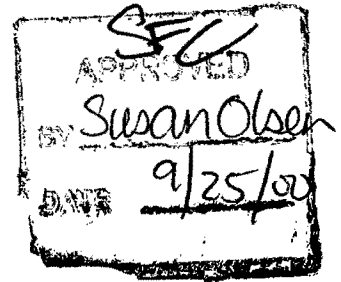


UNITED STATES
DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Region
State, Federal & Constituent Programs Division



Final Completion REPORT

Grantee: Maryland Department of Natural Resources, Fisheries Service

Grant No. NA46FU0359

Project Title: Fish Passage in Maryland

Period Covered: October 1, 1994 through December 31, 1999

Prepared by: Lawrence K. Leasner, Director, Fish Passage *L. K. Leasner*
Jackie Fary, Fisheries Biologist *JF*

George L. Herlth, Jr.
Approved by: George L. Herlth, Jr., Director of Administration

Date: March 31, 2000

Statutory Funding Authority: Anadromous Fish Conservation Act
(P.L. 89-304)

- ☒ X Chesapeake Bay Studies
- ☐ Endangered Species Act
- ☐ Interjurisdictional Fisheries
Act (Title III of P.L. 99-659)
- ☐ Magnuson Act
- ☐ Oyster Disease Research
- ☐ Saltonstall-Kennedy
- ☐ Unallied Industry Projects
- ☐ Unallied Science Projects

Federal Fiscal Year 1994
Grant NA46FU0359
Final Completion Report for the Period
October 1, 1994 through December 31, 1999

Job # 1, Coordination

The leading goal of the Maryland Fish Passage Program has been to restore the stocks of migratory fish in the Chesapeake Bay through reopening historic spawning habitat. Primarily, activities had included directing projects such as construction of fishways, dam removals, culvert replacements, and weir notches. The Program also implements other projects that support the overall goal of reopening habitat, such as monitoring fish ladders, finding and researching new sites, updating the fish passage blockage database, operating and maintaining existing fish ladders, and education activities that involve the general public in the plight of migratory fish in the Chesapeake Bay.

During the five year period of this grant, a variety of coordination tasks were conducted. Staff attended meetings of the Interstate Fish Passage Workgroup to coordinate fish passage activities with neighboring jurisdictions and federal agencies. Efforts to remove two stream blockages on Rock Creek in Rock Creek National Park in the District of Columbia were coordinated through the National Park Service, District of Columbia and the Interstate Commission on the Potomac River Basin. Activities to plan and design a fishway at the Little Falls dam on the Potomac River were coordinated with the U.S. Army Corps of Engineers' Baltimore District office and the U.S. Fish and Wildlife Service. Staff worked with the State Highway Administration to assess the practicality of fish passage at numerous SHA owned road crossings. Coordination activities were completed regarding Anacostia River and Rock Creek habitat assessments. Upstream habitat was assessed above the Johnson Pond dam in Salisbury, the Bishopville Pond dam and the Foreman Branch dam. The owner of a small dam just above Route 1 on Octoraro Creek agreed to cooperate with the Fish Passage program to breach the dam.

Staff attended wetlands training through the Corps of Engineers, and Maryland Biological Stream Survey training through the Department of Natural Resources. The Fish Passage director attended a workshop sponsored by the U.S. Congress's Office of Technology Assessment. The purpose of the workshop was to recommend innovative fish passage solutions to the Congress. A network of volunteers who help maintain and operate fishways was created in cooperation with the Chesapeake Bay Foundation and the Free State Fly Fishers. About 45 individuals volunteer their time each year to assist with this very important activity. Staff organized and assembled a Fish Passage database comprising almost 1,000 records and about thirty-five fields. Version 1 of the database was initially published and an updated version 2 was published during the grant period.

An intensive fishway biological monitoring study was started in the spring of 1998. Staff monitored the Van Bibber dam on Winters Run in Harford County. Van Bibber has a Denil fish ladder that was constructed in 1990 and reopened 3.5 miles of spawning habitat. A conservative estimate of 18,500 blueback herring passed the fish ladder along with six alewives and one hickory shad. In addition to these target species, smallmouth bass, white suckers, northern hogsuckers, carp, river chub, gizzard shad, sea lampreys, bluegill, redbreast and pumpkinseed sunfish were also documented using the ladder. Even though a large number of herring used the

ladder, it was only approximately 7-10% of the 250,000 (+or-) herring run that migrated up to the base of the ladder over the 1998 spring season. The reason such low numbers of herring passed the fishway in comparison to the total number in the stream is not known. They may have had difficulty in finding the entrance to the fishway, the sampling methods could have been somewhat different, or it could have been merely due to coincidence. This situation was not noticed during monitoring activities conducted during the early nineties. The herring that did pass the ladder traveled approximately 0.8 miles upstream of the dam to spawn, although 3.5 miles of stream have been reopened. Ichthyoplankton sampling confirmed successful spawning.

The Denil fish ladder at the Tuckahoe Creek dam, constructed in 1993, was intensively monitored during the spring of 1999. Tuckahoe Creek is a tributary to the Choptank River on Maryland's mid-eastern shore. Target species passing above the fishway consisted of 4,269 alewife, 487 blueback herring, 1 American shad, 589 white perch, and 14 yellow perch. The low numbers of blueback herring were disappointing, but it may have been due to low flow conditions caused by the a serious spring drought. However, the number of alewife and white perch far exceeded any other collections at Maryland fishways. Other species documented using the ladder included gizzard shad, bluegill sunfish, black crappie, brown bullhead, carp, chain pickerel, channel catfish, creek chub, creek chubsucker, golden shiner, goldfish, largemouth bass, pumpkinseed sunfish, redbreast sunfish, redhorse sucker, redear sunfish, silvery minnow, sunfish species (undetermined hybrids), white crappie, white sucker, and yellow bullhead. The white crappie and silvery minnow were previously unreported to have ascended any Maryland fishway.

In addition, the Denil fishway at Bloede Dam, which is the first blockage on the Patapsco River, was monitored during the spring of 1998 and 1999 to determine the usage of the ladder by target species. The ladder was constructed in 1993. Species that used the fish ladder at Bloede Dam in 1998 included: gizzard shad, sea lampreys, white suckers, rainbow trout, brown trout, rock bass, channel catfish, bluegill, green sunfish, redbreast sunfish, and pumpkinseed sunfish. A small run of approximately 1,000 blueback herring were observed at the base of the dam. They spawned at a large gravel bar just below the ladder. In 1999, the first four blueback herring were documented using the Bloede Dam fish ladder. Again, approximately 1,000 fish were observed in the Patapsco River, but the runs were characterized very differently between the two years. In 1999, the run was much more spread out, with fish moving in groups of 20-30 fish. Although the numbers of migratory fish are low in the Patapsco, it is still an encouraging sign of the comeback of the River, which has been closed by dams for over 150 years. Other fish collected at the Bloede dam fishway in 1999 included: American eel, sea lamprey, gizzard shad, bluegill sunfish, carp, northern hogsucker, rainbow trout, redbreast sunfish, rock bass, smallmouth bass, and white sucker. In addition, there were also numerous observations of hickory shad in the river. Four were captured for otolith analysis. Two otoliths were readable, one fish was from a hatchery stocking and the other fish was of wild origin. The 1998 fishway biological monitoring report was submitted to the National Marine Fisheries Service with the 18th. Quarterly grant report for the period from January to March, 1999.

Funding through State sources was provided to the University of Maryland Eastern Shore (UMES) Coastal Ecology Research Laboratory to complete an assessment of anadromous and resident fishes in the Wicomico River downstream of Johnsons Pond. Sampling occurred during the spring of 1996 just below Johnsons Pond. Sampling consisted of electro fishing, daily visual observations, and ichthyoplankton collection. Eighteen species of fish were collected, the most

notable were blueback herring, alewife herring, American shad, gizzard shad, white perch, striped bass, yellow perch, American eel, and largemouth bass. The study concluded that anadromous species congregated and spawned in high numbers below the dam and a fishway could allow passage of numerous fish. The investigators of the study also provided field trips for local schools and made several recommendations. A copy of the report is available from the Maryland Fish Passage Program.

Staff investigated numerous sites to determine the potential for fish passage projects. Coordination activities for this grant ended by March 31, 1999.

Job #2, State Management for Fish Passage

This job involves daily management of the fish passage construction projects. The Maryland Fish Passage Program supplied funding to remove two blockages on Rock Creek in the District of Columbia, which resulted in 2.6 reopened stream miles up to the National Zoo. The Interstate Commission on the Potomac River Basin (ICPRB) arranged the procurement services for the Fish Passage program. The five and ten year priority site lists for the Fish Passage Program were revised and updated.

The Maryland Department of Natural Resources, U.S. Fish and Wildlife Service and the Army Corps of Engineers worked cooperatively to design and construct a fishway at the Little Falls Dam. Staff set and read staff stream gauges in the Potomac River at the Little Falls Dam, contracted with an engineering firm to perform a topographical study of the river bottom, attended meetings of the Little Falls Task Force and reviewed and approved conceptual designs at the Conte Anadromous Fish Research Lab. Construction was completed at the end of January 2000.

Staff also worked to resolve technical issues for the design of the Simkins Dam fishway and attended biweekly progress meetings for the construction of all fishways. Fish passage projects in the Anacostia River watershed were reviewed before construction by the Army Corps of Engineers. Completed Anacostia fishways through the Corps included: Route 1, 38th. Street and Dam #1 on Paint Branch. The State Highway Administration completed fish passage projects on Route 648 on Cattail Creek (2 miles), Route 234 on Budds Creek (4 miles), Route 12 on Nassawango Creek (49 miles), Route 589 on Turville Creek (4 miles), and Route 6 at Gilbert Run (2 miles). Site visits were made to the Foreman Branch Dam (Chester River) to survey the site and read staff stream gauges so that FWS engineers could complete a conceptual design. Substantial damage occurred to fishways during February 1996 flooding from heavy snow and rains. Staff cleaned large amounts of silt and debris, made repairs, and submitted for Federal Disaster Relief.

Staff worked towards building a fishway at the Jones Lake Dam, on Andover Branch of the Chester River. The project was first initiated by contacting the landowner in late 1993. The State and the landowner came to an agreement that constructing a Denil fish ladder would be the preferred option for creating fish passage at the Jones Lake Dam. The State offered to completely finance the design and construction costs for the fish ladder. When the fish ladder was completed, the ownership and the responsibility of operating and maintaining it would be transferred to the owner (Jones Lake Corporation). Unfortunately, this was not acceptable to the landowner, who did not want the fish ladder built at all and did not want the responsibility of

operating and maintaining it. The State offered to provide operation and maintenance for the first ten years and then transfer ownership. This was also rejected by the landowner. By mid 1995 negotiations had reached an impasse. By October 1995 the Fisheries Service finally offered to maintain the fishway permanently, while maintenance of the dam would remain the responsibility of the owner. However, the Jones Lake Corporation wanted DNR to also maintain the dam for the duration of the life of the fish ladder. The Fisheries Service responded that maintaining a privately owned dam was not an option for the State. A 1995 Dam Safety inspection stated that the dam was in very poor condition. Also at this time, DNR investigated the possibility of purchasing the site using Program Open Space funds. Negotiations continued and broke down in 1996. Due to the impending grant expiration and subsequent funding loss, the grant was amended and the Andover branch funds were spent towards constructing fishways at the Simkins dam on the Patapsco River and at Unicorn dam on Unicorn Branch, a tributary to the upper Chester River.

Staff wrote fishway study biological monitoring protocols, manned outdoor expositions and provided a display at the 1995 Alliance for the Chesapeake Bay Annual meeting. Prospective sites were investigated with FWS engineers. A Fish Passage demonstration on the Patapsco River was held for Bruce Babbitt, Secretary of the Interior, in 1995. Staff coordinated with the National Civilian Community Corps to help with small fishway projects at Elkton and the CSX Railroad crossing over Dorsey Run, just below route 32 and the dam on Western Branch below Route 216.

Job #3, Training, Local Government Advisory and Information

Staff organized and hosted the "Small Blockage Fish Passage Training Conference" in Baltimore for 75 people on December 16-18, 1994. The conference consisted of two days of lecture and one day of field visits to several fish passage sites. The purpose of the conference was to provide instruction in planning, designing and constructing fishways at small obstructions to fish passage such as culverts, pipelines, gauges and low-head dams. Speakers included Dick Quinn of U.S. Fish and Wildlife Service, Chris Katopodis of the Freshwater Institute of Canada, as well as experts from Maryland, Virginia, and Pennsylvania. Information was disseminated to conference participants, including providing literature, educational displays, and lecture summaries.

A "Fish Passage Training Workshop" was held March 21-23, 1995 in Williamsburg, Virginia for forty people. The event was organized and co-hosted with the Virginia Fish Passage Program. The workshop focused on the basics of migratory fish requirements and modern techniques of fishway design for small dams and other blockages. The lectures dealt with biology, engineering, planning, design and the entire process of providing fish passage from conception to implementation. Highlights included a panel discussion and a full day field trip to local fishways.

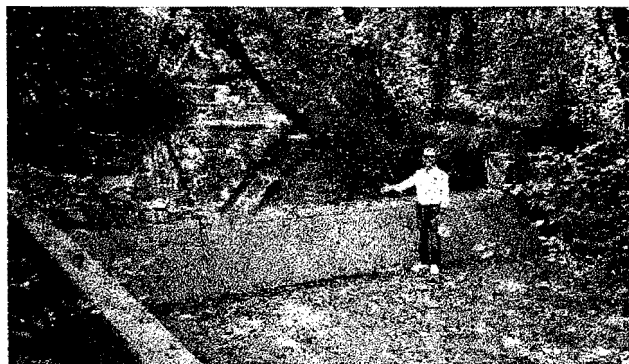
In addition, staff also presented several education presentations and exhibits to schools, conferences, and outdoor shows, worked with an engineering class from the University of Maryland to teach fishway design to the students and provided site visits upon request.

Job #4, Patuxent River Fish Passage Mitigation Projects

Funding for these projects was provided by the Potomac Electric Company as part of its Chalk Point Power Plant mitigation. These funds may only be spent in the Patuxent River watershed. Out of 152 blockages from the fish passage blockage database for the Patuxent River, about 40 sites were chosen for field investigation. Ten sites were chosen for a fish passage project; six have been completed and one is under construction.

Horsepen Branch Dam (PXU-05):

Located near Bowie, Horsepen Branch is a tributary of the Western Branch of the Patuxent River. Removing this dam resulted in 10 miles of spawning habitat for migratory fish. Staff completed the wetlands evaluation, reviewed the engineering design, submitted the permit applications, negotiated an easement with the landowner, finalized the Memorandum of Agreement, and monitored the progress of the project. Work was completed in November of 1995. The photo at right shows the dam just before removal.



Western Branch Dam (PXM-16):

An old mill dam blocks upstream passage on Western Branch, a sizable tributary to the Patuxent River. The blockage is just below Route 216 in Kettering. A team of eight National Civilian Community Corps (NCCC) workers removed steel gates from the dam and then rearranged several large rocks. Cobble was removed to create a four foot channel below the dam in order to create passage for fish. The NCCC was able to complete the project without heavy equipment. Work was completed in October of 1994.

Towsers Branch, Evergreen Road culvert (LPX-19):

The Evergreen Road culvert was replaced as part of a cooperative effort between DNR and the Anne Arundel County Department of Public Works, the culvert's owner. An Alaskan Steeppass fishway was proposed for this site; however, the County DPW proposed replacing the culvert instead of building a fishway if DNR would provide funding equivalent to the cost of the proposed fishway. A Memorandum of Agreement was signed by both parties and the County provided the remainder of the funding necessary to replace the culvert. Replacing this culvert resulting in 0.4 miles of reopened habitat. This project was part of the overall effort to reopen all of Towsers Branch to migratory fish. The new culvert was set 18 inches below the stream invert to prevent causing another blockage to fish passage. Work was completed in October of 1995.

Towsers Branch, Waugh Chapel Road culvert (LPX21):

This is the furthest upstream blockage to fish passage on Towsers Branch. The project was also directed by the Anne Arundel County Department of Public Works. It began in November of 1997 and was completed in February of 1998. Cost were shared between the Fish Passage program and Anne Arundel county. A series of Rosgen-type rock vortices (also called

step pools) was designed and constructed. The purpose of these weirs is to trap sediment and increase the stream elevations so that there will no longer be a water drop at the bottom of the culvert. A total of 1.2 stream miles was reopened by this project.

Unnamed tributary, Sands Road culvert (PXM-42) and Charles Branch, Croom Station Road culvert (PXM-07):

Staff reviewed engineering designs, performed wetlands evaluations, and completed site surveys. These projects were deferred due to observations of abnormally low water flows.

Dorsey Run, Railroad crossing (LPX-02):

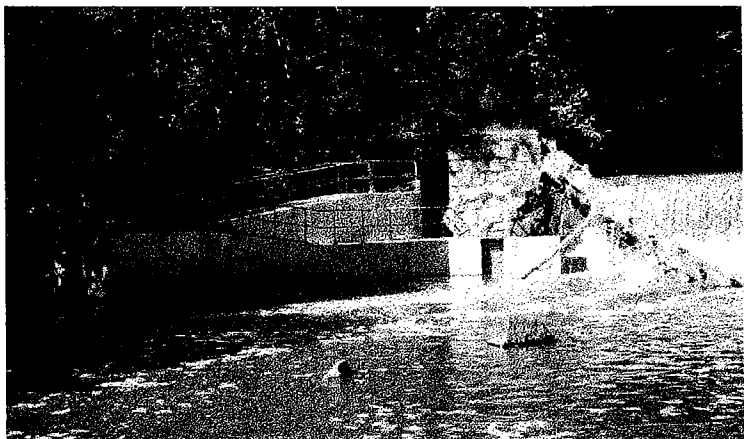
An accumulation of debris, including very large boulders, scrap steel and tires, had formed a permanent structure that caused a 1.5 foot water drop in the stream. A team of eight NCCC workers removed the large pieces of debris and rearranged boulders and cobble to reopen the stream for upstream movement of migratory fish. All work was completed by October of 1994. This project reopened 0.1 miles on the mainstem of Dorsey Run, up to the Route 32 culvert. This culvert was replaced by the State Highway Administration during 1994. These two projects together reopen 2.4 miles on Dorsey Run up to the next blockage (Dorsey Run Dam).

Dorsey Run Dam (LPX-03):

The Fish Passage Program staff have worked in conjunction with the Watershed Restoration Division (WRD) of the Department of Natural Resources for this project. The original design was to remove the eight foot dam and dredge the sediment that had accumulated behind the dam. A sediment survey behind the dam was completed. Upon meeting with permit reviewers, the amount of sediment that would be required to be removed would be cost prohibitive to the project. The alternative idea was to create a new stream channel that would completely bypass the dam and impoundment. The fill from the stream channel will be used to fill in the impoundment. In addition, the surrounding area was to be regraded in order to restore the natural functions of 17 acres of riparian wetlands. The Howard County Soil Conservation Service completed the conceptual design for the project, which consisted of a curved stream channel with five weir structures. This project is still ongoing and efforts now focus on reconsidering removing the dam.

Job #5, Design and construction of Simkins Fishway

The Simkins dam is the second of four large dams on the mainstem of the Patapsco River that have been slated for fish passage projects. A Denil fish ladder was designed and constructed at the dam, which reopened 3.8 miles of historic spawning habitat. The dam could not be removed since it was owned and

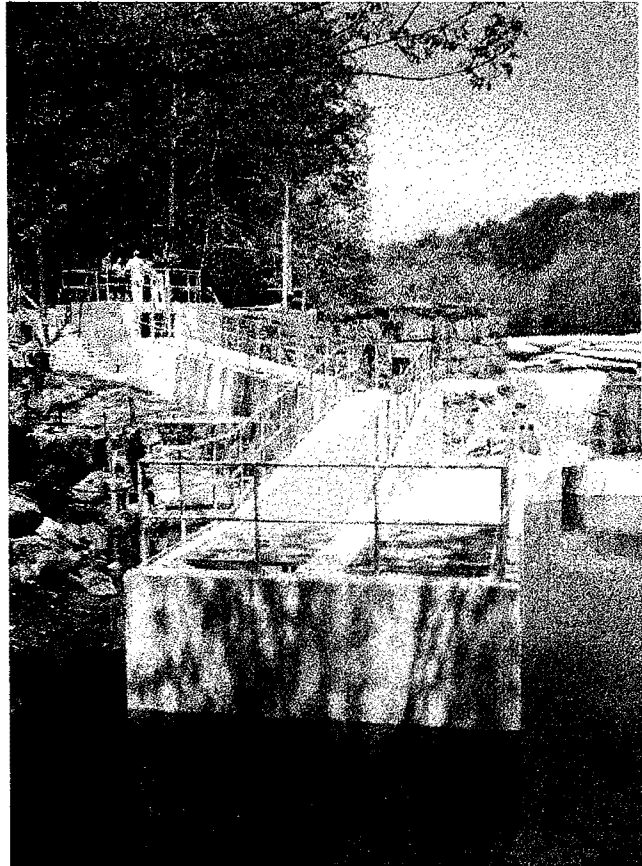


still operated by Simkins Industries to provide non-process cooling water for a recycling paperboard plant. Negotiations with Simkins Industries were complex and involved discussions of payment, ownership of the fishway and the responsibility of operating and maintaining the fish ladder. Simkins Industries donated 38 acres of land and \$54,000 of the construction funds. The land, valued at \$147,000, became part of Patapsco Valley State Park. The Fish Passage Program agreed

to operate and maintain the fishway and fund the design and construction costs minus the \$54,000 Simkins donation. Funding was provided through several Baltimore Harbor mitigation settlements.

Construction at this site was very difficult. The fishway was constructed through the old overflow spillway on a narrow strip of land between the dam and active railroad tracks. The railroad would not allow heavy equipment to access the site along the tracks. Access could only be provided by transporting portable construction equipment across the river on a barge. Due to these constraints, the contractor was forced to excavate bedrock with portable jack hammers. Concrete could only be poured by pumping it across the river through a flexible pipeline floated on truck tire inner tubes. Construction began on October 7, 1996 and was completed by the end of June 1997. Despite the severe site access and construction problems, the job was completed \$150,000 below the engineer's estimate.

The Simkins dam fishway was the last fish ladder to be completed on the Patapsco River's mainstem. The river was designated as the highest priority river system for the Fish Passage Program. Other Patapsco River projects included a Denil fish ladder at Bloede Dam and Daniels Dam, and a breach and bank stabilization on Union Dam. With these four projects, 23 miles of the Patapsco River has been completely reopened for the first time since 1842. Migratory fish can now enter the Baltimore Harbor and travel up to Liberty Reservoir in Carroll County, a distance of forty-four miles.



Job #6, Design and Construction of Wilsons Mill Fishway

Due to the cost of this project, the funding is also covered by the FFY 1995 grant (NA66FU0101). Care was taken to avoid charging the same work to both grants. Wilsons Mill dam, located on Deer Creek, is a tributary to the Susquehanna River. Activities during the early part of this grant including staff stream gauge readings, surveying the site and developing a

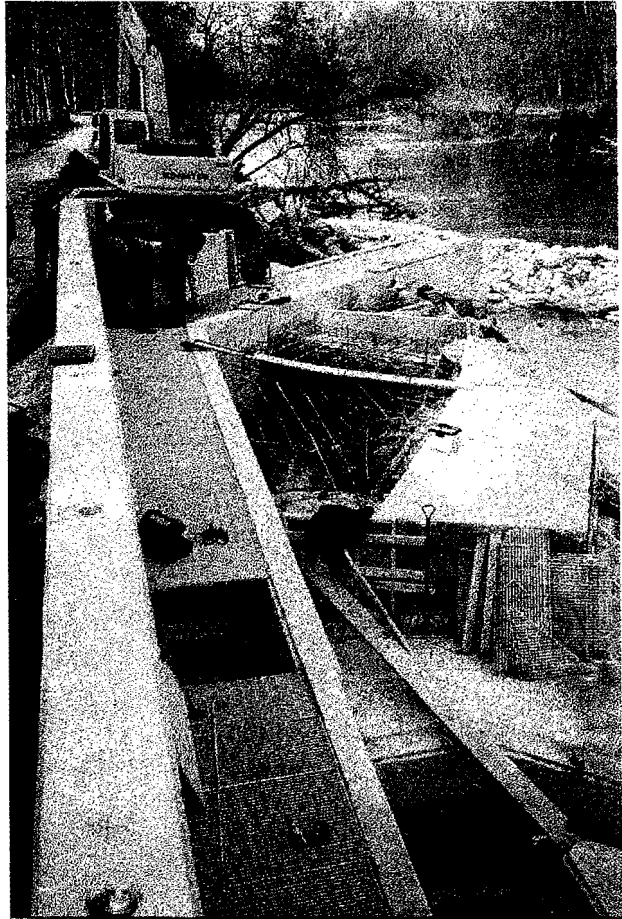
conceptual design. However, during the design process complicating factors were discovered that greatly increased the cost of the fishway, requiring additional funding. In addition, the funding provided through the FFY 94 grant was based on very preliminary estimates provided long before the engineering phase began.

There were long delays in implementing this project partly due to the difficulty in determining who the owners of the property actually are and where they reside. Eventually it was learned that the owners are foreign investors who were tracked through several countries. Once contact with the owners was made, extensive negotiations through their local representatives began.

A small scale generator at the site had once provided electricity that was sold on the local power grid. The on-site manager of the property wanted to resume electrical generation which would have placed the project under the control of the Federal Energy Regulatory Commission. After three years, FERC eventually ruled that as long as generation is not produced, the state has authority over the project. The owners legal representative would not sign the agreement allowing the state to access the property to construct the fishway until the Department of Natural Resources indicated it may seek to put a lien on the property that would require future owners to construct a fishway at their own expense. This step was necessary because the grants were to expire and they could not be extended again. The agreement was signed in summer 1999.

Other necessary activities that were completed before construction could begin included completing the final engineering design, review by the Maryland Historical Trust, wetlands evaluations, and finalizing a right-of-entry agreement with the Harford County Department of Public Works to close an adjacent county road during construction. Construction began during the third quarter of 1999. At expiration of this grant on December 31, 1999, construction was about 90% complete. The fishway itself was essentially completed by year's end. Remaining tasks to complete the job included repairing a buttress wall between the fishway and the dam's spillway, replacing a gravel road adjacent to the fishway and general site cleanup. Final close-out will be completed during March, 2000. All project costs incurred after the first of the year will be paid through state funds. The photo at right shows the fishway essentially completed during early January. The rebar in the center of the photo is to repair the buttress wall between the fishway and the dam's spillway. In addition, the gravel road seen at the top left runs adjacent to the fishway. It was removed and must be replaced as part of the project.

Twenty-four miles of excellent historic mainstem spawning habitat were reopened by the

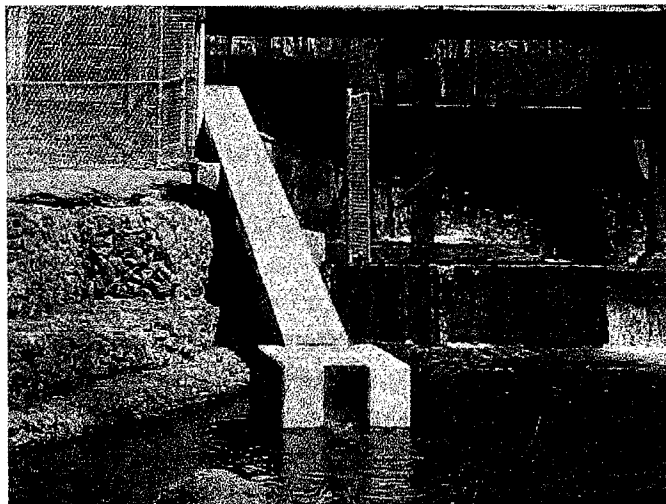




fishway for the first time in nearly 300 years. Settlers built the first grist mill dam on or near this site in 1788. Dams have existed in the vicinity of the Wilson Mill dam for nearly the entire interval since construction of the first dam. Hickory shad are the most important of the target species in Deer Creek; however, alewife, blueback herring, white and yellow perch, and American shad are target species also. A remnant run of at least several thousand each of hickory shad and river herring ascend Deer Creek to the base of this dam every spring. American shad will probably be present only in small numbers. In addition, many resident species should also use the fishway. The fishway was constructed to the left of the photo at left above, around the concrete buttress wall. The photo at right above shows a view of the dam's spillway.

Job #7, Design and Construction of Broadway Branch Fishway

The Lake Bonnie dam impounds Broadway Branch, a tributary to the Choptank River in Caroline County on Maryland's mid-eastern shore. This project builds on another fishway previously constructed at Red bridges, about 2.5 miles downstream of Lake Bonnie. The Lake Bonnie dam has existed in some form for approximately 300 years. Mill dams at this site were constructed by settlers during colonial days. The present earthen dam has the remnants of an earlier wooden dam buried inside of it. Negotiations with the owner were long and protracted due to several issues. The owner's concerns focused on availability of water in the impoundment to irrigate nearby fields, safety of the fish ladder for kids staying in the adjacent campground,



placement of the ladder, and the possible entrance of carp into the lake via the fish ladder. Delays to the project occurred during the bidding process. The project was awarded to the second highest bidder because the lowest bidder was rejected due to bond irregularities. Construction began on November 1, 1999. At year's end, the project was about 85% complete. Construction of this project went surprisingly well. There were no change orders. An Alaskan Steeppass fishway will be completed in February 2000 and reopen 12.5 stream miles to migratory fish.

Job #8, Maryland Stream Habitat Surveys

The work for the stream habitat surveys was completed by the Monitoring and Non-Tidal Assessment Division of the Department of Natural Resources. The sites chosen to be evaluated for migratory fish spawning habitat were Andover Branch, Unicorn Branch, Cypress Branch, Broadway Branch, and Morgan Run. These streams, all located in the Chester or Choptank River watersheds, were chosen because of current or potential fish passage projects located on the streams. An estimation of spawning and nursery habitat was completed in the targeted streams. The report was published in October 1995.

The report compiled information from existing literature on HSI (Habitat Suitability Indices) scores for the target anadromous species, which included American shad, hickory shad, alewife herring, blueback herring, white perch and yellow perch. Spawning habitat parameters tended to be conservative, and hickory shad habitat requirements were assumed to be similar to American shad due to lack of information.

First order streams were excluded from sampling because it was deemed that they were too small to support a viable population of anadromous fish. Sites were chosen by a stratified random sampling design for habitat assessment. These assessments were based on methods developed by the Maryland Biological Stream Survey. Each site was a 75 meter long segment in which physical characteristics of the stream itself and a small riparian zone were measured or described, such as land use, general stream characteristics, wetted width, depth, velocity, sinuosity, etc. A total of 89 sites were evaluated.

Habitat scores were generally in the "poor" to "marginal" range for most sites. None of the sites had "optimal" habitat. The spawning habitat estimates for American shad and hickory shad were zero in all five streams. White perch had the highest estimates out of all target species, followed by yellow perch. The spawning habitat estimates for Andover Branch were: 28.70 hectares for white perch, 20.27 ha for yellow perch, 11.44 ha for blueback herring, and 10.48 ha for alewife herring. Various life stages were estimated for nursery habitat in Andover Branch: 0.97 hectares for yellow perch fry, 7.53 ha for yellow perch juveniles, zero for blueback and alewife herring juveniles, 0.16 ha for American shad egg incubation, and 0.70 ha for American shad larvae and juveniles. In Cypress Branch, a total of 28.78 hectares for white perch, 21.08 ha for yellow perch, 1.05 ha for blueback herring, and 5.86 ha for alewife herring was estimated for spawning habitat. Nursery habitat in Cypress Branch included 0.97 ha for yellow perch fry, 7.53 ha for yellow perch juveniles, and 0.22 ha for American shad incubation (no habitat for remaining species). For Unicorn Branch spawning habitat, there was 19.61 ha for white perch, 8.75 ha for yellow perch, 2.73 ha for blueback herring, and 1.62 ha for alewife. Nursery habitat in Unicorn Branch was 1.61 ha for yellow perch fry and 4.25 ha for yellow perch juveniles. The spawning habitat estimates for Broadway Branch were 9.42 ha for white perch, 7.68 ha for yellow perch,

2.07 ha for blueback herring, and 0.58 ha for alewife. Only 0.16 ha for yellow perch fry and 1.77 ha for yellow perch juveniles was estimated in Broadway Branch. In Morgan Run: there was 0.65 ha white perch and 0.55 ha yellow perch for spawning habitat estimates, and 0.36 ha nursery habitat for yellow perch juveniles.

Hectares are converted into stream miles of spawning habitat by assuming each stream is twenty feet wide on average; therefore, one hectare equals about one mile of stream ($2.47 \text{ ha} \times 43,264 \text{ sq. ft./acre} \div 20 = 5,343$). The report mentioned that the values used to determine suitable habitat may have been too conservative. Minimum depths were especially conservative in some cases. It was acknowledged that fish may do well in what would be considered "borderline environmental conditions" which were not accounted for in the parameters selected for the report. For example, the relatively large impoundments in these two watersheds may provide habitat but they were not counted in the overall estimate of habitat. Traditional HSI measurements may penalize the coastal plain streams of the Eastern Shore even though there may already be successful populations of anadromous fish in them. Deep, low velocity areas can provide spawning habitat but were generally excluded based on the parameters used in the report. However, the parameters were developed based upon existing literature and were not developed independently. The full report is available from the Maryland Fish Passage Program.

Unmet Objectives: There were no totally unmet objectives. Although the Wilson Mill fishway, job #6, was not totally completed by the grant's expiration date, the fishway itself was completed. The only remaining construction work to complete are the ancillary cleanup tasks associated with most construction jobs. The Broadway Branch/Lake Bonnie fishway, job #7, was not totally complete either, but the remaining 15% of the job is also the ancillary construction tasks. Both fishways will be fully completed soon and both will be able to pass migratory fishes during the spring spawning season.

Realistic Objectives: The goals of the grant were doable, but there can be extensive delays associated with any capital project.

Unexpected Benefits: Through the spring monitoring activities, several new species were discovered to be ascending Maryland fishways. Completion of the Simkins dam fishway was achieved through a unique public/private partnership, proving that such ventures can be accomplished in a manner agreeable to both sectors. In addition, thirty-eight acres of land were donated to the Patapsco Valley State Park in a rapidly developing area with expensive real estate prices. Flat land in that area sells for \$130,000 to \$150,000 an acre. Although the land that was donated to the State is mostly on steep slopes and largely not buildable, it is heavily forested and valued at \$147,000.

Additional Research: More monitoring needs to be done at Maryland fishways; however, this activity is ongoing.

NA66FU0295, FFY 1994

Grant Expenditures

Jobs	Original Budget	Expenditures	State Match Balance	Federal Balance	Status
#1, Coordination Federal Match	\$ 45,000 \$ 0.00	\$45,000 \$166,790	\$0.00	\$0.00	Complete
#2, Management Federal Match	\$0.00 \$12,510	\$0.00 \$12,510	\$0.00	\$0.00	Complete
3, Trng, Loc Gov't, Federal Match	\$16,500 \$ 0.00	\$16,500 \$0.00	\$0.00	\$0.00	Complete
#4, PEPCO ¹ Federal Match	\$0.00 \$180,000	\$0.00 \$0.00	\$ 0.00	\$0.00	Complete
#5, Simkins Dam Federal Match	\$0.00 \$278,990	\$0.00 \$369,287.83	\$(90,297.83)	\$0.00	Complete
#6, Wilson Mill Federal Match	\$190,000 \$0.00	\$108,266.24 \$0.00	\$0.00	\$81,733.76 ²	Complete
#7, Broadway Br. Federal Match	\$190,000 \$0.00	\$218,503.45 \$0.00	\$0.00	(\$28,503.45)	Complete
#8, Stream Surveys Federal Match	\$30,000 \$0.00	\$30,000 \$0.00	\$0.00	\$0.00	Complete
Total	\$	\$			
Federal	\$471,500	\$418,269.69		(\$53,230.31)	
Match	\$471,500	\$548,587.83	\$(77,087.83)		

¹ PEPCO projects were completed, but not charged to this grant because of the overmatch at the Simkins fishway project, Job #5.

² Some invoices have not yet been received pending change order resolution.