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MACROINVERTEBRATE ANALYSIS.

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AQUATIC ECOSYSTEM INVENTORY

Macroinvertebrate Analysis

MANTI-LASAL NATIONAL FOREST

PRICE RANGER DISTRICT

MONTICELLO RANGER DISTRICT

1994

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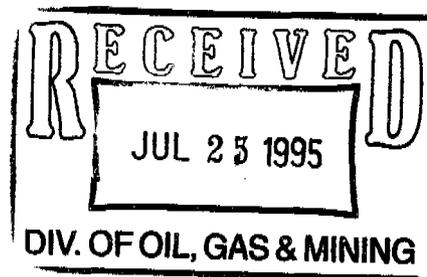
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NATIONAL AQUATIC ECOSYSTEM
MONITORING CENTER

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AQUATIC ECOSYSTEM INVENTORY
Macroinvertebrate Analysis



MANTI-LASAL NATIONAL FOREST
PRICE RANGER DISTRICT
MONTICELLO RANGER DISTRICT
1994

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INTRODUCTION

The goal of the Clean Water Act is to preserve and restore the biological integrity of aquatic resources. Monitoring is a tool we use to measure our management successes and failures. Under the Clean Water Act federal agencies have the responsibility for monitoring water quality and associated habitat quality on federally managed lands.

Aquatic macroinvertebrates are an important component of aquatic ecosystems and have long been used to evaluate water and habitat quality. After considering all of the biotic components of an aquatic ecosystem macroinvertebrates are one of the best suited for monitoring and can provide valuable information to assist in making resource decisions. They are relatively easy to collect and identify, are not as mobile as fish, they have sufficiently long life cycles to integrate environmental changes over an annual period, and they provide a vital link in the food chain between primary producers (algae and macrophytes) and fish. They have also been shown to be a cost effective monitoring tool for evaluating the effects of management activities on stream and riparian condition.

This report provides an assessment of the aquatic ecosystems based on the aquatic macroinvertebrate communities. The information provided should be integrated with other data collected in the watershed to gain a more complete understanding of conditions, possible impacts, and trends.

The data for this evaluation are from 63 aquatic macroinvertebrate samples from 12 stations on 10 streams along with water chemistry and physical habitat data provided by your aquatic specialist(s).

SAMPLING METHODS

Samples were taken stratified randomly from the riffle habitat with a Winget-Modified Surber Net, which provides one square foot samples. The 280 micron mesh net collects even the smallest insect instars. These are quantitative, reproducible samples, and the data obtained can be used in ecosystem management to document conditions and trends in relation to management activities in drainages. They provide a basis for spatial and temporal monitoring.

LABORATORY PROCESSING

The aquatic macroinvertebrates were identified in the USFS National Aquatic Ecosystem Monitoring Centers' BYU-Provo, UT Laboratory.

1--Subsampler

Samples were subsampled by placing them in a 1000 ml beaker which is positioned over an automated subsampler containing eight pans with fine-meshed screens on the bottom. The pans are rotated on a phonograph-like table and the sample is flushed from the beaker with water delivered through a tube to the bottom of the beaker. The subsampler has been shown to divide the sample into eight equal parts with high efficiency. Large taxa (such as stoneflies) are added to the subsample to be processed. The contents of one to eight pans are processed and standardly 250-300 organisms are picked from the sample.

2--DAT Diversity Index

Data for the DAT Diversity Index--can be obtained while picking the macros from the petri dishes. An accurate DAT is dependent upon taxonomic training of technicians. Technicians should be trained to identify the taxa as they pick them from the sample. Many of the taxa should be identified to the genus or species level. A Veeder Root counter can be used to count taxa picked and to record the diversity.

3--Taxonomy

The macroinvertebrates are classified to species when keys to nymphs/larvae are available (mostly mayflies) to genus for most other orders of insects.

Chironomids are not classified past tribe, some other diptera are taken to family, and miscellaneous invertebrate taxa are sometimes taken to class, order or even phylum. There are so many good indicators of conditions in the EPT orders and dipterans that there has been a great deal of positive feedback about the accuracy of evaluations of ecosystems and thus we feel quite comfortable with these levels of taxonomic identification.

4--Microscopes

Samples are picked with the aid of a dissection-type microscope, and a zoom-magnification feature is desirable. The taxa are separated into small, 35 X 10 mm petri dishes with micro-fine pointed forceps.

A Nikon 0.8 to 4 X lens and 10X eyepiece provides ample magnification for basic Taxonomy. A Leica Stereozoom 0.7 to 3X lens and 10X or 20X eyepiece provides excellent optics for most structures used for identification.

A compound microscope to 90X is helpful for finer detail needed for some invertebrate identifications.

5--Dry Weight Biomass

Following identification and enumerations samples are oven dried in small aluminum 5/8ths inch deep X 2.25 inch pans at 75 degrees Celsius for 8 hours to get dry-weight biomass, which is reported as a mean in grams/m²/station/date. These data are valuable to help assess fishery potential and benthic community productivity and health.

6--Quality Control

For quality control in the Provo-BYU lab, every sample is checked and the data recorded by our full-time Quality Control Taxonomist who has worked in the lab for over eleven years. Occasionally final resolution is reached through our joint effort. Our lab was 'certified' by EPA in the early 1980's. Loys Parrish visited the lab and consequently sent a letter of approval.

DATA ANALYSIS

The evaluation of ecosystem integrity and health is based upon aquatic macroinvertebrate data and information along with physical habitat and water quality information provided by your aquatic specialist.

Although the BCI has been the most reliable index used over the years, other indices are being tested and may provide some insight about community structure and health. Numerical values for some of these indices, a discussion of their proposed use and observed weaknesses is included in this report.

Tolerances of individual taxa is indicated by alphabetic and other symbols for each taxon on computer printouts.

INDICES Biotic Condition Index (BCI)

This index has been developed by the USDA Forest Service over the past 18 years, providing a versatile monitoring tool for evaluating conditions in aquatic ecosystems and associated drainages.

This index -

1. measures a stream against its own potential, not that of another stream.

2. is sensitive to most forms of environmental stress.
3. is applicable to various types and sizes of streams.
4. provides a basis for assessment of unstressed to stressed conditions.
5. is independent of sample size, if sample contains a representative assemblage of the species in the community.
6. is based upon data easily acquired.
7. (meshes with and supports stream habitat and water quality data).
Integrates biological, physical habitat and water chemistry data.
8. is easily understood, like a score on a test.
9. is particularly useful for monitoring trends.
10. is based mainly upon tolerances (TQ's) of benthic invertebrate taxa (in the sampled community), (84)(88).

Tolerance quotient values used for the BCI have been refined/validated through research on the environment profiles of selected mayfly species (89)(90)(91) using the vast Forest Service database.

Weaknesses:

If a species is present in low numbers, it is treated as if it were present in resident population numbers. The use of CTQd compensates for this in some cases, but it may require further interpretation.

Taxa (species) richness

This index is based upon the fact that a community with good taxonomic diversity generally indicates better conditions than one with low taxonomic diversity (50). This can be a useful metric under certain good conditions.

A good number of families, genera, or species depends upon:

- the level of taxonomic classification,
- elevation,
- topography and parent soil types which affect the water chemistry in the drainage.

Weaknesses:

1. A community may have excellent diversity in an ecosystem with a long history of environmental impacts, and all of the taxa will be those with high tolerance levels.
- EPT (mayfly, stonefly and caddisfly) species may be present, but would be tolerant species.
2. Organic enrichment can increase biodiversity.
3. This index depends upon sample size (Yapp, 1979).

EPT/Chironomidae

Theoretically, this index compares groups of aquatic insects that have the most clean water (sensitive) species with Chironomidae, a family with a majority of the species tolerant to many forms of pollution (82).

Weaknesses:

1. All or most of the EPT species could be tolerant to the perturbations being evaluated. Thus, one would be comparing tolerant to tolerant species which would not provide the intended contrast. A low

- value will often provide a false impression about the environmental quality of an ecosystem.
2. The Chironomid species present could be moderately tolerant to sensitive species.

EPT Index

This index is based upon the fact that most of the cleanwater species are found in the Orders Ephemeroptera, Plecoptera, and Trichoptera. In some cases this will be a valid index.

Percent of the community needed to be in these groups to indicate fair or good or excellent conditions depends upon level of classification.

Weaknesses:

1. Some or all of the EPT species might be tolerant to moderate or severe perturbations.

Percent of Shredder Functional Feeding Group and Total Number of Individuals

Shredders are good indicators of riparian Zone Impacts and may show effects of toxicants adsorbed to the leaves that can affect the microbiological communities that colonize the Coarse Particle Organic Matter (CPOM), (leaves), or can affect shredders directly (82).

Weaknesses:

1. Some shredders are facultative - can utilize in-stream periphyton rather than leaves. Indicators of riparian health must be carefully chosen.
2. Depending upon species present this may or may not be a valid index.

Modified Hilsenhoff Biotic Index (HBI)

Used for EPA RBP-III, this organic enrichment index is based broadly upon family taxonomy. The scale 1-10 is used to estimate the chances that a taxon from a given family would be tolerant to organic enrichment.

This index would work best where an ecosystem has severe organic enrichment impacts. A stream with low organic nutrients would have a low score. Ecosystems with extreme organic enrichment impacts would have a high score (up to 10).

Taxa are assigned TV's (Tolerance Values). The mean value for the community indicates the pollution level. Water with values 0-2 are considered clean, 2-4 slightly enriched, 4-7 enriched and 7-10 polluted (43,44,45).

Weaknesses:

1. Each family of aquatic macroinvertebrates has species which do not compete well where there is organic enrichment. Alignment with tolerances of species in the community could be "right on," completely wrong, or somewhere in between.
2. This index is not designed to detect non-organic effects.

DIVERSITY INDICES

(Variations of Shannon Weaver, 1949)
Shannon's 1949

These indices are based upon the information theory, the more species there are in the community, the more "information." It is a measure of the average degree of "uncertainty" in predicting to what species an individual chosen at random will belong. This increases as the number of species increases and distribution of individuals among species becomes even (83).

Scale: 0 - 1 Poor diversity
1 - 2 Fair diversity
2 - 3 Good diversity
>3 Very good diversity

Weaknesses:

1. If a severely stressed community had a low number of species and each species had close to the same number of organisms, this index would indicate perfect conditions.
2. Diversity, richness and evenness indices often provide a false high. Elimination of a few clean-water species could 'even' the community and show better conditions instead of warning of increased impacts.
3. A dominance among sensitive species could show stress conditions.

Simpson's Index 1949

Values from 0 to 1. Gives probability of two individuals drawn at random from population belonging to the same species. If the probability is high, then the community diversity is low. The higher the number, the higher the diversity (46).

Shannon - Weaver D.I.

Dbar - Dominance Index - values range from 0 - 4.

0 - 1	Poor
1 - 2	Fair
2 - 3	Good
3 - 4	Excellent

RICHNESS INDICES

Menhinick Index (1967) - Margalefs Index (1958)

M.I. = Index of species richness = $\frac{s}{\sqrt{n}}$
(s = number of species in community)
(n = number of organisms)

$$s = k\sqrt{n}$$

This index presupposes that a functional relationship exists between s and n, or where k is the constant. This must hold true or M.I. will vary with samples containing different values of n. Therefore, communities cannot be compared (83).

s = 30, n = 100, M.I. = 3
s = 15, n = 25, M.I. = 3
s = 10, n = 25, M.I. = 2

Weaknesses:

1. These richness indices vary with sample size.
2. Communities cannot be compared.
3. Must use samples of equal size to work.
4. It is possible to use a rarefaction curve for each habitat sampled to correct for different sample sizes. This is based upon a model dealing with the probabilities that each species will be included in the sample.

Evenness Index

Evenness is a measure of the distribution (numbers of organisms) for taxa in the community. When all species in a community are equally abundant, the index is maximum. It decreases toward zero as abundances of species diverge away from evenness (87).

Percent Contribution of Dominant Taxon

A community dominated by a relatively few species would indicate environmental stress (82). This metric is based upon taxonomic identifications to genus or species level. Values range from 1 to 100%. Lower values indicate a more balanced community and better water quality

Community Similarity Indices

These are used when reference communities exist.

1. Community Loss Index - measures the loss of species between reference and experimental stations. Values = 0 to infinity (83).

$$I (\text{community loss}) = \frac{a-c}{b}$$

(a = # taxa at unimpacted site)

(b = # taxa at study site)

(c = # taxa common to a and b)

2. Jaccard Coefficient of Community - indicates similarity in taxonomic composition. Coefficient increases from 0 to 1.0 as similarity increases between communities (83). This index will show stronger relationships between species with similar tolerances.
3. Index of Similarity Between Two Samples - to detect shifts in community assemblages sites above and below pollution impact (83).

a = # species in Sample 1

b = # species in Sample 2

c = # species common to both samples

$$s = \frac{2c}{a+b}$$

Ratio of Scraper and Filtering Collector Functional Feeding Groups

Theory: Imbalances in community would indicate stress conditions in the ecosystem (83). This is often true but requires interpretation.

A description of the functional feeding group concept is recorded in Cummins (1973). Genus-level functional feeding groups can be found in Merrit & Cummins (1984).

Feeding groups may be specialists for a specific food resource or facultative and thus able to use a broader range of food resources.

The trophic generalists are expected to be better able to tolerate disturbance to aquatic habitats and may become numerically dominant because they are more flexible in foods utilized.

- The numbers of scrapers is highest where there is an abundance of diatoms, lower where filamentous algae or mosses are the dominant vegetation.
- Organic enrichment increases the numbers of filtering collectors by increasing the phytoplankton and zooplankton they feed upon.
- Sedimentation could add another dimension to this formula by covering rocks and diatoms used by scrapers.
- In general 50 to 75% scrapers is considered favorable.

Weaknesses:

1. Toxicants in the water chemistry could be absorbed by any of the forms of phytoplankton or periphyton and could affect this ratio.
2. Numbers of filtering collectors may vary seasonally.
3. Some scrapers are more tolerant than others, but in general represent more sensitive species.

ECCLES CREEK

Station 1, above confl. with South Fork Eccles - June 29, 1994

There were indications of some sedimentation at this station. Sediment tolerant indicator taxa present per square meter were *Euparyphus* (14), Ephydriidae (7), and Tubificidae (86). Cleanwater taxa included just one stonefly, *Zapada cinctipes*, with extremely low population numbers, which indicated it was not living successfully under existing conditions. There were three species in the community which have been observed to exist mainly where there is adverse water chemistry. Those were *Euparyphus*, *Brachydelitera*, and another dipteran in the family Ephydriidae.

The observed number of shredders in the community is generally found where the riparian habitat is in poor condition or where instream habitat conditions are not suitable for these species. The DAT at this station was 10.0, which indicates fair biodiversity.

Compared to summer data from 1984 and 1989 at Station 1, conditions in 1994 were not as good as in prior years. BCI values indicated fair conditions (72) in 1984, poor conditions (60) in 1989, and severely stressed conditions (58) in 1994.

The potential for a fishery at this station appeared to be poor. The macroinvertebrate biomass of 0.4 g/m² would limit the number and size of fish that could be supported in this community and the scarcity of cleanwater species indicated limited spawning substrate in this stream reach.

The BCI of 58 indicated that extreme stress conditions were present in this stream reach. It appeared that there may be opportunities for management to improve water quality, riparian habitat quality, and instream habitat quality in this aquatic ecosystem.

Station 1 - October 19, 1994

There was low diversity, and none of the taxa had resident numbers, which indicates instability or periodic severe stress conditions. There were some indications of sedimentation in this stream reach. Sediment tolerant indicator taxa present per square meter were *Hydropsyche* (4), *Brachycentrus americanus* (11), *Euparyphus* (11), and Tubificidae (398). A dipteran, *Euparyphus*, which has been observed to be tolerant to adverse water chemistry, was found in this community. Cleanwater taxa included just one mayfly, *Rhithrogena*, with low population numbers, which indicates that it was not successfully living there under existing conditions.

The observed lack of shredders in the community is generally found where the riparian habitat is in poor condition or where instream habitat conditions are not suitable for these species. The DAT at this station was 3.0, which indicates poor biodiversity.

Compared to fall data from 1984 and 1989 at Station 1, conditions in 1994 appeared to be more stressed. BCI values indicated poor conditions (65) in 1984, (62) in 1989, and (60) in 1994. All of the analysis elements indicated more stress in 1994; see analysis data table.

The potential for a fishery at this station appeared to be poor. The macroinvertebrate biomass of 0.1 g/m² would severely limit the number and size of fish that could be supported in this community and the scarcity of cleanwater species indicated limiting habitat conditions in this stream reach.

The BCI of 60 indicated that stress conditions were present in this stream reach. It appeared that there may be opportunities for management to improve water quality, riparian habitat quality, and instream habitat quality in this aquatic ecosystem.

MACROINVERTEBRATE ANALYSIS

Investigators: PAUL BURNS/DENNIS KELLY
 Forest/District: MANTI-LASAL NF/PRICE R.D.
 Stream: ECCLES CREEK
 State/County: UT/CARBON COUNTY

<u>Station</u>	<u>Location</u>	<u>Date</u>	<u>Diversity Index DAT (mean)</u>	<u>Standing Crop g/m² (mean)</u>	<u>Number of Organisms /m²</u>	<u>Number of Taxa</u>	<u>Biotic Condition Index BCI 50</u>
1		6 29 94	10.0	0.4	1,525	25	58
1		10 19 94	3.0	0.1	671	15	60
1		7 24 89	8.5	1.1	1,861	23	60
1		9 29 89	4.4	0.5	2,389	18	62
1		7 05 84	6.9	0.3	16,108	10	72
1		10 04 84	2.4	1.7	5,821	17	65

<u>Scale</u>	<u>DAT</u>	<u>Standing Crop</u>	<u>BCI</u>
Excellent	18 - 26	4.0 - 12.0	above 90
Good	11 - 17	1.6 - 4.0	80 - 90
Fair	6 - 10	0.6 - 1.5	72 - 79
Poor	0 - 5	0.0 - 0.5	below 72

TOTAL SAMPLE STATISTICS

STATION: 1 Eccles Creek, above confl. with So Fork Eccles, Carbon Co., Manti-Lasal NF, Price R.D.

DATE: 6 29 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	25	1525	559	2490	886.75	33.57	58.15	3.0831	85	86

EPT Index is 13.41%.
 EPT/Chironomidae is 0.29.
 The Margalef Index of richness is 3.274.
 The Menhinick Index of richness is 0.640.
 Simpson's Diversity Index is 0.235.
 Hill's Evenness Index is 0.501.
 Shannon's Index is 2.137.
 The Modified Hilsenhoff Tolerance Index is 3.909.
 Percent contribution of dominant taxa is 71.06%.
 Ratio of Scrapers to Collector-Gatherers is 0.322222.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.007059.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.847059.
 Ratio of Filterer functional feeding group to total number of organisms is 0.101176.
 Ratio of Scraper functional feeding group to total number of organisms is 0.272941.
 Ratio of Predator functional feeding group to total number of organisms is 0.051765.
 Ratio of Piercer functional feeding group to total number of organisms is 0.051765.

• = Clean Water Taxa
 1 = Moderately Tolerant Taxa
 □ = Shredders
 S = Sediment Tolerant Taxa
 O = Organic Enrichment Tolerant Taxa
 C = Adverse Chemistry Tolerant Taxa
 U = Large Stoneflies

SPECIES ANALYSIS

STATION: 1

Eccles Creek, above confl. with So Fork Eccles, Carbon Co., Manti-Lasal NF, Price R.D.

DATE: 6 29 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	LOG10 TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	CINYGMULA		⊥	36	1.555	30	46
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	HEPTAGENIA		⊥ O	18	1.254	54	67
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	93	1.970	72	141
INSECTA	PLECOPTERA	NEMOURIDAE	ZAPADA	CINCTIPES	□	7	0.856	16	13
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	ACROPEDES	⊥ C	7	0.856	72	61
INSECTA	TRICHOPTERA	HYDROPTILIDAE	LEUCOTRICHIA		S	4	0.555	108	59
INSECTA	TRICHOPTERA	LIMNephilidae	NEOTHREMA		⊥ S	39	1.596	24	38
INSECTA	COLEOPTERA	ELMIDAE			S	68	1.834	104	190
INSECTA	COLEOPTERA	ELMIDAE	ZAITZEVIA		S	126	2.099	104	218
INSECTA	COLEOPTERA	ELMIDAE	OPTIOSERVUS		S	11	1.032	104	107
INSECTA	HEMIPTERA	CORIXIDAE			S	4	0.555	108	59
INSECTA	DIPTERA					4	0.555	108	59
INSECTA	DIPTERA	TIPULIDAE	HEXATOMA		⊥ S	18	1.254	36	45
INSECTA	DIPTERA	TIPULIDAE	TIPULA		OSO	4	0.555	80	44
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		⊥	7	0.856	72	61
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	700	2.845	108	307
INSECTA	DIPTERA	EMPIDIDAE	CHELIFERA		S	32	1.509	95	143
INSECTA	DIPTERA	STRATIOMYIDAE	EUPARYPHUS		S C	14	1.157	108	124
INSECTA	DIPTERA	EPHYDRIDAE			S C	7	0.856	108	92
CRUSTACEA	COPEPODA					72	1.856	108	200
CRUSTACEA	OSTRACODA				S	75	1.877	108	202
PELECYPODA					S	7	0.856	108	92
OLIGOCHAETA	TUBIFICIDAE				SO	86	1.935	108	208
ARACHNIDA	HYDRACARINA				SO	79	1.897	98	185

MEAN BIOMASS GM/SQM: 0.4 TOTALS: 1525 3.183

TOTAL SAMPLE STATISTICS

STATION: 1 Eccles Creek, above confl. with So Fork Eccles, Carbon Co., Manti-Lasal NF, Price R.D.

DATE: 10 19 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	15	671	512	830	145.93	12.56	21.75	1.9276	84	84

EPT Index is 29.95%.
 EPT/Chironmidae is 6.22.
 The Margalef Index of richness is 2.151.
 The Merhinick Index of richness is 0.579.
 Simpson's Diversity Index is 0.411.
 Hill's Evenness Index is 0.640.
 Shannon's Index is 1.336.
 The Modified Hilsenhoff Tolerance Index is 3.556.
 Percent contribution of dominant taxa is 91.98%.
 Ratio of Scrapers to Collector-Gatherers is 0.295082.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.000000.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.978610.
 Ratio of Filterer functional feeding group to total number of organisms is 0.037433.
 Ratio of Scraper functional feeding group to total number of organisms is 0.288770.
 Ratio of Predator functional feeding group to total number of organisms is 0.010695.
 Ratio of Piercer functional feeding group to total number of organisms is 0.016043.

- = Clean Water Taxa
- ⊥ = Moderately Tolerant Taxa
- D = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- U = Large Stoneflies

SPECIES ANALYSIS

STATION: 1

Eccles Creek, above confl. with So Fork Eccles, Carbon Co., Manti-Lasal NF, Price R.D.

DATE: 10 19 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	TQ	LOG10 XTQ
INSECTA	EPEMEROPTERA	HEPTAGENIIDAE	RHITHROGENA		-	18	1.254	21	26
INSECTA	EPEMEROPTERA	BAETIDAE	BAETIS		SO	158	2.198	72	158
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	HYDROPSYCHE		S	4	0.555	108	59
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	VAGRITA	1	4	0.555	30	16
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	BRACHYCENTRUS	AMERICANUS	1 S	11	1.032	48	49
INSECTA	TRICHOPTERA	HYDROPTILIDAE	HYDROPTILA		S	7	0.856	108	92
INSECTA	COLEOPTERA	ELMIDAE			S	4	0.555	104	57
INSECTA	COLEOPTERA	ELMIDAE	ZAITZEVIA		S	4	0.555	104	57
INSECTA	DIPTERA	TIPULIDAE	ANTOCHA	MONTICOLA	1 S	4	0.555	40	22
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	32	1.509	108	162
INSECTA	DIPTERA	CERATOPOGONIDAE	BEZZIA		S	4	0.555	96	53
INSECTA	DIPTERA	STRATIOMYIDAE	EUPARYPHUS		S C	11	1.032	108	111
CRUSTACEA	COPEPODA					11	1.032	108	111
OLIGOCHAETA	TUBIFICIDAE				SO	398	2.600	108	280
ARACHNIDA	HYDRACARINA				SO	4	0.555	98	54

MEAN BIOMASS GM/SQM: 0.1 TOTALS: 671 2.827

SOUTH FORK ECCLES CREEK

Station 1, above confl. with Eccles - June 29, 1994

There were indications of sedimentation in this stream reach. Sediment tolerant indicator taxa present per square meter included Tubificidae (276). Cleanwater taxa indicated fairly good water quality and some good instream substrate and included *Zapada*, *Zapada cinctipes*, and *Arctopsyche grandis*.

The observed number of shredders in the community is generally found where the riparian habitat is in good condition. Flows as low as 0.1 cfs were found at this station, which would make good quality pools essential to support a fishery. The DAT at this station was 14.4, which indicates good biodiversity.

Compared to summer data from 1984 and 1989 at Station 1, conditions in 1994 were not as good as in 1984, and similar to those found in 1989. BCI values indicated very good conditions (91) in 1984 and fair conditions (72-74) in 1989 and 1994.

The potential for a fishery at this station appeared to be fair to poor. The macroinvertebrate biomass of 0.7 g/m² would limit the number and size of fish that could be supported in this community. The clean water taxa present indicated that there could be some suitable spawning substrate.

The BCI of 72 indicated that this ecosystem was in just fair condition. It appeared that there may be opportunities for management to improve instream habitat quality and possibly water quality in this aquatic ecosystem.

Station 1 - October 19, 1994

Organic enrichment tolerant taxa and sediment tolerant taxa had fairly good biodiversity in the community. There were some indications of organic enrichment and sedimentation in this stream reach. Sediment tolerant indicator taxa present per square meter included Tubificidae (187). Dipterons which have been observed to be tolerant to adverse chemistry were present. These included *Pericoma*, *Atherix*, and *Euparyphus*. Cleanwater taxa included just one stonefly, *Zapada cinctipes*.

The DAT at this station was 18.7, which indicates excellent biodiversity. Compared to fall data from 1984 and 1989 at Station 1, conditions in 1994 were not as good.

The potential for a fishery at this station appeared to be fair. The macroinvertebrate biomass of 1.6 g/m² could provide nutrients for a fairly good fishery but the scarcity of cleanwater species indicated limiting habitat conditions in this stream reach.

The BCI of 60 indicated that poor conditions were present in this stream reach. The macroinvertebrate community indicated that there may be opportunities for management to improve water quality and instream habitat quality in this aquatic ecosystem.

MACROINVERTEBRATE ANALYSIS

Investigators: PAUL BURNS/DENNIS KEELY
 Forest/District: MANTI-LASAL NF/PRICE R.D.
 Stream: SOUTH FORK ECCLES CREEK
 State/County: UT/CARBON COUNTY

<u>Station</u>	<u>Location</u>	<u>Date</u>	<u>Diversity Index DAT (mean)</u>	<u>Standing Crop g/m² (mean)</u>	<u>Number of Organisms /m²</u>	<u>Number of Taxa</u>	<u>Biotic Condition Index BCI 50</u>
1		6 29 94	14.4	0.7	10,036	25	72
1		10 19 94	18.7	1.6	5,992	29	60
1		7 24 89	13.8	2.2	13,352	30	74
1		9 28 89	14.8	2.4	16,793	28	81
1		7 05 84	11.1	3.3	7,460	21	91
1		10 04 84	10.4	3.2	23,156	24	85

<u>Scale</u>	<u>DAT</u>	<u>Standing Crop</u>	<u>BCI</u>
Excellent	18 - 26	4.0 - 12.0	above 90
Good	11 - 17	1.6 - 4.0	80 - 90
Fair	6 - 10	0.6 - 1.5	72 - 79
Poor	0 - 5	0.0 - 0.5	below 72

TOTAL SAMPLE STATISTICS

STATION: 1 South Fork Eccles Creek, above confl. with Eccles, Carbon Co., Manti-Lasal NF, Price R.D.

DATE: 6 29 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	25	10036	839	19232	8446.16	48.59	84.16	3.6465	67	69

EPT Index is 35.90%.
 EPT/Chironmidae is 1.80.
 The Margalef Index of richness is 2.605.
 The Menhinick Index of richness is 0.250.
 Simpson's Diversity Index is 0.108.
 Hill's Evenness Index is 0.741.
 Shannon's Index is 2.528.
 The Modified Hilsenhoff Tolerance Index is 3.636.
 Percent contribution of dominant taxa is 66.07%.
 Ratio of Scrapers to Collector-Gatherers is 0.511905.

Functional feeding groups
 Ratio of Shredder functional feeding group to total number of organisms is 0.058634.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.720772.
 Ratio of Filterer functional feeding group to total number of organisms is 0.060064.
 Ratio of Scraper functional feeding group to total number of organisms is 0.368967.
 Ratio of Predator functional feeding group to total number of organisms is 0.051484.
 Ratio of Piercer functional feeding group to total number of organisms is 0.144798.

- = Clean Water Taxa
- ⊥ = Moderately Tolerant Taxa
- = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- U = Large Stoneflies

SPECIES ANALYSIS

STATION: 1

South Fork Eccles Creek, above confl. with Eccles Creek, Carbon Co., Manti-Lasal NF, Price R.D.

DATE: 6 29 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	CINYGMULA		⊥	359	2.555	30	76
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	HEPTAGENIA		⊥ O	100	2.002	54	108
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	COLORADENSIS	⊥ S	29	1.458	28	40
INSECTA	EPHEMEROPTERA	LEPTOPHLEBIIDAE	PARALEPTOPHLEBIA		⊥ S	29	1.458	30	43
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	761	2.881	72	207
INSECTA	PLECOPTERA	NEMOURIDAE	ZAPADA		- □	330	2.519	16	40
INSECTA	PLECOPTERA	NEMOURIDAE	ZAPADA	CINCTIPES	- □	258	2.412	16	38
INSECTA	TRICHOPTERA					29	1.458	72	104
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	ARCTOPSYCHE	GRANDIS	-	43	1.634	18	29
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	ACROPEDES	⊥ C	115	2.060	72	148
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	VAGRITA	⊥	72	1.856	30	55
INSECTA	TRICHOPTERA	LIMNAPHILIDAE	NEOTHREMA		⊥ S	1478	3.170	24	76
INSECTA	COLEOPTERA	ELMIDAE			S	488	2.688	104	279
INSECTA	COLEOPTERA	ELMIDAE	ZAITZEVIA		S	474	2.675	104	278
INSECTA	DIPTERA	TIPULIDAE	HEXATOMA		⊥ S	43	1.634	36	58
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		⊥	29	1.458	72	104
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	1977	3.296	108	355
INSECTA	DIPTERA	EMPIDIDAE	CHELIFERA		S	43	1.634	95	155
INSECTA	DIPTERA	CERATOPOGONIDAE	BEZZIA		S	115	2.060	96	197
INSECTA	DIPTERA	STRATIOMYIDAE	EUPARYPHUS		S C	14	1.157	108	124
CRUSTACEA	COPEPODA					57	1.759	108	189
CRUSTACEA	OSTRACODA				S	502	2.701	108	291
TURBELLARIA	TRICLADIDA	PLANARIIDAE	PLANARIA		O	962	2.983	90	268
OLIGOCHAETA	TUBIFICIDAE				SO	276	2.441	108	263
ARACHNIDA	HYDRACARINA				SO	1453	3.162	98	309

MEAN BIOMASS GM/SQM: 0.7 TOTALS: 10036 4.002

TOTAL SAMPLE STATISTICS

STATION: 1 South Fork Eccles Creek, above confl. with Eccles, Carbon Co., Manti-Lasal NF, Price R.D.

DATE: 10 19 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	29	5992	0	13080	6509.36	62.72	108.63	3.4312	79	83

EPT Index is 7.19%.
 EPT/Chironmidae is 0.25.
 The Margalef Index of richness is 3.219.
 The Menhinick Index of richness is 0.375.
 Simpson's Diversity Index is 0.145.
 Hill's Evenness Index is 0.638.
 Shannon's Index is 2.378.
 The Modified Hilsenhoff Tolerance Index is 4.167.
 Percent contribution of dominant taxa is 72.63%.
 Ratio of Scrapers to Collector-Gatherers is 0.234528.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.036527.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.735329.
 Ratio of Filterer functional feeding group to total number of organisms is 0.102994.
 Ratio of Scraper functional feeding group to total number of organisms is 0.172455.
 Ratio of Predator functional feeding group to total number of organisms is 0.058683.
 Ratio of Piercer functional feeding group to total number of organisms is 0.104192.

- = Clean Water Taxa
- ⊥ = Moderately Tolerant Taxa
- = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- U = Large Stoneflies

SPECIES ANALYSIS

STATION: 1

South Fork Eccles Creek, above confl. with Eccles Creek, Carbon Co., Manti-Lasal NF, Price R.D.

DATE: 10 19 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	CINYGMULA		J	129	2.111	30	63
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	EPHEMERELLA	INERMIS	S	22	1.333	92	122
INSECTA	EPHEMEROPTERA	LEPTOPHLEBIIDAE	PARALEPTOPHLEBIA		J S	4	0.555	30	16
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	29	1.458	72	104
INSECTA	PLECOPTERA				LD	4	0.555	48	26
INSECTA	PLECOPTERA	NEMOURIDAE	ZAPADA	CINCTIPES	o D	158	2.198	16	35
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	ACROPEDES	J C	57	1.759	72	126
INSECTA	TRICHOPTERA	LIMNEPHILIDAE	HESPEROPHYLAX		OSO	25	1.400	108	151
INSECTA	TRICHOPTERA	LIMNEPHILIDAE	NEOTHREMMIA		J S	4	0.555	24	13
INSECTA	COLEOPTERA	ELMIDAE			S	298	2.474	104	257
INSECTA	COLEOPTERA	ELMIDAE	ZAITZEVIA		S	420	2.623	104	272
INSECTA	COLEOPTERA	ELMIDAE	OPTIOSERVUS		S	54	1.731	104	180
INSECTA	COLEOPTERA	DYTISCIDAE			S	14	1.157	72	83
INSECTA	DIPTERA	TIPULIDAE	DICRANOTA		J S	118	2.073	36	74
INSECTA	DIPTERA	TIPULIDAE	HEXATOMA		J S	47	1.669	36	60
INSECTA	DIPTERA	TIPULIDAE	TIPULA		OSO	32	1.509	80	120
INSECTA	DIPTERA	SIMULIIDAE			O	79	1.897	108	204
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		J	18	1.254	72	90
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	1737	3.240	108	349
INSECTA	DIPTERA	CERATOPOGONIDAE	BEZZIA		S	83	1.917	96	183
INSECTA	DIPTERA	PSYCHOIDAE	PERICOMA		S C	208	2.318	86	199
INSECTA	DIPTERA	ATHERICIDAE	ATHERIX		S C	14	1.157	66	76
INSECTA	DIPTERA	STRATIOMYIDAE	EUPARYPHUS		S C	22	1.333	108	143
CRUSTACEA	COPEPODA					14	1.157	108	124
CRUSTACEA	OSTRACODA				S	502	2.701	108	291
PELECYPODA					S	22	1.333	108	143
TURBELLARIA	TRICLADIDA	PLANARIIDAE	PLANARIA		O	1069	3.029	90	272
OLIGOCHAETA	TUBIFICIDAE				SO	187	2.271	108	245
ARACHNIDA	HYDRACARINA				SO	624	2.795	98	273

MEAN BIOMASS GM/SQM: 1.6 TOTALS: 5992 3.778

FISH CREEK

Station 1, "post rotenone" - July 1, 1994

There were indications of sedimentation and organic enrichment in this stream reach. Sediment tolerant indicator taxa present per square meter were *Hydropsyche* (165), *Brachycentrus americanus* (416), and *Hesperophylax* (222). The caddisfly *Brachycentrus* competes best where there is a film of sediment over the substrate. Cleanwater taxa indicated fairly good water quality and some good instream substrate and included *Rhithrogena* and *Skwala americana*. The DAT at this station was 18.7, which indicates excellent biodiversity.

Compared to summer data from 1984-1993 at Station 1, conditions in 1994 were about the same as those found in 1984, not as good as in 1989, and better than have been found since the 1991 rotenone project. BCI values have indicated poor conditions (69) in 1984 and 1994, (62) in 1993, and extremely stressed conditions (58) in 1992.

There appeared to be a good potential for a fishery at this station. The macroinvertebrate biomass of 4.9 g/m² could provide nutrients for an excellent fishery. The clean water taxa present indicated that there should be some suitable spawning substrate.

The BCI of 69 indicated that poor conditions were present in this stream reach. It appeared there may be some opportunity for management to improve the instream habitat quality and possibly water quality in this aquatic ecosystem.

Station 1, "post rotenone" - September 15, 1994

There were indications of some sedimentation at this station. Sediment tolerant indicator taxa present per square meter were *Hydropsyche* (395), *Brachycentrus americanus* (50), and *Optioservus* (1406). Cleanwater taxa included just one mayfly, *Drunella doddsi*, with less than population numbers. This mayfly has reappeared three years after the rotenone treatment.

Four of the species found in the pre-rotenone community have not been seen in this stream reach since the rotenone application in the fall of 1991; see Table 1. Of the four species missing, one was a mayfly, *Epeorus*, two were caddisflies, *Glossosoma* and *Oecetis*, and the other was a megalopteran, *Sialis*. Grazing impacts may be complicating the return of these species.

The observed number of shredders in the community is generally found where the riparian habitat is in at least fair condition. The DAT at this station was 17.9, which indicates good biodiversity.

Compared to fall data from 1984-1993 at Station 1, conditions in 1994 were better than those found since the rotenone application in 1991, but not as good as in 1984 or 1989. BCI values indicated good conditions (82-86) in 1984 and 1989, severely stressed conditions (54-58) in 1991 and 1992, poor conditions (68) in 1993, and fair conditions (70) in 1994.

There appeared to be fairly good potential for a fishery at this station. The macroinvertebrate biomass of 1.4 g/m² could provide nutrients for a fairly good fishery. However, the scarcity of cleanwater species indicated there could be limited spawning substrate in this stream reach.

The BCI of 70 indicated that this ecosystem was in just fair condition. It appeared there may be some opportunity for management to improve the instream habitat quality and possibly water quality in this aquatic ecosystem.

TABLE 1
Fish Creek - Station 1

SEPTEMBER 18, 1991
(Pre-Rotenone)

(Post-Rotenone)

TAXA	<u>10-03-91</u>	<u>06-11-92</u>	<u>09-24-92</u>	<u>6-18-93</u>	<u>9-15-93</u>	<u>7-1-94</u>	<u>9-15-94</u>
Ephemeroptera							
Epeorus	0	0	0	0	0	0	0
Heptagenia	0	+	+	0	+	+	+
Ephemerella inermis	0	+	+	+	+	+	+
Drunella grandis	0	0	0	+	0	0	0
Drunella doddsi	0	0	0	0	0	0	+
Tricorythodes minutus	0	+	0	0	0	0	0
Paraleptophlebia	0	+	+	0	+	+	+
Baetis	0	+	+	+	+	+	+
Plecoptera							
Sweltsa	0	0	+	0	0	0	0
Suwallia	0	0	+	0	0	0	0
Skwala americana	0	0	0	0	0	+	0
Pteronarcella badia	0	0	0	+	+	+	+
Capniidae	0	0	r	0	+	0	+
Trichoptera							
Hycropsyche	0	0	0	+	+	+	+
Glossosoma	0	0	0	0	0	0	0
Oecetis	0	0	0	0	0	0	0
Lepidostoma	+	0	0	0	+	0	+
Coleoptera							
Zaitzevia	0	0	0	+	+	0	+
Optioservus	+	+	+	0	0	+	+
Diptera							
Antocha monticola	0	+	0	0	0	0	0
Hexatoma	+	+	0	0	+	+	+
Simuliidae	0	+	0	+	+	+	0
Chironomidae	+	+	+	+	+	+	+
Bezzia	+	+	+	+	+	+	+
Miscellaneous							
Ostracoda	0	+	+	0	+	+	+
Physa	0	+	+	0	0	0	+
Sialis	0	0	0	0	0	0	0
Oligochaeta	+	+	+	+	+	+	+
Hydracarina	+	+	+	+	+	+	+
Pelecypoda	+	+	+	0	0	0	+
TOTAL MISSING	<u>22</u>	<u>14</u>	<u>11</u>	<u>19</u>	<u>14</u>	<u>15</u>	<u>11</u>

MACROINVERTEBRATE ANALYSIS

Investigator: PAUL BURNS/DENNIS KELLY
 Forest/District: MANTI-LASAL NATIONAL FOREST / PRICE R.D.
 Stream: FISH CREEK
 State/County: UTAH / CARBON COUNTY

<u>Station</u>	<u>Location</u>	<u>Date</u>	<u>Diversity Index DAT (mean)</u>	<u>Standing Crop g/m² (mean)</u>	<u>Number of Organisms /m²</u>	<u>Number of Taxa</u>	<u>30Biotic Condition Index BCI 50</u>
1		07 01 94	18.7	4.9	9,609	34	69
1		09 15 94	17.9	1.4	6,204	34	70
1		09 15 93	9.8	1.0	18,331	24	68
1		06 18 93	6.1	3.8	9,271	19	62
1		06 11 92	8.5	4.8	37,387	26	58
1		09 24 92	12.2	1.7	2,874	28	61
1		09 18 91	15.4	0.4	2,038	31	78
1		10 03 91	5.4	0.1	513	9	54
1		07 24 89	14.7	1.9	9,257	31	78
1		09 28 89	12.0	3.3	10,857	23	82
1		07 05 84	7.6	1.8	12,847	21	69
1		10 04 84	16.8	9.3	13,902		86

<u>Scale</u>	<u>DAT</u>	<u>Standing Crop</u>	<u>BCI</u>
Excellent	18 - 26	4.0 - 12.0	above 90
Good	11 - 17	1.6 - 4.0	80 - 90
Fair	6 - 10	0.6 - 1.5	72 - 79
Poor	0 - 5	0.0 - 0.5	below 72

TOTAL SAMPLE STATISTICS

STATION: 1

Fish Creek, Forest Boundasry, post-rotenone, Carbon Co., Manti-Lasal NF, Price R.D.

DATE: 7 1 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	34	9609	5101	14116	4139.82	24.87	43.08	3.8820	73	72

EPT Index is 60.72%.

EPT/Chironmidae is 5.11.

The Margalef Index of richness is 3.599.

The Menhinick Index of richness is 0.347.

Simpson's Diversity Index is 0.102.

Hill's Evenness Index is 0.662.

Shannon's Index is 2.691.

The Modified Hilsenhoff Tolerance Index is 3.118.

Percent contribution of dominant taxa is 58.10%.

Ratio of Scrapers to Collector-Gatherers is 0.805755.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.100822.

Ratio of Coll/Gath functional feeding group to total number of organisms is 0.830471.

Ratio of Filterer functional feeding group to total number of organisms is 0.098581.

Ratio of Scraper functional feeding group to total number of organisms is 0.669156.

Ratio of Predator functional feeding group to total number of organisms is 0.179238.

Ratio of Piercer functional feeding group to total number of organisms is 0.043316.

- = Clean Water Taxa
- ⊥ = Moderately Tolerant Taxa
- = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- ∅ = Large Stoneflies

SPECIES ANALYSIS

STATION: 1 Fish Creek, Forest Boundary, post-rotenone, Carbon Co., Manti-Lasal NF, Price R.D. DATE: 7 1 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	LOG10 TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	RHITHROGENA		-	560	2.748	21	57
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	HEPTAGENIA		1 0	495	2.695	54	145
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	EPHEMERELLA	INERMIS	S	280	2.447	92	225
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	COLORADENSIS	1 S	244	2.387	28	66
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	SERRATELLA	TIBIALIS	1	144	2.157	24	51
INSECTA	EPHEMEROPTERA	LEPTOPHLEBIIDAE	PARALEPTOPHLEBIA		1 S	57	1.759	30	52
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	2339	3.369	72	242
INSECTA	EPHEMEROPTERA	BAETIDAE	CLOEON		SO	14	1.157	72	83
INSECTA	PLECOPTERA				1 0	43	1.634	48	78
INSECTA	PLECOPTERA	CHLOROPERLIDAE			1	22	1.333	24	31
INSECTA	PLECOPTERA	PERLODIDAE	SKWALA	AMERICANA	-	14	1.157	18	20
INSECTA	PLECOPTERA	PERLODIDAE	ISOPERLA		1 S	29	1.458	48	69
INSECTA	PLECOPTERA	PTERONARCYIDAE	PTERONARCELLA	BADIA	1 0 S	696	2.843	30	85
INSECTA	TRICHOPTERA					7	0.856	72	61
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	HYDROPSYCHE		S	165	2.218	108	239
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	ACROPEDES	1 C	14	1.157	72	83
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	BRACHYCENTRUS	AMERICANUS	1 S	416	2.619	48	125
INSECTA	TRICHOPTERA	HYDROPTILIDAE	HYDROPTILA		S	29	1.458	108	157
INSECTA	TRICHOPTERA	HYDROPTILIDAE	NEOTRICHIA		S	43	1.634	108	176
INSECTA	TRICHOPTERA	LIMNephilidae	HESPEROPHYLAX		DSO	222	2.347	108	253
INSECTA	COLEOPTERA	ELMIDAE			S	703	2.847	104	296
INSECTA	COLEOPTERA	ELMIDAE	OPTIOSERVUS		S	919	2.963	104	308
INSECTA	DIPTERA	TIPULIDAE	HEXATOMA		1 S	93	1.970	36	70
INSECTA	DIPTERA	TIPULIDAE	TIPULA		DSO	7	0.856	80	68
INSECTA	DIPTERA	SIMULIIDAE			0	359	2.555	108	275
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		1	215	2.333	72	167
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	926	2.966	108	320
INSECTA	DIPTERA	EMPIDIDAE	HEMERODROMIA		S	72	1.856	95	176
INSECTA	DIPTERA	CERATOPOGONIDAE	BEZZIA		S	36	1.555	96	149
CRUSTACEA	OSTRACODA				S	7	0.856	108	92
OLIGOCHAETA	TUBIFICIDAE				SO	14	1.157	108	124
OLIGOCHAETA	LUMBRICIDAE				SO	7	0.856	90	77
ARACHNIDA	HYDRACARINA				SO	388	2.588	98	253
NEMATODA					S	29	1.458	108	157

MEAN BIOMASS GM/SQM: 4.9 TOTALS: 9609 3.983

TOTAL SAMPLE STATISTICS

STATION: 1

Fish Creek, Forest Boundary, post-rotenone, Carbon Co., Manti-Lasal NF, Price R.D.

DATE: 9 15 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	34	6204	3963	8444	2057.64	19.15	33.17	3.7414	70	71

EPT Index is 48.58%.
 EPT/Chironomidae is 4.69.
 The Margalef Index of richness is 3.779.
 The Menhinick Index of richness is 0.432.
 Simpson's Diversity Index is 0.112.
 Hill's Evenness Index is 0.667.
 Shannon's Index is 2.593.
 The Modified Hilsenhoff Tolerance Index is 2.733.
 Percent contribution of dominant taxa is 65.64%.
 Ratio of Scrapers to Collector-Gatherers is 0.801260.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.091961.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.826489.
 Ratio of Filterer functional feeding group to total number of organisms is 0.076345.
 Ratio of Scraper functional feeding group to total number of organisms is 0.662233.
 Ratio of Predator functional feeding group to total number of organisms is 0.117987.
 Ratio of Piercer functional feeding group to total number of organisms is 0.035281.

- = Clean Water Taxa
- 1 = Moderately Tolerant Taxa
- = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- U = Large Stoneflies

SPECIES ANALYSIS

STATION: 1

Fish Creek, Forest Boundary, post-rotenone, Carbon Co., Manti-Lasal NF, Price R.D.

DATE: 9 15 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	HEPTAGENIA		↓ 0	133	2.123	54	114
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	EPHEMERELLA	INERMIS	S	230	2.361	92	217
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	DODDSI	-	7	0.856	2	1
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	SPINIFERA	↓	39	1.596	24	38
INSECTA	EPHEMEROPTERA	LEPTOPHLEBIIDAE	PARALEPTOPHLEBIA		↓ S	248	2.394	30	71
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	994	2.997	72	215
INSECTA	PLECOPTERA				↓ 0	18	1.254	48	60
INSECTA	PLECOPTERA	CHLOROPERLIDAE			↓	190	2.279	24	54
INSECTA	PLECOPTERA	PERLODIDAE			↓	39	1.596	48	76
INSECTA	PLECOPTERA	PERLODIDAE	ISOPERLA		↓ S	18	1.254	48	60
INSECTA	PLECOPTERA	PTERONARCYIIDAE	PTERONARCELLA	BADIA	↓ OS	276	2.441	30	73
INSECTA	PLECOPTERA	CAPNIIDAE			↓ 0	18	1.254	32	40
INSECTA	TRICHOPTERA					36	1.555	72	111
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	HYDROPSYCHE		S	395	2.596	108	280
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	BRACHYCENTRUS	AMERICANUS	↓ S	50	1.701	48	81
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	MICRASEMA		↓ S	65	1.810	24	43
INSECTA	TRICHOPTERA	LEPIDOSTOMATIDAE	LEPIDOSTOMA		↓ 0	258	2.412	24	57
INSECTA	COLEOPTERA	ELMIDAE			S	682	2.834	104	294
INSECTA	COLEOPTERA	ELMIDAE	ZAITZEVIA		S	50	1.701	104	176
INSECTA	COLEOPTERA	ELMIDAE	OPTIOSERVUS		S	1406	3.148	104	327
INSECTA	DIPTERA	TIPULIDAE	HEXATOMA		↓ S	22	1.333	36	47
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		↓	47	1.669	72	120
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	596	2.775	108	299
INSECTA	DIPTERA	EMPIDIDAE	CHELIFERA		S	11	1.032	95	98
INSECTA	DIPTERA	CERATOPOGONIDAE	BEZZIA		S	29	1.458	96	139
INSECTA	DIPTERA	ATHERICIDAE	ATHERIX		S C	7	0.856	66	56
CRUSTACEA	OSTRACODA				S	18	1.254	108	135
GASTROPODA	LYMNAEIDAE	LYMNAEA			0	29	1.458	108	157
GASTROPODA	PHYSIDAE	PHYSA			0	22	1.333	108	143
PELECYPODA					S	11	1.032	108	111
TURBELLARIA	TRICLADIDA	PLANARIIDAE	PLANARIA		0	7	0.856	90	77
OLIGOCHAETA	TUBIFICIDAE				SO	25	1.400	108	151
ARACHNIDA	HYDRACARINA				SO	219	2.340	98	229
NEMATODA					S	11	1.032	108	111

MEAN BICMASS GM/SQM: 1.4

TOTALS: 6204 3.793

GENTRY HOLLOW

Station 1, at Cyprus Plateau Mine - June 27, 1994

There were indications of some sedimentation at this station. Organisms observed to be tolerant to adverse water chemistry were present and included *Rhyacophila acropedes*, *Euparyphus*, and *Ephydriidae*. Cleanwater taxa indicated fairly good water quality and some good instream substrate and included *Epeorus*, *Zapada*, *Zapada cinctipes*, *Amphinemura*, and *Parapsyche elsis*.

The observed number of shredders in the community is generally found where the riparian habitat is in excellent condition. With a stream gradient of 2.0, this stream reach should have good maintenance capability. The DAT at this station was 17.6, which indicates good biodiversity.

There appeared to be a fairly good potential for a fishery at this station. The macroinvertebrate biomass of 7.9 g/m² could provide nutrients for a good fishery. The clean water taxa present indicated that there should be some suitable spawning substrate.

The BCI of 77 indicated that this ecosystem was in fair condition. It appeared there may be some opportunity for management to improve instream habitat quality and water quality in this aquatic ecosystem.

Station 1, above Wild Cattle Hollow - September 23, 1994

There were some indications of organic nutrients and sedimentation in this stream reach. Cleanwater taxa indicated fairly good water quality and some good instream substrate and included *Epeorus*, *Rhithrogena*, *Zapada*, *Zapada cinctipes*, *Amphinemura*, and *Arctopsyche grandis*.

The observed number of shredders in the community is generally found where the riparian habitat is in good condition. The DAT at this station was 21.2, which indicates excellent biodiversity.

There appeared to be a good potential for a fishery at this station. The macroinvertebrate biomass of 2.3 g/m² could provide nutrients for a good fishery. The clean water taxa present indicated that there should be some suitable spawning substrate.

The BCI of 75 indicated that this ecosystem was in fair condition. It appeared there may be some opportunity for management to improve instream habitat quality and water quality in this aquatic ecosystem.

MACROINVERTEBRATE ANALYSIS

Investigators: PAUL BURNS/DENNIS KELLY
 Forest/District: MANTI-LASAL NF/PRICE R.D.
 Stream: GENTRY HOLLOW CREEK
 State/County: UT/EMERY COUNTY

<u>Station</u>	<u>Location</u>	<u>Date</u>	<u>Diversity Index DAT (mean)</u>	<u>Standing Crop g/m² (mean)</u>	<u>Number of Organisms /m²</u>	<u>Number of Taxa</u>	<u>Biotic Condition Index BCI 50</u>
1		6 27 94	17.6	7.9	7,944	33	77
1		9 23 94	21.2	2.3	10,188	40	75

<u>Scale</u>	<u>DAT</u>	<u>Standing Crop</u>	<u>BCI</u>
Excellent	18 - 26	4.0 - 12.0	above 90
Good	11 - 17	1.6 - 4.0	80 - 90
Fair	6 - 10	0.6 - 1.5	72 - 79
Poor	0 - 5	0.0 - 0.5	below 72

TOTAL SAMPLE STATISTICS

STATION: 1

Gentry Hollow, at Cyprus Plateau Mine, Emery Co., Manti-Lasal NF, Price R.D.

DATE: 6 27 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	33	7944	3410	12477	4163.48	30.26	52.41	3.4753	65	65

EPT Index is 51.36%.
 EPT/Chironmidae is 1.65.
 The Margalef Index of richness is 3.563.
 The Menhinick Index of richness is 0.370.
 Simpson's Diversity Index is 0.148.
 Hill's Evenness Index is 0.609.
 Shannon's Index is 2.409.
 The Modified Hilsenhoff Tolerance Index is 3.643.
 Percent contribution of dominant taxa is 73.67%.
 Ratio of Scrapers to Collector-Gatherers is 0.285322.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.163957.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.821590.
 Ratio of Filterer functional feeding group to total number of organisms is 0.056911.
 Ratio of Scraper functional feeding group to total number of organisms is 0.234417.
 Ratio of Predator functional feeding group to total number of organisms is 0.088528.
 Ratio of Piercer functional feeding group to total number of organisms is 0.053749.

- = Clean Water Taxa
- ⊥ = Moderately Tolerant Taxa
- D = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- U = Large Stoneflies

SPECIES ANALYSIS

STATION: 1		Gentry Hollow, at Cyprus Plateau Mine, Emery Co., Manti-Lasal NF, Price R.D.				DATE: 6 27 94			
TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	LOG10 TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	EPEORUS		-	57	1.759	18	31
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	CINYGMULA		⊥	129	2.111	30	63
INSECTA	EPHEMEROPTERA	LEPTOPHLEBIIDAE	PARALEPTOPHLEBIA		⊥ S	757	2.879	30	86
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	1421	3.153	72	226
INSECTA	PLECOPTERA				⊥ O	43	1.634	48	78
INSECTA	PLECOPTERA	CHLOROPERLIDAE			⊥	4	0.555	24	13
INSECTA	PLECOPTERA	NEMOURIDAE	ZAPADA		- O	57	1.759	16	28
INSECTA	PLECOPTERA	NEMOURIDAE	ZAPADA	CINCTIPES	- O	205	2.311	16	36
INSECTA	PLECOPTERA	NEMOURIDAE	AMPHINEMURA		- O	933	2.970	6	17
INSECTA	PLECOPTERA	PERLODIDAE	ISOPERLA		⊥ S	29	1.458	48	69
INSECTA	TRICHOPTERA					29	1.458	72	104
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	HYDROPSYCHE		S	54	1.731	108	186
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	PARAPSYCHE	ELSTS	-	14	1.157	10	11
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	HYALINATA	⊥	75	1.877	24	45
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	ACROPEDES	⊥ C	115	2.060	72	148
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	VAGRITA	⊥	158	2.198	30	65
INSECTA	COLEOPTERA	ELMIDAE			S	154	2.188	104	227
INSECTA	COLEOPTERA	ELMIDAE	ZAITZEVIA		S	14	1.157	104	120
INSECTA	COLEOPTERA	HYDROPHILIDAE			S	14	1.157	72	83
INSECTA	DIPTERA	TIPULIDAE	ANTOCHA	MONTICOLA	⊥ S	4	0.555	40	22
INSECTA	DIPTERA	TIPULIDAE	HEXATOMA		⊥ S	11	1.032	36	37
INSECTA	DIPTERA	TIPULIDAE	TIPULA		SO	65	1.810	80	144
INSECTA	DIPTERA	SIMULIIDAE			O	29	1.458	108	157
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		⊥	158	2.198	72	158
INSECTA	DIPTERA	CHIRONOMIDAE	ORTNOCLADIINAE		SO	2314	3.364	108	363
INSECTA	DIPTERA	EMPIDIDAE	CHELIFERA		S	118	2.073	95	196
INSECTA	DIPTERA	CERATOPOGONIDAE	BEZZIA		S	115	2.060	96	197
INSECTA	DIPTERA	STRATIOMYIDAE	EUPARYPHUS		S C	18	1.254	108	135
INSECTA	DIPTERA	EPHYDRIDAE			S C	14	1.157	108	124
CRUSTACEA	OSTRACODA				S	355	2.550	108	275
OLIGOCHAETA	LUMBRICIDAE				SO	25	1.400	90	125
ARACHNIDA	HYDRACARINA				SO	427	2.630	98	257
NEMATODA					S	29	1.458	108	157

MEAN BIOMASS GM/SQM: 7.9 TOTALS: 7944 3.900

TOTAL SAMPLE STATISTICS

STATION: 1 Gentry Hollow, above Wild Cattle Hollow, Emery Co., Manti-Lasal WF, Price R.D.

DATE: 9 23 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	40	10118	9186	11051	856.52	4.89	8.47	4.0399	67	67

EPT Index is 45.11%.
 EPT/Chironmidae is 2.65.
 The Margalef Index of richness is 4.229.
 The Menhinick Index of richness is 0.398.
 Simpson's Diversity Index is 0.097.
 Hill's Evenness Index is 0.626.
 Shannon's Index is 2.800.
 The Modified Hilsenhoff Tolerance Index is 3.438.
 Percent contribution of dominant taxa is 61.42%.
 Ratio of Scrapers to Collector-Gatherers is 0.341410.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.069504.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.643972.
 Ratio of Filterer functional feeding group to total number of organisms is 0.211348.
 Ratio of Scraper functional feeding group to total number of organisms is 0.219858.
 Ratio of Predator functional feeding group to total number of organisms is 0.173050.
 Ratio of Piercer functional feeding group to total number of organisms is 0.039716.

- = Clean Water Taxa
- ⊥ = Moderately Tolerant Taxa
- = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- ∅ = Large Stoneflies

SPECIES ANALYSIS

STATION: 1

Gentry Hollow, above Wild Cattle Hollow, Emery Co., Manti-Lasal NF, Price R.D.

DATE: 9 23 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	LOG10 TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	EPEORUS		-	57	1.759	18	31
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	CINYGMULA		↓	14	1.157	30	34
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	RHITHROGENA		-	57	1.759	21	36
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	HEPTAGENIA		↓ O	545	2.737	54	147
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	EPHEMERELLA	INERMIS	S	115	2.060	92	189
INSECTA	EPHEMEROPTERA	LEPTOPHLEBIIDAE	PARALEPTOPHLEBIA		↓ S	861	2.935	30	88
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	1191	3.076	72	221
INSECTA	PLECOPTERA				↓ O	86	1.935	48	92
INSECTA	PLECOPTERA	CHLOROPERLIDAE			↓	14	1.157	24	27
INSECTA	PLECOPTERA	NEMOURIDAE	ZAPADA		- O	187	2.271	16	36
INSECTA	PLECOPTERA	NEMOURIDAE	ZAPADA	CINCTIPES	- O	14	1.157	16	18
INSECTA	PLECOPTERA	NEMOURIDAE	AMPHINEMURA		- O	215	2.333	6	13
INSECTA	PLECOPTERA	PERLODIDAE	MEGARCYS		↓ S	14	1.157	30	34
INSECTA	PLECOPTERA	PERLODIDAE	ISOPERLA		↓ S	373	2.572	48	123
INSECTA	PLECOPTERA	CAPNIIDAE			↓ O	144	2.157	32	69
INSECTA	TRICHOPTERA					57	1.759	72	126
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE			S	14	1.157	108	124
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	HYDROPSYCHE		S	14	1.157	108	124
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	ARCTOPSYCHE	GRANDIS	-	86	1.935	18	34
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA		↓	373	2.572	30	77
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	ACROPEDES	↓ C	86	1.935	72	139
INSECTA	TRICHOPTERA	HYDROPTILIDAE	LEUCOTRICHIA		S	43	1.634	108	176
INSECTA	COLEOPTERA	ELMIDAE			S	158	2.198	104	228
INSECTA	COLEOPTERA	ELMIDAE	ZAITZEVIA		S	29	1.458	104	151
INSECTA	DIPTERA	TIPULIDAE	ANTOCHA	MONTICOLA	↓ S	29	1.458	40	58
INSECTA	DIPTERA	TIPULIDAE	DICRANOTA		↓ S	14	1.157	36	41
INSECTA	DIPTERA	TIPULIDAE	TIPULA		OSO	57	1.759	80	140
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		↓	115	2.060	72	148
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	1607	3.206	108	346
INSECTA	DIPTERA	EMPIDIDAE	CHELIFERA		S	115	2.060	95	195
INSECTA	DIPTERA	CERATOPOGONIDAE	BEZZIA		S	158	2.198	96	211
INSECTA	DIPTERA	PSYCHODIDAE	PERICOMA		S C	86	1.935	86	166
CRUSTACEA	COPEPODA					14	1.157	108	124
CRUSTACEA	OSTRACODA				S	2009	3.303	108	356
PELECYPODA					S	14	1.157	108	124
TURBELLARIA	TRICLADIDA	PLANARIIDAE	PLANARIA		O	230	2.361	90	212
OLIGOCHAETA	TUBIFICIDAE				SO	43	1.634	108	176
OLIGOCHAETA	LUMBRICIDAE				SO	115	2.060	90	185
ARACHNIDA	HYDRACARINA				SO	402	2.604	98	255
NEMATODA					S	359	2.555	108	275

MEAN BIOMASS GM/SQM: 2.3 TOTALS: 10118 4.005

HUNTINGTON CREEK

Station 1, main stem below forks - June 24, 1994

There were indications of sedimentation in this stream reach. Sediment tolerant indicator taxa present per square meter were *Hydropsyche* (72), *Brachycentrus americanus* (287), *Optioservus* (2497), *Atherix* (244), and Tubificidae (115). Cleanwater taxa included *Arctopsyche grandis* and *Apatania*, both with less than resident population numbers.

With a stream gradient of 3.0, this stream reach should have good maintenance capability. The DAT at this station was 11.1, which indicates good biodiversity.

Compared to summer data from 1984 and 1989 at Station 1, conditions in 1994 appeared to be close to the same as found in 1984 but not as good as in 1989. BCI values have indicated fair conditions (74-76) in 1984 and 1994, and good conditions (85) in 1989. Biomass and DAT values were most similar in 1984 and 1994; see analysis data charts.

The potential for a fishery at this station appeared to be fairly good. The macroinvertebrate biomass of 6.2 g/m² could provide nutrients for a good fishery but the low numbers of cleanwater species indicated there could be limited spawning substrate in this stream reach. The large biennial stonefly, *Hesperoperla pacifica*, indicated by its 2-year nymphal stage that this remains a perennial stream and would be an important source of nutrients for the fishery, particularly for larger fish in the community.

The BCI of 74 indicated that this ecosystem was in fair condition. It appeared that there may be opportunities for management to improve water quality and instream habitat quality in this aquatic ecosystem.

Station 1 - September 22, 1994

There were warning numbers of sediment tolerant taxa at this station. Sediment tolerant indicator taxa present per square meter were *Hydropsyche* (1044), *Brachycentrus americanus* (43), *Optioservus* (1091), *Atherix* (86), and Tubificidae (39). Cleanwater taxa included just one caddisfly, *Arctopsyche grandis*, which indicated fairly good water quality and some good instream substrate.

The observed number of shredders in the community is generally found where the riparian habitat is in at least fair condition. The DAT at this station was 17.4, which indicates good biodiversity.

Compared to fall data from 1984 and 1989 at Station 1, conditions in 1994 were not as good as in prior years. BCI values indicated excellent conditions (96) in 1984, very good conditions (89) in 1989, and fairly good conditions (82) in 1994. The DAT value was highest in 1994 and biomass remained good; see analysis data table.

There appeared to be good potential for a fishery at this station. The macroinvertebrate biomass of 3.6 g/m² could provide nutrients for a good fishery. The clean water taxa present indicated that there could be some suitable spawning substrate. The large biennial stonefly, *Hesperoperla pacifica*, indicated by its 2-year nymphal stage that this remains a perennial stream and would be an important source of nutrients for the fishery, particularly for larger fish in the community.

The BCI of 82 indicated that this stream reach was in fairly good condition but could be better. It appeared there may be some opportunity for management to improve the instream habitat quality in this aquatic ecosystem.

MACROINVERTEBRATE ANALYSIS

Investigators: PAUL BURNS/DENNIS KELLY
 Forest/District: MANTI-LASAL NF/PRICE R.D.
 Stream: HUNTINGTON CREEK
 State/County: UT/EMERY COUNTY

<u>Station</u>	<u>Location</u>	<u>Date</u>	<u>Diversity Index DAT (mean)</u>	<u>Standing Crop g/m² (mean)</u>	<u>Number of Organisms /m²</u>	<u>Number of Taxa</u>	<u>Biotic Condition Index BCI 50</u>
1	blw forks	6 24 94	11.1	6.2	22,554	31	74
1		9 22 94	17.4	3.6	12,486	34	82
1		7 25 89	13.3	2.2	16,240	32	85
1		9 29 89	9.0	10.6	44,030	20	89
3 (1)		7 19 84	10.5	6.3			76
3 (1)		10 03 84	12.1	2.5			96

<u>Scale</u>	<u>DAT</u>	<u>Standing Crop</u>	<u>BCI</u>
Excellent	18 - 26	4.0 - 12.0	above 90
Good	11 - 17	1.6 - 4.0	80 - 90
Fair	6 - 10	0.6 - 1.5	72 - 79
Poor	0 - 5	0.0 - 0.5	below 72

TOTAL SAMPLE STATISTICS

STATION: 1

Huntington Creek, Main Stem Below Forks, Emery Co., Manti-Lasal NF, Price R.D.

DATE: 6 24 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTOD
			LL	UL						
3	31	22554	6283	38825	14943.58	38.25	66.26	3.0598	65	68

EPT Index is 47.53%.
 EPT/Chironmidae is 4.82.
 The Margalef Index of richness is 2.993.
 The Menhinick Index of richness is 0.206.
 Simpson's Diversity Index is 0.197.
 Hill's Evenness Index is 0.609.
 Shannon's Index is 2.121.
 The Modified Hilsenhoff Tolerance Index is 3.357.
 Percent contribution of dominant taxa is 80.34%.
 Ratio of Scrapers to Collector-Gatherers is 0.818447.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.000636.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.872733.
 Ratio of Filterer functional feeding group to total number of organisms is 0.019726.
 Ratio of Scraper functional feeding group to total number of organisms is 0.714286.
 Ratio of Predator functional feeding group to total number of organisms is 0.054725.
 Ratio of Piercer functional feeding group to total number of organisms is 0.078269.

- = Clean Water Taxa
- ┘ = Moderately Tolerant Taxa
- = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- U = Large Stoneflies

SPECIES ANALYSIS

STATION: 1 Huntington Creek, Main Stem Below Forks, Emery Co., Manti-Lasal NF, Price R.D. DATE: 6 24 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	LOG10 TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	CINYGULA		1	57	1.759	30	52
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	HEPTAGENIA		1 O	144	2.157	54	116
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	EPHEMERELLA	INERMIS	S	359	2.555	92	235
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	GRANDIS	1 S	115	2.060	32	65
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	COLORADENSIS	1 S	431	2.634	28	73
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	SPINIFERA	1	29	1.458	24	34
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	SERRATELLA	TIBIALIS	1	172	2.236	24	53
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	8511	3.930	72	282
INSECTA	PLECOPTERA	PERLODIDAE	ISOPERLA		1 S	57	1.759	48	84
INSECTA	PLECOPTERA	PERLIDAE	HESPEROPERLA	PACIFICA	1 S O	115	2.060	30	61
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	HYDROPSYCHE		S	72	1.856	108	200
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	ARCTOPSYCHE	GRANDIS	-	57	1.759	18	31
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	BRACHYCENTRUS	AMERICANUS	1 S	287	2.458	48	117
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	MICRASEMA		1 S	57	1.759	24	42
INSECTA	TRICHOPTERA	HYDROPTILIDAE	HYDROPTILA		S	172	2.236	108	241
INSECTA	TRICHOPTERA	HYDROPTILIDAE	LEUCOTRICHIA		S	14	1.157	108	124
INSECTA	TRICHOPTERA	LIMNIPHILIDAE	APATANIA		-	57	1.759	18	31
INSECTA	TRICHOPTERA	LEPIDOSTOMATIDAE	LEPIDOSTOMA		1 O	14	1.157	24	27
INSECTA	COLEOPTERA	ELMIDAE			S	3380	3.529	104	367
INSECTA	COLEOPTERA	ELMIDAE	ZAITZEVIA		S	57	1.759	104	182
INSECTA	COLEOPTERA	ELMIDAE	OPTIOSERVUS		S	2497	3.397	104	353
INSECTA	DIPTERA	TIPULIDAE	ANTOCHA	MONTICOLA	1 S	1536	3.186	40	127
INSECTA	DIPTERA	TIPULIDAE	DICRANOTA		1 S	14	1.157	36	41
INSECTA	DIPTERA	SIMULIIDAE			O	29	1.458	108	157
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		1	86	1.935	72	139
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	2138	3.330	108	359
INSECTA	DIPTERA	EMPIDIDAE	CHELIFERA		S	86	1.935	95	183
INSECTA	DIPTERA	ATHERICIDAE	ATHERIX		S C	244	2.387	66	157
OLIGOCHAETA	TUBIFICIDAE				SO	115	2.060	108	222
ARACHNIDA	HYDRACARINA				SO	1593	3.202	98	313
NEMATODA					S	57	1.759	108	189

MEAN BIOMASS GM/SQM: 6.2 TOTALS: 22554 4.353

TOTAL SAMPLE STATISTICS

STATION: 1 Huntington Creek, Main Stem Below Forks, Emery Co., Manti-Lasal NF, Price R.D.

DATE: 9 22 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	34	12486	3595	21377	8165.40	37.76	65.40	3.1711	56	61

EPT Index is 49.20%.
 EPT/Chironmidae is 22.83.
 The Margalef Index of richness is 3.499.
 The Menhinick Index of richness is 0.304.
 Simpson's Diversity Index is 0.176.
 Hill's Evenness Index is 0.631.
 Shannon's Index is 2.198.
 The Modified Hilsenhoff Tolerance Index is 2.647.
 Percent contribution of dominant taxa is 79.28%.
 Ratio of Scrapers to Collector-Gatherers is 0.787869.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.003736.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.866954.
 Ratio of Filterer functional feeding group to total number of organisms is 0.106322.
 Ratio of Scraper functional feeding group to total number of organisms is 0.683046.
 Ratio of Predator functional feeding group to total number of organisms is 0.068966.
 Ratio of Piercer functional feeding group to total number of organisms is 0.079310.

- = Clean Water Taxa
- ┘ = Moderately Tolerant Taxa
- ◻ = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- U = Large Stoneflies

SPECIES ANALYSIS

STATION: 1		Huntington Creek, Main Stem Below Forks, Emery Co., Manti-Lasal NF, Price R.D.				DATE: 9 22 94			
TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	LOG10 TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	CINYGMULA		⊥	144	2.157	30	64
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	HEPTAGENIA		⊥ O	90	1.953	54	105
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	GRANDIS	⊥ S	226	2.354	32	75
INSECTA	EPHEMEROPTERA	LEPTOPHLEBIIDAE	PARALEPTOPHLEBIA		⊥ S	39	1.596	30	47
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	3818	3.582	72	257
INSECTA	PLECOPTERA				⊥□	11	1.032	48	49
INSECTA	PLECOPTERA	CHLOROPERLIDAE			⊥	68	1.834	24	44
INSECTA	PLECOPTERA	PERLODIDAE	ISOPERLA		⊥ S	47	1.669	48	80
INSECTA	PLECOPTERA	PERLIDAE			⊥ O	29	1.458	24	34
INSECTA	PLECOPTERA	PERLIDAE	HESPEROPERLA	PACIFICA	⊥ S O	83	1.917	30	57
INSECTA	PLECOPTERA	PTERONARCYIDAE	PTERONARCELLA	BADIA	⊥ OS	11	1.032	30	30
INSECTA	PLECOPTERA	CAPNIIDAE			⊥□	11	1.032	32	33
INSECTA	TRICHOPTERA					29	1.458	72	104
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	HYDROPSYCHE		S	1044	3.019	108	326
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	ARCTOPSYCHE	GRANDIS	-	172	2.236	18	40
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	COLORADENSIS	⊥	11	1.032	30	30
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	HYALINATA	⊥	57	1.759	24	42
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	VAGRITA	⊥	97	1.986	30	59
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	BRACHYCENTRUS	AMERICANUS	⊥ S	43	1.634	48	78
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	MICRASEMA		⊥ S	18	1.254	24	30
INSECTA	TRICHOPTERA	LIMNIPHILIDAE	OLIGOPHLEBODES		⊥ S	83	1.917	30	57
INSECTA	TRICHOPTERA	LEPIDOSTOMATIDAE	LEPIDOSTOMA		⊥□	14	1.157	24	27
INSECTA	COLEOPTERA	ELMIDAE			S	2957	3.471	104	360
INSECTA	COLEOPTERA	ELMIDAE	OPTIOSERVUS		S	1091	3.038	104	315
INSECTA	DIPTERA	TIPULIDAE	ANTOCHA	MONTICOLA	⊥ S	786	2.895	40	115
INSECTA	DIPTERA	TIPULIDAE	HEXATOMA		⊥ S	11	1.032	36	37
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	269	2.430	108	262
INSECTA	DIPTERA	EMPIDIDAE	CHELIFERA		S	32	1.509	95	143
INSECTA	DIPTERA	CERATOPOGONIDAE	BEZZIA		S	14	1.157	96	111
INSECTA	DIPTERA	ATHERICIDAE	ATHERIX		S C	86	1.935	66	127
CRUSTACEA	OSTRACODA				S	11	1.032	108	111
PELECYPODA					S	57	1.759	108	189
OLIGOCHAETA	TUBIFICIDAE				SO	39	1.596	108	172
ARACHNIDA	HYDRACARINA				SO	990	2.996	98	293

MEAN BIOMASS GM/SQM: 3.6 TOTALS: 12486 4.096

LEFT FORK HUNTINGTON CANYON

Station 2 - June 24, 1994

There were indications of sedimentation in this stream reach. Sediment tolerant indicator taxa present per square meter were *Hydropsyche* (230), *Brachycentrus americanus* (100), *Atherix* (43), and Tubificidae (144). Cleanwater taxa included just one mayfly, *Epeorus*, with less than resident population numbers.

With a stream gradient of 4.0, this stream reach should have good maintenance capability. The DAT at this station was 12.9, which indicates good biodiversity.

Compared to summer data from 1984 and 1989 at Station 2, conditions in 1994 remained in the fair range (BCI 71). This ecosystem remained productive; see analysis data table.

There appeared to be fairly good potential for a fishery at this station. The macroinvertebrate biomass of 5.6 g/m² could provide nutrients for an excellent fishery but the scarcity of cleanwater species indicated there could be limited spawning substrate in this stream reach. The large biennial stonefly, *Hesperoperla pacifica*, indicated by its 2-year nymphal stage that this remains a perennial stream and would be an important source of nutrients for the fishery, particularly for larger fish in the community.

The BCI of 71 indicated that this ecosystem was in just fair condition. It appeared there may be some opportunity for management to improve the instream habitat quality, riparian habitat quality, and possibly water quality in this aquatic ecosystem.

Station 2 - September 22, 1994

There were indications of sedimentation in this stream reach. Sediment tolerant indicator taxa present per square meter were *Hydropsyche* (804), *Optioservus* (3674), and *Atherix* (144). Cleanwater taxa included *Drunella doddsi* and *Arctopsyche grandis*, both with less than resident population numbers.

The observed number of shredders in the community is generally found where the riparian habitat is in at least fair condition. The DAT at this station was 13.5, which indicates good biodiversity.

Compared to fall data from 1984 and 1989 at Station 2, conditions in 1994 were not as good as in prior years. BCI values indicated good conditions (88-89) in 1984 and 1989, and fair conditions (78) in 1994.

The potential for a fishery at this station appeared to be fairly good. The macroinvertebrate biomass of 3.2 g/m² could provide nutrients for a good fishery but the low numbers of cleanwater species indicated there may be limited spawning substrate in this stream reach.

The BCI of 78 indicated that this ecosystem was in fair condition. It appeared that there may be opportunities for management to improve instream habitat quality in this aquatic ecosystem.

MACROINVERTEBRATE ANALYSIS

Investigators: PAUL BURNS/DENNIS KELLY
 Forest/District: MANTI-LASAL NF/PRICE R.D.
 Stream: LEFT FORK HUNTINGTON CREEK
 State/County: UT/EMERY COUNTY

<u>Station</u>	<u>Location</u>	<u>Date</u>	<u>Diversity Index DAT (mean)</u>	<u>Standing Crop g/m² (mean)</u>	<u>Number of Organisms /m²</u>	<u>Number of Taxa</u>	<u>Biotic Condition Index BCI 50</u>
2		6 24 94	12.9	5.6	12,056	31	71
2		9 22 94	13.5	3.2	11,395	30	78
2		7 25 89	11.7	3.6	18,565	26	72
2		9 29 89	9.2	7.0	41,118	20	89
2		7 19 84	10.0	3.9	17,869	23	77
2		10 03 84	17.1	1.9	10,986	29	88

<u>Scale</u>	<u>DAT</u>	<u>Standing Crop</u>	<u>BCI</u>
Excellent	18 - 26	4.0 - 12.0	above 90
Good	11 - 17	1.6 - 4.0	80 - 90
Fair	6 - 10	0.6 - 1.5	72 - 79
Poor	0 - 5	0.0 - 0.5	below 72

TOTAL SAMPLE STATISTICS

STATION: 2

Left Fork Huntington Canyon, Emery Co., Manti-Lasal NF, Price R.D.

DATE: 6 24 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	31	12056	9812	14300	2060.75	9.87	17.09	3.2297	64	70

EPT Index is 35.48%.
 EPT/Chironmidae is 3.01.
 The Margalef Index of richness is 3.192.
 The Menhinick Index of richness is 0.282.
 Simpson's Diversity Index is 0.167.
 Hill's Evenness Index is 0.639.
 Shannon's Index is 2.239.
 The Modified Hilsenhoff Tolerance Index is 2.812.
 Percent contribution of dominant taxa is 80.71%.
 Ratio of Scrapers to Collector-Gatherers is 0.759669.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.005952.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.861905.
 Ratio of Filterer functional feeding group to total number of organisms is 0.038095.
 Ratio of Scraper functional feeding group to total number of organisms is 0.654762.
 Ratio of Predator functional feeding group to total number of organisms is 0.047619.
 Ratio of Piercer functional feeding group to total number of organisms is 0.095238.

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- ◻ = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- U = Large Stoneflies

SPECIES ANALYSIS

STATION: 2

Left Fork Huntington Canyon, Emery Co., Manti-Lasal NF, Price R.D.

DATE: 6 24 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	EPEORUS		-	29	1.458	18	26
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	CINYGULA		L	14	1.157	30	34
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	HEPTAGENIA		L O	57	1.759	54	94
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	EPHEMERELLA	INERMIS	S	172	2.236	92	205
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	GRANDIS	L S	72	1.856	32	59
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	SERRATELLA	TIBIALIS	L	129	2.111	24	50
INSECTA	EPHEMEROPTERA	LEPTOPHLEBIIDAE	PARALEPTOPHLEBIA		L S	14	1.157	30	34
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	3000	3.477	72	250
INSECTA	EPHEMEROPTERA	BAETIDAE	CLOEON		SO	57	1.759	72	126
INSECTA	PLECOPTERA	CHLOROPERLIDAE			L	29	1.458	24	34
INSECTA	PLECOPTERA	NEMOURIDAE			LO	14	1.157	36	41
INSECTA	PLECOPTERA	PERLOIDAE			L	57	1.759	48	84
INSECTA	PLECOPTERA	PERLIDAE	HESPEROPERLA	PACIFICA	L S O	29	1.458	30	43
INSECTA	PLECOPTERA	PTERONARCYIDAE	PTERONARCELLA	BADIA	LOS	57	1.759	30	52
INSECTA	TRICHOPTERA					14	1.157	72	83
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	HYDROPSYCHE		S	230	2.361	108	254
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	ACROPEDES	L C	14	1.157	72	83
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	VAGRITA	L	43	1.634	30	49
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	BRACHYCENTRUS	AMERICANUS	L S	100	2.002	48	96
INSECTA	TRICHOPTERA	HYDROPTILIDAE	LEUCOTRICHIA		S	144	2.157	108	232
INSECTA	COLEOPTERA	ELMIDAE			S	890	2.949	104	306
INSECTA	COLEOPTERA	ELMIDAE	OPTIOSERVUS		S	3272	3.515	104	365
INSECTA	DIPTERA	TIPULIDAE	ANTOCHA	MONTICOLA	L S	445	2.648	40	105
INSECTA	DIPTERA	TIPULIDAE	DICRANOTA		L S	129	2.111	36	76
INSECTA	DIPTERA	SIMULIIDAE			O	129	2.111	108	228
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	1421	3.153	108	340
INSECTA	DIPTERA	EMPIDIDAE	CHELIFERA		S	100	2.002	95	190
INSECTA	DIPTERA	ANTERICIDAE	ATHERIX		S C	43	1.634	66	107
OLIGOCHAETA	TUBIFICIDAE				SO	144	2.157	108	232
ARACHNIDA	HYDRACARINA				SO	1148	3.060	98	299
NEMATODA					S	57	1.759	108	189

MEAN BIOMASS GM/SQM: 5.6 TOTALS: 12056 4.081

TOTAL SAMPLE STATISTICS

STATION: 2

Left Fork Huntington Canyon, Emery Co., Manti-Lasal NF, Price R.D.

DATE: 9 22 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	30	11395	8606	14185	2561.70	12.98	22.48	2.9321	58	64

EPT Index is 44.33%.

EPT/Chironomidae is 18.53.

The Margalef Index of richness is 3.105.

The Menhinick Index of richness is 0.281.

Simpson's Diversity Index is 0.207.

Hill's Evenness Index is 0.632.

Shannon's Index is 2.032.

The Modified Hilsenhoff Tolerance Index is 2.438.

Percent contribution of dominant taxa is 83.12%.

Ratio of Scrapers to Collector-Gatherers is 0.847076.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.018892.

Ratio of Coll/Gath functional feeding group to total number of organisms is 0.840050.

Ratio of Filterer functional feeding group to total number of organisms is 0.076826.

Ratio of Scraper functional feeding group to total number of organisms is 0.711587.

Ratio of Predator functional feeding group to total number of organisms is 0.081864.

Ratio of Piercer functional feeding group to total number of organisms is 0.108312.

- = Clean Water Taxa
- ⊥ = Moderately Tolerant Taxa
- ◊ = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- U = Large Stoneflies

SPECIES ANALYSIS

STATION: 2

Left Fork Huntington Canyon, Emery Co., Manti-Lasal NF, Price R.D.

DATE: 9 22 94

TAXONOMIC LIST
CLASS

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	LOG10 TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	HEPTAGENIA		1 O	287	2.458	54	132
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	GRANDIS	1 S	115	2.060	32	65
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	DODDSI	-	14	1.157	2	2
INSECTA	EPHEMEROPTERA	LEPTOPHLEBIIDAE	PARALEPTOPHLEBIA		1 S	72	1.856	30	55
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	3258	3.513	72	252
INSECTA	PLECOPTERA				10	14	1.157	48	55
INSECTA	PLECOPTERA	CHLOROPERLIDAE			1	57	1.759	24	42
INSECTA	PLECOPTERA	PERLOOIIDAE	ISOPERLA		1 S	57	1.759	48	84
INSECTA	PLECOPTERA	PTERONARCYIDAE	PTERONARCELLA	BADIA	10S	144	2.157	30	64
INSECTA	PLECOPTERA	CAPNIIDAE			10	29	1.458	32	46
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	HYDROPSYCHE		S	804	2.905	108	313
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	ARCTOPSYCHE	GRANDIS	-	72	1.856	18	33
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	ACROPEDES	1 C	43	1.634	72	117
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	VAGRITA	1	14	1.157	30	34
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	MICRASEMA		1 S	14	1.157	24	27
INSECTA	TRICHOPTERA	LIMNEPHILIDAE	HESPEROPHYLAX		0SO	14	1.157	108	124
INSECTA	TRICHOPTERA	LIMNEPHILIDAE	OLIGOPHLEBODES		1 S	14	1.157	30	34
INSECTA	TRICHOPTERA	LIMNEPHILIDAE	NEOTHREMMA		1 S	14	1.157	24	27
INSECTA	TRICHOPTERA	LEPIDOSTOMATIDAE	LEPIDOSTOMA		10	14	1.157	24	27
INSECTA	COLEOPTERA	ELMIDAE			S	502	2.701	104	280
INSECTA	COLEOPTERA	ELMIDAE	ZAITZEVIA		S	14	1.157	104	120
INSECTA	COLEOPTERA	ELMIDAE	OPTIOSERVUS		S	3674	3.565	104	370
INSECTA	DIPTERA	TIPULIDAE	ANTOCHA	MONTICOLA	1 S	373	2.572	40	102
INSECTA	DIPTERA	TIPULIDAE	HEXATOMA		1 S	14	1.157	36	41
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	273	2.436	108	263
INSECTA	DIPTERA	EMPIDIDAE	CHELIFFERA		S	43	1.634	95	155
INSECTA	DIPTERA	ANTERICIDAE	ATHERIX		S C	144	2.157	66	142
OLIGOCHAETA	LUMBRICIDAE				SO	14	1.157	90	104
ARACHNIDA	HYDRACARINA				SO	1234	3.091	98	302
NEMATODA					S	57	1.759	108	189

MEAN BIOMASS GM/SQM: 3.2 TOTALS: 11395 4.057

UPPER HUNTINGTON CANYON

Station 3, above Eccles Lake and Burnout Canyon - June 29, 1994

There were indications of sedimentation and organic enrichment in this stream reach. Organic enrichment tolerant simuliids numbered 976/square meter. Cleanwater taxa included *Epeorus* and *Drunella doddsi*, which indicated relatively good water quality and instream substrate.

With a stream gradient of 3.0, this stream reach should have good maintenance capability. The DAT at this station was 11.8, which indicates good biodiversity.

Compared to summer data from 1984 and 1989 at Station 3, conditions in 1994 remained in the fair range (BCI 72) but were not quite as good as in prior years. The DAT was similar and biomass was in an excellent range; see analysis data tables.

There appeared to be fairly good potential for a fishery at this station. The macroinvertebrate biomass of 5.0 g/m² could provide nutrients for an excellent fishery and cleanwater species present indicated there should be some suitable spawning substrate in this stream reach. The large biennial stonefly, *Hesperoperla pacifica*, indicated by its 2-year nymphal stage that this remains a perennial stream and would be an important source of nutrients for the fishery, particularly for larger fish in the community.

The BCI of 72 indicated that this ecosystem was in fair condition. It appeared there may be some opportunity for management to improve the instream habitat quality, riparian habitat quality, and possibly water quality in this aquatic ecosystem.

Station 3 - September 23, 1994

The community was dominated by sediment tolerant taxa. There were indications of sedimentation and organic enrichment in this stream reach. Sediment tolerant indicator taxa present per square meter were *Ephemerella inermis* (574), *Hydropsyche* (29), *Brachycentrus americanus* (230), *Optioservus* (5597), and *Atherix* (115). Cleanwater taxa included just one mayfly, *Drunella doddsi*, with less than resident population numbers.

The observed number of shredders in the community is generally found where the riparian habitat is in at least fair condition. The DAT at this station was 17.3, which indicates good biodiversity.

Compared to fall data from 1984 and 1989 at Station 3, conditions in 1994 were not as good as in 1984 or 1989. BCI values indicated excellent conditions (96) in 1984, fair conditions (79) in 1989 and (72) in 1994. Productivity and DAT remained in a good range; see analysis data tables.

The potential for a fishery at this station appeared to be good. The macroinvertebrate biomass of 3.3 g/m² could provide nutrients for a good fishery and the cleanwater taxon present indicated there should be some suitable spawning substrate in this stream reach.

The BCI of 72 indicated that this ecosystem was in just fair condition. It appeared that there may be opportunities for management to improve water quality and instream habitat quality in this aquatic ecosystem.

MACROINVERTEBRATE ANALYSIS

Investigators: PAUL BURNS/DENNIS KELLY
 Forest/District: MANTI-LASAL NF/PRICE R.D.
 Stream: UPPER HUNTINGTON CREEK
 State/County: UT/EMERY COUNTY

<u>Station</u>	<u>Location</u>	<u>Date</u>	<u>Diversity Index DAT (mean)</u>	<u>Standing Crop g/m² (mean)</u>	<u>Number of Organisms /m²</u>	<u>Number of Taxa</u>	<u>Biotic Condition Index BCI 50</u>
3		6 29 94	11.8	5.0	31,173	39	72
3		9 23 94	17.3	3.3	22,482	33	72
3		7 24 89	11.8	2.7	15,279	24	79
3		9 28 89	17.5	3.0	28,058	29	79
3		7 19 84	10.5	6.3	12,209	23	76
3		10 03 84	12.1	2.5	15,265	23	96

<u>Scale</u>	<u>DAT</u>	<u>Standing Crop</u>	<u>BCI</u>
Excellent	18 - 26	4.0 - 12.0	above 90
Good	11 - 17	1.6 - 4.0	80 - 90
Fair	6 - 10	0.6 - 1.5	72 - 79
Poor	0 - 5	0.0 - 0.5	below 72

TOTAL SAMPLE STATISTICS

STATION: 3 Upper Huntington Canyon, abv Eccles Lake and Burnout Canyon, Emery Co., Manti-Lasal NF, Price R.D.

DATE: 6 29 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	39	31173	18359	43986	11767.89	21.80	37.75	2.6708	67	69

EPT Index is 60.96%.
 EPT/Chironmidae is 6.82.
 The Margalef Index of richness is 3.672.
 The Menhinick Index of richness is 0.221.
 Simpson's Diversity Index is 0.304.
 Hill's Evenness Index is 0.516.
 Shannon's Index is 1.851.
 The Modified Hilsenhoff Tolerance Index is 3.118.
 Percent contribution of dominant taxa is 83.61%.
 Ratio of Scrapers to Collector-Gatherers is 0.817025.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.001842.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.941068.
 Ratio of Filterer functional feeding group to total number of organisms is 0.038674.
 Ratio of Scraper functional feeding group to total number of organisms is 0.768877.
 Ratio of Predator functional feeding group to total number of organisms is 0.022099.
 Ratio of Piercer functional feeding group to total number of organisms is 0.036832.

- = Clean Water Taxa
- ± = Moderately Tolerant Taxa
- = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- ∩ = Large Stoneflies

SPECIES ANALYSIS

STATION: 3

Upper Huntington Canyon, abv Eccles Lake and Burnout Canyon, Emery Co., Manti-Lasal NF, Price R.D.

DATE: 6 29 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	LOG10 TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	EPEORUS		-	29	1.458	18	26
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	CINYGULA		L	344	2.537	30	76
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	EPHEMERELLA	INERMIS	S	373	2.572	92	236
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	GRANDIS	L S	29	1.458	32	46
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	DODDSI	-	144	2.157	2	4
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	COLORADENSIS	L S	57	1.759	28	49
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	SERRATELLA	TIBIALIS	L	1091	3.038	24	72
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	16189	4.209	72	303
INSECTA	PLECOPTERA	CHLOROPERLIDAE			L	115	2.060	24	49
INSECTA	PLECOPTERA	PERLOIDAE			L	57	1.759	48	84
INSECTA	PLECOPTERA	PERLIDAE	HESPEROPERLA	PACIFICA	L S U	29	1.458	30	43
INSECTA	PLECOPTERA	PTERONARCYIDAE	PTERONARCELLA	BADIA	LOS	29	1.458	30	43
INSECTA	TRICHOPTERA					29	1.458	72	104
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	HYDROPSYCHE		S	29	1.458	108	157
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	ACROPEDES	L C	29	1.458	72	104
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	BRACHYCENTRUS	AMERICANUS	L S	57	1.759	48	84
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	MICRASEMA		L S	172	2.236	24	53
INSECTA	TRICHOPTERA	HYDROPTILIDAE	LEUCOTRICHIA		S	29	1.458	108	157
INSECTA	TRICHOPTERA	LIMNIPHILIDAE	OLIGOPHLEBODES		L S	172	2.236	30	67
INSECTA	COLEOPTERA	ELMIDAE			S	1780	3.250	104	338
INSECTA	COLEOPTERA	ELMIDAE	ZAITZEVIA		S	29	1.458	104	151
INSECTA	COLEOPTERA	ELMIDAE	OPTIOSERVUS		S	4564	3.659	104	380
INSECTA	COLEOPTERA	DYTISCIDAE			S	57	1.759	72	126
INSECTA	DIPTERA	TIPULIDAE	ANTOCHA	MONTICOLA	L S	230	2.361	40	94
INSECTA	DIPTERA	TIPULIDAE	DICRANOTA		L S	29	1.458	36	52
INSECTA	DIPTERA	TIPULIDAE	HEXATOMA		L S	29	1.458	36	52
INSECTA	DIPTERA	TIPULIDAE	TIPULA		OSO	29	1.458	80	116
INSECTA	DIPTERA	SIMULIIDAE			O	976	2.989	108	322
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		L	402	2.604	72	187
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	2382	3.377	108	364
INSECTA	DIPTERA	EMPIDIDAE	CHELIFERA		S	86	1.935	95	183
INSECTA	DIPTERA	CERATOPOGONIDAE	BEZZIA		S	57	1.759	96	168
INSECTA	DIPTERA	ATHERICIDAE	ATHERIX		S C	29	1.458	66	96
CRUSTACEA	COPEPODA					115	2.060	108	222
CRUSTACEA	OSTRACODA				S	29	1.458	108	157
OLIGOCHAETA	TUBIFICIDAE				SO	57	1.759	108	189
OLIGOCHAETA	LUMBRICIDAE				SO	57	1.759	90	158
ARACHNIDA	HYDRACARINA				SO	1148	3.060	98	299
NEMATODA					S	86	1.935	108	208

MEAN BIOMASS GM/SQM: 5.0 TOTALS: 31173 4.494

TOTAL SAMPLE STATISTICS

STATION: 3 Upper Huntington Canyon, abv Eccles Lake and Burnout Canyon, Emery Co., Manti-Lasal NF, Price R.D.

DATE: 9 23 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	33	22482	11281	33684	10287.71	26.42	45.76	3.4686	71	69

EPT Index is 53.18%.
 EPT/Chironmidae is 5.19.
 The Margalef Index of richness is 3.193.
 The Menhinick Index of richness is 0.220.
 Simpson's Diversity Index is 0.133.
 Hill's Evenness Index is 0.681.
 Shannon's Index is 2.404.
 The Modified Hilsenhoff Tolerance Index is 3.267.
 Percent contribution of dominant taxa is 73.73%.
 Ratio of Scrapers to Collector-Gatherers is 0.699124.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.007660.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.911267.
 Ratio of Filterer functional feeding group to total number of organisms is 0.024258.
 Ratio of Scraper functional feeding group to total number of organisms is 0.637089.
 Ratio of Predator functional feeding group to total number of organisms is 0.066390.
 Ratio of Piercer functional feeding group to total number of organisms is 0.024896.

- = Clean Water Taxa
- ⊥ = Moderately Tolerant Taxa
- = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- U = Large Stoneflies

SPECIES ANALYSIS

STATION: 3 Upper Huntington Canyon, abv Eccles Lake and Burnout Canyon, Emery Co., Manti-Lasal NF, Price R.D.

DATE: 9 23 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	LOG10 TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	CINYGULA		L	2325	3.366	30	100
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	HEPTAGENIA		L O	215	2.333	54	125
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	EPHEMERELLA	INERMIS	S	574	2.759	92	253
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	GRANDIS	L S	201	2.303	32	73
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	DODDSI	-	29	1.458	2	2
INSECTA	EPHEMEROPTERA	LEPTOPHLEBIIDAE	PARALEPTOPHLEBIA		L S	1263	3.101	30	93
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	3947	3.596	72	258
INSECTA	EPHEMEROPTERA	SIPHONURIDAE	AMELETUS		S	14	1.157	72	83
INSECTA	PLECOPTERA	CHLOROPERLIDAE			L	316	2.499	24	59
INSECTA	PLECOPTERA	PERLODIDAE			L	29	1.458	48	69
INSECTA	PLECOPTERA	PERLODIDAE	ISOPERLA		L S	29	1.458	48	69
INSECTA	PLECOPTERA	CAPNIIDAE			L O	158	2.198	32	70
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	HYDROPSYCHE		S	29	1.458	108	157
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	BRACHYCENTRUS	AMERICANUS	L S	230	2.361	48	113
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	MICRASEMA		L S	2569	3.410	24	81
INSECTA	TRICHOPTERA	HYDROPTILIDAE	HYDROPTILA		S	14	1.157	108	124
INSECTA	TRICHOPTERA	LIMNAPHILIDAE	HESPEROPHYLAX		OSO	14	1.157	108	124
INSECTA	COLEOPTERA	ELMIDAE			S	847	2.928	104	304
INSECTA	COLEOPTERA	ELMIDAE	ZAITZEVIA		S	14	1.157	104	120
INSECTA	COLEOPTERA	ELMIDAE	OPTIOSERVUS		S	5597	3.748	104	389
INSECTA	COLEOPTERA	DYTISCIDAE	AGABUS	TRISTUS	S	14	1.157	72	83
INSECTA	COLEOPTERA	CARABIDAE				431	2.634	104	273
INSECTA	DIPTERA	TIPULIDAE	ANTOCHA	MONTICOLA	L S	144	2.157	40	86
INSECTA	DIPTERA	TIPULIDAE	HEXATOMA		L S	115	2.060	36	74
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		L	165	2.218	72	159
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	2138	3.330	108	359
INSECTA	DIPTERA	EMPIDIDAE	CHELIFERA		S	29	1.458	95	138
INSECTA	DIPTERA	ANTERICIDAE	ATHERIX		S C	115	2.060	66	135
CRUSTACEA	OSTRACODA				S	244	2.387	108	257
PELECYPODA					S	43	1.634	108	176
OLIGOCHAETA	TUBIFICIDAE				SO	43	1.634	108	176
OLIGOCHAETA	LUMBRICIDAE				SO	43	1.634	90	147
ARACHNIDA	HYDRACARINA				SO	545	2.737	98	268

MEAN BIOMASS GM/SQM: 3.3 TOTALS: 22482 4.352

NUCKWOODWARD CREEK

Station 1, at Cyprus Plateau Mine - June 27, 1994

There were indications of some sedimentation at this station. Cleanwater taxa indicated fairly good water quality and some good instream substrate and included *Epeorus*, *Drunella doddsi*, and *Zapada*.

The observed number of shredders in the community is generally found where the riparian habitat is in good condition. Flows as low as 0.5 cfs were found at this station, which indicated the need for good pool quality to support a fishery. With a stream gradient of 2.0, this stream reach should have good maintenance capability. The DAT at this station was 16.2, which indicates good biodiversity.

The potential for a fishery at this station appeared to be fairly good. The macroinvertebrate biomass of 1.3 g/m² could provide nutrients for a fairly good fishery. The clean water taxa present indicated that there should be some suitable spawning substrate.

The BCI of 79 indicated that this ecosystem was in fair condition. It appeared that there may be opportunities for management to improve instream habitat quality in this aquatic ecosystem.

Station 1 - September 23, 1994

There were indications of some sedimentation at this station. Cleanwater taxa included *Epeorus*, *Zapada*, *Zapada cinctipes*, and Leuctridae, which indicated relatively good water and habitat quality. The DAT at this station was 19.0, which indicates excellent biodiversity.

Compared to fall data from 1993 at Station 1, conditions in 1994 were almost as good. BCI values indicated that conditions had dropped from fairly good (83) in 1993 to fair (79) in 1994. DAT and biomass values were higher in 1994.

The potential for a fishery at this station appeared to be fairly good. The macroinvertebrate biomass of 1.4 g/m² could provide nutrients for a fairly good fishery and cleanwater species present indicated there could be some suitable spawning substrate in this stream reach.

The BCI of 79 indicated that fair conditions were present in this stream reach. It appeared that there may be opportunities for management to improve instream habitat quality in this aquatic ecosystem.

MACROINVERTEBRATE ANALYSIS

Investigators: PAUL BURNS/DENNIS KELLY
 Forest/District: MANTI-LASAL NF/PRICE R.D.
 Stream: NUCKWOODWARD CREEK
 State/County: UT/EMERY COUNTY

<u>Station</u>	<u>Location</u>	<u>Date</u>	<u>Diversity Index DAT (mean)</u>	<u>Standing Crop g/m² (mean)</u>	<u>Number of Organisms /m²</u>	<u>Number of Taxa</u>	<u>Biotic Condition Index BCI 53</u>
1	*	6 27 94	16.2	1.3	7,506	38	79
1		9 23 94	19.0	1.4	6,473	40	79
1		9 13 93	15.6	0.6	6,588	32	83

* Vicinity of Cyprus-Plateau Mine

<u>Scale</u>	<u>DAT</u>	<u>Standing Crop</u>	<u>BCI</u>
Excellent	18 - 26	4.0 - 12.0	above 90
Good	11 - 17	1.6 - 4.0	80 - 90
Fair	6 - 10	0.6 - 1.5	72 - 79
Poor	0 - 5	0.0 - 0.5	below 72

TOTAL SAMPLE STATISTICS

STATION: 1

Muckwoodward Creek, at Cyprus Plateau Mine, Manti-Lasal NF, Price R.D.

DATE: 6 27 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	38	7506	3136	11876	4013.43	30.87	53.47	3.6171	64	67

EPT Index is 51.48%.
 EPT/Chironmidae is 10.99.
 The Margalef Index of richness is 4.146.
 The Menhinick Index of richness is 0.439.
 Simpson's Diversity Index is 0.134.
 Hill's Evenness Index is 0.608.
 Shannon's Index is 2.507.
 The Modified Hilsenhoff Tolerance Index is 2.882.
 Percent contribution of dominant taxa is 69.89%.
 Ratio of Scrapers to Collector-Gatherers is 0.814045.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.076482.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.850860.
 Ratio of Filterer functional feeding group to total number of organisms is 0.025335.
 Ratio of Scraper functional feeding group to total number of organisms is 0.692639.
 Ratio of Predator functional feeding group to total number of organisms is 0.067878.
 Ratio of Piercer functional feeding group to total number of organisms is 0.015296.

- = Clean Water Taxa
- 1 = Moderately Tolerant Taxa
- = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- U = Large Stoneflies

SPECIES ANALYSIS

STATION: 1

Nuckwoodward Creek, at Cyprus Plateau Mine, Manti-Lasal NF, Price R.D.

DATE: 6 27 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	EPEORUS		-	57	1.759	18	31
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	CINYGMULA		1	531	2.725	30	81
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	EPHEMERELLA	INERMIS	S	140	2.146	92	197
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	COLORADENSIS	1 S	118	2.073	28	58
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	DODDSI	-	11	1.032	2	2
INSECTA	EPHEMEROPTERA	LEPTOPHLEBIIDAE	PARALEPTOPHLEBIA		1 S	79	1.897	30	56
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	2006	3.302	72	237
INSECTA	PLECOPTERA				10	14	1.157	48	55
INSECTA	PLECOPTERA	CHLOROPERLIDAE			1	25	1.400	24	33
INSECTA	PLECOPTERA	NEMOURIDAE	ZAPADA		- 0	542	2.734	16	43
INSECTA	PLECOPTERA	PERLODIDAE	ISOPERLA		1 S	43	1.634	48	78
INSECTA	PLECOPTERA	CAPNIIDAE			10	7	0.856	32	27
INSECTA	TRICHOPTERA					7	0.856	72	61
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	HYALINATA	1	36	1.555	24	37
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	ACROPEDES	1 C	165	2.218	72	159
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	VAGRITA	1	14	1.157	30	34
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	MICRASEMA		1 S	57	1.759	24	42
INSECTA	TRICHOPTERA	LEPIDOSTOMATIDAE	LEPIDOSTOMA		10	11	1.032	24	24
INSECTA	COLEOPTERA	ELMIDAE			S	1421	3.153	104	327
INSECTA	COLEOPTERA	ELMIDAE	ZAITZEVIA		S	746	2.873	104	298
INSECTA	COLEOPTERA	ELMIDAE	OPTIOSERVUS		S	144	2.157	104	224
INSECTA	DIPTERA	TIPULIDAE	ANTOCHA	MONTICOLA	1 S	14	1.157	40	46
INSECTA	DIPTERA	TIPULIDAE	DICRANOTA		1 S	14	1.157	36	41
INSECTA	DIPTERA	TIPULIDAE	HEXATOMA		1 S	29	1.458	36	52
INSECTA	DIPTERA	SIMULIIDAE			0	14	1.157	108	124
INSECTA	DIPTERA	SIMULIIDAE	SIMULIUM		0	14	1.157	108	124
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		1	22	1.333	72	95
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	330	2.519	108	272
INSECTA	DIPTERA	EMPIDIDAE	CHELIFERA		S	11	1.032	95	98
INSECTA	DIPTERA	CERATOPOGONIDAE	BEZZIA		S	43	1.634	96	156
INSECTA	DIPTERA	DIXIDAE	DIXA			11	1.032	60	61
CRUSTACEA	OSTRACODA				S	154	2.188	108	236
CRUSTACEA	COPEPODA					7	0.856	108	92
TURBELLARIA	TRICLADIDA	PLANARIIDAE	PLANARIA		0	269	2.430	90	218
OLIGOCHAETA	TUBIFICIDAE				SO	251	2.400	108	259
OLIGOCHAETA	LUMBRICIDAE				SO	25	1.400	90	125
ARACHNIDA	HYDRACARINA				SO	115	2.060	98	201
NEMATODA					S	7	0.856	108	92

MEAN BIOMASS GM/SQM: 1.3 TOTALS: 7506 3.875

TOTAL SAMPLE STATISTICS

STATION: 1

Muckwoodward Creek, at Cyprus Plateau Mine, Manti-Lasal NF, Price R.D.

DATE: 9 23 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	40	6473	4534	8411	1780.21	15.88	27.50	3.4674	64	67

EPT Index is 30.54%.
 EPT/Chironmidae is 1.19.
 The Margalef Index of richness is 4.444.
 The Menhinick Index of richness is 0.497.
 Simpson's Diversity Index is 0.161.
 Hill's Evenness Index is 0.563.
 Shannon's Index is 2.403.
 The Modified Hilsenhoff Tolerance Index is 3.053.
 Percent contribution of dominant taxa is 75.72%.
 Ratio of Scrapers to Collector-Gatherers is 0.616970.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.047672.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.914634.
 Ratio of Filterer functional feeding group to total number of organisms is 0.008869.
 Ratio of Scraper functional feeding group to total number of organisms is 0.564302.
 Ratio of Predator functional feeding group to total number of organisms is 0.055987.
 Ratio of Piercer functional feeding group to total number of organisms is 0.004989.

- = Clean Water Taxa
- 1 = Moderately Tolerant Taxa
- = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- U = Large Stoneflies

SPECIES ANALYSIS

STATION: 1		Nuckwoodward Creek, at Cyprus Plateau Mine, Manti-Lasal NF, Price R.D.				DATE: 9 23 94			
TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE			⊥	57	1.759	48	84
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	EPEORUS		"	14	1.157	18	20
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	CINYGMULA		⊥	384	2.584	30	77
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	HEPTAGENIA		⊥ O	115	2.060	54	111
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	EPHEMERELLA	INERMIS	S	700	2.845	92	261
INSECTA	EPHEMEROPTERA	LEPTOPHLEBIIDAE	PARALEPTOPHLEBIA		⊥ S	29	1.458	30	43
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	111	2.046	72	147
INSECTA	PLECOPTERA				⊥O	14	1.157	48	55
INSECTA	PLECOPTERA	CHLOROPERLIDAE			⊥	22	1.333	24	31
INSECTA	PLECOPTERA	CHLOROPERLIDAE	SWELTSIA		⊥	7	0.856	24	20
INSECTA	PLECOPTERA	NEMOURIDAE			⊥O	7	0.856	36	30
INSECTA	PLECOPTERA	NEMOURIDAE	ZAPADA		" O	22	1.333	16	21
INSECTA	PLECOPTERA	NEMOURIDAE	ZAPADA	CINCTIPES	" O	14	1.157	16	18
INSECTA	PLECOPTERA	PERLODIDAE	MEGARCYS		⊥ S	7	0.856	30	25
INSECTA	PLECOPTERA	TAENIOPTERYGIDAE	TAENIONEMA		⊥O O	18	1.254	48	60
INSECTA	PLECOPTERA	LEUCTRIDAE			" O	115	2.060	18	37
INSECTA	PLECOPTERA	CAPNIIDAE			⊥O	108	2.032	32	65
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	ACROPEDES	⊥ C	75	1.877	72	135
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	VAGRITA	⊥	32	1.509	30	45
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	MICRASEMA		⊥ S	50	1.701	24	40
INSECTA	TRICHOPTERA	LIMNAPHILIDAE	OLIGOPHLEBOEUS		⊥ S	75	1.877	30	56
INSECTA	COLEOPTERA	ELMIDAE			S	413	2.616	104	272
INSECTA	COLEOPTERA	ELMIDAE	ZAITZEVIA		S	1747	3.242	104	337
INSECTA	COLEOPTERA	ELMIDAE	OPTIOSERVUS		S	36	1.555	104	161
INSECTA	DIPTERA					7	0.856	108	92
INSECTA	DIPTERA	TIPULIDAE	ORMOSIA		S	7	0.856	72	61
INSECTA	DIPTERA	TIPULIDAE	DICRANOTA		⊥ S	22	1.333	36	47
INSECTA	DIPTERA	TIPULIDAE	TIPULA		OSO	11	1.032	80	82
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		⊥	7	0.856	72	61
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	1658	3.219	108	347
INSECTA	DIPTERA	EMPIDIDAE	CHELIFERA		S	39	1.596	95	151
INSECTA	DIPTERA	CERATOPOGONIDAE	BEZZIA		S	32	1.509	96	144
INSECTA	DIPTERA	PSYCHODIDAE	PERICOMA		S C	97	1.986	86	170
CRUSTACEA	OSTRACODA				S	29	1.458	108	157
PELECYPODA					S	29	1.458	108	157
TURBELLARIA	TRICLADIDA	PLANARIIDAE	PLANARIA		O	147	2.168	90	195
OLIGOCHAETA	TUBIFICIDAE				SO	129	2.111	108	228
OLIGOCHAETA	LUMBRICIDAE				SO	18	1.254	90	112
ARACHNIDA	HYDRACARINA				SO	32	1.509	98	147
NEMATODA					S	36	1.555	108	167

MEAN BIOMASS GM/SQM: 1.4 TOTALS: 6473 3.811

WILD CATTLE HOLLOW

Station 1, at Cyprus Plateau Mine - June 27, 1994

There were some indications of organic enrichment and sedimentation in this stream reach. Cleanwater taxa indicated good water quality and some good instream substrate and included *Epeorus*, *Zapada*, *Arctopsyche grandis* and *Parapsyche elsis*.

With a stream gradient of 3.0, this stream reach should have good maintenance capability. The DAT at this station was 17.1, which indicates good biodiversity.

There appeared to be fairly good potential for a fishery at this station. The macroinvertebrate biomass of 7.8 g/m² could provide nutrients for an excellent fishery. The clean water taxa present indicated that there could be some suitable spawning substrate.

The BCI of 72 indicated that this ecosystem was in just fair condition. It appeared there may be some opportunity for management to improve the instream habitat quality and possibly water quality in this aquatic ecosystem.

Station 1 - September 23, 1994

There were indications of sedimentation and organic enrichment in this stream reach. Cleanwater taxa indicated fairly good water quality and some good instream substrate and included *Zapada cinctipes*, *Amphinemura* and *Arctopsyche grandis*.

The observed number of shredders in the community is generally found where the riparian habitat is in good condition. The DAT at this station was 18.0, which indicates good biodiversity.

The potential for a fishery at this station appeared to be good. The macroinvertebrate biomass of 7.9 g/m² could provide nutrients for a good fishery. The clean water taxa present indicated that there should be some suitable spawning substrate.

The BCI of 72 indicated that this ecosystem was in just fair condition. It appeared that there may be opportunities for management to improve instream habitat quality in this aquatic ecosystem.

MACROINVERTEBRATE ANALYSIS

Investigators: PAUL BURNS/DENNIS KELLY
 Forest/District: MANTI-LASAL NF/PRICE R.D.
 Stream: WILD CATTLE HOLLOW CREEK
 State/County: UT/EMERY COUNTY

<u>Station</u>	<u>Location</u>	<u>Date</u>	<u>Diversity Index DAT (mean)</u>	<u>Standing Crop g/m² (mean)</u>	<u>Number of Organisms /m²</u>	<u>Number of Taxa</u>	<u>Biotic Condition Index BCI 50</u>
1	*	6 27 94	17.1	7.8	9,099	31	72
1		9 23 94	18.0	7.9	20,279	33	72

* Near Cyprus Plateau Mine, Above Gentry Hollow Creek

<u>Scale</u>	<u>DAT</u>	<u>Standing Crop</u>	<u>BCI</u>
Excellent	18 - 26	4.0 - 12.0	above 90
Good	11 - 17	1.6 - 4.0	80 - 90
Fair	6 - 10	0.6 - 1.5	72 - 79
Poor	0 - 5	0.0 - 0.5	below 72

TOTAL SAMPLE STATISTICS

STATION: 1

Wild Cattle Hollow, at Cyprus Plateau Mine, Manti-Lasal NF, Price R.D.

DATE: 6 27 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	31	9099	4616	13583	4117.53	26.13	45.25	3.4972	70	69

EPT Index is 47.40%.
 EPT/Chironmidae is 2.27.
 The Margalef Index of richness is 3.291.
 The Menhinick Index of richness is 0.325.
 Simpson's Diversity Index is 0.119.
 Hill's Evenness Index is 0.743.
 Shannon's Index is 2.424.
 The Modified Hilsenhoff Tolerance Index is 3.692.
 Percent contribution of dominant taxa is 70.50%.
 Ratio of Scrapers to Collector-Gatherers is 0.300189.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.029180.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.832808.
 Ratio of Filterer functional feeding group to total number of organisms is 0.072555.
 Ratio of Scraper functional feeding group to total number of organisms is 0.250000.
 Ratio of Predator functional feeding group to total number of organisms is 0.178233.
 Ratio of Piercer functional feeding group to total number of organisms is 0.063091.

- = Clean Water Taxa
- ⊥ = Moderately Tolerant Taxa
- = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- U = Large Stoneflies

SPECIES ANALYSIS

STATION: 1

Wild Cattle Hollow, at Cyprus Plateau Mine, Manti-Lasal NF, Price R.D.

DATE: 6 27 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	LOG10 TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	EPEORUS		-	14	1.157	18	20
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	CINYGMULA		↓	144	2.157	30	64
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	COLORADENSIS	↓ S	72	1.856	28	51
INSECTA	EPHEMEROPTERA	LEPTOPHLEBIIDAE	PARALEPTOPHLEBIA		↓ S	531	2.725	30	81
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	1234	3.091	72	222
INSECTA	PLECOPTERA	NEMOURIDAE			↓ D	57	1.759	36	63
INSECTA	PLECOPTERA	NEMOURIDAE	ZAPADA		- D	129	2.111	16	33
INSECTA	PLECOPTERA	PERLODIDAE	ISOPERLA		↓ S	7	0.856	48	41
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	ARCTOPSYCHE	GRANDIS	-	43	1.634	18	29
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	PARAPSYCHE	ELDIS	-	43	1.634	10	16
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	ACROPEDES	↓ C	1349	3.130	72	225
INSECTA	TRICHOPTERA	LIMNephilidae				14	1.157	108	124
INSECTA	TRICHOPTERA	LIMNephilidae	NEOTHREMMIA		↓ S	675	2.829	24	67
INSECTA	COLEOPTERA	ELMIDAE			S	29	1.458	104	151
INSECTA	COLEOPTERA	ELMIDAE	ZAITZEVIA		S	14	1.157	104	120
INSECTA	COLEOPTERA	ELMIDAE	OPTIOSERVUS		S	14	1.157	104	120
INSECTA	DIPTERA	TIPULIDAE	DICRANOTA		↓ S	22	1.333	36	47
INSECTA	DIPTERA	TIPULIDAE	TIPULA		DSO	79	1.897	80	151
INSECTA	DIPTERA	SIMULIIDAE			O	14	1.157	108	124
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		↓	108	2.032	72	146
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	1794	3.254	108	351
INSECTA	DIPTERA	EMPIDIDAE			S	36	1.555	95	147
INSECTA	DIPTERA	EMPIDIDAE	CHELIFERA		S	29	1.458	95	138
INSECTA	DIPTERA	CERATOPOGONIDAE	BEZZIA		S	14	1.157	96	111
INSECTA	DIPTERA	ANTERICIDAE	ATHERIX		S C	14	1.157	66	76
CRUSTACEA	COPEPODA					7	0.856	108	92
CRUSTACEA	OSTRACODA				S	553	2.742	108	296
TURBELLARIA	TRICLADIDA	PLANARIIDAE	PLANARIA		O	1363	3.135	90	282
OLIGOCHAETA	TUBIFICIDAE				SO	57	1.759	108	189
ARACHNIDA	HYDRACARINA				SO	574	2.759	98	270
NEMATODA					S	65	1.810	108	195

MEAN BIOMASS GM/SQM: 7.8 TOTALS: 9099 3.959

TOTAL SAMPLE STATISTICS

STATION: 1

Wild Cattle Hollow, above Gentry H.G., Manti-Lasal NF, Price R.D.

DATE: 9 23 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	33	20279	5463	35096	13607.45	38.74	67.10	3.6057	71	69

EPT Index is 45.79%.
 EPT/Chironomidae is 3.08.
 The Margalef Index of richness is 3.227.
 The Menhinick Index of richness is 0.232.
 Simpson's Diversity Index is 0.120.
 Hill's Evenness Index is 0.684.
 Shannon's Index is 2.499.
 The Modified Hilsenhoff Tolerance Index is 3.625.
 Percent contribution of dominant taxa is 69.14%.
 Ratio of Scrapers to Collector-Gatherers is 0.381851.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.051663.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.787686.
 Ratio of Filterer functional feeding group to total number of organisms is 0.082803.
 Ratio of Scraper functional feeding group to total number of organisms is 0.300778.
 Ratio of Predator functional feeding group to total number of organisms is 0.051663.
 Ratio of Piercer functional feeding group to total number of organisms is 0.043878.

- = Clean Water Taxa
- ┘ = Moderately Tolerant Taxa
- ◻ = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- U = Large Stoneflies

SPECIES ANALYSIS

STATION: 1

Wild Cattle Hollow, above Gentry H.G., Manti-Lasal NF, Price R.D.

DATE: 9 23 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	HEPTAGENIA		1 O	29	1.458	54	78
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	EPHEMERELLA	INERMIS	S	875	2.942	92	270
INSECTA	EPHEMEROPTERA	LEPTOPHLEBIIDAE	PARALEPTOPHLEBIA		1 S	402	2.604	30	78
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	2713	3.433	72	247
INSECTA	PLECOPTERA	NEMOURIDAE			10	86	1.935	36	69
INSECTA	PLECOPTERA	NEMOURIDAE	ZAPADA	CINCTIPES	10	373	2.572	16	41
INSECTA	PLECOPTERA	NEMOURIDAE	AMPHINEMURA		10	344	2.537	6	15
INSECTA	PLECOPTERA	PERLOIDAE			1	100	2.002	48	96
INSECTA	PLECOPTERA	PERLOIDAE	MEGARCYS		1 S	29	1.458	30	43
INSECTA	PLECOPTERA	CAPNIIDAE			10	158	2.198	32	70
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	ARCTOPSYCHE	GRANDIS	1	115	2.060	18	37
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	ACROPEDES	1 C	732	2.864	72	206
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE			1	1076	3.032	48	145
INSECTA	TRICHOPTERA	HYDROPTILIDAE	HYDROPTILA		S	14	1.157	108	124
INSECTA	TRICHOPTERA	LIMNEPHILIDAE				29	1.458	108	157
INSECTA	TRICHOPTERA	LIMNEPHILIDAE	NEOTHREMA		1 S	2210	3.344	24	80
INSECTA	COLEOPTERA	ELMIDAE			S	86	1.935	104	201
INSECTA	COLEOPTERA	ELMIDAE	OPTIOSERVUS		S	29	1.458	104	151
INSECTA	DIPTERA	TIPULIDAE	DICRANOTA		1 S	115	2.060	36	74
INSECTA	DIPTERA	TIPULIDAE	HEXATOMA		1 S	29	1.458	36	52
INSECTA	DIPTERA	TIPULIDAE	TIPULA		SO	86	1.935	80	154
INSECTA	DIPTERA	SIMULIIDAE			O	29	1.458	108	157
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		1	86	1.935	72	139
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	2928	3.467	108	374
INSECTA	DIPTERA	CERATOPOGONIDAE	BEZZIA		S	29	1.458	96	139
INSECTA	DIPTERA	PSYCHODIDAE	PERICOMA		S C	72	1.856	86	159
INSECTA	DIPTERA	STRATIOMYIDAE	EUPARYPHUS		S C	57	1.759	108	189
CRUSTACEA	COPEPODA					144	2.157	108	232
CRUSTACEA	OSTRACODA				S	1392	3.144	108	339
TURBELLARIA	TRICLADIDA	PLANARIIDAE	PLANARIA		O	4779	3.679	90	331
OLIGOCHAETA	TUBIFICIDAE				SO	29	1.458	108	157
ARACHNIDA	HYDRACARINA				SO	875	2.942	98	288
NEMATODA					S	230	2.361	108	254

MEAN BIOMASS GM/SQM: 7.9 TOTALS: 20279 4.307

INDIAN CREEK

Station 1, .25 mi above Boundary Fence - September 30, 1994

There were some indications of organic enrichment and sedimentation in this stream reach. Organic enrichment tolerant simuliids numbered 1704/square meter. High numbers of simuliids indicate organic nutrient loading, which could be associated with grazing. Sediment tolerant indicator taxa present per square meter were *Hydropsyche* (151), *Hesperophylax* (75), *Argia* (4), *Bezzia* (25), *Euparyphus* (7), and Tubificidae (54). Cleanwater taxa included just one stonefly, *Zapada*, with extremely low population numbers.

The observed number of shredders in the community is generally found where the riparian habitat is in at least fair condition. With a stream gradient of 2.5, this stream reach should have good maintenance capability. The DAT at this station was 18.3, which indicates excellent biodiversity.

The BCI of 63 at this station indicated high diversity among the tolerant taxa, but all of the other analysis elements indicated that conditions were better at this station than at the station below the boundary fence; see analysis data table.

The potential for a fishery at this station appeared to be fair. The macroinvertebrate biomass of 0.9 g/m² would limit the number and size of fish that could be supported in this community and the scarcity of cleanwater species indicated there could be limited spawning substrate in this stream reach.

The BCI of 63 indicated that poor conditions were present in this stream reach. It appeared that there may be opportunities for management to improve water quality and instream habitat quality in this aquatic ecosystem.

Station 2, below Boundary Fence - September 30, 1994

Few of the taxa had resident population numbers, which often indicates instability or periodic stress. There were some indications of organic enrichment and sedimentation in this stream reach. Organic enrichment tolerant simuliids numbered 567/square meter. Cleanwater taxa included *Rhithrogena*, *Drunella doddsi*, and *Arctopsyche grandis*, each with less than resident population numbers, which indicates that they were not successfully living under existing conditions.

The observed number of shredders in the community is generally found where the riparian habitat is in fair to poor condition. With a stream gradient of 2.0, this stream reach should have good

maintenance capability. The DAT at this station was 10.1, which indicates fairly good biodiversity. Compared to data from the station (1) above the boundary fence, there were more indications of stress at this station (2).

The potential for a fishery at this station appeared to be poor. The macroinvertebrate biomass of 0.3 g/m² would limit the number and size of fish that could be supported in this community and the scarcity of cleanwater species indicated limited spawning substrate in this stream reach.

The BCI of 63 indicated that poor conditions were present in this stream reach. It appeared that there may be opportunities for management to improve water quality, riparian habitat quality, and instream habitat quality in this aquatic ecosystem.

Station 3, below Red Ledges - October 12, 1994

There were indications of some sedimentation and organic nutrients at this station. Cleanwater taxa indicated fairly good water quality and some good instream substrate and included *Epeorus*, *Rhithrogena*, *Drunella doddsi*, *Zapada cinctipes*, *Zapada Oregonensis*, and *Arctopsyche grandis*.

The observed number of shredders in the community is generally found where the riparian habitat is in good condition. With a stream gradient of 2.0, this stream reach should have good maintenance capability. The DAT at this station was 13.7, which indicates good biodiversity. Compared to data from the lower stations, conditions at this upper station appeared superior.

There appeared to be a fairly good potential for a fishery at this station. The macroinvertebrate biomass of 1.1 g/m² could provide nutrients for a fairly good fishery. The clean water taxa present indicated that there should be some suitable spawning substrate.

The BCI of 94 indicated that this stream reach was fairly close to meeting its potential and that the ecosystem was stable. It appeared there may be some opportunity for management to improve the instream habitat quality and possibly water quality in this aquatic ecosystem. A management option might be to maintain existing good conditions in this aquatic ecosystem.

MACROINVERTEBRATE ANALYSIS

Investigator: PAUL BURNS/DENNIS KELLY/ANA EGNEW
 Forest/District: MANTI-LASAL NATIONAL FOREST / MONTICELLO R.D.
 Stream: INDIAN CREEK
 State/County: UTAH / SAN JUAN COUNTY

<u>Station</u>	<u>Location</u>	<u>Date</u>	<u>Diversity Index DAT (mean)</u>	<u>Standing Crop g/m² (mean)</u>	<u>Number of Organisms /m²</u>	<u>Number of Taxa</u>	<u>Biotic Condition Index BCI 50</u>
1	@	9 30 94	18.3	0.9	5,414	35	63
2	@@	9 30 94	10.1	0.3	1,751	25	63
3	@@@	10 12 94	13.7	1.1	7,348	27	94
1	*	09 16 93	18.0	0.2	1,722	34	85
1		07 06 93	11.1	0.8	1,747	22	83
1		05 07 88	10.0	0.7	11,499	22	72
1		08 19 87	16.6	3.0	9,921	32	94
1		06 04 82	6.3	0.9			72

@ .25 mi above Boundary Fence
 @@ below Boundary Fence
 @@@ below Red Ledges
 * 100' below Shay-M rd. crossing

<u>Scale</u>	<u>DAT</u>	<u>Standing Crop</u>	<u>BCI</u>
Excellent	18 - 26	4.0 - 12.0	above 90
Good	11 - 17	1.6 - 4.0	80 - 90
Fair	6 - 10	0.6 - 1.5	72 - 79
Poor	0 - 5	0.0 - 0.5	below 72

TOTAL SAMPLE STATISTICS

STATION: 1 Indian Creek, ASP-.25 mi abv. Bndry Fence, San Juan Co., Manti-Lasal NF, Monticello R.D.

DATE: 9 30 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	35	5414	2157	8672	2991.89	31.90	55.26	3.2628	78	80

EPT Index is 32.21%.
 EPT/Chironmidae is 1.38.
 The Margalef Index of richness is 3.955.
 The Menhinick Index of richness is 0.476.
 Simpson's Diversity Index is 0.176.
 Hill's Evenness Index is 0.593.
 Shannon's Index is 2.262.
 The Modified Hilsenhoff Tolerance Index is 3.474.
 Percent contribution of dominant taxa is 76.81%.
 Ratio of Scrapers to Collector-Gatherers is 0.296407.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.040424.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.885355.
 Ratio of Filterer functional feeding group to total number of organisms is 0.357190.
 Ratio of Scraper functional feeding group to total number of organisms is 0.262425.
 Ratio of Predator functional feeding group to total number of organisms is 0.053678.
 Ratio of Piercer functional feeding group to total number of organisms is 0.038436.

- = Clean Water Taxa
- 1 = Moderately Tolerant Taxa
- D = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- U = Large Stoneflies

SPECIES ANALYSIS

STATION: 1 Indian Creek, ASP-.25 mi abv. Bndry Fence, San Juan Co., Manti-Lasal NF, Monticello R.D. DATE: 9 30 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA					4	0.555	64	35
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	EPHEMERELLA	INERMIS	S	36	1.555	92	143
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUHELLA	GRANDIS	1 S	14	1.157	32	37
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	983	2.993	72	215
INSECTA	EPHEMEROPTERA	SIPHONURIDAE	AMELETUS		S	7	0.856	72	61
INSECTA	PLECOPTERA	CHLOROPERLIDAE			1	161	2.208	24	52
INSECTA	PLECOPTERA	NEMOURIDAE	ZAPADA	CINCTIPES	1 D	4	0.555	16	8
INSECTA	PLECOPTERA	PERLODIDAE			1	22	1.333	48	63
INSECTA	PLECOPTERA	CAPNIIDAE			1D	25	1.400	32	44
INSECTA	TRICHOPTERA					154	2.188	72	157
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	HYDROPSYCHE		S	151	2.178	108	235
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	BRACHYCENTRUS	AMERICANUS	1 S	7	0.856	48	41
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	MICRASEMA		1 S	50	1.701	24	40
INSECTA	TRICHOPTERA	LIMNAPHILIDAE	HESPEROPHYLAX		DSO	75	1.877	108	202
INSECTA	TRICHOPTERA	LEPIDOSTOMATIDAE	LEPIDOSTOMA		1D	50	1.701	24	40
INSECTA	COLEOPTERA	ELMIDAE			S	54	1.731	104	180
INSECTA	COLEOPTERA	ELMIDAE	ZAITZEVIA		S	4	0.555	104	57
INSECTA	ODONATA	GOMPHIDAE			S	7	0.856	108	92
INSECTA	ODONATA	COENAGRIONIDAE	ARGIA		S	4	0.555	108	59
INSECTA	DIPTERA					29	1.458	108	157
INSECTA	DIPTERA	TIPULIDAE	ANTOCHA	MONTICOLA	1 S	14	1.157	40	46
INSECTA	DIPTERA	TIPULIDAE	TIPULA		DSO	65	1.810	80	144
INSECTA	DIPTERA	SIMULIIDAE			O	1704	3.232	108	349
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		1	226	2.354	72	169
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	1037	3.016	108	325
INSECTA	DIPTERA	EMPIDIDAE	HEMERODROMIA		S	14	1.157	95	109
INSECTA	DIPTERA	CERATOPOGONIDAE	BEZZIA		S	25	1.400	96	134
INSECTA	DIPTERA	DIXIDAE	DIXA			29	1.458	60	87
INSECTA	DIPTERA	STRATIOMYIDAE	EUPARYPHUS		S C	7	0.856	108	92
CRUSTACEA	COPEPODA					11	1.032	108	111
CRUSTACEA	OSTRACODA				S	61	1.785	108	192
GASTROPODA	PLANORBIDAE				O	14	1.157	108	124
OLIGOCHAETA	TUBIFICIDAE				SO	54	1.731	108	186
OLIGOCHAETA	LUMBRICIDAE				SO	104	2.017	90	181
ARACHNIDA	HYDRACARINA				SO	208	2.318	98	227

MEAN BIOMASS GM/SQM: 0.9 TOTALS: 5414 3.734

TOTAL SAMPLE STATISTICS

STATION: 2

Indian Creek, below Bndry Fence, Manti-Lasal NF, Monticello R.D.

DATE: 9 30 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	25	1751	59	3443	1553.88	51.24	88.75	3.0884	76	79

EPT Index is 25.00%.
 EPT/Chironmidae is 0.99.
 The Margalef Index of richness is 3.214.
 The Menhinick Index of richness is 0.597.
 Simpson's Diversity Index is 0.177.
 Hill's Evenness Index is 0.662.
 Shannon's Index is 2.141.
 The Modified Hilsenhoff Tolerance Index is 3.643.
 Percent contribution of dominant taxa is 79.92%.
 Ratio of Scrapers to Collector-Gatherers is 0.250620.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.100410.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.825820.
 Ratio of Filterer functional feeding group to total number of organisms is 0.430328.
 Ratio of Scraper functional feeding group to total number of organisms is 0.206967.
 Ratio of Predator functional feeding group to total number of organisms is 0.071721.
 Ratio of Piercer functional feeding group to total number of organisms is 0.014344.

• = Clean Water Taxa
 1 = Moderately Tolerant Taxa
 □ = Shredders
 S = Sediment Tolerant Taxa
 O = Organic Enrichment Tolerant Taxa
 C = Adverse Chemistry Tolerant Taxa
 U = Large Stoneflies

SPECIES ANALYSIS

STATION: 2 Indian Creek, below Bndry Fence, Manti-Lasal NF, Monticello R.D.

DATE: 9 30 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	LOG10 TO	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	RHITHROGENA		-	4	0.555	21	11
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	EPHEMERELLA	INERMIS	S	11	1.032	92	94
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	DODDSI	-	4	0.555	2	1
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	205	2.311	72	166
INSECTA	EPHEMEROPTERA	SIPHONURIDAE	AMELETUS		S	4	0.555	72	39
INSECTA	PLECOPTERA				LD	4	0.555	48	26
INSECTA	PLECOPTERA	CHLOROPERLIDAE			L	65	1.810	24	43
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	HYDROPSYCHE		S	11	1.032	108	111
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	ARCTOPSYCHE	GRANDIS	-	11	1.032	18	18
INSECTA	TRICHOPTERA	LIMNAPHILIDAE	HESPEROPHYLAX		OSO	4	0.555	108	59
INSECTA	TRICHOPTERA	LEPIDOSTOMATIDAE	LEPIDOSTOMA		LD	118	2.073	24	49
INSECTA	COLEOPTERA	ELMIDAE			S	14	1.157	104	120
INSECTA	COLEOPTERA	ELMIDAE	OPTIOSERVUS		S	4	0.555	104	57
INSECTA	ODONATA	AESHNIDAE			S	4	0.555	72	39
INSECTA	DIPTERA	TIPULIDAE	ANTOCHA	MONTICOLA	L S	4	0.555	40	22
INSECTA	DIPTERA	TIPULIDAE	TIPULA		OSO	50	1.701	80	136
INSECTA	DIPTERA	SIMULIIDAE			O	567	2.754	108	297
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		L	79	1.897	72	136
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	362	2.559	108	276
INSECTA	DIPTERA	CERATOPOGONIDAE	BEZZIA		S	4	0.555	96	53
INSECTA	DIPTERA	STRATIOMYIDAE	EUPARYPHUS		S C	7	0.856	108	92
CRUSTACEA	COPEPODA					18	1.254	108	135
CRUSTACEA	OSTRACODA				S	147	2.168	108	234
OLIGOCHAETA	TUBIFICIDAE				SO	29	1.458	108	157
ARACHNIDA	HYDRACARINA				SO	25	1.400	98	137

MEAN BIOMASS GM/SQM: 0.3 TOTALS: 1751 3.243

TOTAL SAMPLE STATISTICS

STATION: 3

Indian Creek, Below Red Ledges, San Juan Co., Manti-Lasal NF, Monticello R.D.

DATE: 10 12 94

Repl	Total No. Taxa	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			LL	UL						
3	27	7348	4637	10059	2489.79	19.56	33.88	3.2007	55	53

EPT Index is 86.43%.
 EPT/Chironmidae is 13.21.
 The Margalef Index of richness is 2.921.
 The Menhinick Index of richness is 0.315.
 Simpson's Diversity Index is 0.177.
 Hill's Evenness Index is 0.614.
 Shannon's Index is 2.219.
 The Modified Hilsenhoff Tolerance Index is 2.786.
 Percent contribution of dominant taxa is 74.51%.
 Ratio of Scrapers to Collector-Gatherers is 0.883139.

Functional feeding groups

Ratio of Shredder functional feeding group to total number of organisms is 0.291016.
 Ratio of Coll/Gath functional feeding group to total number of organisms is 0.584961.
 Ratio of Filterer functional feeding group to total number of organisms is 0.039063.
 Ratio of Scraper functional feeding group to total number of organisms is 0.516602.
 Ratio of Predator functional feeding group to total number of organisms is 0.424805.
 Ratio of Piercer functional feeding group to total number of organisms is 0.025391.

- = Clean Water Taxa
- ⊥ = Moderately Tolerant Taxa
- = Shredders
- S = Sediment Tolerant Taxa
- O = Organic Enrichment Tolerant Taxa
- C = Adverse Chemistry Tolerant Taxa
- U = Large Stoneflies

SPECIES ANALYSIS

STATION: 3

Indian Creek, Below Red Ledges, San Juan Co., Manti-Lasal NF, Monticello R.D.

DATE: 10 12 94

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	TYPE	MEAN N/SQM	LOG10 N/SQM	LOG10 TQ	LOG10 XTQ
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	EPEORUS		-	22	1.333	18	23
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	CINYGMULA		1	395	2.596	30	77
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	RHITHROGENA		-	273	2.436	21	51
INSECTA	EPHEMEROPTERA	HEPTAGENIIDAE	HEPTAGENIA		1 0	2232	3.349	54	180
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	EPHEMERELLA	INERMIS	S	57	1.759	92	161
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	DODDSI	-	301	2.479	2	4
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS		SO	79	1.897	72	136
INSECTA	EPHEMEROPTERA	SIPHONURIDAE	AMELETUS		S	7	0.856	72	61
INSECTA	PLECOPTERA				10	1909	3.281	48	157
INSECTA	PLECOPTERA	CHLOROPERLIDAE			1	488	2.688	24	64
INSECTA	PLECOPTERA	NEMOURIDAE	ZAPADA	CINCTIPES	- 0	43	1.634	16	26
INSECTA	PLECOPTERA	NEMOURIDAE	ZAPADA	OREGONENSIS	- 0	14	1.157	16	18
INSECTA	PLECOPTERA	PERLODIDAE			1	57	1.759	48	84
INSECTA	PLECOPTERA	PERLODIDAE	MEGARCYS		1 S	86	1.935	30	58
INSECTA	PLECOPTERA	TAENIOPTERYGIDAE			10	22	1.333	48	63
INSECTA	PLECOPTERA	CAPNIIDAE			10	151	2.178	32	69
INSECTA	TRICHOPTERA					7	0.856	72	61
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE	ARCTOPSYCHE	GRANDIS	-	14	1.157	18	20
INSECTA	TRICHOPTERA	RHYACOPHILIDAE	RHYACOPHILA	ACROPEDES	1 C	14	1.157	72	83
INSECTA	TRICHOPTERA	LIMNIPHILIDAE	OLIGOPHLEBODES		1 S	179	2.254	30	67
INSECTA	COLEOPTERA	ELMIDAE	ZAITZEVIA		S	29	1.458	104	151
INSECTA	COLEOPTERA	ELMIDAE	OPTIOSERVUS		S	14	1.157	104	120
INSECTA	DIPTERA	CHIRONOMIDAE	TANYPODINAE		1	29	1.458	72	104
INSECTA	DIPTERA	CHIRONOMIDAE	ORTHOCLADIINAE		SO	452	2.655	108	286
CRUSTACEA	OSTRACODA				S	273	2.436	108	263
TURBELLARIA	TRICLADIDA	PLANARIIDAE	PLANARIA		0	14	1.157	90	104
ARACHNIDA	HYDRACARINA				SO	187	2.271	98	222

MEAN BIOMASS GM/SQM: 1.1

TOTALS: 7348 3.866

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