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Bristol Mills Dam Advisory Committee Hosts Sea-Run Fish Researcher from the University of Maine

Bristol, Maine – May 13, 2017 – On May 9th, Dr. Joseph Zydlewski of the University of Maine presented information to the Bristol Mills Dam Committee about the effect of dams and fish passage on sea-run fish populations. This material will inform the Committee's report to the Town that presents options for improvements to fish passage, water level control, and other factors under consideration as part of an ongoing feasibility study.

Zydlewski is a professor in the Department of Wildlife, Fisheries, and Conservation Biology at the University of Maine, Orono. His work centers on fish movements and migrations, including studies of river restoration, physiology and behavior during migration, and species interactions.

In his presentation to the Dam Committee, Zydlewski described four main causes that have led to declines in sea-run fish populations over the past two centuries: loss of habitat, over-exploitation, climate change, and human barriers, of which dams are a major factor. Together with his colleagues and students, Zydlewski's research has found that dams not only block sea-run fishes' access to habitat, but also affect fish behavior and fitness, increase mortality, change the population structure (e.g. average size and age of fish), and reduce the ecological services that sea-run fish provide in freshwater ecosystems. Zydlewski noted that each dam removal has an impact on the species composition in a river. Warm water species, such as golden shiners, may decline when a river is restored to its natural flow, while migratory fish like river herring and shad see population increases.

Sea-run fishes, like alewife, American shad, sea lamprey, and Atlantic salmon, among others, move between the ocean and freshwater during different parts of their life cycle. Most of these species spend their adult lives in ocean waters, returning to their natal rivers to spawn. Larval and juvenile sea-run fish live in freshwater anywhere from a few months (e.g. alewife and shad), to multiple years (e.g. salmon and sea lamprey). Zydlewski presented research showing that blocking access to freshwater spawning areas resulted in population crashes of these species, but that when access was restored through installation of fish passage or dam removal, the populations had the potential to recover quickly.

However, some of his research found that even when fish passage was available, it may not effectively pass all species. In a study at the Veazie Dam on the Penobscot River (removed in 2013), Zydlewski's research found schools of salmon and shad congregating below the dam in high numbers, while only a handful of individuals of each species passed the top of the fishway. Further, even when dams have fish passage installed, migration may still be delayed as fish find the entrance to the fishway. This causes the fish to expend energy during this important part of its life cycle. In turn, the fish may have lower reproductive success and be at a higher risk of dying before completing its migration.

After spawning, most adult sea-run fish return to ocean waters, and juvenile fish must migrate downstream to ocean waters after their time in freshwater is complete. Research from

Zydlewski's group has found that Atlantic salmon smolts (juvenile salmon making their downstream migration from freshwater to salt water) had higher mortality coincident with the number of dams they passed. Salmon smolts that did not pass any dams during their downstream migration had significantly lower mortality rates. During downstream migrations, both adult and juvenile fishes can be subject to death and injury due to falls, being directed through high velocity downstream passage, and in the case of hydropower dams, being hit by turbines. Not all of these impacts result in immediate death – injuries such as losing scales can weaken fish and make them more susceptible to infection and disease, increasing their mortality rate later.

Even when fish passage is installed, shifts in the demography of sea-run fish populations have been found because many passage structures are successful for only certain sizes of fish. These changes, for example in age structure, can alter a population in the same way that an over-harvested fishery changes the demography of a fish population. In a study comparing American shad populations in a river with open migration corridors to a river with multiple dams, Zydlewski's group found that older, larger shad were not found in the latter. This is a concern because as numbers of older fish decline there is a consequent impact on the species as a whole. Older fish not only help "lead" spawning migrations, being the first to arrive each year and possibly navigating the run, but also because older, larger fish tend to be more successful at spawning, produce more offspring because they carry more eggs or milt, and their young have greater fitness.

Sea-run fishes have diverse roles in freshwater ecosystems that are abated when migrations are blocked or limited by dams and inefficient fishways. For example, when sea lampreys spawn each fall, they stir up the stream bed, cleaning substrate of debris and exposing the gravel that trout and salmon use for spawning nests. Migratory fish also provide nutrient exchange between fresh and saltwater. Sea-run fish that die after spawning, like lamprey, provide marine derived nutrients that are incorporated into juvenile and adult fishes living in freshwater at a time when available freshwater nutrients are limited. Zydlewski's group has found that Atlantic salmon juveniles grow larger and faster in streams where lamprey have spawned and died.

Zydlewski concluded with the surprising image of the 'lures' exhibited by a species of freshwater mussels, which imitate small prey for fish. Because these mussels are not mobile, they developed an alternative means to successfully reproduce and disperse their offspring. These lures attract fish to bite these structures which contain their spawning gametes. The fish then collect the mussels' gametes in its mouth, and disperse the spawn to other areas in the stream.

Upcoming meetings of the Bristol Mills Dam Advisory Committee will include discussions about various options for the site (May 23), and a presentation by Wright Pierce Engineering about potential improvements and considerations for firefighting water supply (June 13). The Committee meets the 2nd and 4th Tuesday of every month from 6-8pm at the Bristol Town Office. All meetings are open to the public and all Committee materials, including supplementary reports and background information, are available at the Town Office. We hope to share this process with as many town residents and interested people as possible. Please join us to learn more about this valuable resource. The Dam Committee welcomes Public Comments.