

How Atlantic salmon prepare for life in seawater

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Video Abstract

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Abstract

Salmon are famous for their swims upriver to spawn. Many people focus on this amazing feat of stamina, but even more remarkable is their ability to switch from living in freshwater to seawater, and back again. Most fish make their homes in just one type of water. So how do salmon do it? A team of biologists at Skidmore College, the U.S. Geological Survey, and the University of Gothenburg recently uncovered changes in the expression of certain genes that explain in part how Atlantic salmon make the transition. Atlantic salmon are born in freshwater, and between the ages of one and four migrate downstream to the sea. Before starting this migration, the fish undergo a months-long process preparing them for life in seawater. This is called smoltification. During this time, fish develop gill cells called ionocytes that contain specialized proteins that pump out excess salt. Because the growth hormone and insulin-like growth factor pathways are known to control this process, the researchers thought expression of related binding proteins might change seasonally to aid in smoltification. To find out, the group measured changes in gene expression over the course of development, and also examined expression in response to exposure to seawater. They found that IGF binding proteins 6b1 and 6b2 were more highly expressed in the gills at the peak of smoltification in May. Fish exposed to seawater in March also turned on expression of 6b1 as well as IGF binding protein 4, whereas 6b2 fell, along with 5a, 5b1 and 5b2. The results suggest these binding proteins are involved in regulating IGF to make Atlantic salmon seaworthy. Future experiments comparing these salmon with their landlocked cousins may reveal how these binding proteins act together to support smoltification. This knowledge might also help with conservation efforts to save endangered populations of this migratory fish.