BIODIVERSITY, CHEMISTRY AND STRUCTURE IN STREAMS OF THE NEPALESE HIMALAYA

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Despite the perception that Himalayan rivers are sensitive to many environmental changes, there are almost no data on their biodiversity, or on the biological effects of catchment disturbance and pollution. Thus, in 1991, we began investigations of diatoms, bryophytes, microcrustaceans, macroinvertebrates, fish, river birds, and habitat structure in Nepal. It has now involved almost 150 rivers across a wide altitudinal and geographical range, from Simikot in the west to the Arun in the east. The general aims have been :

i) to assess how different river organisms contribute to biodiversity;
ii) to examine how stream biota and habitat structure might indicate river and catchment quality;
iii) to provide a baseline against which future changes can be assessed;
iv) to better understand river structure and function in Nepal; and
v) to provide an impetus to further research and relevant training in the important but neglected field of river ecology and monitoring.

Here, we present some key results to date. They include:

1. pronounced changes in the taxon richness (e.g., Fig 1), community composition (e.g., Table 1), chemistry (Table 2), habitat structure, and functional attributes of rivers down the Himalayan profile;

2. variations in the chemistry and biology of streams between different regions (e.g., Table 2);

3. variations in the biology of streams in different land uses, particularly among diatoms, fish, and river birds; and

4. variations in biological communities in different stream habitats linked with differences between streams of contrasting habitat structure.

We hope that our studies will contribute to the development of a physico-chemical and biological typology of Nepal's rivers, but further work is required to understand how natural and anthropogenic factors interact to influence stream ecosystems.

Table 1. Stream chemistry in contrasting regions of the Nepal Himalaya

	Simikot (Oct 94)	Dunai (Oct 94)	Annapurna (Mar 92)	Langtang (Mar 92)	Langtang (Dec 94)	Everest (Mar 92)	Makalu (Oct 94)
n of streams	24	22	22	14	25	22	31
Mean values :							
pH	7.7	8.0	7.8	7.3	7.9	7.3	7.4
Calcium	15.7	18.7	19.7	3.8	6.5	6.3	6.5
Magnesium	7.3	2.0	6.1	1.4	1.8	1.5	0.7
Sodium	2.3	2.8	1.4	1.6	1.7	2.2	2.4
Silica	3.4	5.3	2.9	4.0	3.5	4.6	4.5
Nitrate	0.19	0.15	0.19	0.17	0.09	0.06	0.28
Conductivity uS cm^{-1}	139	126	163	37	58	89	40
Chloride	1.4	0.6			0.2		0.4
Phosphate	0.04	0.03			0.02		0.02
Sulphate	7.5	11.2			6.1		2.2
Flouride	0.10	0.13			0.06		0.28
Pottassium	2.1	2.2			1.2		0.8
Strontium	0.02	0.05			0.02		0.01
Barium	0.03	0.01			0.004		0.002
Manganese	0.003	0.003			0.001		0.001
Iron	0.02	0.04			0.03		0.02
Aluminium	0.05	0.05			0.05		0.05

All values in mg/l except pH and conductivity.
All values below detection given nominal value = 1/2 DL.
SDs available on request.

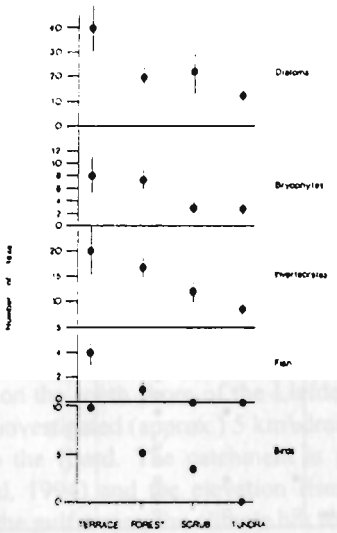

Figure 1 Changes in the numbers of species or families of various groups in catchments of decreasing altitude from tundra, alpine scrub, forest and agricultural terracing in the Langtang and Likhu Khola valleys in Nepal. (winter data from Ormerod et al. 1994)

Table 2.

Relative abundances of aquatic macroinvertebrate families from 3 regions of Nepal during November 1994
Abundance categories: ○=<0.1%, ●= 0.1-1%, ●●= 1-5%, ●●●= 5-10%, ●●●●= 10-15%, ●●●●●= 15-20%, ●●●●●●=>20% of the total number of animals sampled in each region

	Simikot	Dunai	Makalu		Simikot	Dunai	Makalu
EPHEMEROPTERA				ODONATA			
Baetidae	●●●●●	●●●●	●●●●	Anisoptera	●●	●	●●
Ephemerellidae	●●●	●	●●	Zygoptera		○	●●
Heptageniidae	●●●	●●	●●●●	HEMIPTERA			
Ephemeridae	○	○	●	Mesoveliidae			●
Siphlonuridae	●		●●	Aphelocheiridae		○	●
Caenidae	●	●	●	Corixidae		○	○
Prosopistoma			○	Notonectidae			○
Leptophlebiidae	○	○	●●	Gerridae	○		●
PLECOPTERA				Nepidae			○
Perlidae	●●	●	●●	DIPTERA			
Nemouridae	●●●	●●●●	●●	Simuliidae	●●	●●	●
Chloroperlidae	●	●	○	Chironomidae	●●●	●●●	●●●●
Peltoperlidae	○	●●	●	Tipulidae	●●	●●●	●●
Leuctridae	○	○	●	Tabanidae	●	○	●
Perlodidae	●●●	●●	○	Blepharoceridae	●	○	○
Capniidae	○	○	●	Athericidae	●	●	●
Taeniopterygidae	○	○	●	Psychodidae	○	●●	●
TRICHOPTERA				Dixidae	○	●	●
Hydropsychidae	●●●	●●	●●●●●	Ceratopogonidae	○	○	○
Rhyacophilidae	●●	●●	●●	Deuterophlebiidae	○	○	
Stenopsychidae	●	●	●●	Stratiomyidae	●	●	○
Philopotamidae	●●	●●●	●	Amphizoidae			○
Psychomyiidae	●		○	Empididae	●		○
Polycentropodidae	●	●	●	Ephydridae		○	
Glossosomatidae	●	●	●	Rhagionidae		○	○
Odontoceridae			○	Syrphidae			○
Leptoceridae	●	○	●	Osmylidae	○	○	○
Limnephilidae	●●	●●	●	Pyralidae	○		○
Uenoidae	●●	●●	●	Tortricidae			○
Brachycentridae	●●●	●●	●	Corydalidae		○	●
Hydroptilidae	○	○	●	Oligochaeta	●	●	○
Lepidostomatidae	●●	●●	●●	Planariidae	●	●	●
Goeridae	○		○	Collembola		○	○
Hydrobiosidae	○	●	●	Ostracoda	○	●	
Sericostomatidae			○	Freshwater Crab			○
Ecnomidae			○	Hydracarina	○	○	○
Helicopsychidae			●	Hirudinea		○	○
Phryganeidae	○	○		Pisida	●	●	○
Calamoceratidae	●	○	●	Lymnaeidae	○	○	
COLEOPTERA				Zonitidae	○	○	○
Psephenidae			●●				
Elmithidae	●●●●	●●●●●●	●●				
Dytiscidae	●	○	●				
Hydrophilidae	●	●	●●				
Gyrinidae			●				
Sphaeridae			○				
Hydraenidae		●	●				
Helodidae	○						
Notendae			○				
Lampyridae			○				
Scirtidae	●	●	○				
Ptilodactylidae			○				
Coleoptera (Larvae)	○	○	○				