A Biotic and Hydrologic Assessment of Honeycut Springs

Description

Honeycut springs issue at approximately 1,040 ft asl from a limestone ledge lined with maidenhair fern (*Adiantum capillus-veneris*) in an otherwise dry creekbed in eastern Blanco County to form the perennial headwaters of Honeycut Creek. The springs emerge in an area of rather complex geology as several geologic units, primarily of the Trinity Group, such as the Glen Rose Limestone, Hensell Sand, Cow Creek Limestone, Marble Falls Limestone, and the Honeycut Formation are exposed. Based on field investigations and GIS analysis of the spring location in relation to geology, the springs issue from the Cow Creek Limestone at its interface with the underlying Marble Falls Limestone. Honeycut Creek primarily traverses the formation of the same name, the Honeycut Formation, before entering the Pedernales River.

According to the ranch manager, Scott Gardner, springflow generally disappears into the streambed about 300-400m downstream of the headwater springs, but does connect to the Pedernales River during flood events. This is not only important hydrologically, but also biologically as a sporadic connection with a larger waterbody (i.e. Pedernales River) provides an opportunity for immigration and emigration of aquatic species to and from Honeycut Creek.

Additional seeps issue upstream at the head of several unnamed tributaries to Honeycut Creek. These seeps issue from the base of the Glen Rose limestone, where it overlies the Hensell Sand, and their outflow generally disappears (likely lost to evapotranspiration, but perhaps to an underlying formation such as the Hensell Sand) before entering Honeycut Creek. It is also worth noting that upstream of the perennial headwaters (i.e. Honeycut Springs), calcium carbonate deposits (indicative of groundwater emergence) blanketed the cobble and gravel deposits within the dry creekbed during our visit in February 2008. This suggests the seeps observed in upstream tributaries, and likely ephemeral springs that were not observed contribute a significant volume of flow, rich in bicarbonate, following rain events.

Riparian vegetation along Honeycut Creek is relatively limited (about 8-15m wide) and adjacent land is primarily grass prairie. The spring headwaters are heavily shaded by ashe-juniper (*Juniperus ashei*), cedar elm (*Ulmus crassifolia*), live oak (*Quercus virginiana*), sycamore (*Platanus occidentalis*), pecan (*Carya illinoensis*), and walnut (*Juglans* sp.). This vegetation provides abundant leaf litter to the spring and creek, which is an important energy source and colonization site for bio-films. Given the large amount of canopy cover upstream, no aquatic vegetation is present. As the canopy opens downstream numerous small sycamores (*Platanus occidentalis*) are present, a large cottonwood (*Populus freemontii*) was noted, aquatic vegetation (i.e. *Ludwigia* sp.) was sparse and algae (filamentous and *Chara* sp.) was abundant. Such excessive growths of algae are common in impoundments and they can be problematic from an aesthetic perspective as well as biologically.

Discharge from Honeycut Springs forms a shallow pool within the limestone ledge that spills down a small glide into another small (1.0m x 1.0m), shallow (20cm) pool. This small pool outflows through a short run into a broad shallow run filled with abundant leaf litter. From this point downstream habitat has been altered by a series of low water crossings and is thus limited to predominantly pool habitats. Upstream of the impoundments, the substrate is composed of bedrock overlain by cobble, pebble, sand, and thin silt deposits. In contrast, the deeper pools formed by the low water crossings contain abundant silt deposits.

Honeycut Springs was visited on 19 September 2005, 2 November 2005, 6 April 2006, 30 May 2007, and 8 February 2008.

Hydrology

Historic data for Honeycut Springs is limited to one discharge measurement of 16 gallons per minute (GPM) from November 1, 1978 (Brune 1981). Additional discharge estimates were made using standard USGS cross-sections methods (Buchanan and Somers 1976) with the use of a Sontek Flowtracker Acoustic Doppler Flow Meter. Discharge estimates are as follows:

September 19, 2005 – 22 GPM
November 2, 2005 - 22 GPM
April 6, 2006 – 24 GPM
May 30, 2007 – 548 GPM

February 8, 2008 – 63 GPM

Based on these discharge estimates, Honeycut Springs would be best classified as small (4.5 – 45 GPM) in size (Brune 1975). The observed variability in discharge estimates is largely the result of prevailing climatic conditions and subsequent aquifer levels. For example, discharge was relatively stable between September 2005 and April 2006 (22-24 GPM) when rainfall was average to below average. In contrast, discharge greatly increased in May 2007 (548 GPM) as numerous additional springs were issuing upstream of the perennial headwaters due to well above average rainfall received in the preceeding months (2 large flood events and at least 5 inches of rain in previous month). This was the only occasion when flow was observed upstream of Honeycut Springs. Because the observed streamflow was cool and clear and no significant rainfall had occurred in the preceeding days, it is believed to be the product of the upstream seeps and ephemeral springs.

In February 2008, following 6-8 months with little to no rainfall, the springs discharge remained above estimates made in 2005 and 2006. This sustained discharge through a relatively extended dry period is to some extent the result of high groundwater levels (from excessive rainfall the previous year), but also suggests the springs either issue through a restricted flow system, are fed by a regional source, or some combination of the two. The relatively constant flow observed during dry conditions (2005-2006), as compared to more than ten other springs visited by the author in Blanco County also supports this theory. Further hydrogeologic investigations will be needed to better understand the dynamics of this spring system.

Biota

Biological collections were performed in September 2005, April 2006, and May 2007.

Fish collections employed the use of a 3 m x 1.2 m seine (0.6 cm mesh) and were limited to the area upstream of the first low water crossing (a total length of approximately 100m). A total of 4 fish species were collected on each sampling date. Fish species collected include the western mosquitofish (*Gambusia affinis*), roundnose minnow (*Dionda episcopa*), green sunfish (*Lepomis cyanellus*), and longear sunfish (*Lepomis megalotis*). The western mosquitofish was collected primarily on margins throughout the spring run, while the other three species were restricted to particular areas. Sunfishes were limited to the deeper pool habitat formed by the unnatural low water crossing. This area has undercut banks on both sides and numerous "nests" were visible in the substrate. In contrast, the roundnose minnow was primarily collected near the headwaters where a cobble and gravel substrate were exposed and flowing water was available. The use of differential habitats by these species is largely a product of their life history requirements and characteristics.

The western mosquitofish and green sunfish are both widespread species able to tolerate a wide variety of habitats. The western mosquitofish has been stocked extensively across the United States for mosquito control. The green sunfish is recognized as one of the first fish species to penetrate up reaches of streams during high water periods (Pflieger 1975) and repopulate intermittent streams (Cross and Collins 1975). Based on our collections, the western mosquitofish and green sunfish are commonly found in headwater springs of the Edwards Plateau Ecoregion, however, they are most common and abundant in impacted springs (i.e. those with impoundments or other degradation) with abundant algae and/or aquatic vegetation.

In contrast to the western mosquitofish and green sunfish, the roundnose minnow is an endemic species, restricted to spring-fed habitats in Mexico, Texas, and Mew Mexico. This species requires clear gravel and clean, clear flowing water to successfully reproduce and is thus considered an indicator species. The narrow range of requirements for the roundnose minnow is likely the primary reason it is restricted to the upper portion of the spring run.

The longear sunfish is characteristic of clear, permanent-flowing streams with sandy or rocky bottoms and is commonly more abundant in creeks than in large rivers (Pflieger 1975). Based on our collections, the longear sunfish is the most commonly encountered sunfish species in springs of the Edwards Plateau Ecoregion. The habits of the longear sunfish are similar to that of the green sunfish (Plieger 1975) and the two species are reported to hybridize (Robison and Buchanan 1988, Etnier and Starnes 2001)

Aquatic life use ratings based on metric scoring of the fish community using the State's regionalized index of biotic integrity for wadeable streams (Linam et al 2002) varied for the three sampling dates (Tables 1-3). During our first assessment on 19 September 2005, the aquatic life use rating based on the fish community was intermediate (IBI score- 30). On the following two assessments, the aquatic life use rating was limited (IBI score-28). The difference in scores is due to different percentages of invertivores collected (35% in 2005 and 31 and 19% in 2006 and 2007 respectively) and does not appear to reflect any significant changes in the community. Shifts in the community composition may be the result of species interactions and life history characteristics or due to differential success in capturing species. No spring system sampled in Blanco County had an aquatic life use rating higher than intermediate, which is thought to primarily be the result of relatively low flow volumes that characterize the Trinity Aquifer as compared to springs issuing from the Edwards Plateau Aquifer. It is important to note that the statewide IBI is intended for use in wadeable streams and their applicability to spring habitats should be used primarily for comparison between collections at an individual site.

Benthic macroinvertebrate collections from Honeycut Springs yielded a total of 32 unique taxa (Table 4). Twenty-three taxa were collected on 19 September 2005 and 26 taxa were collected on 6 April 2006. Macroinvertebrate samples from 30 May 2007 are still awaiting verification of some species, so this data is not presented. Sorenson's index of similarity suggests the overall taxonomic composition between the two samples was highly similar (S=0.71). Many of the aquatic macroinvertebrates collected from Honeycut Springs have been commonly collected at other springs and appear to be characteristic of springs on the Edwards Plateau.

The relatively high diversity of Ephemeroptera (mayflies) and Trichoptera (caddisflies) suggests the springs provide high quality water. However, the relatively high proportion of the mayfly *Tricorythodes* sp. as compared to other mayflies has primarily been observed in springs with excess silt deposits as this genus is adapted to such habitats. This is likely due to the downstream impoundment that increases sediment retention. In general, Amphipods and/or mayflies dominated the macroinvertebrate community. These taxa are commonly identified as a primary food source for fish and amphibians in creeks and as such play an important role in trophic dynamics and energy transfer.

The aquatic life use rating for Honeycut Springs based on metric scoring of the benthic macroinvertebrate community was high (IBI Score-30) on both dates.

Table 1. Regionalized IBI score for fish community of Honeycut Spring on 19 September 2005.

September-05	**Ecoregion 30**	
Metric Name	**Raw Value**	**IBI Score**
Number of Fish Species	4	1
Number of Native Cyprinid Species	1	1
Number of Benthic Invertivore Species	0	1
Number of Sunfish Species	2	3
Number of Intolerant Species	1	3
% of Individuals as Tolerant Species[a]	3.0	5
% of Individuals as Omnivores	61.6	1
% of Individuals as Invertivores	35.4	3
% of Individuals as Piscivores	3.0	1
Number of Individuals in Sample	99	1
Number of Individuals/seine haul	14.1	1
Number of Individuals/min electrofishing	0.00	1
% of Individuals as Non-native Species	0.0	5
% of Individuals With Disease/Anomaly	0.0	5
	Index of Biotic Integrity Numeric Score:	**30**
	Aquatic Life Use:	**Intermediate**

Table 2. Regionalized IBI score for fish community of Honeycut Spring on 6 April 2006.

April-06	Ecoregion 30	
Metric Name	**Raw Value**	**IBI Score**
Number of Fish Species	4	1
Number of Native Cyprinid Species	1	1
Number of Benthic Invertivore Species	0	1
Number of Sunfish Species	2	3
Number of Intolerant Species	1	3
% of Individuals as Tolerant Species[a]	1.9	5
% of Individuals as Omnivores	67.3	1
% of Individuals as Invertivores	30.8	1
% of Individuals as Piscivores	1.9	1
Number of Individuals in Sample	107	1
Number of Individuals/seine haul	13.4	1
Number of Individuals/min electrofishing	0.00	1
% of Individuals as Non-native Species	0.0	5
% of Individuals With Disease/Anomaly	0.0	5
	Index of Biotic Integrity Numeric Score:	**28**
	Aquatic Life Use:	**Limited**

Table 3. Regionalized IBI score for fish community of Honeycut Spring on 30 May 2007.

May-07	Ecoregion 30	
Metric Name	**Raw Value**	**IBI Score**
Number of Fish Species	4	1
Number of Native Cyprinid Species	1	1
Number of Benthic Invertivore Species	0	1
Number of Sunfish Species	2	3
Number of Intolerant Species	1	3
% of Individuals as Tolerant Species[a]	3.4	5
% of Individuals as Omnivores	77.8	1
% of Individuals as Invertivores	18.8	1
% of Individuals as Piscivores	3.4	1
Number of Individuals in Sample	117	1
Number of Individuals/seine haul	11.7	1
Number of Individuals/min electrofishing	0.00	1
% of Individuals as Non-native Species	0.0	5
% of Individuals With Disease/Anomaly	0.0	5
	Index of Biotic Integrity Numeric Score:	**28**
	Aquatic Life Use:	**Limited**

Table 4. List of aquatic macroinvertebrates collected from Honeycut Springs.

Order	Family	Genus	Species	Fall 05	Spring 06
Ephemeroptera	Baetidae	*Baetodes*	sp.		
		Baetodes	*inermis*		
		Callibaetis	sp.	1	3
		Camelobaetidius	sp.		
		Fallceon	*quilleri*		3
	Caenidae	*Caenis*	*latipennis*	9	2
	Heptageniidae	*Stenonema*	*femoratum*	7	9
	Leptophlebiidae	*Neochoroterpes*	sp.	1	
	Leptohyphidae	*Tricorythodes*	*minutus*		
		Tricorythodes	sp. (early instar)	30	13
Trichoptera	Calamoceratidae	*Phylloicus*	*aeneus*	2	1
	Helicopsychidae	*Helicopsyche*	*borealis*	2	4
	Hydroptilidae	*Leucotrichia*	sp.		
	Leptoceridae	*Nectopsyche*	sp.	8	24
	Odontoceridae	*Marilia*	sp.	5	2
	Polycentropodidae	*Polycentropus*	sp.	1	
Odonata	Coenagrionidae	*Argia*	sp.	5	2
		Argia	*plana*		1
		Argia	*translata*	9	7
		Enallagma	sp.	4	
		Enallagma	*basidens*		2
	Corduliidae	*Tetragoneuria*	*petechialis*	3	
		Epicordulia	*princeps*		
	Gomphidae	*Erpetogomphus*	*designatus*		1
	Libellulidae	*Brechmorhoga*	*mendax*	3	
		Perithemis	sp.		1
Hemiptera	Veliidae	*Rhagovelia*	sp.	4	3
Coleoptera	Dytiscidae	*Coptotomos*	sp. (A)		2
	Hydrophilidae	*Cymbiodyta*	sp. (A)		14
	Psephenidae	*Psephenus*	*texanus (L)*		
Diptera	Chironomidae	Chironomini		3	6

		Tanypodinae		4	1
	Simuliidae	*Simulium*	sp.		
	Stratiomyidae	*Caloparyphus*	sp.		1
		Stratiomys	sp.		1
Gastropoda	Planorbidae	*Gyraulus*	sp.	7	
		Helisoma	*anceps*		2
	Physidae	*Physella*	sp.	1	2
Decapoda	Cambaridae	*Procambarus*	sp.	1	1
Amphipoda	Taltridae	*Hyalella*	*azteca*	18	25
Hydracarina				2	
Tricladida	Planariidae	*Dugesia*	sp.	1	2
			# ind	131	135
			# taxa*	23	26

* number of taxa reported here will differ from that used in calculating IBI scores. The difference is due to the use of broader taxonomic classifications in the IBI (i.e. use genus instead of species).

Table 5. Qualitative IBI score for benthic macroinvertebrate community of Honeycut Spring from 19 September 2005.

Qualitative Benthic IBI

Date	Fall 2005	
Site	Honeycut Spring	
TCEQ ID	0	
Metric	**Value**	**Score**
Taxa Richness	22	4
EPT Index	10	4
HBI	5.39	1
% Chironomidae	5.38	3
% Dominant Taxon	23.08	3
% Dominant FFG	49.62	2
% Predators	27.31	2
Intolerant : Tolerant	0.89	1
% Total Trichoptera as Hydropsychidae	0.00	4
Number of Non-Insect Taxa	6	4
% CG	49.62	1
% n as Elmidae	0.00	1
AQUATIC LIFE USE SCORE	**30**	
AQUATIC LIFE USE RATING	**High**	

Kicknet (Qualitative) Scoring Criteria

Exceptional	>36
High	29 - 36
Intermediate	22 - 28
Limited	<22

Table 6. Qualitative IBI score for benthic macroinvertebrate community of Honeycut Spring from 6 April 2006.

Qualitative Benthic IBI		
Date	4/6/2006	
Site	Honeycut Spring	
TCEQ ID	0	
Metric	**Value**	**Score**
Taxa Richness	24	4
EPT Index	9	3
HBI	5.17	2
% Chironomidae	5.15	3
% Dominant Taxon	18.38	4
% Dominant FFG	45.47	2
% Predators	33.33	2
Intolerant : Tolerant	1.21	1
% Total Trichoptera as Hydropsychidae	0.00	4
Number of Non-Insect Taxa	5	3
% CG	45.47	1
% n as Elmidae	0.00	1
AQUATIC LIFE USE SCORE	**30**	
AQUATIC LIFE USE RATING	**High**	
Kicknet (Qualitative) Scoring Criteria		
Exceptional		>36
High		29 - 36
Intermediate		22 - 28
Limited		<22

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