Factors influencing fish productivity in a newly formed watershed in Kenai Fjords National Park, Alaska

Alexander M. Milner\textsuperscript{1,2} and Geoffrey S. York\textsuperscript{1,3}

With 4 figures and 7 tables

Abstract: Delusion Creek in McCarty Fjord, southcentral Alaska, was studied over three field seasons from 1992 to 1994 to investigate the factors influencing salmonid colonization and productivity of a new stream system formed by glacial ice recession within the last 40 years. Stream discharge was extremely variable during the summer months. Frequent spate events were a major factor in maintaining an unstable channel and in raising turbidity levels, which limit primary production and the abundance and diversity of invertebrates in the main stream channel available to rearing fish. However, in less than 40 years, coho (\textit{Oncorhynchus kisutch}), pink (\textit{O. gorbuscha}), and sockeye (\textit{O. nerka}) salmon have colonized Delusion Creek, and over 1,000 sockeye salmon were observed to spawn along the margin of the upper lake in 1993. Ninety-three percent of juvenile sockeye salmon remained in the lakes for two years prior to smolting. Kettle ponds, formed after ice recession, were also found to be important rearing areas for juvenile coho salmon. In the main stream channel, Dolly Varden (\textit{Salvelinus malma}) char were the most abundant juvenile rearing fish. Water chemistry of the lakes indicated that nitrogen was likely a limiting nutrient to primary production. Experiments with artificial channels showed that enrichment with nitrogen and phosphorus increased chlorophyll-a levels and macroinvertebrate drift was significantly reduced from enriched channels. We suggest that primary productivity and invertebrate abundance may be enhanced by the colonization of spawning anadromous salmon which may, thus, act as a positive feedback to productivity of this new stream.

Key words: Salmonids, colonization, \textit{Oncorhynchus kisutch}, \textit{Salvelinus malma}, artificial channels.

Authors' addresses: Institute of Arctic Biology, University of Alaska, Fairbanks, AK 99775, USA.
\textsuperscript{2} School of Geography and Environmental Science, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK. E-mail: a.m.milner@bham.ac.uk
\textsuperscript{3} U.S. Geological Survey, Biological Resources Division, 1011E Tudor Road, Anchorage, AK 99503, USA.