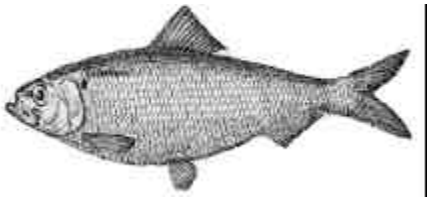
Cape Cod Cranberry Growers' Association
GROWER ADVISORY
Anadromous Fish

Anadromous Fish Background



Anadromous fish species such as alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*), collectively referred to as river herring are present in many river systems throughout southeastern Massachusetts. Anadromous fish normally live in the ocean but ascend fresh water streams to breed. Spawned in shallow areas of fresh water lakes, ponds, and impoundments as well as in streams, the young of the year migrate downstream to the ocean where they spend the next 3 to 4 years. After maturing sexually, the adult fish return each spring to spawn in the same watershed in which they were hatched using a highly developed sense of smell to detect the home stream.

Although river herring have been observed entering freshwater streams in Massachusetts as early as January, most spawning runs occur in late March to the end of May. Alewife spawning begins when water temperatures reach roughly 51^{o}, while blueback herring usually begin when water temperatures reach 57^{o}, as much as a 3 to 4 weeks difference. Immediately after spawning, most adult fish return to the sea although some may remain until much later.

Recent studies indicate that juvenile river herring may begin to leave nursery grounds as early as late June, although the greater numbers remain in ponds and lakes until the fall season. Environmental factors such as heavy rainfalls, high waters, and/or sharp declines in water temperature usually stimulate this downstream migration. Overall, less than 1% of the eggs laid survive to the juvenile stage.

Recommended Practices

Spring & Summer Recommendations

· Determine River Herring Populations in your Watershed

More than 100 Massachusetts rivers, streams, lakes, and ponds support anadromous fish populations. In general, river herring exist in lakes and ponds that have a river outlet to the ocean. Regardless of size, if a river eventually flows from a pond to the ocean there is a distinct possibility that an anadromous fish population exists. For any questions concerning the location of herring populations, please call Phillips Brady with the Massachusetts Division of Marine Fisheries, Southeast Office at (508) 563-1779.

· Remove Debris from Water Passages

During the spring, thousands of river herring journey upstream to spawn. If branches or debris from the past winter blocks the water passageway to these spawning grounds, these fish will be unable to propagate. Remove any branches or debris by hand to provide easier access. If there is an uncharacteristically large congregation of fish that does not appear to be moving upstream, investigate for potential blockage. If herring ladders are found to be impassable, contact the local herring warden in your town or the Division of Marine Fisheries Southeast Office. River herring may spawn in a stream as opposed to ponds if they are unable to reach their destination. This action negatively impacts survival of the young of the year**. In addition, impeding the passage of anadromous fish is illegal according to state law.**

· Holding Late Water

Holding late water in bogs with flow through rivers may adversely impact the river herring fishery and should be avoided. Reducing or stopping stream flow in the spring may prevent adult herring from reaching their breeding areas. Adults stranded in this manner may spawn in the stream or within the bog area, resulting in increased mortality of the young of the year. In some situations, portable fish ladders can be constructed of plywood to enable adult

herring to pass through late water flow through bogs. These types of situations need to be evaluated on a case-by-case basis. Division of Marine Fisheries can provide expertise evaluating the suitability of the site for a temporary ladder and may be able to provide assistance in constructing these temporary ladders.

. Pre-Harvest Run

If water is sufficient, releasing a flow pre-harvest, is an advisable way to release anadromous fish from the system. This is even more helpful in the closed systems involving tail-water recovery. If, on the other hand, water is limited, it should be conserved until the flow is deemed sufficient and released in the fall when the fry are ready to migrate and before the run begins to freeze over.

Fall Recommendations

· Exclusion of Herring During Fall Flooding Operations

During the fall season, young river herring will instinctively search for a current to follow downstream. Young fry exhibit a behavior known as negative rheotaxis, that is, they instinctively follow swift currents. In nature these currents would be the spawning area outlets to the sea. The current caused by a pulled board or a lift pump will also attract young herring. River herring following this current may swim onto bogs or be injured passing through the pump. To exclude herring from the bog during flooding operations, a screen with mesh size 1/4" or smaller for the juveniles to 3/8" for adults should be used. Modified flume screens, a small seine net, or screen material fastened to a floating boom should be used to separate the bog from the water withdrawal point. It is critical that the water velocity *at the screen* should be less than ½ foot per second to prevent the young herring from being impinged on the screen. If the velocity exceeds this rate at the screen, stake the screen further away from the pump intake to expand the area of coverage and lower the velocity rate. To calculate the amount of screen area you will need, use the formula: [(# gallons flow per minute at the pump or flume divided by 0.00223) divide this number by 0.5 to obtain the square feet of submerged screen you will need to insure a flow rate less than ½ foot per second].

> Example using a 2000 gpm pump: [(2000gpm X .00223 = 4.46) 4.46 divided by 0.5 = 8.92] A screen would need to have an area of 8.92 square feet of mesh submerged in the water to reduce the flow velocity to less than ½ foot per second.

It may be necessary to locate a debris screen in front of the herring screen to prevent plugging the small mesh. This screen can be of large mesh size.

Another method of excluding herring from the bog is to use a uniform flow velocity cap intake (UFVCI). The UFVCI was developed to protect power plant cooling water intakes. Essentially, the UFVCI is an intake drain submerged just above the floor of the water source. The cap is circular when viewed from above, and T-shaped in vertical section (see diagram below). The intake cap creates a uniform velocity of water flowing horizontally into the pipe, which is less likely to attract herring to the intake. A horizontal flow is easier for fish to negotiate around than a vertical flow. Juveniles tend to migrate close to shore and near the surface. If possible locate intakes deep and as far out into the water source as possible to avoid attracting juveniles.

Finally, herring like other fish have reduced vision clarity at dawn and dusk when the eye is adjusting from light to night vision and vise versa. Juvenile herring may move during these periods and are more likely to blunder into a bog flume or culvert that they would otherwise avoid. Pumping or flowing at dawn and dusk may increase the likelihood that herring may enter the bog and become stranded. Fish behavior can vary from location to location and is influenced by the type of pond bottom and the surrounding tree and brush cover.

· Removing River Herring from the Bog

If young fry swim onto a bog, dewater the bog slowly to allow these fish to enter the ditches and exit the bog. If water is released too rapidly, the river herring may be stranded in the vines. Also, it is important to be aware that the fry migrate in pulses, not all at once and this should be monitored by the grower. Thus, if water is sufficient it should be released in pulses. It is important to note that if flow is cut the exit of the headwater should be screened off so that fry in subsequent pulses do not become stranded.

. Be aware of the triggers to migration

Falling water temperatures are the first signals to the fry to return downstream. Typically, however this must be in conjunction with a rain event of significant size to markedly increase flow in a given run. After such an event the grower should be increasingly aware of the possibility for a migratory pulse.

· Ensure a Sufficient Water Flow

Massachusetts's law requires an adequate flow of water be maintained in anadromous fish runs to allow juveniles to move from the pond to the ocean (generally at least several inches depth of continuous flow in the riffle or shallowest part of the stream). Reducing water flow that prevents juveniles from leaving could be construed as an illegal activity.

· Harvesting Flow-Through Bogs with Herring Runs

The grower should plan harvest operations so that juvenile herring are not delayed from returning to the ocean. Screens should be placed on the intake side of the bog before flooding operations begin. Once it has been established there are no herring loitering in the bog channel, plank the exit flume and build up the harvest flood as quickly as possible. The bog should be harvested immediately. The intake screen can be removed once the flood level is down below the bog and in the ditch only. If flow through systems will be planked off longer than one week, the local herring officer or the Division of Marine fisheries should be consulted.

· Adhere to Wetland Laws Concerning Sedimentation

Suspended materials in water can damage fish gills. Be sure to observe wetland laws that prohibit releasing water with excessive turbidity. Refer to the Sanding BMP published by the Cranberry Station for more information regarding sedimentation prevention.

. Maintain screens and ladders

The fine mesh used in preventing fry from entering the pump can easily corrode or puncture. Even a small hole in the screen can render it useless as a means of excluding small fish. The screens as well other structures designed for the passage of anadromous fish should be checked annually.

For further information:

River Herring. Marine Recreational Fisheries Leaflet. Division of Marine Fisheries, 100 Cambridge Street, Boston, MA. 02202. CCCGA Office also has a limited supply.

Best Management Practices Guide for Massachusetts Cranberry Production: Sanding and Pesticide Application: Cranberry Experiment Station, E. Wareham, MA 02535

Moss, Sanford A., James G. Hoff, and Francis X. O'Brian. 1979. **Forecasting Fish Entrapment by Velocity Cap Intakes:** A Comparative Approach in New England Power Company Velocity Cap Fish Entrapment Assessment. Phase II, Comparative Study. Prepared for the Yankee Atomic Electric Company. Pp. 183-198

Anadromous Fish GIS Maps: CCCGA Office, 3203-B Cranberry Highway, East Wareham, MA 02538

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Massachusetts General Law Chapter 130 section 19
Providing Safe Passage for Anadromous Fish

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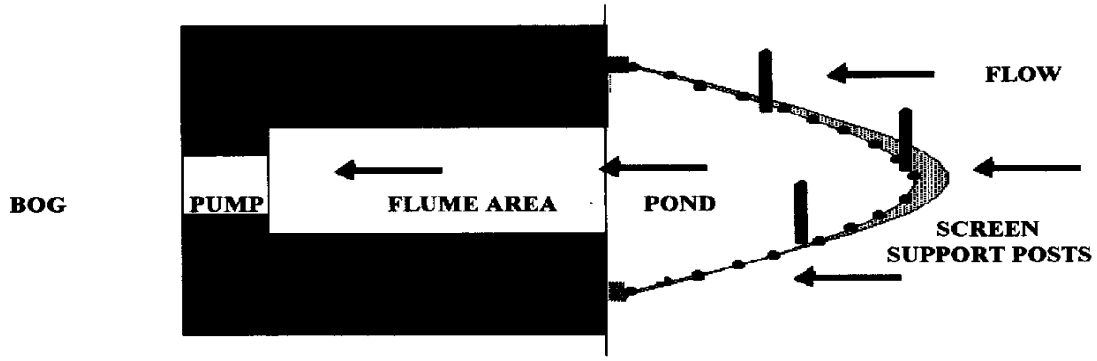
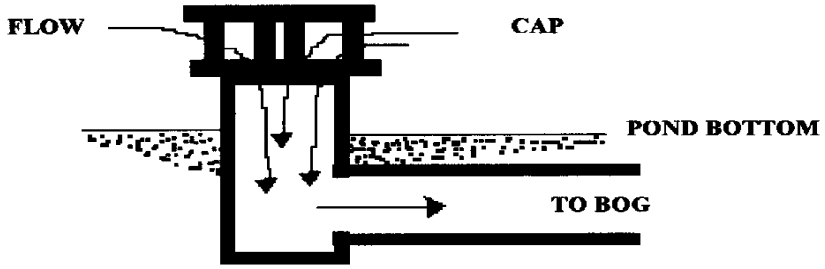
Appendix A

EXCLUSION SCREEN OVER BOG FLUME ENTRANCE



UNIFORM FLOW VELOCITY CAP INTAKE



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