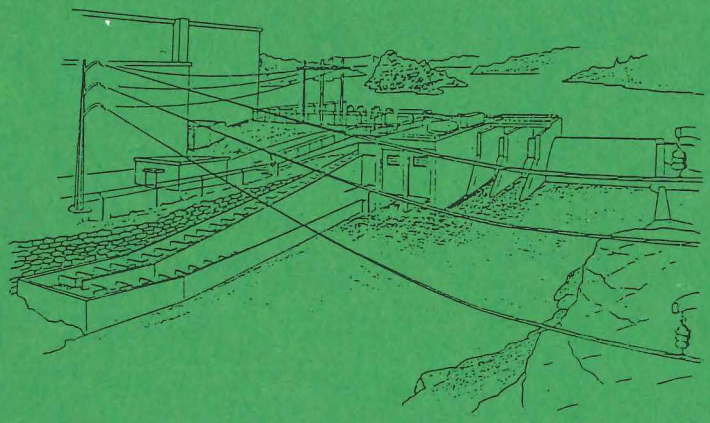
State of Maine

Department of Marine Resources

2000 Brunswick Fishway Report



Maine Department of Marine Resources
Stock Enhancement Division
#21 State House Station
Augusta, ME 04333-0021

March 2001

ANADROMOUS FISH RESTORATION IN THE ANDROSCOGGIN RIVER WATERSHED

2001 Report on the Operation of the Brunswick Fishway FERC #2284

Maine Department of Marine Resources
Stock Enhancement Division
#21 State House Station
Augusta, ME 04333-0021
207-624-6340

March 2001

Prepared by: Michael E. Brown
In Cooperation With: National Marine Fisheries Service (P.L. 89-304)

Table of Contents

Figures

List of Tables

INTRODUCTION

The Androscoggin River, with a drainage area of approximately 3,460 square miles, is Maine's third largest watershed. Historically, the Androscoggin provided access to a large and diverse aquatic habitat and supported great numbers of diadromous and resident fish species. For most species, the natural upstream migration barrier on the main stem of the Androscoggin River was Lewiston Falls, 22 river miles above tidewater. Although Lewiston Falls was an impassable barrier for most species, sea-run Atlantic salmon and American eel were able to ascend these falls and move upstream to Rumford, 80 river miles above tidewater. According to Atkins (1887), Rumford Falls was an impassable barrier to migrating salmon and excluded them from the New Hampshire waters of the Androscoggin River.

The restoration of native diadromous fish species to the Androscoggin River watershed has multiple benefits to the ecosystem and society. American shad and river herring provide important forage to other fish and wildlife species in both inland and coastal ecosystems. Restoring species to healthy habitat will allow individuals to utilize this valuable resource for recreational as well as commercial uses. The Androscoggin system has the potential to produce an annual sustained yield of 1,000,000 pounds of alewives and 500,000 pounds of American shad, valued at $132,000 and $206,000 respectively. The reestablishment of large runs of alewives and American shad could provide employment for a number of commercial fishermen, and large recreational fisheries for American shad could develop in the lower Androscoggin River. The 1,000,000-pound alewife harvest will increase long-term average statewide landings by 33% and provide a substantial source of bait for Maine's 6,700 licensed lobster fishermen. Efforts toward improved water quality, habitat, and fish and wildlife populations improve the overall health of the ecosystem and society.

River herring were known to reproduce in lake and pond habitat throughout the Androscoggin and Little Androscoggin River watersheds below Lewiston Falls, while American shad reproduced in the riverine areas below Lewiston Falls. Atlantic salmon, which could ascend the earliest built low head dams at Brunswick, were caught at Lewiston as late as 1815; however, river herring and American shad were excluded from waters above Brunswick after 1807, when the first dam was built at head-of-tide. The Little Androscoggin River, which enters the main stem Androscoggin on the west bank just below Lewiston Falls, was noted for large runs of diadromous fish. Sea-run fish ascended this major tributary to Biscoe Falls, 35 miles above the river's confluence with the main stem Androscoggin. By the early 1930s, the construction of dams that lacked fish passage capabilities, in combination with severely polluted waters, virtually eliminated all opportunity for fish to live and reproduce in the main stem Androscoggin and most of its tributaries.

Since the early 1970s, substantial improvement in water quality and the provision of fishways at some of the dams have enhanced the potential for successful fish restoration within the lower Androscoggin River watershed. In 1982, the Brunswick vertical slot

fishway and downstream fish passage were constructed at the first upstream dam on the river. In 1987, an upstream fish lift and downstream passage were provided at the Pejepscot Project, the second upstream dam on the river; in 1988, an upstream fish lift and downstream passage were installed at the Worumbo Project, the third upstream dam on the river. Effective upstream fish passage at these three hydropower projects could potentially provide access for diadromous and resident species as far upstream as Lewiston Falls.

Since 1983, Maine Department of Marine Resources (DMR) personnel have distributed over 383,000 adult river herring captured at the Brunswick Fishway into otherwise inaccessible habitat on the Androscoggin and Little Androscoggin Rivers. These stocking efforts continue due to the lack of fish passage at subsequent upstream dams on the Little Androscoggin River that prevents access to alewife spawning and nursery habitat areas.

Since 1984, DMR personnel have transferred over 6,047 prespawn American shad from the Merrimack and Connecticut Rivers for release into the Androscoggin below Lewiston Falls. Beginning in 1999, 280,000 American shad fry were released into the main stem Androscoggin River at Auburn. Stocking continued in 2000 with the release of 529,000 shad fry below Lewiston Falls.

In the six years since 1994, 956 adult shad have been observed at the fishway, while only 190 have actually been captured, indicating that the fishway is likely inadequate for the passage of American shad (Table 7). Beginning in 1999, visual observations from the fishway and underwater video were used to document shad behavior in and around the fishway. Visual observations and the use of video equipment have certain limitations that are considered when analyzing the data, such as the potential for overestimating (same fish counted more than once) or underestimating (limited visibility when looking down into the fishway/water) the number of fish actually present. Based on data collected during the 1999-2000 study results, a quantifiable study will be conducted in upcoming years.

Over 660 Atlantic salmon have passed the Brunswick Fishway since 1983, averaging 35 captured annually. Of those 666, 632 were sea-run in origin, while the remainders were landlocked.

DMR provides an annual report on the operation of the Brunswick Fishway to enhance its cooperative partnership with FPLE, Inc. in the operation of the fishway and to assist the company in meeting its FERC reporting requirements. DMR's report is based upon daily data, records, and logs that are maintained by DMR biologists at the fishway. This includes information regarding daily inspections, fishway cleaning and condition, fish data collection, and operational activities throughout the season (typically May through November). The operation of the Brunswick Fishway is one tool that is utilized in the implementation of the DMR fishery restoration program for the Androscoggin River. The goals and objectives of this program, along with any additional information not

specifically associated with the actual operation of the fishway, are included in this report as a courtesy to provide FERC and FPLE, Inc. with a broader perspective of the purpose, role, and usefulness of the fishway in the DMR program. Several legal authorities and state and federal plans that guide state restoration programs include:

Legal Authorities

- The Fish and Wildlife Coordination Act
- Federal Power Act
- Fish and Wildlife Act of 1956
- Federal Aid in Fish Restoration Act (Dingell-Johnson Act)
- Anadromous Fish Conservation Act
- Title 12 M.R.S.A. §6021, §6022, §6051, §6052, §7701, §7702
- Title 38 M.R.S.A. §630-636

Guidance Documents

- Fishery Management Report No. 35 of the Atlantic States Marine Fisheries Commission - Amendment 1 to the Interstate Fishery Management Plan for Shad and River Herring, April 1999.
- Maine Department of Marine Resources: State of Maine Recovery Plan for American Shad (*Alosa sapidissima*) and River Herring (*Alosa pseuodoharengus* and *Alosa aestivalis*) for Amendment 1 to the Interstate Fishery Management Plan for Shad and River Herring, May 1999.
- Maine Department of Marine Resources: American Shad Management Plan.
- State of Maine Statewide River Fisheries Management Plan, 1982.
- State of Maine Anadromous Alewife Restoration Program – A Report to the Joint Standing Committee on Inland Fisheries and Wildlife. Prepared by the Maine Department of Inland Fisheries and Wildlife and Maine Department of Marine Resources. February 1998.

GOAL AND OBJECTIVES OF THE RESTORATION PROGRAM

The State of Maine's Department of Marine Resources Fishery Restoration Program goal is to increase ecosystem health in the Androscoggin River watershed by restoring native diadromous fish species and their habitats. The primary focus is to restore river herring (alewives and blueback herring) and American shad to historic habitat areas in the Androscoggin and Little Androscoggin River watersheds, while increasing the restoration potential for other native fish species.

Objective 1: Increase the abundance, survival, and natural reproduction of pre-spawning adult river herring and American shad in historic spawning and nursery habitat areas.

Strategies:

1. Trap upstream migrating adults at the Brunswick/Topsham Hydroelectric Project Fishway and distribute them into upstream habitat areas that are inaccessible due to the obstruction of passage by dams.
2. Conduct supplemental releases of adult American shad and river herring from other tributaries when necessary.
3. Conduct American shad fry stocking to increase juvenile abundance in nursery habitat areas.

Objective 2: Protect and enhance the health of the native fish community structure in support of river herring and American shad restoration efforts.

Strategies to characterize and assess the fish community structure:

1. Monitor and facilitate up- and downstream movement of native diadromous and resident fish species into historic habitat by the operation of the Brunswick/ Topsham Hydroelectric Project Fishway.
2. Collect biological data on all fish species captured at the Brunswick Fishway.
3. Collect fish community data during the juvenile river herring surveys conducted upstream in Sabattus Pond and the lower Androscoggin River.
4. Collect fish community data during the adult river herring emigration assessment conducted in the Sabattus River at the outlet of Sabattus Pond.

Objective 3: Characterize the annual migration of adult river herring and American shad in the Androscoggin River watershed.

Strategies:

1. Assess the timing and magnitude and collect biological data from prespawning adult river herring and American shad captured at the Brunswick/Topsham Hydroelectric Project Fishway.

2. Assess the timing and magnitude of the adult American shad migration upstream to the Brunswick Fishway by conducting visual observations and underwater monitoring.
3. Assess the post-spawn adult river herring emigration timing, magnitude, and condition from Sabattus Pond sampling.

Objective 4: Assess the reproductive success of adult and productivity of juvenile alosids in the watershed.

Strategies:
1. Evaluate the juvenile river herring growth and emigration timing, habitat parameters, and fish community in Sabattus Pond, located in the upper Androscoggin River.
2. Evaluate juvenile alosids in the lower river by sampling at the Brunswick Fishway and selected areas in the lower reaches of the Androscoggin River.

Objective 5: Increase the accessibility of historic habitat for native diadromous and resident fish species to increase the abundance, survival, and natural reproduction in historic habitat.

Strategies:
1. Provide oversight, review, and comments on required fish passage operation and downstream effectiveness study plans at hydropower dams.
2. Identify ineffective fish passage and the potential causes by conducting studies, collecting visual observations, and utilizing underwater monitoring data.
3. Provide effective up- and downstream passage for native diadromous fish species at dams currently without passage through the FERC process and non-regulatory partnerships.

Objective 6: Increase public awareness of the Androscoggin River program in order to encourage participation and support in river restoration initiatives.

Strategies:
1. Conduct outreach activities such as providing presentations on the program to public and scientific audiences.
2. Participate in the development and activities of the Androscoggin River Watershed Council.

2000 BRUNSWICK FISHWAY MAINTENANCE AND OPERATION

- Maine Department of Marine Resources (DMR) met with the Brunswick dam owner, FPLE in the spring of 2000 to review Brunswick Station operations, problems occurring with the fishway, and maintenance issues that remained from the fall 1999 season that required resolution prior to the startup of the fishway in May.

- The fishway was officially opened for its 18th consecutive season on May 8, 2000.

- During the first week of operation, there were several problems with the physical condition of the fishway equipment. One of the four wheels of the fish crowder rusted off and dropped into the crowding area. The fish crowder remained out of operation until the wheel was retrieved later that day. The Isolation Gate #1 would not open or close properly. Isolation Gate #2 often remained in the "up" position after attempts to lower the gate with the appropriate controls. The circulation pump that supplies oxygenated water to the handling tanks was also inoperable on the first day DMR attempted to distribute fish captured at the top of the fishway and remained inoperable for six days after notification. The circulation pump is important because it supplies supplemental oxygen to the handling tanks where fish are processed prior to stocking or release upstream. The condition of the fish released from this tank is greatly dependent on the proper operation of the circulation pump, especially during the alewife, American shad, and Atlantic salmon runs.

- Problems with the fish crowder and trapping facility observed on the first day of operation in 2000 were consistent with problems at the end of the 1999 season. The 1999 Brunswick Fishway Report stated, "In 1999, the Brunswick Fishway was dewatered and cleaned on October 20, 1999 and closed for the season. Closure was earlier than usual because the fish crowder was inoperable (the lower panel rusted and fell off) and the cable that lifts the gate adjacent to the fish hoist (Isolation Gate #2) broke." Throughout the 2000 season there were failures of many of the critical components of the fishway, especially the moving parts of the fish trap and crowding areas. FPLE was notified in writing after the 1999 season of the condition of the fishway and the many maintenance issues that needed to be addressed (Appendix A). These concerns were stated again in the 1999 Brunswick Fishway Report, delivered to FPLE in July 2000, stating, "Following the shutdown of the Brunswick Fishway, a letter was prepared and sent to FPLE to address many maintenance needs. Due to the age of the fishway (16 years), rusting grates and other mechanical parts are breaking regularly and have become a safety concern." The fishway grating needs to be inspected prior to the 2001 season and maintenance issues detailed in a letter to FPLE need to be addressed before the fishway can be operated safely.

- The fishway was closed August 10 for 5 hours (7:30 AM to 12:30 PM) to remove debris from the fishway.

- The fishway was closed for the season November 6, 2000.

FISH PASSAGE

RIVER HERRING:

The statewide goal of the Maine Department of Marine Resources is to restore self-sustaining populations of river herring to their historic range. One benefit is to restore individual river watersheds. A second benefit is that with the reestablishment of river herring populations to Maine rivers, adult broodstock become available for restoration purposes in other Maine river systems.

The fishway was opened May 8 and river herring were observed from May 8 through June 12. A total of 9,551 river herring were captured at the fishway during the 2000 season. The 2000 river herring run at the Brunswick Fishway began on May 10, at a water temperature of 13.0°C and water flow of 25,300 (cfs) and ended on June 12, at a water temperature of 16.0°C and water flow of 4,470 (cfs). During the run, the water temperature ranged between 11.1°C and 17.9°C, averaging 14.2°C (Figure 2). The water flows ranged between 2,700 (cfs) and 32,000 (cfs), averaging 14,216 (cfs) (Figure 3). For the ninth consecutive year, the number of river herring captured at the Brunswick Fishway was below average, ranking 11th out of the 18 seasons the fishway has been in operation (Table 1). The majority of the river herring, 58%, were captured over a two-day period, May 10th–11th. On two dates, May 10 and May 11, the numbers of captured adults exceeded 2,000 fish (Table 2). Alewives trapped at the Brunswick Fishway were sampled on five different occasions. Forty percent of the individuals sampled were female, while sixty percent were male. Females averaged 251 mm fork length and weighed 198 grams; males averaged 241 mm fork length and 169 grams (Table 3). Results from preliminary aging studies conducted using scales collected from alewives sampled at the fishway indicate 3% were age 3; 75%, age 4; 20%, age 5; and 2%, age 6. A similar study conducted on American shad sampled at the fishway revealed 2% were age 3; 37%, age 4; 19%, age 5; 9%, age 6; and 2%, age 7 (Table 4). Otoliths collected from alewives at the fishway and dead shad retrieved from the fishway will be used to verify ages using scale aging techniques. The age structure of the fish sampled at the fishway may change after additional ageing techniques are employed

The number of Androscoggin River adult alewives captured for transport and release was less than needed for escapement into upstream spawning and nursery habitat. The adult release target for the Androscoggin watershed was 20,192 river herring into 1,318 hectares of upstream habitat available for restoration. Of the 9,551 adult river herring captured, 5,839 were transported upstream; 3,463 were released into the headpond; 123 were sacrificed for biological sampling; and 126 were transport mortalities. In order to increase the number of released adults, an additional 14,575 river herring from the Kennebec River were distributed (Table 6). The goal was to compensate for the

Androscoggin River deficiency by releasing additional Kennebec River fish into historic spawning habitat on the Androscoggin and Little Androscoggin rivers. From 1985-1992, the Kennebec River River Herring Restoration Program was sustained by the transport of adults from the Androscoggin River and other Maine river systems for distribution into the Kennebec drainage. In more recent years, for various reasons, the health of the river herring population in the Kennebec River has surpassed that of the Androscoggin River. Therefore, in 2000, a total of 14,575 river herring from the Kennebec River was distributed into the Androscoggin River to supplement the number of adults released. A total of 23,877 adult river herring were released into the Androscoggin River, 20,414 of which were released into eight upstream habitat areas totaling 1,318 hectares, excluding the main stems of the Androscoggin and Little Androscoggin Rivers (Table 5). River herring were distributed to Sabattus, Range, Loon, Sutherland, Marshall and Taylor Ponds, Sabattus River, Bog Brook, and the Brunswick headpond. All of these areas received the target number or reached the target stocking density of 14.83 fish per hectare (six fish/acre) except the Brunswick headpond, that was stocked at .9 fish per hectare due to low numbers of native Androscoggin fish successfully using the fishway.

There are several factors that can influence the adult river herring capture rates at the fishway. A few include environmental conditions affecting the size of any given year class of returning adults; temperature, water flows, operational activities of the hydropower facility; effectiveness of the fishway; and the number of adults released to reproduce in upstream spawning habitat four to five years earlier. Returning adult river herring to the Androscoggin River are predominantly four years old when they are captured.

***AMERICAN SHAD*:**

Visual observations of adult shad at the Brunswick Fishway during the spawning run have been noted since the beginning of the restoration program. American shad sightings are routinely higher than those actually captured (Table 7). As a result, detailed visual observations of shad in and around the fishway began in 1999 and continued through 2000. Daily observations were made using two methods: shad that were swimming in the river or inside the fishway itself were simply observed from the walkway and documented in a field notebook. Beginning in 1999, underwater video cameras were positioned in the fishway and near its entrance to document shad behavior in and around the fishway. Observation time, water temperature, and location were also recorded.

Observed Shad:

Between 1994 and 2000, approximately 965 adult shad were observed from the fishway walk, swimming in the river outside the entrance, and in the lower portion of the fishway below the sharp turn halfway up the ladder (Table 7). In that same time frame, a total of 190 were captured (Table 8). In 1995, Central Maine Power (previous site owner), USFWS, and MDMR narrowed the large turn pool at Brunswick with the goal of eliminating holding areas and reducing eddies to increase shad passage efficiency; however, the effects of these changes were never evaluated. In 1998, the highest number of both observed and captured shad was recorded (30 observed and five captured), until 1999, when 543 were observed from the fishway walk and 88 were captured. The 1994 - 1998 data identified the need to initiate a focused effort to collect data on the number of adult shad migrating upstream to the fishway, the activity of shad in and around the fishway, and identify possible solutions to improve upstream passage of shad. The effort was two-fold and utilized underwater video equipment to document shad activity in and around the fishway, as well as recorded observations of shad numbers and behavior from the fishway walk.

In 1999, visual observations were recorded daily from the fishway walk of adult shad present in and around the fishway. A total of 534 shad were observed on 32 separate days, beginning on May 23 and continuing through August 2 (Table 7). In May, a total of 47 shad were observed primarily in the corner pool and viewing window. In June, a total of 487 shad were observed, primarily outside the fishway entrance in the river and in the corner pool. Shad outside the fishway entrance were usually swimming up- and downstream along the concrete wall in a school. In the corner pool, they were usually holding a single position in a school or circling, but not moving up- or downstream. A few individuals identified by distinctive scars or wounds were observed holding in the corner pool for days, but were never captured. Shad were never observed in the upper fishway in 1999 and were rarely observed in the upper sections in 2000. Those that were observed in the DMR viewing window at the top of the ladder were often schooling with river herring or swimming upstream and downstream in front of the window.

During the 2000 shad run, 352 shad were observed in the fishway and the river immediately adjacent to it. In June, a total of 335 shad were observed primarily in the corner pool and lower half of the fishway. In July, a total of 17 shad were observed primarily in the upper pools of the fishway (Table 7). The water temperature when the shad were observed averaged 18.8°C in June and 22.5°C in July (Figure 4). The water flow ranged between 1,990 (cfs) and 7,960 (cfs) in June (average of 4,113 cfs). In July, the water flow ranged between 1,910 (cfs) and 3,430 (cfs) and averaged 2,670 (cfs) (Figure 5).

CAPTURED SHAD:

A total of 88 adults were captured between June 3 and July 3; prior to this, the maximum number of captured adults was 87 in 1999 (Table 8). The numbers captured may be a result of the adult shad releases conducted in 1994 - 1996; the high number of Connecticut River shad were released during these three years, 707, 1,090 and 312 respectively, into the main stem Androscoggin at Auburn (Table 11). It may also be due to increased shad restoration activities in other Maine river systems.

During the 2000 run, the water temperature ranged between 16.0°C and 23.0°C, averaging 18.7°C (Figure 4). The water flows ranged between 1,910 (cfs) and 5,870 (cfs), averaging 3,921 (cfs) (Figure 5). During the 2000 shad run, 352 shad were observed in the fishway and the river immediately adjacent to it. In June, a total of 335 shad were observed primarily in the corner pool and lower half of the fishway. In July, a total of 17 shad were observed primarily in the upper pools of the fishway (Table 7). The water temperature when the shad were observed averaged 18.8°C in June and 22.5°C in July. The water flow ranged between 1,990 (cfs) and 7,960 (cfs) in June (average of 4,113 cfs). In July, the water flow ranged between 1,910 (cfs) and 3,430 (cfs), and averaged 2,670 (cfs). Of the 88 adults passed, 22 were male (25%), 14 were female (16%), and 52 were undetermined sex (59%). The average fork length was 453 mm and average total length was 503 mm. The condition of the shad varied, but all had at least some scale loss on the sides of the body. Many of the fish had significant scale loss and abrasions; some had cuts and hemorrhaging around the head and mouth area. Scales were collected for aging and fin clips were preserved for future genetic analysis. The adult shad were passed upstream into the headpond and may have migrated as far upstream as Auburn. The DMR considers this data essential for the effective management of the species and participates as a member of the Atlantic States Marine Fisheries Commission, in which specific fishery independent monitoring programs for American shad are conducted.

TRANSPORTED & RELEASED SHAD:

The statewide goal of the Maine Department of Marine Resources is to restore self-sustaining populations of American shad to their historic range. A primary benefit of restoring shad to several rivers in Maine is that adult broodstock are available from several nearby Gulf of Maine sources and can be utilized for restoration purposes in other Maine rivers. Therefore, in an effort to establish American shad in the Androscoggin, as well as the Kennebec, the first American shad fry were released into the Androscoggin River. Fry reared at the Waldoboro Hatchery were transported and released by MDMR fishery biologists on June 30 into the main stem river at the Auburn boat launch. The 280,000 fry were 10 to 17 days old and were Connecticut River and Connecticut River/Saco River in origin. They received a tetracycline mark prior to release to distinguish them from wild origin adult returns. The Androscoggin received 529,000 fry 2000 (Table 12). For the eleven-year period from 1987 to 1997, the Androscoggin River

received an average of 428 adult American shad from the Connecticut River. In 1998, no adult shad were released; however, in 1999, the adult stocking program was resumed through coordination with the Connecticut River American Shad Technical Advisory Committee (CRSTAC). In order to approach the number of adults released in 1994 and 1995, 700 shad were requested for the Androscoggin River. The number allocated was 300, 270 of which were successfully released into the main stem Androscoggin at the Auburn boat launch. Including the 88 fish passed upstream at Brunswick, a total of 358 adult shad were released into the main stem river between Brunswick and Auburn in 1999. No prespawn adults from out-of–state waters were released into the Androscoggin River in 2000 (Table 11).

1999 – 2000 American Shad Study:

In April 1999, MDMR was directed by FPLE staff to contact Bill Hanson in its Environmental Department to discuss potentially partnering on the underwater video monitoring portion of the effort. Although FPLE was initially interested, it later determined it would not participate in the project, so MDMR formed a partnership with the U.S. Fish & Wildlife Service to conduct the study. To date, FPL, Inc has not participated in quantitative studies needed to directly address American shad passage issues at this facility, although they did lend DMR a time-lapse video recorder in support of our efforts. DMR would welcome FPLE's participation in partnership with the USFWS in conducting quantitative studies at the fishway in 2001. Underwater videotaping will be conducted in conjunction with the study during the 2001 fishway season.

In 1999, two underwater video cameras taped approximately 832 daylight hours from June 6 to July 28. The corresponding time, water temperature, location, and behavior were recorded. The videotapes that recorded underwater shad activity were reviewed throughout the season. Data collected from the tapes included date, location shad were observed, time of day observed, and total number of shad seen at that time of day. Of the total number observed at a certain time, the behavior was broken down into the following categories: number moving upstream, number moving downstream, and number exhibiting other behavior (moving backward downstream, number circling, and number holding). The daily mean water temperature and mean water flow were also recorded.

In 2000, three underwater video cameras were installed to observe American shad behavior, movement, and numbers in the fishway. One camera was placed in the river to record shad behavior outside the fishway. The second camera was placed in the entrance to Pool 6, the lowest portion of the fishway, where water level is identical to the water level of the river. The last camera was placed at the entrance to Pool 24, just above the corner pool, to record the numbers of shad attempting to ascend the upper fishway (Figure 6). A time-lapse video recorder began recording at 6:00 AM and stopped recording at 6:00 PM each day beginning June 6 and ending July 24. In 2000, 2,016

hours of video were recorded using the three cameras. Project personnel have reviewed all videotape collected in the fishway and river adjacent to the fishway. A malfunction of the videotape equipment prevented data collection from June 6 through 12, 2000. A check to determine positive identification of fish species viewed using the videotape equipment was conducted June 6, 2000 by trapping fish in selected pools and conducting a partial drawdown of the water level in the fishway. All fish were positively identified by species. Identification of American shad in the fishway was simplified due to the limited number of species using the fishway during the shad run. Other fish species identified during videotaping within the fishway were striped bass, American eel, white catfish, brown trout, and sea lamprey.

American shad behavior recorded on the videotape was classified into three categories: shad movements upstream (US), downstream (DS), or other behavior (OB) including circling and holding. A total of 52,837 behavioral observations were recorded during the 2000 spawning season, while 4,377 behavioral observations were recorded at similar locations in 1999 over the same general time period (Table 9). During 2000, the total number of observations recorded on the river camera (Camera 1) was 41,497. The camera in Pool #6, (Camera 2) and Pool# 24 (Camera 3) recorded 10,937 and 402 respectively. Several large schools of American shad were documented within 75 feet of the fishway entrance. Schools of over one hundred shad were observed occasionally while schools of seventy-five fish were common and easily recorded with the river camera. The large numbers of American shad documented recently at the Brunswick Fishway are likely the result of extensive stocking of prespawn adult shad below Lewiston Falls. American shad stocking began in 1984 and will continue in 2001. A total of 6,047 adults and 809,000 fry have all been released below Lewiston Falls at Auburn. Prior to DMR's stocking program, American shad had not been documented using areas in or around the fishway from 1983 through 1990, and only ten adults were documented in this area through 1997. Historically; large numbers spawned in the Androscoggin River above Brunswick. Pollution and barriers preventing upstream passage on the Androscoggin reduced numbers of spawning fish to a fraction of historical levels. To date, there has been no recent evidence of American shad spawning naturally in the Androscoggin River below Brunswick. This point is supported by the number of shad observed at the fishway prior to 1997. Gillnets set in the river during the annual spawning run resulted in only seven shad captured in 17 attempts over a four-year period, 1980 to 1983. It is highly unlikely that spawning at numbers this low would be able to sustain a run in the lower Androscoggin River and even more unlikely produce a viable population imprinted to the river below the Brunswick Fishway that by nature refused to ascend the fishway to access spawning habitat above Brunswick.

In 2000, the predominant behavior recorded by Camera 1 (river camera) was for American shad in the river to move upstream towards the fishway entrance, 72% in June and 67% in July. Only 26% percent of the total number of observations recorded on the river camera was recorded in Pool #6, the last pool of the fishway at river level. The number of shad attempts to move upstream (US) through Pool Number 24, the first pool

above the corner pool, was 194, or 0.5%, of the total number of observations recorded on the river camera. Shad attempted to climb the upper portion of the fishway 194 times. Observations indicate 69 of those attempts resulted in shad moving downstream, leaving a net total of 125 attempts by shad to move upstream (Tables #9 & #10). A total of 88 American shad were captured at the top of the fishway during 2000.

Circling and holding behavior were most commonly exhibited in Pool #6 (Camera 2). Pool Number #6 accounted for 96% of this type of behavior recorded by all cameras in June and 89% in July. Only four percent of the behavior exhibited on Camera #1 (river camera) and Camera #3 (Pool #24) was classified as circling or holding. The effects of this behavior are well documented by Camera 3, which documented a net of only 125 attempts by shad to move beyond the mid-point of the 40-foot vertical climb to the top of the fishway. The data clearly indicates that shad have returned to their natal river to spawn, but are unable to negotiate the fishway to access the spawning habitat above Brunswick into which prespawn and fry stockings have occurred. In fact, few shad moved beyond the halfway point in the 40-foot vertical climb to the fish trap.

Clearly, as with any study, visual observations of shad made from the fishway wall and through the use of video equipment have certain limitations that are considered when analyzing the data, such as the potential for over-estimating (same fish counted more than once) or underestimating (limited visibility when looking down into the fishway/water) the number of fish actually present. The purpose of collecting this preliminary data was to first determine if there is a need to conduct more quantifiable studies that would require substantially more funds, staff, and equipment. Preliminary data clearly indicate the need for a quantitative study focused on the numbers of fish in the river and the effectiveness of the Brunswick Fishway in relation to American shad passage on the Androscoggin River.

Summary:

Based on two years of videotape data collected at the Brunswick Fishway; it is clear that American shad are not utilizing the Brunswick Fishway to reach spawning habitat above Brunswick. Data recorded in 2000 indicate a very small percent (12.8%) of shad observed moving upstream within a 75-foot radius of the entrance enter Pool #6. An even lower percent (0.67%) were viewed exhibiting upstream behavior in Pool 24. The numbers retained at the top of the fishway during the past two years verify that very few of the shad documented at the fishway entrance are successfully ascending the upper half of the fishway and making it into the fish trap. The majority of the behavior recorded by Camera 2 suggests fish are resting and holding in the lower section of the fishway. This was confirmed on June 6, when partial drawdown of the fishway revealed ninety shad holding in the lower portion of the fishway. Currently, the fishway is ineffective in attracting fish to the upper portion of the fishway where the trap is located. Catches of 87 and 88 shad in 1999 and 2000 respectively support these observations. During the 2001 spawning season, a quantitative study will be conducted at the fishway to determine the

numbers of shad holding in the lower sections of the fishway. There is also a need to obtain an adult population estimate in the lower Androscoggin River immediately below the Brunswick Fishway. Comprehensive studies conducted in conjunction with FPLE, including radio tagging a number of shad and changing the flow in the lower fishway would be optimum to clarify the deficiencies in the fishway causing low capture rates of adult American shad at Brunswick.

***ATLANTIC SALMON*:**

Currently, an active Atlantic salmon restoration program is not in place for the Androscoggin River, other than that of providing upstream passage past the first three dams. However, an average of 35 sea-run salmon have been captured annually at Brunswick since 1983 (Table 13). During the 2000 season, a total of four Atlantic salmon were captured at the Brunswick fishway. They were captured between May 11 and November 6, at river temperatures of 12.4°C and 8.4°C respectively, with an average temperature of 15.1°C. Based on scale samples, two of the six salmon captured at the fishway are suspected to be landlocked, according to the Maine Atlantic Salmon Commission, while the remainder were sea-run. Of the sea-run fish, all were of hatchery origin (a one sea-winter and a two sea-winter fish). The average fork length of the sea-run salmon was 769.3 mm. One hatchery fish had a deformed dorsal fin, while the remaining two had no identifying fin clips (Table 14). In June 1999, the Maine Atlantic Salmon Technical Advisory Committee (MSTAC) included the Androscoggin River in an ongoing genetic sampling program. Fin clips gathered in 2000 were collected from salmon captured and provided to the U.S. Fish & Wildlife Service-Maine Anadromous Fish Coordinator. Genetic analysis may be conducted in the future to determine the origin of the salmon to provide more effective management in the watershed. Atlantic salmon adults released upstream may potentially utilize upstream passage at the next two dams to reach spawning and nursery habitat in tributaries upstream of the Brunswick dam.

SEA LAMPREY:

No sea lamprey were captured in 2000. Sea lamprey are sometimes captured at the top of the fishway. Sea lamprey are released downstream and not allowed to pass above Brunswick.

***AMERICAN EEL*:**

Three American eels were captured in the fishway in July and August 2000; their total lengths averaged 500.0 mm in July and 440.0 mm in August. Eels are rarely captured in the trap since the flow rate in the fishway is likely too high for them to negotiate; any that do negotiate the fishway may be small enough to pass through the trap grating. Upstream migrating juvenile eels utilize inland freshwater habitat areas for an average of 20 years of growth to adulthood before emigrating to the Sargasso Sea to reproduce. Fish released above the Brunswick dam may use the fish lift facilities located at the next two dams to reach and utilize upstream habitat (Table 15).

***STRIPED BASS*:**
Ninety-five striped bass were captured at Brunswick in 2000, and many more were observed in the fishway and trapping area. The average length of captured fish ranged from 344.0 mm – 463.0 mm total length (Table 15). Many striped bass were also observed feeding on schools of juvenile alosids in the tailrace area from August to October. In November, 50 striped bass were released downstream when the fishway was closed November 6.

OTHER SPECIES:
From May through November 2000, 13 fish species and 1,021 fish were captured or passed at the Brunswick Fishway, not including American shad and river herring (Table 16). The most common species captured in May, other than river herring, was white sucker. In June, the most common species were common shiner, smallmouth bass, and brown trout. During the warmer months of July and August, common shiner (60), spottail shiner (165) and white perch (403) were the most common. During the fall, the upstream passage was used primarily as downstream passage by emigrating alosids. Juvenile alosids were first observed migrating down the fishway in early July and continued through November.

Only three white catfish were captured this year in the fishway. This is a decrease compared to 1999, when 105 were captured. White catfish are a non-indigenous species unintentionally introduced into Maine waters and are not passed upstream. They were first discovered in the Eastern River, a tributary of the Kennebec, in 1997, and appear to be rapidly expanding their range. The exact rate and location of expansion and the potential effects on native fish communities are undetermined. A full summary of fish community data by month for the 2000 sample season is provided in Table 15.

Several species of juvenile fish use the fishway as an alternative to the downstream passage located between turbine units 1 and 2. Most species, including smallmouth bass, largemouth bass, suckers, rainbow smelt and various species of minnows, move freely between the grate spaces of the fish trap. Sampling these fish is more matter of chance than a directed sampling effort due to the ability of these fish to allude capture. Alewives and American shad migrating later in the summer are sampled when coincidentally captured with adult fish lifted to overhead sampling tanks. Five juvenile American shad were collected in the adult sampling effort. All juvenile American shad migrating downstream were collected and used to determine the success of the supplemental shad fry release at Auburn in 2000.

ENVIRONMENTAL DATA:
Brunswick Fishway air temperature, water temperature, and water flow data recorded from May through November 2000 are shown in Tables 17-23.

Table 1. Adult River Herring Habitat Availability, Run Size and Distribution in the Androscoggin River Watershed, 1985-2000.

Year	Habitat* (hectares)	Run Size	Total No. Stocked (Androscoggin and Kennebec)	Av. Fish / Hectare
1985	3,377	23,895	37,773	11.2
1986	2,678	35,471	17,763	6.6
1987	770	63,523	11,892	15.4
1988	887	74,341	13,183	14.9
1989	887	100,895	13,814	15.6
1990	887	95,574	11,725	13.2
1991	887	77,511	13,574	15.3
1992	887	45,050	12,351	13.9
1993	722	5,202	7,448	10.3
1994	887	19,190	14,549	16.4
1995	852	32,002	10,591	12.4
1996	747	10,198	14,288	19.1
1997	612	5,540	11,524	18.8
1998	1,299	25,189	20,805	16.0
1999	1,318	8,909	8,671	6.6
2000	1,318	9,551	20,414	15.5

* Habitat area does not include the Brunswick headpond.

Table 2. Adult River Herring Captured, Water Temperature and Flow at the Brunswick Fishway, 2000.

Date	Number	Temp. (C)	Water Flow (cfs)	% Total Run
5/10/00	3,233	13.00	25,300	33.85
5/11/00	2,324	12.40	32,000	24.33
5/12/00	510	10.60	31,400	5.34
5/13/00	15	10.10	29,400	0.16
5/15/00	2	12.00	31,600	0.02
5/18/00	181	12.40	18,600	1.90
5/19/00	91	13.00	17,200	0.95
5/20/00	94	12.80	17,800	0.98
5/21/00	55	13.00	14,500	0.58
5/25/00	91	12.80	11,700	0.95
5/26/00	60	13.40	12,100	0.63
5/27/00	79	14.30	11,800	0.83
5/28/00	137	14.30	10,700	1.43
5/29/00	801	14.30	9,560	8.39
5/30/00	652	14.40	9,340	6.83
5/31/00	547	15.20	8,120	5.73
6/1/00	130	16.00	7,960	1.36
6/2/00	66	17.00	6,850	0.69
6/3/00	56	17.00	4,890	0.59
6/4/00	336	17.50	2,700	3.52
6/5/00	83	16.90	4,490	0.87
6/9/00	1	17.90	4,490	0.01
6/12/00	7	16.00	4,470	0.07
00 Total/Av.	**9,551**	**14.19**	**14,216**	**100.00**

Note: Flow Data from USGS Station 01059000 at Auburn, ME

Table 3. Adult River Herring Sampled at the Brunswick Fishway, 2000.

Date	Sex	No.	Ave. Fork Length (mm)	Ave. Weight(gm)
5-13-00	F (33%)	5	250	201
	M (67%)	10	247	180
5-18-00	F (52%)	13	253	206
	M (48%)	12	242	172
5-19-00	F (36%)	9	251	192
	M (64%)	16	240	163
5-20-00	F (39%)	12	252	200
	M (61%)	19	240	163
5-26-00	F (37%)	10	251	191
	M (63%)	17	239	170

Table 4. Preliminary Age Composition of Adult Alewives and American Shad Sampled at the Brunswick Fishway - 2000.

	Number	Ave. TL (mm)	Ave. FL (mm)	Ave. Wt (g)	%M	%F	% of Sample
Age 3 Alewives:	3	284.7	249.0	198.0	0	100	3%
Age 4 Alewives:	75	276.5	244.2	177.7	64	36	75%
Age 5 Alewives:	20	287.4	253.4	204.15	45	55	20%
Age 6 Alewives:	2	299	262.5	217.5	50	50	2%

	Number	Ave. TL (mm)	Ave. FL (mm)	%M	%F	% of Sample
Age 3 Shad	1	490.0	450.0	100	0	2%
Age 4 Shad	17	504.0	443.8	35	59	37%
Age 5 Shad	19	512.0	455.2	26	74	41%
Age 6 Shad	4	508.3	451.0	50	50	9%
Age 7 Shad	1	520.0	477.0	0	100	2%
Undet. Age	4	501.0	460.0	50	50	9%

Table 5. Adult River Herring Stocking Densities, 1998-2000*

Habitat	Hectares	1998 Densities (fish/hectare)	1999 Densities (fish/hectare)	2000 Densities (fish/hectare)
Sabattus Pond	723	14.9	6.9	14.9
Taylor Pond	253	17.1	9.8	15.0
Tripp Pond	311	-	-	-
Lower Range Pond	117	15.8	-	14.9
Androscoggin River	-	-	-	-
Sabattus River	111	14.5	11.0	18.5
Marshall Pond	41	22.7	-	14.9
Bog Brook	24	32.8	-	28.8
Durham Boat Ramp	202	-	-	-
Loon Pond	28	18.0	-	14.8
Sutherland Pond	21	-	-	15.0
Total	**1,831**			

* Target stocking level is 14.83 fish/hectare (1 hectares = 2.47 acres) or 6 fish/acre

Table 6. Adult River Herring Distribution in the Androscoggin Watershed by Site, 1998-2000.

Fish Source: Androscoggin / Kennebec

Habitat	1998	1999	2000
Sabattus Pond	10,783 / 0	4,666 / 292	5,839 / 4,944
Taylor Pond	4,336 / 0	993 / 1,496	0 / 3,801
Tripp Pond	-	-	-
Lower Range Pond	1,852 / 0	-	0 / 1,748
Androscoggin River	4,322/0	1,919 / 0	3,463 / 0
Sabattus River	1,611 / 0	1,224 / 0	0 / 2,050
Marshall Pond	930 / 0	-	0 / 612
Bog Brook	788 / 0	-	0 /690
Durham Boat Ramp	-	-	-
Loon Pond/Curtis Stream	505 / 0	-	0 / 415
Sutherland Pond/Curtis Stream	-	-	0 / 315
TOTAL	**25,127 / 0**	**8,802 / 1,788 = 10,590**	**9,302 / 14,575 = 23,877**
Brunswick Headpond (passed upstream)	4,322 / 0	1,919 / 0	3,463 / 0
TOTAL PASSED	**25,127 / 0**	**8,802 / 1,788=10,590**	**9,302 /14,575 = 23,877**

Table 7. American Shad Observations at the Brunswick Fishway May 1 – August 31, 1994-2000.*

Year / Month	Dead	Viewing Windows	Upper Fishway	Lower Fishway	Corner Pool	Outside Fishway	Total #	Mean Water Temp. (C)[1]
2000 May	-	-	-	-	-	-	-	
June	-	21	17	169	106	22	335	18.7
July	-	3	4	6	4	-	17	22.5
August	-	-	-	-	-	-	-	-
1999 May	6	16	-	5	15	5	47	19.4
June	8	38	-	73	218	150	487	22.9
July	-	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-	-
1998 May	-	-	-	-	-	-	-	-
June	2	1	-	6	-	-	9	17.8
July	1	-	-	-	-	20	21	23.8
August	-	-	-	-	-	-	-	-
1997 May	-	-	-	-	-	-	-	-
June	-	-	-	-	3	36	39	17.9
July	-	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-	-
1996 May	-	-	-	-	-	-	-	-
June	-	-	-	-	-	-	-	-
July	-	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-	-
1995 May	-	-	-	-	-	-	-	-
June	-	-	-	-	-	-	-	-
July	-	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-	-
1994 May	-	-	-	-	-	-	-	-
June	-	-	-	10	-	-	10	23.7
July	-	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-	-
Approx. No.	**17**	**79**	**21**	**269**	**346**	**233**	**965**	
Av. T° (C)								**20.8**
Min/Max T° (C)								**17.8 / 23.8**

*Numbers for the 2000 season are visual observations from the fishway platform and do not include numbers of shad observed using underwater video equipment placed in the fishway or river.

[1] Mean water temperature at the time of shad observations.

Table 8. American Shad Captured at the Brunswick Fishway, 1993-2000.

Date	No.	Water Temp. (C)	Flow (cfs)
6/3/00	1	17.0	4,890
6/5/00	4	16.9	4,490
6/9/00	3	17.9	4,490
6/12/00	4	16.0	4,470
6/14/00	1	16.8	5,870
6/19/00	60	19.0	3,600
6/20/00	9	18.9	3,260
6/21/00	2	19.0	4,040
6/22/00	2	19.5	2,680
7/1/00	1	23.0	1,910
7/3/00	1	22.0	3,430
Total #	**88**		
Av.		**18.7**	**3,921**
Min / Max	**1 / 60**	**16.0 / 23.0**	**1,910 / 5,870**
5/23/99	1	19.0	4,270
5/24/99	2	18.5	4,020
5/26/99	1	18.4	6,500
5/27/99	2	17.7	7,160
5/28/99	11	18.5	6,140
5/29/99	11	19.0	5,660
5/30/99	4	19.0	4,760
5/31/99	3	20.0	4,610
6/1/99	1	19.7	4,270
6/2/99	2	21.0	3,720
6/3/99	17	20.0	3,650
6/4/99	3	21.8	3,380
6/5/99	1	20.0	2,380
6/6/99	2	21.0	2,190
6/7/99	12	21.5	3,570
6/8/99	1	24.0	3,080
6/9/99	2	23.0	3,070
6/14/99	2	22.2	2,740
6/22/99	1	24.0	2,870
6/25/99	1	25.0	2,800
6/26/99	1	25.0	1,710
6/27/99	2	25.5	1,730
6/29/99	3	25.2	2,820
6/30/99	1	25.5	2,740
Total #	**87**		
Av.		**21.4**	**3,743**
Min / Max		**17.7 / 25.5**	**1,710 / 7,160**

Table 8. Continued.

5/24/98	1	18.3	3,640
6/3/98	1	18.4	3,600
6/4/98	1	17.9	4,470
6/5/98	1	17.0	-
7/28/98	1	25.0	-
Total #	**5**		
Av.		**19.6**	**3,903**
Min / Max		**17.0 / 25.0**	**3,600 / 4,470**
6/9/97	1	17.9	-
7/1/97	1	23.2	-
Total #	**2**		
Av.		**20.6**	
6/11/96	1	18.8	-
6/25/96	1	20.4	-
Total #	**2**		
Av.		**19.6**	
6/3/95	1	19.1	-
6/8/95	1	20.5	-
6/10/95	1	21.8	-
Total #	**3**		
Av.		**20.5**	
6/22/94	**1**	**22.2**	-
6/7/93	**1**	**15.3**	-
6/9/90	**1**	**19.0**	-
Grand Total	**190**		
Overall Av.		**19.7**	**3,855.7**
Overall Min / Max		**15.3 / 25.5**	**1,710 / 7,160**

Table 9. Videotaped Observations American Shad Behavior Recorded at the Brunswick Fishway during spring 1999-2000.

June-99	Total No.	US	DS
All Cameras	3655	1495	625

July-99	Total No.	US	DS
All Cameras	722	385	312

Jun-00	Total No.	US	DS	OB
Camera 1	37,741	27,008	10,636	98
Camera 2	10,046	3,534	1,652	4,863
Camera 3	379	184	69	126
Grand Total	**48,166**	**30,726**	**12,356**	**5,087**

Jul-00	Total No.	US	DS	OB
Camera 1	3,756	2,525	1,184	48
Camera 2	891	244	153	494
Camera 3	23	10	0	13
Grand Total	**4,671**	**2,779**	**1,337**	**555**
Percent Difference	**0.90**	**0.91**	**0.89**	**0.89**

Table 10. American Shad Behavior Recorded By Cameras 1-3 and Classified by Behavior Displayed at the Brunswick Fishway During 2000.

June-00	Total No.	US	DS	OB
Camera 1	37,741	87.9%	86.1%	1.9%
Camera 2	10,046	11.5%	13.4%	95.6%
Camera 3	379	0.6%	0.6%	2.5%
	48,166	**100.0%**	**100.0%**	**100.0%**

July-00	Total No.	US	DS	OB
Camera 1	3,756	90.9%	88.5%	8.6%
Camera 2	891	8.8%	11.5%	89.0%
Camera 3	23	0.4%	0.0%	2.4%
	4,671	**100.0%**	**100.0%**	**100.0%**

June-00	Total No.	US	DS	OB	%
Camera 1	37,741	71.6%	28.2%	0.3%	100.0%
Camera 2	10,046	35.2%	16.4%	48.4%	100.0%
Camera 3	379	48.6%	18.1%	33.3%	100.0%
Grand Total	**48,166**				

July-00	Total No.	US	DS	OB	%
Camera 1	3,756	67.2%	31.5%	1.3%	100.0%
Camera 2	891	27.4%	17.2%	55.4%	100.0%
Camera 3	23	42.9%	0.0%	57.1%	100.0%
Grand Total	**4,671**				

Camera 1- Deployed in the river adjacent to the fishway.
Camera 2- Deployed at the entrance to Pool # 6.
Camera 3- Deployed at the entrance to Pool # 24.

Table 11. Adult American Shad Distribution in Main Stem Androscoggin River at Auburn, 1987-2000.

Year	Number distributed		Source		Mortality during transport
		Androscoggin	Connecticut	Merrimack	
2000	88	88	-	-	N/A
1999	357	87	270	-	11.0%
1998	5	5	-	-	N/A
1997	221	2	219	-	13.0%
1996	312	2	310	-	37.8%
1995	1,090	3	1,087	-	9.8%
1994	707	1	706	-	38.0%
1993	580	1	579	-	20.0%
1992	566	-	566	-	15.0%
1991	357	-	357	-	31.0%
1990	354	1	353	-	21.0%
1989	414	-	414	-	25.5%
1988	513	-	513	-	1.2%
1987	92	-	-	92	11.0%
1986	224	-	-	224	17.0%
1985	115	-	-	115	35.8%
TOT.	**5,995**	**190**	**5,374**	**431**	**Av.=20.5%**

Table 12. American Shad Fry Released into the Main Stem Androscoggin River at Auburn, 1999-2000.

Date	Source	No. Released	Age	% Mortality	Loading Site Tem(C)	Receiving Site Temp. (C)	Marking Method
7/10/00	CT x Kennebec	529,000	7-10 days old	~5%	18.7	25.0	Tetra-cycline*
6/30/99	CT x CT and CT x Saco	280,000	10-17 days old	~2.4%	17.3	24.7	Tetra-cycline*

* Fry were exposed to a four-hour Tetracycline bath at the Waldoboro hatchery

Table 13. Number, Origin and Lengths of Sea-run Androscoggin Atlantic Salmon, 1983-2000.

	Sea-Run Hatchery				Sea-Run Wild				Av. Length (mm)	Total
Age	1SW	2SW	3SW	Repeat	1SW	2SW	3SW	Repeat		
Year										
1983	1	16	0	0	0	3	0	1	*	21
1984	4	79	1	0	0	7	0	0	*	91
1985	1	18	0	0	0	2	0	0	*	21
1986	0	72	1	0	0	8	0	0	*	81
1987	2	20	3	0	0	1	0	0	729	26
1988	2	11	0	0	1	0	0	0	723 (TL)	14
1989	1	17	0	0	0	1	0	0	712 (TL)	19
1990	6	168	0	1	1	9	0	0	706	185
1991	0	9	0	0	0	12	0	0	759 (TL)	21
1992	2	9	0	0	1	3	0	0	658	15
1993	1	33	0	0	1	9	0	0	727	44
1994	2	16	0	1	0	6	0	0	707	25
1995	2	12	0	0	0	2	0	0	710	16
1996	2	19	1	0	1	16	0	0	708	39
1997	0	0	0	0	0	1	0	0	*	1
1998	0	4	0	0	0	0	0	0	737	4
1999	1	1	0	0	0	1	2	0	700	5
2000	1	3	0	0	0	0	0	0	652	4
Total	**28**	**507**	**6**	**2**	**5**	**81**	**2**	**1**		**632**

Data source: U.S. Atlantic Salmon Assessment Committee Annual Report 1998/10

SW - # Sea Winters/number of years at sea
Repeat - repeat spawner
TL - total length measured; all others are fork length
* - Data unavailable

Note: 1998 average fork length differs from Table 10 because total length data were used where fork length data were not available

Table 14. Atlantic and Landlocked Salmon passed on the Androscoggin River at the Brunswick fishway, 2000.

Date	Fork Length (mm)	Total Length (mm)	Clips/Marks	Water Temp. (C)
5/11/2000	474	502	LV(sus. Landlocked)	12.4
6/11/2000	755	775	None	16.6
6/22/2000	769	794	Dorsal Fin Absent	19.5
7/3/2000	480	508	LV(sus. Landlocked)	22.0
10/17/2000	784	806	None	11.7
11/6/2000	-	-	None	8.4
Total	**6**			
Average	**652**	**677**		**15.1**
Min. T° (C)				**8.4**
Max. T° (C)				**22.0**

Table 15. Fish Community By Month At The Brunswick Fishway For The 2000 Sample Season.

Summary of Fish Community at BFW: May, 2000

Species	Total #	Destination	Mean Total Length (mm)
alewife adult	5963	Sabattus Pond	-
alewife adult	2786	headpond	-
alewife adult	123	sampled	278
Atlantic salmon	1	headpond	502
brook trout	2	headpond	205
brown trout	9	headpond	353
smallmouth bass	2	headpond	370
white sucker	115	headpond	348
Total Number	9001		
Mean Water Temperature: 12.9°C			

Summary of Fish Community at BFW: June, 2000

Species	Total #	Destination	Mean Total Length (mm)
alewife adult	677	headpond	-
alewife adult	2	mort	-
American shad adult	86*	headpond	506
Atlantic salmon	2	headpond	785
brown trout	16	headpond	323
common shiner	14	headpond/1 mort	-
smallmouth bass	20	headpond	370
striped bass	2	headpond	344
white sucker	6	headpond	347
Total Number	739		
Mean Water Temperature 18.4°C			

*15 dead shad were recovered from the fishway this month

Summary of Fish Community at BFW: July, 2000

Species	Total #	Destination	Mean Total Length (mm)
alewife adult	2	sample	277
alewife juvenile	1530	downstream	-
alewife juvenile	16	sample	70
American eel	1	headpond	500
American shad adult	2	headpond	451
Atlantic salmon	1	headpond	508
brown trout	1	headpond	350
common shiner	60	HP/DS/smpl	-
crayfish	1	mort	35
rainbow smelt juvenile	3	HP/DS/smpl	-
smallmouth bass	24	headpond/mort/DS	193
spottail shiner	163	HP/DS	20
striped bass	8	downstream	400
white catfish	3	downstream	357
white perch	403	HP/DS/smpl	20
Total Number	2218		
Mean Water Temperature 22.1°C			

Summary of Fish Community at BFW: August, 2000

Species	Total #	Destination	Mean Total Length (mm)
alewife juvenile	895	downstream	-
alewife juvenile	3000	not lifted	-
alewife juvenile	128	sampled	83
American eel	2	headpond	440
brown trout	1	headpond	600
largemouth bass	2	headpond	50
smallmouth bass	26	HP/DS	119
spottail shiner	2	headpond	-
striped bass	21	downstream	391
Total Number	4077		
Mean Water Temperature 21.8°C			

Table 15 cont., Fish Community By Month At The Brunswick Fishway For The 2000 Sample Season.

Summary of Fish Community at BFW: September, 2000

Species	Total #	Destination	Mean Total Length (mm)
alewife juvenile	498	downstream	-
alewife juvenile	88	sampled	102
alewife juvenile	1500	not lifted	-
American shad juvenile	2	sampled	91
common shiner	1	headpond	55
smallmouth bass	27	HP/DS/mort	102
spottail shiner	1	headpond	60
striped bass	12	headpond	422
white perch	1	headpond	66
Total Number	2130		
Mean Water Temperature 19.3°C			

Summary of Fish Community at BFW: October, 2000

Species	Total #	Destination	Mean Total Length (mm)
alewife juvenile	348	downstream	-
alewife juvenile	6	mort	-
alewife juvenile	46	sample	112
American shad juvenile	2	sample	101
Atlantic salmon	1	headpond	806
brook trout	1	headpond	254
smallmouth bass	8	headpond	76
striped bass	2	headpond	463
white perch	1	headpond	60
Total Number	415		
Mean Water Temperature 12.0°C			

Summary of Fish Community at BFW: Nov., 2000

Species	Total #	Destination	Mean Total Length (mm)
alewife juvenile	1	downstream	-
alewife juvenile	3	mort	-
American shad juvenile	1	sample	102
Atlantic salmon	1	downstream	-
brown trout	3	downstream/1 HP	-
striped bass	50	downstream	-
Total Number	59		
Mean Water Temperature 8.2°C			

*BFW was closed November 6

Summary of Fish Community at BFW: Dec., 2000

Species	Total #	Destination	Mean Total Length (mm)

Table 16. Fish Species Captured at Brunswick Fishway During May-November 2000.

	Species Total 2000
American Shad *(Alosa sapidissima)*	88
River Herring *(Alosa aestivalis)(Alosa pseudoharengus)*	9551
Atlantic Salmon *(Salmo salar)*	4
Landlocked Salmon *(Salmo salar)*	2
White Sucker *(Catostomus commersoni)*	121
Striped Bass *(Morone saxatilis)*	95
Smallmouth Bass *(Micropterus dolomieu)*	107
Brook Trout *(Salvelinus fontinalis)*	3
Brown Trout *(Salvelinus trutta)*	31
Common Shiner *(Notropis cornutus)*	76
Rainbow Smelt *(Osmerus mordax)*	3
American Eel *(Anguilla rostrata)*	3
Largemouth Bass *(Micropterus salmoides)*	2
White Catfish *(Ictalurus catus)*	3
Spottail shiner *(Notropus hudsonus)*	166
White Perch *(Morone americana)*	405
Monthly Total	10,572

Table 17. Brunswick fishway air and water temperatures/ headpond levels, May 2000.

Day	Air Temp (°C)	Water Temp (°C)	Headpond Level	Flow(cfs)
1	-	-	-	11800
2	-	-	-	11500
3	-	-	-	11300
4	-	-	-	9230
5	-	-	-	8740
6	-	-	-	7360
7	-	-	-	7990
8	-	-	-	11800
9	-	-	-	13900
10	5.0		42.0	25300
11	10.0		42.0	32000
12	11.9	10.9	42.0	31400
13	17.8	10.6	41.2	29400
14	14.4	10.4	41.4	29400
15	15.6	12.5	42.0	31600
16	17.8	12.5	42.0	25900
17	15.9	13.5	41.0	21100
18	13.4	12.7	41.3	18600
19	9.8	13.0	42.6	17200
20	13.7	13.6	42.5	17800
21	12.3	13.0	42.5	14499
22	-	-	-	13300
23	9.3	12.8	42.1	12800
24	9.2	13.2	41.5	11600
25	9.4	12.8	42.0	11700
26	18.6	13.5	42.0	12100
27	17.3	14.3	41.5	11800
28	15.6	14.3	41.2	10700
29	14.5	14.4	40.9	9560
30	15.6	15.0	40.6	9340
31	12.4	15.3	40.5	8120
Mean	**13.3**	**13.1**	**41.7**	**16091.6**

Note: Flow Data from USGS Station 01059000 at Auburn, ME

Table 18. Brunswick fishway air and water temperatures/ headpond levels, June 2000.

Day	Air Temp (°C)	Water Temp (°C)	Headpond Level	Flow(cfs)
1	25.3	-	40.0	7960
2	21.3	-	39.0	6850
3	19.2	17.0	39.0	4890
4	18.3	17.5	38.6	2700
5	17.2	17.3	37.5	4490
6	-	-	-	5440
7	10.0	15.6	39.2	5810
8	20.0	16.8	39.0	4810
9	22.1	17.8	39.0	4490
10	18.7	17.9	38.4	3439
11	11.3	17.1	38.5	3160
12	12.4	16.4	39.0	4470
13	18.2	16.4	39.0	5100
14	15.9	16.9	39.0	5870
15	15.0	16.8	39.0	5840
16	23.4	16.9	39.0	4910
17	26.1	18.0	37.7	4400
18	21.5	19.4	38.0	1990
19	21.3	19.3	39.0	3600
20	24.8	19.2	39.0	3260
21	22.6	18.9	38.0	4040
22	26.9	19.6	38.4	2680
23	24.1	19.8	39.0	2710
24	21.9	20.3	38.5	2290
25	19.4	20.6	38.5	2260
26	24.3	20.9	39.0	3560
27	24.4	22.6	38.5	2990
28	26.2	23.4	38.6	2680
29	-	-	-	3310
30	16.8	22.8	38.5	3400
Mean	**20.3**	**18.7**	**38.7**	**4113.3**

Note: Flow Data from USGS Station 01059000 at Auburn, ME

Table 19. Brunswick fishway air and water temperatures/ headpond levels, July 2000.

Day	Air Temp (°C)	Water Temp (°C)	Headpond Level	Flow(cfs)
1	24.1	23.0	38.4	1910
2	23.9	21.6	37.9	2100
3	25.2	22.6	39.0	3430
4	-	-	-	2360
5	21.1	23.3	38.6	4140
6	21.8	23.0	38.6	3630
7	22.6	23.6	38.7	3090
8	17.7	23.4	38.6	1937
9	-	-	-	2120
10	-	-	-	3200
11	22.1	22.2	38.5	2970
12	25.4	23.5	39.2	3280
13	27.7	23.5	39.6	3290
14	24.2	23.0	38.5	2230
15	-	-	-	1739
16	17.9	22.5	38.0	2630
17	14.9	21.3	39.0	5750
18	17.9	21.1	39.4	7610
19	20.2	21.8	39.4	6500
20	-	-	-	7180
21	19.6	21.5	39.0	6010
22	17.5	21.5	39.0	4110
23	-	-	-	3260
24	25.5	21.7	39.0	3780
25	22.0	21.1	38.0	3520
26	22.6	21.5	38.1	3160
27	16.6	21.3	38.6	3670
28	19.2	20.5	38.0	3489
29	-	-	-	2410
30	19.4	21.2	37.8	2010
31	21.1	21.3	38.7	3330
Mean	**21.3**	**22.1**	**38.7**	**3543.4**

Note: Flow Data from USGS Station 01059000 at Auburn, ME

Table 20. Brunswick fishway air and water temperatures/ headpond levels, August 2000.

Day	Air Temp (°C)	Water Temp (°C)	Headpond Level	Flow(cfs)
1	19.5	21.1	38.5	3040
2	19.9	20.9	38.6	2839
3	19.7	20.9	38.5	3980
4	22.6	22.1	38.5	3640
5	-	-	-	2070
6	25.2	22.9	38.3	2090
7	-	-	-	3310
8	25.8	22.9	38.5	3160
9	-	-	-	2970
10	25.2	23.9	38.0	3760
11	20.7	23.2	37.8	1710
12	-	-	-	2450
13	19.8	22.9	37.9	2600
14	18.8	22.7	38.3	3439
15	19.2	21.9	39.0	4110
16	18.7	22.0	39.0	4890
17	-	-	-	4560
18	19.5	22.3	39.0	4120
19	-	-	-	2490
20	17.4	21.4	38.2	1870
21	19.3	20.9	39.1	3350
22	22.6	18.8	39.0	2330
23	20.0	21.1	38.0	2280
24	22.5	21.4	38.0	2930
25	26.5	22.0	39.0	2080
26	-	-	-	1790
27	26.3	22.0	38.6	1770
28	20.0	22.0	38.2	2650
29	22.5	22.4	38.1	2640
30	21.0	21.5	38.7	2330
31	22.2	21.3	38.6	2250
Mean	**21.5**	**21.9**	**38.5**	**2887.0**

Note: Flow Data from USGS Station 01059000 at Auburn, ME

Table 21. Brunswick fishway air and water temperatures/ headpond levels, September 2000.

Day	Air Temp (°C)	Water Temp (°C)	Headpond Level	Flow(cfs)
1	26.3	21.8	38.1	2650
2	18.9	22.6	38.5	1860
3	-	-	-	1840
4	12.3	21.3	38.6	2760
5	10.5	20.1	38.6	2640
6	12.7	19.2	39.3	2890
7	19.8	20.0	38.9	2380
8	22.4	19.7	39.4	2870
9	24.9	20.8	39.1	2100
10	-	-	-	1780
11	-	-	-	2160
12	18.3	20.3	38.1	2140
13	21.1	20.5	37.9	2360
14	-	-	-	2460
15	16.1	20.0	38.7	2370
16	-	-	-	1980
17	15.9	18.6	39.0	3950
18	21.5	19.0	39.0	3680
19	19.0	18.6	38.4	3120
20	20.4	19.1	39.0	2849
21	21.8	19.6	38.6	2690
22	17.0	19.2	38.7	2510
23	16.5	18.7	39.1	1860
24	-	-	-	1860
25	12.6	17.0	38.8	2700
26	9.2	16.7	39.0	2670
27	13.4	16.3	39.3	2210
28	9.2	16.1	39.0	1880
29	1.1	15.2	39.0	2110
30	-	-	-	1860
Mean	**16.6**	**19.1**	**38.8**	**2439.6**

Note: Flow Data from USGS Station 01059000 at Auburn, ME

Table 22. Brunswick fishway air and water temperatures/ headpond levels, October 2000.

Day	Air Temp (°C)	Water Temp (°C)	Headpond Level	Flow(cfs)
1	-	-	-	1710
2	17.7	15.6	38.3	2210
3	17	15.2	38.5	2300
4	14.3	15.8	39.0	2280
5	8.2	15.6	38.7	2230
6	9.2	15.2	38.0	2640
7	-	-	-	2810
8	-	-	-	2920
9	-	-	-	3190
10	6.5	12.6	39.0	2680
11	14.7	11.9	39.6	2320
12	10.3	11.3	39.0	2480
13	14.1	11.9	38.9	2500
14	-	-	-	2039
15	-	-	-	2110
16	4.4	13.0	38.7	2520
17	9.4	12.3	39.8	2360
18	8.5	10.8	39.7	2670
19	13.1	10.8	38.6	3140
20	10.4	10.8	39.0	3750
21	15.5	11.0	39.0	4200
22	-	-	-	3360
23	8	10.4	38.3	3190
24	12.5	10.0	39.3	2380
25	11.9	10.0	39.3	1980
26	14.3	10.3	39.1	2910
27	10.4	10.9	39.0	1920
28	-	-	-	1880
29	0.5	9.4	39.0	1850
30	4.6	8.6	39.4	2560
31	5.7	7.1	38.9	3270
Mean	**10.5**	**11.8**	**39.0**	**2592.2**

Note: Flow Data from USGS Station 01059000 at Auburn, ME

Table 23. Brunswick fishway air and water temperatures/ headpond levels, November 2000.

Day	Air Temp (°C)	Water Temp (°C)	Headpond Level	Flow(cfs)
1	10.8	7.8	39.4	2610
2	13.6	8.1	38.4	3020
3	12.9	8.3	-	3650
4	-	-	-	2950
5	5.5	7	38	2150
6	5.9	8.4	38.5	3449
Mean	**9.7**	**7.9**	**38.6**	**2971.5**

Note: Flow Data from USGS Station 01059000 at Auburn, ME

***The Brunswick Fishway Closed November 6, 2000.

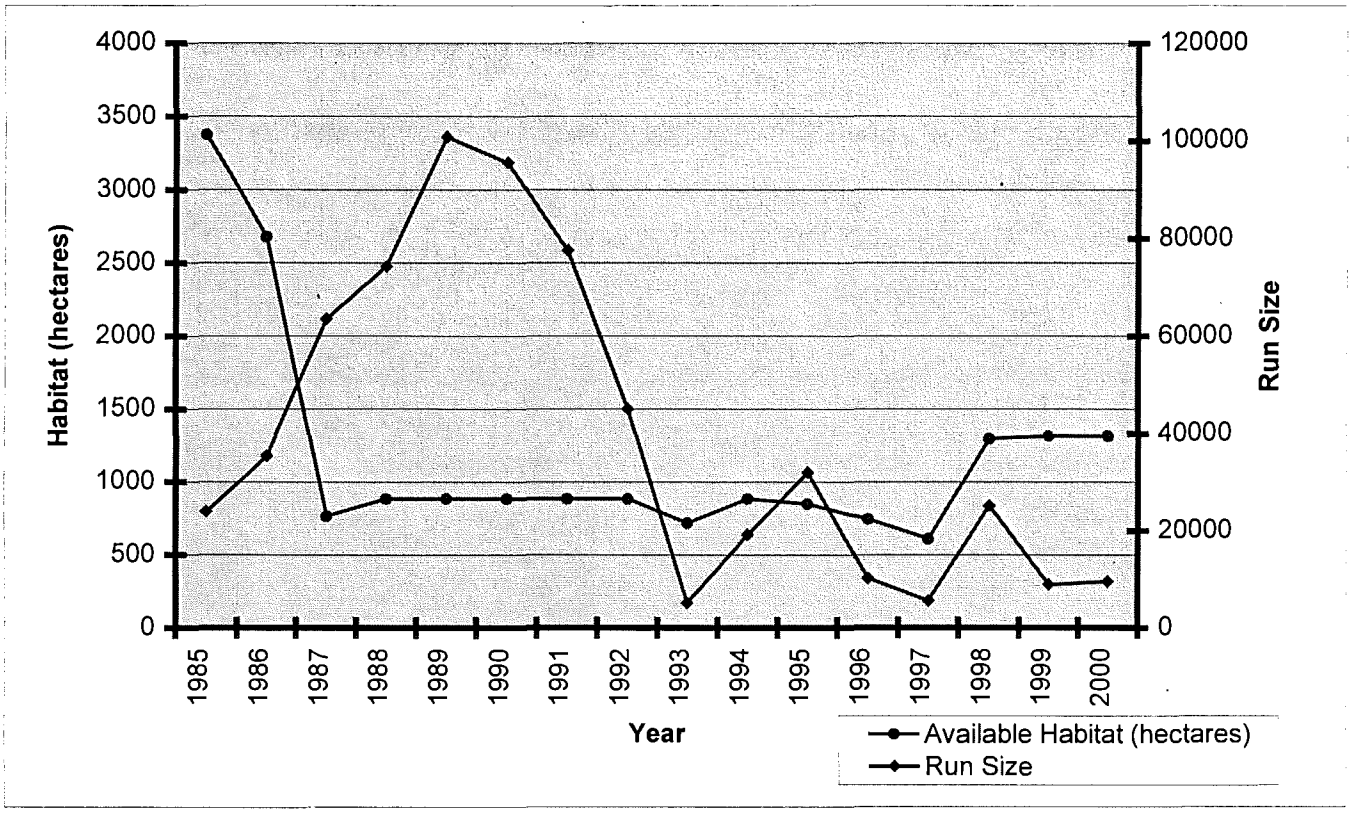


Figure 1. Adult Alewife Run Size and Habitat Availability In The Androscoggin River Watershed, 1985-2000.

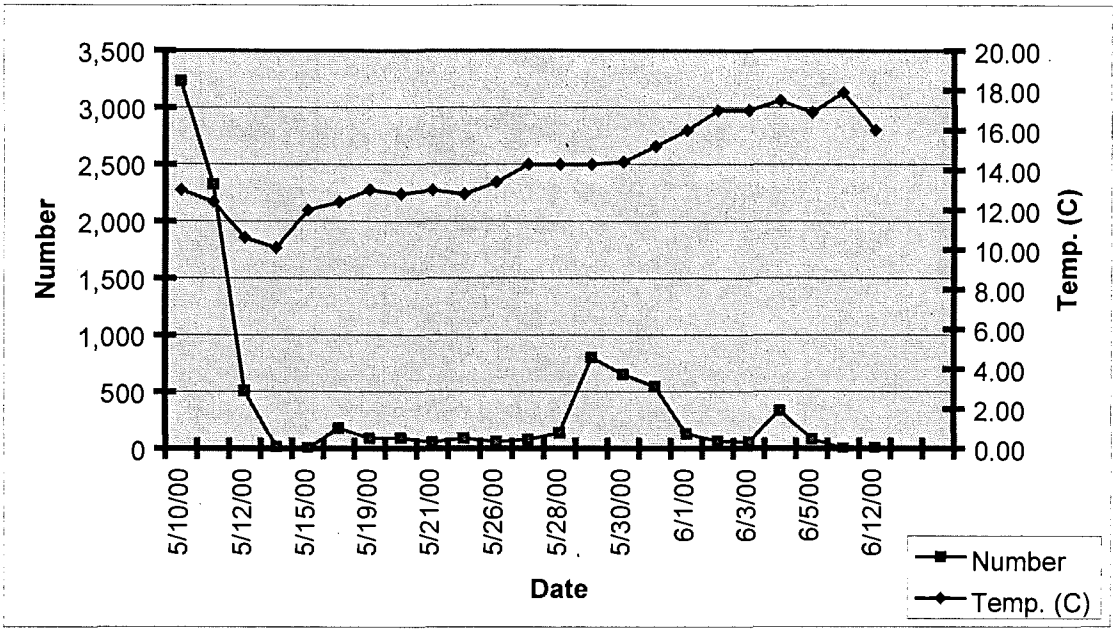


Figure 2. Number Of Adult River Herring Captured vs. Water Temperature At The Brunswick Fishway, 2000.

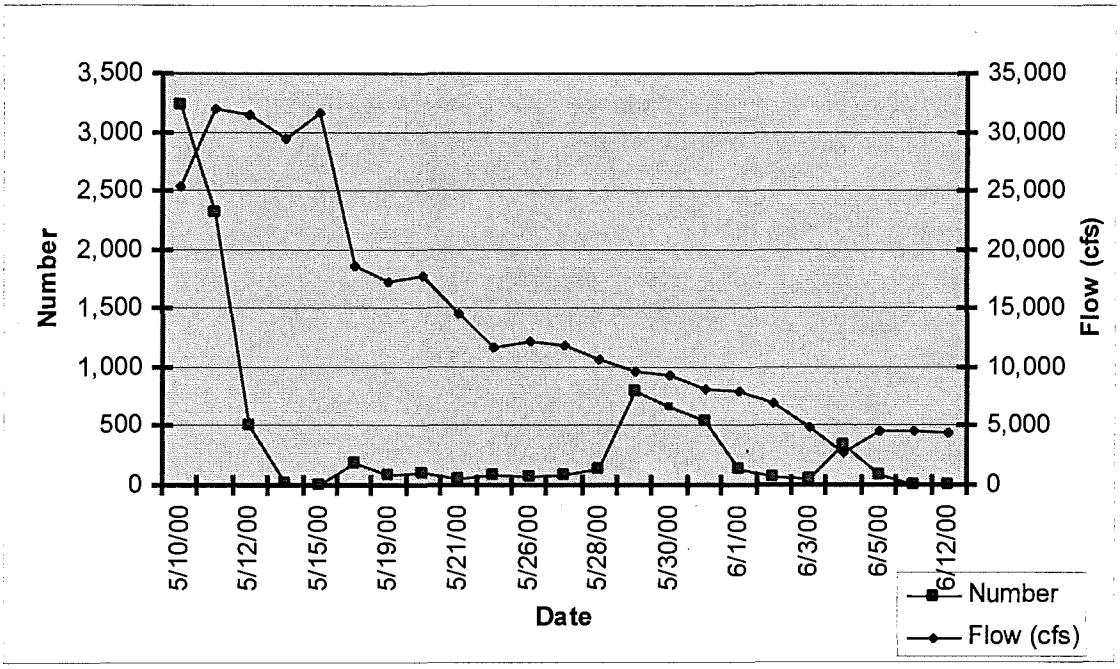


Figure 3. Number Of Adult River Herring Captured vs. Water Flow At The Brunswick Fishway - 2000

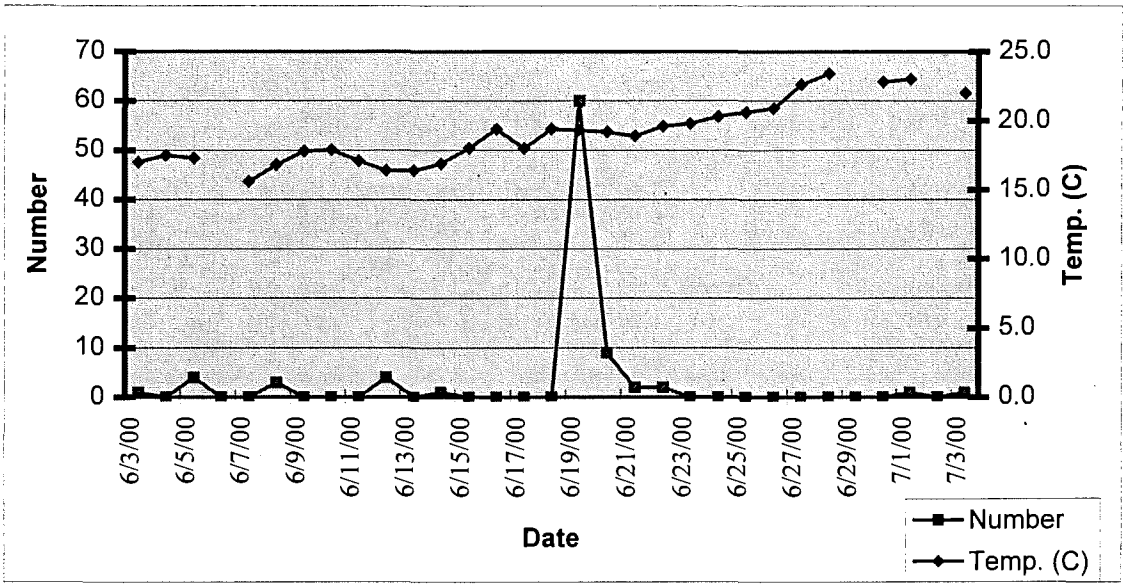


Figure 4. Adult American Shad Captured vs. Water Temperature At The Brunswick Fishway During The 2000 American Shad Run.

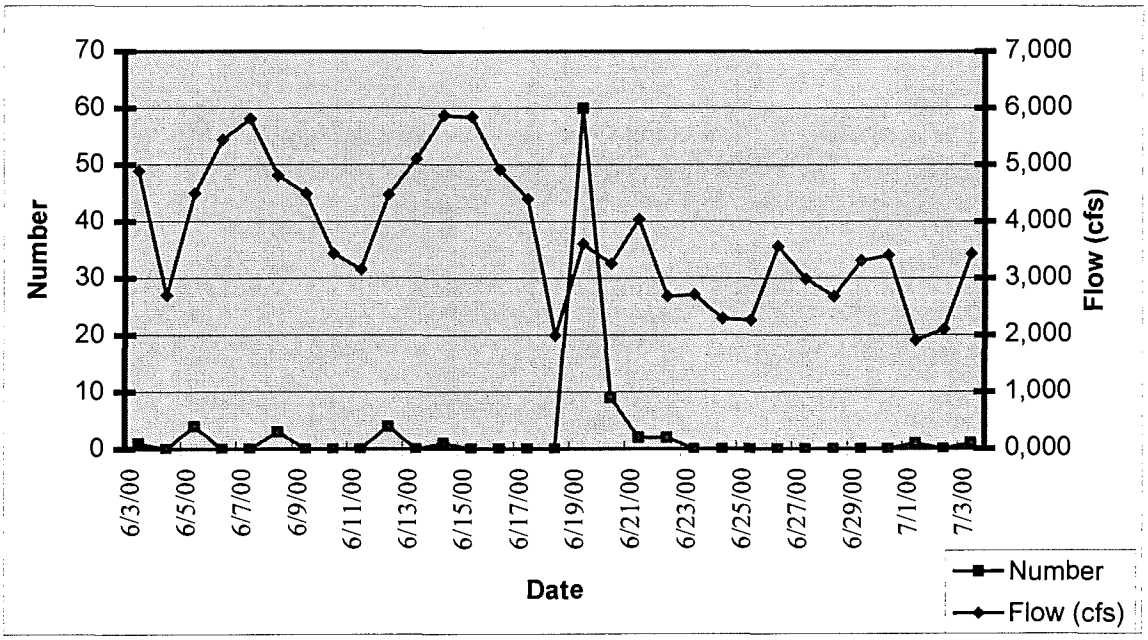
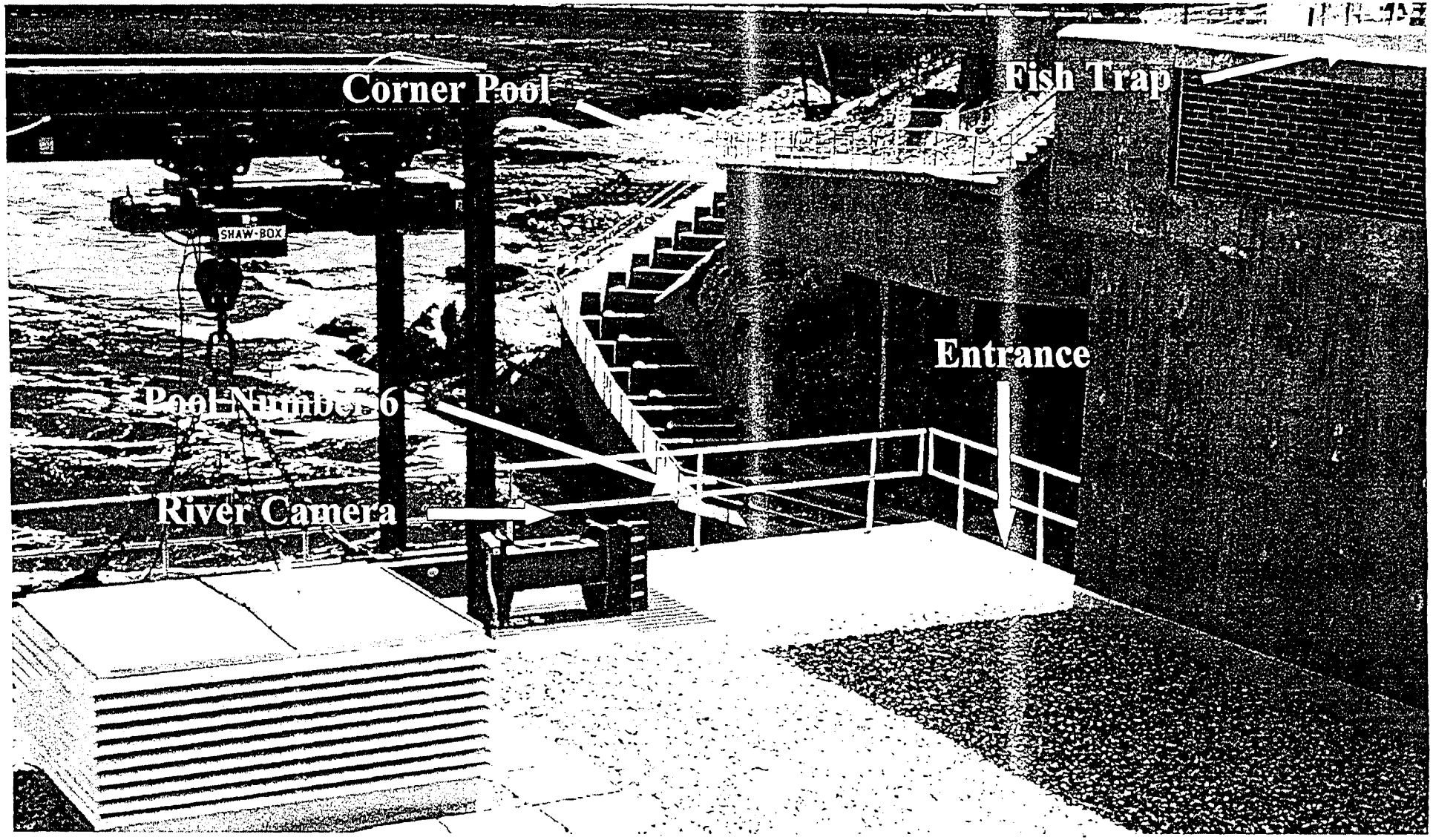


Figure 5. Adult American Shad Captured vs. Flow At The Brunswick Fishway During The 2000 Shad Run.

Figure 6. Location of cameras recording American shad behavior at the Brunswick fishway during the 2000 sample season.



STATE OF MAINE
DEPARTMENT OF
MARINE RESOURCES
21 STATE HOUSE STATION
AUGUSTA, MAINE
04333-0021

ANGUS S. KING, JR.
GOVERNOR

GEORGE D. LAPOINTE
COMMISSIONER

Mr. D.J. Doughty
Florida Power & Light Energy Maine
259 Switzerland Road
Lewiston, ME 04240

October 22, 1999

Dear Mr. Doughty,

Upstream fish passage for the 1999 season at the Brunswick Hydroelectric Facility has come to an end with the dewatering and closing of the fishway that occurred on October 20th. I would like to take this opportunity to acknowledge the assistance the Florida Power & Light Energy Maine (FPL) maintenance crew provided to the Department of Marine Resources (DMR) in maintaining the fishway during its operation this season. Mechanical problems that arose and inhibited the operation of the fishway were usually addressed quickly and allowed us to work effectively in sampling, collecting and passing fish upstream. Problems that occurred this season that were promptly repaired include worn out brakes on Isolation Gate #1; malfunctioning spray bar; broken make-up pump; clogged fish attraction intake and a broken door on the fish hoist. There were many other major and minor repairs that were completed over the course of the season and we appreciate all efforts that were made to keep the fishway operating efficiently.

After the shut down of the fishway this week, we took the opportunity to assess its general condition and to list specific problems that need to be addressed prior to opening the fishway in April, 2000. Initially and most importantly, a detailed inspection needs to be conducted on all gates, cables, grates, hoists and mechanical moving parts for wear or damage. The fishway has been in operation for 16 years (since 1983) and many of the internal structures may need to be repaired or replaced. Specific items that we have identified that need repair include the following:

- There are several holes caused by rust in the grating of the upper fishway. These holes prevent effective trapping of fish, often allowing them to escape and/or become trapped behind the crowder. Once fish are behind the crowder, it is difficult if not impossible to retrieve them, thereby causing unnecessary mortality.

- A panel of grating immediately upstream and to the left of the upstream trapping gate has detached and fallen into the crowding area. This broken grate prevents the use of the crowder, knocking it off its tracks and making it inoperable, and the fish hoist unusable. This problem arose several weeks ago and was immediately addressed by a

temporary welding repair, however it became detached again on October 20th and a permanent repair needs to be made.

The hoist and gates of the fishway seem to be in fairly good shape, with one major exception:

- The Isolation Gate #2 has been sticking on its runners, causing the winch to be ineffective in lowering the gate. On October 20th, the gate dropped suddenly after an attempt to lower it and the wire cable snapped. Due to the proximity of the operators, this was obviously an extremely dangerous situation that could have resulted in serious injury to one or both operators. This gate needs significant repair, and in addition, we recommend that the maintenance crew inspect all moving parts of the fishway at the beginning of each season.

- Overall, the fish hoist has operated well; however earlier in the season a rusted door runner broke and prevented the use of the hoist. It was repaired, but it should be checked to identify and prevent additional potential problems.

The equipment in the DMR office has experienced several problems during the season, particularly the control panel:

- The thermometers on the control panel have caused the most trouble, with both the water and air sensor being broken for most of the six months of operation. It is critical for us to have accurate temperatures, and we request that both thermometers be replaced and that spares be available to provide quick replacement should future problems occur.

- There is a fairly significant leak in the right viewing window. Although a small leak has been present for many months, recently the leak expanded allowing a steady flow of water to enter the office. The water seems appears to be entering along the lower, left edge of the window along the sealant.

In addition to the repairs mentioned, I would like to request an improvement to the structure of the fish holding area. During the 1999 stocking season, we found that fish held in the upper tanks become stressed due to the direct sunlight and extreme heat. It is sometimes necessary to hold fish while multiple hoists are made to obtain numbers sufficient to load the stocking truck. On several occasions we were forced to rig limited shading with tarps, etc., to provide shelter over the tanks and reduce fish mortality. It would be a tremendous help if a roof could be constructed over both tanks or at least the holding tank where fish are kept prior to loading into the stocking vehicle. Something similar to the roof that is currently over the outdoor control panel would work well in serving this purpose. If construction of such a roof is possible we would be happy to assist in creating a design or providing specifications.

Finally, better communications between FPL and DMR staff needs to be established. For example, it is extremely important for DMR to be consulted when major work

conducted upstream of the fishway is being planned, and as soon as the work is scheduled. In August of this year, FPL began a major project of dredging upstream of the fishway without notifying us, and we only became aware of what was happening by observing the heavy equipment required for the project. The dredging had a direct negative impact on the fishway, at one point blocking the water flow so severely that the entire fishway dewatered. An incident like this imperils any fish in the ladder and obviously blocks upstream fish passage entirely. We must be made aware of FPL plans before they are implemented so that we can work together to keep the fishway operational.

We also need to be notified immediately when a boom breaks, due to the tremendous amount of large debris that washes into the fishway following a breech. If we are notified of a breech we can make decisions that might limit the amount of debris that flows into the fishway and allows us to provide better passage.

We would like to thank you again for your assistance in maintaining the fishway at the Brunswick Hydroelectric Facility. The maintenance crew has been very helpful and prompt with repairs. Specifically, I would like to thank Dick Cole, Bo Southerburg, Dana Sullivan, Scott Packard and Steve Grover. If you would like additional information on this matter or would like to meet to conduct an inspection of the fishway, please contact me at 624-6345.

Sincerely,

Sandra J. Lary

Cc: Peter Bragdon

STATE OF MAINE
DEPARTMENT OF
MARINE RESOURCES
21 STATE HOUSE STATION
AUGUSTA, MAINE
04333-0021

ANGUS S. KING, JR.
GOVERNOR

GEORGE D. LAPOINTE
COMMISSIONER

Mr. D.J. Doughty
Florida Power & Light Energy Maine
259 Switzerland Road
Lewiston, ME 04240

November 20, 2000

Dear Mr. Doughty,

Upstream fish passage for the 2000 season at the Brunswick Hydroelectric Facility has come to an end with the dewatering and closing of the fishway that occurred on November 6th. I would like to take this opportunity to acknowledge the assistance the Florida Power & Light Energy Maine (FPL) maintenance crew provided to the Department of Marine Resources (DMR) in maintaining the fishway during its operation this season. Mechanical problems that arose and inhibited the operation of the fishway were usually addressed quickly and allowed us to work effectively in sampling, collecting and passing fish upstream. Problems that occurred this season that were promptly repaired include worn out brakes on Isolation Gate #2; malfunctioning spray bar; broken make-up pump; clogged fish attraction intake; dislodged wheel on fish crowder; and a detached fish measuring board. There were many other major and minor repairs that were completed over the course of the season and we appreciate all efforts that were made to keep the fishway operating efficiently.

After the shut down of the fishway last week, we took the opportunity to assess its general condition and to list specific problems that need to be addressed prior to opening the fishway May 1, 2001. Initially and most importantly, a detailed inspection needs to be conducted on all gates, cables, grates, hoists and mechanical moving parts for wear or damage. The fishway has been in operation for 16 years (since 1983) and many of the internal structures may need to be repaired or replaced. Specific items that we have identified that need repair include the following:

- The fiberglass fish measuring board detached from the metal grating that was supporting it. Water pressure damaged the board to the point where it would be difficult to reattach it properly to the supporting metal grating. The measuring board allows DMR to accurately estimate the length of fish in the viewing window area.

The hoist and gates of the fishway seem to be in fairly good shape, with one major exception:

- The Isolation Gate #2 has been sticking on its runners, causing the winch to be ineffective in lowering the gate. Later in the season the break failed to keep the gate in position once the grate was dislodged. Due to the proximity of the operators, this was obviously an extremely dangerous situation that could have resulted in serious injury to one or both operators. The gate and motor needs repair, and in addition, we recommend that the maintenance crew inspect all moving parts of the fishway at the beginning of each season.

- Overall, the fish hoist has operated well; however deficiencies in the gasket at the bottom of the hopper allow a large amount of water to leak from the hopper during the lift. This gasket should be replaced to prevent a failure in the hopper/lift system that would prevent DMR from lifting fish to the overhead distribution system

The equipment in the DMR office has experienced problems during the season.

- The water thermometer on the control panel has caused the most trouble. The water sensor was inoperable during the beginning of the six months of operation. It is critical for us to have an accurate water temperature, and we requested that the thermometer be replaced which it was. We suggest that FPL have on hand spare water and air sensors and provide quick replacement should future problems occur.

- There is a fairly significant leak in the right viewing window. Although a small leak has been present for many months, recently the leak expanded allowing a steady flow of water to enter the office. The water seems appears to be entering along the lower, left edge of the window along the sealant. An aluminum track was installed to direct the flow of the water but the leak persists.

  We request that any scheduled improvements to the fishway office be done prior to the May 1, 2001 opening date. This includes the painting and new flooring scheduled for the 2000 season.

In addition to the repairs mentioned, I would like to thank FPL for improvements to the structure of the fish holding area. During the 1999 stocking season, we found that fish held in the upper tanks become stressed due to the direct sunlight and extreme heat. It is sometimes necessary to hold fish while multiple hoists are made to obtain numbers sufficient to load the stocking truck. On several occasions we were forced to rig limited shading with tarps, etc., to provide shelter over the tanks and reduce fish mortality. In August 2000, FPL installed a canopy over both tanks where fish are kept prior to loading into the stocking vehicle. This improvement helped to reduce stress on the fish kept in the tanks while DMR collected biological data.

We would like to thank you again for your assistance in maintaining the fishway at the Brunswick Hydroelectric Facility. The maintenance crew has been very helpful and prompt with repairs. Specifically, I would like to thank Bo Southerburg, Dana Sullivan, Scott Packard and Steve Grover. If you would like additional information on this matter

or would like to meet to conduct an inspection of the fishway, please contact me at 624-6345.

Sincerely,

Michael E. Brown