

Pecos River Aquatic Life-Use Study

TEXAS CLEAN RIVERS PROGRAM
United States Section, International Boundary and Water Commission

Preliminary Report August 2000

SUMMARY

With the assistance of Mr. Gregg Larson, TNRCC Region 7, fish and benthic macroinvertebrates were collected at TNRCC station # 13265, Pecos River at FM 652 bridge northeast of the town of Orla. Data collections took place in October 1999 and February 2000. Habitat and water quality were assessed to evaluate their relationship to community structure. This current data set will be used to complement a series of other surveys conducted by Mr. Larson at other sites along the Pecos River. Data analyses and report writing are tentatively scheduled for the week of July 17th. The objective of this study was to assess fish and benthic macroinvertebrate communities in relation to habitat and water quality in the Pecos River near Orla, Texas. This site heavily influenced by wide ranging flow events that occur as a result of periodic releases from Red Bluff Reservoir. These releases coincide with the spring and summer irrigation needs downstream.

MATERIALS/METHODS

Stream flow was determined using the United States Geological Survey (USGS) flow gage located at the site. Turbidity was also measured using a secchi disk. Other physical parameters assessed include riparian, bank, and instream characteristics. Temperature, pH, dissolved oxygen, and specific conductance were also measured using a Hydrolab H₂O multiparameter instrument. The fish sampling effort was conducted using seines and gill nets, while a triangular kick-net was utilized for benthic macroinvertebrate sampling. Benthic organisms and unidentifiable fishes were preserved in the field using a 10% Formalin solution for lab identification at a later date. Habitat quality indices and indices of biotic integrity will be utilized to score and rate aquatic-life communities. The indices and scoring criteria are presented in Table 1 and Table 2. These indices will be used to determine the habitat quality and score each individual site accordingly.

RESULTS/DISCUSSION

Benthic macroinvertebrates have not been examined taxonomically (tentatively scheduled for July 17th). Preliminary results for physicochemical parameters are presented in Table 3. Preliminary results of fish counts from the seine hauls and gill nets are presented in Table 4.

Habitat Quality Index metrics and scoring criteria (Twidwell and Davis, 1989).

Rating Parameter	Attributes of Subcategories for Rating Scores			
Instream Cover	Common (4)	Occasional (3)	Rare (2)	None (0)
Riffles	Common (4)	Occasional (3)	Rare (2)	None (0)
Pool Depth	Large and Deep (4) Max. Pool depth > 4 ft.	Moderate (3) Max. pool depth 2-4 ft.	Small (2) Max. pool depth < 1 ft.	None (1) No existing pools; only shallow auxillary pockets
Bank Stability	Stable (3) Little evidence (< 10%) of eroded banks; side slopes generally (< 30°)	Moderately Stable (2) Some evidence (11-30%) of eroded banks; small areas of erosion mostly healed over. Side slopes up to 40° on one bank	Moderately Unstable (1) Moderate frequency (31-50%) and size of eroded areas. Side slopes up to 60° on some banks.	Unstable (0) Large and frequent (> 50%) eroded areas; raw areas frequent along steep banks; side slopes > 60°
Riparian Cover	Extensive (3) Width of natural cover > 350 ft.	Wide (2) Width of natural cover 150-350 ft.	Moderate (1) Width of natural cover 15-150 ft.	Narrow (0) Width of natural cover < 15 ft.
Flow Fluctuations	Minor (3) Little or none from base flow	Moderate (2) Evidence of debris along middle portion of banks	Severe (0) Evidence of debris high on banks	Severe (0) Intermittent Stream
Channel Sinuosity	High (3) > 2 well defined outside bends with deep outside areas and shallow inside areas	Moderate (2) 1-2 outside bends with at least one bend well defined	Low (1) 1-2 poorly defined outside bends; slight meandering within modified bends	None (0) Straight channel; maybe channelized
Bottom Substrate	Stable (3) > 50% cobbles, rubble, or gravel	Moderately Stable (2) 31-50% gravel or larger substrate	Moderately Unstable (1) 10-30% gravel or larger substrate	Unstable (0) Bottom uniform sand, clay, silt, or, bedrock
Aesthetics	Wilderness (3) Outstanding natural beauty; usually wooded or unpastured area; water clarity exceptional	Natural Area (2) Trees and/or native vegetation common; water clarity discolored	Common Setting (1) Not offensive; water may be colored or turbid	Offensive (0) Stream does not enhance aesthetics; dumping area; water discolored

Total Score and Aquatic Life Subcategories

30-26	Exceptional
25-21	High
20-15	Intermediate
≤ 14	Limited

Pecos River Northeast of Orla (FM 652) Habitat Quality Index

	10/13/99		02/24/00	
Rating Parameter	Metric Value	Site Score	Metric Value	Site Score
Instream Cover	rare	2 - Rare	rare	2 - Rare
Riffles	none	0 - None	none	0 - None
Pool Depth	4.5ft	4 - Large & Deep	1.8ft	3 - Moderate
Bank Stability	27.9%erosion 30.7degrees	2 - Mod Stable	17.5% erosion 7.8 degrees	2 - Mod Stable
Riparian Cover	350 +	3 - Extensive	350 +	3 - Extensive
Flow Fluctuations	severe	0 - Severe	severe	0 -Severe
Channel Sinuosity	1 mod defined	1 - low	1 mod defined	1- low
Bottom Substrate	10%	1 - Mod Unstable	5%	0 - unstable
Aesthetics	Natural Area	2 - Natural Area	Natural Area	2 - Natural Area
Index Score		15 - Intermediate		13 - Limited

Total Score and Aquatic Life
Subcategories

30-26	Exceptional
25-21	High
20-15	Intermediate
≤ 14	Limited

Fish species collection at time of sampling.

Common Name	Scientific Name	10/13/99	%	02/24/00	%	Trophic Guild	Tolerance Rating	Native/Exotic
Carp	<i>Cyprinus carpio</i>	6	7.8	4	5.1	Omnivore	Tolerant	N
Inland silverside	<i>Menidia beryllina</i>	2	2.6	0	0	Insectivore	n/a	N
Western mosquitofish	<i>Gambusia affinis</i>	1	1.3	0	0	Insectivore	Tolerant	N
Gulf killifish	<i>Fundulus grandis</i>	16	20.8	14	17.9	Omnivore	n/a	N
Gizzard Shad	<i>Dorosoma cepedianum</i>	6	7.8	2	2.6	Omnivore	Tolerant	N
Pupfish hybrid (sheepshead minnow x Pecos pupfish)	<i>Cyprinodon variegatus x pecosensis</i>	5	6.5	2	2.6	Omnivore	Tolerant	N
Rainwater killifish	<i>Lucania parva</i>	5	6.5	0	0	Insectivore	n/a	N
Red shiner	<i>Cyprinella lutrensis</i>	36	46.7	56	71.8	Insectivore	Tolerant	N
TOTAL		77	100	78	100			

Index of Biotic Integrity metrics and scoring criteria used to evaluate the Pecos River Fish Community (Karr et al., 1986).

Category	Metric	Scoring Criteria			10/13/99		02/24/00	
		5	3	1	Metric Value	Site Score	Metric Value	Site Score
Species richness and composition	1. Total number of fish species	≥ 10	9 - 5	4 - 0	7	3	4	1
	2. Total number of Cyprinid species (excluding common carp)	> 3	2-3	< 2	1	1	1	1
	3. Total number of catfish species	> 1	1	0	0	0	0	0
	4. Total number of sunfish species (only <i>Lepomis</i> sp.)	> 1	1	0	0	0	0	0
	5. Total number of intolerant species (bonus)		≥ 1		0	0	0	0
	6. % of individual as tolerant species (excluding Poeciliidae)	< 25%	25-55%	> 55%	70.1	1	82.1	1
Trophic Composition	7. % of individuals as omnivores	< 20%	20-45%	> 45%	42.9	3	28.2	3
	8. % of individuals as insectivores	> 66%	33-66%	< 33%	57.1	3	71.8	5
Fish Abundance and condition	9. Number of individuals per seine haul	> 150	75-150	< 75	6	1	6	1
	10. % of individuals as exotic species	< 1 %	1-2%	> 2%	0	1	0	1
	11. % of individuals with disease or another anomaly	< 0.5%	0.5-1%	> 1%	0	5	0	0

18 Limited

13 Limited

Total Score and Aquatic Life
Subcategories

48 - 50	Exceptional
40 - 43	High
33 - 37	Intermediate
≤ 28	Limited

Field measurements obtained at the time of sampling.

Parameter	Unit	Collection Date	
		October 13, 1999	February 24, 2000
Time	military	0930 hrs	0900 hrs
Flow	ft ³ /sec	16.8	8.2
Water Temperature	°C	18.31	11.24
pH	S.U.	7.30	7.44
Dissolved Oxygen	mg/l	6.48	8.15
Conductivity	µmhos/cm	8,200	10,680
Turbidity (secchi)	inches	16	17

Index of Biotic Integrity Metric Descriptions

Metric	Description
Taxa Richness (No. of genera)	Measure of diversity. The number of different genera encountered at each sampling site. High taxa richness usually is associated with good water quality and a stable benthic macroinvertebrate community.
No. of individuals captured	Benthic macroinvertebrate community density can be a good reinforcement metric when used in association with another metric such as EPT index or % dominant genus. A high density of pollution-intolerant taxa could solidify a conclusion that a water body had excellent water quality.
% contribution - dominant genus	A benthic macroinvertebrate community has an even distribution of individuals among taxa reflects good water quality. It can also be a water quality indicator if the dominant genus comprises a pollution tolerant (poor water quality) or intolerant (good water quality) classification.
Ratio of scrapers/filterers	Scrapers prefer periphytic growth on the substrate as a food source whereas filterers utilize organic material suspended in the water column. This metric is used to evaluate the proportion of periphytic to suspended food sources which may favor one of these two functional feeding group.
Biotic index	<p>A community-wide indicator of pollution tolerance. The biotic index is the numerical ranking associated with the ability for a population to tolerate pollution. A low score means low tolerance. A sample characterized by dominance of populations with relatively low pollution tolerance (low biotic index) would be an indicator of good water quality. This metric is calculated</p> $\text{by: } \frac{\sum (n_i)(NCBI\text{value}_i)}{n_i}$
EPT index (No. of EPT genera)	The number of different genera in Ephemeroptera, Plecoptera, and Trichoptera orders for each sample. More taxa present from these pollution-intolerant groups generally reflects good water quality.
Ration of EPT/Chironomids	The ratio of Ephemeroptera, Plecoptera and Trichoptera to Chironomidae individuals. This gives a indication of the proportion of low tolerance populations to high tolerance populations
Functional feedings groups (% of community)	This metric provides an indication of a predominant food source which may favor a specific functional feeding group. In addition to scrapers and filterers described above, shredders may dominate in stream with an abundance of leafy debris or coarse particulate organic matter (CPOM), mners burrow into plants or sediment, gatherers prefer decomposing organic material or loose surface films, and predators feed on animal tissue.

Benthic Macroinvertebrate	10/13/99		02/24/00		NCBI*	Trophic Relationships (Merritt and Cummins, 1984)
	No.	%	No.	%		
Decapoda (shrimps) <i>Palaemonetes pugio</i>	12	8.7	5	2.6	6.7 ^b	Gatherer
Coleoptera (beetles) <i>Berosus</i> sp.	2	1.4	3	1.6	8.6	Gatherer
<i>Tropisternus lateralis</i>	1	0.7	1	0.5	9.8 ^a	Gatherer
Hydrophillidae (unknown)	1	0.7				
Diptera (true flies) Chironomidae	91	65.5	148	78.7		
Hemiptera (true bugs) Cicadellidae(unknown)	2	1.4				
Zygoptera (damselflies) <i>Argia</i> sp.	27	19.5	11	5.9	8.7	Predator
Anisoptera (dragonflies) <i>Erpetogomphus</i> sp.	2	1.4	8	4.3	1.0	Predator
Gastropoda (snails) <i>Physella virgata</i>	1	0.7	3	1.6	8.0	Scraper
Trichoptera (caddisflies) <i>Cheumatopsyche</i> sp.			3	1.6	6.6	Filterer
Annelida (segmented worms) <i>Paranais litoralis</i>			6	3.2		
	139	100	188			