Alewife Floater

Anodonta implicata

Federal Listing	N/A
State Listing	SGCN
Global Rank	G5
State Rank	S3
Regional Status	High

Photo by Ethan Nedeau

Justification (Reason for Concern in NH)

Freshwater mussels have declined dramatically in diversity, abundance, and distribution within the last 200 years and are considered the most imperiled fauna in North America (Richter et al. 1997, Lydeard et al. 2004). Because this species is of high regional concern and high regional responsibility, it was deemed a regional species of greatest conservation need. Because their populations are so closely linked to their species of anadromous host fish (Alewife, blueback herring, and American shad, which are also Species of Greatest Conservation Need in NH), their vulnerability is increased. The decline and loss of alewife in streams likely puts pressure on the alewife floater population, especially in habitats too small to support the American shad, which is typically a more common fish (Nedeau 2008). The prevalence of dams restricts anadromous fish distributions, thus restricting alewife floater distribution, and this has resulted in local extirpations historically (Nedeau et al 2000).

Distribution

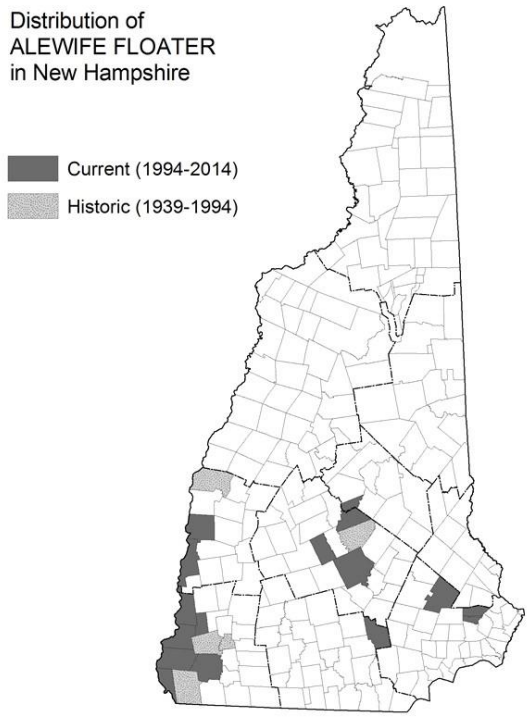
Its range stretches from Maryland up to Nova Scotia and New Brunswick (Nedeau 2008). In New Hampshire, alewife floaters are found in the southern half of the state where it has been observed in most major tributaries of the Connecticut River, the Ashuelot watershed, and scattered through the Merrimack River and Great Bay tributaries. The alewife floater was historically extirpated from many of these areas due to dams that blocked host fish passage, but installation of fish passageways has restored populations to many of these areas (Nedeau 2008). To accommodate for dam fragmentation, fisheries biologists distribute fish species throughout a watershed, and so it's possible that the moving of individual host fish has also moved alewife floaters. Since alewife floaters are attached to a host fish as juveniles, they could easily be moved along with the fish.

Habitat

Alewife floaters can be found in rivers, streams, ponds, and lakes. They seem to tolerate a variety of flow rates and substrate types within these waterbodies, ranging from cobble to silty or sandy. As part of its life cycle, all mussel species must attach to the fins or gills of a fish in order to grow and reach their next life stage, where they sink to the bottom of the waterbody and spend the rest of their lives. The alewife floater is only known to attach to alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), and American shad (*Alosa sapidissima*) (Nedeau 2008). Thus, alewife floaters will occur only in waterbodies that support populations of these host fish.

NH Wildlife Action Plan Habitats

- Large Warmwater Rivers
- Warmwater Rivers and Streams
- Warmwater Lakes and Ponds



Distribution Map

Current Species and Habitat Condition in New Hampshire

Alewife floater populations in NH have apparently benefited from the construction of fish passageways. However, populations remain limited in the state. In the sites where alewife floaters are found, they seem to be abundant in these areas. In areas where alewife, American shad, and blueback herring are plentiful and their populations stable, alewife floater populations are likely the most robust. Researchers encountered a portion of dead alewife floaters during surveys, although cause of death is undetermined.

Population Management Status

There is little management particularly for alewife floaters in New Hampshire. NHFG works to restore fish passage in rivers and streams throughout the state, which greatly benefits the alewife floater by supporting its host fish.

Regulatory Protection (for explanations, see Appendix I)

- Fill and Dredge in Wetlands - NHDES
- Rivers Management and Protection Program - NHDES
- Comprehensive Shoreland Protection Act - NHDES
- Clean Water Act-Section 404

Quality of Habitat

The quality of alewife floater habitat patches in NH is unknown.

Habitat Protection Status

Habitat protection is variable among stream reaches and regions of the state. Some protection of riparian areas is provided by the NH Comprehensive Shoreland Protection Act (NHDES).

Habitat Management Status

Currently there are no management or restoration efforts targeting alewife floater habitat in the state. However, the Nature Conservancy, the Monadnock Conservancy, the Society for the Protection of New Hampshire Forests, and the Southwestern Regional Planning Commission have developed a conservation plan for the Ashuelot River Watershed (Zankel 2004). The Connecticut River Joint Commission published a Connecticut River Management Plan in 2008 (http://crjc.org/pdffiles/WATER.final.pdf).

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a "medium" or "high" score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

Habitat degradation and mortality from dams that alter hydrology upstream and downstream (Threat Rank: High)

The conversion of free-flowing rivers to highly regulated rivers has seriously affected freshwater mussels (Locke et al. 2003, Watters 1996, Watters 1999). Barriers cause direct mortality, prevent dispersal, block gene flow, prohibit re-colonization of rehabilitated habitat, and prevent host fish migration (Layzer et al. 1993, Parmalee and Hughes 1993, Vaughn and Taylor 1999, Watters 1996). Cycles of extreme flooding and dewatering cause direct adult mortality by scouring. Extreme fluctuations in flow disrupt mussels by exposing young mussels to flood-induced damage, mortality, or displacement to unfavorable habitat downstream (Layzer et al. 1993, Layzer and Madison 1995, Hardison and Layzer 2000). Dewatering exposes mussels to heat, desiccation, and opportunistic predators. Predator foraging efficiency increases with decreasing depth.

The Connecticut River watershed has an extraordinary number of dams (Nedeau 2008). Multiple dams within a watershed leads to mussel populations that are isolated and therefore at a higher risk of extirpation (Nedeau 2008). Evidence of the impact on alewife floaters in New Hampshire has not been studied or documented. However, more studied mussel populations, such as the Dwarf Wedge mussel which has similar habitat preferences, have been separated in every river system they inhabit.

During a period of low water in 1997, 163 brook floaters (another similar freshwater mussel) downstream from the Gregg Falls Hydroelectric Dam on the Piscataquog River were lost to predation (Wicklow, Saint Anselm College, unpublished data). In addition, over 100 dwarf wedgemussel valves were collected from muskrat middens in a 15-meter segment of the Ashuelot River during a period of extremely low water (von Oettingen, USFWS and Wicklow, Saint Anselm College, unpublished).

Habitat impacts (fragmentation) from dams that cause inhospitable stream conditions (Threat Rank: High)

Fragmentation from dams or undersized stream crossings causes many issues for mussel populations. This impacts how water flows and transports sediment through the system (Nedeau 2008). Dams can produce low flow conditions which reduce availability of mussel habitat and can increase vulnerability to other threats.

The Connecticut River watershed has an extraordinary number of dams (Nedeau 2008). Multiple dams within a watershed lead to mussel populations that are isolated and therefore more susceptible to other threats such as pollution and habitat degradation (Nedeau 2008, Strayer et al. 1996). Dams can alter stream temperatures in impoundments and downstream areas (Nedeau 2008), which can have direct impacts on mussel species and/or their host fish species.

Any combination of increased water temperature, lack of water, low dissolved oxygen levels, and concentrated pollutants can create inhospitable stream conditions for freshwater mussels (Nedeau 2008). Dams and culverts constrict channels and can cause these poor stream conditions. More common mussel species have shown a decline in abundance downstream of a road crossing (Levine et al. 2003), although this hasn't been specifically studied for alewife floaters.

Habitat degradation and mortality from increased flooding that destroys mussel beds (Threat Rank: High)

Cycles of extreme episodic flooding and dewatering use cause direct adult mortality by scouring. Extreme fluctuations in flow disrupt mussel life cycles by exposing young mussels to flood-induced damage, mortality, or displacement to potentially unfavorable habitat downstream (Layzer et al. 1993, Richter et al. 1997). Dewatering exposes mussels to heat, desiccation, and opportunistic predators. Predator foraging efficiency increases with decreasing depth.

Road stream crossings are extremely common and can impact habitat conditions and have negative impacts on aquatic life. Undersized culverts can be problematic in times of high flow or storm conditions, where flooding may result. In addition, dam maintenance often requires periodic de-watering and flooding that changes the habitat conditions, which has direct impacts on aquatic species (Nedeau 2008). Flooding typically leads to sedimentation, which can cause mass mortality of mussel beds.

Species impacts from reduction or loss of host fish from degraded habitat and species composition changes (Threat Rank: High)

Freshwater mussels may be threatened by changes in fish species composition. Freshwater mussels spend their initial stage of life (called glochidia) attached to the gills, fins and scales of certain fishes. When the mussel drops off the fish as a juvenile, it lives the rest of its life as a suspension feeder on bacteria and organic matter. If host fish are removed from the environment, it's likely that the dependent mussel species will be extirpated.

The alewife floater was historically extirpated from much of its range due to dams that blocked host fish passage, but installation of fish passageways has restored populations to many of these areas (Nedeau 2008). The three main host fish for alewife floater are the Alewife, blueback herring, and American shad, which are all Species of Greatest Conservation Need in New Hampshire.

Mortality from drawdowns for plant control and waterbody management (Threat Rank: Medium)

Drawdowns and the associated dewatering expose mussels to heat, desiccation, and opportunistic predators. Cycles of extreme dewatering can cause direct adult mortality by scouring. Extreme fluctuations in flow disrupt mussel life cycles by exposing young mussels to flood-induced damage, mortality, or displacement to potentially unfavorable habitat downstream (Layzer et al. 1993, Richter et al. 1997). Predator foraging efficiency increases with decreasing depth.

In New Hampshire, drawdowns typically occur in winter months for maintenance and flood control purposes, and occasionally for aquatic plant control. Drawdowns conducted under certain conditions allow drying and freezing of the sediments that become exposed, causing damage or death to certain aquatic weed species. Following a drawdown event, aquatic vegetation and organisms may exhibit changes in species composition and density by causing direct mortality to species and changes to habitat suitability.

List of Lower Ranking Threats:

Habitat degradation and mortality from streambank stabilization

Habitat degradation and mortality from impervious surface run-off that contains excess nutrients, sediment and toxins

Mortality from recreational activities within a stream that can crush mussels

Mortality from the introduction and spread of problematic diseases and parasites

Species impacts from introduced or invasive animals that result in competition, predation, and reduced habitat quality

Habitat impacts from introduced or invasive plants

Habitat impacts and disturbance from development of riparian habitats that increases stream temperature

Habitat degradation and mortality from development of shorelines

Mortality from chemical treatments for nuisance plant control in waterbodies

Actions to benefit this Species or Habitat in NH

Direct swimming and fishing access points away from mussel beds

Primary Threat Addressed: Mortality from recreational activities within a stream that can crush mussels

Specific Threat (IUCN Threat Levels): Human intrusions & disturbance

Objective:
Reduce mortality of mussels from recreational activities within a stream, river or pond.

General Strategy:
As additional information on mussel occurrences is collected and mapped, managers should consider ways to direct recreational activities away from sensitive mussel beds. This can include strategically placing docks, boat launches, parking areas, beaches, and trails away from documented mussel beds.

This will help reduce disturbance to mussels, reduce the potential for direct mortality, and help reduce pollution and sedimentation into mussel habitat. Targeted outreach to fishermen may occur coinciding with this effort, advising that mussels not be cracked open and used for bait. This has been commonly observed during mussel surveys.

Political Location:
Belknap County, Cheshire County, Hillsborough County, Merrimack County, Rockingham County, Sullivan County

Watershed Location:
Lower CT Watershed, Merrimack Watershed, Coastal Watershed

Research and monitoring to evaluate current mussel populations and distribution, and to detect new mussel populations

Objective:
Surveys to detect mussel populations and collect additional land use data in mussel-occupied habitats is needed to better inform management decisions and create conservation plans for the species.

General Strategy:
General distribution surveys should be focused on historic sites and areas where data is lacking. Data on population structure, age class distribution, sex ratio, recruitment, growth rates, and migration is needed, as well as distribution and abundance data on host fish. Studies may also examine the effects of predation and competition. Research is needed to determine the biological response of mussels to artificial flow regimes. Response variables include displacement of juveniles, interference of spawning success, larval release patterns, and host fish attachment success. Villella et al. (2004) used mark-recapture techniques to estimate survival, recruitment, and population growth of freshwater mussels, and this technique could provide valuable demographic information. Currently, much of the information on the condition of mussel populations and habitat is qualitative. Needed are quantitative studies to assess the physical habitat, including sediment type and hydrology, particularly shear, and water quality. As actions are initiated and populations potentially enlarge, mussel sites should be monitored using quantitative, statistically valid methods. Water quality monitoring stations upstream of mussel populations must be established.

Political Location:
Belknap County, Cheshire County, Hillsborough County, Merrimack County, Rockingham County, Sullivan County

Watershed Location:
Lower CT Watershed, Merrimack Watershed, Coastal Watershed

Restoration and management of streams and rivers, with an emphasis on reducing stream fragmentation and restoring natural flow regimes, reducing pollution and riparian disturbance

Primary Threat Addressed: Habitat degradation and mortality from dams that alter hydrology upstream and downstream

Specific Threat (IUCN Threat Levels): Natural system modifications

Objective:

Restoration of fragmented rivers will allow increased dispersal, increasing the overall potential for persistence of mussels. As mussels are established in new habitat, linear range, recolonization, and population size increase.

General Strategy:

Stream fragmentation, and attendant gene flow restrictions, will be reduced by removing barriers such as nonfunctional dams, where feasible, by operating dams at "run of the river" flow regimes, and by rehabilitating degraded river reaches. These measures will increase dispersal and re-colonization of mussels into rehabilitated river reaches. Mussel populations and habitats must be assessed prior to implementation. Mussels found below a dam removal site or rehabilitated river reach may appear within 3 to 5 years, but 10 to 20 years or more may be necessary to establish a viable population. Riparian protection and restoration will be a long-term effort. As additional water quality and habitat assessment information is collected, efforts can be redirected or expanded. Pollution may render stream reaches uninhabitable. Destruction and transformation of riparian corridors accelerates erosion, bank sloughing, and runoff leading to increased levels of stream toxins, sediment, and higher stream temperatures. Education should be provided to adjacent landowners about practices that contribute pollutants into nearby rivers, streams, and ponds. Protection of riparian corridors through fee simple land acquisition, conservation easements, and private landowner cooperation will reduce pollution runoff and sedimentation. Properly sized culverts will reduce sedimentation and mass mortality of mussel beds. Surveys are needed to choose long-term, quantitative monitoring sites in occupied rivers and streams to assess patterns of disturbance and pollution. Following riparian disturbance mitigation or efforts to decrease pollution, the initial response of mussel populations should be monitored with qualitative surveying. As mussel populations increase in size, quantitative methods will be used (Strayer and Smith 2003). As additional water quality and habitat assessment information is collected, efforts can be redirected or expanded. The number of reproducing subpopulations of mussels will indicate the success of the program.

Political Location:

Belknap County, Cheshire County, Hillsborough County, Merrimack County, Rockingham County, Sullivan County

Watershed Location:

Lower CT Watershed, Merrimack Watershed, Coastal Watershed

References, Data Sources and Authors

Data Sources

Literature review, expert review and consultation, and NH mussel survey data (NH Mussel database 2015, Gabriel 1995).

Distribution data was obtained from unpublished reports, scientific literature, and consultation with experts. The threat assessment was conducted by Michael Marchand (NHFG), Barry Wicklow (St Anselm College), and Susi von Oettingen (USFWS).

Data Quality

NHFG has kept records of all mussel occurrences reported from surveys. NHFG also maintains records of mussel species submitted through the NH Wildlife Sightings online reporting website (http://nhwildlifesightings.unh.edu). Many mussel surveys occurring in New Hampshire were

monitoring projects in response to hydroelectric projects or dam impact studies.

The Connecticut River main stem has been surveyed and intermittently monitored for mussels since 1988. Early surveys were conducted by canoe and snorkeling in shallow water, usually within 15 meters of the bank, and later SCUBA surveys were used to survey depths greater than 1.5 meters. The Ashuelot River population downstream of the Surry Mountain flood control dam has been periodically monitored since 1991 (Gabriel and Strayer 1995). In 2004, Nedeau conducted a quantitative survey of dwarf wedgemussels in the Ashuelot River downstream of the Surry Mountain dam, and recorded alewife floater occurrences.
Condition information for alewife floater in New Hampshire is lacking and needs further study.

2015 Authors:
Loren Valliere, NHFG

2005 Authors:
N/A - Species was not listed as SGCN during 2005 WAP

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