Predation and Disease Excerpt of Endangered Species Act Listing Determination for Alewife and Blueback Herring

Prepared for River Herring TEWG Species Interaction Subgroup

Disease

Little information exists on diseases that may affect river herring; however, there are reports of a variety of parasites that have been found in both alewife and blueback herring. The most comprehensive report is that of Landry et al. (1992) in which 13 species of parasites were identified in blueback herring and 12 species in alewives from the Miramichi River, New Brunswick, Canada. The parasites found included one monogenetic trematode, four digenetic trematodes, one cestode, three nematodes, one acanthocephalan, one annelid, one copepod and one mollusk. The same species were found in both alewife and blueback herring with the exception of the acanthocephalan, which was absent from alewives.

In other studies, Sherburne (1977) reported piscine erythrocytic necrosis (PEN) in the blood of 56 percent of prespawning and 10 percent of postspawning alewives in Maine coastal streams. PEN was not found in juvenile alewives from the same locations. Coccidian parasites were found in the livers of alewives and other finfish off the coast of Nova Scotia (Morrison and Marryatt, 1990). Marcogliese and Compagna (1999) reported that most fish species, including alewife, in the St. Lawrence River become infected with trematode metacercariae during the first years of life. Examination of Great Lakes fishes in Canadian waters showed larval Diplostomum (trematode) commonly in the eyes of alewife in Lake Superior (Dechtiar and Lawrie, 1988) and Lake Ontario (Dechtiar and Christie, 1988), though intensity of infections was low (<9/host). Heavy infections of Saprolegnia, a fresh and brackish water fungus, were found in 25 percent of Lake Superior alewife examined, and light infections were found in 33 percent of Lake Ontario alewife (Dechtiar and Lawrie, 1988). Larval acanthocephala were also found in the guts of alewife from both lakes. Saprolegnia typically is a secondary infection, invading open sores and wounds, and eggs in poor environmental conditions, but under the right conditions it can become a primary pathogen. Saprolegnia infections usually are lethal to the host.

More recently, alewives were found positive for Cryptosporidium for the first time on record by Ziegler et al. (2007). Mycobacteria, which can result in ulcers, emaciation, and sometimes death, have been found in many Chesapeake Bay fish, including blueback herring (Stine et al., 2010).

Predation

Information on predation of river herring was compiled and published in Volume I of the River Herring Benchmark Assessment (2012) by ASMFC. The following section on predation was compiled by Dr. Katie Drew from this assessment.

Alewife and blueback herring are an important forage fish for marine and anadromous predators, such as striped bass, spiny dogfish, bluefish, Atlantic cod, and pollock (Bowman et al., 2000; Smith and Link, 2010). Historically, river herring and striped bass landings have tracked each other quite well, with highs in the 1960s, followed by declines through the 1970s and 1980s.
Although populations of Atlantic cod and pollock are currently low, the populations of striped bass and spiny dogfish have increased in recent years (since the early 1980s for striped bass and since 2005 for spiny dogfish), while the landings and run counts of river herring remain at historical lows. This has led to speculation that increased predation may be contributing to the decline of river herring and American shad (Hartman, 2003; Crecco et al., 2007; Heimbuch, 2008). Quantifying the impacts of predation on alewife and blueback herring is difficult. The diet of striped bass has been studied extensively, and the prevalence of alosines varies greatly depending on location, season, and predator size (Walter et al., 2003). Studies from the northeast U.S. continental shelf show low rates of consumption by striped bass (alewife and blueback herring each make up less than 5 percent of striped bass diet by weight) (Smith and Link, 2010), while studies that sampled striped bass in rivers and estuaries during the spring spawning runs found much higher rates of consumption (greater than 60 percent of striped bass diet by weight in some months and size classes) (Walter and Austin, 2003; Rudershausen et al., 2005). Translating these snapshots of diet composition into estimates of total removals requires additional data on both annual per capita consumption rates and estimates of annual abundance for predator species.

The diets of other predators, including other fish (e.g., bluefish, spiny dogfish), along with marine mammals (e.g., seals) and birds (e.g., double-crested cormorant), have not been quantified nearly as extensively, making it more difficult to assess the importance of river herring in the freshwater and marine food webs. As a result, some models predict a significant negative effect from predation (Hartman, 2003; Heimbuch, 2008), while other studies did not find an effect (Tuomikoski et al., 2008; Dalton et al., 2009).

In addition to predators native to the Atlantic coast, river herring are vulnerable to invasive species such as the blue catfish (*Ictalurus furcatus*) and the flathead catfish (*Pylodictis olivaris*). These catfish are large, opportunistic predators native to the Mississippi River drainage that were introduced into rivers on the Atlantic coast. They have been observed to consume a wide range of species, including alosines, and ecological modeling on flathead catfish suggests they may have a large impact on their prey species (Pine, 2003; Schloesser et al., 2011). In August 2011, ASMFC approved a resolution calling for efforts to reduce the population size and ecological impacts of invasive species and named blue and flathead catfish specifically, as species of concern, due to their increasing abundance and potential impacts on native anadromous species. Non-native species are a particular concern because of the lack of native predators, parasites, and competitors to keep their populations in check.

Predation and multispecies models, such as the MS-VPA (NEFSC, 2006), have tremendous data needs, and more research needs to be conducted before they can be applied to river herring. However, given the potential magnitude of predatory interactions, it is an area of research worth pursuing (ASMFC, 2012).

Two papers have become available since the ASMFC (2012) stock assessment that discuss striped bass predation on river herring in Massachusetts and Connecticut estuaries and rivers, showing temporal and spatial patterns in predation (Davis et al., 2012; Ferry and Mather, 2012). Davis et al. (2012) estimated that approximately 400,000 blueback herring are consumed annually by striped bass in the Connecticut River spring migration. In this study, striped bass
were found in the rivers during the spring spawning migrations of blueback herring and had generally left the system by mid-June (Davis et al., 2012). Many blueback herring in the Connecticut River are thought to be consumed prior to ascending the river on their spawning migration, and are, therefore, being removed from the system before spawning. Alternatively, Ferry and Mather (2012) discuss the results of a similar study conducted in Massachusetts watersheds with drastically different findings for striped bass predation. Striped bass were collected and stomach contents analyzed during three seasons from May through October (Ferry and Mather, 2012). The stomach contents of striped bass from the survey were examined and less than 5 percent of the clupeid category (from 12 categories identified to summarize prey) consisted of anadromous alosines (Ferry and Mather, 2012). Overall, the Ferry and Mather (2012) study observed few anadromous alosines in the striped bass stomach contents during the study period. These two recent studies echo similar contradictory findings from previous studies showing a wide variation in predation by striped bass with spatial and temporal effects; however, they exhibit no consistent trends along the coast.

**Summary and Evaluation for Factor C**

While data are limited, the best available information indicates that river herring are not likely affected to a large degree by diseases caused by viruses, bacteria, protozoans, metazoans, or microalgae. Much of the information on diseases in alewife or blueback herring comes from studies on landlocked species; therefore, even if studies indicated that landlocked alewife and blueback herring were highly susceptible to diseases and suffered high mortality rates, it is not known whether anadromous river herring would be affected in the same way. While it may be possible that disease threats to river herring could increase in prevalence or magnitude under various climate change scenarios, there are currently no data available to support this supposition. We have included disease as a threat in the qualitative threats assessment described in detail below.

Alewife and blueback herring are considered to be an important forage fish for many marine and anadromous predators, and therefore, may be affected by predation, especially if some populations of predators (e.g., striped bass, spiny dogfish) continue to increase. There may also be effects from predation by invasive species such as the blue and flathead catfish. Some predation and multispecies models have estimated an effect of predation on river herring, while others have not. In general, the effect of predation on the persistence of river herring is not fully understood; however, predation may be affecting river herring populations and consequently, it is included as a threat in the qualitative threats assessment described below.


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1 Factor C includes consideration of disease and predation.


