I'd do that all day long, day after day, until we got it all done.

We also had to get the corks ready that would hold up the top of the net. We tied six-foot strings on the corks, so the net would hang six feet under the water. Then, if a small boat or a towboat with its barge came along, it would go over the net and not cut it up with its propeller. Some fishermen used eight-, 10-, or 15-foot cork lines, depending on how deep the river was where they were fishing. The longer lines meant that there was less chance of getting the net chopped up if an ocean-going ship ran over it. At most, the ship might cut a few cork lines.

We used six-foot cork lines so that we could work closer to the bank of the river, where the flats were. Our net was about 30 feet wide, so with the cork lines the bottom of the net would hang about 35 to 40 feet under the water. When the net went over the flats, it would drag along the river bottom, but this made for the best fishing because it would just suck up all the fish. They couldn't avoid the net by swimming

AUTHOR RICHARD JOSEPH (*right*) and his brother Walt.

under it. When the net was going over the flats, the corks would bob up and down with all the fish, and eventually the net would just sink because it was so full of fish. So dragging the bottom was the best way—as long as the net didn't get hung up on something. When it did, we had trouble, but that's another story.

After we tied on the cork lines, we would paint the corks whatever color we had decided on. We had a choice of colors—green, blue, white, whatever we decided to use of the paint my father brought home from work. We had three boats and three crews, so we had to have three different colors so that nobody could "borrow" another person's equipment.

We would pour about five gallons of paint into a galvanized tub and then drop in the corks, dunk them down into the paint with a stick, and hang them on a clothesline. Everybody else in the neighborhood was hanging up clothes, and *we* were hanging up corks. When people came down the road in their cars and spotted all these corks on the clothesline, they used to slow way down to see what the heck was going on. We kids used to laugh at these people all the time. I imagine they had never seen anything like that before, and they just couldn't figure out what it was.

Later, in April, we would tie the corks and the rings onto the nets. We had to sew the rings to the bottom sim line where the red marks were. We tied each ring on in three places around the rim so it would lay right along the net and not go whipping around and tangle it. We would also tie the corks on the cork lines to the top sim where the ink marks were. We tied about 30 to 35 corks on a 500-foot shot of net. Usually we fished with three shots, which gave us close to 90 corks out there. Usually each boat had the same amount of net. But I'm getting a little ahead of my story here. Let's go back a little bit.

We had to have floats with flags on them on each end of the net during the daytime so that the ships could see them when they were coming up or down the river. We also had lamps that we would put on the floats at night—kerosene lamps like the ones you would find in railroad stations. As I said earlier, my father used to work for the New York Central Railroad, and I guess he used to borrow a few from there, because we had railroad lamps. We could use the same floats with flags or lamps.

We also had a cuddy, which is what we put the net in. It was a box about five to six feet long, about three feet wide, and about 13 or 14 inches high, with three sides. We would put the cuddy on the boat and shove it to the back end. When we got out on the river, we dropped the float hooked to one end of the net into the water, and then the oarsman would start rowing and the net would pay out of the cuddy and off the end of the boat. A cork and a ring would come up, and we would throw the cork to the right and the ring to the left. The net would just keep coming off the cuddy into the river until the net was all the way out.

***Near the end of the 1940s, nylon nets came out. Oh boy, did that make a difference in catching fish!***

Around late March or early April we would go about a quarter-mile down along the river from our house to the oil dock, where we set up our fishing gear. It was an old Sunoco Oil Company dock that wasn't operating at this time. Once in a while we would see a truck go back and forth, but then that stopped too.

First we would have to clean up the beach, because during the winter and spring the tides were high and a lot of junk would float into the area where we hung our nets. We had to clean up the area and pull the weeds. Sometimes there would still be ice on the ground there in April.

Then we would set up and paint a rack of pipes whatever color we had decided to use that year. One pipe was on the back ground. It was 20 to 30 feet long. We would drive two six-foot pipes into the back ground about 20 feet apart and tie the 30-foot pipe to them so that it was about four or five feet off the ground. Then we would attach three other pipes that were about 20 feet long to that pipe. The other end of these pipes would sit on the ground. We would put canvas under the middle pipe because that's where we set the cuddy with the net in it.

After we had pulled in the nets from a run, we would head in to shore at the oil dock. Then we would unload the boxes of fish and haul the cuddy up to the pipes and set it on the canvas. We would stand there pulling the net up onto the poles and working all the fishtails, or snags, out of it. Then we would put it back into the cuddy. As we did that, we would put the corks in one end of the cuddy and the net and rings in the other. The rings and corks would match up with each other so that when we went out into the river and put our flag out, or our lamp, depending on whether it was day or night, we would have a cork and a ring coming off at the same time.

My boat was a flat-bottomed boat 21 feet long and four feet wide. It had two seats in it and a movable platform about three feet wide and five feet long on the back. The back of the boat was C-shaped and was about two feet deep, except where it was cut out in the middle down to about six inches above the water. The cuddy sat about a quarter of the way up from the rear of the boat. To pick up our net, we pulled it into the boat over the rear and laid it in the cuddy. We took the fish out while we were pulling the net in and threw them over the cuddy and into the boxes we had farther forward. This balanced the boat. When the boxes were full, we just threw the fish into the bottom of the boat. If the boat got too full even for that, and if the price for the bucks was really low, and if we still had a lot of net to go, we would start throwing the bucks back into the river as soon as we caught them. Later we would ship the fish to the Fulton Fish Market in New York City.

On each boat we had an outboard motor, two pairs of oars, an anchor, a five-gallon gas can, floats, and two sets of oarlocks. The oarlocks were mounted onto the boat so we would not lose them, but we always carried two pairs of oars anyway so that in case we were out in a storm and we broke an oar, we wouldn't be up a creek without a paddle, so to speak. Also, the extra oars came in handy during the daytime to flag tugboats, sailboats, ships, or whatever to steer them to the right or left when we thought they were going to run over our net.

By March the boats had been sitting upside down on shore all winter long. We would tip each one over and paint it inside and out in the color that we'd picked as ours. Then we would put a buoy out in the river and shove the boat into the water. Of course, since it had been in dry dock all winter, the wood had dried out and the seams had split, and it would sink—well, not to the bottom. It would sink up to the top of the boat and then just float there. We

would leave it there for a week to let the wood expand. Then we would pull the boat out of the water, bail it out, and put it back in the river to look for leaks. By then the wood in the bottom of the boat had swelled up and most of the cracks had sealed. Of course, wood is not straight all the time, so there would still be leaks. We would have to caulk them with oakum and cotton.

After we got the seams caulked, we put our boats back out and we were ready to go. Even then, we kept a chisel or a screwdriver and some rags with us in the boat all the time because we never knew when we would need to plug a leak.

Some of the equipment we had for motors was pretty sad. We had an old gasoline engine we called the knuckle buster. It had a big wheel on top with a knob on it, and we would attach a battery to the engine and crank it with the knob to get it started. We called it the knuckle buster because when the engine kicked in and started, she'd kick back on us and we would skin our knuckles.

We had to use that motor for our first year, and then my dad bought us a new Johnson three-and-a-half-horse motor. Later we bought a five-horse engine too and then another one. That was nice; we could finally retire the knuckle buster. It was a slow engine—it could pull a load, but it was slow. A three-and-a-half or five-horse was just right for a fishing boat. We could get where we wanted to go fast enough to flag the ships away from our nets, especially with the five-horse.

**Fishing**

Usually by the end of April the shad would start coming, but the smelt would come up the river first, maybe two or three weeks before. We would borrow a dip net from one of our neighbors who used to be a fisherman and hang it over the end of the dock and catch smelt. Herring would also come up the river, and we could hear them swimming along the beach. The bucks were chasing the roes, and they made a swishing sound. The herring would come up just before the shad. When they came around, usually it was only about a week or two before the shad started running.

Our shad nets were gill nets that we put in the river in front of our house and that drifted either downriver or upriver, depending on the tide. When we put the net out, we would set it across the current and a little upriver. We set it a little loose, with some *S* curves in it and with about 20 corks angled off downriver at the far end in a downriver float. That way, when the net got to the flats, the shallow water, at Gunnar's Stakes, after about 40 minutes, the current would have pulled it so it would be laying just about straight across the river. But our net would be closer to the shore than other people's because the angle we put in it at the end kept the current from pulling the net so far out into the river. By the time the net was off the flats by the brickyard, it would be parallel to the shore. The fish, which were coming upriver, would hit the flats and start swarming out into deeper water. Our net would be right there, and they'd be caught.

The tide in the Kingston and Port Ewen area runs eight hours downriver and then turns around and goes back up the river for eight hours. For instance, from our house to the Esopus Lighthouse would be about an hour, so after seven hours of the tide's running downriver, we would put in the net and run the last hour of the tide, and that would put us right in front of the lighthouse if we'd figured it right.

Then the net would hit slack water. It would sit there for about 20 minutes to a half hour and then gradually start going back up the river. That was when we went out and started picking it up. It would take us about three to four hours to get our net picked up, and while we were picking it up, we kept a stretch of four or five corks of net looping out behind the boat. That way, the fish that were running along the net would eventually run into the loop and get caught.

After we got the net all picked up, we would rush to shore, unload the fish, hang the net on the pipes, and get ready for the last part of the upwater tide, if we could catch it. If we could make a two-hour-and-fifteen-minute run up the river, it would take us almost to the Kingston Lighthouse, about five miles up the river. Then the tide would set back down again.

All this trying to catch the tide up and down didn't give us much chance to sleep. Sometimes we would just skip the upwater tide and get some sleep because we caught more fish on the downwater tide anyway.

One year I had a short piece of net that had gotten chopped up by a boat and had hung up on Gunnar's Stakes. After all this there were only about 20 corks of net left on it, or about 120 feet. I would carry it in my boat sometimes and would use it to my advantage in what we called the tricks of the trade. Sometimes I would use it when I was downriver around a channel buoy. If we were still drifting upriver and picking up the net when we came to it and I was afraid the net might wrap around the buoy, I would take the 20-cork piece and clip it to the end of the main net that was in the strongest current. Then the current would pull the net away from the buoy. I didn't catch many fish in the 20-cork piece, but it saved me a lot of work.

THE ESOPUS LIGHTHOUSE.

One time my dad and I used the piece on a downwater drift. It was about five o'clock in the afternoon, and the other fishermen were starting to put their nets out a little early. It looked like somebody had something planned for us. We just sat there on the beach with our net in the boat, trying to figure out what was going on. Our neighbors, the Wellses, had put out their three boats, and the Spinnenwebers had put out their boats, and before we knew it there were five or six boats all going out.

I said to my dad, “What the hell are we going to do? They got the river pretty well tied up here.”

“No,” he said, “we'll be okay. Let's go. Shove off.”

So we shoved off and I started rowing out. Dad wouldn't tell me what he was going to do. He just said, “Keep on rowing.”

We got out there, and one net passed by and went on downriver. Then the next net

was starting to come up. We got right out between the two of them, and I said, "Jeez, Dad, it's going to be awful close. Won't we run into each other?"

He said, "You just keep on rowing." So I kept on going.

When we looked up and down the river, we could see five nets being put out, and we could see the ends with their lamps. They were all lined up in two rows. So we went out past their lamps and kept on going a distance of about 30 corks. Then my father said, "Well, this'll do. Drop the light into the water.

Then Dad told me to head upriver at an angle, which I did, and he started throwing out our net. We had the 20-cork piece in the boat with us, and when we had almost three shots of net out, he said, "Okay, now turn downriver."

I did, and pretty soon he said, "Hold it. Now let's put on the other 20 corks." We clipped the 20-cork piece to the end of the net and kept right on going. We had 100 or 110 corks of net out there.

The Wellses were all upset, of course, because we'd put our net out right between them. But we just went down to the Esopus Lighthouse and sat there waiting for our net to come down. By the time it got to the brickyard, the Wellses' nets were there too, and there we were, running side by side maybe a hundred feet apart.

Our net started passing his, and by the time it got down to the lighthouse, we were ahead of him. Of course, by then the Wellses had come down to pick up their net. They saw us down below them picking up a net, and one of the Wells boys rowed over and yelled, "Hey, you picking up our net?" My dad said, "No, I'm picking up *our* net. That's your net in back of us there." Of course, by then he could see by the color of the buoys that it wasn't their net. They just scratched their heads. I don't know that they ever figured out what had happened.

You see, when we put our net out, we rowed out a lot farther than they did, so our net caught more of the current, and adding an extra 20 corks of net carried it down the river even faster. It ran like a freight train, so we passed them and beat them to the lighthouse. They were all planning to run their nets for just 45 minutes, which would put them off the brickyard when they hit slack water. But, of course, by putting the net out the way we did we could go for an extra 15 or 20 minutes, which would take us right to the lighthouse. And that's what happened. I guess you could say that was one of the tricks of the trade, and I know we had fun doing it.

**A Wicked Storm**

I remember a time when the old Hudson River got pretty nasty. The wind had been blowing south for about eight hours, and it was getting to be about four o'clock in the afternoon. We had to make a decision about whether we were going to put our nets out and go down the river or not. We had waves out there that were four to six feet high, so it was pretty bad. Now, sometimes a storm will die down when the sun goes down—or it will get worse. We didn't know what it was going to do, but it didn't make any difference. We knew we had to go for it anyway, so we put our net out.

On that day I was with my dad and Walt, my brother, was with Charlie Harrington. We went up the river, put our net out, and then went on down to the Esopus Lighthouse and pulled in. There was a small island next to the lighthouse, and we stayed there until our net came down the river and passed us. Then it was time to go out and try to pick it up. I tried first, so Walt and Charlie waited there, and my father and I went out, put the engine on our boat, started it up, and went out.

As I got close to my net, I was riding the waves at an angle and just barely managing. I put my bow into the wind and started picking up the net, and my father grabbed the oars and tried to keep the bow headed into the waves. That day the waves came right over the bow and we'd take in water. So Dad couldn't put the bow directly into the waves. I knew we were in trouble then. After the third wave pushed water into the boat, we thought that was going to be it. We turned around and ran at an angle back to the island at the lighthouse.

We then tried my brother's boat. It was shorter and the bow was higher, so we thought it might ride the waves better. Walt said that he would go with me and we would try it. Walt was the best oarsman on the river in those days. There was nobody better than he was.

I put the engine on the boat and we went out to my net. When we got there, I put the bow into the waves. We didn't take any water, but we were always losing power because the engine drowned out. So my brother started rowing and I jumped into the bow and started grabbing the corks. I didn't bother to take the fish out of the net that day. We just wanted to grab the net and get back to shore.

The storm was so bad that when the boat went down into a trough, the waves were so high that I couldn't see the lighthouse, and we were only three or four hundred yards off it.

We had about 1,800 feet of net out, and the storm just pushed everything together. It took us three to four hours to get the net into the boat. It wasn't easy at all, and when we got done we were almost in the same place we had started, because the storm was blowing us downriver almost as much as the incoming tide was pushing us upriver.

When we finally got the net in, I jumped back into the rear of the boat and started up the engine.

We rode back to between the lighthouse and the island, where my dad and Charlie were waiting. We switched the cuddy with my net back onto my boat, and Walt and Charlie went out to pick up their net. Walt says he had to row for seven hours in all, so he must have spent another three hours out there picking up his own net. My dad and I rowed over toward shore, where the storm was not as bad. It was still bad, but not as bad. At least we could row the boat, and we could start the engine after a while, and we went home.

After they got in that day, Charlie and my brother sat down and drank a bottle of wine. I drank a cup of coffee, because I was only around twelve or thirteen years old then.

## *The Author*

RICHARD JOSEPH was born in Port Ewen, New York, about 50 miles north of New York City, in 1935. At the age of 12, he operated his own shad fishing boat, fishing with a 1,500-foot gill net. He recently wrote and self-published the book "Growing Up on the Hudson: Memories of a Shad Fisherman," which includes stories about his family's experiences shad fishing—the equipment and techniques they used, competition and cooperation with his fellow fishermen, and marketing the fish locally and at the Fulton Fish Market in New York City. His book sells for $14.95 (U.S.) plus $3.00 shipping and handling for the first copy and $0.95 shipping and handling for each additional copy. Write to: Richard Joseph, 9761 W. Calle Cibeque, Tucson, Arizona 85746, USA.

## *Shad Bites*

### New Fish Passages Open to Record Returns on the Susquehanna

The multi-agency restoration program for American shad (*Alosa sapidissima*) and blueback herring (*A. aestivalis*) on the Susquehanna River in Maryland and Pennsylvania received a big boost in spring 1997. New fish elevator systems costing $50 million (U.S.) came on-line in April at the Conowingo, Holtwood and Safe Harbor hydroelectric dams, opening the lower river to natural migrations for the first time since 1910. Fish responded with a record return to the river. Over 103,000 shad and 374,000 blueback herring were counted at Conowingo. Most fish moved freely upstream but 10,700 shad and 27,000 herring were trapped and trucked above the fourth dam at York Haven. Lifts at Holtwood and Safe Harbor passed 28,000 and 21,000 shad, respectively.

The Pennsylvania Fish and Boat Commission reared and marked 8 million shad larvae which were stocked into select large tributaries above dams. Hatchery-produced shad had largely dominated adult returns to the river through 1995. However, in 1996 and 1997 naturally produced fish from past year trap-and-transfer efforts comprised 45 and 60 percent of the runs, respectively. A 500,000 shad fish ladder is currently being designed for York Haven Dam. When completed in April 2000, over 500 miles of the Susquehanna River and its major tributaries, including most of the historic shad range, will be available to all migratory fish.

*For more information contact Richard St. Pierre, USFWS, Harrisburg, PA at 717-238-6425 or e-mail at R5FFA_SRC@fws.gov.*

**Submissions**

Contributions should be double-spaced. Submissions via e-mail or on disk (Mac or DOS) are encouraged. If using e-mailing, you may need to split it up and send it as several messages. No message should exceed 1.7 megabytes. Scanned photographs should be e-mailed individually. Direct your contributions to Richard Hinrichsen, Editor-In-Chief, The Shad Journal, P.O. Box 21748, Seattle, WA 98111-3748 or to the e-mail address: hinrich@cqs.washington.edu.

*Letters to the Editor and Articles*. The Journal publishes letters, commentaries, histories, scientific articles, interviews, reviews, and philosophical and methodological items related to shad the world over. There are no page limits but authors are asked to edit their submissions for clarity and precision. Previously published items from other sources can be republished in the Journal if the contributor obtains permission of the author and the copyright holder, and clearly identifies the original publication.

Please do not include footnotes or references in the text. Choose 4-5 of the most relevant references for inclusion at the end of the article. References may include a World Wide Web address. Write a brief biographical statement which includes your interest in shad, and current work. Please include your e-mail address, fax number, phone number, and postal address.

*News Briefings (Shad Bites)*. Submit news articles on developments relating to shad. For upcoming meetings, submit a brief description, including title, a short paragraph on objectives and content, dates, location, registration requirements, and the meeting contact person's name, street address, and phone/FAX/e-mail address.

*Obituaries*. The Foundation will honor the memory of members and friends through obituaries. The obituary should describe the person's history (date and place of birth, professional address and title) and his/her involvement with shad.

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