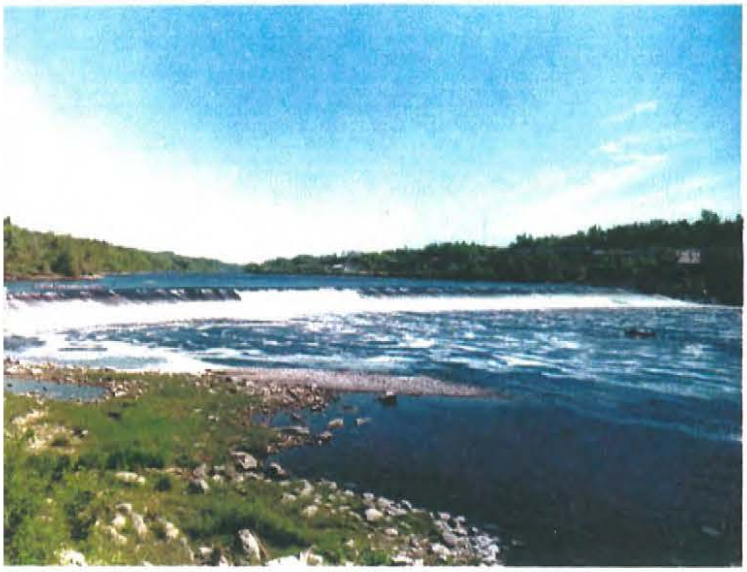
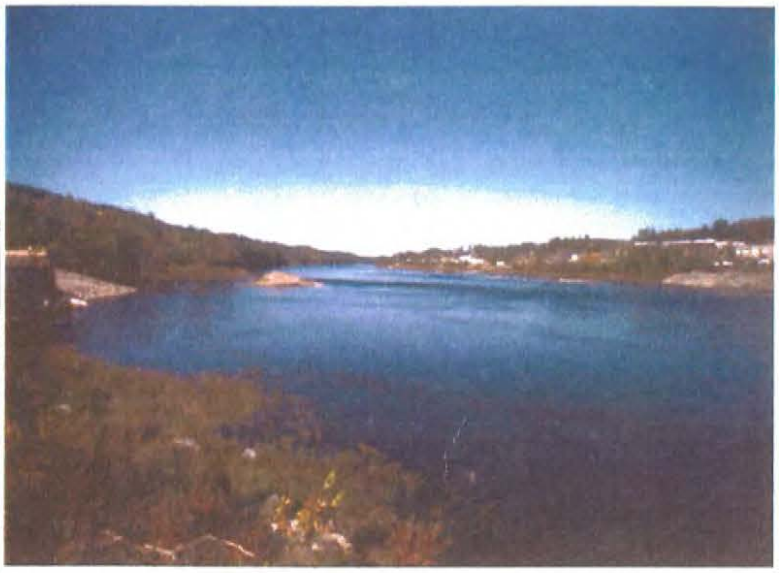
Restoring Our Native Fish Resources





Kennebec River Diadromous Fish Restoration

Annual Progress Report – 1999

Cover: Kennebec River before (left) and after (right) the removal of the Edwards Dam.

Cover photos courtesy of Steve Brooke (American Rivers)

KENNEBEC RIVER
DIADROMOUS FISH RESTORATION

ANNUAL PROGRESS REPORT - 1999

Prepared By:
M. O'Donnell & N. Gray
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MAINE DEPARTMENT OF MARINE RESOURCES
21 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0021

In Partnership with:

KENNEBEC HYDRO DEVELOPERS GROUP, KENNEBEC COALITION, NATURAL RESOURCE CONSERVATION SERVICE, U.S. FISH AND WILDLIFE SERVICE, and NATIONAL MARINE FISHERIES SERVICE

Program Activities Presented in This Report
Were Funded through a Cooperative Agreement
Between the State of Maine,
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DIADROMOUS FISH RESTORATION ON THE KENNEBEC RIVER

As stated in the State of Maine Statewide River Fisheries Management Plan, June 1982, the State's goal related to anadromous fish resources is:

> "To restore, maintain, and enhance anadromous fish resources for the benefit of the people of Maine."

With the following objectives:

1. Determine the status of anadromous fish stocks and their potential for expansion;

2. Identify, maintain, and enhance anadromous fish habitat essential to the viability of the resource; and

3. Provide, maintain, and enhance access of anadromous fish to and from suitable spawning areas.

With respect to the Kennebec River, the States goal is to:

> "Restore striped bass, rainbow smelt, Atlantic sturgeon, shortnose sturgeon, American shad and alewives to their historic range in the mainstem of the Kennebec River."

In 1985, the Maine Department of Marine Resources (DMR) developed ***"The Strategic Plan For The Restoration Of Shad And Alewives To The Kennebec River Above Augusta"***. The goal of this plan was:

> "To restore the alewife and shad resources to their historical range in the Kennebec River System."

To meet this goal the following objectives were developed:

1. To achieve an annual production of six million alewives above Augusta; and

2. To achieve an annual production of 725,000 American shad above Augusta.

Coincident with the creation of this plan, the Kennebec Hydro Developers Group (KHDG) was created, and a new ***"Operational Plan For the Restoration Of Shad and Alewives To The Kennebec River"*** was implemented in 1986. This plan became the first "Agreement" between the KHDG and DMR. While the goals and objectives of this plan were the same as the previous 1985 plan, it allowed dam owners, upstream of the Edwards Dam, to delay the installation of fish passage in exchange for funding a trap, truck, and release program to move adult alewives and shad into upstream habitat.

In 1993, the Natural Resources Policy Division of the Maine State Planning Office drafted the ***"Kennebec River Resource Management Plan: Balancing Hydropower Generation and Other Uses"***. In this plan the goal of anadromous fish restoration in the Kennebec River was:

> "To restore striped bass, rainbow smelt, Atlantic sturgeon, shortnose sturgeon, American shad, and alewives to their historical range in the mainstem of the Kennebec River"

The objectives for striped bass, rainbow smelt, Atlantic sturgeon, and shortnose sturgeon were to restore or enhance populations in the segment of the Kennebec River from Edwards Dam to the Milstar Dam in Waterville. At the time of the 1993 agreement there was an ongoing enhancement program for striped bass that consisted of releasing fall fingerlings. Since striped bass, rainbow smelt, Atlantic sturgeon, and shortnose sturgeon will not utilize fish passage facilities the strategy for restoration of these species was to remove the Edwards Dam. The removal of this dam would also enhance the ongoing shad and alewife restoration program by reducing the cumulative impacts of dams on outmigrating juvenile alosids.

With the end of the KHDG Agreement and the removal of the Edwards Dam, a second agreement, '***The Agreement Between Members of the Kennebec Hydro Developers Group (KHDG), The Kennebec Coalition, The National Marine Fisheries Service, The State of Maine, and The U.S. Fish and Wildlife Service,***' was implemented on May 26, 1998. Under this agreement, the Maine Department of Marine Resources (DMR) continues to be responsible for implementing a trap, truck, and release program for anadromous alewives and American shad. DMR is also responsible for ensuring that the goals and objectives of the 1982 plan identified for the Kennebec River are met through monitoring and assessment of other anadromous fish species. DMR, the KHDG, and beginning in 2000, the U.S. Fish and Wildlife Service will provide funds for the continued implementation of the state fishery agencies' fishery management plan.

SUMMARY OF 1999 ACTIVITIES:

The strategy developed to meet the objectives of alosid restoration was planned in two phases. The first phase (January 1, 1986 through December 31, 2003) involves restoration by means of trap and truck of alewives and shad for release into spawning and nursery habitat. The second phase (January 1, 2004 through December 31, 2010) involves providing upstream and downstream fish passage at Phase I release sites, as well as trap and truck operations to Phase II lakes. As originally planned, the Edwards Dam (whose owner chose not to participate in the KHDG/State Agreement) was to be the primary site for capturing returning adults for the restoration program. Fish for the restoration were not obtained at the Edwards Dam until 1993 for several reasons. No capture facilities were available during 1987 and 1988. In 1989, an experimental fish pump was installed by the owner, but proved to be ineffective in capturing sufficient numbers for release in upriver spawning habitat. As a result, from 1987 through 1992,

all the alewife brood stock stocked in Phase I lakes (see Table 1) came primarily from the Androscoggin River.

A shift in the source of alewife brood stock occurred in 1993 due to increased number of alewife returns in the Kennebec below Edwards Dam and the simultaneous decline in the run of the Androscoggin donor stock of alewives. In 1993, all adult alewives transferred to upstream habitat were Kennebec River returns and predominantly trapped by netting. The alewife brood stock source was split between the two rivers in 1994, but the bulk of the fish (93%) were Kennebec River returns, with most collected by the fish pump. Since 1995, DMR obtained alewife brood stock exclusively from the Kennebec River at the Edwards Dam. From 1996-1999, the majority of alewives were collected using the fish pump. In addition, the Phase I alewife stocking goals for 1996 through 1999 were achieved , with the exception of Sebasticook Lake in 1999 (5.7 alewives $acre^{-1}$).

Due to the increased number of adult alewife returns to the Kennebec River since 1994 DMR has not only met Phase I stocking goals, but has had additional alewives available for other restoration sites in Maine. In 1998, alewives from the Kennebec River were released into four additional ponds within the Kennebec drainage and 14 ponds in eight other drainages. In 1999, due to a smaller run, this stocking practice was limited to the Androscoggin River.

The issue of the future of the head-of-tide Edwards Dam was settled in 1998. The State of Maine took possession of the dam on January 1, 1999 as part of an agreement reached in 1998 with the dam's previous owner, Edwards Manufacturing Company. The relicensing process of the Edwards Dam included several landmarks that contributed to the Edwards Manufacturing Company's decision to turn the dam over to the State of Maine. In the fall of 1997, the Federal Energy Regulatory Commission (FERC) released a basin-wide Environmental Impact Statement, which recommended removal of the Edwards Dam. The FERC voted on this removal recommendation and ordered it in December 1997. In addition, Edwards' power contract with FPL Energy expired December 31, 1998. Rather than participate in a protracted legal battle, Edwards Manufacturing chose to negotiate with, and turn the dam over to, the State of Maine, allowing its ultimate removal by the State.

The State of Maine began physical removal of the dam in early June 1999 and removal was complete by the end of October 1999. The breaching of the dam on July 1,1999 and resultant fish passage, coupled with the dewatering of the impoundment previously created by the dam, will allow restoration of the Kennebec and Sebasticook Rivers above Augusta. An important component of this restoration is the access to spawning and nursery areas for all anadromous fish species, including striped bass, rainbow smelt, shortnose sturgeon, and Atlantic sturgeon, which do not utilize conventional fish passage facilities. Since dam removal was not completed in time for the 1999 spring spawning runs of alewife and American shad, trap and truck operations continued at Edwards in 1999 to ensure that alewives and shad trapped below the dam were able to spawn upstream.

Under the 'Agreement', with the Edwards Dam removed, an interim trapping facility will be constructed at the Ft. Halifax Dam on the Sebasticook River to collect returning adult alewives and American shad in the spring of 2000. This interim facility will be used for the trapping and trucking adults for release upstream until 2003, when either a permanent fish lift will be in place at Ft. Halifax or the dam will be removed. Based upon past adult releases and projected returns, there should be sufficient brood stock returns available at Ft. Halifax to complete the 2000 alewife stocking transfers to the Phase I lakes in the Kennebec drainage. Any surplus adults will be transferred to other restoration areas in Maine.

Under Phase I of the restoration plan, only those lakes approved by the Department of Inland Fisheries & Wildlife (MIF&W) were to be stocked with six alewives per surface acre. Of the 21 impoundments listed under Phase I, only 10 were stocked at the beginning of the program in 1987, Wesserunsett Lake was to be stocked starting in 1995. Restoration at eight of the 11 remaining impoundments is contingent upon the outcome of a cooperative research project sponsored by DMR and MIF&W to assess the interactions of alewives with smelt and salmonids. Restoration at two of the three remaining impoundments, Threemile Pond and Three-cornered Pond, both in the Sevenmile Stream drainage will be delayed until such a time when the impacts of alewife stocking in Webber pond can be determined (since juvenile alewives leaving Threemile and Three-cornered Ponds must migrate through Webber Pond to leave the system).

The initial restoration of alewives to Webber Pond had been postponed for several years to allow the Maine Department of Environmental Protection (DEP) time to establish a better, long-term water quality database on this pond. In fact, DMR deferred stocking alewives into the whole Sevenmile Stream drainage (Webber, Threemile, and Three Cornered Ponds) for a number of years due to the ongoing work in water quality improvement by DEP, local residents, lake associations, and the China Region Lake Alliance. In early 1995, DMR, DEP, and MDIF&W agreed that alewife restoration at six alewives $acre^{-1}$ would have no negative impact on water quality and may, in fact, have a positive long-term impact through phosphorus export from the lakes. However, a conservative plan was agreed upon which called for stocking in only Webber Pond initially. Webber Pond was stocked in 1997 with two alewives per acre, four alewives per acre in 1998, and six alewives per acre in 1999. In 2000, Webber Pond will again receive the prescribed six alewives per acre. Threemile Pond and Three-cornered Pond will be stocked at some time in the future, based upon the level of success of the Webber Pond stocking

On June 25th, 1999, DMR, in cooperation with MDIF&W, installed a barrier on Seven Mile Stream to exclude undesired, non-indigenous species. European carp (previously excluded by the Edwards Dam) have been shown to be detrimental to pond ecosystems. At this time not enough is known about the potential impacts of this species to risk NOT having a strategic barrier on the Seven Mile drainage. The barrier was checked daily for cleaning and observation. Tropical depression Floyd caused the Sevenmile drainage to flood briefly in mid September. Water velocities and volume rose dramatically and the weir would have been destroyed had not the Webber Pond Association stopped its

annual drawdown to allow the barrier to be repaired and reinforced. The barrier was removed November 15, 1999 and will be reinstalled in early April 2000.

In 1999, DMR continued to transfer American shad from the Connecticut River to the Waldoboro shad hatchery for use as captive brood stock in the hatchery's tank spawning egg take program. In previous years adults transferred from the Connecticut River were released directly into the Kennebec. Shad restoration efforts in other rivers, such as the Susquehanna, have shown fry releases to be more successful than fingerling or adult releases. Therefore, no brood stock American shad were transferred from the Connecticut directly to the Kennebec River in 1998 or 1999, DMR concentrated on providing brood stock for the hatchery's tank spawning effort. The Connecticut River Technical Advisory Committee limits the total number of shad allowed for transfer out of the Connecticut River basin.

In 1999, DMR transferred additional shad brood stock from the Saco River, captured at the Cataract Fish Lift. These shad were also placed in the tank spawning system at the Waldoboro shad hatchery to further augment egg production for the Kennebec restoration effort.

American shad fry production was increased in 1997, with expansion of the hatchery facility funded by the Maine Outdoor Heritage Fund and the KHDG. The 1999 shad culture operational budget was funded by DMR and KHDG. In 1999, DMR released more shad fry than in previous years in both the Kennebec and Sebasticook Rivers. Additionally, DMR released fall fingerlings into the Kennebec River. All shad fry and fingerlings raised at the hatchery in Waldoboro were from either Connecticut River or Saco River eggs, and were oxytetracycline marked prior to release.

ALEWIFE RESTORATION METHODS:

Trap, transport, and release

In 1999, (DMR) utilized the Kennebec River adult alewife returns for release into Phase I restoration lakes. The large number of alewife returns to the Kennebec River from 1993 through 1998, coupled with improved capture techniques using the Edwards Dam fish pump, prompted DMR to trap alewives in the Kennebec again in 1999.

Prior to the 1999 alewife run, DMR and Edwards Manufacturing Company (i.e., Edwards Dam) agreed that the fish pump, which had been used for trapping brood stock alewives at the site from 1994 through 1998, would be reinstalled and operated during the 1999 season. As in past years, the pump was positioned at the south side of the upper tailrace and was affixed to girders above. The 10-inch diameter pump intake pipe was positioned at the same location as in 1998; in the eddy created by the concrete abutment located between the discharges from the two southern turbines in the upper powerhouse.

Improvements to the pump system from 1994-1997 were used in 1998 and again in 1999. As in past years, a three-foot long section of 10 inch diameter transparent lexan, was attached to the intake end of the pipe. The clear tip on the pipe was added to make

the pump less obtrusive to the fish and thus, more effective. The intake end of the pipe, just above the lexan tip, was fastened in place with cable. Cable tension and the vertical position of the intake were maintained by adjusting a "come along" attached to the cable and supporting davit attached to the concrete pier. The intake was also secured by several lines fastened to the concrete pier, which helped prevent the intake pipe from jerking violently as the pump cycled between suction and discharge phases. This more static intake nozzle may have contributed to pump efficiency by scaring the fish less than the unstable arrangement used several years prior.

The pump lifted and deposited the alewives and water into a fiberglass tank located at the top of the granite wall, just south of the upper tailrace. The receiving tank measured 9' x 7'6" x 4'6" deep. The tank floor was painted white to provide better visual contrast with the alewives and allow more accurate estimates of alewife numbers in the tank. Dipping alewives from this tank proved difficult until the alewife density was very high. Alewives were also removed by draining the tank, especially when fish density was low. Draining was accomplished by stopping the pump and removing a drain plug in the tank floor. A supplemental water supply utilized from 1994 -1998 was used for the 1999 season. This water was supplied by an electric pump and discharged onto the surface of the holding tank water through a two-inch hose. This backup supply was used to provide the alewives in the tank with fresh, oxygenated water, especially if the fish pump was shut down. With this arrangement, in the absence of a stocking truck, the pump could be shut down when a sufficient number of alewives had been trapped. This arrangement allowed alewives to be held without causing stress or mortality due to crowding or decreased dissolved oxygen levels.

During the 1999 season, the pump tank was usually drained only at the end of the day. During truck loading, alewives were intercepted as they exited the pipe downstream of the pump, before they entered the holding tank. While standing on removable wooden decks placed over the top of the pump tank, DMR personnel used dip nets to capture the alewives as they entered the tank. The head of the net was usually braced on a wooden plank against the force of the pumped water stream and the alewives were screened from the water as it flowed through the bag of the net. The bag of the dip net was allowed to float in the tank water to reduce stress on the alewives trapped in it. The dip net was exchanged for an empty one between pump cycles and the alewives in the loaded net were placed in the truck tank. Typically, one or two DMR personnel manipulated the dip nets to catch alewives while another worker was handed the full nets, and sorted/counted fish as they were released into the truck tanks. While loading the twin tank truck, two personnel counted and loaded alewives on the truck. The second person was especially helpful for loading the front tank on the twin tanker as it is impossible to get the front of the truck close to the pump tank because of site configuration.

Prior to the seining or removal of alewives from the receiving tank, the stocking trucks were filled with water from the Edwards headpond using the auxiliary water pump. Water was circulated in the stocking tanks with the truck-mounted pumps. Oxygen was introduced into the stocking tank water via a porous pipe arrangement. Water circulation and oxygen introduction continued as alewife loading progressed in order to provide a healthy, stable environment in the stocking tanks. Alewives were transported

in two stocking trucks purchased with funds provided by the KHDG Agreement. A complete description of these trucks, associated equipment, and standard methods of operation is provided in the 1994 annual report, available from DMR upon request.

Alewives were transported from the loading site directly to the lake being stocked and immediately released. The name, location, and Phase I stocking goals for alewife restoration are provided in Table 1. Figure 1 illustrates the location of each lake.

Juvenile sampling

Lake systems were sampled during the summer season to obtain data on young-of-the-year [YOY] alewives, the progeny of the spring 1999 stocking. Juvenile alewives were collected with beach seines (fished from the shores of the lakes), fyke nets, and dip nets. Two beach seines were employed, one measuring 66' long x 6' deep, the other 40' long x 4' deep. Seines were constructed of $^1/_4$" or $^1/_8$" delta mesh and were treated with a green dip to prevent rotting. Fyke nets were constructed of $^1/_4$" delta mesh and were placed in outlet streams to collect downstream migrants. When juvenile alewives were observed in the shallow littoral zone, on the surface, or near a lake outlet dam, a dip net was sometimes used to collect a sample. Dip net frames varied in dimensions, but were hung with either $^1/_4$" or $^1/_8$" delta mesh netting.

All fish species collected were identified to species, enumerated, and released. A subsample of 50 alewives was measured for total length. Also, a subsample of 10 fish per species of other fish species collected was measured for total length. All measurements were recorded in millimeters.

1999 commercial alewife harvest

There was no reported catch in the 1999 commercial alewife harvest below the Augusta Dam. Three permits were issued, but two fishermen did not fish below Edwards Dam and the third has not reported catch at this time. Fishermen failing to report landings data on their Kennebec alewife harvest forfeit the opportunity to obtain the special harvesting permit required to legally participate in the fishery the following season. At the time of this report, it has not been decided if a commercial alewife harvest will exist below Ft. Halifax in 2000. Alewives crowding below the facility may necessitate an emergency fishery if a possible fish kill is perceived due to low oxygen levels. Permits for the 2000 commercial alewife harvest below the Ft. Halifax, if any, will be issued through the Maine Department of Inland Fisheries and Wildlife; however, DMR will still require landings data.

ALEWIFE RESTORATION RESULTS & DISCUSSION:

Trap, transport, and release

In 1999, 71,857 brood stock alewives were stocked into eight upriver Phase I lakes in the Kennebec River watershed. These eight lakes are identified for restoration as described in Phase I of the ***"Strategic Plan and Operational Plan for the Restoration of Shad and Alewives to the Kennebec River Above Augusta."*** In total, 11,999 acres of lake surface area were stocked to a density of approximately six

alewives acre^{-1}. Alewife stocking rates in the eight Phase I lakes are summarized in Table 3.

Seven of the eight lakes that received alewives in 1999 (six in the Sebasticook River subdrainage and two in the Kennebec River drainage), were stocked in 1998 as part of the ongoing alewife restoration program in the Kennebec drainage. Due to relatively low catch per effort of adult alewives at the Edwards Dam in 1999, Lovejoy Pond was not stocked in 1999. Lovejoy Pond was also selected for deletion from Phase I stocking in 1999 because of the poor downstream passage conditions that are typical at the outlet, Mill Stream. The dam at the outlet of Lovejoy Pond has leakage thereby reducing spill over the top of the dam and making downstream passage impossible on all but the wettest years. The deletion of Lovejoy Pond from the list of Phase I alewife restoration ponds caused a decrease of surface acreage of Phase I lakes currently being stocked from 12,323 acres in 1998 to 11,999 acres in 1999. Alewives will be released in Lovejoy Pond if adult alewives are available at Ft. Halifax Dam.

DMR did not release alewives in the Edwards impoundment in 1998 or 1999. In 1996 and 1997, approximately 20,000 alewives were released into the Edwards Dam impoundment. The subsequent behavior and sightings of these fish in the Sebasticook River below the Ft. Halifax Dam, as well as their absence in other areas, confirmed DMR's belief that the vast majority would home to the mouth of the Sebasticook River. There are no plans to stock alewives in the main stem Kennebec River in 2000.

Alewife stocking efficiency from Edwards Dam in 1999 was similar to that from 1994 through 1998. There was very little overlap between the alewife stocking in the Phase I lakes and the American shad brood stock transfers from the Connecticut River to the Waldoboro hatchery during the 1999 season. The shad transfers were largely completed prior to and after the alewife stocking to Kennebec drainage ponds, thus allowing the twin tank truck to be employed regularly for alewife transport. Alewife hauling tank densities in 1999 were slightly lower than those of 1998, but somewhat higher than densities prior to 1998. Increased reliance on the twin tank truck probably contributed to the slightly higher densities transported in 1998 and 1999. The heavy alewife run and availability of alewives at Edwards Dam during the peak of the run allowed high densities of fresh, lively alewives to be loaded into the tanks rapidly. This rapid loading precluded any degradation of the condition of the alewives by avoiding lengthy holding tank times.

YEAR	ALEWIVES STOCKED	# TRIPS	ALEWIVES X TRIP^{-1}
1999	71,857	36	1,996
1998	73,148	34	2,151
1997	74,165	41	1,809
1996	67,441	41	1,645
1995	59,080	34	1,738
1994	58,701	36	1,631
1993	36,503	28	1,303
1992	23,579	31	761

The 71,857 alewives stocked in the Sebasticook and Kennebec drainage Phase I lakes in 1999 was slightly lower than the number stocked in 1998 (73,148). The highest number of alewives stocked in Phase I lakes occurred in 1997 (74,165) (Table 4). The 1999 alewife stocking represents the first time in six years that all ponds stocked in the Sebasticook drainage were not stocked to their target stocking density of six alewives $acre^{-1}$ (Sebasticook Lake was only stocked to 5.7 alewives $acre^{-1}$). However, all other ponds in both the Sebasticook and Kennebec drainages were stocked to at least the target of six alewives $acre^{-1}$. Additionally, 1999 marked the third year of stocking in Webber Pond (currently up to six alewives $acre^{-1}$). In total, only 36 alewife, stocking trips were made to the upriver ponds; this trip count is slightly higher than that of 1998 (34), but lower than the 41 trips required in 1996 and 1997. All 36 trips originated at the Edwards Dam, in Augusta, as the Kennebec River was the sole source of alewife brood stock in 1999. It was not necessary to import brood stock from outside the Kennebec to meet the goals of the program. The alewife stocking program in the Phase I lakes required 16 days to complete, May 16 to June 2, 1999. This is twice as many days as it took in 1998 (8) and more than it took in 1997 (10) and 1996 (15). A chronological list of individual stocking trips to the eight Phase I lakes is presented in Table 5.

The efficiency of trapping at Edwards Dam in 1999 was lower than previous years, due to several factors. The flash boards normally installed on the dam crest were not installed in 1999. Uncontrolled spill provided a much grater attraction potential than did the upper tailraces. The quality of water in the upper tailraces was severely degraded by the loss of the turbines. The turbines, in effect serve to both laminate and deenergize the discharge into the tailraces. Water in the tunnel discharges was extremely turbulent and carried huge amounts of air mixed with the water from the turbine pits. This air-laden water caused the seal water pump to lose its prime frequently, causing the fish pump to shut down. DMR staff frequently adjusted the gate house gates to optimize water levels. The inspection gate at the upper powerhouse was manually operated with chain hoists to modify attraction flows in the tailrace. The peak day of pumping in 1999 on May 18 was significantly lower than previous peak days in 1996 through 1998. The high numbers of alewives pumped on the peak days in 1996-1997 were due to continuous pump operation to support the short duration, heavily loaded truck trips to the Edwards Dam headpond. Similar highs probably could have been attained in 1998 if the pump had been operated continuously at the peak of the alewife run.

YEAR	PEAK TRAPPING DAY
1999	9,965 alewives
1998	16,311
1997	21,756
1996	22,205
1995	10,634
1994	13,050

In 1999, the pump operated on 23 days and trapped alewives on all of these days. Over 3,000 alewives were pumped on nine days; over 5,000 on seven days; and we never collected more than 10,000 alewives on a single day (Table 6, Figure 2).

The most stocking trips completed to the Phase I ponds in one day was four, occurring on May 21, 22, 30, and 31. The peak number of trips day^{-1} in 1999 was lower than the peak number of trips day^{-1} in 1998 (five to Phase I and three to ponds other then Phase I, for a total of eight trips in one day). The fewer trips day^{-1} were due to lower concentrations of fish below the dam than in previous years and attributed to lower overall stocking numbers than in previous years.

Based on experience gained during alewife trapping at Edwards in previous years, DMR developed a standard operating procedure for using the fish pump in an efficient manner. Since the majority of shad transfers in 1999 did not occur at the same time alewife stocking was underway, there were usually five KHDG Project personnel available to work on alewife trapping and transport. While two crew members traveled with each of the two stocking trucks, the fifth worker usually remained at Edwards to coordinate pump operations.

Based on the pump's alewife trapping rate and the time trucks were due back at the site, DMR personnel could perform rough calculations to determine the number of alewives already in the pump tank and the number likely to be pumped into the tank prior to a truck's return. If too many alewives were likely to be trapped prior to a truck's return, the pump could be stopped by an Edwards employee. A maximum of approximately 2,500 alewives could be stockpiled in the pump tank. A supplemental circulating water supply (added during the 1994 season) allowed alewives to be held in the tank when the pump was switched off. If the single tanker was due to return first, a whole load of alewives (1,500 to 1,800) could be stockpiled in the pump tank. If the twin tanker or both trucks were due to return, the maximum stockpile of alewives (2,500) could be held. Ideally, these fish would be trapped immediately preceding the arrival of the truck to allow the alewives to be held in the tank for a minimum amount of time. As the loading of the double tank truck commenced, the pump would be restarted and additional alewives would be trapped to finish the load. This operational mode allowed loading to be as efficient as possible without sacrificing the quality of the alewives. Because of efficient loading, they spent less time in the truck tanks at the loading site, which also helped minimize trucking mortalities.

Loaded trucks were immediately dispatched from Edwards to the stocking site. Three remaining crew members were usually able to complete loading even the double tanker. This immediate and staggered departure method allowed tankers to return from the lakes to Edwards at alternating intervals and prevented waiting in line to load the next batch of alewives, contributing to more efficient trucking overall. If trucks did overlap at Augusta, the waiting crew helped load the first tanker and accelerated its departure.

The configuration of the hauling tank system and the operational procedure used by the DMR/KHDG crew were very important in hauling the large loads of alewives. The porous pipe/oxygen delivery system first fitted to the trucks in 1992 for American shad hauling was used extensively during the 1999 alewife trucking operations. This system consisted of porous polyethylene pipes four feet long, fastened to the tank floors and connected to lexan-ball type flow meters downstream of the welding type regulators attached to the oxygen tank. This porous pipe produced finer diameter bubbles and used less volume of

oxygen than previous systems. These fine bubble, porous pipes are used on the Susquehanna River shad hauling trucks to increase dissolved oxygen levels.

One of the double tanker tanks was fitted with a Bio-Weve diffuser, which was also used during the 1995 -1998 seasons. This experimental application continued to work about as well as the porous polyethylene tubing for delivering oxygen, but may be more durable. Flexible, porous, rubber tubing was also used during the 1999 trucking season. It appeared to perform comparably to the porous polyethylene and Bio-Weve diffusers, but is much less costly and more durable. Evaluation of this product and new diffusers will continue in future seasons.

After truck tanks were filled with river water, the circulation pumps were operated prior to loading the first alewives. Dissolved oxygen levels in the tank water were monitored during loading and while on the road, remote probes in the tanks connected to a meter in the truck cabs were used. During the loading process, the flow of oxygen into the tank water was increased as alewife density increased. With the remote monitoring of the DO level in the tank water, oxygen input could be adjusted to keep the tank DO within acceptable limits, usually above 6mg/l, and below saturation at the current temperature. Monitoring during loading and transport indicated that the oxygen input was more than adequate to maintain tank DO and keep pace with alewife oxygen demand at the fish densities and average temperatures experienced in 1999.

The maximum alewife density hauled to the lakes during the 1999 season was 1,970 alewives/1,000 gallons of water per tank. This new high was achieved as part of the second largest load of alewives transported in the twin tank truck (3,712 alewives vs. the largest load in 1998 of 3,772), with no hauling mortalities (one hour on the road, plus loading time). If necessary, it may be possible in future years to experiment with even heavier loads. Few problems were experienced with the KHDG tank trucks during the 1999 stocking season.

During the 1999 season, 80,047 alewives were trapped at the Edwards Dam. Of these, 71,857 were stocked in the eight Phase I lakes; 4,724 were stocked in Kennebec drainage lakes other than Phase I lakes; 1,788 were stocked in the Androscoggin River drainage; 772 were released below the Edwards Dam; 400 were collected for biological samples; and 10 and 546 were fish pump and trucking mortalities, respectively. The 546 alewives lost while trucking represents a 0.69% mortality rate of the total alewives loaded.

Operation of the fish pump commenced on May 10, when 50 alewives were captured and kept as a biological sample. Alewife transfers to the Phase I lakes commenced with single loads hauled May 16 through May 20 and accelerated on May 21 when 8,101 alewives were trapped. There were two peaks in the number of alewives trapped in 1999 (Figure 2). There were 9,965 alewives trapped on May 23 and 9,250 on May 31. These peaks are much lower than the peaks of 16,311 and 16,114 on May 18 and 19 in 1998. River temperatures associated with the peaks in 1999 were in the 17.5-18.5°C range.

Stocking in Phase I lakes was completed on June 2, after two loads were transported to Pleasant Pond. Stocking of other drainages, which had commenced to a limited degree during the stocking of the Phase I lakes, was completed by June 3 (see Table 7). Alewife trapping ended on June 3.

In 1999, transfers from the Edwards Dam trapping site to waters other than the Phase I lakes totaled 7,043 alewives loaded, with 6,512 stocked and 531 trucking mortalities (Table 7). Alewives transferred to waters other than the Phase I lakes represented 9% of the total number of alewives trapped at Augusta. In 1999, all alewives stocked out of the Kennebec River drainage were stocked into the Androscoggin River drainage. Alewives stocked in the Kennebec drainage represented approximately 98% of the total number of alewives trapped at Augusta, while alewives transferred to the Androscoggin River represented 2% of the total.

Juvenile sampling

During the summer and fall of 1999, young-of-the-year (YOY) alewives were captured in seven of the eight Phase I restoration lakes; Douglas Pond was not sampled for YOY (Table 8). Juvenile alewives were captured in six of the 14 seine hauls made in 1999. Dip nets contributed five samples in five attempts. Fyke net sets produced two samples of young-of-the-year alewives from three attempts. In total, 588 young-of-the-year alewives were measured over the course of the 1999 season (Table 8). Juveniles sampled in Webber Pond and Sebasticook Lake were notably larger than fish sampled in other Phase I lakes, 122.7mm and 119.1mm respectively. The largest juveniles sampled at other lakes range from 44.6mm in Wesserunsett to 106mm in Pattee Pond (Table 9).

AMERICAN SHAD RESTORATION METHODS:

Similar methods were used in 1999 as in previous years. Therefore, please refer to any other KHDG report from 1987 through 1994 for details. Adult shad from the Saco and Connecticut River were transported to the Waldoboro hatchery for spawning and egg take. Prior to release, all larvae are marked with Oxytetracycline (an antibiotic which leaves a mark on the otolith, inner ear bone) so that DMR can later distinguish adult returns as either hatchery or wild origin. For general Hatchery Operational procedures refer to the 1997 Waldoboro Shad Hatchery Annual Report and for an annual update refer to the 1999 report. The 1999 season also included transferring adult prespawner shad from the Hadley Falls lift on the Connecticut River and released above Vernon Dam, NH as part of the broodstock transfer agreement with the Connecticut River Technical Advisory Committee.

AMERICAN SHAD RESTORATION RESULTS & DISCUSSION:

Fish health inspection

Prior to transfers of live broodstock to Maine, a fish health inspection was performed on the Connecticut River shad stock in the spring of 1999. A 60-fish sample of adult American shad was collected at the Holyoke fish lift on May 2, 1999. The shad were packed in ice and transported to the Maine Department of Inland Fisheries and Wildlife,

Governor Hill Hatchery facility, in Augusta, Maine. Kidney, spleen, and gill samples were taken in accordance with the American Fisheries Society, Fish Health Blue Book Procedures. Samples were processed for the detection of bacterial and viral fish pathogens and found to be free of those pathogens of concern to the State of Maine. These procedures are necessary to comply with state law concerning importation of live fish and eggs into Maine waters.

Adult transfers

No brood stock American shad were released directly into the Kennebec River from the Hadley fish lift in 1999. However, seven trips were made to obtain brood stock for the Waldoboro hatchery on May 10, 11, 17,19, 20 and June 1, and 4th. Of the 522 shad loaded at Hadley, 511 were released alive in the experimental egg take tank, resulting in a hauling mortality of 2.2%. Brood stock shad for tank spawning were also obtained from the Saco River at the Cataract fishlift. On June 3, 4, 10, 17, 24, and July 8 and 20th, a total of 401 shad were transported to the Waldoboro hatchery from the Saco River; only two mortalities were recorded during these transfers (Table 10).

As in past years, as part of the out of basin broodstock transfer agreement with the Connecticut River Technical Advisory Committee DMR transported and released shad upriver on the Connecticut. Four shad upstream transport trips were made on the Connecticut, from Holyoke to the Vernon Dam headpond at West Chesterfield, NH. These trips resulted in a total of 1,003 adults released in West Chesterfield, with no mortalities during these trips.

Connecticut River egg take

On the evenings of May 26-31 and June 1-5, 1999, a total of 3,934,763 eggs were taken from ripe and running female shad in the Connecticut River. The eggs were collected and transported by Normandeau Associates to the hatchery under contract with DMR. The eggs were disinfected and then placed in four custom-built upwelling egg incubators where they remained until hatch out. Of the 3.9 million eggs taken, an estimated 3,090,774 hatched (78.5%).

Spawning tank operation

From May 10 - June 4, DMR personnel transferred 511 prespawner adult American shad from the Holyoke fish lift on the Connecticut River to the hatchery for experimental tank spawning (Table 10), where they were allowed to spawn over the next several weeks. The fertilized eggs were collected, disinfected, and placed in upwelling incubators, as described above.

From June 3-July 7, DMR personnel transferred 399 prespawner adult American shad from the Saco River to the hatchery for experimental tank spawning (Table 10). Four stocking trips were made to the Saco to release these shad fry, on July 19,21, and 26 and August 10. In 1999, a total of 172,502 fry were released below Bar Mills on the Saco. The remainder of the Saco origin fry was released in the Kennebec and Sebasticook Rivers.

On June 21 and 22, an estimated 1,680,199 shad fry ranging from 14-23 days old were released into the Kennebec River in the Hydro-Kennebec (UAH) headpond (Table 11).

On June 14, an estimated 381,881 shad fry were released at the Waterville boat launch. On June 16 and 18, a total of 856,192 shad fry were released into the Sebasticook River just downstream and in the impoundment of the Burnham Dam. Historical shad fry stocking in the Kennebec and Sebasticook Rivers is presented in Figure 3.

DMR's decision to stock a portion of the shad fry available in 1999 into the Sebasticook River was based on several factors: DMR sought to ensure that returning adult shad could be collected and used for the restoration through the spawning operation at the hatchery. Using brood stock collected from the Kennebec is preferred over continuing to collect brood stock from out-of-state. Fry stocked in 1999 will return in 2004 as five-year-old spawners. Trapping shad in a fish passage facility at Lockwood and Ft. Halifax will be a more effective means of acquiring live, healthy brood stock, rather than gill netting or attempting to trap shad in the open segment of the Kennebec River below Waterville.

In addition to releasing fry into the Sebasticook River in 1999, DMR released fry into the UAH-Hydro Kennebec headpond for the first time. DMR viewed the Kennebec River, above the Hydro Kennebec Dam, and the Sebasticook River as logical places to receive shad fry for several reasons. First, to support the burgeoning alewife restoration program on the Sebasticook River, FPL Energy is required to construct an upstream fish passage and trapping facility at Ft. Halifax by May 2003. When such passage at Ft. Halifax is built, the site becomes a natural place to trap returning brood stock shad imprinted with an upriver segment to fuel the hatchery egg take effort. Second, the lower hydroelectric dams on the Sebasticook River, Benton Falls and Ft. Halifax, have installed permanent downstream passage facilities. Third, the Lockwood and Hydro Kennebec facilities are required to install, and have operational, interim fish passage facilities by May 2006; releasing fry above Hydro Kennebec in 1999 will ensure seven year old shad returns at the Lockwood facility when upstream passage becomes available. Furthermore, DMR did not want to stock all fry available in 1999 in one river segment. Since there were 3,090,774 fry available for release in 1999, DMR sought to distribute them in two river segments so as not to "put all our eggs [fry] in one basket" and on the chance of some type of lethal condition occurring in the "one" segment, lose a major portion of the whole year's fry production. Finally, DMR chose the area below Burnham and above Benton Falls to receive the shad fry due to the large amount of quality habitat available in this long river segment; DMR believes this area is highly productive and conducive to good shad growth.

The remaining fry were released into the three culture ponds at the hatchery and raised until fall. On October 13 and14, 13,152 fall fingerlings 2-6" in length were released in Waterville, in the impoundment above the Hydro-Kennebec (UAH) facility. American shad fall fingerling releases in 1999 are presented in Table 12. The history of shad fall fingerling stocking in the Kennebec is represented in Figure 4.

Juvenile sampling

No juvenile shad were captured during the 1999 field season. In years past, the #7 and #8 turbine forebay at the Edwards site was the primary sampling station for outmigrant YOY shad. Due to the removal of Edwards Dam, this site was no longer available. Fyke nets were placed in the Benton Falls impoundment, but no shad were captured. Several

new sampling/assessment plans are under construction at DMR to sample YOY shad in the seventeen mile stretch between Augusta and Winslow as well as in fry stocked headponds during the 2000 field season.

FISH PASSAGE METHODS:

In 1997 the Federal Energy Regulatory Commission ordered the decommissioning and removal of the Edwards dam. Subsequent to that order, State and federal fishery agencies, the KHDG, and nongovernmental agencies signed the *Lower Kennebec River Comprehensive Hydropower Settlement Accord* which contained provisions for the removal of Edwards dam, fish passage requirements at upriver dams, and funds for fisheries restoration. Because an additional 17 miles of riverine habitat would be available to alewives and American shad when the Augusta dam was removed, the settlement included a new timetable for fishways at the KHDG dams and called for interim trapping-and-trucking until fishways were completed. Fishway construction is the responsibility of the hydropower dam owners; they bear all costs associated with fishway construction and operation. As part of the *Settlement Accord,* the State agreed to take the lead in seeking fish passage for four non-hydro dams on the Sebasticook River, which included the outlet dam on Pleasant Lake, the outlet dam on Plymouth Pond, and the two, mainstem dams in Newport. The owners of the Ft. Halifax dam are required to provide for the interim trapping of alewives and shad in 2000 in order to continue the interim trap and truck program and they are required to provide state-of-the art passage by May 1, 2003 or to remove the dam. Passages at the next two upriver hydroelectric dams are required to be operational by no sooner than May 1, 2002, but this requirement is contingent upon the installation of permanent upstream fish passage at Ft. Halifax and the four aforementioned non-hydro dams.

In reference to passage effectiveness studies, section III (F) of the KHDG Agreement provides that:

> "KHDG dam owners will conduct effectiveness studies of all newly constructed interim and permanent upstream and downstream fish passage facilities at project sites. Study plans for these effectiveness studies will be filed with FERC and Maine DEP no later than the date on which passage at a particular project becomes operational, and will be subject to a consultation process with, and written approval from the resource agencies."

At the time of this report no plans for effectiveness studies have been filed. At the March 2, 2000 Annual KHDG Meeting, Mr. Kevin Webb, CHI Energy, Inc. (Burnham Hydroelectric project) presented a letter to DMR stating his intent to conduct passage effectiveness studies in 2000. DMR will pursue effectiveness studies at the remaining projects in 2000.

Lake outlet monitoring

Lake outlet streams were surveyed to determine the presence of obstacles to downstream passage of juvenile and adult post-spawn alewives. The streams were traveled by boat or on foot; obstructions to juvenile alewife migration were noted and

their structure and location recorded. Beaver dams on the streams below Pattee, Plymouth, and Pleasant Ponds were frequently encountered and in previous years when active, require regular attention during the late summer/fall to permit free emigration of postspawner and YOY alewives. A small hole made in the dam in question usually allowed downstream passage for several days, until the beavers repaired it.

Hydropower downstream passage monitoring

Downstream passage at hydropower facilities located on the Sebasticook and Kennebec Rivers was monitored through the summer and fall. Hydroelectric facilities were visited routinely to assess any problems that downstream migrating juveniles might encounter. The condition and operation of downstream bypass facilities, magnitude and location of spilled water, number of turbines in operation, and the presence or absence of juvenile alewives at each facility were noted. The dam sites and their locations are presented in Table 2, while locations of the dams are illustrated in Figure 1.

FISH PASSAGE RESULTS AND DISCUSSION:

It is proposed to provide passage at the following dams on the Sebasticook River by 2001: Sebasticook Lake outlet dam (Newport); Guilford dam (located downstream of the Sebasticook Lake outlet dam); Pleasant Pond outlet dam; and Plymouth Pond outlet dam. The **United States Fish and Wildlife Service** (USFWS) prepared conceptual designs and cost estimates for these sites. Their total estimated cost for passage **at all four** dams was **$510,000** (1997 dollars).

DMR requested assistance for constructing fishways from the US Army Corp of Engineers (ACORE) under Section 206. An initial site visit by representatives of the ACORE was made in December 1998. The ACORE will need to prepare a preliminary resource plan in order to seek approval for a feasibility study for these four sites prior to fishway construction. Under Section 206, the ACORE will fund 65% of the project cost with the State funding the remaining 35%. If the total cost of the projects is **$510,000** (as the USFWS estimated) the State will need **$178,500** to match **ACORE**. However, initial estimates by the ACORE indicate the total cost for the fishways may be much greater the UFWS estimate (as high as $1,000,000).

In 1999, the Town of Stetson decided to rebuild the spillway of the **Pleasant Lake outlet dam**. DMR contacted the Town to see if they would install the fishway in conjunction with the reconstruction the spillway. The Town agreed it would be to everyone's benefit if the fishway were installed when the spillway was reconstructed. The ACORE could not undertake the fishway project in 1999 so the Town and DMR sought alternative funding sources. The construction cost for the fishway, approximately **$57,370**, was completely funded the Natural Resource Conservation Service (NRCS) **($39,734)**, the United States Fish & Wildlife Service **($15,000)**, and the Maine Department of Marine Resources **($2,635)**.

At this time, the State is still proceeding in trying to obtain assistance from the ACORE through the Section 206 program for the other three projects. The ACORE has tentatively estimated that fishways **at the three remaining projects** may cost as

much as **$800,000 to $1,000,000** to build through their Section 206 program. This would require the State to come up with as much as **$350,000** in match. The State initially set aside $178,500 in the Kennebec River Fisheries Restoration Fund. Additional money is being sought to cover the potential shortfall.

In 1999, DMR and the Town of Stetson also worked with the U. S. Department of Agriculture (USDA) and NRCS to remove the remnants of the **Archer Sawmill Dam**. This project included: 1) removal and disposal of up to 5 concrete piers; 2) removal and disposal of up to 300 cubic yards of stone and dam debris; and 3) removal and disposal of up to 500 cubic yards of sawdust, logs and associated debris upstream of the dam. All removed debris was disposed of on the easement grantor's property. Disturbed areas were stabilized with stone and vegetation as specified by NRCS biologist and left in as natural a state as practicable. The cost of this removal was completely funded by NRCS and the USFWS.

Lake outlet monitoring

In 1999, lake outlets were surveyed after the alewife trap, truck, and release season ended to note any difficulties with downstream migration of both adult and juvenile alewives. Starting in July, DMR personnel surveyed four lake outlets regularly through late October; Sebasticook Lake in Newport, Pleasant Pond in Stetson, Plymouth Pond in Plymouth and Wesserunsett Lake in Skowhegan (Table 13). Of these four lakes the Sebasticook Lake outlet was checked less frequently, due to a post Labor Day water quality drawdown that typically limits passage. Plymouth Pond was checked on nine days from July 13 through October 22. Due to the drought conditions encountered in 1999, passage at the outlet dam was non-existent until the first week in October, when a severe rain event (Tropical depression Floyd) raised the pond level to above the spillway level. Passage was available on all four visits to Plymouth Pond in October over the dam's spillway. DMR is currently seeking assistance from the ACORE, for the installation of a fish passage on Plymouth Pond, to improve both up and downstream passage. Pleasant Pond in Stetson was visited ten times from July 17-October 27. Pleasant Pond also suffered from low water levels for most of the 1999 season. Construction of a cofferdam to install fish passage combined with the low water levels made passage impossible on five of the ten days visited. Juvenile alewives were observed above the dam on four visits. The removal of the Archer Mills dam will further the success of outmigrating alewives from this pond in the 2000 season. Wesserunsett Lake in Skowhegan was surveyed eight times from July 17-October 22. Generally, Wesserunsett has had few problems with downstream passage. Downstream passage is available throughout most of the season over the outlet dam spillway. Wesserunset YOY alewives tend to outmigrate small and early, as the lake is fairly oligotrophic in comparison with most ponds on the Sebasticook drainage.

The three remaining Phase I lakes stocked with alewives in 1999: Unity Pond in Unity, Webber Pond in Vassalboro, and Pattee Pond in Winslow were not checked regularly for downstream passage for various reasons. Unity Pond has no outlet dam and has excellent downstream passage into the Twenty Five Mile stream on all but the driest of years. Webber Pond, like Sebasticook Lake, also uses a fall water quality draw down and usually has sufficient water to allow passage over the spillway throughout the season.

Pattee Pond has no outlet dam and has in the past demonstrated excellent out-migration of alewives.

Hydropower downstream passage monitoring

In 1999, DMR made frequent site visits to hydro projects on the Sebasticook and Kennebec Rivers. At each hydro project, observations concerning availability of downstream passage and presence/absence of juvenile alosids were noted (Table 14).

The **Ft. Halifax Project** in Winslow is operated by FPL Energy and is the lowermost dam on the Sebasticook River. FPL Energy installed permanent downstream bypass facilities during the summer and fall of 1993. The permanent bypass uses the same trash sluice opening that was used in past years for the interim facility. The old trash sluice was refitted with a weir gate to control depth of flow at the entrance of the downstream bypass. The downstream side of the opening was fitted with a metal trough with an open top to carry water and fish down close to the tailrace elevation. A 12-foot deep metal punch plate trash rack overlay was installed to aide in excluding alewives from the turbine forebays. This downstream bypass configuration and operational regime was approved by the FERC order issued on September 30, 1996 and was utilized again during the 1999 season.

DMR made three complete visits to the Ft. Halifax Dam in 1999, on July 13, 29 and October 12; the downstream bypass was open and operational on all three of these visits. During the October visit, alewives were observed using the downstream bypass and a few dead alewives were observed exiting out of the turbine into the tailrace. The dead alewives observed during the October visit may have originated from a significant fish kill upstream at the Benton Falls project.

DMR personnel made more frequent visits to the Ft. Halifax Project over the course of the summer and fall, but because access to the facility is not permitted without FPL Energy staff present, observations were made from the Route 201 bridge just downstream of the project. Water flow through the bypass could be observed, but little else could be noted from this location. DMR and FPL Energy staff tried to coordinate visits at the site to make downstream passage observations, but alignment of schedules proved to be cumbersome on a regular basis.

In section IV (E), a, the resource agencies and the Kennebec Coalition have allowed FPL Energy to delay the installation permanent upstream fish passage "... in order to allow licensee sufficient time to decide if continued operation of the Ft. Halifax dam is economically viable...". Section IV (E), 1 b and c of the KHDG Agreement provide for temporary alewife and shad capture at the Ft. Halifax project. Temporary passage for both shad and alewives must be in place, operational, and maintained by May 1, 2000. At the time of this report, FPL Energy has begun constructing the necessary structures to install the Transvac Pump at the Ft. Halifax site. Also, in conjunction with Lakeside Engineering they have begun to develop alternative methods for capturing shad below the Ft. Halifax project. Blueprints of the alternative capture methods have been distributed to the resource agencies and NGO's for comment.

The **Benton Falls Project** is equipped with permanent downstream passage facilities that have been on line since 1988. The bypass at Benton Falls consists of two surface weirs, one located above each turbine intake, which interconnect and discharge into the tailrace through a large diameter pipe. Water flow into each weir is regulated by a gate, which can be lowered to allow a controlled surface spill into the weir. After passing over this gate, fish become committed to the bypass and cannot reenter the headpond. The large turbine weir intake is open throughout the migration period and the small turbine weir intake is typically closed.

DMR personnel observed the Benton Falls downstream passage during 10 visits in 1999, beginning June 13 and ending November 4. The bypass was open and operating during all of the site visits except October 12. American shad fry were stocked in the river reach above the Benton Falls Project during the summer of 1999, as they were in years past. On five visits, DMR personnel observed young-of-the-year alosids either above or below the Benton Falls Project.

On October 12, the downstream bypass was plugged with debris forcing outmigrants to pass through the turbines. As result, significant mortalities were observed extending downstream along the banks below the project. This fish kill was observed and reported to DMR by the public. In an October 26, 1999 letter from DMR Commissioner George Lapointe (Appendix A), the Benton Falls Plant Operator was informed that DMR was aware of the fish kill. The plant operator was informed that it was a significant fish kill and a violation of the Benton Falls FERC License and State Water Quality Certification. The operator was further instructed that, "the turbines should be shut down during any time period that you cannot keep the downstream passage facility fully functional or when you close it for cleaning". Pursuant to Commissioner Lapointe's letter, the Maine Department of Environmental Protection (DEP) Dams and Hydro Supervisor issued a letter reviewing the Benton Falls DEP file on December 7, 1999 (Appendix B). Along with this letter, Benton Falls was issued a Notice of Violation from DEP. DEP is pursuing further action on the matter.

In past years, downstream passage at **Burnham Dam** had been accomplished by notching the flashboard closest to the intake structure. However, after the January 1998 KHDG/State joint meeting, Burnham's owner, CHI, agreed to upgrade interim downstream passage prior to the issuance of the new FERC license. Consultation between CHI, DMR, and USF&WS resulted in a plan for the installation of an improved downstream facility. In addition, the existing trash racks would be screened with a metal punch plate overlay, similar to the one in use at Ft. Halifax. The overlay would serve to aid in physically excluding fish from the wide-spaced trash rack and thus prevent their entrainment into the pen stock.

The new downstream bypass was completed in time for the 1999 outmigration season. DMR visited the Burnham Dam on 14 days in 1999. On one visit, September 9, there was very little flow available at the bypass due to construction of the new fishway. During a visit on September 20, the new bypass facility was observed to be operating. Only on one occasion, October 12, were fished observed at the Burnham Project, below the dam.

In 1999, downstream passage at the **Pioneer Dam** in Pittsfield consisted of passage over the stop log weir crest of the downstream bypass (located near the trash racks, with its associated concrete work and wood bypass trough) or passage via intermittent spills over the crest of the spillway. Pioneer's owner, Chris Anthony, has made some attempt to comply with the requirement to reduce trash rack spacing to one inch from June 15 to November 30. The metal mesh overlay, which was hung over the project racks in past years and utilized for the 1999 season, does have a small, clear space which would probably physically exclude alewives from passing through it. However, the overlay does not fit securely and oftentimes has gaps. The biggest problem with the mesh overlay is that it clogs very rapidly when a turbine is operational; water then flows under the six-foot depth of the overlay and alewives are likely to be drawn in the same direction. Cleaning the overlay appears to be another major shortcoming of the materials and design used.

Of the 12 site visits conducted by DMR in 1999, observations indicated that downstream passage through the bypass was available 11 times. The one time that the downstream bypass was not operating, the turbine was not operating; in fact, only during the first visit on July 13 was a turbine operating. There were no alewives observed either above or below the Pioneer Project during any visit.

DMR visited the **Waverly Avenue Dam** on 10 days during the 1999 season. All 10 visits revealed some type of downstream passage available at the site. Problems encountered during the 1999 season at Waverly Avenue were similar to those of previous seasons. First, gate leakage at the stop log bays on the far side of the spillway remained a problem; this leakage causes downstream migrants to be attracted away from the bypass during low flow conditions. Second, the bypass itself frequently collects debris and loses its effectiveness with this fouling. DMR personnel did not observe YOY alewives at Waverly Avenue during the 1999 season. Alewives were neither observed in the headpond nor passing downstream.

DMR visited both the **Lockwood** and **Hydro-Kennebec** Dams as often as possible in 1999. Both of these projects are located on the Kennebec River and must pass all downstream migrant alewives from the Wesserunsett Lake alewife restoration effort. During the 1999 season, interim downstream passage at Lockwood was made available over the crest of a trash sluice, which is located near the turbine trash racks. No interim downstream bypass was available at the Hydro-Kennebec Project other than passage through the two large turbines. No post spawner or YOY alewives were observed at either site by DMR personnel. More regular visits will be attempted during the summer and fall of 2000.

In July 1999, the **Edwards Mill Dam** was breached. No observations were made at the Edwards dam prior to its removal.

ATLANTIC SALMON

The Atlantic Salmon Commission (ASC) has, in recent years, been monitoring salmon usage of Togus Stream, Bond Brook, and other tributaries to the Kennebec River

below Augusta. Because of the lack of fish passage above Augusta the ASC has had limited activities above that point.

Now that the Edwards Dam is no longer an impasse it is the intention of the ASC to evaluate the available habitat upstream from Augusta beginning in summer2000. ASC will coordinate efforts with the Dept. of Marine Resources, Inland Fisheries and Wildlife, and other groups that want to be involved.

The ASC plans to hire a Biologist and technician to work on rivers south of the Penobscot River to begin on July 1, 2000. The extent of ASC efforts will include the main stem of the Kennebec and all tributaries up stream to the first obstacle. The ASC will examine available habitat, including some water quality parameters and will sample for resident fish species and evidence of salmon spawning (redds) during appropriate seasons. A complete report of ASC activities on the Kennebec River will be available at the close of the 2000 field season.

AMERICAN EEL:

The Lower Kennebec River Comprehensive Hydropower Settlement Accord requires that KHDG dam owners and DMR, in consultation with National Marine Fisheries Services (NMFS) and USFWS, and subject to approval by FERC, undertake a three-year research project to determine: 1) the appropriate placement of upstream passage for American eel at each of the seven KHDG facilities based upon field observations of where eels are passing or attempting to pass upstream at each facility, and 2) appropriate permanent downstream fish passage measures, based upon radio telemetry and other tracking mechanisms and field observations.

Upstream passage methods

The primary objective of this study is to determine where juvenile eels pass or attempt to pass upstream at each of the seven KHDG facilities. Secondary objectives are to determine the timing of the upstream migration, the magnitude of the migration, and the size distribution of the migrants. This information should increase the efficiency and decrease the cost of the final passage design.

The DMR typically uses portable passages to monitor upstream eel migration and determine the appropriate placement of permanent upstream passage facilities. Each portable passage is a self-supporting wooden trough, six feet long, one foot wide, and four inches deep. The bottom of the trough is covered with nylon mesh on which the eels climb, and an aluminum cover discourages predators. Water is allowed to trickle down the nylon mesh to keep it moist and to attract eels. All eels which climb the passage are captured and retained alive in a bucket suspended from the top. These portable units can be easily moved to determine where eels congregate at each facility.

In 1999, the DMR installed portable upstream passages at five of the seven KHDG facilities. Likely locations for the passages had been scoped at each site during the fall of 1998. Two passages were installed on June 3 at the Ft. Halifax Project and were left in place until September 16. An enormous number of eels arrived at Ft. Halifax in June and prevented installation of passages at other locations until later in the season. One

passage was installed at the Benton Falls Project on June 4, but was not activated until June 21. On June 25, we replaced it with an elver fyke net set immediately below the dam; the net was removed on September 16. A passage was installed near the tailrace at the Hydro-Kennebec Project on June 29 and a second on July 3, below the spillway gate; both were removed on September 16. Installation of a passage at the Lockwood Project, also scheduled for the first week in June, was delayed because of flow conditions and safety concerns. At the request of the DMR, Florida Power and Light erected higher flashboards on the eastern 25' of the dam. They were intended to create an area of reduced flow, attractive to eels, immediately below the dam. Unfortunately, flow over the east side of the dam remained high, and installation of a passageway immediately below the dam was not possible. One passage finally was installed at the Lockwood Project on July 13 and one at the Shawmut Project on July 20; both were removed on August 13.

After the first 24-hour sampling period at Ft. Halifax, it became clear that the number of migrating eels at this site far exceeded the capacity of the portable passages. In addition, leakage under the flashboards along the southern 220' of the dam made it impossible to attract migrating eels to a confined area where passage entrances could be located. We assumed all eels which had used the passages and those which left the main channel of the river and were on the ledge or in pools immediately below the dam were attempting to migrate upstream. To estimate the total magnitude of the migration, eels immediately below the dam were collected with dip nets and were combined with eels that had used the passages.

In general, passages were operated Monday through Friday and were tended once a day, except for those at Ft. Halifax, which often were visited during the day and at night (9 PM - 2 AM) during June. The passages at Halifax were not operated for several days between June 16 - June 21 because of field work in Boothbay Harbor. On several occasions, the passages at Hydro-Kennebec and Benton Falls were damaged or rendered inoperable by high flows. When the number of eels captured at a site was less than 150, all eels were measured and total weight recorded. When catches exceeded 150, all eels in a subsample were weighed and measured, and the total weight of the remaining eels was determined. After biological data were recorded, eels were released above the dam into the headpond. Environmental data were also recorded daily. On July 8, we sacrificed a sample of 50 eels from Ft. Halifax for age determination from otoliths.

Ft. Halifax

Approximately 551,262 eels were passed over the Ft. Halifax dam between June 4 and September 15 (Fig. 6A), but 90% were passed between June 4 and July 9. Eels ranged from 7.2 - 22.8cm total length, with a peak at 10.5 - 11.4cm (Fig. 6B). Although otoliths have not yet been examined, based upon the size distributions seen at Cobbosseecontee Stream, the majority of the eels captured at Halifax probably entered the Kennebec River as glass eels in the spring of 1998.

Benton Falls

An estimated 14, 335 eels were passed over the Benton Falls dam between June 22 and September 16 (Fig. 7A). The migration here showed a different pattern than at Ft.

Halifax. Approximately 71% of the eels were passed from June 22 - July 30, but 26% were collected on a single day (September 16). These eels may represent a portion of the run which was passed at Ft. Halifax in June or they may have been residents in the Ft. Halifax headpond. The median size of eels was similar to those at Halifax (Fig. 7B), but eels less than 10.0cm and greater than 15.9cm were more common at Benton Falls.

Hydro-Kennebec

A total of 683 eels were passed at Hydro-Kennebec from July 5 through September 16 (Figure 8A). The migration appeared to be more protracted and the eels smaller than those captured at the other sites (Figure 8B). The median eel size was 10.0 - 10.4cm total length.

Lockwood and Shawmut

In an attempt to find concentrations of eels, passages were moved to a slightly new location every week during the time they were operated. However, no eels were captured at Lockwood and only a single eel was taken at Shawmut.

Upstream passage results and discussion:

The Ft. Halifax Project appears to impede upstream eel migration. Although tens of thousands of eels congregated at the base of the dam every night during June, the only place more than 12 eels were seen scaling the dam was on the extreme southern end near the retaining wall. We estimate that this slow-moving line of eels contained 100-200 individuals each evening. Permanent upstream passage should be installed at Ft. Halifax as soon as possible at the southern end of the dam. Leakage along the southern 220' of flashboards will have to be reduced or channeled in order to attract eels to the passage entrance. If a collection facility is located in the headpond, this site could be used as a recruitment monitoring station. Installation of a permanent upstream facility would allow DMR personnel to concentrate on the remaining projects.

Eels arriving at Benton Falls appear to leave the main channel and enter a series of small pools in the ledge along the southern portion of the dam (similar to Ft. Halifax). A second field season is needed to determine exactly where permanent upstream passage should be placed. Very few eels were captured at the three projects on the main stem Kennebec River (Lockwood, Hydro-Kennebec, and Shawmut) compared to those on the Sebasticook River, and additional field seasons will be needed at these sites. It is possible that flow conditions impeded, delayed, or altered the migration; passages were not installed sufficiently early in the season or in an inappropriate area; or recruitment was low and insufficient for the Kennebec and the Sebasticook Rivers. We also intend to install passages at the remaining two KHDG facilities (Burnham and Weston) in 2000. Determining the appropriate placement of eel upstream passage may take less than three years of field study at each site.

Downstream migration methods

The primary objectives of this study are to determine the seasonal and diel timing of the downstream migration of adult eels, the behavior of migrating adult eels at hydropower facilities, and the efficiency of various downstream passage measures for adult eels. The study initially will be conducted at the three KHDG facilities on the Sebasticook River because there are weir fisheries for adult eels within the Sebasticook River watershed

and eels for the study can be obtained easily. Radio and possibly ultrasonic telemetry will be used to track the horizontal and vertical movements of eels over time as they approach and pass/attempt to pass the hydropower facility.

During the fall of 1998, DMR personnel scoped the Ft. Halifax, Benton Falls, and Burnham Projects on the Sebasticook River to determine where to deploy telemetry equipment. We determined that three Yagi (aerial) antennae and several underwater antennae ("droppers") would be installed at each site to monitor tagged eels. At each project, one Yagi antenna would detect signals upstream, one would detect signals in the headpond above the dam, and one would detect signals in the water below the dam. In addition, droppers would be used to detect signals at the intake, in the tailrace, and in any bypass facilities.

Work was initiated on this project during late August 1999. Jerry Braley, an eel weir fisherman, was contacted and agreed to provide eels for the study. Three Yagi antennae were installed at the Halifax Project and calibration of each antenna was initiated. In early September, DMR personnel visited Merrie Gallagher at the University of Maine to observe her method of anaesthetizing and operating on eels to insert radio transmitters. In addition, antenna cables and dropper antennae were constructed and installed at Ft. Halifax and calibration of each antenna was begun. We experienced a number of problems with tools and connectors needed to construct the cables and droppers. In mid-September, we began a final calibration of the entire system and experienced problems with the antenna switcher, which required several weeks to solve. Many of our dropper antennae, originally deployed during extreme low water conditions, had to be removed and reinstalled with additional weight and protection after Hurricane Floyd struck on September 16. High flow and resulting spill conditions at Halifax for the remainder of September and October precluded further calibration near the intake, bypass, and minimum flow gate. Following the hurricane, we could not obtain silver eels for tagging. The fisherman's weir had been removed or washed out. After the hurricane, we set fyke nets at several locations along Fifteen Mile Stream and Twenty-five Mile Stream and fished until November 15, but never captured any silver eels.

Downstream passage results and discussion

During the 1999 field season, we encountered and solved a number of equipment problems. In addition, the unusual environmental conditions probably affected the outmigration of silver eels. The extreme drought during the summer, followed by the sudden arrival of Hurricane Floyd, may have resulted in a single peak of outmigrating eels. We intend to deploy and calibrate telemetry equipment beginning July 2000.

TABLE 1. 1999 ALEWIFE STOCKING PLANS – PHASE I LAKES

Sebasticook River

Ponded Area	Location	River Section	Stocking Goal[#]
Plymouth Pond	Plymouth	East Branch	2,880[*]
Douglas Pond	Pittsfield	West Branch	3,150[*]
Pattee Pond	Winslow	Main Stem	4,272[*]
Pleasant Pond	Stetson	East Branch	4,608[*]
Unity Pond	Unity	Main Stem	15,168[*]
Sebasticook Lake	Newport	East Branch	25,728[*]
Lovejoy Pond	Albion	Main Stem	**

Kennebec River

Webber Pond	Vassalboro	Kennebec River	7,512[*]
Wesserunsett Lake	Madison	Kennebec River	8,676[*]
Three Mile Pond	China	Kennebec River	ns
Three Cornered Pond	Augusta	Kennebec River	ns
	TOTAL 1999 STOCKING GOAL:		**71,994[*]**

\# Six adult alewives per lake surface acre
* Stocked in 1999
** Stocked in previous years, but not in 1999
ns These lakes have never been stocked

TABLE 2. HYDROELECTRIC FACILITIES MONITORED FOR DOWNSTREAM PASSAGE, 1999

Dam	FERC #	Body of Water	Town	Location (Fig. 1)
Waverly Avenue	4293	West Branch Sebasticook River	Pittsfield	43
Pioneer	8736	West Branch Sebasticook River	Pittsfield	42
Burnham	-----	Sebasticook River	Burnham	39
Benton Falls	5073	Sebasticook River	Benton	31A
Fort Halifax	2552	Sebasticook River	Winslow	31
Edwards Mill	2389	Kennebec River	Augusta	1

TABLE 3. 1999 ALEWIFE DISTRIBUTION IN KENNEBEC RIVER WATERSHED PHASE I LAKES

HABITAT AREA	SURFACE ACRES	STOCKING GOAL*	NUMBER RELEASED	NUMBER OF TRIPS	% OF TARGET # ACHIEVED	ALEWIVES PER ACRE
Sebasticook Lake	4,288	25,728	24,295	10	94.4	5.7
Unity Pond	2,528	15,168	15,240	7	100.5	6.0
Plymouth Pond	480	2,880	3,029	1	105.2	6.3
Pleasant Pond (Stetson)	768	4,608	4,971	4	107.9	6.5
Douglas Pond	525	3,150	3,178	2	100.9	6.1
Pattee Pond	712	4,272	4,460	3	104.4	6.3
Wesserunsett Lake	1,446	8,676	8,864	4	102.2	6.1
Webber Pond	1,252	7,512	7,820	5	104.1	6.2
TOTALS:	**11,999**	**71,994**	**71,857**	**38**	**102.5**	**6.2**

* Six alewives per lake surface acre

TABLE 4. KENNEBEC RIVER PHASE I LAKES ALEWIFE DISTRIBUTION SUMMARY (1985-1999)

Lake (acres)	Year														
	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985
Sebasticook Lake (4,288):	24,295	26,173	25,835	25,913	25,934	25,911	17,281	2,853	21,030	11,166	24,966	14,850	12,099	8,478	3,567
Plymouth Pond (480):	3,029	3,087	3,043	3,032	3,012	3,002	3,199	2,903	2,921	2,530	2,925	3,027	2,797	1,220	0
Pleasant Pond (768):	4,971	4,912	4,669	4,718	4,628	4,789	2,224	3,546	4,689	3,475	4,614	2,648	2,688	0	0
Douglas Pond (525):	3,178	3,243	3,251	3,349	3,229	3,333	3,504	3,188	3,150	2,959	3,257	3,099	2,286	525	0
Lovejoy Pond (324):	0	2,016	2,042	2,045	2,000	2,008	699	1,952	1,976	2,077	1,741	2,055	1,949	0	0
Pattee Pond (712):	4460	4,295	8,556	4,366	4,316	4,315	4,450	4,287	4,327	3,919	4,363	3,393	4,031	0	0
Unity Pond (2,528):	15,240	15,313	15,366	15,312	15,961	15,343	3,125	2,845	4,632	559	3,301	0	0	0	0
Webber Pond (1,252):	7,820	5,241	2,548	0	0	0	0	0	0	0	0	0	0	0	0
Wesserunsett Lake(1,446):	8,864	8,868	8,855	8,706	0	0	0	0	0	0	0	0	0	0	0
Total:	**71,857**	**73,148**	**74,165**	**67,441**	**59,080**	**58,701**	**34,482**	**21,574**	**42,725**	**26,685**	**45,167**	**29,072**	**25,850**	**10,223**	**3,567**

TABLE 5. 1999 ALEWIFE DISTRIBUTION BY TRIP IN KENNEBEC RIVER WATERSHED PHASE I LAKES

DATE	LOCATION*	NUMBER LOADED	NUMBER MORTS	NUMBER RELEASED
5/16/99	Unity Pond	851	0	851
5/17/99	Pleasant Pond (Stetson)	797	0	797
5/18/99	Unity Pond	1,477	0	1,477
5/19/99	Sebasticook Lake	1,029	0	1,029
5/20/99	Sebasticook Lake	963	0	963
5/21/99	Sebasticook Lake	1,678	0	1,678
	Sebasticook Lake	2,600	0	2,600
	Unity Pond	1,516	0	1,516
	Sebasticook Lake	2,307	0	2,307
5/22/99	Sebasticook Lake	3,160	0	3,160
	Pattee Pond	1,718	4	1,714
	Sebasticook Lake	3,315	1	3,314
	Unity Pond	1,427	0	1,427
5/23/99	Unity Pond	3,154	0	3,154
	Patte Pond	1,512	0	1,512
	Webber Pond	1,587	0	1,587
5/25/99	Pleasant Pond (Stetson)	1,050	0	1,050
5/27/99	Webber Pond	1,307	0	1,307
5/28/99	Patte Pond	1,235	1	1,234
	Wesserunsett Lake	2,367	0	2,367
5/29/99	Sebasticook Lake	3,257	2	3,255
	Douglas Pond	1,579	1	1,578
	Unity Pond	3,317	1	3,316
5/30/99	Plymouth Pond	3,030	1	3,029
	Douglas Pond	1,600	0	1,600
	Wesserunsett Lake	3,290	0	3,290
	Webber Pond	990	0	990

(continued next page)

TABLE 5. Continued

5/31/99	Wesserunsett Lake	1,612	1	1,611
	Sebasticook Lake	3,120	3	3,117
	Wesserunsett Lake	1,596	0	1,596
	Sebasticook Lake	2,872	0	2,872
6/1/99	Unity Pond	3,499	0	3,499
	Webber Pond	2,464	0	2,464
	Webber Pond	1,472	0	1,472
6/2/99	Pleasant Pond (Stetson)	1,427	0	1,427
	Pleasant Pond (Stetson)	1,697	0	1,697
Total Fish:		**71,872**	**15**	**71,857**
Total Days:	**16**			
Total Trips:	**36**			

* Within a date, locations are in order which they were stocked

TABLE 6. ALEWIFE TRAPPING AND DISTRIBUTION FROM EDWARDS DAM, KENNEBEC RIVER - 1999

	# of Alewives*		Trucking				
Date	Pumped	Pump Mortalities	Loaded	Mortalities	Released	Biological Samples	Released Below Dam
May 10	50	0	0	0	0	50	0
11	***	0	0	0	0	0	0
12	5	0	0	0	0	0	5
13	84	0	0	0	0	50	34
14	243	0	0	0	0	0	243
15	***	0	0	0	0	0	0
16	851	0	851	0	851	0	0
17	847	0	797	0	797	50	0
18	1,477	0	1,477	0	1,477	0	0
19	1,029	0	1,029	0	1,029	0	0
20	1,013	0	963	0	963	50	0
21	8,101	0	8,101	0	8,101	0	0
22	9,620	0	9,620	5	9,615	0	0
23	9,965	0	9,965	0	9965	0	0
24	430	0	0	0	0	50	380
25	2,062	0	2,062	0	2,062	0	0
26	110	0	0	0	0	0	110
27	1,357	0	1,307	0	1,307	50	0
28	3,602	0	3,602	1	3,601	0	0
29	8,153	0	8,153	4	8,149	0	0
30	8,910	0	8,910	1	8,909	0	0
31	9,250	0	9,200	4	9,196	50	0
1	8,521	10	8,461	500	7,961	50	0
2	4,124	0	4,124	30	4,094	0	0
3	293	0	293	1	292	0	0
TOTALS:	**80,047**	**10**	**78,915**	**546****	**78,369**	**400**	**772**

* Includes alewives that were stocked in the Kennebec River drainage and other river drainages
** Represents a 0.69% trucking mortality
***Pump not operated on this day

TABLE 7. DISPOSITION OF KENNEBEC RIVER ALEWIVES DISTRIBUTED IN LOCATIONS OTHER THAN PHASE I LAKES – 1999

DRAINAGE	DATE	LOCATION	NUMBER LOADED	MORTALITIES	NUMBER RELEASED
KENNEBEC RIVER:	5/23/99	Pleasant Pond (Gardiner)	3,712	0	3,712
	5/25/99	Pleasant Pond (Gardiner)	1,012	0	1,012
TOTAL:			**4,724**	**0**	**4,724**
ANDROSCOGGIN:	6/1/99	Taylor Pond	1026	500	526
	6/2/99	Taylor Pond	1000	30	970
	6/3/99	Sabattus Pond	293	1	292
TOTAL:			**2,319**	**531**	**1,788**
GRAND TOTAL:			**7,043**	**531**	**6,512**

TABLE 8. JUVENILE ALEWIFE SAMPLES FROM PHASE I LAKES – 1999

Lake	Stocking Density	# Seine Hauls	# Dip Net Attempts	# Fyke Net Sets	# of Juveniles
Sebasticook Lake	5.7	1/3	0/0	0/1	50
Unity Pond	6.0	3/4	0/0	0/0	143
Plymouth Pond	6.3	1/2	1/1	0/0	100
Pleasant Pond	6.5	0/0	3/3	0/0	121
Douglas Pond	6.1	0/0	0/0	0/0	0
Pattee Pond	6.3	0/3	0/0	1/1	24
Wesserunsett Lake	6.1	1/2	1/1	0/0	100
Webber Pond	6.2	0/0	0/0	1/1	50
TOTALS:		**6/14**	**5/5**	**2/3**	**588**

Notes:
Stocking density is adult alewives per lake surface area
# of seine hauls is the # of hauls producing alewives/total # of hauls (seasonal total)
# of dip net attempts is the # of dips producing alewives/total # of dips (seasonal total)
fyke net sets is the # of sets producing alewives/total # of sets (seasonal total)
of juveniles is the total # of juveniles measured (seasonal total)

TABLE 9. LENGTHS OF JUVENILE ALEWIVES SAMPLED IN PHASE I LAKES - 1999

Date	Length	Pattee Pond	Pleasant Pond	Plymouth Pond	Sebasticook Lake	Unity Pond	Webber Pond	Wesserunsett Lake
7/14/99	N =		21					
	mean =		48.43					
7/27/99	N =					42		
	mean =					53.27		
8/4/99	N =					50		
	mean =					63.26		
8/12/99	N =			50				
	mean =			73.42				
8/11/99	N =							50
	mean =							44.64
8/16/99	N =						50	
	mean =						122.69	
8/24/99	N =					50		
	mean =					75.32		
8/27/99	N =			50	50			
	mean =			75.86	119.09			
8/30/99	N =							50
	mean =							44.46
9/1/99	N =		50					
	mean =		70.80					
9/24/99	N =		50					
	mean =		84.18					
10/28/99	N =	24						
	mean =	105.96						

* N = number of fish measured on a given day, mean = mean lengths expressed in millimeters

TABLE 10. TRANSFERS OF AMERICAN SHAD BROODSTOCK TO THE WALDOBORO SHAD HATCHERY, 1999

Date	Origin	Trapping Site	#Loaded	#Morts	#In
5/10	Conn. River	Holyoke Lift	78	0	78
5/11	Conn. River	Holyoke Lift	53	0	53
5/17	Conn. River	Holyoke Lift	75	0	75
5/19	Conn. River	Holyoke Lift	75	1	74
5/20	Conn. River	Holyoke Lift	82	1	81
6/1	Conn. River	Holyoke Lift	79	6	73
6/4	Conn. River	Holyoke Lift	80	3	77
6/3	Saco River	Cataract Lift	50	1	49
6/4	Saco River	Cataract Lift	120	0	120
6/10	Saco River	Cataract Lift	50	0	50
6/17	Saco River	Cataract Lift	51	0	51
6/24	Saco River	Cataract Lift	61	0	61
7/8	Saco River	Cataract Lift	35	0	35
7/20	Saco River	Cataract Lift	34	1	33
TOTAL			**923**	**13**	**910**

After the completion of tank spawning operations the surviving 66 shad were released into the Medomak River at head of tide in Waldoboro, Maine on 8/9/99.

TABLE 11. AMERICAN SHAD FRY RELEASES IN THE KENNEBEC AND SEBASTICOOK RIVERS, 1999

RIVER	DATE	# LOADED	TOWN	RELEASE POINT
Kennebec	6/14	374,243	Waterville	Boat Launch
	6/21	490,238	Waterville	Hydro Kennebec Boat Launch
	6/22	651,493	Waterville	Hydro Kennebec Boat Launch
	6/22	504,864	Waterville	Hydro Kennebec Boat Launch
		2,020,838		
Sebasticook	6/16	466,731	Pittsfield	Burnham Dam Tailwaters
	6/18	372,337	Pittsfield	Burnham Dam Headpond
		839,068		

TABLE 12. AMERICAN SHAD FALL FINGERLING RELEASES IN THE KENNEBEC RIVER, 1999

DATE	#LOADED	#MORTALITIES	#RELEASED	TOWN	ACCESS POINT
10/13/99	8,449	0	8,449	Waterville	Hydro Kennebec*
10/14/99	3,128	11	3,117	Waterville	Hydro Kennebec*
10/14/99	1,575	0	1,575	Waterville	Hydro Kennebec*
TOTAL:	**13,152**	**11**	**13,141**		

*Shad stocked into UAH hydro Kennebec headpond from boat launch immediately above project.

TABLE 13. DOWNSTREAM PASSAGE OBSERVATIONS AT LAKE OUTLETS, 1999

DATE	SEBASTICOOK LAKE	PLYMOUTH POND	PLEASANT POND	WESSERUNSETT LAKE
7/13		O	O	X[j&l]
7/29		O	O	
9/1		O	O[j]	S
9/10	S	O	O	S
9/20		O	X[j]	S
9/24	X		O[j]	
10/1		S	X	S
10/6	X	S	X	S
10/15		S	X[j]	X
10/22		S	X	S
10/27				
TOTAL VISITS	**3**	**9**	**10**	**8**

X = Downstream passage available
O = No downstream passage available
= Not surveyed on this day
* = Dead alosids present below outlet
l = Live alosids present below outlet
a = Juvenile alosids using downstream passage facilities
A = Adult alewives using downstream passage facilities
j = Juvenile alosids above outlet
S = downstream passage available only over dam spillway

TABLE 14. DOWNSTREAM PASSAGE OBSEVATIONS AT HYDROELECTRIC FACILITIES, 1999

DATE	FORT HALIFAX	BENTON FALLS	BURNHAM	PIONEER	WAVERLY	HYDRO KENNEBEC
7/13	X	X	X	X	X	O
7/29	X	X[f]	X	X	X	X
9/1					X	
9/10			X	X	X	
9/20		X	X	X	X	
9/24			X	X	X	
10/1			X	X	X	
10/6		X	X	X	X	
10/12	X*[fa]	O*[a]	X			
10/15		X*[a]	X	X	X	
10/22		X	X	X	X	
10/27		X	X			
11/4		X	X			
TOTAL VISITS	**3**	**9**	**12**	**9**	**10**	**2**

X = Downstream passage available
O = No downstream passage available
= Not surveyed on this day
* = Dead alosids present in tailrace
a = Juvenile alosids using downstream passage facilities
A = Adult alewives using downstream passage facilities
f = Juvenile alosids in turbine forbay
s = downstream passage available only over dam spillway

FIGURE 1:

Kennebec River Drainage

ANADROMOUS FISH RESTORATION PROGRAM

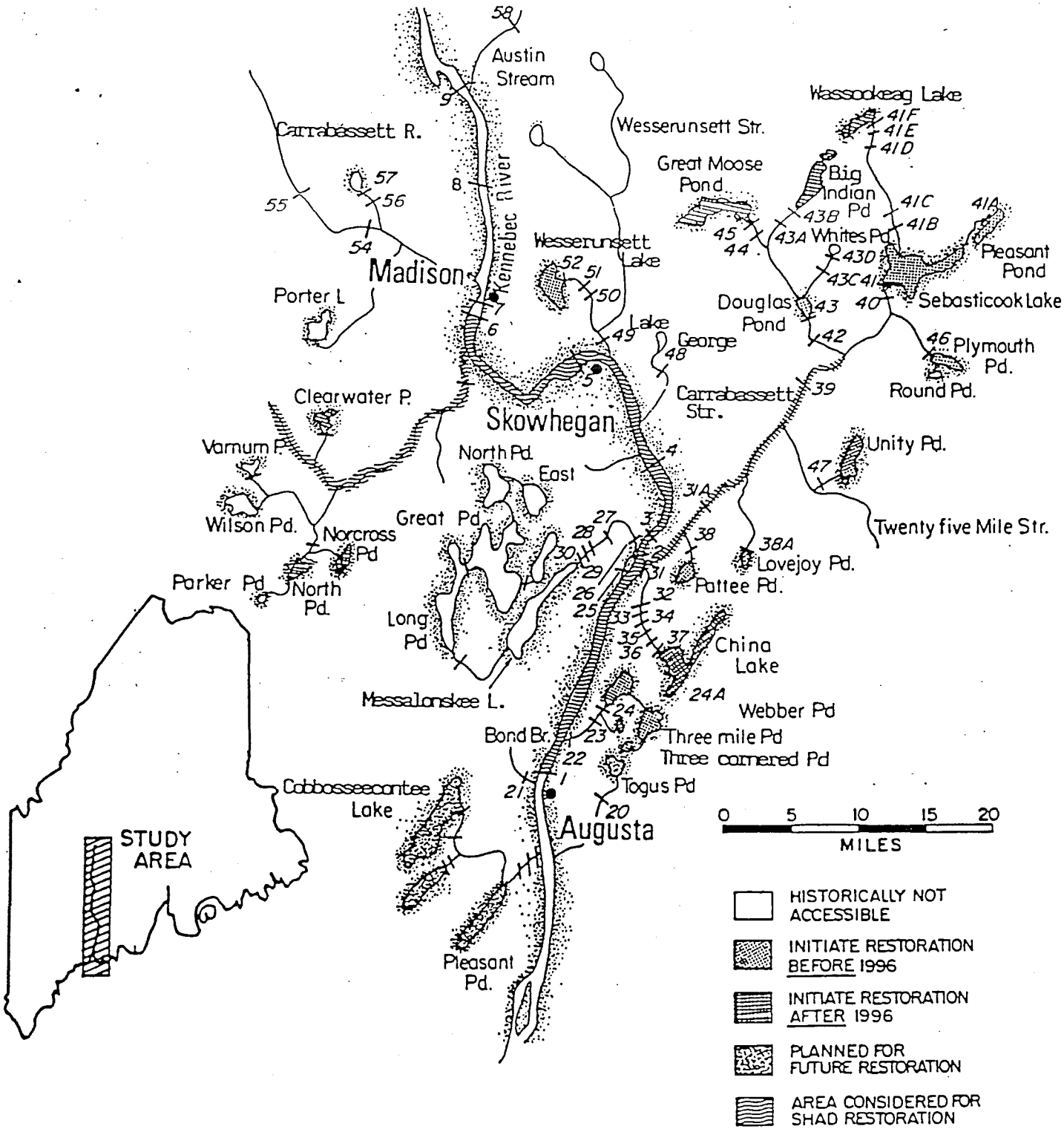


Figure 2. Alewife Handling at Edwards Dam Spring 1999

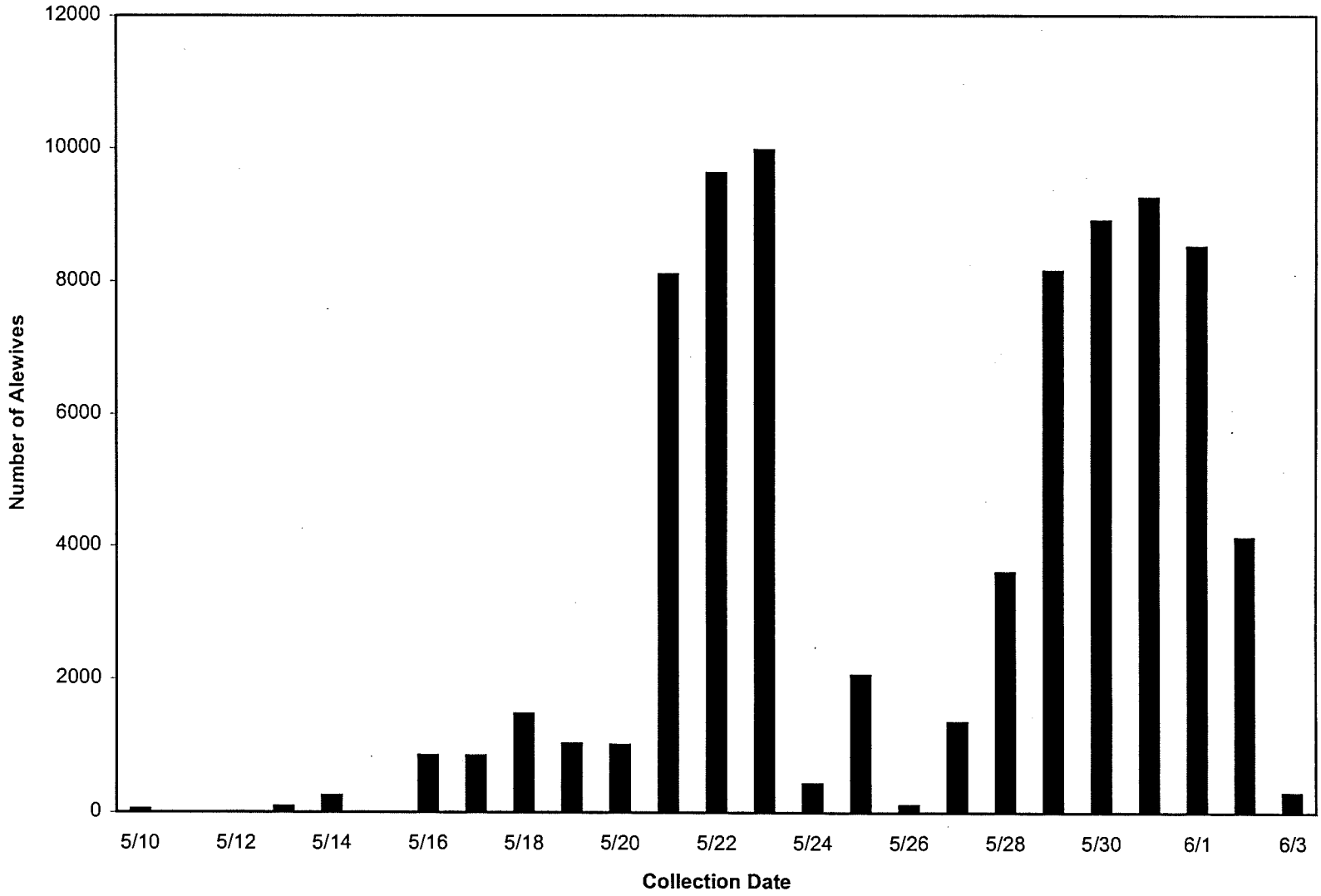


Figure 3. Number of American Shad Fry Released in the Kennebec and Sebasticook Rivers

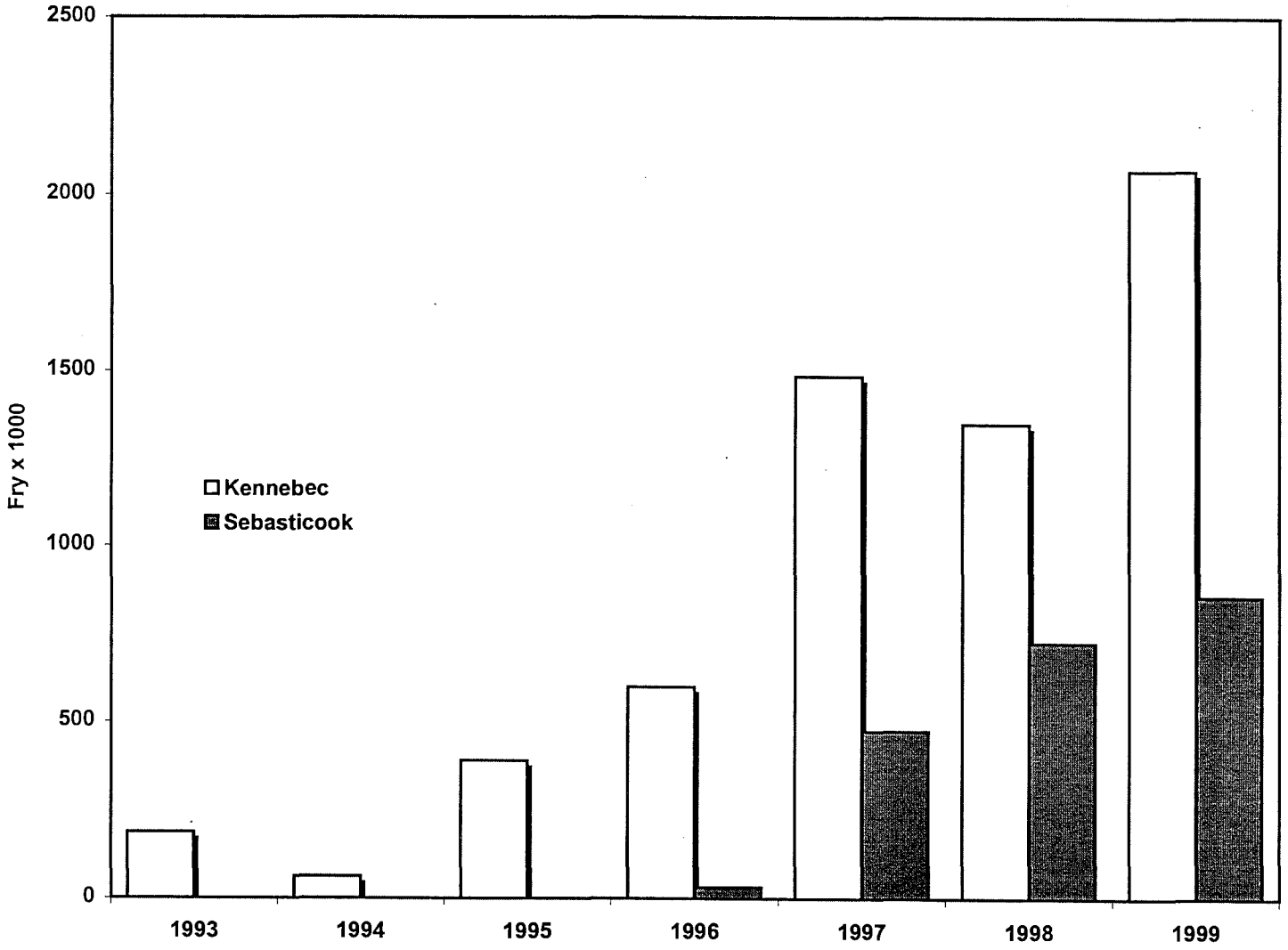


Figure 4. Number of American Shad Fingerlings Released in the Kennebec River

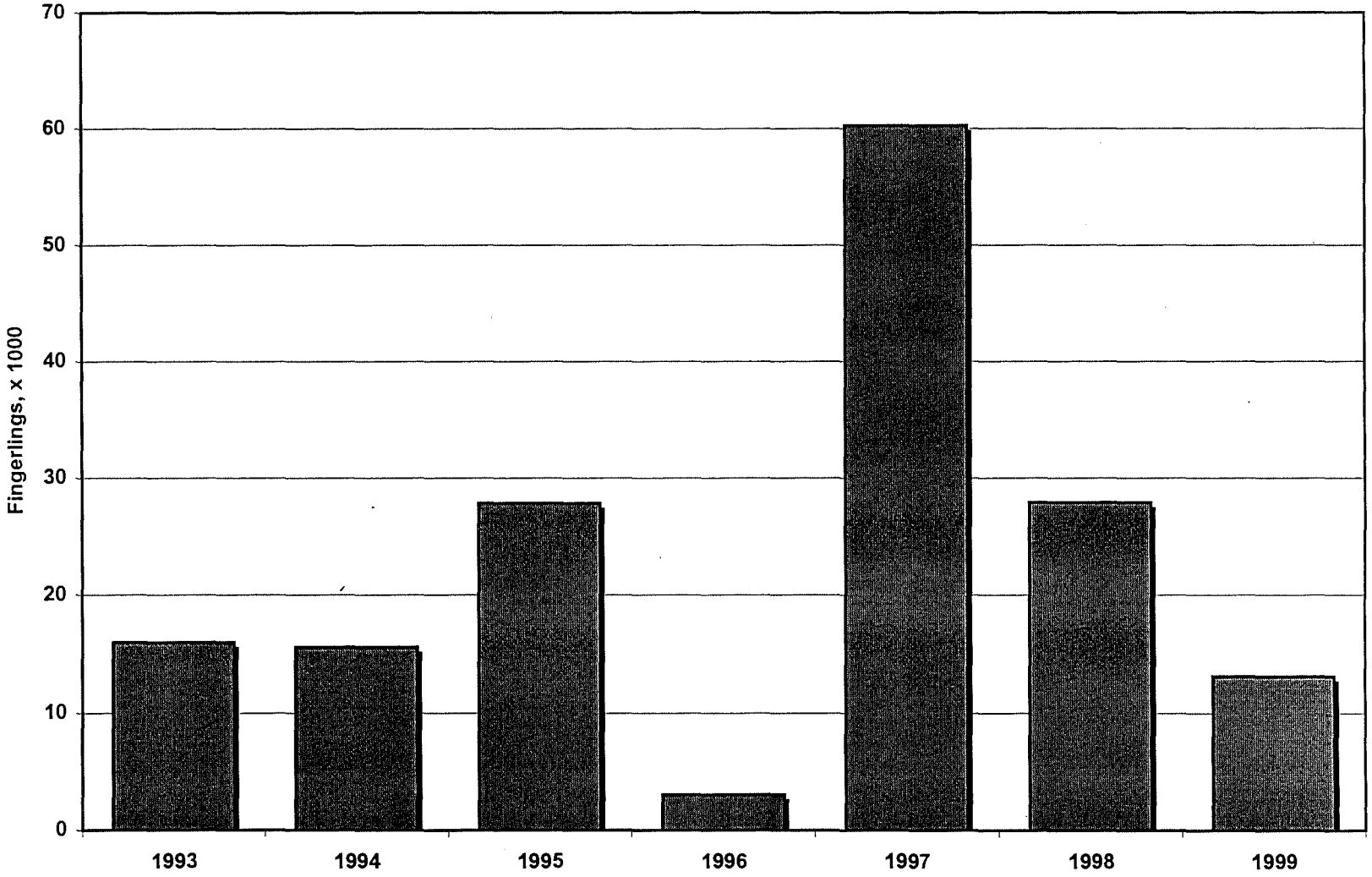
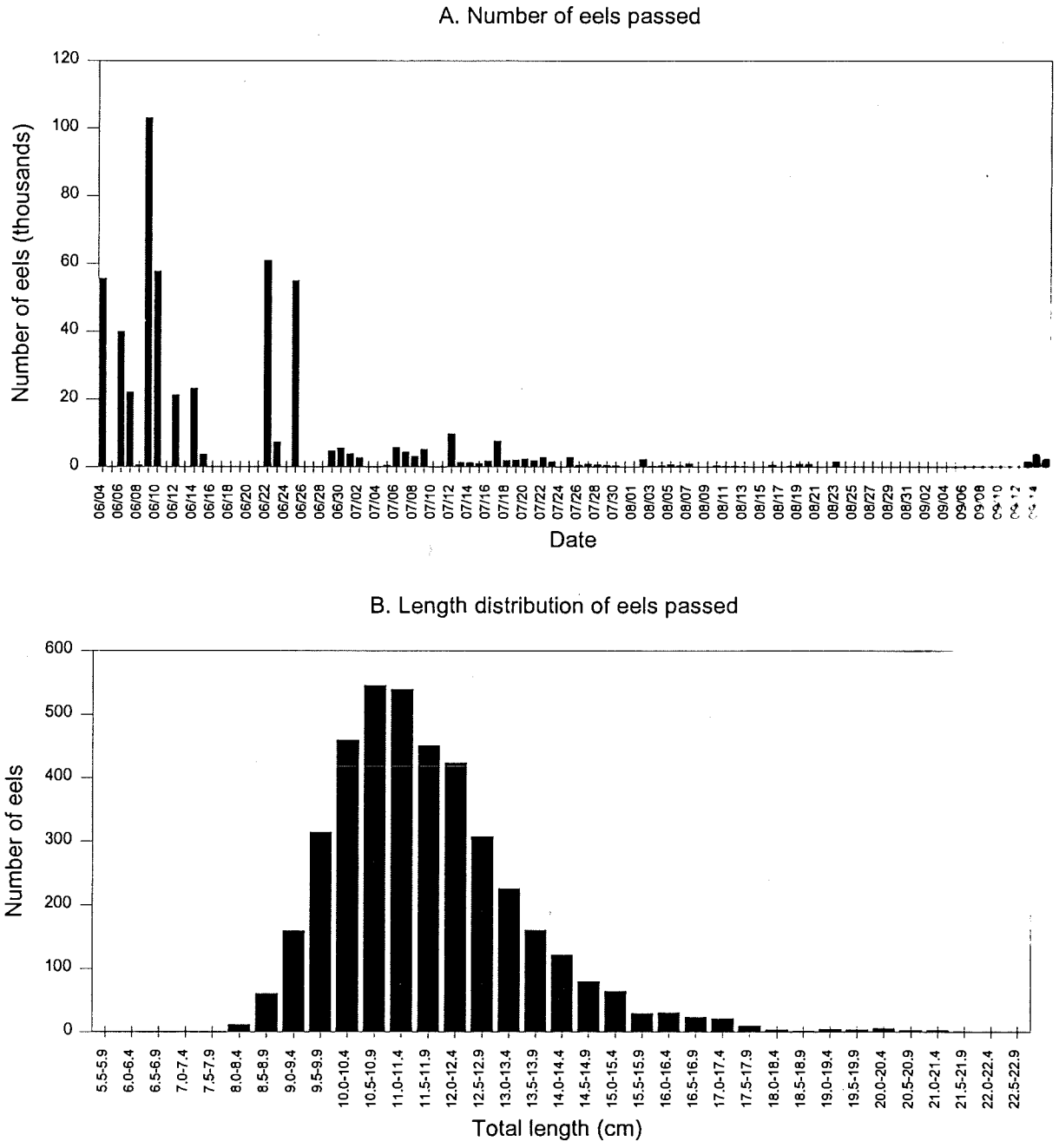


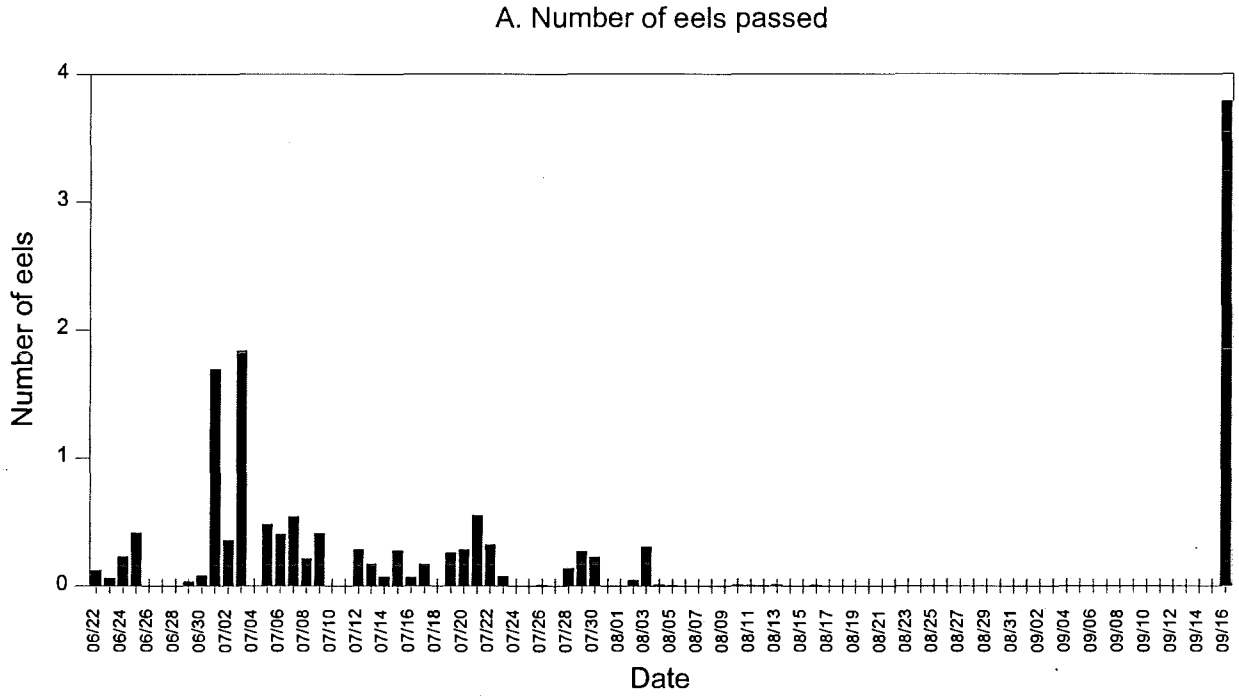
Figure 5. Stetson prior to removal of Archer Sawmill Dam

Figure 6. Stetson Stream after removal of Archer Sawmill Dam. The Town of Stetson was the lead in removal of Archer Sawmill Dam. The partners were; NRCS; USFWS; American Rivers; DMR.

Figure 7. Ft. Halifax, 1999



Figur 8. Benton Falls, 1999.



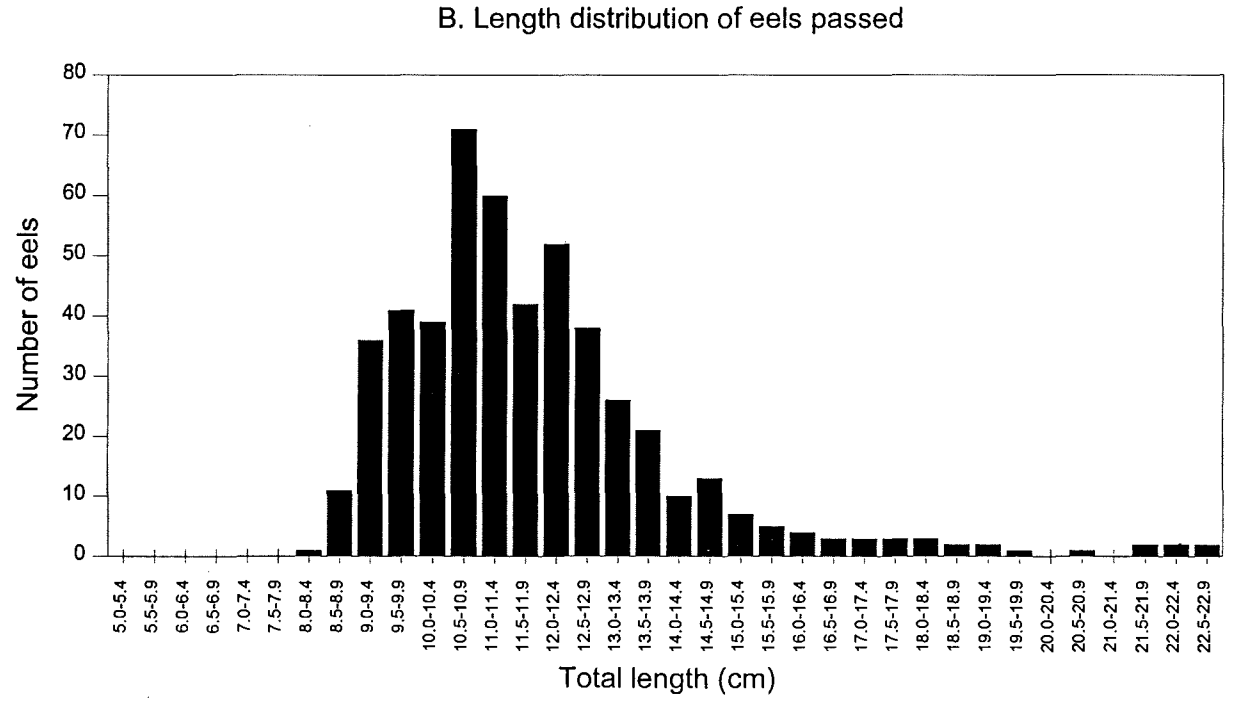
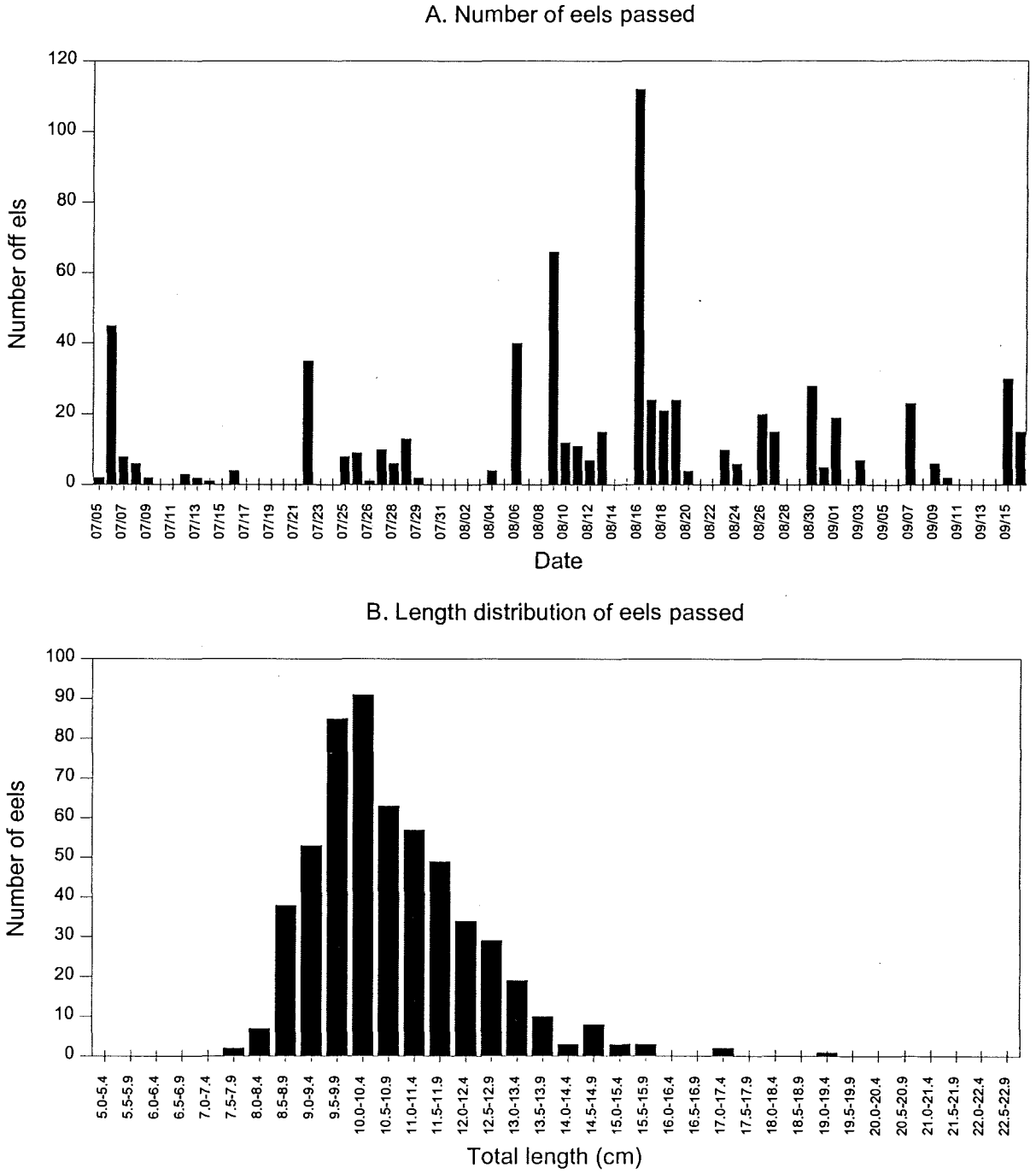


Figure 9. Hydro-Kennebec , 1999.



APPENDIX A

October 26, 1999

Stacy Fitts
Benton Falls Project
Benton Fall Associates
1075 Clinton Avenue
Benton, ME 04901

RE: Benton Falls Fish Kill

Dear Mr. Fitts:

As you are aware, the Department of Marine Resources received a complaint that hundreds of fish were being killed or injured as they passed through the turbines at the Benton Falls Hydroelectric Project (FERC #5073) on October 11, 1999. It was also reported that hundreds of dead fish were observed along the west bank of the river below the facility. The condition of some of these dead fish indicated they had been killed 24 to 48 hours earlier.

DMR's Tom Squiers and Nate Gray investigated this incident on October 12. Significant mortalities had occurred and were continuing at the Benton Falls facility when they arrived at 12:30PM. Hundreds of dead alewives were found near the base of the dam and extended along the west shoreline for at least 1500 feet. All juvenile fish examined were alewives; no juvenile shad were found. Approximately 12 to 20 dead or injured juvenile alosids per minute were observed passing by the west shore, about 1000 feet downstream of the hydro facility. DMR staff also checked the east shore of the river, near the confluence of Pattee Pond Brook and the Sebasticook River, about one-half mile downriver of the dam. Dead juvenile alewives were observed on the shoreline and injured/dead juvenile alosids were seen floating downriver, being fed upon by seagulls and one immature bald eagle. The river was too wide at this point to obtain any quantitative estimate of fish floating downstream; however, it was noted that all the bird activity was limited to this location, indicating significant numbers of dead or injured fish reaching at least one-half mile downstream.

After surveying the river below Benton Falls, Tom Squiers and Nate Gray visited the hydroelectric station and observed that you were in the process of removing debris from in front of dam. The downstream facility was shut down and the turbines were operating. Nate counted approximately 30 dead or injured juvenile alosids per minute being discharged from the large turbine. Tom subsequently interviewed you to determine if you were aware of the fish kill, what caused it, and what was being done to stop the significant mortalities. You indicated that the log boom had broken and caused a significant amount of debris to be released downstream against the powerhouse, clogging the downstream facility; you were in the process of cleaning the debris away from the dam in order to turn the downstream facility back on. You acknowledged that you had only been made aware of the fish kill that morning.

There are two downstream sluices at this site, but normally only the west side sluice is operational. Previous downstream passage studies indicated that under most conditions, the west shore sluice passes the majority of downstream migrating juveniles. Due to the extenuating circumstances, Tom Squiers requested that you operate both sluices. You notified Tom by Voicemail on the afternoon of October 12 that the facility had been cleaned of debris and both sluices were operating.

No significant mortality of downstream migrating fish has been observed at the Benton Falls Hydroelectric site since you cleared the downstream passage facility of debris. It appears clear that the "fish kill" was caused by the ineffectiveness of the downstream passage facility, which had become clogged by debris. Based upon our information, it appears that the facility was not functioning properly on at least October 11 and 12. Based upon the condition and number of dead juvenile alosids on the shoreline, it is also very likely that the downstream passage facility was not functioning effectively on October 10 or prior thereto. You indicated to Tom that you did not work on October 9, 10, and 11, but that another employee checked the site daily. It appears that the downstream facility was not kept clear of trash for at least part of that time period. The broken log boom repair does not excuse the facility's operators for failing to keep the downstream facility operational.

In the future, in order to comply with the terms of your FERC License and State Water Quality Certification conditions for downstream passage, the turbines should be shut down during any time period that you cannot keep the downstream passage facility fully functional or when you close it for cleaning.

Sincerely,

GEORGE D. LAPOINTE
COMMISSIONER

cc: Lewis Flagg, DMR
Thomas S. Squiers Jr., DMR
Nate Gray, DMR
Martha Kirkpatrick, DEP
Dana Murch, DEP
Jeff Pidot, Attorney General's Office
Jon Edwards, Attorney General's Offic
Lee Perry, IF&W
Peter Bourque, IF&W
Steve Timpano, IF&W
Gordon Russell, USFWS
Dan Morris, NMFS
KHDG members
Anton J. Sidoti, Regional Director, Federal Energy Regulatory Commission
Douglas Watts, Augusta, ME
Gerald P. Cates, Kennebec Valley Chapter of Trout Unlimited

Attachments:

Letter from Douglas Watts to the editor of the Kennebec Journal, October 15, 1999
Article by Dwayne Rioux, Maine Lore, Central Maine Newspapers, October 17, 1999
Print outs of digital photos by DMR documenting dead alewives below Benton Falls indicating types of injuries inflicted by turbines

APPENDIX B

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

ANGUS S. KING, JR
GOVERNOR

MARTHA KIRKPATRICK
COMMISSIONER

December 7, 1999

Stacey Fitts, Plant Operator
Benton Falls Hydro Associates
1215 Clinton Avenue
Benton, ME 04901

RE: Violations of Permit/Certification/Water Quality Standards
Benton Falls Hydro Project, FERC No. 5073

Dear Mr. Fitts:

As you are aware, on October 11, 1999 the Department of Marine Resources received a complaint that migrating alewives were being killed or injured at the Benton Falls Project. Upon investigating the complaint the following day, DMR personnel observed significant numbers of dead and injured alewives at the site, and determined that downstream migrating juvenile alewives were being killed or injured as a result of passing through the project turbines, due to the fact that the downstream fish passage facility was clogged with debris and was off-line. DMR reports that the facility was back on-line by the afternoon of October 12. Details of DMR's investigation and findings are included in the enclosed October 26, 1999 letter to you from DMR Commissioner George Lapointe.

A review of the DEP's files reveals the following facts:

- On September 23, 1983, the DEP issued a state hydropower development permit and water quality certification approving the construction and operation of the Benton Falls Hydro Project. Among the conditions of the DEP approval was a requirement that upstream and downstream fish passage be constructed as required by DMR.

- In 1985, DMR began stocking adult spawning alewives in the Sebasticook River drainage above the Benton Falls Project.

- Project construction was completed and the project went on-line during late 1987-early 1998.

- On February 24, 1988, the DEP modified the project permit and water quality certification to incorporate the terms of the 1986 Agreement Between the State of Maine and Kennebec Hydro Developers Group. Under the terms of the 1986 Agreement and the 1988 permit modification, interim downstream passage measures were required at the Benton Falls Project immediately, and permanent downstream passage facilities were required to be installed and operational by December 31, 1991. Also under the terms of the 1986 Agreement and the 1988 permit modification, final design and operational plans for downstream fish passage facilities were to be approved by relevant state and federal agencies, and the efficiency of downstream passage was to be studied.

- Permanent downstream fish passage facilities were installed and became operational at the Benton Falls Project during 1998, three years ahead of the required schedule. The design plans for the facility were reviewed and approved by the Atlantic Salmon Commission, the Department of Marine Resources, and the U.S. Fish and Wildlife Service.

- Following a fish kill of downstream migrating alewives during a NEPOOL-required capacity test at the project during October of 1988, Benton Falls Hydro Associates filed a downstream fish passage operating plan with DEP. The plan stated that the "downstream fish passage will be operated on a twenty-four hour per day basis from June 15 thru [sic] November 30 beginning in 1989." The plan further stated that "plant operators will check downstream fish passage operation, record observations and clean as required debris from the fish passage intake a minimum of twice per day or more frequently during heavy run-off causing added debris in the river." This operating plan was approved without comment by DMR and DEP.

- Downstream fish passage efficiency studies were conducted at the project over a 5-year period (1990-94), in accordance with approved study plans. These studies concluded that the passage facilities in place were up to 99 % effective in passing juvenile and adult alewives.

- On July 31, 1998, the DEP modified the project permit and water quality certification to incorporate the terms of the 1998 Agreement Between Members of the Kennebec Hydro Developers Group, the Kennebec Coalition, the National Marine Fisheries Service, the State of Maine, and the U.S. Fish and Wildlife Service. Under the terms of the 1998 permit modification, Benton Falls Hydro Associates was required to "continue to maintain and operate the permanent downstream fish passage facilities that have been

installed at the project in compliance with the terms of the 1986 KHDG Agreement and prior DEP approval."

It is the DEP's position that, by failing to keep the downstream fish passage facility at the Benton Falls Hydro Project clear of debris and fully operational on or about October 11 & 12, 1999, which resulted in death or injury to migrating juvenile alewives, Benton Falls Hydro Associates: violated the Maine Waterway Development and Conservation Act, 38 MRSA Section 630 et seq., and Section 401 of the Federal Clean Water Act, 33 USC 1251 et seq.; violated the terms and conditions of the hydropower development permit and water quality certification for the Benton Falls Project (DEP Order #02/49-7519-11040 dated September 23, 1983, as amended); violated the terms and conditions of the 1986 KHDG Agreement; caused the Sebasticook River to violate its assigned water quality standards, 38 M.R.S.A. Section 464 et seq; and failed to adhere to the requirements of its approved downstream fish passage operating plan. A Notice of Violation citing these violations is enclosed.

To respond to the violations noted above, Benton Falls Hydro Associates must prepare and implement a plan to keep the downstream fish passage facility clear of debris and fully operational on a continuous basis annually from June 15 through November 30 or, in the event that the downstream fish passage facility is not fully operational or is shut down, to modify project operation to provide an alternate means of safe and effective downstream fish passage. This plan, along with any comments you may have on the results of DMR's investigation, must be filed with DEP within 30 days.

The DEP acknowledges that the project owner constructed permanent downstream fish passage facilities at the project significantly ahead of schedule, and that this has been of benefit to the State's on-going alewive restoration effort. The DEP also acknowledges that studies have shown these facilities to be extremely effective in providing passage for alewives. However, it is obvious that the design and installation of these facilities are only part of the picture—the facilities must also be properly maintained and operated in order to efficiently and effectively pass fish. Lapses in proper maintenance and/or operation of fish passage facilities, especially where these lapses result in the death or injury of migrating fish, cannot be tolerated. To have fish killed or injured as a result of the unavoidable inefficiency of a well-designed, constructed and operated fish passage facility is one thing; to have fish killed or injured as a result of avoidable circumstances arising from project owner/operator action or inaction is another.

As you know, significant commitments of time and money have been made in recent years to support the restoration of alewives and other anadromous fish to the Kennebec River Basin. As a member of the Kennebec Hydro Developers Group, Benton Falls Hydro Associates has played an important role in making these commitments. The DEP expects the company to continue to live up to its commitments, and will work to make sure that other parties to the on-going restoration effort live up to theirs.

The DEP reserves the right to pursue an Administrative Consent Agreement, which may include a monetary penalty, to resolve the violations noted above.

Please call me at 287-3901 if you have any questions.

Sincerely,

Dana Paul Murch

Dana Paul Murch
Dams & Hydro Supervisor

Enclosures
cc: Tom Squires, DMR
Jon Edwards, DAG
Ron Keisman, Kennebec Coalition
Laura Rose Day, NRCM
Anton Sidoti, FERC
Gordon Russell, USF&WS
Matt Kearns, FPL Energy
Bill Fiedler, Hydro-Kennebec
Kevin Webb, Ridgewood Maine Hydro Partners

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STATE OF MAINE

Department of Environmental Protection

BUREAU OF LAND & WATER QUALITY
17 STATE HOUSE STATION, AUGUSTA , MAINE 04333
TELEPHONE: 207-287-3901

--NOTICE OF VIOLATION--

NAME: Benton Falls Hydro Associates	NOV NUMBER: WQC99-0100
ADDRESS: 1215 Clinton Avenue Benton, ME 04901	DATE OF ISSUANCE: December 7, 1999
	TELEPHONE NO. 453-9703
PERSON TO CONTACT AT SOURCE: Stacey Fitts, Facility Operator	LICENSE NO. L-02/49-7519-11040, as amended

DISTRIBUTION: case file [x], enforcement file [x], attorney general [x], FERC [x]

You are hereby notified that you or your company is considered responsible for a violation or violations of Maine environmental laws, regulations or orders. This matter is subject to enforcement action under the provisions of 38 M.R.S.A. Sections 347-A, 348 and 349 and/or other applicable regulations or statutes.

SUMMARY OF VIOLATIONS:

By failing to keep the downstream fish passage facility at the Benton Falls Hydro Project clear of debris and fully operational on or about October 11 & 12, 1999, which resulted in death or injury to migrating juvenile alewives, Benton Falls Hydro Associates: violated the Maine Waterway Development and Conservation Act, 38 MRSA 630 et seq., and Section 401 of the Federal Clean Water Act, 33 USC 1251 et seq.; violated the terms and conditions of the hydropower development permit and water qulaity certification for the Benton Falls Project (#02/49-7519-11040 dated September 23, 1983, as amended), violated the terms and conditions of the Agreement Between the State of Maine and Kennebec Hydro Developers Group (effective January 22, 1987); caused the Sebasticook River to violate its assigned water quality standards, 38 M.R.S.A. Section 464 et seq.; and failed to adhere to the requirements of its approved downstream fish papssage operating plan.

CORRECTIVE ACTION REQUIRED:

Benton Falls Hydro Associates must prepare and implement a plan to keep the downstream fish passage facility clear of debris and fully operational on a continuous basis annually from June 15 through November 30 or, in the event that the downstream fish passage facility is not fully operational or is shut down, to modify project operation to provide an alternate means of safe and effective downstream fish passage.

YOU MUST RESPOND TO THIS NOTICE BY: JANUARY 7, 2000

ENFORCEMENT OFFICER: Dana Murch TELEPHONE: 287-3901	CERTIFIED MAIL: Z 355 655 780