SEPT 1992

Rapid Bioassessment of Five Rio Grande Tributaries in White Rock Canyon, New Mexico.

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J. S. Hopkins

During the week of September 7-11, 1992, five tributary streams to the Rio Grande (Mortandad Canyon, Pajarito Canyon, Ancho Canyon, Chaquehui Canyon and Frijoles Canyon) (Fig. 1) were sampled using EPA's Rapid Bioassessment Protocols level II (RBA II). This methodology involves the comparison of the biological community with an evaluation of the available habitat to determine not only the quality of the benthic community but also the degree to which the habitat is utilized. This effort was undertaken to test the usefulness of the RBA II protocols on small, warmwater systems and to provide biological information to augment ongoing chemical and radiological surveys in this area.

The segment of the Rio Grande that receives the five systems in question is bisected by the flood-stage level of Cochiti Reservoir and so the tributary streams have been divided into two groups on the basis of habitat evaluations. Mortandad and Pajarito Canyons join the Rio Grande above the level flooded by Cochiti Reservoir and so scored much higher on the habitat assessment than did Ancho, Chaquehui or Frijoles Canyons (Table 1). Because of these habitat differences and the disparate scores they generated, Mortandad Canyon is compared to Pajarito Canyon and Frijoles Canyon serves as a reference for Ancho and

Chaquehui Canyons.

Floodplain and riparian vegetative communities above the Cochiti flood pool are typical of Southern Rocky Mountain Ecoregion floodplains with Oneseed Juniper (Juniperus monosperma) dominating the uplands and Coyote Willow (Salix exigua) and Fremont Cottonwood (Populus fremontii) occupying the riparian areas with an often dense mix of other phreatophytic deciduous shrubs. Ancho, Chaquehui and Frijoles Canyons, which have been flooded periodically by Cochiti Reservoir, now pass through a very different type of landscape. Large woody plants such as Juniper and Cottonwood have been drowned to a height of forty to fifty feet above the current level of the Rio Grande and the floodplain has been buried to an often considerable depth by sediments deposited during high water events. While Ancho and Frijoles Canyons have cut down to the approximate levels of their original channels, Chaquehui Canyon no longer supports surface flow to the Rio Grande, if it ever did. The floodplain vegetation in this area is dominated by the skeletons of drowned juniper and a thin ground cover of Kochia scoparia. Living woody vegetation at the time of sampling was largely limited to isolated clumps of Current bushes (Ribes sp.) and Coyote Willow (S. exigua) in the riparian area. Herbaceous vegetation in this area is limited to a usually sparse growth of forbes and grasses. The net effect of this recently flooded environment is increased sediment input to the streams in question as well as an increase in insolation and water temperature. Evidence of utilization of

floodplain and riparian areas by cattle was found in all five canyons. At the time of this survey those areas of Frijoles and Chaquehui Canyons that supported forage were being grazed by a herd of at least ten, apparently stray, cattle. Because the only remaining forage in these canyons was located in wet riparian areas, grazing and loafing activities were concentrated along the streams.

Samples were collected using a 1 mm mesh 'D' net. Where flow permitted, riffles were sampled by agitating the substrate upstream of the net. Where flow was insufficient for this method, pools were sampled by sweeping the net through the water and substrate. All available habitats were sampled. Samples were rinsed in the 'D' net, dewatered on a no. 35 standard mesh screen and preserved with 70% ethanol. After further washing to remove preservative and residual turbidity, samples were floated in a gridded white enamel pan. Grid cells were selected using a pseudo-random number generator and sorted until approximately 100 organisms were sub-sampled. With the exception of Nematoda and Ostracoda, specimens were identified to the level of Family and enumerated. Only seven of the eight metrics normally used in RBA II could be utilized for the Ancho/Chaquehui/Frijoles group. As no scraper insects were found the scraper/filtering collector ratio could not be run. In addition to the eight metrics listed for RBA II, Percent Model Affinity, Shannon-Wiener Diversity and Winget and Mangum's CTQa were calculated (Table 2). A rough estimate of relative standing crop was developed by calculating

the mean number of organisms per cell in the sorting tray. These data were not incorporated in the RBA II process. Rather, they were calculated for comparison to the RBA II results and as 'tie-breakers' should the assessment of any station not fall within clearly defined assessment limits.

Results of the RBA process show all stations to be 'Moderately Impaired' relative to their respective reference stations (Fig. 3). It should be noted that Pajarito Canyon, the reference station for Mortandad Canyon, is also 'Moderately Impaired' relative to the biological community at Frijoles Canyon. With the exception of a result of 'Partially Supporting' for Mortandad Canyon, habitat evaluations for all stations yielded results of at least marginally 'Supporting'. In that Pajarito Canyon scored 166 on the habitat assessment, 195% of Frijoles score of 85, it is possible that some as yet unidentified water quality effect is influencing community structure there. Frijoles Canyon produced the greatest number of high water quality dependent macroinvertebrates and was therefore used as the local reference for Ancho and Chaquehui Canyons. However, diversity at this station was low and community composition skewed due to the apparent absence of numerous taxa found at similar stations (Table 2). Whether or not this imbalance is related to the contamination of the Rito de los Frijoles by DDT and associated breakdown products as documented by the National Park Service and NMEID in 1988 and 1989 (M.R. Fletcher, N.P.S., Pers. Comm.) or is an artifact generated by the small number of cells sub-sampled

during the sorting process (3) is not clear at this time. Note that the two stations with the lowest relative standing crop, Mortandad and Chaquehui, both produced greater numbers of taxa than their respective reference stations. Thus there is a direct correlation between the number of cells counted and the number of taxa found. This is an artifact that is amplified by differences between stations and further work on sub-sampling techniques is clearly required.

The greatest indication of water quality impairment found in these five streams is the generally high value developed by the Family Level Biotic Index (Hilsenhoff, 1988), which indicates communities tolerant to depressed dissolved oxygen levels. This condition is interpreted as an indication of organic nutrient loading. High nutrient loads are to be expected in Mortandad Canyon since flow is maintained in that system by effluent from the White Rock Waste Water Treatment Plant. Sources of nutrient enrichment in Pajarito, Ancho and Chaquehui Canyons are not readily apparent but sediment loading, groundwater inputs and cattle dung should be considered as well as non-contaminant related effects such as elevated water temperatures and site selection artifacts. One aspect of the benthic community in Mortandad Canyon, the near total lack of any filtering-collectors (fig. 2), raises the possibility that toxic materials are being sorbed to suspended particulate material in that system. The filtering-collector trophic group strains fine particulates from the water column as a food source and can be eliminated if the

fines are contaminated with toxic materials.

Flooding by Cochiti Reservoir has had a profound effect on habitat at the three lower stations. The combination of sandy soils and the removal of the sheltering effect of the Juniper forest has made the establishment of good ground cover difficult. Surface soils are, consequently, subject to erosion and stream banks remain unstable over much of the area. Above the Cochiti flood pool, Mortandad Canyon appears to be suffering the effects of a general destabilization of its channel. Ground cover has been disturbed over much of the valley floor and there is evidence of sediment deposition in the stream bed.

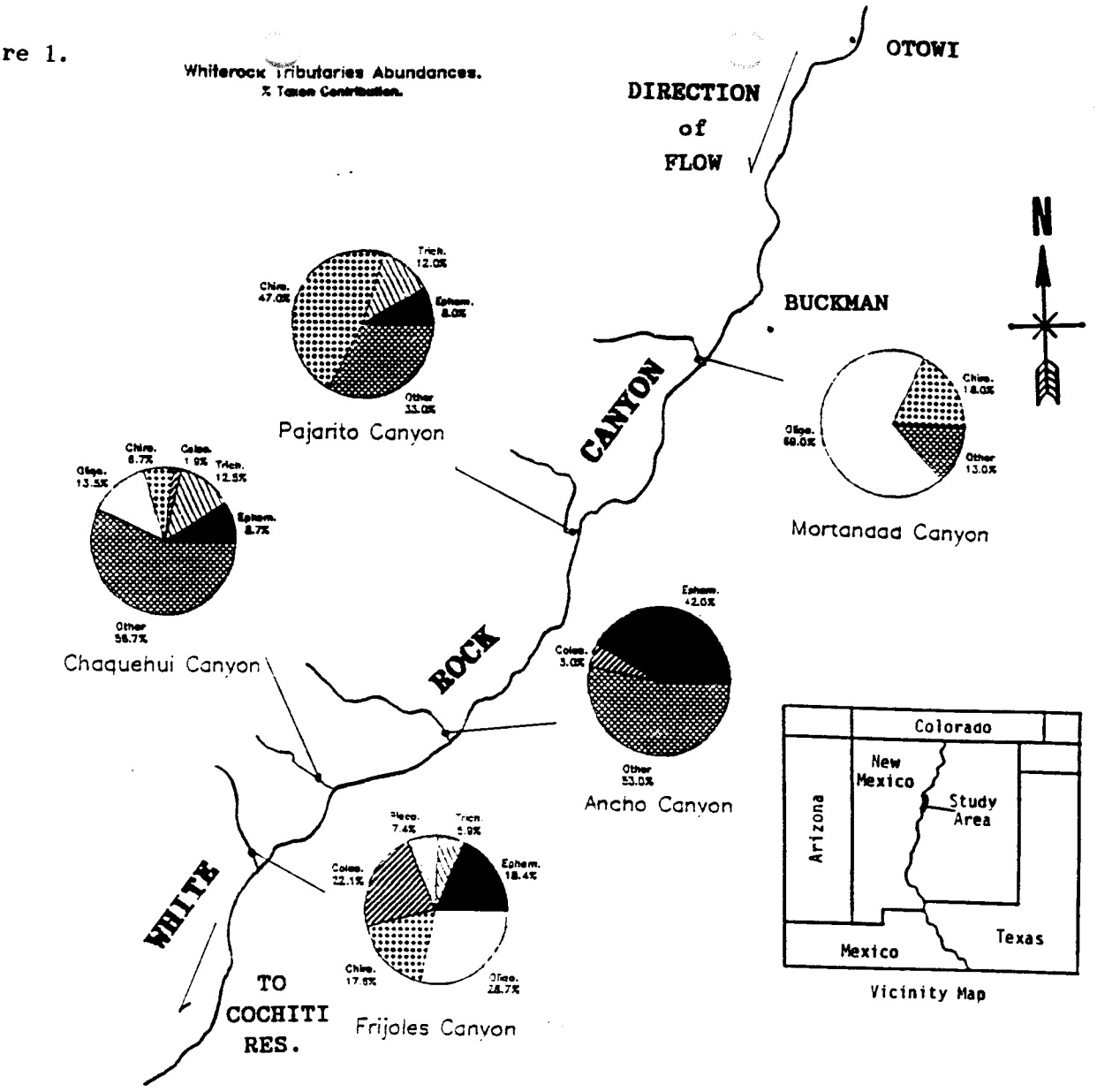
The Percent Model Affinity metric (PMA), as developed by Novak and Bode for use in New York State was run along side the RBA protocols for comparison. This metric, which requires identification of macroinvertebrates only to the level of Order, has been shown to correlate well with other metrics, notably Hilsenhoff's FBI. Results of this metric here parallel the results of the RBA II process closely and may offer an economical and truly rapid bio-assessment technique.

A number of concrete recommendations may be made on the basis of this survey. Nutrient analyses should be run on all five systems on an 'above and below" basis ie, samples should be drawn as high as is practicable in the watershed as well as down on the Rio Grande floodplain. Additionally, all five systems, and

especially the Rito de los Frijoles, should be sampled for DDT and associated decomposition products. The removal of cattle from federal land in White Rock Canyon would remove a major impediment to the re-establishment of riparian vegetation along tributary streams and the eventual stabilization of their banks. Damage to vegetative cover in some areas of Chaquehui and Frijoles Canyons caused by grazing and loafing activities was significant. It is apparent that sub-sampling methods for the RBA protocols need improvement over the method used here. One methodology that appears promising is to sort some percentage of cells in the tray. While there are drawbacks with this method as well, eg. some impacted stations may yield very low numbers, the bias engendered by unequal sampling effort would be minimized.

It is desirable but probably not practical at this time to conduct RBA II surveys on all five systems on an above and below basis to aid in separating watershed effects from base water quality effects. A program of this nature would be an invaluable aid in assessing the progress of any remediation efforts that might be undertaken on these streams.

Figure 1.



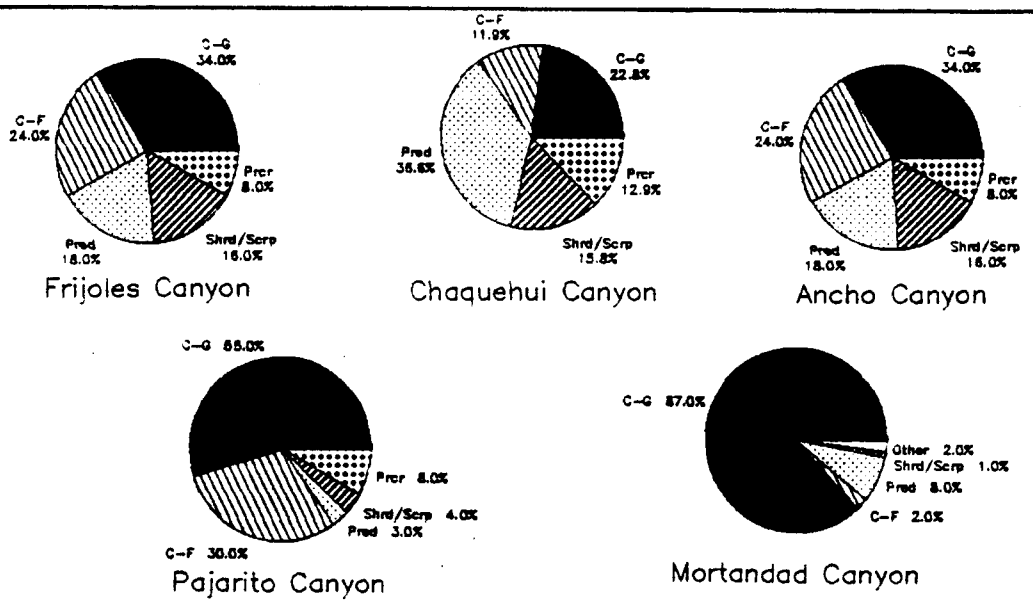
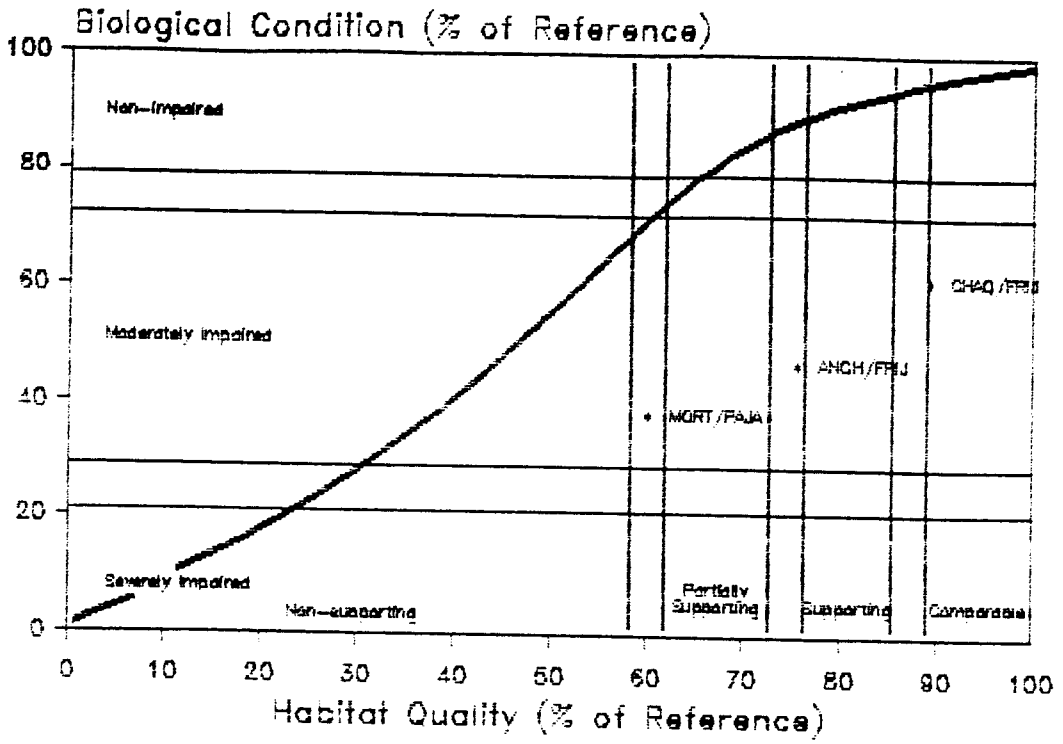


Figure 2.

Whiterock Tributaries % Trophic Groups:
Percent of population by trophic group.

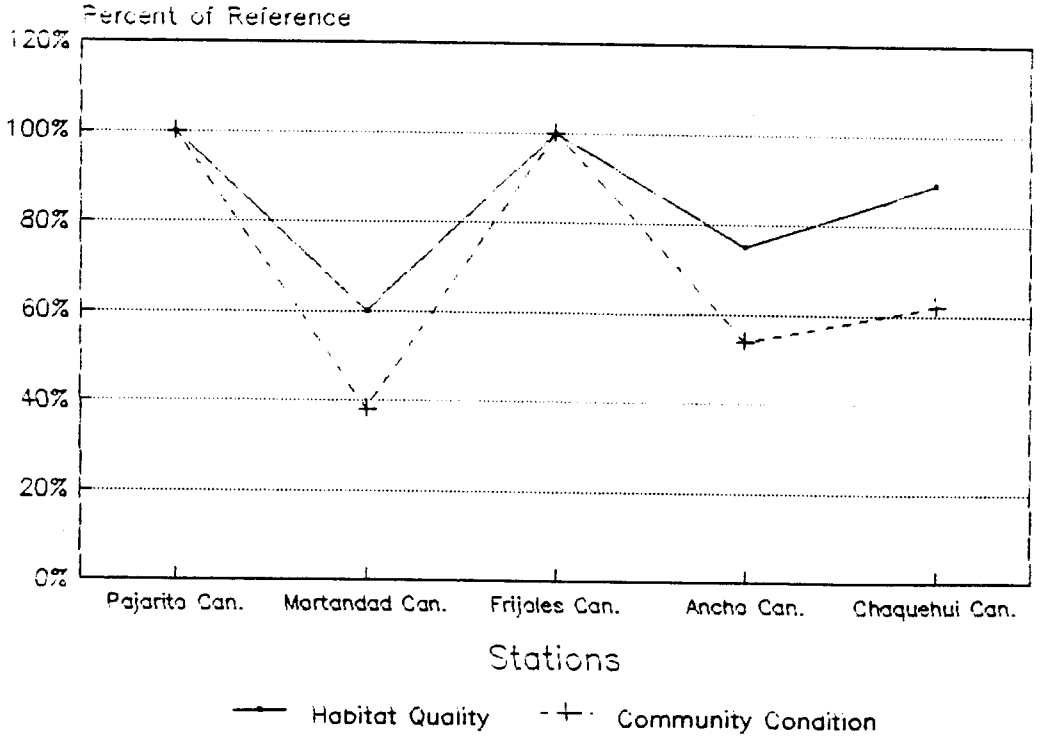
C-G = gatherer, C-F = filterer, Pred = predator, Shrd/Scrp = shredder/scraper, Prcr = piercer, Other = nematodes

Figure 3. Bioassessment Summary: RBA II
Biological Condition vs Habitat Quality



Reference stations assumed to be 100%.

White Rock Canyon Stations:
Habitat Quality vs Biological Condition



Values given are percent of rererence.

Table 1. RAPID BIOASSESSMENT (PROTOCOL II) OF PAJARITO AND MORTADAD CANYONS, SEPTEMBER 8 - 11, 1992.

METRIC	Station 2 Pajarito Canyon (Reference)	Station 1 Mortandad Canyon
Calculated Value		
Number of Taxa	9	11
Biotic Index		
FBI	6.56	7.82
Shredders/Total	.11	.09
EPT/(Chironomids + EPT)	0.80	0
% Dominant Taxa	47	69
EPT Index	4	0
Community Loss	-	0.64
Scrapers/(Scrapers + Collector-Filterers)	0.25	0
Percent of Reference		
Number of Taxa	100%	122%
Biotic Index		
FBI	100	84
Shredders/Total	100	82
EPT/(Chironomids + EPT)	100	0
% Dominant Taxa	100	146
EPT Index	100	0
Community Loss	-	0.64
Scrapers/(Scrapers + Collector-Filterers)	100	0
Score		
Number of Taxa	6	6
Biotic Index		
HBI	6	3
Shredders/Total	6	6
EPT/(Chironomids + EPT)	6	0
% Dominant Taxa	6	0
EPT Index	6	0
Community Loss	6	3
Scrapers/(Scrapers + Collector-Filterers)	6	0
Total	48	18
Biological Condition	100% reference	38% Moderately Impared
Habitat Condition	166	100 Partially Supporting 60 % of Reference

Table 1 (cont). RAPID BIOASSESSMENT (PROTOCOL II) OF LOWER WHITE ROCK CANYON STATIONS

Metric	STATIONS Station 5 Frijoles (reference)	 Station 4 Chaquehui	 Station 3 Ancho
Calculated Value			
No. of Taxa	11	16	9
Biotic Index			
HBI	4.12	6.97	6.26
Shredders/Total	.20	.06	0.00
EPT/Chironomids + EPT	.89	.67	1.00
% Dominant Taxa	30	16	34
EPT Index	8	2	2
Community Loss	ref.	.58	1.00
Percent of Reference			
No. of Taxa	100	145	82
Biotic Index			
HBI	100	59	66
Shredders/Total	100	30	0
EPT/Chironomidae + EPT	100	75	112
% Dominant Taxa	30	16	34
EPT Index	100	25	25
Community Loss	ref	.58	1.00
Score			
No. of Taxa	6	6	6
Biotic Index			
HBI	6	3	3
Shredders/Total	6	3	0
EPT/Chironomidae + EPT	6	3	6
% Dominant Taxa	3	6	3
EPT Index	6	0	0
Community Loss	6	3	3
Biological Condition			
Total	39	24	21
Biological Condition	100% Non Impaired	62% Moderately Impaired	54% Moderately Impaired
Habitat Condition	85 Reference	76 89% Comparable	64 75% Supporting

Table 2. TAXONOMIC LISTS FOR PAJARITO AND MORTADAD CANYONS, SEPTEMBER 8 - 11, 1992.

TAXON	Station 2 Pajarito Canyon (Reference)	Station 1 Mortandad Canyon
Lumbricidae	-	69
Nematoda	-	2
Ostracoda	-	1
Naucoridae	-	1
Ochteridae	-	1
Ceratopogonidae	1	2
Chironomidae	48	18
Culicidae	-	1
Dolichopodidae	2	-
Simuliidae	27	-
Tabanidae	-	2
Tipulidae	-	1
Pyralidae	4	-
Baetidae	8	-
Hydropsychidae	3	-
Philopotamidae	1	-
Hydroptilidae	8	-
Libellulidae	2	-
TOTAL	102	100

NON-RBA METRICS	VALUE	
Shannon-Weiner Diversity	2.64	1.60
Hmax	3.17	3.46
E	.68	.46
BCI/CTQa	102	107
No. cells picked	5	12
$\bar{X}$ no. per cell	20	8
Percent Model Affinity (PMA)	Ref.	31
PMA/Frijoles as reference	40	24

Table 2 (cont). TAXONOMIC LISTS FOR FRIJOLES, CHAQUEHUI AND ANCHO CANYONS, SEPTEMBER 8 - 11, 1992.

TAXON	Station 5 Frijoles Canyon (Reference)	Station 4 Chaquehui Canyon	Station 3 Ancho Canyon
Lumbricidae	3	12	-
Naididae	-	2	-
Nematoda	-	-	-
Ostracoda	-	5	20
Physidae	-	13	16
Notonectidae	-	3	-
Corixidae	-	1	1
Gerridae	-	7	-
Ceratopogonidae	-	3	-
Chironomidae	24	7	-
Ephydridae	-	1	-
Simuliidae	-	-	4
Tipulidae	-	4	-
Elmidae	30	-	-
Dytiscidae	-	2	5
Perlidae	3	-	-
Pteronarcidae	2	-	-
Nemouridae	2	-	-
Perlodidae	3	-	-
Baetidae	22	9	34
Tricorythidae	3	-	8
Hydroptilidae	1	13	-
Brachycentridae	7	-	-
Coenagrionidae	-	5	9
Libellulidae	-	17	-
TOTAL	100	104	100

NON-RBA METRICS	VALUE		
S/W Diversity	2.66	3.61	2.64
Hmax	3.46	4.00	3.17
E	.77	.90	.83
BCI/CTQa	88	95	93
No. cells picked	3	10	3
$\bar{X}$ no. per cell	33	10	33
% Model Affinity (PMA)	Ref.	27	30
PMA/Pajarito as ref.	40	58	41

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