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A COMPARATIVE ECOLOGICAL STUDY OF THREE STREAM FAUNAS IN THE AUCKLAND AREA

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INTRODUCTION

This comparative study was undertaken to ascertain whether Limestone country, as found to the north of Auckland, would adversly affect the fauna of the streams draining such areas.

The three streams studied were:–

(I) The Waitakere Stream, at a point 20 yards downstream from the Cascade Stream junction. This stream was taken as a "typical" freshwater stream draining the conglomerate and sandstone of the area.

(II) The upper reaches of North River near the Waipu Limestone Caves. The stream drains an area which includes a large Limestone outcrop, however, the area is not wholly Limestone country.

(III) The Waiomio Stream, sampled near the end of the Waiomio Road, this did however drain an area of more extensive Limestone deposits.

METHODS OF SAMPLING

As a Freshwater Ecologist is aware, there exists in streams a wide range of microhabitats – from the deep almost still pools there is a gradation to shallow riffles where the water tumbles over the rocks and pebbles.

For the purpose of this study, two microhabitats were investigated:–

(a) Pools which invariably had fine silty bottoms, these were sampled by means of a 'drag-net' measuring 6 feet by 3 feet.

(b) Riffles; these were sampled with a "Suber sampler". Areas of 900 square centimeters were enclosed by the metal base frame of the sampler and substrate to the depth of 5 cm was washed into the net.

RESULTS

Pool Fauna:

Drag-net samples from the three streams showed similar faunas. The species collected were:–

Oniscigaster wakefieldi (Ephemeroptera)

Paranephrops planifrons (Crustacea)

Gobiomorphus basalis (Pisces)

From within the caves themselves at Waipu, mainly in the cave known as Two-tone, two further species of fish were caught. These were:–

Galaxias fasciatus (Native Brown Trout)

Anguilla sp (Eel)

A fourth species of fish was taken in the pools of the Waiomio Stream and the Waitakere Stream. This species was –

Retropinna retropinna.

There appeared to be no qualitative differences among the pools of the streams sampled. As only single specimens of all the fish were taken.

except in the case of the ever present *Gobiomorphus*, no significance could be attributed to the presence or absence of a species.

Riffle Fauna:

In order to make worthwhile comparisons between riffles, some kind of standard conditions of sampling had to be derivedl It has been noted by several workers that the substrate and the water-speed are perhaps the two most important factors in determining the bottom fauna. Dodds and Hisaw (1925) reported this effect for Ephemeroptera (Mayflies) and Trichoptera (Caddis-flies) and Winterbourn (1964a) reported on similar effects in New Zealand Plecoptera (Stoneflies).

The "standard" conditions used in this study were:—

(I) Riffle conditions where the water-speed was 55-60cm/sec.

(II) Substrate size, 3-6 cm diameter.

Waterspeeds were determined using a stop-watch and a cork attached to a one meter length of cotton. An average of five runs was taken as the final speed at any one station.

To illustrate the effect of current on the fauna, a transect of North River was undertaken across a region of the stream which appeared to, be fairly uniform. Waterspeeds at the edges of the stream were slower, less than 5 cm/sec, than those experienced in the middle of the stream, 50-60 cm/sec.

The stream was 12 feet wide where the transect was taken and samples were collected at two feet intervals. That is the collecting stations were at 1 foot and then at two foot intervals up to 11 feet. The composition of fauna from each of these stations is recorded in figure 1. Stations 1 and 6 were in the slower waters at the sides of the stream while stations 3 and 4 were in midstream, the region of highest water velocity.

Even in this part of the stream, which appeared to be reasonably uniform, it may be noted.

(I) the mollusc *Potamopyrgus antipodum* prefers the stiller waters — being virtually absent from the swifter midstream stations.

(II) *Olinga feredavi* and *Archichauliodes diversus* show a marked preference for swifter waters.

From this first survey the "standard" riffle condition, as detailed above, was derived. Samples, for comparative purposes, were then taken from "standard" riffle conditions in the Waiomio and Waitakere Streams. The analysis of these results is shown in figure 2. The composition of the faunas is essentially similar in each stream, the major differences being in the proportions of each species present. The best example of this can be seen in the Trichopteran species *Olinga feredayi* and *Pycnocentrodes aureola*, which show a large change of proportion between the North River / Waitakere Stream and the Waiomio Stream.

Water Analysis:

At the collecting stations on each of the three streams, a sample of water was collected and on return to the laboratory was analysed for Calcium and Magnesium content.

The analyses gave the following results:—

Tap-water 3.4×10^{-4} M (Total Mg and Ca)

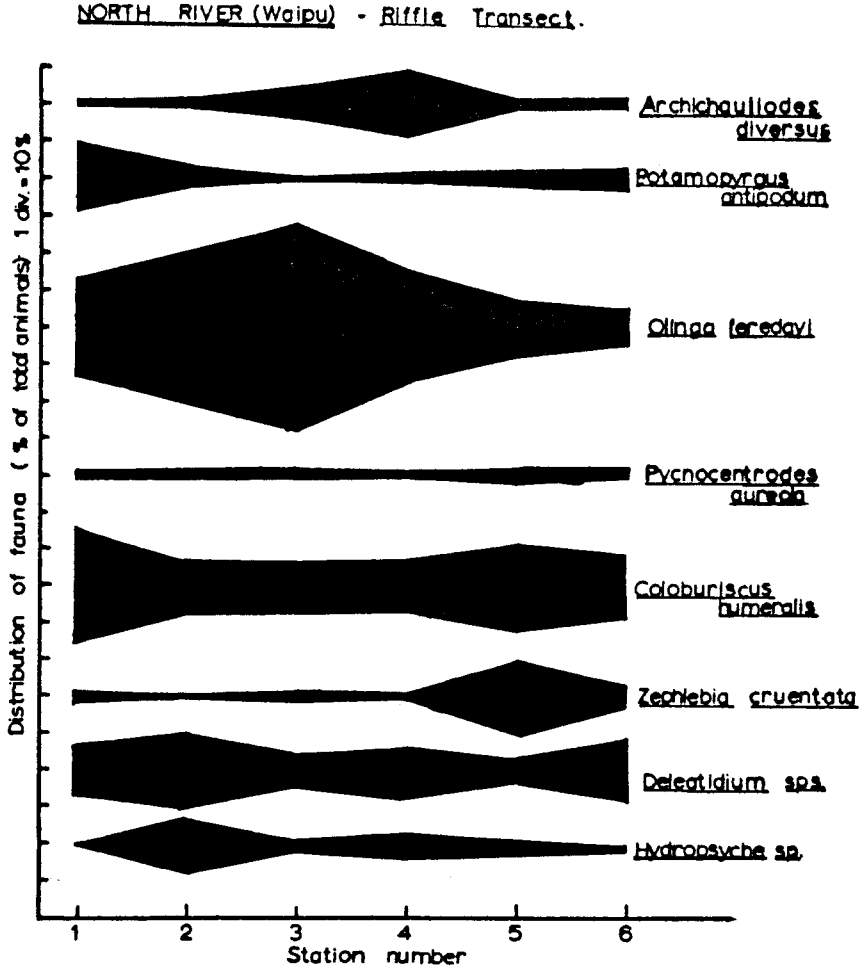
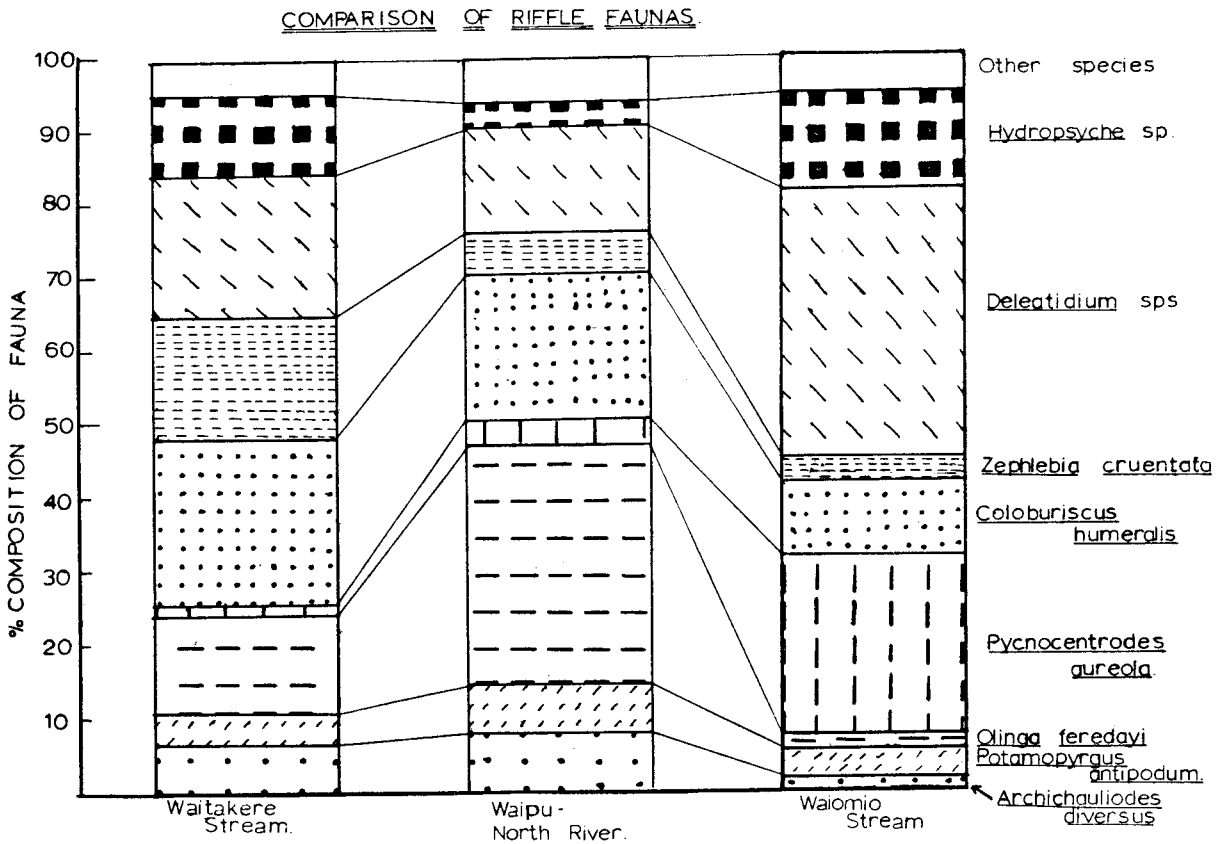

NORTH RIVER (Waipu) - Riffle Transect.
Distribution of fauna (% of total animals) 1 div. = 10%
Archichaulioides diversus
Potamopyrgus antipodum
Olinga feredayi
Pycnocentrodes aureola
Coloburiscus humeralis
Zephlebia cruentata
Deleatidium spp.
Hydropsyche sp.
1
2
3
4
5
6
Station number

FIGURE 1


COMPARISON OF RIFFLE FAUNAS.
% COMPOSITION OF FAUNA
100
90
80
70
60
50
40
30
20
10
Other species
Hydropsyche sp.
Deleatidium sps
Zephlebia cruentata
Coloburiscus humeralis
Pycnocentrodes aureola.
Olinga feredayi
Potamopyrgus antipodum.
Archichauliodes diversus
Waitakere Stream.
Waipu-North River.
Waiomio Stream
FIGURE 2.

Waitakere Stream	3.2×10^{-4} M (M = Molar)
North River	1.6×10^{-4} M
Waiomio Stream	6.1×10^{-4} M

Referring back to the general Geology of these areas, it is surprising to find the figure for North River so comparatively low. Closer examination of the area showed one small tributary which flowed directly from a cave entrance. The Calcium and Magnesium concentration of the water flowing from the cave was 7.6×10^{-4} M. The same tributary, sampled before it disappeared down a tomo into the cave known as Two-tone, had a total Calcium/Magnesium concentration of 1.2×10^{-4} M.

These figures show that although the water gained in Calcium and Magnesium ion concentrations, on joining the main stream this relatively high concentration was diluted by the main body of water in North River.

DISCUSSION

Macan (1961) noted that

"Calcium is probably more variable in amount than any other ion in the general run of fresh waters".

Macan further notes that it is possible to make two divisions of freshwater species, namely

"(i) Groups in which the presence of Calcium appears to be favourable to all or nearly all the species and

(ii) Groups in which species characteristic of limepoor water contrast with species characteristic of Calcareous waters".

The only division that can be made in this case is that the higher Calcium/Magnesium concentration seems to favour the sandgrain tube dwelling caddis *Pycnocentrodes aureola* over the secreted horny-cased caddis *Olinga feredayi* which appears to thrive better in regions of lower Calcium/Magnesium concentration.

FAUNA LIST

Insecta

Ephemeroptera

Family Siphlonuridae

Oniscigaster wakefieldi

Coloburiscus humeralis

Family Leptophlebiidae

Deleatidium sps

Zephlebia cruentata

Trichoptera

Family Sericostomatidae

Olinga feredayi

Pycnocentrodes aureola

Family Hydropsychidae

Hydropsyche sp

Neuroptera
Family Corydalidae
Archichauliodes diversus

Mollusca
Family Hydrobiidae
Potamopyrgus antipodum

Vertebrata
Pisces
Gobiomorphus basalis
Galaxias fasciatus
Anguilla sp
Retropinna retropinna

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