Habitat Restoration Efforts Emphasize Stream Connectivity

Results of a two-year survey of stream crossings throughout the Casco Bay watershed are guiding ongoing efforts to improve passage for brook trout and anadromous fish while reducing flooding risks and maintenance costs.

Dams and Culverts around Casco Bay Block Access to Critical Spawning Habitats

For decades, dams, railroads, and roads within the Casco Bay watershed have prevented native fish and other aquatic organisms from reaching critical upstream habitats, limiting their population and distribution (Maine IFW 2015). Restoring connectivity between diverse aquatic ecosystems is critical to historically abundant native freshwater and migratory fish, such as Eastern brook trout, shad, blueback herring, alewife, sturgeon, and striped bass.

Undersized, perched and deteriorating culverts can restrict the movement of water, sediments, wood and organisms in riverine systems—diminishing habitat, causing structural failure of road crossings, exacerbating dangerous flooding and requiring costly repairs and maintenance (Gillespie *et al.* 2014). Where roads and other structures cross wetlands, they typically alter local hydrologic conditions, degrading the wetlands.

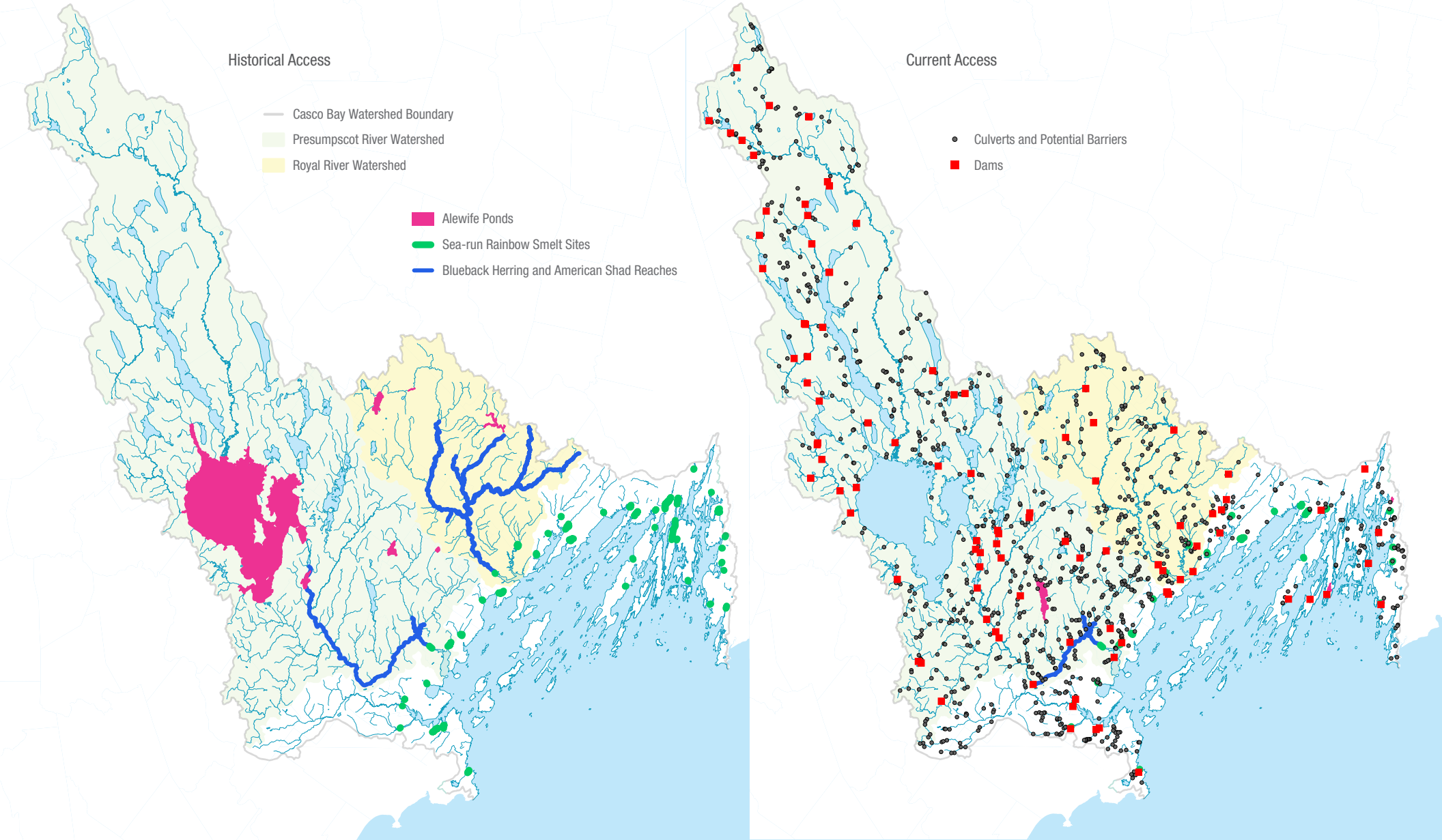
Most Road Crossings within the Watershed Restrict Fish Passage

In 2009–2010, the U.S. Fish and Wildlife Service Gulf of Maine Coastal Program —in cooperation with CBEP and Trout Unlimited volunteers—surveyed fish-passage restoration opportunities throughout the watershed. Among more than

CBEP helped facilitate installation in 2011 of a pipe arch culvert in Brunswick, increasing tidal exchange into Thomas Bay Marsh. CBEP has identified more than 70 potential tidal restrictions around Casco Bay, and assessed over 20 of these sites. Since 2011, CBEP has worked with partners to restore tidal flow at three salt marshes and to monitor ecosystem response.

Fish Passage in the Casco Bay Watershed: Historical versus Current

Historical access to the Casco Bay watershed for shad, blueback herring, alewife, and smelt, compared with current access. *Note:* Historical documents confirm that the main stem of the Presumpscot River supported abundant smelt, blueback herring, alewife, and shad, as well as Atlantic salmon. Historical use of many of the Presumpscot's tributaries is presumed likely but is not displayed on the map below due to a lack of paper documentation. *Data: USFWS GOMCP 2015*



1,400 crossings identified, about one-third of culverts never permit fish to pass upstream, and the majority block access some of the time or to certain species of fish. Only a relative handful of crossings provide complete access for fish and other aquatic organisms (CBEP 2010; Maine Stream Connectivity Working Group 2015).

Assessing Connectivity of Key Tributaries in the Lower Watershed

One way to gauge the extent of fragmentation is the *functional stream network,* a measure of the average length of river and stream segments connected to each other. While the Presumpscot River watershed has 1,270 miles of rivers and streams, the number of existing culverts and dams results in an average functional stream network length of only 3.63 miles. For sea-run fish, the only accessible habitat is in the lowermost Presumpscot, including the newly constructed passage over Cumberland Mills Dam in Westbrook.

Bridge Street Dam in Yarmouth, one of two dams that span the lower main stem of the Royal River, sits just one-third of a mile upstream from head of tide, disconnecting the Royal River watershed from Casco Bay.

In 2013, Trout Unlimited, working closely with private landowners and Caribou Springs, LLC, removed Randall Mill Dam on Chandler Brook (a tributary to the Royal River), with support from CBEP, USFWS Gulf of Maine Coastal Program, Maine Rivers, Royal River Conservation Trust and others. A dam had been on the site since 1796.

> Where roads cross tidal wetlands, they alter local hydrologic conditions, degrading adjacent wetlands.

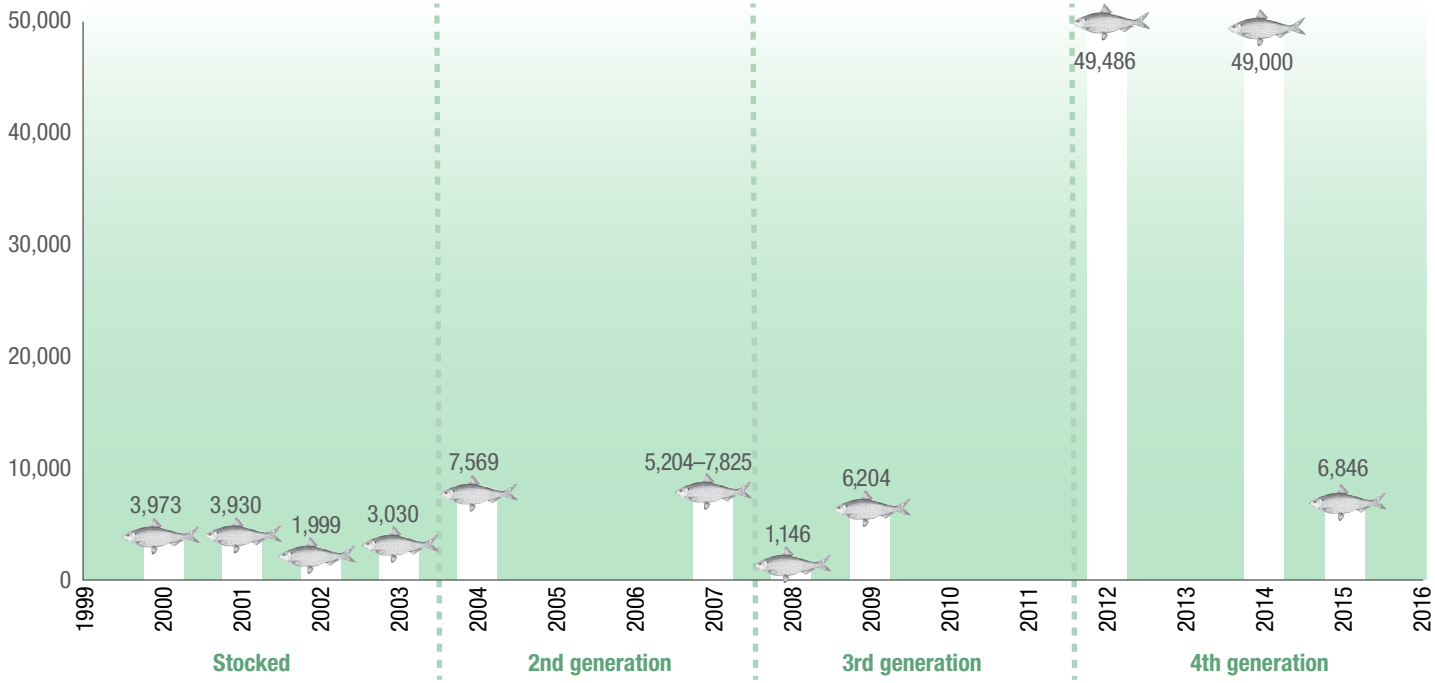
The Royal River watershed, with 310 miles of rivers and streams, has an average functional stream network of 4.16 miles (USFWS GOMCP 2015). Above the mainstem dams in Yarmouth, the river has a total connected network of 126 miles. Although fish ladders were retrofitted at the Bridge Street Dam and the Elm Street Dam in the 1970s, these structures have not been maintained and are considered ineffective for upstream passage—leaving just one-third of a mile of the lower mainstem accessible to anadromous fish.

Alewives Return in Force to Highland Lake

Alewives (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*) help support the Bay's food web—being prey to recreationally and commercially valued fish species and many birds. They also represent the preferred bait of the spring lobster fishery (Maine DMR).

In recent years, as many as 50,000 adult alewives have migrated annually from the Gulf of Maine into the Presumpscot River, up Mill Brook, and into Highland Lake to access critical spawning and nursery habitat. The return of alewives into Highland Lake was made possible through collaboration and pooled resources spanning 15 years. The run was "seeded" with alewives from other Maine streams between 2000 and 2003, and four subsequent generations of alewives have now returned to Highland Lake.

Meanwhile, on the Presumpscot River, an estimated 9,300 river herring passed over Cumberland Mills Dam in downtown Westbrook in 2014, accessing parts of the river that have been blocked from anadromous fish for hundreds of years (S.D. Warren 2014).



Total number of alewives entering Highland Lake, 2000–2015.

Sources: Wippelhauser and Bartlett 2012; Enterline 2015; Wippelhauser 2015

For additional references and information, please view the Bibliography of the full *State of the Bay 2015* report at www.cascobayestuary.org/state-of-the-bay-2015.