City of Austin
WATERSHED PROTECTION

Inventory of Freshwater Mussels (Unionidae) in Austin, Texas

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Abstract

This project surveyed creeks within the jurisdiction of the City of Austin to catalogue species and locations of freshwater mussels. A total of 29 creeks and two reservoirs contained unionids. Fifteen species of freshwater mussels have been identified; live specimens have been recovered for only 9 species. One species that is listed as threatened by the Texas Parks and Wildlife Department has been collected in Austin.

Introduction

Freshwater mussels (Mollusca: Unionidae) are a poorly understood class of invertebrates, but interest in them has peaked due to their susceptibility both to in-stream pollutants including those caused by increased siltation, gravel-mining operations, agricultural practices, diminished riparian zones and clear cutting of watersheds (Bogan 1993, Williams *et al* 1993). Additional stressors such as temperature, flow regime changes and lack of host fish (Watters 1996, Williams *et al* 1993) have been tied to in-channel dams. Of the nearly 300 species that are native to North America, 213 taxa (71.7%) are considered endangered, threatened or of special concern; 21 taxa (7.1%) are listed as endangered but are possibly extinct; 77 taxa (20.6%) are listed as endangered but are extant; 43 taxa (14.5%) are listed as threatened; 72 taxa (24.2%) are species of special concern; 14 taxa (4.7%) have no status information; and 70 taxa (23.6%) are considered in stable condition (Williams *et al* 1993). United States Fish and Wildlife Service (USFWS) reported that 62 were federally listed as either endangered or threatened, and 130 were considered to be in need of conservation status (1995, 1996). In 2007, Machtinger, reported that 35 species were considered extinct.

In Texas, the Ouchita Rock Pocketbook (*Arkansia wheeleri*) is listed as endangered (USFWS 2010) and 15 other species of Texas mussels have been placed on the threatened listed by Texas Parks and Wildlife Department (TPWD 2009). Mussels have been an important resource throughout history for Native Americans who used them for food sources, tools, jewelry and art (Machtinger *et al* 2007) and in the early 20th century they were harvested for gem quality pearls and use in the button industry (Howells *et al.* 1996).

Freshwater mussels inhabit a variety of water body types ranging from large rivers to ponds. Regardless of type of water body, stable mussel habitats tend to have larger, more diverse populations. While some species are more tolerant to a variety of conditions, others are very narrow in their preferences. Typically, the most limiting substrate types are deep shifting sand and soft, deep silt; although heavy boulder and cobble substrates are often poorly populated as well. The most populated areas contain mud, sand, gravel, and cobble or a combination of these (Howells *et al.* 1996). Species vary with flow conditions, which can range from no-flow ponds to rapidly flowing streams and rivers. Unionids prefer waters with depths less than 7.6 m (Coker 1919). Areas where water levels have receded due to drought or draw-downs can have unusually high mussel populations when water levels return to normal. Mussel kills have been attributed to increases in reservoir levels, silt deposition, oxygen depletion or a combination of one or more of these (Howells *et al* 1996).

Methods

Study Area

Creeks were selected from the 45 watersheds located within or draining through the Extra Territorial Jurisdiction (ETJ) of the City of Austin. Sites were selected from the City of Austin's Environmental Integrity Index (EII) program. This program incorporates water quality, habitat and biological data from these creeks on a biannual basis. EII sites typically focus on headwater, middle reaches, and lower reaches of each watershed. Sixteen creeks were not surveyed due to geological characteristics (limestone bedrock substrate) that are typically not favorable to freshwater mussels.

Mussels were located by shoreline collection and wading using tactile searches in ≤1 meter water. Unionids were collected from March 2007 to June 2010 with an intensive mussel survey conducted in April 2008. In addition to the creeks, two of the larger water bodies (Lake Austin and Lady Bird Lake) were surveyed for the presence of unionids. These reservoirs belong to the chain of Highland Lakes that are impoundments of the Colorado River. The flow of the lower Colorado River for downstream water rights, power generation, and flood control is regulated by the Lower Colorado River Authority (LCRA).

Survey Methods

Mussels were located using the following methods:

- Visual
- Snorkeling (only done on Onion Creek)
- Shoreline collection of shells
- Tactile
- SCUBA. Typically most surveys employed more than one method.

Results

Of the 29 watersheds surveyed, only 15 (Figure 1) contained either 1.) spent valves without the recovery of live specimens; 2.) live specimens only or 3.) live specimens and spent valves (Figure 2). A total of 633.5 live mussels and 1032.5 spent valves were collected from 2007-

2010. Fifteen species of Unionidae were recorded from these 15 water bodies (Table 1), with 4 species (*Lampsilis teres, Pyganodon grandis, Uniomerus tetralasmus, and Utterbackia imbecillis*) representing 82% of spent valves and live specimens collected.

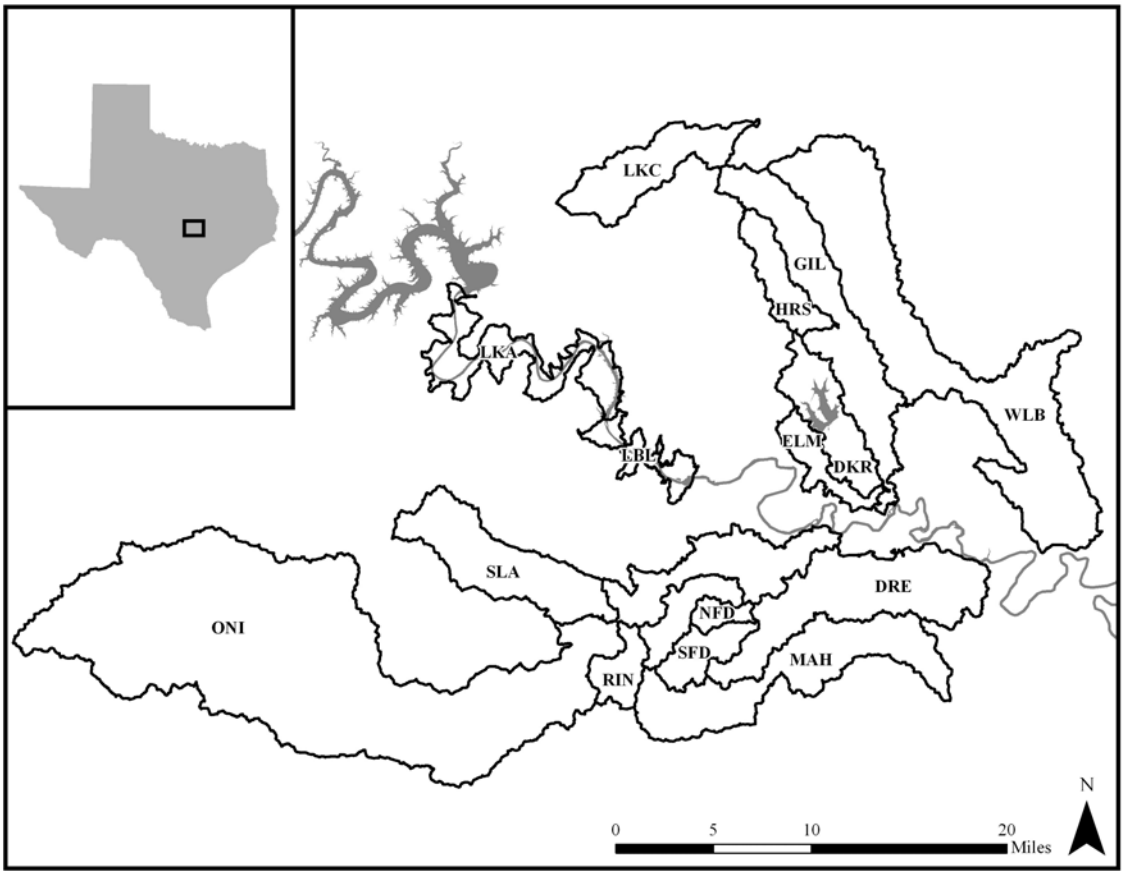

FIGURE 1. Austin, TX creeks where freshwater mussels were collected 2007-2010. Abbreviations for creek names are listed below Table 1. A total of 15 creeks contained freshwater mussels.

TABLE 1 – Species of mussels collected in Austin, TX and creeks where each species was found. Each creek has a notation of either live (L) or valves (S) being collected. A total of 15 species were collected from the Colorado River watershed (2007-2010).

Species	Common Name	Water body
Quadrula apiculata	Southern Mapleleaf	LBL^{L,S} GIL^{S} ONI^{S}
Amblema plicata	Threeridge	LBL^{L,S} LKA^{S}
Arcidens confragosus	Rock Pocketbook	LBL^{S}
Potamilus purpuratus	Bleufer	LBL^{S} LKA^{S} DKR^{S} ONI^{S}
Lampsilis teres	Yellow Sandshell	LBL^{L,S} GIL^{S} DKR^{L,S} LKC^{S} WIL^{S}
Toxolasma parvus	Lilliput	SLA^{L,S}
Toxolasma texasiensis	Texas Lilliput	WIL^{S} HRS^{S} ONI^{S} SLA^{S} RIN^{S}
Uniomerus tetralasmus	Pondhorn	(GIL, DRE, NFD, HRS, WIL)^{L,S} (DKR, RIN, ELM, SFD, MAH)^{S}
Uniomerus declivis	Tapered Pondhorn	DRE^{S} ELM^{S}
Pyganodon grandis	Giant Floater	LBL^{L,S} LKA^{S} DKR^{L} ONI^{L,S} WLB^{S} DRE^{S}
Uttebackia imbecillis	Paper Pondshell	LBL^{L,S} SLA^{L,S} DKR^{L,S} ONI^{S} GIL^{S} WLB^{S} LKA^{S} DRE^{S}
Crytonaias tampicoensis	Tampico Pearlymussel	LBL^{S} LKA^{S}
Leptodea fragilis	Fragile Papershell	WIL^{S}
Quadrula houstonensis	Smooth Pimpleback	LKA^{S}
Tritogonia verrucosa	Pistolgrip	LBL^{L}

LBL = Lady Bird Lake
DKR = Decker Creek
DRE = East Dry Creek
LKA = Lake Austin
ELM = Elm Creek
LKC = Lake Creek
WLB = Wilbarger Creek
ONI = Onion Creek
MAH = Maha Creek
GIL = Gilleland Creek
RIN = Rinard Creek
SLA = Slaughter Creek
HRS = Harris Branch Creek
NFD = North Fork Dry Creek
SFD = South Fork Dry Creek

^{L} = Live mussels
^{S} = Spent valves

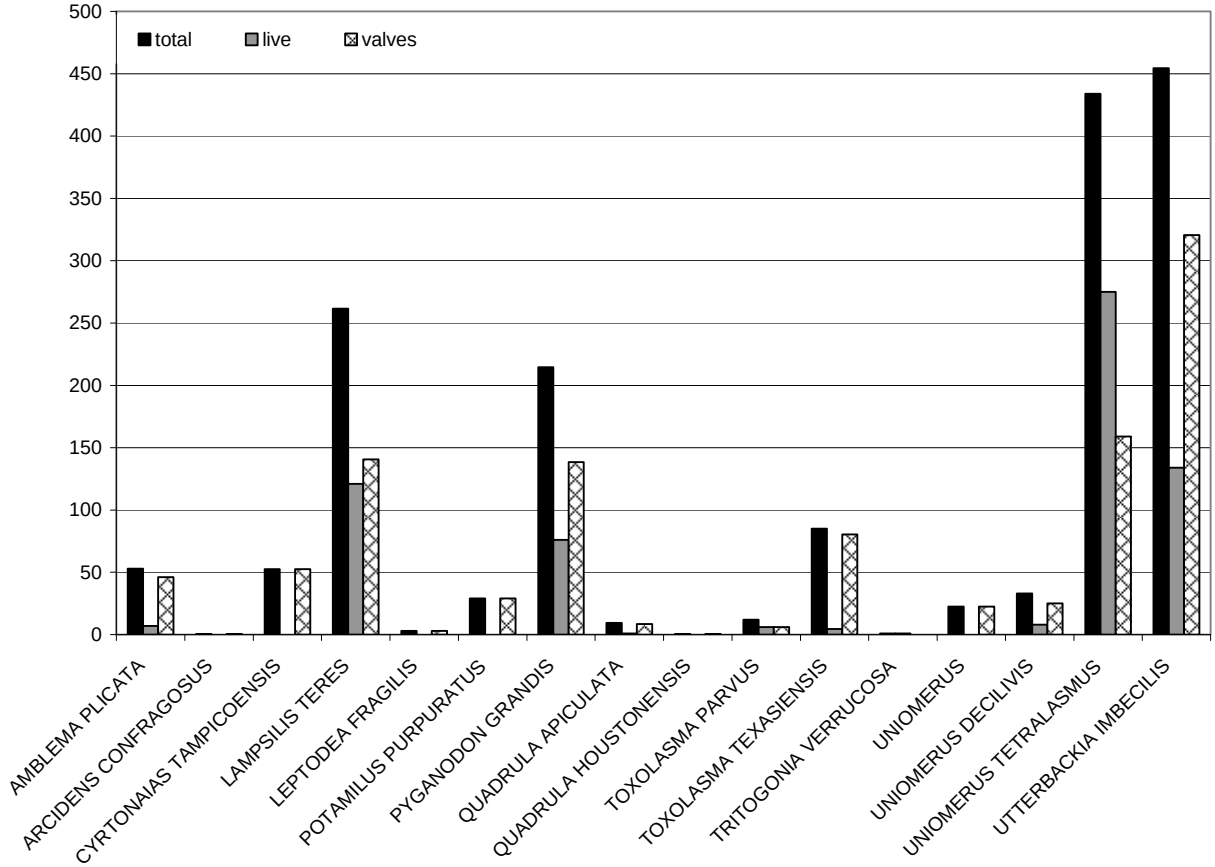

FIGURE 2. Total number of all unionid species collected from Austin, TX 2007-2010. Black bars indicate total for the species (live organisms and valves), grey bars indicate live specimens only, and patterned bars indicate spent valves collected.

Watersheds that were included in the survey that did not contain mussels were: Brushy Creek, Cottonmouth Creek, Marble Creek, Little Walnut Creek, Buttermilk Creek, Tannehill Creek, Boggy Creek, Harpers Branch Creek, Fort Creek, South Boggy Creek, Country Club Creek, Carson Creek, Turkey Creek and Williamson Creek. All of these creeks had a minimum of three sites searched that typically were in the upper, middle and lower portions of the watershed.

A total of 15 species of freshwater mussels were collected in Austin. Information below is from Howells *et al,* 1996. Our observations follow from locations where each species was collected.

Amblema plicata "Threeridge" – found on silt, mud, gravel and cobble in streams, rivers, lakes and reservoirs (Howells *et al*, 1996). Our survey found *A. plicata* in very few locations. Several long dead partial valves were collected from Onion Creek, Wilbarger Creek and Lake Austin. All live specimens were collected on Lady Bird Lake and were found in mud, mud/gravel mixture, and on top of clay [collected: 7 live, 46 valves].

Arcidens confragosus "Rock Pocketbook" – found on mud, sand, and gravel in swiftly moving waters and can tolerate some reservoirs (Howells *et al*, 1996). One partial valve was collected

from Lady Bird Lake, no live specimens were ever located during our surveys [collected: .5 valve].

Cyrtonaisas tampicoensis "Tampico Pearlymussel" – found on mud, sand, gravel or a combination of afore mentioned can be found infrequently on cobble/rock. Can be found in slow-flowing, mud-bottomed rivers or gravel-bottom streams with swift currents and can adapt to deep reservoirs (Howells *et al*, 1996). No live *C. tampicoensis* were ever collected during our surveys. Many spent valves were recovered from Lady Bird Lake and the Colorado River where IH-130 crosses the river. At the location below the IH-130 bridge there are remnant beds that have been eliminated due to a large siltation event [collected: 52.5 valves].

Lampsilis teres "Yellow Sandshell" – can tolerate substrates from rock to mud, but avoids deep, shifting sands. Found in both small and large streams, rivers, and is often in warm water and can be found in turbid waters that are slow to fast velocities (Howells *et al*, 1996). The majority of *L. teres* that were found were from Lady Bird Lake behind the Brackenridge Field Laboratory (BFL) that is operated by the University of Texas. On Lady Bird Lake smaller live *L. teres* were located upstream behind BFL in hard packed sand; downstream larger live specimens were located in hard packed sand that was covered with a soft layer of fine silt. *L. teres* located below Lake Walter E. Long on Decker Creek were found in a slow moving area upstream of a wetland. These live mussels were observed in very deep anoxic sediment/silt layer. Often mussels were 4-6 inches below the surface of the silt. Observers would often sink ~1 foot deep into the substrate while searching. At this location, both male and females were located in close proximity and many juvenile specimens were collected. As the survey progressed across the silty substrate into more muddy/gravel substrate, mussels were sparse. Spent valves were recovered from Lake Creek, Gilleland Creek and Wilbarger Creek [collected: 121 live, 140.5 valves].

Leptodea fragilis "Fragile Papershell" – tolerate a variety of habitats from mud, mud/gravel, gravel, sand and silt. Found in small streams and large rivers; deep or shallow waters; and slow to swift flowing waters (Howells *et al*, 1996). A citizen collected a *L. fragils* shell from the Colorado River, but verification of the location has not been possible. Wilbarger Creek is the only location where *L. fragilis* has been collected, and only valves were found. *L. fragilis* on Wilbarger Creek are approximately 2 miles upstream of the confluence with the Colorado River. Anecdotal reports of large beds with live mussels have been made, but access to private property is currently a limiting factor in verification [collected: 3 valves].

Potamilus purpuratus "Bleufer" – found in mud, fine/medium gravel with mud; deep streams or quiet pools; in Texas, this species can occur in reservoirs, streams and rivers with slow to moderate currents (Howells *et al* 1996). *P. purpuratus* was never collected live, spent valves were found on Lady Bird Lake, Lake Austin and upstream of both the confluence of Onion Creek to the Colorado River and Wilbarger Creek to the Colorado River [collected: 29 valves].

Pyganodon grandis "Giant Floater" – commonly found on soft mud, and can withstand no flow to low flow conditions (Howells *et al* 1996). Live *P. grandis* were most commonly collected on Lady Bird Lake in areas that had a mixture of packed sand covered by a soft silt deposit. Other live specimens were collected at Decker Creek below the outfall of Walter E Long Lake, substrate at this location was very soft anoxic sediment covered by a 4-6 inch layer of soft silt.

Young specimens and juveniles were collected, often at both locations. Two live specimens were collected on Onion Creek in 2007 after a period of very heavy rains; these two specimens were collected amongst large boulders and bedrock. Valves were recorded from Dry Creek and Wilbarger Creek [collected: 76 live; 138.5 valves].

Quadrula apiculata "Southern Mapleleaf" – found in mud, mud/gravel, mud/sand, gravel and cobble; rivers, streams, slow-moving canals, and reservoirs (Howells *et al* 1996). *Q. apiculata* was only collected live from Lady Bird Lake on hard clay. Spent valves were collected from Lady Bird Lake, Gilleland Creek and Wilbarger Creek [collected: 1 live, 8.5 valves].

Quadrula houstonensis "Smooth Pimpleback" – found in mud, sand and fine gravel; Texas endemic (Howells *et al* 1996). This species has been listed by TPWD as threatened (2009). Half a sub-fossil valve was collected from Lake Austin [collected: .5 valves].

Toxolasma parvus "Lilliput" – found in mud or mud/sand substrate; commonly found in still waters in lakes or very shallow depths 0.25-1.07 m (Howells *et al* 1996). Live *T. parvus* were collected from a tributary of Harris Branch. Substrate consisted of soft sand/mud/small gravel along the margins of a riffle. One live *T. parvus* was collected from Slaughter Creek along the margins of the creek in soft mud. Valves were recovered from Wilbarger Creek, Slaughter Creek and Harris Branch [collected: 6 live, 6 valves].

Toxolasma texasiensis "Texas Lilliput" – found in mud or sand; typically in still waters (Howells *et al* 1996). Four live *T. texasiensis* were found from Wilbarger Creek beneath a railroad trestle amongst construction debris on mud mixed with fine-small gravel. Valves were recovered from several locations: Lake Austin, Onion Creek, Slaughter Creek, Dry Creek, North Fork Dry Creek, Rinard Creek, Gilleland Creek, Elm Creek and Wilbarger Creek [collected: 4 live, 81 valves].

Tritogonia verrucosa "Pistolgrip" – found in any stable substrate, buried deeply; they are observed in fast and still waters (Howells *et al* 1996). One female *T. verrucosa* was collected on Lady Bird Lake and verified via photograph by Marsha May (TPWD). The specimen was found on clay sediment during the 2008 drawdown [collected: 1 live].

Uniomerus declivis "Tapered Pondhorn" – observed in clay substrate in lakes and ephemeral streams. May be able to withstand desiccation (Howells *et al*1996). Live *U. declivis* have only been collected from a small tributary of Harris Branch. Specimens were found inhabiting a small riffle consisting of small gravel over a sandy/muddy substrate, fine gravel/mud mixture with some larger gravel beneath a box culvert, and mud/fine gravel/detritus mixture. Valves have been gathered from Wilbarger Creek and Dry Creek [collected: 8 live, 25 valves].

Uniomerus tetralasmus "Pondhorn" – mud substrates are preferred; found in lakes, ponds, small streams, oxbows and impoundments. *U. tetralasmus* can be tolerant of long periods of drought and desiccation (Howells *et al* 1996). *U. tetralasmus* has been found living on several creeks: Gilleland, Dry, North Fork Dry, Wilbarger and Harris Branch. Typically, *U. tetralasmus* is found in packed mud, mud/fine gravel, clay, clay amongst reeds, shallow riffles consisting of gravel/mud, soft mud/silt and shallow riffles consisting of small gravel. In some locations mussels are thriving amongst illegal dump sites where appliances, lawnmowers, dead animals,

car batteries and house hold trash are being discarded. *U. tetralasmus* is more commonly found inhabiting shallow riffles, but has been found in deeper water beneath bridges. This is the most commonly collected species from Austin creeks [collected: 275 live, 159 valves].

Uniomerus spp.- several collected valves (22.5) were not easily distinguished between *Uniomerus declivis* or *Uniomerus tetralasmus* and were identified only to genus.

Utterbackia imbecillis "Paper Pondshell" – observed in silt, silt and sand, can be found on gravel and cobble; inhabits rivers, streams, reservoirs and lakes (Howells *et al* 1996). Live *U. imbecillis* were collected from several locations: Lady Bird Lake, Slaughter Creek and Decker Creek. A variety of substrates were inhabited including hard packed sand, detritus, soft silt and bedrock. During the 2008 drawdown on Lady Bird Lake *U. imbecillis* were often exposed on deltas and shallower exposed sections of the lake making them easy prey for raccoons, wading birds, turtles and dogs [collected: 134 live; 320.5 valves].

Discussion

The geology of Austin is a good predictor of where unionid mussels can be found. Austin is situated between two geologic provinces: to the west are limestone formations from the Cretaceous and Precambrian eras and the east is dominated by the Blackland prairie (Spearing 1991). The western portion of Austin (Travis County) is often referred to as the Hill Country, and is known for its karst features and limestone bedrock streams. Typically, freshwater mussels are not located in the western Hill Country streams due to its lack of suitable habitat and "flashiness" after rains. The eastern portion of Travis County, which is located in the Blackland prairie, has streams that consist of soft bottomed, muddy substrate which is often preferred habitat for unionids. The eastern portion of the City of Austin is located in a section that is designated as Desired Developmental Zone in the COA Land Development Code. Many of the streams that contain freshwater mussels are located within this area and could be under direct threat from development pressures while some are potentially facing more immediate habitat degradation due to planned construction projects.

In January 2008 LCRA lowered Lake Austin for the control of *Hydrilla verticillata*, at a rate of 6 inches per day until the lake was lowered 15 feet for 30 days. Lake Austin was accessed for other biological surveys during the drawdown and mussels were noted in areas where sampling was performed. The City of Austin lowered Lady Bird Lake 2.5 feet in 2 days for maintenance purposes in mid January 2008. Lady Bird Lake remained lowered for approximately 2 weeks. During this period, we surveyed Lady Bird Lake by shoreline access for 4 days. Due to the high number of stranded mussels during this drawdown, staff of the COA Watershed Protection Department worked in conjunction with the LCRA during April 2010 to lower Lady Bird Lake at a slower rate (6 inches per day) and for a shorter duration (1 week).

Drawdowns are another potential detrimental impact to the unionid populations within the two reservoirs located within Austin's city limits, Lady Bird Lake (Town Lake) and Lake Austin. While drawdowns on Lake Austin are controlled by the LCRA, the drawdowns on Lady Bird Lake are controlled by the City of Austin. The drawdowns on Lake Austin are primarily designed to control the growth of Hydrilla and Eurasian milfoil. These drawdowns are conducted at a much slower rate and for an extended period of time. Lake Austin drawdowns are

also planned on a regular interval, occurring at least every other year unless *Hydrilla* growth is of concern to safety of boaters and swimmers. Additional limitations that affect these drawdowns are drought conditions, downstream water rights, electrical power generation, and seasonal recreation Drawdowns on Lady Bird Lake occur less frequently and for shorter durations. These drawdowns are often for dock construction or other infrastructure repair, and typically occur at a faster rate than Lake Austin. Since these later drawdowns are done on such a rapid time span any stranded unionids are unable to migrate to the safety of the lake. Rapid drawdowns may not be of much concern if the duration is for shorter periods of time (i.e days and not weeks), or if water levels are gradually lowered rather than within a 24-48 hour time period.

During the drawdown period on Lake Austin in January 2008, deltas were exposed along the reservoir. At the Bull Creek delta, mussel tracks were noticed and could be followed from beginning to the waters edge (vertical migration) where mussels were submerged in water. Vertical migration was reported in three unionid species in the River Spree, Germany, by Schwalb and Pusch (2007). This phenomenon was not observed on Lady Bird Lake. Most of the live mussels found on Lady Bird Lake were < 2 meters from the waters edge with no ability to migrate successfully into the water. Most of these stranded mussels were able to survive because water had become trapped in the mussel pits (areas dug out by mussels). However, stranded mussels became easy prey for raccoons and wading birds; of the 496 spent valves collected during the Lady Bird Lake drawdown, 24% (121) were classified as very recently dead (soft tissue attached to the shell; shell in good condition, essentially as it would be in a living specimen; internal and external colors were not faded). Finally, the April 2010 drawdown on Lady Bird Lake is not addressed because only one location was surveyed and was done as a training event with TPWD and Texas Commission on Environmental Quality (TCEQ).

Recommendations

Future research goals depending upon funding and priority include the following:

- Incorporate unionid presence/absence at creeks during EII surveys,
- Measures area (cm^2) of live unionids,
- Determine recruitment in mussel beds on Lady Bird Lake and creeks with larger mussel populations
- Mark and recapture live specimens to monitor long term growth patterns and possible establishment of specimen ages

And additional conservation goal would be the education of the citizens of Austin about the potential human impacts on freshwater mussel populations and how to protect freshwater mussel habitat. This could be accomplished through website construction, incorporation into established educational events, and presentations to board and commissions.

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