

## **SCOPE OF WORK**

### **U.S. Fish and Wildlife Service**

#### **Habitat use and movement by the fountain darter and changes in critical habitat following a period of drought**

#### **TASK 1: Evaluate the effect of recent rainfall following a period of drought on the habitat conditions of the endangered fountain darter, *Etheostoma fonticola* in the Comal River**

##### **BACKGROUND**

The threat of drought combined with water use practices make it necessary to understand how fountain darter critical habitat is affected by low spring flow. Furthermore, recent rainfall following the drought has also provided an opportunity to examine recovery of fountain darter habitat. It is important to not only collect data during low flow events, but also during a period of recovery following a drought to determine if and how the fountain darter recovers from habitat alteration during drought. Data collected during the drought and early recovery prior to the initiation of this study (August 2009 – January 2010) will be added to the data collected in this study as we follow this species through a period of habitat recovery. This data collection portion of this study will be completed in July 2010.

This study will examine multiple aspects of fountain darter habitat in the Comal River including parasite load, turbidity, macrophyte type, associated macroinvertebrates including native and non-native snail assemblages, water quality, and fountain darter gut content starting from drought conditions of August 2009 through increases to normal and possibly even above normal levels of flow. The EARIP HCP will be designed to contribute to the recovery of the federally-listed species. This study will provide recovery data for the fountain darter which has not been previously investigated and determine critical areas of habitat that need to be protected.

##### **SubTask 1.1 – Sample Collection**

Sites to be examined in the Comal River were selected due to their proximity to springs as well as sites from traditional darter monitoring locations. These will include: site 1 (upper Landa Lake – Houston Street), site 2 (Landa Lake above Spring Island), site 3 (Landa Lake below Spring Island and near Spring Runs 1 and 2), site 4 (the Old Channel), and site 5 (the lower Comal River above the confluence and opposite “The Other Place”). There will be monthly collections of data from each site. We will collect fishes with a dip net. There will be a set number of dips per habitat type proportional to the size of the available habitat (33% of each habitat type will be sampled). Invertebrate assemblage will be assessed to evaluate potential food items, and to evaluate any flow related shifts. Community makeup of macro-invertebrates will be quantified using a slack sampler (500µm mesh) outfitted with a dolphin bucket (500µm mesh) at the cod end, and

a (30cm x 35cm) quadrat placed directly upstream of net (USGS 2002). Evaluation of gastropod community for intermediate host densities will be conducted by snail assemblage survey. Community makeup of snails will be quantified using a slack sampler (500µm mesh) outfitted with a dolphin bucket (500µm mesh) at the cod end, and a (16 x 16 in) quadrat placed directly upstream of net (USGS 2002). All macroinvertebrates and snails collected will be preserved in 80% ethanol and later identified. Estimation of snail assemblage will occur using same equation as for invertebrate assessments. Strata within sites will be based primarily on probably *E. fonticola* cover types. Substrate, vegetation type and percent cover, wading discharge, flow rate and depth, pH, dissolved oxygen, and specific conductivity will be recorded for each site. Water samples will be taken at each site prior to initiation of any other sampling to analyze for levels of turbidity. A subsample of darters will be collected to analyze for gut content and a cercarial count (gill parasite) on the gills. Timeline: February – July 2010

### **SubTask 1.2 – Process and Prepare Samples**

Invertebrate and snail samples will be brought back to the laboratory and sorted and identified to family (invertebrates) and species (snails). Preserved darters will be dissected for gut-content analysis and stomach contents will be identified to family. All metacercaria on the gills will be counted. Turbidity samples will be immediately brought into the laboratory and read with a spectrophotometer. Timeline: August – December 2010.

**Deliverable: Figures and tables of macroinvertebrates and gastropods found by microhabitat type following sorting and identification will be prepared. Figures and tables of percent frequency of occurrence of prey items consumed by fountain darters and percent frequency of occurrence of dominant prey types will be prepared. A table or figure of turbidity readings by site and month will be prepared. Data in a table or figure format on number of gill parasite by microhabitat type by month will be prepared.**

### **SubTask 1.3 – Evaluate Sample Taxa**

All macro-invertebrates will be identified to lowest possible taxa, however, since gut contents are identified only to order, community makeup will be presented at the order level. Multivariate analysis will be used to examine trends between abiotic and biotic habitat variables and fountain darter density. Timeline: December 2010 – April 2011

**Deliverable: Figures and tables of community makeup by microhabitat type as well as a microhabitat use as related to abiotic and biotic variables will be prepared.**

**TASK 2: Evaluate the effect of rainfall following a period of drought on habitat use and recovery of the endangered fountain darter and native and non-native snail assemblages in the San Marcos River.**

**BACKGROUND**

By tracking fountain darter numbers and movement from a period of drought through normal spring flow and recovery, this study will provide a better picture of habitat needs during times of low flow and during a period of recovery following a drought, and if and how the fountain darter recovers from habitat alteration during drought. We will also be able to determine if the fountain darter can move from non-ideal habitat types to ideal habitat types following periods of stress. Native and non-native snail assemblages, as well as monthly monitoring of parasite numbers found on fountain darters gills will be sampled simultaneously at these microhabitats to document changes following a drought. Data collected during the drought and early recovery prior to the initiation of this study (August 2009 – January 2010) will be added to the data collected in this study as we follow this species through a period of habitat recovery. This data collection portion of this study will be completed in July 2010. Analysis will immediately follow.

**SubTask 2.1 – Capture, Mark, and Track Specimens**

Darters will be marked monthly for at least one year in the San Marcos River in the side channel area as well as those found in the adjacent flowing deeper areas with batch mark Visible Implant Elastomer tags (VIE; Northwest Marine Technology, Shaw Island, WA, USA). Individuals will be anesthetized in a 60 mg/l solution of MS222, then measured (total length, mm), sexed, and given a mark specific to the habitat and time of marking (can vary the color and position of the mark). Fish will then be placed in an aerated holding container and released upon recovery from the anesthetic. Water quality as well as weighted stream discharge, vegetation type and area, and gill condition will also be recorded at the marking sites. Each month, any marked darters collected from previous months will be collected with associated data, such as length, sex, type and placement of mark. In addition, the microhabitat type found in will be recorded. Any captured marked darters will be re-released following recovery to the location from which they were collected. Ten darters will be collected and sent monthly to Dexter Fish Health Center (USFWS) for gill parasite analysis. Snails will be collected from each habitat type with a slack sampler. Timeline: February – July 2010

**SubTask 2.2 – Process and Prepare Samples**

Number of darters per microhabitat type will be determined. Mean distance moved by recaptured darters as well as habitat type that they move into will be identified. Multivariate analysis will be used to examine trends between movers and abiotic and biotic variables. Darter density will be calculated by dividing the total number of *E. fonticola* per habitat patch by the sampled area of the habitat. Home range will be calculated as the linear distance between the source and destination habitat patches. Movement rate will be calculated as the proportion of the recaptures that were movements. Factors identified as being associated with movement through multivariate statistics will be used in a logistic regression model to determine the variables most associated with individual probability of movement from a habitat patch. This model will allow us to test hypotheses regarding the effects of each variable on movement.

Timeline: August – October 2010

**Deliverable: Figures and tables detailing fountain darter use of microhabitat as related to biotic and abiotic variables will be prepared. A table detailing movement descriptives will be prepared.**

#### **SubTask 1.3 – Evaluate Sample Taxa**

Snails will be identified and quantified. Fountain darter gills will be isolated, and the parasite will be quantified. Multivariate analysis will be used to examine trends between abiotic and biotic habitat variables and fountain darter density. Timeline: August – December 2010

**Deliverable: Figures or tables of gastropods found by microhabitat type following sorting and identification will be prepared. A table detailing parasite infection by month will be prepared.**

#### **TASK 4: Report Preparation**

A single draft final report will be prepared that includes the scope of work; a description of the research performed; the methodology and materials used; any diagrams or graphics used to explain the procedures related to the study; any data collected; an electronic copy of any computer programs, maps, or models along with an operations manual and any sample data set(s) developed under the terms of this contract; analysis of the research results; conclusions and recommendations; a list of references, a Table of Contents, List of Figures, List of Tables, an Executive Summary, and any other pertinent information. This report will be completed by May 2011.

Following comments received on the draft final report, a final report will be submitted to the EARIP, TWDB, and USFWS ES Austin Field Office. The final report will include a full copy of the TWDB comments as submitted to the EARIP.

## **TASK BUDGET**

### **Task 1. Drought/Recovery Habitat**

1.1 Sample Collection	\$ 8,500.00
1.2 Process and Prepare Samples	\$ 6,187.50
1.3 Evaluate Sample Taxa	\$ 6,187.50

### **Task 2. Drought/Recovery Movement**

2.1 Sample Collection	\$ 2,250.00
2.2 Evaluate darter movements	\$ 3,000.00
2.3 Evaluate sample Taxa	\$ 2,562.00

### **Task 3. Report Preparation**

	<u>\$ 5,125.00</u>
Subtotal	\$33,812.00
USFWS overhead (17%)	<u>\$ 5,748.04</u>
<b>Total Cost</b>	<b>\$39,560.04</b>

## **EXPENSE BUDGET**

Salaries	\$ 33,562.00
Supplies	\$ 250.00
Overhead	<u>\$ 5,748.04</u>
<b>Total Cost</b>	<b>\$ 39,560.04</b>