Hidden biodiversity maintains resilience of steelhead populations

*This document was written and distributed by the primary author, Jonathan Moore.

A recent study on steelhead from the Skeena and Nass rivers uncovered remarkable hidden diversity in steelhead life cycles and discovered that this biodiversity stabilizes these populations.

In collaboration with provincial fisheries biologists, SFU assistant professor Dr. Jonathan Moore and post-doctoral fellow Dr. Justin Yeakel examined a large dataset on the diversity of life cycles in steelhead in the Nass and Skeena rivers and analyzed how this diversity buffers population size in the face of environmental variability.

Steelhead completed their life cycle in 36 different ways, the most ever documented for steelhead populations. They spent two to six years in freshwater and one to four years in the ocean. Some individuals spawn once, while others made up to four spawning migrations. These different life cycles represent an important form of biodiversity that is often overlooked or hidden.

Just like investment managers can minimize their financial risk by diversification of their stock portfolios, the diversity of steelhead life-cycles also buffers risk to the population. For example, if there is a bad year in early-marine survival, cohorts with different ocean-entry year will smooth over the effect of this environmental variability and enable more stable adult steelhead returns. This study estimated that this "portfolio effect" made steelhead abundances at least 20% more stable.

These findings were based on life cycle data from 7227 fish scales collected from summer-run steelhead in the Skeena and Nass rivers between 2000-2011. Like trees, fish scales grow in rings, and scientists can analyse the number and spacing of rings to learn about fish life cycles.

This paper was recently published in the Journal of Animal Ecology[1].

The remarkable hidden biodiversity of steelhead in the Skeena and Nass watersheds is likely the result of relatively pristine habitats and centuries of local adaptation, unpolluted by hatchery influence. Other watersheds have likely lost diversity due to hatchery propagation and habitat degradation[2]. Studies from California for example, have found that over the last century, genetic differences among steelhead populations have been eroded[3]. These historic losses make the remarkable biodiversity and its buffering capacity of Skeena and Nass steelhead particularly notable.

For more information, please contact:

Jonathan Moore, 778-782-9246, jwmoore@sfu.ca, http://moorelab.wix.com/moorelab

Further scientific readings:

[1]Moore, J.W., Yeakel, J.D., Peard, D., Lough, J. & Beere, M. (2014) Life-history diversity and its importance to population stability and persistence of a migratory fish: steelhead in two large North American watersheds. Journal of Animal Ecology, doi: 10.1111/1365-2656.12212
[2]Moore, J.W., McClure, M., Rogers, L.A. & Schindler, D.E. (2010) Synchronization and portfolio performance of threatened salmon. Conservation Letters, 3, 340–348.
[3]Pearse, D.E., Martinez, E. & Garza, J.C. (2011) Disruption of historical patterns of isolation by distance in coastal steelhead. Conservation Genetics, 12, 691–700.

Description: An adult steelhead resting in the shallows of a Skeena River tributary. The orange tube next to the dorsal fin is from a marking study to estimate population size of adult steelhead. Photo credit: Jonathan Moore.