Rapid re-colonization of river after extreme flood event

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(Phys.org)—After being virtually wiped out during a flood in 2005 in Wolf Point Creek, Alaska, salmon, meiofauna and most macroinvertebrates all re-colonized within two years, according to research published by University of Birmingham environmental scientists in the journal *Nature Climate Change* today.

During the flood over 400mm of rain fell over a four day period with 130mm falling on a single day on top of recent snowfall. The intensity of the rainfall indicated that this event was a one in a hundred year occurrence. The channel almost halved in width and deepened by up to a meter. Extreme flood events of this nature are becoming more common with climate change.

The scientists had previously studied salmon populations and macroinvertebrate and meiofauna communities in Wolf Point over a 28 year period as the stream developed following ice recession, providing them with a unique long term data-set prior to the flood in 2005. They were then able to use these data to compare with the taxa that started to recolonize and recover in the river after the flood.

Responses to flood events are dependent on the organism's resistance, it's ability to withstand a disturbance, and resilience, it's ability to recover from disturbance.

Pink salmon, whose cohort of eggs was virtually wiped out in the flood, returned to the stream in 2007 in very low numbers, less than 500. Four

years later their numbers had recovered to pre-flood levels to more than 15,000. Juvenile silver salmon also recovered rapidly.

The macrointertebrate community structure was significantly different after the flood, as some of the earlier colonizers which had become extinct pre-flood were able to recolonize as later colonizers were eliminated. The Dytiscidae beetles, freshwater shrimp Gammarus and the caddisfly Ecclisomyia were lost from the community and had not recolonised by 2008, but the overall taxa richness was not influenced markedly by the flood. Some species such as the midge larvae Diamesa, considered a 'poor competitor', were able to recolonize in the stream due to less competition from other organisms post-flood.

Meiofaunal abundance (small animals of less than 1 millimeter) immediately increased post-flood. These organisms found it easier to re-colonize, because some of the sediment was removed during the flood, as they favour interstitial spaces within the substrate without sediment

The study has provided insights into the resistance and resilience of riverine communities to major flood events, with body size considered a major contributing factor. Larger bodied juvenile salmon and some macroinvertebrates showed lower resistance but high resilience, whereas smaller bodied meiofauna showed both high resistance and high resilience.

Sandy Milner, Professor of River Ecosystems from the University of Birmingham, who led the study, said: "We were really surprised by our findings. They illustrate the rapidity with which pink salmon populations are able to recover, and demonstrates their resilience to high-magnitude flow disturbances. The post-flood communities even included previously unrecorded meiofaunal species for the river and macroinvertebrates taxa that had been extinct for many years."

"The geomorphology of the stream changed dramatically as the result of the flood, it deepened and sediment was deposited where water originally flowed. These changes, however, did not affect the biological recovery in the river, which was unexpected."

Provided by University of Birmingham