

## BENTHIC INVERTEBRATES OF STREAMS ON THE ALBURZ MOUNTAIN RANGE NEAR TEHRAN, IRAN

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### Abstract

Samples of benthic invertebrates were collected from riffle sites on two river systems in the southern Alburz Mountains in the neighbourhood of Tehran, Iran. Main river channels had a fauna of Oligochaeta, Plecoptera, Ephemeroptera, Trichoptera, Coleoptera, Diptera and Potamonidae and downstream changes in community structure were observed. Tributary streams had few or no benthic invertebrates. The main factors determining fauna appeared to be frequent flooding and high levels of suspended solids caused by quick run-off of rain and melting snow from the bare, eroded and degraded mountain sides.

### Introduction

Iran is a vast, mainly arid country with some important freshwater resources in the northern and western regions. Here in the extensive and massive Zagros and Alburz Mountain ranges rivers flow perennially with waters of the melting snow. There is virtually no published information on the fauna and flora of these rivers. However, Sanford (personal communication) hopes to publish the findings of his observations on seasonal changes in the invertebrate fauna of the Bareghan river in the Alburz range.

The author spent six weeks during November and December 1977 in Tehran and was able to make several field trips to streams in the neighbourhood. This paper reports the results of this work.

### Materials and methods

Benthic invertebrates were collected by foot sampling. Working across the river, the bed was disturbed at several places and the dislodged animals and debris were caught in a handnet (12 meshes per cm in a rectangular frame 24 cm high and 24 cm wide, depth of net 45 cm) held immediately downstream. This operation took two minutes and was followed by an additional two minutes during which stones were lifted from the river bed and attached and clinging animals were removed into the net. Two samples such as this were taken at each site, all in riffle stretches where the bed was composed of gravel and stones up to 20 cm. By sampling with the same effort for a fixed period of time it is considered that the samples give some indication of the relative abundance of taxa at different sites.

The sites investigated (Fig. 1) were on the Jujerud river, some 20-30 km north and east of Tehran, and the Bareghan river, 55 km north-west of Tehran. Both rivers rise among peaks of 4000 m altitude and flow approximately southwards over the slopes of the Alburz Mountains. They are fast and shallow with long stretches of riffle zones interspersed by deeper pools. Both receive many small tributaries, some of which are perennial, others intermittent and formed during snow melts. In places the Jujerud runs through a canyon only 200 m wide. The Bareghan river is a major tributary of the Ab-e-Shur river which feeds the Namak Lake Basin. Some details of the sites are given in Table 1. During the author's visit snow covered the mountain peaks and ranged down to an altitude of 2200 m.

Data on water chemistry of the Jujerud river is given in Table 2. These are extracted from 'Quality of Surface

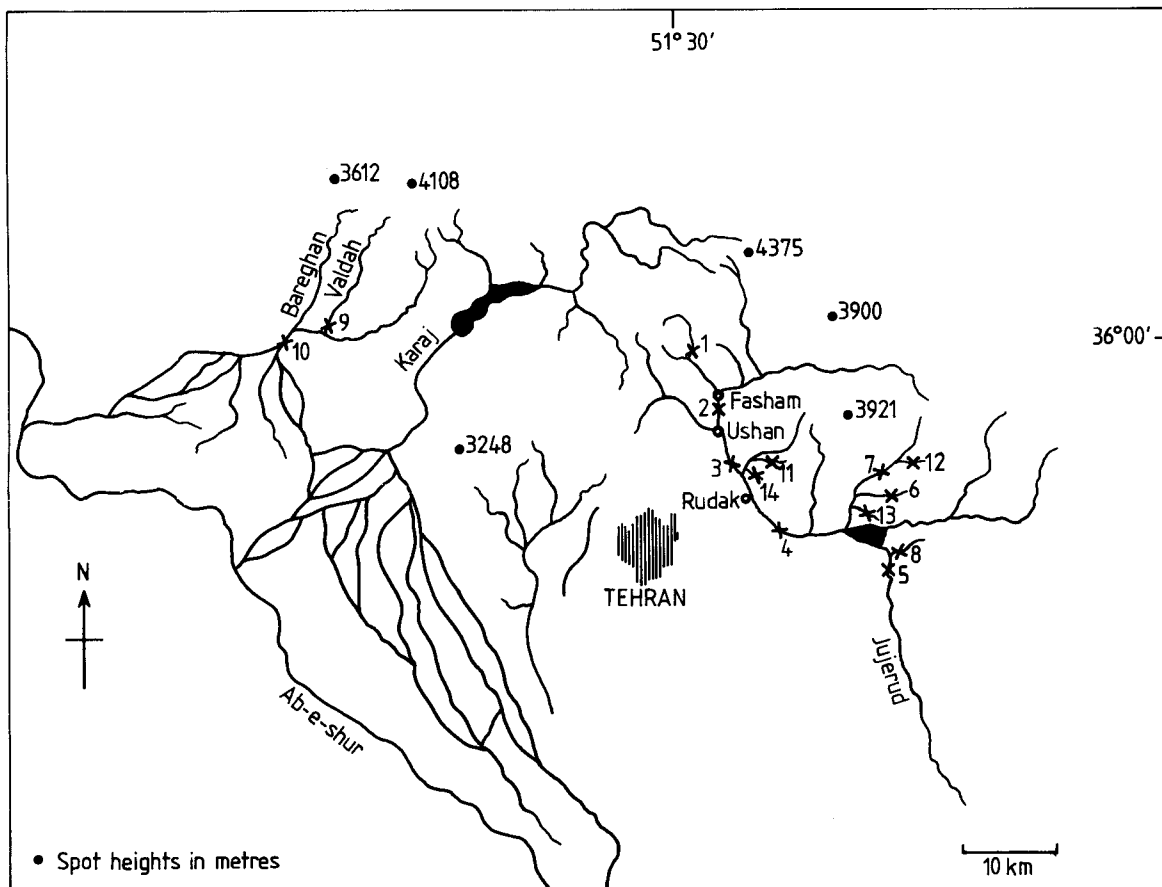


Fig. 1. Map showing locations of sampling sites on rivers near Tehran, Iran.

Waters of Iran' Volume 3, Ministry of Water and Power, Tehran, 1970, to illustrate the chemical quality of the water at different times of the year and in different discharge conditions. There are several villages each of two or three thousand people who use its water for washing and waste disposal. The land surface includes thick limestones and shales.

At most sites examined the stream margins were lined with trees, including cultivated fruit trees, poplars, willows and sycamores, and shrubs for a distance of up to about 100 m. Beyond this, vegetation was very sparse, the bare mountain sides being strewn with rocks and boulders and clearly much eroded and degraded.

The stream bed at each site on the main rivers was composed mainly of gravel and stones to a diameter of about 30 cm. In the small tributaries (Sites 6-8) there was a higher proportion of fine gravel. Filamentous algae were present on stones at Sites 3, 4 and 5 but stones

were bare of algae or moss at the other sites. Sediment deposition was heavy within the stream bed at the site downstream of the dam (Site 5).

Microscopic examination of samples of the suspended solids at Sites 9 and 10 (Table 1) showed that they were comprised mainly of particles of sharp sand and mineral matter of diameter 2-6  $\mu$ . There were few particles larger than 12  $\mu$  diameter and no cellular material was present. There was a large number, although in total only a small volume, of particles of approximately 0.5  $\mu$  diameter which stained with methylene blue, suggesting they were of organic nature.

## Results

The invertebrates collected in samples taken in the Jujerud river are listed in Table 3. The sites are arranged in

Table 1. Details of the sites where benthic fauna was sampled.

	River	Co-ordinates		Altitude (m)	Width (m)	Remarks	Date
		N	E				
1	Jujerud	35° 58'	51° 30'	2200	4	fast, turbid, no algae or moss on stones	13.11.77
2	Jujerud	35° 54'	51° 33'	1900	30	fast, turbid, no algae or moss	13.11.77
3	Jujerud	35° 51'	51° 34'	1750	20	fast, turbid, algae on stones	13.11.77
4	Jujerud	35° 49'	51° 35'	1650	20	turbid, plentiful algae on stones, visibility 8 cm	7.11.77
5	Jujerud	35° 44'	51° 44'	1450	12	fast, algae on stones, visibility 30 cm total suspended solids 0.00%	6.12.77
6	Tributary	35° 49'	51° 41'	1750	1	very turbid, no algae	7.11.77
7	Tributary	35° 50'	51° 40'	1800	8	very turbid, no algae	7.11.77
8	Tributary	35° 44'	51° 44'	1450	1	clear, TSS 0.00%	6.12.77
9	Valdah	35° 57'	50° 57'	1800	10	turbid, TSS 0.3%, conductivity 360 micromhos/cm	17.11.77
10	Bareghan	35° 54'	50° 51'	1500	18	turbid, TSS 1.0%, conductivity 335 micromhos/cm	17.11.77

downstream order. The fauna comprised larvae of a range of stoneflies, mayflies, caddis, beetles and flies belonging to genera which have representatives in Europe or North America. In addition to the animals included in the table there were other taxa represented by one or two specimens at individual sites.

Several downstream changes in the composition of the fauna are apparent including a decrease in the numbers of Plecoptera (*Amphinemura*, *Leuctra*, *Perlodes*) and some Heptageniidae (*Heptagenia*, *Ironopsis*, *Iron*) and an increase in *Caenis*. These changes can be attributed to the lower current flow and less abrasive conditions at the more downstream sites, also indicated by the presence of filamentous algae on the stones there. The site (5) downstream of the dam differed from those above it in lacking Plecoptera and having fewer *Macronemum* but having higher densities of *Caenis* and *Hydroptila* and some additional species of e.g. Hirudinea (*Erpobdella*, *Helobdella*).

The *Paragnetina* ranged in size up to 21 mm suggesting the species takes two years to grow. The other species of Plecoptera and the Ephemeroptera are all winter growing species emerging in the spring. *Macronemum* is a large fleshy species of Trichoptera with individuals weighing up to 0.04 g wet weight, and where it was common up-

stream of the dam it contributed a major part of the biomass present.

The tributaries of the Jujerud river contained very few benthic invertebrates. The samples from Site 7 contained three *Baetis*, one *Iron* and one Hydrophilidae adult; those from Site 8 contained 7 *Baetis* and 8 Oligochaeta; and those from Site 6 one Oligochaeta only. Four sites (Sites 11-14, Fig. 1) were examined for about 15-20 minutes each without any invertebrates being found.

The invertebrates collected in the samples from the Bareghan river are also listed in Table 3. The range of animals present is similar to that of the Jujerud river. There were fewer specimens of most taxa at Site 10 than at Site 9 presumably because of the more severe conditions at the former site. Owing to the lack of taxonomic research on Iranian freshwater organisms it is at present not possible to identify most invertebrates collected further than appears in Table 3. The Oligochaeta include a species of Lumbricidae, *Tubifex tubifex* (Müller) and *Eiseniella* sp. and the Rhagionidae are *Atherix* sp.

Microscopic examination of the gut contents of at least six specimens of each of certain genera gave the following results:

Table 2. Surface water quality of Jujerud river at Rudak (35° 53'N, 51° 32'E) and at Latian (35° 46'N, 51° 42'E). Quantities of ions are given in milli-equivalents per litre.

Date	Discharge m <sup>3</sup> /sec	Sum cations	Na <sup>+</sup>	Mg <sup>++</sup>	Ca <sup>++</sup>	Sum anions	SO <sub>4</sub> <sup>--</sup>	Cl <sup>-</sup>	HCO <sub>3</sub> <sup>--</sup>	CO <sub>3</sub> <sup>--</sup>	pH	Ec μS cm <sup>-1</sup>	TDS mg/l
At Rudak													
15. 4.67	6.7	4.90	4.15	0.60	0.15	5.19	1.44	0.20	1.45	2.10	9.4	452	280
16. 5.67	13	3.70	1.90	0.85	0.95	4.81	1.16	0.20	2.85	0.60	8.5	352	220
19. 5.67	43	4.40	4.00	0.25	0.15	4.55	1.10	0.15	2.00	1.30	9.5	436	252
28. 5.67	18	3.40	2.50	0.50	0.40	3.56	0.71	0.20	2.35	0.30	8.2	343	208
12.10.67	1.8	4.40	0.50	1.10	2.80	4.68	1.78	0.30	2.60	—	7.8	389	295
1. 3.68	3.4	3.70	0.40	1.15	2.15	3.98	1.18	0.25	2.55	—	8.1	368	244
25. 5.68	28	3.89	0.29	0.60	3.00	4.21	1.06	0.25	2.90	—	7.5	375	250
At Latian													
15.11.67	2.2	4.37	0.72	1.35	2.30	4.42	1.02	0.65	2.75	—	7.7	431	280
15. 1.68	0.7	4.67	0.92	1.65	2.10	5.35	1.20	0.85	3.30	—	7.9	515	332
19. 3.68	5.9	4.89	0.84	1.55	2.50	4.65	1.15	0.60	2.90	—	7.4	446	281
17. 5.68	20	3.59	0.44	0.80	2.35	3.98	1.03	0.35	2.60	—	7.9	335	225
3. 7.68	11	2.99	0.34	0.50	2.15	3.30	1.20	0.25	1.85	—	7.8	287	188

*Amphinemura* (4-5 mm) fine detrital matter, some filamentous algae, diatoms, no evidence of animal matter,

*Leuctra* (4-9 mm) fine detrital, fibrous and cellular plant matter, some filamentous algae, pieces of arthropods, a little mineral matter,

*Perlodes* (6-13 mm) one contained six dismembered *Baetis* nymphs, one chironomid larva head, and several other insect legs, another contained legs from two *Baetis* nymphs and an almost whole chironomid larva, a third contained a dismembered *Baetis*

nymph, others contained small pieces of animal matter and exoskeleton, arthropod legs and claws, diatoms, clumps of particles of brown detrital matter (1-5 μ diameter),

*Ironopsis* (5-8 mm) fine detrital matter, some mineral, and small filaments of algae,

*Macronemum* (9-14 mm) pieces of dipterous larvae and other insects, cellular plant matter, algae and fine particulate matter,

*Atherix* (6-8 mm) gut empty, except one specimen containing some brown detrital matter.

Probably the most interesting animal caught was the freshwater crab *Potamon persicum* Pretzmann of the family Potamonidae. In Europe freshwater crabs occur at locations in the Balkans and Italy only and they are absent from North America. Little is known about their ecology.

During the course of sampling benthic invertebrates, fish of the genera *Varicorhinus* (Cyprinidae) and *Nemacheilus* (Cobitidae) were caught at several sites.

## Discussion

The tributaries of the Jujerud river which were examined were either lacking a benthic fauna (Sites 11-14) or had a sparse one (Sites 6-8). At all of these sites the waters were turbid, light grey in colour and it was impossible to see into them. They seemed fairly persistent streams in that they had well-marked water courses and banks on which grew shrubs, trees and grasses. The upper sites of the

Table 3. The benthic invertebrates of the Jujerud and Bareghan rivers. Figures given are the numbers of animals caught in each sample.

River	Jujerud										Bareghan			
	Site	1	1	2	2	3	3	4	4	5	5	9	9	10
OLIGOCHAETA	28	20	18	12	3	7	6	6	0	0	4	4	0	0
HIRUDINEA	0	0	0	0	0	0	0	0	7	6	0	0	0	0
PLECOPTERA														
Amphinemura	8	6	2	1	2	1	1	0	0	0	2	1	0	0
Leuctra	32	28	0	0	0	0	1	1	0	0	1	0	0	0
Paragnetina	0	0	2	3	2	1	1	3	0	0	0	0	11	7
Perlodes	7	6	2	2	0	0	0	0	0	0	20	14	3	2
EPHEMEROPTERA														
Caenis	1	1	2	3	4	7	19	21	199	151	26	17	2	1
Baetis (2 spp)	309	207	98	105	270	211	177	166	295	223	105	97	7	12
Heptagenia	25	16	2	1	4	1	1	1	5	3	9	6	0	0
Rhithrogena	2	5	26	20	50	38	20	26	0	0	84	47	2	3
Ironopsis	49	53	32	29	19	15	0	0	0	0	0	0	0	0
Iron	3	4	4	2	0	1	2	0	0	0	4	2	1	0
TRICHOPTERA														
Macronemum	29	42	90	76	100	87	75	109	2	4	22	24	7	4
Hydroptila	2	1	0	0	1	1	1	2	21	26	5	2	0	0
COLEOPTERA														
Elminthidae	1	2	1	1	9	3	0	1	1	0	3	1	3	3
Dytiscidae	3	1	2	2	6	2	0	3	0	0	1	2	2	0
Hydrophilidae	2	2	0	0	12	3	0	0	0	0	0	0	0	0
DIPTERA														
Tipulidae	5	2	4	1	3	2	8	1	4	2	2	3	1	2
Chironomidae	17	12	5	2	6	8	9	10	56	28	0	1	0	0
Simuliidae	23	8	1	3	2	1	0	0	0	0	11	7	0	0
Stratiomyidae	4	5	4	3	2	2	0	2	2	2	4	3	3	2
Empididae	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Rhagionidae	4	2	27	13	0	0	1	0	0	0	1	1	1	0
Tabanidae	2	1	2	2	0	0	2	5	1	0	15	12	10	7
MALACOSTRACA														
Potamon persicum	0	0	0	0	0	0	1	0	0	0	0	0	2	0

Jujerud and the two sites on the Bareghan river were also turbid. Away from the stream margins catchment areas are bare with little vegetation, so providing conditions for quick run-off of rain and melting snow. Total suspended solids were measured as 1% at Site 10 on the Bareghan river. Sandford (personal communication) has recorded values of 2% and more at sites on some rivers. It would appear that the frequent flooding and high levels of suspended solids are the main factors determining the amount and quality of benthic invertebrates at many sites of the streams flowing in the southern Alburz range. It is presumably the abrasive action of the suspended material that restricts the development of a benthic community, and the absence of filamentous algae and mosses at many sites tends to confirm this. During sampling of invertebrates the net often filled with fine 1 mm gravel.

In the main rivers themselves the benthic communities were varied, the most numerous invertebrates being the flat, clinging larvae of Heptageniidae (*Heptagenia*, *Rithrogena*, *Ironopsis*), the net-spinning *Macronemum* and *Baetis* spp. and *Caenis*.

Although there were numerous villages disposing their waste into the Jujerud river there was little direct evidence of organic pollution, presumably owing to the fast-flowing conditions. The lack of Plecoptera, the reduction in numbers of other organisms and the presence of the leeches *Erpobdella* and *Helobdella* may indicate some organic pollution at the site below the dam (Site 5). There was a good deal of sediment on the bed at this site.

Among the gravel and stones at most sites there appeared to be a moderate amount of decomposing leaves and detrital vegetation. Such plant matter forms the basis of stream production in many parts of the world and at sites such as those on the Jujerud where algae and mosses are absent, must be of special importance. Restoration of the overgrazed drainage areas of the southern Alburz rivers would increase this basis of production as well as improve the stability of the stream banks by reducing floods.

Several sites had one or two species of fish. These were *Varicorhinus* and *Nemacheilus*, both genera containing species which can withstand high levels of suspended solids. *Varicorhinus* feeds on any organic matter including leaves, algae and invertebrates. Conditions in both the Jujerud and Bareghan at times would be too severe for trout which cannot tolerate high levels of suspended solids and Sandford (personal communication) confirms that there are no known natural stocks of trout

present. However brown trout (*Salmo trutta*) were stocked in the Bareghan river in autumn 1975 and had survived for two years, but it is difficult to believe that they could survive the conditions the author found on 17 November 1977 when the suspended solids reached 1%.

## Summary

1. Samples of benthic invertebrates were collected in November and December 1977 from rivers flowing southwards over the slopes of the Alburz Mountains, in the vicinity of Tehran. Sampling sites were in fast-flowing, shallow riffles. Stream margins were often lined with trees or shrubs but beyond 100 m distance vegetation was sparse. Mountain sides were strewn with rocks and stones and were clearly much eroded and degraded.

2. The fauna of the Jujerud comprised Oligochaeta and larvae of several species of Plecoptera, Ephemeroptera, Trichoptera, Coleoptera and Diptera. Downstream changes including decreases in certain Plecoptera (*Ampinemura*, *Leuctra*, *Perlodes*) and Heptageniidae (*Heptagenia*, *Ironopsis*) and an increase in *Caenis*, were observed. A site downstream of the dam forming Farahnaz Pahlavi Lake lacked Plecoptera, had fewer *Macronemum*, a filter feeder, but higher densities of *Caenis* and *Hydroptila*. The freshwater crab *Potamon persicum* was present at one site. The fauna of the Bareghan river was qualitatively similar to that of the Jujerud. Fish of the genera *Varicorhinus* (Cyprinidae) and *Nemacheilus* (Cobitidae) were caught at sites on both rivers.

3. Tributaries of the Jujerud contained few or no benthic invertebrates. Their waters were turbid, light grey in colour and it was impossible to see into them. Algae and moss were absent.

4. There was little evidence of the effect on invertebrates of organic pollution from the villages on the Jujerud, presumably owing to the fast-flowing conditions. Frequent flooding and the abrasive action of large quantities of suspended solids appeared to be the most important factors determining the amount and quality of stream invertebrates at many sites throughout the area.

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