B E A V E R P O N D P R O J E C T

Gothic, Colorado

July-August, 1962

Marian Stoecker
John Pohly
Freshwater Ecology

The following report is the culmunation of work done on a beaver pond by John Pohly and Marion Stoerker as a joint project in Fresh Water Ecology. The pond was surveyed and charted by John Pohly; statistical charts and species identification by Marion Stoerker.

The author wishes to especially thank Dr. Jean Langenheim for her assistance in identifying certain of the vegetation around the pond and Dr. John Cairns, Jr. for guidance on the project and assistance in procedures of sampling and identification of species.

Marion A. Stoerker

ILLUSTRATIONS, CHARTS AND PHOTOGRAPHS

Page No.

Beaver pond and locality facing east. The water source enters at right foreground into small pool, over dam and into upper pond in which samples were taken. Visible, also, is the top of the beaver house beyond the large, fallen dead tree. Farther, beyond the beaver house, is the Gothic-Emerald Lake Road with Avery Peak in the background 9

The lower color photograph is a close up of the pond looking northwest. The beaver run went between the small log on the right and the tussock on the left 9

Beaver seen at point of Quadrat No. 1 10

North edge of pond showing a killdeer, which was observed at various times 10

Map of beaver pond showing depth, sampling areas and other physical properties 11

Chart of different species with population frequency and sampling intervals 12

Histogram of total individuals compared in early and late samples . . . . . 13 & 14

Correlation scatter diagram 15

A beaver pond was chosen as a project in Fresh Water Ecology in an attempt to determine the aquatic communities and subsequent population variation over a period of weeks. The pond, from which samples were obtained, was situated four miles northwest of Gothic, Colorado on the west side of the forest road to Emerald Lake. The source of water enters the west end of the pond through a series of beaver runs and short dams. Beaver activity was in evidence during the study of the pond. There were actually two ponds at the site of the study, although only the upper, shallow pond was sampled. The larger, deeper pond in which a beaver house was situated lay about one foot lower, separated from the sampling area by a dam.

There were one or two fish noticed in the upper pond and several more seen in the large pond. Although their size and species were undetermined, it was concluded from the habitat that they belonged to the trout family.

The vegetation around the pond consisted of Heracleum lanatum, the cow parsnip; Mertesia ciliata, tall chiming bells; Carex rostrata, a water grass, and another grass which was predominant over the entire area. The pond was approximately 300 feet from the east edge of a spruce-fir forest.

Besides the beaver, which was observed at close hand on one occasion, there were deer, chipmunks, ground squirrels, shrews and one badger seen within the area of the pond. There were several toads near the pond and tadpoles were included in some of the samples. The ruby-throated humming bird was seen many times, and at the edge of the pond an occasional killdeer was observed.

It is not enough to record variations in population unless we understand some of the causes for these variations and use sampling to illustrate and substantiate the factors involved.

Noting the histogram on the frequencies of species at various intervals (Chart, pages 12, 13 and 14), we may conclude that seasonal variation does affect the aquatic population. In the beaver pond, there are several conditions which help determine species population. The water level fluctuates during the day due to the action of the sun's rays on the glacial source of the stream. In the early part of the day, the water level is low because of the slow melting rate but as the sun reaches a more direct angle, the stream volume is increased and the water level of the pond rises. This variation in depth is not more than a few inches but it adds to the controlling effects of seasonal variation upon organisms.

In the early fall, due to evaporation, as well as source depletion, the pond water level drops causing high temperature loading, oxygen reduction and a lower pH level. The shallow areas offer little resistance to ultra violet light from the sun. This allows the water to absorb heat and results in the death of those oxygen producing algae, and certain stenothermic organisms which are unable to migrate to deeper, cooler water. There is not much organic decomposition due to a low calcium content in the water. The leaching of pine needles also helps keep the pH level down. An effect of this is shown by the fact that only one PLECOPTERA--stone fly naiad--was found during the sampling. The stone fly naiad is much more sensitive to O_2 content since it has only poorly developed, thread-like gills under the thorax.

The pond can be classified as dystrophic since the sub strata is mud and the pond itself is new. From these facts it was concluded that the nutrient level was not low because it supports some fish and many different species of aquatic organisms. The food cycle is present from the protozoan up to the aquatic insects. One area in particular which seemed to yield the greatest variety of species was in a very shallow portion of the pond, away from the current and beaver runs, and where the only water vegetation found was Carex rostrata. This shallow section contained a higher temperature than the rest of the pond. It was in this warm, shallow area that the toad tadpoles were found. Their evidence is indicative of some vegetation other than the above mentioned Carex because tadpoles are herbivorous and these were observed to be growing quite rapidly from week to week.

The EPHEMEROPTERA naiads--may flies--were seen to flick their gills almost constantly. This bears out the comment Kendeigh makes about respiration and oxygen requirements. The species of naiads which inhabit swift streams have fewer gills and never flick them because the motion of the water keeps oxygen supplied.

The most predominant population were the PENTANEURA--midge fly larvae. There were several species present in both the larval and pupa forms. Of this population all but a few larvae were light or semi-transparent in color. The remaining few were deep red in color, caused by hemoglobin in the blood. It was concluded from the sampling of this particular population of TENDIPIDAE larvae that this particular beaver pond was not in a strongly polluted zone--even though there was only one Plecoptera larva found.

Two species of Tricoptera--caddis fly larvae--were readily identified; that of the Phrygeaneidae and the Limnophilidae. The first family builds the cage out of hollow plant stems and tiny leaves. The second family mentioned builds the large, cumbersome cages of pine needles and sticks of wood. The individuals of this last group are the larger of the two. The caddis fly larvae were much more abundant in the early samples but the population density declined in the later intervals due to the emergence of adults.

A post observation made from a half pint sample showed effects of extreme high temperature and O_2 depletion. The sample was tightly closed and subjected to 95° F. temperatures--in the closed trunk of an auto--for three days. During this time the original altitude of 9500 feet was reduced to 700 feet. The color of the water was clear but the silt and algae were black and no living aquatic organisms were observed, putrefaction was evident. The cover was removed from the container and the contents left untouched. After a month's interval, microscopic examination revealed DIATOMS, INFUSORIA-Coleps and ROTATORIA-Notammatidae. There were eleven young GASTROPODA observed. There was no putrid oder present.

From the samples taken, a correlation coefficient of .81 was obtained. On the basis of this coefficient a chart was drawn (p. 15). The reliability of r = .81 is given by the formula $\sigma_r = \frac{1}{\sqrt{n-3}}$ which yields .447. Using a 95% confidence limit, there is a significant relationship between samples because .447 is within the limits of .233 and 2.021 (.447 - .894, .447 + .894). These results would, again, become more evident had there been more samples taken. It can be observed from the statistical charts that there was a population variation dependant upon seasonal variation. 50% of all the recognized species showed an increase in population during the later

sampling intervals (pp. 13 & 14). The species noted seemed to be established but the population density fluctuated. This fluctuation would have been clarified if more sampling had been completed. In the Poisson series the mean number of individuals per quadrat should equal the variance - eontagious distribution. The formula: $\frac{\Sigma (x-\bar{x})^2}{\bar{x}\,(n-1)} = 1$ where x is the number in each quadrat, $\bar{x}$ is the mean number in all quadrats, and n is the number of quadrats - yields .000134, which is much less than one or unity. Therefore, there is a negative contagious distribution in this beaver pond as determined by the number of samples. The species are spaced more regularly than would be expected by chance.

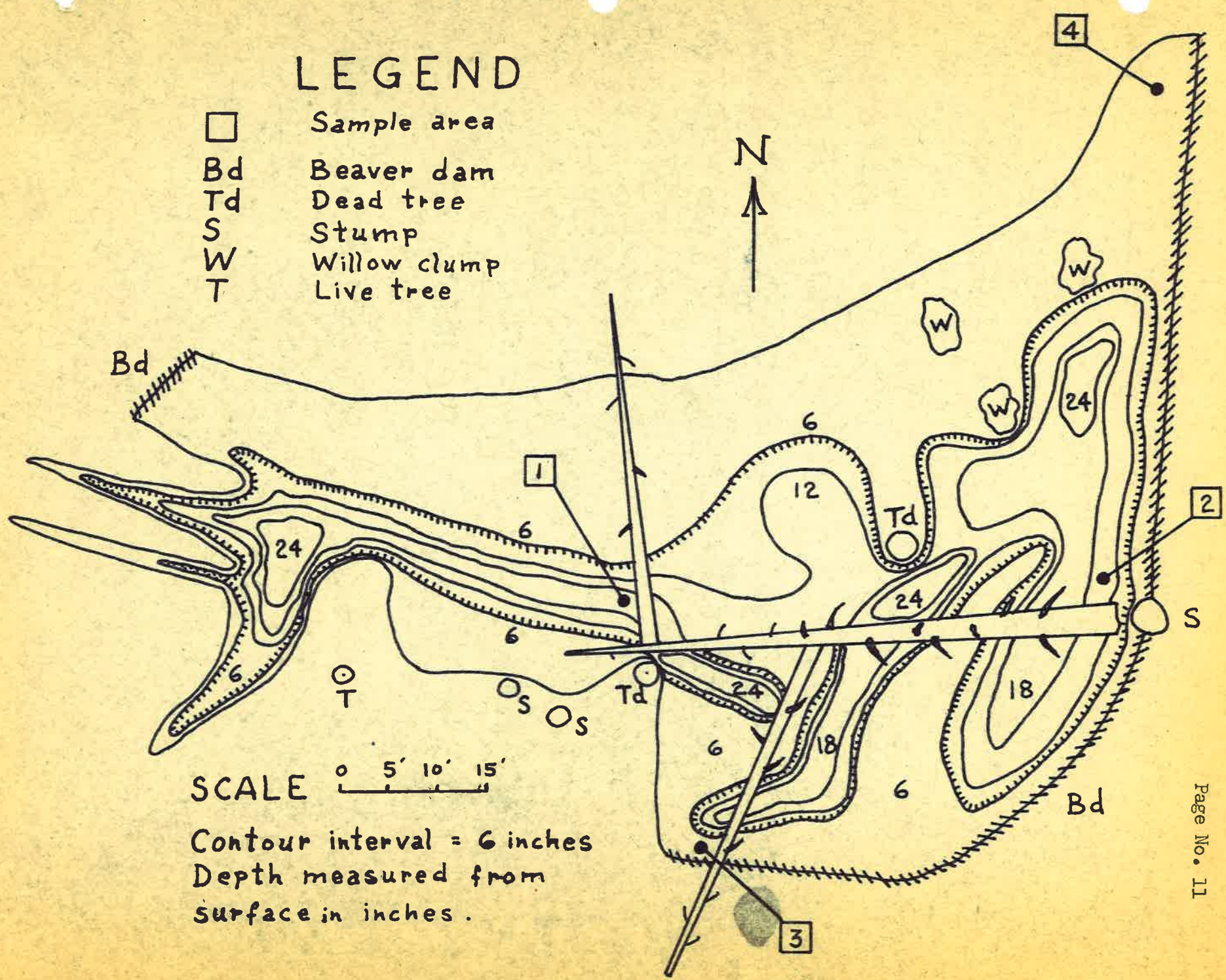
It is also evident that there were not enough samples taken and that they were not taken at any specific time intervals. There is definitely an error due to collecting in trying to characterize this aquatic community. The experience of working on such a project makes one aware of the many facets of Limnology and the difficulty involved in obtaining significant samples in an attempt to describe the community and its enviroment.







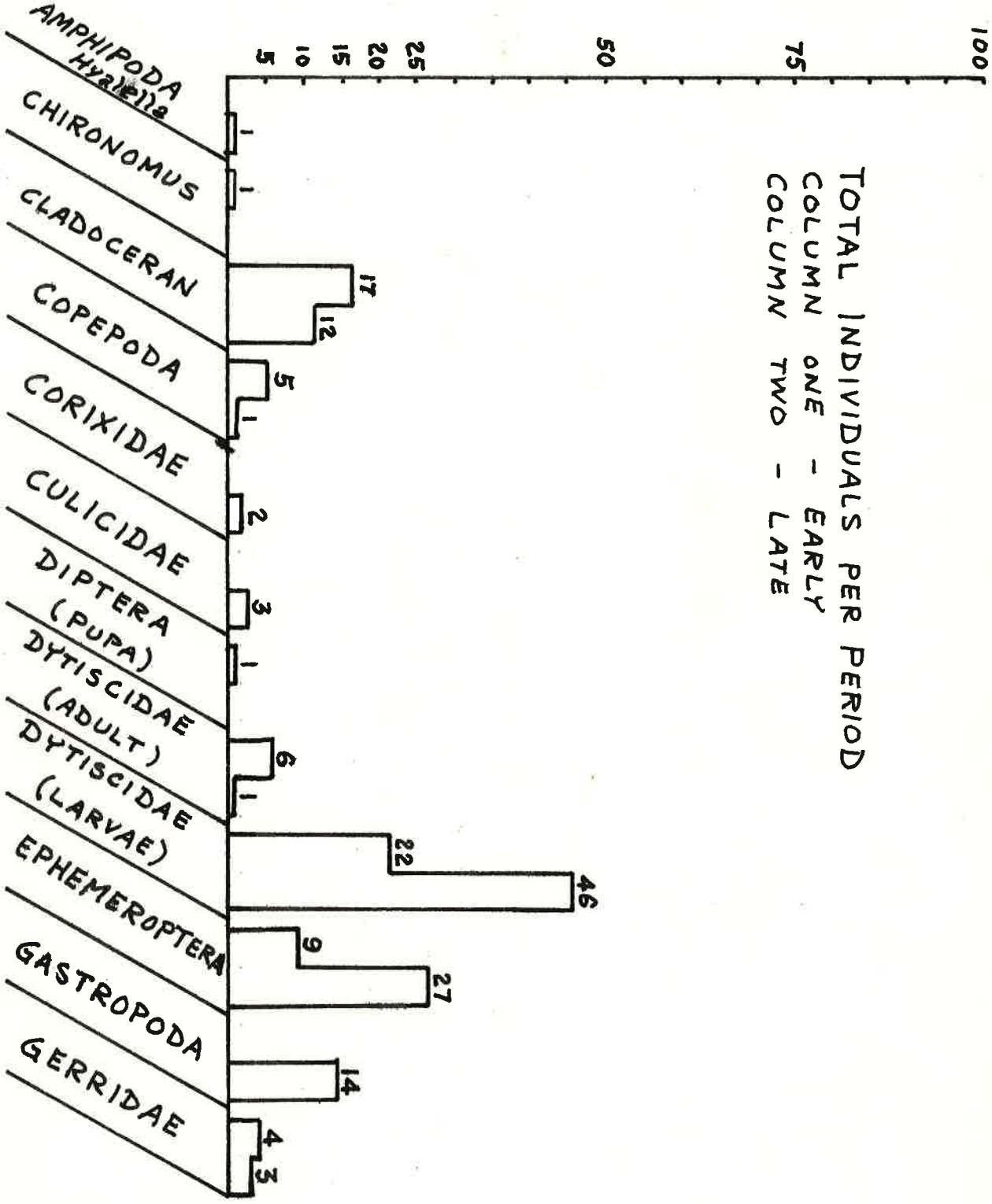


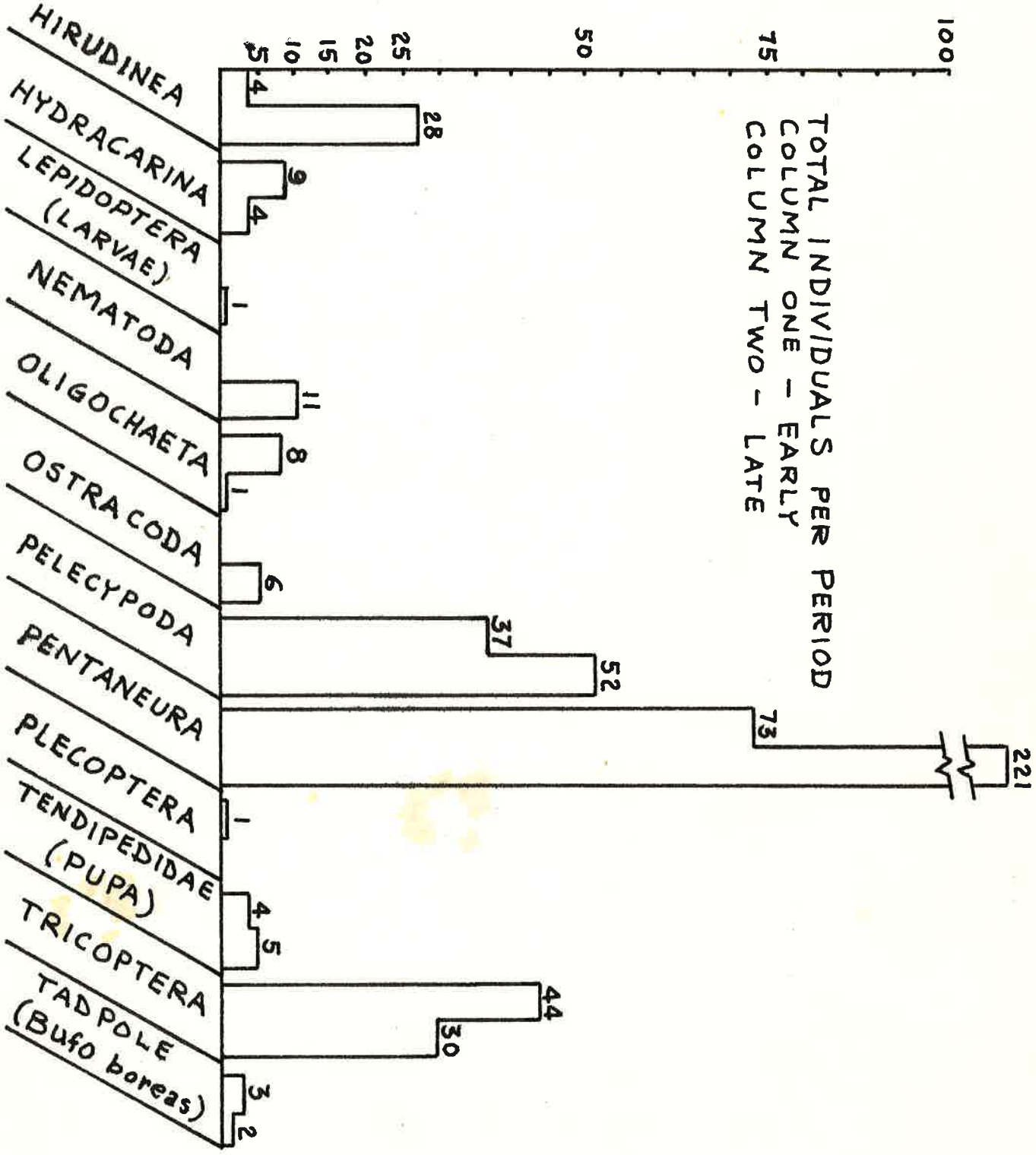

LEGEND
Sample area
Bd Beaver dam
Td Dead tree
S Stump
W Willow clump
T Live tree
N
Bd
Td
S
W
T
1
2
3
4
6
12
18
24
SCALE 0 5' 10' 15'
Contour interval = 6 inches
Depth measured from
surface in inches.

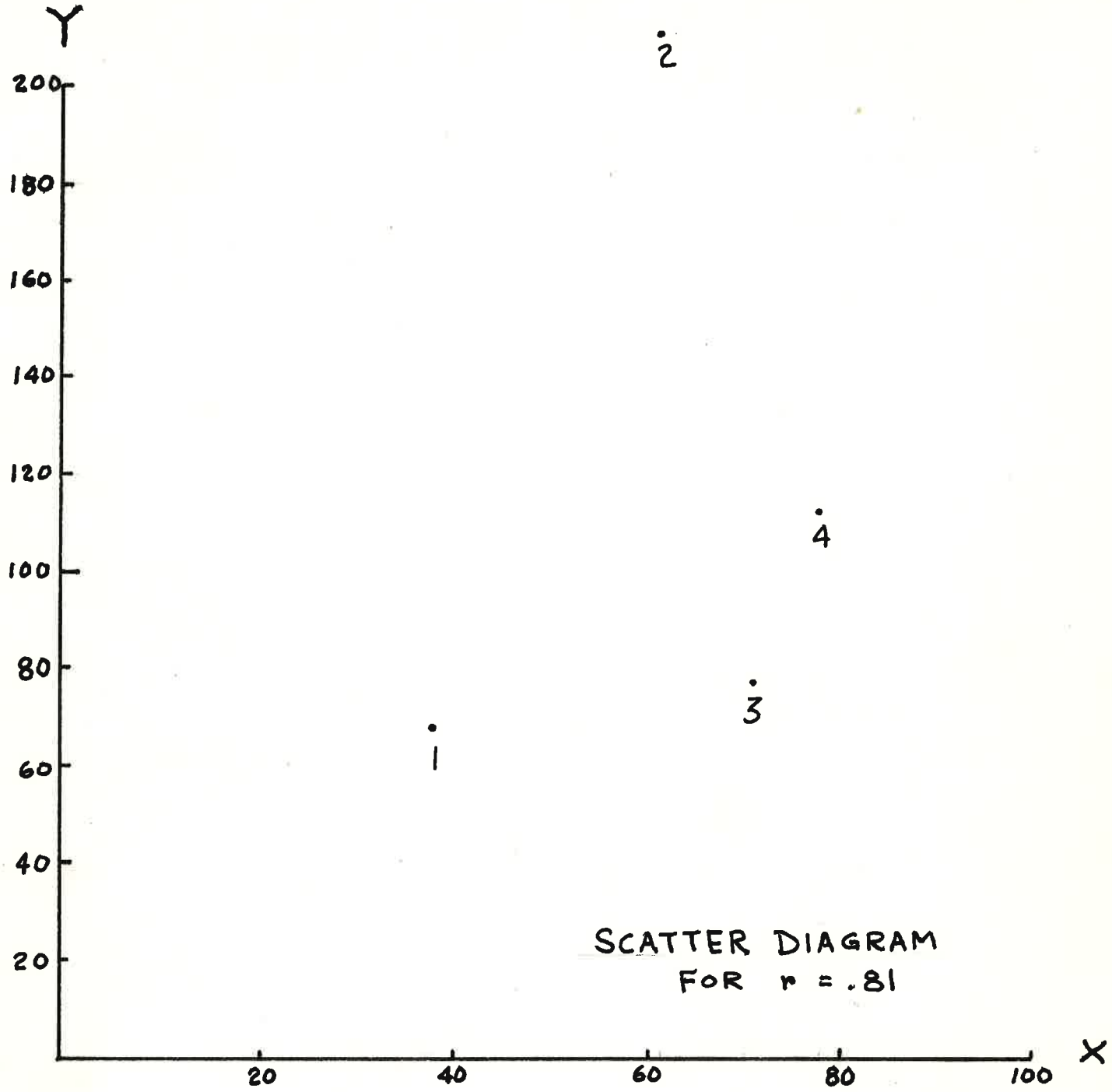
SAMPLE AREAS

	1	2	3	4	1	2	3	4
AMPHIPODA Hyalella						1		
CHIRONOMUS	1							
CLADOCERAN		2		15		1	1	10
COPEPODA	1	2	1	1				1
CORIXIDAE					1	1		
CULICIDAE							1	2
DIPTERA — Pupa	1							
DYTISCIDAE — Adult	1	3		2		1		
DYTISCIDAE — Larvae	1	6	8	7	2	33	2	9
EPHEMEROPTERA	2	1	2	4	5	1		21
GASTROPODA								14
GERRIDAE		4						3
HIRUDINEA Glossiphonia		3	1			26	2	
HYDRACARINA	2	2		5		1		3
LEPIDOPTERA - Larvae								1
NEMATODA					4	6		1
OLIGOCHAETA		7		1				1
OSTRACODA								6
PELECYPODA	1	12	21	3	1	37	12	2
PENTANEURA	13	9	16	35	54	88	54	25
PLECOPTERA				1				
TENDIPEDIDAE — Pupa	3	1				1	1	3
TRICOPTERA	12	7	22	3	1	15	5	9
TADPOLE - Bufo boreas		2		1				2
	July 7	July 8	July 17	July 18	July 23	July 26	Aug. 4	Aug. 5

SAMPLE INTERVALS


TOTAL INDIVIDUALS PER PERIOD
COLUMN ONE - EARLY
COLUMN TWO - LATE
5
10
15
20
25
50
75
100
AMPHIPODA
Hyalella
CHIRONOMUS
CLADOCERAN
COPEPODA
CORIXIDAE
CULICIDAE
DIPTERA (PUPA)
DYTISCIDAE (ADULT)
DYTISCIDAE (LARVAE)
EPHEMEROPTERA
GASTROPODA
GERRIDAE
1
1
17
12
5
1
2
3
1
6
1
22
46
9
27
14
4
3


HIRUDINEA
HYDRACARINA
LEPIDOPTERA (LARVAE)
NEMATODA
OLIGOCHAETA
OSTRACODA
PELECYPODA
PENTANEURA
PLECOPTERA
TENDIPEDIDAE (PUPA)
TRICOPTERA
TADPOLE (Bufo boreas)
5
10
15
20
25
50
75
100
4
28
9
4
1
11
8
1
6
37
52
73
221
1
4
5
44
30
3
2
TOTAL INDIVIDUALS PER PERIOD
COLUMN ONE - EARLY
COLUMN TWO - LATE



Correlation coefficient $r = \dfrac{n\Sigma xy - \Sigma x \Sigma y}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}}$

$r = .81$ Where: n = NUMBER OF SAMPLE QUADRATS
X = EARLY SAMPLES
Y = LATE SAMPLES

REFERENCE BOOKS

B I B L I O G R A P H Y

Coker, Robert E., 1954, STREAMS-LAKES-PONDS
The University of North Carolina Press

Kendeigh, S. Charles, 1961, ANIMAL ECOLOGY
Prentice-Hall, Inc.

Morgan, Ann Haven, 1930, FIELD BOOK OF PONDS AND STREAMS
G. P. Putnam's Sons

Pennak, Robert W., 1953, FRESH WATER INVERTEBRATES OF THE UNITED STATES
Roland Press

Ward, Henry B. & Whipple, George C., 1918, FRESH WATER BIOLOGY
Stanhope Press