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Food web structure and function in two arctic streams with contrasting disturbance regimes

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SUMMARY

1. We studied the effect of substratum movement on the communities of adjacent mountain and spring tributaries of the Ivishak River in arctic Alaska (69°1′N, 147°43′W). We expected the mountain stream to have significant bed movement during summer because of storm flows and the spring stream to have negligible bed movement because of constant discharge.
2. We predicted that the mountain stream would be inhabited only by taxa able to cope with frequent bed movement. Therefore, we anticipated that the mountain stream would have lower macroinvertebrate species richness and biomass and a food web with fewer trophic levels and lower connectance than the spring stream.
3. Substrata marked *in situ* indicated that 57–66% of the bed moved during summer in the mountain stream and 4–20% moved in the spring stream.
4. Macroinvertebrate taxon richness was greater in the spring (25 taxa) than in the mountain stream (20 taxa). Mean macroinvertebrate biomass was also greater in the spring (4617 mg dry mass m^{-2}) than in the mountain stream (635 mg dry mass m^{-2}). Predators contributed 25% to this biomass in the spring stream, but only 7% in the mountain stream.
5. Bryophyte biomass was >1000 times greater in the spring stream (88.4 g ash-free dry mass m^{-2}) than the mountain stream (0.08 g ash-free dry mass m^{-2}). We attributed this to differences in substratum stability between streams. The difference in extent of bryophyte cover between streams probably explains the high macroinvertebrate biomass in the spring stream.
6. Mean food-web connectance was similar between streams, ranging from 0.18 in the spring stream to 0.20 in the mountain stream. Mean food chain length was 3.04 in the spring stream and 1.83 in the mountain stream. Dolly Varden char (*Salvelinus malma*) was the top predator in the mountain stream and the American dipper (*Cinclus mexicanus*) was the top predator in the spring stream. The difference in mean food chain length between streams was due largely to the presence of *C. mexicanus* at the spring stream.
7. Structural differences between the food webs of the spring and mountain streams were relatively minor. The difference in the proportion of macroinvertebrate biomass contributing to different trophic levels was major, however, indicating significant differences in the volume of material and energy flow between food-web nodes (i.e. food web function).

Keywords: Alaska, bryophytes, *Cinclus*, macroinvertebrates, *Salvelinus*, spring streams, substratum stability

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Introduction

Disturbance is defined as a change in abiotic factors affecting the structure of a biological community and is a fundamental determinant of stream community

