MAINE DEPARTMENT OF MARINE RESOURCES

2020 Maine Herring Sustainable Fishing Plan Update (with revisions for recreational fishery)

Bureau of Marine Science

Update Approved August 4, 2020

The Sustainable Fisheries Management Plan Update provided below contains information that by Maine state law needs to remain confidential. This information may only be used by the ASMFC River Herring and Shad Technical Committee in the course of evaluating the updated river herring management plan. This information may not be shared with any individual or group outside of this committee. The expectation that this information will remain confidential facilitates the State of Maine's ability to collect the best quality data available from individual fishermen for use in managing Maine's commercial river herring fisheries.

§6173. Confidentiality of statistics

1. Collection and reporting of statistics. The commissioner may, with the advice and consent of the advisory council, adopt rules to collect pertinent data with respect to the fisheries, including, but not limited to, information regarding the type and quantity of fishing gear used, catch by species in numbers of fish or weight, areas in which fishing was conducted, time of fishing, number of hauls and the estimated processing capacity of, and the actual processing capacity utilized by United States fish processors. The commissioner may collect statistics from any source and may require reporting of these statistics. The information collected by or reported to the commissioner is confidential and may not be disclosed in a manner or form that permits identification of any person or vessel, except when required by court order or when specifically permitted under this section. The commissioner may share data collected under this section with the National Marine Fisheries Service or successor organization for research or fisheries management purposes, provided that federal laws and regulations protect the confidentiality of the shared data. The commissioner shall adopt rules to carry out the purposes of this section. Rules adopted under this section are routine technical rules pursuant to Title 5, chapter 375, subchapter2-A.

Maine ASMFC River Herring Sustainable Fishing Plan Update 2015

1. Introduction

The purpose of this sustainable fisheries management plan is to ensure that existing river herring resources within Maine continue to thrive and provide a source of forage for Maine's fish and wildlife and provide commercial fishing opportunities in coastal Maine's communities.

The State of Maine Department of Marine Resources (DMR) and municipalities that historically harvest river herring operate under cooperative site specific management plans that guide conservation and harvest of river herring resources within these municipalities. These plans promote and manage healthy commercial and non-commercial river herring resources where they occur within the state. Maine formalized mutual river herring management plan formats in 1950, though mutual management plans and harvest agreements existed prior to this date

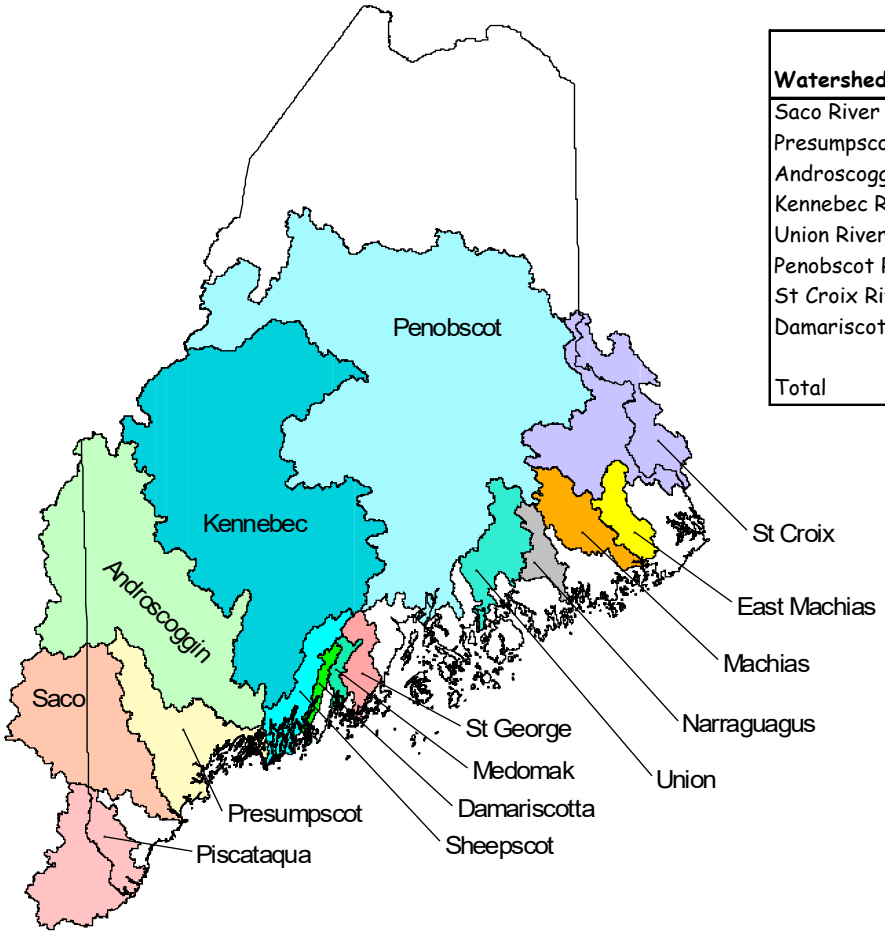
Maine has forty municipalities with the exclusive right to commercially harvest river herring. The State of Maine, in conjunction with the municipalities, and in accordance with cooperative river herring management plans, reviews these plans on an annual basis. Currently, twenty-four municipalities actively harvest river herring (Table 1). Joint fisheries operate through cooperative agreements between municipalities with a shared waterway. One example is Winnegance Lake in mid-coast Maine. The three municipalities, Bath, West Bath, and Phippsburg, that boarder the spawning habitat along Winnegance Lake share management responsibilities and coordinate harvest.

Directed commercial harvest of alewife or blueback herring does not occur in the main stem of nine of Maine's largest rivers (Penobscot, Kennebec, Androscoggin, Saco, St. Croix, Presumpscot, Machias, Salmon Falls, and East Machias). Commercial fisheries do exist on the tributaries of larger rivers, for example, harvest is permitted on the Sebasticook River six miles above its confluence with the Kennebec. Maine limits directed harvest in these rivers through time/area closures and gear restrictions. These traditional conservation strategies allow alewife and blueback herring unrestricted access to spawning habitats upstream. To further conserve existing river herring populations in coastal waters this plan prohibits the use of all gear types to fish for, catch, harvest, or sell blueback herring or alewife (Alosa aestivalis, Alosa pseudoharengus**)**, collectively known as river herring in Maine territorial waters (inside three miles) with the exception of the permitted municipal fisheries. **(Appendix B)**

There are ongoing efforts to improve commercial and non-commercial runs that occur throughout historic spawning habitats in the state. Dam construction during the last two centuries isolated river herring from many of the inland waters DMR is trying to restore through alewife reintroduction. The historical significance of anadromous fish to these waters was eventually lost, and freshwater fish communities, especially recreational game fish, began dominating these habitats. In the 1980s, DMR began restoring historic spawning habitats for anadromous fish in inland waters. Establishing a baseline for reintroduction was important to inland fisheries managers that manage fishing opportunities for salmon, trout, and bass. The interim restoration target for inland spawning habitats is six fish per surface acre for inland lake and pond locations stocked by truck. The State of Maine established this stocking rate as a result of a 10-year study conducted by MDMR, Maine Department of Environmental Protection, and Maine Inland Fisheries and Wildlife (Kircheis 2002). The goal of the study was to quantify the effects of a spawning population of alewife on the resident fish species and zooplankton community within inland waters. A

stocking rate of six fish per surface acre of lake or pond habitat exhibited no negative effects on growth rates of resident fresh water fish species. The DMR observes this stocking rate for all truck-stocked locations. It is important to note that the initial stocking rate for this study was arbitrary and the stocking density could be higher and still not demonstrate significant impacts to resident fish species. The potential alewife population based on historically available habitat and estimates of current production would exceed 54.5 million fish (Figure 1).

Figure 1. Estimates of potential alewife returns from historic alewife habitat by watershed (@235/fish/acre).



Watershed	Alewife Potential
Saco River	720,630
Presumpscot River	147,700
Androscoggin River	2,300,000
Kennebec River	11,143,086
Union River	2,000,000
Penobscot River	14,561,305
St Croix River	22,660,000
Damariscotta	1,034,000
Total	54,566,721

The Maine Department of Marine Resources must receive a permit from the Maine Department of Inland fisheries and Wildlife before stocking any state waters with river herring. The numbers of spawning fish allowed into some historic spawning habitats is limited, or not permitted at all, based on perceived conflicts with rainbow smelt and recreational sport fish species such as landlocked salmon, smallmouth bass, and largemouth bass. Although there appears to be no basis for these concerns the number of river herring permitted into some historic spawning locations range from zero to six fish per surface area based on the Lake George Report. State legislation prohibits stocking river herring into several waters in the state. Most commercial runs could expand if they were not constrained by permitting or fish passage restrictions unrelated to the commercial harvest. One example is the Androscoggin River, Maine's third

largest River where only 1/3 of the historic spawning area is open to river herring restoration. A similar issue occurred on the St. Croix River when the Maine Legislature ordered modifications to these fishways to prevent river herring from ascending the river. Soon after the state closed these fishways in the 1980s, the river herring run declined from a population of 2.8 million returns to approximately 5,000. In 2013 the Maine Legislature reversed its decision and river herring were allowed to pass into a larger portion of the watershed beginning in 2014. The DMR is also working with state, federal resource agencies and NGOs to increase access to historic spawning habitats on the St. Croix River and other rivers statewide.

Commercial harvesters and supporters of river herring restoration continue to advocate for increased passage for river herring. All of the current municipalities that exercise commercial river herring fishing rights maintain and monitor up and downstream passage during the spring and fall. Since 2008 commercial fisherman collected scale samples from their respective commercial catches to meet the data collection objectives of Amendment 2. In municipalities which do not exercise their right to fish, river herring returns typically remain below expectations. In most cases, there is no local interest in providing/improving passage or monitoring these runs.

Table 1. Maine municipalities with directed commercial river herring fishing rights

Municipality	Fishery	Municipality	Fishery
Alna*	Long Pond	Lincolnville	Pitcher Pond
Arrowsic	Sewall Pond	Northport	
Bath*		Mount Desert	Somes Pond
Phippsburg*	Winnegance Pond	Newcastle*	Damariscotta Lake
West Bath*		Nobleboro*	
Benton*	Sebasticook River	Orland*	Orland River
Boothbay Harbor	West Harbor Pond	Pembroke*	Pennimaquan Lake
Breman	Webber Pond	Perry*	Boyden Lake
Bristol	Pemaquid Pond	Penobscot*	Peirce Pond
Cape Elizabeth	Alewife Pond	Phippsburg	Center Pond
Cherryfield*	Narraguagus River	South Berwick	Salmon Falls River
Columbia Falls*	Pleasant River	Steuben*	Tunk Lake
Dresden*	Mill Pond	Sullivan*	Flanders Pond
East Machias*	Gardiner Lake	Surry	Patten Pond
Ellsworth*	Union River	Tremont	Sea Cove Pond
Franklin*	Great Pond	Vassalboro*	Webber Pond
Gouldsboro*	West Bay Pond	Waldoboro	Medomak River
Hampden	Souadabscook Pond	Warren*	St. George River
Jefferson*	Dyer-Long Pond	West Bath	New Meadows Pond
Kennebunk	Alewife Pond	Woolwich*	Nequasset Lake

* Towns that currently harvest river herring

2. Current regulations

Commercial Fisheries

Local municipalities control access to most commercial quantities of river herring. These municipalities, in cooperation with the State of Maine, manage the state's river herring resources. The State of Maine requires municipalities with historic river herring harvest rights to file an annual notification that they wish to maintain exclusive fishing rights. An annual harvest plan is required for each fishery prior to approval by the Department of Marine Resources. Most commercial harvest plans follow the model plan provided below, while some plans have additional management requirements specific to an individual run. Each municipality restricts the number of harvesters to one individual who is responsible for harvesting fish under the municipality's management plan. All commercial fisheries have a 72-hour closed period or conservation equivalency to insure proper escapement into spawning habitat. Individual river/stock specific plans were provided to ASMFC for review if additional information is required. Municipal fisheries that operate under conservation equivalencies are required to pass the minimum number of spawning river herring upstream based on habitat availability at the rate of 35 fish per surface acre of spawning and nursery habitat and/or provide additional escapement periods.

Commercial Season

The annual river herring harvest begins when fish a river at the harvest site, typically the last week of April, though many runs do not commence until the first week of May. The run timing of commercial catches is progressively later as you move eastward along the coast. The river herring season ends June 5 unless the municipality submits a request for a 10-day extension until June 15. The DMR will award an extension if environmental conditions delay run timing during the season and river herring are not available to the commercial harvester. Closed periods still apply which effectively reduce the extension period to no more than seven and as few as five additional fishing days for the season. Most years the June 15 end date coincides with the start of the blueback herring run in Maine rivers. Commercial harvesters do capture blueback herring toward the end of the alewife season at some locations (Orland, Benton, Warren). Most commercial alewife harvest locations do not support blueback herring populations. In general, Maine rivers with blueback herring runs see spawning continue through the third week of July. Most commercial quantities of blueback herring are found in the main stems of our large rivers and larger tributaries and are protected by time/area closures and gear restrictions.

Model Harvest Ordinance for the Harvest of River Herring

1) A minimum unobstructed opening of two feet (2') shall be maintained at all times between the riverbank and the downstream end of the weir.

2) The maximum mesh size of wire, twine, or other material used in the weir shall not exceed one inch by one inch (1" x 1").

3) There shall be a 72-hour weekly closed season on alewives from sunrise each Thursday morning until sunrise the following Sunday morning. During the closed period, a minimum size unobstructed opening of three feet by three feet (3' x 3') shall be maintained in the upstream and downstream end of the trap to allow escapement of spawning alewives and other migratory fish.

4) Migratory fish such as salmon, shad, or other species except alewives and blueback herring that enter the trap shall be removed and allowed to pass upstream.

5) Fishing operations shall cease and all fishing gear obstructing the passage of fish shall be removed from the fishing waters not later than June 5. If late-run alewives are entering the river, the Town must seek approval from the Department of Marine Resources to extend the season up to but no later than June 15.

6) The total landings in pounds or bushels and value of the catch shall be made available to the Maine Department of Marine Resources and/or National Marine Fisheries Service on request by these agencies.

Additional Regulations for Streams with Atlantic Salmon Runs

1) The entrance to the dipping pen or trap shall be covered by bars, slats, or spacers with a maximum width of two inches (2") between said bars, slats or spacers.

2) Dipping of alewives shall be confined to the dipping pen or trap.

The U.S Fish and Wildlife Service lists Atlantic salmon as endangered in the eastern two thirds of the State of Maine. There are no known conflicts with commercial alewife fisheries in the rivers where these fisheries currently exist. River herring may provide possible benefits to the Atlantic salmon smolts during emigration by increasing the numbers of forage fish within the system during migration. The U.S. Fish and Wildlife Service is currently testing the hypothesis that alewives provide a cover for migrating Atlantic salmon smolts, lessening the morality during downstream migration to the sea.

Newly Enacted Legislation

The 124th Maine Legislature passed legislation presented as proposed legislation in the previous Sustainable Fisheries Management Plan. This legislation crates a “Commercial Pelagic and Anadromous Fishing License and Establishes the Pelagic Fisheries Fund.” This legislation requires mandatory reporting of all catch data within 60 days, tracks bycatch for river herring, and provides funding to conduct limited research **(Appendix B)**. This legislation tracks river herring bycatch statewide and helps identify fishing locations and gear types that have high incidence of river herring bycatch in coastal waters.

The 126th Maine Legislature passed legislation opening up the St. Croix River to the passage of river herring. “*By May 1, 2013, the commissioner and the Commissioner of Inland Fisheries and Wildlife shall ensure that the fishways on the Woodland Dam and the Grand Falls Dam located on the St. Croix River are configured or operated in a manner that allows the unconstrained passage of river herring.*”

Recreational Fisheries

Limited opportunities exist for recreational river herring harvest in tidal and inland waters. Current state law allows recreational anglers to take 25 fish per day for personal use. Few locations in Maine permit recreational anglers to regularly catch 25 fish per day. Gear restrictions limit anglers to hook and line and dip net only. These gear types are permitted only in areas outside of a watershed and downstream of the municipal harvest location where exclusive rights are granted by the State. The recreational fisheries do not affect escapement of spawning fish passed at commercial fishing operations.

3. Brief Description - Current Status of the Stocks

The State of Maine manages Individual river herring runs as separate stocks. These stocks have separate, well-defined spawning habitats, migration routes, and run timing that make them unique compared to similar runs throughout the state. Maine's commercial stocks were categorized as stable or increasing based on data presented in the 2008 ASMFC stock status report, though they did reflect annual variation based on a number of factors related to the environment, upstream and downstream passage efficiency, annual harvest, escapement, and bycatch in other fisheries. Data analyses compiled during the ***Atlantic States Marine Fisheries Commission 2008 River Herring Stock Status Report*** indicate increasing trends in population and stable age structure during the past two decades. The same analyses for the period 2009 through 2015 indicate similar trends in run size for commercial and non-commercial locations. These data are included below and will be included as part of Maine's section of the Atlantic States Marine Fisheries Commission 2017 River Herring Stock Status Report update.

Non-commercial runs are stable at low levels, except where active restoration efforts are improving run size. Many non-commercial runs are small by nature and experience passage issues that limit reproduction and run size. Despite commercial closure, many of these runs maintain only remnant populations. Improving upstream and downstream passage and stocking efforts to rebuild these runs could enable these habitats to produce excess fish for commercial harvest in the future.

The State of Maine is currently updating the Maine section of the ASMFC Stock Assessment Committee document ***Atlantic States Marine Fisheries Commission 2008 River Herring Stock Status Report*** with data through 2015. Highlights of the information from the 2008 report and updates through 2015 are provided below as support for the sustainable fisheries management plan update.

- Male and female river herring survival estimates using the Beverton-Holt method indicate Z-values of .69 and .54 for males and females respectively for alewives collected from the Androscoggin River for the period 2000 to 2007. The same calculation run for the period 2008 – 2016 were .54 and .33 for males and females respectively, indicating increased survival of both sexes on the Androscoggin River.

- Results are similar for the Sebasticook River where Z-estimates for both male and female river herring declined from .84 and .77 to .78 and .65 for male and females respectively. These values indicate increased survival for the period 2000 - 2015. Assessment of the period 2008 – 2015 returned survival estimates of .71 for males and .53 for females.

  Figure 2. Fisheries independent Beverton-Holt Z-Estimates.

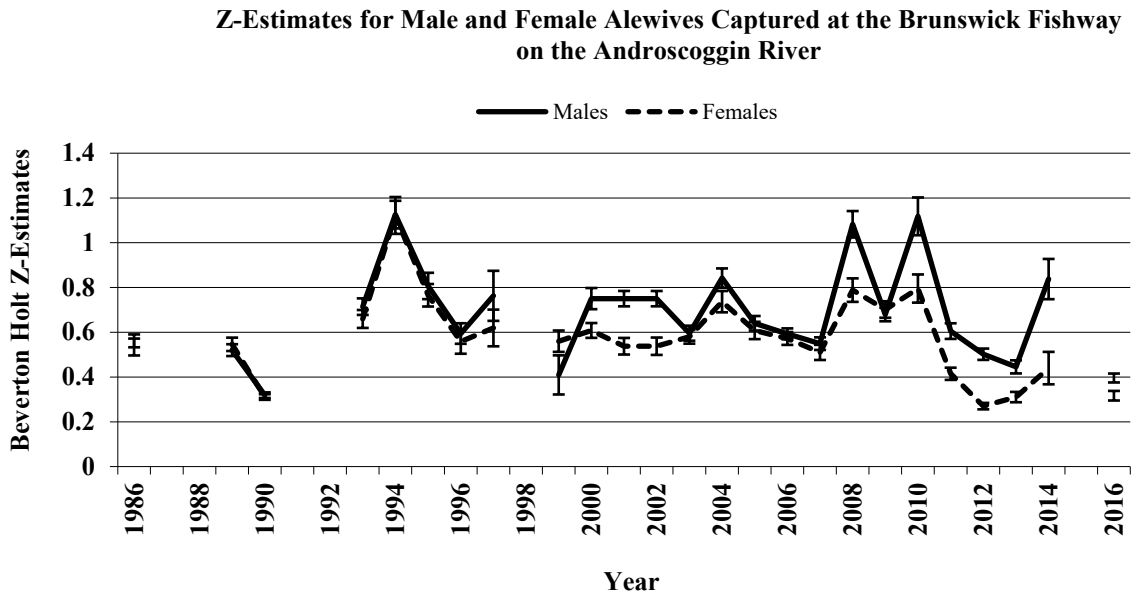


Figure 3. Fisheries independent estimates of male Z-values using Catch Curve, Heinke and Chapman-Robson.

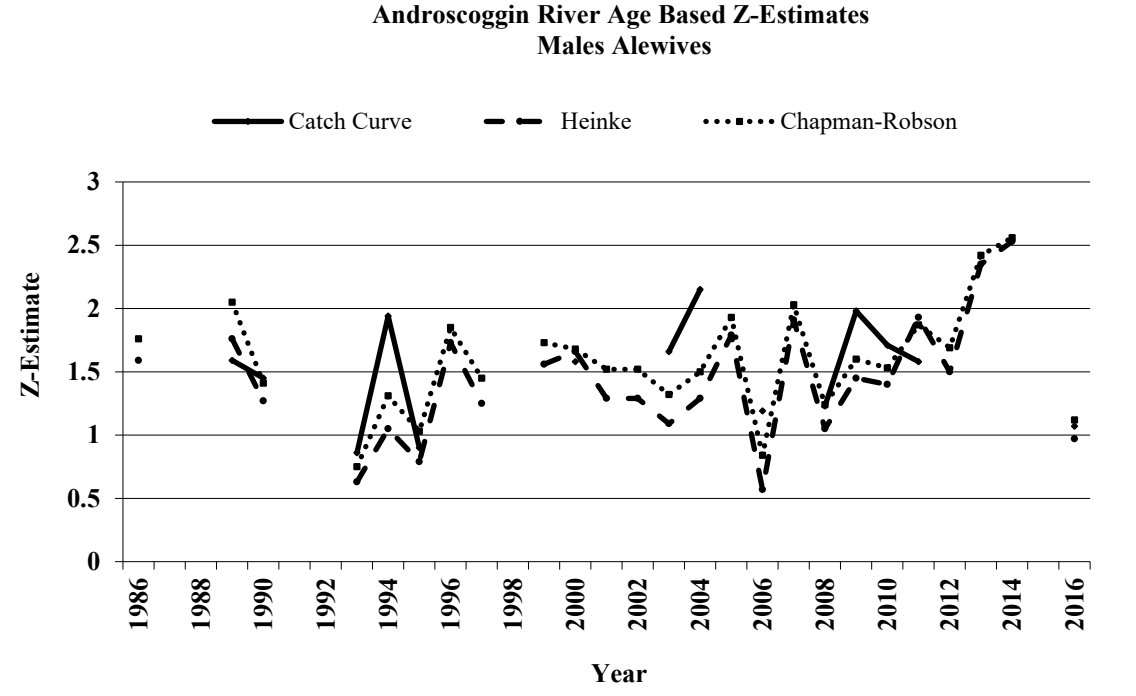
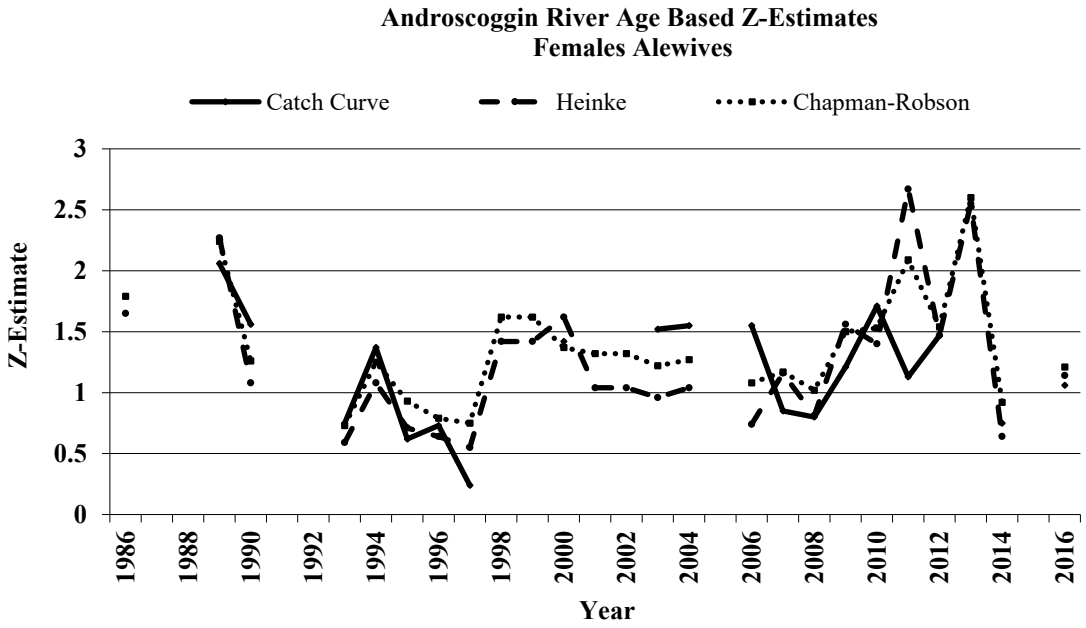


Figure 4. Fisheries independent estimates of female Z-values using catch curve, Heinke and Chapman-Robson.



- Exploitation of the Damariscotta River run was <6% for the period 1993-2000. Since 2000 the exploitation rate has ranged as high as 62%. For the years 2012 through 2016 exploitation has returned to less than 15%. The trend in exploitation for the Union River declined from 1982 – 2016 and was 50% for 2016, well below exploitation rates of greater than 90% prior to 1989.

- Increasing trends in run size in Maine for the Androscoggin, Damariscotta, and Sebasticook rivers.

- Stable maximum age for alewife and blueback herring compared to historical observations. Data from scale sample analysis show river herring as old as 8-years in our commercial fisheries. (ASMFC 2008 RHSSR page 48)

  Age data collected by Rounsefell in 1943 indicate that two commercial fisheries, Damariscotta and Orland, where dominated by single age classes of spawning fish. There were no data available for subsequent years, though Rounsefell's estimates of exploitation (90% for Maine fisheries) would indicate that there were few repeat spawning fish during the years immediately prior to or following 1943 (Rounsefell & Stringer 1943 p.6). Current age data and exploitation rates have improved the age structure and improved the repeat spawning component of these runs.

- Stable mean length at age for fisheries-independent data collected from the Androscoggin River. (ASMFC 2008 RHSSR page 48)

  Historical data collected by the U.S Fish and Wildlife Service in 1943 at Damariscotta Lake and the Orland River support the current trends discussed in the Stock Status Report for Maine alewife populations. The U.S. Fish and Wildlife Service determined that the mean lengths of male alewives were 268.9 mm and 269.7 mm respectively. Mean female lengths for the same rivers

during 2008 were 275.0 mm and 278.2 mm respectively. The mean lengths observed by the U.S. Fish and Wildlife Service are shorter than those observed in biological samples collected from the 2010 and 2015 commercial fisheries at these locations. Damariscotta males averaged 274.2 (2010); 274.8 (2015) mm while females averaged 286.7 (2010); 293.1 (2015) mm, both longer than the lengths observed in 1943. Length data collected in 2010 and 2015 from the commercial fishery on the Orland River show the same trends. Mean length for males is 278 (2010); 274.9 (2016) mm and mean length for females is 294 (2010) and 286.3 (2015) mm. (Rounsefell & Stringer 1943 p.7, 23)

- Repeat spawning rates based on fisheries-independent data collected at the Brunswick Fishway have averaged 25% since 2007 and increased to 29.5% for the years 2008 through 2016. (ASMFC 2008 RHSSR page 38)

a. Landings

The State of Maine requires mandatory reporting of municipal landings by August 1st of each year. Trend analysis indicates an increasing trend in state landings for the period 1981 to 2016. The Department of Marine Resources tracks annual landings through time to observe trends by stock. Total annual landings data is becoming less dependable as a metric to assess the health of commercial runs. An increasing number of municipal harvesters are choosing to harvest for personal use or limited retail sale and not fully exploiting the available population as has occurred historically. Escapement numbers are unknown in most Maine river herring fisheries and are estimated using a ratio of closed days and reported commercial landings. Estimates of escapement and total run size using commercial landings are the best estimators of population size for most on Maine's commercial runs. A reduced commercial harvest results in a substantially lower estimate of escapement and total run size when runs are not actively harvested.

Fisheries independent estimates of annual escapement for commercial runs can range from 15 – 80 percent. To ground truth estimates of escapement to actual escapement, runs where daily counts were conducted were used as a proxy for commercial fisheries. The ratio of the number fish passed on closed days when commercial fisheries were not allowed were compared to open days when commercial fisheries were allowed. These data indicate that consecutive closed days during the week can achive an escapement rate approximating 42.8 percent of the annual run. The daily counts at the Sebasticook River Fishway indicate escapement similar to those observed at Brunswick. The escapement rate at the Sebasticook River Fishway was 45 percent based on the numbers of fish passed upstream on fishing days vs non-fishing days (Table 2). Data were also collected at the Weber Pond Fishway where an active harvest exists and the numbers of fish that pass into the lake were counted daily. These data also indicate that for the past six years escapement exceeds the target escapement of 42.8 percent. Fisheries staff bases these estimates on upstream passage at fisheries independent and fisheries dependent locations where counts provide total escapement numbers by day.

Table 2. Fisheries independent and fisheries dependent estimates of annual harvest rates associated with daily counts.

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2001-2009
Total number passed at Brunswick Fishway (FI)										
	18,196	104,520	53,732	113,686	25,846	34,239	60,577	91,859	44,725	547,380
Number passed at Brunswick Fishway (FI) during allowed fishing days										
	12,162	37,126	29,385	67,667	10,517	25,986	50,487	44,946	18,248	296,524
Estimated proportion of run harvested										
	0.67	0.36	0.55	0.60	0.41	0.76	0.83	0.49	0.41	0.54

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2010-2016
Total number passed at Brunswick Fishway (FI)										
	30,676	54,886	170,191		55,678	71,887	114,874			498,192
Number passed at Brunswick Fishway (FI) during allowed fishing days										
	21,397	25,829	77,629		31,372	37,802	46,097			240,126
Estimated proportion of run harvested										
	0.70	0.47	0.46		0.56	0.53	0.40			0.48

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2010-2016
Total number passed at Sebasticook River (FI)										
	1,628,187	2,751,473	1,702,631	2,272,025	2,378,906	2,157,983				12,891,205
Number passed at Sebasticook Fishway (FI) during allowed fishing days										
	907,123	1,227,788	1,035,058	1,252,662	1,430,235	1,266,239				7,119,105
Estimated proportion of run harvested										
	0.56	0.45	0.61	0.55	0.60	0.59				0.55

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2010-2016
Total number passed at Webber Pond Fishway (FD)										
	191,133	253,983	540,375	207,419	529,730	649,200	526,290			2,898,130
Number harvested at Webber Pond Fishway (FD) during allowed fishing days										
	47,520	110,520	265,200	71,160	150,840	282,240	173,520			1,101,000
Proportion of run harvested										
	0.25	0.44	0.49	0.34	0.28	0.43	0.33			0.38

b. Fisheries Independent and Fish Dependent Indices

Both fisheries independent and fisheries dependent data are available to provided relative measures of river herring run health and status. Most fisheries independent data come from beach seine surveys, fishway counts, or fish counts on rivers without commercial fisheries. Analysis of these data indicates that most commercial populations statewide are stable. Analysis of these data alone may not be the best way to determine the health of stock specific runs throughout the state. Stock specific data for the

runs below originate from reported landings data and scale samples collected by commercial fishermen or fisheries biologists and analyzed by a Department fisheries staff (Table 3).

Table 3. Fisheries independent estimates of Z for periods 2014 & 2015.

Fisheries Independent Data — **Age Based Z-Estimates**

2015	Catch Curve				Heinke				Chapman-Robson			
	Male		Female		Male		Female		Male		Female	
Fishery	Z	SE	Z	SE	Z	SE	Z	SE	Z	SE	Z	SE
Alewife					0.98	0.36	1.10	0.67	1.20	0.45	1.10	0.67
Card Mill	0.76	0.34	0.59	0.40	1.03	0.16	0.87	0.14	0.99	0.15	0.84	0.13
Center			1.90	0.30	2.03	0.39	2.30	0.40	2.13	0.41	2.22	0.38
Dennys	1.35	0.65			0.77	0.11	0.74	0.11	1.09	0.15	1.11	0.18
Long	1.83	0.33	1.21	0.05	1.45	0.22	1.51	0.24	1.58	0.25	1.63	0.26
Medomak					*1.86*	*0.28*			*1.99*	*0.31*		
Pembroke			1.34	0.43	2.44	0.65	0.96	0.15	2.48	0.66	1.19	0.19
Seal Cove					2.64	0.93	1.80	0.23	2.64	0.93	1.95	0.26
Sewalls	0.72	0.42	0.81	0.28	1.54	0.45	1.39	0.34	1.15	0.33	1.13	0.27
Walker			1.89	1.09	3.47	0.97	3.14	0.68	3.47	0.97	2.77	0.55
Wights	1.10	0.95			3.20	0.68	3.74	0.98	2.83	0.55	3.74	0.98

Sexes Combined

Fisheries Independent Data — **Age Based Z-Estimates**

2014	Catch Curve				Heinke				Chapman-Robson			
	Male		Female		Male		Female		Male		Female	
Fishery	Z	SE	Z	SE	Z	SE	Z	SE	Z	SE	Z	SE
Brunswick			0.75	0.37	2.53	0.65	0.64	0.15	2.56	0.67	0.92	0.22
Card Mill					*2.12*	*0.51*			*2.20*	*0.53*		
Center	*1.1*	*0.18*			*0.84*	*0.09*			*0.99*	*0.10*		
Dennys					2.94	0.95	2.67	0.66	2.94	0.95	2.71	0.67
Long	1.10	0.19			1.58	0.19	1.10	0.47	1.46	0.17	1.25	0.55
Patten	1.51	0.34	1.30	0.22	1.93	0.32	1.58	0.30	1.83	0.3	1.54	0.29
Pembroke			1.86	0.67	2.87	0.55	2.69	0.54	2.91	0.56	2.46	0.47
Pierce	1.45	0.15	1.23	0.02	1.33	0.20	1.47	0.22	1.44	0.22	1.59	0.25
Seal Cove					*1.03*	*0.13*			*1.33*	*0.17*		
Sewalls	0.58	0.44	0.89	0.21	1.00	0.19	0.63	0.11	1.00	0.19	0.83	0.15
Wights	1.72	0.61	1.46	0.24	1.04	0.16	1.24	0.18	1.28	0.20	1.39	0.21
All Runs	1.14	0.23	1.22	0.21	1.42	0.09	1.30	0.08	1.42	0.09	1.24	0.08

Sexes Combined

Table 4. Fisheries dependent estimates of Z for periods 2014 and 2015.

Fisheries Dependent Data **Age Based Z-Estimates**

2015	Catch Curve				Heinke				Chapman-Robson			
	Male		Female		Male		Female		Male		Female	
Fishery	Z	SE	Z	SE	Z	SE	Z	SE	Z	SE	Z	SE
Alna	*1.34*	*0.56*			*2.81*	*0.42*			*2.69*	*0.39*		
Benton	0.80	0.16			1.56	0.28	1.61	0.28	1.63	0.30	1.77	0.32
Damariscotta	1.47	0.22	1.20	0.58	1.75	0.29	0.74	0.12	1.70	0.28	1.05	0.17
Dresden	1.88	0.45			2.46	0.46	1.47	0.23	2.32	0.42	1.66	0.27
Ellsworth					2.71	0.66	2.42	0.46	2.74	0.67	2.48	0.47
Gouldsboro	*1.58*	*0.20*			*1.09*	*0.10*			*1.28*	*0.12*		
Grist Mill	1.90	0.17	1.49	0.22	2.14	0.36	1.77	0.29	2.10	0.35	1.72	0.28
Jefferson	1.81	0.23	1.25	0.14	1.55	0.25	1.20	0.18	1.65	0.27	1.28	0.19
Orland	1.43	0.59	1.18	0.05	2.08	0.39	1.30	0.21	1.88	0.34	1.35	0.22
Perry	1.98	0.02	0.86	0.10	2.01	0.31	1.61	0.30	2.02	0.31	1.34	0.25
Sullivan	1.11	0.22	1.00	0.81	0.67	0.10	1.69	0.36	0.94	0.14	1.45	0.30
Warren	1.63	0.18	0.59	0.13	1.45	0.27	1.16	0.15	1.54	0.29	1.09	0.14
Webber	1.68	0.97	1.73	0.20	2.74	0.66	2.00	0.39	2.40	0.54	1.95	0.37
Winnegance					2.72	0.47	1.70	0.58	2.77	0.48	1.79	0.62
Woolwich	1.81	0.44			1.29	0.19	1.32	0.21	1.47	0.22	1.54	0.25

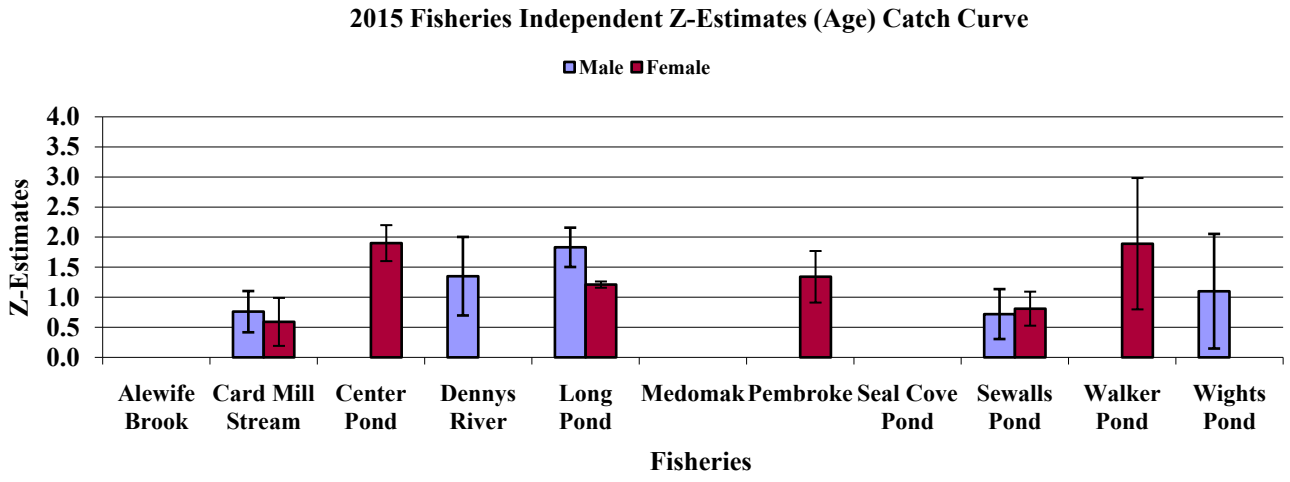
Sexes Combined

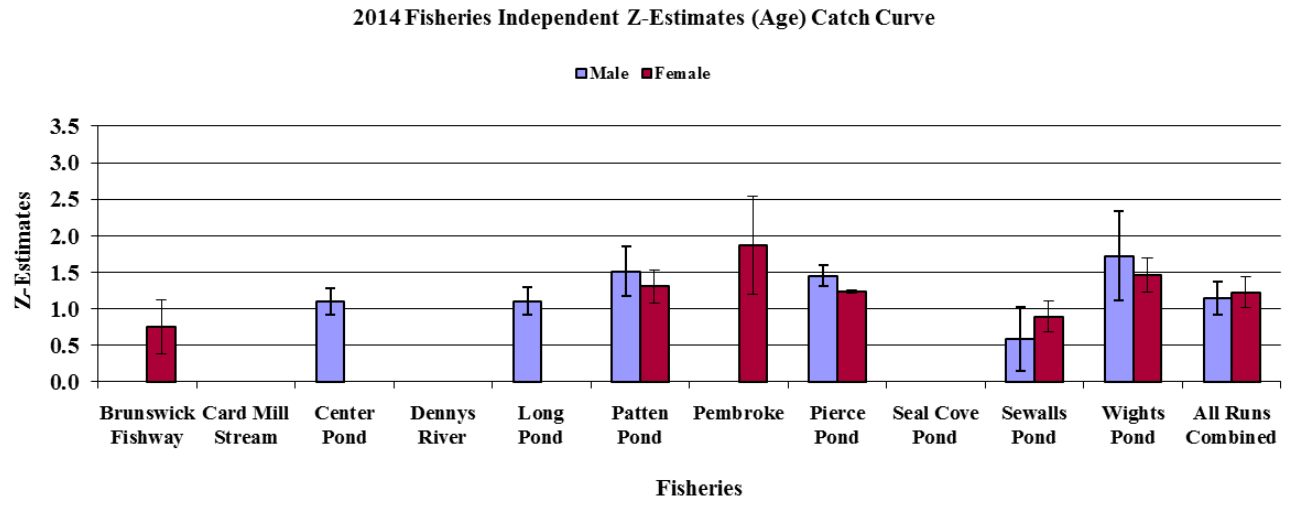
Fisheries Dependent Data **Age Based Z-Estimates**

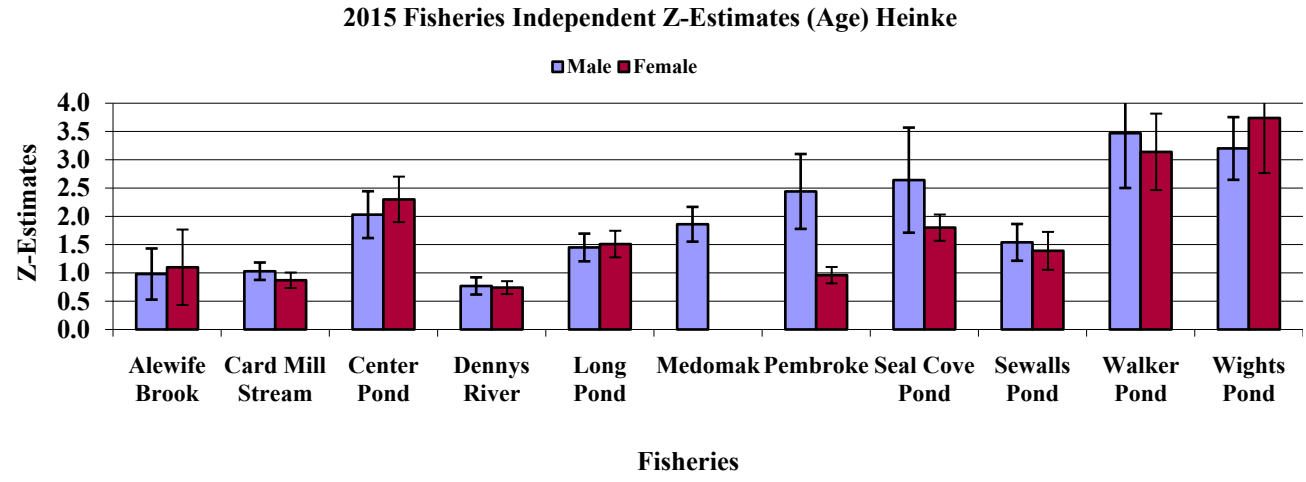
2014	Catch Curve				Heinke				Chapman-Robson			
	Male		Female		Male		Female		Male		Female	
Fishery	Z	SE	Z	SE	Z	SE	Z	SE	Z	SE	Z	SE
Alna	0.5	0.23			0.49	0.06	1.39	0.34	0.67	0.09	1.57	0.388
Benton	1.65	0.02	1.08	0.62	1.70	0.33	2.56	0.53	1.72	0.34	1.99	0.37
Damariscotta	0.71	0.18	1.04	0.28	0.98	0.16	0.94	0.14	1.05	0.17	0.96	0.14
Dresden	0.80	0.23	0.73	0.16	0.62	0.09	0.54	0.08	0.81	0.12	0.72	0.11
E. Machias			1.26	0.13	2.16	0.51	1.08	0.14	2.23	0.54	1.16	0.15
Ellsworth	1.18	0.52	1.58	0.91	1.72	0.31	2.55	0.46	1.57	0.28	2.23	0.38
Gouldsboro	2.12	0.59	0.13	0.05	2.90	0.47	1.20	0.18	2.73	0.43	1.14	0.17
Grist Mill	1.20	0.11	0.93	0.16	1.16	0.22	0.80	0.10	1.28	0.24	0.92	0.12
Jefferson	1.20	0.27	1.29	0.26	1.01	0.15	0.90	0.10	1.20	0.18	1.04	0.11
Narraguagus	*1.31*	*0.23*			*1.33*	*0.15*			*1.27*	*0.14*		
Orland	1.17	0.11	1.02	0.26	1.34	0.22	0.89	0.15	1.37	0.23	1.10	0.19
Perry	1.52	0.85			0.69	0.11	1.98	0.43	1.05	0.17	2.08	0.46
Stueben	*1.01*	*0.47*			*1.84*	*0.32*			*1.46*	*0.24*		
Sullivan	0.85	0.49	0.09	0.58	1.32	0.21	0.62	0.09	1.24	0.20	0.72	0.10
Warren	0.63	0.07	0.60	0.23	0.66	0.13	0.73	0.10	0.77	0.15	0.72	0.10
Webber	1.14	0.07	0.42	0.04	1.01	0.16	0.57	0.08	1.11	0.18	0.69	0.10
Winnegance	1.13	0.49			2.23	0.37	1.18	0.25	1.79	0.27	1.42	0.30
Woolwich	1.42	0.18	1.04	0.60	1.66	0.41	1.61	0.40	1.61	0.39	1.43	0.35
All Runs	1.6	0.25	1.33	0.174	1.59	0.25	0.98	0.04	1.34	0.06	1.04	0.039

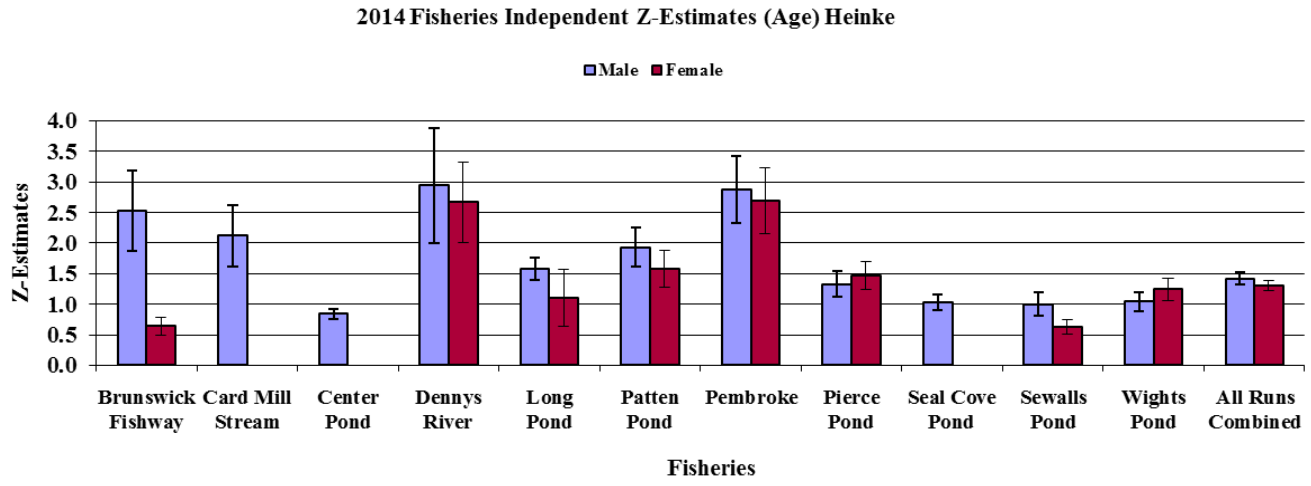
Sexes Combined

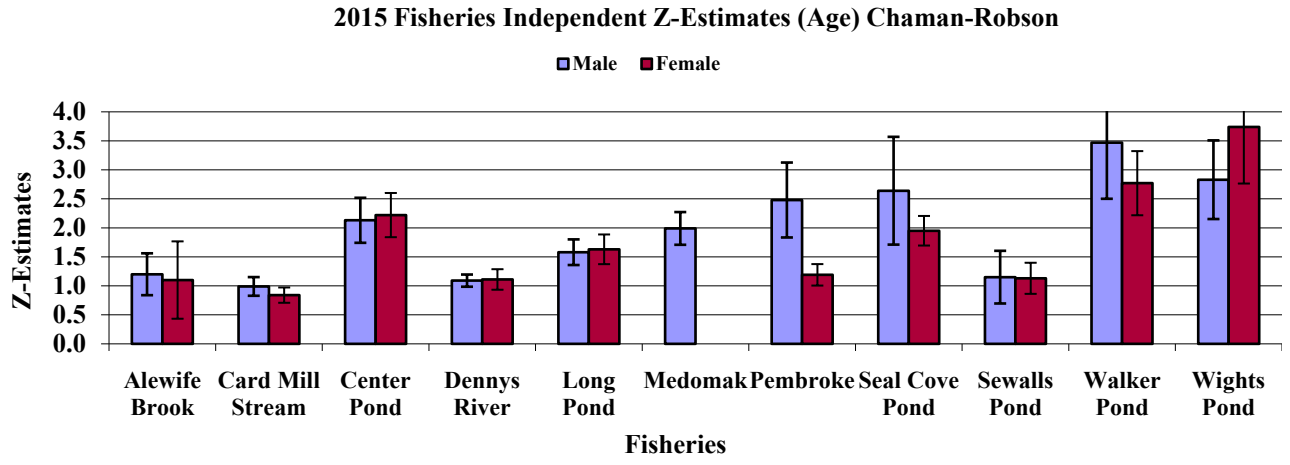
Figure 5. Fisheries independent estimates of Z for 2014 and 2015.








2014 Fisheries Independent Z-Estimates (Age) Heinke
Male
Female
Z-Estimates
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Brunswick Fishway
Card Mill Stream
Center Pond
Dennys River
Long Pond
Patten Pond
Pembroke
Pierce Pond
Seal Cove Pond
Sewalls Pond
Wights Pond
All Runs Combined
Fisheries


2015 Fisheries Independent Z-Estimates (Age) Chaman-Robson
Male
Female
Z-Estimates
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Alewife Brook
Card Mill Stream
Center Pond
Dennys River
Long Pond
Medomak
Pembroke
Seal Cove Pond
Sewalls Pond
Walker Pond
Wights Pond
Fisheries

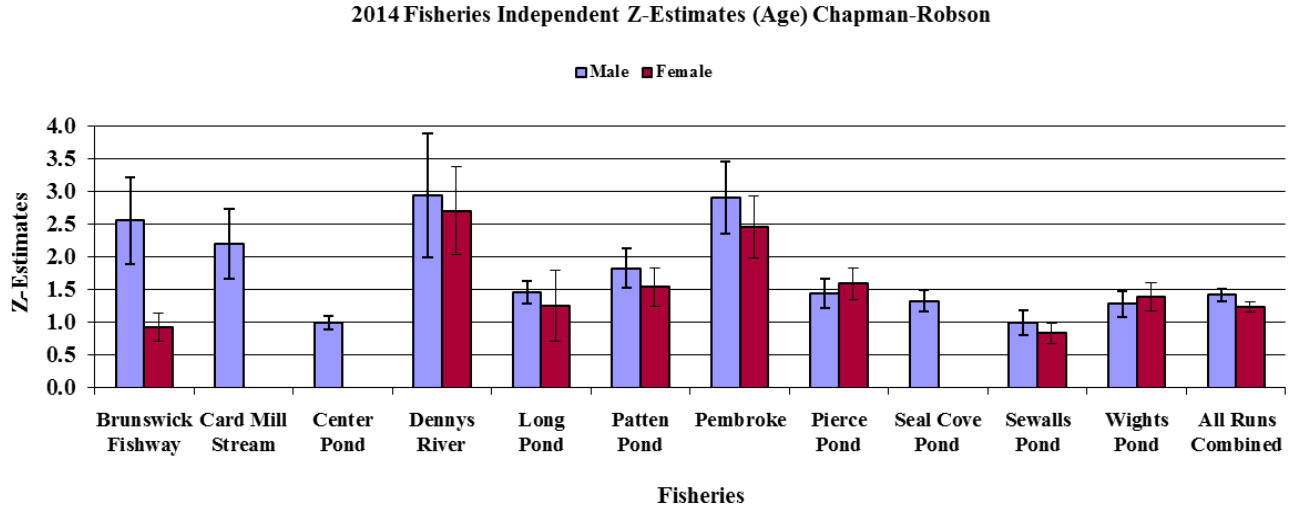
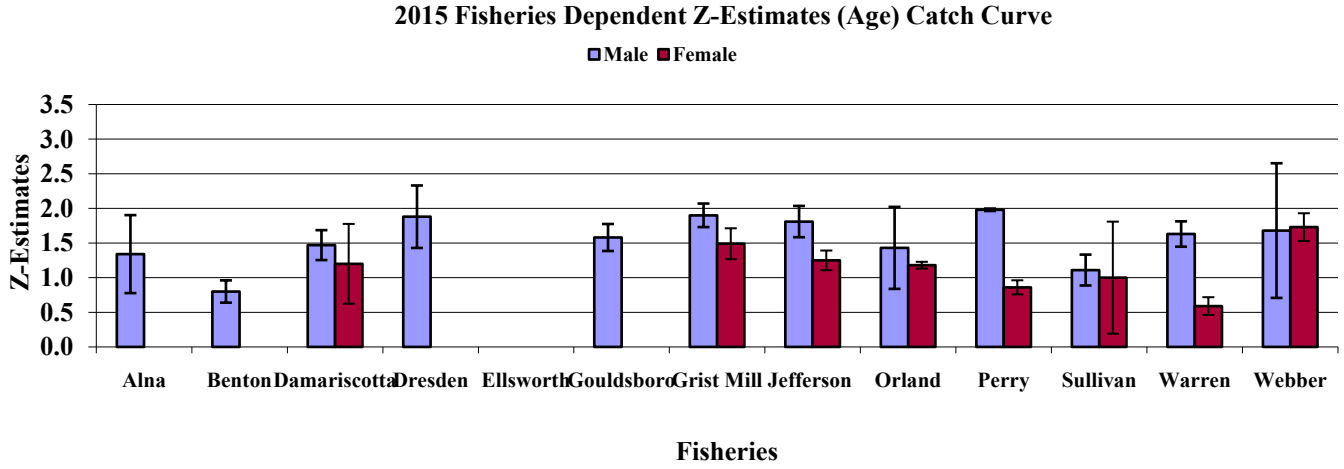
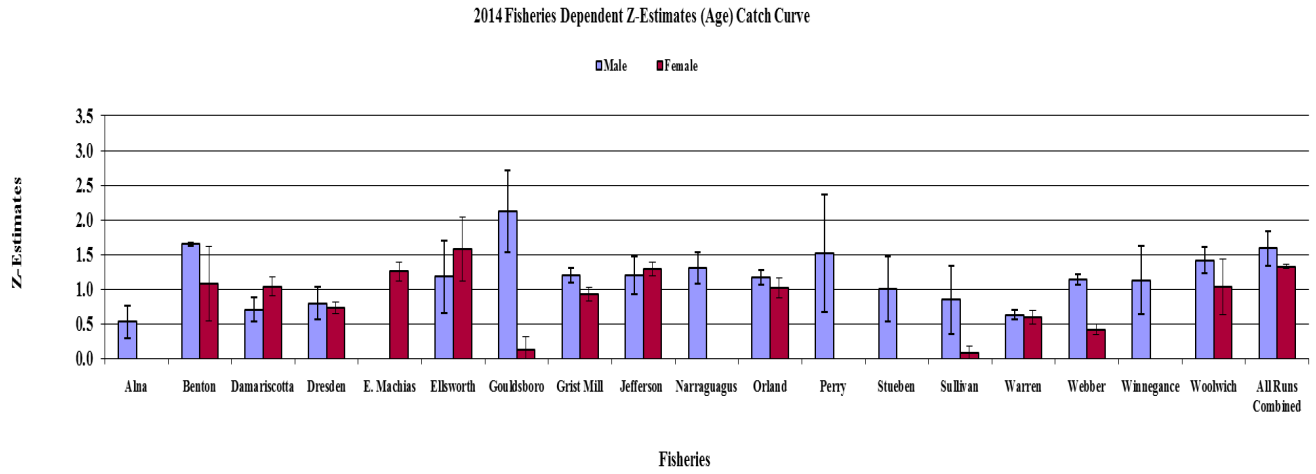
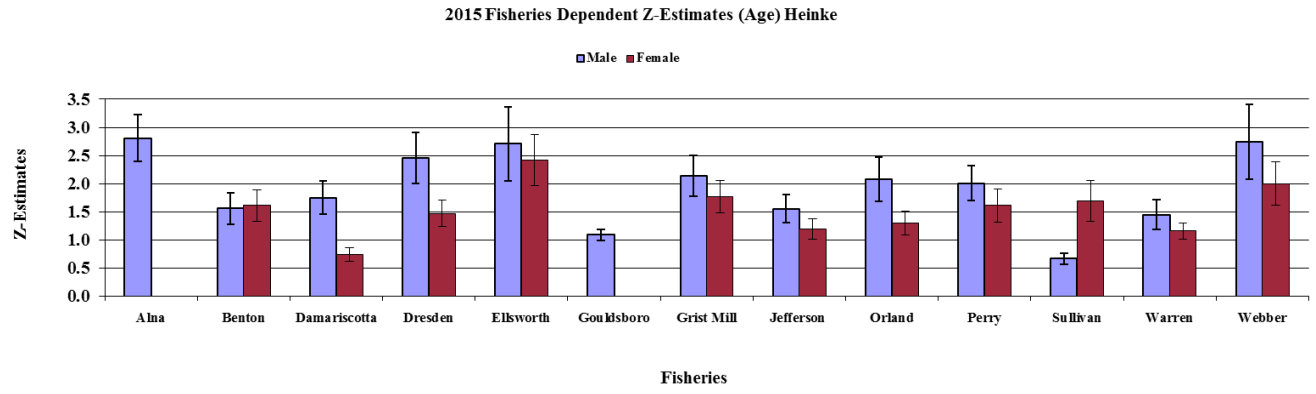
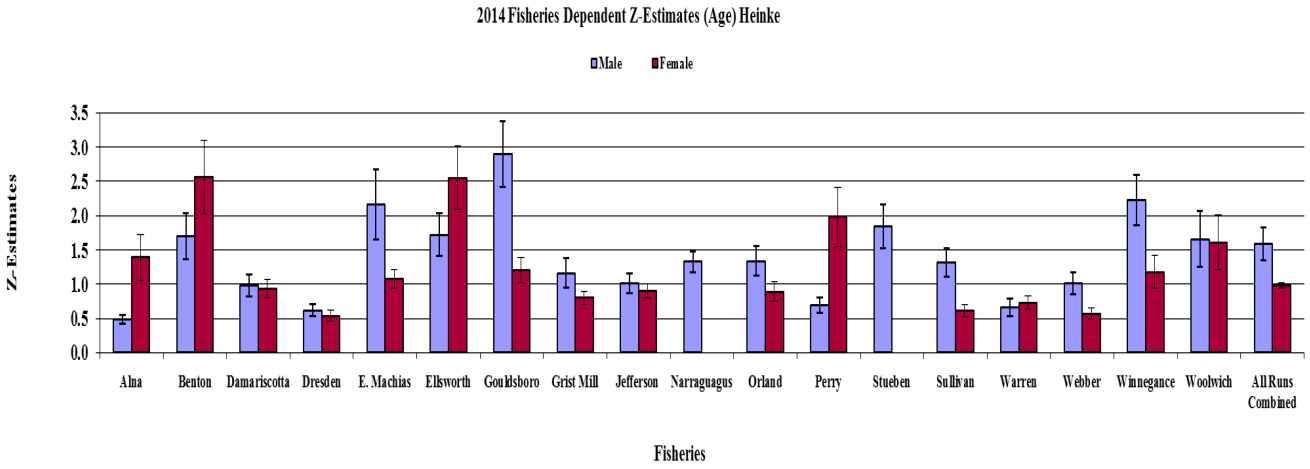

2014 Fisheries Independent Z-Estimates (Age) Chapman-Robson
Male
Female
Z-Estimates
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Brunswick Fishway
Card Mill Stream
Center Pond
Dennys River
Long Pond
Patten Pond
Pembroke
Pierce Pond
Seal Cove Pond
Sewalls Pond
Wights Pond
All Runs Combined
Fisheries

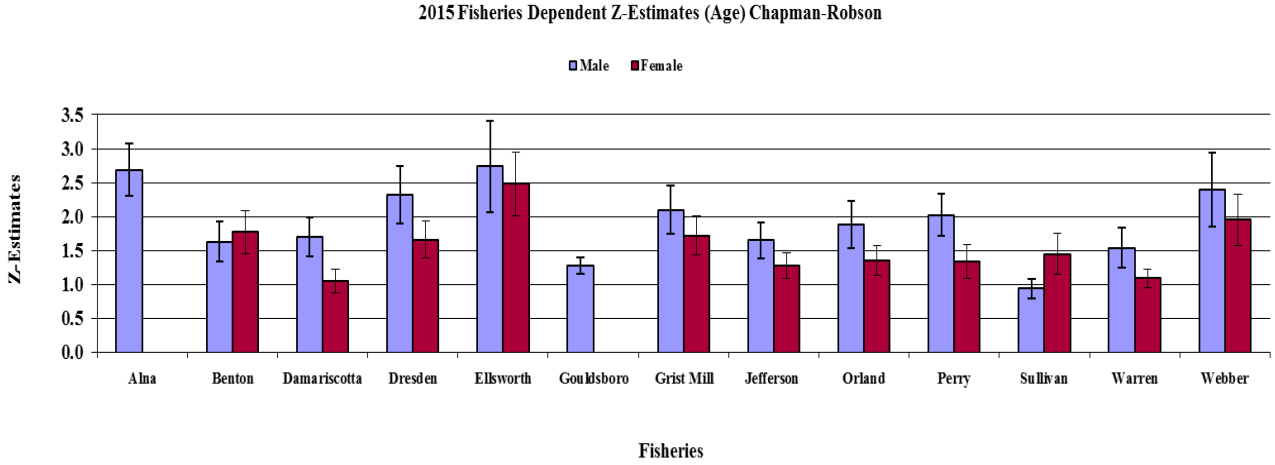
Figure 6. Fisheries dependent estimates of Z for 2014 and 2015.

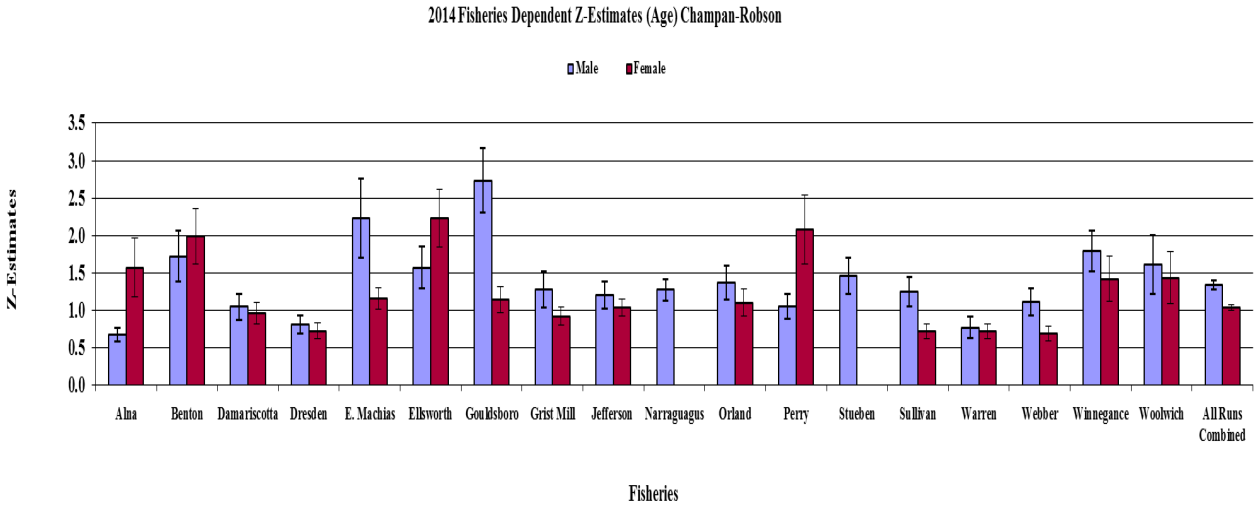












Z-estimates and associated graphs presented for Maine's 2010 Sustainable Fisheries Management Plan are in Appendix A.

4. Fisheries to Remain Open

Municipality	Fishery	Municipality	Fishery
Alna	Long Pond	Jefferson	Dyer-Long Pond
Bath Phippsburg West Bath	Winnegance Pond	Newcastle Nobleboro	Damariscotta Lake
Benton	Sebasticook River	Orland	Orland River
Cherryfield	Narraguagus River	Perry	Boyden Lake
Dresden	Mill Pond	Sullivan	Flanders Pond
East Machias	Gardiner Lake	Steuben	Tunk Lake
Ellsworth	Union River	Mount Desert	Somes Pond
Franklin	Great Pond	Vassalboro	Webber Pond
Gouldsboro	West Bay Pond	Warren	St. George River
Woolwich	Nequasset Lake		

Commercial Justifications for the Municipal Fisheries Listed Above:
In the commercial landings graphs provided below, years with extremely low landings or zero landings for one or more years indicate fishing during that year did not occur or occurred at very low levels. Two main reasons for zero landings are 1) the municipality decided to close the fishery for conservation or other purposes or 2) the harvester fished for a limited number of days due to weather, gear, price, or other factors that created unfavorable market conditions. In 2005, extreme high water prevented many commercial fishermen from conducting normal fishing operations during the season. The result was a major decline in reported landings for 2005 statewide. Biological data by river for most river systems, other than commercial harvest data, are unavailable for years prior to 2008. The State of Maine and commercial harvesters began collecting data in 2008 to address concerns presented in ASMFC Amendment 2 to the Shad and River Herring Management Plan.

The sustainability threshold established in 1984 for most Maine commercial fisheries is 35 fish per surface acre of spawning habitat. Since 1984, MDMR has used 235 fish/acre to estimate commercial alewife production in Maine's lakes and ponds. The Department established this unit production value from the commercial harvest in six Maine watersheds for the years 1971-1983. Based on these data, commercial yield was assumed to be 100 pounds/surface acre of ponded habitat. This value is slightly less than the average of the lowest yield/acre for all six rivers and within the range of yields experienced in other watersheds. Assuming a weight of 0.5 pounds per adult, the commercial yield equals 200 adults/surface acre. The commercial harvest was assumed to represent an exploitation rate of 85%, because most

alewife runs were harvested six days per week. Exploitation rates on the Damariscotta River, for example, ranged from 85-97% for the years 1979-1982. When commercial yield is adjusted for the 15% escapement rate, the total production is 235 adult alewives/acre. This is a conservative estimate of the numbers of returns based on an average individual weight value of .5 pounds per return, including blueback herring.

The Maine Department of Marine Resources estimates escapement for commercial runs where actual counts are not conducted. The estimate is calculated by dividing the number of fishing days allowed by the potential number of fishing days in a week then multiplying by the reported landings for the year. For most fisheries this will be 0.43 * number of fish reported landed for the season.

Fishery Specific Information

Alna Commercial Fishery:
The Maine Department of Marine Resources manages this system for a commercial escapement of 35 fish per acre. The spawning escapement needs for this system are 20,000 river herring passed upstream by the harvester throughout the season. The management plan has always achieved returns to meet the target escapement developed for this system or passed the entire run upstream. Harvesting occurs in the fishway just downstream of Long Pond, which is the only accessible spawning habitat on the east branch of the Sheepscot River. The Department of Inland Fisheries and Wildlife will not permit alewives access to historical spawning habitat in Sheepscot Pond, or the watershed above, because of concerns with disease issues that may affect sport fish raised at a state own fish hatchery downstream of Sheepscot Pond.

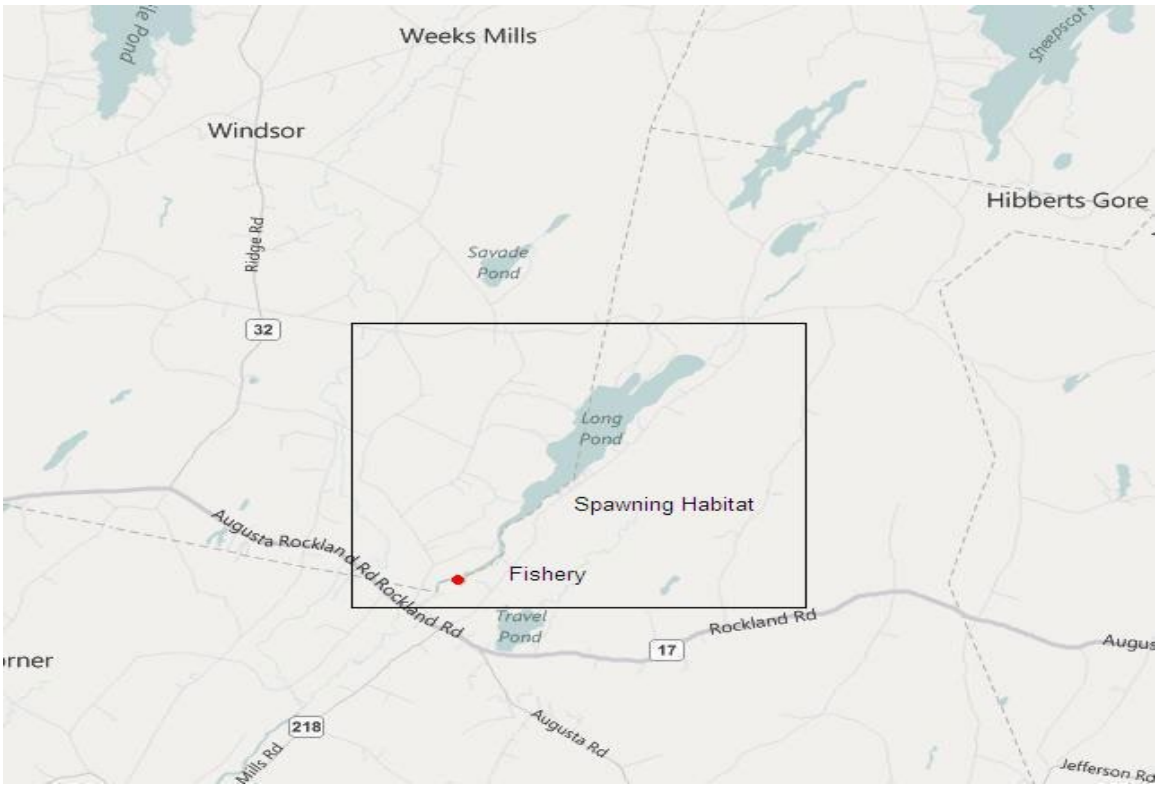
The west branch of the Sheepscot River leading to Branch Pond contains very few river herring. For several years the DMR stocked Branch Pond to propagate an artificial run while planning and designing a fishway to provide access to Branch Pond. An old mill sits directly on top of the outlet stream and the engineering and constructions costs of installing fish passage at this time is prohibitive. Stocking Branch Pond no longer occurs but will resume if fisheries staff can overcome fiscal challenges to acquiring fish passage in the future. There are stray river herring that do ascend the west branch each year but the numbers are low and not harvested commercially. The commercial harvester, through the town of Alna, retains the right to harvest these fish. The harvester keeps the west branch closed to promote natural recolonization of blueback herring to this branch of the river.

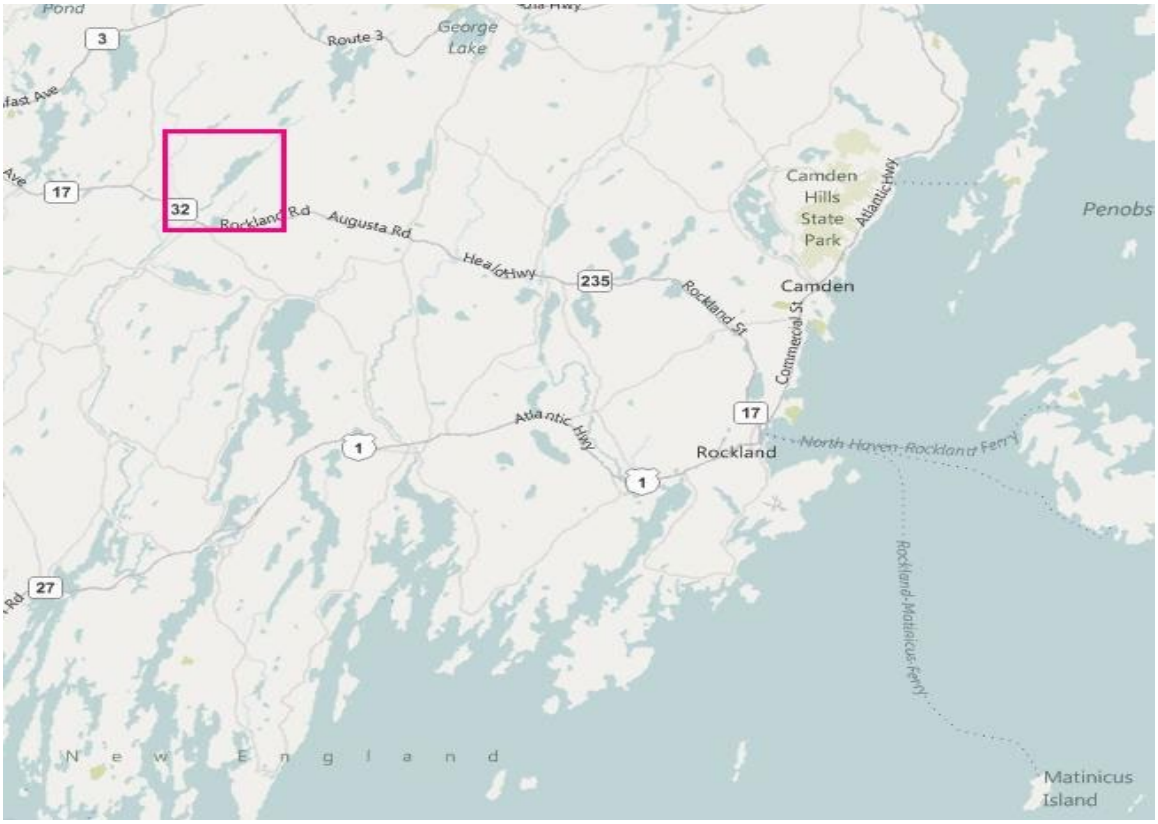
Spawning habitat is available to blueback herring in the river below the fishway. Incidences of blueback herring in the commercial catches or sampling below the fishway are rare. There is no available spawning habitat for alewives in the Sheepscot River below the commercial fishery and there are no reports of juvenile blueback herring emigrating from this system in appreciable numbers.

The Sheepscot River alewife run would be considerably larger if all historic river herring habitat were accessible to river herring. In 2017 the dam at Coopers Mill, the current harvest location, will be removed. Dam removal will facilitate upstream and downstream passage, but is unlikely to increase production significantly. Access restrictions placed on the harvester and the Maine Department of Marine Resources by the Maine Department of Inland Fisheries and Wildlife to Sheepscot Pond are unlikely to change in the near future. In 2016 a purchase and sale agreement was signed that will allow fish passage to be

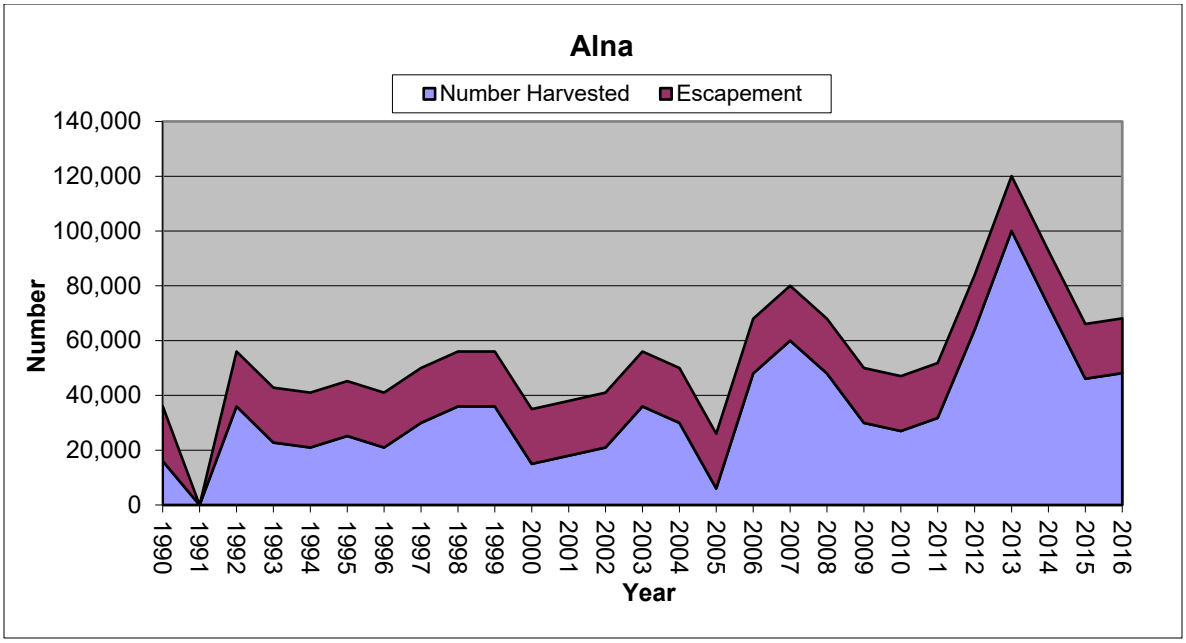
constructed at Branch Pond. This will increase production on the west branch of the Sheepscot River and is likely to increase the harvest of this commercial fishery.

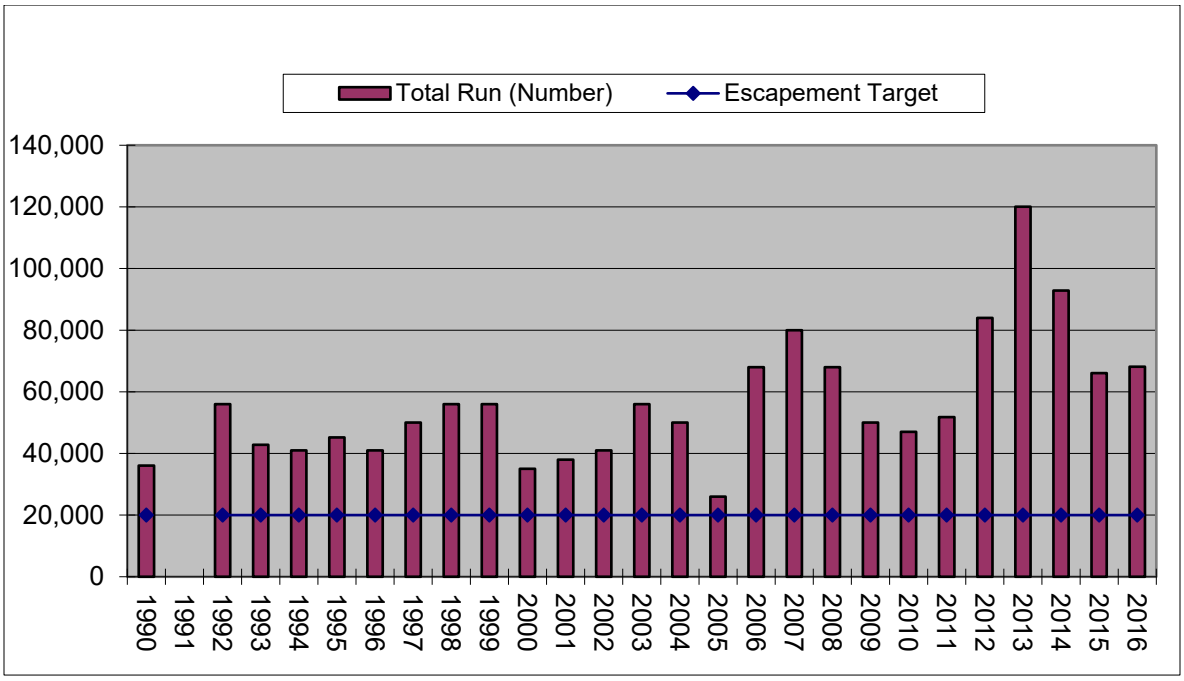
Town	River	Lake size (acres)	Threshold (N/acre)
Alna	Sheepscot	571	35





Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2015	Coopers Mills	Sheepscot	9.1	91.00	8.00	0.00	1.00	1.44
2014	Coopers Mills	Sheepscot	41.0	59.00	36.00	5.00		1.23
2013	Coopers Mills	Sheepscot	33.8	66.20	32.30	1.00	0.50	1.81
2012	Coopers Mills	Sheepscot	7.2	92.76	6.58	0.66		2.65
2011	Coopers Mills	Sheepscot	22.0	78.00	22.00			1.27
2010	Coopers Mills	Sheepscot	4.9	95.15	3.88	0.97		2.29
2009	Coopers Mills	Sheepscot	19.0	81.00	17.00	2.00		1.85
2008	Coopers Mills	Sheepscot	10.0	90.00	10.00			2.20





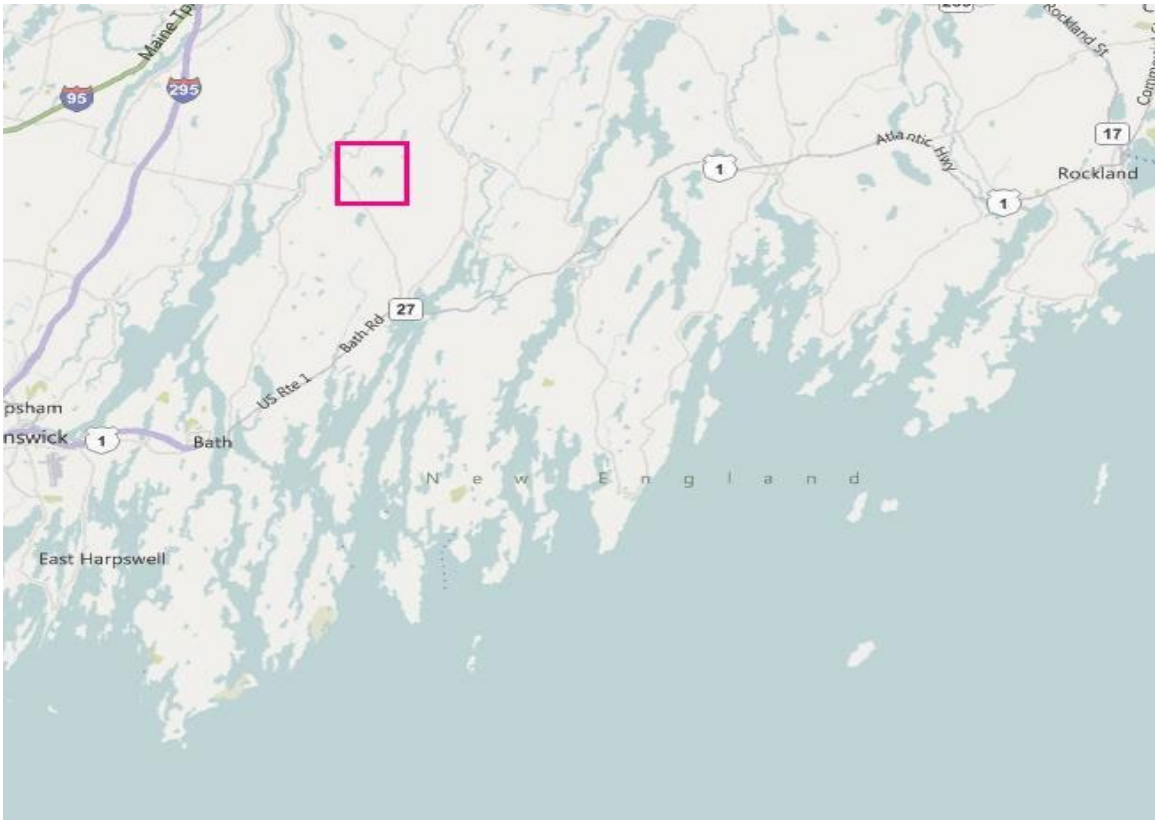
Dresden Commercial Fishery:

The Maine Department of Marine Resources manages this system for a minimum commercial escapement of 35 fish per acre. The spawning escapement need for this system is 5,950 river herring passed upstream through three consecutive closed days per week during the fishery. The management plan has always achieved returns to meet the escapement threshold developed for this system or passed the entire run for the season. The DMR does not permit the river herring fishery in the main stem of the Eastern River. The Eastern River provides available spawning and rearing habitat for blueback herring, American shad, shortnose sturgeon and striped bass. The fishery for river herring occurs upstream of

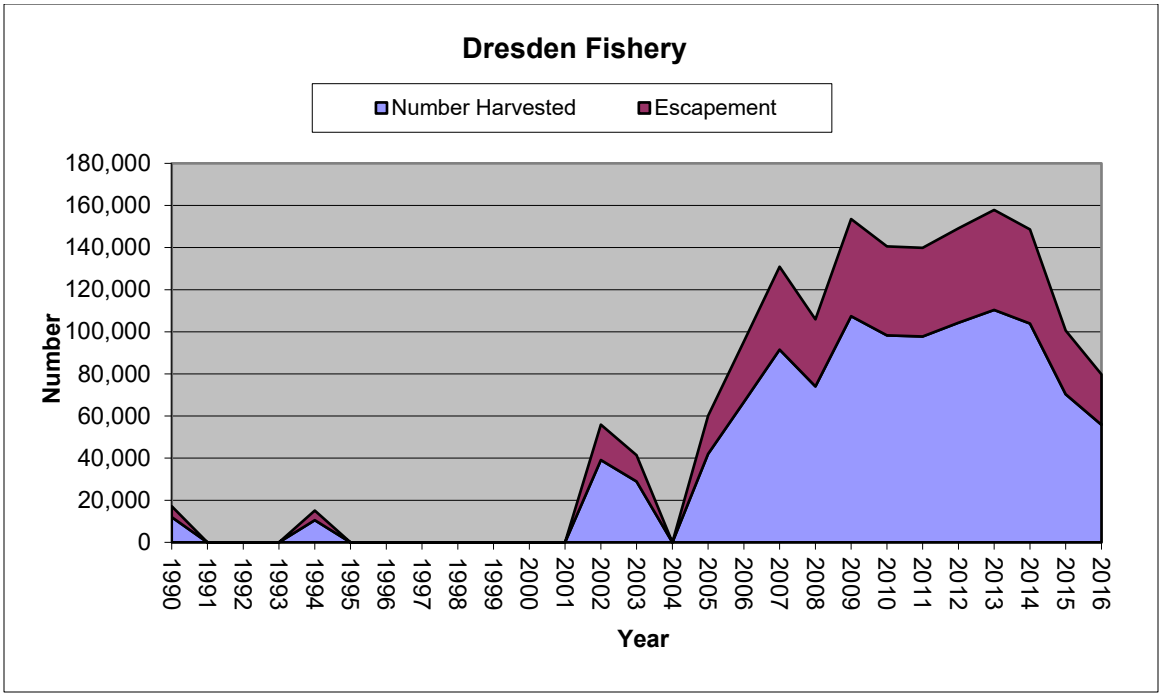
the confluence of the Eastern River and Mill Stream, which leads to spawning habitat in Mill Stream and Dresden Bog.

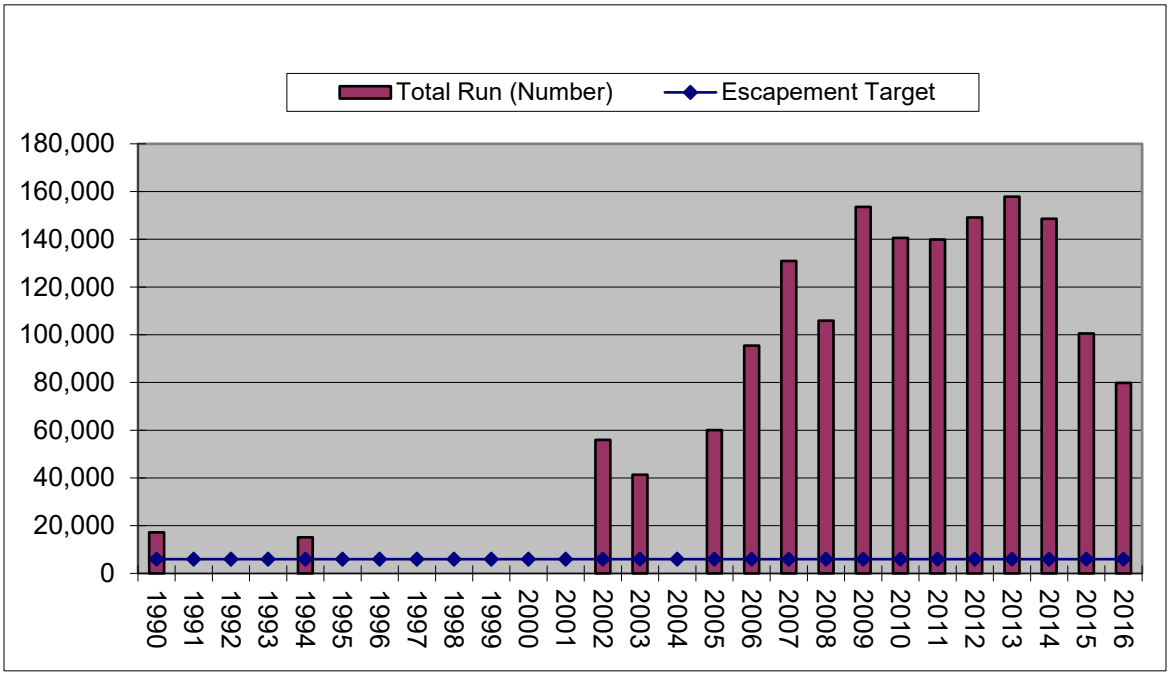
The Eastern River is one of several rivers in Maine that protect spawning populations of anadromous fish through gear restrictions, time/area closures and seasons. The Eastern River is a free flowing tidal river without any upstream barriers to delay upstream passage. There are no estimates of numbers blueback herring spawning in the Eastern River, though numbers may be as high as several hundred thousand based on the available habitat. It is unknown if alewives spawn in the main stem of the Eastern River. Biological sample data indicate that blueback herring and alewife may interbreed in the main stem of the Eastern River. In general spawning success of alewives in Maine rivers and hydropower headponds is poor.

Town	River	Lake size (acres)	Threshold (N/acre)
Dresden	n/a	170	35



Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2015	Dresden	Eastern River	45.5	54.55	41.41	4.04		1.3
2014	Dresden	Eastern River	29.0	71.00	19.00	8.00	2.00	1.16
2013	Dresden	Eastern River	50.5	49.45	24.17	9.89	16.48	0.42
2012	Dresden	Eastern River	24.5	75.52	18.56	3.37	2.53	1.48
2011	Dresden	Eastern River	22.1	77.87	13.27	8.25	0.59	1.5
2010	Dresden	Eastern River	52.5	47.51	40.33	8.83	3.31	0.95
2009	Dresden	Eastern River	38.4	61.60	29.30	5.10	4.00	1.00
2008	Dresden	Eastern River	29.7	70.30	18.80	6.90	4.00	0.96





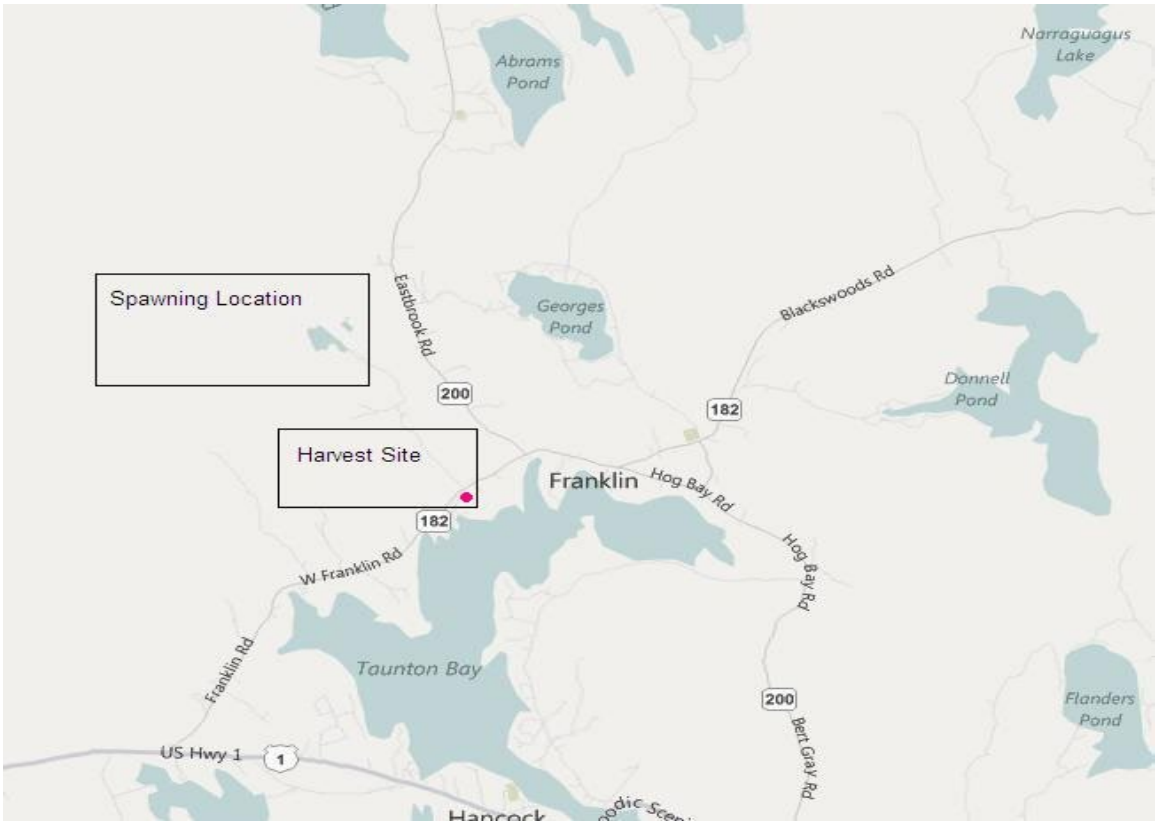
Franklin Commercial Fishery:

The Maine Department of Marine Resources manages Great Pond (Grist Mill Stream) for a minimum commercial escapement of 35 fish per acre. The spawning escapement need for this system is 9,170 river herring passed upstream through three closed days per week during the fishery. The management plan has always achieved returns that meet the target escapement developed for this system or passed the total run upstream. There is no spawning below the pond. Beaver dams are a perennial problem at this location effecting upstream and downstream migration during periods of low flow. As with many small coastal runs, access to spawning habitat is influenced by spring and fall water levels necessary to permit

upstream and downstream migration. Spawning does not occur in the stream below or above the commercial fishery for alewife. Blueback herring are not observed in this system and there are no historical records to indicate that blueback herring inhabited the stream.

The Franklin fishery at one time only harvested post spawn runback river herring. This practice is not permitted currently but likely had a significant effect on spawning stock, exploitation rates, and number of repeat spawning fish within the system historically.

Town	River	Lake size (acres)	Threshold (N/acre)
Franklin	n/a	262	35



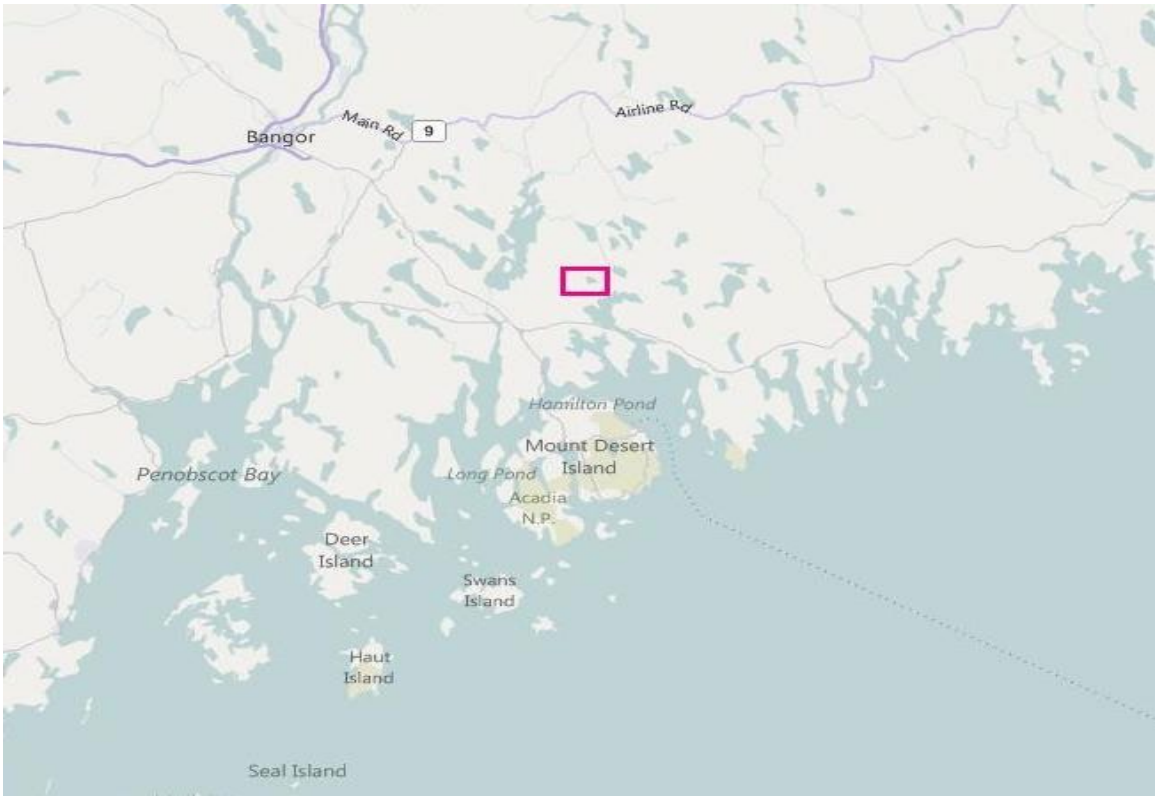
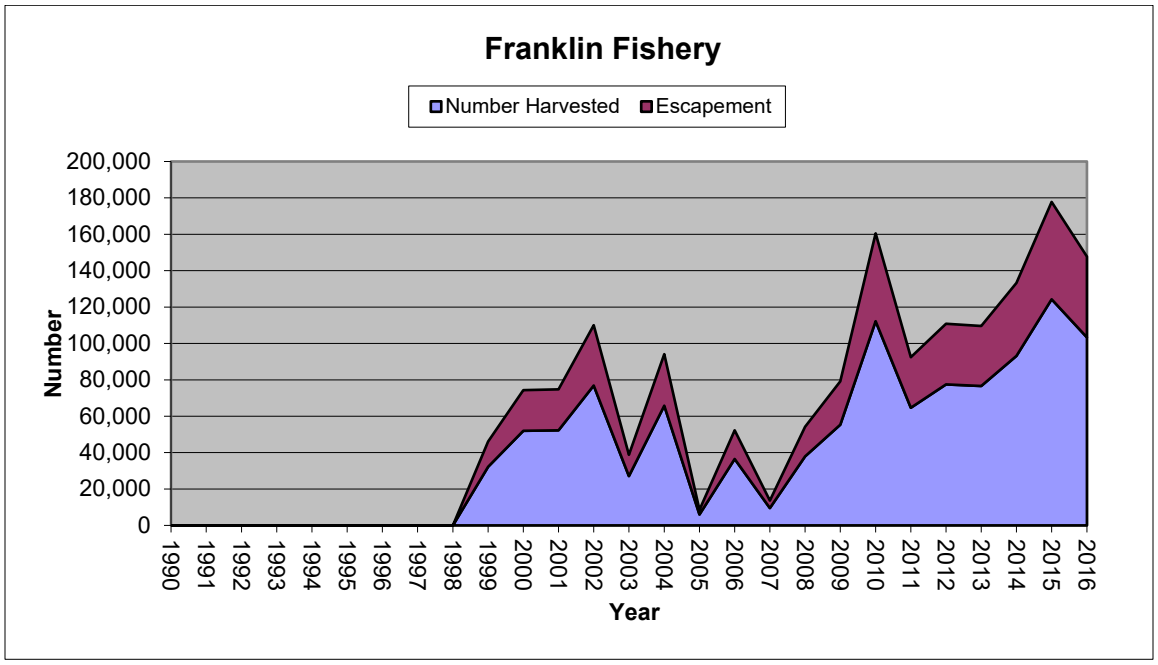
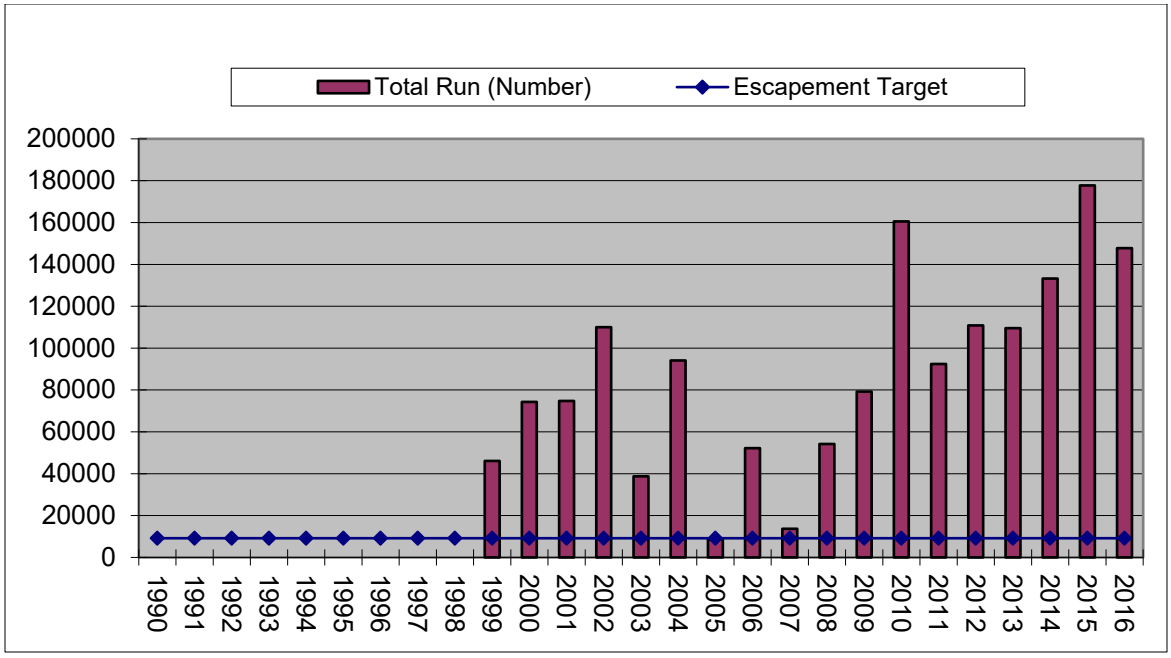


Figure 6. Harvest location for Great Pond in Franklin, Maine.

Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2015	Franklin	N/A	18.2	81.19	16.83	1.98		1.86
2014	Franklin	N/A	49.5	50.50	41.58	5.94	1.98	1.17
2013	Franklin	N/A	43.8	56.17	37.65	6.17		1.1
2012	Franklin	N/A	13.8	86.17	11.47	2.35		1.8
2011	Franklin	N/A	28.4	71.63	26.54	1.45	0.36	1.95
2010	Franklin	N/A	18.8	81.17	16.31	2.50		1.77
2009	Franklin	N/A	9.7	90.30	8.90	0.80		2.38
2008	Franklin	N/A	27.6	72.40	19.40	7.10		1.39





Nobleboro and Newcastle Commercial Fishery:

The Nobleboro and Newcastle fishery is a joint fishery conducted by two municipalities at one fishing location. The current municipal management plan for this fishery permits all river herring arriving at the fishway during the first week of the season free passage upstream (Figure 9). This fishery is one of two fisheries in Maine that currently allows continuous escapement of spawning fish throughout the season in addition to closed days, though traditionally they harvested seven days a week. Historically, Damariscotta Lake never had a river herring run. The run began in 1806 with the construction of a 42-foot high fieldstone fishway and an initial introduction of broodstock from the Sheepscot River. After local residents established the run, the fishing rights granted by the State of Massachusetts in 1810 permitted the fishery to occur seven days per week. Continuous escapement up the fishway occurred throughout the season. Estimated annual exploitation rates for this run ranged from 85-95 percent from the early 1800s through the 1984.

A tidal stream leads from the Damariscotta River to the base of the fishway. Alewives arrive and depart the area downstream of the fishway based on the tidal stage in the river. During the height of the run the tidal stream and fishway are full of alewives attempting to ascend into Damariscotta Lake. The run is entirely alewife with no blueback herring mixed in with the commercial catches. There is no spawning habitat for either species below the fishway due to high salinities, but an occasional American shad is observed in the area below the fishway.

The Maine Department of Marine Resources manages this pond for a minimum commercial escapement of 35 fish per acre. The spawning escapement needs for this system are 153,335 river herring counted upstream by the harvester. The age and design of the previously existing fishway limited the numbers of river herring entering spawning habitat. A 1-million dollar fishway renovation, started in 2007, significantly improved escapement into spawning habitat in Damariscotta Lake (Figures 10-12).

A hydropower turbine is located at one of the lakes two outlets and produces a limited amount of hydropower during early spring and winter. The hydropower station does not operate during the downstream migration period for alewife or American eel (July – November). Operation schedules during the 1960s and 1970s are unknown as are any associated adult or juvenile mortality events.

Damariscotta Lake is an oligotrophic lake that produces small juvenile river herring compared to other lakes in the area. These juveniles start to emigrate from the lake in early July at total lengths as small as 42 mm. Work conduced at Damariscotta indicates that increased escapement levels negatively affect the numbers of juveniles produced within the lake. Increased stocking rates appear to lead to diminished yield per adult spawner. (Walton 187. Table 1; Figure 1) (Figures 7 – 8)

Town	River	Lake size (acres)	Threshold (N/acre)
Nobleboro	n/a	4,381	35

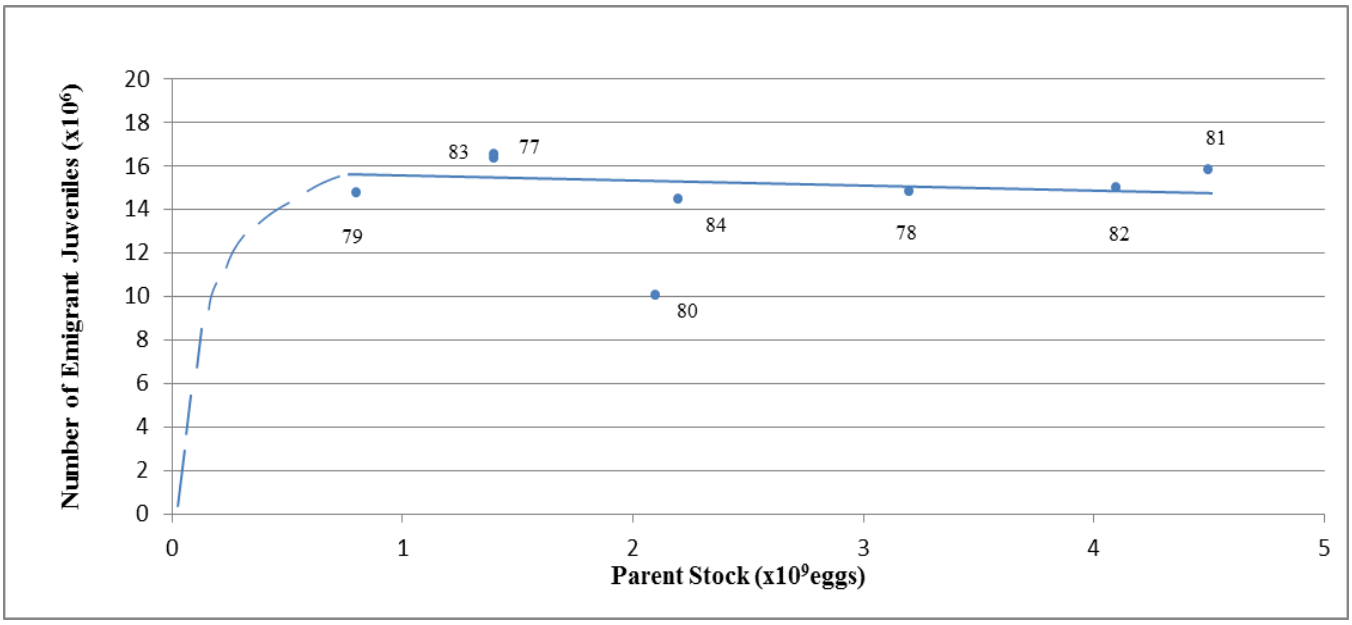


Figure 1. Relationship between an index of parental stock abundance (estimated annual egg deposition) and numbers on emigrating juvenile alewives, Damariscotta Lake, Maine, 1977-1984 (*r = +0.03; P > 0.05).*

Table 1. Statistics for adult and juvenile alewives in Damariscotta Lake, Maine 1977 -1984.

Year	Total Fish Harvested*	Fish entering the lake[b]	Male:Female ratio in lake	Females entering the lake[c]	Estimated egg deposition (10^9)	Juvenile emigrants (103)d
1977	1277640	27740	1.9:1	9,460+/-2,300	1.4	16,365+/-3,042
1978	909490	53180	1.6:1	20,580+/-3,720	3.2	14,823+/-4,505
1979	77940	20310	2.1:1	5,620+/-910	0.8	14,777+/-3,766
1980	844240	43865	2.3:1	13,470+/-1,360	2.1	10,082+/-4,100
1981	626370	69079	1.4:1	28,790+/-1,030	4.5	15,823
1982	330210	56653	1.2:1	25,930+/-1,070	4.1	14,991
1983	98730	21156	1.2:1	9,690+/-1,040	1.4	16,522
1984	231410	39561	1.7:1	14,860+/-610	2.2	14,477

[a]Estimates are rounded to the nearest 10 fish

[b]Total counts of adults were recorded after 1979

[c]Estimates +/- 95% confidence intervals

[d]Estimates +/- 95% confidence intervals, 1977-1980; total counts of juvenile emigrants were recorded after 1980.

Figure 7. Adult returns per individual spawner for the period 1977 - 2012

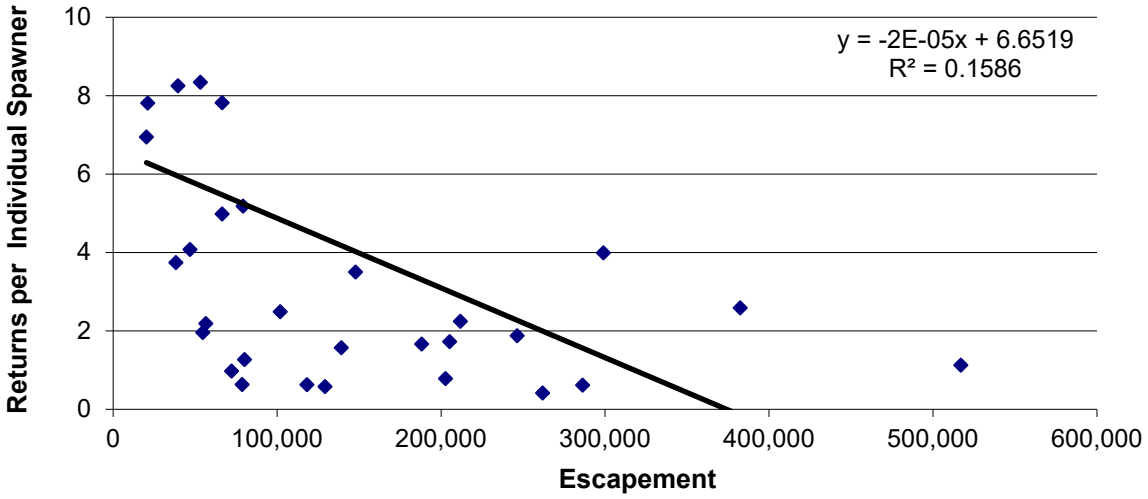
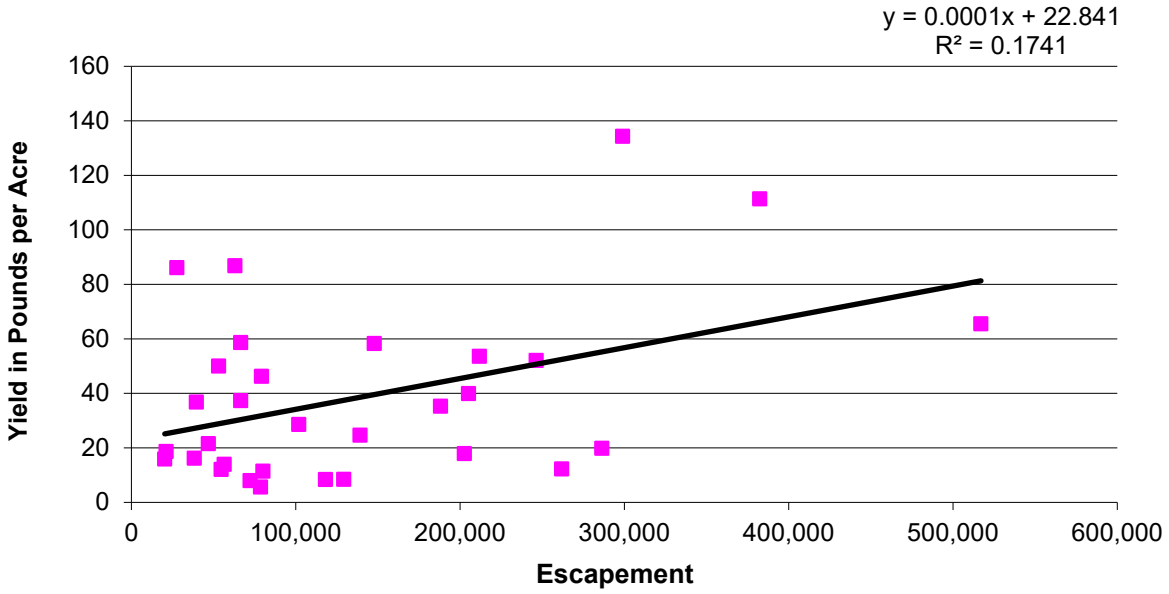
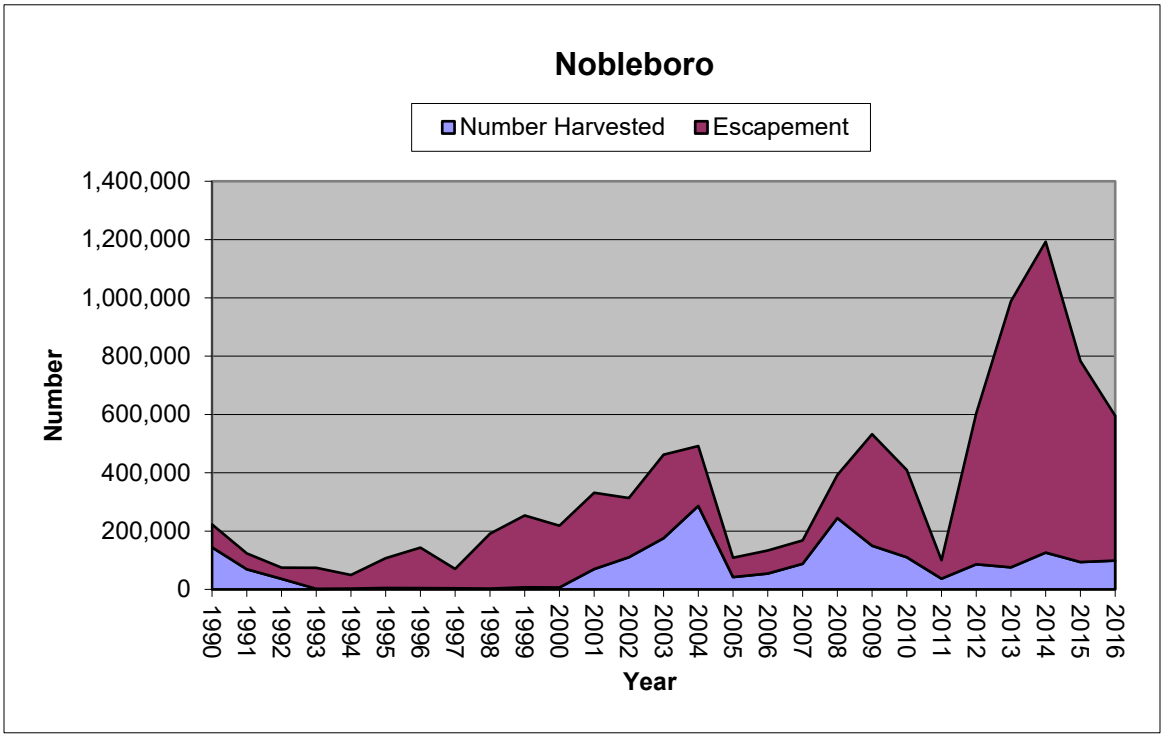


Figure 8. Yield in pounds per acre vs. escapement for the period 1977 – 2012



Year	Municipality	River	% repeat spawners by	R-0	R-1	R-2	R-3	Z-value
2015	Nobleboro	Damariscotta	25.6	70.41	23.47	5.10	1.02	1.42
2014	Nobleboro	Damariscotta	30.4	69.60	14.70	14.70	1.00	1.27
2013	Nobleboro	Damariscotta	23.8	76.20	22.80	1.00		2.17
2012	Nobleboro	Damariscotta	16.3	83.70	10.80	4.80	0.80	1.48
2011	Nobleboro	Damariscotta	33.2	66.80	27.70	5.50		1.25
2010	Nobleboro	Damariscotta	17.9	82.00	14.40	2.60	1.00	1.49
2009	Nobleboro	Damariscotta	44.7	55.30	42.60	2.10		1.64
2008	Nobleboro	Damariscotta	29.7	-	-	-	-	

Figure 9. Commercial harvest of river herring at Damariscotta Lake in the 1980s



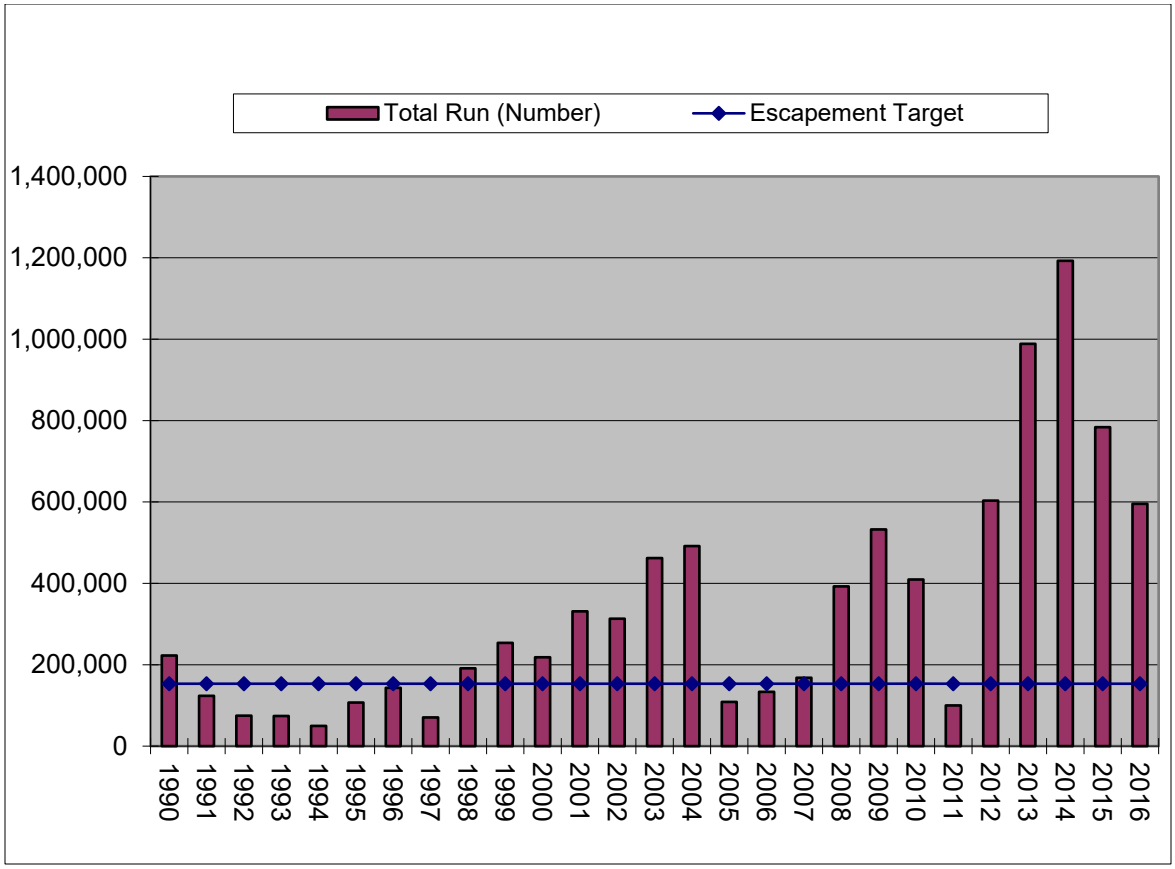


Figure 10. Entrance to the Damariscotta Fishway.

Figure 11. Upper section of the Damariscotta Fishway prior to restoration.

Figure 12. Upper section of the fishway after restoration.

Phippsburg Commercial Fishery:
The Maine Department of Marine Resources manages this pond for a minimum commercial escapement of 35 fish per acre. The spawning escapement need for this system is 4,795 river herring passed upstream through the fishway during the three day closed period per week during the fishery. The management plan has always achieved returns that meet the target escapement developed for this system or passed the total run upstream. The fishway leads from the tidal zone directly into a 137-acre lake (Figure 12A). This fishery is typically the earliest of all Maine river herring runs, with river herring arriving as early as March 15. There is no spawning below the tidal fishway.

The commercial harvester catches blueback herring at this location toward the end of the commercial fishing season. These fish enter the lake with the last of the alewife run. It is unknown how well blueback spawn or survive in the lake. Blueback herring may drop out of the lake prior to spawning to look for suitable spawning habitat which is not available in the lake. Field staff has not observed any juvenile blueback herring in biological samples collected emigrating from the lake in the fall.

The fishery at Winnegance Lake is currently on the watch list. Though the fishery currently meets the minimum escapement levels in the plan, the annual run is below expectations. The cause for the decline in the annual run is not clear. There are several factors that may be impacting annual returns. In the early 2000's the dam at the outlet of the lake was reconstructed to repair the dam and improve the harvest area. The existing denil fishway is sufficient to pass fish into the lake but the existing configuration may make it difficult for fish to find the downstream passage. There are periods of time when downstream passage appear to be nonexistent due to low flow during the summer and fall. The size of the water combined with the numbers of fish passed into the lake may not be able to support the numbers of juvenile fish for an extended period.

In addition, the dam is low enough that the Kennebec River regularly flows back into the lake during above average high tides. The salinity of the river water flowing into the lake could be as high as 15ppm. Once this water enters the lake there is no way for the water to exit the lake. In recent years, northern pike and black crappie were illegally introduced into the lake and predation on adult and juvenile has likely increased. Both species are known to prey heavily on alewives in Maines freshwater ecosystems.

Prior to the 2017 season the Department will deploy a sonde into the lake soon after ice out to collect water quality data. In conjunction with the assessment of downstream passage the department will consider adding additional closed days to the fishery to see if there is any response in returns.

Town	River	Lake size (acres)	Threshold (N/acre)
Phippsburg	n/a	137	35


Fishing Location
Phippsburg
Spawning Location
Arrowsic
Georgetown
East Harpswell
Sebasco Estates
Ridley Cove
Robinhood Cove
Reid State Park
Sagadahoc Bay
Atkins
Halls Bay
Knubble Bay
Gunnet Rd
Harpswell Islands Rd
24

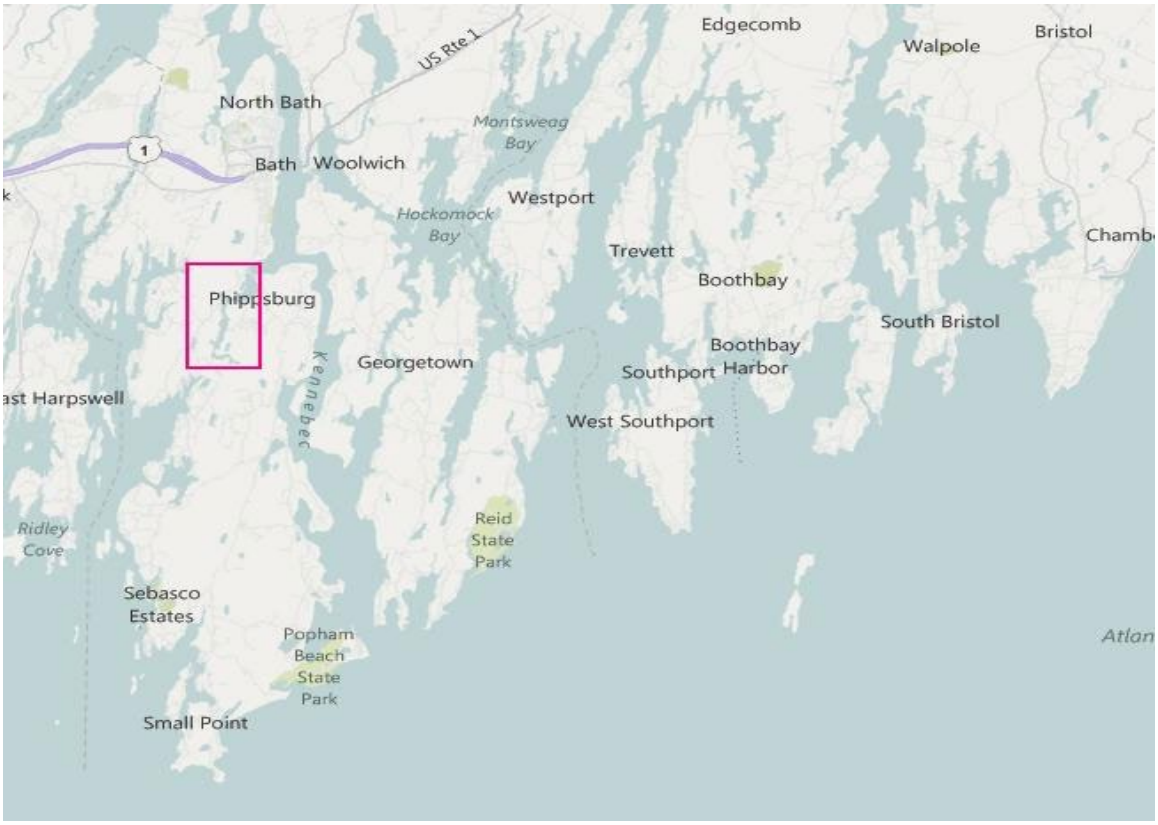
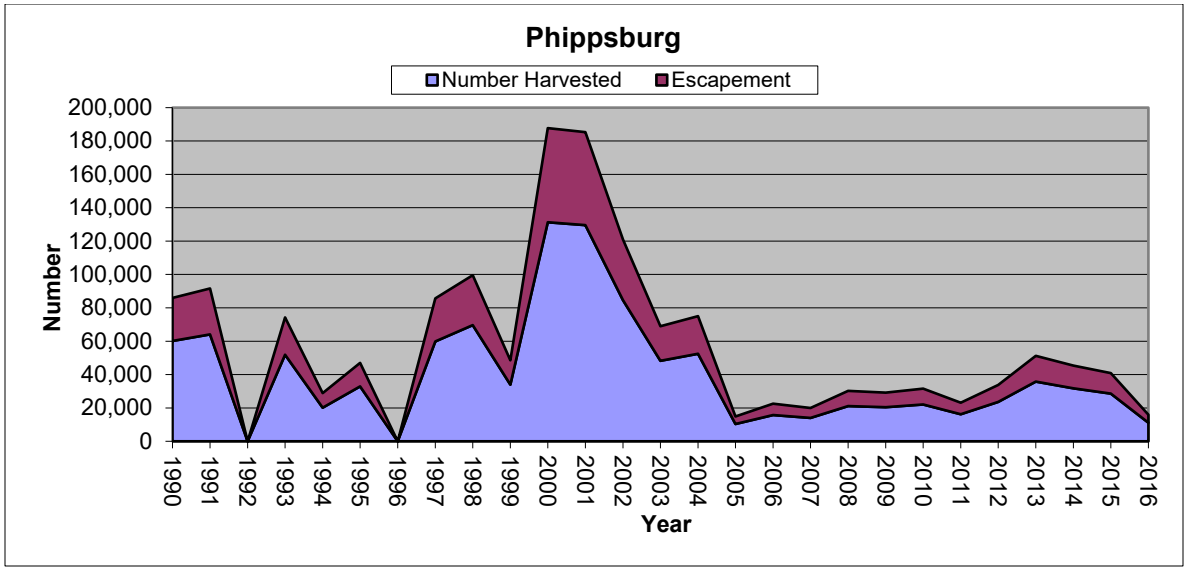
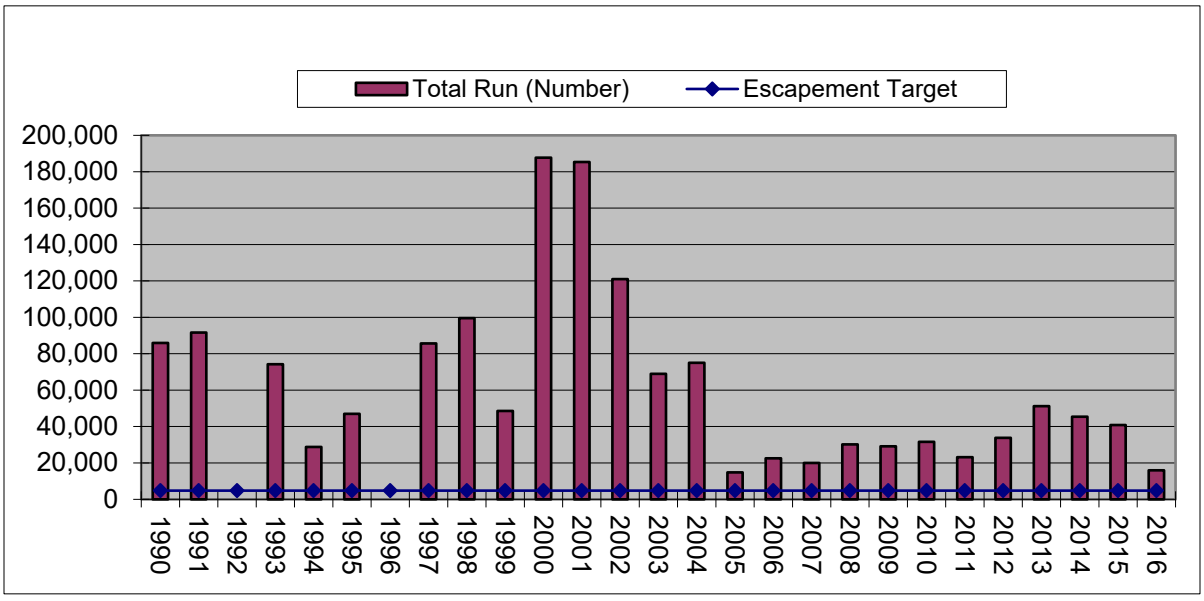

US Rte 1
North Bath
Bath
Woolwich
Montsweag Bay
Hockomock Bay
Westport
Edgecomb
Walpole
Bristol
Trevett
Boothbay
South Bristol
Boothbay Harbor
Southport
West Southport
Phippsburg
Georgetown
Kennebec
Reid State Park
Ridley Cove
Sebasco Estates
Popham Beach State Park
Small Point
1

Figure 12A. The Winnegance fish trap located in the lake above the fishway.

Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2015	Bath	Kennebec	39.0	62.00	34.00	4.00		1.37
2014	Bath	Kennebec	16.1	83.90	12.90	2.20	1.10	1.48
2013	Bath	Kennebec	8.8	91.20	7.30	1.50		2.05
2012	Bath	Kennebec	8.0	92.00	5.00	2.00	1.00	1.45
2011	Bath	Kennebec	6.5	93.46	4.52	2.01		1.92
2010	Bath	Kennebec	25.5	74.49	17.35	8.16		1.11
2009	Bath	Kennebec	9.0	91.00	7.00	2.00		1.91
2008	Bath	Kennebec						





East Machias Commercial Fishery:

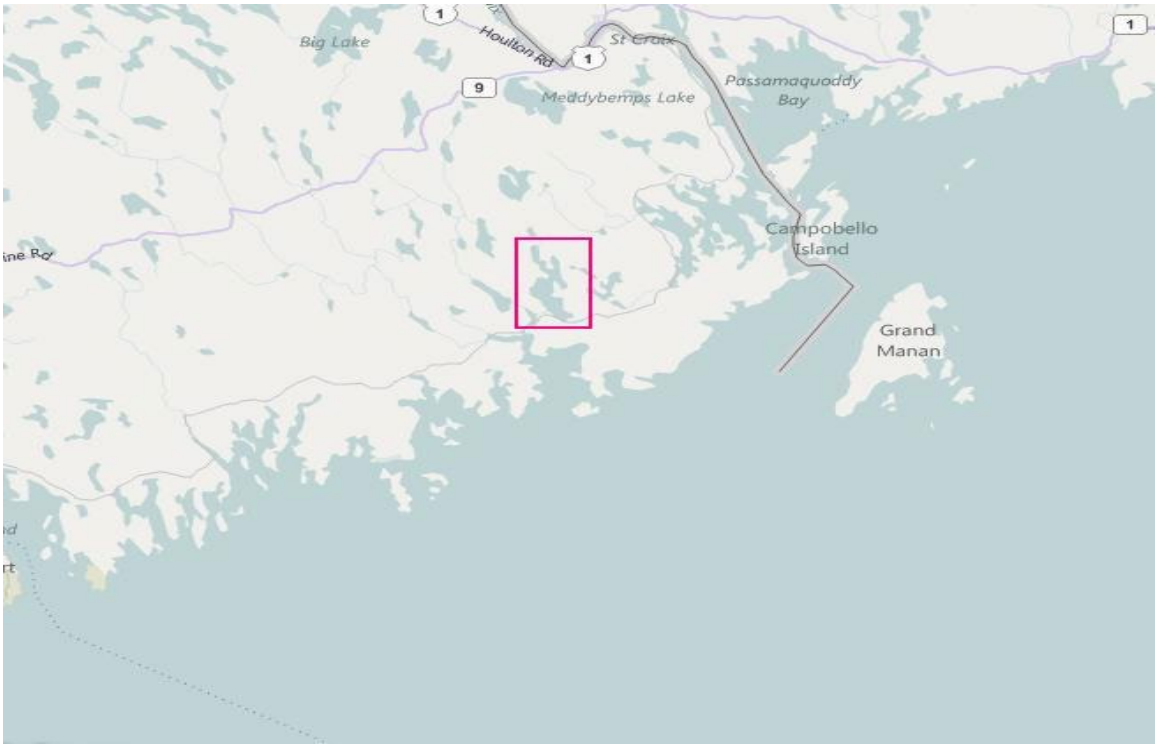
The Maine Department of Marine Resources manages Gardiner Lake for a commercial escapement of less than 35 fish per acre but there is no specific target for this system established at this time. The spawning escapement need for this system is 176,225 river herring passed upstream through three closed days per week in the fishery. The management plan has not achieved returns to meet the 35 fish per acre target escapement developed for other systems.

The main stem East Machias River system has a large run of river herring that is unexploited. The main stem river remains closed as a conservation measure while allowing a larger harvest at the first tributary on the river at the outlet of Gardiner Lake (Figures 13 -14). An estimated run of 2.1 – 4.5 million river herring ascend the East Machias' 9,000 acres of accessible habitat. An unknown number of blueback herring ascend the river to spawn in the main stem. These fish are not harvested and are allowed free

access up and down the river. The DMR allows a higher exploitation rate for Gardiner Lake to keep the main stem of the East Machias open to free passage for all anadromous fish. The East Machias River has no dams on the main stem and provides spawning and juvenile habitat for native Atlantic salmon.

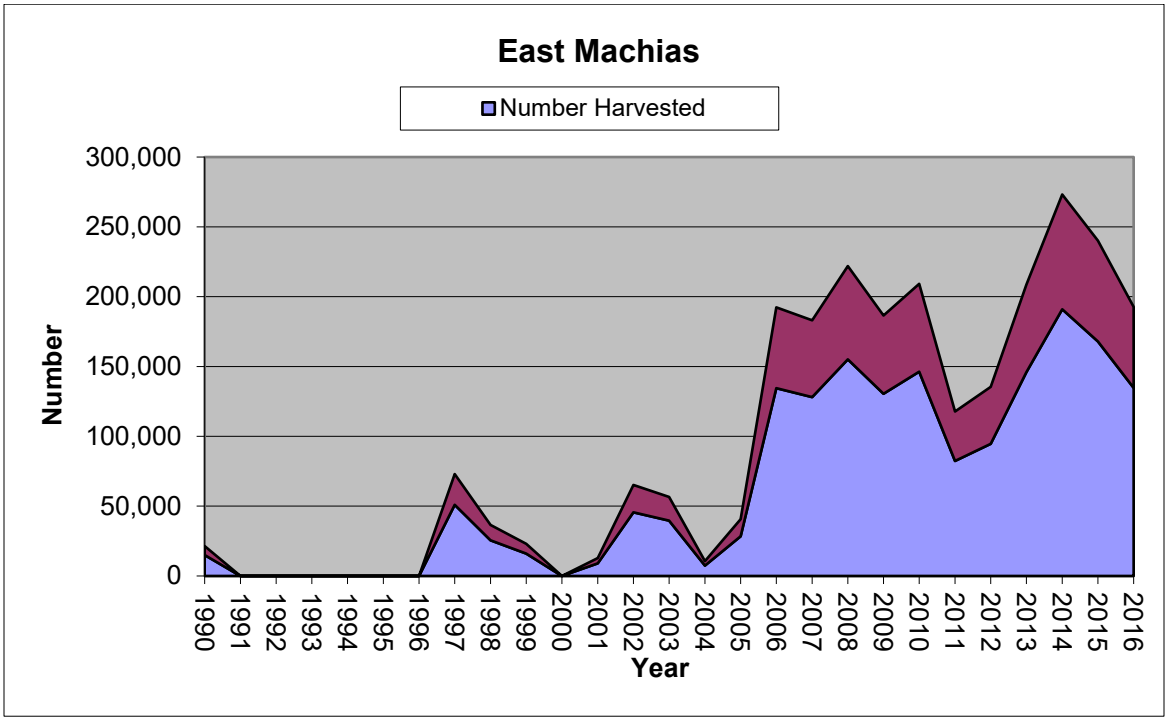
For several years prior to 2010 the harvest data from the Gardiner fishery was severely under reported. Historical landings data that are the basis for calculating escapement indicate the escapement into the lake was far below expectations compared to runs in general. Under new management and with accurate landings data the run is closer to meeting expectations. Additional data collected from this system and future analysis of the 2015 and 2016 scale samples will indicate the direction this fishery is trending. If indications are that escapement from the commercial fishery is not increasing, DMR will impose additional closed days in 2017.

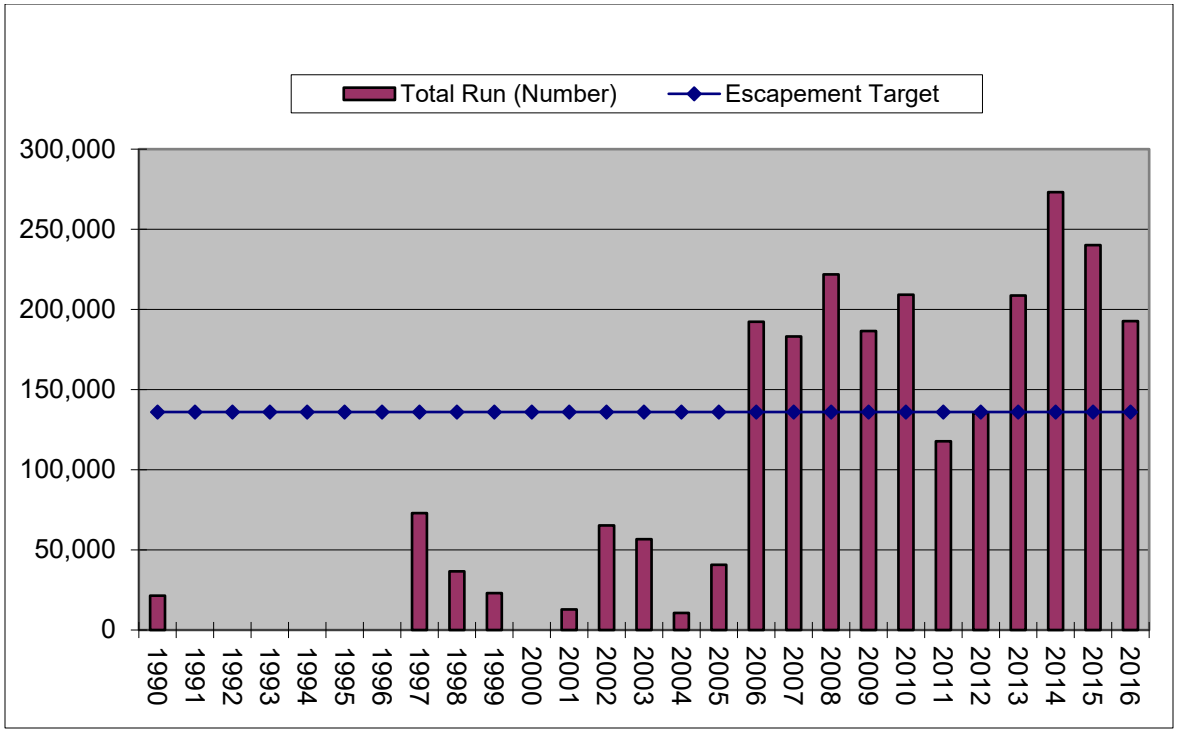
Town	River	Lake size (acres)	Threshold (N/acre)
East Machias	n/a	5,035	35



Figures 13 - 14. Chase Mill Stream is a tributary to the East Machias River. Fishing gear is deployed at the top of the fishway to capture returns to Gardiner Lake.

Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2015								
2014								
2013	East Machias	N/A	31.6	68.40	28.00	2.60	1.00	1.51
2012	East Machias	N/A	20.5	79.53	14.42	4.69	1.34	1.34
2011	East Machias	N/A	50.9	49.05	41.50	9.43		0.82
2010	East Machias	N/A	23.2	76.76	22.22	0.00	1.01	1.46
2009	East Machias	N/A	17.7	82.30	17.70			1.54
2008	East Machias	N/A	6.0	94.30	5.70			2.81





Gouldsboro Commercial Fishery:

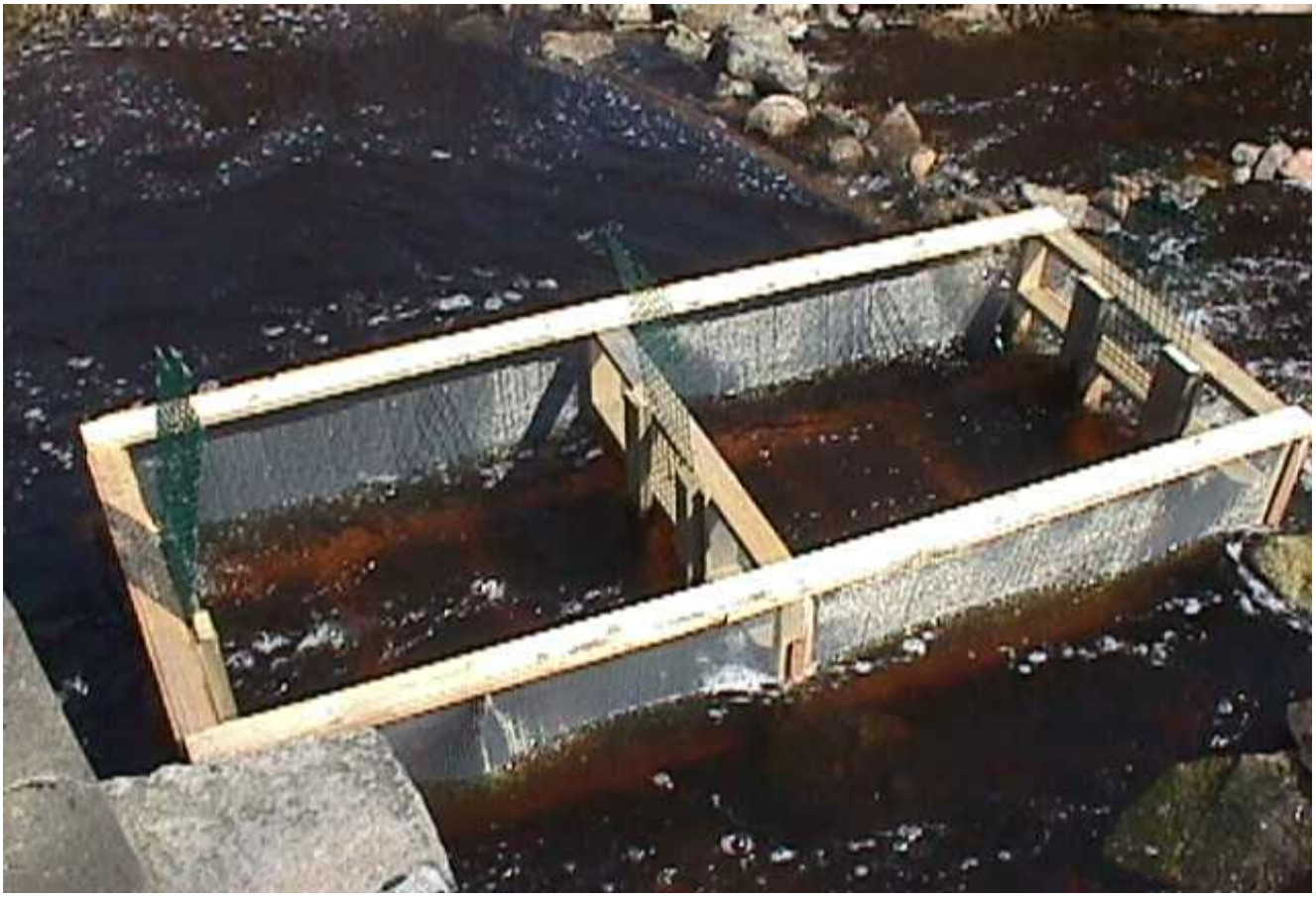
The Maine Department of Marine Resources manages this pond for a minimum commercial escapement of 35 fish per acre. The spawning escapement need for this system is 3,500 river herring passed upstream through three closed days per week during the season (Figures 15 -17). The management plan has achieved returns to meet the target escapement developed for this system 95% of the years during the past 20-year period or passed the entire run upstream. The run is comprised of all alewife and spawning does not occur below the fishery for either species.

Town	River	Lake size (acres)	Threshold (N/acre)
Gouldsboro	n/a	100	35

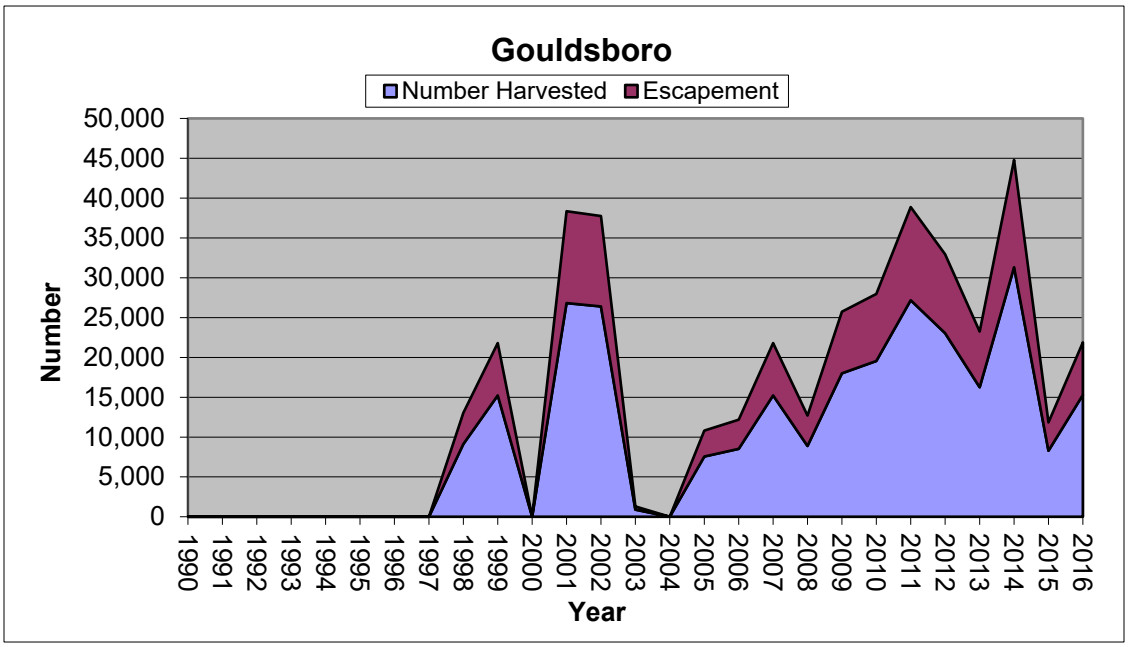

Spawning Location
Fishing Location
Steuben
Scenic Byway
Route 1
1
Route 1
Gouldsboro
186
S Gouldsboro Rd
Jones Pond
Forbes Pond
W Bay Rd
Prospect

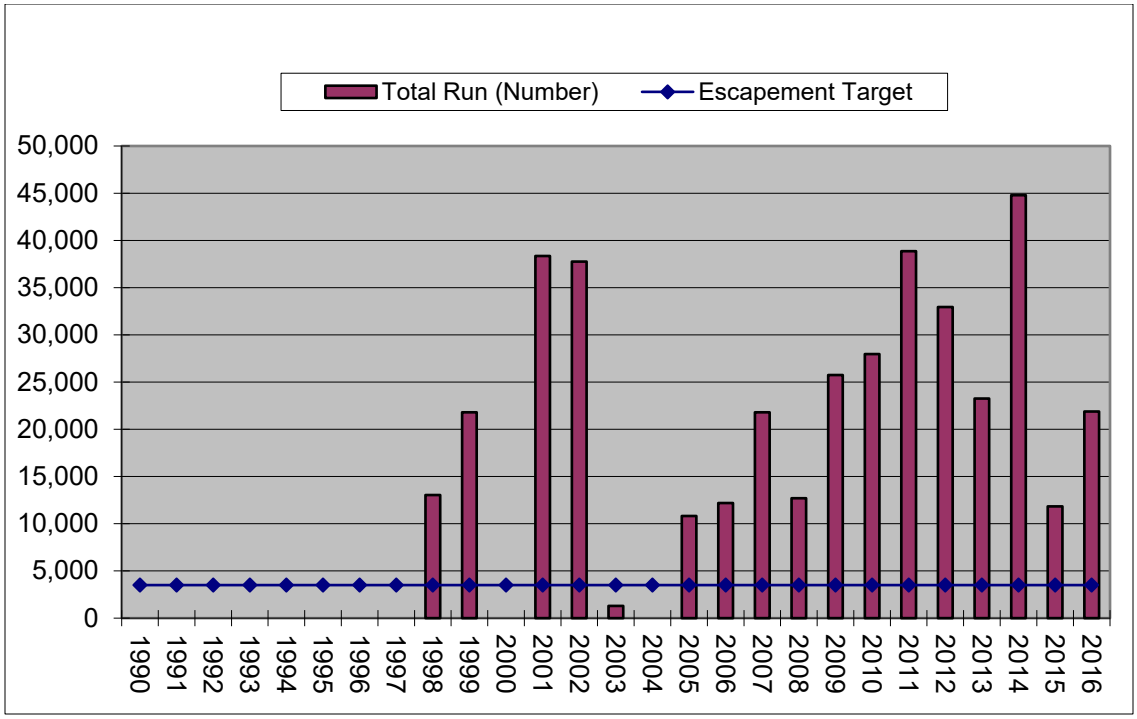

Bangor
Main Rd
9
Airline Rd
Hamilton Pond
Mount Desert Island
Long Pond
Acadia N.P.
Deer Island
Swans Island
Haut Island

Figures 15-17. Fishway, fishing location, and trap deployed in the Gouldsboro alewife fishery.



Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2015	Gouldsboro	N/A	26.6	73.42	22.15	3.17	1.27	1.14
2014	Gouldsboro	N/A	17.6	82.40	13.60	4.00		1.51
2013	Gouldsboro	N/A	33.3	66.70	30.10	2.70	0.50	1.71
2012	Gouldsboro	N/A	22.2	77.80	22.20			1.25
2011	Gouldsboro	N/A	33.8	66.15	30.76	3.07		1.54
2010	Gouldsboro	N/A	17.5	82.50	15.00	2.50		1.75
2009	Gouldsboro	N/A	17.9	82.10	3.60	14.30	4.00	0.87
2008	Gouldsboro	N/A	29.7	52.40	47.60			0.10



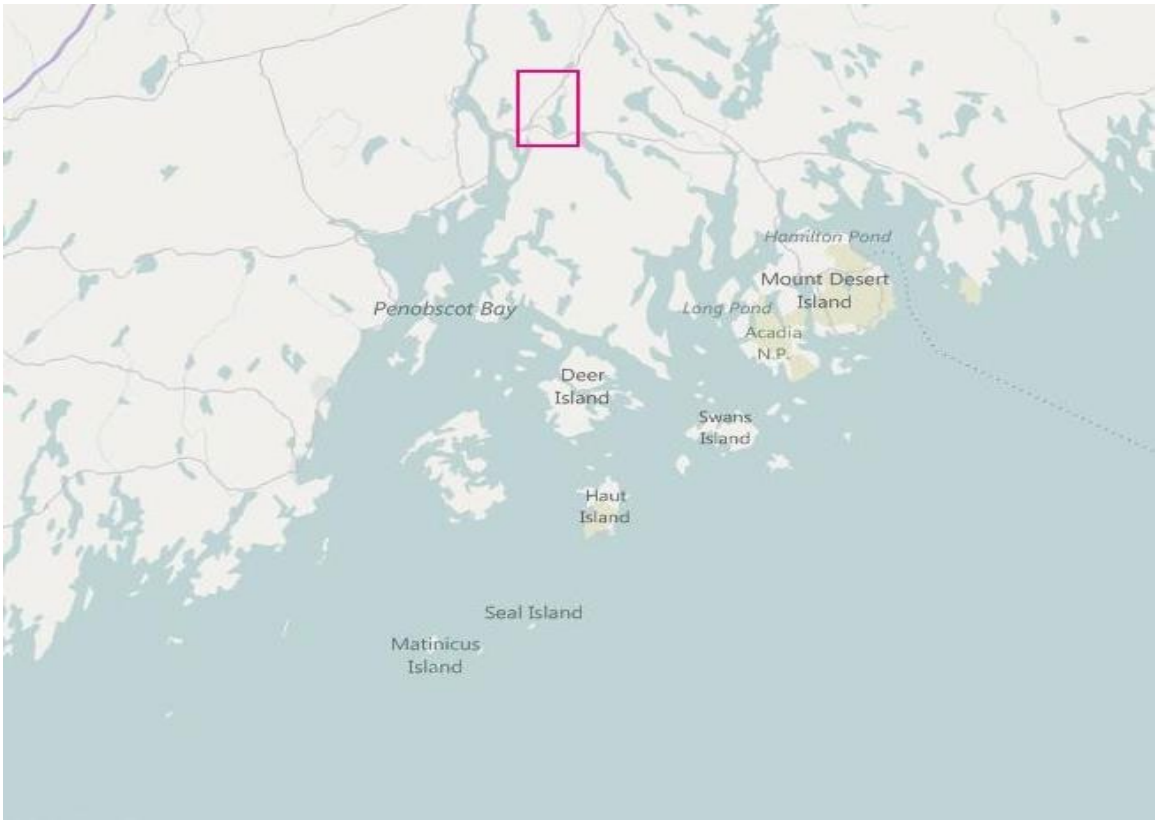


Orland Commercial Fishery:

The Maine Department of Marine Resources manages this system for a minimum commercial escapement of 35 fish per acre. The spawning escapement need for this system is 39,655 river herring passed upstream through three closed days per week during the fishery. The management plan has achieved returns to meet the target escapement developed for this system for 95% of the years during the past 20-year period or passed the entire run upstream. Only a portion of historic spawning habitat in the Orland River Watershed is accessible to river herring. Access to many of the historic spawning habitats is excluded due to conflicts with sport fish species. There is no expectation that additional habitat will reopen in the near future. The State of Massachusetts granted the municipality of Orland exclusive harvest rights in 1805. Orland is one of two fisheries that DMR permits to use tidal weirs to fish for river herring due to the size of the river at the fishing location. Like the smaller box traps, tidal weirs capture the entire run during the open fishing days (Figures 18-20). Once river herring pass the fishery they are prevented from falling back below the weir because the weir spans the entire river at low tide, preventing them from reentering the fishery. The Orland River before it was dammed likely contained runs of American shad and Atlantic salmon. There are no observations of either species at this location by field staff.

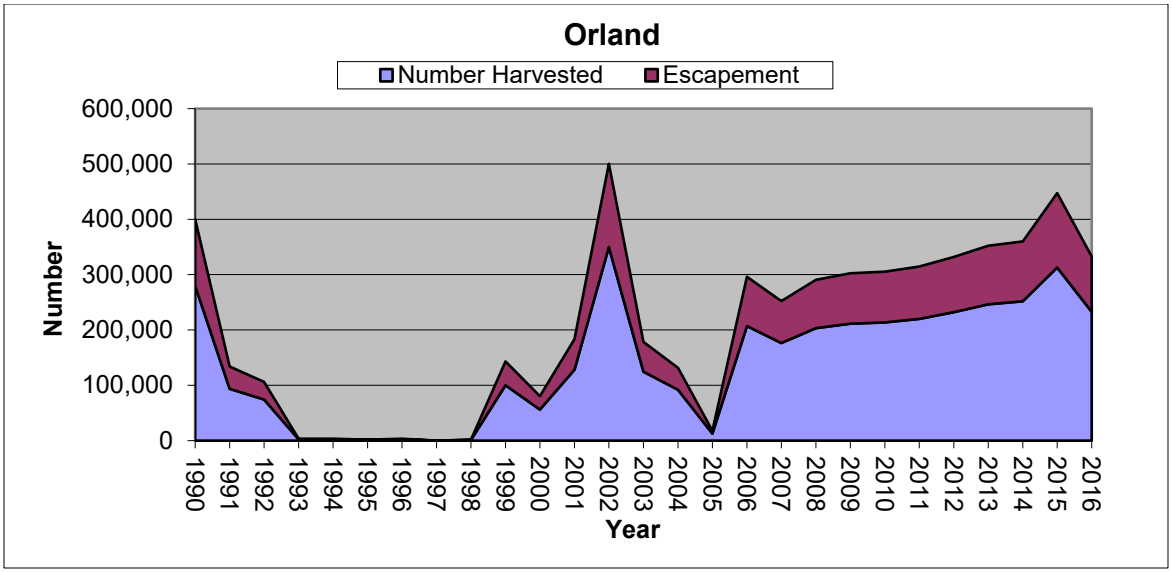
The Orland fishery captures blueback herring in the alewife fishery toward the end of the fishing season. Blueback herring account for 2-5% of the annual river herring catch. There is no spawning below the tidal fishways on the Orland River. The first dam on the Orland River has two Alaska Steep Pass fishways which provide upstream passage. Neither of these passages is available during two hours on either side of low tide.

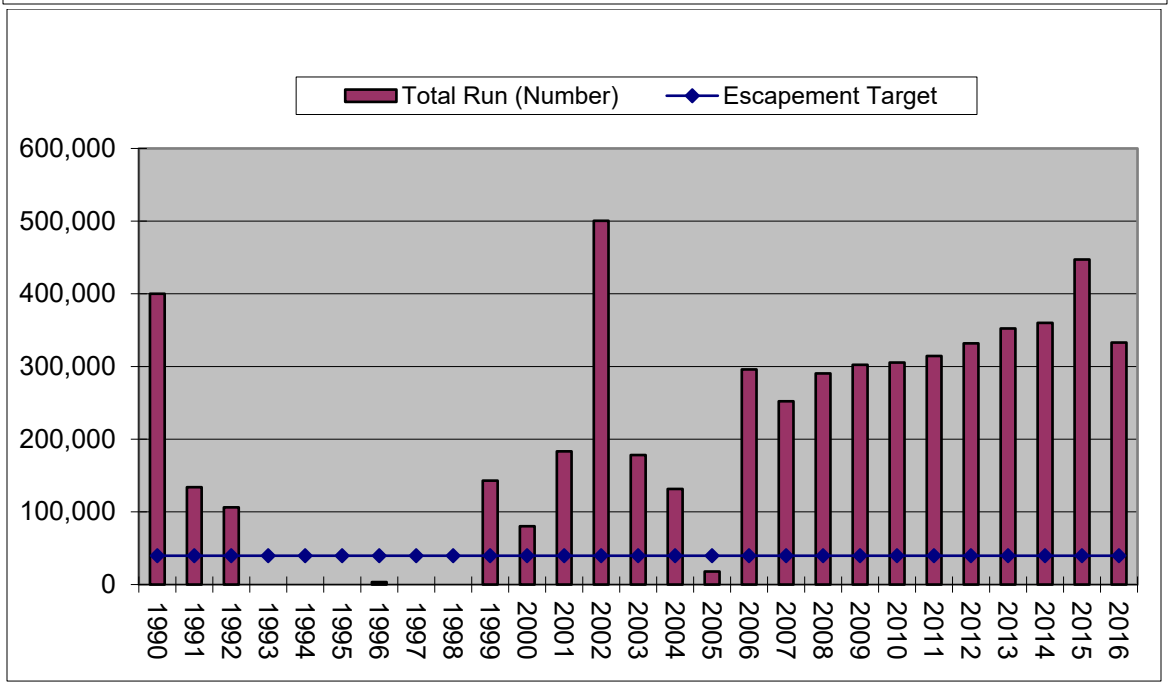
Town	River	Lake size (acres)	Threshold (N/acre)
Orland	Orland	1,133	35



Figures 18-20. Tidal weir and commercial catches of river herring in May 2010 (bottom left) and May ~ 1970 (bottom right).

Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2015	Orland	Orland River	20.4	79.61	13.59	6.80		1.23
2014	Orland	Orland River	16.7	83.33	15.33	1.33		2.07
2013	Orland	Orland River	14.1	85.90	11.20	1.50	1.50	1.42
2012	Orland	Orland River	15.0	85.00	10.00	5.00		2.14
2011	Orland	Orland River	60.0	39.89	58.08	2.02		1.49
2010	Orland	Orland River	25.0	75.00	21.00	4.00		1.75
2009	Orland	Orland River	22.2	77.80	20.20	2.00		1.83
2008	Orland	Orland River	17.2	82.80	17.20			1.57





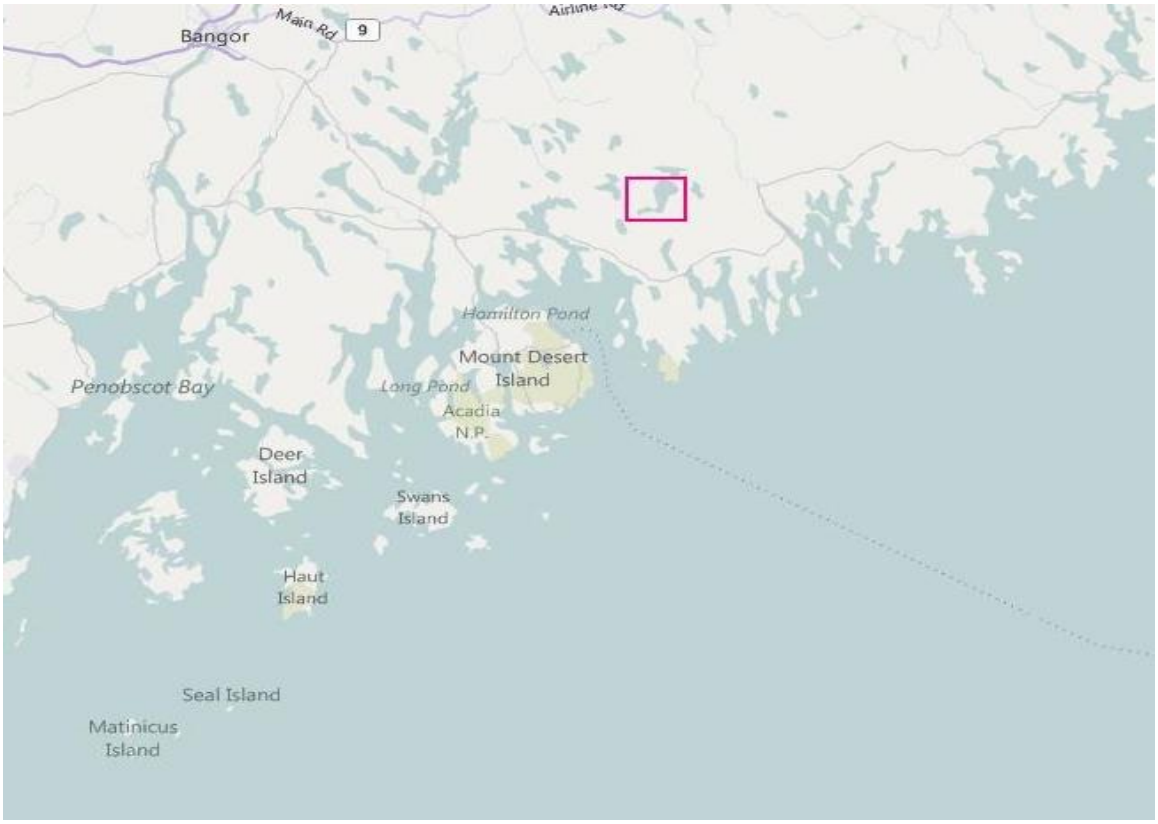
Steuben Commercial Fishery:

The Maine Department of Marine Resources manages this system for a minimum commercial escapement of three fish per acre. The spawning escapement need for this system is 6,213 river herring passed upstream by closing the harvest three days per week. The management plan has achieved returns to meet the target escapement developed for this system for 85% of the years during the past 20-year period or passed the entire run upstream. The Steuben system is located several miles inland and is severely limited by beaver activity along the 15-mile long brook leading to spawning habitat at Tunk Lake. Alewife production at this site depends on high water during both the spring and fall seasons. As a result, production from this system varies widely. This is one of several systems with landlocked salmon, lake trout, and rainbow smelt that the Maine Department of Inland Fisheries and Wildlife

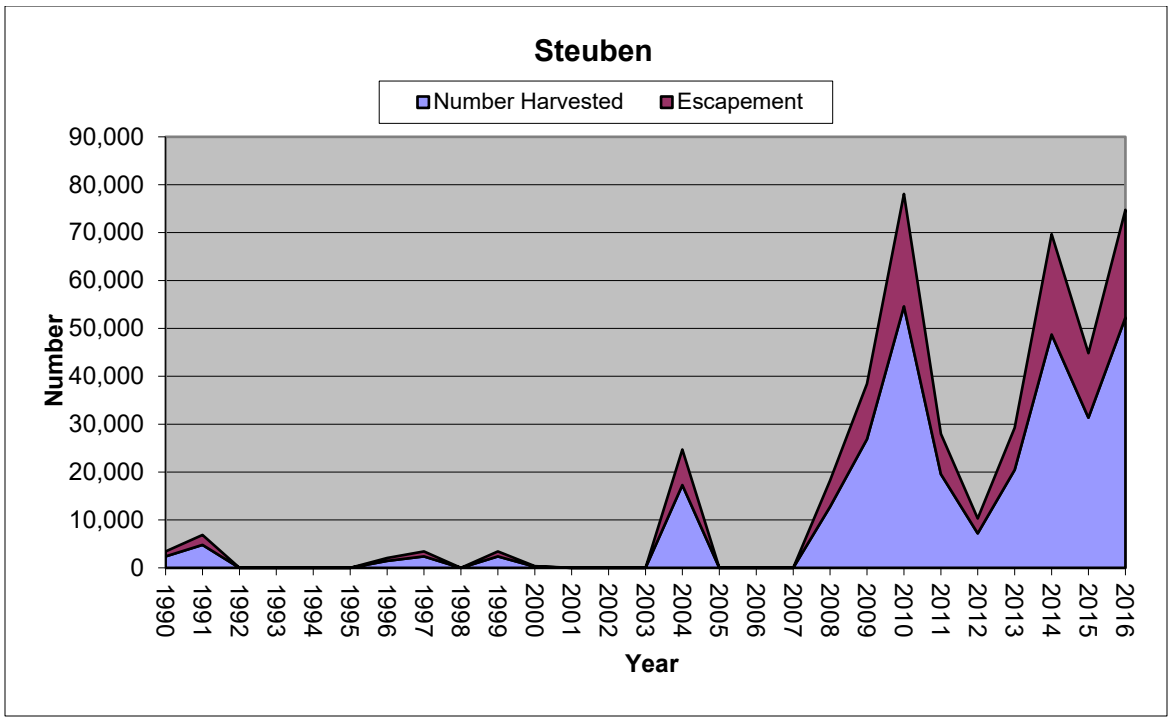
manages for sport fish species. There is no known spawning for either anadromous species within the stream leading to the pond.

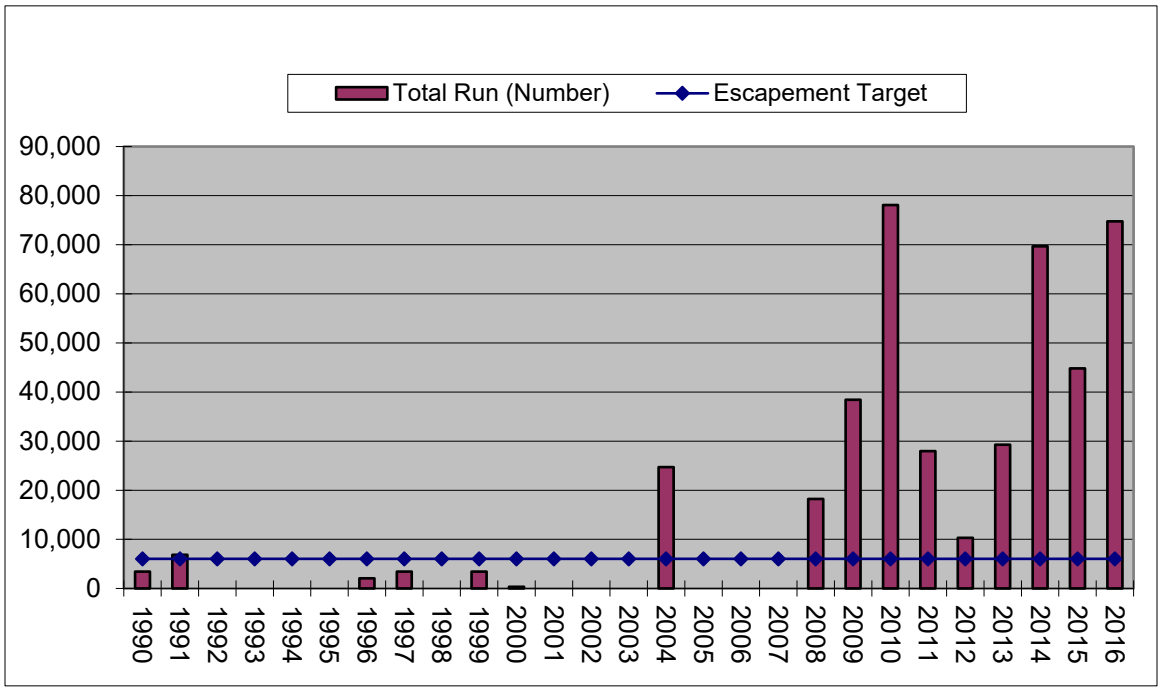
Due to water quality issues associated with its oligotrophic characteristics, Tunk Lake produces very small juvenile alewives that emigrate to sea from July – October. The lake is nutrient poor and is not as productive as other lakes in the region. It is unlikely that increased escapement beyond the 3 fish per acre would produce consistently higher annual returns.

Town	River	Lake size (acres)	Threshold (N/acre)
Steuben	n/a	2,071	3



Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2016								
2015			Unreadable					
2014	Stueben	Tunk River	16.8	83.17	7.92	8.91		1.12
2013	Stueben	Tunk River	48.0	52.00	48.00			0.08
2012								
2011	Stueben	Tunk River	20.6	79.38	14.40	6.18		1.21
2010	Stueben	Tunk River	19.6	80.40	15.70	2.00	2.00	1.3
2009								
2008								





Webber Pond Commercial Fishery:

The commercial fishery at Vassalboro began in 2009 as the result of a restoration project at Webber Pond started by the Maine Department of Marine Resources in 2000. Until 2009, alewives were unable to reach spawning habitat in Vassalboro unless they were hand dipped over the dam (Figure 21). Upstream passage now provides access to spawning habitat within this municipality. The Maine Department of Marine Resources manages this system for a minimum commercial escapement of 35

fish per acre. The municipality currently chooses to have the commercial harvester pass at least 18,000 alewives into spawning habitat before commercial harvest can commence. The minimum spawning escapement need for this system is 42,035 river herring passed upstream through three closed days per week during the season. The management plan has achieved the target escapement developed for this system during all years that the commercial harvest has occurred. Current returns to the commercial fishery are the result of trap and transfer operations that initially stocked the system with approximately 6 fish per acre though an agreement with the Maine Department of Inland Fisheries and Wildlife.

There is no spawning in the stream leading to Webber Pond. Like many of the small streams that lead to spawning habitat in lakes and ponds in Maine the stream is often plugged with beaver dams. The harvester must obtain a permit to remove these dams prior to downstream migration in the fall and the spawning run in the spring.

Town	River	Lake size (acres)	Threshold (N/acre)
Vassalboro	n/a	1,201	35

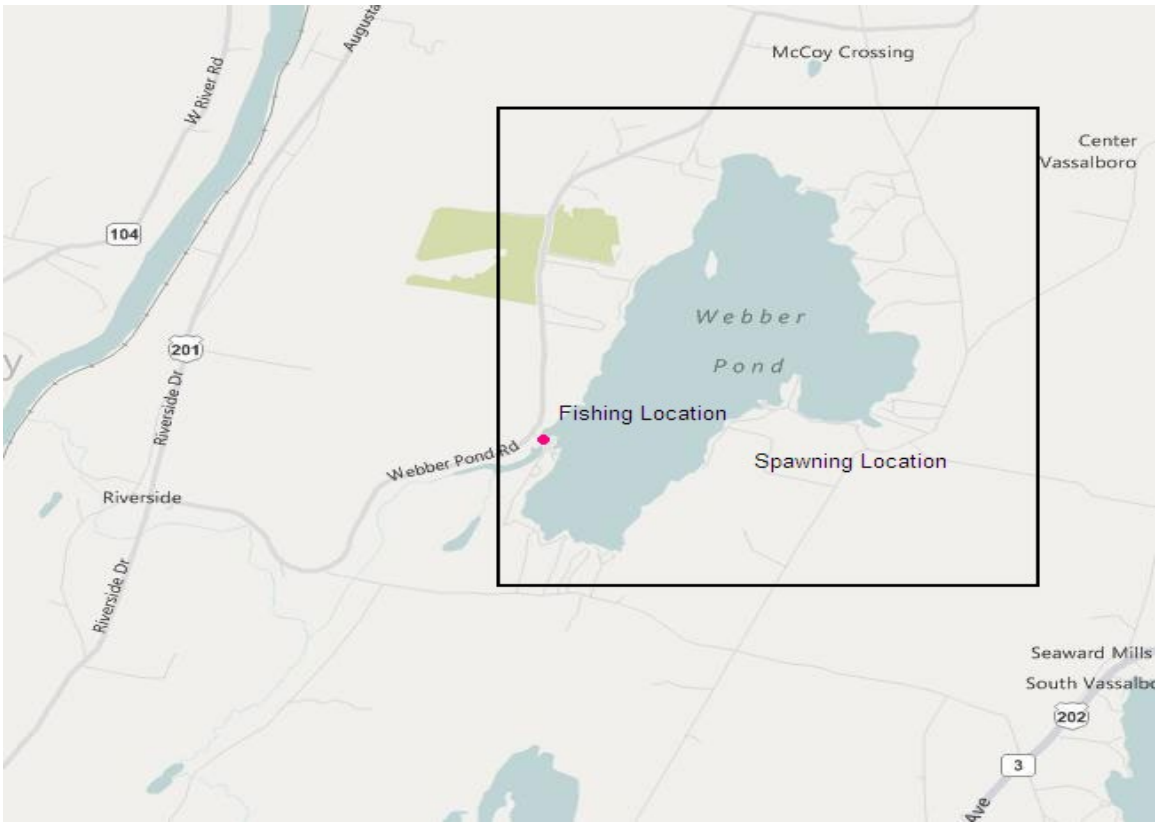
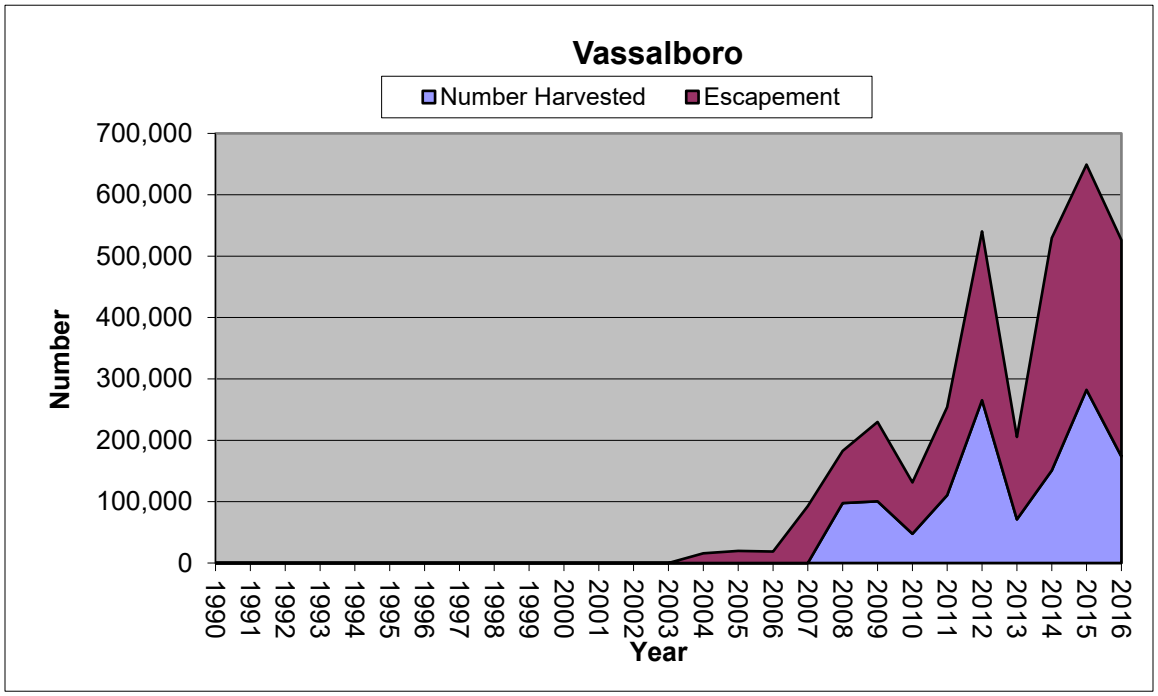
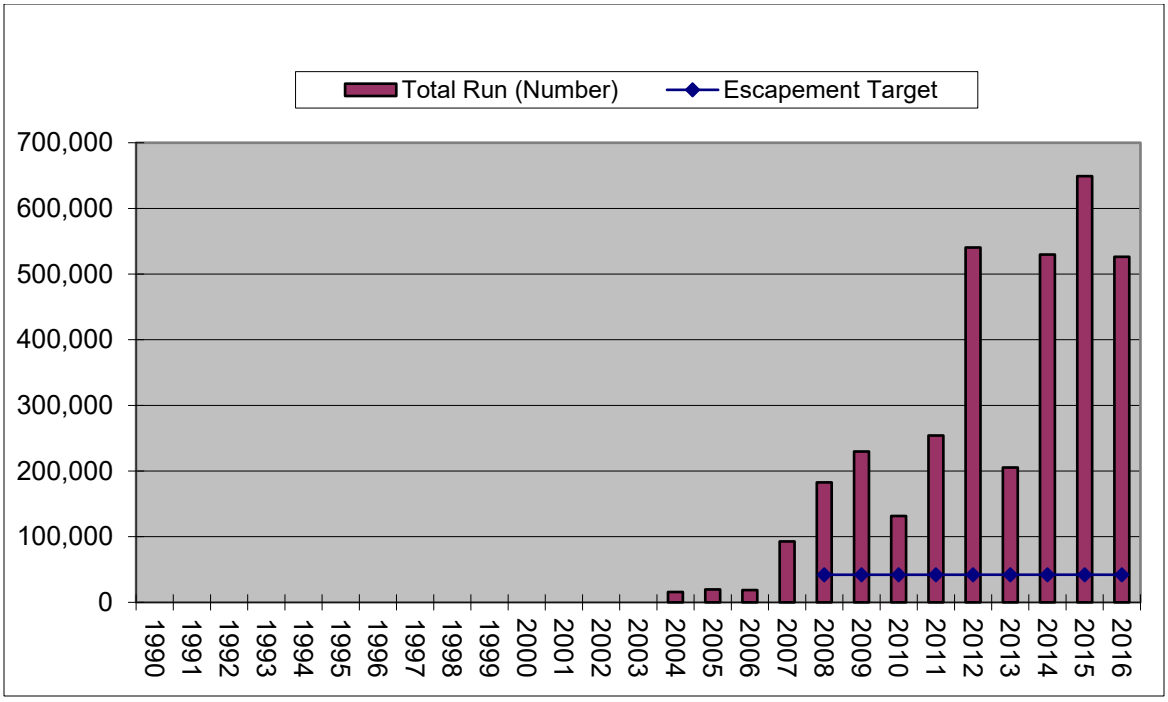


Figure 21. Outlet dam at Webber Pond. The commercial fishery occurs upstream and to the left of the dam.

Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2015	Vassalboro	N/A	14.0	86.00	12.00	2.00		1.88
2014	Vassalboro	N/A	23.3	76.80	18.20	5.10		1.36
2013	Vassalboro	N/A	36.3	63.70	31.40	3.90	1.00	1.45
2012	Vassalboro	N/A	13.3	86.70	10.70	2.70		1.73
2011	Vassalboro	N/A	75.8	24.19	50.00	24.19	1.16	0.89
2010	Vassalboro	N/A	25.2	74.80	13.80	10.60	0.80	1.39
2009	Vassalboro	N/A	12.9	87.10	10.60	2.40		1.80
2008		N/A						





Ellsworth Commercial Fishery:

There are two large dams on the Union River. The largest is the Ellsworth Dam approximately 66.7 feet high and has four turbine generators and a FERC-authorized capacity of 8.9MW. Graham Lake Dam is approximately 30 feet high and used only to release water from the Graham Lake impoundment. The water storage dam expanded the size of Graham Lake to over 9,000 surface acres. Since 1996, the hydropower owner has artificially propagated the alewife run through a long term trap and truck program. For several years the numbers alewife stocked above the hydropower dam occurred as the result of the hydropower company owners trucking as many fish as possible during the closed fishing days. Prior to the 1980s the state resource agencies transported fish above the hydropower facility to initiate a river herring run. These stockings resulted in returns as high as 1.8 million returning alewives in the mid-1980s.

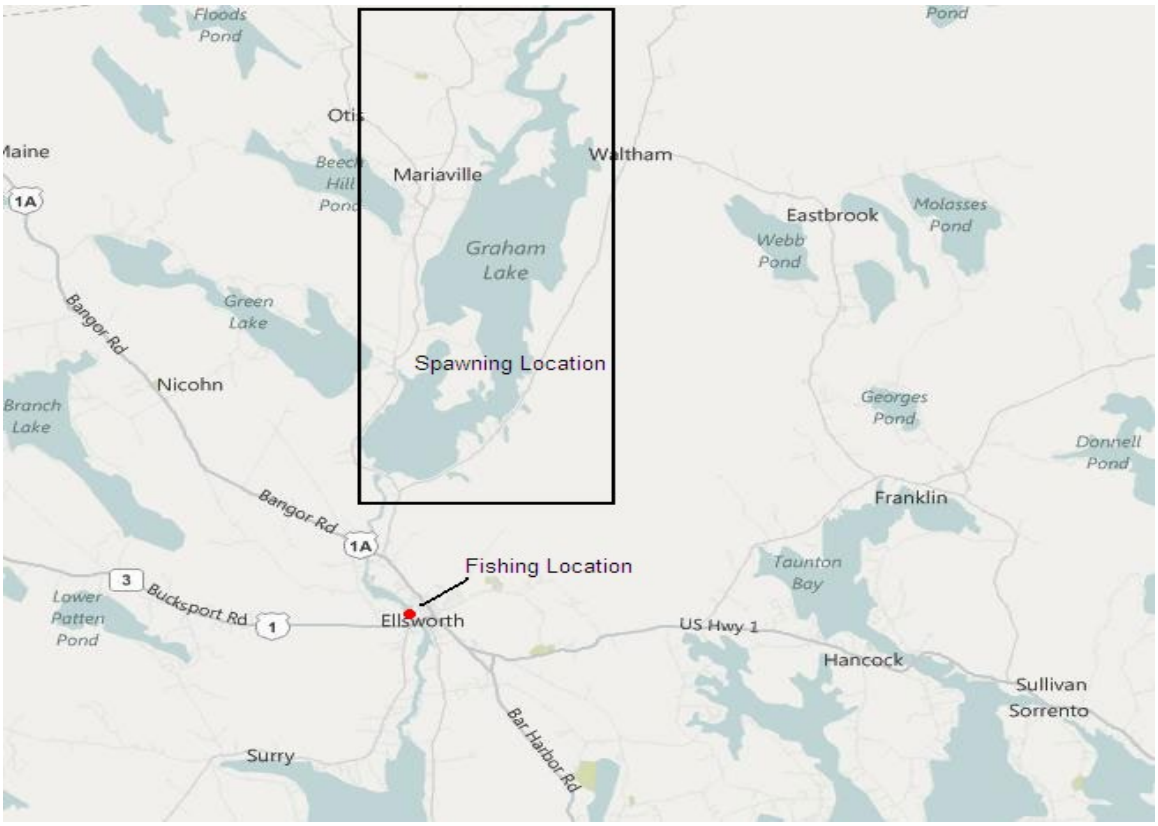
In accordance with the 2015-2017 Union River Fisheries Management Plan, the company currently stocks a minimum of 315,000 alewives annually upstream into Graham and Leonard lakes. Once the initial 150,000 alewives are captured and stocked upstream, harvesting is allowed Monday through Friday each week, with the stocking of the additional 165,000 alewives conducted on weekends through June 15 each year in order to represent the run throughout the entire spawning period. Once the harvester attains the stocking goal, the management plan permits the municipality to harvest all remaining river herring coming up the fishway which ends in the hydropower station parking lot.

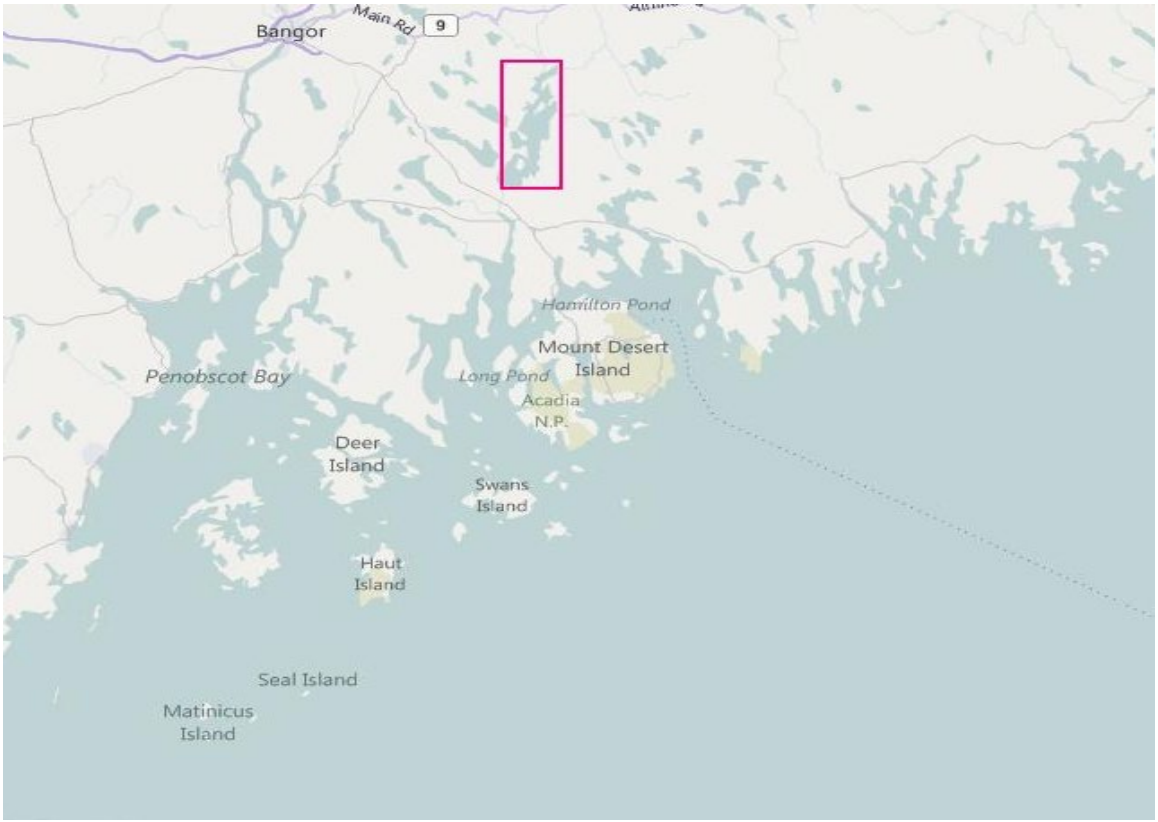
In addition to the downstream passage at the Graham Lake Dam, migrating fish are also known to pass through the turbines at Ellsworth. This can result in high mortality for both adult and juvenile river herring. The number of repeat spawning fish returning to the Union River is low compared to all other rivers in Maine. The lack of repeat spawning fish is likely the result of additional mortality from the turbines and high exploitation rate. As the numbers of fish stocked above the dam increase the number of repeat spawning fish should increase. The management plan has achieved the target escapement developed for this system each year during the past 20-year period solely through the efforts of the Black Bear Hydro Partners and the contractors the hire for the trap and truck program.

The hydropower facility is a peaking operation where water is stored during the night and passed though the turbines during the day when power demand is highest. Spill conditions exist for only three weeks during the early spring ice melt. During the remainder of the year, there is no spill over the dam except during high water resulting from an extreme rain event.

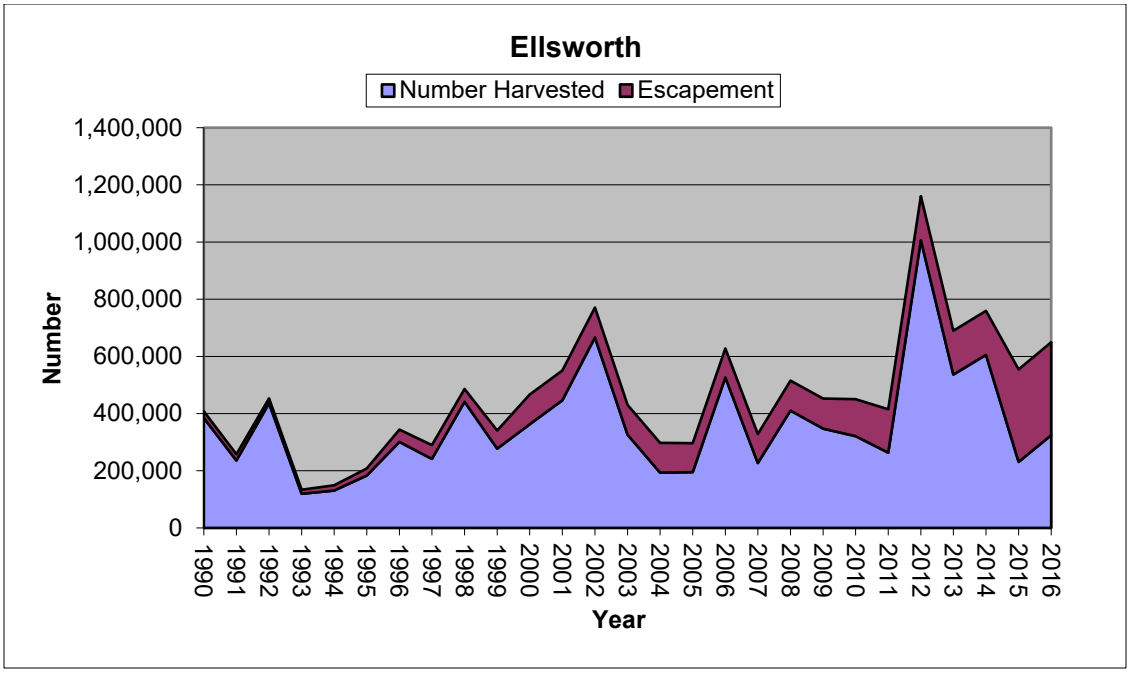
There is no spawning below the dam for either species. The Union River is tidal to the base of the dam and provides little riverine habitat for any anadromous fish species. Atlantic salmon are present during some years and when caught in the trap are trucked upstream to spawning habitat. There are several ponds in the watershed that could support river herring but alewife reintroductions are not permitted by the Department of Inland Fisheries and Wildlife because of perceived conflicts with sport fish species, rainbow smelt, or hatchery operations.

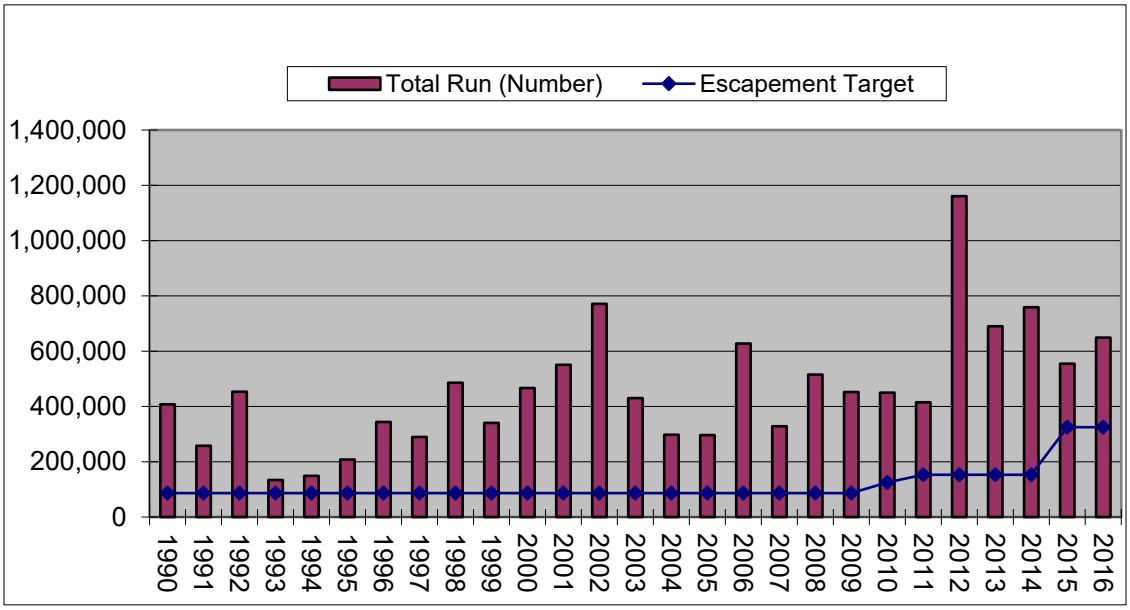
Town	River	Lake size (acres)	Threshold (N/acre)
Ellsworth	Union River	7,865	41





Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2015	Ellsworth	Union	7.8	92.22	7.78			2.47
2014	Ellsworth	Union	17.0	83.00	12.00	5.00		1.4
2013	Ellsworth	Union	12.0	88.00	12.00			1.99
2012	Ellsworth	Union	10.9	89.10	7.90	3.00		2.56
2011	Ellsworth	Union	7.9	92.10	7.23	0.65		2.48
2010	Ellsworth	Union	8.0	92.00	7.00	1.00		2.26
2009	Ellsworth	Union	7.0	92.30	2.80	4.90		1.47
2008	Ellsworth	Union	2.0	98.00	2.00			3.89





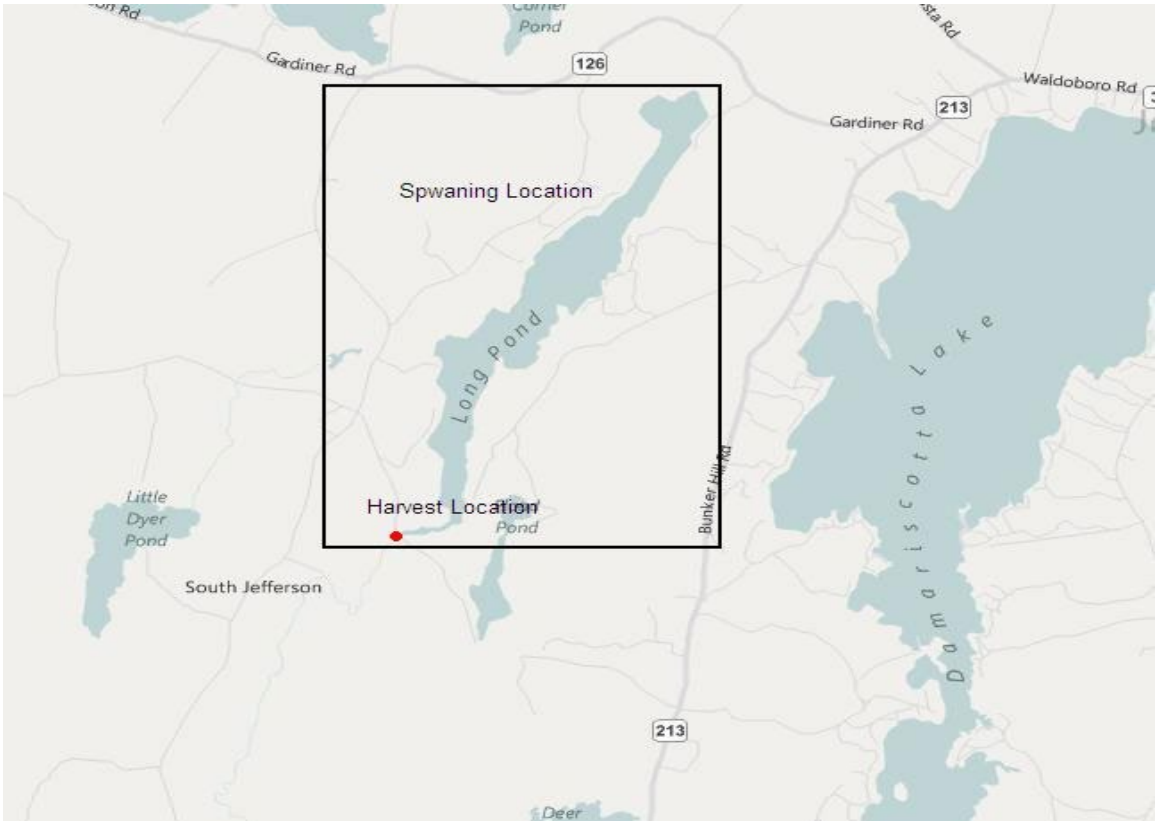
Jefferson Commercial Fishery:

The Maine Department of Marine Resources manages this system for a minimum commercial escapement of 35 fish per acre. The spawning escapement need for this system is 14,875 river herring passed upstream through a three day closed period per week throughout the season. The management plan has achieved returns to meet the target escapement developed for this system or passed the entire run during each year for the past 20-year period. This fishery is typical of the smaller commercial river herring fisheries in Maine (Figures 22-24). The outlet stream from dyer-long Pond is a small coastal tributary to the lower Sheepscot River. This stream is heavily is impacted by beaver activity in the fall

that delay downstream passage and obstruct upstream passage the following spring if the dams are not breached or spring flows do not overtop the dams.

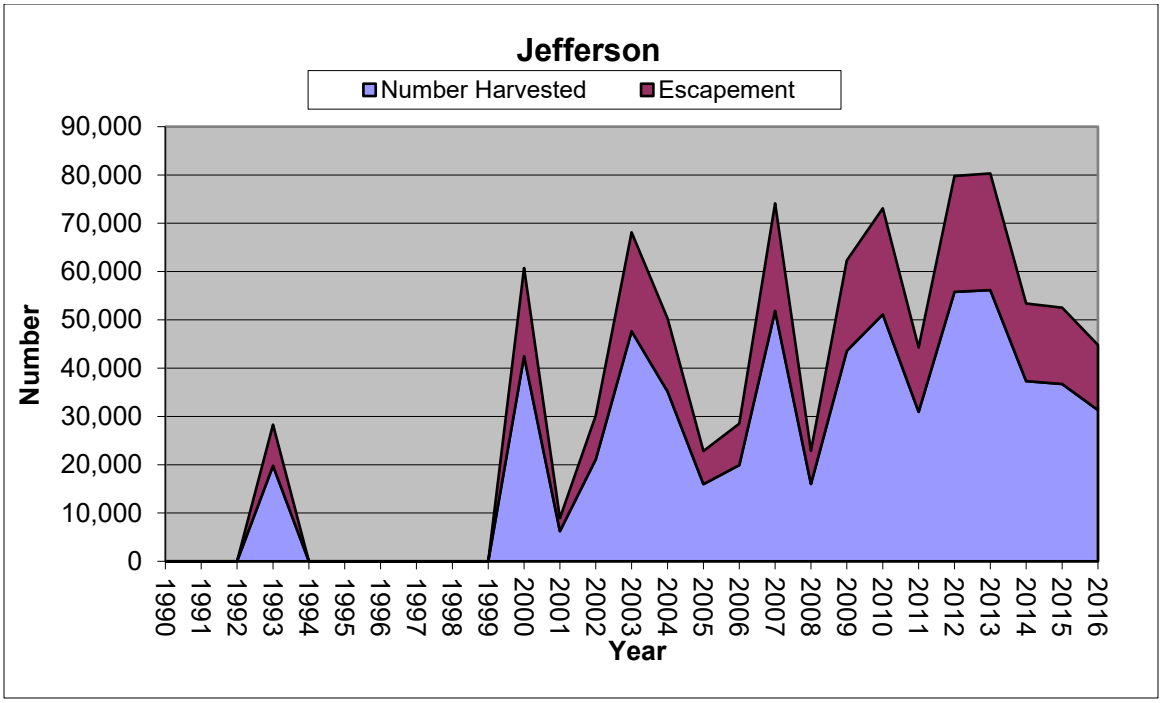
The river herring run into Dyer-Long Pond is entirely alewife. Blueback herring are not present in the commercial catches or samples collected by field staff. There is no spawning habitat below the fishway for blueback herring or alewife. Poaching along the stream is a problem at times during the spring migration. The stream is easily accessible at several points along its course to the Sheepscot River.

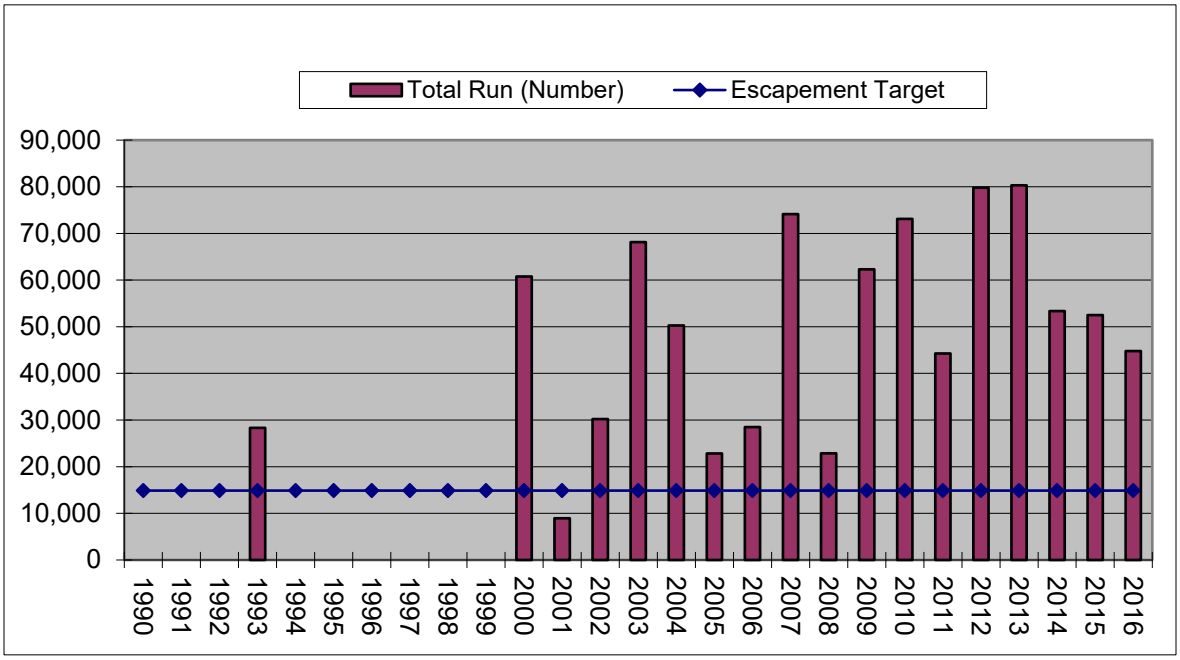
Town	River	Lake size (acres)	Threshold (N/acre)
Jefferson	Dyer River	425	35



Figures 22 - 24. Outlet stream from Dyer-Long Pond, fishway leading into the pond and alewife trap at the pond outlet.

Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2015	Jefferson	Dyer River	24.8	75.24	20.00	3.81	0.95	1.48
2014	Jefferson	Dyer River	26.5	73.50	20.60	5.20	0.60	1.58
2013	Jefferson	Dyer River	23.9	76.10	20.60	3.20		1.58
2012	Jefferson	Dyer River	34.3	65.70	28.30	5.10	1.00	1.28
2011	Jefferson	Dyer River	64.0	36.00	62.00	2.00		1.45
2010	Jefferson	Dyer River	15.2	84.40	14.10	1.50		2.02
2009	Jefferson	Dyer River	1.8	98.20	1.80			4.00
2008	Jefferson	Dyer River	62.7	37.25	60.78	1.96		1.47





Sullivan Commercial Fishery:

The Maine Department of Marine Resources manages this system for a minimum commercial escapement of 35 fish per acre. The spawning escapement need for this system is 3,222 river herring passed upstream during the three required closed days in the fishery each week. The management plan has achieved returns to meet the target escapement developed for this 90% of the time for the past 20-year period system or passed the entire run upstream. The harvester monitors the stream during the spring and fall migration periods to ensure upstream and downstream passage. There is no spawning

habitat in the stream below or above the fishery other than the lake habitat. Blueback herring are not observed in the biological samples or commercial catches. There are no dams located on the stream, but the previous fishway and culvert did impede upstream passage at certain flows (Figure 25). In 2012 a new bottomless arched culvert was installed, eliminating fish passage issues for anadromous fish in this system.

Town	River	Lake size (acres)	Threshold (N/acre)
Sullivan	n/a	92	35

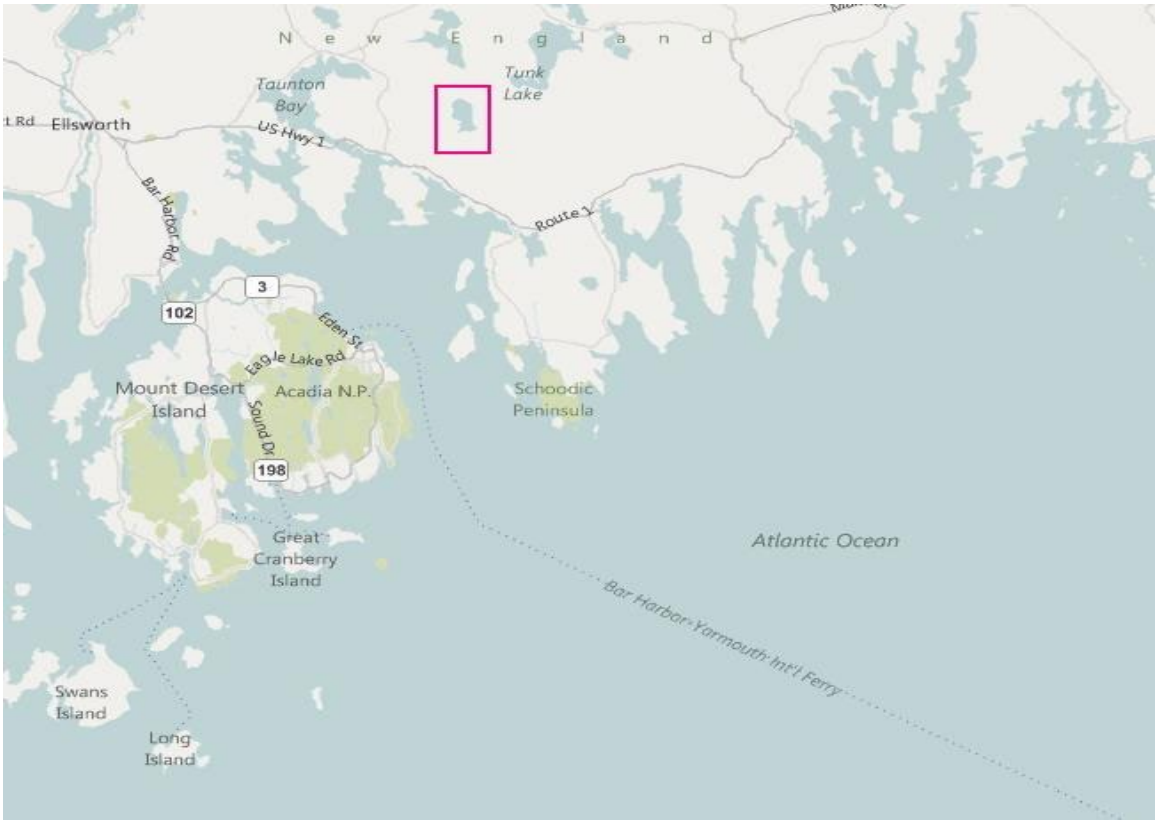
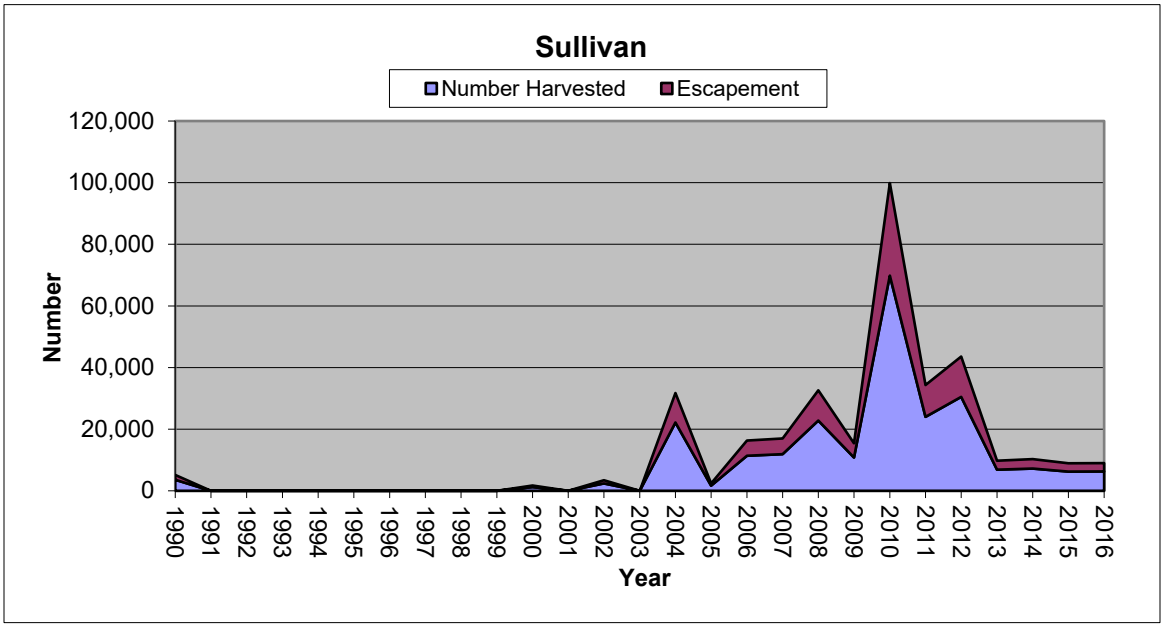
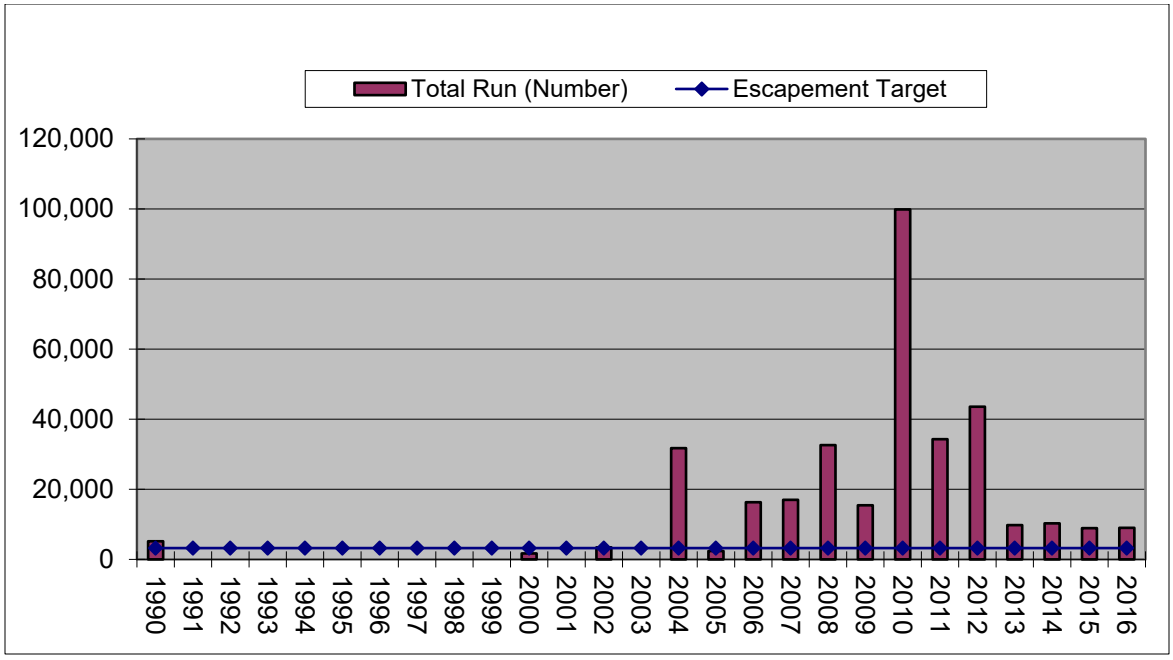


Figure 25. Fishway leading to spawning habitat in Flanders Pond prior to fall of 2012 (left). Removal of the fish ladder and installation of a bottomless arch culvert ready for the 2013 alewife migration (right).

Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2015	Sullivan	N/A	48.5	51.52	33.33	8.08	7.07	0.74
2014	Sullivan	N/A	43.0	57.00	21.00	22.00		0.48
2013								
2012	Sullivan	N/A	8.5	91.50	8.50			2.38
2011								
2010	Sullivan	N/A	11.8	88.20	10.50	1.30		2.11
2009	Sullivan	N/A	26.3	73.70	23.70	2.60		1.67
2008	Sullivan	N/A	33.3	66.70	22.20	11.10		0.90



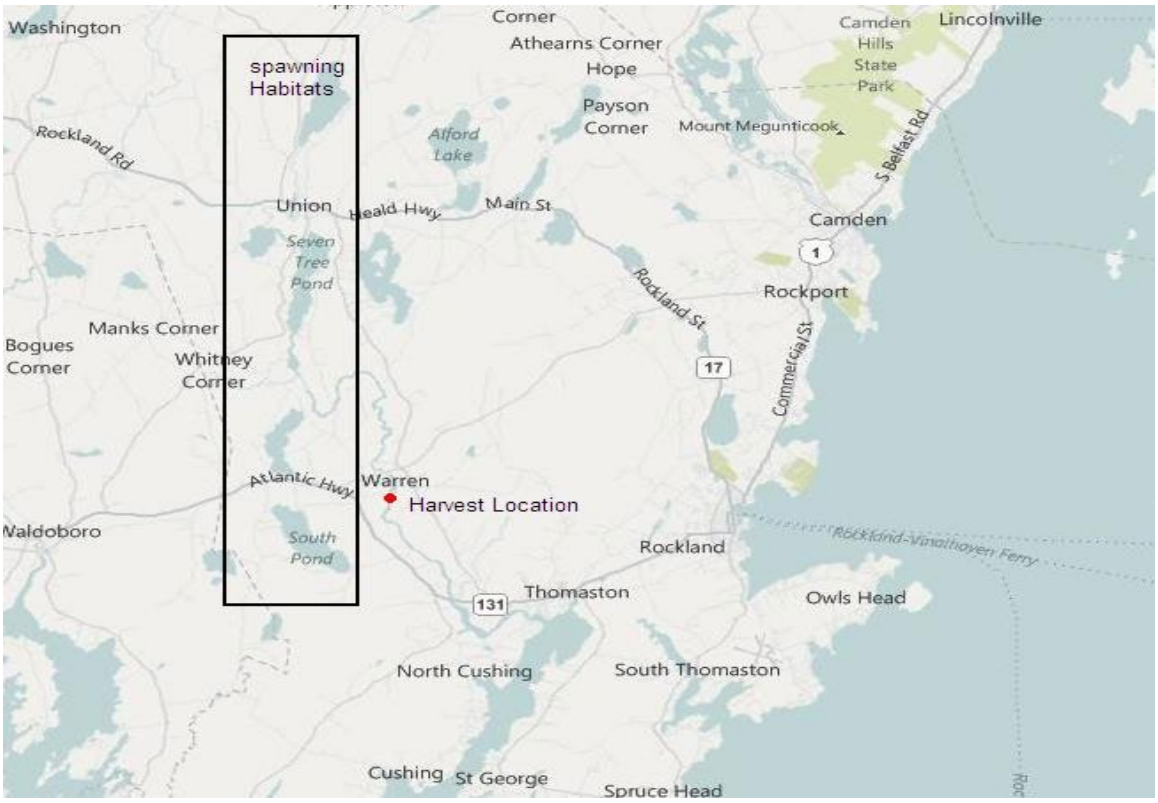


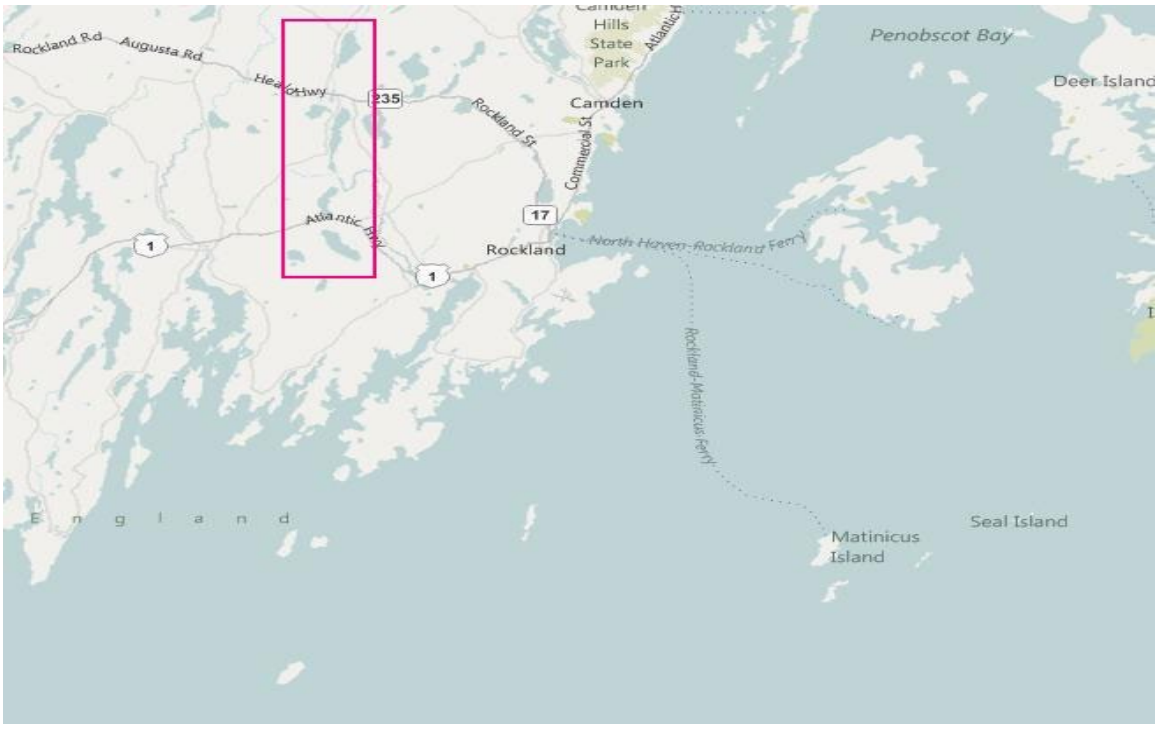
Warren Commercial Fishery:

The Maine Department of Marine Resources manages this system for a minimum commercial escapement of 35 fish per acre. The management plan has achieved returns to meet the target escapement developed for this system 95% of the time for the past 20-year period. The spawning escapement need for this system is 66,115 river herring passed upstream by a two-day closure of the fishery each week and a delay in deploying the weir until sometime after May 1 of the fishing year (Figure 26). Due to the size of the weir and spring flows in the river, deploying the weir and active fishing at this location typically does not occur until the second week of May. This permits, during some years, a larger proportion of spawning stock upstream than typical fisheries. There are several individual and varied spawning habitats within the St. George Watershed that act to support the large river herring run, both blueback herring and alewife. Unfortunately in 2016 significant drought conditions resulted in reports of several fish killing in the drainage. Fish were stranded in pools and above beaver dams as waters receded and stranded migrating fish. The impact to the 2016 year class is unknown and will first be observed when fish return in 2020 as 4-year olds.

Warren is one of the oldest and most productive commercial fisheries in Maine. The State of Massachusetts granted Warren exclusive harvest rights in 1802. By 1869 there were 16 dams on the main stem of the St George River. The main stem river is now clear of manmade obstructions and most spawning habitat is now accessible to river herring. There are portions of historic habitat that are still inaccessible in the upper watershed. Dams at lake outlets without fish passage are the biggest obstacle to full restoration of the river. There are blueback herring mixed in with the commercial alewife catches toward the end of the season. Blueback herring continue to migrate upstream after the June 5 closing date. The numbers of blueback herring in the system is estimated at 950,000 based on available spawning habitat. There is no spawning habitat located below the town fishery for either species.

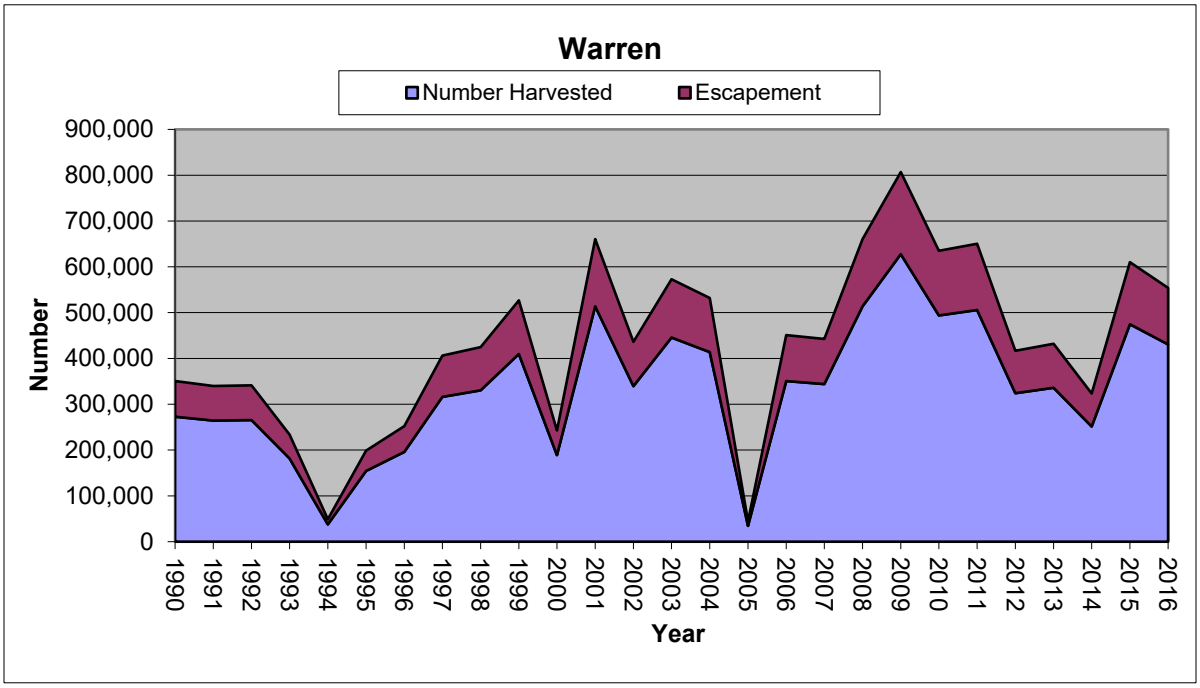
Town	River	Lake size (acres)	Threshold (N/acre)
Warren	St. George	1,889	35

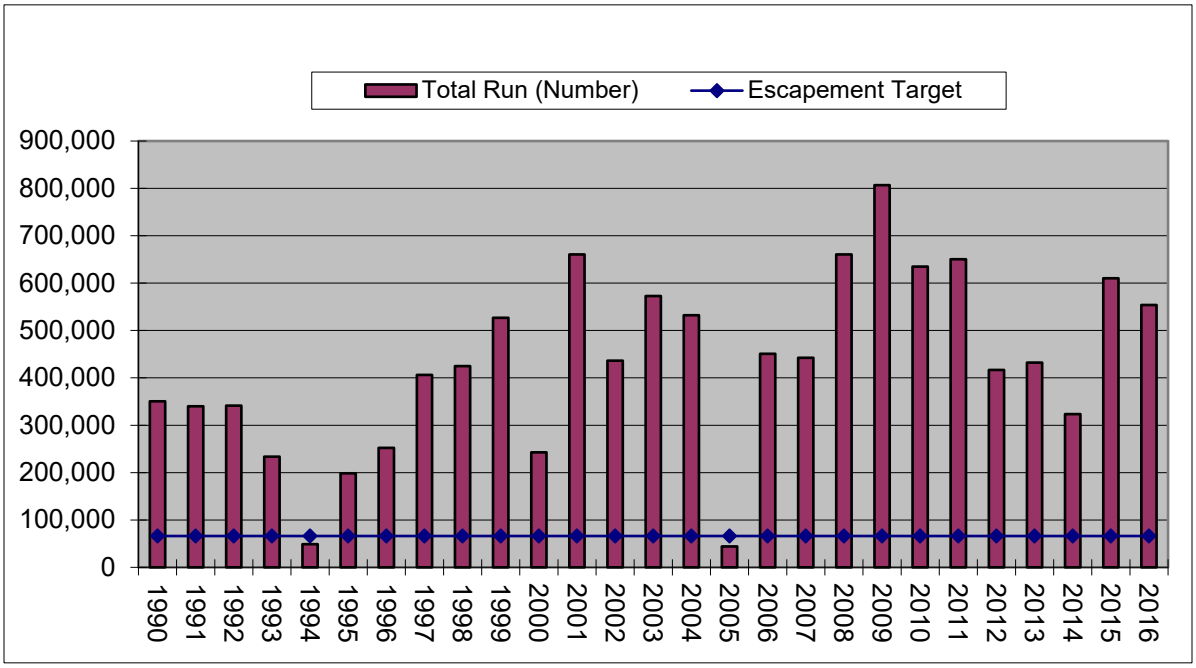




Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2015	Warren	St .George	23.7	76.32	13.16	5.26	5.26	0.89
2014	Warren	St .George	37.6	62.38	20.79	6.93	9.90	0.66
2013	Warren	St .George	35.1	64.90	27.40	4.80	2.80	1.12
2012	Warren	St .George	44.4	55.60	30.50	8.60	5.30	0.83
2011	Warren	St .George	29.8	70.20	21.91	5.47	2.39	1.15
2010	Warren	St .George	20.0	80.00	15.00	5.00		1.39
2009	Warren	St. George	28.0	72.00	22.80	4.00	1.10	1.43
2008	Warren	St. George	37.0	63.00	24.00	13.00		0.97

Figure 26. Fishing weir located at the head of tide on the St. George River in Warren, Maine.





Cherryfield Commercial Fishery:

The Maine Department of Marine Resources manages this system for a minimum commercial escapement of 35 fish per acre. The spawning escapement need for this system is 29,050 river herring passed upstream through the three closed fishing days per week throughout the fishing season. The management plan has achieved the target escapement developed for this system 85% of the time for the past 20-year period or passed the entire run.

The Narraguagus River is an Atlantic salmon river with a significant number of alewives spawning in the lakes upstream of the dam located just above the head of tide (Figure 27). A small run of American shad also spawn in the river above the dam and provide sport fishing opportunities for the region. There is no indication that blueback herring utilize this river based on commercial samples collected at the fishing location. There is only a short stretch of freshwater below the dam and there is no evidence that river herring spawn in this stretch of river.

Town	River	Lake size (acres)	Threshold (N/acre)
Cherryfield	Narraguagus	830	35

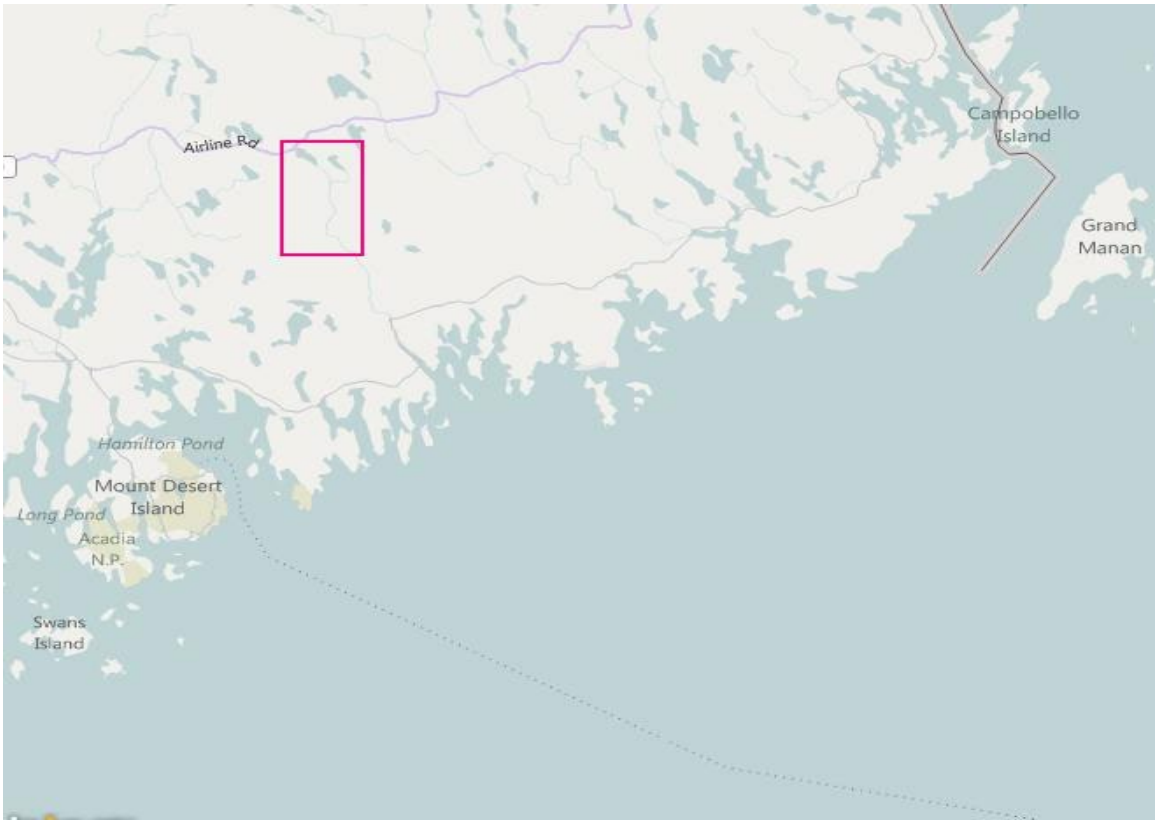
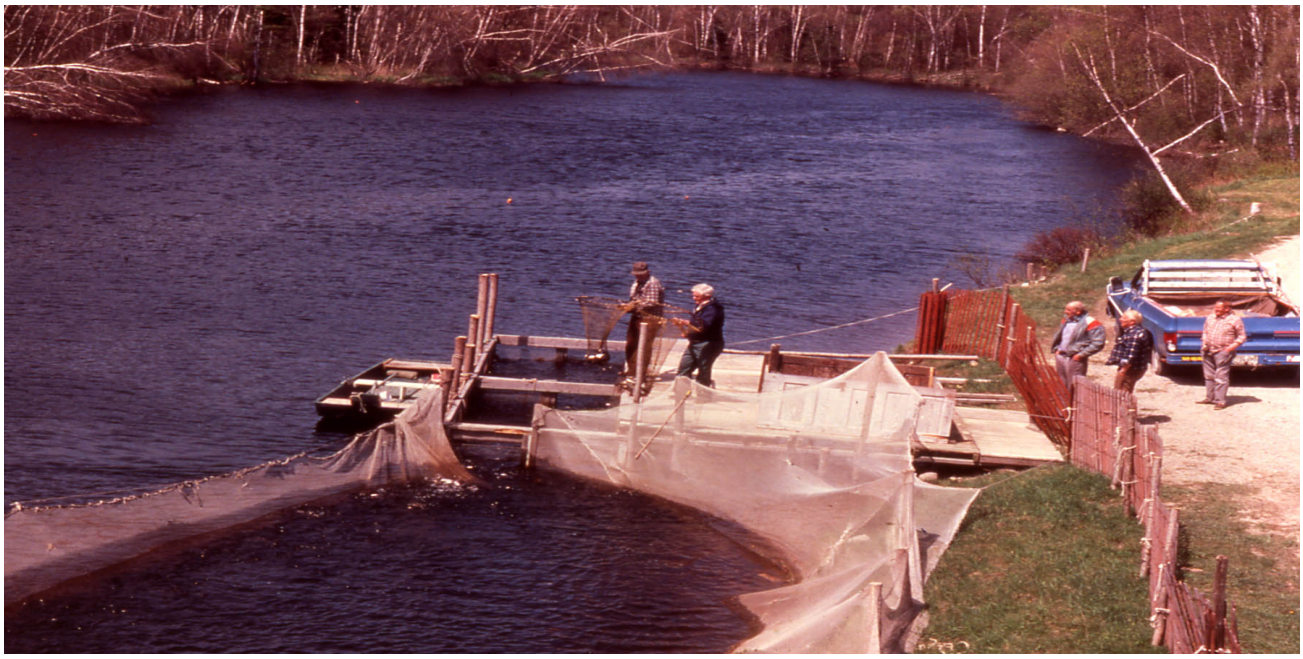
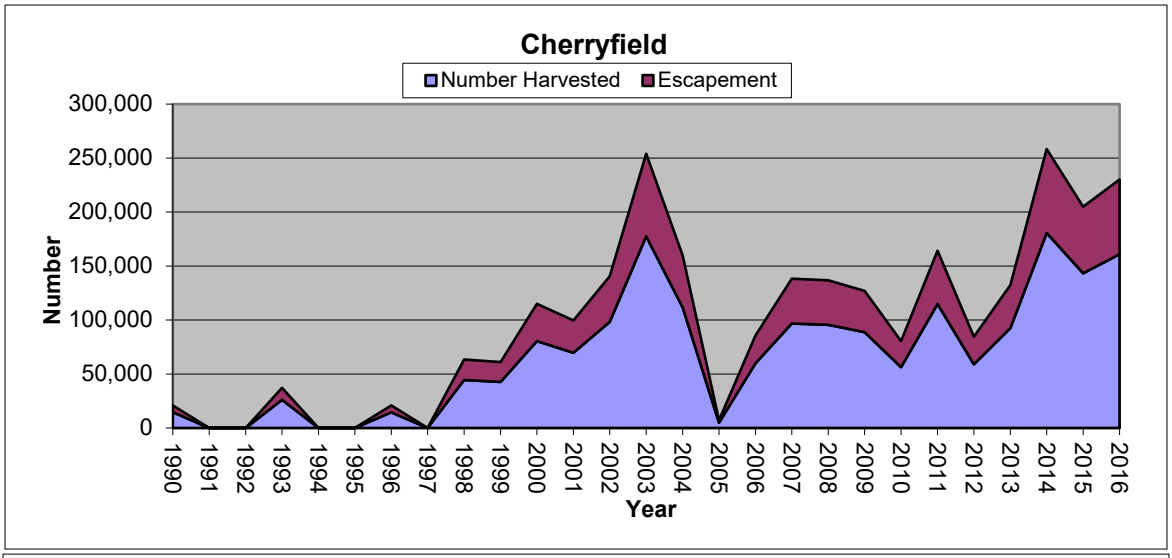
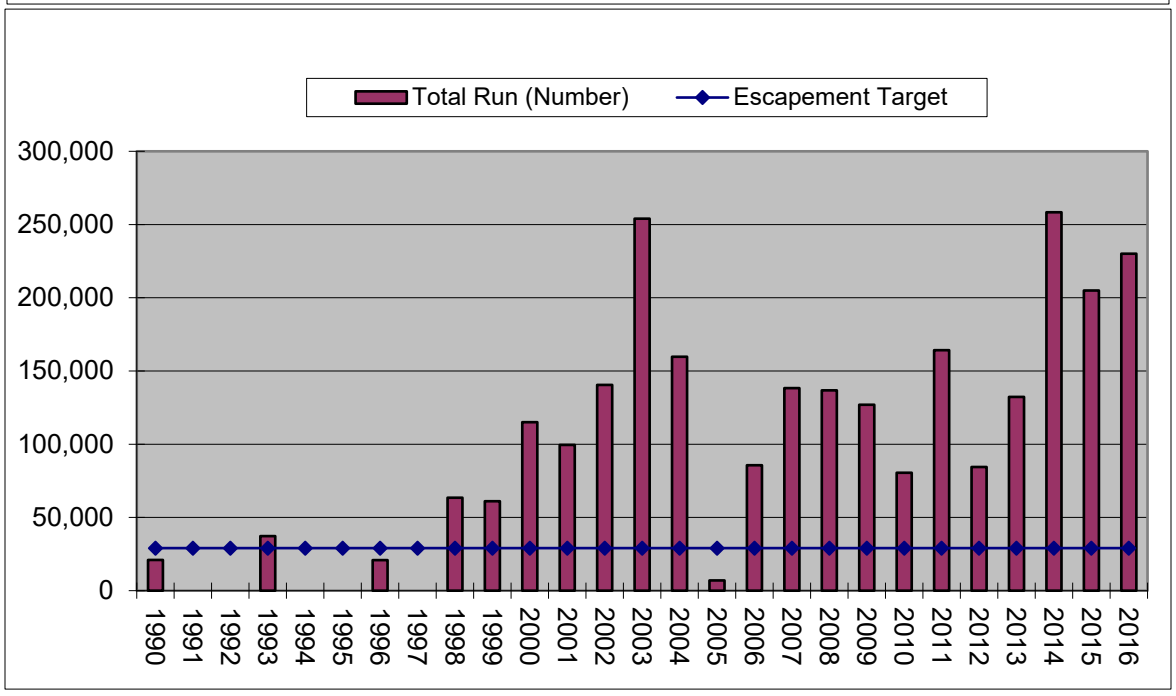


Figure 27. Commercial alewife fishery above the Cherryfield dam during the 1980s.



Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2015								
2014	Cherryfield	Narraguagus	23.3	76.77	12.12	11.00		0.97
2013	Cherryfield	Narraguagus	26.7	73.30	22.00	4.00	0.70	1.57
2012	Cherryfield	Narraguagus	29.0	70.94	20.94	6.10	2.00	1.19
2011	Cherryfield	Narraguagus	37.0	63.20	32.18	4.60		1.3
2010	Cherryfield	Narraguagus	20.0	80.00	18.00	1.00	1.00	1.6
2009	Cherryfield	Narraguagus						
2008	Cherryfield	Narraguagus	29.3	82.80	15.20	2.00		1.86





Woolwich Commercial Fishery:
The Maine Department of Marine Resources manages this system for a minimum commercial escapement of 35 fish per acre. The spawning escapement need for this system is 13,720 river herring passed upstream by the harvester. The management plan has achieved returns to meet the target escapement developed for this system or passed the entire run each year for the past 20-year period. This fishery is one of two commercial fisheries that allow constant spawning escapement throughout the run and closed for an additional 72-hours during the week (Figures 28 - 29). To improve passage the fishway was rebuilt in 2014 and monitoring of the new passage structure is ongoing.

The fishery is located at the entrance to the tidal fishway that leads to Nequasset Lake. The Nequasset fishery is one of a handful of locations that harvest river herring for food. River herring are salted and smoked as a seasonal delicacy. Smoked alewives sell for $90.00 per/bushel compared to $20.00 per/bushel for lobster bait. Alewives sold as bait at Nequasset are rationed between the numbers of fishermen that arrive in the morning to pick up bait. Nequasset, like most fisheries cap the number of alewives sold to any one fisherman at 2-4 bushel per day. This system allows the limited amount of bait caught on any one day to supply a larger number of individual fishermen.

Nequasset Lake is a municipal water supply for several towns in the surrounding area. Maintaining high water quality is important to the water district. Currently there are no limitations on the number of alewives permitted into the lake to spawn, though some municipal water districts prohibit alewife reintroduction. There is no evidence to this point that alewives are causing water quality concerns.

Town	River	Lake size (acres)	Threshold (N/acre)
Woolwich	n/a	392	35

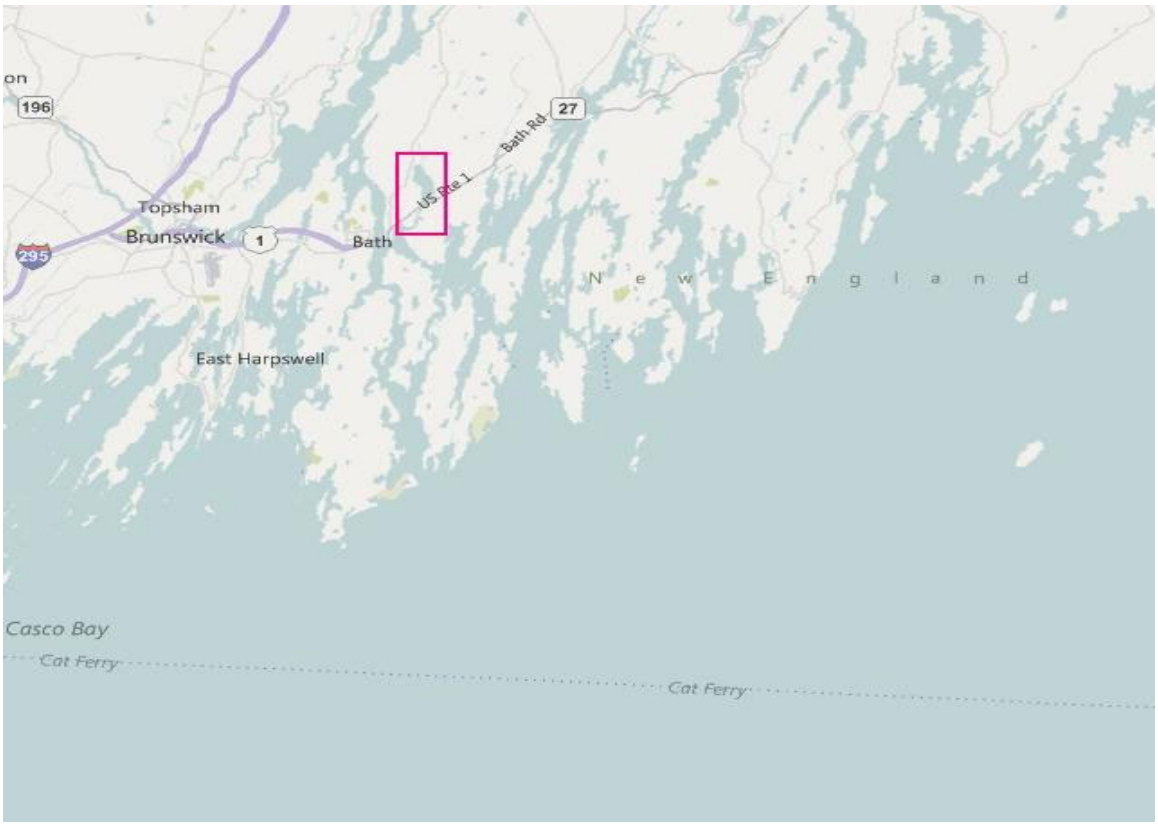
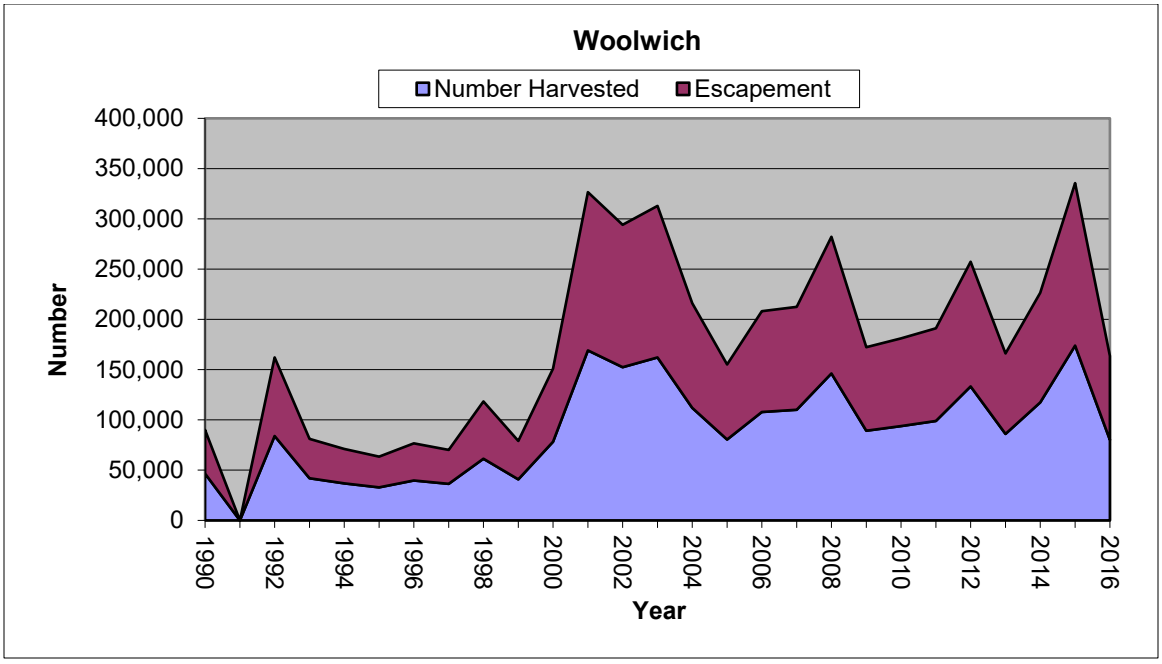
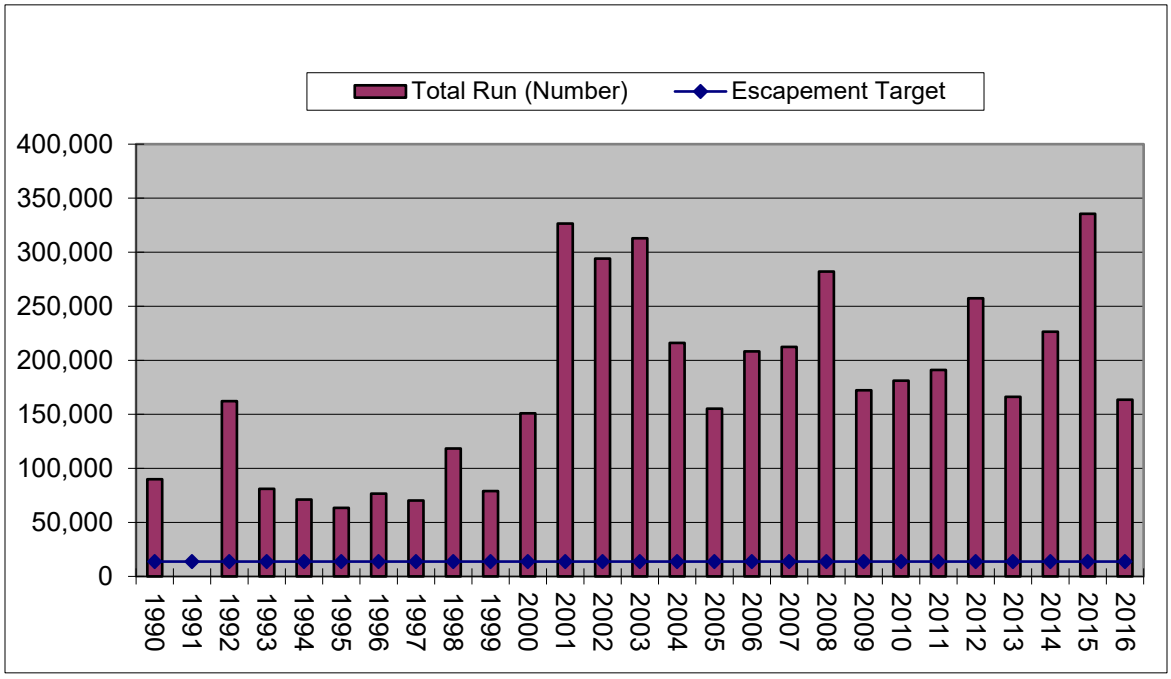


Figure 28. Historic picture of the Nequasset Mill and fish passage to spawning habitat and the trapping facility prior to 2014 rebuild.

Figure 29. The Nequasset fishway and entrance to the trapping facility after repair in 2014.

Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2015	Woolwich	Kennebec	27.6	72.45	27.55			0.97
2014	Woolwich	Kennebec	11.0	89.00	10.00	1.00		2.24
2013	Woolwich	Kennebec	20.3	79.70	18.90	1.40		2.02
2012	Woolwich	Kennebec	15.2	84.80	14.30	1.00		2.22
2011	Woolwich	Kennebec	15.0	84.96	13.72	0.65	0.65	1.77
2010	Woolwich	Kennebec	9.1	90.90	7.10	2.00		1.91
2009	Woolwich	N/A	47.5	51.30	43.60	5.10		1.15
2008	Woolwich	N/A	53.8	46.20	38.50	15.40		0.55





Perry Commercial Fishery:

The Maine Department of Marine Resources manages this system for a minimum commercial escapement of 35 fish per acre. The spawning escapement need for this system is 59,570 river herring passed upstream through a three day per week closure in the fishery. The management plan has achieved the target escapement developed for this system 90% of the time during the past 20-year period or passed the entire run. This fishery is has significant issues with beaver dams that restrict upstream and downstream migration throughout the season. Fish that escape the commercial fishery may, or may not, reach spawning habitat depending on water conditions. Boyden Lake is a municipal water supply

operated by the Passamaquoddy Indian Tribe. Fluctuating water levels during upstream and downstream migrations influence the number of annual returns (Figure 30). The system is responsive when spawning fish are able to access the pond. There is no spawning habitat below the dam for either species of river herring. Low water flows that fail to attract fish to the stream or fishway are the main obstacles to producing a larger run. Commercial harvest did not occur for several years prior to 2004.

The fishery in the town of Perry is operated by a commercial fisherman who chooses to harvest fish for personal use and not commercial retail sale. The harvester elects to pass fish upstream in addition to the required closed days. As a result, the harvest reported for this system is lower than expected and estimates of escapement based on harvest are low. The Maine Department of Marine Resources and Maine Sea Grant will install electronic fish counters at this location in 2017 to assess escapement.

Town	River	Lake size (acres)	Threshold (N/acre)
Perry	n/a	1,702	35

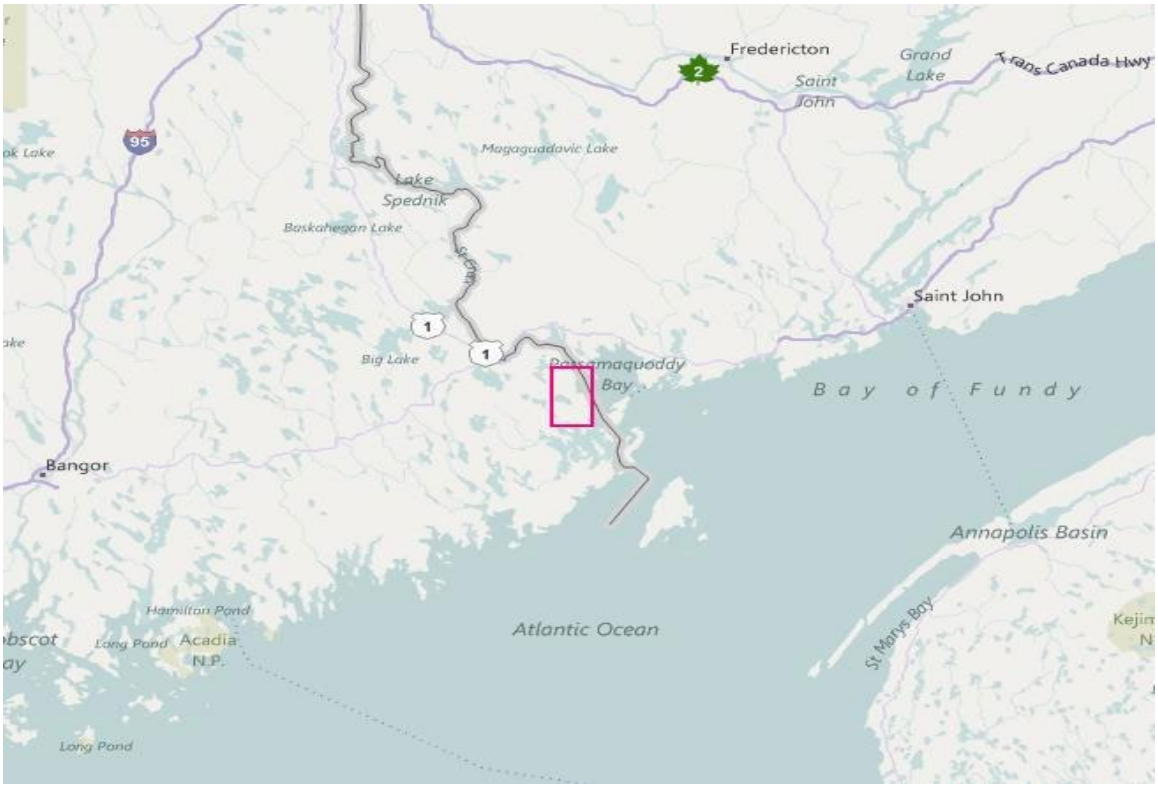
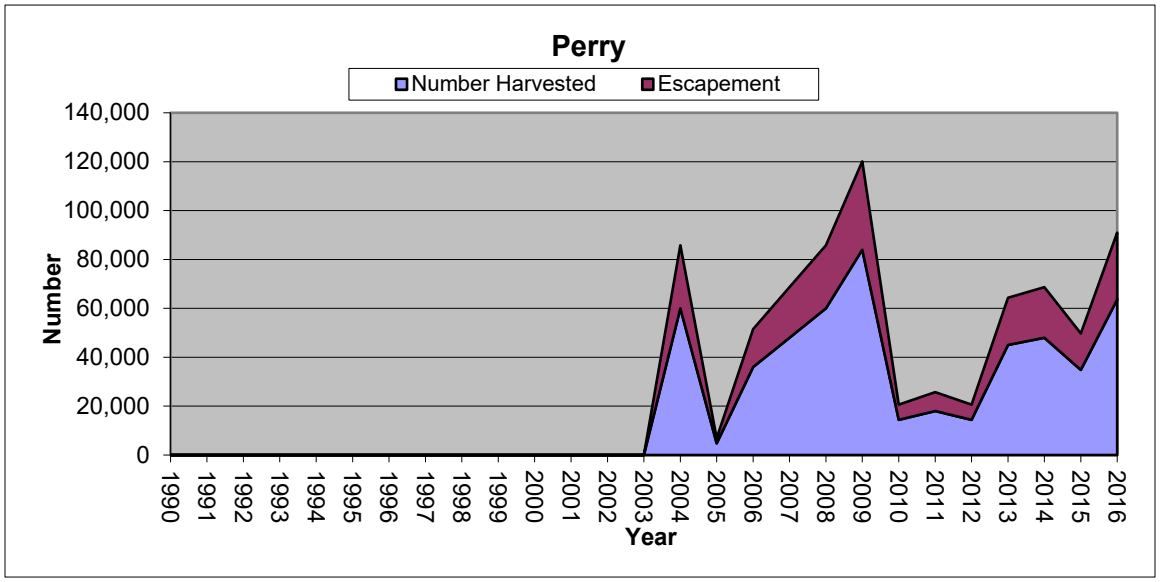
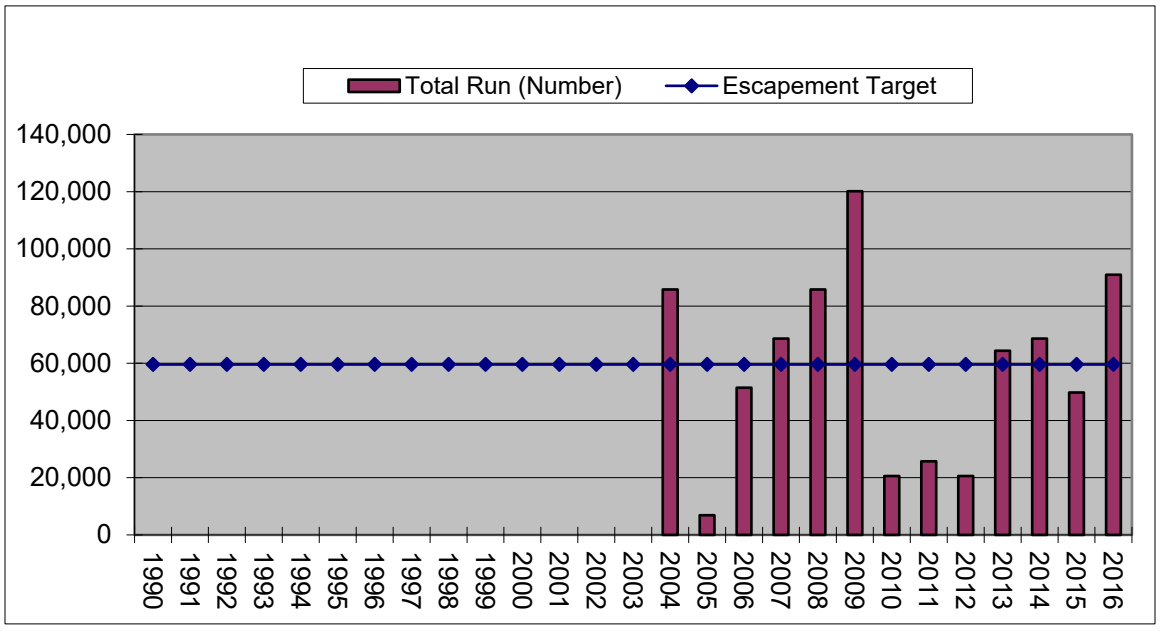


Figure 30. Dam and fishway under high flow conditions in 2006. Note harvest box and sluice pipe located at the corner pool of the fishway used to transport harvested fish into totes.

Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2015	Perry	Little River	16.8	83.17	11.88	4.95		1.95
2014	Perry	Little River	8.1	91.90	7.10	1.00		2.26
2013	Perry	Little River	30.0	70.00	28.00	2.00		1.78
2012	Perry	Little River	8.1	91.90	7.10	1.00		2.26
2011	Perry	Little River	21.2	78.80	15.20	6.10		1.28
2010	Perry	Little River	38.0	62.00	34.00	4.00		1.37
2009	Perry	Little River	4.0	96.00	4.00			3.18
2008	Perry	Little River	7.0	93.00	7.00			2.59

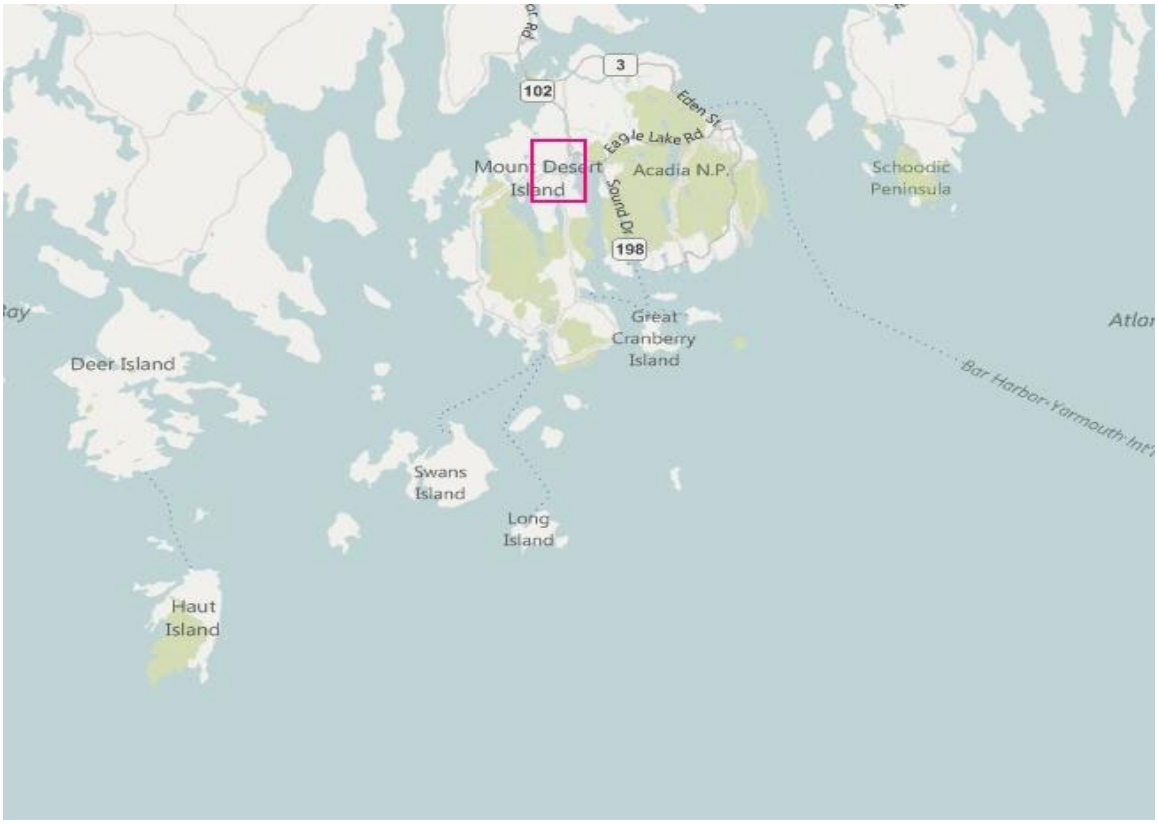




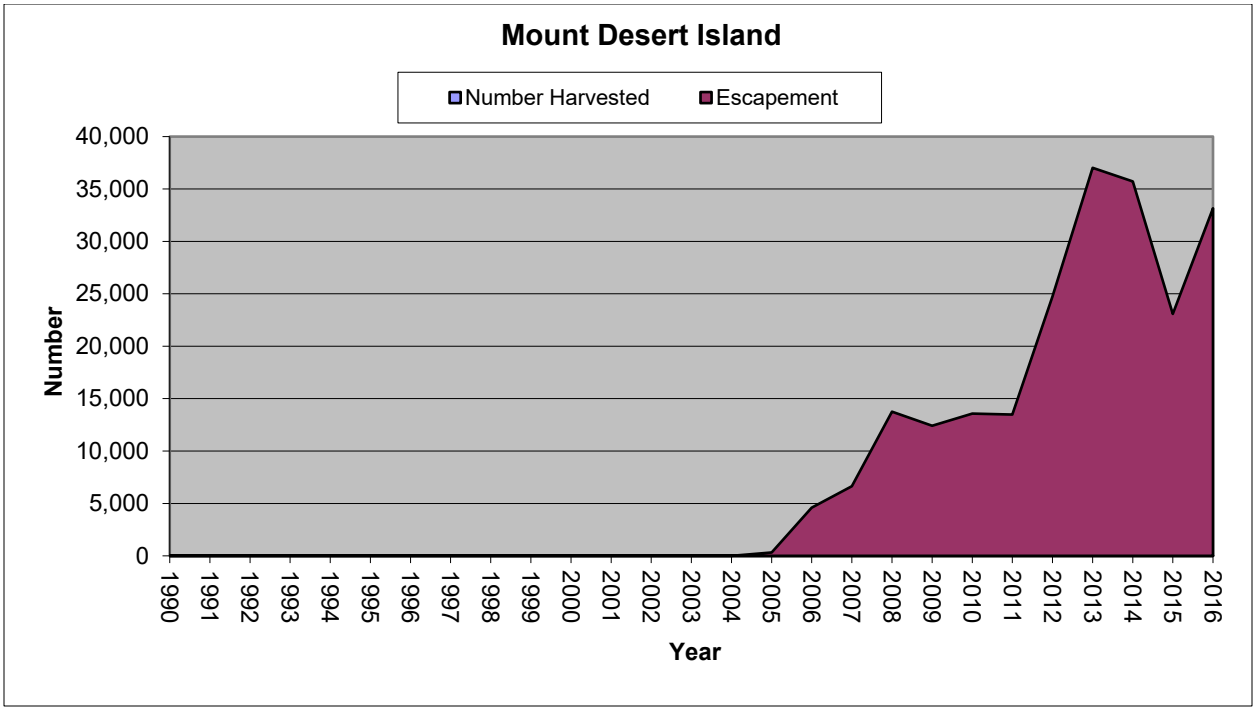
Mount Desert Commercial Fishery:
The Maine Department of Marine Resources manages this system for a minimum commercial escapement of 35 fish per acre. The spawning escapement need for this system is 3,640 river herring passed upstream. The municipality of Mount Desert selects to keep the run closed for conservation at this time, though recent counts indicate that a harvest is possible. Fisheries staff began to collect age and repeat spawning data at this location in 2010. The spawning habitat at this location is limited and historically never produced large numbers of fish migrating to Somes Pond.

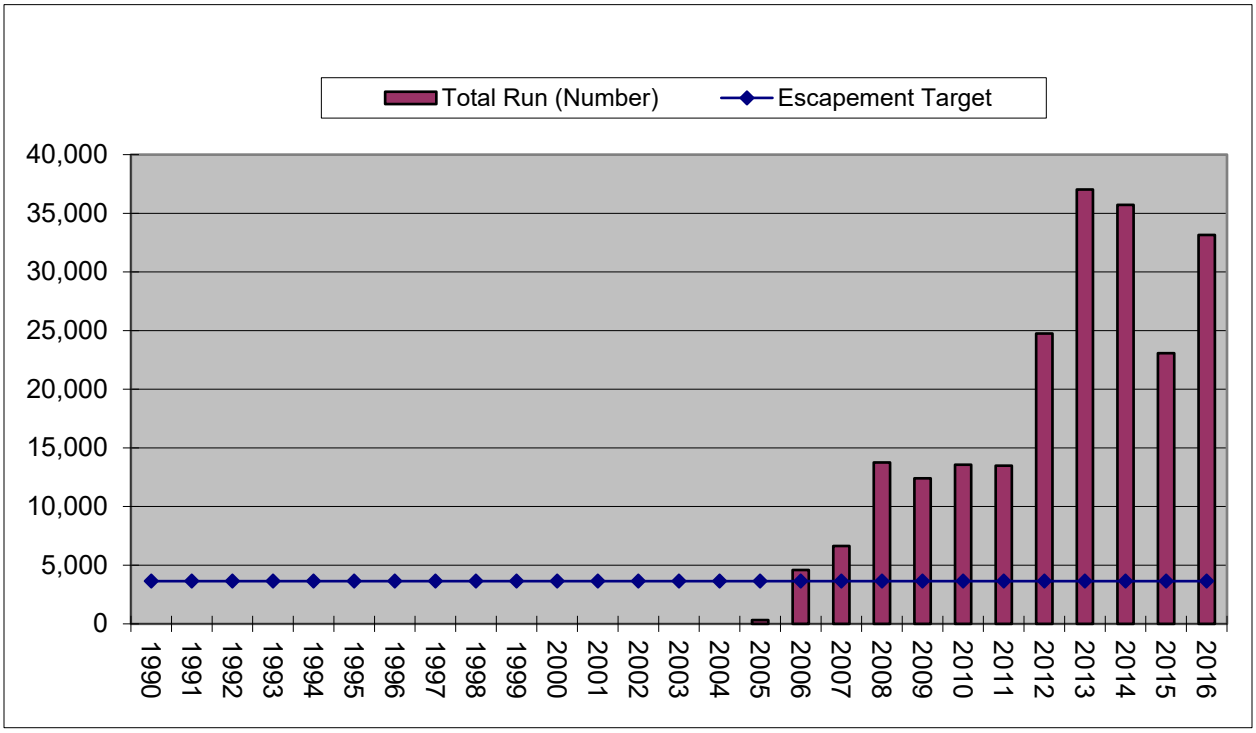
The fishway is a tidal fishway that is accessible only as the tide rises to meet the fishway entrance (Figures 31-32). This limits the opportunities for fish to access the fishway and spawning location upstream. This is common at several commercial harvest locations throughout the state. This emphasizes the need to maintain, clean, and monitor the tidal fish passages daily to ensure unobstructed upstream passage. The harvesters hired by the municipalities often fill this role, freeing state personnel to address other passage issues.

Town	River	Lake size (acres)	Threshold (N/acre)
Mount Desert	n/a	104	35



Figures 31-32. Tidal denil fishway located in Somes Harbor and Somes Brook leading to Somes Pond.


Mount Desert Island
Number Harvested
Escapement
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Number
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
Year


Total Run (Number)
Escapement Target
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016

Benton Commercial Fishery:
In 2009 the Town of Benton resumed a commercial fishery for river herring for the first time in 198 years. The fishery is the result of the removal of the Edwards Dam in Augusta, Maine and a ten-year fisheries restoration program.

Soon after the restoration project began, the Maine Department of Inland Fisheries and Wildlife and Maine Department of Marine Resources permitted a limited dip net fishery in the river below the first dam (2000-2006). MDMR staff believes landings for this period were underreported based on the numbers of fishing permits issued and the number of landings reported at the end of the fishing season. The MDMR closed the fishery in 2007 to allow the municipality of Benton to reacquire historical rights to the harvest. The Town of Benton conducted its first commercial dip net fishery in the Sebasticook in 2009 and the Town maintains this harvest method through 2016.

The Maine Department of Marine Resources began the Sebasticook River Restoration Project by stocking 6 fish/acre into available historic spawning habitat as permitted by the Maine Department of Inland Fisheries and Wildlife. The initial stocking, which placed 57,533 pre-spawn adults within the 10,854 acres of spawning habitat, created an estimated run on the Sebasticook River ranging between 1.5 and 3.5 million fish within six years. There was no permanent upstream passage available until the State of Maine and conservation groups removed the Fort Halifax Dam in 2008. Prior to 2007, an unlimited commercial dip net harvest below the first dam on the river captured returning adults. The fish escaping the fishery remained below the dam until they dropped out of the system during early summer. Estimates of the number of river herring remaining below the dam ranged from 1.25– 3 million individuals.

The main stem river and several lakes and ponds within the Sebasticook River drainage provide excellent spawning and nursery habitat for river herring. These habitats currently support the largest monitored river herring run in Maine. Restoration efforts in the watershed will continue to open additional historic spawning areas over the next several years. There are two hydropower dams that remain on the main stem of the Sebasticook River. Both dams have dedicated upstream and downstream passage for anadromous fish. The passage efficiency for both sites is unknown at this time, though the Benton Falls Dam does pass more than 2 million fish per year on a regular basis.

Upstream passage counts during the past several seasons ranged from 1.3 to 3.5 million individuals in addition to the commercial harvest. The municipal commercial harvest plan restricts harvest gear at the base of the hydropower dam to dip nets and cast nets (Figure 33). Discussions on how to improve harvest are occurring between the harvester and the Town. These gear types severely limit the numbers of fish that the harvester can access during the fishing season.

The Maine Department of Marine Resources, in conjunction with the hydropower company, operates and monitors upstream passage on the Sebasticook River. Upstream passage is a priority at this location with 100,000 fish required to pass upstream prior to commencing harvest activities. Spawning habitat is available in the river above and below the dam for blueback herring and American shad but not alewife. There is a mix of blueback herring in the commercial alewife catch toward the end of the season. Most of the blueback herring escape the commercial alewife fishery due to the early closed date of June 5 each year. Blueback passage numbers at the Benton fish lift can exceed 400,000 for the season.

The repeat spawning rate for the Benton fishery is above average compared to most other commercial fisheries in Maine, and is among the top three in annual harvest. Maine fisheries staff started collecting scale samples in 2010 and has a collection of scales through 2016 to categorize this fishery. The Maine Department of Marine Resources currently manages this system for a minimum commercial escapement of 35 fish per acre. The minimum spawning escapement need for this system is 379,890 river herring passed upstream into several spawning habitats in the Sebasticook River drainage.

Town	River	Lake size (acres)	Threshold (N/acre)
Benton	Sebasticook	10,854	35

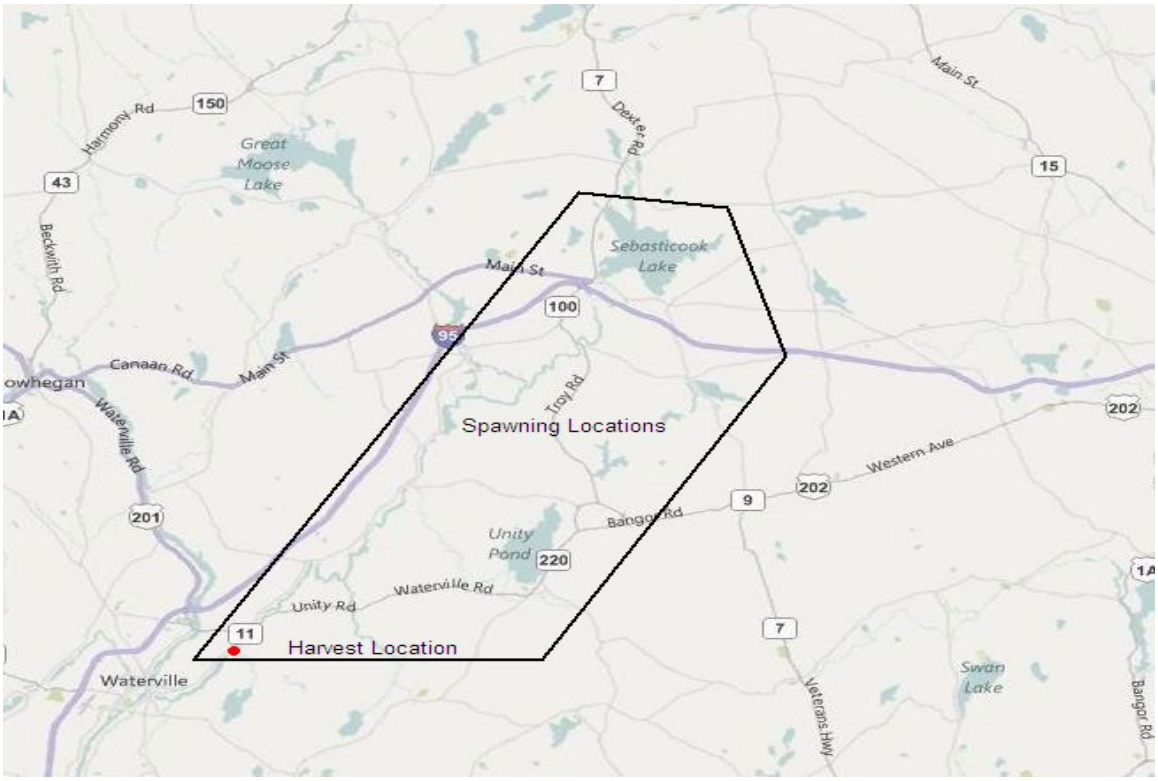
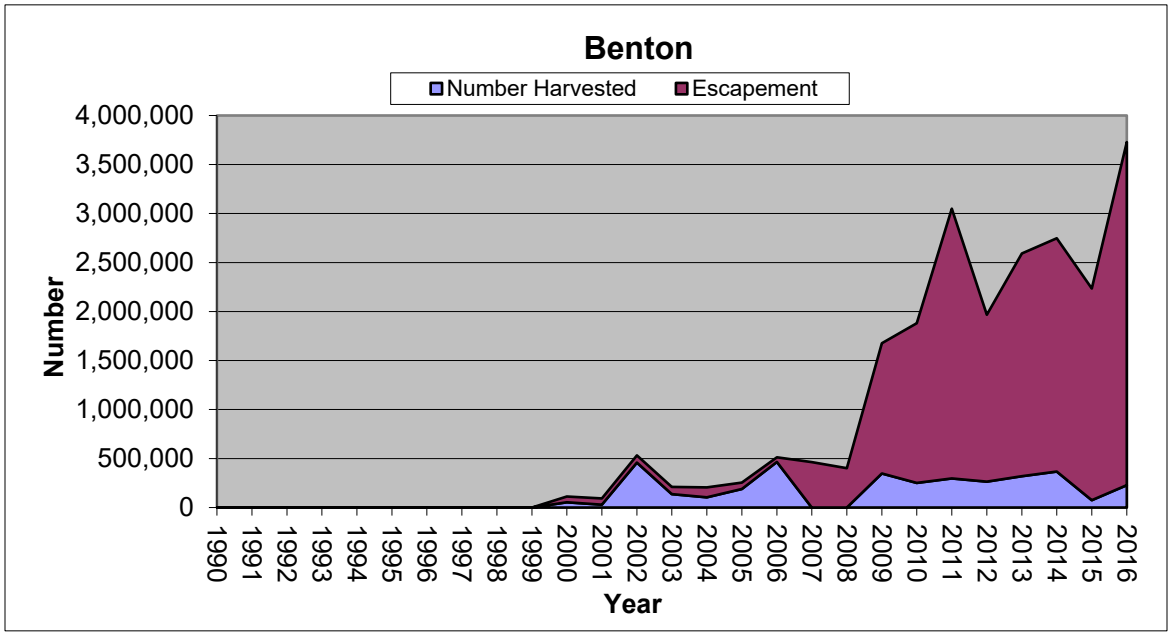
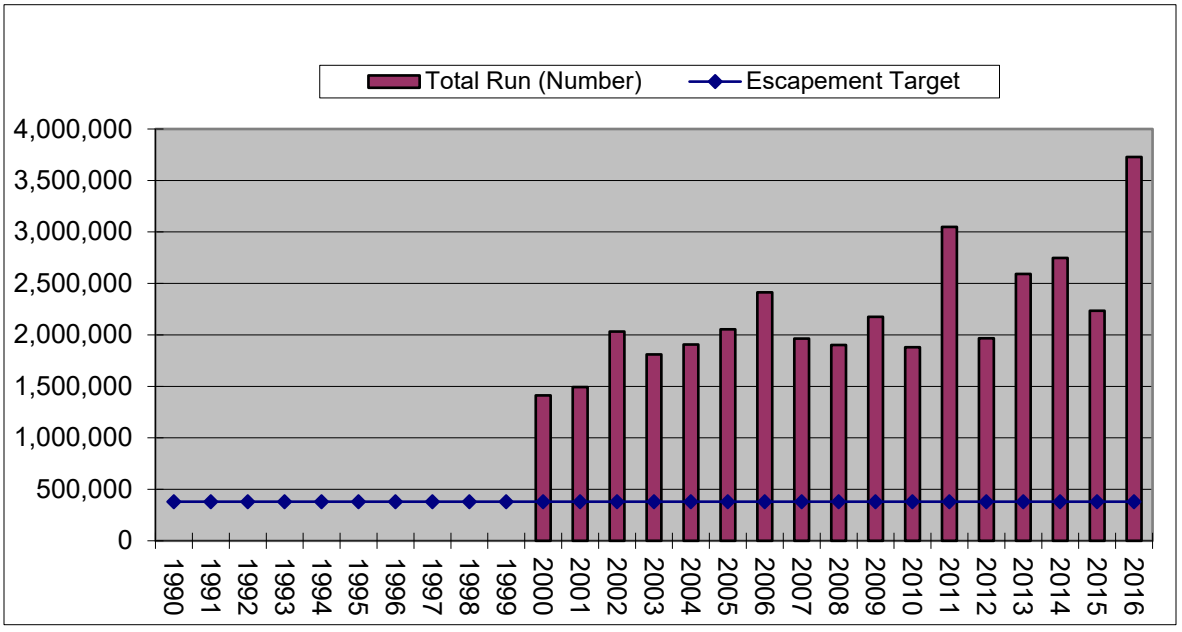


Figure 33. Benton Falls Hydropower Station. The commercial fishery occurs below the dam.

Year	Municipality	River	% repeat spawners by year and frequency	R-0	R-1	R-2	R-3	Z-value
2016								
2015	Benton	Sebasticook	21.5	78.49	19.35	1.08	1.08	1.57
2014	Benton	Sebasticook	34.3	65.71	25.71	5.70	2.85	1.22
2013	Benton	Sebasticook	26.7	75.75	22.72	15.15		1.96
2012	Benton	Sebasticook	18.9	81.10	18.90	1.59		1.46
2011	Benton	Sebasticook	16.3	83.67	14.28	1.02	1.02	1.59
2010	Benton	Sebasticook	60.0	40.00	52.00	6.00	2.00	1.11
2009								
2008								





b. Recreational

Municipalities which maintain historic harvest rights control access to the majority of the river herring resources within the state. Municipalities maintain this control through exclusive harvest rights granted by the Department of Marine Resources. All locations inhabited by river herring and which are managed by a joint state/municipal management plan are open to recreational harvest if the management plan permits recreational harvest. All recreational harvest must occur below the commercial fishing location and within the municipality that owns the river herring harvest rights. The number of river herring allowed for personal use is 25 river herring per person per day with associated gear restrictions (hook and line, dip net) down from 120 fish per day allowed in 2012.

Most municipalities choose to keep recreational river herring fisheries closed. Municipalities that choose to keep the recreational fishing closed can do so through the municipal harvest plan. Closing the recreational harvest prevents recreational harvest at any location within the municipal boundaries or in the watershed above the municipality that maintains harvest rights.

Most recreational catches of river herring are used as bait to catch striped bass, halibut or smoked and used as food. Very little recreational fishing occurs for river herring in the state of Maine. The State of Maine relies on the MRIP program to collect the catch statistics for the recreational catches of blueback herring and alewife.

All locations statewide outside and below locations controlled by the states municipal fisheries will remain open to recreational fishing. A limited recreational catch/possession limit of 25 fish per person per day and gear restrictions will apply along with a statewide closed period to allow escapement of spawning fish. The statewide closed period runs from 6:00 AM Thursday to 6:00 AM Sunday each week.

5. Fisheries Requested to be Closed (if more specific than statewide)

a. Commercial

Municipality	Municipality	Municipality
*Arrowsic	Blue Hill	Boothbay Harbor
*Breman	Cape Elizabeth	Hampden
Kennebunk	*Phippsburg Center Pond)	Lincolnville
*Bristol	Northport	South Berwick
*Surry	*Waldoboro	West Bath
North Bath	*Gardiner	*Penobscot
*Surry		

The state and/or municipality will close, or keep closed, one or more waters in these towns to the harvest of river herring until these runs can produce harvestable numbers in excess of minimum escapement requirements. Commercial fisheries occurred in all the municipalities listed above prior to Amendment 2. Some of these runs are currently under restoration (*), while others return viable numbers of fish

without supplemental stocking and could support a small harvest. Most of these runs have passage problems that prevent the current population from increasing to commercially harvestable numbers. Typical returns to these rivers range from 50 to 120,000 individuals based on actual counts in Cape Elizabeth and Waldoboro.

b. Recreational

All locations statewide outside and below locations controlled by municipal fisheries will remain open to recreational fishing. A limited recreational catch/possession limit of 25 fish per person per day and gear restrictions will apply.

c. Incidental

Incidental catch of river herring may occur in small mesh trawl fisheries, weir, bait gill net, and seine fisheries for other species. There is mandatory catch/bycatch reporting for all of these fisheries. Based on Vessel Trip Reports (VTR) and Dealer Reports (DR), bycatch in state waters appears to be low. An existing law requires all commercial fishermen who fish for pelagic or anadromous species to purchase the "Pelagic and Anadromous Commercial Fishing License" will make reporting of all river herring landings mandatory. **(Appendix B)**

6. Sustainability Target/Threshold

Sustainability Definition – The number of alewife broodstock needed per surface area of spawning habitat in Maine to provide alewife populations capable of sustaining annual alewife runs at current levels while providing surplus broodstock for harvest or increasing run size in the future.

The sustainability threshold will provide an escapement number equal to 35-fish per surface acre of spawning habitat. This plan will achieve escapements numbers through passage counts above commercial fisheries, closed fishing days, season length, gear restrictions or continuous escapement.

An escapement level of six fish per surface acre is used by the Department to provide broodstock for initial introductions of anadromous alewife in Maine lakes and ponds under restoration. This number was developed as the result of a nine year study researching the effects of alewife introductions into freshwater habitats. Initial introductory or restoration stocking can produce runs that may exceed six fish per acre depending on passage and habitat. This escapement number may grow to allow for a small commercial harvest or allow managers to increase spawning stock by passing all returns upstream.

Method Used to Develop Spawning Threshold

The sustainability threshold of 35-fish per acre of spawning habitat is the result of a combination of studies, observations, and documented commercial catches over a number of years. Maine uses this sustainability threshold for continuing commercial fisheries that require escapement of broodstock from river specific populations.

Since 1984, MDMR has used 235 fish/acre to estimate commercial alewife production. The Department established this unit production value from the commercial harvest in six Maine watersheds for the years 1971-1983. Based on these data, commercial yield was assumed to be 100 pounds/surface acre of ponded habitat. This value is slightly less than the average of the lowest yield/acre for all six rivers and within the range of yields experienced in other watersheds. Assuming a weight of 0.5 pounds per adult, the commercial yield equals 200 adults/surface acre. The commercial harvest was assumed to represent an exploitation rate of 85%, because most alewife runs were harvested six days per week. Exploitation rates on the Damariscotta River, for example, ranged from 85-97% for the years 1979-1982. When commercial yield is adjusted for the 15% escapement rate, the total production is 235 adult alewives/acre.

Results from studies conducted at one of these lakes in the 1970s-1980s, Damariscotta Lake, located in mid-coast Maine, indicate that increasing the escapement of spawning alewives ranging from 40 to 60 fish per acre caused the parent progeny relationship to trend downward. (Walton, C.J. 1987. Parent-Progeny relationship for an Established Population of Anadromous Alewives in a Maine Lake. American Fisheries Society Symposium 1:451 – 454, 1987)

The relationship between increased numbers of spawning individuals and returns 4-5 years later does not support increased escapement rates for many Maine runs. Analysis of escapement numbers and commercial catches in fisheries with a sustained level of escapement over a number of years does indicate a large variation in run size unassociated with the number of spawning fish.

The State of Maine uses an alternative 6-fish per acre target or when establishing new river herring runs. The 6-fish per acre target was established through fisheries work designed to examine the effect of anadromous alewives on existing fish populations in lakes without anadromous alewives (Lake George Study). The nine year study conducted by the Maine Department of Inland Fisheries and Wildlife, Department of Environmental Protection, and the Department of Marine Resources, determined that stocking six prespawn fish per surface acre does not negatively affect growth of inland game-fish species including trout, landlocked salmon, or rainbow smelts but that there were indications that increased numbers of alewives did change the zooplankton structure in the nursery habitat. Based on the study results the Lake George Study remains the basis for the multispecies fisheries management plans in habitats that will receive new introductions of anadromous alewives.

Monitoring to be Conducted to Support Target(s)

Commercial

Fisheries staff will continue to use annual landings data, escapement counts, mortality estimates, escapement estimates, and scale sample data to track relative health of river specific stocks. Additional data comes from the JAI survey conducted in Kennebec River, Merrymeeting Bay and associated rivers to track populations of river herring possibly spawning in the main stem Kennebec River and Merrymeeting Estuary. These monitoring efforts will continue for all commercial fisheries and will occur for all directed commercial fisheries that wish to open in the future.

Recreational
For locations where commercial fisheries are permitted the monitoring of the commercial catches and existing controls will remain in place. For locations where there is no existing commercial fishery, or existing municipal harvest rights, fishway counts will be used to monitor run size. **(Appendix C)**

Fisheries staff will continue to use annual run data, escapement counts, mortality estimates, estimates, and scale data to track relative health of river specific stocks where these data are collected. Additional data may come from the JAI survey conducted in Kennebec River, Merrymeeting Bay and associated rivers to track populations of river herring possibly spawning in the mainstem Kennebec River and Merrymeeting Estuary.

7. Proposed Rule-Making to Support Target(s)

Commercial fisheries that cannot support commercial harvest levels above the spawning threshold will remain closed for conservation. In addition, this plan eliminates the directed harvest, possession, and sale of any river herring within state waters other than the approved directed fisheries contained within this plan. The State has also created a Pelagic Fisheries license which requires the harvester to report all river herring harvest activities annually. **(Appendix B)**

The Department passed a rule making proposal prohibiting the opening of new river herring fisheries as required by the Atlantic State Marine Fisheries Commission Management Board.

30.02 Limits on River Herring

Beginning January 1, 2012 it shall be unlawful for any person to take, possess, harvest or sell river herring in the State of Maine or in waters under the jurisdiction of the State of Maine.

Exceptions:

A. River Herring fishing rights. A municipality or an individual with existing river herring harvest rights granted by the Commissioner in accordance with 12 M.R.S. §6131 are not subject to Chapter 30. The Commissioner may authorize a future river herring fishery, authorized pursuant to 12 M.R.S. §6131, after submission of a sustainable fisheries management plan for that fishery by the Department, which is approved by the Atlantic States Marine Fisheries Commission (ASMFC) Management Board.

Since January of 2012 there has been no additional rule making or statute chances that affect river herring harvest.

8. Adaptive Management

a. Evaluation schedule

The Maine Department of Marine Resources reviews all municipal fisheries plans annually. Many plans carry over year to year because they provide adequate protection for the river herring resource. Plan

reviews incorporate landings data, escapement counts, broodstock needs, and effort controls. There is no plan to change the review schedule for river herring management plans at this time.

b. Consequences or control rules

All Maine directed commercial river herring runs operate under a 72-hour closed period or conservation equivalent. The Maine Department of Marine Resources will extend closed periods, modify conservation equivalencies, or close fisheries that cannot sustain existing commercial fisheries.

Commercial

1) Additional management review and/or changes will occur based on decreasing trends in running three-year averages of annual landings, increasing time series trends in total mortality (z), and trends in repeat spawning rates for fishery dependent and fishery independent sites.

2) Fisheries staff will review harvest and age data collected from annual returns to assess the need to increase the number of closed days in the fishery. Due to the variability of river herring runs in Maine under stable stocking rates, run size, and age class structure are expected to exhibit wide swings in annual values.

3) The management objective is to ensure that the commercial fisheries maintain a minimum (35 fish/acre) spawning stock threshold into the future. A commercial fishery that does not meet the minimum spawning stock escapement established for that system will be required to close the following season until fishery achieves the escapement goal for that year.

Recreational

All Maine recreational river herring runs operate under a 72-hour closed period. The Maine Department of Marine Resources will extend closed periods, modify conservation equivalencies, or close fishing on populations that cannot meet the 25th percentile fisheries independent run counts.

1) Additional management review and/or changes will occur based on decreasing trends in running three-year averages of annual landings, increasing time series trends in total mortality (z), and trends in repeat spawning rates for fishery dependent and fishery independent sites where these data are collected.

2) All recreational river herring fisheries not associated with a commercial run will close if the mean statewide fishway count falls below the 25-percentile for three consecutive years.

3) Recreational fisheries not associated with a commercial fishery will close regionally if one of the fisheries independent fishway counts fails to achieve the 25-percentile for three consecutive years. The management objective is to ensure that regional recreational fisheries do not impact spawning stock on rivers without river specific monitoring. The rivers in table Fishery Independent Management Triggers for Recreational River Herring Harvest will represent regions of the state

equidistance between fishway locations listed below. The 25-percentile values are fixed but will be updated once every five years when state River Herring SFMP's are reviewed and updated.

Fishery Independent Management Triggers for Recreational River Herring Harvest

Fishway	25th-Percentile
Saco River Cataract Fishways	9,327
Androscoggin River Fishway Brunswick	23,689
Kennebec River Fishway Lockwood	45,754
Penobscot River Fishway Milford	2,039
St. Croix River Fishway Milltown	13,365
Fishway Totals	154,711
Fishway Mean	76,636

References:

Kircheis, F.W., J.G Trial, D.P Boucher, B. Mower, Tom Squiers, Nate Gray, Matt O'Donnell, and J.S. Stahlnecker. 2002. Analysis of Impacts Related to the introduction of Anadromous Alewife into a Small Freshwater Lake in Central Maine, USA. Maine Inland Fisheries & Wildlife, Maine Department of Marine Resources, Maine Department of Environmental Protection. 53 pp.

Rounsefell,G.A.,L.D, Stringer. 1943. Restoration and Management of the New England Alewife Fisheries with Special Reference to Maine. United States Department of the Interior Fish and Wildlife Service Fishery Leaflet 42.

Walton, C. J. 1987. Parent-progeny relationship for an established population of anadromous alewife in a Maine lake. American Fisheries Society Symposium 1: 451-454.

Appendix A

Fisheries Independent Data **Age Based Z-Estimates**

2008

	Catch Curve				Heinke				Chapman-Robson			
	Male		Female		Male		Female		Male		Female	
Fishery	Z	SE	Z	SE	Z	SE	Z	SE	Z	SE	Z	SE
Androscoggin River	1.23	0.24	0.80	0.17	1.05	0.12	0.81	0.11	1.24	0.14	0.81	0.11
Card Mill Stream	1.67	0.16	1.43	0.19	1.89	0.38	1.68	0.29	1.85	0.37	1.65	0.28
Flanders Stream	-	-	-	-	1.79	0.83	1.10	0.67	1.79	0.83	1.10	0.67
Patten Pond	-	-	1.39	0.40	1.79	0.28	1.85	0.34	1.93	0.31	1.73	0.32
Sewall Pond	1.25	0.59	1.49	0.24	0.76	0.08	0.88	0.08	1.08	0.12	1.13	0.11

Fisheries Independent Data **Age Based Z-Estimates**

2009

	Catch Curve				Heinke				Chapman-Robson			
	Male		Female		Male		Female		Male		Female	
Fishery	Z	SE	Z	SE	Z	SE	Z	SE	Z	SE	Z	SE
Androscoggin River	1.30	0.43	0.85	0.25	0.56	0.05	0.52	0.06	0.87	0.08	0.83	0.10
Card Mill	-	-	-	-	2.30	0.90	1.79	0.59	2.30	0.90	1.87	0.62
Medomak River	-	-	-	-	*0.93*	*0.12*	-	-	*1.25*	*0.17*	-	-
Sewall Pond	1.82	0.59	0.68	0.09	1.13	0.16	0.78	0.09	1.36	0.20	0.97	0.12

Sexes Combined

Fisheries Dependent Data **Age Based Z-Estimates**

2009

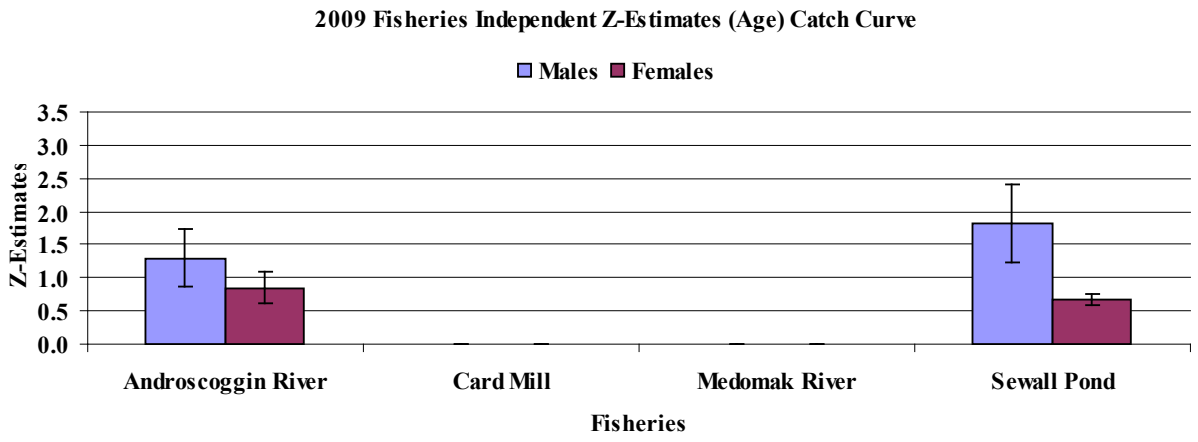
	Catch Curve				Heinke				Chapman-Robson			
	Male		Female		Male		Female		Male		Female	
Fishery	Z	SE	Z	SE	Z	SE	Z	SE	Z	SE	Z	SE
Damariscotta	-	-	-	-	2.56	0.92	1.87	0.60	2.56	0.92	1.95	0.63
Dresden	1.12	0.23	0.92	0.13	0.67	0.09	1.13	0.23	0.93	0.13	1.18	0.24
E. Machias	*2.00*	*0.63*	-	-	*1.22*	*0.15*	-	-	*1.44*	*0.18*	-	-
Gouldsboro	*1.00*	*0.31*	-	-	*0.73*	*0.15*	-	-	*0.96*	*0.20*	-	-
Grist Mill	*1.39*	*0.66*	-	-	*0.78*	*0.10*	-	-	*1.10*	*0.15*	-	-
Jefferson	-	-	-	-	-	-	2.69	0.47	-	-	2.74	0.48
Orland	0.87	0.01	1.59	0.28	0.99	0.20	1.30	0.24	1.10	0.22	1.44	0.27
Perry	-	-	-	-	*1.72*	*0.21*	-	-	*1.88*	*0.24*	-	-
Sheepscot	-	-	-	-	*1.54*	*0.20*	-	-	*1.73*	*0.23*	-	-
Surry	-	-	-	-	2.04	0.36	2.64	0.66	2.14	0.38	2.67	0.67
Union	-	-	1.42	0.11	1.79	0.48	1.34	0.30	1.90	0.52	1.42	0.32
Vassalboro	1.70	0.72	1.70	0.72	0.92	0.13	1.10	0.25	1.20	0.18	1.17	0.27
Warren	1.22	0.49	0.80	0.25	0.99	0.13	0.80	0.10	1.16	0.15	0.86	0.11
Winnegance	1.47	0.38	-	-	1.22	0.15	2.44	0.65	1.37	0.18	2.48	0.66
Woolwich	-	-	1.35	0.38	-	-	1.79	0.48	-	-	1.66	0.44

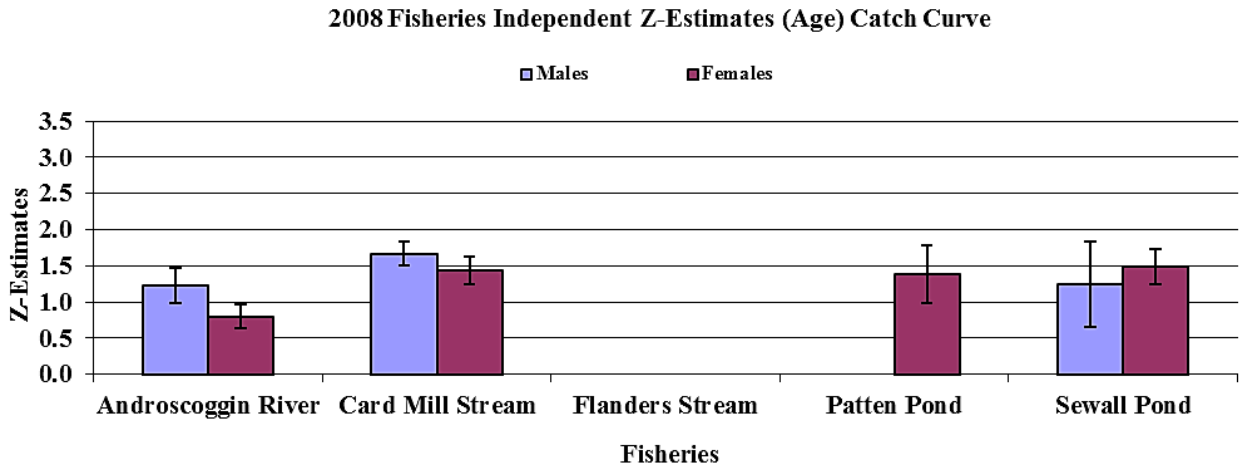
Sexes Combined

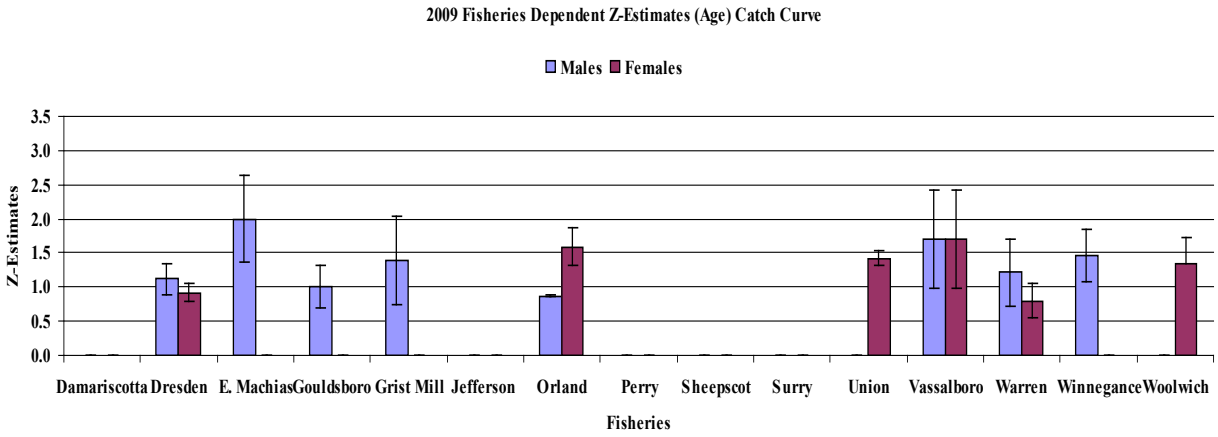
Fisheries Dependent Data **Age Based Z-Estimates**

2008	Catch Curve				Heinke				Chapman-Robson			
	Male		Female		Male		Female		Male		Female	
Fishery	Z	SE	Z	SE	Z	SE	Z	SE	Z	SE	Z	SE
Dresden	0.9	0.2	0.7	0.4	0.8	0.1	0.6	0.1	1.0	0.2	0.8	0.1
E. Machias	*1.9*	*0.1*	-	-	*1.7*	*0.2*	-	-	*1.8*	*0.2*	-	-
Flanders Pond	-	-	0.9	0.1	1.2	0.3	0.9	0.3	1.4	0.4	1.0	0.3
Gouldsboro	-	-	-	-	1.6	0.8	0.9	0.3	1.6	0.8	1.2	0.4
Grist Mill	1.1	0.1	1.1	0.2	0.9	0.2	1.3	0.2	1.1	0.2	1.2	0.2
Narraguagus	*0.8*	*0.1*	-	-	*0.6*	*0.1*	-	-	*0.8*	*0.1*	-	-
Orland	*0.9*	*0.2*	-	-	*0.9*	*0.1*	-	-	*1.1*	*0.1*	-	-
Perry	*1.6*	*0.1*	-	-	*1.4*	*0.2*	-	-	*1.5*	*0.2*	-	-
Sheepscot	*1.3*	*0.4*	-	-	*0.6*	*0.1*	-	-	*0.9*	*0.1*	-	-
Union	-	-	-	-	2.1	0.4	1.9	0.4	2.2	0.4	2.0	0.4
Warren	1.0	0.3	-	-	0.7	0.1	1.8	0.4	0.9	0.1	1.9	0.4
Woolwich	-	-	-	-	1.0	0.3	1.7	0.5	1.3	0.4	1.8	0.5

Sexes Combined



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Males
Females
Z-Estimates
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2.5
2.0
1.5
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0.0
Damariscotta
Dresden
E. Machias
Gouldsboro
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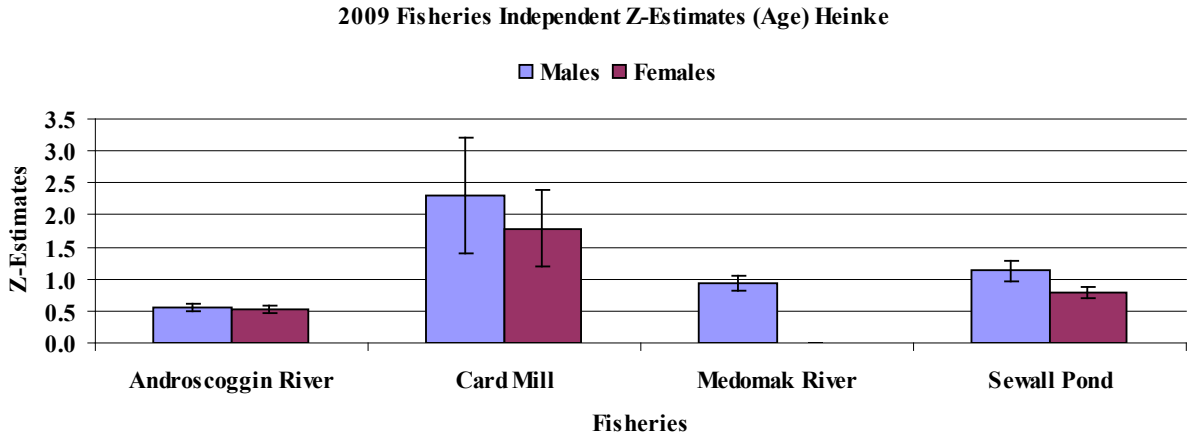
Jefferson
Orland
Perry
Sheepscot
Surry
Union
Vassalboro
Warren
Winnegance
Woolwich
Fisheries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Females
Z-Estimates
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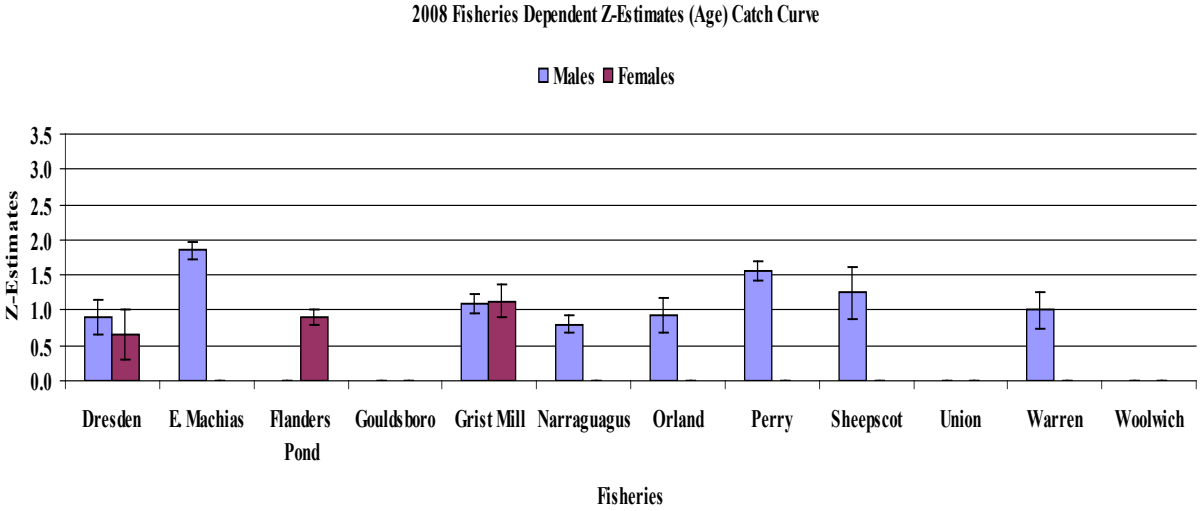
Androscoggin River
Card Mill
Medomak River
Sewall Pond
Fisheries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Females
Z-Estimates
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Dresden
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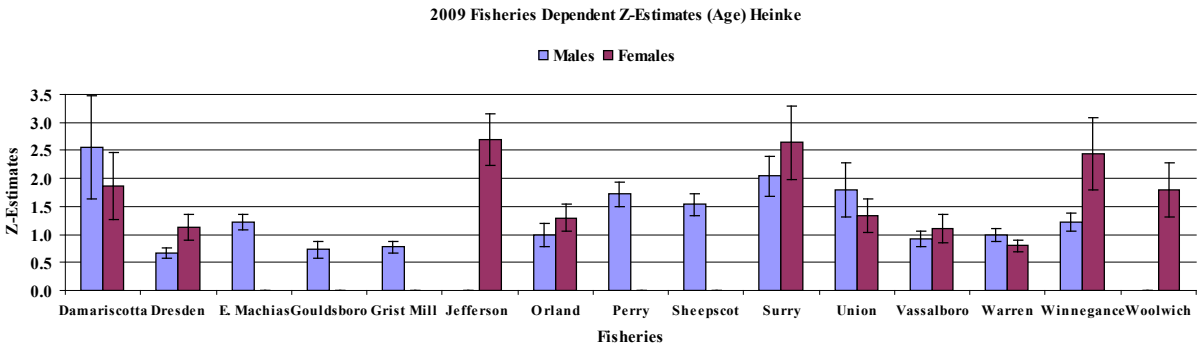
Narraguagus
Orland
Perry
Sheepscot
Union
Warren
Woolwich
Fisheries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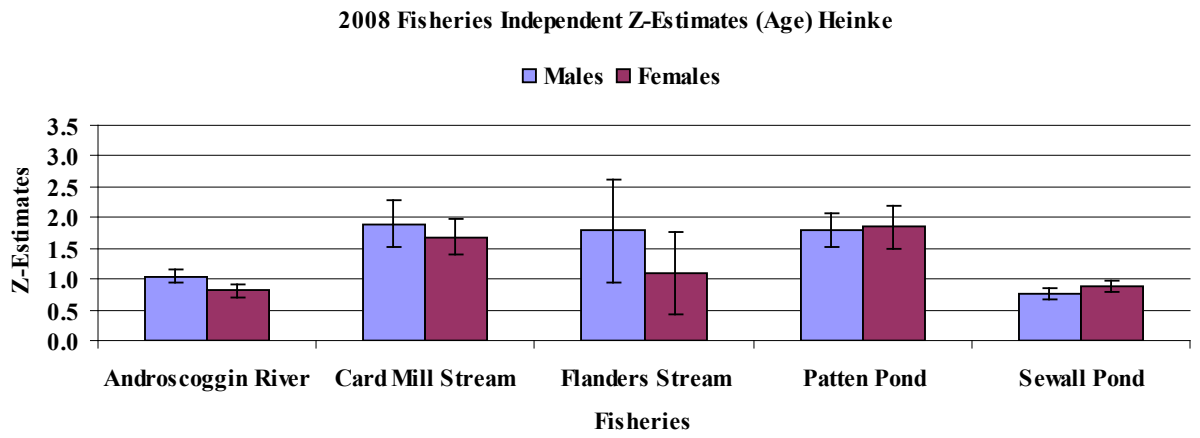
Dresden
E. Machias
Gouldsboro
Grist Mill
Jefferson
Orland
Perry
Sheepscot
Surry
Union
Vassalboro
Warren
Winneganace
Woolwich
Fisheries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Females
Z-Estimates
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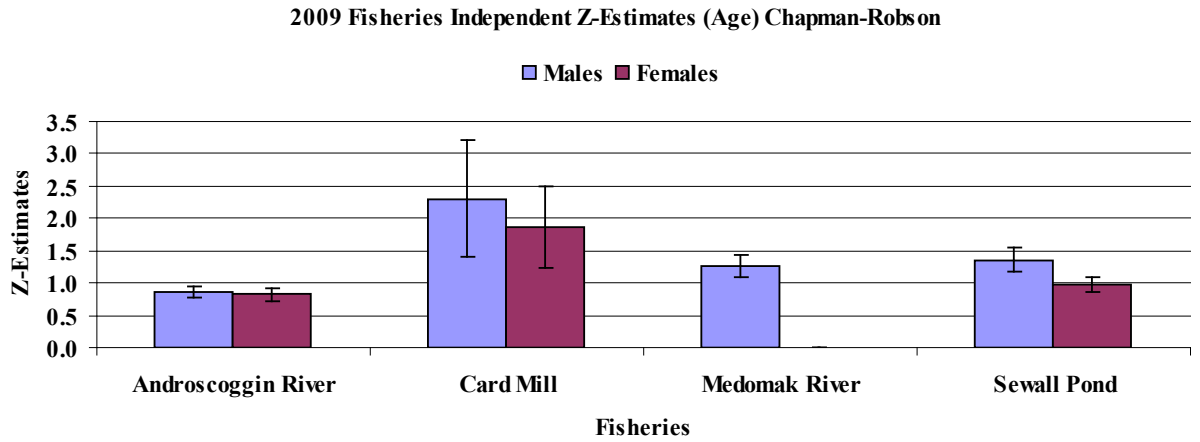
Androscoggin River
Card Mill Stream
Flanders Stream
Patten Pond
Sewall Pond
Fisheries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Females
Z-Estimates
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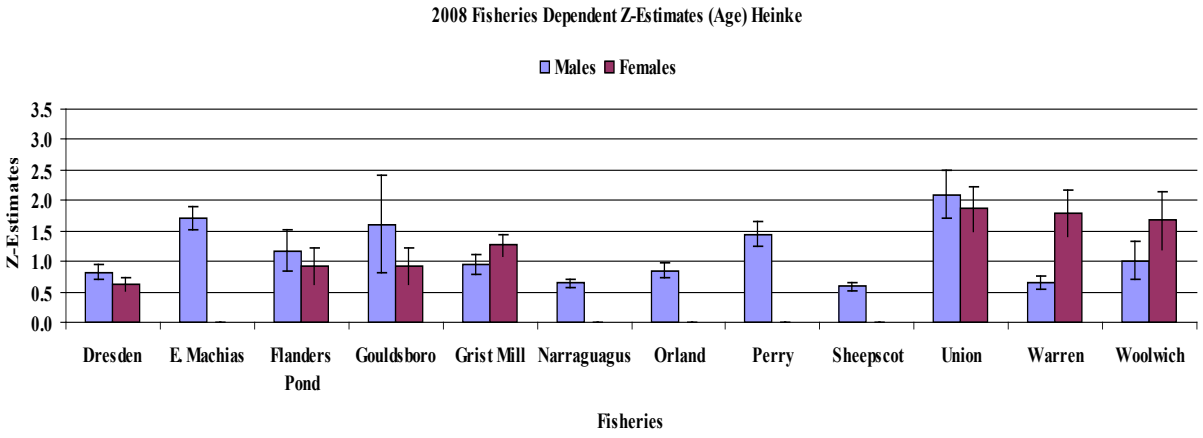
Androscoggin River
Card Mill
Medomak River
Sewall Pond
Fisheries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Males
Females
Z-Estimates
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Dresden
E. Machias
Flanders Pond
Gouldsboro
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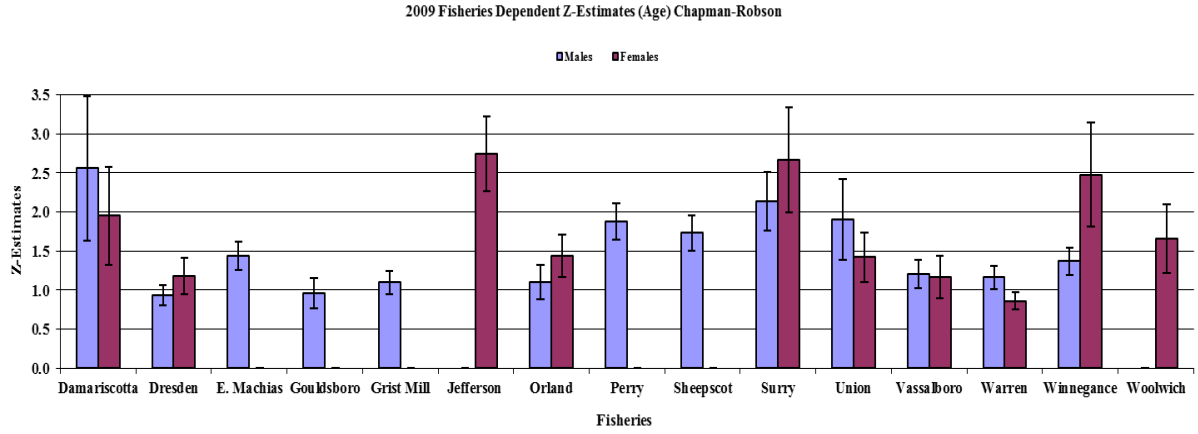
Narraguagus
Orland
Perry
Sheepscot
Union
Warren
Woolwich
Fisheries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Males
Females
Z-Estimates
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3.0
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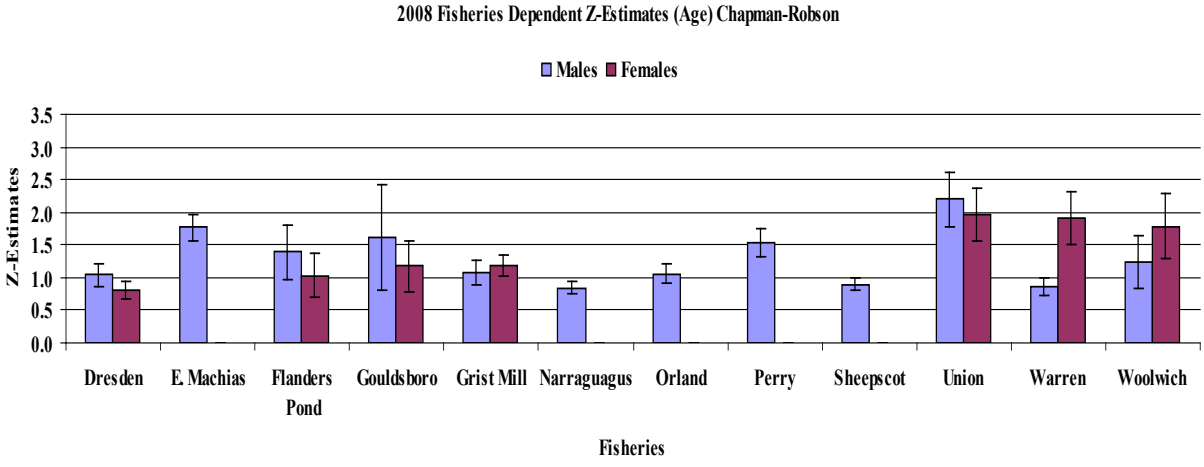
Damariscotta
Dresden
E. Machias
Gouldsboro
Grist Mill
Jefferson
Orland
Perry
Sheepscot
Surry
Union
Vassalboro
Warren
Winnegance
Woolwich
Fisheries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Males
Females
Z-Estimates
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1.5
1.0
0.5
0.0
Dresden
E. Machias
Flanders Pond
Gouldsboro
Grist Mill
Narraguagus
Orland
Perry
Sheepscot
Union
Warren
Woolwich
Fisheries

Appendix B

§6134. River herring passage; fishways on the St. Croix River

By May 1, 2013, the commissioner and the Commissioner of Inland Fisheries and Wildlife shall ensure that the fishways on the Woodland Dam and the Grand Falls Dam located on the St. Croix River are configured or operated in a manner that allows the unconstrained passage of river herring. [2013, c. 47, §1 (NEW).]

SECTION HISTORY
1995, c. 48, §1 (NEW). 2007, c. 587, §1 (RPR). 2011, c. 598, §12 (AMD). 2013, c. 47, §1 (RPR).

§6041. Pelagic and Anadromous Fisheries Fund

1. Uses of fund. The commissioner shall use the fund for research directly related to Pelagic or Anadromous fishery management and the processing of landings data information. The commissioner may authorize the expenditure of money in the fund for research and development programs that address the restoration, development, or conservation of Pelagic or Anadromous resources.

2. Sources of revenue. The fund is capitalized by surcharges assessed under **Section 2. 12 MRSA §6503**. In addition to those revenues, the commissioner may accept and deposit in the fund money from any other source, public or private.

Sec. 2. 12 MRSA §6503, is enacted to read:

§6503. Commercial Pelagic and Anadromous Fishing License

1. License required. A person may not engage in the activities authorized under this section without a current:

A. Pelagic and Anadromous fishing single license for a resident operator;

B. Pelagic and Anadromous fishing crew license for a resident operator and all crew members;

C. Nonresident Pelagic and Anadromous fishing license for a nonresident operator and all crew members.

2. Licensed activity. The holder of a Pelagic and Anadromous fishing license may fish for or take or possess, ship, transport or sell pelagic or anadromous fish that the holder has taken. The license authorizes crew members aboard the licensee's boat when it is engaged in Pelagic or Anadromous fishing to undertake these activities, if the license provides for crew members.

3. Exemptions. The licensing requirement under subsection 1 does not apply to activities described in this subsection.

A. A person may fish for, take, possess or transport any species of pelagic or anadromous fish if they have been taken by spear gun, harpoon, minnow trap, or hook and line and are only for personal use.

4. Eligibility. A Pelagic and Anadromous fishing license may be issued only to an individual.

5. Fees. Fees for Pelagic and Anadromous fishing licenses are:

A. Forty-one dollars for resident operator;

B. One hundred eleven dollars for resident operator and all crew members; and

C. Seven hundred and fifty-dollars for nonresident operator and all crew members.

6. Surcharges. The following surcharges are assessed on Commercial Pelagic and Anadromous fishing licenses issued by the department:

A. For a resident Pelagic and Anadromous fishing license, $150;

B. For a resident Pelagic and Anadromous fishing license with crew, $100; and

C. For a non-resident Pelagic and Anadromous fishing license with crew, $100.

7. Definition. For the purposes of this chapter, "pelagic fish or Anadromous fish" means Atlantic herring, Atlantic menhaden, whiting, spiny dogfish, alewife, Atlantic mackerel, blueback herring, and squid, butterfish, scup, black sea bass, smelt and shad.

8. Violation. A person who violates this section commits a civil violation for which a forfeiture of not less than $100 nor more than $500 may be adjudged.

Appendix C

Table 1. Fisheries independent monitoring locations to monitor recreational river herring fisheries in Maine.

	River Herring					
Year	**Androscoggin**	**Saco**	**Kennebec**	**Sebasticook**	**Penobscot**	**St. Croix**
1981						169,620
1982						233,102
1983	601					151,952
1984	2,530					152,900
1985	26,895					368,900
1986	35,471					1,984,720
1987	63,523					2,624,700
1988	74,341					2,590,750
1989	100,895					1,164,860
1990	95,574					1,339,050
1991	77,511					358,410
1992	45,050					203,750
1993	5,202	831				289,720
1994	19,190	2,240				362,930
1995	32,002	9,820				215,133
1996	10,198	9,162				645,978
1997	5,540	2,137				225,521
1998	25,189	16,078				177,317
1999	8,909	31,070				25,327
2000	9,551	25,136				8,569
2001	18,196	66,890				5,202
2002	104,520	20,198				900
2003	53,732	26,760				7,901
2004	113,686	32,801				1,299
2005	25,846	388				22
2006	34,239	7,994	4,094	45,960		11,829
2007	60,662	16,084	3,448	461,412		1,294
2008	92,359	22,563	93,775	401,331		12,261
2009	42,759	2,012	45,754	1,327,915		10,424
2010	39,689	19,258	76,947	1,626,872	222	58,776
2011	54,886	39,597	37,846	2,751,473	2,039	25,124
2012	170,191	28,058	179,357	1,703,520	54	36,168
2013	69,267	43,414	94,456	2,272,492	12,708	16,677
2014	55,953	11,576	108,432	2,282,454	187,438	26,893
2015	71,887	53,891	91,850	2,157,983	782,521	93,503
2016	114,874	22,644	224,990	3,128,753	1,259,307	33,016
2017	49,923	44,929	289,188	3,547,091	1,256,061	157,750
2018	170,040	92,836	307,035	5,579,903	2,174,745	270,659

Figure 1. Locations of Recreational River Herring Monitoring Counts.

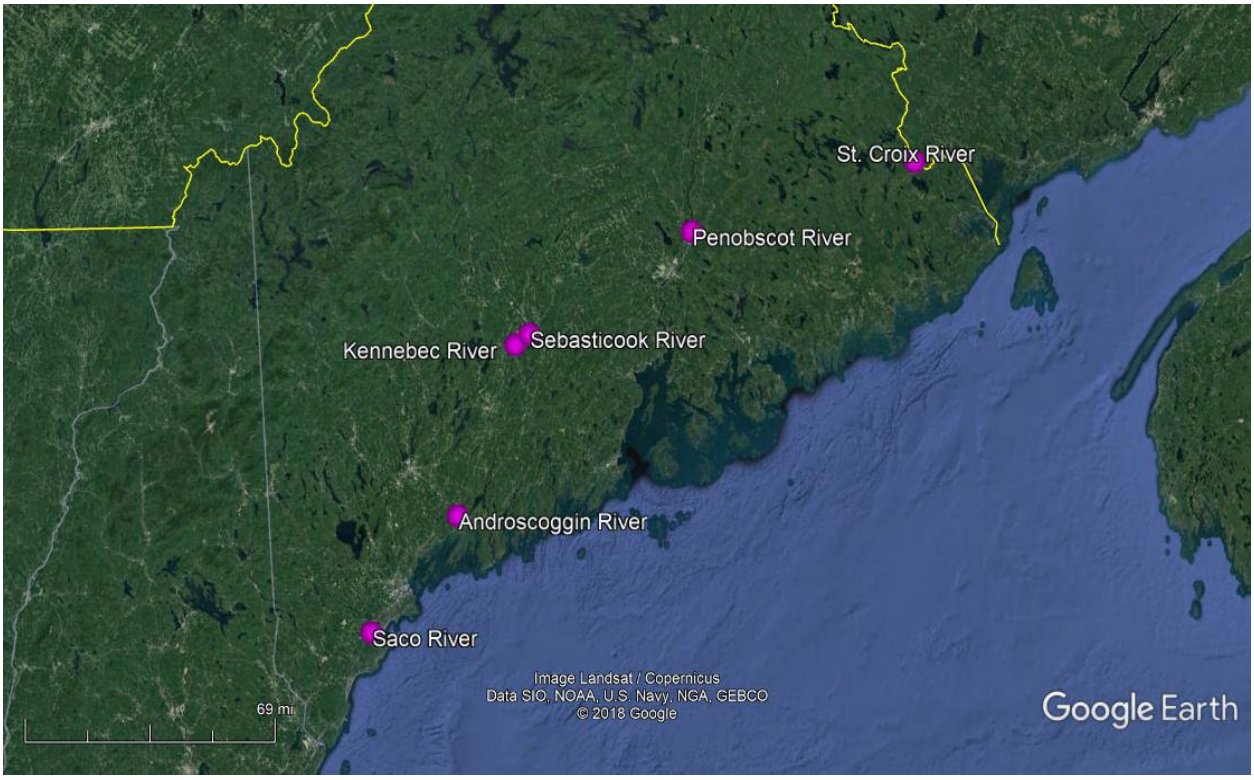
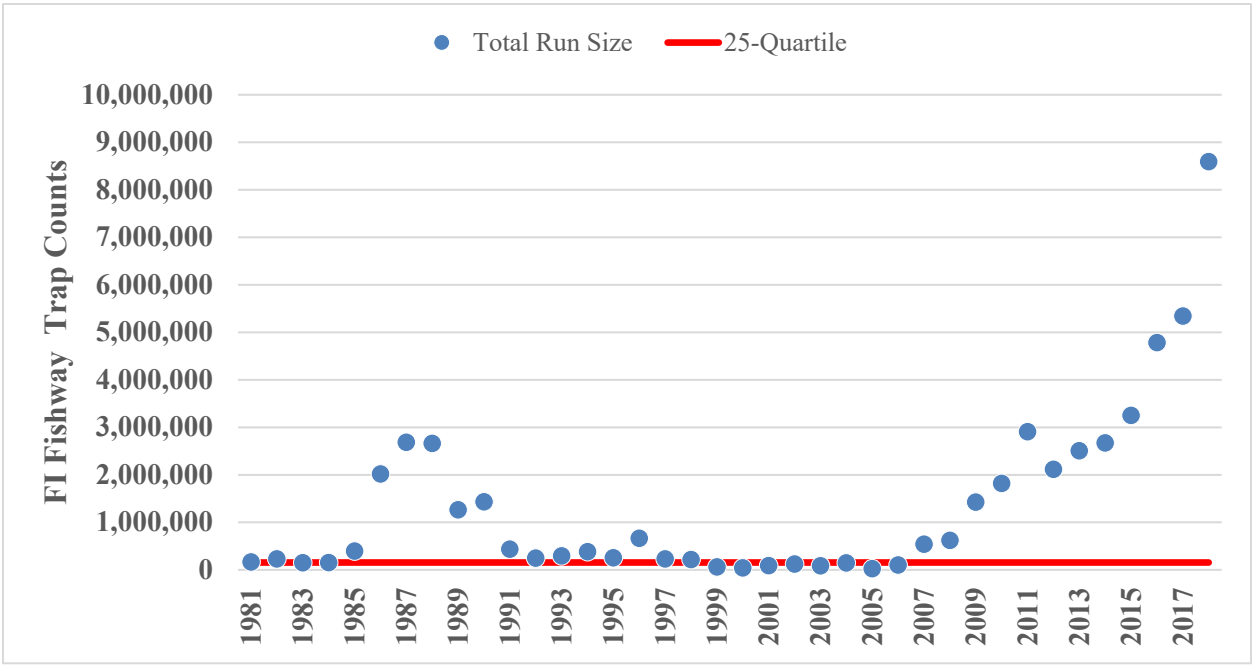


Figure 2. Total fishway counts for the six rivers used to monitor fish populations.



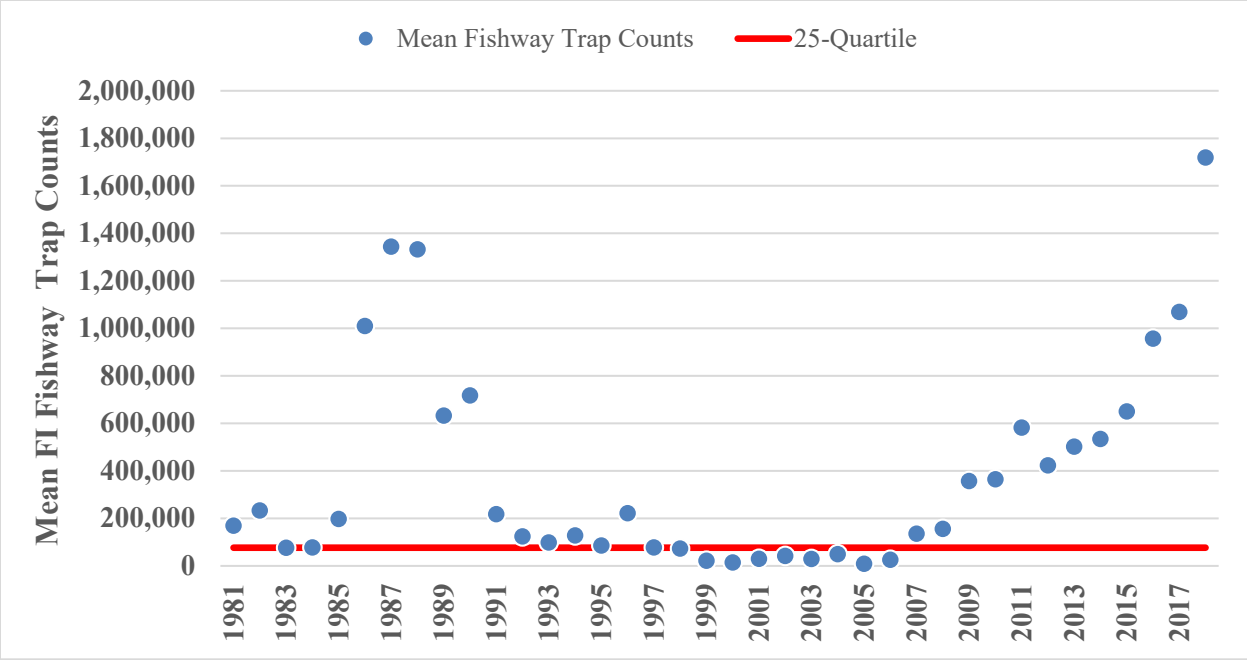


Figure 3. Mean fishway counts for the six rivers used to monitor fish populations.

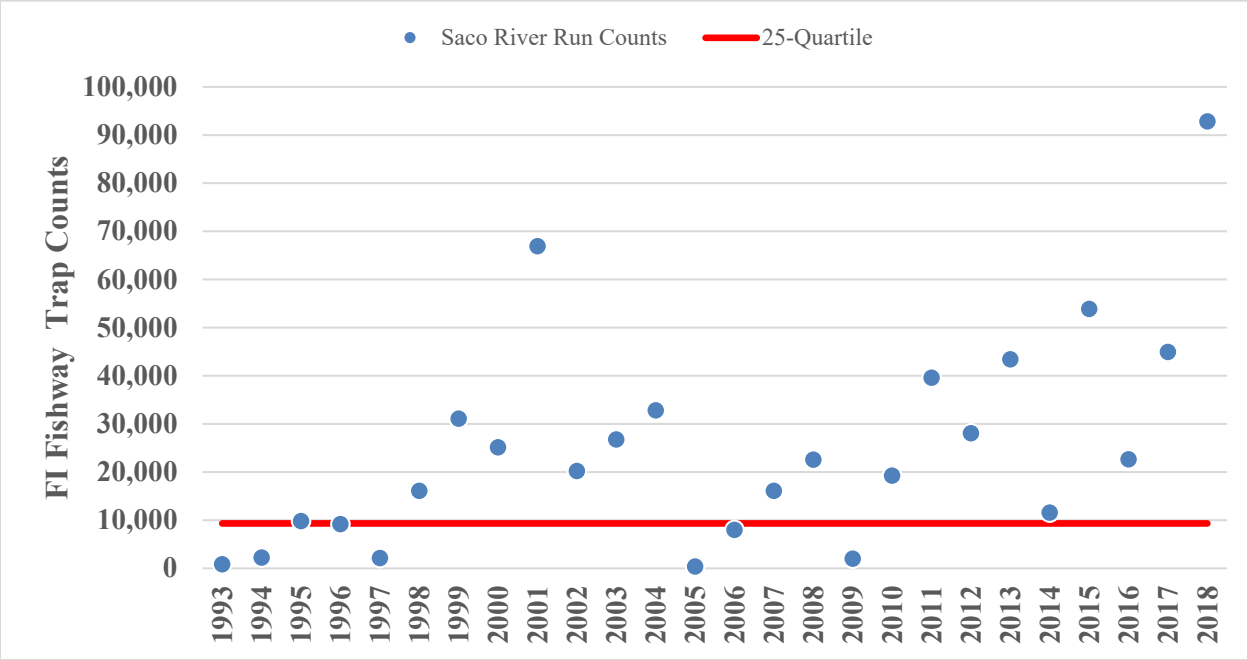


Figure 4. Fishway counts for the Saco River.

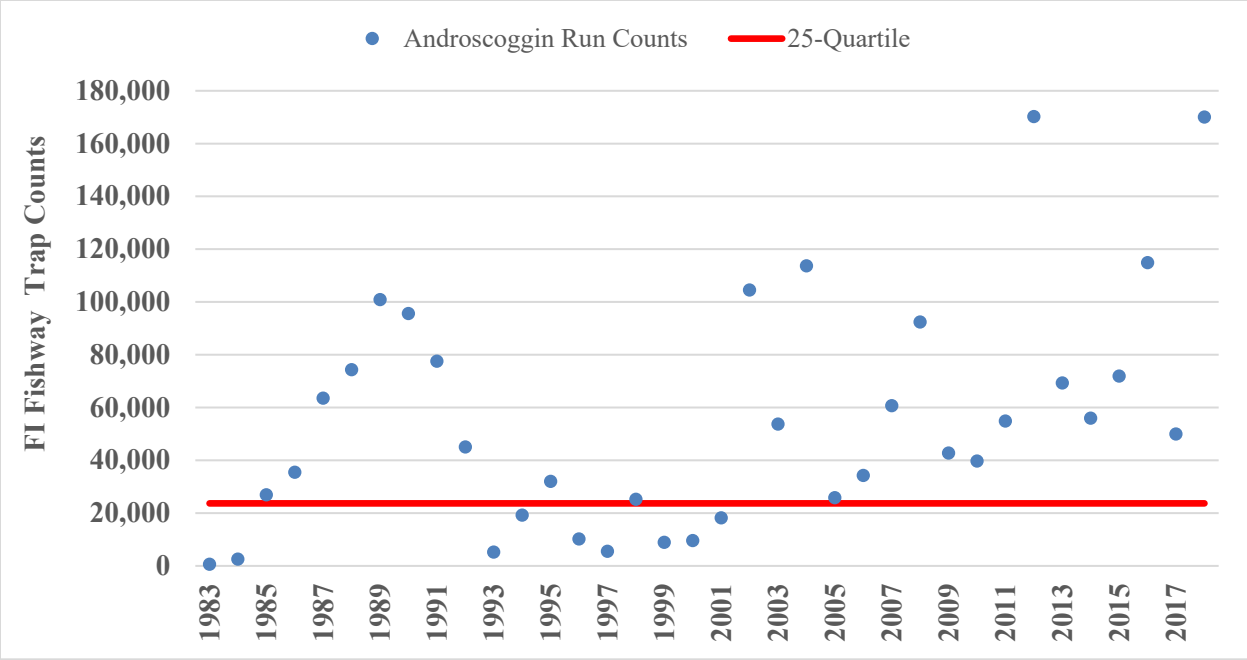


Figure 5. Fishway counts for the Androscoggin River.

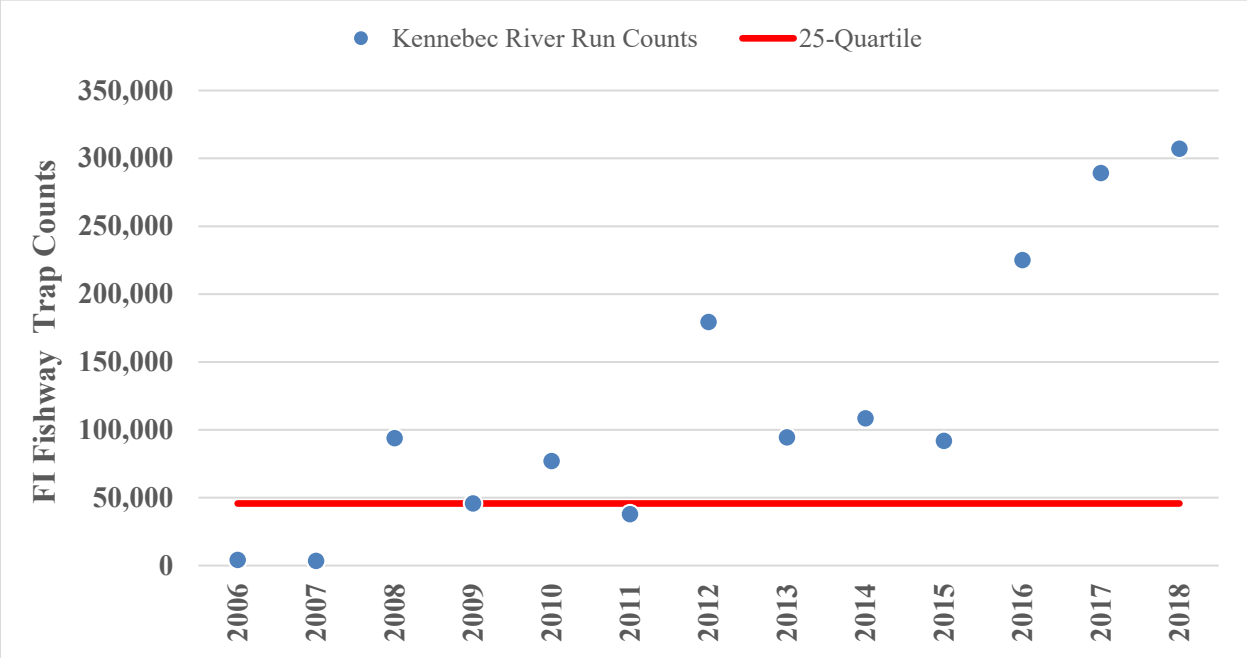


Figure 6. Fishway counts for the Kennebec River.

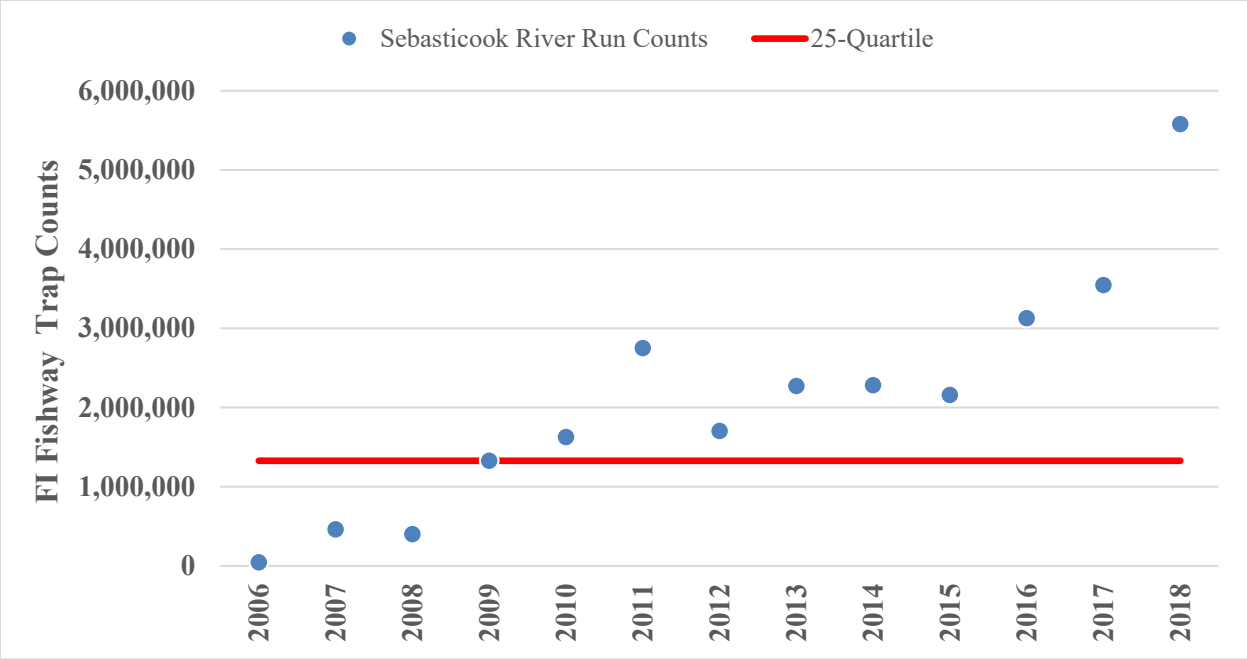


Figure 7. Fishway counts for the Sebasticook River.

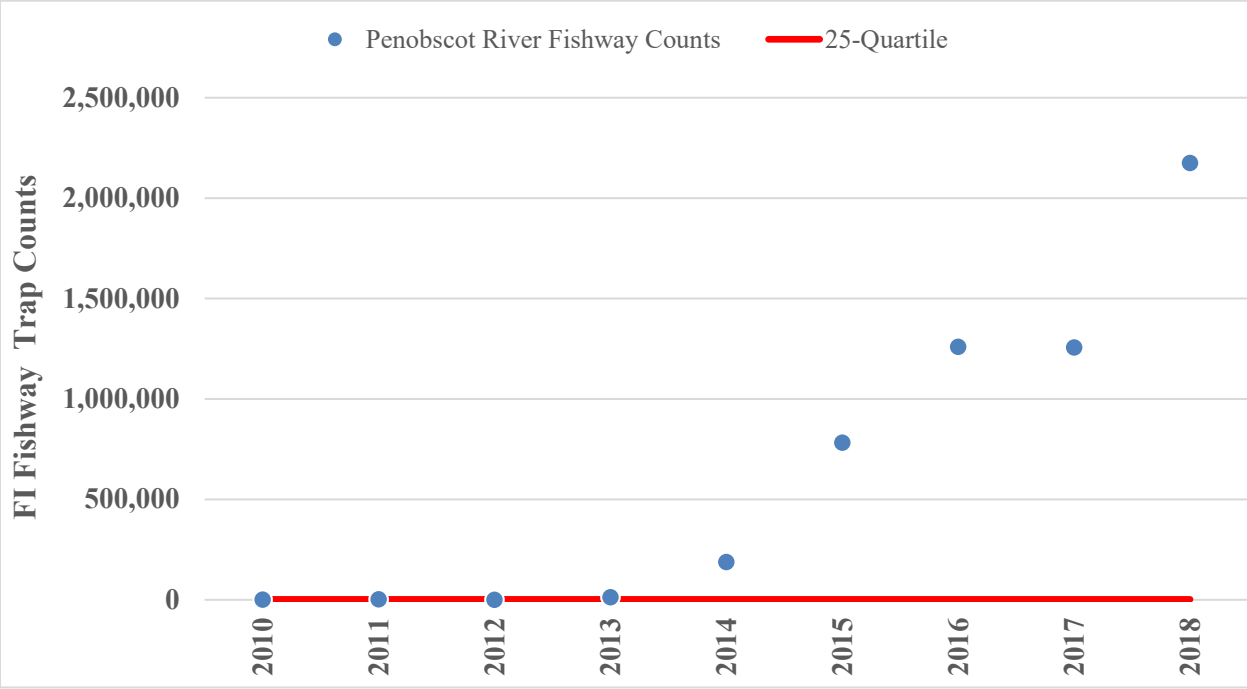


Figure 8. Fishway counts for the Penobscot River.

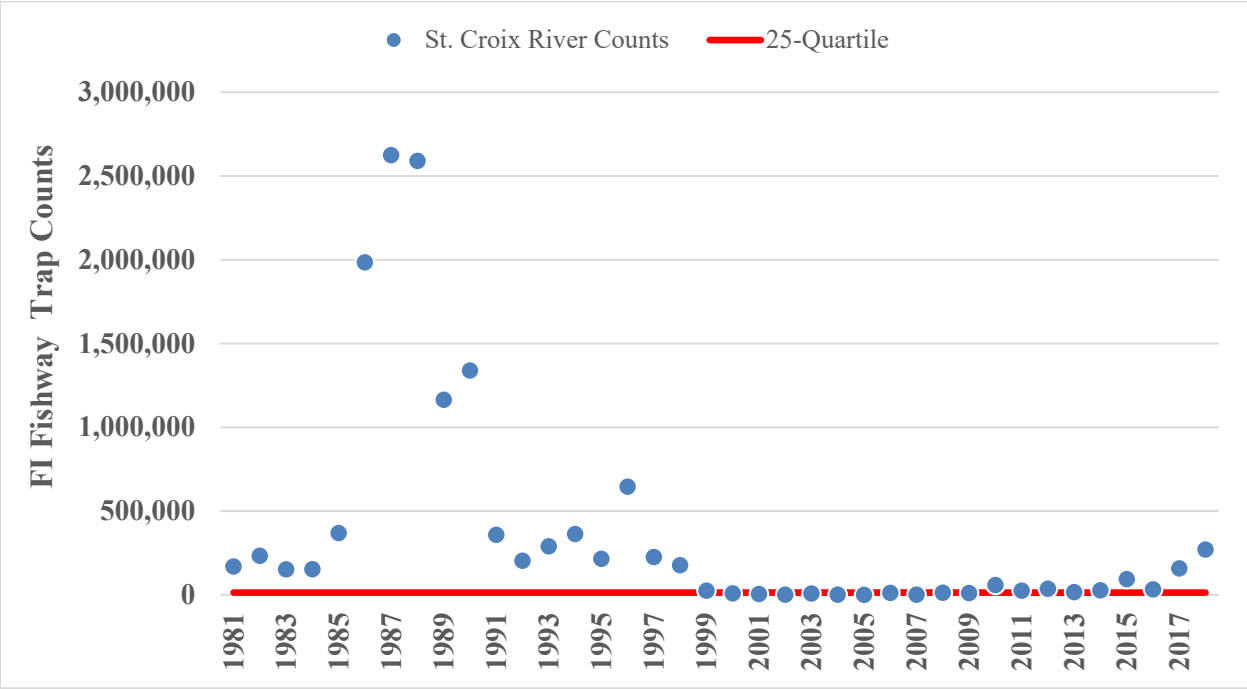


Figure 9. Fishway counts for the St. Croix River.

Addendum to the State of Maine Sustainable River Herring Fisheries Management Plan

SUMMARY

Maine Department of Marine Resources recommends that ASMFC consider a limited fishery at three locations based on improvements in returns given recent restoration efforts and based on Maine's unique potential for sustaining these efforts statewide. This document describes criteria that can be utilized to demonstrate limited harvest opportunities for some runs currently under restoration. The goal of this addendum is to provide incentive to local communities to implement and to continue restoration actions for river herring. Costly and lengthy monitoring requirements are an impediment to future restoration and data collection efforts where the decision to invest in fishways or their monitoring makes the best of the economic and cultural opportunities that a timely harvest provides. The benefits of a small harvest are continued community support for restoration efforts statewide, data collection, educational programs and stewardship of river herring populations that the DMR is unable to accomplish on a regular basis. Benefits of continued community involvement will ultimately determine the amount of data available to the DMR and ASMFC to track and monitor river herring populations coastwide and the eventual success of these restoration programs.

INTRODUCTION

River herring (*Alosa pseudoharengus* and *Alosa aestivalis*) are native to all coastal waters of Maine. Anadromous fisheries resources are a historic part of Maine fishing communities and coastal towns. The unique management and harvest of alewives and blueback herring in Maine, and the northeast in general, promotes a close connection between these species and the coastal communities where they are harvested. Restoration and stewardship of this important fishery resource continues to be one of the top priorities for Maine's coastal towns. Providing the most suitable upstream and downstream passage is critically important to towns that maintain their historical harvest rights to this resource and for those towns that hope to harvest fish in the future under Amendment 2.

Stewardship of Maine's river herring resources has occurred for the past two centuries. Citizens relying on anadromous fish for food, income and industrial products demanded fish passage over an ever-increasing number of dams that were being constructed on the migratory pathways. Whether these dams facilitated log drives, powered mills or produced power to run factory machinery, they all blocked fish passage and required fishways. Unfortunately, there were times when fishway laws were not enforced and the fishways that were built were ineffective or environmental conditions had become so degraded that the fish could not survive to use any fishways that were provided.

During the 1970's there was a revival of restoration interest and effort that continues today in Maine. In addition to the ongoing management of municipal runs that the towns harvested, Maine's larger rivers also benefitted from upstream and downstream passage for species of anadromous fish impacted by hydropower development and modernization. Today upstream and downstream passage exists on Maine's ten largest rivers and many of their tributaries. Providing for or improving passage has increased river herring returns statewide. The spawning population of river herring that returned to Maine in 2018 was estimated to be 25 million fish, most of which was the result of recent work by the

State of Maine, federal agencies, municipalities, NGO's, and local partners. Maine's history, economy, communities and natural environment now provide this state with unique opportunities to further sustain even more successful restoration efforts if more communities can be incentivized to participate.

CURRENT MANAGEMENT

River herring resources are managed on a watershed or sub watershed basis depending on location and size of the run. All river herring harvested are distinct and separate populations native to the watershed where harvest occurs. There are 36 municipalities in Maine that hold exclusive harvest rights. Twenty-two of these municipalities are eligible to harvest under our current sustainable fisheries management plan. The State of Maine permits each municipality, based on its possessing exclusive harvest rights, to harvest fish at a specific location utilizing one harvester per system. For each of these existing eighteen fisheries there is one licensed fisherman and associated crew that has sole access to the harvest. Commercial harvest is limited to one location and no additional harvest is permitted upstream of the harvest site for either commercial or recreational use. Most often harvest sites are located at the head of tide or at an existing fish passage facility. By limiting the number of harvesters, harvest locations and fish populations targeted for harvest, the population responses to management actions are easier to quantify.

River herring populations respond positively to restoration and management actions where habitat, passage and harvest practices support population growth. Stocking small numbers of pre-spawn fish often produce large returns of fish back to the system within four to six years. Several restoration projects started after 2000 now produce one million to five million fish annually. Several harvested runs average more than one million fish each year and provide income to coastal communities and fishermen. The DMR is confident that current restoration efforts will continue to grow if properly managed and supported by the communities.

SIGNIFICANT COMMUNITY RESTORATON EFFORTS

Maine is fortunate to have an active and successful statewide anadromous fish passage and habitat restoration program. The DMR estimates that 25 million river herring returned to Maine's inland waters to spawn in 2018. The population is expected to continue to grow as additional habitat projects are completed and new fishways are installed across the state. There are presently six active fish passage projects scheduled for 2019, plus a FERC order to reopen an existing fishway that has been blocked to fish passage until this year. These fish passage and restoration projects will add 53.7 square miles of river herring spawning habitat in Maine.

There are more than 50 additional waters that are under consideration for assessment and restoration programs. These historical habitats are spread along Maine's 3,476 miles of coastline and inland by as many as 150 miles. The geographic distance and limited number of sea-run fisheries staff requires that the department work closely with local communities to conduct many of the biological data collection and restoration activities associated with realizing river herring population growth in Maine. These communities also assume the roles associated with fund raising, grant writing and construction oversight through local non-profit organizations or through there own town administration and public works

crews. This model has worked very well and will be the model that Maine will continue to use for its restoration efforts. Community support and partnership are the key to achieving the resiliency needed to achieve Amendment 2 goals in the state of Maine.

Restoration projects vary based on size and complexity. Construction costs range from $100,000 to several million dollars per project. Data collection, run monitoring, debris removal requires additional funding and staff time after the initial fishway construction. The five existing DMR staff are unable to conduct monitoring at these locations without local assistance. The data collection associated with development of a sustainable harvest plan for each site, along with annual sampling poses another layer of complexity to achieving restoration in all existing historical river herring habitat with in Maine. Without community involvement to support these efforts Maine will not be able to continue to expand its existing river herring populations.

State and federal resource agencies and national and local nonprofit organizations provide most of the funding to restore fish passage. Local town governments and volunteers cover the expenses of sampling and operating fish passage after construction. Several small towns and coastal communities continue to support and lead on the ground restoration efforts along the coast with the goal of harvesting river herring. Volunteer efforts are critical for fishway construction, collecting biological samples, clearing beaver dams to provide passage and conducting annual fishway counts. Volunteer efforts have continued to dramatically increase the impact of the overall restoration of Maine's river herring populations within small coastal watersheds.

The coastal towns of Arrowsic, Penobscot and Phippsburg and many others have active river herring restoration and monitoring programs. In addition to providing funds for fishway construction, these communities continue to make annual financial commitments through town government and/or volunteer efforts. Many of the monitoring efforts have been ongoing for several decades. Examples of such collaborative work of the aforementioned towns are as follows:

The coastal town of Arrowsic has a population of 446 residents. More than 50 of the residents are currently active or have been active in the restoration and monitoring of the Sewall Pond river herring population. In 2014 the Maine Department of Transportation removed the last obstacle to fish passage by replacing an old culvert with a suitable fishway. The Conservation Committee has collected biological data from Sewall Pond for the DMR for 12-years.

The town of Penobscot, population 1,263 residents, in conjunction with state, federal, NGO's and local partners removed the dam at Wight's Pond and replaced it with a rock ramp, that is more natural. The total project cost to provide this unobstructed passage was $346,250. The town continues to budget funds for the alewife committee to use for the benefit of its river herring resource and to provide count and biological samples to DMR. Funds are allocated at the annual town meeting and are subject to the approval of the town voters. The allocation of these funds from the budget passes with unanimous approval each year. This demonstrates the continued commitment to support the river herring populations within this town. The town has actively managed this population and facilitated passage because of its importance to the town and those that utilized the resource. Many towns, including the town of Penobscot, have extensive local knowledge of these resources and how they were managed to utilize and conserve these populations.

Several volunteers remain committed to assist with monitoring the annual run at Wight's Pond and Pierce Pond, both in the town of Penobscot. In addition to mandatory monitoring of alewife runs associated with management requirements, Penobscot received funding for purse and beach seine sampling gear that is being used to study juvenile and sub-adult alewife life stages in the ponds and the Bagaduce Estuary. Working with local NGOs and multiple university professors, the waters within the town of Penobscot are part of a scientific study to determine the relative productivity between ponds and how that information can be best used to determine future harvest levels. This work has implications at the local level to direct future harvests and at a species wide level to answer questions that scientists and managers have identified as important data gaps. This effort demonstrates the capacity of local resources that, because of socio-economic ties that this addendum leverages, are committed to restoring this species for sustainable harvest and other natural resource benefits.

Center Pond in the town of Phippsburg is typical of a small coastal pond with a growing river herring resource. With a population of 2,216 residents, it has maintained an active alewife committee since the late 1970s'. Located near the mouth of the Kennebec River, a major challenge facing this small coastal pond is that river herring access is subject to the tidal stage of the Kennebec River which makes it accessible for only 48% of the tide. The town has provided or pledged more than $124,521 in town and private funds toward a new $300,000 fishway to improve passage into and out of Center Pond. Additionally, the town budgets annual funds to the alewife committee for the counting and tagging of fish. The volunteer alewife committee continues to collect data to better manage the river herring population and to meet the sustainability goals of the Maine SFMP. With an alewife run dating back to the 1800's and hard return data since 2012, Center Pond continues to be a critical study site because of its unique location very near the mouth of the Kennebec River and its three consecutive years of fish tagging data.

Within the past decade dozens of restoration projects targeting river herring, American shad and Atlantic salmon have started to witness a dramatic return of spawning river herring. Restoration projects like those described above vary in size and impact, from removing head tide dams that produces millions of fish, to small stream improvements of coastal lakes and ponds that produce thousands of fish. All of these restoration projects are significant, both in terms of the fish produced and in the significant amount of community support they provide for future restoration projects. Numerous other restoration efforts are currently underway, either in planning stages or actively under construction, with runs anticipated to grow by several million fish within the next five years.

DATA NEEDS

During the 2012 River Herring Assessment, river herring were determined to be data deficient, complicating the ability to fully assess these species coastwide. There is a need to continue to collect fisheries independent data for river herring populations that are not currently commercially harvested. Many unharvested river herring populations are under restoration and benefit from monitoring during the spring spawning run and fall migration of juveniles downstream. The towns and volunteers that monitor these populations deploy and operate counting stations, collect biological data (scales, species, sex, length, weight) and bycatch information that can be used to meet ASMFC data needs.

Biological samples and harvest data are collected annually from all commercially harvested river herring populations. Data collection and landing reports are mandatory requirements for any municipality that

commercially harvests under its exclusive harvest rights. For populations that do not have a dedicated harvest, data collection becomes the responsibility of the State of Maine DMR. Because of state budget constraints, Maine's expansive 3,478-mile coastline and demands for current data collection, the responsibility of biological and run count data collection rests with those towns focused on obtaining/utilizing their exclusive harvest rights. It is the volunteers, NGO's and others that are willing to partner to collect biological data that are doing the work. Without the continued assistance from local towns and volunteers most of Maine's river herring populations would not be monitored at current levels.

The data collected by volunteers and NGO's provide basic information to assess and track river herring populations. The DMR analyzes scales and additional data collected to calculate and track population metrics including species, age structure, sex ratio, repeat spawning, length at age and mortality estimates. Without assistance from those outside of state government most noncommercial runs would not be monitored on an annual basis.

FUNDING CONTINUED RESTORATION EFFORTS

The Atlantic States Marine Fisheries Commission manages river herring coastwide. Under Amendment 2 individual states may develop alternative state management strategies to restore river herring populations. Alternative state management approaches are beneficial because they allow flexibility for state fisheries managers to achieve monitoring, research and population recovery goals outlined in Amendment 2. The State of Maine proposes an addendum to the existing SFMP to furthers encourage continued local municipal restoration and sustainable management of river herring resources as a goal for increasing restoration success in Maine.

Maine will benefit from a state management program that builds upon restoration success experienced by the towns and the investment that municipalities continue to put into restoring river herring runs. A limited commercial river herring fishery at these locations will: incentivize volunteers and engage fishermen in restoration and sustainable harvest practices; provide educational programs for children and adults; allow a limited harvest which will provide resources to the state or town through the DMR Migratory Fish Fund; demonstrate to taxpayers the tangible rewards of such restoration projects; provide a limited additional source of lobster bait for that industry which is facing severe bait shortages because of recently curtailed herring catch limits.

Many towns that monitor river herring resources within their municipality have an established alewife committee or town conservation commission that oversees and coordinates the town's interaction with the local river herring resource. Participants are typically volunteers or current town employees. Funding programs as complicated as run counts and biological data collection can be problematic. Many towns lack the equipment necessary for expanding data collection, recording environmental conditions and counting river herring runs. The Migratory Fish Fund could be used to continue restoration efforts statewide by providing equipment, staff and standardized training necessary for data collection.

In cases where harvest rights are being established or restored, a municipality can exercise its commercial harvesting rights only after approval by the ASMFC Management Board. The provisional addendum of these three waters to the existing Maine Sustainable Fisheries Management Plan will

provide a modest incentive for community members to continue restoration efforts without risking significant impact to the resource.

MUNICIPAL GOALS

The collective goal of the municipalities is to continue building public support for river herring restoration, education, management and monitoring. With the mandatory closures required by Amendment 2, several municipalities have lost the volunteer support and ability to monitor and harvest these resources. Collectively, these three municipalities strongly support the opportunity to harvest a small number of fish to be sold with revenue going to fund educational programs, collect additional data and maintain the existing migratory corridors and fishways. A limited harvest will support fisheries dependent data collection, supply a limited source of bait and income for commercial fishermen, food for a small number of town residents and a very modest revenue return for some of the communities' tremendous time and money invested in the restoration, which can add up to thousands volunteer hours and dollars respectively. Furthermore, it will promote and sustain a network of restoration proponents, advocates and volunteers and could become a model for other states.

The Maine DMR supports this approach and is prepared to oversee funding, data collection efforts, educational training programs and provide any other assistance that it may be able to offer. The collective benefits to the municipalities are support toward meeting their goals of funding educational programs, collecting additional data, increasing the existing river herring populations and providing a limited amount of bait for commercial fishermen. DMR and ASMFC will benefit from data provided by the municipalities to enable tracking of recovery progress through standardized fisheries dependent and fisheries independent data collection. Some municipalities have been collecting data for several years and these data will provide valuable population trend information for the next full ASMFC river herring assessment in 2022.

IMPLEMENTATION OF AMENDMENT 2

Implementation of Amendment 2 requires a significant amount of data to demonstrate that individual populations of river herring are sustainable. Historical data collected for most river herring populations prior to Amendment 2 consisted of harvest weights and numbers along with limited amounts of scientific work conducted over the past 40 years. In many cases the limited fisheries dependent data available were insufficient for developing comprehensive management plans or for use in a coastwide assessment.

In 2008 the nonprofit association Alewife Harvesters of Maine began collecting biological samples and count data, at their own expense, in cooperation with the Maine Department of Marine Resources, to meet the anticipated requirements of Amendment 2. These data were used to develop the framework for the first sustainable fisheries management plan for river herring. Municipalities that are currently harvesting river herring are required to collect data to improve the management of this fishery. Municipalities that currently possess exclusive harvest rights and cannot harvest, or those towns that hope to gain access to newly restored runs, are also collecting data to develop sustainable management plans as their restoration programs continue. Biological data and count information obtained from these populations will originate from these towns and volunteer groups willing to collect data. Within some communities the data collection requirements necessary to meet the exiting data standards applied by

ASMFC are considered overly burdensome in years required and counterproductive to restoration progress and community support.

ASMFC MANAGEMENT PROGRAM IMPLEMENTATION

In Amendment 2 the ASMFC Management Board approved the following commercial and recreational fisheries management measures defining sustainability and providing guidelines for data collection.

"Systems with a sustainable fishery are defined as those that demonstrate their alewife or blueback herring stock could support a commercial and/or recreational fishery that will not diminish potential future stock reproduction and recruitment."

This addendum to the current SFMP proposes to assess the merits of a provisional process to allow limited harvest of river herring while continuing restoration efforts on rivers and streams that do not meet the current SFMP criteria or do not meet minimum time series data requirements for meaningful assessment. Within a five-year period, the three municipal waters selected for inclusion in this program must meet the following sustainable criteria for their runs to be added to the existing SFMP. These criteria are: 1) escapement of at least 235 fish per acre, 2) 20-percent repeat spawning ratio, 3) Z-estimates of < 2.0 for repeat spawning fish, 4) an age structure that demonstrates the presence of older aged fish (ages 3-7).

The data series used to determine the TSM and initial harvest levels are based on time series data collected after a significant restoration event implemented to support population growth. The Technical Committee felt that data collected after restoration would best represent future run counts compared to historic data or data collected prior to significant restoration events. For Sewall and Wight's ponds, data for the years 2015 through 2019 were used to develop initial harvest levels. For Center Pond the years 2012 through 2019 were used to develop initial harvest levels.

All the river herring populations in this proposed addendum to the SFMP have experienced varying levels of restoration success. While none of the proposed fisheries achieve all the sustainable fisheries standards currently established in the Maine River Herring SFMP or those developed after the Technical Committee review in 2017, the proposed harvest rates in this addendum are capped at 15% of the time series mean and should not permanently affect the overall restoration of these runs. The ASMFC Technical Committee will review the progress of these three runs toward meeting Maine SMFP standards. The Technical Committee may propose additional management measures or propose to close these fisheries during the 2022 SFMP review period.

Proposed Harvest @ 15% of Time Series Mean				
		Sewall Pond	**Center Pond**	**Wight's Pond**
Years of Data		12	8	8
Lake/Pond Surface Area		43	75	135
Average Run Size		19,813	27,202	45,503
@.15 TSM	Number	2,972	4,080	6,825
	Bushel	25	34	57

Restoration projects will continue at all three locations where fish are harvested from the existing population under this proposed addendum. The small commercial harvests proposed are not anticipated to minimize effects of restoration progress where population growth, age structure and fishing mortality are limiting factors of meeting restoration goals. While the limited commercial harvests will likely not prevent the subsequent success of these restoration programs it will delay restoration progress. Stricter biological controls and monitoring will track each population and DMR or the ASMFC Technical Committee may reduce harvests below 15% prior to the end of the five-year period. Fisheries targeting river herring stocks that do not meet each of the sustainability targets needed for inclusion in the Maine SFMP at the end of the five-year period will close.

The benefits of the proposed small harvests are: continued community support for restoration efforts statewide, data collection, educational programs and stewardship of river herring populations that the DMR is unable to accomplish by itself or monitor on a regular basis. These continued benefits of community involvement will ultimately determine the amount of data available for DMR's and ASMFC's tracking and monitoring of river herring populations coastwide and the eventual success of these restoration programs. Furthermore, the positive effects of this proposed addendum are the continued volunteerism and local support of these fish populations.

1. Sustainability Threshold

Sustainability Definition – For the fisheries within this addendum sustainability will be defined as follows: annual release of at least 235 fish spawning fish per surface acre to provide an alewife population capable of increasing annual river herring run size; the run must demonstrate a repeat spawning ratio of 20 percent; Z-estimates of < 2.0 calculated for repeat spawning fish; an age structure that demonstrates the presence of older age fish (ages 3-7).

Monitoring to be Conducted to Support Target(s)
DMR fisheries staff will use annual escapement counts conducted by the municipality, volunteers or NGO and scale sample data (sex, age, mortality, repeat spawning, and species) to track relative health of these three river specific stocks. Additional data may come from the Bagaduce JAI survey conducted in the Bagaduce Estuary and DMR data collection and counts at these locations as time permits. Monitoring efforts will continue for all current commercial fisheries and for all directed commercial fisheries that propose to open in the future.

2. Proposed Rule-Making to Support Target(s)
Fisheries within the addendum that choose to participate in this limited fishery and do not achieve sustainability levels for spawning escapement, mortality estimates, repeat spawning ratio, age structure and run counts within five years will be closed. All recreational river herring fisheries will close to prevent additional harvest of spawning fish within the watershed. An assessment of each of the three fisheries in the addendum will occur prior to commencing the limited fishery the following year and once again after the conclusion of the harvest. The ASMFC Technical Committee will review restoration progress in 2022 as part of Maine's SMFP review.

3. Adaptive Management

a. Evaluation schedule

The Maine Department of Marine Resources conducts an annual review of all municipal fisheries plans. Many plans carry over year to year because they provide adequate protection for the river herring resource. However, this proposal requests an exemption from Amendment 2 sustainability requirements necessitating the need for more frequent review. Plan reviews will incorporate count data, escapement counts, spawning escapement, effort controls and results from analysis of biological data collected by the municipality and analyzed by DMR. Plans will be reviewed at least twice each year for those municipalities in this addendum that choose this limited harvest. The first review will occur during the early summer to review data collected from the current harvest year. A second review will occur to assess downstream migration and develop harvest plans for the proceeding harvest season.

Once these fisheries meet the existing criteria in the current SFMP Addendum they will be forwarded to the Shad and River Herring Technical Committee for approval and addition to the formal SFMP. Additional runs will be proposed for a limited harvest if there is an active restoration program and the existing population can demonstrate continued growth and progress toward meeting sustainability metrics. The decision to add more waters for the Technical Committees review will be determined only after this program demonstrates that a limited harvest can occur during the restoration progress by providing three consecutive run counts greater than 235 spawning fish per acre.

b. Consequences or control rules

While the management objective within this addendum continues to recognize these populations are in recovery and any removal of spawning fish will impact production and future returns, it also at the same time recognizes tangible incentives for municipalities to continue their voluntary river herring recovery efforts. Under this addendum no harvest shall exceed 15% of the TSM measured in bushels. The TSM will be recalculated annually to incorporate changes in populations size during the five-year period. The assessment criteria used to evaluate population growth will be the same criteria used to evaluate existing commercially harvested populations. The Maine Department of Marine Resources will close those runs that do not meet the sustainability thresholds in this addendum during the five-year review period. The Maine Department of Marine Resources will reduce harvest from the allowed 15% TSM based on the following criteria used to measure progress toward achieving sustainability targets. The management responses to be taken if these sustainability standards are not met are outlined below:

1) Harvest will occur after May 18 to allow a proportion of the river herring run escape the fishery. All harvested fish must be accompanied by a receipt from the town indicating names of the seller/buyer, date, quantity and time of sale which is to be attached to the Annual Harvest Report at the end of the fishing season.

2) Towns that allow a recreational fishery must enumerate and subtract the recreational river herring harvest from their commercial catch allowance for the season. If there is a significant documented loss that occurs from poaching the commercial fishery will be closed.

3) Management changes will occur based on the following;

A) Decreasing trends in running three-year averages of annual run counts.
If the run demonstrates a declining trend in the running three-year average of annual run counts the fishery will close for the following year.

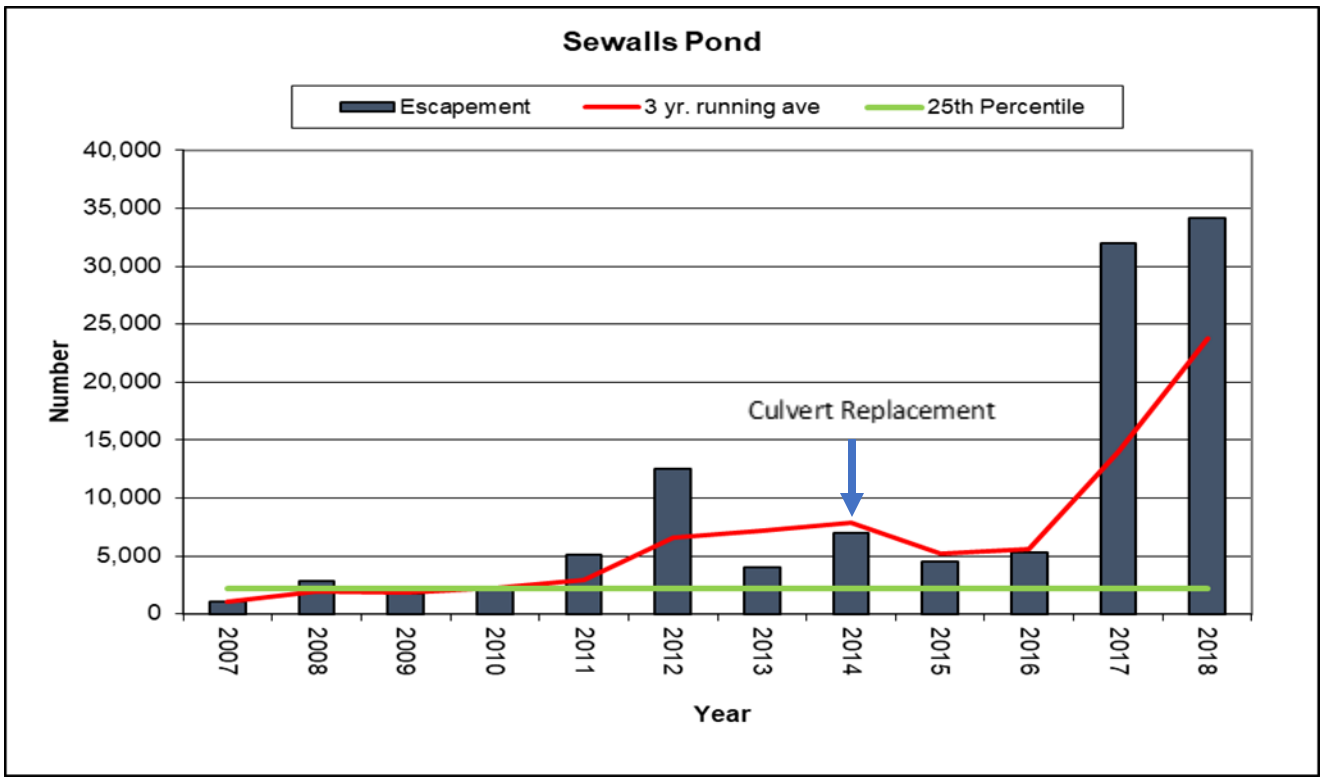
B) Increasing time series trends in total instantaneous mortality (Z) for repeat spawning fish. If the fishery does not achieve a Z-estimate of 2.0 or less for repeat spawners for the current year the fishery will be reduced by five percent of the TSM for the remainder of the five-year harvest period or until the Z-estimate falls below 2.0.

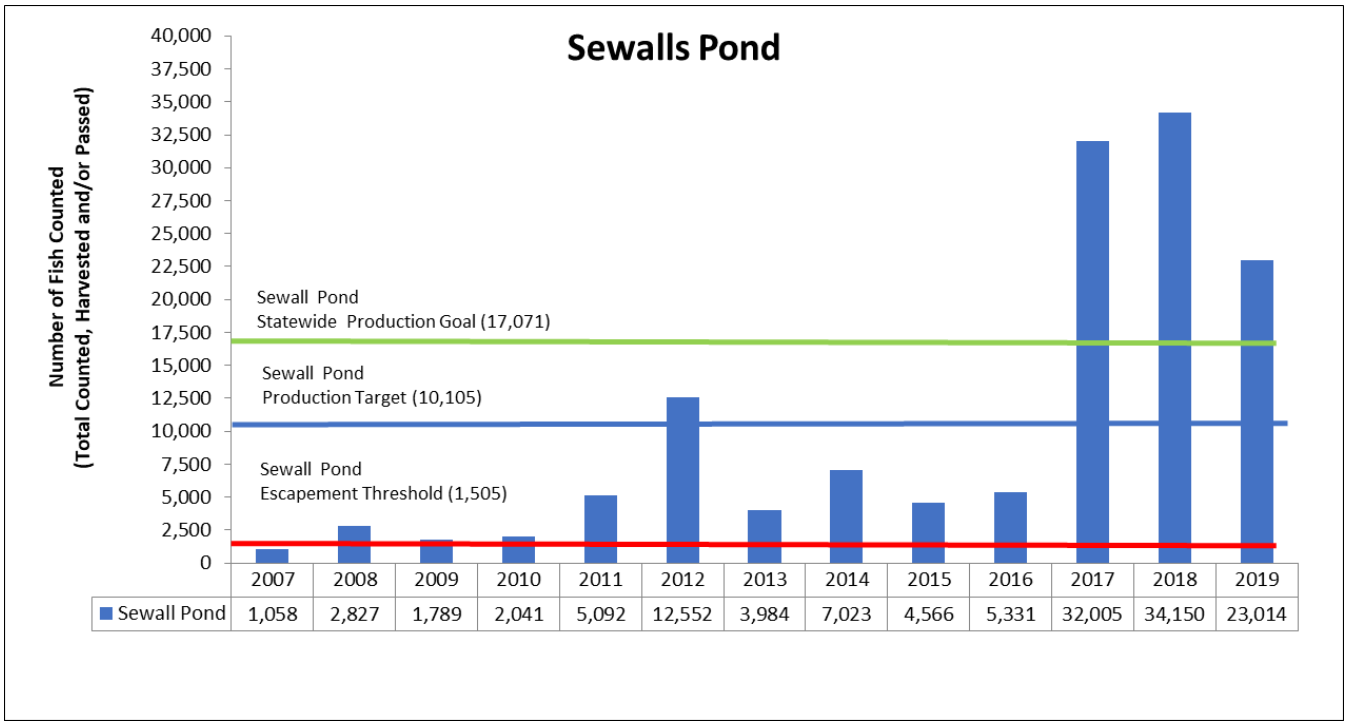
C) Decreasing time series trends in repeat spawning rates.
If the average number of repeat spawning fish for the TSM and sample year do not achieve 20 percent the fishery will be reduced by five percent for the remainder of the five-year harvest period or until either the annual repeat spawning rate or the mean for the time series exceeds 20 percent.

D) Decreasing time series trends in age structure.
River herring populations that that do not demonstrate the presence of fish ranging in age from three to seven years will be reduced by ten-percent at the end of the 2022 addendum review period.

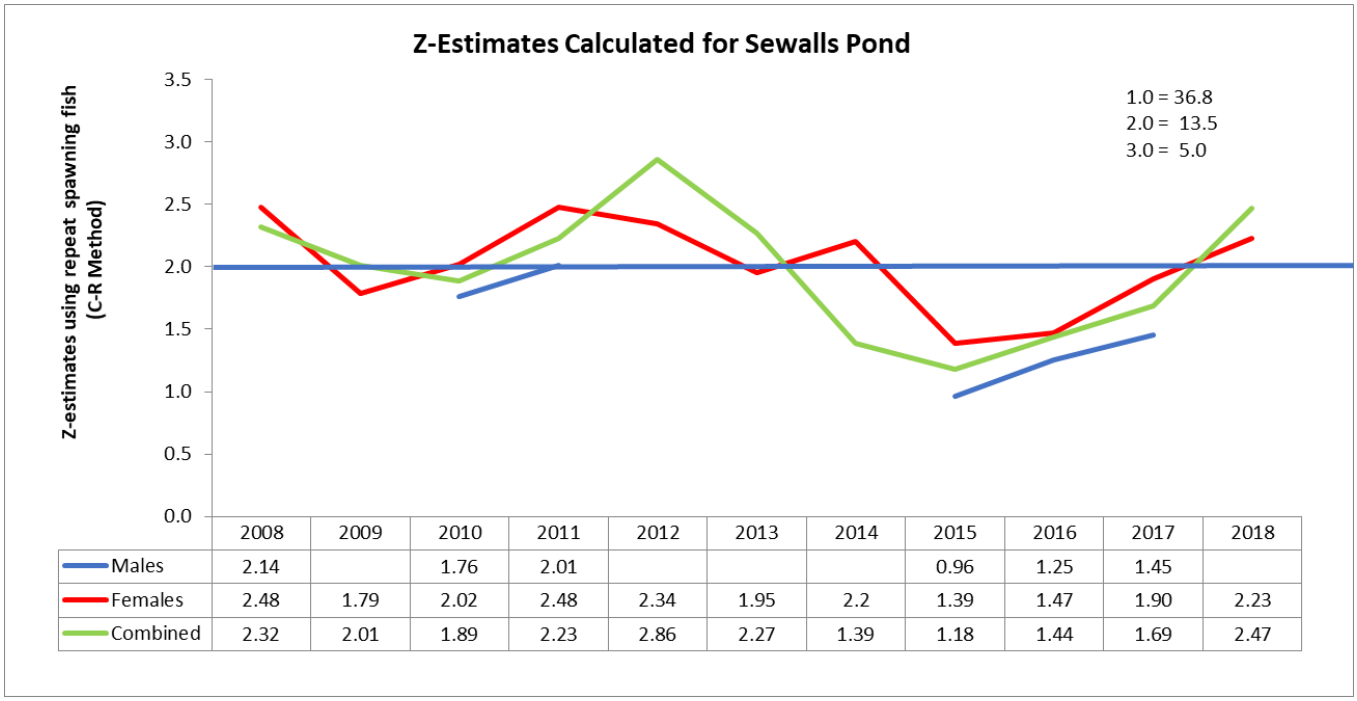
4) The release of a minimum spawning stock threshold of 235 fish/acre must be achieved annually. A commercial fishery that does not meet the minimum spawning stock escapement established for that system will be required to close the following season until fishery achieves the escapement goal for that year.

5) DMR and ASMFC Technical Committee fisheries staff will review age data, mortality rates, and repeat spawning rates and annual escapement derived from annual data collection to assess the need to suspend any fishery short of the five-year period.

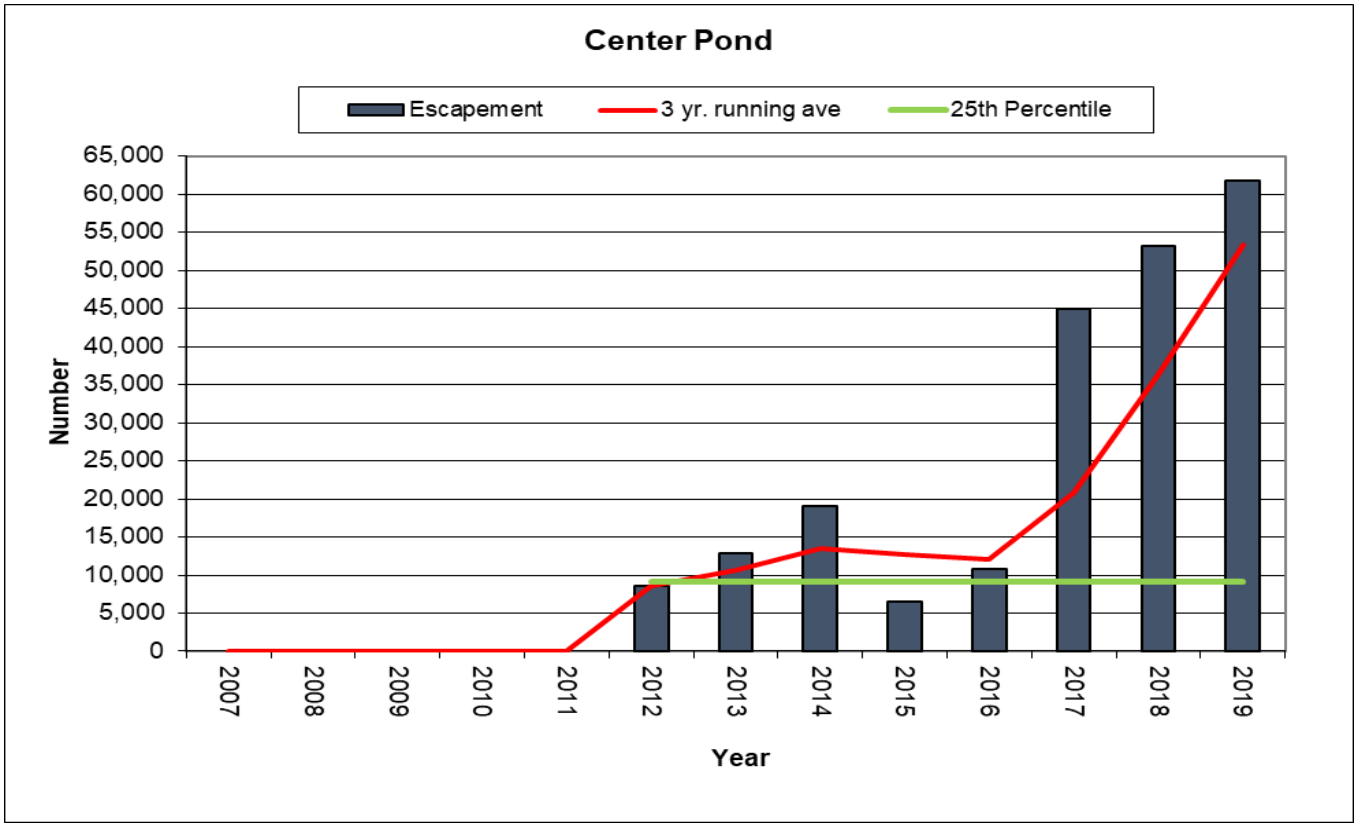


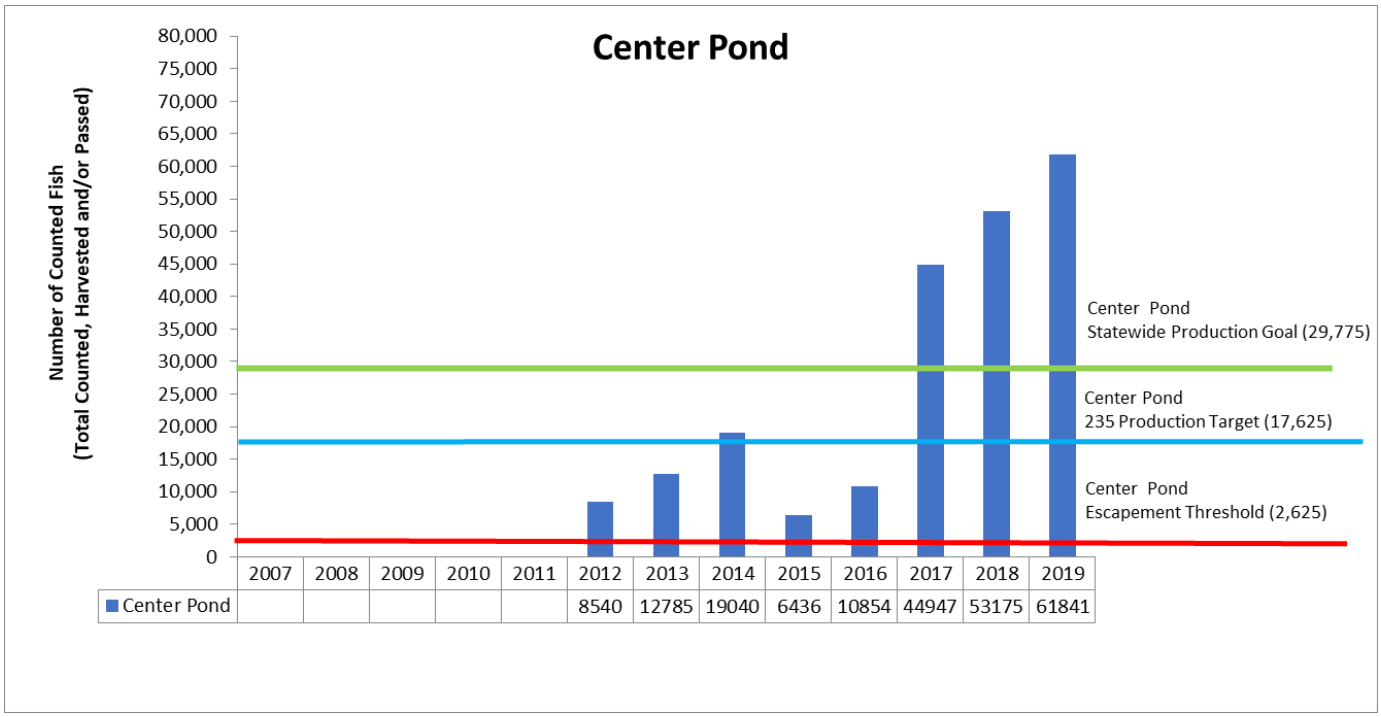


	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sewall Pond	1,058	2,827	1,789	2,041	5,092	12,552	3,984	7,023	4,566	5,331	32,005	34,150	23,014

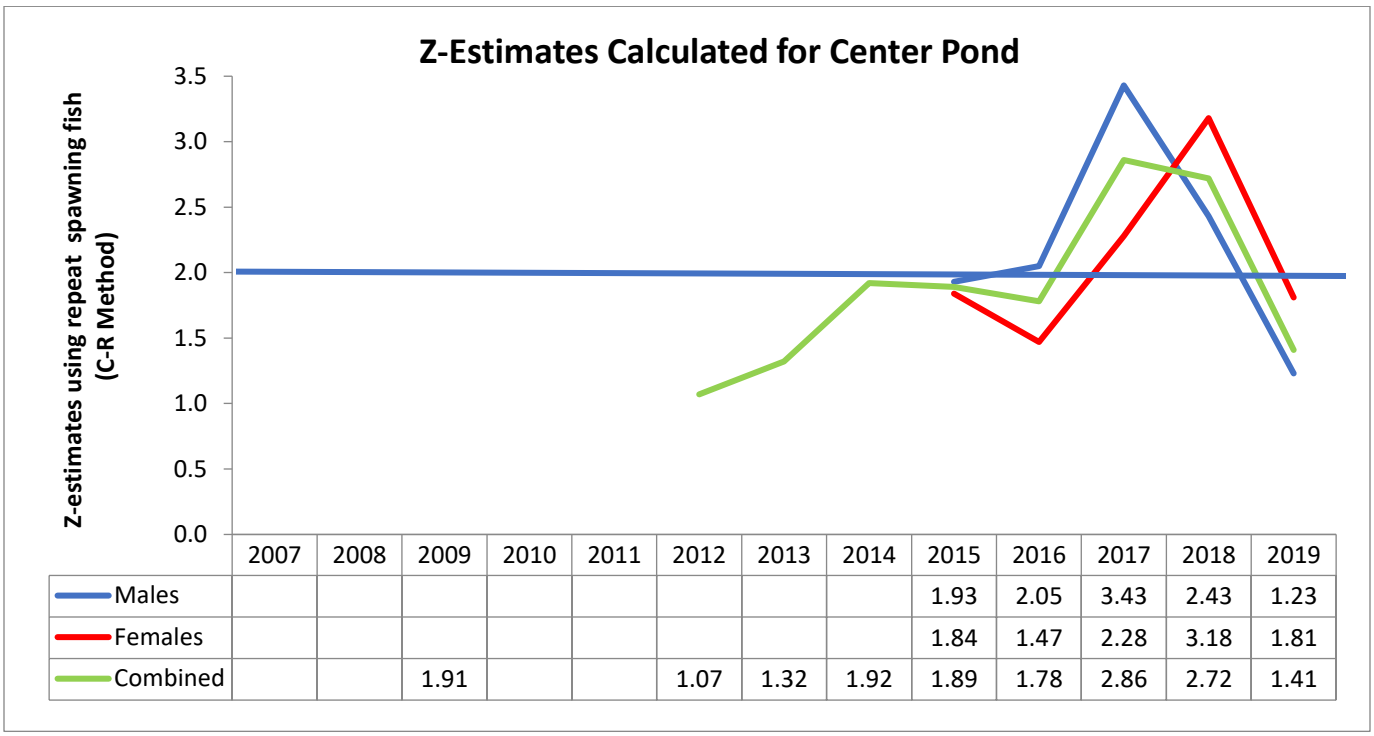


	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Males	2.14		1.76	2.01				0.96	1.25	1.45	
Females	2.48	1.79	2.02	2.48	2.34	1.95	2.2	1.39	1.47	1.90	2.23
Combined	2.32	2.01	1.89	2.23	2.86	2.27	1.39	1.18	1.44	1.69	2.47

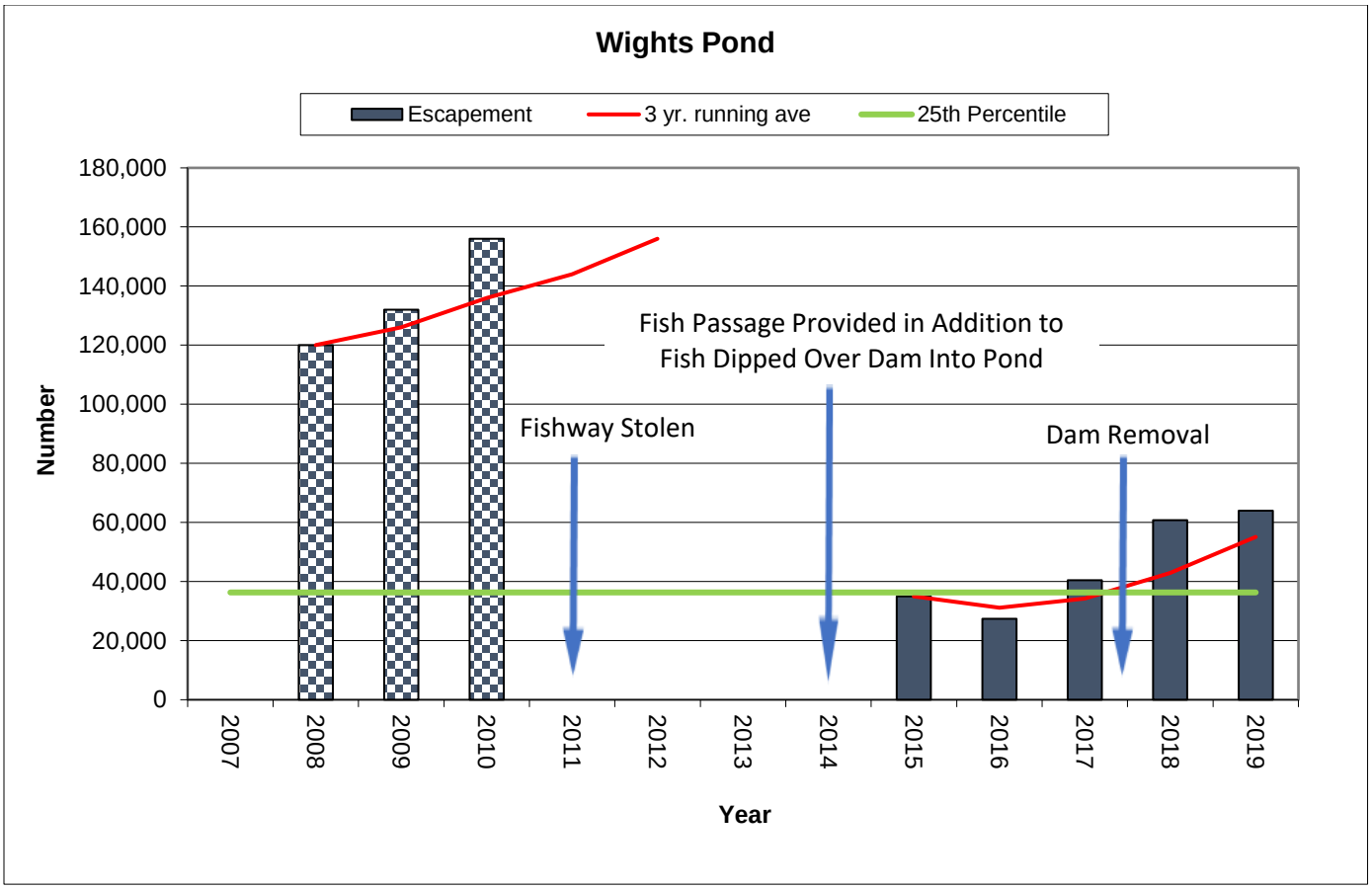


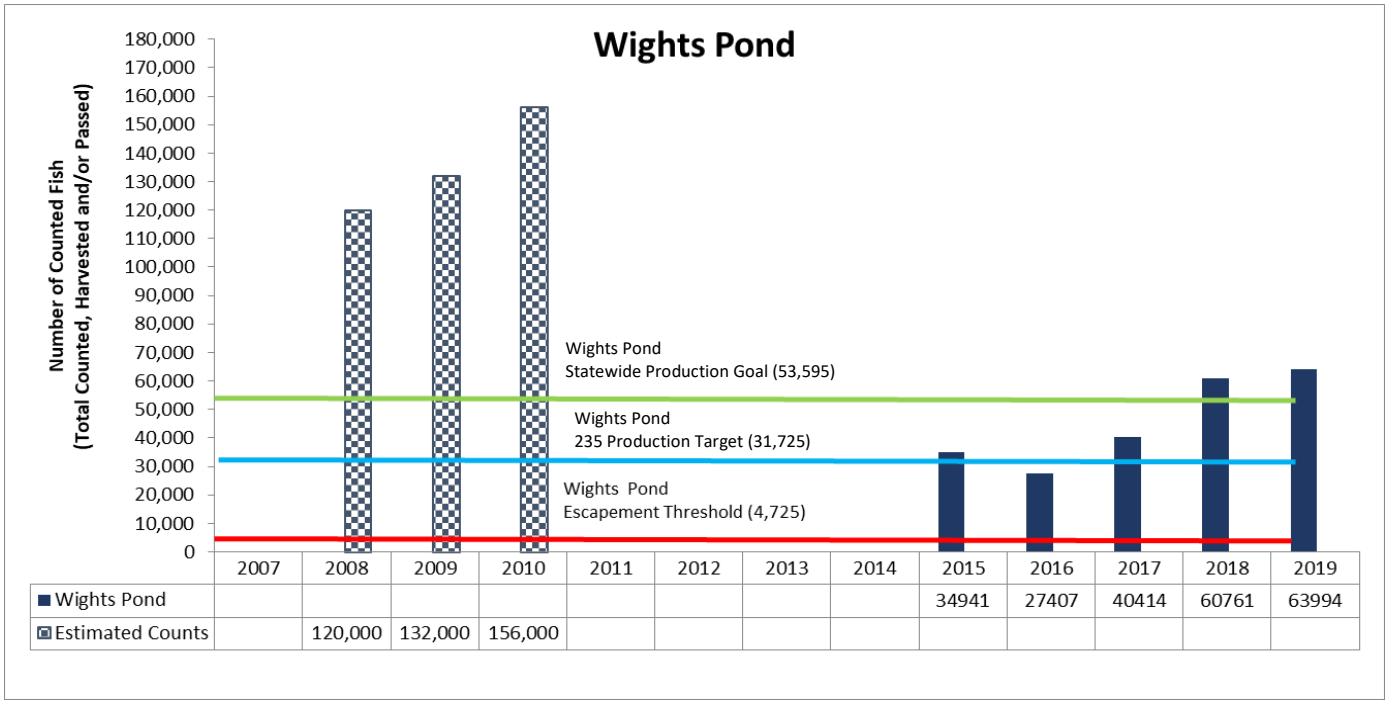


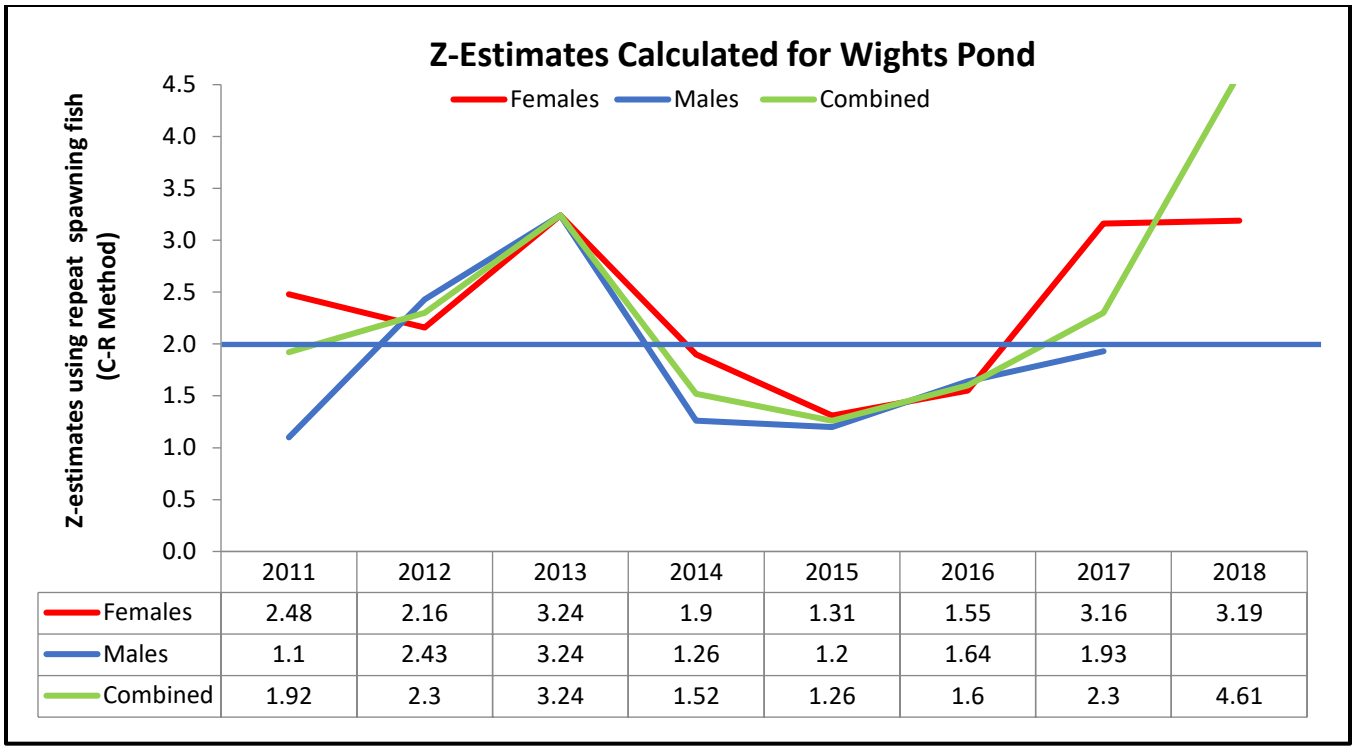
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Center Pond						8540	12785	19040	6436	10854	44947	53175	61841



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Males									1.93	2.05	3.43	2.43	1.23
Females									1.84	1.47	2.28	3.18	1.81
Combined			1.91			1.07	1.32	1.92	1.89	1.78	2.86	2.72	1.41


Wights Pond
Escapement
3 yr. running ave
25th Percentile
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Number
Fish Passage Provided in Addition to
Fish Dipped Over Dam Into Pond
Fishway Stolen
Dam Removal
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Year


Wights Pond
Number of Counted Fish
(Total Counted, Harvested and/or Passed)
180,000
170,000
160,000
150,000
140,000
130,000
120,000
110,000
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Wights Pond
Statewide Production Goal (53,595)
Wights Pond
235 Production Target (31,725)
Wights Pond
Escapement Threshold (4,725)
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
Wights Pond 34941 27407 40414 60761 63994
Estimated Counts 120,000 132,000 156,000



	2011	2012	2013	2014	2015	2016	2017	2018
Females	2.48	2.16	3.24	1.9	1.31	1.55	3.16	3.19
Males	1.1	2.43	3.24	1.26	1.2	1.64	1.93	
Combined	1.92	2.3	3.24	1.52	1.26	1.6	2.3	4.61