

MAINE STATE LEGISLATURE

The following document is provided by the
LAW AND LEGISLATIVE DIGITAL LIBRARY
at the Maine State Law and Legislative Reference Library
<http://legislature.maine.gov/lawlib>



Reproduced from scanned originals with text recognition applied
(searchable text may contain some errors and/or omissions)

State of Maine
122nd Legislature
Second Regular Session

-Eel and Elver Management Fund Plan

A Report to the Joint Standing Committee on Marine Resources

May 2004 -

Committee members:

Patricia Bryant, Nobleboro
Randal Bushey, Milbridge
Gerald Crommett, Passadumkeag
Merry Gallagher, DIFW
Scott Hall, PPL Maine, LLC

Dr. James McCleave, UM
Lt. Dave Mercier, DMR
Bob Richter, FPL Energy
Glenn Steeves, Raymond
Dr. Gail Wippelhauser, DMR



Table of Contents

Executive Summary.....	3
Eel and Elver Management Fund Committee	4
Elver fishery.....	4
Young-of-year recruitment study.....	5
Introduction	5
Methods	5
Results and Discussion.....	5
Elver upstream passage and recruitment monitoring.....	6
Introduction	6
Methods	6
Results and Discussion.....	6
Downstream passage of silver eels.....	8
Introduction	8
Methods and discussion	8
Elver enforcement.....	8
Coastal and inland eel fishery	9
Relicensing of Hydropower Projects.....	9
Table 1. Members of the Eel and Elver Management Fund Committee.	10
Table 2. Status of research, monitoring, and enforcement needs identified by the Eel and Elver Management Fund Committee in 1996-1997.	11
Table 3. Number of resident licenses by gear type for the elver fishery, 1996-2003.....	11
Table 4. Harvest and effort for the elver fishery, 1977-2003.....	12
Table 5. Summary of glass eels and pigmented eels recruiting to West Harbor Pond in 2003.....	12
Table 6. Average total length, weight, and pigmentation stage of glass eels, 2001-2002.....	12
Table 7. Summary of visual observations at five projects.....	13
Table 8. Summary of upstream eel migration at Ft. Halifax and Benton Falls projects, 1999-2002.....	13
Table 9. Summary of Marine Patrol activities, 1996-2003, for A) 1997-2000 and B) 2001-2003.....	13
Table 10. Summary of elver fishery violations, 1999 –2003, for A) Division I and B) Division II.....	14
Table 11. Licenses issued by DMR for eel pots in tidal water and permits issued by DIFW for eel pots and weirs in inland waters.....	15
Table 12. Status of hydroelectric projects being relicensed in Maine.....	16
Figure 1. Location of young-of-year survey, and close-up view of vertical elver passage.....	17
Figure 2. Recruitment of (A) glass eels and (B) pigmented eels into West Harbor Pond, ME, in 2003.....	18
Figure 3. Location of hydropower projects and fishways within the Kennebec River watershed.....	19
Figure 4. Total length of eels at Hydro-Kennebec during the 2003 field season.....	20
Figure 5. Eel passage at Ft. Halifax Dam in 2003.....	20
Figure 6. Total length of eels passed at Ft. Halifax Dam in 2003.....	21
Figure 7. Total length of eels passed at Benton Falls Dam in 2003.....	22
Figure 8. Eel harvest in Maine.....	23



Executive Summary

The Commissioner of the Department of Marine Resources (DMR) is required to present a plan to the Joint Standing Committee on Marine Resources for expenditures from the dedicated Eel and Elver Management Fund by May 1 of each year for the next fiscal year, beginning in calendar year 1997. In order to develop the plan, the Department of Marine Resources formed the Eel and Elver Management Fund Committee in 1996, representing elver, yellow eel, and silver eel fisheries; hydro-electric interests; law enforcement; academia; and resource managers from DMR and the Department of Inland Fisheries and Wildlife (DIFW). The Committee met three times between 1996 and 1997 to identify and prioritize research, monitoring and enforcement needs.

This document summarizes the research, management and enforcement undertaken on eels and elvers in 2003, and lists proposed work for 2004. The proposed expenditures will fund research, monitoring, and enforcement needs that were identified by the Committee or that are required by the Atlantic States Marine Fisheries Commission.

The laws and regulations governing the elver fishery have not changed since 1999 with the exception of a lottery that allows people to enter the fishery as other leave. The numbers of harvesters and the amount of gear declined from 1999 to 2001, but has been relatively stable since then. The 2003 harvest was 3,325 pounds, and average price was \$25.29 per pound.

DMR continued the glass eel (young-of-year) recruitment study that is required by the Atlantic States Marine Fisheries Commission. Recruitment of glass eels was very low in 2003 compared to 2001 and 2002. Approximately 15,004 glass eels and 1,110 small pigmented eels used elver passages to enter West Harbor Pond (Boothbay Harbor) between April 15 and June 26.

DMR passed approximately 155,012 eels at the Ft. Halifax Project and 6,434 at the Benton Falls Project on the Sebasticook River, made recommendations to improve efficiency at newly installed passages at the Hydro-Kennebec and Shawmut projects on the Kennebec River, and made nighttime observations at the Lockwood Project. Passages will be installed at the Weston and Burnham projects in 2004.

DMR intended to continue a study of the behavior of emigrating silver eels at the Lockwood Project, which is located on the Kennebec River approximately 0.5 mile above the confluence of the Sebasticook River and the Kennebec River. However, the 2003 study was not completed, because the eel migration occurred early and calibration of radio telemetry equipment was delayed by annual turbine maintenance.

Marine patrol officers worked fewer hours on elver enforcement in 2003 than in the previous years. However, the number of complaints addressed and summonses issued were higher in 2003 than in 2002. The most common violations were fishing during the closed season or closed period, harvesting in the middle third of the waterway, and molesting gear.

A total of 21 licenses and permits were issued in 2003 for the coastal eel pot, inland eel pot, and inland weir fisheries. Harvesters reported a total catch of 15,212 pounds of eels.

Each year the Department of Marine Resources consults with the owners of hydropower projects being relicensed by the Federal Energy Regulatory Commission, and requests fish passage when appropriate. Upstream and/or downstream eel passage currently exists, is required, or is being requested at 27 hydropower projects located on 10 rivers in Maine.

In 2004, DMR personnel will continue to 1) obtain harvest, effort, and location data for all eel fisheries, 2) assess young-of-year recruitment survey, 3) install and monitor upstream passages and obtain recruitment data, 4) study downstream passage measures, 5) and comment on the relicensing of hydropower projects.

Eel and Elver Management Fund Committee

The Department of Marine Resources (DMR) formed the Eel and Elver Management Fund Committee in 1996 to develop a multi-year plan for expenditures from the fund. The members of the committee (Table 1) represent elver, yellow eel, and silver eel fisheries, hydroelectric interests, law enforcement, academia, and resource managers from DMR and DIFW. The Committee met three times between 1996 and 1997, and developed a comprehensive list of 25 research, monitoring, and enforcement needs. Since 1998, the members of the Committee have met annually to review activities from the previous fiscal year and to consider those proposed for current fiscal year.

Many of the research needs identified in 1996 and 1997 have been addressed. Final reports for these projects have been completed, and the results have been published in peer-reviewed journals. Table 2 contains a list of ongoing research and monitoring projects, enforcement needs, and potential research projects. DMR biologists currently are studying glass eel recruitment, elver recruitment, upstream and downstream passage design and efficiency. Fieldwork to study the growth rates and movements of eels in inland waters has been completed, but the final report has not been issued.

Elver fishery

The laws and regulations governing the elver fishery did not change in 2003. The fishery is controlled by legislation, passed in 1999, which instituted a limited entry system for the elver fishery, reduced the amount of gear a harvester could use, and decreased the length of the season. Participation in the fishery was limited to 827 people, initially those who held elver licenses and gear tags in each of the three years of 1996, 1997, and 1998. The amount of gear allowed per individual in 1999 was equal to the average amount of gear used by that individual in 1996, 1997, and 1998 with a maximum of two units. The elver-fishing season was reduced by approximately three weeks; elvers can be harvested from March 22 to May 31. Additional legislation was passed in 2000 that authorized the Commissioner of DMR to establish a lottery system under which a person who did not hold an elver license in the previous year could become eligible to obtain a license, with the stipulation that the total number of elver licenses issued not exceed 827, and that a person obtaining a license through the lottery is restricted to a single piece of gear.

The fishery began to decline in 1999 when the market for elvers collapsed (elvers primarily were shipped to Asia for aquaculture in ponds). The number of licenses and amount of gear declined between 1999 and 2001, was relatively stable between 2001 and 2003, and declined again in 2004 (Table 3). A total of 462 licenses were sold in 2003, and harvesters paid gear fees for 506 fyke nets and 190 dip nets. The 2003 catch (3,325 pounds) was the third lowest on record for the years 1994-2003, and the price remained low (average \$25.29/pound). As in previous years, eels were primarily captured by fyke net.

Young-of-year recruitment study

Introduction

The current status of the American eel stock is poorly understood because of limited and non-uniform information on abundance and age across the range of this species. The glass eel life stage provides a unique opportunity to assess the annual recruitment of each year's cohort, because glass eels result from the previous year's spawning activity, and are all the same age. In order to assess the annual variation in recruitment of American eel, the Atlantic States Marine Fisheries Commission's (ASMFC) Interstate Fishery Management Plan for American Eel requires that each member state conduct an annual survey of young-of-year (YOY) abundance.

Methods

The study was conducted at the outlet of West Harbor Pond, Boothbay Harbor (Fig. 1). Fresh water from Knickerbocker Lakes and West Harbor Pond flows through a box culvert under Route 27 directly into high salinity coastal water. A concrete dam at the end of the culvert prevents salt water from entering the pond except during unusually high spring flood tides. The mean tidal range at this site is 8.8 ft, and mean spring tidal range is 10.1 ft. Approximately 12 years ago, DMR installed a steep pass fishway at the dam, which was designed to pass adult alewives. When tidal height exceeds 11 ft, flow in the fishway reverses, and eels near the fishway entrance can be carried "downstream" by the current into West Harbor Pond. During studies at West Harbor Pond in 1999 and 2000 we determined that relatively few eels enter West Harbor Pond via the steep pass fishway.

Three elver passages were used to quantify the recruitment of YOY and pigmented eels into West Harbor Pond. In 2001 the passages were standard "ramps" that extended from the top of the dam towards the water at an angle of 30°. In 2002 we replaced the western ramp with a vertical piece of plywood (21.5-inch long, 12-inch wide, covered with Enkamat flatback 7220) that extended from a ledge outcrop to the top of the dam, and was attached to seaward face of the dam (Fig. 1); the eastern ramp was replaced with a vertical piece of Enkamat-covered plywood (60-in long, 12-in wide). The middle ramp, covered with Akwadrain Soil Strip Drain (25 mm thickness) and installed perpendicular to the dam, was not altered. Each passage terminated in a reverse ramp and tube that emptied into an escape-proof collection box. A float switch at the bottom of the passages turned on attraction water, which was provided for 6-7 hours around high tide both day and night. One battery-powered 500-gallon per hour (GPH) pump supplied attraction water for all passages. The three passages and attraction water system used in 2003 were unchanged from 2002.

Passages were operational for 73 days (10+ weeks) from April 15 to June 26, and were tended every 1-3 days. The eels in each catch box were removed, and taken to the DMR laboratory for processing. Glass eels from each passage were counted, weighed, and total number estimated gravimetrically; pigmented eels were counted. All eels were released into West Harbor Pond approximately 30 m above the passages to minimize the chance of recapture. Environmental data including air temperature, sea surface temperature, wind speed, precipitation, time of high tide, and tidal heights were obtained from the DMR laboratory. Water temperature in the pond was recorded with an automated datalogger (HOBO).

Results and Discussion

Approximately 15,004 glass eels and 1,110 pigmented eels used the three passages in 2003 (Table 5). The number of glass eels recruiting to West Harbor Pond was much lower than in previous years (18% of 2002 recruitment; 29% of 2001 recruitment). Recruitment of pigmented eels to West Harbor Pond also was lower than in the previous two years. Low recruitment did not appear to be related to proximal environmental cues. Average daily sea surface temperatures at Boothbay and average surface pond temperatures for May 1 and May 31 were very similar in 2002 and 2003. Several other states along the east coast reported low YOY recruitment in 2003, which indicates that larger scale oceanographic processes may have affected recruitment.

Approximately 94% of the glass eels recruited to inland waters in the first 30 days of the study (Fig. 2A). Recruitment of small pigmented eels occurred later in the season and was more protracted. Only 54% of the pigmented eels migrated to inland waters in the first 30 days of the study (Fig. 2B). The timing of migration to inland waters of glass eels was not highly correlated with any of the measured environmental variables (air temperature, sea surface temperature, pond temperature, tide stage, wind, rain). As the season progressed, average total length and weight declined slightly, while pigmentation increased (Table 6).

Elver upstream passage and recruitment monitoring

Introduction

Juvenile eels, known as glass eels or elvers depending on the degree of pigmentation, migrate into Maine's coastal waters in the spring. Some elvers remain in estuarine habitat, but many attempt to migrate to growth habitat in inland waters. Natural and man-made obstacles, such as hydropower dams, may prevent or delay the upstream migration. Two management plans, Maine's American Eel (*Anguilla rostrata*) Species Management Plan and the Atlantic States Marine Fisheries Commission's American Eel Fisheries Management Plan, call for 1) maintaining and enhancing eel abundance in all watersheds where they now occur, 2) restoring eels to waters where they had historical presence but may now be absent, and 3) providing adequate upstream passage and escapement into inland waters of elvers and eels. Migration of eels past dams and other obstacles must be improved to accomplish these goals.

During the Federal Energy Regulatory Commission (FERC) licensing process, the owner of a hydropower facility consults with resource agencies to determine appropriate fish passage measures. Once the license is issued, the operating conditions are fixed for the licensing period, typically 30-50 years. Since 1997, DMR has been requesting upstream and downstream passage for eels at appropriate hydropower projects during the licensing process.

The Lower Kennebec River Comprehensive Hydropower Settlement Accord, signed prior to the removal of Edwards dam in Augusta, requires that Kennebec Hydro-Developers Group (KHDG) dam owners and DMR undertake a three-year research project to study upstream and downstream passage measures for eels at the seven KHDG facilities. Three of the facilities are located on the Sebasticook River and four on the mainstem Kennebec River (Fig 3). The primary objective of this study was to determine where juvenile eels pass or attempt to pass upstream at each of the hydropower facilities. Secondary objectives were to determine the timing of the upstream migration, the magnitude of the migration, and the size distribution of the migrants.

Methods

DMR staff conducted nighttime visual observations at five sites in 2003 (Table 7). As in previous years the locations of concentrations of eels were noted, an estimate was made of the number of eels, and a sample usually was taken for total length measurements.

Upstream passages, which have been described in previous reports, were installed at the Ft. Halifax and Benton Falls projects. In general, the passages were operated five days per week, and were tended at least twice per week. If the number of eels captured at a project was less than 70, all eels were counted and total weight recorded. If catches exceeded 70, all eels were weighed and the number estimated from subsamples. Eels were released above each dam into the headpond after measurements were taken. Water temperature at Ft. Halifax was obtained from Normandeau Associates. Other environmental information was recorded when the passages were tended.

Results and Discussion

Observations were made on five occasions at the **Lockwood** Project (July 8, 10, 16, 22, and 29) in 2003. DMR staff observed small numbers of eels ranging from approximately 20 to several hundred at various

locations at the base of the dam or climbing the dam. These observations confirm previous observations that there is no single place where eels tend to concentrate because of widespread and variable leakage.

Personnel at the **Hydro-Kennebec** Project installed an experimental upstream eel passage made of flexible exhaust hose with Enkamat lining the invert on the west side of the spillway at the end of June. DMR staff installed a catch box at the top of the passage on July 8, and that night observed eels being attracted to various locations along the dam by leakage from the flashboards and ram-pump. No eels were found in the catch box the next day. When sections of the hose were dismantled, eels were found to have climbed as far as the penultimate section. To eliminate these problems, Hydro-Kennebec staff reworked the connection between the last two sections of exhaust hose, reduced flashboard leakage with bark, and attempted to consolidate flow from the ram-pump. Approximately 4,747 eels climbed the passage over the next 11 days (July 11- 21). The size distribution (Figure 4) was similar to previous years. On the evenings of July 16 and 23, DMR staff observed that eels continued to be attracted to various locations by leakage from the flashboards and ram-pump. In addition, the entrance seemed to be incorrectly oriented. At DMR's request, additional steps were taken to reduce leakage and the lower three sections of exhaust hose were replaced with an Enkamat-covered ramp. By the end of July, the number of migrating eels had started to decline and the ramp was not properly tested. We recommend that installation begin as early as possible in 2004 and that the exhaust hose be replaced with an Enkamat-covered ramp. Problems that arise with the climbing substrate are more visible and easily repaired with the ramp design.

FPL Energy (FPLE) installed an upstream eel passage at the **Shawmut** Project during the week of June 9. Modifications to the passage entrance were made on July 18 following site visits by DMR, FPLE, and Normadeau staff to assess whether eels were successfully using the passage. We recommend that the passage be installed earlier in 2004 (i.e., end of May or beginning of June).

Maintenance and repair work were conducted on the south channel dam of the **Weston** Project during the summer and fall of 2003. The repair work on the dam caused changes in leakage flow patterns. DMR recommended that installation of the upstream eel passage be delayed until 2004.

The passage at the **Fort Halifax** Project, which was installed on June 9 and modified on July 18, was operated for a total of 60 days between June 11 and September 17 in 2003, passing an estimated 155,012 eels, the third highest number since 1999 (Table 8). The upstream migration was more protracted than in previous years. Approximately 90% of the eels moved upstream within a two-month period (Figure 5), as opposed to a one-month period in the previous four years. Eels started migrating when the water temperature in the headpond was 18.2° C and flow measured at Pittston was 946 cfs. Peaks of migration did not appear to be related to temperature or river flow (Figure 5). Two peaks in August followed periods when the passage was not checked daily (August 9-12) or was shut down (August 14-25). The size distribution of eels passing in 2003 (Figure 6) was similar to previous years.

The passage at **Benton Falls** Project was operated for just 16 days in 2003, and passed approximately 6,434 eels, the lowest number passed since 1999 (Table 8). Nearly 90% of the eels passed on a single date (July 1). The passage was not operated for most of the summer, primarily because one turbine was being repaired. Consequently, the entrance to the passage was flooded by inflow being passed over the spillway from July 10-29 and August 13-September 23. In addition, the attraction water hose had to be repaired at the beginning of the season. The size distribution of eels changed dramatically in 2002 and this trend continued in 2003. From 1999-2001, the length distribution was unimodal with the most common length being 105-109 or 110-114 mm. In 2002, the distribution became multimodal with 37% of the eels > 150 mm. In 2003, the distribution was multimodal with 41% of the eels >150mm (Figure 7).

Downstream passage of silver eels

Introduction

Adult eels, known as silver eels, migrate in late summer and fall from Maine's inland waters to the sea to spawn. Two management plans, Maine's American Eel (*Anguilla rostrata*) Species Management Plan and the Atlantic States Marine Fisheries Commission's American Eel Fisheries Management Plan, call for 1) maintaining and enhancing eel abundance in all watersheds where they now occur, 2) restoring eels to waters where they had historical presence but may now be absent, and 3) providing adequate escapement to the ocean of prespawning adult eels. Migration of eels past dams and other obstacles must be improved to accomplish these goals.

During the Federal Energy Regulatory Commission (FERC) licensing process, the owner of a hydropower facility consults with resource agencies to determine appropriate fish passage measures. Once the license is issued, the operating conditions are fixed for the licensing period, typically 30-50 years. Since 1997, DMR has been requesting upstream and downstream passage for eels at appropriate hydropower projects during the licensing process.

The Lower Kennebec River Comprehensive Hydropower Settlement Accord, signed prior to the removal of Edwards dam in Augusta, requires that Kennebec Hydro-Developers Group (KHDG) dam owners and DMR undertake a three-year research project to study downstream passage measures for eels at the KHDG facilities, three of which are located on the Sebasticook River and four on the mainstem Kennebec River. The primary objectives of this study were 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 existing downstream passage measures for adult eels.

Methods and discussion

DMR intended to continue its study of eel behavior at the Lockwood Project, which is located on the Kennebec River approximately 0.5 mile above the confluence of the Sebasticook and the Kennebec Rivers. However, the 2003 study was not completed, because the eel migration occurred early and calibration of radio telemetry equipment was delayed by annual turbine maintenance (September 6-20). The telemetry equipment was installed from 8/7-9/9, but a final calibration was not conducted until 10/14. A fyke net was set in Carrabasset Stream, and fished for ten nights from 10/14-11/14, but no downstream migrating eels were caught. High flow often made it impossible to set the net and it was damaged on several occasions by debris. A number of resident fishes were caught in the net, indicating that it was fishing correctly. We learned from an eel weir fisherman that most eels migrated with the first heavy rains in early October. The study will be continued in 2004.

Elver enforcement

Marine patrol officers in each division worked fewer hours on elver enforcement in 2003 than in the previous year (Table 9), although Division I officers spent more time on elvers than Division II officers. Compared to 2001 and 2002, Division II officers addressed more complaints while Division I officers addressed fewer complaints (Table 9). The number of summons issued in Division I and Division II were higher in 2003 than in the previous year (Table 10). The most common violations were: setting nets during the closed season, harvesting in the middle third of the waterway, harvesting during closed season, and molesting gear.

Coastal and inland eel fishery

Each year the Department of Marine Resources obtains harvest information from eel fishermen. Beginning in 2001, providing harvest information became mandatory as required by the Atlantic States Marine Fisheries Commission. A total of 21 licenses and permits were issued in 2003 for the coastal eel pot, inland eel pot, and inland weir fisheries (Table 13). Harvesters reported a total catch of 15,212 pounds of eels.

The estimated harvest of eels in Maine, from inland and coastal waters, has varied enormously from a high of 400,130 pounds in 1912 to a low of 8,764 pounds in 1984. The average annual harvest for the period from 1887-2002 is 91,775 pounds. Catches exceeded the long-term average from 1900-1933 and from 1975-1980 (Fig. 8). However, the peak in catch in the late 1970s was not as pronounced nor as long-lived as the peak in early 1900s.

Relicensing of Hydropower Projects

Each year the Department of Marine Resources consults with the owners of hydropower projects being relicensed by the Federal Energy Regulatory Commission (FERC), and requests fish passage when appropriate. Upstream and/or downstream eel passage currently exists, is required, or is being requested at 27 hydropower projects located on 10 rivers in Maine (Table 12).

Table 1. Members of the Eel and Elver Management Fund Committee.

Name/phone number	Affiliation	Address
Patricia Bryant 563-5611	Elver Association	74 Duck Puddle Road Nobleboro, ME 04555
Randal Bushey 546-2804	Elver fisherman Elver dealer	PO Box 394 Millbridge, ME 04658
Gerald Crommett 732-4536	Silver/yellow eel fisherman Eel dealer	82 Pleasant Street PO Box 49 Passadumkeag, ME 04475
Merry Gallagher 941-4381	Resource Manager-DIFW	650 State Street Bangor, ME 04401
Scott Hall 827-5364	Hydro-power	PPL Maine, LLC PO Box 276 Milford, ME 04461
James McCleave 581-4392	Researcher	School of Marine Sciences 5751 Libby Hall University of Maine Orono, ME 04469
Lt. David Mercier 633-9595	Law enforcement-DMR	PO Box 8 West Boothbay Harbor, ME 04575
Bob Richter 771-3536	Hydro-power	FPL Energy, Inc 100 Middle St. Portland, ME 04101
Tom Squiers 624-6348	Resource manager-DMR	#21 State House Station Augusta, ME 04333
Glenn Steeves 655-3303	Yellow eel fisherman Elver fisherman	109 Valley Rd Raymond, ME 04071
Gail Wippelhauser 624-6349	Resource manager-DMR	21 State House Station Augusta, ME 04333

Table 2. Status of research, monitoring, and enforcement needs identified by the Eel and Elver Management Fund Committee in 1996-1997.

Research, monitoring, and enforcement needs	Status
01 Obtain harvest, effort, fishing location for all eel fisheries	DMR ongoing
02 Conduct annual young-of-year (YOY) survey	DMR ongoing
03 Comment on hydropower licenses to improve eel passage	DMR ongoing
04 Maintain enforcement in elver fishery	DMR ongoing
05 Design and test upstream passage, obtain recruitment data	DMR ongoing
06 Determine downstream mortality/behavior of adult eels at dams	DMR ongoing
07 Determine extent, size, and timing of the fall run of adult eels and environmental correlates of migration	DMR ongoing
08 Work with eel/elver industry to develop legislation/regulations	DMR ongoing
09 Assess bycatch of elver fishery	DMR ongoing
10 Collect information of eel aquaculture	DMR ongoing
11 Determine effect of pollutants on eels (chlorine, PCBs, dioxins etc)	DMR assisting DEP
12 Determine behavior of elvers at dams (time before ascending)	
13 Determine effectiveness of diversion techniques for eels at dams	
14 Determine effect of eel stocking in areas where eels have declined	
15 Determine why are eels scarce/absent from some areas	
16 Determine why some areas have big elver runs but no big eels	

The number preceding each item does not indicate priority.

Table 3. Number of resident licenses by gear type for the elver fishery, 1996-2003.

A maximum of 1868 people legally fished for elvers in 1995 (prior to legislation requiring an elver fishing license). Nonresident licenses were not sold after 1999 (9 were sold in 1996, 15 in 1997, 21 in 1998 and 1 in 1999).

License type	1996	1997	1998	1999	2000	2001	2002	2003	2004
1 fyke	34	22	41	33	24	33	51	137	78
2 fykes	50	55	61	272	263	175	161	135	101
3 fykes	6	6	64						
4 fykes	5	6	8						
5 fykes	37	25	27						
1 fyke + dip	362	202	344	225	204	138	123	99	53
2 fykes + dip	318	223	307						
3 fykes + dip	61	40	237						
4 fykes + dip	20	23	51						
5 fykes + dip	198	127	271						
Dip net	1,107	655	882	213	174	113	108	91	38
Total	2,198	1,384	2,293	743	665	459	443	462	270

Table 4. Harvest and effort for the elver fishery, 1977-2003.

Year	Harvest (pounds)	Number of licenses	Number of fyke nets	Number of dip nets	Total number of nets
2003	3,325	462	506	190	696
2002	9,654	443	496	231	727
2001	3,131	459	521	251	772
2000	2,625	665	754	378	1,132
1999	3,587	744	804	438	1,242
1998	14,360	2,314	3,806	2,111	5,917
1997	7,360	1,399	1,844	1,283	3,127
1996	10,193	2,207	2,632	2,075	4,707
1995	16,599	<1,868			
1994	7,374				
1978	16,645				
1977	22,000				

Table 5. Summary of glass eels and pigmented eels recruiting to West Harbor Pond in 2003.

Gear	2001		2002		2003	
	Number glass eels	Number pigmented eels	Number glass eels	Number pigmented eels	Number glass eels	Number pigmented eels
West passage	18,321	388	43,207	91	3,756	113
East passage	34,303	867	38,766	1,483	10,643	820
Middle passage	16	174	886	138	605	177
Total	52,640	1,429	82,860	1,712	15,004	1,110

Table 6. Average total length, weight, and pigmentation stage of glass eels, 2001-2002.

Date	Avg TL (mm)	Avg weight (g)	Avg pigmentation
4/29/03	62.89	0.14	1.25
5/15/03	60.88	0.14	1.62
5/20/03	63.05	0.16	1.92
5/21/03	60.84	0.16	2.17
5/22/03	60.94	0.15	2.90
5/23/03	61.25	0.14	2.77
5/30/03	69.63	0.14	1.68
6/6/03	60.54	0.14	2.42
6/13/03	58.35	0.11	3.94

Table 7. Summary of visual observations at five projects.

Project	Dates of nighttime observations				
Lockwood	7/8	7/10	7/16	7/22	7/29
Hydro-Kennebec	7/8	7/10	7/16	7/28	
Shawmut	7/8	7/10	7/16		
Weston	7/22				

Table 8. Summary of upstream eel migration at Ft. Halifax and Benton Falls projects, 1999-2002.

Year	Fort Halifax		Benton Falls	
	Passage operating	Eel passed	Passage operating	Eels passed
2003	6/11-9/17	155,012	16 days	6,434
2002	6/10-9/13	56,292	6/18-9/13	22,502
2001	5/26-8/24	224,373	6/6-8/24	231,859
2000	6/21-7/28; 8/15-8/22	81,628	6/29-7/28; 8/14-8/24	37,207
1999	6/4-9/15	551,262	6/22-9/16	14,335

Table 9. Summary of Marine Patrol activities, 1996-2003, for A) 1997-2000 and B) 2001-2003.

A Category	Division I				Division I			
	1997	1998	1999	2000	1997	1998	1999	2000
Eel Enforcement Hours Worked	3134	3516	1534	587	2354	2749	756.5	467
Overtime Hours Worked	844	766	336.5	29	539	540	104	0
Summons Issued	113	73	5	2	101	131	8	2
Verbal and Written Warnings Issued	93	145	23	5	95	119	10	5
Complaints Addressed	205	248	39	1	219	132	4	0

B Category	Division I			Division I		
	2001	2002	2003	2001	2002	2003
Eel Enforcement Hours Worked	258	543.5	476	337	561	238.5
Overtime Hours Worked	1.5	1		0	42	2
Summons Issued	1	3	10	5	12	10
Verbal and Written Warnings Issued	12	0	12	14	13	8
Complaints Addressed	9	14	8	4	9	12

Table 10. Summary of elver fishery violations, 1999 –2003, for A) Division I and B) Division II.

A.	Violation	Division I									
		Warnings					Summons				
		1999	2000	2001	2002	2003	1999	2000	2001	2002	2003
	Closed Season, Harvesting	0	0	1	0	2	0	1	0	0	0
	Closed Season, Locating Nets	0	0	0	0	0	1	0	0	0	
	Closed Season, Setting Nets and Traps	2	3	4	0	2	1	1	0	0	
	Closed Season, Nets of Certain Sizes	0	0	0	0	1	0	0	0	0	
	Closed Period, Harvesting	6	0	0	0	4	1	0	1	1	
	Closed Area, Fishing for Elvers	1	0	0	0	0	0	0	0	0	
	Closed Area, 150' of a Fishway	0	0	0	0	0	0	0	0	1	
	Closed Area, Fishing Middle Third	7	1	1	0	3	0	0	0	1	
	Closed Area, Use of Dip Net Inside Fyke Net	0	0	0	0	0	0	0	0	0	
	Method of Fishing, Limits on Gear	3	0	5	0	0	0	0	0	0	
	Method of Fishing, Fishing from a Boat	0	0	0	0	0	0	0	0	0	
	Method of Fishing, Standing in Water	0	0	0	0	0	0	0	0	0	
	Method of Fishing, Inadequate Excluder Panel	0	0	0	0	0	0	0	1	0	
	Molesting Elver Gear	2	0	1	0	0	0	0	0	1	
	Elver Fishing License (Fishing without a License)	0	1	0	0	0	2	0	0	0	
	Elver Tags (Untagged Nets)	2	0	0	0	1	0	0	0	0	
	Theft	0	0	0	0	0	0	0	0	0	
	Miscellaneous	0	0	0	0	0	0	0	0	1	
	Totals	23	5	12	0	13	5	2	1	3	

B.	Violation	Division II									
		Warnings					Summons				
		1999	2000	2001	2002	2003	1999	2000	2001	2002	2003
	Closed Season, Harvesting	0	4	0	0	0	0	0	0	0	
	Closed Season, Locating Nets	1	0	0	0	0	0	2	0	0	
	Closed Season, Setting Nets and Traps	0	0	0	0	1	1	0	0	4	
	Closed Season, Nets of Certain Sizes	0	0	0	0	5	0	0	0	0	
	Closed Area, Fishing Middle Third	1	0	5	6	2	5	0	3	4	
	Closed Area, Fishing for Elvers	2	0	3	1	0	0	0	2	0	
	Closed Area, 150' of a Fishway	0	0	0	0	0	0	0	0	1	
	Closed Area, Fishing Middle Third	3	1	3	1	1	2	0	0	3	
	Closed Area, Use of Dip Net Inside Fyke Net	1	0	0	0	0	0	0	0	0	
	Closed Area, Alewife Trap	0	0	0	0	0	0	0	0	0	
	Method of Fishing, Limits on Gear	0	0	0	0	0	0	0	0	0	
	Method of Fishing, Fishing from a Boat	0	0	0	0	0	0	0	0	0	
	Method of Fishing, Standing in Water	0	0	0	0	0	0	0	0	0	
	Method of Fishing, Inadequate Excluder Panel	0	0	0	1	0	0	0	0	1	
	Molesting Elver Gear	0	0	0	4	0	0	0	0	2	
	Elver Fishing License (Fishing without a License)	1	0	1	0	0	0	0	0	0	
	Elver Tags (Untagged Nets)	1	0	2	0	1	0	0	0	3	
	Totals	10	5	14	13	10	8	2	5	12	

Table 11. Licenses issued by DMR for eel pots in tidal water and permits issued by DIFW for eel pots and weirs in inland waters.

Year	Number DMR licenses	Number DIFW permits
2003	11	10
2002	10	13
2001	15	21
2000	25	27
1999	26	42
1998	41	79
1997	53	74
1996	48	71
1995	no data	124
1994	55	51
1993	39	60
1992	33	80
1991	32	56
1990	29	34
1989	19	25
1988	17	22
1987	14	16
1986	12	23
1985	28	23

Table 12. Status of hydroelectric projects being relicensed in Maine.

Dam number refers to relative position in the river (e.g. the dam at Veazie is the first dam on the Penobscot River encountered by a fish migrating from the ocean). US refers to upstream passage; DS refers to downstream passage.

River system	Dam number	Project name	FERC Number	Status/comments
Penobscot	1	Veazie	2403	settlement negotiations
	2	Great Works	2312	settlement negotiations
	3	Milford	2534	settlement negotiations
	4	West Enfield		settlement negotiations
	5	Medway	2666	license - US / DS eel passage required
Piscataquis	1	Howland	2721	settlement negotiations
Stillwater	1	Orono	2710	settlement negotiations
	2	Stillwater	2712	settlement negotiations
Damariscotta	1	Damariscotta	11566	license - DS eel passage required
Kennebec	1	Lockwood	2574	relicensing ongoing – US eel study
	2	Hydro-Kennebec	2611	license - US eel passage installed
	3	Shawmut	2322	license - US eel passage installed
	4	Weston	2325	license - US eel passage in 2004
	5	Abenaki	2364	license - US / DS eel passage required
	6	Anson	2365	license - US / DS eel passage required
Sebasticook	1	Ft Halifax	2552	license - US eel passage installed
	2	Benton Falls	5073	license - US eel passage installed
	3	Burnham	11472	license - US eel passage in 2004
Cobbosseecontee	2	American Tissue	2809	interim DS eel passage measures
Presumpscot	3	Saccarappa	2897	license - US / DS eel passage required
	4	Mallison	2932	license - US / DS eel passage required
	5	Little Falls	2941	license - US / DS eel passage required
	6	Gambo	2931	license - US / DS eel passage required
	7	Dundee	2942	license - US / DS eel passage required
	9	Eel Weir		relicensing ongoing - US / DS requested
	Saco	4	Bar Mills	2194
Salmon Falls	1	South Berwick	11163	license - US eel passage installed

Figure 1. Location of young-of-year survey, and close-up view of vertical elver passage.

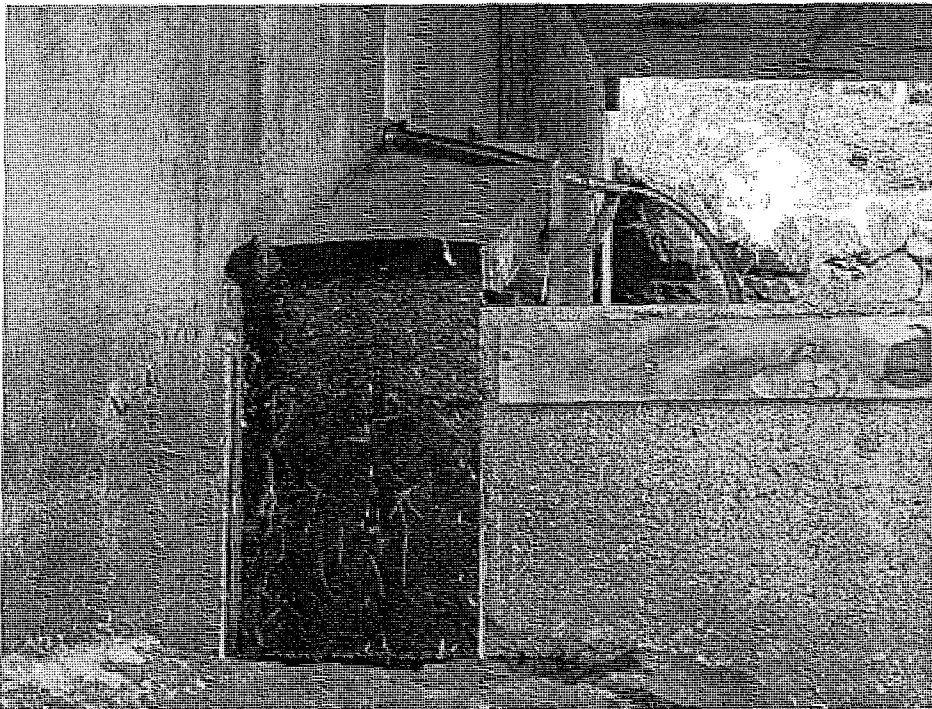
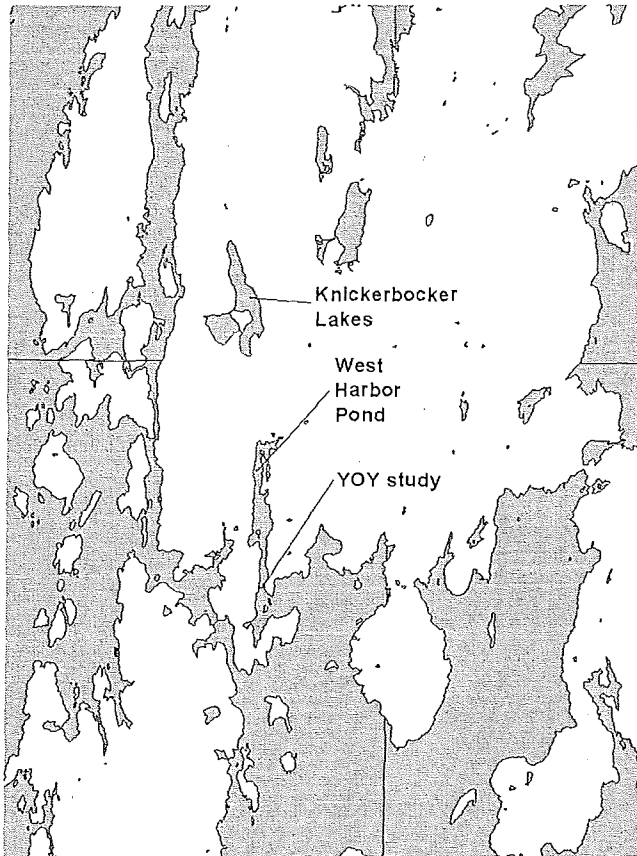


Figure 2. Recruitment of (A) glass eels and (B) pigmented eels into West Harbor Pond, ME, in 2003.

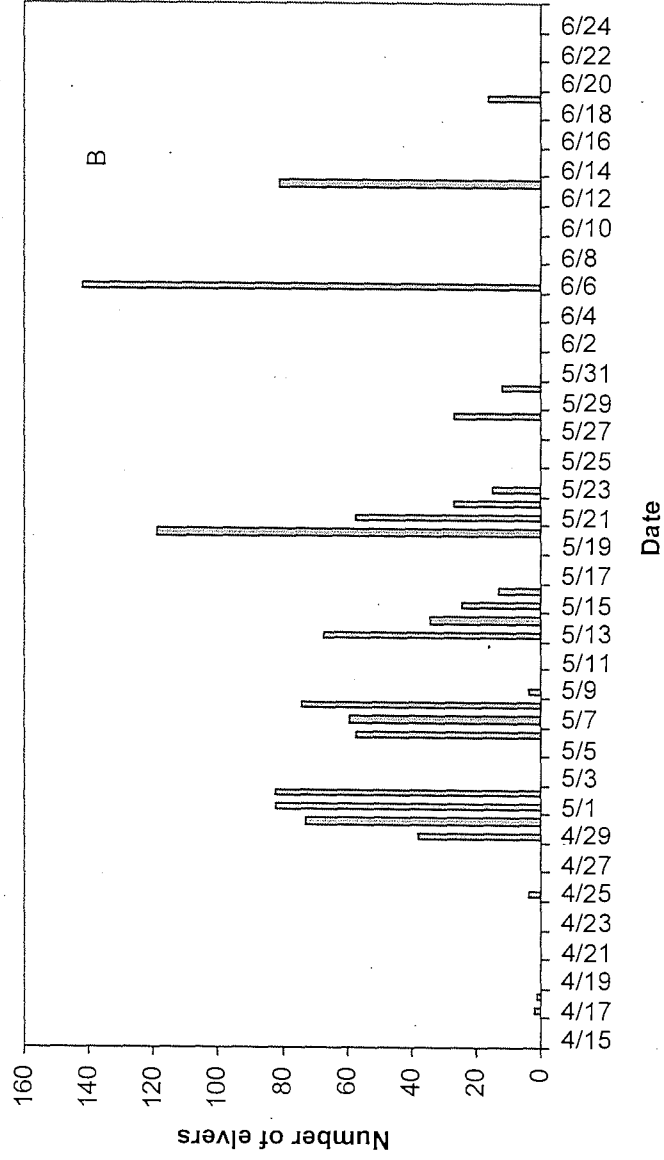
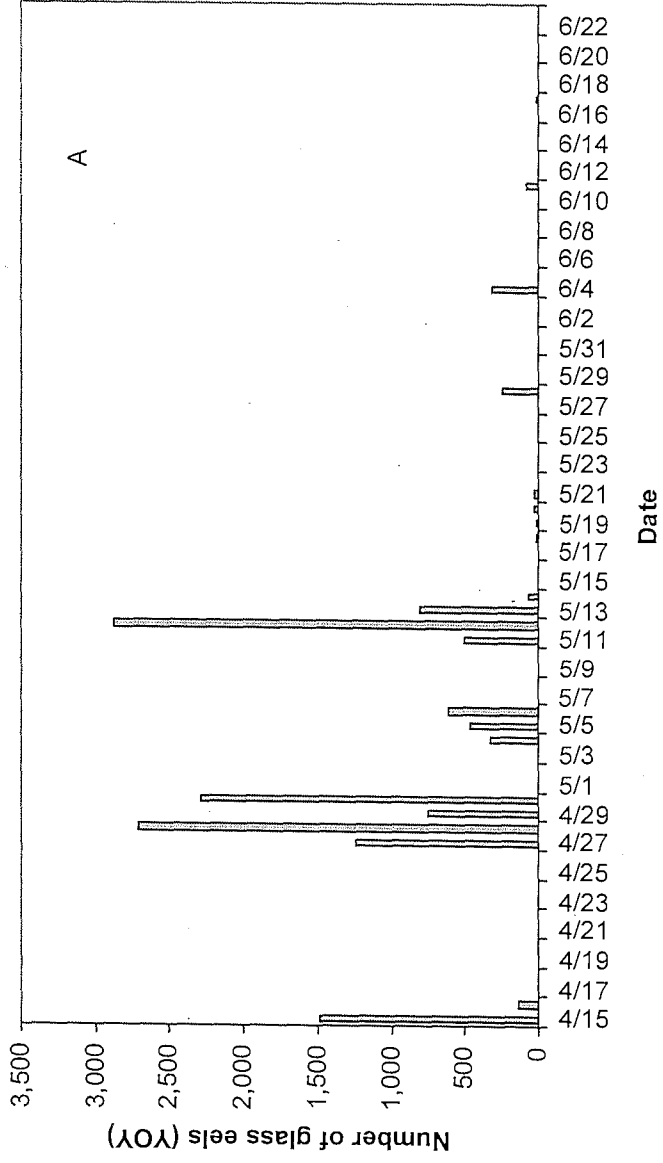


Figure 3. Location of hydropower projects and fishways within the Kennebec River watershed.

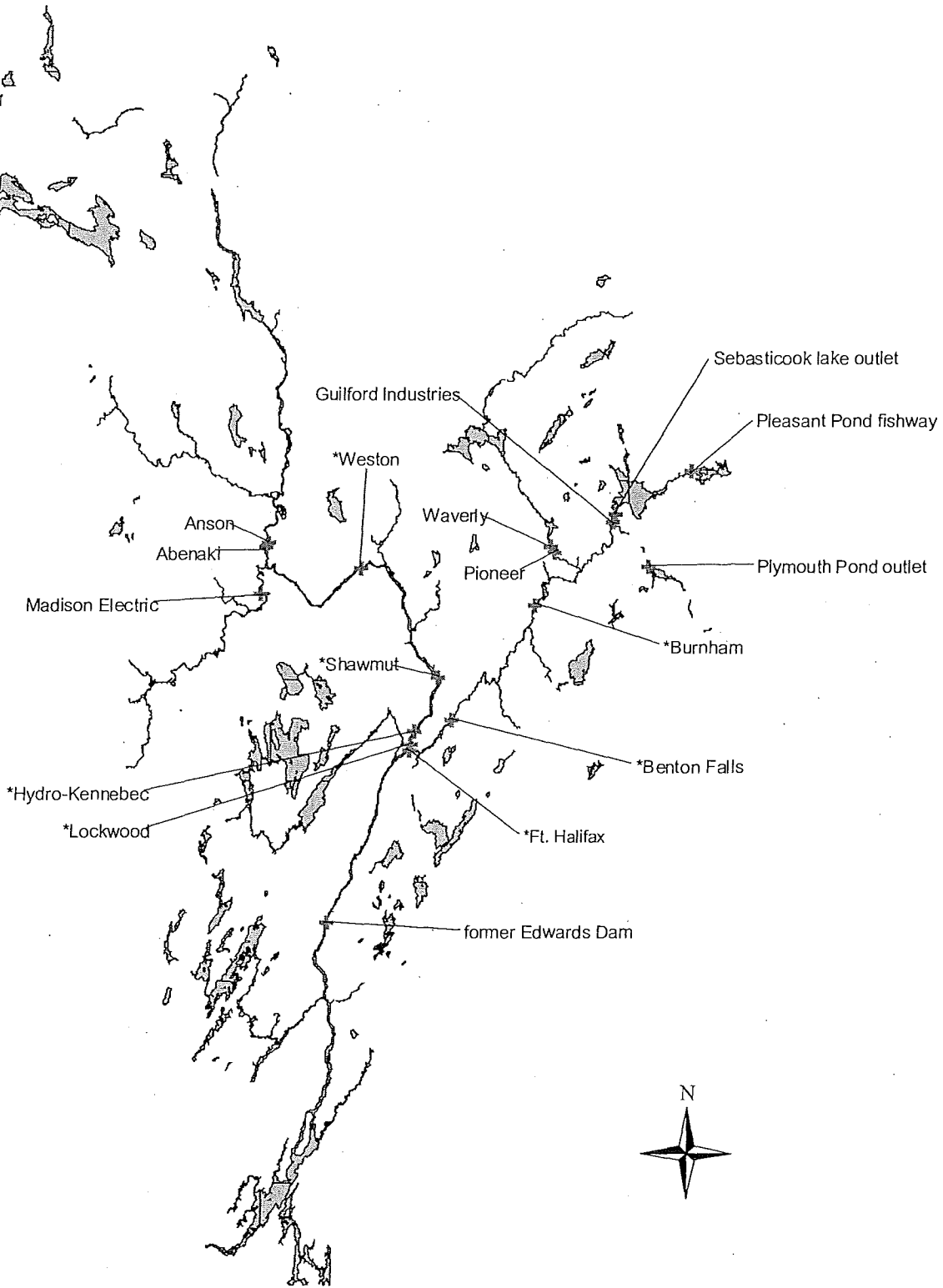


Figure 4. Total length of eels at Hydro-Kennebec during the 2003 field season.

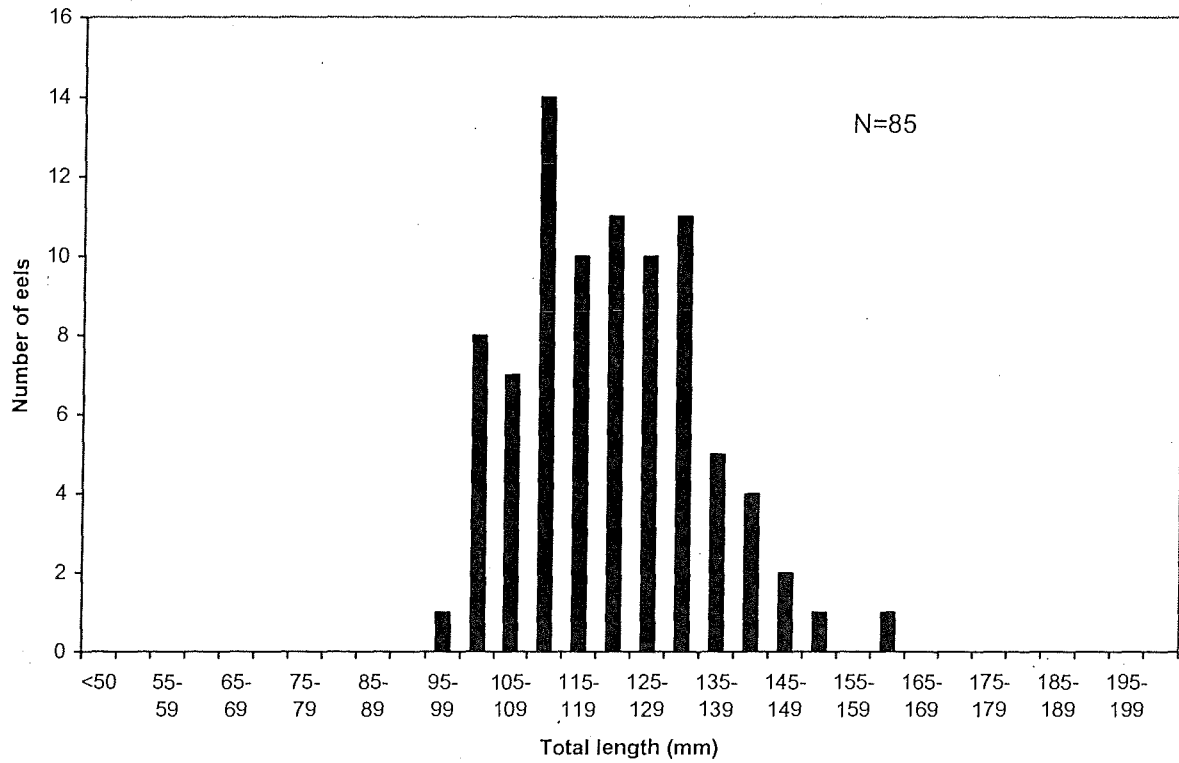


Figure 5. Eel passage at Ft. Halifax Dam in 2003.

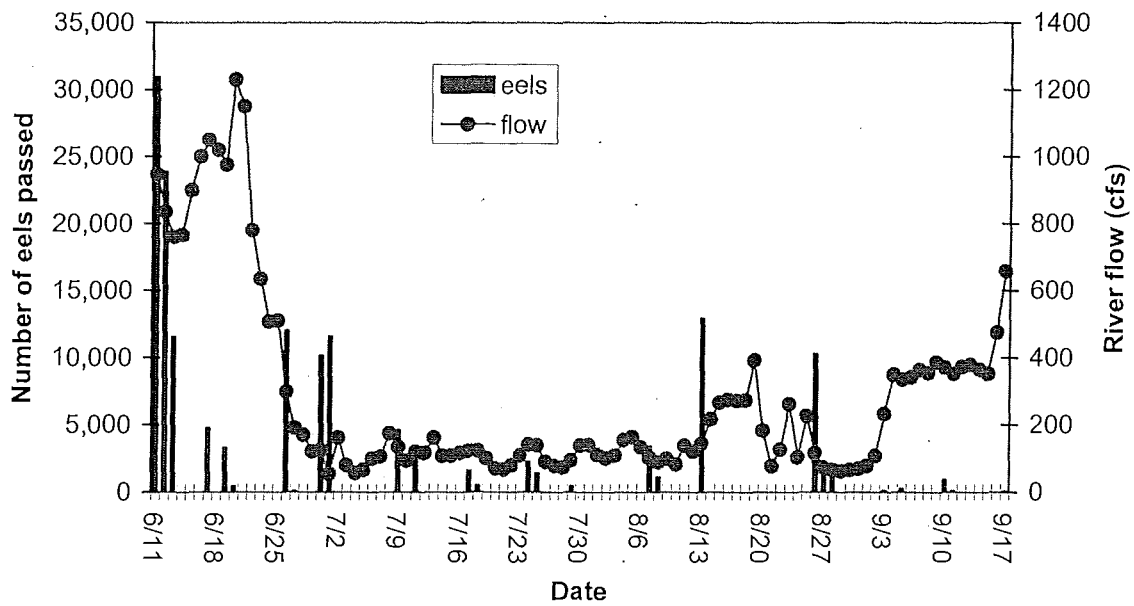


Figure 6. Total length of eels passed at Ft. Halifax Dam in 2003.

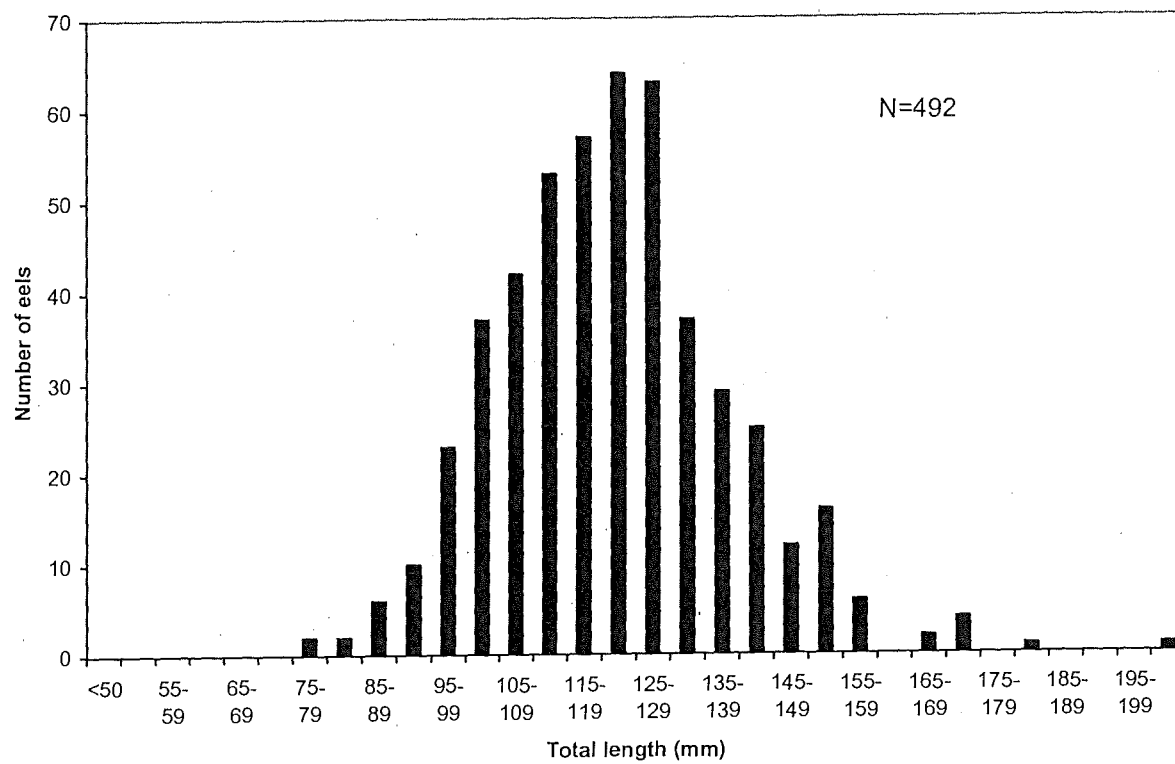


Figure 7. Total length of eels passed at Benton Falls Dam in 2003.

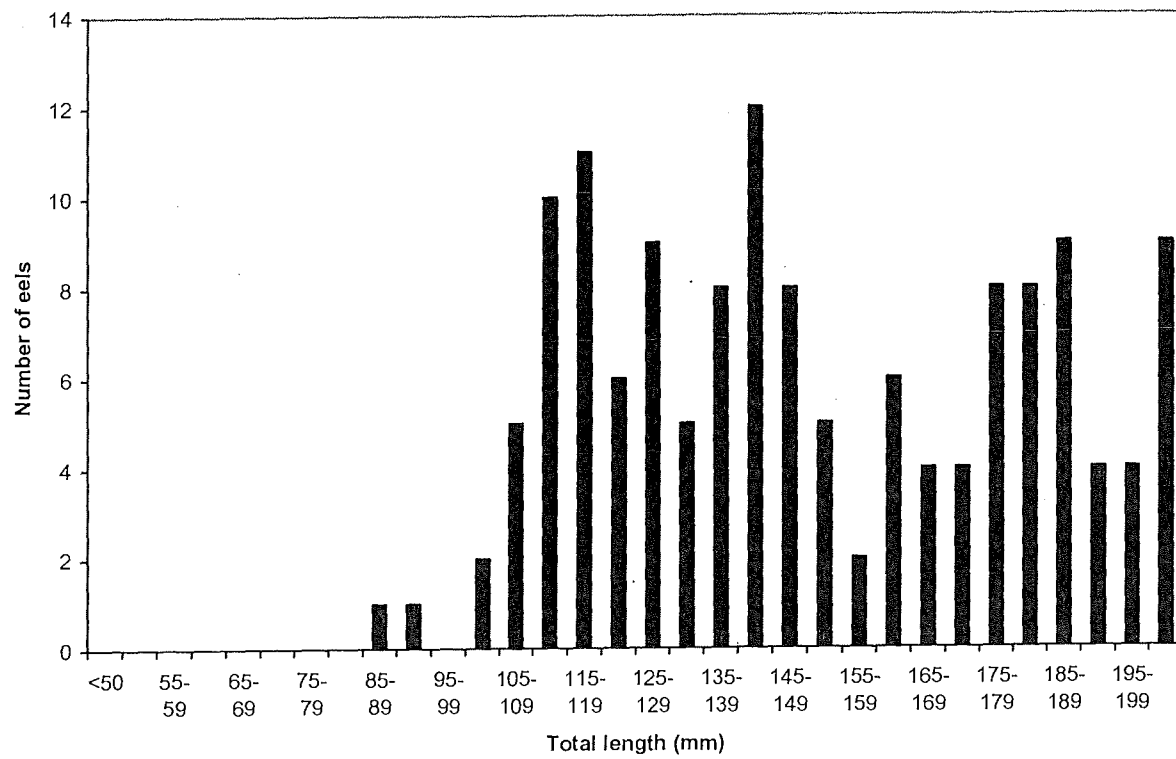


Figure 8. Eel harvest in Maine.

