

STAFF NOTES

San Marcos Aquatic Resources Center October 2015

Aquatic Species Conservation and Management: Refugium Activities

San Marcos salamander- As of 30 October 2015, 302 San Marcos salamanders were being maintained in the SMARC refugia. Thirteen dead salamanders were removed from the refugium this month (Table 1). Wild stock salamanders oviposited 14 eggs this month, while their offspring did not oviposit eggs in October (Table 1). (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 | | July 2015 | | | August 2015 | | | September 2015 | | | October 2015 | | |
|---------------------------|------------|-----------|----|----|-------------|----|----|----------------|----|----|--------------|----|----|
| | | JA | OV | EG | JA | OV | EG | JA | OV | EG | JA | OV | EG |
| San Marcos salamander | RWS | 343 | 1 | 16 | 331 | 0 | 0 | 315 | 0 | 0 | 302 | 1 | 14 |
| | FX | 62 | 0 | 0 | 62 | 0 | 0 | 90 | 0 | 0 | 75 | 0 | 0 |
| | Quarantine | WS | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Texas blind salamander | RWS | 140 | 0 | 0 | 138 | 0 | 0 | 136 | 0 | 0 | 135 | 2 | 16 |
| | FX | 127 | 0 | 0 | 127 | 0 | 0 | 127 | 0 | 0 | 127 | 0 | 0 |
| | Quarantine | WS | 0 | - | - | 0 | - | - | 1 | - | - | 8 | - |
| Barton Springs salamander | RWS | 30 | 0 | 0 | 29 | 0 | 0 | 27 | 0 | 0 | 27 | 0 | 0 |
| | FX | 578 | 0 | 0 | 580 | 0 | 0 | 575 | 0 | 0 | 575 | 0 | 0 |

Texas blind salamander- As of 30 October 2015, 135 wild caught Texas blind salamanders were being maintained in the SMARC refugia. EARDC (Edwards Aquifer Research and Data Center) staff collected nine salamanders from Sessom Creek Springs and one from Texas State University (TXST) Artesian Well. One dead salamander was removed from the refugium this month, while three salamanders died in quarantine (Table 1). Wild stock Texas blind salamanders oviposited 16 eggs in October while their offspring did not oviposit eggs this month (Table1). (CSF 7.12.5.4)

Barton Springs salamander- No salamanders were collected from Barton Springs in October (Table 1). No wild stock salamander mortalities were removed this month (Table 1). Wild stock Barton Springs salamanders and their offspring did not oviposit eggs this month (Table 1). (CSF 7.12.5.4)

Fountain darter- On October 30, 2015, there were 551 wild stock fountain darters in the SMARC refugia. Fifty-one mortalities were recovered in September from the San Marcos (lower = 7, middle = 14, and upper = 15) and Comal (upper = 11 and lower = 4) captive populations. Due to high mortality, formalin treatments (150 mg/L) were administered to all darters 6-15 October. Wildstock fountain darters were collected from the San Marcos River on 29 October for fish health and refugia. (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=157) and another from Pinto Creek (N=91). During September, two wildstock minnows (San Felipe Creek) were euthanized and transferred to Dr. Huffman's Lab for examination. During October, F1 DRM from Pinto Creek, spawned in September, were quantified and transferred to 7.5 L aquaria (N =475). The SMARC continues to maintain ~2800 F1 DRM from Pinto Creek in 9' indoor raceways, and 956 F1 DRM from Pinto Creek and 721 F1 DRM from San Felipe creek in outdoor raceways. (CSF 7.12.5.4)

Comal Springs riffle beetle- Approximately 100 adult wild stock Comal Springs riffle beetles, six F1 adult offspring, and 200 larvae are being maintained at the SMARC. (CSF 7.12.5.4)

Peck's cave amphipod- Approximately 50 adult Peck's cave amphipods are being maintained at the SMARC. (CSF 7.12.5.4)

Comal Springs dryopid beetle- Nine Comal Springs dryopid beetles are being held in captivity at the SMARC to evaluate a new holding system. (CSF 7.12.5.4)

Texas wild rice- As of 30 October 2015, the SMARC had 174 Texas wild rice plants in refugia. There are 161 plants in greenhouse raceways and 13 in quarantine along with an additional 99 plants at Uvalde NFH (Table 2). Tillers were collected on 14 October 2015 from the San Marcos River (N= 13 Section A) and are being held in quarantine. Plants collected in October and November 2014 were moved into refugia tank 3. The survival rate of tillers collected in October and November 2014 was 46%, possibly due to the 2% salt treatment that occurred when tillers were brought into SMARC. Plants in the outdoor raceways exhibited survival rates of less than 5% due to excessive algae. Plants in the outdoor raceway that survived will be repotted and planted into river section from which they were collected. Collection of tillers will be made as recommended within the Texas wild rice genetics report starting at river section A and working downstream over the next 12-24 months. All current refugia plants without known GPS locations and area coverage of the stand they were collected from will be transitioned out and replaced with plants of a known location. (CSF 7.12.5.4)

On 30 September 2015, the SMARC had 22,159 ($N_{2009} = 390$, $N_{2010} = 585$, and $N_{2011} = 1,941$, $N_{2012} = 10,152$, $N_{2013} = 6,550$, $N_{2015} = 2,541$) Texas wild rice seeds in storage (Table 3). Texas wild rice was observed flowering August through October this year following the May flood, but the 30 October 2015 flood re-submerged the flowers and seeds. (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 \pm ISE = 61 \pm 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 | 13 | 0 | | 13 | 31 | 57 |
| B | 63 | 0 | | 0 | 19 | 82 |
| C | 24 | 4 | | 0 | 10 | 34 |
| D | 0 | 0 | | 0 | 6 | 6 |
| E | 7 | 0 | | 0 | 0 | 7 |
| F | 25 | 0 | | 0 | 4 | 29 |
| G | 1 | 0 | | 0 | 8 | 9 |
| H | 1 | 0 | | 0 | 0 | 1 |
| I | 0 | 0 | | 0 | 0 | 0 |
| J | 10 | 0 | | 0 | 2 | 12 |
| K | 3 | 0 | | 0 | 4 | 7 |
| Research Stock | 14 | 0 | | 0 | 15 | 29 |
| Total | 161 | 0 | | 13 | 99 | 273 |

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 | 2014 | 2015 | Total |
|-------|------|------|-------|--------|-------|------|-------|--------|
| Jan | | | | | 491 | | | 491 |
| Feb | | | | | | | | |
| Mar | | | | | | | | |
| Apr | | | | | | | | |
| May | | | | | 264 | | 2,541 | 2,805 |
| 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 | 0 | 2,541 | 22,159 |

Research and Restoration Activities

Barton Springs salamander - SMARC staff, working with Dr. Joseph R. Tomasso (TXST) and Justin Crow, determined the effects of temperature and nitrogenous contaminants on the Barton Springs salamander. In February 2014, a growth study was initiated. Best growth was obtained at 18°C and poorest growth at 28°C. The mean upper temperature tolerance for the salamander was found to be 32.6°C. An additional study to examine the effects of toxic chemicals (i.e., ammonia, nitrite, and nitrate) commonly found in rainwater runoff on salamander survival was conducted. The ammonia trial was completed in December 2014, nitrite in February 2015, and nitrate was completed in April 2015. Data analyses and composition of the results were completed in July 2015. Justin successfully defended his thesis on 6 August 2015. It is currently being formatted for publication. (CSF 7.12.5.4)

Fountain darter- Kenneth Ostrand is working collaboratively with Tim Bonner (TXST) and Miranda Clark (TXST graduate student) who are examining predator-prey relationship in the San Marcos and Comal rivers. A series of laboratory experiments are being conducted at TXST to assess the behavior of fountain darters with and without predators; quantify predation rates of fountain darters with invertebrate and vertebrate predators; and evaluate how aquatic vegetation and substrates might mediate predator consumption of fountain darters. Results to date suggest that the levels of fountain darter consumption by crayfish and bass are additive and not interactive or cascading. Bass consumed 0 to 3 crayfish among the six experimental units with crayfish and bass combined in addition to the consumption of 0 to 4 fountain darters by either crayfish or bass. As such, mortality of fountain darters was greater, though not statistically different from crayfish only and bass only, than the control. Preliminary findings demonstrate that crayfish and bass will consume fountain darters and suggest that both predators will additively increase mortality of fountain darters. As such, the removal of largemouth bass during low flow periods will predictably reduce fountain darter mortalities via predation without causing a trophic release (i.e., greater predation by crayfish). Additional replications were completed and final data analyses were completed. Miranda defended her thesis 14 October 2015. (CSF 7.12.5.4)

Devils River minnow- Stephen Harding is now working on the identification of an encysted trematode metacercariae found in the cranial bones and associated tissues in Devils River minnow. Several wild stock specimens from the spring-fed localities of San Felipe Springs, Pinto Creek, and Blue Hole on the Devils River have been examined along with specimens that demonstrated a “spinning” behavior while in the SMARC refugium. This behavior can be described as a loss of equilibrium and motility, eventually resulting in the death of the minnow. One objective of the project is to determine whether the trematode metacercariae or a symbiotic, *neorickettsia* sp. bacterium is the cause of this behavior and subsequent mortality of the minnow. The first step of the project is to isolate adult trematode worms from a suspected definitive host. Because adult trematode worms have been reported in gars and bow fins from other watersheds, the stomach and intestines from five live wild caught specimens of gar, collected 17 October 2015 from Dolan Falls and Blue Hole on the Devils River, were preserved in ice and analyzed. However, no adult trematodes of any kind were found. One wild caught *Dionda argentosa* that was also collected with the gar and coexists with *D. diaboli* was necropsied. Fifteen metacercariae cysts from the cranium were recovered, 10 of which were

preserved in 95% ethanol and stored for future DNA analysis. The remaining five metacercariae were excysted, photographed, preserved in an alcohol, formalin, and acetic acid fixative for morphological analysis, and archived by Dr. David Huffman at Texas State University. (CSF 5.3.7)

Texas wild rice- 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 Tube 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 seasonal germination patterns. To date, germination rates for river collected seeds ranged from 19 to 95%. Preliminarily, wild collected Texas wild rice seeds do not appear to exhibit seasonal germination patterns presumably because abiotic conditions within the San Marcos River are relatively constant. Seeds produced at the SMARC have relatively similar germination rates (44 to 96%) and also do not exhibit any seasonal germination pattern. On 24 May 2015, a flood event submerged the flowering Texas wild rice and washed away or scoured the flowers and seeds. During the last week of June, only a few Texas wild rice plants in river sections A, B, and C were observed with flowers or seeds. Massive flowering was observed during August through October in river sections A and B. On 30 October 2015 during a flood event, the panicles were again submerged and the seeds were likely washed away. (CSF 7.12.5.4)

Leah Murray and Jeff Hutchinson set up ten tanks to test the effects of various copper concentrations (0.0 to 6.0 ppm) on Texas wild rice, arrowhead, creeping primrose willow, and water stargrass. The objective of the project is to determine an acceptable application rate that simultaneously controls algae without negatively affecting plants. The first treatment occurred in December 2014 and the experiment will be repeated. At 3 weeks post-treatment, water stargrass exhibited ca. 25% necrosis but none of the other species were affected by the treatments, regardless of concentration. As of May 2015, all native plants have survived the treatments and algae remains minimal. The greenhouse was reconfigured for additional electrical outlets so that additional fiberglass tanks could be set up to run additional copper trials. Texas wild rice seedlings were potted on 20 October 2015 and copper trials will begin in early November. (CSF 7.12.5.4)

The annual Texas wild rice survey was held from 20 to 24 July. Approximately 30 volunteers from the City of San Marcos's Conservation Crew, Hays County Master Naturalist, and TXST assisted throughout the week with the survey. This year was a little more difficult due to the strong currents compared to the last 2 years. Preliminary analysis has the area coverage of TWR increasing from 8,452 square meters in 2014 to 12,363 square meters in 2015. The survey was stopped at Old Bastrop Road because the current was strong and the water was murky, making it difficult to find the outliers in the lower part of the river. The final segment of the survey was completed 2 October 2015 with an additional 8.4 m² of coverage measured in the lower range of Texas wild rice.. (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

for the City of San Marcos’ native aquatic plant restoration efforts. Plant transfers to the City of San Marcos began in March 2013 to meet the restoration goals outlined in the Edwards Aquifer Habitat Conservation Plan. In 2014, the SMARC provided a total of 12,551 aquatic and terrestrial plants including Texas wild rice to the City of San Marcos. In January 2015, spring flows increased enough to allow planting activities under the City’s 10(a)(1)(B) permit to resume (Table 9). As of 30 October, 6,546 aquatic plants were provided to the City of San Marcos since the beginning of 2015. The City received 4,311 Texas wild rice seedlings, 1,175 creeping water primrose willow, 297 arrowhead, 718 water stargrass, and 45 Illinois pondweed plants for their restoration efforts. SMARC staff continues to maintain and propagate additional plants for future restoration work. (CSF 7.12.5.4)

Table 9. Aquatic and terrestrial plants provided to the City of San Marcos for restoration work in and along the San Marcos River during 2015.

| | | |
|---------------------------|----------------------------------|------------------|
| Aquatic Plants | | |
| Arrowhead | <i>Sagittaria platyphylla</i> | 297 |
| Creeping primrose willow | <i>Ludwigia repens</i> | 1,175 |
| Illinois pondweed | <i>Potamogeton illinoensis</i> | 45 |
| Texas wild rice | <i>Zizania texana</i> | 4,311 |
| Water stargrass | <i>Heteranthera liebmannii</i> | 718 |
| | | $\Sigma = 6,546$ |
| Terrestrial Plants | | |
| American elm | <i>Ulmus americana</i> | 31 |
| Anaqua | <i>Ehretia anacua</i> | 22 |
| Baby blue eyes | <i>Nemophila phacelioides</i> | 20 |
| Bald cypress | <i>Taxodium distichum</i> | 61 |
| Beautyberry | <i>Callicarpa americana</i> | 8 |
| Black walnut | <i>Juglans nigra</i> | 19 |
| Black willow | <i>Salix nigra</i> | 31 |
| Box elder | <i>Acer negundo</i> | 36 |
| Brushy bluestem | <i>Andropogon virginicus</i> | 30 |
| Buttonbush | <i>Cephalanthus occidentalis</i> | 90 |
| Cedar elm | <i>Ulmus crassifolia</i> | 19 |
| Cottonwood | <i>Populus deltoids</i> | 36 |
| Crow-foot sedge | <i>Carex crus-corvi</i> | 25 |
| Dewberry | <i>Rubus trivialis</i> | 1 |
| Eastern gamagrass | <i>Tripsacum dactyloides</i> | 105 |
| Eastern redbud | <i>Cercis canadensis</i> | 6 |
| Elderberry | <i>Sambucus canadensis</i> | 57 |
| Emory's sedge | <i>Carex emoryi</i> | 233 |

| | | |
|-----------------------|---------------------------------|------------------|
| Inland sea oats | <i>Chasmanthium latifolium</i> | 117 |
| Lean flatsedge | <i>Cyperus setigerus</i> | 12 |
| Lindheimer's muhly | <i>Muhlenbergia lindheimeri</i> | 4 |
| Mexican buckeye | <i>Ungnadia speciose</i> | 12 |
| Mexican plum | <i>Prunus mexicana</i> | 11 |
| Osage-orange | <i>Maclura pomifera</i> | 4 |
| Pecan | <i>Carya illinoensis</i> | 25 |
| Pencil cactus | <i>Opuntia leptocaulis</i> | 40 |
| Pink mimosa | <i>Mimosa borealis</i> | 27 |
| Possumhaw | <i>Ilex decidua</i> | 8 |
| Prickly pear cactus | <i>Opuntia macrorhiza</i> | 15 |
| Red buckeye | <i>Aesculus pavia</i> | 8 |
| Retama | <i>Parkinsonia aculeate</i> | 12 |
| Rough-leaf dogwood | <i>Cornus drummondii</i> | 3 |
| Switchgrass | <i>Panicum virgatum</i> | 93 |
| Sycamore | <i>Platanus occidentalis</i> | 48 |
| Texas ash | <i>Fraxinus texensis</i> | 16 |
| Texas mountain laurel | <i>Sophora secundiflora</i> | 20 |
| Texas rush | <i>Juncus texanus</i> | 60 |
| Trumpet creeper | <i>Campsis radicans</i> | 4 |
| Western soapberry | <i>Sapindus saponaria</i> | 15 |
| | | $\Sigma = 1,384$ |

During March to May, native seeds of riparian and terrestrial plants were collected from City of San Marcos properties along the San Marcos River. Seeds were collected from grasses, forbs, shrubs, and trees and are being stored at the SMARC in labeled containers. The seeds will be used for future planting. Volunteer planting days were held on 18 and 27 March at Rio Vista Park area, and a total of 530 plants were provided by the SMARC and planted in areas where non-native trees were removed (Table 7). The SMARC hosted its first Volunteer Planting Day to re-vegetate the San Marcos River Banks on Wednesday 18 March 2015 in coordination with the City of San Marcos near Playscape Park. Total attendance was approximately 30 people. The area will be fenced off for up to 10 years so plants can establish themselves. The SMARC hosted its second Volunteer Planting Day with 16 Phoenix High School students on 27 March 2015 on the San Marcos River in coordination with the City of San Marcos at Rio Vista Park. Planting days were also held on 4, 18, and 24 April to plant native vegetation propagated at the SMARC. Planting areas were bare from recreational use and invasive plant removal efforts and presumably have a high erosion potential. On June 24, a planting day was held along the San Marcos River by I-35 to restore an eroded gully on a steep incline that was eroding into a stand of Texas wild rice during rain events. SMARC and the City of San Marcos had additional planting days on the river on 17 and 18 July. Volunteers from a youth service group assisted

with the project. Riparian shrubs, trees, grasses and sedges grown at SMARC were planted to control erosion and to re-vegetate areas. Planting areas were void of vegetation due to recreation activities and invasive removal. On 29 October 2015, the SMARC Friends Group and students from Phoenix School worked with Leah Murray to plant a disturbed riparian area in Ramon Lucio Park along the San Marcos River. The plantings were scoured the following day due to a flood event. Additional planting dates are planned in November and December 2015. (CSF 7.12.5.4)

Aquatic nuisance species-The SMARC is responsible for the removal of the 5% residual exotic plant *Cryptocoryne beckettii* from the San Marcos River that Dredge America was not required to remove. We are removing missed plants and re-growth resulting from small pieces of plant rhizomes not removed by the dredge. This removal requires surveying approximately 2 miles of river bottom and removing rooted and loose plants by hand. During the March 2012 survey, no plants were found. Unfortunately, two plants were found during the November 2012 survey and were removed from the system. Beginning in late March to 3 June 2013 the SMARC staff using SCUBA surveyed the river. No plants were observed during the survey. The second biannual survey was conducted in September 2013 and again no plants were observed. A survey was conducted in July 2014 by Region 2 SCUBA divers (Patricia Echo-Hawk, Randy Gibson and Valentin Cantu). The SMARC SCUBA dive team found no evidence of *Cryptocoryne beckettii* within the San Marcos River. As a result, future surveys for the plant and other exotics will be conducted annually as opposed to biannually. On 19-21 October 2015, two SMARC dive team members (Randy Gibson and Valentin Cantu) and two snorkelers (Justin Crow and Joshua Abel) surveyed the San Marcos River stretch. No water trumpet plants or new invasive species were detected. (CSF 12.2.4)

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

During October, all SMARC biological staff were involved with data analysis and manuscript preparation or revision. So far this fiscal year, no articles have been published by peer-reviewed journals, three articles have been accepted for publication, and seven articles have been submitted but not yet accepted. (CSF 5.3.7)

Publications Accepted- Randy Gibson collaborated with Cheryl Barr (UC Berkeley, emeritus) and Pete Diaz (TXFWCO) to describe three new species of subterranean riffle beetles from springs associated with the Edwards Aquifer in west Texas. A manuscript entitled, “*Typhloemis*, a new stygoiontic riffle beetle genus with three new species from Texas, USA (Coleoptera: Elmidae: Elminae)” has been composed and was submitted for publication to *Coleopterist Bulletin* on 10 May 2015. The article was accepted for publication on 13 August 2015. Page proofs were received during October and should be published in December 2015. (CSF 5.3.7)

Daniel Huston (Inks Dam NFH), Randy Gibson, Kenneth Ostrand, Chad Norris (TPWD), and Pete Diaz (TXFWCO) submitted an article entitled, “Monitoring and marking techniques for the endangered Comal Springs riffle beetle *Heterelmis comalensis* (Coleoptera: Elmidae)” to *Insect Conservation and Diversity* on 12 February 2015. It was not accepted by the journal. It was submitted to *Coleopterist Bulletin* and accepted for publication on 8 September 2015. The

results detailed in this manuscript suggest that the novel marking methods described have merit for aquatic invertebrates and could be used to assess movement patterns and determine population estimates through mark and recapture techniques. Page proofs were received during October and the manuscript should be published in December 2015. (CSF 5.3.7)

Extension activities/meetings-

Leah Murray set up a monarch booth at TXFWCO Annual Kid's Fishing Day on 17 October 2015. Leah presented information on the differences among similar butterflies and information on host-plants.

Bekki Muscher-Hodges (San Antonio Zoo) started working at the SMARC on 1 October 2015. She will be working one day per week for several months with Leah Murray and Jeff Hutchinson to learn Texas wild rice refugia procedures.

Friends of the San Marcos Aquatic Resources Center was granted federal non-profit status in October 2015. They have a board of five members, including Lance Jones, Richard McBride, Susan Hanson, Kathleen Theis, and Margo Case. No specific officer positions have been voted on to date. Leah Murray is the primary liaison to the group. A meeting is planned in November for continued organization of the group.

Staff Training

Leah Murray, Josh Abel and Juan Martinez completed the online and field portions of Type 2 Wildland Firefighter training and are now certified. Courses completed include S-130 Basic Wildland Firefighter Training, S-190 Introduction to Wildland Firefighter Behavior, L-180 Human Factors in the Wildland Fire Service, and I-100 Introduction to the Incident Command System. The field portion of the training was completed 9-10 October at Balcones Canyonlands National Wildlife Refuge.

On 13 - 15 October 2015, Valentin Cantu and Randy Gibson participated in the 2015 National Diving Control Board Meeting at Columbia, Missouri. The meeting involved both field training and conference discussions. They were trained to dive, snorkel, and sample for rare mussel species from an ancient mussel bed in the Lower Osage River while learning to improve a suite of rescue diver skills. The conference included a presentation on using "laser marked" mussels for mark and recapture surveys, discussions of recent dive incidents to reduce dive accidents, and a group discussion to improve the current USFWS hookah dive safety protocol.

On 19 - 21 October 2015, two new staff members, Justin Crow and Joshua Abel, were trained by Randy Gibson and Valentin Cantu to survey the San Marcos River for the invasive water trumpet plants and for new invasive species. Justin Crow is currently being trained to manage the dive program at SMARC.

Beginning on 26 October 2015, Kenneth Ostrand began a 4-week job swap with Edwin B. Forsythe National Wildlife Refuge Manager Virginia Rettig as a part of the USFWS Advanced Leadership Development Program.

Facilities and Equipment

During October, Randy Gibson continued to manage computer software and troubleshoot operating and software issues at the SMARC.

During October, Valentin Cantu and Community Service Restitution (CSR) volunteers completed a variety of tasks at the SMARC. The tasks including grass cutting, removing trash and asphalt debris left behind from the McCarty Lane construction project, cleaning the facility's 1-acre pond, acid washing salamander tank systems, adding scrap pond liner between the Barton Springs building and the Pad to make a weed barrier around the pumps and heater/chiller units, reinforcing a large sign with appropriate hardware to reduce damage from strong winds, and building backup drain pipe screens for the Barton Springs building and the Pad.

On 7 October 2015, Randy Gibson and Valentin Cantu installed a 10' drift net over an artesian outflow pipe at Spring Lake to collect cave-adapted invertebrates and salamanders. Non-listed amphipods will be used as surrogates for listed species to learn how to keep them alive in captivity at SMARC and for comparison with other amphipods that dwell in the Edwards Aquifer area. Texas blind salamanders collected from the net will be transferred and maintained in the SMARC refugia with existing populations.

The area received approximately 10 inches of rain on 30 October that resulted in flash flood conditions on local roads, and caused damage in some area watersheds. During the storm, electricity was lost to the station's two wells and diesel-powered back-up generators operated automatically. The power company restored electricity after about 6 hours.

Visitors

The USFWS Directorate participated in a one-day tour of the SMARC and Texas Fish and Wildlife Conservation Office on 28 October. Station staff created research posters that will be re-used for outreach purposes and manned 6 stations focusing on station activities. Tours of the Texas wild rice beds SMARC staff restored at Sewell Park and a glass-bottomed boat tour of Spring Lake were provided. The Directorate also had the opportunity to seine for fish with TXFWCO staff.

During October, Dr. John Abbott (St. Edwards University) completed photographing EAHCP listed species at the SMARC for the EAA.