

STAFF NOTES
Short version
April 2014
Aquatic Resources Center
San Marcos, Texas

Aquatic Species Conservation and Management: Refugium Activities

San Marcos Salamander- As of 29 April, two San Marcos salamanders were collected. The salamanders were returned immediately to Spring Lake given that the SMARC refugia is at capacity for this species (Table 1). Six salamander mortalities were observed in the refugia population this month. As of 29 April, wild stock San Marcos salamanders oviposited 55 eggs but their offspring did not oviposition during April. (CSF 7.12.5.4)

Table 1.- Four-month summary of the number of salamanders held in and number of eggs produced for the refugia at the San Marcos Aquatic Resources Center. Abbreviations are as follows: RWS= refugium wild stock, WS=wild stock (specimens in quarantine), FX=offspring, JA=juveniles/adults, OV=ovipositions, and EG=eggs.

Species		January 2013			February 2014			March 2014			April 2014		
		JA	OV	EG	JA	OV	EG	JA	OV	EG	JA	OV	EG
San Marcos salamander	RWS	369	0	0	363	0	0	356	1	15	350	2	55
	FX	69	0	0	67	1	12	63	0	0	59	0	0
Quarantine	WS	0	-	-	0	-	-	0	-	-	0	-	-
Texas blind salamander	RWS	82	4	53	96	2	35	104	0	0	106	3	67
	FX	55	1	4	55	1	31	54	3	42	54	1	16
Quarantine	WS	10	-	-	10	-	-	5	-	-	7	-	-
Texas (Comal) salamander	RWS	2	0	0	1	0	0	1	0	0	1	0	0
	FX	0	0	0	0	0	0	0	0	0	0	0	0
Quarantine	WS	0	-	-	0	-	-	0	-	-	0	-	-
Barton Springs salamander	RWS	42	0	0	42	0	0	42	0	0	40	0	0
	FX	696	0	0	695	8	370	642	2	69	642	1	23

Texas Blind Salamander- As of 29 April, SMARC staff collected three Texas blind salamanders from Primer’s fissure and three from Johnson’s well (Table 1). Edwards Aquifer Research and Data Center (EARDC) staff transferred two salamanders from the TSU artesian well to the SMARC refugia. Three of five salamanders that were in quarantine last month were incorporated into the refugia, while the other two (larvae) died in quarantine (Table 1). In addition, one of eight salamanders collected this month was incorporated into the refugia. The SMARC refugia lost two older adult salamanders this month. As of 29 April, wild stock Texas blind salamanders oviposited 67 eggs while their offspring produced 16. (CSF 7.12.5.4)

Barton Springs Salamander- No salamanders were collected from Barton Springs in April (Table 1). As of 29 April, wild stock Barton Springs salamanders did not oviposit eggs; however, their offspring oviposited 23. Two wild stock salamander mortalities were observed this month. The Texas A&M University health team will provide the SMARC with their

recommended disease treatments, husbandry, and dietary suggestions when additional tissue sample examinations have been completed. (CSF 7.12.5.4)

Fountain Darter- A total of 587 wild stock fountain darters were in the SMARC refugia on 29 April. Eight mortalities were recovered during April. These fish were from the San Marcos (Upper = 4, Middle = 2, and Lower = 2) stock. (CSF 7.12.5.4)

Devils River Minnow- The SMARC is maintaining two stocks of wild caught Devils River minnows (DRM) in refugia, one from San Felipe Creek (N = 196) and another from Pinto Creek (N = 85). The SMARC is also maintaining F1 (N ≈ 1,500) offspring. No DRM were collected from the wild but 150 Pinto Creek offspring were produced during April. Some fish at the SMARC are being maintained in an outdoor raceway to evaluate if this is a less labor intensive method of producing genetically diverse fish for restocking purposes. The genetic analysis of wild stock San Felipe Creek and Pinto Creek DRM is ongoing at the Dexter SNARRC. As the genetic information becomes available, it will be incorporated into a propagation/genetic management plan for DRM. On April 21, ten Devils River Minnow (Pinto Creek stock) fry were sent to the SNARRC Fish Health Unit for disease and parasite examination. The fry were sent because they appear to stop eating at around 2 to 3 months of age. The Fish Health Unit suggested the possible use of flubendazole to treat fry until their examination is complete. (CSF 7.12.5.4)

Comal Springs Riffle Beetle- Approximately, 102 adult wild stock Comal Springs riffle beetles, five F1 adult offspring, and 116 larvae are being maintained in the SMARC refugia. During March, a temperature controlled room in the greenhouse was outfitted with a tank system for maintenance of invertebrates. This room should provide stable water temperatures and reduce the possibility of unwanted invertebrate introductions. Additionally, the effluent leaving this room drains through a sand filter and chlorinator thereby minimizing the risk of escapement. During April, all Comal Springs riffle beetles were moved from the open-air system to this room. (CSF 7.12.5.4)

Peck's Cave Amphipod- Approximately 55 adult Peck's cave amphipods are being maintained in refugia at the SMARC. Four of these 55 specimens were collected in April and 51 are from collections made during 2013. In April, an additional 100 *Stygobromus* juveniles were collected at Comal Springs during regular yearly monitoring by BIO-WEST, Inc. and brought into captivity at the SMARC. The 151 juvenile *Stygobromus* species that were collected in May 2013 appear to be in good condition. Six of these previously collected juveniles have increased in size reaching approximately 7 mm in length. Juveniles *Stygobromus* must be raised to maturity before they can be identified to species and incorporated into the refugia. The six juvenile amphipods that have exhibited growth along with 16 recently collected juveniles have been stocked into solitary growth chambers. The growth chambers are intended to eliminate cannibalism while simultaneously allowing individual growth and development to be tracked through time. Evaluation of these growth chambers is ongoing. (CSF 7.12.5.4)

Texas Wild Rice- The 2014 count of potted Texas wild rice plants in refugia at the SMARC is 158 in greenhouse raceways, 76 in outdoor raceways, 40 in quarantine, along with an additional

86 plants at Uvalde NFH (Table 2). On April 21, Jeffery Hutchinson and Colin Findley (TSU student) collected an additional 20 Texas wild rice tillers from Section's A and B in the San Marcos River to supplement the refugia. For each tiller collected, data was collected from the Texas wild rice stand and included: a tissue sample for genetic analysis, GPS coordinates, stand area coverage, water depth, and phenology. Additional collection of tillers will be made throughout 2014-2015 based on the recommendations outlined in the Texas wild rice genetics report. (CSF 7.12.5.4)

Table 2.- Current number of Texas wild rice plants being maintained in refugia at the SMARC and Uvalde NFH. San Marcos River segments are defined in accordance with the USFWS 1996 Contingency Plan where each segment represents a particular stand's genetic make-up. The number of plants within each pot varies (Mean ± ISE = 61 ± 6 stems per pot). The research stock is comprised of clones and plants produced from various river segments.

	Number of Potted Plants					Total
	Greenhouse	SMARC Refugia		Quarantine	Uvalde NFH	
		Outdoor Raceway			Refugia	
A	6	23	26	18	73	
B	46	49	14	19	128	
C	26	4	0	10	40	
D	3	0	0	6	9	
E	8	0	0	0	8	
F	19	0	0	4	23	
G	1	0	0	8	9	
H	3	0	0	0	3	
I	0	0	0	0	0	
J	13	0	0	2	15	
K	6	0	0	4	10	
Research Stock	27	0	0	15	42	
Total	158	76	40	86	360	

The 2014 number of Texas wild rice seeds stored at the SMARC totals 19,618 ($N_{2009} = 390$, $N_{2010} = 585$, and $N_{2011} = 1,941$, $N_{2012} = 10,152$, $N_{2013} = 6,550$) (Table 3). No additional seeds have been collected since November 2013. Extended periods of near freezing or freezing temperatures during January and February 2014 caused the senescence of emergent Texas wild rice stems possibly delaying flowering and seed set until May. (CSF 7.12.5.4)

Table 3.- Number of Texas wild rice seeds stored at the SMARC. Seeds are stored by month and year.

Month	2009	2010	2011	2012	2013	Total
Jan					491	491
Feb						
Mar						
Apr						
May					264	264
June			433		2,307	2,740
July			650		1,172	1,822
Aug					2,316	2,316
Sept				3,428		3,428
Oct		325	273	1,785		2,383
Nov	390	260	585	3,267		4,502
Dec				1,672		1,672
Total	390	585	1,941	10,152	6,550	19,618

Research and Restoration Activities

Fountain Darter- Kenneth Ostrand is working collaboratively with Tim Bonner (TSU), Harlan Nichols (TSU masters student), and BioWest Inc. on a project examining reproductive maturity in fountain darters that occupy disparate abiotic and biotic conditions. It is reasoned that low flow conditions will alter the physical habitats of the fountain darter, and that these changes in physical habitats, especially low-growing vegetation, will reduce the reproductive readiness and success of the fountain darter. To test this hypothesis, indicators of fountain darter reproduction (gonadal recrudescence, ovarian development, fecundity, and oocyte maturation) among available flow gradients ranging from low flow (10-30 cfs Upper Spring Run Reach – Comal River), moderate flow (50 to 60 cfs; Old Channel-Comal River), moderate flow (80 to 100 cfs; New Channel-Comal River), and high flow (100 to 120 cfs; San Marcos River) conditions and among physical habitat types and substrates (open substrates, low growing and tall-growing aquatic vegetation) are being compared monthly. Fountain darters have been collected since February and laboratory data collection is ongoing. We anticipate that fish collections from these habitat types will continue throughout 2014.

Kenneth Ostrand is working collaboratively with BioWest Inc. on a fountain darter mark and recapture study to determine how movement is affected by habitat and temperature changes under low flow conditions. In April 2014, 471 fountain darters were uniquely marked with visual implant elastomer (VIE) at two locations in both the Upper Spring Run of the Comal River (N = 540) and Blieders Creek (N = 317). These areas are known to experience extreme abiotic conditions and are typically the first river reaches to be negatively affected by low spring flows. By marking fountain darters in these stream reaches we hope to determine when aquatic vegetation is rendered unsuitable habitat and darters seek other habitat types; and, how far will fountain darters move to find usable habitat. The field mark and recapture study will be augmented by manipulative trials in an experimental pond to address the effects of specific factors on fountain

dart movement. Fountain darters will continued to be marked throughout the year and sampled for recaptures. Marked fish have been observed during snorkeling and eight fish have been recaptured when dip netting. All of the recaptured fish were collected close to their release site.

Kenneth Ostrand is a committee member for Sophia DeColo, a graduate student at TSU. The title of her project is: Effects of turbidity on female preference for larger males in fountain darters, *Etheostoma fonticola*. Sophia successfully defended her thesis April 10th. (CSF 7.12.5.4)

Comal Springs riffle beetle- Bronte Gonzales (TSU student) and Dr. Robert McLean (TSU) working with Randy Gibson are examining Comal Springs riffle beetles lures (cotton cloth placed under spring run substrate for 1 to 4 months) to determine the microorganism assemblage that colonize the lures. During 2013, Bronte was able to isolate and maintain 14 separate bacteria colonies in the laboratory. Randy Gibson and the TXFWCO collected 70 *Heterelmis vulnerata* (a common relative of the Comal Springs riffle beetle) from nearby Plum Creek in Luling, Texas. On 24 June, microorganism culture isolates were offered to the proxy riffle beetles at the SMARC and preferences for specific microorganisms by these beetles were noted and experimental techniques were refined. During July 2013, experiments began with Comal Springs riffle beetles and continued through August 2013. Data analysis is currently underway. In April, additional biofilm samples were collected from Comal Springs resulting in four more culture isolates. These culture isolates are preserved for future identification and potential experimentation. (CSF 7.12.5.4)

Peck's cave amphipod- Randy Gibson is identifying specimens of subterranean invertebrates collected by Zara Environmental, LLC to be included in the "Deep aquifer biota study of the Edwards Aquifer" final report for the Edwards Aquifer Authority. (CSF 5.3.7)

Texas wild rice- In April, Jeffrey Hutchinson composed a HACCP Plan for non-listed aquatic plants. The document covers collection methods, treatments to control snails and other organisms, and quarantine procedures. The document is undergoing internal review before external review by the ANS coordinator (Dave Britton) and Dexter SNARRC Fish Health Unit. (CSF 7.12.5.4)

On April 29, a 0.1-acre outdoor pond (C7) was stocked with Texas wild rice tillers from San Marcos River sections A (N = 20) and B (N = 30). The pond was designed and modified with a terrace system to provide additional flow and algae control. Additional Texas wild rice will be added to the pond over the summer of 2014 to evaluate the effectiveness of the pond design for maintaining Texas wild rice over multiple years. (CSF 7.12.5.4)

During April 2014, mass-flowering and seed production of Texas wild rice was observed in Section B of the San Marcos River below University Drive Bridge downstream to the river bend before the Lion's Club Tub Rental. Given that mass-seed production in the San Marcos River is uncommon, a seed germination experiment was initiated to test the viability of wild-stock seeds, compare wild and refugia produced seed germination rates, and evaluate two seed storage protocols. On April 24, 2014 a total of 1,390 Texas wild rice seeds were collected and potted.

These seeds will be monitored over the next 3 to 4 months for percent germination. An additional 1,680 Texas wild rice seeds were collected to evaluate seed storage protocols. Two methods of storage (i.e. moist paper towel or in water) at 3 to 4 °C will be evaluated by removing the seeds from storage and potting a subset from each group monthly for one year. The goals of the experiment are to determine if one storage methods maintains the viability of the seeds longer than the other and to determine the I₅₀ value of Texas wild rice seeds based on storage time and method. (CSF 7.12.5.4)

During January 2014, a study was initiated to evaluate the effects of varying flow rates on the phenology of Texas wild rice. Growth rates of Texas wild rice will be measured every two weeks, and the plants monitored for flowering, seed production, tiller formation, and senescence. This study is on-going and currently flowering characteristics are being measured weekly. (CSF 7.12.5.4)

An additional study was initiated during January to evaluate the viability of Texas wild rice seeds stored in refrigeration at SMARC from 2009 to 2013. A total of 2,154 seeds from 2009 to 2013 were potted and will be monitored for germination. A cursory study revealed that Texas wild rice seeds stored for 6.5 months started to germinate at 8 days. The objective of the study is to determine the storage time in which 50% of the seeds lose viability. The last date of any seed germination was February 20, 2014. The results from this experiment were highly variable. Texas wild rice germination rates were highest (range = 23 to 51%) for seeds stored up to nine months. Seeds stored 13 to 18 months had the lowest germination rates (range = 1 to 13%). We surmise that the observed differences in germination rates among adjacent months were an artifact of the paper towel moisture content. Some paper towels were completely dried out and some were too wet with fungus developing on the seeds. Additional trials will need to be conducted to confirm or refute the results of this first experiment. (CSF 7.12.5.4)

Jeff Hutchinson is co-advising Michelle Crawford (Ph.D. student at Texas State University) on a project that is examining the effects of light attenuation and siltation on Texas wild rice at Uvalde NFH. A field component was added to her dissertation that will be conducted in the San Marcos River and use Texas wild rice plants produced at the SMARC. She had her first committee meeting in February. The committee approved her experimental design and draft proposal. She is scheduled to complete her full proposal by May. Texas wild rice seeds (N = 400) were potted on April 28 and will be re-potted as individuals in May. These plants will be used during the field portion of Michele's research. (CSF 7.12.5.4)

Jeff Hutchinson is collaborating with Jason Bildo, a Masters student at TSU, to examine the competitive interactions between Illinois pondweed and hydrilla. Jason's proposal was accepted by his committee. During April, Jason set out field plots in Spring Lake and the San Marcos River to evaluate how different flows and sediment loads effect the competitive interactions of Illinois pondweed and hydrilla. (CSF 7.12.5.4)

Native Aquatic Plants - Native aquatic and terrestrial plants currently are being propagated and maintained in the SMARC greenhouse in fiberglass tanks and under outdoor irrigation systems. To maintain genetic diversity of the plants at the SMARC, additional plants of each species will

be collected from wild populations throughout the year. As the plants grow and send out new shoots, they will be divided, repotted, and moved into outdoor raceways. (CSF 7.12.5.4)

To meet the restoration goals outlined in the Edwards Aquifer Habitat Conservation Plan, native plant production is needed. The SMARC has been employed by the City of San Marcos to produce native aquatic plants for their restoration efforts. Plant transfers to the City of San Marcos began in March 2013. From January to April 2014, the SMARC provided a total of 3,019 aquatic and terrestrial plants to the City of San Marcos (Table 4). The staff at SMARC will continue to provide plants for the restoration work in the upper section of the San Marcos River through 2019. Two terrestrial tree planting days organized by the City of San Marcos and SMARC were held on March 8 and 22, and the SMARC provided plants for these events. Additional planting events are planned for late summer, early fall 2014. (CSF 7.12.5.4)

Table 4.- List of plants species, common name, and number of plants provided from January to April of 2014 for aquatic and terrestrial restoration work in the San Marcos River.

Plant Species	Common Name	Number of Plants
Aquatic		
<i>Sagittaria platyphylla</i>	Arrowhead	174
<i>Ludwigia repens</i>	Creeping primrose willow	1352
<i>Heteranthera liebmannii</i>	Water stargrass	566
<i>Zizania texana</i>	Texas wild rice	695
		Σ aquatic = 2,787
Terrestrial		
<i>Berberis trifoliolata</i>	Agarito	1
<i>Bouteloua gracilis</i>	Blue grama	8
<i>Sambucus canadensis</i>	Elderberry	30
<i>Taxodium distichum</i>	Bald cypress	7
<i>Salix nigra</i>	Black willow	6
<i>Acer negundo</i>	Box elder	2
<i>Cyperus setigerus</i>	Lean flatsedge	2
<i>Equisetum hyemale</i>	Horsetail	5
<i>Pluchea odorata</i>	Purple pluchea	10
<i>Panicum virgatum</i>	Switchgrass	28
<i>Morus rubra</i>	Red mulberry	19
<i>Marsilea macropoda</i>	Water clover	1
<i>Carex emoryi</i>	Emory's sedge	58
<i>Chasmanthium latifolium</i>	Inland sea oats	54
<i>Platanus occidentalis</i>	Sycamore	1
		Σ terrestrial = 232
		$\Sigma\Sigma$ Total = 3,019

Leadership in Science and Technology: Publications, extension activities/meetings, and presentations

During April, all SMARC biological staff were involved with data analysis and manuscript preparation or revision. So far this fiscal year, six articles have been published by peer-reviewed journals, four other articles have been accepted for publication and four articles have been submitted but not yet accepted. (CSF 5.3.7)

Publications- The manuscript titled “Experimental Exposure of Adult San Marcos Salamanders and Larval Leopard Frogs to the Cercariae of *Centrocestus formosanus*” authored by Daniel Huston, Valentin Cantu, and Dr. David Huffman (TSU) was submitted for publication in the Journal of Parasitology during October 2013. The article was published during April 2014 (100:239-241). (CSF 5.3.7)

Lily Swanbrow, a graduate student at TSU, completed a thesis titled “Effects of turbidity on anti-predator response and foraging behavior in the fountain darter, *Etheostoma fonticola*.” She successfully defended her thesis on 2 April 2012. A manuscript, co-authored with Kenneth Ostrand, has been completed and was submitted for publication in Transactions of the American Fisheries Society during April. (CSF 5.3.7)

Sophia DeColo, a graduate student at TSU, composed a manuscript from one of her thesis chapters titled “Effects of turbidity on association preferences for size in the fountain darter, *Etheostoma fonticola*.” The manuscript co-authored with Kenneth Ostrand was composed in April and has been sent to TSU faculty for internal review. (CSF 5.3.7)

Kelly McDermott, Dan Huston, Tom Arsuffi (Texas Tech University) and Kenneth Ostrand submitted a manuscript titled “Exotic digenetic trematode (*Centrocestus formosanus*) distribution and occurrence, its exotic snail intermediate host (*Melanoides tuberculatus*), and fish infection rates in West Texas Springs Systems” to Southwestern Naturalist (SWAN) on 8 May 2012. The article was accepted on 6 January 2014. The manuscript FRG-06 is scheduled for Volume 59(2) and is in line for final editing for style and format of the Journal. Final editing of manuscripts for 59(2) should be completed late April-early May. (CSF 5.3.7)

Extension activities/meetings-

Tom Brandt gave a presentation at the TSU Aquatic Biology Seminar on April 9th. His presentation was titled “San Marcos Aquatic Resources Center”.

Valentin Cantu and Randy Gibson continue to work with Texas Parks and Wildlife (Andy Gluesenkamp) and EAA (Gary Schindel and David Gregory) to gain access to additional EAA sampling sites in Hays (SWT Farms, Crystal Clear, San Marcos Baptist Academy, and the SM Bad Water Line wells) and Comal (Garden Ridge, Bracken, HWY 306, Loop 337, Panther Canyon, and Mission Valley wells) counties. In April, SMARC staff continued trapping efforts at Garden Ridge, Bracken and SWT farms wells.

On 3 April 2014, Valentin Cantu coordinated a meeting with Dr. Benjamin Schwartz, a TSU

professor who is taking the place of Dr. Longley at EARDC. Dr. Schwartz met with SMARC staff to find out how both institutions can continue to support each other with continued Texas blind salamander and troglodytic invertebrate sampling efforts from TSU wells (TSU artesian and Rattlesnake well) and springs sites (Diversion Springs, Spring Lake outflow, upper Sessom's Springs, and lower Sessom's Springs). TSU is interested in adding permanently mounted PVC fittings over the spring openings at Sessom's Creek to facilitate the attachment and removal of drift nets and prevent nets from washing away during flood events. Although USFWS is unable to provide funding to EARDC for continued Texas blind salamander sampling efforts, the SMARC has agreed to help improve current net designs and consult with Austin ES to determine the feasibility of modifying existing sampling sites.

In April, McLean Worsham (TSU graduate student), working with Valentin Cantu, began sampling at Diversion Springs. Although he is collecting live invertebrates as part of his Master's Thesis to find a host for *Huffanella huffanni*, an endemic parasite to San Marcos Springs, he will provide the SMARC with Texas blind salamanders when they are captured. As of 29 April, no Texas blind salamanders were collected.

On April 8th Patricia Echo-Hawk hosted the National Dive Control Board conference call with all Regional Dive Officers and Region 9 Safety Manager. Policy changes for FWS 240-10 are being implemented and developed for surface supplied diving procedures as well as training standards for each region. The Joint Gulf Coral Project with NOAA tentatively scheduled for the summer of 2014 was discussed.

Kenneth Ostrand and Jeff Hutchinson transferred 30 Texas wild rice seedlings on 4 April to Dr. John Goolsby with the USDA's Knipling-Bushland Research Laboratory in Edinburg, Texas. Dr. Goolsby is testing a biological control agent for giant reed (*Arundo donax*) and will be using the Texas wild rice in comparison tests since both giant reed and Texas wild rice are members of the grass family. Dr. Goolsby gave Kenneth and Jeff a tour of the Level 3 laboratory and discussed quarantine procedures and precautions. The information from the tour will be used in the design and development a quarantine facility at the SMARC.

Jeff Hutchinson and Scott Davis set up an exhibit at and participated in the Texas wild rice festival on Saturday 12 April. A 10 x 1 x 1 foot tank containing native and non-native plants common in the San Marcos River was used as an interactive display so visitors could handle and compare plants. Approximately 250 visitors stopped by the exhibit.

Personnel development: Training

Daniel Huston as a participant of the Pathways Program returned to the SMARC after a 60 day rotation at Bitter Lake NWR. While at Bitter Lake NWR he was able to get a taste of the refuge system and understand their role in the Service. More specifically, he assisted with invasive plant removal and water fowl and wetland management practices including fire and impoundment manipulation. He even wrote an article for the Roswell Newspaper about darters. We at the SMARC are glad he is back and are grateful to the Bitter Lake NWR for giving him the opportunity.

Facilities and equipment

On 14 April, Ted Breihan completed the electrical wiring needed to install the heat pump's heat strips for the holding house and TXFWCO office. Concurrent with the electrical work Reliable Air completed the installation of an additional air duct in the holding house to improve the heat pumps efficiency and life span. They also installed the heat strips in the holding house and TXFWCO office heat pumps.

On 14 April 2014, Harlan Nichols (TSU graduate student) working with Kenneth Ostrand volunteered to wear a formaldehyde monitoring badge, during fountain darter specimen dissections, to ensure that exposure limits did not exceed OSHA standards (see 29 CFR 1910 and USFWS 242 FW9 1048; time weighted average (TWA) = 0.75). Samples were sent to the Sensor Safety Products lab for analysis. Harlan's exposure to formaldehyde was far below OSHA standards (Actual TWA < 0.016). Monitoring will continue to ensure exposure limits are not exceeded.

Randy Gibson is working with Dr. Glenn Longley (TSU), the Edwards Aquifer Data Research Center (EARDC) and a graduate student, Laura McCalla, to monitor the SMARC water wells and other water wells upstream and downstream of the site of the Paso Robles housing development and golf course. This large-scale development will occur near two wells that supply all the water for the SMARC. Although initial land clearing was planned to start in December 2010, the project has been delayed, allowing us to obtain baseline information on water quality prior to any development. It is unknown what effects the development and subsequent chemical usage (herbicides, pesticides, reuse water) by the golf course and home owners will have on the water quality of the aquifer and on listed aquatic species held at the SMARC. Water quality sampling began during February 2011. Water samples from Hunter well collected during March, June, and September 2011 contained relatively high levels of total coliform. This may indicate the influence of nearby recharge features that needs further investigation. The last samples for this project were taken on 19 July 2012. During August, all sample analyses were completed. Laura McCalla's thesis was completed in December 2012. The SMARC continues to constantly (every 15 min.) monitor temperature and conductivity in both wells. Monitoring has not detected any substantial changes that could represent possible pollution events. The EARDC has received funding from TCEQ-SEP program to continue periodic monitoring of SMARC and City of San Marcos wells for two years. During 21-25 April, water quality sampling took place in SMARC and city of San Marcos wells. Analyses of the samples are ongoing. (CSF 7.12.5.4)

During April, Randy Gibson continued to manage computer software and troubleshoot computer operating issues at the SMARC. Installation of mapping software (ArcGIS and Pathfinder Office for Trimble GPS units) was completed on all computers with appropriate licenses.

In April 2014, all SMARC staff participated in Cross Programmatic Service workday performing general housekeeping in the shop and maintenance facility. The workday was held to bring the area in compliance of safety violations from the 2013 safety inspection.

In April, Valentin Cantu led a crew of ten CSR (Community Service Restitution) volunteers to

trim and cut grass at the SMARC. In addition the volunteers helped removed about eight square yards of a terrestrial invasive plants (Bastard-cabbage *Rapistrum sp.*) growing along the McCarty Lane ditch, modified a concrete raceway by constructing a temporary retaining wall to hold back water from a work area, dug out a trench for a drain pipe that leads into a sand filter/chlorinator, reconstructed a cover for a sand filter/chlorinator system and removed sediments and grass from the vicinity, cleaned restrooms, watered trees using reuse water, collected live food (amphipods) for salamanders, and began setting up a new refugia tank system for wild stock Texas blind salamanders.

Visitors

On April 26th Patricia Echo-Hawk conducted a tour for 20 students and three teachers from Stockville Junior High School