Status of the Kennebec River Watershed Anadromous Fish Restoration Program

Prepared for the Joint Standing Committee
on Marine Resources

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Executive Summary

The restoration of anadromous fish to the Kennebec River and its tributaries is proceeding on schedule. The trap and truck program for alewives, which were initially collected from the Androscoggin River in 1987, followed by the former Edwards Dam in Augusta, and most recently from the Fort Halifax Dam in Winslow, has generated an annual migration run between one and two million alewives to the Sebasticook River alone. In addition, American shad restoration has also been proceeding according to schedule; Department of Marine Resources' (DMR) scientists estimate that a little over 2,000 adult shad returned to the system in 2003 from previous years' stocking efforts. Over the last five years, DMR have stocked over 14 million shad fry into the Kennebec River and almost five million to the Sebasticook River.

Fish passage systems have been provided at six dams in the past five years. The most significant was the removal of the Edwards Dam, which had blocked upstream passage of *all* migratory fish species since the mid 1800s. Its removal in 1999 allowed species such as alewives, American shad, striped bass, Atlantic salmon, rainbow smelt, and shortnose and Atlantic sturgeon to migrate to the Waterville-Winslow area for the first time in over 160 years. As an interesting aside, DMR staff has observed a seal in the Waterville area the past two seasons as it followed the alewife migration upriver.

Fish passage has also been incorporated in dams in the upper Sebasticook River drainage. These include the removal of the Guilford Dam in Newport, a pool-and-chute fishway at the Sebasticook Lake outlet dam in Newport, a fish ladder at the Plymouth Pond outlet dam in Plymouth, and a fish ladder at the Pleasant Pond dam in Stetson, with subsequent removal of the decrepit Archer sawmill dam downstream.

The 1998 Agreement between members of the Kennebec Hydro Developers Group, state and federal agencies, as well as nongovernmental environmental groups, requires that upstream fish passage be completed at the larger hydroelectric dams, Benton Falls and Burnham, one year after fish passage is completed at the Guilford and Sebasticook Dams, the Plymouth Pond Dam, and the Pleasant Pond Dam. A fish lift was required at Fort Halifax Dam by May 1, 2003 or it was to be breached in 2003. Despite a year-long delay in the federal approval process, the Federal Energy Regulatory Commission has just ruled that the Fort Halifax Dam in Winslow can be breached. Its removal, combined with fish passage installation at the next two dams upstream this year, will allow anadromous fish to migrate annually from the ocean to the headwaters of the Sebasticook River to complete their spawning cycles. American shad will have access to 28 miles of spawning and nursery habitat and alewives to almost one-half of their historical spawning and nursery habitat.

Section I. History of Restoration in the Kennebec River Watershed

History of the Management Plan

As documented 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 state's 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

Coincidentally 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 its goals and objectives were the same as those of 1985, it allowed dam owners upstream of 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.* Its goal for anadromous fish restoration in the Kennebec River remained the same as that established in 1982:

> "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 in Augusta to the Milstar Dam in Waterville. At the time of the 1993 Agreement, there was an ongoing DMR enhancement program for striped bass that consisted of fall fingerling releases. Since mature striped bass, rainbow smelt, and Atlantic and shortnose sturgeon will not utilize fish passage facilities, the strategy for the restoration of these species was to remove the Edwards Dam. Its removal would also enhance the ongoing shad and alewife restoration program by reducing the cumulative impacts of dams on out-migrating juvenile alosids.

With the end of the KHDG Agreement and the ultimate 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 US Fish and Wildlife Service,* was implemented on May 26, 1998. Under the 1998 KHDG Agreement, DMR continues to be responsible for

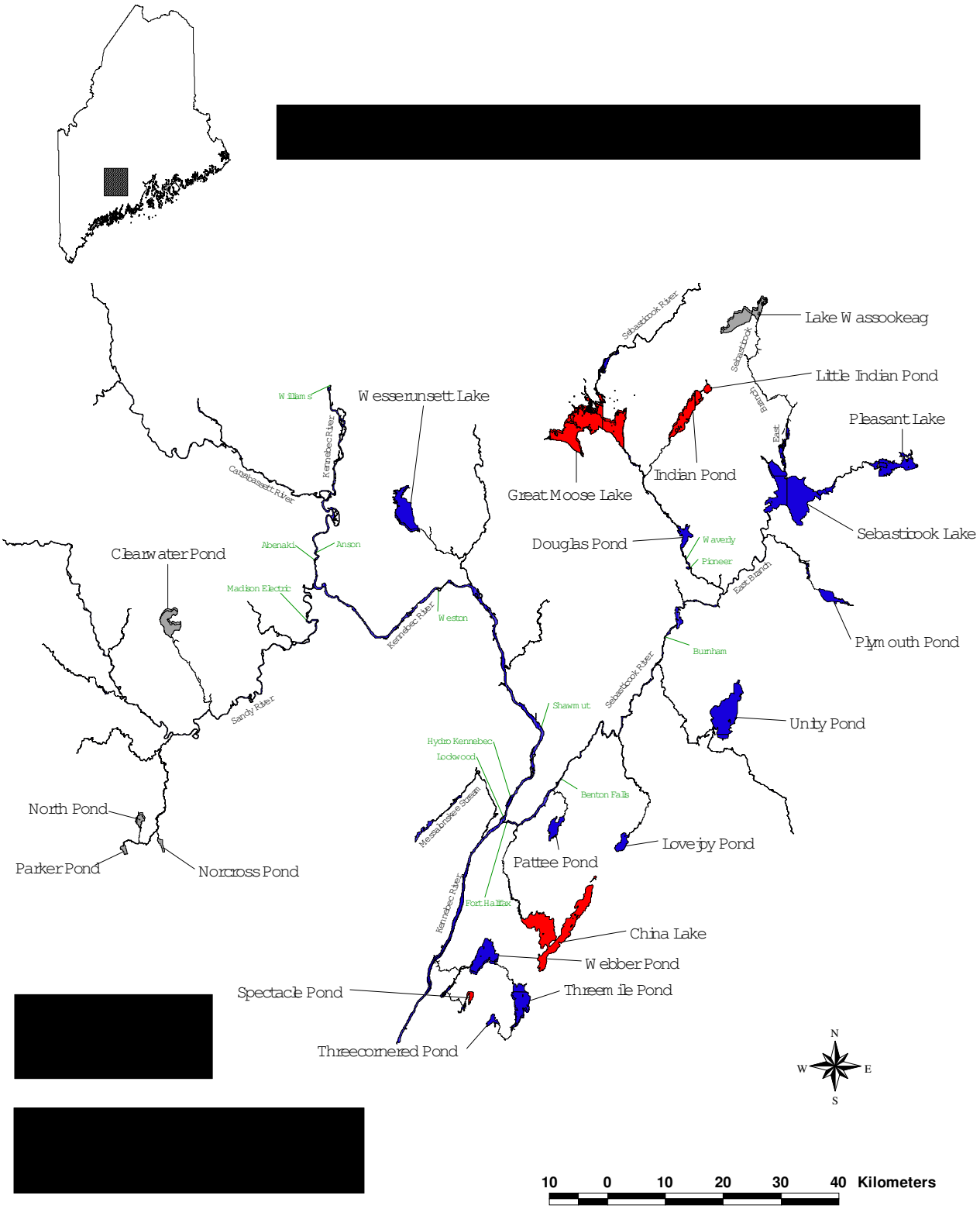
implementing a trap, truck, and release program for anadromous alewives and American shad. DMR is also responsible for ensuring that the goals and objectives identified for the Kennebec River in the 1982 plan are met through monitoring and assessment of anadromous fish species. DMR, KHDG, and the US Fish and Wildlife Service provide funds for the continued implementation of the state fishery agencies' fishery management plan.

Implementation of the Management Plan (1986-2001)

The strategy developed to meet the objectives of alosid restoration was planned in three phases. Phase I (January 1, 1986 through December 31, 2001) involved alewife and shad restoration by means of trap and truck for release into spawning and nursery habitat. Phase II (January 1, 2002 through December 31, 2010), which is ongoing, involves providing upstream and downstream fish passage at Phase I release sites, as well as trap and truck operations to Phase II lakes. Phase III lakes (beginning in 2009) involve two lakes further up in the watershed. **See Figure 1.** 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. However, for several reasons, fish were not obtained at Edwards until 1993. No capture facilities were available during 1987 and 1988; in 1989, however, an experimental fish pump was installed by the owner, but proved to be ineffective in capturing sufficient numbers of fish for release into upriver spawning habitat. As a result, from 1987 through 1992, all the alewife broodstock stocked in Phase I lakes came primarily from the Androscoggin River.

A shift in the source of alewife broodstock occurred in 1993, due to an increased number of adult returns ton the Kennebec below Edwards and the simultaneous decline in the run of the Androscoggin donor stock. In 1993, all adult alewives transferred to upstream habitat were Kennebec River returns and were predominantly trapped by netting. The broodstock 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.

Figure 1


Lake Wassookeag
Little Indian Pond
Pleasant Lake
Wesserunsett Lake
Great Moose Lake
Indian Pond
Sebasticook Lake
Douglas Pond
Clearwater Pond
Plymouth Pond
Unity Pond
Shawmut
Benton Falls
Lovejoy Pond
Pattee Pond
China Lake
Webber Pond
Threemile Pond
Spectacle Pond
Threecornered Pond
North Pond
Parker Pond
Norcross Pond
Sebasticook River
Kennebec River
Carrabassett River
Sandy River
Messalonskee Stream
Abenaki
Anson
Madison Electric
Weston
Hydro Kennebec
Lockwood
Fort Halifax
Burnham
Waverly
Pioneer
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10 0 10 20 30 40 Kilometers

Since 1995, DMR has obtained alewife broodstock exclusively from the Kennebec River. Between 1996 and 1999, the majority of alewives transported were collected using the fish pump at the Edwards Dam. Following the removal of Edwards, the pump was moved upstream to the Fort Halifax Dam in Winslow and all fish transported since that time have been collected at this site.

Due to the increased number of adult alewife returns to the Kennebec River since 1994, DMR typically not only meets Phase I stocking goals, but also has additional alewives available for other restoration sites in Maine. In 1998, alewives from the Kennebec were released into four additional ponds within its drainage and 14 ponds in eight other drainages. In 1999, due to a smaller run, this stocking practice was limited to three ponds in the Androscoggin River. In 2002, a record number of alewives was captured at Fort Halifax and released into 44 ponds throughout the state.

The breaching of the Edwards Dam in 1999 and resultant fish passage, coupled with the dewatering of the impoundment previously created by the dam, also allowed natural restoration of the Kennebec River above Augusta. An important component of this restoration was the access to spawning and nursery areas for *all* anadromous fish species, including striped bass, rainbow smelt, and shortnose and Atlantic sturgeon, none of which 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 to ensure that those fish trapped below were able to spawn upstream.

Under the 1998 KHDG Agreement, an interim trapping facility was constructed at the Fort Halifax Dam on the Sebasticook River to collect returning adult alewives and American shad in the spring of 2000. This interim facility is slated for use in the trapping and trucking of adults for release upstream through the 2004 spring alewife migration. The Federal Energy Regulatory Commission recently approved an application from the owner of the Fort Halifax Dam, Florida Power and Light (FPL), to decommission and partially breach this dam. It is anticipated that it will be breached in the summer of 2004,

pending approval of additional permits from the Maine DEP, the Army Corps of Engineers, and the Town of Winslow.

Under Phase I of the restoration plan, only those lakes approved by the Department of Inland Fisheries & Wildlife (IFW) were to be stocked with six alewives per surface acre. Of the 11 lakes and ponds listed under Phase I, only eight were stocked at the beginning of the program in 1987; Wesserunsett Lake was stocked beginning in 1996, and Threemile Pond in 2001. Restoration at the ten remaining impoundments was contingent upon the outcome of a cooperative research project sponsored by DMR, the Department of Environmental Protection (DEP), and IFW to assess the interactions of alewives with resident smelt and salmonids. In June 1997, IFW confirmed that the Lake George Study indicated no negative impacts of alewife reintroduction on resident fish populations and approved a schedule for stocking alewives into Phase II and Phase III habitat.

In 2002, DMR continued to transfer American shad from out-of-basin to the Waldoboro Shad Hatchery for use as captive broodstock in the tank-spawning program. However, beginning in 2001, DMR collected its prespawner adults from the Merrimack River rather than the Connecticut River. Because of the increased run size on the Merrimack over the past few years and the fact that it is much closer to Maine than the Connecticut River, DMR felt it a logical spot to obtain broodstock[1].

American shad fry production increased in 1997 with the Maine Outdoor Heritage and KHDG-funded expansion of the hatchery facility. The 2000 shad culture operational budget was funded by the DMR and Kennebec River Restoration Fund. In 2002, DMR released more larval shad (2.6 million into the Kennebec watershed) than in previous years. All larval shad raised at the hatchery were marked with oxytetracycline (OTC) prior to release. OTC stains the otoliths (ear bones) of the fry and enables DMR

[1] 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 broodstock American shad have been transferred from out-of-basin (the Connecticut River was the primary source in past years) directly to the Kennebec River since 1997. Rather, DMR has concentrated on providing broodstock for the hatchery's tank spawning effort.

biologists to determine the amount of natural reproduction vs. hatchery-reared shad in the watershed.

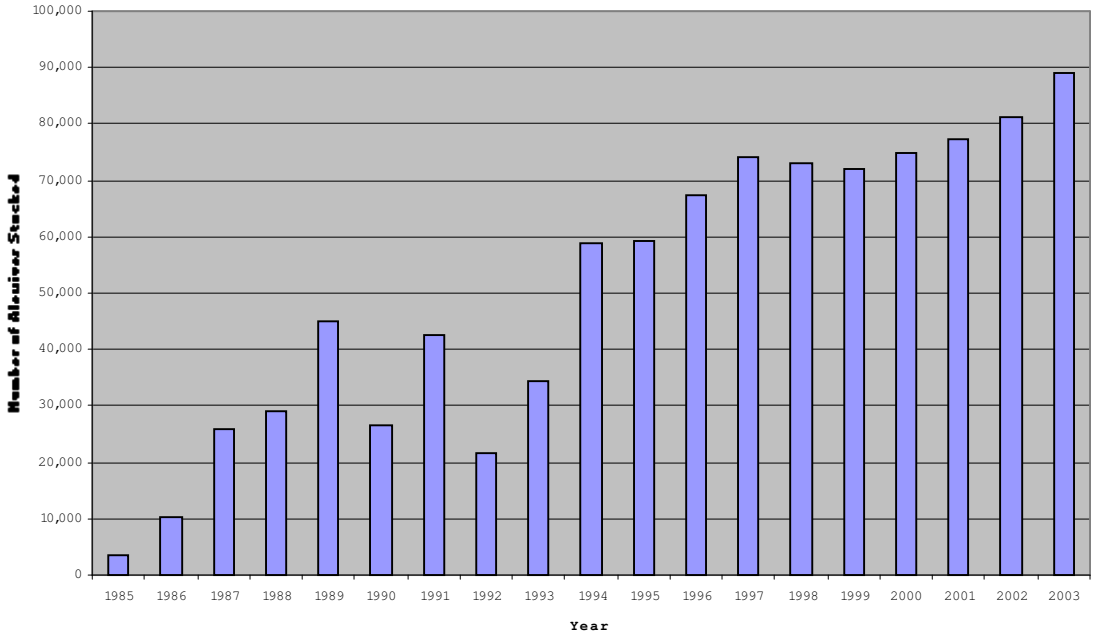
Section II. Restoration of Anadromous Fish in the Kennebec River Watershed

Alewives

Phase I Restoration

As previously discussed, alewives have been restored into Phase I waterbodies at the rate of six adults/surface acre. **Figure 2** depicts the number of alewives that have been stocked into Phase I waterbodies since 1985.

Figure 2: Alewives Stocked into Phase I Habitat, 1985-2003



Beginning in 1994, the number of alewives stocked began to sharply increase for a number of reasons, including more returning alewives available as broodstock for additional lakes; improved trapping, sorting, and trucking methodologies; and improved trapping locations. DMR has been trapping its alewife broodstock on the Sebasticook River at the Fort Halifax Dam, located in Winslow, since 2000. The number of alewives

returning to the Sebasticook River is estimated to be between one to two million alewives, which would make it the largest run of alewives in Maine and one of the largest runs in New England. This estimate is based on return rates in other river systems where known numbers of alewives were stocked and the returning progeny enumerated four and five years later. Full restoration of alewives in the Sebasticook watershed is expected to produce an estimated 4.5 million alewives annually.

Phase II & III Restoration

According to the restoration plan as approved by DMR, IFW, and DEP, Phase II restoration was originally slated to begin in 2001 with the reintroduction of alewives into Great Moose Lake in Hartland, and Big and Little Indian Ponds in St. Albans. In early 2001, DMR conducted a series of public meetings in the Hartland/St. Albans region to better inform the public of the impending restoration program for alewives. Although the scientific data collected during the ten-year Lake George Study determined that the stocking of alewives did not negatively impact resident fish populations or water quality, DMR is continuing to work with IFW staff in addressing the concerns of a few local citizens. **See Appendix I** for a list of public meetings and venues at which DMR presented information regarding the benefits of alewife restoration.

DMR had originally planned to restore the alewife run into China Lake beginning in 2004. However, a season-long survey of the lake's Outlet Stream revealed two significant obstacles to out-migrating alewives, so DMR will not initiate stocking at China Lake this year. DMR is in the process of working with landowners to remove these obstructions and plans to begin restoration of China Lake in 2005.

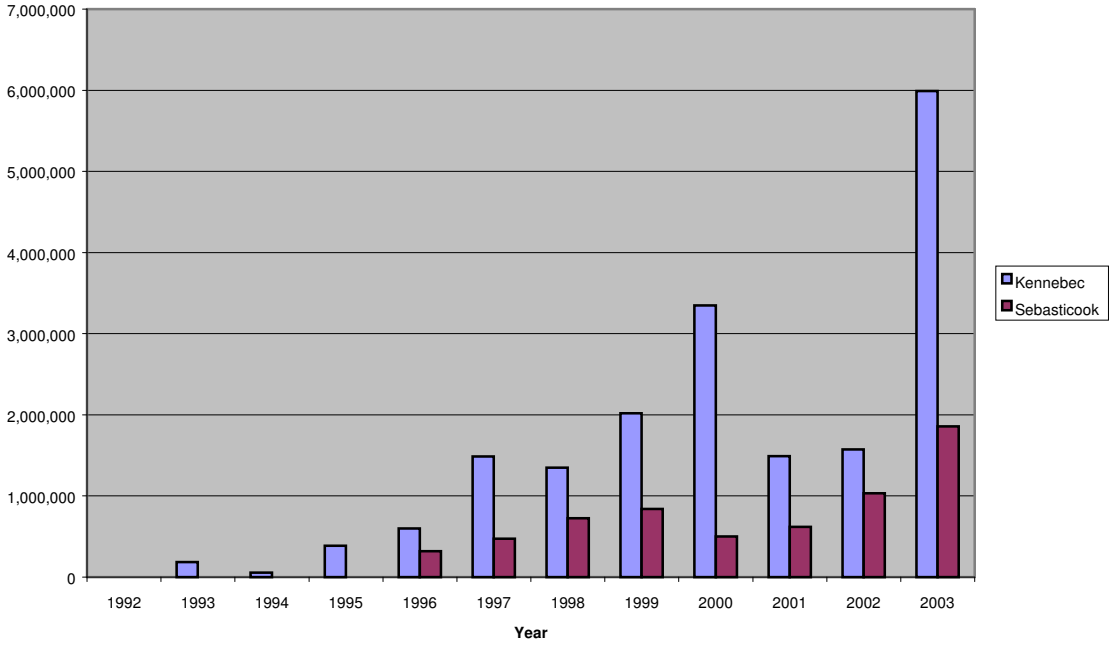
American Shad

In addition to restoring alewives, DMR is also in the process of restoring American shad into the Kennebec and Sebasticook Rivers. Like the alewife, the American shad is also a member of the herring family, but attains a much larger size (4-5 lbs). American shad are a popular sport fish along the entire East Coast.

Each spring, DMR personnel release shad fry into suitable nursery habitat; these fry imprint to the watershed and after spending the summer there, migrate to sea in late summer/early fall. After five to six years at sea, where the majority of their growth takes place, the shad ascend their home rivers to spawn in May and June. Since 1991, DMR has been involved in an experimental shad hatchery program located on the Medomak River in Waldoboro. This project was initially a cooperative program between the Department of Marine Resources, the Town of Waldoboro, and the Time & Tide Mid-Coast Fisheries Development Project. DMR personnel transfer adult shad broodstock to the hatchery from the Merrimack River in Lawrence, Massachusetts. The shad spawn in large tanks at the hatchery and the resulting eggs hatch in four to eight days. Most of the fish are removed from the hatchery in late June or early July and stocked at age 20-40 days old. Prior to release, the shad fry are marked with oxytetracycline (OTC) to identify them as hatchery origin. The OTC mark shows up as a fluorescent-green ring in any calcified structure of the fish, such as vertebrae or otoliths. Since 1993, approximately 18.5 million shad fry have been released into the Kennebec River. Additionally, 6.4 million fry have been released into the Sebasticook River since 1996. **See Figure 3**.

Based on the results of over a decade of research in the successful American shad restoration of the Connecticut River, DMR biologists have estimated the production potential of shad in the Kennebec watershed. **Table 1** shows the yearly, natural production potential by river segment, adjusted for 10% mortality resulting from passage through each hydroelectric facility in the river reach, within the historical range of American shad. **Table 2** shows the number of adult shad that are estimated to return annually to the Sebasticook River based on previous stocking numbers. These estimates are based on the Susquehanna River adult shad returns of one adult shad returning for every 318 fry stocked.

Figure 3: American Shad Fry Stocked into the Kennebec and Sebasticook Rivers, 1992-2003



As previously mentioned, DMR has not conducted a formal mark-and-recapture study to determine the shad population in the watershed. However, FPL Energy Maine Hydro, LLC, the Licensee of the Fort Halifax Dam on the Sebasticook River in Winslow, conducted a limited study in the vicinity of the dam. In 2002, a total of 50 adult American shad were captured by electrofishing near the confluence of the Sebasticook and Kennebec Rivers, while an additional five were captured by angling in the Fort Halifax tailrace[2]. Of these, four females were transported to the hatchery in Waldoboro as broodstock, while the majority of the remaining fish (47) were marked with a Floy tag and a yellow Hallprint tag, and then released back into the river. All shad that were released were also marked with an upper caudal clip[3]. Under the right conditions, shad were observed in large numbers in this area. Smaller schools were occasionally observed

[2] FPL Energy Maine Hydro LLC and Normandeau Associates, Inc. 2003. *FPL Energy Maine Hydro LLC Diadromous Fish Passage Efforts in the Lower Kennebec River Watershed During the 2002 Migration Season*.

[3] Ibid.

Table 1. Annual Production Numbers for American Shad for the Kennebec River Watershed above Augusta[1]

River Segment	Habitat Units (100 sq. yd.)	Potential Shad Production[2]	Potential Shad Production With 10% Downstream Mortality[3,4]
Sandy River above Madison Electric Dam, Madison	36,370	83,650	44,455 (5)
Kennebec River above Weston Dam, Skowhegan	55,869	128,498	75,877 (4)
Kennebec River from Shawmut Dam, Fairfield to Weston Dam	61,252	140,879	92,431 (3)
Kennebec River from Hydro Kennebec Dam, Waterville to Shawmut Dam	25,314	58,221	42,443 (2)
Kennebec River from Augusta to Lockwood Dam, Waterville	63,066	145,053	130,547 (1)
Sebasticook River above Burnham	22,986	52,867	34,686 (3)
Sebasticook River from Benton Falls to Burnham Dam, Burnham	20,847	47,948	34,954 (2)
Sebasticook River from Fort Halifax Dam, Winslow to Benton Falls, Benton	14,199	32,658	26,453 (1)
Total Kennebec	**205,501**	**472,651**	**341,298**
Total Sebasticook	**58,032**	**133,473**	**96,093**
Total, Kennebec watershed above Augusta	**263,533**	**689,774**	**481,846**

[1] Based on 10% downstream mortality at each hydroelectric dam

[2] Based on estimates derived from Susquehanna shad restoration efforts of 2.3 adult shad per Habitat Unit

[3] 10% mortality estimates based on downstream passage efficiencies at hydroelectric facilities along the Susquehanna River

[4] Number in parentheses represents the total dams from that area downstream

Table 2. Projected Shad Returns to the Sebasticook River Based on One Adult Return for 318 Fry Stocked[1,2]

Stocking Year	Number Fry Stocked[3]	Adult Return From 5-year Stock Date
1996	320,000	0
1997	456,800	0
1998	725,420	0
1999	839,068	0
2000	500,004	0
2001	618,879	503
2002	505,902	1,221
2003	1,857,184	2,038
2004	500,000	1,927
2005	500,000	2,292
2006	500,000	1,759
2007	500,000	1,769
2008	500,000	3,716
2009	500,000	7,671
2010	500,000	5,791
2011	500,000	5,624
2012	500,000	5,100
2013		7,056
2014		12,958
2015		15,034
2016		12,988
2017		12,296
2018		12,943
2019		20,015
2020		27,993
2021		28,022
2022		25,284
2023		25,239
2024		32,957

[1] Based on research from American shad restoration in Susquehanna and Connecticut Rivers of one adult return for every 318 fry stocked

[2] Does not include returns from natural reproduction

[3] Numbers from 2004 and beyond based on a minimum stocking rate of 500,000 fry

in the Fort Halifax tailrace, while others were noted in the Lockwood tailrace (personal communication with Jason Seiders, Normandeau Consultants, Inc., 2003). Of the shad observed near Lockwood, five had been previously tagged; two tagged shad were observed in the Fort Halifax tailrace (Ibid.). They would linger for a brief period of time

below the project and then move back downstream out of the tailrace. It is unknown how many entered the Sebasticook River or what percentage were repeat sightings of the same school. None of the marked shad were recaptured in 2002.

In 2003, DMR personnel made frequent observations at the Fort Halifax tailrace for the presence of shad. Due to the shallow depth (approximately two to four feet) of a portion of the tailrace, under appropriate conditions (low water flow and bright sunlight), shad were observed as they darted about in the river. On June 25, a single DMR employee observed 74 shad in a four-hour period, with at least one school of ten documented. However, it should be noted that this is not an accurate means to determine the number of shad in the vicinity as several sightings were most likely repeats; also, the viewing methods were subjective as some observers noticed shad at times when others did not.

In addition to the observations, DMR staff conducted informal angler surveys at Fort Halifax Park in Winslow. During the early evening of July 1, DMR staff interviewed eight anglers at the park. All fishermen stated that they were targeting shad, which were noted by DMR staff to be spawning in the vicinity. While no estimate of success was determined, anglers indicated that they had been successful in their attempts to catch shad in that vicinity. More formal angler surveys will be conducted in 2004.

Section III. Fish Passage in the Kennebec River Watershed

Completed Fish Passage Projects

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 Kennebec Hydro Developers Group (KHDG), and nongovernmental agencies signed the *Lower Kennebec River Comprehensive Hydropower Settlement Accord*, which contained provisions for dam removal, 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 trap and truck until the fishways were completed. Fishway construction at hydropower dams remained the responsibility of dam owners, who bear all costs associated with both fishway construction and operation.

As part of the KHDG Agreement, the state agreed to take the lead in seeking fish passage at four nonhydro dams on the Sebasticook River. These dams included the outlet dams on Pleasant Lake in Stetson, Plymouth Pond in Plymouth, Sebasticook Lake in Newport, and at Guilford of Maine in Newport. In its 1999 Annual Report, DMR proposed that passage be provided at these dams in 2001. The US Fish and Wildlife Service (USFWS) prepared conceptual designs and cost estimates for these sites; total estimated cost for passage at all four dams was $510,000 (1997 dollars).

Subsequent to the USWFS estimate, DMR requested assistance for fishway construction from the US Army Corps of Engineers (ACORE) under Section 206. An initial site visit by representatives of the ACORE was made in December 1998, and a preliminary resource plan was prepared to seek approval for site feasibility studies prior to fishway construction. ACORE estimated the fish passage construction at the four sites would approach $1,000,000, almost double the USFWS estimate.

Pleasant Pond Dam, Stetson

In 1999, the Town of Stetson decided to rebuild the spillway of the Pleasant Pond Outlet Dam, which drains into Stetson Stream. DMR and the town agreed it would be to everyone's benefit if a fishway were installed during spillway reconstruction, and as a result, an Alaskan steeppass fishway was installed at a cost of $57,370. In addition, the old Archer sawmill dam downstream was removed, which was completely funded by NCRCS and the USFWS. See **Figure 4**.

Figure 4. Fishway at Pleasant Pond, Stetson

Plymouth Pond Dam, Plymouth

In the summer of 2002, two Alaskan steeppass fishways were installed at the Plymouth Pond site. **See Figure 5**. The outlet, which is located on Martin Stream, a tributary to the East Branch of the Sebasticook River, is divided into two distinct channels by a ledge projecting from the middle portion of the dam in a westerly direction. As a result, a passage was cut into this ledge to allow fish in the south channel to pass to the north channel and access the fishways. This project was completed for a total cost of $122,275.

Figure 5. Alaskan Steeppass Fishways at Plymouth Pond Outlet Dam, October 2002

Guilford Industries Dam, Newport

Throughout the summer and fall of 2002, the removal of the 80-year-old Guilford Dam and subsequent river channel restoration were undertaken. The structure, which was owned by the Town of Newport, was in poor shape and viewed as a liability. In 2001, DMR worked with Newport and Guilford of Maine Industries (to which the dam provided fire water protection) to provide an alternative supply of water for fire control.

In May 2001, the Guilford Dam headpond was drawn down to facilitate surveys of the Rt. 2 bridge structure and the substrate beneath the bridge piers. The physical removal of the Guilford Dam began in July and was initially completed in August 2002. However, higher than expected water velocities from the Sebasticook Lake seasonal drawdown resulted in the formation of a head cut being created at the Rt. 2 bridge abutments. The cut worked its way upstream approximately 40-50 feet, threatening the town's sub-channel waterline and ultimately creating an impassable barrier to alewives and other species. As a result of this unexpected issue, the river channel was reworked and additional larger boulders were inserted into the streambed, ultimately reducing future higher velocities, protecting the waterline, and maintaining fish passage in the channel. The final restoration was completed in December 2002. The total cost of the restoration project, including the rebuild of the channel, was $237,429. **See Figure 6**.

Figure 6. Site of the Former Guilford Dam, August 2002

Sebasticook Lake Dam, Newport

The Sebasticook Lake Outlet Dam, which is owned by the Town of Newport, was constructed in the mid-1980s to maintain lake levels and allow a fall drawdown to flush nutrients from the lake. Upstream passage at this site, which was completed on June 13, 2003, consists of a pool and chute fishway on the eastern side (**Figure 7**). The fishway was designed to allow accessibility for public viewing. The pool and chute design also minimizes the amount of water needed for effective upstream and downstream passage. The fishway has already passed adult alewives, which migrated into the lake to spawn, and is currently passing juvenile alewives in the tens of thousands as they migrate to the ocean to mature into adults.

Figure 7. Sebasticook Lake Outlet Fishway, August 2003

Fishway construction was sponsored by the Town of Newport, the Maine Department of Marine Resources, and the Natural Resources Conservation Service (NRCS), a division of the US Department of Agriculture (NRCS also provided daily construction monitoring through completion of the project); the National Fish & Wildlife Foundation's Maine Habitat Restoration Partnership; the US Fish & Wildlife Gulf of Maine Office; the Maine Corporate Wetlands Restoration Partnership; the Conservation Law Foundation/National Oceanic and Atmospheric Administration; and the Environmental Protection Agency's Five Star Challenge Grant. The fishway was designed by URS and constructed by Construction Divers, Inc.; total cost was $392,000.

Future plans for the outlet fishway may include the installation of a viewing window to allow spectators to closely observe the fish at eye level as they swim through the fishway. It would also allow biologists to monitor the fish species utilizing the fishway.

Section IV. Future Fish Passage in the Kennebec River Watershed

Fish passage at the hydroelectric dams on the lower Kennebec and Sebasticook Rivers is dictated by the *Lower Kennebec River Comprehensive Hydropower Settlement Accord*, which is an agreement between members of the Kennebec Hydro Developers Group, the Kennebec Coalition, the National Marine Fisheries Service, the State of Maine, and the US Fish and Wildlife Service. This Settlement Accord was signed by the parties in 1998 and was subsequently incorporated into each project's FERC license. **Refer to Figure 1** above for locations of the hydroelectric facilities.

Mainstem Kennebec Fish Passage

Lockwood Hydro, Waterville

By May 1, 2006, the Licensee will install an *interim* trap, lift, and transfer facility for American shad, river herring (i.e., both alewives and blueback herring), and Atlantic salmon. Permanent upstream passage is required no earlier than 2010, triggered by passage of 8,000 American shad in the interim trap, lift, and sort facility at Lockwood. **Status**: On schedule. Licensee has submitted plans for interim trap, lift, and transfer facility for agency review. Agencies have approved plans with minor modifications.

UAH Hydro-Kennebec, Fairfield

Permanent upstream passage is required no earlier than 2010, triggered by passage of 8,000 American shad in the interim trap, lift, and sort facility at Lockwood.
Status: On schedule.

Shawmut Hydro, Fairfield

Permanent upstream passage is required no earlier than 2012, triggered by passage of 15,000 American shad in the permanent upstream facility at UAH Hydro-Kennebec.
Status: On schedule.

Weston Hydro, Skowhegan

Permanent upstream passage is required no earlier than 2014, triggered by passage of 35,000 American shad in the permanent upstream facility at Shawmut.
Status: On schedule.

Mainstem Sebasticook Fish Passage

Fort Halifax, Winslow

Per the KHDG Agreement and the project license, the Licensee was required to install a permanent upstream fish lift by May 1, 2003, or breach the dam in 2003. In 2002, the Licensee proposed to decommission and partially breach the dam in order to provide upstream passage. However, FERC did not approve FPLE's Application to Surrender its license and partially breach the dam until January 23, 2004. Currently, alewives are collected at the facility with a pump and transferred into upstream spawning habitat in stocking trucks.
Status: Licensee has applied to FERC to decommission the facility and partially breach the dam, providing permanent upstream fish passage. All appropriate agencies and signatories to the 1998 KHDG Agreement have approved this method of permanent fish passage. As of January 23, 2004, FERC approved the partial breach of the Fort Halifax Dam, slated to begin in the summer of 2004 if all necessary permits are obtained. FPLE still needs to obtain permits from the Maine Department of Environmental Protection, the US Army Corps of Engineers, and the Winslow Planning Board before it begins removal of an 87-foot section of the dam.

Benton Falls, Benton

Permanent upstream passage is scheduled to be completed one year following the completion of four fish passage projects upstream. These projects included the construction of fishways at the Pleasant Pond dam in Stetson, the Plymouth Pond dam in Plymouth, the Sebasticook Lake outlet dam in Newport, and the removal of the Guilford Dam in Newport. These projects were completed on June 13, 2003, triggering a June 14, 2004 date for fish passage to be operational.

Status: Licensee has submitted conceptual plans for both a vertical slot fishway and fish lift, both of which were approved, with modifications, by the appropriate agencies as means of permanent fish passage. However, Licensee has not responded to the reviewing agencies with revised designs for either passage system. Licensee has also indicated to DMR that it is awaiting the FERC decision on the Fort Halifax issue before it submits its revised plans. Permanent fish passage installation will likely begin in 2004 and be operational by May 1, 2005. The trap and truck program for alewives and American shad will continue downstream at the Fort Halifax project in 2004. DMR plans to work with the Licensee regarding incorporating a trap and truck facility in the Benton Falls fish passage facility.

Burnham Hydro, Burnham

Similar to Benton Falls, permanent upstream passage was scheduled for completion one year (by June 14, 2004) following the completion of the four fish passage projects upstream. These projects included the construction of fishways at the Pleasant Pond dam in Stetson, the Plymouth Pond dam in Plymouth, the Sebasticook Lake outlet dam in Newport, and the removal of the Guilford Dam in Newport. These projects were completed on June 13, 2003, triggering a June 14, 2004 date for fish passage to be operational.

Status: Licensee has not submitted conceptual plans for permanent fish passage to the appropriate agencies for review. They have submitted plans and the fishery agencies have sent comments. The Licensee has indicated to both DMR and USFWS that it is exploring means of installing a vertical slot fishway at the facility. Licensee has also

indicated to DMR that it is awaiting the FERC decision on the Fort Halifax issue before it submits its plans. Permanent fish passage installation will likely begin in 2004 and be operational by May 1, 2005.

Pioneer and Waverly Avenue Dams, Pittsfield

These two municipally owned hydroelectric dams are leased to a private entity for the purpose of generation. The Licensee of the projects chose not to participate in the KHDG Agreement, but will be required to install fish passage at the dams no earlier than a target date of 2006.

Status: DMR is in the preliminary stages of corresponding with the Natural Resources Conservation Service (NRCS) in funding the projects. Concurrently, US Fish and Wildlife Service engineers are designing conceptual fish passage plans for each facility. DMR is also consulting with IFW on the possibility of rebuilding the Waverly Avenue Dam that impounds Douglas Pond and provides crucial nesting habitat for the state-endangered black tern.

Great Moose Lake Outlet Dam, Hartland and Big Indian Pond Outlet Dams, St. Albans

Fish passage at these municipally owned dams (one located at the outlets of both Great Moose Lake and Big Indian Pond, and two other dams located immediately downstream of Big Indian Pond) would provide access to 4,719 acres of spawning habitat for adult alewives. DMR has recently worked with the Town of Hartland and a local contractor to remove a series of boulders from the outflow of the downstream fish bypass chute, which was installed when the dam was rebuilt in the 1980s, in anticipation of alewife restoration at a later date. The removal of the boulders will provide safe downstream passage for out-migrating alewives.

Status: USFWS engineers have developed conceptual permanent fish passage designs for all four dams in the region. DMR is in the preliminary stages of consulting with the towns, as well as NRCS for funding purposes.

Corundel Bog Dam, Corinna

This small dam, which is owned by the Town of Corinna, impounds Corundel Bog, which serves as valuable breeding habitat for a variety of water birds, including the state-listed black tern. Currently, IFW is in the process of assuming ownership of the dam, which the town wants to relinquish.

Status: DMR consulted with both IFW and NRCS in the fall of 2003 regarding installing fish passage at the dam. As soon as IFW assumes ownership, NRCS has agreed to work with both state agencies in funding the rebuilding of the dam, as well as incorporating a fish passage system.

China Lake Outlet Stream Dams, Vassalboro

DMR and USFWS personnel have surveyed the Outlet Stream of China Lake in order to determine the magnitude of blockages to alewife restoration. This stream was highly developed in the past, and six dams remain that would require some means of fish passage. USFWS engineers are in the process of developing conceptual fish designs for each of the dams, at least two of which are decrepit and require complete rebuild or removal. In addition, a survey conducted by DMR staff throughout 2003 has revealed that out-migrating alewives would not be able to negotiate two of the dams: one at the China Lake Outlet and the other at the Morneau site, which is choked by lumber from an abandoned sawmill located upstream.

Status: DMR is in the preliminary stages of consulting with the dam owners regarding fish passage and with NRCS for funding purposes.

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APPENDIX 1

Department of Marine Resources

Kennebec River Anadromous Fish Restoration Program
Public Informational Meetings

1985 Augusta, Public Hearing
Presenter: Department of Marine Resources (DMR)
Topic: The Maine Department of Marine Resources (DMR) completed a draft plan for the restoration of American shad and alewives to the Kennebec River above Augusta, including the Sebasticook River, in 1985. A legal public hearing was held by DMR in 1985 to seek comments on that plan. As a result, a number of dam owners on the Kennebec and Sebasticook Rivers formed the Kennebec Hydro Developers Group (KHDG), a partnership to address fish passage on a coordinated basis.

1986 Augusta, Public Hearing
Presenter: DMR
Topic: The DMR held a second legal public hearing to allow comments on a revised restoration plan. The 'Strategic Plan for the Restoration of Shad and Alewives to the Kennebec River Above Augusta" was legally adopted in December 1986. The KHDG signed an Agreement with state fishery agencies in 1987, specifying the obligations of the participating dam owners in providing funding, conducting studies, and providing fish passage to facilitate anadromous fish restoration in accordance with the state's restoration plan. The dam owners agreed to install upstream fish passage in the Fort Halifax Dam and the Benton Falls Dam on the Sebasticook River by May 1, 1999 and in the Lockwood Dam and the Hydro-Kennebec Dam on the mainstem of the Kennebec River by May 1, 1999.

1991 City of Augusta, Public Informational Meeting
Presenter: State Planning Office (SPO), DMR
Topic: *Kennebec River Resource Management Plan: Balancing Hydropower Generation and Other Uses*. Anadromous fish restoration program; requirements of hydropower owners. This plan incorporated the requirements of the 1986 DMR plan.

Town of Skowhegan, Public Informational Meeting
Presenter: SPO, DMR
Topic: K*ennebec River Resource Management Plan: Balancing Hydropower Generation and Other Uses*. Anadromous fish restoration program; requirements of hydropower owners. This plan incorporated the requirements of the 1986 DMR plan.

State of Maine Sportsman Show, Augusta Civic Center
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Eastern Maine Sportsman Show, Bangor Auditorium
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Fisherman's Forum, Samoset Resort, Rockland
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

1992 City of Augusta, Public Hearing
Presenter: SPO, DMR
Topic: Public hearing regarding the adoption of the *Kennebec River Resource Management Plan: Balancing Hydropower Generation and Other Uses*. Anadromous fish restoration program; requirements of hydropower owners. This plan incorporated the requirements of the 1986 DMR plan.

Town of Bingham, Public Hearing
Presenter: SPO, DMR
Topic: Public hearing regarding the adoption of the *Kennebec River Resource Management Plan: Balancing Hydropower Generation and Other Uses*. Anadromous fish restoration program; requirements of hydropower owners. This plan incorporated the requirements of the 1986 DMR plan.

State of Maine Sportsman Show, Augusta Civic Center
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Eastern Maine Sportsman Show, Bangor Auditorium
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Fisherman's Forum, Samoset Resort, Rockland
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

1993 State of Maine Sportsman Show, Augusta Civic Center
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Eastern Maine Sportsman Show, Bangor Auditorium
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Fisherman's Forum, Samoset Resort, Rockland
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

1994 **State of Maine Sportsman Show, Augusta Civic Center**
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Eastern Maine Sportsman Show, Bangor Auditorium
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Fisherman's Forum, Samoset Resort, Rockland
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

1995 **Webber Pond Association, China Lakes Alliance, & Vassalboro selectmen, Vassalboro**
Presenter: DMR
Topic: Anadromous fish restoration program. Alewife restoration to the Seven Mile Stream watershed

State of Maine Sportsman Show, Augusta Civic Center
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Eastern Maine Sportsman Show, Bangor Auditorium
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Common Ground Country Fair, Unity
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Fisherman's Forum, Samoset Resort, Rockland
Presenter: DMR
Informational booth; DMR staff present to answer questions on restoration program

1996 **Webber Pond Association, China Lakes Alliance, & Vassalboro selectmen, Vassalboro**
Presenters and participants: DMR, DEP and IFW
Topic: Anadromous fish restoration program; alewife restoration to the Seven Mile Stream watershed.

State of Maine Sportsman Show, Augusta Civic Center
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Eastern Maine Sportsman Show, Bangor Auditorium
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Common Ground Country Fair, Unity
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Fisherman's Forum, Samoset Resort, Rockland
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

1997 **State of Maine Sportsman Show, Augusta Civic Center**
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Eastern Maine Sportsman Show, Bangor Auditorium
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Common Ground Country Fair, Unity
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Fisherman's Forum, Samoset Resort, Rockland
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

1998 **City of Augusta, Public Meeting**
Presenter: SPO, DMR
Topic: Anadromous fish restoration program; Edwards Dam removal

Whatever Week Family Festival, Pine Tree Arboretum, Augusta
Benefits of a Clean Kennebec River
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

State of Maine Sportsman Show, Augusta Civic Center
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Eastern Maine Sportsman Show, Bangor Auditorium
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Common Ground Country Fair, Unity
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Fisherman's Forum, Samoset Resort, Rockland
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

1999 **Town of Stetson**
Presenter: DMR
Topic: Anadromous fish restoration program & fish passage at town-owned dam. Fish passage installed in 1999. Totally funded by DMR, the Natural Resources Conservation Service (NRCS), the US Fish & Wildlife Service (USFWS).

Sebasticook Lake Association
Presenter: DMR
Topic: Anadromous fish restoration program & fish passage at town-owned dam

State of Maine Sportsman Show, Augusta Civic Center
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Eastern Maine Sportsman Show, Bangor Auditorium
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Common Ground Country Fair, Unity
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Fisherman's Forum, Samoset Resort, Rockland
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

2000 **Town of Newport**
Presenter: DMR
Topic: Anadromous fish restoration program & fish passage at town-owned dam

Town of Plymouth, Special Town Meeting
Presenter: DMR
Topic: Anadromous fish restoration program & fish passage at town-owned dam

State of Maine Sportsman Show, Augusta Civic Center
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Eastern Maine Sportsman Show, Bangor Auditorium
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Common Ground Country Fair, Unity
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Fisherman's Forum, Samoset Resort, Rockland
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

2001 **Town of Hartland, Great Moose Lake Association, Sebasticook River Watershed Association, Hartland Community Center on April 21**
Presenter: DMR
Topic: Anadromous fish restoration program in Great Moose, Big Indian, and Little Indian Ponds.

Town of Hartland, Follow-up Meeting, Hartland School on May 30
Presenter: DMR (Lew Flagg, Matt O'Donnell, Tom Squiers) & SPO (Betsy Elder)
Topic: Follow-up to April 12, 2001 meeting. Lew Flagg announced DMR postponing stocking in 2001.

Sebasticook Lake Association Annual Meeting, Newport on July 7
Presenter: DMR (Matt O'Donnell)
Topic: Overview of Kennebec River/Sebasticook River Anadromous Fish Restoration Program

Great Moose Lake Association Annual Meeting, Hartland on July 21
Presenter: DMR (Gail Wippelhauser)
Topic: Overview of Kennebec River/Sebasticook River Anadromous Fish Restoration Program

State of Maine Sportsman Show, Augusta Civic Center
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Eastern Maine Sportsman Show, Bangor Auditorium
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Common Ground Country Fair, Unity
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Fisherman's Forum, Samoset Resort, Rockland
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

2002 Town of Winslow, Public Meeting
Presenter: SPO, DMR
Topic: Anadromous fish restoration program & fish passage at town-owned dam

Town of Hartland, Great Moose Lake Association, April 7
Presenter: DMR (Tom Squiers) & IFW (Jim Stahlnecker)
Topic: Anadromous fish restoration program in Great Moose, Big Indian, and Little Indian Ponds.

Trout Unlimited's Alewife Appreciation Day, Winslow
Presenter: DMR
Topic: Anadromous fish restoration program & fish passage issues

State of Maine Sportsman Show, Augusta Civic Center
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Eastern Maine Sportsman Show, Bangor Auditorium
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Common Ground Country Fair, Unity
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Fisherman's Forum, Samoset Resort, Rockland
Presenter: DMR
Informational booth with pamphlets and DMR staff to answer questions

2003 Fisherman's Forum, Samoset Resort, Rockland
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Town of China Selectman's Meeting, March 10
Presenter: DMR
Topic: Anadromous fish restoration program & fish passage on Outlet Stream

Kennebec Valley Council of Governments, Fairfield on March 11
Presenter: SPO, DMR, representatives from Benton, Pittsfield, and Winslow.
Topic: Anadromous fish restoration program; requirements of hydropower owners

China Region Lakes Alliance, Kennebec Water District, Vassalboro on March 12
Presenter: DMR
Topic: Anadromous fish restoration program & fish passage on Outlet Stream

Eastern Maine Sportsman Show, Bangor Auditorium, March 21-23
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

State of Maine Sportsman Show, Augusta Civic Center, March 28-30
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Town of Pittsfield Selectman's Meeting, April 1
Presenter: DMR
Topic: Anadromous fish restoration program & fish passage at town-owned dams

Hartland Town Selectmen's Meeting, April 15
Presenter: DMR (John Perry, Tom Squiers)
Topic: Alewife restoration and fish passage

Town of St. Albans, April 28
Presenter: DMR (John Perry)
Topic: Anadromous fish restoration program & fish passage at town-owned dam

Kennebec Valley Council of Governments, Fairfield, July - present (monthly)
Presenter: DMR, representatives from the Towns of Winslow, Benton, Burnham, and Pittsfield, Save Our Sebasticook (SOS)
Topic: Monthly forum to update the group on fish passage, fish restoration, Fort Halifax issues

Common Ground Country Fair, Unity, September
Presenter: DMR
Informational booth: DMR staff present to answer questions on restoration program

Friends of Lake Winnecook Meeting, Unity, October 28
Presenter: DMR, DEP, IFW and Maine Rivers
Topic: Discussion regarding perceived impacts of alewife program to water quality issues