

## BOTTOM FAUNA OF THE STREAMS OF KOHAT DISTRICT AND KURRAM AGENCY AFTER WINTER RAINS

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The productivity of the bottom fauna of the streams of Kohat district and Kurram Agency has been determined by number and weight per unit area after winter rains and it has been compared with that of the ponds of the same areas. The productivity of bottom fauna is high in some of the streams while it is usually high in all ponds. More than 50% of fishes live on bottom organisms.

### Introduction

The purpose of the present investigation is primarily to determine the production of bottom organisms in the streams of Kohat district and Kurram Agency by number and weight per unit area, to compare the production of bottom organisms with that of ponds in the same regions, and finally to correlate bottom organisms with the food of fishes.

### Physical Features

The areas under investigation are in Kohat district and Kurram Agency in the north-west of West Pakistan. In the north-west of West Hindukush Range runs from the plateau of Pamir. Minor ranges run from the Hindukush to the Kabul river. The Safed Koh Range is on the south of the Kabul river and runs east and west. The Safed Koh mountain has an average height of 12000 ft and is frequently covered with snow. The Kurram river lies in the south of this range and is fed by the streams from the Safed Koh. Kurram Agency lies in the upper part of the Kurram valley which provides a route to Kabul and Ghazni through the Piewar Pass on the Durand Line. The agency is surrounded on three sides by Afghanistan. The main town of the agency is Parachinar which is 5000 ft high. The greater part of the agency is hilly.

Kohat district is bounded on the north by Peshawar district; on the north-west by Orakzi Triah; on the south-west by Waziristan; on the south-east by Bannu and Mianwali districts and on the east by the Indus. The district consists of ranges of broken hills whose trend is east and west and between which lie open valleys. The ranges are of no great height. Kohat proper is 1600 ft and Hangu 2800 ft above the sea level. The general slope is to the east towards the Indus, but on the south-east, the fall is towards the west into the Kurram river. Thal, Hangu and Kohat are situated in the lower part of the Kurram valley.

The beds of Kohat contain red clay and limestone in which Nummulites and other fossils are found. The basal Hangu beds are of sandstone and shale with abundant molluscan fauna. Above the limestone there is gypsum and red clay. Nummulites are also present. The bottom of streams consists of boulders, gravel, sand and silt.

The average minimum and maximum temperatures of Parachinar is 28.6°F and 87.7°F respectively and the average rainfall is 30.25 in. Kohat is quite cold in winter and hot in summer. The average rainfall is 18 in.

### Methods

Bottom samples were collected with a Surber one sq ft sampler in riffles and with Ekman dredge in muddy areas of streams and ponds. Samples were washed through sieves to separate sand, silt, gravel and debris. The samples were placed in wide mouth bottles and preserved in 10% formaldehyde solution. At last two samples were taken from each place. In the laboratory samples were washed to remove silt and formaldehyde. The material was placed in petri dishes, and animals were picked under a dissecting binocular microscope. The animals were identified and recorded for each sample. The identification was done up to class, order or genus as this is sufficient for present study. The animals of each sample were preserved as an individual sample in vials.

In addition to bottom organisms, fishes were also collected generally from the same areas and preserved in formaldehyde solution. In the laboratory these fishes were dissected and the contents of their stomach and intestines were studied to show how bottom organisms were being used as food.

*Sampling Stations:* For collecting bottom samples, the whole area was divided into Kohat, Hangu, Thal and Kurram Agency regions.

*Kohat.*—Samples were collected from Panjpeer stream, the stream in cantonment area, the stream near Government College and a stream 18 miles on Kohat-Hangu Road.

*Hangu.*—A stream 5 miles from Hangu on Hangu-Kohat Road, streams in Hangu cantonment, a pond near Hangu town, and a pond 10 miles on Hangu-Thal Road.

*Thal.*—Mandhira, 5 miles from Thal, a stream 43 miles from Parachinar, and a stream 23 miles from Parachinar.

*Kurram Agency.*—Twelve miles from Parachinar, Zaman Kelay (8 miles from Parachinar), Kharlachi, Mangalzai, Piewar, Burkai and Shozalon.

*Productivity of Bottom Fauna:* Forty samples of bottom organisms were collected during April and May. Meehan and Ali<sup>15</sup> classified the streams of Rawalpindi and Wah according to gradient or slopes: low, moderate and high gradients. According to these workers the productivity of bottom of fauna was high in low gradient and polluted streams, and high gradient portions of streams with violent run off, fall into the category of low production areas. "Riffles are more productive than pools; rubble and gravel bottoms are more productive than bedrock and sand, the plant beds in streams are very productive", Usinger.<sup>16</sup>

The sampling stations of the areas under investigation are of high gradient. Productivity was used by Hazzard<sup>1</sup> to classify streams. His standards were: Grade I (rich stream) more than 22 g of bottom organisms per m<sup>2</sup> or 2152 organisms; Grade II (average) 11–22 g or 1072 to 2152 organisms; Grade III (poor) less than 11 g or less than 1072 organisms.

*Productivity of Bottom Fauna by Number: Kohat (Table 1).*—In Kohat region streams are of high gradient, except the stream on 18-mile Kohat-Hangu Road which is of moderate gradient, and is of grade I due to productivity of organisms in number. Other three streams are of grade II. Small number of oligochaetes indicates that the water was not polluted. There was sufficient number of clean water forms, eg., *Baetis*, *Caenis*, *Gammarus* and *Molluscs*. *Gammari* were not found in any other region. Sufficient number of snails and mussels shows the presence of calcium salts in water.

*Hangu (Table 2).*—Hangu Tehsil is the most fertile part of the district. The Hangu stream No. 1 is of moderate gradient while the others

are of high gradient. The water was clear and cold. Three streams show high production and have greater variety of organisms. The stream under the bridge is highly polluted and is of grade III in productivity. Large number of *Hydrae* were found in one stream.

*Thal (Table 3).*—All the streams are of low gradient. In two streams the productivity is low and a few kinds of organisms were found. In other two the productivity is grade I. Clean water organisms as mayfly nymphs and mussels were found.

*Kurram Agency (Table 4).*—All stream are of high gradient. The water is clear, fast running and very cold. Productivity in number is very high in the stream No. 2 of Piewar and water contained domestic pollution as woodash and charcoal pieces. The stream, 12 miles below Parachinar, has also high productivity. The productivity of the rest of the streams is of grade III,

TABLE I.—NUMBER OF ORGANISMS PER FT<sup>2</sup> IN KOHAT REGION.

Organisms	Panj- peer stream	Stream in can- tonment	Stream near college	Stream 18 miles on Kohat- Hangu Road
Planarians ..	14	116	60	—
Oligochaetes ..	20	80	—	207
Leeches ..	2	100	—	2
Crustacea:—				
Shrimps ..	1	4	—	—
<i>Gammarus</i> ..	12	—	—	—
<i>Heteroptera</i> (Bugs) ..	57	—	—	2
Ephemeropteran nymphs				
<i>Baetis</i> sp. ..	—	—	—	9
<i>Caenis</i> sp. ..	—	—	—	9
<i>Choroterpes</i> sp. ..	—	—	—	1
Lepidopterous larvae				
(Terrestrial) ..	—	—	—	19
Trichopteran larvae ..	1	4	—	—
Coleopteran larvae ..	5	—	—	3
Chironomid larvae ..	17	508	4	20
Chironomid pupae ..	—	4	4	2
Ceratopogonid larvae ..	—	—	—	3
Simulium larvae ..	—	—	—	36
Simulium pupae ..	—	—	—	1
Other dipteran adults ..	—	—	4	1
<i>Arachnida</i>				
Mites ..	—	—	—	1
Spiders ..	—	—	12	—
Gastropods ..	1	58	12	—
Mussels ..	—	48	4	80
Total ..	130	920	100	486
Total per m <sup>2</sup> ..	1430	10120	1100	5346
Weight in g per m <sup>2</sup> ..	3.4433	21.52	5.1648	15.8172

TABLE 2.—NUMBER OF ORGANISMS PER FT<sup>2</sup> IN HANGU REGION.

Organisms	5 miles Hangu-Kohat Road	Stream in cantonment Number—1	Stream in cantonment Number—2	Hangu Stream under bridge
<i>Hydra viridis</i>	406	—	—	—
Planarians	—	—	9	—
Nematodes	1	—	5	—
Oligochaetes	335	9	1,895	—
Leeches	3	—	—	—
Crustacea ( <i>Cyproidea</i> )	9	—	2	60
<i>Collembola</i>	—	8	—	—
Ephemeropteran nymphs ( <i>Baetis</i> sp.)	4	4	155	—
Odonata nymphs (Dragon fly)	1	—	—	—
Heteroptera	2	48	—	—
Coleopteran adult	2	—	—	—
Coleopteran larvae	2	—	1	—
Chironomid larvae	86	24	162	12
„ pupae	11	—	37	—
„ adults	2	—	4	—
Tabanid larvae	4	—	2	—
Coratopogonid larvae	1	—	—	—
Simulium larvae	1	—	323	—
„ pupae	—	—	25	—
Tipulid pupae	—	—	—	4
Other dipteran larvae	4	—	—	—
Terrestrial insects	1	4	—	—
Gastropoda ( <i>Planorbis</i> sp.)	236	16	—	—
<i>Limnaea</i> sp.	1	88	—	—
Pelecypoda (Mussels)	11	—	18	—
Total	1123	201	2638	76
Total per m <sup>2</sup>	12353	2411	29018	836
Weight in g per m <sup>2</sup>	11.624	7.2038	46.6874	.0086

i.e., the streams are poor in the production of bottom organisms. *Collembola* were found in the streams of this region with the exception of Piewar stream No. 2 and other streams had a few kinds of organisms.

**Ponds (Table 5).**—As compared to streams the productivity of ponds is generally higher. In the pond of Mustikhel, the productivity is of grade II, while in other four ponds it is much higher. There were no clean water organisms as the water was polluted due to decaying leaves and village wastes.

**Productivity of Bottom Fauna by Weight (Tables 1 to 5):** The productivity of bottom fauna by weight is low in many places. In Kohat region productivity is of grade II in the streams at Cantonment area and 18 miles Kohat-Hangu Road; in the Panjpeer stream and near Government College, the productivity is of grade III. In Hangu the productivity is grade I in stream No. 2; in the stream 5 miles Hangu Kohat Road and in the other two it is of grade III; in Thal area 23 miles from Parachinar, the productivity is

TABLE 3.—NUMBER OF ORGANISMS PER FT<sup>2</sup> IN THAL REGION.

Organisms	Streams 5 miles before Thal (Mandhira)	Stream 43 miles before Parachinar	Stream No. 1 before Parachinar	Stream No. 2 23 miles before Parachinar
Planarians	—	—	12	—
Nematodea	—	—	—	4
Oligochaetes	14	12	272	1872
Crustacea ( <i>Cyproidea</i> )	—	—	12	—
Ephemeropteran nymphs				
<i>Baetis</i> sp.	2	—	—	8
<i>Caenis</i> sp.	4	—	—	—
Heteroptera (Bugs)	—	—	4	4
Chironomid larvae	8	—	90	8
Chironomid pupae	1	—	—	—
Tabanid larvae	—	4	—	—
Trichopteran larvae	1	—	—	—
Arachnida				
Mites	1	—	—	—
Spiders	—	—	—	—
<i>Pelecypoda</i> ( <i>Corbicula</i> sp.)	—	—	32	72
Total	31	16	412	1972
Total per m <sup>2</sup>	341	176	4532	21692
Weight in g per m <sup>2</sup>	.7723	.0258	6.6	219.56

very high, i.e. 219.56g/m<sup>2</sup> and in the remaining three the productivity is very low. In two streams of Kurram Agency: Piewar No. 2 and 12 miles from Parachinar, the productivity is of grade I, while in the rest the productivity is of grade III. In the ponds of Thal and Hangu, the productivity is very high and in the remaining three productivity is of grade III.

**Bottom Organisms Used by Fishes (Table 6):** For the study of gut contents the following nine species of fishes were collected:

- (1) *Barbus (Tor) putitora* (Ham.), (2) *Barbus (Puntius) ticto* (Ham.), (3) *Barilius vagra* (Ham.), (4) *Aspidoparia morar* (Ham.), (5) *Cyprinion watsoni* (Day), (6) *Nemacheilus botia* (Ham.), (7) *Glyptothorax cavia* (Ham.), (8) *Schizocypris brucei* (Regan), and (9) *Chela cachus* (Ham.).

Five species live on bottom organisms. *Glyptothorax cavia*, *Barilius vagra*, *Chela cachus* and *Barbus (Tor) putitora* feed only on bottom organisms, while *Barbus (Puntius) ticto* feeds on filamentous algae and corixid bugs. *Aspidoparia morar*, *Cyprinion watsoni*, *Schizocypris brucei* and *Nemacheilus botia* live on filamentous algae and diatoms.

### Discussion

The bottom fauna of the areas under investigation consisted of nearly all typical aquatic or-

TABLE 4.—NUMBER OF ORGANISMS PER FT<sup>2</sup> IN KURRAM AGENCY.

Organisms	Piewar stream No. 1	Piewar stream No. 2	Burkai	Shozalon	Kharlachi	12 miles before Parachinar
Planarians .. ..	—	15	—	—	—	—
Nematodes .. ..	—	6	—	2	—	4
Oligochaetes .. ..	11	2,963	16	5	—	268
Oligochaetes (Cocoons) .. ..	—	34	—	1	—	—
<i>Collembola</i> .. ..	—	11	—	2	1	—
Ephemeropteran nymphs ( <i>Bactis</i> sp.) .. ..	1	3	—	—	—	—
<i>Coleoptera</i> (Adults) .. ..	1	1	—	—	—	—
Chironomid larvae .. ..	15	329	14	—	2	28
" pupae .. ..	3	75	2	—	—	—
" adults .. ..	—	2	—	—	3	—
Tabanid larvae .. ..	—	6	1	—	—	—
" pupae .. ..	—	1	—	—	—	—
Simuliid larvae .. ..	—	5	—	—	—	—
Tipulid .. ..	—	1	—	—	—	—
Other dipteran larvae .. ..	—	1	—	—	—	—
Other dipteran pupae .. ..	—	1	—	—	—	—
Other dipteran Adults .. ..	3	—	—	—	1	—
Terrestrial insects .. ..	2	3	—	—	—	—
<i>Arachnida</i> :-						
Mites .. ..	2	—	—	—	—	—
Spiders .. ..	—	—	—	1	1	—
Pelecypods ( <i>Corbicula</i> sp.) .. ..	—	—	—	—	—	188
Fishes eggs .. ..	—	4	—	—	—	188
Total .. ..	36	3,463	47	11	8	488
Total per m <sup>2</sup> .. ..	396	48093	517	121	88	5368
Weight in g per m <sup>2</sup> .. ..	1.2965	22.9188	1.0155	3.2387	0.2044	75.7496

TABLE 5.—PRODUCTIVITY OF BOTTOM FAUNA IN PONDS PER FT.<sup>2</sup>

Organisms	Mastikhel	Zaman Kelay	Managalazi	Thal	Hangu
(1)	(2)	(3)	(4)	(5)	(6)
Planarians .. ..	—	40	—	—	—
Nematodes .. ..	—	28	168	68	—
<i>Cyproidea</i> .. ..	—	—	148	144	—
Oligochaetes .. ..	—	140	8	—	7672
Leeches .. ..	—	—	—	—	4
<i>Collembola</i> .. ..	—	—	—	4	—
Damselfly nymphs .. ..	—	20	—	—	—
<i>Heteroptera</i> (Bugs) .. ..	0	—	76	16	—

(Continued)

TABLE 5 (Continued)

(1)	(2)	(3)	(4)	(5)	(6)
<i>Coleoptera</i> (Adults) .. ..	4	—	4	—	—
Chironomid larvae .. ..	92	—	16	—	272
Tabanid larvae .. ..	—	—	4	4	—
Ceratopogonid larvae .. ..	—	20	—	4	4
Other dipteran pupae .. ..	4	—	4	—	—
<i>Arachnida</i> (Mites) .. ..	4	—	8	—	—
<i>Volvox</i> colonies					
Total .. ..	144	248	508	264	7752
Total per m <sup>2</sup> .. ..	1254	2728	5588	2904	85272
Weight in g per m <sup>2</sup> .. ..	3.8736	3.0988	3.4432	30.1250	110.00

TABLE 6.—FOOD OF FISHES.

Scientific names	Verna- cular names	Gut-contents
1. <i>Aspidoparia morar</i> (Ham.)	Chillwa	Filamentous algae Diatoms
2. <i>Barilius vagra</i> (Ham.)	Chal	Mayfly ( <i>Baetis</i> sp.) nymphs Corixid bugs
3. <i>Cyprinion watsoni</i> (Day)	—	Filamentous algae Diatoms Debris
4. <i>Chela cachiis</i> (Ham.)	Moriah	Chironomid Larvae
5. <i>Puntius ticto</i> (Ham.)	Chiddu	Filamentous algae
6. <i>Schizocypris brucei</i> (Regan)		Filamentous algae
7. <i>Barbus (Tor) putitora</i> (Ham.)	Mahseer	Oligochaetes  Cyclops Mayfly nymphs (Three genera) Mites
8. <i>Nemacheilus botia</i> (Ham.)	Saantal	Filamentous algae
9. <i>Glyptothorax cavia</i> (Ham.)	—	Debris Bugs Chironomid larvae

ganisms. *Hydra* and *Gammarus* were found in Hangu and Kohat regions, these organisms were not common in the streams of higher altitudes. Very few Trichoptera were found and there was complete absence of aquatic Lepidoptera. Trichopteran larvae are numerous in the streams of Rawalpindi and Wah (Campbellpur district). Aquatic Lepidopterous larvae are also found in Rawalpindi and Wah.

The productivity of bottom fauna by number was high in many streams of Kohat district, while it was low by weight.

For the improvement of streams and ponds, systematic study of the bottom organisms should be made in different seasons and chemical nature of the water should be studied.

Ponds were usually polluted due to decaying leaves and domestic waste. No fish was found in ponds. The streams and ponds which are near villages and towns, can be improved by proper management and can be utilized for rearing the fish and thus help in increasing the production of protein food. By the study of the gut contents of fishes, it is quite evident that more than fifty percent of fishes feed on bottom organisms. No piscivorous fishes were found in the streams of these regions.

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For the improvement of streams and ponds systematic study of the bottom organisms should be made in different seasons and chemical nature of the water should be studied.

Fishes were usually polluted due to decaying leaves and domestic waste. No fish was found in ponds. The streams and ponds which are near villages and towns can be improved by proper management and can be utilized for carrying the fish and thus help in increasing the production of protein food. In the study of the fat contents of fishes it is quite evident that more than fifty percent of fishes fed on bottom organisms. No piscivorous fishes were found in the streams of these regions.

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Table 2.—Fishes of Rohat.

Sl. No.	Scientific name	Family	Sub-family	Order
1.	<i>Trichoptera</i> sp.	Trichoptera	Trichoptera	Trichoptera
2.	<i>Trichoptera</i> sp.	Trichoptera	Trichoptera	Trichoptera
3.	<i>Trichoptera</i> sp.	Trichoptera	Trichoptera	Trichoptera
4.	<i>Trichoptera</i> sp.	Trichoptera	Trichoptera	Trichoptera
5.	<i>Trichoptera</i> sp.	Trichoptera	Trichoptera	Trichoptera
6.	<i>Trichoptera</i> sp.	Trichoptera	Trichoptera	Trichoptera
7.	<i>Trichoptera</i> sp.	Trichoptera	Trichoptera	Trichoptera
8.	<i>Trichoptera</i> sp.	Trichoptera	Trichoptera	Trichoptera
9.	<i>Trichoptera</i> sp.	Trichoptera	Trichoptera	Trichoptera
10.	<i>Trichoptera</i> sp.	Trichoptera	Trichoptera	Trichoptera

Trichoptera larvae are numerous in the streams of Rawalpindi and Feroz (Campbellpur district). Aquatic Trichoptera larvae are also found in Rawalpindi and Feroz.