MEMORANDUM

TO:	Nathan Pence
FROM:	Ed Oborny (BIO-WEST)
DATE:	**August 29, 2014**
SUBJECT:	EA HCP Biological Monitoring – **Week 20**

BIOLOGICAL MONITORING UPDATES

COMAL SYSTEM:

At the time of this memorandum, the total system discharge at Comal Springs was 65 cfs. Figure 1 shows the steep decline in total system discharge over the past month. This week marks the twentieth consecutive week below 150 cfs, and therefore, the required weekly habitat evaluation was conducted on August 28th. Weekly habitat evaluations and memorandums will continue to occur until total system discharge at Comal Springs/River increases and consistently stays above 150 cfs. As total system discharge is consistently below 80 cfs, several additional HCP species specific triggers have been initiated. Aquatic vegetation mapping and fountain darter presence/absence dip netting will be performed monthly, while Comal Springs salamander and discharge measurements will be conducted weekly. Should total system discharge decline below 60 cfs, fountain darter presence/absence dipnetting will also be performed weekly. The next full system Critical Period monitoring effort will be triggered when total system discharge consistently declines below 50 cfs.

The following activities associated with HCP Biological Monitoring at Comal Springs were completed this week and are scheduled for next week:

CRITICAL PERIOD MONITORING

- August 25-31
  - Comal springs salamander sampling on August 28th.
  - Comal springs discharge measurements on August 28th.
  - Weekly photo documentation and habitat evaluation on August 28th.
- September 1-7
  - Fountain darter presence/absence dip netting.
  - Comal springs salamander sampling
  - Comal springs discharge measurements
  - Weekly photo documentation and habitat evaluation
  - Comal Spring riffle beetle collections and reset of lures

SAN MARCOS SYSTEM:

The total system discharge for San Marcos Springs/River is approximately 111 cfs. At present there are no Critical period monitoring activities being conducted on the San Marcos system. Texas wild-rice physical measurements in vulnerable stands will be restarted when total system discharge reaches 105 cfs. A Critical Period full sampling event is not triggered until total system discharge declines below 100 cfs. As part of COMPREHENSIVE monitoring, summer dip net

fountain darter sampling and annual full-system mapping of Texas wild-rice were completed this past week.

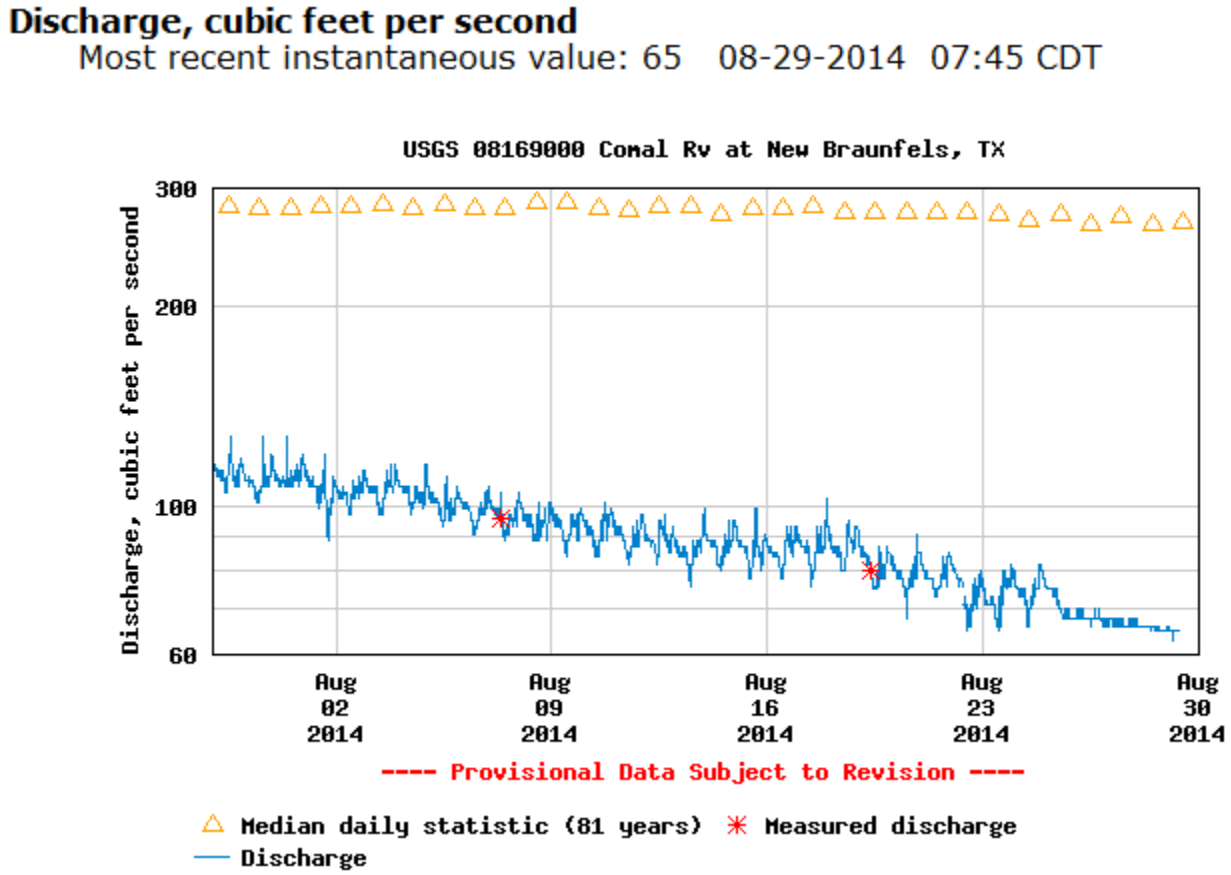

Figure 1: Screen shot of USGS webpage for the ***COMAL*** gage (08169000) showing total system discharge over the past month.

COMAL SPRINGS/RIVER - WEEK 20 CONDITIONS:
Weekly habitat observations and photo documentation associated with HCP triggered sampling were conducted on Thursday, August 28th.

OBSERVATIONS AND ACTIVITIES:
The J17 water level at the time of photo documentation this week had declined to the 625's and total system discharge has consistently declined below 70 cfs for the first time since 1990. As mentioned last week, each week sets a new all time low relative to the initiation of the biological monitoring program in fall 2000. Surface habitat conditions at all major spring runs, the Spring Island area and the Upper Spring run continue to deteriorate relative to flow, water level and exposed substrate. Surface water flow and surface habitat in Spring Run 1 is extremely limited (Figure 2) down past the confluence of Spring Run 2 where a wetted channel is being maintained. However, most of the water past that confluence is backwater from Landa Lake as Spring Run 1 has less that 0.1 cfs of surface flow and Spring Run 2 is not presently flowing (Table 1). Figure 3 shows a riffle beetle subsurface monitoring station recently installed by the U.S. Fish and Wildlife Service in Spring Run 1. Spring Run 2 is essentially devoid of any surface habitat at this time (Figure 4). Spring Run 3 continued to exhibit drying of surface habitat at the headwaters this

week (Figure 5) with the channel constricting in several locations downstream. Although Spring Run 3 continues to support the most discharge of any of the major spring runs at this time, it too is impacted with a considerable reduction in surface habitat.

Table 1. Comparison of discharge (cfs) throughout Comal Springs during 2014.

	Discharge (cfs)				
Date	**April 23**	**July 17**	**July 31**	**August 14**	**August 28**
Spring Run 1 –	3.1	0.7	1.1	0.2	0.06
Spring Run 2 –	2.5	1.4	1.8	0.1	0
Spring Run 3 –	16.9	10.0	12.2	5.8	2.1
Old Channel –	52.2	52.7	53.9	54.4	47.9
Upper Spring Run –	2.3	0.6	2.1	0*	0*
Total USGS Gage -	143.0	113.0	109.0	85.0	66.0

* Not measureable although still visual evidence of spring upwelling in select areas

Figure 2: Extremely limited surface water habitat in Spring Run 1.

Figure 3: Randy Gibson (USFWS- right) and Chad Norris (TPWD - left) discussing the recent installation of the Comal Springs riffle beetle subsurface monitoring station.

Figure 4: Spring Run 2 – no surface habitat below park entrance road.

Figure 5: Spring Run 3 drying of surface habitat near headwaters and constrictions downstream.

Fountain darter habitat continues to deteriorate in the Upper Spring run reach and is in extremely poor condition (Figure 6). Yet, a night dive on Tuesday for the movement study confirmed recaptures of fountain darters within the tagging sites again this week. Remarkably, water temperatures continue to be maintained in this uppermost reach of the system (Figure 7). Figure 7 is a graph of water temperature data taken from a thermister in the Upper Spring Run reach as well as in Blieders Creek. Water temperatures as of this most recent download were below 27 °C in the Upper Spring Run reach but exceeded 30 °C in Blieders Creek. Water quality data (conventional parameters) measured as part of the Critical period full sampling <100 cfs triggered event are presented in Table 2. Data is presented from upstream to downstream in the system. with sample locations for water quality measurements and nearby thermisters shown in Figure 8. Nothing in this round of water quality grab samples stood out relative to historically collected conventional parameter data on the Comal system.

The surface water level in the Spring Island area this week continued to decline with exposed surface habitat along large portions of the eastern and northern side of the island. Figure 9 shows the exposed surface habitat as well as the BIO-WEST crew conducting Comal Springs salamander surveys last Thursday. Water from springs on river left continue to flow upstream and around the island on river right (Figure 10) because surface flow has been mostly blocked (other than the mysterious channel cut through- Figure 9) by exposed substrate all the way across the river left side. Both spring runs associated with Spring Island continue to remain completely dry on the surface with subsurface flow still evident at the base of the island.

Figure 6: Extremely poor fountain darter habitat in the Upper Spring Run reach.

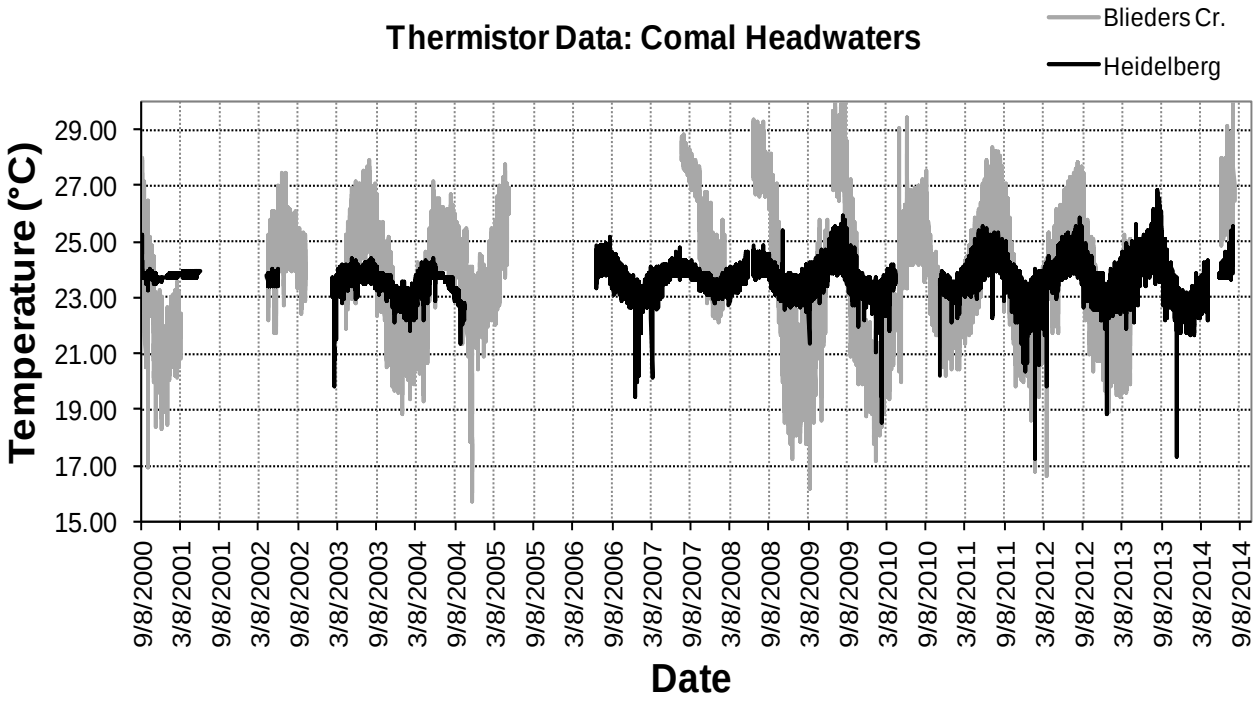

Figure 7: Water temperature data from Upper Spring Run reach (Heidelburg) and Blieders Creek.

Table 2. Conventional water quality parameter results from Comal Springs on August 11, 2014.

	TSS (mg/L)	Alkalinity (mg/L)	Ammonium (mg/L)	Nitrate (mg/L)	Total N (mg/L)	SRP (mg/L)	Total P (mg/L)
Blieders Creek	5.4	230	0.0743	1.34	3.13	<.05	<.02
Heidelberg, Main Channel	7.1	240	0.0291	1.72	2.56	<.05	<.02
Island Park, Far Channel	<1.43	250	0.0161	1.75	2.19	<.05	<.02
Island Park, Near Channel	<1.43	240	<.01	1.84	2.18	<.05	<.02
Spring Run 1	<1.43	250	0.042	1.93	2.29	<.05	<.02
Spring Run 2	<1.43	240	0.0194	1.96	2.55	<.05	<.02
Spring Run 3	<1.43	240	<.01	1.98	2.35	<.05	<.02
New Channel, upstream	<1.43	240	0.0242	1.67	2.35	0.062	<.02
New Channel, downstream	<1.43	250	0.0113	1.73	2.26	<.05	<.02
Old Channel, upstream	1.6	240	0.0129	1.72	2.09	<.05	<.02
Old Channel, downstream	3.1	240	<.01	1.72	1.99	0.128	<.02
Union Avenue	3.3	250	0.0178	1.67	2.04	<0.05	<.02

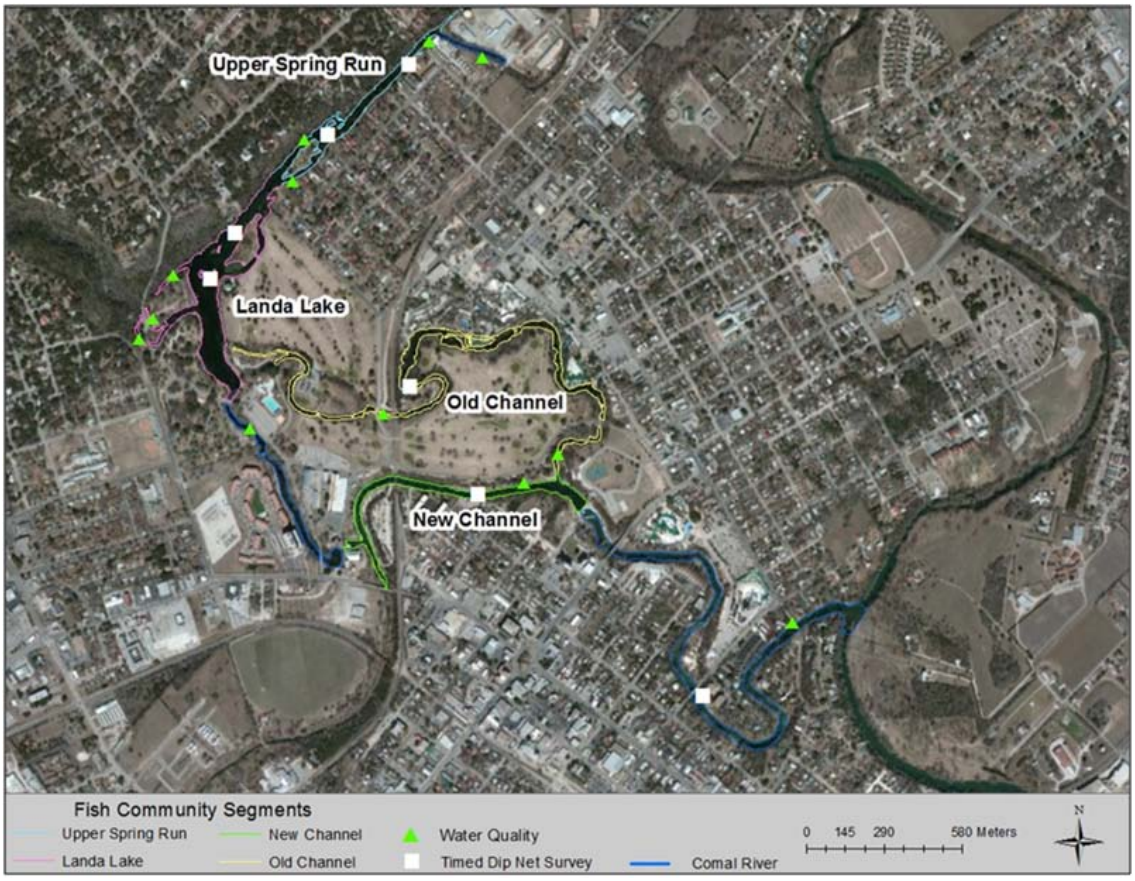

Figure 8: Water Quality grab sample locations – Comal System (Green triangles)

Figure 9: Exposed surface habitat adjacent to Spring Island. Crew conducting Comal Springs salamander survey.

Figure 10: Upstream flow adjacent to Spring Island.

Table 3 shows the long-term average as well as recent counts of Comal Springs salamanders in each of the sample locations. No salamanders were observed in either Spring Run 1 or the dry spring runs on Spring Island. Whether or not salamanders in these restricted surface flow areas move downward into interstitial spaces and subsurface flow is an important question. We will continue to monitor during this extended low-flow period and after these areas get reconnected with surface flow in the future. In contrast, Comal Springs salamanders continue to inhabit Spring Run 3 and are maintaining average counts in the eastern outfall to Spring Island. Although the Comal Springs salamander is listed in the HCP and Incidental Take Permit (ITP), the conditions in the ITP are not presently active for this species as it is not listed as threatened or endangered with this directly acknowledged (Item H: 7-9) in the ITP.

Table 3: Comal Springs salamander timed counts

Survey Date	Salamander Counts			
	Spring Run 1	Spring Run 3	Spring Island (runs)	Spring Island – Eastern outfall
Long-term average (2002-2014)	22	13	3	9
April 18, 2013	17	15	0	4
August 16, 2013	8	12	0	8
September 12, 2013	6	13	1	11
October 29, 2013	7	9	2	6
April 25, 2014	12	23	3	7
July 17, 2014	16	24	0	8
July 31, 2014	27	27	0	11
August 14, 2014	1	6	0	7
August 28, 2014	0	8	0	11

Downstream in the main portion of Landa Lake, floating mats of aquatic vegetation continue to build up at these lower than average discharge conditions (Figure 11) and are again in need of attention. The restored habitat within Landa Lake is continuing to expand in areas not impacted by extremely shallow water levels and/or build up of floating mats of aquatic vegetation on the surface. Overall, quality fountain darter habitat continues to be supported in Landa Lake but impacts are occurring. The Old Channel continues to support high quality fountain darter habitat with thriving restored native aquatic vegetation (Figure 12). Figure 13 shows that water temperature is also being maintained within the Old Channel but showing more daily variability with lower overall total system discharge this year. The New Channel continues to support aquatic vegetation throughout most of the reach above the confluence of the Old Channel, but fountain darter habitat is of lesser quality than in either Landa Lake or the Old Channel at this time. Figure 14 shows the very minimal flows currently occurring in the New Channel.

Figure 11: Floating vegetation mats in Landa Lake.

Figure 12: Two fishermen enjoying the restored habitat conditions in the Old Channel.

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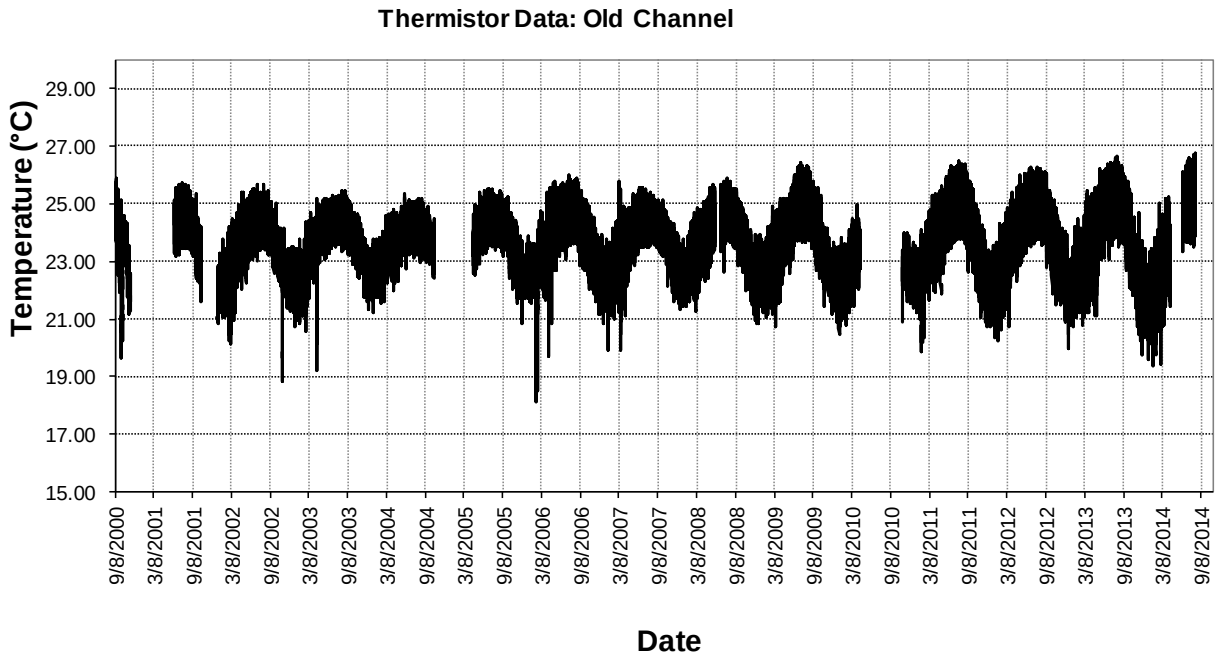

Figure 13: Water temperature data from Old Channel of the Comal River.

Figure 14: Very limited flow in New Channel study reach.

Figure 15 demonstrates presence/absence dipnet data collected since 2005, including the most recent Critical period collection. Fountain darter dip net sampling continues to confirm that darters remain abundant throughout the system with 84% of sites sampled being occupied. Areas such as the Upper Spring run reach and the New Channel show lesser percentages which is not surprising with the degrading habitat in those locations. In contrast, Landa Lake and the Old Channel are exhibiting higher than average conditions in part due to improved habitat conditions via aquatic vegetation restoration efforts.

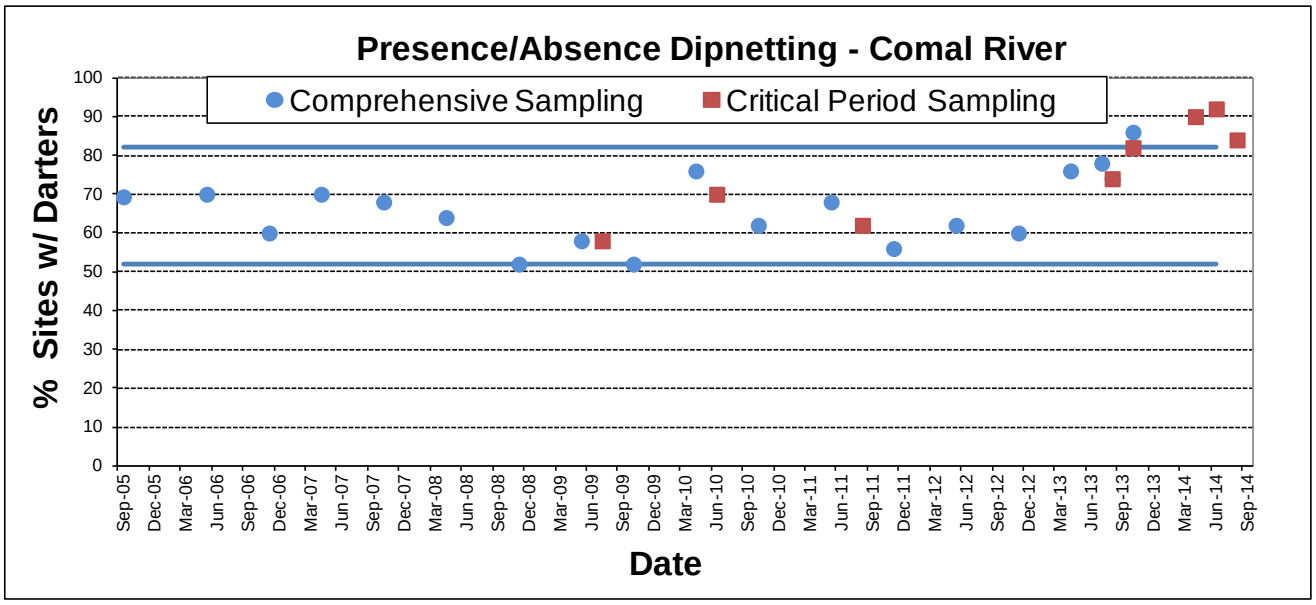

Figure 15: Percentage of sites (N=50) where fountain darters were present during stratified random presence/absence dipnetting. Solid blue lines mark 5th and 95th percentiles of Comprehensive Period data.

At this time, cotton lures have been in place at each of the designated sampling locations for the Comal Springs riffle beetle surveys from May through present with the next round of counts slated for this upcoming week.

In summary, the continued decline in total system discharge this past week led to worsening surface habitat conditions for the Comal Springs invertebrates. Endangered invertebrate habitat is clearly being impacted for surface dwelling invertebrates at this time with near total loss of surface habitat in Spring Run 1, Spring Run 2 and the spring runs on Spring Island. Impacts to fountain darter habitat in the Upper Spring run reach are also increasing each week, yet the darters continue to persist at this time. As discussed last week, impacts are increasing in Landa Lake with extremely shallow areas becoming more common and thick mats of floating aquatic vegetation lodging on top of rooted native aquatic vegetation. The same lower than average discharge not moving vegetation mats through Landa Lake is causing impacts in the New Channel by reducing quality habitat conditions. At present, the Old Channel is the only remaining high quality fountain darter habitat in the system. Should total system discharge continue to decline past 60 cfs this next week, flow split management will be triggered resulting in a necessary reduction of discharge within the Old Channel to support the rest of the system.

As always, if you have any questions, please give me a shout. Ed