Fish Relocation: Permit Guidance, Process Recommendations, Resources and Summary of Events 2015-2018

City of Austin
WATERSHED PROTECTION

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Abstract

To protect the biological integrity of Austin-area streams and in accordance with regulations of the Texas Administrative Code, the Watershed Protection Department (WPD) strives to meet or exceed the Texas Parks and Wildlife Department's requirements for the relocation of fish and/or mussels during temporary dewatering of streams as needed for stream bank stabilization and utility projects. WPD staff does not have the capacity to provide these services for City of Austin construction projects. Therefore, WPD has developed this guidance document for project managers so that they may be informed of the process and how to implement or subcontract part, or all the responsibilities required This report provides the background, comprehensive guidance and resources for fish relocation events that require a permit and associated Aquatic Resources Relocation Plan (ARRP). In addition to detailed guidance on the permit process, a summary of the results of six City fish relocation events from 2015-2018 are presented as references for future events. Blank forms, TPWD guidelines, field resources, fish identification key and an example approved permit/ARRP are provided in the appendices. TPWD requirements/forms and TAC references are subject to change and should be verified for current status.

Introduction

This report is intended to provide comprehensive information and start-to-finish guidance regardless of the level of familiarity of the topic. Although it is encouraged to read the entire report, management, project managers and contractors may only need to refer to specific components. The following navigation guide (Figure 1) can be used to determine which parts of the report may expeditiously provide the desired level of information:

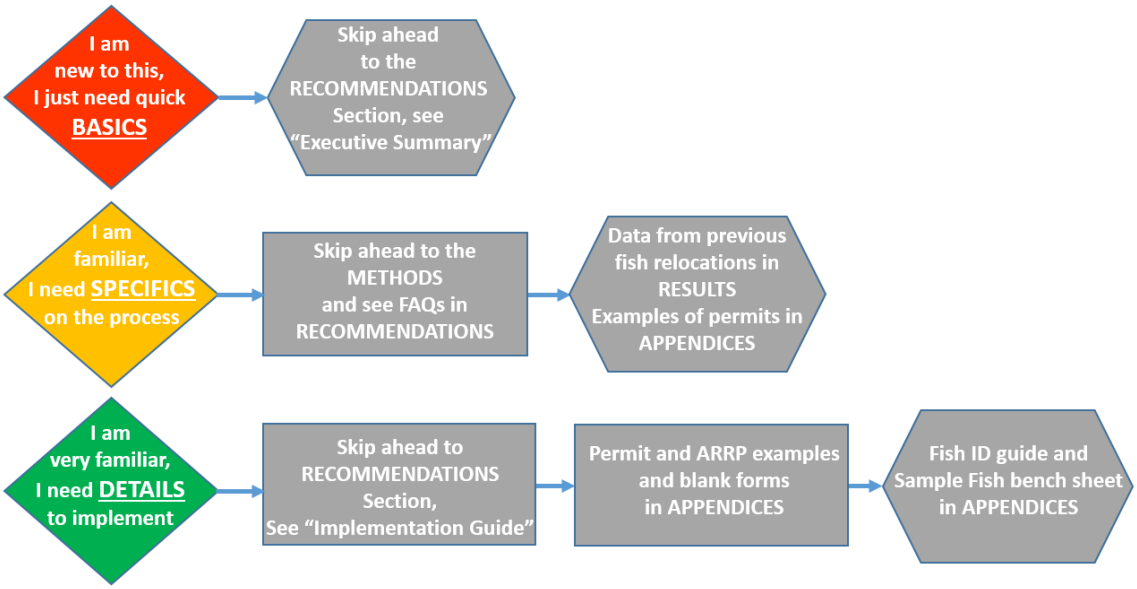


Figure 1. Navigation guide for this report

The following paragraphs provide background information, context, and regulatory citations related to fish relocation. The Methods and Results sections include detailed guidance and examples of data from previous fish relocations. The Recommendations section provides distilled summary information for use by management, project managers and contractors. Appendices include blank forms and example applications, guidance, and useful field resources as follows:

- Appendix A: Blank ARRP Format
- Appendix B: Blank TPWD Permit Application Form
- Appendix C: Example of an ARRP
- Appendix D: Example of a Permit Application
- Appendix E: Example of an Approved Permit
- Appendix F: TPWD ARRP guidance as of 11/2019
- Appendix G: Example Field Fish Bench Sheet
- Appendix H: Water Snakes in Austin
- Appendix I: Austin-area Quick Reference Fish Guide

The wildlife inhabiting Austin-area streams is a valued asset and a significant component of the aquatic resources that the City of Austin Watershed Protection Department seeks to protect. Construction projects in creeks can result in long term protection of aquatic habitat but may inherently cause significant short-term impacts to the local aquatic community. For example, stream bank stabilization projects and wastewater infrastructure repair projects can reduce pollutants such as turbidity, sedimentation, nutrients and bacteria concentrations but often require heavy equipment in the streambed for the excavation for footers, trenching for repair/installation of wastewater mains, and other related construction activities in addition to impacts related to access. Temporary dewatering of stream reaches may be required to enable in-channel construction. Unfortunately, construction and dewatering may be devastating to the local fish community due to stranding, decreased dissolved oxygen, increased turbidity, increased temperature, physical injury or other forms of stress. To complicate the matter, killing fish without a permit may result in penalties from the Texas Parks and Wildlife Department (TPWD). This presents a conundrum in which the solution providing a long-term benefit creates a short-term problem. This problem can be mitigated by the capture and relocation of fish.

Capturing and relocating fish from dewatered streams can be successful if conducted properly but could cause more harm than good to the receiving water if poorly implemented. For example, stress or injury can reduce the health of fish by making them more susceptible to infection and parasitism. Additionally, relocation of fish may result in overcrowding of the destination location which may result in stress and increased mortality to both the dewatered individuals and the community at the relocation site. Complicating these efforts, the community may contain protected species or exotic/invasive species which each have specific regulations that apply to take, capture and transport. For this and other fishery-related considerations a permit is required for any introduction of fish or shellfish (including relocations) into public waters under the authority of Texas Administrative Code Title 31, Chapter 57, Subchapter C "Introduction of Fish, Shellfish, and Aquatic Plants". For the purposes of these permits, 'public water' means the bays, estuaries, and water of the Gulf of Mexico within the jurisdiction of the state, and the rivers, streams, creeks, bayous, reservoirs, lakes, and portions of those waters where public access is available without discrimination. This includes not only navigable rivers and streams but also those where access for fishing is available at interstate and/or county highway right-of-ways. It does not include off-channel ponds or off-channel stormwater infrastructure.

Over the past two decades TPWD has taken an increasingly active role in the regulation and oversight of the relocation of aquatic resources. This more active role includes increased scrutiny of construction/dewatering activities and a requirement that certain fish relocation efforts shall secure a permit to relocate/introduce aquatic resources. Under the authority of 31 TAC §57.253(e) the applicable permit requires an Aquatic Resource Relocation Plan (ARRP) that outlines the details and protocols of the field effort. This planning and permitting process enables the applicant to work with TPWD and try to minimize impacts to aquatic resources such that, if the procedures of the ARRP are followed, potential civil and criminal liability can be minimized.

As stated in the Guidelines for Aquatic Resource Relocation (see Appendix F): "The Texas Parks and Wildlife Code authorizes the department to investigate fish kills and any type of pollution that may cause loss of fish or wildlife resources, estimate the monetary value of lost resources, and seek restitution or restoration from the party responsible for the fish kill or pollution through suit in county or district court. The Texas Administrative Code requires the department to actively seek full restitution for and/or restoration of fish, wildlife, and habitat loss occurring as a result of human activities. The restitution value of lost resources can be significant, in particular for species classified as threatened or endangered. Restitution for each individual of a threatened species is at least $500 and for each individual of an endangered species is at least $1,000. In addition, the Texas Parks and Wildlife Code makes it a criminal offense to kill any fish or wildlife resources classified as threatened or endangered."

The ARRP relies on a knowledgeable biologist for both design and accurate implementation of the field effort in order to correctly identify fish and mussel species to distinguish between those that are game, non-native and protected species. The ARRP also relies on a biologist familiar with fish/mussel habitat and basic water quality parameters in order to ensure accurate implementation. Although the Watershed Protection Department (WPD) includes Environmental Scientists with the appropriate background and experience for these activities and can provide guidance, WPD staff does not have the capacity to provide these services for City of Austin construction projects. Therefore, WPD has developed this guidance document for project managers so that they may be informed of the process and how to implement or subcontract part, or all the responsibilities required.

Methods

Project managers who are responsible for construction activities within the channel that may require dewatering of a portion of a creek are encouraged to comply with applicable regulations and inform themselves of the process as early as possible prior to construction whether the work is to be implemented by subcontractors or City crews. The typical process can be described by four stages:

- **Project Evaluation**: Evaluate the project scope and site and determine 1) if a permit is necessary, 2) if scope can be modified to reduce/avoid impacts, and 3) determine which facets of the process will be the responsibility of the City and which will be subcontracted.
- **Permit Application**: Develop a site-specific Aquatic Resource Relocation Plan (ARRP) and submit this plan and a permit application to TPWD at least 30 days prior to the event. TPWD may require revision(s).
- **Implementation**: Notify TPWD at least 3 days prior to fish relocation and implement the ARRP on the day(s) of dewatering under the supervision of the designated biologist who will record required data.
- **Permit Renewal and Reporting**: The permit will include an expiration date and must be renewed if dewatering events are anticipated to occur beyond this date. Submit a report to TPWD no more than 30 days following relocation event(s) documenting the required data and close out the permit when no additional events are anticipated.

A flowchart for this process is provided in Figure 2. Supporting details, additional guidance and expectations for each of these processes is provided in the following paragraphs. Results from previous fish relocations are presented in the Results section of this report. Example permits, forms, references, keys, reports and TPWD guidance documents are provided in the appendices. Please be advised that guidance is current as of the date of this report; TPWD may change permit forms and requirements.

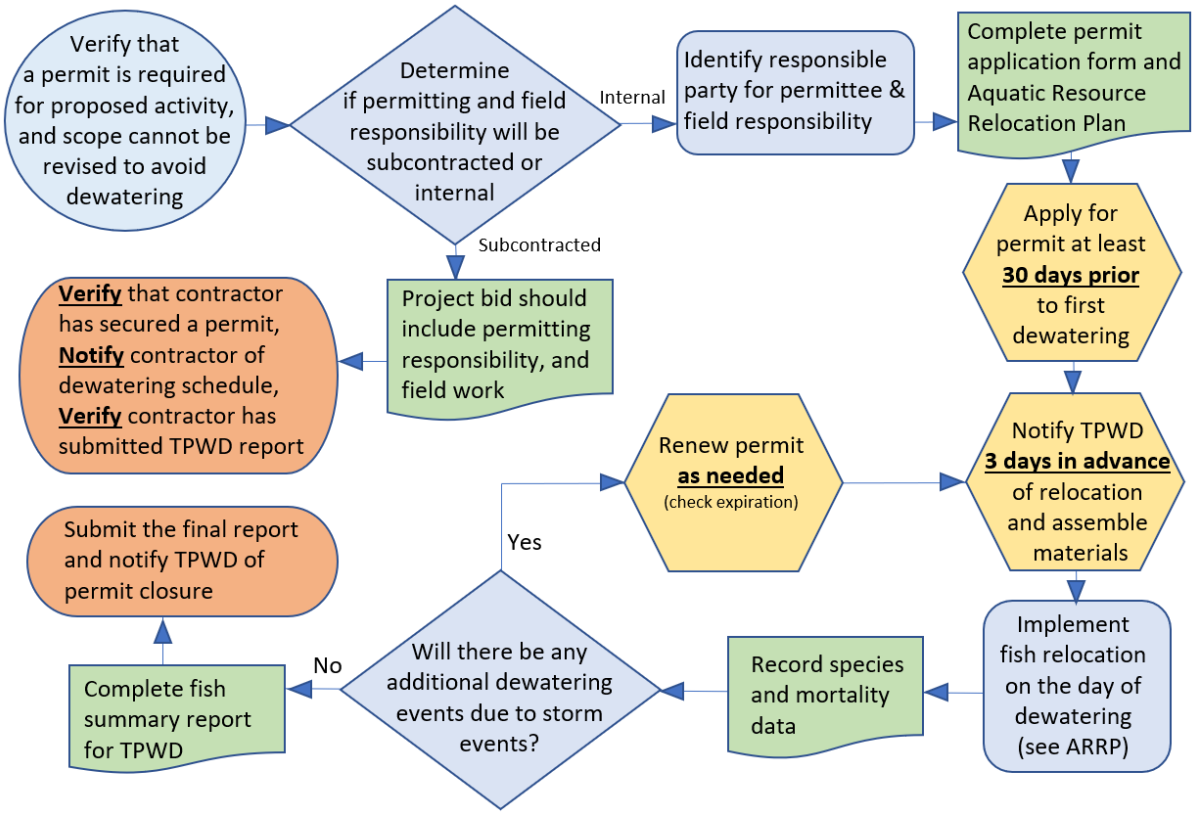


Figure 2. Flowchart for fish relocation permitting, documentation and activities

Project Evaluation

During preliminary design, the project scope and site should be evaluated to determine if a permit is required and if the scope can either be modified to reduce impacts or avoid impacts altogether to negate the need for a permit. Following this evaluation, the project manager should then determine what will be conducted in-house (if anything) and what will be subcontracted.

Step 1: Determine if a permit is required

Dewatering and other construction-related activities may impact native fish or mussels and the state agency authorized to regulate these aquatic resources is the Texas Parks and Wildlife Department. Similar to the responsibility a hunter or fisherman assumes in acquiring a proper permit, an individual who accepts responsibility for a project that dewaters a creek may need a permit pursuant to Texas Administrative Code Title 31, Chapter 57, Subchapter C for the "Introduction of Fish, Shellfish, and Aquatic Plants". Therefore, if a project anticipates dewatering a stream which may impact fish or freshwater mussels (specifically game fish, endangered/threatened or exotic/invasive species), then a permit would be required by the TPWD. Restitution (monetary fines) and or criminal offense may result in some cases with failure to acquire appropriate permit(s).

A project that does not impact fish or mussels would not require an introduction permit. This may be the case for dry/ephemeral streambeds or for intermittent streams for which the construction takes place when the stream is dry, and no pools are present that harbor refuge for fish or unionid mussels. This may also be the case for a streambed that is of such character that there is no habitat and/or no presence of fish or mussels. Project managers are advised to consult a knowledgeable aquatic biologist to thoroughly evaluate the project area and provide input regarding the observed or potential presence of applicable aquatic resources. A Project Manager should then consider this information in the determination of whether to acquire the relevant permit. Consultation with TPWD permitting group staff is advised. Requests for TPWD consultation should be sent to IFpermits@tpwd.texas.gov or contact the TPWD Region 1 representative.

Project Managers should be aware that dewatering does not always require a permit. Certain circumstances may preempt the requirement. For example, TAC Section 57.252(g) states:

> "A permit is not required for any person, while fishing, to place goldfish (*Carassius auratus*), common carp (*Cyprinus carpio*), native shrimp, crabs, crawfish and nongame fish into public waters or to immediately release any fish that does not comply with size and bag limits for that species."

Fish relocation can be interpreted to meet the definition of "fishing" as defined by TAC Section 57.251(5):

> "Taking or attempting to take aquatic animal life by any means"

Therefore, if the scope includes fish immediately placed back in the water adjacent to dewatered area (e.g. placed on the other side of coffer dam), and these fish include only nongame fish, then a relocation plan and permit may not be necessary. This would require the pre-existing knowledge of all fish species in the dewatered area. Since this is typically unknown, permits are usually recommended. TPWD (IFpermits@tpwd.texas.gov) is available for consultation and their coordination is advised.

Step 2: Determine if the scope can be modified to avoid permit

Project Managers should evaluate the proposed scope to verify that dewatering of a portion of the creek is the only feasible method to achieve the project goal(s). For example, the construction may be conducted from the land, or the access to the streambed may be achieved through other methods that do not require dewatering such as pads or temporary stable fill that does not restrict or confine baseflow. In most instances neither of these options are reasonable and a portion of the creek must be dewatered with a baseflow bypass. In this case, the project area should be minimized to the maximum extent practicable and a biologist should be consulted to determine if there are portions of the creek that are especially sensitive or likely to be habitat for sensitive or protected species. If the footprint of the dewatered area is flexible, or if an appropriate relocation site is located just upstream or downstream of the dewatered area, this may greatly reduce the cost/effort/liability of the associated fish relocation effort.

Step 3: Determine the responsible party(s)

The Project Manager shall determine if all permit responsibilities (e.g. permit/plan development, permit acquisition, permit holder, fish relocation plan implementation, permit reporting, etc.) shall be assumed in-house or if part/all of these responsibilities will be subcontracted. Environmental consultants in the Austin-area are available to provide this service and can be subcontracted separately or through the construction bid process. Sample bid language for line-item or separate contract may include all, or part of the following:

> "Services necessary for the acquisition of TPWD INT permit for the relocation of aquatic resources (fish and freshwater mussels) and the subsequent implementation of collection/relocation/reporting related to the transportation of aquatic resources in accordance with 31 TAC §57 to include 1) development and acquisition of an approved ARRP and permit with renewals, 2) implementation of necessary fish relocation(s) and identification in accordance with the approved ARRP to be supervised by a knowledgeable aquatic biologist, and 3) submittal of report to TPWD as required by the approved permit."

The Project Manager should ensure that a subcontractor understands the timeline of permitting aspects (see Recommendations Section) and that fish relocation is expected to be conducted with close coordination with the construction crew to occur immediately during site dewatering and may require subsequent fish relocations following storm events if the construction area is inundated and requires additional dewatering. Subsequent fish relocations following additional dewatering(s) due to storm events can be expected to involve a much smaller percentage of the initial effort. It has been the experience of City staff efforts (see Results section) that follow-up relocations are significantly less labor intensive than initial event (less than 10% of fish initially relocated).

Project Managers are encouraged to review the sample ARRP and permit application as this step may be within their level of expertise, however consultation with an aquatic biologist is advised and WPD staff may be available to provide consultation and guidance. Project Managers should also consider that construction crews can be appropriate to provide labor for fish relocation under the supervision of a designated subcontractor aquatic biologist thereby reducing the level of effort (and subsequent cost) of the subcontractor.

Permit Application

A permit application (with supporting ARRP) shall be submitted to TPWD at least 30 days prior to fish relocation as required by 31 TAC §57.253(c). As of the time of this report, there is no fee required for the permit. TPWD may require one or more revisions to the permit and/or ARRP prior to permit approval. TPWD periodically updates guidance and forms necessary for permit application, therefore, Project Managers are encouraged to check with TPWD to verify the most current resources and rules. Coordination with TPWD during the development process is strongly recommended. Contact information for the TPWD Kills and Spills Team (KAST) regional biologist can be found at: https://tpwd.texas.gov/landwater/water/environconcerns/kills_and_spills/regions/. As of the writing of this report, available resources from TPWD include blank permit form (Appendix A) and ARRP (Appendix B) in addition to detailed ARRP guidance (Appendix F) which can all be accessed at the following two websites:

- Guidelines for ARRP
  https://tpwd.texas.gov/publications/pwdpubs/media/pwd_lf_t3200_1958_arrp_guidelines_packet.pdf
- Fillable pdf Application for Permit
  https://tpwd.texas.gov/publications/pwdforms/media/pwd_1019_t3200_app_permit_stock_public_waters.pdf

The ARRP should be written by a qualified biologist due to the technical nature of several components of the plan. The attached example of previously approved ARRP (Appendix C) shows that a substantial amount of the plan requires expertise and a site investigation by an aquatic biologist. For example, the designated relocation site must be suitable for the expected addition of fish and comparable to the habitat of the site to be dewatered. In addition, although proposed protocols may be identical to a previous relocation event, the specific habitat characteristics of the dewatered site and the proposed relocation site, and evaluation for protected/exotic species would require an experienced biologist that can identify species and respective habitat requirements of observed/presumed species. The permit requires designation of a single responsible permittee for which a social security number is required per federal and state statute on the permit application, however this sensitive information can be relayed over the phone instead of in print. If the applicant prefers to list additional applicants as part of the permit, a permit applicant addendum should be completed: https://tpwd.texas.gov/publications/pwdforms/media/pwd_1420_t3200_permit_applicants_addendum.pdf.

- The ARRP should be submitted to the TPWD Kills and Spills Team (KAST) regional biologist contact (see link above). Do not send the permit application to the KAST regional biologist but note in your email that the application has been submitted.
- The permit application should be submitted to the TPWD Inland Fisheries permit coordinator. (512) 389-4742, IFpermits@tpwd.texas.gov

Implementation

In accordance with permit requirements, TPWD must be notified at least 3 days prior to dewatering and fish relocation. Implementation shall be in accordance with the protocols and limitations of the ARRP. A copy of the permit and ARRP should be available on-site during the relocation effort in addition to any resources such as fish or mussel identification references. TPWD reserves the right to observe the effort and ensure appropriate implementation of the plan under the supervision of the designated biologist(s). The permit holder is primarily responsible for supervising the effort to identify fish species, record data related to mortality, and minimize aquatic stressors (e.g. overcrowding, handling, exhaustion, temperature change, dissolved oxygen, etc).

Materials List

In general, the individual or team responsible for the relocation effort will have previously coordinated with the construction supervisor and project manager regarding the designated date/time of dewatering. Materials that should be assembled for a relocation event include, but are not limited to:

- waders (chest or hip) preferably with slip-resistant souls
- water quality monitoring equipment to measure D.O., conductivity, pH and temperature
- battery powered aerators and back-up supplies (extra aerators, tubes, stones, batteries, etc)
- variety of nets (seine, large kick/dip nets, medium sized aquarium dip nets, etc)
- latex or rubber gloves (reduces damage to fish mucous coating during handling)

- appropriate references (fish and mussel identification guides, see Appendix I for fish ID key
- paperwork (permit, ARRP, field sheets to record species, quantities and mortality data)
- camera (helpful to document before/during/after event and species identification)
- screening (to wrap around pump inlets if the construction crew does not have baffles)
- zip lock bags, tape measure and sharpie for recording and disposal of dead fish
- duct tape to secure cooler or bucket lids for travel (if necessary)
- any additional materials as identified in the ARRP
- coolers or comparable large vessels such as buckets (enough to handle the expected quantity of fish). Coolers should have holes drilled in the lids to insert aeration tubes (see Figure 12) and some method to fasten the aerators to the sides of the cooler. Special fishing lids can be purchased for standard 5-gallon buckets (see Figure 8) that have holes and places to attach aerators.

Any materials previously used in relocation effort or other aquatic application should follow the General clean/drain/dry BMPs described in the TPWD Guidelines for ARRP (see Appendix F).

Field event

The relocation effort should plan to minimize damage/stress on the aquatic life and maximize expeditious collection/transport to the designated location. This requires proficiency and adherence to the guidance described in the ARRP and TPWD Guidelines (see Appendix F). In general, a relocation effort can be expected to follow the following procedure:

1. Pre-plan the relocation date/time to avoid the hottest part of the day and ensure that the forecast is free of a storm event that would otherwise require a duplication of effort
2. Attach screen/diffusers to the pump intakes prior to dewatering (metal mesh/screen or similar wide separation from pump intake to avoid fish being sucked in, or stuck to pump intake)
3. Dewater stream to a shallow depth (<12" or as determined by designated biologist) prior to fish collection.
4. Fill containers with clean (low turbidity) ambient creek water and continuously aerated with bubblers
5. Collect fish with tools appropriate to site habitat and substrate (seine,kicknet, dipnet, aquarium net, etc)
6. Place fish in containers and avoid overcrowding as determined by designated biologist
7. Transport fish/mussels to the designated location expeditiously (avoid dumping water into creek if the destination is a different creek, and especially if there are known invasive species such as zebra mussels)
8. Record information as necessary (species ID's, etc) as required by permit, and set aside dead fish
9. Continue dewatering/collecting/transporting as directed by designated biologist
10. Document (ID, enumerate, measure) mortality and dispose of dead fish as required by permit/ARRP
11. After work is complete, clean, drain, dry all equipment (see Appendix F TPWD guidance)

The level of field effort (duration, crew size, materials) is highly variable depending on the size and depth of the area dewatered, substrate, water clarity and the weather at the time of relocation. Effort should not be underestimated. Examples of relocation results are presented in the Results section of this report. Although small events could be conducted by one or two people, based on the larger field events described in this report, the relocation team should include a designated biologist plus a minimum of two additional people for medium-sized events and up to five additional people for large events.

Permit Renewal and Reporting

A July 2017 revision to 31 TAC §57.252(c) enabled TPWD to issue fish introduction (INT) permits for longer than 30 days (previous limitation). Permits are now issued with expiration dates established that is comfortably beyond the expected completion date of the project such that renewals are unlikely. However, if the project duration exceeds the expiration date, renewal is easily accomplished by sending TPWD an email request that references the original permit (preferably a response to the original approved permit email) and requests a new permit.

Following completion of all relocation activities, a report must be submitted to TPWD no more than 30 days following relocation event(s). The report should document the ARRP-required data and request close-out of the permit when no additional events are anticipated. Data typically includes 1) the dates of relocation events, 2) species list, 3) enumeration and measurements of fish mortality.

Results

The first major fish relocation that the City of Austin (ERM division) conducted was for the construction of the Waller Tunnel inlet structure on Waller Creek in Waterloo Park in 2012. Since this time ERM has received or assisted with acquiring permits for several fish relocation events to enable construction activities related to streambank stabilization, access for construction and infrastructure repair. The primary components of a fish relocation are:

- Permit acquisition (submittal of TPWD permit application and ARRP compilation),
- Field effort for fish relocation(s) in accordance with the ARRP, and
- Documentation and reporting to satisfy permit requirements

Over the course of fish relocation events from 2015-2018, ERM staff has either conducted all three aspects of the process, shared various aspects of these responsibilities with managers/contractors, or provided guidance to managers/contractors without accepting responsibility. For example, the 2018 fish relocation at Shoal Creek at Gaston was entirely conducted by ERM staff from permit application to final reporting. In contrast, the two fish relocations at Givens on Tannehill Branch were significantly less labor-intensive on ERM staff because ERM responsibility was limited to permit/supervision/reporting, while most of the field effort was performed by the contracted construction crew. The three fish relocations at Shoal Creek at White Rock were wholly conducted by an aquatic biologist subcontractor with ERM providing only guidance. Figure 3 identifies the locations of fish relocations described above.

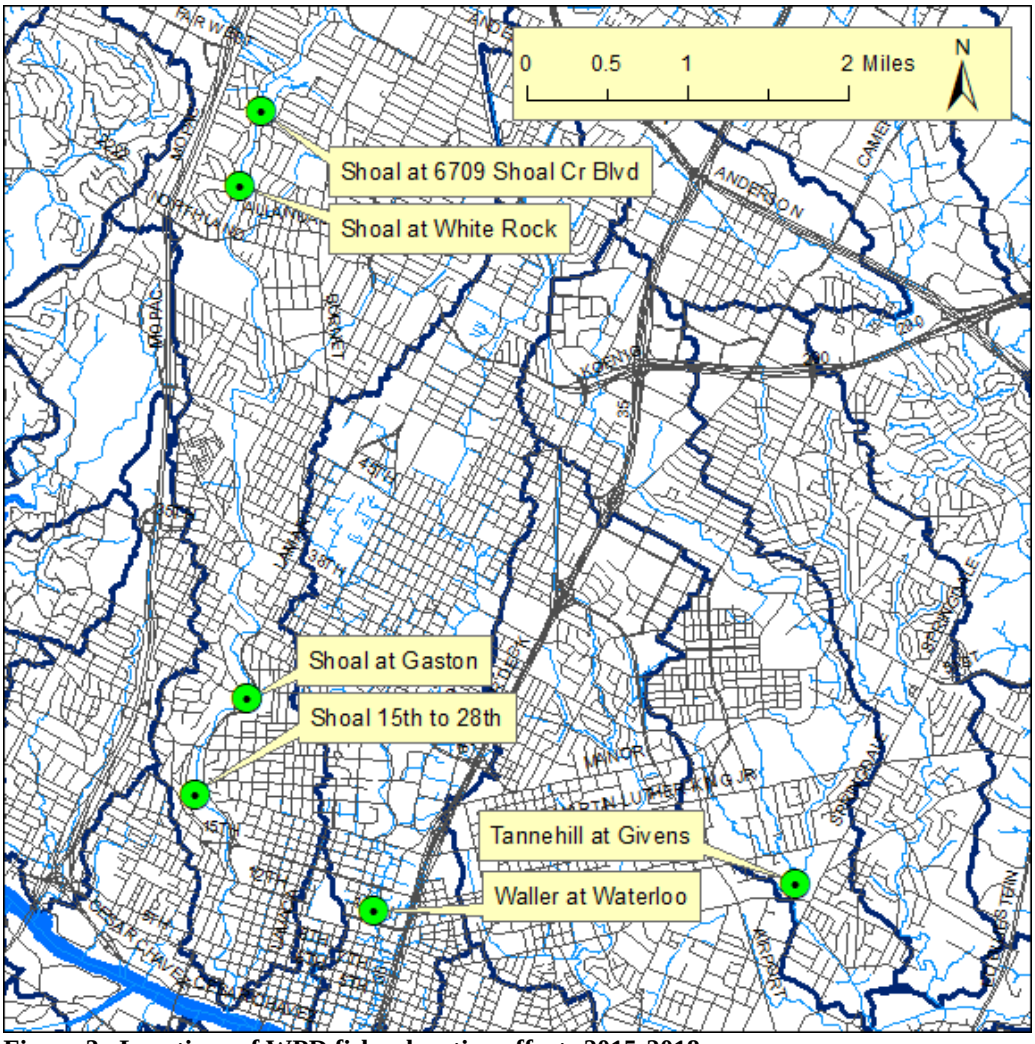


Figure 3. Locations of WPD fish relocation efforts 2015-2018

The six fish relocations described in this report resulted in a total of approximately 37,687 fish collected from dewatered stream reaches for construction projects. Table 1 presents logistical data including total field effort, estimated area and linear feet of dewatering event and repeated field dates due to large areas or storm events. Fish species and estimated total numbers for four selected relocation events are presented in Table 2. The total number of fish collected per project was highly variable.

Table 1. COA Relocation Events 2015-2018

Location	Permit number(s)	COA ERM Staff involvement	Activity	Field Date(s)	Dewatered area			~Field Effort	
					length in feet	area in sq feet	# pools	COA ERM	Other
Waller at Waterloo	(not acquired)	Permit holder, Supervising biologist, Field effort, reporting	Waller Tunnel construction	03-09-2012	500	10,500	2	20 mh	0
Shoal Creek 15th – 28th (Peace Park)	INT 14 08-14b INT 14 08-28a INT 14 12-17a INT 15 02-17b INT 15 04-17b INT 15 06-22a INT 15 11-01a INT 15 12-17c INT 16 02-22b INT 16 05-04a	Guidance, Permit holder, Supervising biologist, Field effort (shared), Reporting	Bank stabilization, and wastewater line maintenance	01-07-2015 01-14-2015 01-15-2015 03-03-2015 04-07-2015 07-23-2015 07-29-2015 11-20-2015 02-25-2016	5,300	53,000	30	170 mh	80 mh
Shoal Creek at 6709 Shoal Creek Blvd	INT 16 07-05a INT 17 03-30a INT 17 07-28a INT 17 09-18a	Guidance, Permit holder, Reporting	(no events)	(no events)	n/a	n/a	n/a	n/a	n/a
Shoal Creek at White Rock	INT 17 11-22b	Guidance, Permit holder	Bank stabilization	03-08-2018 04-04-2018 04-12-2018	375	4,000	1	0	16 mh
Shoal Creek at Gaston	INT 18 06-18a	Guidance, Permit holder, Supervising biologist, Field effort, reporting	Water line maintenance	06-26-2018	130	1,700	2	18 mh	20 mh
Tannehill Branch at Givens Park	INT 18 11-12	Guidance Permit holder Supervising biologist Field effort, reporting	Bank stabilization	12-12-2018	215	5,000	2	8 mh	33 mh

Table 2. Fish data from select* relocation events

Location*	Sunfish (green, bluegill, orange spotted, longear, redear, redbreast, etc)	largemouth bass	Shiner (red and blacktail)	gambusia	gizzard shad	bullhead catfish	central stoneroller	Rio Grande cichlid**	Mexican tetra**	Total Fish	Avg # of fish per linear foot of project area (ft)	Avg # of fish per area (sqft)	Avg # of fish per pool
Shoal Creek at Peace	5,082	14	3,931	573	5	1	15,730	697	1	26,144	5	0.49	871
Shoal Creek at White	765	19		140						924	3	0.23	924
Shoal Creek Gaston	1,280	5		426	10		223	641	160	2,748	21	1.62	1,374
Tannehill at Givens	612			1,488		57	226	478		2,861	13	0.57	1,431

*Waller at Waterloo was not included due to lack of records. 6709 Shoal Creek is not included because no fish were collected

**Rio Grande cichlids and Mexican tetras are native to Texas, but considered to be non-native to the Austin area by TPWD

Follow-up dewatering due to storm events

A site that is dewatered may need to remain dewatered for an extended period in order to complete construction. Storm events during construction may require some pools to be dewatered more than once. Although the resident fish community was removed, fish may recolonize the habitat after a storm. Therefore, one or more subsequent follow-up dewatering/relocations may be necessary. Follow-up dewatering will likely have fewer fish (~90% fewer). Shoal Creek at White Rock included two follow-ups, Shoal at Gaston included one follow-up and Tannehill at Givens included one follow-up dewatering after storm events. From these three events (Table 3), it can be inferred that follow-up fish relocations include less than 10% of the original dewatering event.

Table 3. Fish data from follow-up relocations due to storm events

Location	Number of fish from initial dewatering	Number of fish from 1st follow-up dewatering	Number of fish from 2nd follow-up dewatering	Avg % of fish from follow-up events
Shoal Creek at White Rock	855	39	28	7.8 %
Shoal Creek at Gaston	2,293	455	n/a	5.0 %
Tannehill Branch at Givens Park	2,861	237	n/a	8.3 %

Mortality

Implementation of the proper protocols and best management practices as described in the ARRPs has resulted in low mortality of native species. The average mortality of native fishes during relocation was 3.5% (1,150 / 32,677) of the total number of fishes relocated based on the three events for which this information was recorded (4.2% Shoal at Peace, 1.8% Shoal at White Rock, 1% Tannehill at Givens, 0.2% Shoal at Gaston). Most of the native mortality occurred during the heat of the summer at Pease Park when fish were already stressed due to high water temperature and low ambient dissolved oxygen. Anecdotally, some mortality was attributed to physical damage from dip nets, pump intakes and areas with cobble substrate, which made it harder to collect the fishes.

Field Event Photographs

The following photographs from the relocation events described above may provide insight for project managers.

Figure 4. Do not underestimate the quantity of fish at a site. Over 12,000 fish were collected in just a few pools like this in Shoal Creek on one day (7/23/2015)

Figure 5. Fish identification is not easy and requires a skilled biologist. In this photo there are twelve fish of five species. One of which (cichlid) is considered non-native by TPWD

Figure 6. A baffle must be placed over the pump intake to stop even small fish from being drawn into the pump

Figure 7. Multiple pumps are recommended for large pools to expedite the drawdown time

Figure 8. Transportation is easy with 5-gal buckets with special lids designed for fishing. The rim has attachment points for battery-powered bubblers.

Figure 9. Standard sized coolers provide more volume to hold more fish. Regardless of size, do not overcrowd the container and ensure consistent aeration (bubblers can be taped to handles).

Figure 10. Keep containers in the shade to keep the water temperature low to maintain adequate oxygen at all times.

Figure 11. Several different sizes of nets are advised. Hip waders with slip resistant soles increase safety.

Figure 12. If fish need to be transported long distances to the relocation site, lids should be firmly secured and aerator tubes should be installed to maintain air flow.

Figure 13. TPWD requires a species list of fish collected as well as enumeration and measurements of dead native fish. Non-native fish are to be euthanized, bagged and properly disposed of in a landfill.

Recommendations

The following section provides distilled summaries and recommendations for upper management, project managers and contractors. Supporting details are provided in Methods section and resources are provided in the Appendices.

EXECUTIVE SUMMARY:

- The killing of native game/protected fish and/or protected mussels resulting from the dewatering of a public waterway is not in accordance with the Texas Administrative Code and can therefore result in enforcement and penalties assessed by TPWD. Therefore, these aquatic resources should be relocated to an appropriate habitat in accordance with permit requirements (31 TAC §57 subchapter C).
- Permit considerations should be determined prior to project design/bid so the permit acquisition and field effort can be included in the project scope if necessary.
- Permits are free, issued by the TPWD, and must be accompanied with an Aquatic Resource Relocation Plan (ARRP). Permit application is required at least 30 days prior to relocation event.
- WPD ERM has experience with the permitting and ARRP implementation and can provide guidance, however, a private contractor should provide the service of permit acquisition, field effort and reporting.

PROJECT MANAGER SCHEDULE:

- During project design: Determine if permit is required (see Methods step 1).
- During bid: Identify responsible permit holder and implementer. Please be advised that the plan and implementation will require significant biological expertise (fish ID, mussel ID, habitat, water quality, etc)
- ≥30 days prior to estimated dewatering event ensure permit application (and ARRP) to TPWD
- ≥3 days prior to dewatering event: notify the designated ARRP TPWD representative
- ≥1 day prior to dewatering event: coordinate subcontractor, dewatering, equipment (see Methods)
- Additional dewatering/relocation may be necessary following storm events
- ≤30 days after relocation event: document results (see Methods) and forward data to the designated ARRP TPWD representative

IMPLEMENTATION RECOMMENDATIONS:

- Examples of blank permit applications and ARRP are provided in Appendix A and B, and examples of completed permit and ARRP are provided in Appendix C and D. Early TPWD coordination is encouraged.
- Review the Results section of this report describing results of different size projects
- Suggested materials list is provided in the Methods section
- Overestimate the quantity of fish expected for relocation and plan equipment and crew accordingly
- Notify the designated ARRP TPWD representative at least three days prior to relocation event
- A quick-reference Fish ID guide for the Austin-area is provided in Appendix I

FAQs:

When do I need a permit?

TPWD requires a permit for any introduction of fish or shellfish (including relocations) under the authority of TAC 31, Chapter 57 Subchapter C. If project can demonstrate it will not impact game fish, protected species or invasive/threatened species, TPWD should be consulted to determine if a permit is necessary. Any project that proposes dewatering of a public waterway that would otherwise impact native fish or mussels should acquire a permit to relocate these aquatic resources. Application for permit should be at least 30 days prior to dewatering.

What could happen if I don't get a permit?

Killing fish due to dewatering and/or the collection/transportation of some fish may result in potential civil and criminal liability. The Texas Administrative Code Title 31 designates the Texas Parks and Wildlife Department as the responsible authority for permitting and/or enforcement of regulations that apply to impacts to fish and mussels.

Can WPD/ERM do this service for me?

WPD/ERM does not have the bandwidth to provide these services, however, staff can provide guidance, recommendations and technical support for the permit process by request. ERM recommends sub-contracting the permit considerations and associated field work as a line item within the bid for construction.

What bid language should I use for scope?

Subcontractor bid or line-time language should include all parts of the process and indicate that there may be more than one collection/relocation event. Sample language may include:

> Services necessary for the acquisition of TPWD INT permit for the relocation of fish and the subsequent implementation of collection/relocation/reporting related to the transportation of aquatic resources (fish and freshwater mussels) in accordance with 31 TAC §57 to include 1) development and acquisition of an ARRP and permit with renewals, 2) implementation of necessary fish relocation(s) in accordance with the approved ARRP to be supervised by a knowledgeable aquatic biologist, and 3) submittal of report to TPWD as required by the approved permit.

Should I be concerned about snakes?

It has been ERM experience that snakes are not a significant safety risk during fish relocation. The overwhelming majority of water snakes in the Austin-area are non-venomous *Nerodia* species. The only venomous semi-aquatic species in Austin (the cottonmouth) has not yet been encountered during a fish relocation. ERM field staff have spent extensive amount of time in Austin-area waterways over the past thirty years and have rarely encountered cottonmouths. However, cottonmouths do exist in the Austin-area (primarily observed in the Onion, Bull and Barton watersheds) and it is always advised that field crews should be aware of any physical and biological hazards in their surroundings. Appendix H provides a quick reference identification guide for water snakes in Austin

Acknowledgements

I extend sincere appreciation to fellow City staff who have shown great dedication and diligence in the field sometimes under adverse conditions. These staff include, but not limited to: Todd Jackson, Brent Bellinger, Ryan Burke, Jeff Selucky, Ana Gonzalez, Staryn Wagner, John Clement, Liz Johnston, Stephen Davis, Kay Colletti, Emily Yeoman, Angela England, and many others. In addition, I hold the following project managers in the highest regard for their respect for nature, environmental stewardship, adherence to regulations, field assistance/participation in the permit process and fish relocation efforts: Janna Renfro, Michele Adlong, Charlie Kaough, and Tom Franke. Special thanks to the staff at Texas Parks and Wildlife (Travis Tidwell, Greg Conley, Monica McGarrity) who have been professional, courteous and generous with their time and advice.

APPENDIX A: Blank ARRP Format (as of 11/2019)

Aquatic Resource Relocation Plan (ARRP)

The ARRP should include the following information to be considered complete.

1) A description of the project and associated aquatic/instream activities with sufficient detail for department staff to evaluate the risk to aquatic resources.

(Insert text)

2) A computer generated map showing the project location and the relocation site, including the county, GPS coordinates, and the Texas Commission on Environmental Quality (TCEQ) water body segment number.

(Insert map)

3) Expected start dates of the project and the aquatic resource relocation. An applicant must submit any changes to the start date of aquatic resource relocation activities at least 72 hours prior to the revised start date.

(Insert text)

4) Identify any state or federally threatened or endangered species that may occur. Explain what methods will be used to protect these species. If the project area contains any state or federally listed freshwater mussels, a mussel survey may be necessary prior to approval of the ARRP (see Attachment 4 for Freshwater Mussel Survey Protocols). The following web link may help in identifying the location of these species by county: http://www.tpwd.texas.gov/gis/rtest/

(Insert text)

5) List all shellfish that may become stranded due to the operation. Explain what methods will be used to protect these shellfish including freshwater mussels (See Attachment 2 for Freshwater Fish and Shellfish Handling Protocols).

(Insert text)

6) Identify List all known exotic and invasive species in the project area. Describe decontamination procedures for preventing the spread of exotic and invasive species. See link below for more information: http://tpwd.texas.gov/huntwild/wild/species/exotic/

(Insert text)

7) Methods of collecting and relocating aquatic resources, including the types and sizes of containers used, the mode of transportation, and best management practices (BMPs) to protect aquatic resources. Provide an estimate of the time expected to complete the collection and relocation (See Attachment 2 for Freshwater Fish and Shellfish Handling Protocols).

(Insert text)

8) Describe how the receiving waters will be protective of aquatic life (i.e., sufficient dissolved oxygen levels, water body size and flow, and similar habitat as the source water).

(Insert text)

9) Describe how dead fish and shellfish as well as exotic and invasive species will be disposed of and documented. Documentation should include no less than the species and number of individuals found dead, including the lengths (inches) of all fish and mussels for both native and non-native species.

(Insert text)

10) Identify best management practices (BMPs) to be used to prevent or minimize the risk of transporting any species, including aquatic invasive species (AIS) to new locations on equipment, boats, trailers, and vehicles. These BMPs should also ensure compliance with regulations that prohibit the possession and transport of certain AIS species. For more information see Attachment 3.

(Insert text)

Appendix B: Blank TPWD Permit Application Form

(Current as of 11/2019)

Application for Permit to Introduce Fish, Shellfish or Aquatic Plants into Public Waters

(No Fee Required)

For assistance completing this form, please call 512-389-4742 or email IFpermits@tpwd.texas.gov.

NOTE: This application will not be considered unless fully completed and must be received by the Department at least 30 days before the proposed introduction. Consultation with local or regional fisheries biologists before application submission is required for aquatic resource relocations and recommended for all applicants.
If you have not yet consulted the local biologist, please call or email the permits office for their contact information.

1. APPLICANT INFORMATION:

Effective September 1, 2015, Texas Parks & Wildlife is required to collect Social Security numbers for the purpose of child support enforcement under the Texas Family Code, Section 231.302 and Federal Statute 42 U.S.C. §666. Missing or incomplete information may delay application processing time.

Name: _____ Social Security #: _____

Address: _____
Street City State Zip

Email: _____ Primary Phone: (_____) _____-___

Would you like to help us reduce paper by choosing to receive your permit by email? ☐ Yes ☐ No

2. PUBLIC WATER WHERE ORGANISMS WILL BE INTRODUCED (address or GPS coordinates):

_____

3. EXPECTED DATE OF INTRODUCTION: _____/_____/_____(MM / DD / YYYY)

For relocations or plantings—what is the expected end date of the activity? _____/_____/_____

4. WHAT IS THE PURPOSE OF THIS INTRODUCTION?

☐ Fish Stocking ☐ Planting ☐ Aquatic Resource Relocation ☐ Research

☐ Other – Please Describe: _____

5. SPECIES TO BE INTRODUCED (for aquatic resource relocations, please skip this question):

Common Name	Scientific Name	Number	Size
1			
2			
3			
4			
5			
6			

6. SOURCE OF ORGANISMS: _____

_____

_____

7. COMMENTS: _____

_____

_____

8. AFFIDAVIT:

I certify that
(1) all the information provided above is accurate and complete and
(2) that I have received and read the rules pertaining to Introduction of Fish, Shellfish, or Aquatic Plants (31 TAC Ch. 57C: http://texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=5&ti=31&pt=2&ch=57&sch=C&rl=Y).

I understand that under Texas Penal Code §37.10, it is a felony to make a false statement on this form.

_____ _____ / / _____
Signature of Applicant Date

Please return completed application to: Permit Coordinator, Inland Fisheries Texas Parks and Wildlife Department
4200 Smith School Road
Austin, Texas 78744

To help our office process your request more efficiently, you may email completed applications to IFpermits@tpwd.texas.gov or fax to: 512-389-4405

Texas Parks and Wildlife Department maintains the information collected through this form. With few exceptions, you are entitled to be informed about the information we collect. Under Sections 552.021 and 552.023 of the Texas Government Code, you are also entitled to receive and review the information. Under Section 559.004, you are also entitled to have this information corrected.

Appendix C: Example of an ARRP

Aquatic Resource Relocation Plan for
"Tributary to Tannehill Branch at 1209 EM Franklin"
City of Austin, Watershed Protection Department

1) A description of the project and associated aquatic/instream activities with sufficient detail for department staff to evaluate the risk to aquatic resources.

This project will include stabilizing approximately 60 linear feet of eroding streambanks in a small tributary of Tannehill Branch located at 1209 EM Franklin Road near MLK (see map) for the purpose of arresting erosion of the stream bed (plunge pool downstream of culvert) and banks. The proposed project will include the use of limestone boulders, rip rap, and recontoured slopes with native revegetation. As part of the project construction, about 60 linear feet of stream (two small pools) will be dewatered to allow construction activities within the active channel while avoiding discharge of sediment into the creek. This Aquatic Resource Relocation Plan has been designed to preserve and temporarily relocate the aquatic life which may otherwise be stranded during construction.

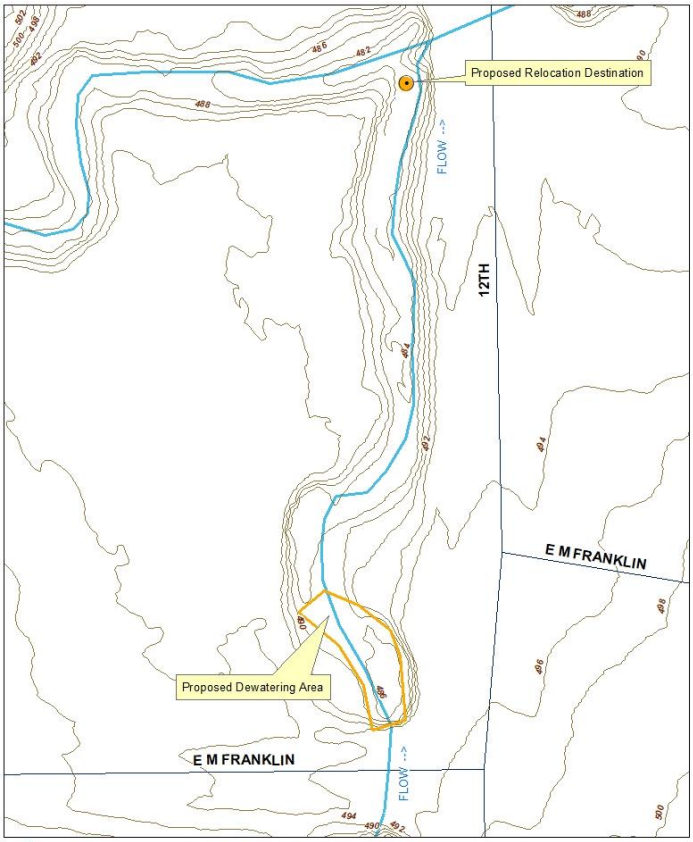
Inspection of the pools indicated less than 25 fish (~10 sunfish and 10 gambusia). No game fish or non-natives were observed. The reach to be dewatered contains two shallow intermittent pools. The width of water is variable, from 4 – 10 ft wide, and approximately 400 ft^2 total area. The average depth in the pool is about 1 ft (0.5 ft min to 2 ft max) with a substrate of hard pan clay (see picture). Dewatering of the pool will be in conjunction with a bypass to maintain baseflow through the creek and dewatering will occur gradually with a screen over the intake to concentrate aquatic life in the pool to minimize stress during capture.

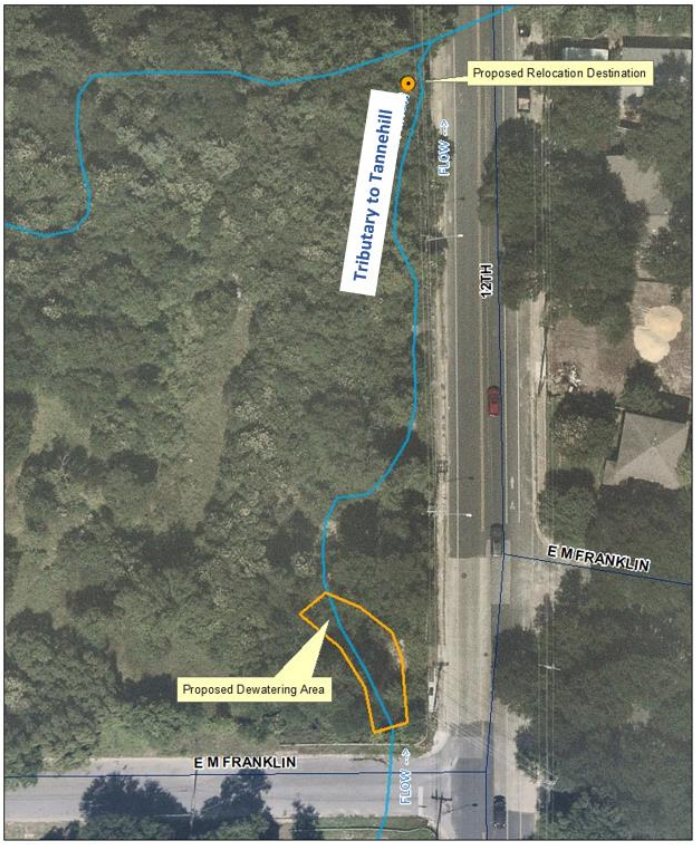
Site facing downstream (east). Two shallow pools to be dewatered just downstream of MLK near E.M.Franklin

Site facing upstream (west). Two shallow pools to be dewatered just downstream of MLK near EM Franklin

2) A computer-generated map showing the project location and the relocation site, including the county, GPS coordinates, and the Texas Commission on Environmental Quality (TCEQ) water body segment number.

The project location is in Austin, Travis County, Texas. The proposed dewatering location is a small tributary to Tannehill Branch located at the northeast corner of EM Franklin and 12ft Street. The aquatic life will be relocated 200ft downstream of the dewatered site in a pool that is larger than both pools in the project area. This destination location is -97.6936 W, 30.278 N on the same tributary of TCEQ segment 1428F as shown in the following maps. See attached topographic and aerial map of the project area.





3) Expected start dates of the project and the aquatic resource relocation. An applicant must submit any changes to the start date of aquatic resource relocation activities at least 72 hours prior to the revised start date.

Expected relocation date may be as early as October 16, 2019 and construction may continue for 1-2 months afterward depending on weather conditions. Project team anticipates one relocation effort lasting less than 1 hour, but construction schedule and fish relocations will depend on weather. Dewatering and fish rescue date(s) throughout the project will be dependent on construction schedule. COA representative Andrew Clamann (512-974-2694) will notify the KAST Biologist, Travis Tidwell as soon as possible prior to the expected dates of fish relocation.

4) Identify any state or federally threatened or endangered species that may occur. Explain what methods will be used to protect these species. If the project area contains any state or federally listed freshwater mussels, a mussel survey may be necessary prior to approval of the ARRP (see Attachment 4 for Freshwater Mussel Survey Protocols). The following web link may help in identifying the location of these species by county: http://www.tpwd.texas.gov/gis/rtest/

No State or Federally threatened or endangered aquatic species are known to this reach of Tannehill Branch. The scoured limestone bedrock substrate does not support mussels. Springs are not present in this reach that might support salamanders. No protected fish are known to Tannehill Branch.

5) List all shellfish that may become stranded due to the operation. Explain what methods will be used to protect these shellfish including freshwater mussels (See Attachment 2 for Freshwater Fish and Shellfish Handling Protocols).

No native shellfish are known to this section of Tannehill Branch. The only mussel presumed to occur in this reach is the non-native *Corbicula fluminea*, which will not be protected if encountered. The project area is a scoured compact clay-pan that does not support native mussels. In the unlikely event that native mussels are encountered, mussels will be placed back in sediment (presuming there is any available) with anterior end down at the proposed designated relocation site and notify the KAST biologist.

6) Identify List all known exotic and invasive species in the project area. Describe decontamination procedures for preventing the spread of exotic and invasive species. See link below for more information: http://tpwd.texas.gov/huntwild/wild/species/exotic/

A site reconnaissance did not reveal any problematic aquatic exotic or invasive species in the project area. Fish not native to the Austin-area such as Rio Grande cichlids and Mexican tetra will be identified, enumerated, secured in zip-lock bags and disposed of in sanitary landfill. If zebra mussels are encountered at the project location, TxDOT will notify TPWD biologists Monica McGarrity at 512-552-3465 and/or Brian Van Zee at 254-495-8341.

7) Methods of collecting and relocating aquatic resources, including the types and sizes of containers used, the mode of transportation, and best management practices (BMPs) to protect aquatic resources. Provide an estimate of the time expected to complete the collection and relocation (See Attachment 2 for Freshwater Fish and Shellfish Handling Protocols).

Fish will either be transported directly via dip net from the dewatered area to the relocation site (just downstream of project area), or will be temporarily stored in standard Igloo/Colman coolers for short periods of time before being transported to the relocation site by foot. Battery powered aerators will be used continuously in standard sized Coleman/Igloo coolers with native water. Water will be maintained at a minimum 8 inch depth and in shade to minimize elevated temperatures. Fish will be relocated immediately. Relocation will be conducted by the construction crew under supervision by a City of Austin Staff Environmental Scientist. City Staff Environmental Scientist will determine adequate carrying capacity of each cooler based on size and number of fish and fish behavior. Overcrowding will be avoided following the recommendations provided in Attachment 3 of the TPWD Guidelines for ARRP.

The relocation area is just downstream of the project area and provides access to ample habitat, DO, shade, structure, as well as access to downstream pools, runs and riffles to sustain adults and provide refugia for small and/or juvenile fish. Hydrolab sondes will be used as necessary to measure Dissolved Oxygen during relocation and at the relocation site to ensure adequate DO levels.

8) Describe how the receiving waters will be protective of aquatic life (i.e., sufficient dissolved oxygen levels, water body size and flow, and similar habitat as the source water).

Receiving waters will be the same as the dewatered pool (just downstream), and due to the small number of fish observed (<10), there is no concern for overcrowding. Fish will be relocated 20-100 feet downstream within water of comparable temperature, conductivity, dissolved oxygen, pH, etc.

9) Describe how dead fish and shellfish as well as exotic and invasive species will be disposed of and documented. Documentation should include no less than the species and number of individuals found dead, including the lengths (inches) of all fish and mussels for both native and non-native species.

Dead fish (including exotic and invasive) will be secured in zip-lock bags and disposed of in sanitary landfill. Dead individuals (both native and non-native euthanized) will be identified, enumerated, and length documented in an excel spreadsheet and provided to KAST biologist.

10) Identify best management practices (BMPs) to be used to prevent or minimize the risk of transporting any species, including aquatic invasive species (AIS) to new locations on equipment, boats, trailers, and vehicles. These BMPs should also ensure compliance with regulations that prohibit the possession and transport of certain AIS species. For more info see Attachment 3.

No boats, trailers or vehicles will be used during the relocation effort. Equipment (i.e. coolers, hydrolab, dip nets, etc) will be cleaned prior to, and after use in addition to adherence to other equipment BMPs described in the TPWD Guidelines for ARRP. Additionally, the following procedures shall be followed for all equipment used in the water, even if unrelated to aquatic resource relocation. AFTER work in the water is complete:

- Clean: Remove mud, plant fragments, and other debris from all equipment before leaving the site – this includes nets, mesh bags, buckets, boot tread, waders, snorkel/SCUBA gear, boats, trailers, vehicles, and ANY other equipment used in or adjacent to the water. Before leaving the site, you should also rinse equipment that may harbor plant fragments (e.g. boot tread) – a gallon of jug water and a scrub brush or scraper can help to get things clean. If a carwash is available, the high pressure spray can help to clean boats, trailers, vehicles, and equipment. Otherwise, you should use a spray nozzle and water hose to finish cleaning equipment before use in another water body.
- Drain: Drain all water from boats, fish hauling units, buckets, or other receptacles at a location where the water will not drain into any water body.
  - Soaking equipment with 10% bleach solution (i.e. 1 part household bleach to 9 parts water) for 10 minutes followed by a thorough rinse before drying can help to prevent transfer of zebra mussel larvae, golden algae, and fish pathogens such as viruses and should neutralize any hidden snails or plant fragments. Milder disinfectants (e.g. 1% Virkon Aquatic for 10 minutes) or a 20-30 minute soak in very hot tap water (at least 110 F) can help decontaminate nets or equipment that bleach could damage.
- Dry: Allow all equipment to dry completely before use in another water body.

Appendix D: Example of a Permit Application

TEXAS PARKS & WILDLIFE

Application for Permit to Introduce Fish, Shellfish or Aquatic Plants into Public Waters

(No Fee Required)

For assistance completing this form, please call 512-389-4742 or email IFpermits@tpwd.texas.gov.

NOTE: This application will not be considered unless fully completed and must be received by the Department at least 30 days before the proposed introduction. Consultation with local or regional fisheries biologists before application submission is required for aquatic resource relocations and recommended for all applicants. If you have not yet consulted the local biologist, please call or email the permits office for their contact information.

1. APPLICANT INFORMATION:

Effective September 1, 2015, Texas Parks & Wildlife is required to collect Social Security numbers for the purpose of child support enforcement under the Texas Family Code, Section 231.302 and Federal Statute 42 U.S.C. §666. Missing or incomplete information may delay application processing time.

Name: Andrew Clamann Social Security #:

Address: 505 Barton Springs Road Austin Texas 11 Floor
Street City State Zip

Email: andrew.clamann@austintexas.gov Primary Phone: (512) 974 -2964

Would you like to help us reduce paper by choosing to receive your permit by email? ☐ Yes ☐ No

2. PUBLIC WATER WHERE ORGANISMS WILL BE INTRODUCED (address or GPS coordinates):

1209 EM Franklin Rd, Austin, Texas

3. EXPECTED DATE OF INTRODUCTION: 10 /16 /2019 (MM / DD / YYYY)

For relocations or plantings—what is the expected end date of the activity? 10 / 16 / 2019

4. WHAT IS THE PURPOSE OF THIS INTRODUCTION?

☐ Fish Stocking ☐ Planting ■ Aquatic Resource Relocation ☐ Research

☐ Other – Please Describe:

5. SPECIES TO BE INTRODUCED (for aquatic resource relocations, please skip this question):

	Common Name	Scientific Name	Number	Size
1)	western mosquitofish	Gambusia affinis	20	<2"
2)	bluegill sunfish	Lepomis macrohirus	5	<6"
3)	green sunfish	Lepomis cyanellus	5	<6"
4)				

PWD 1019 – T3200 (07/19)

5. SPECIES TO BE INTRODUCED (continued):

	Common Name	Scientific Name	Number	Size
5)				
6)				
7)				
8)				

6. SOURCE OF ORGANISMS: Same stream reach as destination (200ft upstream). A tributary of Tannehill Branch Creekin Austin, Texas at 1209 EM Franklin Rd.

7. COMMENTS: Erosion stabilization project will impact two small pools. Fish in pools will be moved downstream to comparable pool.

8. AFFIDAVIT:

I certify that
(1) all the information provided above is accurate and complete and
(2) that I have received and read the rules pertaining to Introduction of Fish, Shellfish, or Aquatic Plants (31 TAC Ch. 57C:
http://texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=5&ti=31&pt=2&ch=57&sch=C&rl=Y).

I understand that under Texas Penal Code §37.10, it is a felony to make a false statement on this form.

Signature of Applicant

10 /3 /2019
Date

Please return completed application to:
Permit Coordinator, Inland Fisheries
Texas Parks and Wildlife Department
4200 Smith School Road
Austin, Texas 78744

To help our office process your request more efficiently, you may email completed applications to IFpermits@tpwd.texas.gov or fax to: 512-389-4405

Texas Parks and Wildlife Department maintains the information collected through this form. With few exceptions, you are entitled to be informed about the information we collect. Under Sections 552.021 and 552.023 of the Texas Government Code, you are also entitled to receive and review the information. Under Section 559.004, you are also entitled to have this information corrected.

PWD 1019 – T3200 (07/19)

Appendix E: Example of an Approved Permit

TEXAS PARKS & WILDLIFE

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www.tpwd.texas.gov

To manage and conserve the natural and cultural resources of Texas and to provide hunting, fishing and outdoor recreation opportunities for the use and enjoyment of present and future generations.

10/14/2019

Andrew Clamann
City of Austin
505 Barton Springs Rd. 11th Floor
Austin, TX 78704

Andrew Clamann:

This letter is in response to your application to introduce fish, shellfish or aquatic plants into public water of the state. Your request to introduce fish into public water has been approved.

Attached to this letter is an approved permit (INT 19 10-14) to introduce all native aquatic species removed from the project site at Tannehill Branch tributary downstream from MLK at EM Franklin back into the suitable downstream habitat within the same waterbody following the terms of the permit and the approved Aquatic Resource Relocation Plan. This permit is being issued to address bank stabilization/construction activity. This permit is valid from 10/14/2019 to 12/15/2019.

The official Texas Parks & Wildlife Department (TPWD) contact listed on the permit, Travis Tidwell, must be notified three days prior to the relocation by phone at 512-389-8612 or by email at travis.tidwell2@tpwd.texas.gov so that a TPWD biologist may be present, if available, to verify numbers, size, and species of aquatic resources being relocated. If any state or federally listed species is discovered, the permit holder shall immediately contact the official department contact listed on the permit. Within 30 days of completion of the relocation, the permit holder shall submit to the department a summary list of species relocated or disposed as specified in the permit.

We appreciate your careful review of the conditions of the permit and your efforts to consistently meet all applicable requirements. If you need further information or have any questions, please contact the Permit Coordinator at ifpermits@tpwd.texas.gov.

Sincerely,

Inland Fisheries Permits

cc: Travis Tidwell

TEXAS PARKS & WILDLIFE

Permit to Introduce Fish, Shellfish or Aquatic Plants into Public Waters INT 19 10-14

A permit is hereby issued to Andrew Clamann (permit holder; City of Austin) authorizing the introduction of native aquatic species removed from the project site at Tannehill Branch tributary downstream from MLK at EM Franklin (project area) into the suitable downstream habitat within the same waterbody (relocation area; 30.278000°, -97.693600°).

1. All representations contained in the permit application shall be conditions upon which the permit is issued. Variations from these representations shall be unlawful unless the permit holder first contacts the Texas Parks and Wildlife Department to amend the permit and the department approves the amendment.

2. Acceptance of the permit by an applicant constitutes an acknowledgment and agreement that the permit holder will comply with all rules, regulations, and orders of the department issued in conformity with the Parks and Wildlife Code and the conditions precedent to the granting of the permit. Acceptance includes consent to the entrance of department employees and agents into the project area and relocation area at reasonable times to investigate conditions relating to the activities authorized by the permit including compliance with the permit.

3. The permit shall not be sold or transferred except with the approval of the department.

4. The permit is valid from 10/14/2019 to 12/15/2019 or until the permitted introduction has been completed, whichever comes first.

5. The official department contact for this permit is:
Travis Tidwell, TPWD KAST
Phone: 512-389-8612
Email: travis.tidwell2@tpwd.texas.gov

6. The permit holder shall adhere to all procedures and protocols described in the approved Aquatic Resource Relocation Plan. If any state or federally listed species is discovered, the permit holder shall immediately contact the department contact listed above.

7. Nothing in the permit acts as a waiver or release of any potential liability under Parks and Wildlife Code §§ 12.0011(b)(1) and 12.301–12.308, or of responsibility to comply with any applicable federal, state, or local law, rule, regulation, or permit.

8. A person who violates a provision of the permit commits an offense punishable by the penalty prescribed by Parks and Wildlife Code § 66.012.

9. If a person violates a provision of the permit, the department may suspend or revoke the permit after notifying the permit holder that a violation has occurred. All contested cases on the suspension or revocation shall be conducted pursuant to the provisions of Government Code, Chapter 2001.

TEXAS PARKS & WILDLIFE

Permit to Introduce Fish, Shellfish or Aquatic Plants into Public Waters INT 19 10-14

10. The permit holder shall provide written or verbal notice to the department contact listed above at least three days in advance of introducing aquatic species. Notice should include the name and telephone number of the permitted individual who will be supervising the activity.

11. Upon completion of a survey or relocation, the permit holder shall submit to the department a summary, in list form, of all species relocated. In addition, the permit holder shall document how dead fish and shellfish, including exotic and invasive species, were disposed of and provide documentation. Documentation should include no less than the species and number of individuals (fish and mussels) found dead, or disposed of, including the lengths (for fish only; inches, by size class) of all native species that were affected by the event for which this permit was granted. All documentation must be submitted to the department contact listed above no more than 30 days after the relocation is complete.

12. The permit holder shall provide copies of any future project reports to the department contact listed above.

Permit No. INT 19 10-14
Issued on 10/14/2019

Lauren Reynolds, Permit Coordinator

Appendix F: TPWD ARRP guidance as of 11/2019 (reformatted to fit this document)

Texas Parks and Wildlife Department

Guidelines for Aquatic Resource Relocation Plans for Fish and Shellfish, Including Freshwater Mussels

Dewatering, maintenance, and construction related activities in rivers, creeks, streams, lakes, sloughs, reservoirs, bays, estuaries, stilling basins, and other flood control structures may negatively impact fish, shellfish, and other aquatic resources. The Texas Parks and Wildlife Department is the state agency with primary responsibility for protecting the state's fish and wildlife resources. The Texas Parks and Wildlife Code authorizes the department to investigate fish kills and any type of pollution that may cause loss of fish or wildlife resources, estimate the monetary value of lost resources, and seek restitution or restoration from the party responsible for the fish kill or pollution through suit in county or district court. The Texas Administrative Code requires the department to actively seek full restitution for and/or restoration of fish, wildlife, and habitat loss occurring as a result of human activities. The restitution value of lost resources can be significant, in particular for species classified as threatened or endangered. Restitution for each individual of a threatened species is at least $500 and for each individual of an endangered species is at least $1,000. In addition, the Texas Parks and Wildlife Code makes it a criminal offense to kill any fish or wildlife resources classified as threatened or endangered.

Besides potential impacts to other aquatic resources, the department is particularly concerned about declining freshwater mussel populations, reflected in the 2009 Texas Parks and Wildlife Commission's decision to list 15 species of freshwater mussels as threatened. In order to avoid adverse impacts to aquatic resources and potential civil and criminal liability, the department recommends entities coordinate with the department to develop a plan to avoid impacts to aquatic resources and, in some instances, relocate aquatic resources outside of the project area.

There are two steps to this planning process. First, an applicant develops a written Aquatic Resource Relocation Plan (ARRP) to control and limit the impacts of dewatering, maintenance, or construction related projects on aquatic resources and submits it to the appropriate TPWD representative. The plan should be submitted no less than four weeks prior to beginning the project. The applicant must receive formal approval of the ARRP by the department prior to initiating dewatering, maintenance, or construction related activities. See Attachment 1 below for the specific information necessary for the ARRP. The TPWD point of contact for the project location can be found in Attachment 5.

Second, an applicant must complete an "Application for Permit to Introduce Fish, Shellfish, or Aquatic Plants into Public Waters." Because the application is to be received 30 days prior to the activity, it is suggested that both the ARRP and this permit application be submitted at the same time. The application can be obtained at the following web link:
http://tpwd.texas.gov/publications/pwdforms/media/pwd_1019_t3200_app_permit_stock_public_waters.pdf

There is no application fee for the ARRP or introduction permit. Once the department has issued the introduction permit, please have a copy available at the project site in case the local game warden or other department staff requests to see it. A department representative may be present during some or all of the proposed activity.

Please do not hesitate to contact your TPWD point of contact if you have any questions or require additional assistance.

Attachment 1: Aquatic Resource Relocation Plan (ARRP). The ARRP should include the following information to be considered complete.

1) A description of the project and associated aquatic/instream activities with sufficient detail for department staff to evaluate the risk to aquatic resources.

2) A computer generated map showing the project location and the relocation site, including the county, GPS coordinates, and the Texas Commission on Environmental Quality (TCEQ) water body segment number.

3) Expected start dates of the project and the aquatic resource relocation. An applicant must submit any changes to the start date of aquatic resource relocation activities at least 72 hours prior to the revised start date.

4) Identify any state or federally threatened or endangered species that may occur. Explain what methods will be used to protect these species. If the project area contains any state or federally listed freshwater mussels, a mussel survey may be necessary prior to approval of the ARRP (see Attachment 4 for Freshwater Mussel Survey Protocols). The following web link may help in identifying the location of these species by county: http://www.tpwd.texas.gov/gis/rtest/

5) List all shellfish that may become stranded due to the operation. Explain what methods will be used to protect these shellfish including freshwater mussels (See Attachment 2 for Freshwater Fish and Shellfish Handling Protocols).

6) Identify List all known exotic and invasive species in the project area. Describe decontamination procedures for preventing the spread of exotic and invasive species. See link below for more information: http://tpwd.texas.gov/huntwild/wild/species/exotic/

7) Methods of collecting and relocating aquatic resources, including the types and sizes of containers used, the mode of transportation, and best management practices (BMPs) to protect aquatic resources. Provide an estimate of the time expected to complete the collection and relocation (See Attachment 2 for Freshwater Fish and Shellfish Handling Protocols).

8) Describe how the receiving waters will be protective of aquatic life (i.e., sufficient dissolved oxygen levels, water body size and flow, and similar habitat as the source water).

9) Describe how dead fish and shellfish as well as exotic and invasive species will be disposed of and documented. Documentation should include no less than the species and number of individuals found dead, including the lengths (inches) of all fish and mussels for both native and non-native species.

10) Identify best management practices (BMPs) to be used to prevent or minimize the risk of transporting any species, including aquatic invasive species (AIS) to new locations on equipment, boats, trailers, and vehicles. These BMPs should also ensure compliance with regulations that prohibit the possession and transport of certain AIS species. For more information see Attachment 3

Attachment 2: Texas Parks and Wildlife Department

Fish and Shellfish Handling Protocols

Introduction

A key element in the survival of aquatic life such as fish and shellfish (oysters and freshwater mussels) which are caught and released is how they are handled during the process. Physiologically, these organisms experience many stressors during a catch and release and transport. By minimizing the amount of stress, the chance of survival after release improves greatly. During a catch and release event, fish, as well as shellfish, can experience a combination of many stress factors. Below is a list of some types of stressors that aquatic life can experience during catch and release.

- behavior stress – crowding
- handling stress – capture, struggle, confinement
- exercise stress – prolonged swimming, being chased
- temperature stress – change in temperature
- salinity stress – change in salinity
- hypoxial stress – removal from the water/low oxygen
- toxicity stress – exposure to ammonia

The primary response of stress is the releasing of hormones into the blood causing a disturbance to the physical state of the fish. The secondary stress responses are disturbances to osmoregulation, blood chemistry, metabolism, and immune system. These effects can reduce the fish's resistance to fungal and bacterial infections that lead to mortality in some cases.

In order to reduce these effects, proper care and procedures should be taken when catching and releasing aquatic life. In order to minimize these stressors, follow the recommendations listed below.

Handling, Maintaining, and Transporting Aquatic Life

Fish

- Catch the fish fast and efficiently. As the fish resists capture, its oxygen demand increases. The fish will need oxygen to recuperate after the capture. Therefore, keep the water in the transport basin well aerated.
- If a landing net is used, rubber netting works best for minimizing mucous loss. Cloth and nylon type dip nets disrupt the protective mucous coating, disturb scales, and increase the possibility of injury or secondary infection that usually results in fish mortality.
- Help keep the protective mucous coat and scales of the fish from rubbing off by using wet hands when handling fish.
- Keep handling of the fish to a minimum. If at all possible, do not grab fish with hands. Instead, go directly to the transport basin. Avoid excess handling and/or dropping of the fish on the ground and the floor of the boat.
- Help keep the protective mucous coat and scales of the fish from rubbing off by using wet hands when handling fish. NovAqua ® or StressCoat ® can be added to the water in holding tanks to help mitigate the abrasive damage of capture and handling to the external mucous coating.
- Keep the fish in the water as much as possible to reduce stress. As a rule, keep the fish out of water no longer than you can hold your breath. Fish can suffer from brain damage from pro-longed loss of oxygen.
- Water temperatures above 84° Fahrenheit tend to be stressful for warm water fish. Therefore, adding ice to the transport basin can minimize stress.

- Avoid overcrowding fish in the transport basin. A good rule of thumb to use would be to place no more than 5 fish in the 15”-20” range for a 120 quart cooler equipped with some type of an aeration system. Plan on 25% water exchange every 20-30 minutes. About 7.5 gallons (1.5 buckets if using a five gallon bucket). Use common sense, the more fish (>5) and the longer they sit in the transport basin, the more frequent water exchanges need to occur.
- Live-wells or other holding tanks should be fitted with a water recirculation system. Oxygen cylinders are expensive, but provide the best aeration while maintaining water temperature.
- Run the aeration system continuously! Transport basins should be filled with ambient water to aid in acclimating the fish to the transport conditions.

When transporting saltwater fish, it is important to keep the transport water as close to the same salinity and temperature as the water from which the fish were collected. If possible, it is preferable to lower the water temperature a couple of degrees to reduce stress during the transport procedure. The oxygen concentration in the water should be between 5.0 - 7.0 mg/L. Water with oxygen levels lower than 4.0 mg/L can cause stress and eventually lead to a fish kill. The pH of the water should range between 8.0-8.3 for saltwater fish and 6.5-8.0 for freshwater fish.

Shellfish (freshwater mussels)

- While collecting freshwater mussels, place them in 3-5 gallon mesh bags or 5 gallon buckets keeping them inundated in the water until they are ready to be brought ashore.
- Once brought to shore, place the mussels in appropriate sized ice chests containing ambient water (with small amounts of ice if necessary) for use in transportation to the relocation site.
- Keep live mussels in transportation containers no longer than 8 hours.
- When placing mussels back in the sediment at the relocation site, carefully hand place them with the anterior end down.

Attachment 3:

TEXAS PARKS & WILDLIFE

Aquatic Surveys, Introductions, and Relocations: Best Management Practices to Prevent or Minimize Aquatic Invasive Species (AIS) Transfer

Introduction

All permitted aquatic surveys, aquatic species introductions, and aquatic resource relocations are required to comply with regulations regarding possession, transport, and introduction of controlled exotic species into public waters. These regulations apply even to small fragments or seeds of these species, regardless of whether the transfer is intentional or accidental. Implementation of Best Management Practices (BMPs) is necessary to prevent or minimize the risk of accidentally possessing or transferring exotic species or pathogens.

Aquatic invasive species (AIS) cause or are likely to cause harm to our native ecosystems, both directly by competition or predation on native species and indirectly by altering the environment (e.g., reducing dissolved oxygen, shading). Many AIS cause significant economic harm in many ways—by damaging water transfer and hydroelectric infrastructure and increasing maintenance costs, clogging waterways and costing millions of dollars each year to manage, increasing evaporative water loss from reservoirs, and even lowering property values. These AIS can also impact human health and quality of life by helping to cause harmful algal blooms, impeding boater access, fouling beaches, and creating hazards for swimmers.

Because of these potential impacts, the legislature delegated to the Texas Parks and Wildlife Commission the authority to develop a list of Exotic Harmful or Potentially Harmful Fish, Shellfish, and Aquatic Plants that may not be possessed, transported, or introduced into public waters except as authorized by rule or permit issued by the department (TPWD)[a]. A complete list of these species hereafter referred to as controlled species, can be found on the department website at http://tpwd.texas.gov/huntwild/wild/species/exotic/prohibited_aquatic.phtml. Possession or transfer of controlled AIS, live or dead, or the eggs, seeds, or fragments thereof, is punishable as a Class C Misdemeanor (with a fine up to $500); repeat violations can be elevated.

Examples of controlled AIS include zebra mussels (*Dreissena polymorpha*) and their microscopic larvae, Tilapia (*Oreochromis* spp.), hydrilla (*Hydrilla verticillata*), giant and common salvinia (*Salvinia molesta*, *S. minima*), and Eurasian watermilfoil (*Myriophyllum spicatum*). Some controlled AIS are fairly widespread in Texas, but their prevalence increases, rather than negates, the risk of accidental transfers that could cause infestations in new areas. More information about most of the controlled species that have been found in Texas, including maps of where they have been found, is available on www.TexasInvasives.org and a few especially problematic species are described below.

It is your responsibility to ensure that you and your team are not possessing, transporting, or introducing controlled AIS. However, by implementing a few general BMPs, you can achieve a high degree of confidence that you aren't accidentally doing so. In addition, implementing these BMPs will help to prevent transfer of non-prohibited, yet potentially harmful, AIS as well as harmful algae or pathogens that could negatively impact our natural resources

[a] Texas Administrative Code, Title 31, Rule §57.112

General BMPs

- DURING surveys, introductions, and relocations, do not transfer water from one site to another unless specifically approved by the department; minimize water transfer whenever possible, using nets to transfer fish. For questions about treating hauling water, see the section on fish hauling units below.
- AFTER work in the water is complete:
  - **CLEAN:** Remove mud, plant fragments, and other debris from all equipment before leaving the site—this includes nets, mesh bags, buckets, boot tread, waders, snorkel/SCUBA gear, boats, trailers, vehicles, and ANY other equipment used in or adjacent to the water. Before leaving the site, you should also rinse equipment that may harbor plant fragments (e.g., boot tread)—a gallon jug of water and a scrub brush or scraper can help to get things clean. If a carwash is available, the high pressure spray can help clean boats, trailers, vehicles, and equipment. Otherwise, you should use a spray nozzle and water hose to finish cleaning equipment before use in another water body.
  - **DRAIN:** Drain all water from boats, fish hauling units, buckets, or other receptacles at a location where the water will not drain into any water body.
  - Soaking equipment with 10% bleach solution (i.e., 1 part household bleach to 9 parts water) for 10 minutes followed by a thorough rinse before drying can help prevent transfer of zebra mussel larvae, golden algae, and fish pathogens such as viruses and should neutralize any hidden snails or plant fragments. Milder disinfectants (e.g., 1% Virkon Aquatic for 10 minutes) or a 20-30 minute soak in very hot tap water (at least 110˚F) can help decontaminate nets or equipment that bleach could damage.
  - **DRY:** Allow all equipment to dry completely before use in another water body.

Special Rules and Recommendations

Boats

Regulations require that all water be drained from vessels traveling to and from any public water body, except for travel between access points on the same water body within the same day[b]. Texas law also specifically requires that all controlled aquatic plants be immediately removed from boats, trailers, and vehicles used to transport or launch them, and disposed lawfully[c].

Vehicles

Vehicles used to launch boats or driven in the water or in mud adjacent to the water can easily harbor and transport AIS. It is especially important to check them thor oughly, remove all vegetation, rinse well with a spray nozzle, and allow them to dry completely before you visit another water body. Check the wheels, axle, bumper, and undercarriage carefully and be sure to rinse everything well. Texas law specifically requires that all controlled aquatic plants be immediately removed from vehicles used to transport or launch boats and disposed lawfully[c].

Fish Hauling Units

For specific recommendations for decontaminating fish hauling units and treating hauling water to prevent transferring controlled AIS, golden alga, or fish pathogens, please see "A Biosecurity Manual for Inland Fisheries Division Hatcheries," online at: http://tpwd.texas.gov/publications/pwdpubs/media/pwd_rp_t3200_1776.pdf

Zebra Mussel Infested Water Bodies

A current map and list of infested lakes can be found on the department website at: http://tpwd.texas.gov/huntwild/wild/species/exotic/zebramusselmap.phtml. Zebra mussels are spread via both transfer of adults and microscopic larvae in water. When working at a site on a water body where zebra mussels or their larvae have been found, it is critical to ensure that no water is transferred and all equipment is allowed to dry thoroughly. You will also need to be very thorough in checking equipment for mud or debris that could harbor dislodged adults. For these projects, your methods should specify where decontamination will take place and identify and address any special equipment that could transfer zebra mussel larvae (e.g., bladder dam) and how it will be cleaned. **If zebra mussels are found at the site, you must report the finding to TPWD immediately by calling Monica McGarrity (512-389-8292), Brian Van Zee (254-495-8341), or your department contact. Native mussels with zebra mussels attached should never be relocated to another water body; if zebra mussels are attached, consult the department before proceeding.**

[b] Texas Administrative Code, Title 31, Rule §57.1001
[c] Parks and Wildlife Code, Rule §66.0071

Non-native Species and Aquatic Resource Relocations

The Aquatic Resource Relocation Plan (ARRP) should stipulate that non-native species will not be relocated or specifically describe which species will (or will not be) relocated. In most cases, the department will not issue a permit for relocation of non-native species (i.e., not native at the watershed or sub-watershed level), regardless of whether or not they are designated as controlled AIS by TPWD regulations, because permitting their introduction would be inconsistent with department management goals. For example, suckermouth catfishes (genera *Hypostomus* and *Pterygoplichthys*) are highly invasive and their relocation will not be permitted, even though they are not a controlled AIS. Asian clams (*Corbicula fluminea*) are not native to Texas and should not be relocated. Rio Grande Cichlids (*Herichthys cyanoguttatum*) are native only to the lower Rio Grande drainage in Texas but may be found in other water bodies and can impact some native species; although they should not typically be relocated outside their native range, in some cases it may be permitted (e.g., park ponds or reservoirs). In some cases, relocation of Common Carp (*Cyprinus carpio*) may be permitted at the discretion of the Inland Fisheries district supervisor.

Controlled fish AIS, such as tilapia, that are removed from a water body cannot be relocated and also must be promptly beheaded or gutted prior to disposal or transport for disposal. A complete list of controlled AIS can be found on the department website at: http://tpwd.texas.gov/huntwild/wild/species/exotic/prohibited_aquatic.phtml

Triploid grass carp (*Ctenopharyngodon idella*) is a controlled AIS for which relocation could be approved, but only if the relocation site is in the same water body. If triploid grass carp were stocked for nuisance aquatic vegetation control, they must be relocated within the same water body unless otherwise approved by the department. The department website provides a current list of all public water bodies where triploid grass carp have been stocked: (http://www.tpwd.state.tx.us/landwater/water/environconcerns/nuisance_plants/public_tgc_permits.phtml). If grass carp are encountered in other water bodies not on this list, they must be beheaded or gutted and disposed unless otherwise directed by the Inland Fisheries district supervisor.

Disposal of Fish (Non-native or Native)

Dead animals, including fish, are classified as municipal solid waste. Although they are considered special waste, no special authorization is required for disposal at any Type I or Type IAE landfill. For government roadway maintenance projects by TxDOT or county or municipal agencies, fish may be disposed by burial on the highway right-of-way as long as the disposal does not cause a nuisance or endanger public health or the environment and the carcasses are covered with at least two feet of soil. Other individuals or entities should dispose of fish in a landfill.

Some Controlled Species to Know – Easily Transported by Accident

Giant Salvinia (Salvinia molesta) ***http://www.texasinvasives.org/plant_database/detail.php?symbol=SAMO5***
Common Salvinia (S. minima) ***http://www.texasinvasives.org/plant_database/detail.php?symbol=SAMI7***

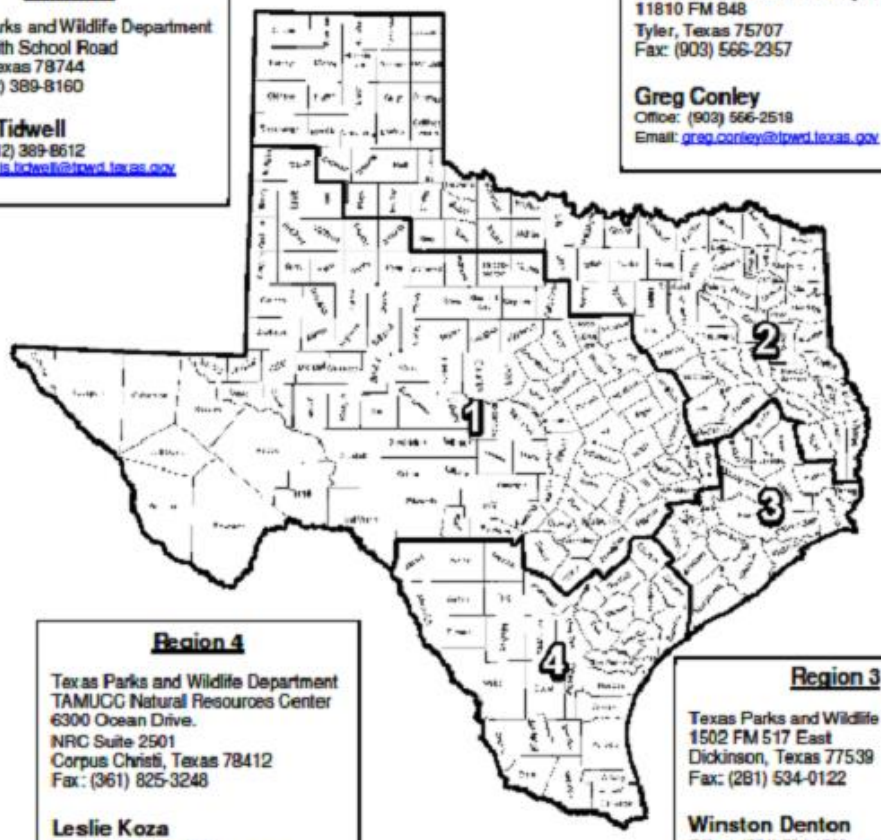
Hydrilla (Hydrilla verticillata)
http://www.texasinvasives.org/plant_database/detail.php?symbol=HYVE3
http://aquaplant.tamu.edu/plant-identification/alphabetical-index/hydrilla/
http://plants.ifas.ufl.edu/node/183
Eurasian Watermilfoil (Myriophyllum spicatum)
http://www.texasinvasives.org/plant_database/detail.php?symbol=MYSP2
http://aquaplant.tamu.edu/plant-identification/alphabetical-index/eurasian-watermilfoil/
http://plants.ifas.ufl.edu/node/278
Alligatorweed (Alternanthera philoxeroides)
http://www.texasinvasives.org/plant_database/detail.php?symbol=ALPH
http://aquaplant.tamu.edu/plant-identification/alphabetical-index/alligator-weed/
Torpedograss (Panicum repens)
http://aquaplant.tamu.edu/plant-identification/alphabetical-index/torpedograss/
http://plants.ifas.ufl.edu/node/308
Zebra mussels (Dreissena polymorpha) **http://texasinvasives.org/animal_database/detail.php?symbol=10**
Island applesnail (Pomacea insularum) ***http://texasinvasives.org/animal_database/detail.php?symbol=15***

A complete list of controlled exotic fishes can be found on the department website at:
http://tpwd.texas.gov/huntwild/wild/species/exotic/prohibited_aquatic.phtml
To learn more about other AIS, how to identify them, and where they've been found in Texas, visit:
http://www.texasinvasives.org/invasives_database/

Texas Parks and Wildlife Department
Aquatic Resource Relocation Plan

Contacts

Below are the names of the Biologists to be contacted for coordinating Aquatic Resource Relocation Plan development for the counties listed in the respective regions on the map below.



Region 1

Texas Parks and Wildlife Department
4200 Smith School Road
Austin, Texas 78744
Fax: (512) 389-8160

Travis Tidwell
Office: (512) 389-8612
Email: travis.tidwell@tpwd.texas.gov

Region 2

Texas Parks and Wildlife Department
11810 FM 848
Tyler, Texas 75707
Fax: (903) 566-2357

Greg Conley
Office: (903) 566-2518
Email: greg.conley@tpwd.texas.gov

Region 4

Texas Parks and Wildlife Department
TAMUCC Natural Resources Center
6300 Ocean Drive.
NRC Suite 2501
Corpus Christi, Texas 78412
Fax: (361) 825-3248

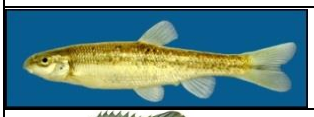
Leslie Koza
Office: (361) 825-2329
Email: leslie.koza@tpwd.texas.gov

Region 3

Texas Parks and Wildlife Department
1502 FM 517 East
Dickinson, Texas 77539
Fax: (281) 534-0122

Winston Denton
Office: (281) 534-1038
Email: winston.denton@tpwd.texas.gov

Appendix G: Example Field Fish Bench Sheet

Reference picture	Name	Number Collected	Number Dead (with sizes)
	Central Texas Stoneroller		
	Sunfish (bluegill, green, long ear, red breast, etc)		
	Largemouth Bass		
	Red shiner		
	Blacktail shiner		
	Gambusia		
	Gizzard Shad		
	Black Bullhead catfish		
	Yellow Bullhead catfish		
	Mexican tetra (not native to Central Texas)*		
	Rio Grande Cichlid (not native to Central Texas)*		
	Variable Platy (not native to Texas)*		

Appendix H: Water Snakes in Austin

Diamond-backed water snake (*Nerodia erythrogaster*) Non-venomous	**Plain-bellied water snake** (*Nerodia rhombifer*) Non-venomous	**Cottonmouth/Moccasin** (*Agkistrodon piscivorus*) Venomous
 Long with a gradually tapering tail	 Long with a gradually tapering tail	 Stumpy. Tip of tail narrows abruptly
 Blunt nose, striped lips, round pupil	 Blunt nose, striped lips, round pupil	 Pointed nose, dark band across eyes
 Regular series of X's across back made from dark lines	 Regular series of brown saddles bordered by thin light lines	 Irregular blobs zig-zag brown and dark brown blotches
		

Photos and/or clips of photos accessed from internet search

Individual color can vary greatly and may even appear solid dark or even patternless for specimens that are old, muddy, or preparing to shed. The Plain-bellied and the Diamond-backed are both very common in Austin creeks, however the cottonmouth is uncommon and unlikely to be encountered. Watersheds known to have cottonmouths include Bull, Barton and Onion. Plain-bellied and Diamond backed can both extend jaws outward to appear to have triangular heads, but the noses will always be blunt and rounded. Cottonmouth noses will appear flat on top with crisp/sharp edges.

Appendix I: Austin-area Quick Reference Fish Guide

Appendix I:

Austin-area Fish Identification Quick Reference

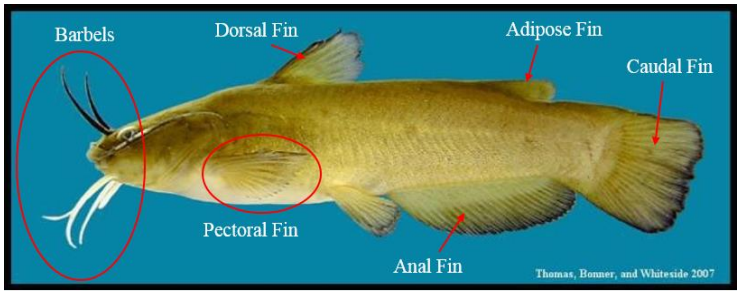
This guide is adapted and composed of excerpts from

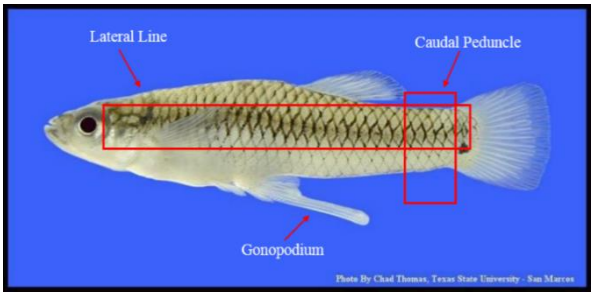
The Inland Fishes of Texas Pictorial Key 2017

Cody A. Craig, Nicky M. Hahn, Timothy H. Bonner

Glossary

Adipose fin: Fleshy rayless fin on the middle of the back between the dorsal and the caudal fin
Heteroceral: Vertebrae extend into caudal fin, making the fin appear slightly longer
Homocercal: Vertebrae truncated
Incisors: Cutting teeth typically located in the front of the mouth
Gonopodium: Modified anal fin of male used to transfer sperm to the female genital pore
Operculum/opercle: Flaps covering the gill chamber
Subterminal: Slightly overhung by snout; opens horizon

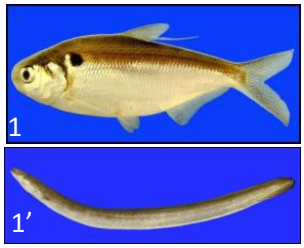




Austin-area Family Key

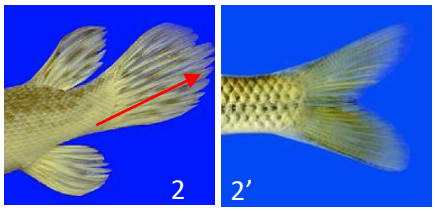
1. With pelvic fins… 2

1’. Without pelvic fins… **Freshwater Eels (Anguillidae)**



2. (1aa.Abbreviated Heteroceral caudal fin…**Gars (Lepisosteidae)**

2’. Caudal fin homocercal… 3

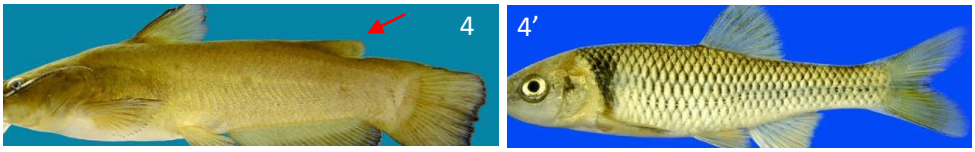


3. 1 dorsal fin, no spine in pelvic fin… 4

3’. 1 or 2 dorsal fins, spine in pelvic fin… 7

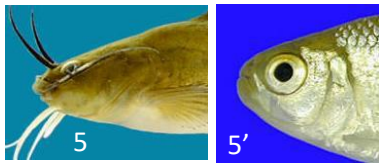
4. Adipose Fin… 5

4’. No adipose fin… 11



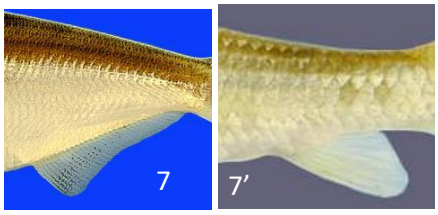
5. With barbels on head… **Bullhead Catfishes (Ictaluridae)**

5’. Without barbels… 6



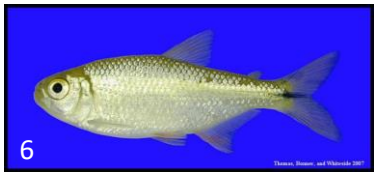
6. Incisor teeth... **Tetras (Characidae)**

6’. No incisor teeth... **Trouts (Salmonidae)**



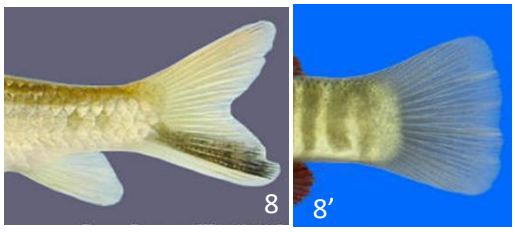
7. Long anal fin... **Shads (Clupeidae)**

7’. Short anal fin….8



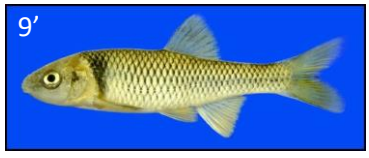
8. Fork or emarginated caudal fin… 9

8’. Truncated or rounded caudal fin… 10



9. Fleshy mouth… **Suckers (Catostomidae)**

9’. Mouth not fleshy… **Carps and Minnows (Cyprinidae)**

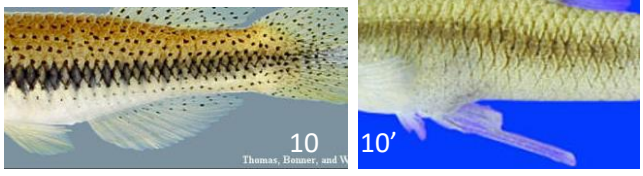


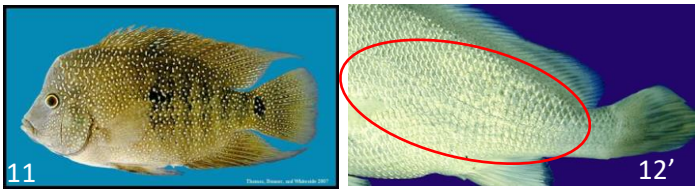
10. Males without gonopodium... **Killifishes (Fundulidae)**

10’. Males with gonopodium... **Livebeares (Poeciliidae)**

11. Interrupted lateral line…**Cichlids (Cichlidae)**

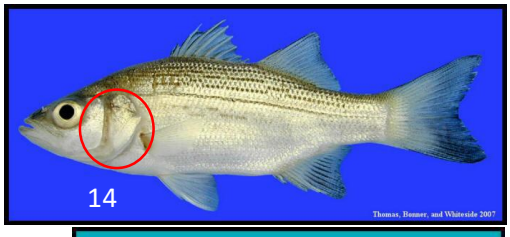
11’. lateral line complete, incomplete or absent… 12





12. Lateral line does not extend into caudal fin… 13

12’. Lateral line extends into caudal fin… **Drums (Sciaenidae)**

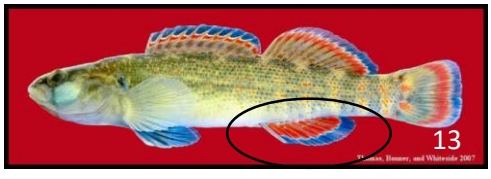


13. 1-2 anal fin spines… **Perches (Percidae)**

13’. 3-8 anal fin spines… 14

14. Sharp spine in operculum…**Temperate Basses (Moronidae)**

14’. No operculum spine… **Sunfishes (Centrarchidae)**



Austin-area Species Key (by Family)

Anguillidae (Eels)

American Eel

Anguilla rostrate, 12 in

Characidae (Characins)

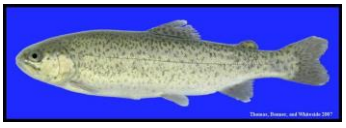
Mexican Tetra

Astyanax mexicanus, 2.5 in

Salmonidae (Trout)

Rainbow Trout

Oncorhynchus mykiss, 11 in



Poeciliidae (Livebearers)

Western Mosquitofish

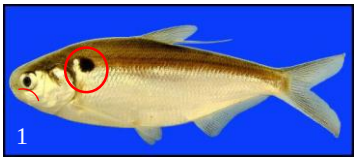
Gambusia affinis, 1.7

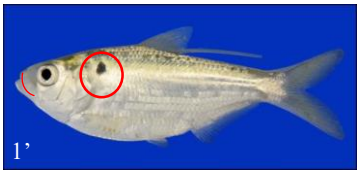
Sciaenidae (Drums)

Freshwater Drum

Aplodinotus grunniens, 7 in

Clupeidae (Shads)

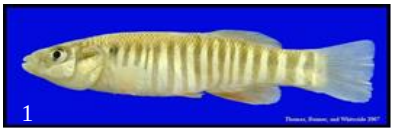


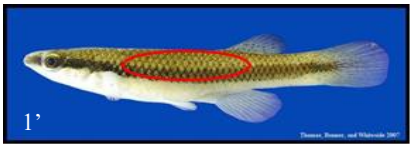


1. 29 to 33 anal fin rays; mouth subterminal and below level of middle of eye; black shoulder spot equal to or larger than pupil…**Gizzard Shad –** *Dorosoma cepedianum*, 9 in

1'. 24 to 28 anal fin rays; mouth terminal and at level of eye; black shoulder spot (especially in young) smaller than pupil **Threadfin Shad –** *Dorosoma petenense*, 3.5 in

Fundulidae (Topminnows)

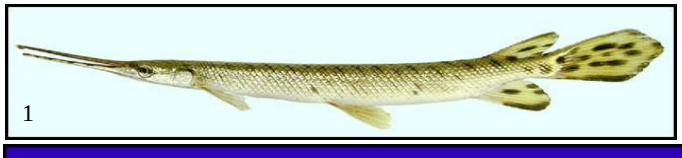


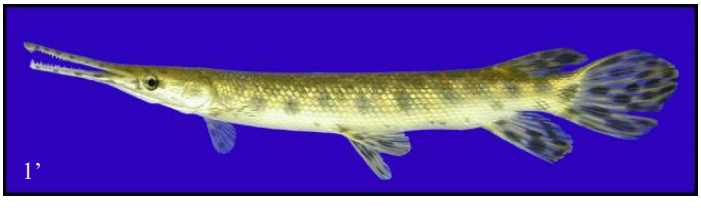


1.Dark vertical barring, 42 to 50 scale rows in lateral series. **Plains Killifish** – *Fundulus zebrinus,* 3.4-3.7

1'. Body with distinct dark lateral band, no vertical barring; distinct black spots near base of dorsal and caudal fins. **Blackstripe Topminnow** – *Fundulus notatus,* 3.2

Lepisosteidae (Gars)

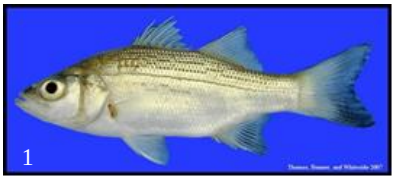




1. Beak long and narrow, least width goes about 12 to 20 times in length; width of beak at nostril < eye diameter, snout more than 2/3 of head length. **Longnose Gar –** *Lepisosteus osseus*,

1'. Beak short and blunt, least width goes about 5 to 7 times in length; width of beak at nostrils > eye diameter; snout less than 2/3 of head length; with dark spots on head.**Spotted Gar –** *Lepisosteus oculatus*,

Moronidae (Temperate Basses)



1. Body depth goes <3 times in standard length; teeth in single patch on back of tongue…**White Bass** – *Morone chrysops,* 11 in

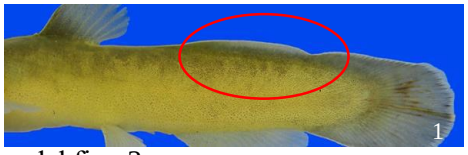
1'. Body depth goes >3 times in standard length; teeth in 2 parallel patches on back of tongue. **Striped Bass** – *Morone saxatilis,* 24 in

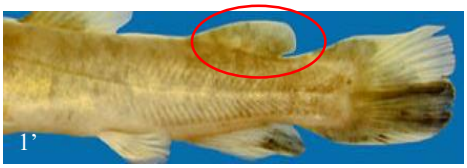
Cichlidae (Cichlids)

1. Anal fin spines 5 to 6. **Rio Grande Cichlid** – *Herichthys cyanoguttatus,* 9 in

1'. Anal fin spins <5 . **Blue Tilapia** – *Oreochromis aureus,* 9.4 in

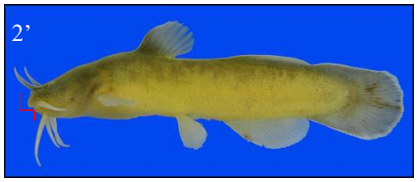
Ictaluridae (Catfishes)

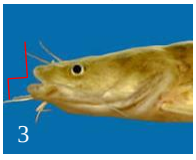




1. Adipose fin joined to the caudal fin separated by a shallow notch...2
1'. Adipose fin free at tip, not joined to caudal fin...3

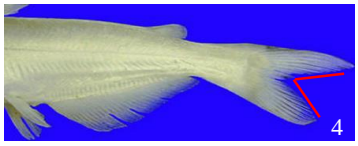
2(1). Jaws nearly equal, mouth terminal; pectoral fin spine not serrated; dark axial streak conspicuous; dorsal, anal, and caudal fins not dark edged; lower lip and chin not heavily speckled with dark pigment. **Tadpole Madtom –** *Noturus gyrinus*, 3.7 in
2'. Lower jaw underslung, mouth sub-terminal; pectoral spine serrated; axial streak inconspicuous; dorsal, anal, and caudal fins with dark edges; lower lip and chin heavily speckled with dark pigment. **Freckled Madtom –** *Noturus nocturnus*, 2.4 in

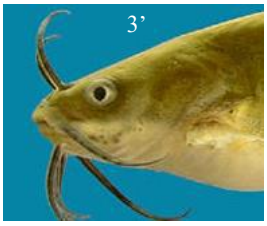


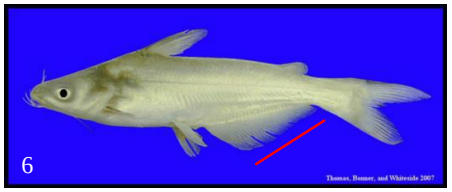


3(1). Head dorso-ventrally compressed; mouth terminal to superior
3'. Head rounded; mouth subterminal… 4

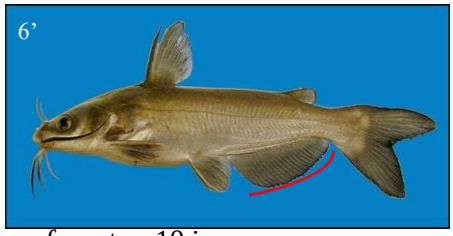
4.(3) Caudal fin rounded or shallowly emarginated… 5
4'. Caudal fin deeply forked… 6



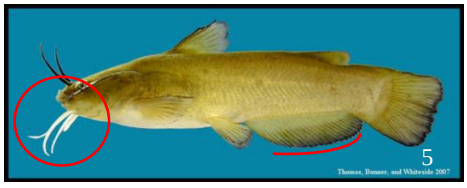


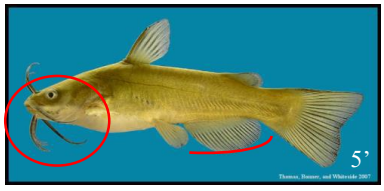


5(4). Chin barbels white or yellow; anal fin rays 24 to 27; margin of anal fin generally straight. **Yellow Bullhead –** *Ameiurus natalis*, 8 in
5'. Chibarbels completely or partially black; anal fin rays 17 to 24; anal fin broadly rounded. **Black Bullhead –** *Ameiurus melas*, 4.6 in



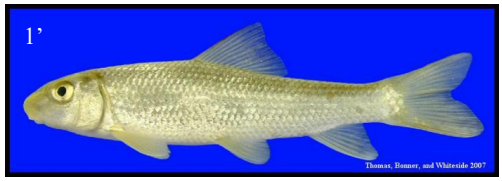
6(4). Anal fin rays 30 to 36; anal fin free margin is straight; medial keel-like ridge anterior to dorsal fin forms humped back appearance **Blue Catfish** – *Ictalurus furcatus*, 10 in
6'. Anal fin rays 27 to 29; pectoral fin spine goes <5 times into standard length; random scattering of few dark spots may be present; no humped back appearance.
Channel Catfish – *Ictalurus punctatus*, 12 in





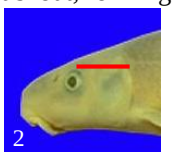
Catostomidae (Suckers)

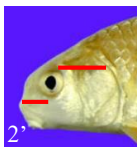
1. Dorsal fin long, base >1/3 of standard length; 22 to 30 dorsal fin rays… 2
1'.. Dorsal fin short, base <1/4 of standard length; 11 to 12 dorsal fin rays; 44 to 46 scales along the lateral line. **Grey Redhorse –** *Moxostoma congestum,* 10 in

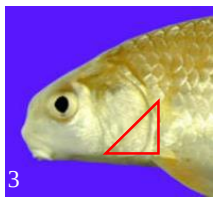


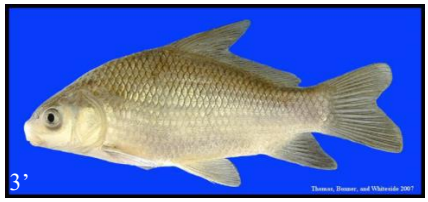
2(1). Lateral line >50; eye close to back of head than to tip of snout; head abruptly more slender than body. **Blue Sucker –** *Cycleptus elongates,* 4 in
2'. Lateral line scales < 45; eye closer to tip of snout than back of head… 3

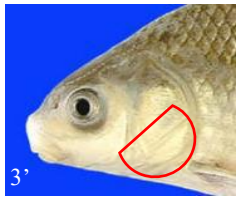
3(2). Subopercle triangular, broadest towards base; blunt snout, forming level with eye. **River Carpsucker –** *Carpiodes carpio, 9.2 in*
3'. Subopercle semicircular, broadest towards middle; rounded snout, forming below level of eye.
Smallmouth Buffalo – *Ictiobus bubalus 10in*



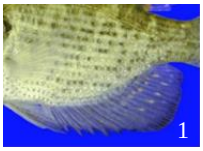


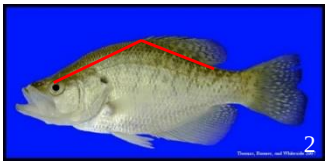






Centrarchidae (Bass and Sunfish)

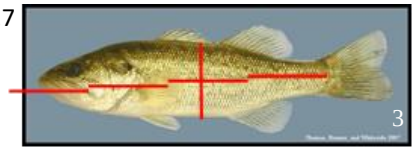


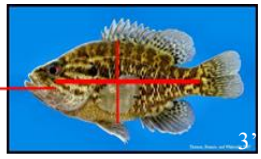


1. Five to eight anal spines… 2
1'. Three anal spines…3

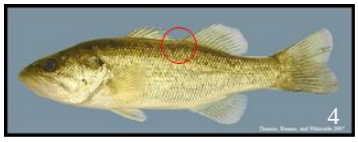
2(1) Dorsal fin set back on body, length of dorsal fin base < distance from its origin to posterior margin of eye; lateral body with wide to narrow dorsal black bands. **White Crappie** – *Pomoxis annularis,* 8 in
2'. Dorsal fin set forward on body, length of dorsal fin base equal to or greater than distance from its origin to posterior margin of eye; lateral body with checkerboard black and light pattern. **Black Crappie** – *Pomoxis nigromaculatus,* 10 in

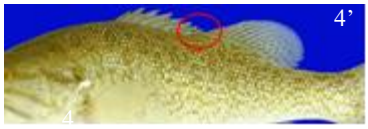
3(1). Body slender, body depth contained > 3 times into standard length…4
3'. Body deep; depth contained < 3 times into standard length…7





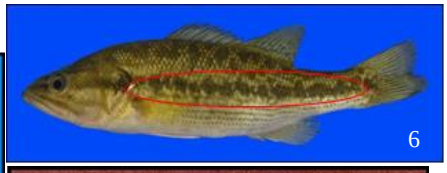
4(3). Dorsal fins narrowly joined at base forming a deep notch; upper jaw extends past posterior margin of eye in adults; mid-lateral stripe generally complete, rows of spots ventral to mid-lateral stripe faint and incomplete. **Largemouth Bass** – *Micropterus salmoides*, *11in*
4'. Dorsal fins broady joined at base forming a shallow notch; upper jaw does not reach past posterior portion of eye…5





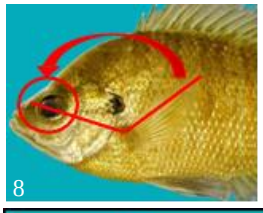
5(4). No tooth patch on tongue; lower lateral region scales without dark spots forming horizontal rows. **Smallmouth Bass** – *Micropterus dolomieu,* 9 in
5'. Tooth patch on tongue; lower lateral region scales with dark spots forming horizonatal rows…6

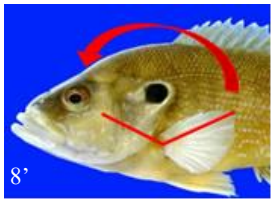
6(5). Mid-lateral stripe often appears interrupted anteriorly, rows of spots ventral to mid-lateral stripe distinct and complete. **Spotted Bass** – *Micropterus punctulatus,* 10 in
6'. Dark wide mid-lateral stripe present and disconnected anteriorly into a narrow mid-lateral stripe posteriorly, forming vertical bars. **Guadalupe Bass** – *Micropterus treculii,* 9 in



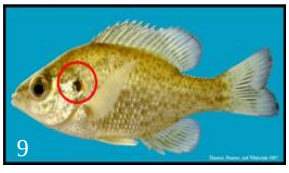
7(3). Teeth on tongue; head and opercula with 3-5 distinct dark and light longitudinal stripes. **Warmouth** – *Lepomis gulosus,* 8.6 in
7'. No teeth on tongue; no longitudinal stripes on opercula…8

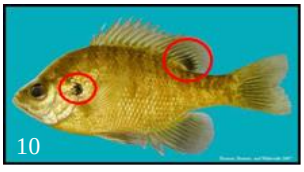
8(7). Pectoral fins long and pointed, reach anterior portion of eye or beyond when bent forward…9
8'. Pectoral fins short and rounded, do not reach past eye when bent forward…11

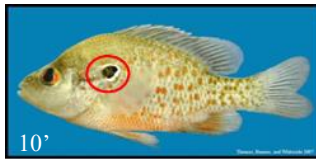




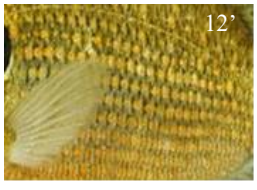
9(8) Opercule flap stiff to its margin, posterior margin either red or orange in live specimens. **Redear Sunfish** – *Lepomis microlophus,* 8.5 in
9'. Opercle flap flexible…10

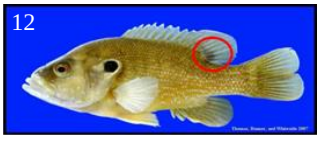






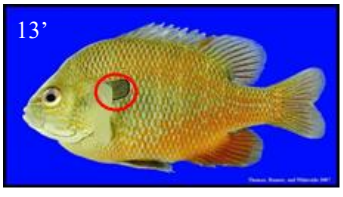
10(9). Opercle flap dark to the margin; black spot on posterior base of soft dorsal fin. **Bluegill Sunfish** – *Lepomis macrochirus,* 8.5 in
10'. Opercle flap outlined with thick white band; lacking black spot on posterior base of dorsal fin. **Orangespot Sunfish** – *Lepomis humilis,* 3 in





11(8). Black opercle flap stiff; bone supporting majority of the flap… 12
11'. Black opercle flap flexible; no bone supporting flap…13

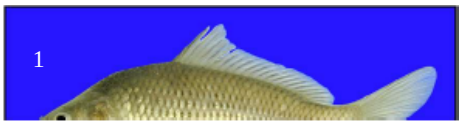
12(11). Body elongated with black spot on posterior base of soft dorsal fin. **Green Sunfish** – *Lepomis cyanellus*, 6.5 in
12'. Body rounded without black spot on posterior base of soft dorsal fin; lateral body with alternating stripes formed from black and red spots. **Redspotted Sunfish** – *Lepomis miniatus*, 4.1 in



13(11). Opercle flap dark to the posterior margin. **Redbreast Sunfish** – *Lepomis auritus,* 7 in
13'. Opercle flap with thin white margin. **Longear Sunfish** – *Lepomis megalotis,* 6.5 in

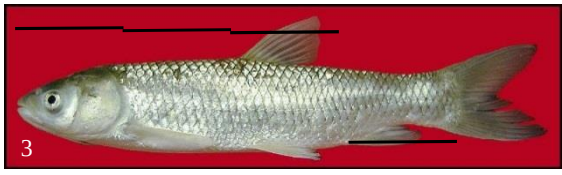
Cyprinidae (Carps and Minnows)

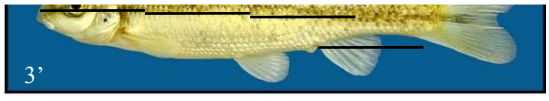
1. More than 15 soft rays on dorsal fin; dorsal and anal fins each with a strong serrated spine… 2
1’. Fewer than 10 soft rays on dorsal fin; dorsal and anal fins without spine…3



2(1). Upper jaw with two pairs of barbels. **Common Carp** – *Cyprinus carpio,*
2’. Upper jaw without barbels. **Goldfish** – *Carassius auratus*, 3.6 in

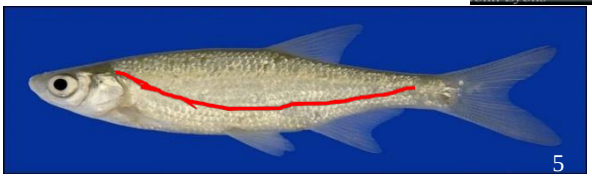
3(1). Anal fin near caudal fin, distance from snout to origin of anal fin is > 2.5 times the distance from origin of anal fin to base of caudal fin; pharyngeal teeth with prominent parallel grooves. **Grass Carp** - Ctenopharyngodon *idella,* 14.5 in
3’. Anal fin not noticeably near caudal fin: distance from snout to origin of anal fin is < 2.5 times the distance from origin of anal fin to base of caudal fin; pharyngeal teeth without prominent parallel grooves…4

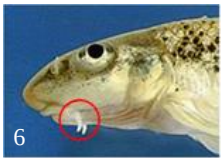


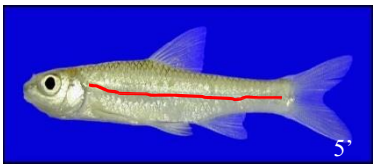


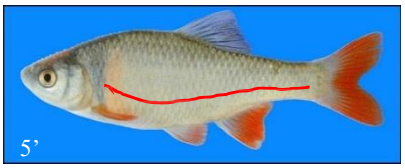
4(3). Intestine wound completely around swim bladder; cartilaginous ridge on lower jaw. **Central Stoneroller** – *Campostoma anomalum,* 4 in
4’. Intestine not wound spirally around swim bladder; cartilaginous ridge of lower jaw hardly evident… 5

5(4) Abdomen behind pelvic fins with a fleshy keel lacking scales; lateral line greatly decurved distance between anterior lateral line scale and ventral most lateral line scale is >3 scales in height. **Golden Shiner** – *Notemigonus crysoleucas,* 2.3in
5’. Abdomen behind pelvic fin with scales; lateral line not greatly decurved, lateral line descends <3 scales ventrally from highest point… 6

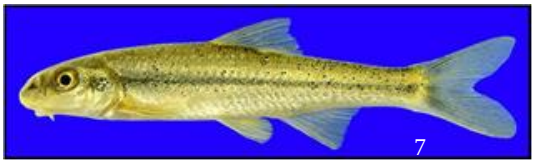


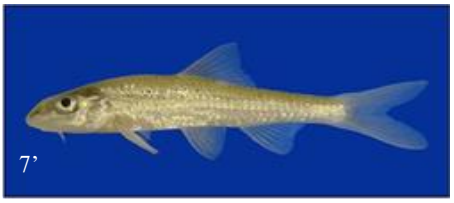




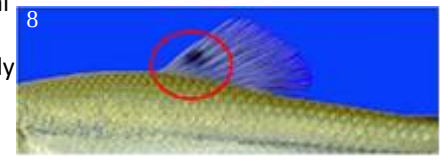


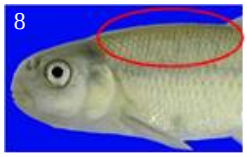
6(5). With maxillary barbels, might be small and not observable without opening the mouth or magnification…7
6’. Without maxillary barbels… 8





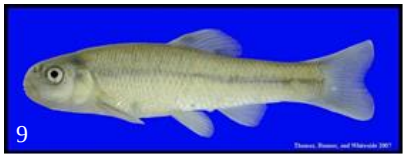
7(6). Prominent mid-lateral stripe reaching from opercle to caudal peduncle. **Burrhead Chub** – *Macrhybopsis marconis,* 2.4 in
7’. Incomplete mid-lateral stripe and more pronounced posteriorly on caudal peduncle; dorsal scales with black melanophores lining scale margins. **Shoal Chub** – *Macrhybopsis hyostoma,* 2.7 in

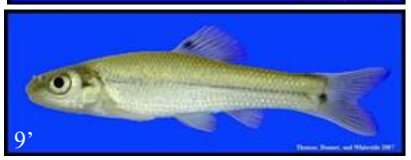




8(6). Predorsal scales appear smaller than scales on lateral body, or appear as overlapping scales; black spot in the middle, anterior portion of the dorsal fin… 9
8’. Predorsal scales not crowded; without black spot in the middle, anterior portion of the dorsal fin… 10

9(8). Caudal spot, if distinct, continuous with mid-lateral stripe; lateral line incomplete; intestine long, more than twice the standard length. **Fathead Minnow** – *Pimephales promelas,* 2.6 in
9’. Caudal spot distinct from mid-lateral stripe; lateral line complete; intestine forming a short S-shaped loop. **Bullhead Minnow** – *Pimephales vigilax,* 2.5 in

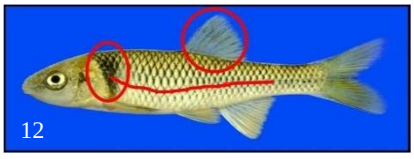


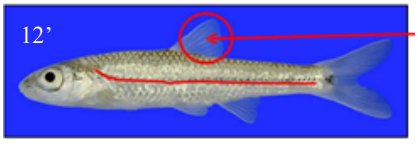


10(8). Long intestine in a flat coil...11
10’. Short S-shaped intestine….12

Cyprinidae (Carps and Minnows) (continued)

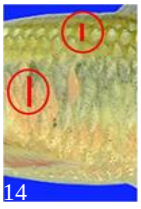
11(10). Black mid-lateral stripe extends through the eye to snout; eye width greater than or equal to snout length. **Guadalupe Roundnose Minnow** – *Dionda nigrotaeniata,* 2.5 in
11'. Mid-lateral . stripe, if present does not extend through the eye to the snout; small eyes, width less than snout length. **Plains Minnow** – *Hybognathus placitus,* 3.2 in

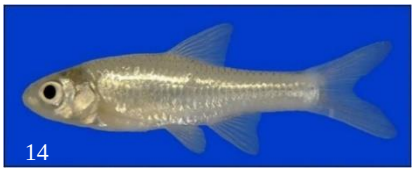




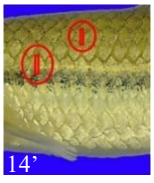
12(10). Straight or slightly decurved; scales not diamond shaped… 14
12'. Moderately decurved lateral line; diamond shaped scales… 13

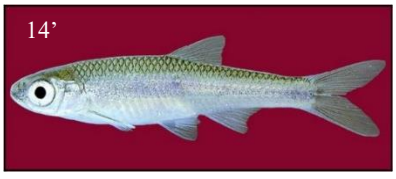
13(12). Terminal mouth. **Red Shiner** – *Cyprinella lutrensis,* 2.5 in
13'. Subterminal mouth with black caudal spot. **Blacktail Shiner** – *Cyprinella venusta,* 4 in





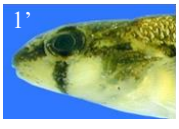
14(12). Elevated lateral line scales (taller than wide) without black pigment on lateral line. **Ghost Shiner** – *Notropis buchanani,* 1.3 in
14'. Without elevated lateral line scales; depressed pelvic fins reach or extend past origin of anal fin; eye diameter greater than snout length. **Texas Shiner** – *Notropis amabilis,* 2.4 in





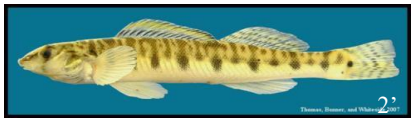
Percidae (Perches)

1. Long snout overhanging upper lip; many dark vertical bars on body…2
1'. Snout not overhanging upper lip; few dark vertical bars on body, or body with a pattern other than vertical bars…3

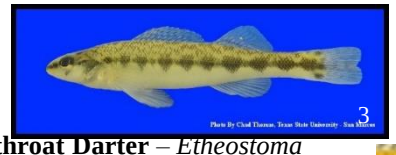


2(1). Body with 14 to 16 thin vertical bars of similar length… **Bigscale Logperch** – *Percina macrolepida*, 4in
2'. Body with hourglass shaped bars… **Texas Logperch** – *Percina carbonaria*, 4.7 in

3(1). Sides of body with large dark blotches; midline of abdomen naked or with enlarged scales. **Dusky Darter** – *Percina sciera*, 4 in
3'. Sides of body without large dark blotches; scales on abdomen normal… 4



4(3). Lateral line arched; breast without scales. **Slough Darter** – *Etheostoma gracile*
4'. Lateral line straight…5



5(4). Horizontal dashes between vertical bars. **Greenthroat Darter** – *Etheostoma lepidum*, 2.3 in
5'. Anterior dark dashes, posterior vertical barring. **Orangthroat Darter** – *Etheostoma spectabile,* 1.4-1.6 in