NATIONAL
FISH HABITAT
PARTNERSHIP

Meeting of the National Fish Habitat Board Hosted by:

TEXAS PARKS & WILDLIFE

Meeting Book for The National Fish Habitat Board

October 17-18, 2018

National Fish Habitat Board Meeting
Kerr Wildlife Management Area in Hunt, Texas
October 17 - 18, 2018

Agenda and Board Book Tabs

Conference line: 800.768.2983, **Passcode:** 8383466

Wednesday WebEx link: https://cc.callinfo.com/r/1d87t9g40p95x&eom

Wednesday, October 17, 2018

9:00 – 9:30	Welcome		Craig Bonds *(Texas Parks and Wildlife Department Director of Inland Fisheries)*

9:30 – 10:30	Welcome, Attendance, Introductions, and Housekeeping
	Desired outcomes:
	• Welcome and introduce new Board members.
	• **Board action** to:
	  o **Approve** the October meeting agenda and June meeting summary.
	• **Chair Nomination Committee** nominates a new NFHP Board Chair, **Board votes** on nominee.
	• **Board awareness** of 2019 meeting schedule.
	  o **Discuss** and decide on a 2019 fall meeting location.
		Tab 1	Chris Moore (*Acting Board Chair, Mid-Atlantic Fishery Management Council*)

10:30 – 11:00	FHP Workshop Summary *Desired outcome:* • **Board awareness** of FHP workshop discussions, accomplishments, and next steps.		*TBD*
11:00 – 11:15	BREAK		
11:15 – 11:45	Update from the Fish & Wildlife Service *Desired outcome:* • **Board awareness** of status of FY19 funding and NFHP staff support from FWS.		David Hoskins (*Board Member, US Fish and Wildlife Service)*
11:45 – 12:15	Legislative Update *Desired outcome:* • **Board awareness** of status of NFHP legislation and committee actions to contribute resources for FHP educational toolkit.	Tab 2	Christy Plumer (*Board Member, Theodore Roosevelt Conservation Partnership)*
12:15 – 1:30	Lunch at Mo Ranch		

1:30 – 2:00	Budget & Multistate Grant Update *Desired outcome:* • **Board awareness** of NFHP budget and status of multistate grant application.	Tab 3	Ryan Roberts (*Board Staff/AFWA)*
2:00 – 2:45	Beyond the Pond Update *Desired outcomes:* • **Board awareness** of Beyond the Pond July Board meeting outcomes, new NFHP Board representatives, and future plans. • **Board nomination** of new NFHP Beyond the Pond Board representatives.	Tab 4	Chris Moore (*Vice Chair, Mid Atlantic Fishery Management Council)* and Ryan Roberts (*Board Staff/AFWA)*
2:15 – 3:00	Science & Data Committee Update *Desired outcomes:* • **Board awareness** of committee accomplishments including progress on the NFHP Project Tracking Database. • **Board awareness** of USGS supporting work for NFHP Science and Data efforts	Tab 5	Gary Whelan *(Science and Data Committee Co-Chair)* Daniel Wieferich (*USGS)*
3:00 – 3:15	BREAK		
3:15 – 3:30	Communications Committee Update *Desired outcome:* • **Board awareness** of committee accomplishments from the 2018 work plan and the 2018 Waters to Watch list.	Tab 6	Ryan Roberts *(Board Staff/AFWA)*
3:30 – 4:00	Presentation from Western Native Trout Initiative *Desired outcome:* • **Board awareness** of latest WNTI projects and progress.	Tab 7	Therese Thompson (*Western Native Trout Initiative FHP coordinator*)
4:00 – 5:00	2019 Visioning *Desired outcome:* • **Continuation of Board discussion** from 2016 Executive Session and March 2018 Board meeting.	Tab 8	Chris Moore (*Vice Chair, Mid Atlantic Fishery Management Council)*

Thursday, October 18, 2018

Conference line: 800.768.2983, **Passcode:** 8383466
Thursday WebEx link: https://cc.callinfo.com/r/1xumv0ui6xc6h&eom

9:00 – 9:15	Welcome & Housekeeping		New Board Chair
9:15 – 9:45	Overview of Lake Wichita Project *Desired outcome:* • **Board awareness** of a local NFHP project.	Tab 9	Tom Lang (*Board Member, American Fisheries Society*)
9:45 – 10:15	Coastal Conservation Association *Desired outcome:* • **Board awareness** of CCA projects.	Tab 10	John Blaha (*Director, Coastal Conservation Association)*
10:15 – 11:15	Partnerships Committee Update *Desired outcome:* • **Board awareness** of the overall results from the FHP Evaluation process. • **Board review** of draft FHP Evaluation report (to be finalized on January Board call).	Tab 11	Stan Allen *(Board Member, Pacific States Marine Fisheries Commission)*
11:15 – 11:30	BREAK		
11:30 – 11:45	AFS/NFHP Award Proposal *Desired outcome:* • **Board awareness** of the decisions and next steps of the committee with regard to an AFS/NFHP award.	Tab 12	Tom Lang (*Board Member, American Fisheries Society*)
11:45 – 12:15	Native Fish Conservation Areas of the Southwestern USA: Texas Field Trip Intro *Desired outcome:* • **Board awareness** of a local NFHP projects in Texas as they relate to a larger effort.	Tab 13	Tim Birdsong *(Texas Parks and Wildlife)*
12:15	Board Meeting Adjourns		
12:30 – 1:30	Lunch at Mo Ranch		
1:30 – 5:00	Field trip - Guadalupe River fish habitat project tour		

Tentative National Fish Habitat Board Meetings 2019-2020

Year	Date	Location	Comments
2019	January 16 (Wed)	Tele/web conference	Annual budget & priorities
	March 13-14 (Wed-Thurs)	Washington, DC Area	Trout Unlimited holding room
	June 26 (Wed)	Tele/web conference	
	Summer (TBD)	Tele/web conference	Introductory call for new members.
	October 16-17 (Wed-Thurs)	Coastal MI (Great Lakes)?	
2020	January 15 (Wed)	Tele/web conference	
	March 18-19 (Wed-Thurs)		
	June 24 (Wed)	Tele/web conference	
	Summer (TBD)	Tele/web conference	Introductory call for new members.
	October 14-15 (Wed-Thurs)	Hawaii? Seattle, WA?	

Record of Past Board Meetings 2006-2018

Year	Date	Location	Facility
2006	September 22	Aspen, Colorado	Hotel
	November 16	Washington, DC	Hall of States
2007	January 16	Teleconference	
	March 1-2	Washington, DC	Environmental Protection Agency
	June 6-7	Washington, DC	Commerce Department
	October 2-3	Arlington, VA	Hotel
2008	February 20-21	St. Petersburg, FL	Tampa Bay Watch
	May 13-14	Arlington, VA	The Nature Conservancy
	October 7-8	Arlington, VA	The Nature Conservancy

2009	March 4-5	Harrisburg, PA	Pennsylvania Fish & Boat Commission
	June 25, 2009	Leesburg, VA	National Conference Center
	October 7-8	Arlington, VA	The Nature Conservancy
2010	January 15	Teleconference	
	March 3-4	Memphis, TN	Ducks Unlimited
	June 9-10	Silver Spring, MD	NOAA headquarters
	August 25	Teleconference	
	October 12-14	Portland, OR	Columbia River Intertribal Fisheries Commission
2011	January 13	Teleconference	
	March 11	Teleconference	
	April 12-13	Arlington, VA	The Nature Conservancy
	July 26-27	Madison, WI	Hotel
	October 19-20	Albuquerque, NM	FWS Regional Office
2012	January 12	Teleconference	
	March 1	Teleconference	
	April 17-18	Arlington, VA	The Nature Conservancy
	July 10-11	Portland, ME	Hotel
	October 16-17	Ridgedale, MO	Big Cedar Lodge
2013	January 16	Teleconference	
	February 26-27	Arlington, VA	FWS headquarters
	April 15	Teleconference	
	June 25-26	Salt Lake City, UT	Utah State Capitol
	October 22-23	Charleston, SC	SC DNR
2014	January 15	Teleconference	
	March 9-10	Denver, CO	
	June 25	Tele/web conference	
	November 8-9	National Harbor, MD	Held in conjunction w/ RAE Summit
2015	January 14	Tele/web conference	
	March 3-4	Arlington, VA	The Nature Conservancy
	June 24	Tele/web conference	
	September 22	Tele/web conference	Introductory call for new members and interested individuals.
	October 20-21	Sacramento, CA	Hotel
2016	January 20	Tele/web conference	
	March 8-9	Arlington, VA	The Nature Conservancy
	June 29	Tele/web conference	
	October 26-27	Panama City, FL	
2017	January 18	Tele/web conference	
	March 21	Rosslyn, VA	Trout Unlimited Offices
	June 28	Tele/web conference	
	August 29	Tele/web conference	Introductory call for new members and interested individuals.
	October 18-19	Rapid City, SD	South Dakota Game, Fish & Parks

2018	January	Tele/web conference	
	March 7-8	Washington, DC	USFS
	June 7	Tele/web conference	Introductory call for new members and interested individuals.
	June 27	Tele/web conference	
	October 17-18	Hunt, TX	Texas Parks and Wildlife Department

Total: 52 regularly scheduled meetings (in-person and teleconference) held to date. 3 introductory calls for new members held to date.

Draft National Fish Habitat Board Meeting Summary: June 27, 2018

Members present:

Peter Aarrestad (NEAFWA)
Stan Allen (PSMFC)
Chair Tom Champeau (At-Large State Seat)
David Hoskins *for* Jim Kurth (USFWS)
Tom Lang (AFS)
Mike Leonard (ASA)
Vice Chair Chris Moore (MAFMC)
Bryan Moore *for* Chris Wood (TU) – *second half*
Doug Norton *for* Benita Best-Wong (EPA)
Doug Nygren (MAFWA)
Sam Rauch (NOAA Fisheries), Pat Montanio (NOAA Fisheries)
Ed Schriever (WAFWA)
Dan Shively *for* Rob Harper (USFS)
Bobby Wilson (SEAFWA)

Members absent:

Mike Andrews (TNC), Doug Beard (USGS), Doug Boyd (SBPC), Christy Plumer (TRCP), Ron Regan (AFWA), and Sean Stone (CCA).

Approved by motion:

- March Meeting Summary; motion by Chris Moore, seconded by Stan Allen.
- June Board meeting agenda as amended; motion by Peter Aarrestad, second by Chris Moore.
- Membership of the 2018 Nomination Committee (Chris Moore, Tom Lang, and Doug Boyd); motion by Ed Schriever, seconded by Stan Allen.

Updates and discussions:

- Welcome – Tom introduced Bobby Wilson as the SEAFWA representative (replacing Ross Mellinchuk) on the NFHP Board and Bobby introduced himself to the group. Tom informed the Board that we are looking to replace Fred Matt as the Tribal representative on the Board and is open to recommendations from Board members as to who would be a suitable replacement (email any suggestions to Susan Wells and Alex Atkinson). Tom reminded the Board of our upcoming meeting schedule: next in person meeting October 17-18 in Texas and next webinar call will be in January 2019 (date TBD). All Board members are highly encouraged to also attend the FHP Workshop to be held on October 15-16 in Texas. Tom announced his retirement beginning September 1, 2018 and that a new chair will be elected at the October meeting. An ad-hoc Nominations Committee was formed with Board member volunteers (Chris Moore, Tom Lang, Doug Boyd). Chris Moore, Vice Chair, will act as Board Chair until the new Board chair is elected. Tom notified the Board that staff will be assembling an email-based update to keep Board members informed in between Board meetings on Board actions and progress, FHP updates, and the NFHP newsletter.

- Update from U.S. Fish & Wildlife Service – David Hoskins updated the Board on 2018 FHP allocations (totaling nearly $4M) and internal adjustments allowing more funding to go directly to on the ground projects in response to concerns raised by the NFHP Board. This year, all FHPs will receive $75k in coordination funds, including Southeast Alaska and Pacific Lamprey FHPs, and the remaining funds go towards the 18 FHPs eligible for project funds. The USFWS will no longer fund the NFHP Assessment.

- Science and Data Committee Update – Gary Whelan updated the Board on the Science and Data Committee's 2018 priorities. The SDC held a call with Doug Norton (EPA) to discuss the use of the NFHP Assessment data in the USEPA Healthy Watershed Assessment. The NFHP Assessment data is being used appropriately, however, the SDC will work with Doug to clarify the caveats in the documentation

outlining the assumptions in the NFHP Assessment data. The Inland Assessment (Priority N) does not have funding and is not moving forward. The Coastal Assessment is moving forward, task teams are populated, a model approach was reviewed, and funding is being acquired. Work on the NFHP Project Tracking Database (Priority O) to complete database functions continues. Through USGS in-kind support, maintenance and improvement of NFHP Assessment data (Priority P) is also moving forward.

- Legislative Committee Update – Mike Leonard updated the Board on legislative activity, although there is not much to update since the March Board meeting. The Committee is focusing on getting a House bill introduced and is working with Congressman Rob Whittman (R-VA) on finishing the language.
- Partnerships Committee Update – Stan Allen updated the Board on the Partnerships Committee's four main priorities. The FHP Evaluation Review (Priority A) Team has formed and is working to review the submitted Evaluations from the FHPs. The Review Team will complete a draft report to share with the Board at the October Board meeting. The current Multistate Conservation Grant process is ongoing and the Committee will look to include the Budget and Finance Committee in a dialog about a future application approach (Priority B). Conversations are occurring on FHP bi-monthly calls as well as among the Workshop Planning Team around strategies for multiple FHPs to jointly submit project proposals to alternative funding sources (Priority C). The Committee will also look to include the Budget and Finance Committee in further discussions. An FHP Workshop Planning Team has formed and is meeting regularly to advance planning for October 15-16 FHP Workshop (Priority D). A survey was completed to gather initial input from FHP coordinators and Board members.
- Multistate Grant Update – Ryan Roberts updated the Board about the 2019 multistate grant awards proposal process. NFHP will be notified in the next two weeks as to whether they've been selected to submit a full proposal. AFWA is finishing up the process to get 2018 funding out to FHPs. Ryan reminded the Board that language to include the NFHP Project Tracking Database was added to our National Conservation Need statement back in January so it could be funded through this mechanism in future years. NOAA put forward the $20k this year in order to keep it operating.
- FHP Workshop Planning Update – Debbie Hart updated the Board on the FHP Workshop planning process. October 15-16, 2018 will be the next FHP workshop. An FHP Workshop Planning Team has formed and met three times and will meet again on June 29. A survey was developed and sent to FHP coordinators and Board members to gather input on workshop topics and ideas. The Workshop will focus on funding and fundraising, but will also include topics such as business planning, growing capacity, and developing an online RFP and other lessons learned to be shared among FHPs. The Workshop Planning Team also suggested several agenda ideas for the Beyond the Pond Board meeting in July to Ryan Roberts.
- Communications Committee Update – Ryan Roberts updated the Board about committee activities including: Rep Your Water company fundraising deal with Beyond the Pond, Waters to Watch, and the upcoming, in-person Beyond the Pond Board meeting on July 23, 2018 in Denver, CO. The Waters to Watch campaign deadline was extended to June 15 and we have 6 submissions. The Board discussed accepting multiple submissions from FHPs in order to complete the 10 Waters to Watch.
- Beyond the Pond Update – Ryan Roberts updated the Board about the planning for the upcoming Beyond the Pond in-person Board meeting on July 23, 2018 in Denver, CO. Six of the eight Board members will be in attendance and NFHP Vice Chair, Chris Moore, will also attend. Sessions during the all-day meeting will address Board composition, management, budget, fundraising, FHP needs, and a session for dialog with FHPs. Ryan will distribute the draft agenda to NFHP Board members and FHPs if there is interest. NFHP Board members should share any comments or ideas about next steps for the Beyond the Pond Board with Ryan.
- FHP Update – Debbie Hart updated the Board about FHP coordination. FHP bi-monthly calls have been resumed this year starting in March and are now led by rotating FHPs who work together to develop the call agendas. These calls provide an opportunity for FHPs to share and discuss successes and challenges and also receive updates on NFHP Board activities and plans from Board staff. NFHP Board

members are invited and encouraged to attend these calls. Discussions from the May 24 FHP call focused on identifying a thematic topic to identify a niche for NFHP to help develop new funding sources. FHPs are also interested in a dialog with the U.S. Fish and Wildlife Service about FHP accomplishments as well as exploring where FHPs can best help leverage the funding from the USFWS.

Action items:

- Nomination committee led by Chris Moore will schedule a call in the coming weeks (Tom Lang and Doug Boyd).
- Tribal NFHP Board representative replacement – send suggestions to Susan Wells and Alex Atkinson.
- Email board update in between Board meetings – send Alex Atkinson suggestions for any other ideas of information that would be helpful to be aware of in between NFHP Board meetings.
- Planning for the Beyond the Pond Board meeting on July 23, 2018 in Denver, CO – send Ryan Roberts any suggestions for topics, questions, or concerns that should be incorporated into that meeting. Chris Moore will be attending that meeting on behalf of NFHP.

Future Board meetings (2018-2019):

- October 17-18, 2018 (San Antonio, Texas) with FHP Workshop October 15-16
- January 2019 webinar (date TBD)

Board approved documents:

- March Board Meeting Notes

Additional attendees:
Alex Atkinson (Board Staff – NOAA contract)
Gary Whelan (SDC Co-Chair MI DNR)
Ryan Roberts (Board Staff - AFWA)
Debbie Hart (SEAKFHP)
Steve Perry (EBTJV)
Therese Thompson (WNTI)
Jessica Graham (SARP)
Stephanie Vail-Muse (DFHP)
Heidi Keuler (Fishers and Farmers FHP)
Rick Westerhof (GLBFHP)

Title: Legislative Update

Desired outcome: Board awareness of and engagement on the National Fish Habitat Conservation Through Partnership Act

Background:

Since the inception of the National Fish Habitat Partnership, a NFHP legislative coalition has been working to craft a legislative proposal that would achieve the goals of the Board and establish an organic statute for the Partnership and the National Fish Habitat Action Plan. The NFHP legislative team includes representatives from The Nature Conservancy, Trout Unlimited, the Association of Fish and Wildlife Agencies, the American Sportfishing Association, the Theodore Roosevelt Conservation Partnership, the Coastal Conservation Association and the Congressional Sportsmen's Foundation. Since 2006, this team has worked closely together to advance this legislative proposal – now known as the National Fish Habitat Conservation Through Partnerships Act (NFHCTPA). Previous versions of NFHCTPA have enjoyed broad bipartisan support in Congress, including bipartisan approval by the Senate Environment and Public Works (EPW) Committee (the Senate Committee of jurisdiction) and the Senate Energy and Natural Resources (ENR) Committee. The legislation has not been introduced in the House of Representatives since 2009, and instead the legislative team has focused in recent years on the Senate as the most likely body in which to advance the bill. For several reasons, Congressional approval of NFHCTPA has been complicated, with leadership shifts, initial concerns about the scope and extent of the program, a general distaste for new federal programs and the cost of the legislation among the primary obstacles.

In recent years, smaller pieces of legislation such as NFHCTPA are often unsuccessful as stand-alone bills and must move forward on larger legislative packages such as comprehensive energy legislation or public lands packages. For several Congresses now the legislative team has worked to ensure NFHCTPA language is an integral component of any sportsmen's package. During 2015 and 2016, the NFHP legislative coalition worked actively with Congressional staff from the Senate ENR Committee on the inclusion of NFHCTPA in S. 659, the Bipartisan Sportsmen's Act. NFHCA language was included in this package thanks largely to the leadership of Senator Lisa Murkowski (R-AK). The Bipartisan Sportsmen's Act was then included in the Senate Energy Bill, which passed the Senate in April 2016 by a vote of 85-12. While companion NFHCTPA language was not included in the House Energy Bill, Congress ran out of time to rectify differences between the two chambers' Energy Bills during conference negotiations last year. Further, the start of the new Congress required the legislative team to focus once again on reintroduction of NFHCTPA in the 115th Congress.

2018 Legislative Priority and Accomplishments:

Board Priority Task A: *Continue coordination with legislative affairs team in supporting developments of the National Fish Habitat Conservation Act; (assign to eligible Board members and legislative team)*

Accomplishments: With a shift in leadership this Congress at the Senate EPW Committee from Chairman Boxer (D-CA) to Chairman Barrasso (R-WY), the legislative team has recently seen a renewed interest in an EPW Committee-driven sportsmen's package (as compared to last Congress when the Senate ENR Committee ran this package). Last year, EPW Committee Chairman Barrasso

introduced the HELP for Wildlife Act (S. 1514) which includes strong NFHCTPA language. Senator Cardin (D-MD), the Ranking Member of the Subcommittee of jurisdiction over NFHCTPA, has also continued to be one of our strongest proponents and has worked closely with Chairman Barrasso to ensure inclusion of NFHCTPA in the Committee's sportsmen's package. The HELP for Wildlife Act was approved by the Senate EPW Committee and moved to the full Senate calendar on October 5, 2017.

Similarly, the legislative coalition has received ongoing support for NFHCTPA from the Senate ENR Committee this Congress, still under Chairman Murkowski's leadership, as this Committee works to advance their own sportsmen's package. Currently, the Senate ENR Committee sportsmen's package (S. 733) does not include NFHCA language. However, Murkowski staff supports pulling the EPW Committee NFHCTPA language into a merged sportsmen's package should a pathway become evident for advancing a Senate Energy Bill this Congress.

Additionally, for the first time since 2009, NFHCTPA legislation was introduced in the House of Representatives. On August 7, 2018, Congressman Rob Wittman (R-VA, 1st) introduced companion House NFHCTPA legislation.

Approach: As we near the end of the 115th Congress, the NFHP legislative coalition is focusing on educating key Congressional members on the importance of enacting NFHCTPA this Congress. The Legislative Team will be focusing greater attention on House Member outreach and education on fish habitat partnerships and their on-the-ground success as well as working to identify potential packages upon which the NFHCTPA may be able to move through Congress this year. There is a small chance a natural resources legislative package – often termed a "Lands Package" – may be moved forward during the lame duck session of the 115th Congress. Should a package of this nature arise, the NFHP Legislative Team will be strongly encouraging our House and Senate champions to include NFHCTPA within this larger package.

Title: Budget and Multistate Conservation Grant Program Update

Desired outcomes:
• Board awareness of the 2019 Multistate Grant Application supporting NFHP through the AFWA Fisheries and Water Resources Policy Committee and Ocean Resources Policy Committee.

Background:
In 2015, the FHPs under the National Fish Habitat Partnership agreed to a 3-year collaborative approach to applying for Multistate Grant Funding through the Association of Fish & Wildlife Agencies (AFWA). The 2018 application marked the last year of that agreement.

The first grant in this 3-year approach was awarded during the 2016 Grant cycle, at $86,000. The 2017 grant was awarded at $143,000 and the 2018 grant was awarded at $209,680. It is expected that NFHP will request a 12-month extension on the funding remaining for the 2018 grant that would extend the grant until December of 2019.

The National Conservation Need (NCN) established by the Fisheries and Water Resources Policy Committee and Ocean Resources Policy Committees of AFWA was reviewed in December and the Board through AFWA should work with the Committees to maintain that support for NFHP.

The National Fish Habitat Board was successful in their grant application for the partnerships in 2019, being awarded $250,680.00 for the partnerships and to support the National Fish Habitat Board. Other relevant NFHP grants applications that were awarded for the 2019 cycle, included the NFHP Project Tracking Database ($20,000) (Pacific States Marine Fisheries Commission), and the Driftless Area Restoration Effort ($30,000) (Trout Unlimited). The grant award for the Driftless Area project was applied for through the Farm Bill NCN for NFHP, which was a better fit for the Driftless application. The 2019 application funding is expected to be received between January to March of 2019.

It is expected that following the National Fish Habitat Partnership October workshop there will be an Action item related to how the FHPs would like to proceed in future grant years (FY 20) and beyond.

Timeline for future proposals:
November (Complete)
The Association of Fish and Wildlife Agencies (Association) solicits National Conservation Needs (NCNs) from each Association committee and the four Regional Associations of state fish and wildlife agencies.

February (Complete)
Each committee or Regional Association may submit one proposed NCN. NCNs are due to the MSCGP Coordinator.

March -April
North American Wildlife & Natural Resources Conference (Grants Committee Meeting – March 29)

During the North American Wildlife and Natural Resources Conference, the National Grants Committee convenes to review the proposed NCNs and prepare a list of recommended NCNs for the State Directors' approval.

State Directors approve NCNs during the Association's business meeting at the North American Conference. The selected NCNs establish the states' funding priorities for the upcoming grant cycle.

Briefing Book Materials:
Tab xx 2019 NFHP Grant Application which was awarded.

2019 Multistate Conservation Grant Program

Grant Proposal

Executive Summary
(Limit – 2 Pages)

1. **Project Title: Conserving Fish Habitat collaboratively in the U.S. through the National Fish Habitat Partnership**

2. **Full Legal Name of Organization:** National Fish Habitat Board.
   If awarded, the grant will be administered on behalf of the National Fish Habitat Board by the Association of Fish and Wildlife Agencies, 1100 First Street NE, Suite 825, Washington DC, 20002

3. **Organization Information:**
   a. Applicant Classification: Nongovernmental Organization
   b. Nongovernmental Organization Classification (if applicable): 501(c)6

4. **Lead Applicant's Contact Information:**
   Mr. Tom Champeau, Chief (Inland Fisheries), Florida Fish and Wildlife Commission
   Chair, National Fish Habitat Board
   c/o Association of Fish and Wildlife Agencies
   1100 1st Street NE, Suite 825
   Washington, DC 20002
   Email: tom.champeau@myfwc.com
   Phone Number: 850-556-7684

5. **Name and Affiliation of Co-Investigator(s)/Partner(s) (if applicable):**
   Gary Whelan, Michigan Department of Natural Resources
   Ryan Roberts, National Fish Habitat Partnership Program Manager

6. **Project Length: (1 year)**

7. **Funding Requested:**
   a. Total Amount for 2018: $250,680.00

8. Estimate of Partnership Funds to be Leveraged (if applicable): $ 1 Million

9. Funding Source.

Percent WR:_____% Percent SFR: 100%

10. State Benefit Requirement: a. X b. X c. X d.___

11. Primary National Conservation Need (NCN) Addressed:
NCN #13: Broadening Conservation Partnerships through the National Fish Habitat Partnership

12. Terms and Conditions. *Use of MSCGP Grants - All applicants must ensure that their proposed project does not fund, in whole or in part, an activity that promotes or encourages opposition to the regulated hunting or trapping of wildlife or taking of sport fish.*

☒ I agree with the above terms and conditions.

13. Summary Statement (200 words or less):
This project will help address conservation of waterways, to promote healthy habitat, and thriving fish populations that are vital to the well-being of American society, providing clean water, food, and recreation. Healthy waters sustain their ecological functions and resilience while meeting the economic and social needs of society. Unfortunately, in many places around the United States, fish and the habitats on which they depend are in decline. Through the efforts of the National Fish Habitat Partnership, established in 2006 our 20 partnerships established regionally are collaborating on efforts to stop and reverse declines and impairment of fish habitat through voluntary, non-regulatory efforts. The National Fish Habitat Partnership brings a focused and coordinated approach to conserving, rehabilitating, and enhancing the nation's aquatic habitats under the objectives of the National Fish Habitat Action Plan. This proposal strengthens that approach by linking the oversight responsibility of the Board and the operational responsibility of the FHPs to achieve national and regional conservation goals established through the National Fish Habitat Action Plan 2nd Edition (2012). Through collaborative projects, partnerships under the National Fish Habitat Partnership are compounding their efforts in maximizing potential, reach and ultimately successful conservation outcomes in collaboration regionally through this project.

Project Narrative
(Limit – 10 Pages)

Title:
Conserving Fish Habitat collaboratively in the U.S. through the National Fish Habitat Partnership

Problem Statement:
Waterways, healthy habitat, and thriving fish populations are vital to the well-being of American society, providing clean water, food, and recreation. Healthy waters sustain their ecological functions and resilience while meeting the economic and social needs of society. Unfortunately, in many places around the United States, fish and the habitats on which they depend are in decline. This is a particular concern to the 48 million recreational anglers who pursue fish and too many others who depend upon fish and shellfish for sustenance and commerce. Nearly 40 percent of the nation's freshwater fish species are considered at risk or vulnerable to extinction. Through the efforts of the National Fish Habitat Partnership, established in 2006 our 20 Fish Habitat Partnerships established regionally are collaborating on efforts to stop and reverse declines and impairment of fish habitat through voluntary, non-regulatory efforts.

Project Goals and Objectives
The project goals for this grant application as described in the deliverables section are diverse and designed to meet additional needs and build capacity for the Fish Habitat Partnerships to achieve their objectives. This grant funding provides resources to the Fish Habitat Partnerships that they otherwise would not have to accomplish strategic objectives, due to current limited funding and growing partnership needs. The number of Board Recognized Fish Habitat Partnerships have grown in number over the past several years, but overall funding for the National Fish Habitat Partnership has remained static. This multistate grant funding provides an opportunity for Fish Habitat Partnerships to coordinate shared regional and national conservation priorities, advancing strategic initiatives for fish habitat while catalyzing collaboration across the U.S.

Deliverables and Benefits

The National Fish Habitat Partnership brings a focused and coordinated approach to conserving, rehabilitating, and enhancing the nation's aquatic habitats under the objectives of the National Fish Habitat Action Plan. This proposal strengthens that approach by linking the oversight responsibility of the Board and the operational responsibility of the FHPs to achieve national and regional science and data driven conservation goals.

In general, this project will support activities of the Fish Habitat Partnerships that will help to achieve four of the objectives in the National Fish Habitat Action Plan, 2nd Edition:

1. *Achieve measurable habitat conservation results* through strategic actions of Fish Habitat Partnerships that improve ecological condition, restore natural processes, or prevent the decline of intact and healthy systems leading to better fish habitat conditions and increased fishing opportunities.
2. *Broaden the community of support for fish habitat conservation* by improving fish populations that lead to increased fishing opportunities, fostering the participation of local communities – especially young people – in conservation activities, and raising public awareness of the role healthy fish habitats and robust fisheries play in the quality of life and well-being of local communities.
3. *Fill gaps in the National Fish Habitat Assessment* and its associated database to empower strategic conservation action supported by the best available scientific information to improve people's lives in a manner consistent with fish habitat conservation goals.
4. *Communicate the conservation outcomes* produced collectively by Fish Habitat Partnerships, as well as new opportunities and voluntary approaches for conserving fish habitat, to the public and conservation partners.

More specifically, the project will provide the following deliverables:

- Across the United States through the **Reservoir Fish Habitat Partnership**, this project will help fisheries habitat loss in reservoirs due to the natural aging process threatens the recreational and economic value of this vital resource. The U.S. Army Corps of Engineers (USACE) is initiating internal discussions on how to deal with and correct issues of declining storage, flood control capacity, hydropower generation, restricted navigation, municipal water supply, etc. due largely to sedimentation and nutrification. However, to date, no natural resource affects have been discussed. While sedimentation is a primary concern, nutrification and water releases need to be included in discussions moving forward. The Reservoir Fisheries Habitat Partnership proposes to develop a "white paper" focusing on the effects of reservoir aging on habitat loss and what that means to fish community structure and the resultant effects on recreational opportunities and associated economics. This effort will be done in concert with USACE staff (Land Uses and Natural Resources Program Manager and Senior Hydrologist), Dr. Esteban Miranda (habitat loss and effects on fish community structure) and Dr. Kevin Hunt (economics) at Mississippi State University. This information will then be provided to USACE Administration to provide background for inclusion of "natural resource" ramifications of reservoir aging in the hope that funding for the remediation of these issues will be included in any funding packages. NFHP MSCG funding, through the Reservoir Fisheries Habitat Partnership, will be used for graduate student literature reviews and any coordination efforts (travel, salaries) to produce the white paper. Additional funding will be needed for this effort and we intend to solicit funding from USACE and the Bureau of Reclamation.

- **In Hawaii**, the Hawaii Fish Habitat Partnership is **Developing a spatial framework to link watershed characteristics to coastal ecosystems -** This project will expand on-going stream and estuary hydrologic and habitat analysis to include adjacent near-coastal marine habitats. In Hawaii, these aquatic systems function as nursery habitat and are critically important for production of recreationally- and commercially-important fish and invertebrates. A variety of shallow-water aquatic systems are represented along the coastline of the main Hawaiian Islands. These include semi-enclosed embayments, both groundwater- and surface water-supported estuaries and ancient Hawaiian fishpond structures. This subaward will provide continuation support to current effort to develop a spatial framework linking watershed characteristics to estuarine systems. This geospatial analysis will include the Island of Oahu and will extend to Maui as funding and resources permit. Results of this work will provide information for prioritizing conservation and management of Hawaiian estuaries and will produce information for revisions of the Hawaii portion of National Assessment of Fish Habitat.

- On the Pacific Coast, a program will be implemented titled: ***Intertidal Water Crossing Structures on U.S. West Coast Estuarine Fish and Their Habitat: A Multi-State Conservation Grant Proposal from the California Fish Passage Forum, the Pacific Marine and Estuarine Fish Habitat Partnership, and the Pacific Lamprey Fish Habitat Partnership***

  Water crossing structures enable the transportation of people, livestock, vehicles, and materials across rivers and other bodies of water. These structures have often created barriers to fish passage, an issue which has recently drawn intense scrutiny due to concerns over impacts to anadromous fish. Although much work has focused on the impacts of *freshwater* crossing structures, *intertidal* structures have received less attention. This may be due to the importance of passage for adult anadromous fish in freshwater, and that bidirectional flows in intertidal environments complicate interpretation of structures as barriers. Intertidal water crossing structures likely have adverse impacts on juvenile life stages of fish due not only to impacts to passage, but also to impacts to estuarine habitats extensively used by these species as rearing environments. Examining the impacts of intertidal water crossing structures only through the lens of fish passage therefore misses key aspects to how these structures can affect fish.

  A 2018 draft report, titled, "*Effects of Intertidal Water Crossing Structures on Estuarine Fish and Their Habitat: A literature review and synthesis*," (NOAA, Washington Department of Fish and Wildlife, Cramer Fish Sciences) reviews literature on intertidal water crossing structures and how they affect fish that depend on intertidal habitats for passage during migration or for extended rearing during early life stages. Their findings are important for establishing fish passage criteria, providing design guidelines, and identifying key data gaps for future research of intertidal water crossing structures.

  The report notes that numerous information gaps exist concerning intertidal water crossing structures. Simple questions regarding the impacts of intertidal water crossing structures upon fish populations remain unanswered because we lack information on everything from the

locations of these structures, to local movement dynamics and the population consequences of lost access and changes in habitat quality and quantity.

Deliverable for the project would include the following:

1. Existing efforts—Identify existing efforts underway to document restrictions to tidal connectivity in U.S. West Coast estuaries (e.g., Oregon Watershed Enhancement Board effort, PNW Coast Landscape Conservation Design, Washington Habitat Connectivity Work Group, ODFW Connectivity Team)

2. Data gathering and compilation – Implement a call for data to obtain and compile that identify locations of passage/connectivity sites. (note: Several syntheses have occurred to date).

3. Gap analysis—Identify locations on the landscape where we lack data and information – where assessments are needed to identify where these restrictions exist.

4. Spatial analysis—Identify extent of area behind identified structures/restrictions.

5. Convening—Host a summit to identify gaps and technical (science and data) information needed to address ways to reduce restrictions as well as share tools and products developed (spatial database, etc.).

- In the Midwest**, the Midwest Glacial Lakes Partnership, Fishers and Farmers Fish Habitat Partnership, and Great Lakes Basin Fish Habitat Partnership** will collaborate throughout the Upper Midwest and provide conservation messaging regarding property management choices made by riparian property owners and how their property management can affect habitat quality in streams, lakes, and Great Lakes. It is critical for our fish habitat partnerships to collaborate with private property owners to identify critical information needs, attitudinal barriers, and limits for restoration based on property uses such as recreation or agriculture. There are numerous programs operated by county, state, and federal agencies to incentivize and manage conservation projects on private lands, but knowledge of the ecological benefits of natural shorelines and buffer zones does not necessarily lead to action by property owners. Recent research has shown that connecting to property owners' underlying sense of stewardship increases their willingness to act. Furthermore, enabling property owners to envision their property and how they would continue to achieve their objectives for their property after the proposed conservation actions are implemented would increase participation. This project will identify property owners that have implemented conservation projects and develop marketing materials to recruit and encourage other property owners to complete similar projects. Specifically, the project will contract with professional photographers, writers, and web developers to create these promotional materials. The project builds upon a previous Multistate Conservation Grant awarded to NFHP and the Midwest Glacial Lakes Partnership by expanding the ecosystems covered from inland lakes to include streams and Great Lakes. It will further build upon that grant by converting the materials created in the grant into draft articles to be submitted to targeted print and digital media such as Better Homes and Gardens, Lake and Home, Country Life, Hobby Farm, local newspapers, and tourism magazines to reach a broad audience.

- In the Western U.S. the grant would fund two strategic elements through the **Western Native Trout Initiative (WNTI) and the Desert Fish Habitat Partnership (DFHP):**

  1) Continue the successful multi state grant collaboration between WNTI and DFHP to produce an infographic/kiosk and related outreach materials for two projects co-funded by WNTI and DFHP in Idaho and Oregon in 2017. In Idaho, the Tincup Creek Stream Restoration project improves riparian conditions and habitat for 1.25 miles and 5 acres for Yellowstone Cutthroat Trout, northern leatherside chub, boreal toad, western pearl shell mussels and bluehead sucker. In Oregon, the Deep Creek Floodplain Restoration Project improves aquatic habitat and riparian function on 3.5 miles of the Deep Creek watershed, the most interconnected habitat for Redband Trout in the Crooked River basin. Project activities restore 6 sections of stream, 150 acres of floodplain, and create a temperature refuge in the North Fork Crooked River watershed for Redband Trout, speckled dace, and Columbia spotted frog. Outreach efforts will focus on increasing citizen understanding and awareness of the area and project objectives, the value of these types of restorations, and the root causes which have necessitated restoration actions.

  2) Support to strengthen strategic partnership development and outreach by working with well-established public, private and non-governmental conservation groups to develop communication, education and outreach materials to help inform potential partners and to increase overall NFHP-based western project awareness and understanding of goals, objectives and accomplishments. More specifically, activities will support a Western Native Trout Challenge angling program across 12 western states for 21 species of western native trout and char.

- Through three partnerships in the East, (**Eastern Brook Trout Joint Venture, Atlantic Coastal Fish Habitat Partnership, Southeast Aquatic Resources Partnership)** will continue its multi-year collaborative focus on whitewater to bluewater fish habitat connectivity needs that span the geographic boundaries of these three Eastern Fish Habitat Partnerships (FHPs). We will continue to assist culvert assessment work throughout the region. Additionally, we will identify priority HUC12s within our two priority HUC8s (Rivanna and Rapidan-Upper Rappahannock Rivers) in which to address fish habitat fragmentation. This will include identifying significant fish passage barriers using the tools we have previously produced, as well as apply the results of our ongoing culvert assessment work. Through the funding opportunity, these partnerships will communicate the scientific basis of river restoration through connectivity improvements throughout the Eastern U.S. to their constituents and partners.

- This grant will also provide **staff and Board support for the National Fish Habitat Partnership** through activities that highlight the National Fish Habitat Partnership program. Activities include support of national meetings in 2019. Activities also include providing communications support for the Board and partnership as well as outreach to constituents at regional and national meetings, as well as providing management services for the Board.

Monitoring and Evaluation

All of the Fish Habitat Partnerships conduct regular short and long-term monitoring for on-the-ground projects that are implemented through this grant program. Reports are also provided to the National Fish Habitat Board throughout the year and updates regarding the grant are provided to relevant AFWA committees. Outcomes are also presented at national and regional meeting across the U.S. through our network of partnerships.

Experience

Galvanized into action by continuing losses of aquatic habitat, an unprecedented coalition of anglers, conservation groups, scientists, state and federal agencies, and industry leaders forged the National Fish Habitat Action Plan in 2006. The Action Plan is an investment strategy for making the most effective use of habitat conservation dollars and achieving real gains in aquatic habitat quality and quantity by protecting, restoring, and enhancing key fisheries habitats.

Since 2006, the Partnership has supported over 700 projects benefiting fish habitat in all 50 states. The Partnership works to conserve fish habitat nationwide, leveraging federal, state, tribal, and private funding resources to achieve the greatest impact on fish populations through priority conservation projects of 20 regionally-based Fish Habitat Partnerships.

Certification Regarding Fishing/Hunting

"By submitting this proposal, the organization's primary contact and/or authorized representative identified in this grant application certifies that the National Fish Habitat Partnership (1) will not use the grant funds to fund, in whole or in part, any activity of the organization that promotes or encourages opposition to the regulated hunting or trapping of wildlife or the regulated taking of fish; and (2) that the grant funds will not be used, in whole or in part, for an activity, project, or program that promotes or encourages opposition to the regulated hunting and trapping of wildlife or the regulated taking of fish."

Certification Regarding Partnership Funds (if applicable)

"By submitting this proposal, the organization's primary contact and/or authorized representative identified in this grant application certifies that the National Fish Habitat Partnership: 1) understands that partnership fund contributions are assessed in the Association's review and selection of its priority list of MSCGP projects, but are not considered by the USFWS to be an official non-federal match/cost-share; 2) will provide the partnership funds identified in order to complete the proposed project; 3) understands that if the promised partnership funds are not provided, and there is not a sufficient explanation, potential consequences could include a poor "quality assurance" evaluation by the National Grants Committee for the organization's future MSCGP applications; the imposition of "special award conditions" on this proposed grant and/or future grants (pursuant to 43 CFR 12); and if the failure to provide partnership funds affects the scope/objective or deliverables or other terms and conditions of the grant, then the USFWS could take necessary enforcement and termination actions (pursuant to

43 CFR 12)."

Budget

*P.F: Partnership Funds – projects are not required to provide partnership funds for the multistate conservation grant program, however higher consideration is given to P.F when 2 or more projects score the same.

Budget Reflects indirect cost rate included in Total Request

	Fish Habitat Partnerships	**MSCGP**	**P.F.***	**Total**
AFWA	Program Support	$31,400.00		$31,400.00
Eastern U.S.	Atlantic Coastal FHP, Eastern Brook Trout Joint Venture, Southeast Aquatic Resources Partnership	$30,000.00		$30,000.00
Western U.S.	Desert FHP Western Native Trout Initiative	$25,000.00		$25,000.00
Midwest U.S.	Midwest Glacial Lakes Partnership Fishers and Farmers Partnership Great Lakes Basin Partnership	$30,000.00		$30,000.00
U.S.	Reservoir Fish Habitat Partnership	$20,000.00		$20,000.00

Pacific Northwest	California Fish Passage Forum Pacific Marine and Estuarine Partnership Pacific Lamprey Partnership	$60,000.00		$60,000.00
Hawaii	Hawaii Fish Habitat Partnership	$20,000.00		$20,000.00

Budget Breakdown
Total request = $250,680.00

2019 Proposed Budget

	Budget
Salary	5,900.00
Benefits	1,200.00
Travel	17,000.00
Supplies	1,500.00
Contract	185,000.00
Other	5,800.00
Total	216,400.00
Indirect on Contracts	28,000.00
Indirect on other expenses	6,280.00
Grant total	$250,680.00

Total MSCGP for the 1-year project is $250,680.00; Total matching partnership funds for the 1 year project are $1,000,000.

Qualifications of Key Personnel

Tom Champeau, Chairman, National Fish Habitat Board
Mr. Champeau became chair of the National Fish Habitat Board in 2015. Tom has spent 35 years with

the Florida Fish & Wildlife Commission. While working in the field, Tom led major lake habitat restoration projects, worked with the local communities and the mining industry on lake design and management for phosphate mined pits, and defining fish community metrics for establishing minimum flows for rivers in Southwest Florida. Tom holds degrees from the University of Michigan and University of Nebraska.

Ryan Roberts, Program Manager, National Fish Habitat Partnership
Ryan Roberts is the Communications Coordinator for the National Fish Habitat Partnership. Mr. Roberts has 10 years of experience in public relations/communications and has worked on the National Fish Habitat Partnership since 2008. Mr. Roberts created several communications toolkits for use by National Fish Habitat Partnerships and created an overall communications strategy for the partnership. Mr. Roberts' contributions were key in the development and release of the Status of Fish Habitat Partnership 2010 Assessment and the 2nd Edition of the National Fish Habitat Action Plan (2012). Mr. Roberts graduated from Penn State University with a B.S. in Telecommunications/Business (Minor).

Gary Whelan, NFHP Board Science and Data Committee Co-Chair
Gary Whelan is one of the two co-chairs of the NFHP Board Science and Data Committee and has worked on NFHP since its inception. Mr. Whelan is a Program Manager for the Michigan Department of Natural Resources – Fisheries Division where he manages the Research Section, oversees the Fish Health Program, and provides direct support to and manages components of the Habitat Management Unit. His fisheries career has spanned over 34 years and he has worked in nearly every aspect of fisheries in the State of Michigan. In his role for NFHP, he has been responsible for all of the Board's Science and Data efforts including the development and release of the Status of Fish Habitat Partnership 2010 and 2015 Assessments. He was also deeply involved in the development of the 1st (2006) and the 2nd Editions of the National Fish Habitat Action Plan (2012). Mr. Whelan holds a B.S. in Zoology (Fisheries Management focus) from the University of Wyoming and a M.S. in Fisheries Management from the University of Missouri.

Staff level leadership and management support of the work of the Board group will be provided by AFWA, USFWS, NOAA, state agencies and other partners such as NGO's.

National Fish Habitat Board Members: http://www.fishhabitat.org/about/staff-board/

Title: Beyond the Pond Update

Desired Outcome:

- **Board awareness** of Actions and Information from the Beyond the Pond July Board Meeting.

Background:

The National Fish Habitat Fund, which was approved by the IRS in June 2015 as a 501(c)(3) non-profit, was established to help partnerships seek additional funding for on-the-ground projects and activities. The National Fish Habitat Fund is marketed under the title and logo, Beyond the Pond. In 2016, a website was launched: http://beyondthepondusa.com/, along with securing a trademark, developing a fact sheet, and creation of an Amazon Smile account. In 2017 an online page to make donations was developed through Process Donation and several Fish Habitat Partnerships have created their own donation pages through the site.

Update:

RepYourWater

The Beyond the Pond Board met on July 23 at Bass Pro Shops in Denver Colorado. Five of the eight Board members were present at the meeting and action items from the Board meeting included, appointing two new Board members from the membership of the National Fish Habitat Board to replace outgoing Board members Mike Andrews and Tom Champeau. According to the bylaws of Beyond the Pond, an election of Board members needs to be held at the annual fall National Fish Habitat Board Meeting. Non-federal members of the National Fish Habitat Board will vote for (2) new members from the membership of the National Fish Habitat Board. Two Board members, Christy Plumer (TRCP) and Doug Boyd (SFBPC), have put their names forward for consideration with support from the Beyond the Pond Board. The Beyond the Pond Board also discussed appointing a treasurer and hiring an outside firm for financial management of Beyond the Pond. The Board also discussed contracting with Kara Nichols to do some Part-Time development work for the non-profit.

Financial Update (As of 7/31/18):

Total Liabilities	$160,650.63
Liabilities and Net Assets	$175,949.43

Beyond the Pond is anticipating receiving another $17,000 in indirect costs from an existing grant being managed by Beyond the Pond. The work for that existing grant is expected to be finished in 2019.

Title: Science and Data Committee Report

Desired Outcome:

- **Board understanding** of Science and Data Committee accomplishments as they relate to 2018 Board Priorities
- **Board approval** of Science and Data Committee 2019 work priorities.

2018 Priorities and Outcomes:

Priority L: Science and Data Committee Operations

- Completing updating Science and Data Committee (SDC) membership following SDC Terms of Reference.
- Completing filling of current SDC Co-Chair vacancy.
- The SDC met twice during FY2018 via conference call to update SDC membership on NFHP progress and Board actions.
- Outreach
    - Overall Board National Fish Habitat Assessment strategy written up as a book chapter in an upcoming American Fisheries Society publication and chapter is under review.
    - Two invited presentations given at two AFS annual meeting symposiums on 2015 Board National Assessment products.
    - Updates on Board Science and Data efforts provided at: March 2018 North American Wildlife and Natural Resources Conference; August 2018 American Fisheries Society Meeting; and September 2018 AFWA meeting at the Fisheries and Water Resources Policy and Ocean Resources Policy Committees.
    - Webinar on overall Board National Fish Habitat Assessment given to USEPA staff in August and follow up meeting with select USEPA staff occurred at the AFWA meeting in September.

Priority N: Planning and Initiation of Future Assessment Work.

- Inland
    - No progress has been made on the Board's new Inland Fish Habitat Assessment as funding has not been made available. New funding sources are being sought at this time. The delay in funding has created the following outcomes at this time:
        - no new work has or can been done on improving and updating the inland component of the National Fish Habitat Assessment;
        - National Fish Habitat Assessment staff are not available to assist FHPs in their assessment work or to facilitate needed coordination between the National and FHP Assessment products. The loss of

funding also will mean that new core staff would need to be hired; and
        - The Board planned update to the 2015 National Fish Habitat Assessment will not be available until 2023 at the earliest assuming funding is available in the near term.
    - Some data mining from the 2015 National Fish Habitat Assessment was completed using MI DNR support and assistance from the Michigan State University scholars which included invited presentations on: trout habitat stressors; the relationship of NFHP inland habitat scores and fish community diversity; the relationship of protected lands with fish community diversity; and the relationship between FHP projects and severe habitat stressors.
- Coastal
    - Work continues on the Northeast Regional Coastal Habitat Assessment using the Board approved assessment direction. The overall assessment guidance document is completed, inshore and offshore project teams have been populated and making progress, potential model approaches are under review, and funding continues to be acquired to work on the assessment. Work is also continuing at a very good pace on the West Coast Assessment. An example of these products is on the PMEP website with part of the West Coast Assessment work displayed as an estuary viewer and explorer that includes information on current and historical estuary extent, estuary points, biotic habitat, tidal wetland losses, and eelgrass habitat. The Great Lakes Assessment strategy is currently under review with long-term development being examined.

Priority O: Continue work to complete the NFHP Project Tracking Database

- Background - In 2010, a grant of $100,000 was provided to PSMFC from USGS via National Fish and Wildlife Foundation to develop a NFHP project tracking database. In 2015, a grant of $10,912 from NOAA funded basic operation and maintenance of the system through the end of the calendar year. In 2016, an additional grant of $19,000 from USGS funded transfer and housing of the database along with basic maintenance and operations of the system. In 2018, an additional $20,000 was received from NOAA to fund continued maintenance and operations of the system. This database will:
    - Allow the Board, FHPs, and all partners to exchange project information.
    - Allow online submission of project information; management and retrieval of information; geographic information system (GIS) outputs; and project progress reporting.
    - Allow expansion and modification as the national program and the regional partnerships evolve.
- 2018 Progress - In fall of 2017, the current version of the NFHP project tracking database became ready for use by partnerships. *Please note: there are still bugs in the user interface, and the quality of the outputs of the database depends on the extent of review and updates by FHP coordinators, which is still in progress.*

- Worked directly with Partnerships and NFHP staff to improve and fill data gaps in current project progress and performance measures in the NFHP system, including location information;
- Reviewed and updated data for all 20 partnerships using 2017 USFWS Accomplishment Reports and 2018 NFHP Board Evaluations. High quality of data in the database for projects funded FY 2014-2017. There are currently 850 projects in the database.
- Developed geographic information system (GIS) outputs using web map services;
- Provided a help service for FHP's working with their data on the system;
- Created custom reports on projects in the NFHP system as requested.
- PSMFC has developed a work plan for management and improvements of the user-interface and reporting over the next year. The work plan and budget options will be presented to the Board during the October meeting.

- Funding for completing most of the database functions, particularly reporting functions, is part of the MSCG request.

Priority P: Maintain and improve the NFHP Data System (USGS In-kind support)

- As a result of other USGS priorities, limited effort has been made on the NFHP Data System and viewer since the last Board update.
  - USGS continues to develop a viewer to summarize and display NFHP assessment data in the National Biogeographic Map. USGS has been working on open source solutions to summarize habitat condition indices and disturbances (i.e. severe, pervasive and total lists) to ecological and jurisdictional areas. The viewer system will accept and process new areas of interest as they are identified and can be adapted to help drive the next generation of the NFHP data system.

Proposed Science and Data Priorities for FY2019:

1) Continue Outreach Efforts on the 2015 Assessment Products if funding is made available

   a) Implemented recommendations made by assessment stakeholders as identified which will include:
      i) Making it easier to drill down and retrieve the underlying data sets on which analyses are based – Initial work completed and some limited improvements continue to be made to allow better data downloads.
      ii) Packaging and presenting results by state – This task remains to be completed.
      iii) Continue to implement report versioning and revision history tracking – This task remains to be completed.
   b) Continue to implement outreach and education efforts to improve understanding and use of 2015 Assessment products including developing new analyses using existing information.
   c) **Budget needs** – Included as part of Future Assessment Work.

2) Planning and Initiation of Future Assessment Work if funding is made available.

   a) Implement NFHP Board approved National Fish Habitat Assessment direction by continuing scoping with FHPs and conducted trial work on selected watersheds.
      i) Conclude initial scoping on hydrology and connectivity processes with FHP.
   b) Update existing national data layers as new information is received.
   c) **Budget Needs** – To fully implement the National Fish Habitat Inland Assessment development, $160,000 for the inland assessment is needed annually. To facilitate coastal assessment development, NOAA is asked to continue to provide $50,000 annually for development of regional coastal assessments along with technical support. The National Inland Fish Habitat Assessment funding will also support efforts in Task 1. SDC members will work to find additional new Inland Fish Habitat Assessment funding sources in FY2019.

3) Continue work to complete and implement the NFHP Project Tracking Database

   a) Work directly with Partnership coordinators to assist with USFWS end of year reporting for projects funded FY 2015-2018.
   b) Assist Partnerships with data management plans and maintain a help service for Partnerships working with their data on the system.
   c) Improve reporting capabilities of the system to support evaluations and other needs.
   d) Maintain the database on PSMFC servers, including server maintenance, server updates, and data backups.
   e) **Budget Need** – A total of for FY2019 is needed to support this work and funding has been requested through the NFHP Multi-States Grant.

4) Maintain and improve the NFHP Data System

   a) Ongoing maintenance and hosting
   b) Make data assets and other products from the 2015 Assessment available for downloading.
   c) Add dynamic querying for FHP and state level data and this is in progress.
   d) Continue to examine if we need to make substantial changes for FY2019. For example, continue aligning the NFHP data assets with the USGS Biogeographic Information System, allowing for greater flexibility and integration with other data assets being developed externally to NFHP work.
   e) **Budget Need** – currently anticipating in-kind support from USGS. Science and Data Committee chairs will meet with USGS in late 2018 to fully define FY2019 level of support if additional funding is needed.

5) Science and Data Committee Operations

   a) Science and Data Committee will meet quarterly by conference call on Assessment direction, Board actions, and Board assignments.
   b) Allow one Science and Data Committee meeting to examine and review Assessment direction and work on other Board Science and Data assignments.

i) **Budget Need** - $15,000 to support travel for members to attend.

c) Allow Science and Data Committee Co-Chair to support Board work and provide outreach and education on Board Science and Data products.
   i) **Budget Need** - $12,000 to support travel expenses for Science and Data Committee Chair.

Report written by: Gary E. Whelan (MI DNR Fisheries Division)
Board Science and Data Co-Chair
September 13, 2018

Title: Communications Committee Report

Desired outcome: An informational update to the Board regarding progress on the committee's 2018 work plan.

Priorities:

Task A – NFHP website additions. Additions in 2018 are expected to improve partnership pages and connections between The National Fish Habitat Partnership and Beyond the Pond.

> **Update:** In September we debuted our 2018 Waters to Watch projects to the website. In addition, we added new news stories to the Fish Habitat website and developed a new graphic to highlight the RepYourWater agreement that benefits the Eastern Brook Trout Joint Venture and Atlantic Coastal Fish Habitat Partnership through the sale of logoed hats and apparel.

Task B - Develop an improved marketing strategy integrating both NFHP and Beyond the Pond develop a marketing strategy that integrates both the National Fish Habitat Partnership and Beyond the Pond. This strategy will be intricate in raising awareness of FHP project needs and work to help raise funding to meet FHP needs.

> **Update:** The Beyond the Pond Board met in July and discussed hiring someone for development help for Beyond the Pond. A description of deliverables is still being developed and will likely include some marketing elements. We have been working to update the Beyond the Pond website and have highlighted our relationships with RepYourWater on the Beyond the Pond website.

Task C - Expand the reach and messaging of the NFHP program within the conservation community. Support travel and marketing for the National Fish Habitat Partnership to raise awareness of NFHP projects. Deliverables will also include enhancing the National Fish Habitat Partnership assessment and meeting with partners to expand the reach and input into the assessment.

> **Update:** Between the Science and Data Committee and the Communications Committee representing the Board, we will be presenting at the upcoming meetings of the American Fisheries Society Annual meeting in 2018 and provided updates regarding NFHP at the AFWA Annual Meeting in September. There are also several meetings planned with fishing industry companies at ICast in July. Ryan Roberts also recently provided a presentation on NFHP and the work of the Eastern Brook Trout Joint Venture to the PA Council of Trout Unlimited (new audience) in late February. Gary Whelan, Ryan Roberts and Tom Champeau also provided updates related to the NFHP program at the North American Wildlife and Natural Resources Conference in March.

Task D - Improve the Waters to Watch Campaign for the future.
Work to improve the Waters to Watch campaign and utilize the campaign as a marketing piece to understand and promote additional project needs for FHPs to raise additional resources.

> **Update**: The Waters to Watch list for 2018 was released in September, http://www.fishhabitat.org//waters-to-watch/archive/2018. We will be working with our partners over the next month to get the word out about the projects. The Communications Committee is also working on developing a contact list for FWS regional communications folks.

Task E - Monitor National Fish Habitat Legislation. Work with the NFHP legislative affairs team to identify communications needs to advance the National Fish Habitat Conservation Act.

> **Update:** The Legislative team is developing a strategy for the National Fish Habitat Conservation through Partnerships Act in both the Senate and the House, now that a House bill was introduced in August. The legislative team is developing educational materials related to NFHP.

Task F- Prepare detailed reports regarding Beyond the Pond for the NFHP Board as Beyond the Pond develops, we will work to keep the National Fish Habitat Board informed of marketing and fundraising developments regarding Beyond the Pond.

> **Update:** An informational update will be provided at in-person Board meetings in 2018.

134 Union Boulevard, Suite 665 | Lakewood, CO
Tel 303-236-4402 | westernnativetrout.org

WESTERN NATIVE TROUT INITIATIVE

2017 ANNUAL REPORT

DEAR FRIENDS,

Thank you for making 2017 another successful year for the Western Native Trout Initiative!

In 2017, the Western Native Trout Initiative (WNTI) and our partners funded eight habitat restoration projects benefiting our focal species with a total of $272,415 National Fish Habitat Partnership funds leveraged to partner matches of $4.4 million for a total projects value of $4,672,415.

WNTI additionally funded eight small projects through our Small Grants Program, awarding $18,800 in funding that was matched by $98,014 in other public and private funding, for a total small grants projects value of $116,814. WNTI's Small Grants Program is funded through contributions from partners and individual donors like you. We would especially like to thank Running Rivers' Rocky Mountain Flyathlon for their partnership and support of our small grants projects in Colorado.

Collectively, projects funded in 2017 will remove or bypass 12 barriers to restore access to 53 miles of stream for fish passage, restore 27 miles of riparian habitat, complete 26 habitat assessments, assess 60 stream miles, and construct one barrier to protect 17 miles of high priority Westslope Cutthroat Trout habitat.

PROJECTS FUNDED THROUGH NATIONAL FISH HABITAT PARTNERSHIP IN 2017:

- Tincup Creek Stream Restoration, *Idaho*
- Boundary Creek Fish Passage Enhancement, *Oregon*
- Deer Creek Floodplain Enhancement Project, *Oregon*
- Lower Staley Creek Floodplain Restoration, *Oregon*
- Whychus Canyon Restoration Project – Phase 2, *Oregon*
- Deep Creek Floodplain Restoration Project, *Oregon*
- North Fork Spanish Creek Westslope Cutthroat Restoration, *Montana*
- Mill Creek Watershed Restoration, *Utah*

SMALL GRANTS PROJECTS FUNDED IN 2017:

- Get to Know Your Native – Gila Trout poster, *Arizona and New Mexico*
- TROUT at WHCCD (Transforming Research Opportunities for Undergraduate Training at West Hills Community College District), *California*
- Habitat Monitoring and Stream Assessment Program, *Colorado*
- Middle Fork Carnero Creek Culvert Replacement, *Colorado*
- Butler Creek Riparian Restoration, *Colorado*
- Bates Access Signs and Stewardship, *Idaho*
- Gila Trout Restoration Project Informational Sign: Willow Creek, *New Mexico*
- Jacobs Creek Upper Culvert Fish Passage, *Utah*

Thank you for being a part of the Western Native Trout Initiative in 2017. We could not accomplish all that we do without the continued support and dedication of our partners and donors. We are looking forward to continued success in 2018!

Sincerely,

JULIE MEKA CARTER
Chair, WNTI Steering Committee

THERESE THOMPSON
Coordinator

Results

Since its inception in 2006, the Western Native Trout Initiative has directed over $5 million in federal fish habitat funds leveraged to $23.4 million public and private matching dollars for 139 priority native trout conservation projects. By leveraging funding provided to WNTI by the National Fish Habitat Partnership, WNTI and over 350 partners to date, have successfully improved the status of western native trout populations in 12 western states including Alaska. With the collaboration and coordination of WNTI Partners, together we have removed 87 barriers to fish passage, reconnected or improved 1,130 miles of native trout habitat, and placed 30 protective fish barriers to conserve important native trout conservation populations.

COMPLETED CRITICAL NATIVE TROUT POPULATION AND HABITAT ASSESSMENTS

In order to ensure our collaborative investments are directed toward the highest priority projects, WNTI has funded over 671 watershed, fish population, and habitat surveys to date.

Coastal Cutthroat Trout ©Joseph R. Tomelleri

In 2017, along with our partners led by the Pacific States Marine Fisheries Commission, WNTI completed a multi-year rangewide assessment for Coastal Cutthroat Trout. Through this effort:

- Survey records were collected from 52 governmental agencies, universities, tribal nations, consultants, and non-governmental organizations.
- 102,002 records were gathered that describe a field survey for Coastal Cutthroat Trout throughout their geographic range. Of these, there were 74,266 positive observations.
- Meetings were held with over 157 professional biologists in eight workshops.
- 49,865 square miles, or approximately 13 million hectares, were assessed, that represent hundreds of level five hydrologic units (areas corresponding to watersheds).
- A website was created that houses a map viewer with distribution data and other information. **coastalcutthroattrout.org**

In addition, a potential habitat data layer for Coastal Cutthroat Trout using an Intrinsic Potential (IP) model was developed and used to support the assessment. The model demonstrated potential for better understanding the upstream extent of Coastal Cutthroat Trout distribution.

The long-term impact of this project cannot be overstated. The efforts of the Coastal Cutthroat Trout Interagency Committee, the data collected for the observation and distribution database, the potential habitat model, and results of the assessment are the most significant contribution to improve the management and conservation of Coastal Cutthroat Trout throughout their native distribution to date.

©Joseph R. Tomelleri

Photo courtesy of Tyler Coleman

OUTREACH ACTIVITY HIGHLIGHTS

Chasing Native Trout Campaign

Have you ever caught a native Western trout? It's now easier for all angling adventurers to take a road trip and catch the fish of their dreams. Along with a gorgeous inspirational video filmed in southern Colorado, WNTI added eight additional sub species in 2017 to our original four species course of tips and tricks for where and when to find these beautiful native trout. As part of the course, subscribers receive one email per week full of information for planning their next great fishing adventure. The 12 fish covered are:

Apache Trout – AZ
Bonneville Cutthroat – UT
California Golden Trout - CA
Coastal Cutthroat – OR
Colorado River Cutthroat – WY
Dolly Varden – AK
Gila Trout – NM
Lahontan Cutthroat – NV
Redband Trout – ID
Rio Grande Cutthroat – CO
Westslope Cutthroat – WA
Yellowstone Cutthroat – ID

Visit the campaign landing page and be sure to subscribe to receive all the e-newsletters: chasing.westernnativetrout.org

Collaboration with RepYourWater

If the fish fits, wear it! Thanks to a collaborative partnership with RepYourWater, you can now purchase a different hat for all 21 species of western native trout and char that the WNTI represents. We hope this unique offering will promote pride in our native trout species and an interest in where they live. The hats have been very popular with anglers and other members of the public. We started a hashtag "#matchthehat" on social media in summer 2017 and invite people to share photos of themselves holding a native trout that matches the native trout on their hat. A percentage of the proceeds from hat sales will support on-the-ground habitat conservation projects in all 12 states where WNTI works. **repyourwater.com/collections/western-native-trout**

About WNTI

THE WESTERN NATIVE TROUT INITIATIVE is a public-private Fish Habitat Partnership that works collaboratively across 12 western states to conserve, protect, restore and recover 21 native trout and char species. To achieve this mission, WNTI works together with its on-the-ground partners to:

ESTABLISH JOINT PRIORITIES FOR NATIVE TROUT CONSERVATION

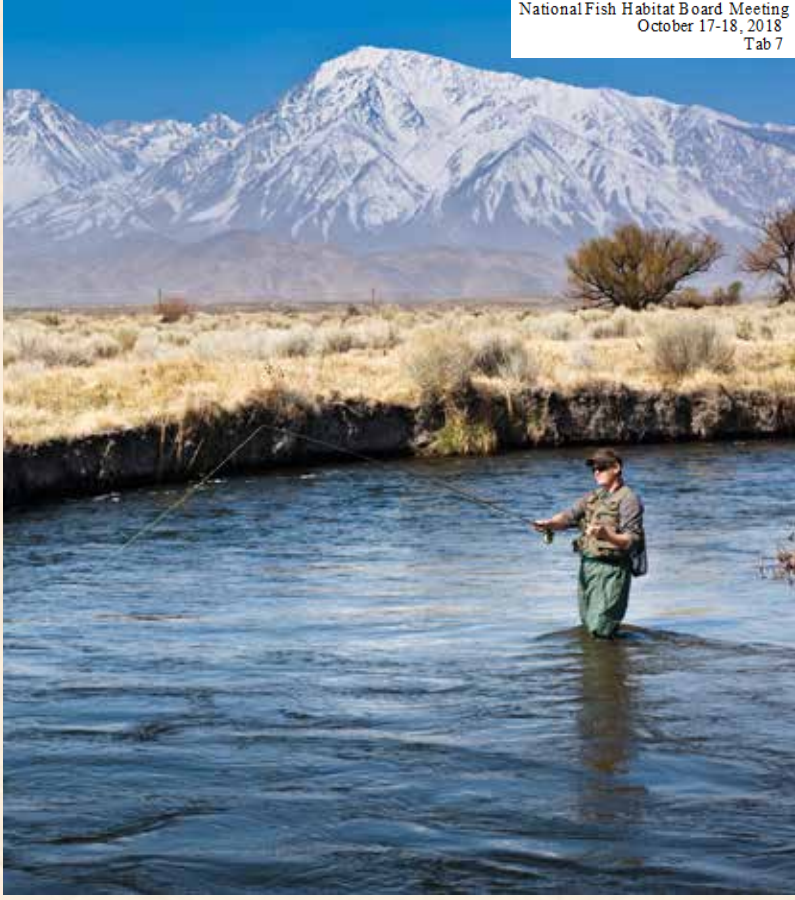
Covering over 1.75 million square miles of public and privately managed lands, WNTI and our partners combine science-based assessments along with expert and local knowledge to establish joint priorities for native trout conservation at a landscape scale.

COORDINATE INVESTMENT AND COLLABORATIVE ACTION

WNTI provides a forum for partners to coordinate and invest their collective assets and capacity toward completing the highest-priority, native trout conservation efforts across the West. Proposed and led by local communities and resource agencies, these projects are funded and supported through WNTI's grant programs and in kind contributions by our partners.

EDUCATION, OUTREACH AND STEWARDSHIP

WNTI seeks to support and sustain the ongoing efforts of our on-the-ground partners by raising awareness for the importance of healthy native trout watersheds and facilitating greater public support for native trout conservation within local communities. Through our **Campaign for Western Native Trout**, WNTI helps encourage private investment and involvement in native trout projects and regional native trout conservation initiatives.



OUR SUCCESS BY THE NUMBERS
2006-2017

- **87** *Fish Passage Barriers removed*
- **1,130** *Stream miles reconnected, restored, or improved*
- **30** *Barriers constructed to conserve and protect priority populations*
- **597** *Miles of habitat protected above barriers*
- **671** *Watersheds or populations surveyed or assessed*

STEERING COMMITTEE

Operating under the guidance of the Western Association of Fish and Wildlife Agencies, the Western Native Trout Initiative is governed by a Steering Committee that represents 12 western state fish and wildlife agencies, 5 federal resource management agencies, tribes, and nonprofit fisheries conservation organizations.

Julie Meka Carter, Chair
Arizona Game and Fish Department

Jon Sjöberg, Vice Chair
Nevada Department of Wildlife

Jeff Dillon
Idaho Department of Fish and Game

Craig Burley
Washington Department of Fish and Wildlife

Bruce McIntosh
Oregon Department of Fish and Wildlife

Paul Dey
Wyoming Game and Fish Department

Gillian O'Doherty
Alaska Department of Fish and Game

Kirk Patten
New Mexico Department of Game and Fish

Andrew Cushing
Utah Division of Wildlife Resources

Melissa Dickard
Bureau of Land Management

Scott Spaulding
U.S. Forest Service

Robert Clarke
U.S. Fish and Wildlife Service

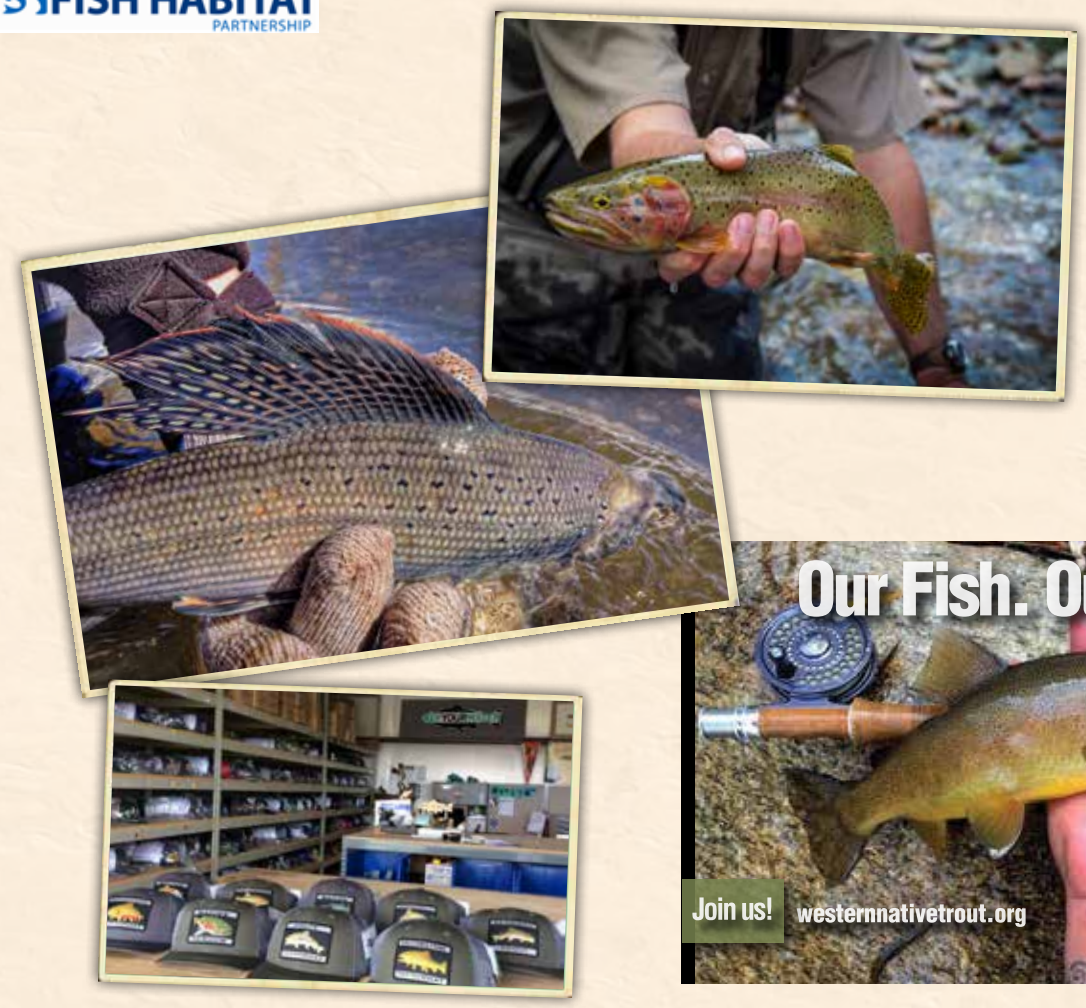
Warren Colyer
Trout Unlimited

Ed Schriever
Western Association
of Fish and Wildlife Agencies

STAFF
Therese Thompson
Coordinator

THANK YOU PARTNERS AND SUPPORTERS

Alaska Department of Fish and Game
Americanfishes.com
Angling Trade Magazine
Arizona Game and Fish Department
Association of Fish and Wildlife Agencies
Basin+Bend
Bitter Root Water Forum
Blue Valley Ranch
California Department of Fish and Wildlife
Clark Fork Coalition
Coeur d'Alene Tribe
Colorado Parks and Wildlife
El Paso County, Colorado
Federation of Fly Fishers – Southwest Council
Friends of the Teton River
Idaho Department of Fish and Game
Kenai Watershed Forum
Klamath Basin Rangeland Trust
Klamath Lake Land Trust
Long Tom Watershed Council
Lower Clark Fork Watershed Group
McKenzie Watershed Alliance
Mid-Columbia Fisheries Enhancement Group
Middle Colorado Watershed Council
Montana Fish, Wildlife and Parks
Mountains to Sound Greenway Trust
National Fish Habitat Partnership
National Forest Foundation
Native Trout Addicts
Nevada Department of Wildlife
New Mexico Department of Game and Fish
Nooksack Salmon Enhancement Association
North Fork John Day Watershed Council
Oregon Department of Fish and Wildlife
Pacific States Marine Fisheries Commission
Pyramid Lake Paiute Tribe
RepYourWater
Rocky Mountain Flyathlon (Running Rivers)
Sage Lion Media
Sierra Pacific Fly Fishers
Smith River Watershed Council
Southern Rockies LCC
Spokane Riverkeeper
Terry Lee Wells Nevada Discovery Museum
Trout Unlimited
Turner Endangered Species Fund, LLC
Upper Deschutes Watershed Council
U.S. Bureau of Land Management
U.S. Fish and Wildlife Service
U.S. Forest Service
U.S. Geological Survey
Utah Division of Wildlife Resources
Washington Department of Fish and Wildlife
West Hills Community College District
Western Association of Fish and Wildlife Agencies
Wild Fish Conservancy
Wyoming Game and Fish Department
And all the individual donors who contribute to WNTI!



The future of native trout conservation depends on the generosity of individuals like you who care about sustaining healthy western watersheds. When you give to WNTI, 100% of your donation is leveraged to support on-the-ground, locally led projects.

134 Union Boulevard, Suite 665
Lakewood, CO

WESTERN
NATIVE
TROUT
INITIATIVE

NATIONAL FISH HABITAT PARTNERSHIP

WESTERN NATIVE TROUT INITIATIVE

THE CAMPAIGN FOR WESTERN NATIVE TROUT

—Sustaining Our Western Heritage Through Native Trout Conservation—

Our fish, our future

RESTORING OUR WATERS, PROTECTING OUR HERITAGE

Wild, native trout evolved over millennia alongside buffalo, lynx, grizzly and grouse. They flourished and thrived across untamed landscapes that continue to define the American West - from high mountain lakes and dry desert plateaus to grassy, expansive plains and lush coastal estuaries. But with the advent of modern technologies and widespread development we have altered native ecosystems faster than we have repaired, creating a cascade of consequences our forefathers could not have imagined. We have changed forever a once balanced and biologically rich landscape, sending native trout and other keystone species into decline.

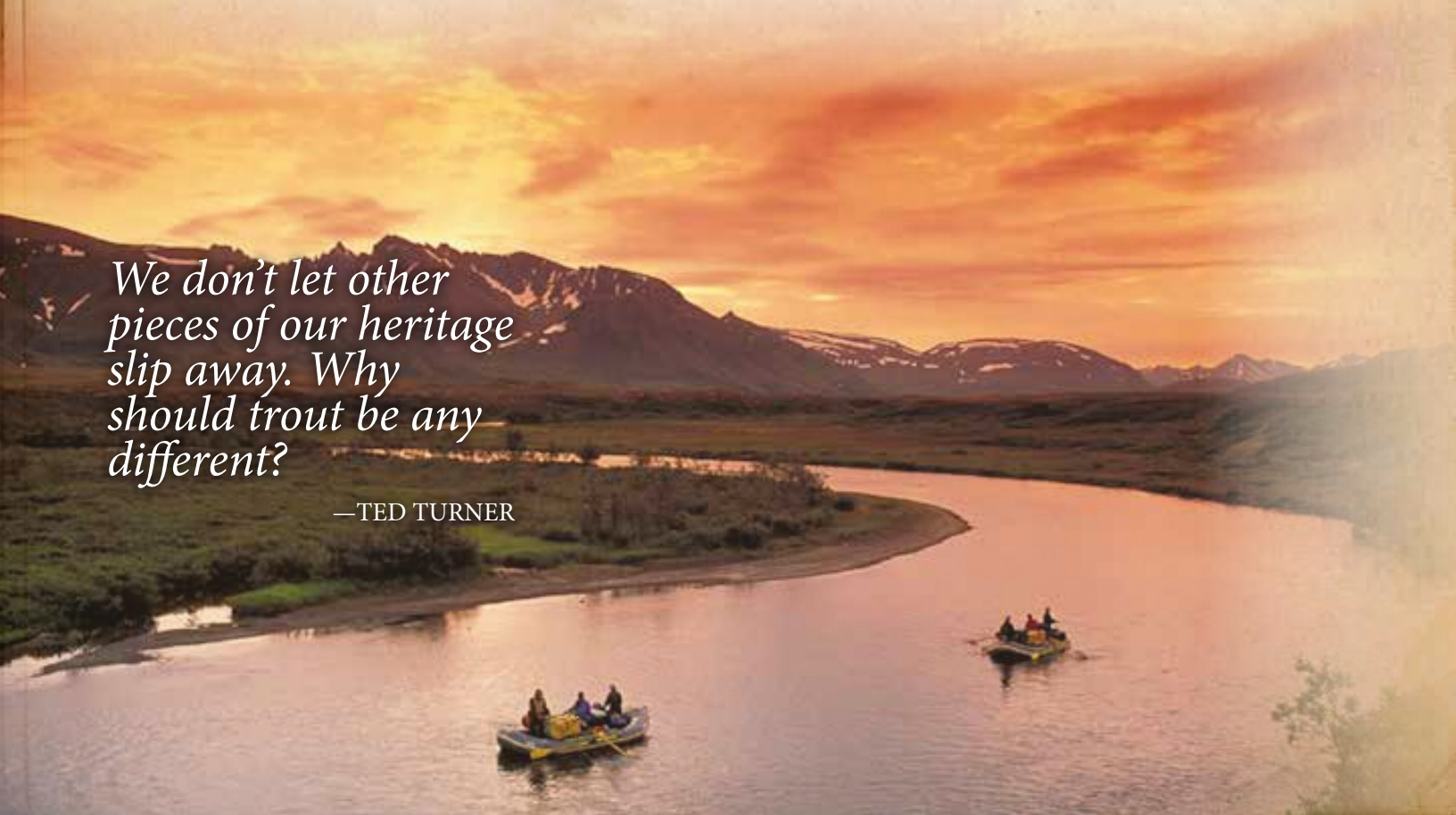
The Western Native Trout Initiative (WNTI) seeks to reverse centuries of habitat degradation and native trout declines by bringing together private and public sector leaders to collaboratively restore, rebuild, and permanently protect the last remaining rivers, lakes, streams, and wildlands that provide cold, clean water to cities, suburbs, farms and ranches, and of course, support wild, native trout. By combining, focusing, and leveraging our collective resources and passion for the West, we can measurably improve the health of western watersheds and ensure a future where fish, wildlife, and people continue to thrive.

SUPPORTING AND SUSTAINING WESTERN ECONOMIES

In addition to providing water for ranches, farms, families, and fish, healthy, free-flowing native trout streams also draw hunters, anglers, kayakers and campers to rural areas, generating valuable revenue to local communities across the West. Lured by the promise of a once-in-a-lifetime catch, a trophy buck, or epic rapids, recreationists spend money on equipment, lodging, restaurants, and professional guide and outfitting services. Money injected into local economies via recreation and tourism is shared with every corner of western communities, propping up banks, family-owned shops and restaurants. Compared to other forms of revenue generated by natural resources, recreation has the longevity and predictability to sustain communities over the long-haul. As the profitability of agriculture, oil and gas fluctuate according to world markets, many communities are turning to recreation to make ends meet. By supporting native trout restoration projects in these places, we improve habitat and recreation opportunities, drawing more resources to communities working to diversify their economies.

PROVIDING THE BEST CONSERVATION VALUE

The best long-term conservation strategies involve investing in the protection and restoration of relatively intact, pristine habitats because such investments are less expensive and more reliable than restoring those places that are severely degraded and disconnected. The western U.S. is home to more varieties of living native cutthroat trout than anywhere else in the nation. Projects funded by Western Native Trout Initiative are located in these last, best places, creating lasting benefits not only for western native trout, but also for other associated fish, wildlife, and surrounding communities.



We don't let other pieces of our heritage slip away. Why should trout be any different?

—TED TURNER

A strategy for success

The Western Native Trout Initiative is 1.75 million square miles of public and privately managed lands, and crosses the borders of 12 western states. We work cooperatively to restore and recover the last remaining western native trout species across their historic range by funding efforts to raise public awareness, and by investing limited private and public resources toward completing the highest-impact, on-the-ground projects led by local communities and resource agencies across the western United States. The following are the strategies and values that guide our organization's success.

SUPPORT SCIENCE-BASED, COMMUNITY-DRIVEN ACTION

Western native trout face challenges and opportunities unique to their geographic range and life history. Projects funded by the Western Native Trout Initiative are proposed by local communities and agencies, and result from ongoing collaboration between private landowners, businesses, regional and state fishery managers, tribes, and community groups with local knowledge, expertise and interest in conserving the rivers and trout in their homewaters. Projects are selected by our Steering Committee of highly respected resource managers and conservation groups according to the prioritized needs of each trout species. Projects must address the real and unique threats to each western native trout population according to the best available science.

MAXIMIZE OUR COLLECTIVE INVESTMENT

Donors get the most bang for their buck by investing in Western Native Trout Initiative projects because each dollar is leveraged with state, local, and federal funds dedicated to native trout restoration. For every dollar invested by private donors, an average of $3 in matching funds are provided by the public sector entities. Thus, a $20,000 contribution has an $80,000 impact. Our administrative expenses are also kept to a minimum and supported by federal sources, so every dollar goes to fund on-the-ground projects that benefit western native trout.

ACHIEVE REAL MEASURABLE RESULTS

Since 2006, the Western Native Trout Initiative and our partners have directed investments of over $14 million in private and public funding toward 110 on-the-ground, community-based priority conservation projects that have reconnected, restored and enhanced over 466 stream miles of habitat for western native trout. Additionally, we have helped complete over 600 native trout population assessments to guide collaborative watershed planning, prioritization, and management. We utilize our relationships with teams of volunteers and agency biologists to continuously monitor the watersheds where we work, ensuring that projects we fund are improving the status of native trout and water quality in the most important rivers across the west.

HOW YOU CAN HELP

The future of native trout conservation depends directly on the generosity of individuals like you who care about sustaining healthy western watersheds. When you give to WNTI, 100% of your donation is tax deductible and leveraged to support on-the-ground, locally led projects. Please consider one or more of the giving options below.

DONATE DIRECTLY TO OUR CAUSE To donate to WNTI online, please visit **westernnativetrout.org** or send a check to 134 Union Blvd., Ste. 675, Lakewood, CO 80228. Please make checks payable to Foundation for Western Fish and Wildlife, our 501(c)(3) fiscal sponsor.

LEAVE A LEGACY Gift planning options range from simple will bequests to more complicated trust and annuity arrangements, but they all share the same basic benefit: they enable you to help secure the future for the people, places, fish, and wildlife that matter to you most. You can discuss planned giving with your financial advisor or call us at (303) 618-1975.

BECOME A CORPORATE PARTNER From fly shops to forestry, your business, large or small, can serve as a steward in the local community where you operate. Please contact us to discuss projects needing funding in the watersheds where you operate.

LEVERAGE YOUR GIFT Employer matching gifts programs are an easy way to increase the impact of your donation. Simply contact your employer (or former employer, if you're retired), to request a matching gift form, and send it to the address listed on the back of this document.

HONOR A LOVED ONE To celebrate a special occasion like a birthday, or to honor the life of a loved one, consider giving a timeless and meaningful gift – the gift of native trout conservation. You can make a donation in the name of a friend or relative on our website **westernnativetrout.org**.

Ready to give or have questions about giving? Please contact Therese Thompson, Director of Strategic Partnerships, at (303) 618-1975 or tthompsonwesternnativetrout.org.

NATIONAL FISH HABITAT PARTNERSHIP

WESTERN NATIVE TROUT INITIATIVE

OUR MISSION

To serve as a key catalyst for the conservation and recovery of western native trout for the purpose of improving recreation opportunities for native trout anglers and others who appreciate and enjoy healthy watersheds.

134 Union Boulevard, Suite 675
Lakewood, CO 80228
720.314.1219
westernnativetrout.org

NATIONAL FISH HABITAT PARTNERSHIP

WESTERN NATIVE TROUT INITIATIVE COLLECTION

This collection of hats is a collaborative project with the Western Native Trout Initiative. The Western Native Trout Initiative is a public-private Fish Habitat Partnership that works collaboratively across 12 western states to conserve, protect, restore and recover 21 native trout and char species. This collection of hats represents all of those 21 species. All hats in the collection are Standard Fit, Mesh Back Hats and available in either Gray/Gray or Green/Gray.

WNBC51 $27 WNBT51 $27 WNCC51 $27

WNCR51 $27 WNDV51 $27 WNGL51 $27

GRAY/GRAY

WNWS51 $27
GRAY/GRAY

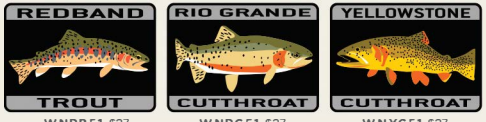
WNAC51 $27 WNAG51 $27 WNAT51 $27

WNGC51 $27 WNGT51 $27 WNLT51 $27

GREEN/GRAY

WNAR51 $27
GREEN/GRAY

WNKG51 $27 WNLC51 $27 WNNK51 $27 WNPC51 $27



WNRB51 $27 WNRG51 $27 WNYC51 $27

Title: Fish Habitat Partnership & Board Engagement Session

Desired outcome: NFH Board and FHP members discuss high level topics from the March 2016 Board Executive Session.

Background: During the March 2016 NFH Board Meeting, the Board had an Executive Session during which a range of topics were discussed. Topics included: NFHP Board (mission, purpose, membership, committees, and staff), NFHP legislation, and FHPs (purpose, role, and relationship with the Board). Notes from those discussions are below along with action and parking lot items highlighted in red. However, the Board has not yet had an opportunity to discuss these topics with the Fish Habitat Partnerships.

The Board would like to utilize this interactive session during the March Board meeting to engage FHP staff and Board members in a two-way discussion on some high level topics (& any other suggested topics) from this Executive Session. The Board would like to hear FHP feedback and input on the following topics:

- NFHP staffing
- NFHP legislation
- Goals and objectives of NFHP
- Future of NFHP
- Relationship between FHPs and the Board (Document of Interdependence)

Materials provided: March 2016 Executive Session Meeting notes (below)

NFH Board Meeting 2016-03-08 Executive Session – Compiled Notes

Part 1 – General Board Function and Operation

Topic 1: National Fish Habitat Partnership (NFHP) mission.

Background: What is the current NFHP Mission and what was it developed to address?
Discussion: Is the current NFHP mission still relevant today? If not, why not, and how should the mission be amended?

Major Discussion Points:

- "foster fish habitat conservation" is a bit limiting. Perhaps we need to broaden to include something like "and aquatic health" to include water quality.
- Shorten the statement to "foster fish habitat." Or "partnerships conserving fish habitat".
- We need to make marine environment explicit, not implicit. Marine environment need more emphasis in goals or strategies (e.g. Make it clear that this includes all habitats from mountain top to shelf; maybe add to first and second goals)
- It is noted that "fish" seems to include both.

- Much prior effort has gone into crafting the current version. But we need to be careful, seemingly minor things can have impact (e.g. on the Hill "protect" can be a loaded term).
- NFHP was modeled after the wetlands NAWCA (National Wetlands Conservation Act)/Joint Ventures.

Action Item: edit mission statement to make FW, estuarine, marine explicit

Topic 2: Board Purpose.

Background: What was the National Fish Habitat Partnership Board (Board) originally charged with? Why does it exist?
Discussion: Given the NFHP mission (and its accompanying goals and objectives), what is the Board's purpose over the next 10 years?

Major Discussion Points:

- Bigger funding expected and Board would help to manage.
- Private funding to generate stature and to show what we can do.
- In 2007 or 2008 national goals and objectives were established, quantitative. They turned out to be unrealistic.
- Wouldn't goals and objectives be more relevant at Partnership level? FHP goals would roll up into conservation goals.
- We also have national conservation strategies (2013)

Parking Lot: Discussion of national conservation goals and objectives

Topic 3: Board Membership.

Background: Who makes up the Board? How are members appointed and how long do they serve? What are their responsibilities?
***Discussion*:** Does the current membership support accomplishing the Board's purpose? Does the current Member appointment process and terms result in an effective Board? If not, what changes should be made?

Skipped Board Membership, how members are appointed, and how long they serve due to time constraints. Staff presented Board Member Roles and Expectations and Board members appear to be comfortable with their role.

Topic 4: Board Committees and Working Groups.

***Background*:** What Board committees and working groups are in existence and what is their purpose?
***Discussion*:** Are the committees and working groups fulfilling their purpose? Are they still relevant? If not, what changes should be made?

Major Discussion Points:

- There were questions about how/what the Federal Caucus is, whether it is being used, and whether the calls and interactions are useful. There was a question about whether there regularly-scheduled calls and who participates.

- It was noted that the Federal caucus [historically] met quarterly. There's been a lot of discussion about what the purpose of that group really is - why is it here, what is it supposed to do? Caucus would like the Board to give them direction.
- There was a question about what the NFHP Coalition is and how it works. It was noted that it is groups with interest. There is a list of 500 entities that originally supported the Action Plan in the Appendix. They constituted the "coalition". This list has slowly been replaced by a contact database.
- There was a question about how committees are formed. The answer was volunteering or the Chair makes requests to individuals. It was also noted that Science and Data Committee has a Terms of Reference, and that this should be considered for other committees.
- It was noted that there isn't tremendous Board representation [on Committees]; the Chair urged Board members to get involved and noted that a finance committee should be formed.
- It was also noted that the FHP Evaluation team currently cycles every 3 years. We discussed ongoing and annual approach to this process. This would allow for continual improvement.

Parking Lot:
- **Purpose, participants, and work (e.g. meeting tasks/charge) of the Federal Caucus**
- **Board discussion on development of a Finance/ Budget Committee**

Action Items:
- **Circulate Committee rosters and purpose [this was included in the Board Book]**
- **Circulate list of Fed Caucus members and call schedule (Cecilia)**
- **Review committees; identify ones that should include members of the Board.**

Topic 5: Board Staff.

Background: What was the original Board staffing plan and what is it now? What does the Board require from its staff?
***Discussion*:** Is the current Board staff meeting the needs of the Board and the Fish Habitat Partnerships (FHPs)? If not, what changes are needed?

Major Discussion Points:
- Original vs current Staffing: Fewer people, more responsibilities than original plan. It was noted that we likely need new resources and prioritizing. It was suggested that NGOs could assist with internships and staffing and that the Federal Caucus could be chaired by others.
- FWS is looking at how to use Regional Coordinators more effectively for coordination and timing of funding.
- It was noted that we don't really have a staff coordinator, executive director role for staff. In general we tend to leave too many decisions to the Board level. How can we put decision-making at the right level/place?
- There was a question of whether the AFWA staff person is overloaded with finance and communications? It was noted that in early days there was another AFWA staff, a bit more bandwidth was available and coordination was good because they were co-located.

Parking Lot: Discuss decision-making process; clarify which decisions can be made at other levels (ie. not by the Board)
Action Items:
- **NGO internships for Board staff**
- **Staff coordinator needed**
- **Finances person needed to help AFWA staff**

Topic 6: Board Funding.

Background: How is the Board funded? How has that funding been allocated over the past 10 years?
Discussion: What fiscal resources does the Board need to conduct its business? Are current funding sources sufficient? If not, where can additional funding be obtained? If no additional funding is obtained, how should funds be allocated?

Major Discussion Points:

- There was a question about who is using the project tracking database. It was noted that it isn't being used because it's still being populated, but it would be used by Congress. It was suggested that if we can identify who is using it, then we can talk with those people for funding.
- It was noted that we have passed the hat in the past, and that we need a sustainable way to allow work to progress. A funding subcommittee was noted.
- It was noted that USGS focuses on doing science for management purposes. If we could show this connection we could make a much stronger case within USGS. If we can make better tie between things like national assessment and USGS science program we could probably get better support.
- There was a question about why NRCS isn't part of this process, noting that this is where the real money comes from. It was noted that they have been invited to be on Board but have declined, however they are involved with FHPs. It was suggested that we need to identify the right person.
- It was noted that expanding funding beyond federal agencies would be extremely helpful and is necessary. This problem can't be solved on the backs of Federal agencies.
- A question was asked about whether the 501c3 will be linked or used as source of funding? It was noted that this money is almost always donor-driven and these sorts of things are almost never funded by donors.

Action Items:

- **Identify the users of Board products**
- **Connect Board Science products to management decisions**
- **Identify the right person and invite NRCS**
- **Not just Feds should be providing funding**

PART II: Legislation (10:00 – 10:30A)

Topic 7: New NFHP legislation

***Background*:** What is in the current National Fish Habitat Conservation Through Partnerships Act, particularly with respect to Board function? What is the status of the legislation? What are its future prospects?
Discussion: How will the new legislation help achieve the NFHP mission? How will it affect the Board? How will it affect federal agencies or other specific Board members?

Major Discussion Points:

- The history of the NFHP legislation is that it has made it through Committee 3 times in Senate. It is now in a bigger package, the Sportman's Bill (this is the more controversial package). It underwent a lot of red lining by champions of the legislation: Senators Cardon, Crapo, and Chris Carter

(Murkowski staff – really helped). Sportsman's Bill has been approved by House Committee on Environment and Public Works.

- A summary of the substance of the legislation is as follows:
  - Partnerships are the essence
  - Board has roles: set conservation priorities/goals; establish/select Partnerships; and approving/recommending projects to DOI.
  - Agriculture and Industry reps are on the Board
  - $7.2 million authorized
  - Money for technical assistance for entities committee has jurisdiction over
  - Can pay for land acquisition and water acquisition
- FWS has 2 major concerns about legislation:
  - FWS has established scoring criteria and process for allocating funds. FWS reads leg as shifting that responsibility to the Board. If FWS rejects, must provide explanation to Board. Would largely over-ride FWS process.
  - 5% cap for USFWS staffing and administration, which equates to 360K per year. 160K to MSU, would only leave 200K to headquarters. This would be a big reduction in funding available to FWS (approximately $2 million reduction). Not enough money to support Regional Coordinators. Practical result will be that FWS tech assistance will go away (currently $3 million goes to the field for coordination).
- It was noted that 5% is pretty good to get for supporting bureaucrats. And there ought to be a way to replace the lost FWS funding. There are other habitat programs that could be used to support. However, FWS notes that it is strictly limited by "NFHP budget" allocation. NFHP max will be drastically reduced and cannot ask for more when Congress has allocated X amount and specified that FWS should only get 5% of that (max).
- It was noted that other Agencies get some money (500K) also (e.g. USGS, NOAA, etc.).
  - NOAA has found other funds internally without any appropriation. NOAA might use $500K support funds for Habitat Assessment and potential FHP coordination for coastal work.
  - USGS is providing in-kind support and legislative funds would enhancement capabilities
  - EPA currently has no line item support and using in-kind
- Board may need to assist USFWS to find funds to fill hole; maybe have other agencies to step up. If/when the legislation passes this will be something for the Federal Caucus to take up.
- It was also noted that we need to think about how Partnership coordinator positions are funded. Some of those are FWS employees. To better inform Board on what proposed language means to FHPs we need to ask FHPs
- There was a question about how the 501c3 might affect this. It was noted that FWS cannot be funded by 501c3 dollars.

Parking Lot:

- **Impact of legislation on FWS.**
- **Federal Caucus Role in determining (potentially) how to use appropriated funds.**
- **Involvement of other Fed/non-Fed entitites.**

Action Items:

- **Address the "now what" question of the Legislation**
- **Ask the FHPs [about the potential impacts of the legislation].**

Break (10:30 – 10:40A)

PART III: The Board and the FHPs

(10:40A – 12:00P)

Topic 8: Purpose and role of FHPs.

Background: What is the purpose of the FHPs? What roles are the FHPs fulfilling in the conservation community?
Discussion: How are the Partnerships performing in the conservation community?

Major Discussion Points:

- The FHPs are leveraging funding 3:1, but a missing role may be raising money. FHPs are not likely raising significant private funding, though they are probably in best position to do so (and they may not know it).

Action Items:

- **Define the role of Partnerships in raising money. If it's fund raising, then train them in this (talk to WNTI)**
- **Identify the private FHP partners.**

Topic 9: Relationship between Board and FHPs.

***Background*:** What is the current relationship between the Board and the FHPs? What commitments has the Board made to the FHPs? What commitments have the FHPs made to the Board?
***Discussion*:** Is the current Board/FHP relationship achieving the NFHP mission? Is each side fulfilling its commitments? If not, what changes should be made?

Major Discussion Points:

- Need to ask the partnerships if the Board is performing/what action they need from the Board, through another survey. It was noted that the last Board survey by FHPs showed funding as a need.
- It was noted that the roles, expectations have never been thoroughly discussed and explicitly defined/agreed to.
- It was noted that the Partnership committee is understaffed.

Parking Lot: Solidify how the Board supports the FHPs; define commitments from the Board to the FHPs and vice versa.
Action Item: Ask the FHPs if the Board is performing

Topic 10: New FHPs.

***Background*:** How many FHPs are there and how did we get to that number? What are the requirements and process for becoming a FHP? What new FHPs are being proposed?
Discussion: What are the consequences of a growing number of FHPs? Do additional FHPs help achieve the NFHP mission? How should the Board and Board staff respond to inquiries about forming new FHPs?

Major Discussion Points:

- USFWS has frozen number eligible for FWS funding at 18, it is not treated as an obligation to give funding to new FHPs. Southeast Alaska does not receive any FWS funding. Lamprey group is still moving forward with their application and have been warned about funding issue.
- It was suggested that candidate partnerships Salmon in the City and Salmon Stronghold should be removed.

- It was noted that all 18 FHPs are getting 75K for base operational funding. It was however noted that as partnerships mature funding needs to change. Some don't really need coordination dollars as much, whereas for new FHPs it's a critical need. Seven coordinators are USFWS employees.
- It was noted that early on we had major gaps, but now it seems geographic coverage is good, so why would we support more FHPs?
- On the flip side, it was noted that it seems there's benefits even if you don't get FWS funding. Why limit the numbers when more partners can translate into more support from a Congress person, for example.
- There was a caution against diluting the Brand and using 501c3 as benefits.
- A question of whether there is a baseline of performance was asked; do we ever take a look at the partnerships that are performing less well? It was noted that the USFWS funding allocation process looks back at the last 3-5 years (6 criteria), and two criteria are prospective. 15 of 18 FHPs have received project based support at some level.

Action Items:

- **Remove Lower Mississippi River Conservation Committee, Salmon in the City, and North American Salmon Stronghold Partnership**
- **Determine which FHPs have a FWS coordinator**

Parking Lot:

- **Should acceptance of new FHPS cease?**
  - **If not, how should new FHPs be handled**
  - **Timeframe (need to develop a 5-year perspective on how to approach this issue)**
- **Approaching the candidate partners (need to come to closure on pending applications)**

Topic 11: The NFHP 501(c)(3).

Background: What is the 501(c)(3) and what is its purpose? What is the relationship between the 501(c)(3), the Board, and the FHPs?
Question: Does the current relationship between the Board, the 501(c)(3), and the FHPs support the NFHP mission?

Major Discussion Points:

- It was noted that the key to this is for FHPs to be the money raisers. Local issues, local funding. They need to learn how. So far this has not born much fruit.
- Marketing needs to happen - web site should launch this month and material is being prepared to give to potential donors.

Action Item:

- **Advance the skills of the FHPs in fundraising**

Topic 12: Marketing and Branding.

Background: What is the current branding and marketing direction? How important is branding and marketing to the Board and the FHPs?
Question: Has the current branding and marketing direction been effective? Does it need adjustment?

Major Discussion Points:

- It was noted that confusion on what NFHP is still exists.
- It was also noted that the FHPs think this is important, but want to maintain individuality. They want to link to the NFHP - they defended/fought for that name - now they should use it.
- It was noted that more coordination between FHPs is now seen - there is lots of coordination between FHPs on the west coast, and to a certain extent on the east coast, but less so in the mid-West. On the flip side, however it was noted that the FHPs still operate as distinct businesses and that there needs to be a clear link between FHPs.

Parking Lot:

- **Still lack of awareness of NFHAP – even within fisheries community – need to promote awareness.**
- **FHPs still appear/operate as distinct, unrelated entities; their relation to national network is not clear.**

Final Discussion Topic - What do the next 10 years look like?

- In 1-3 words:
  - Dynamic
  - Corporate investment
  - More protection
  - Growing
  - Explicit use of National Assessment
  - $30K to be a player as a FHP
  - Money
  - Bigger
  - Relevance
  - Relatable to groups
  - Profile
  - Governance involving FHPs
  - Recognized
  - Fund raising
  - Well defined
  - Adaptive
  - Alignment
  - More fun

Title – An Enduring Tale of the Holistic Revitalization of a Texas Reservoir, Lake Wichita

Desired outcome – Board awareness of an ongoing renowned reservoir revitalization effort by the Reservoir Fish Habitat Partnership and its partners

Background – Built in 1901, Lake Wichita in Wichita Falls, has served the region of North Texas as a recreation destination, driving economic force, as a home for the wise-use and conservation of fish and wildlife resources, and as a foundation for community growth by serving as a drinking water source. At 117 years, Lake Wichita is the third oldest reservoir in Texas and consequently the proverbial canary in the coal mine of reservoirs. Essentially, the natural reservoir aging-process (among other issues) has led to its present state of no longer being able to provide significant social, economic, ecological, or recreational benefits to the community.

In 2013, an effort consisting of community volunteers, local and state government entities, foundations, and the Reservoir Fish Habitat Partnership's Friends of Reservoirs began the marathon process of fixing this 1,224-acre reservoir. While understanding the ecological issues and how to solve them was relatively straightforward, they are but a small portion of the efforts needed to accomplish the goal of making Lake Wichita a viable reservoir for another century. The background studies and required permitting efforts have been mountainous. Educating a community on the project efforts and benefits, cultivating and maintaining their belief in the project and thus political support required, acquiring and including community desires, dispelling myths, and mobilizing support have required sustained Herculean efforts. Cultivating and maintaining relationships with key community leaders, businesses, foundations, and donors have proven invaluable as the daunting price tag of the project and successful fundraising efforts and milestones have raised the attention and subsequent ire from groups supporting other community efforts and groups with conflicting ideologies.

With both medals and scars acquired from the past five year's events in hand, the Lake Wichita Revitalization Project is in the process of growing and transforming into the organization required to attain its goals. By better demonstrating the connections and positive implications a revitalized Lake Wichita will have regarding more salient issues, it is believed that the project will garner the social, political, and thus financial capital required to accomplish this project. Further, when completed, it is hoped Lake Wichita will serve as the proof of concept to garner the political capital required for increased and long-term funding from all levels of government and foundations, ultimately enabling our country to continue to reap the multitude of social, economic, ecological, and recreational benefits into the future.

Materials provided – None.

NATIONAL FISH HABITAT PARTNERSHIP

The Texas Gulf Coast Initiative

BUILDING CONSERVATION TRUST

CCA's National Habitat Program

THE TEXAS GULF COAST NEEDS YOU NOW.

Your gift to CCA's National Habitat Program, the Building Conservation Trust (BCT), is vital to make a positive impact on marine habitat creation and restoration, from coast to coast. Every dollar you give to BCT is leveraged multiple times to create a conservation impact far beyond your initial gift. Start making a difference now for marine habitat, fish, outdoorsmen and future generations by making your gift to BCT's Texas Gulf Coast Initiative.

Don't wait. Call BCT at (713) 626-4234 today to speak with our fundraising staff for your area.

Since the creation of Habitat Today for Fish Tomorrow (HTFT) by the CCA Texas Executive Board in 2009, CCA Texas has been a partner in 38 projects along the Texas coast with a total contribution of over $5.6 Million. Project partners include: Texas Parks and Wildlife Department, Galveston Bay Foundation, Coastal Bend Bays and Estuaries Program, Harte Research Institute, Aransas County, San Antonio Bay Foundation and Texas Ducks Unlimited.

2018 BCT and CCA Texas Funded Habitat Projects

· Vancouver Nearshore Reef: $10,000

· Dickinson Bayou Marsh Grass Planting: $25,000

· Trinity Bay Discovery Center Living Shoreline: $40,000

· Nueces Bay Demonstration Oyster Reef: $60,000

· Baffin Bay's Unique Serpulid Reef Habitat Conservation Science: $60,000

· Sabine Lake Restored Oyster Reef Expansion: $100,000

· Rio Grande Valley Nearshore Reef: $150,000

· Sabine Nearshore Reef: $200,000

· Big Man's Nearshore Reef: $250,000

Total Dollars Committed: $895,000

EQUATES TO $3.6 MILLION IN MARINE HABITAT

A Natural Partnership

BUILDING CONSERVATION TRUST
CCA's Habitat

COASTAL CONSERVATION ASSOCIATION TEXAS
Habitat Today for Fish Tomorrow

Building Conservation Trust strives to be the largest marine habitat restoration, enhancement and creation entity in the United States. BCT is a development and major gift program that multiplies and maximizes funds raised to restore and enhance marine habitat. The grassroots-driven projects achieve one or more of five key objectives: Restore degraded habitats; Create new habitats; Advance the science of coastal habitat restoration and marine fisheries conservation; Foster habitat stewardship; and Educate coastal communities of the value of conservation.

To Become a Project Partner Contact sstone@buildingconservation.org · (713) 626-4234

NATIONAL FISH HABITAT PARTNERSHIP

HABITAT TODAY FOR FISH TOMORROW

CCA Texas Projects

1. Cedar Bayou/Vinson Slough Restoration	$1,600,000
2. Building Conservation Trust's Texas Habitat	$1,565,000
3. Oyster Restoration - East Galveston Bay	$ 500,000
4. Nearshore Reefing - Port O'Connor	$ 300,000
5. Nearshore Reefing - Matagorda	$ 200,000
6. Shoreline Stabilization - Oyster Lake	$ 200,000
7. Shoreline Stabilization - San Bernard NWR	$ 200,000
8. Nearshore Reefing - Rio Grande Valley	$ 155,000
9. Shoreline Protection/Marsh Creation - Moses Lake	$ 138,000
10. Marsh Restoration - Bird Island Cove	$ 150,000
11. HRI Oyster Restoration Site Locator/Mapping Study	$ 120,000
12. Nearshore Reefing - Corpus Christi	$ 100,000
13. Nearshore Reefing - Sabine	$ 100,000
14. Nearshore Reefing - Galveston	$ 100,000
15. Bahia Grande Restoration	$ 95,000
16. Marsh Restoration - Dickinson Bayou	$ 75,000
17. Oyster Reef - St. Charles Bay	$ 75,000
18. Oyster Restoration - Aransas Bay	$ 75,000
19. Oyster Restoration - Copano Bay	$ 75,000
20. Marsh Restoration - Egery Island	$ 70,000
21. Marsh Restoration - Matagorda Island	$ 70,000
22. Nueces Bay Delta Water Management Gates	$ 70,000
23. HRI Nearshore Reef Enhancement Study	$ 50,000
24. Marsh Restoration - Goose Island	$ 50,000
25. Nearshore Reefing - Freeport	$ 50,000
26. Nearshore Reefing - Port Mansfield	$ 50,000
27. Shoreline Stabilization - Cow Trap Lake	$ 50,000
28. Shoreline Stabilization - J.D. Murphree WMA	$ 50,000
29. Marsh Restoration - Oxen & Gang's Bayou	$ 42,000
30. Marsh Restoration - Nueces Bay	$ 24,000
31. Marsh Restoration - Snake Island Cove	$ 20,000
32. Oyster Restoration - Deep Reef Sabine Lake	$ 15,000
33. Weed Eradication for Water Flow Restoration	$ 15,000
34. Bay Debris Removal - Aransas Pass	$ 5,600

TOTAL FUNDED BY 2017: $6,454,600

If you are interested in contributing to our Habitat program,
Contact Sean Stone at sstone@buildingconservation.org.

Title: Partnerships Committee June 2018 Update

Desired outcomes:

- **Board awareness** of Partnerships Committee 2018 accomplishments and ongoing activities.

Background

The Partnerships Committee serves as a forum for preliminary discussions, fact-finding, and formulating recommendations for Board actions that affect Fish Habitat Partnerships.

Members:

Jeff Boxrucker (RFHP)
Doug Boyd (SBPC)
Jessica Graham (SARP)
Debbie Hart (SEAK FHP)
Lisa Havel (ACFHP)
Heidi Keuler (F&F FHP)
Joe Nohner (MGLFHP)
Steve Perry (EBTJV)

Tri-Chairs
Stan Allen (PSMFC)
Bryan Moore (TU)
Therese Thompson (WNTI)

Staff
Susan Wells (USFWS)
Alex Atkinson (ERT-NMFS)

2018 Priorities

- Priority A: Complete recommended improvements to the FHP Performance Evaluation measure wording and overall evaluation process for Board approval.

  Update: Revisions to the FHP Performance Evaluation measures were completed by the work group during 2017 and a timeline for the 2018 process was established. At the March Board meeting the Performance Evaluation Review Team was established (Tom Champeau, Doug Nygren, Tom Lang, Stan Allen, Bryan Moore, Susan Wells, Gary Whelan, and Alex Atkinson). Performance Evaluation materials were distributed to the FHPs on April 6, 2018 with a revised deadline to submit completed materials to the committee by June 15, 2018. The team plans to have a draft report summarizing the FHP review by the October 17-18, 2018 Board meeting.

FHP Evaluation Timeline:

~~The 2018 performance measures and timeline were approved at the January 2018 NFHP Board meeting.~~	~~January 17, 2018~~
~~Board staff distributes FHP Performance Evaluation form, spreadsheet, and scoring criteria on behalf of the Board.~~	~~April 7, 2018~~
~~Each FHP submits a completed performance evaluation form.~~	~~COB May 31, 2018~~
~~Board staff distributes FHP evaluation forms and scoring materials to the Review team~~	~~Rolling – ongoing between May 31 – June 15~~
~~Review Team provides completed scoring materials to Board staff for compilation~~	~~June 21, 2018~~
~~Review Team discusses scoring results via conference call~~	~~Week of June 25~~
~~Review Team provides evaluation outcomes to FHPs for review~~	~~Week of July 9~~
~~FHPs provide responses to Review Team~~	~~July 27, 2018~~
~~Review Team convenes via conference call to finalize FHP evaluation scores~~	~~Week of July 30~~
~~Final scores are provided to the FHPs and included in the Board briefing book~~	~~September 7~~
Draft report by Review Team to the NFHP Board at October 2018 Board meeting	October 17, 2018
NFHP Board approves final report by Review Team at January 2019 Board meeting	January 2019

- Priority B: Develop an approach for future Multistate Conservation Grant Program submissions (in collaboration with the Budget and Finance Committee).

  Update: see below.

- Priority C: Develop strategies for multiple FHPs to jointly submit project proposals to alternative funding sources and programs (in collaboration with the Budget and Finance Committee).

  Update: Although the Partnerships Committee has not completed specific actions to advance these priorities (B & C), conversations have been happening among the FHPs during bi-monthly calls and beyond as to how we can advance these priorities. This topic will also be addressed during the FHP Workshop planning in October 2018.

- Priority D: Work with staff to develop purpose and agenda and implement a 2018 Fish Habitat Partnership workshop.

  Update: At the March Board meeting, the Board discussed fundraising as the primary theme for the FHP Workshop planned for October 15-16, 2018 in conjunction with the Board meeting. The Workshop Planning Team was formed (Bryan Moore, Stan Allen, Jeff Boxrucker, Debbie Hart, Therese Thompson, Gary Whelan, and Alex Atkinson) on the FHP bi-monthly call on May 24. The group developed a survey for FHPs and Board members to provide input on agenda planning and met on June 6 to review the survey results. The group met regularly to plan the workshop agenda, identify speakers, and solidify workshop logistics.

Title –NFHP/AFS Partnership for Fish Habitat Conservation Awards

Desired outcome – Endorsement by the NFHP Board for partnering with AFS on proposed new AFS award and existing NFHP awards.

Background – American Fisheries Society Fish Habitat Section (AFS-FHS) officers (President Tom Lang, President-elect Kimberly Dibble, Past-President Tom Bigford), National Fish Habitat Partnership (NFHP) representative Ryan Roberts, and NOAA Fisheries staff have worked together to review the suite of existing awards coordinated by various groups for outstanding achievement related to fish habitat conservation. Efforts determined the existing efforts by professional societies, agencies, and other groups can be bolstered by coordination, partnership, and a new award to honor those who dedicate their careers to fish habitat science, management, policy, education, communication, or other discipline.

AFS would like to partner with NFHP to implement a national effort to honor individuals and groups who over a career and through policy, management, research, education, project implementation, communications and outreach, or some other endeavor achieved significant success in a fish habitat field. The international award would cover freshwater, coastal, and marine habitats. This specific award would be the "Stan Moberly Award for Outstanding Contributions in Fish Habitat Conservation." The award would replace and expand upon the NFHP Jim Range Award. Further the FHS would like to partner with NFHP on the existing NFHP awards and new FHS student/young professional awards.

Several existing awards were investigated as we considered this new recognition including:

1. NOAA Nancy Foster Habitat Conservation Award given to up to three individuals on a biennial basis for work in marine systems.
2. NFHP Habitat Conservation Awards.
3. Steve Berkeley Marine Conservation Award ($10,000) given annually to one graduate student and AFS member.
4. The AFS Fisheries Management Section's Hall of Excellence that honors one fisheries management professional annually who have made outstanding contributions to the advancement of fisheries management.
5. AFS Fellows Program for recognition of Society members for their career accomplishments. That award opened with about 75 individuals in 2015 and adds about five each year.

Similarly, we reviewed the procedures established by existing awards to ensure a fair and equal process, including:

1. Other awards by AFS and NFHP.
2. The scientific and management awards presented by the Coastal and Estuarine Research Federation.

3. The Nancy Foster Habitat Conservation Award mentioned above.

Common concerns discovered in our award reviews included; lack of capacity to consistently administer some awards, lack of capacity to acquire representative nominations, and breadth of award categories. Also discussed were concerns with potential overlap and competition for nominations.

We believe a partnership between AFS and NFHP on a new "Stan Moberly Award for Outstanding Contributions in Fish Habitat Conservation," would lessen the burden on NFHP for administering a lifetime achievement award, increase number and breadth of nominations, increase meaningfulness of the award (by being from both NFHP and AFS), and increase awareness of the award, award winners, their achievements, and fish habitat conservation. Procedurally, by coordinating with NOAA and sharing nomination information we believe that issues with lack of nominations could be curtailed. Further, we believe that procedurally an effort to give preference to freshwater candidates during Dr. Nancy Foster award years and alternately preference to marine and estuarine candidates during off years could minimize issues with overlap. It is recommended that the Moberly Award be given at the AFS annual meeting plenary session, but additional observances will be considered to increase attention to efforts.

Further we propose partnership of NFHP and AFS via committee participation for the administration of the remaining NFHP awards and new AFS-FHS student/young professional awards. By increasing capacity, we believe this partnership will aid in increasing nominations, increase the consistency of how often they are awarded, increase meaningfulness of the awards, and increase breadth of fish habitat efforts included. The new AFS-FHS student and professional awards would be given at the AFS-FHS annual business meeting but additional observances will be considered to increase attention to efforts.

Materials provided – Table outlining research review of existing and proposed new awards in fish habitat, award type, water category, lead, number of awards, frequency, and venue of award presentation.

Fish Habitat Conservation Awards Review Conducted in Developing NFHP-AFS Partnership Recommendation

NOTE: Existing awards are in black; new awards are in blue; discontinued award is in red. The blue award for "Career Accomplishments" is proposed to the AFS MC and GB.

Award Category	Freshwater	Estuarine/marine	Lead	No.	Frequency	Venue
Graduate students/ Young Professionals	AFS – New award	AFS – New award	AFS FHS	1-3	Annual	AFS FHS annual business meeting
Career accomplishments	NFHP – Range	NFHP – Range	NFHP staff	N/A	Replaced by Moberly	N/A
		NOAA – Foster	NMFS Habitat	1-3	Even years	Varies
		CERF – Davidson	CERF Awards Cmte	1	Odd years	CERF conference plenary
	AFS – New Moberly Award (replaces Range)	AFS – New Moberly Award (replaces Range)	AFS FHS	1	Annual	AFS annual meeting plenary

Other habitat awards reviewed –

Award Category	Freshwater	Estuarine/marine	Lead	No.	Frequency	Venue
Project/group/partner	NFHP – Extraordinary Action	NFHP – Extraordinary Action	NFHP staff	1	Biennial	NFHP Meeting
	NFHP – Outreach and Education	NFHP – Outreach and Education		1	Biennial	NFHP meeting
		NOAA – Foster	NMFS Habitat	1	Even years	RAE-CSO Summit
		CERF – Davidson	CERF Awards Cmte	1	Biennial	CERF conference plenary
Science	NFHP – Scientific Achievement	NFHP – Scientific Achievement	NFHP staff	1	Varies Biennial	NFHP meeting
		NOAA – Foster	NMFS Habitat	1-3	Even years	
Outreach/education	NFHP – Outreach/Education	NFHP – Outreach and Education	NFHP staff	1-3	Biennial	NFHP Meeting
		NOAA – Foster	NMFS Habitat	1	Even years	Varies
		CERF – Davidson	CERF Awards Cmte	1	Odd years	CERF conference plenary

Factors to consider: cost per award (monetary, travel, registration fees, cost of award, etc.), type of award (art, framed certificate, crystal, etc.), number of winners each cycle, NFHP/AFS.AFS-FHS capacity, idea of an article in *Fisheries* to announce intent following initial AFS Governing Board approval.

Native Fish Conservation Areas of the Southwestern USA

Facilitating Landscape-Scale Conservation of Aquatic Habitats and Freshwater Fishes

Photo: T. Birdsong, TPWD

Llano River, Texas located within the Central Edwards Plateau Rivers Native Fish Conservation Area

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Therese Thompson, Partnership Coordinator, Western Native Trout Initiative

Stephanie Vail-Muse, Partnership Coordinator, Desert Fish Habitat Partnership

Joanna B. Whittier, Ph.D., Assistant Research Professor, School of Natural Resources, University of Missouri

Project Funding:

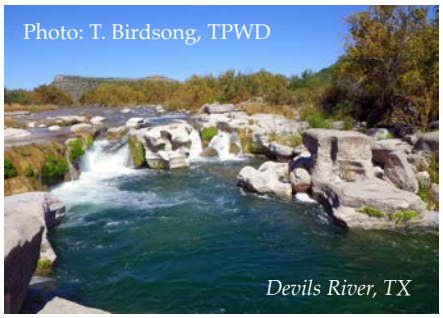
Funding for multi-species aquatic assessments (Figures 2-4; Table 3) was provided by the Association of Fish and Wildlife Agencies Multistate Conservation Grant Program, U.S. Fish and Wildlife Service Science Applications Program (through the Great Plains Landscape Conservation Cooperative and Southern Rockies Landscape Conservation Cooperative), U.S. Fish and Wildlife Service State Wildlife Grants Program, and Texas Parks and Wildlife Department

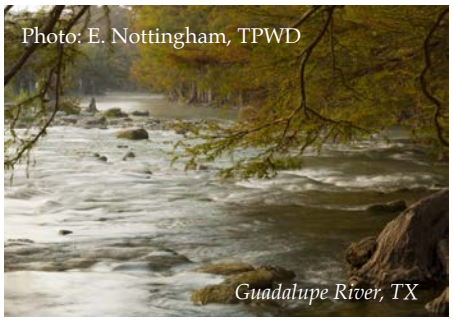
Funding for conservation planning (Figure 4; Tables 4-9) was provided by the U.S. Fish and Wildlife Service Science Applications Program, Wildlife Management Institute, U.S. Fish and Wildlife Service State Wildlife Grants Program, Southeast Aquatic Resources Partnership, and Texas Parks and Wildlife Department

Funding for aquatic gap sampling (Figure 28) was provided by the U.S. Fish and Wildlife Service State Wildlife Grants Program, Texas Parks and Wildlife Department, and University of Texas at Austin

Funding for conservation delivery was provided by the National Fish and Wildlife Foundation, Texas Parks and Wildlife Department, Texas Parks and Wildlife Foundation, U.S. Department of Agriculture, U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program, U.S. Fish and Wildlife Service Fish and Aquatic Conservation Program, National Fish Habitat Partnership, Southeast Aquatic Resources Partnership, Western Native Trout Initiative, and Desert Fish Habitat Partnership

Table of Contents





Executive Summary

Native Fish Conservation Areas of the southwestern USA consist of springs, ciénegas, creeks, rivers, and associated watersheds uniquely valued in preservation of freshwater fish diversity. These freshwater systems were identified through a spatial prioritization approach that identifies areas critically important to the long-term persistence of focal fish species. Through a shared mission of collaborative stewardship, conservation partnerships have formed among non-governmental organizations, universities, and state and federal agencies to plan and deliver actions to restore and preserve native freshwater fishes and aquatic habitats within the Native Fish Conservation Areas. Furthermore, the Native Fish Conservation Areas have increased awareness of the ecological, recreational, and economic values of freshwater systems in the region, and helped increase interest and capacity of local landowners, communities, and recreational users (e.g., paddlers, anglers) to act as advocates and local stewards of these systems. By facilitating partnership development, coordinating multi-species, watershed-based conservation planning, and leveraging technical and financial resources toward strategic conservation investments, Native Fish Conservation Areas have served as a catalyst for collaborative, science-based stewardship of native freshwater fishes and aquatic habitats in the southwestern USA. Efforts described herein to prioritize and deliver a network of Native Fish Conservation Areas in the southwestern USA offer a successful case study in multi-species and watershed approaches to freshwater fish conservation transferrable to other states and regions of the USA. This report offers a synthesis of recent (2011-2018) multi-species aquatic assessments, Native Fish Conservation Area prioritizations, conservation planning, and conservation delivery within the southwestern USA explicitly focused on implementation of the Native Fish Conservation Areas approach.

Lower Colorado River Native Fish Conservation Area located downstream of Austin, Texas

Suggested citation for this report:

Birdsong, T.W., D.C. Dauwalter, G.P. Garrett, B.J. Labay, M. Bean, J. Broska, J. Graham, S. Magnelia, K.B. Mayes, M. McGarrity, K.M. Johnson, S. Robertson, T. Thompson, S. Vail-Muse, and J.B. Whittier. 2018. Native Fish Conservation Areas of the Southwestern USA: Facilitating Landscape-Scale Conservation of Aquatic Habitats and Freshwater Fishes. Final report submitted to the Wildlife Management Institute in fulfillment of Grant Agreement *GPLCC 2015-01, Watershed-Based Conservation Planning to Inform Selection and Implementation of a Network of Native Fish Conservation Areas*. 147 pp.

Conservation Needs of Native Freshwater Fishes in the Southwestern USA

The primary cause of fish species imperilment in the southwestern USA (delineated for the purposes of this report as the area contained within the U.S. states of Arizona, New Mexico, Oklahoma, and Texas) is anthropogenic alteration of freshwater systems, which continues to occur at rates and scales that threaten the long-term resiliency of freshwater habitats, species, and ecosystems (Dodds et al. 2013). Extraction of groundwater for agricultural irrigation, energy development, and municipal water supply has substantially altered groundwater levels and resulted in concomitant reductions in spring discharge and instream flows (Costigan and Daniel 2012; Steward et al. 2013; Garrett et al., in press). The erection of dams has fragmented rivers, altered natural flow patterns, and reduced the availability of suitable habitats for native fishes (Wilde and Urbanczyk 2013; Perkin et al. 2014; Worthington et al. 2014; Perkin et al. 2015; Mayes et al., in press). The cumulative impacts of urbanization and other land use changes have substantially altered natural watershed processes. These and a myriad of other interrelated challenges – degradation of water quality, instream habitat degradation, and the negative effects of non-indigenous species (e.g., predation on, competition with, and hybridization with native forms) – threaten freshwater fish diversity (Gido et al. 2010; Hoagstrom et al. 2011). If unchecked, these issues will likely continue to contribute to the imperilment and loss of native fishes and other freshwater species (Gido et al. 2010; Hoagstrom et al. 2011). Coordinated conservation intervention is urgently needed to ensure the preservation of native freshwater fish diversity (Hoagstrom et al. 2011; Perkin et al. 2015).

Declining freshwater fish diversity is a conservation issue not unique to the southwestern USA (Jelks et al. 2008). Freshwater fishes are threatened globally. Only 46% of 7,301 freshwater fish species have been mapped and have had threats identified, and of those, 31% are threatened with extinction (Darwall and Freyhof 2016). North America alone has over 700 species of freshwater fishes (Page and Burr 1991). Fishes, along with mollusks, snails, and crayfishes, are highly imperiled, and many species are listed as endangered and some are known to have gone extinct (Taylor et al. 2007; Jelks et al. 2008; Haag and Williams 2014). The imperilment status of fishes and other aquatic species also exceeds that of their terrestrial counterparts (Master et al. 2000). Innovative and systematic conservation approaches are needed that can be effective at restoration and maintenance of the functional watershed processes necessary to sustain freshwater systems and native fishes (Margules and

Pressey 2000; Groves et al. 2002; Balmford and Whitten 2003; Abell et al. 2007; Martinuzzi et al. 2014; Donlan 2015).

Partnership-Based Efforts to Conserve Native Fishes in the Southwestern USA

The National Fish Habitat Action Plan (NFHAP; AFWA 2012; http://fishhabitat.org) provides strategies for cooperative, inter-jurisdictional, and landscape-scale conservation of fishes and other aquatic resources in the USA, and serves as the strategic plan for a network of regionally-focused conservation partnerships. Within the southwestern USA, three conservation partnerships are actively engaged in regional implementation of the NFHAP.

The Desert Fish Habitat Partnership (DFHP) was formed in 2005 to conserve native desert fishes by protecting, restoring, and enhancing their habitats in cooperation with state and tribal fish and wildlife agencies, federal resource agencies, research and private organizations, and engaged individuals (www.desertfhp.org; DFHP 2015). DFHP supports on-the-ground projects that protect the most under-served, imperiled desert fish species by addressing critical fish and aquatic habitat conservation needs in the Great Basin and Mohave, Sonoran, and Chihuahuan deserts in the southwestern USA. These lands support 179 non-salmonid native fish taxa prioritized for conservation by DFHP under the guidance of State Wildlife Action Plans and DFHP (DFHP 2015). By identifying priority species and habitats, working across geo-political boundaries, integrating and applying the best available science and promoting community involvement, DFHP identifies and prioritizes necessary conservation actions to protect and restore desert fish habitats. Through 2018, DFHP has directed over $2.6 million in federal NFHAP funds to support 28 habitat protection and restoration projects to benefit desert fishes.

The Western Native Trout Initiative (WNTI) works collaboratively across 12 western U.S. states to conserve, protect, restore, and recover 21 native trout and char species throughout their historical ranges (www.westernnativetrout.org). Operating under the guidance of the Western Association of Fish and Wildlife Agencies since 2006 and as a recognized NFHAP Fish Habitat Partnership since 2007, WNTI is governed by a Steering Committee that represents 12 western U.S. state fish and wildlife agencies, 5 federal natural resource management agencies, tribes, and nonprofit conservation organizations. WNTI and its partners invest private and public resources toward completing the highest-impact, on-the-ground projects led by local communities and resource agencies across the western USA.

To achieve its mission, WNTI works together with its partners to establish joint priorities for conservation by combining science-based assessments with expert and local knowledge to establish joint priorities for native trout conservation at a landscape scale. Through its Campaign for Western Native Trout, WNTI catalyzes education, outreach, and stewardship by raising awareness for the importance of healthy watersheds and facilitating greater public support for native trout conservation within local communities. Between 2006 and 2017, WNTI directed almost $5.5 million in federal NFHAP funds leveraged with just over $25 million in public and private matching dollars to implement 141 priority conservation projects. WNTI and its partners have removed 87 barriers to fish passage, reconnected or improved 1,817 km (1,129 mi) of native trout habitat, assessed 671 watersheds or populations, and placed 30 protective fish barriers to conserve important native trout conservation populations (WNTI 2008; WNTI 2016).

The Southeast Aquatic Resources Partnership (SARP; http://www.southeastaquatics.net/) is a collaborative, multi-agency conservation partnership geographically aligned with the 14 member states of the Southeastern Association of Fish and Wildlife Agencies, including the southwestern U.S. states of Oklahoma and Texas. Formed in 2001, the mission of SARP is to protect, conserve and restore aquatic resources, including habitats throughout the region, for the continuing benefit, use and enjoyment of the American people. Since the partnership's inception, SARP has served as a regional catalyst and network builder for fish habitat conservation, spearheading regional assessments of flow alteration, riparian condition, and fish passage barriers, and supporting on-the-ground delivery of 180 aquatic habitat restoration projects. The partnership was formally-recognized as a NFHAP Fish Habitat Partnership in 2007, and in 2008, SARP and partners published the Southeast Aquatic Habitat Plan (SARP 2008), which established regional conservation objectives (Table 1) and targets (i.e., 5, 10, and 15-year outcomes) used by the partnership to monitor progress and to continually adapt and refine regional fish habitat conservation strategies (SARP 2014). The Southeast Aquatic Habitat Plan has also provided the fundamental underpinnings for multi-species, watershed-scale conservation projects conducted or supported by SARP through its Native Black Bass Initiative (http://southeastaquatics.net/sarps-programs/native-black-bass-initiative) and Southeast Aquatic Connectivity Project (http://southeastaquatics.net/sarps-programs/southeast-aquatic-connectivity-assessment-program-seacap).

Table 1 - Objectives of the Southeast Aquatic Habitat Plan, the strategic plan of the Southeast Aquatic Resources Partnership (SARP 2008, 2014).

Objectives of the Southeast Aquatic Habitat Plan
(1) Establish, improve and maintain riparian zones
(2) Improve or maintain water quality
(3) Improve or maintain watershed connectivity
(4) Improve or maintain appropriate hydrologic conditions for the support of biota
(5) Establish, improve and maintain sediment flows
(6) Maintain and restore physical habitat in freshwater systems
(7) Restore or improve the ecological balance in habitats negatively affected by invasive species
(8) Conserve, restore or create coastal, estuarine and marine habitats

Maximizing Efficiency and Effectiveness of Investments in Conservation of Native Fishes

Restoration of aquatic systems is now a multi-billion dollar per year industry (Bernhardt et al. 2005). Restoration programs exist in every corner of North America, as well as in many parts of the world (Cowx and Welcomme 1998; Palmer et al. 2007). Early restoration efforts (i.e., following passage of the Clean Water Act and similar environmental laws) focused on restoring water quality degraded from point source pollutants. Current restoration efforts have transitioned toward integrated restoration of ecosystem processes and ecological integrity (Beechie et al. 2013; Jones et al. 2018). The majority of restoration projects are small-scale, short-term, and implemented on a reach-by-reach basis, whereas some are focused in entire watersheds over decades (Bernhardt et al. 2007; Pierce and Podner 2019).

Efficient allocation of scarce resources to maximize conservation benefits is challenging but can be guided by effective goal development, resource assessment, planning, and prioritization (Knight et al. 2006; Ferrier and Wintle 2009). There are many different sites or watersheds in which to implement conservation actions, and prioritizing conservation actions or restoration treatments in a watershed can be difficult (Williams et al. 2007; Roni et al. 2013). However, advances in spatial data and assessment methods over the last 40 years help to facilitate a better understanding of resources and prioritization of conservation actions across broad landscapes (Ferrier and Wintle 2009). This has allowed spatial

conservation assessment and prioritization to become more available as a formal part of conservation planning and decision making (Knight et al. 2006).

Assessment of aquatic systems and species can take many forms. It can range from assessment of water quality and single-species in individual waterbodies (Zale et al. 2012), to broad-scale surveys designed to draw regional inferences on the status and trend of ecological integrity (Karr 1993). More recently, assessment of aquatic systems has included spatially explicit, desktop assessments of habitat condition, ecological threats, and species diversity (Kuehne et al. 2017). This has been facilitated by recognition of the need to go beyond single-species approaches to focus on ecosystems and entire communities (Franklin 1993), as well as continued advancement of spatially explicit datasets representing various aquatic ecosystem components and improved prediction of species distributions (Olden 2003; Mainali et al. 2015; Dauwalter et al. 2017). Some contemporary multi-species aquatic conservation assessments now integrate conservation biology principles underpinning protected area or reserve selection to conserve biodiversity (Table 2) with ecological integrity and threat assessment in a spatially explicit framework. The assessment output is a conservation rank or value for each spatial planning unit (e.g., catchment, watershed, hydrologic unit) across entire river basins.

Table 2 - Definitions of terms and concepts used in spatial conservation planning and prioritization (Kukkala and Moilanen 2013).

Definitions
Systematic conservation planning - A structured approach to identify priority areas based on their complementarity
Complementarity - The contribution of a spatial planning unit toward a measure of biodiversity (i.e., functional, community, species) that complements other units
Comprehensiveness - The representation of many biodiversity features across all planning units in a set
Efficiency - Representation of the highest amount of biodiversity features in the fewest number of planning units
Irreplaceability - A measure of uniqueness associated with a spatial planning unit based on the biodiversity features represented
Representation - The occurrence of a biodiversity feature in a selected set of spatial planning units
Representativeness - The total number biodiversity features represented in a selected set of spatial planning units
Redundancy - The replication of the measure of biodiversity across spatial planning units

Methods for assigning conservation value to spatial planning units can generally be categorized as scoring-based or complementarity-based approaches (Ferrier and Wintle 2009). Scoring-based approaches are relatively straight-forward as they assign an independent score for each planning unit based on specified factors of interest (e.g., habitat quality, presence/absence of focal species, species richness, threats). Multiple factors are often scored and summed (or multiplied) into a final composite score intended to reflect conservation value. For example, if each planning unit in Figure 1A receives one point for each species present, planning unit 1 will have the highest score (and thus highest conservation value) and planning units 2 and 3 will have the same score (tied conservation value) despite different species composition and not accounting for the species represented in planning unit A. While scoring approaches have utility for some applications, they fail to account for species membership and complementarity, that is, how different planning units complement each other when considered as a set (McKinney 1997), which is one of the conceptual underpinnings of contemporary systematic conservation planning (Margules and Pressey 2000; Sarkar and Illoldi-Rangel 2010; Linke et al. 2011). Some conservation planning problems require that the maximum number of species be represented in a minimum number (or a set number) of planning units. For example, in Figure 1A planning unit 1 has the highest conservation value because it represents five species. However, the next highest conservation value would be assigned to planning unit 5 because it is the only planning unit that contains a new species not represented in planning unit 1; that is, planning unit 5 complements planning unit 1 and together they represent the greatest number of species across a set of two planning units. Thus, their value depends on what is represented in the other planning units in the set and how they complement one another. A set of planning units with high complementarity will have the most species represented in the fewest number of planning units, or in other words, they will have the highest benefit:cost (number of species:number of units) ratio for conservation purposes (Nel et al. 2009). Complementarity is often the fundamental basis for the complex algorithms implemented in popular spatial conservation prioritization software programs (e.g., Marxan, Zonation, ConsNet, C-Plan; Moilanen et al. 2005).

Quantitative approaches to conservation assessment for terrestrial and marine systems were developed far ahead of approaches for freshwater systems (Linke et al. 2011). However, assessment methods now exist to address the unique lateral and longitudinal characteristics of dendritic riverine systems (Linke et al. 2008). Unlike terrestrial systems, riverine systems can be impacted by threats occurring far upstream in the watershed. Freshwater assessment

A)

Species	Planning Unit 1	2	3	4	5	Range
A	1	1	1	1	0	4
B	1	0	1	1	0	3
C	1	1	0	0	1	3
D	1	0	1	1	0	3
E	1	1	1	0	0	3
F	0	1	0	0	1	2
G	0	0	0	0	1	1
Richness	**5**	**4**	**4**	**3**	**3**	

B)

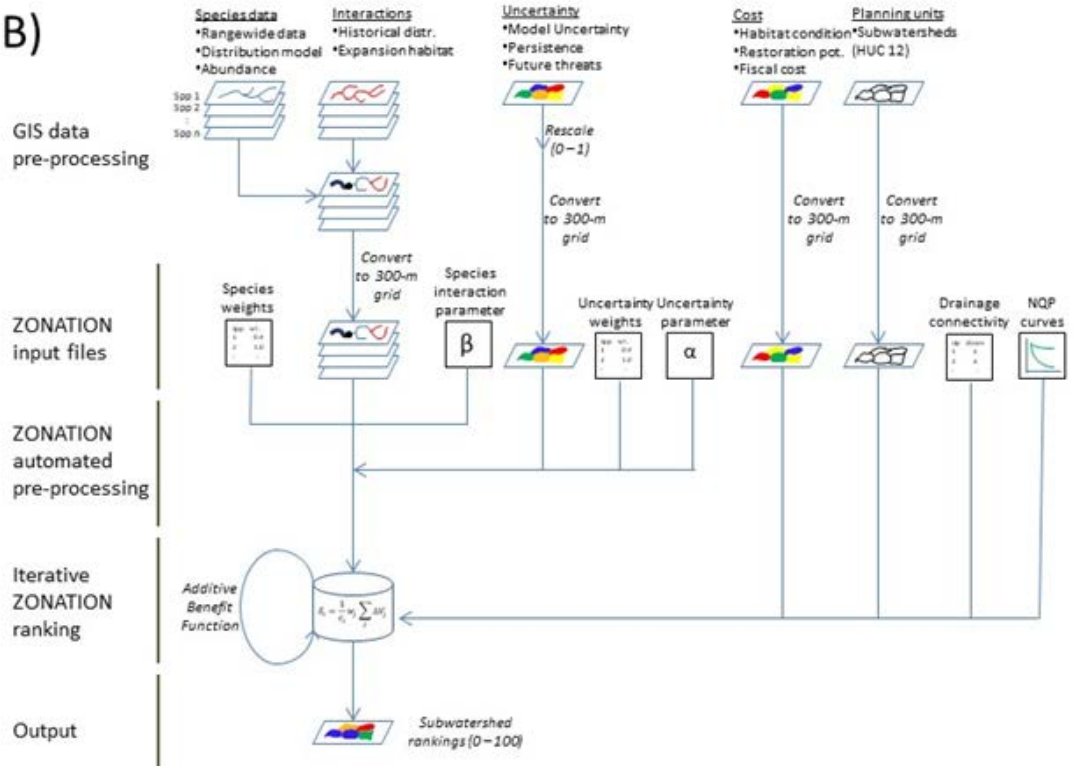


Figure 1 - Simple set of planning units and species presence data showing complementarity and species representation (A), versus one example of a more complex analysis workflow that incorporates different types of species data, connectivity among planning units, habitat condition, species interactions, and other ecological factors in a complementary-based algorithm (B).

methods can now account for dendritic connectivity in riverine systems and integrate them with complementarity principles (Abell et al. 2007; Linke et al. 2008). Zonation and Marxan are two commonly-used software programs that now have this capability. At the same time, conservation assessments can also incorporate more than just species representation by

including factors that contribute to species persistence such as habitat types, stream connectivity, dispersal capabilities, or minimum home range size (Margules and Pressey 2000; Nel et al. 2011). Figure 1B depicts the complexity and ecological reality that can now be incorporated into aquatic conservation assessments, which includes: species representation and persistence, interactions between species, minimum habitat requirements based on home range size, and the effect of current habitat conditions or future threats on the landscape. Each of these factors can now be integrated into a comprehensive assessment of entire river basins where each catchment or stream segment can be assigned a conservation value between 0 (low value) to 1 (high value). High conservation values reflect important planning units for the representation of native fish species balanced by the habitat condition or threat level, watershed connectivity, and in some cases proximity to protected areas (e.g., National Parks). The availability of these approaches has led to their increased use in freshwater conservation planning applications (Wenger et al. 2009; Dauwalter et al. 2011; Howard et al. 2018; Birdsong et al., in press).

Multispecies Aquatic Assessments Conducted within the Southwestern USA

Conservation organizations and partnerships representing large geographies often have the difficult task of deciding where to focus conservation efforts with limited resources. Numerous approaches to aquatic conservation assessment have been developed to help with this task (Kuehne et al. 2017). Assessment frameworks range from simple overlays of spatial data on environment and human stressors, to very quantitative optimization algorithms focused on the conservation principles of comprehensiveness, representation, and others while accounting for species biology (home ranges), landscape connectivity, threats, climate change, and other factors as described herein and elsewhere (Pressey and Cowling 2001; Moilanen et al. 2005). Algorithms, and the assessment outputs they produce (rankings and priority areas), are not a panacea but rather serve to guide and inform rather than prescribe planning decisions. They are part of the planning process and not the process itself. The assessments simply highlight important areas and become part of a decision support system, in which humans are integral, for conservation decision making (Pressey and Cowling 2001). When good data are available, quantitative assessment and prioritization can enhance the explicitness, repeatability, and scientific credibility of conservation decision making (Ferrier and Wintle 2009).

As partnerships representing large geographies, DFHP and WNTI have had to be creative in completing aquatic assessments in focal basins (and WNTI focal species and subspecies) that represent both the scale at which the partnerships operate and a scale appropriate to the conservation priorities and historical ranges of native fishes. The partnerships have had to work together to identify diverse funding sources and diverse partners to pursue development of basin-specific assessments. Likewise, basin-specific aquatic assessments naturally align with the regional biogeography of fishes. For example, the historical distribution of native trouts largely align with the individual basins for which assessment were completed: Colorado River Cutthroat Trout *O. c. pleuriticus* in the Upper Colorado River basin; Apache Trout *O. apache* and Gila Trout *O. gilae* in the Lower Colorado River basin; Rio Grande Cutthroat Trout *O. c. virginalis* in the Rio Grande Basin. Non-game fish distributions are also, mostly, unique to individual basins at the same scale (Smith 1981). Early, trout-based rangewide assessments funded by WNTI have produced spatial data on trout populations across the species (or subspecies) ranges that been used directly in some assessments.

The aquatic assessments completed to date have largely been used to provide a landscape or basin-wide perspective to projects proposed to these Fish Habitat Partnerships for funding. Both Fish Habitat Partnerships use a scoring rubric to rank proposed projects. As mentioned earlier, projects proposed to DFHP for funding include projects on streams and rivers – habitats for which the assessments discussed herein focus – but they also include projects on springs and ciénegas where assessments have not been completed. The lack of consistent information across habitat types and geographies prohibits the assessments from being formally integrated into project scoring rubrics. However, completed assessments: 1) do give important basin-wide context to proposed projects, 2) highlight hydrologic units with high value for conserving native fish diversity at a landscape scale because of high species richness or representation of rare species; 3) identify habitat and protection needs by overlaying high value hydrologic units with human stressor indices or land protection status (Howard et al. 2018; Williams et al., in press); and 4) can be used to identify focal watersheds for collaboration, efficient use of resources, and targeted long-term conservation efforts (Dauwalter et al. 2011; Birdsong et al. 2015; Labay et al. 2018). Social, economic, and political considerations all influence where conservation is implemented on the ground. However, landscape-scale aquatic assessments such as those presented here can be used in conjunction with socioeconomic and political factors to ensure that opportunities for conservation action

are balanced with biological priorities as a form of informed opportunism (Noss et al. 2002; Pressey and Bottrill 2008).

Efficient conservation delivery is a balance between pragmatism, socioeconomic and political forces, and maximizing the representation persistence of focal biodiversity. There are simply not enough conservation resources available to be wasteful, and many freshwater fishes are imperiled (Darwall and Freyhof 2016). Luckily, spatial conservation assessment methods are more accessible than ever and are being applied to aquatic systems with watersheds as a focal unit. Completed assessments facilitate conservation planning at landscape scale through integration with the local knowledge and pragmatism of field biologists that have expertise on native fishes and in habitat restoration, land protection, and threat abatement. This naturally lends itself to a dual-pronged approach that is both top down (assessment driven) and bottom up (local knowledge) to deliver informed and efficient conservation across broad landscapes and large river basins.

Because of the large landscapes they cover, DFHP and WNTI have together pursued development and use of multi-species aquatic assessments that highlight hydrologic units important for native fish diversity to inform partnership decision making within river basins (WNTI has also supported development of species-specific range-wide status assessments, e.g., Gresswell 2011; Muhlfeld et al. 2015). These assessments produce a rank for all catchments (land area draining a ~1-km stream segment) or subwatersheds (Hydrologic Unit Code 12, ~30,000 ha) that represent conservation value of that unit based on fish species richness and representation of rare species (representation, complementarity, and comprehensiveness), aquatic connectivity relative to species biology, and threats to aquatic systems (Figure 2). The values are scaled to range from low to high conservation value. The initial assessment effort (Table 3) focused on the Lower Colorado River basin, Arizona, whereby the U.S. Geological Survey initiated an aquatic gap analysis to identify riverine fishes that were inadequately represented (gaps) within the existing network of protected lands (e.g., National Parks; Whittier et al. 2011). The analytical framework used known and modeled species distributions, riverine connectivity, species-specific home range sizes, and an ecological threat index. The utility of the Lower Colorado River basin assessment resulted in interest in an equivalent assessment in the Upper Colorado River, which was funded through the U.S. Fish and Wildlife Service Multistate Conservation Grant program to the National Fish Habitat Partnership, administered by the Western Association of Fish and Wildlife Agencies and WNTI, and completed by the University of Missouri (Whittier and Sievert 2014). The Rio Grande basin assessment was funded by the Southern Rockies

Landscape Conservation Cooperative and WNTI, and it was completed by Siglo Group (Figures 2 and 3; Table 3; Labay et al. 2018). The diverse partners represented in each assessment effort represents a synergy towards combining resources to accomplish a common goal, that is, developing the assessment and shepherding it towards meaningful and targeted delivery of aquatic conservation on the landscape.

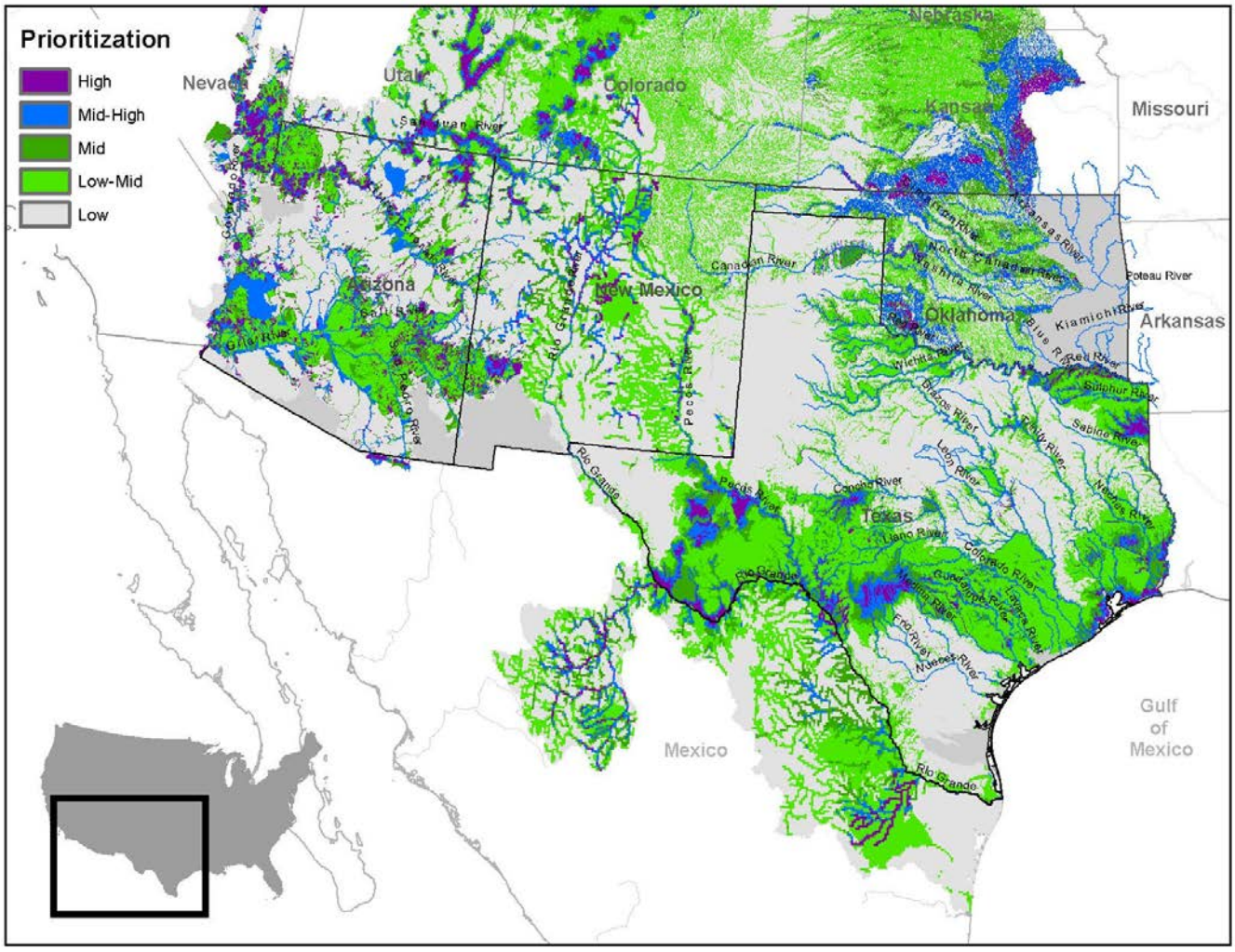


Figure 2 - Conservation value of freshwater systems of the southwestern USA based on fish species richness and representation of rare species (representation, complementarity, and comprehensiveness), aquatic connectivity relative to species biology, and threats to aquatic systems.

Table 3 - Funding sources and lead entities of multispecies aquatic assessments completed for use in State Fish and Wildlife Agency and Fish Habitat Partnership decision-making in the southwestern USA.

Region/Basin	Funding	Assessment Lead	Year Completed
Lower Colorado River Basin	U.S. Geological Survey National Gap Program	U.S. Geological Survey / Kansas State University	2011
High Plains, Southwestern Tablelands, Central Great Plains, Arizona/New Mexico Mountains, Chihuahuan Desert, and Edwards Plateau ecoregions of Texas	Texas Parks and Wildlife Department / Great Plains Landscape Conservation Cooperative	University of Texas at Austin / Texas Parks and Wildlife Department	2013
Upper Colorado River Basin	U.S. Fish and Wildlife Service Multistate Conservation Grant Program / Western Native Trout Initiative	University of Missouri	2014
Portions of the Arkansas, Canadian, and Red River Basins within the U.S. Great Plains	Great Plains Landscape Conservation Cooperative	University of Texas at Austin	2014
State of Texas	U.S. Fish and Wildlife Service State Wildlife Grants Program / Texas Parks and Wildlife Department	University of Texas at Austin / Texas Parks and Wildlife Department	2015
Rio Grande Basin	Southern Rockies Landscape Conservation Cooperative / Western Native Trout Initiative	Siglo Group	2018

Consistent with the conservation prioritization needs of DFHP and WNTI, SARP has collaborated with State Fish and Wildlife Agencies to select priority watersheds throughout the partnership's 14-state geography. Termed "Conservation Opportunity Areas," those watersheds have been targeted for investments in conservation planning, restoration of instream connectivity, instream flow restoration, riparian habitat restoration, and other conservation actions. Conservation Opportunity Areas have been selected based on priorities identified in existing conservation plans, such as State Wildlife Action Plans, with each member state requested by SARP to select their five highest priority watersheds (Hydrologic Unit Code 8). As a potential supplemental approach to consider in selection of Conservation Opportunity Areas, SARP partnered with the U.S. Fish and Wildlife Service Science Applications Program (i.e., Great Plains Landscape Conservation Cooperative), Great Plains

Fish Habitat Partnership, Texas Parks and Wildlife Department (TPWD), University of Texas at Austin, and Siglo Group to conduct a series of multi-species aquatic assessments (Table 3) that utilized consistent methods as those completed for DFHP and WNTI. The assessments combined known and modeled fish species distributions and spatial prioritization analysis to identify high priority freshwater systems within a portion of the State of Oklahoma contained within the U.S. Great Plains (funded by the Great Plains Landscape Conservation Cooperative; Labay et al., in press) and for the entirety of the State of Texas (funded in part by the Great Plains Landscape Conservation Cooperative and the U.S. Fish and Wildlife Service State Wildlife Grants Program; Birdsong et al., in press).

Freshwater systems of Texas and western Oklahoma were prioritized based on their ability to meet the four critical elements of a Native Fish Conservation Area (NFCA), as defined by Williams et al. (2011): (1) natural physical processes remain intact (or have the potential to be restored) within the watershed that support the maintenance of freshwater habitat complexity, diversity and connectivity; (2) habitats are contained within the watershed that support all life history stages of the fish species being preserved; (3) the watershed or fragmented river segment is large enough to provide for long-term persistence of native fish populations (e.g., effective population size); and (4) management plans and other agreements can be developed that will allow the watershed or river segment to be managed in a manner that sustains aquatic and riparian habitat integrity over time and across management jurisdictions and land ownerships. This resulted in development of conservation planning products including species distribution models for focal freshwater fishes, a landscape ranking and prioritization that identifies focal areas for conservation of focal species, and a spatial framework for conservation planning and delivery via identification of high-priority freshwater systems considered NFCAs (Birdsong et al., in press; Labay et al., in press). Detailed descriptions of the concepts and methods used in prioritization of NFCAs are discussed by Labay et al. (2018) and Labay et al. (in press). Thus, methods will be only briefly discussed here.

For the multispecies aquatic assessment focused on the State of Texas, fish species chosen for distribution modeling and subsequent analyses were selected on the basis of their inclusion in a recommended list of Texas freshwater fish species of greatest conservation need (SGCN) assembled by Cohen et al. (2018). The list identifies 90 species of freshwater fishes, each with a conservation status that warrants listing as SGCN (Appendix A). It is anticipated that those 90 species will be listed as SGCN in the forthcoming update of the Texas State Wildlife Action Plan (i.e., Texas Conservation Action Plan; TPWD 2012) in 2023. Species

distribution models (SDMs) were assembled for 85 of the 90 species; SDMs were not assembled for four species that are likely extinct (Maravillas Red Shiner *Cyprinella lutrensis blairi*, San Marcos Gambusia *Gambusia georgei*, Phantom Shiner *Notropis orca*, Rio Grande Bluntnose Shiner *Inotropic simus simus*) or for one additional species considered a unique, disjunct population (Spotted Sucker *Minytrema melanops*). This list of focal species encompassed the freshwater fish SGCN contained in the interjurisdictional watersheds shared by the states of Oklahoma and Texas (i.e., Canadian and Red rivers).

The SDMs converted point occurrence data into range-wide probabilities of occurrence (Guisan et al. 2013). Fish occurrence data used in development of SDMs consisted of museum-vouchered specimens available from the University of Texas at Austin Fishes of Texas database and data available from the Global Biodiversity Information Facility that were compiled, reviewed, and partially normalized (Hendrickson et al. 2010; Cohen et al. 2013). Specific hydrologic, climatic, and topographic variables included in SDM development are described by Labay et al. (in press). Individual SDMs in GIS-ready formats and detailed information on the model production methodology can be accessed through the University of Texas at Austin Fishes of Texas Project model download portal (http://www.fishesoftexas.org/models/).

The SDMs were used within Zonation (conservation planning software; Moilanen et al. 2005) to spatially rank and prioritize freshwater systems based on their value in conservation of the diversity of freshwater fish SGCN. Conservation value was assessed based on spatially explicit levels of species, habitat, or ecosystem occurrence, as defined by SDM estimation of the relative probability of occurrence. The prioritization emphasized species rarity as opposed to species richness (Moilanen et al. 2005). This approach resulted in prioritization of freshwater systems important in preservation of the diversity of freshwater fish SGCN (Figure 2). Zonation was then used to identify species-based geographic management units, here referred to as NFCAs, based on distance and compositional similarity among the priority freshwater systems. This analysis resulted in identification of 20 NFCAs for inclusion in the target geography (Figure 3), which represents a selection of springs, ciénegas, creeks, rivers, and associated watersheds that serve as "native fish strongholds" and that are now considered priority landscapes for conservation investments by SARP, DFHP, TPWD, and local conservation partners (Birdsong et al., in press). The diversity of native and non-native fishes that occur (or occurred historically) in each of the 20 NFCAs are outlined in Appendix A. Consistent methods were used by Labay et al. (2018) to expand the multi-species aquatic assessment and NFCA prioritization of the Rio Grande basin within Texas to incorporate the

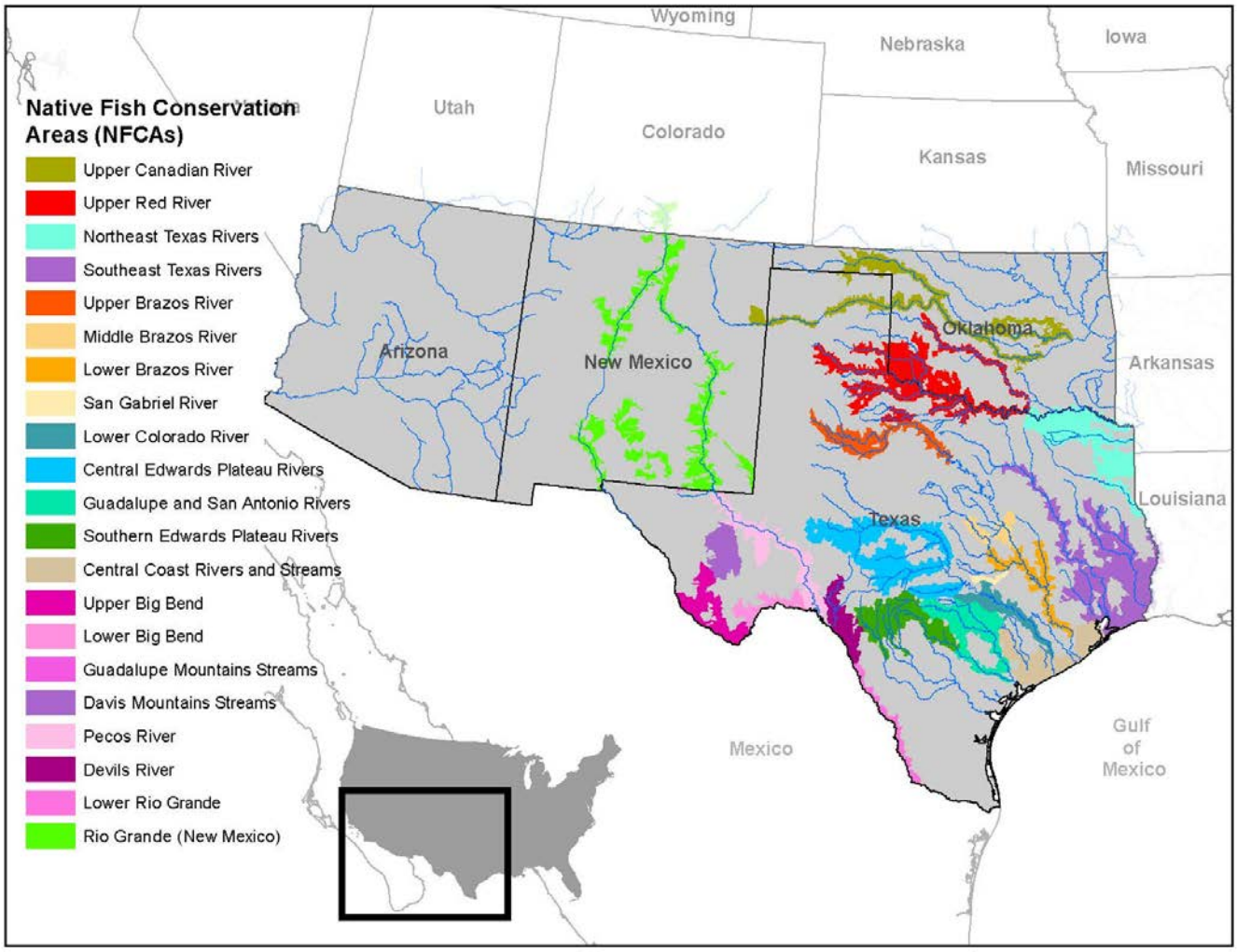


Figure 3 - Freshwater systems of the southwestern USA prioritized for investments in conservation of native freshwater fishes and aquatic habitats, and recommended as Native Fish Conservation Areas.

remainder of the basin in Colorado, New Mexico, and Mexico. Labay et al. (2018) recommended establishment of additional NFCAs within the upper Rio Grande, upper Pecos River, and their tributaries throughout the upper Rio Grande basin (i.e., area of Figure 3 shaded in lime green). Those recommended NFCAs are now being considered as potential priority areas for conservation investments by WNTI, DFHP, and partners.

Initial efforts to prioritize NFCAs in Texas were conducted in 2013 (Table 3), through funding provided by the Great Plains Landscape Conservation Cooperative (Birdsong et al., in press). That pilot phase focused on prioritization of freshwater systems for conservation of 71 fish SGCN that occur within six ecoregions located in the northwestern portion of the state (i.e., High Plains, Southwestern Tablelands, Central Great Plains, Arizona/New Mexico Mountains, Chihuahuan Desert, and Edwards Plateau ecoregions). Prioritization of

freshwater systems in that geography identified the following 11 conservation priority areas: Upper Canadian River NFCA, Upper Red River NFCA, Upper Brazos River NFCA, Central Edwards Plateau Rivers NFCA, Southern Edwards Plateau Rivers NFCA, Devils River NFCA, Pecos River NFCA, Guadalupe Mountains Streams NFCA, Davis Mountains Streams NFCA, Upper Big Bend NFCA, and Lower Big Bend NFCA (Figure 3). Through additional funding provided by the Great Plains Landscape Conservation Cooperative, Labay et al. (in press) completed a prioritization of NFCAs throughout the entire geography of the Great Plains Landscape Conservation Cooperative. That prioritization recommended additional NFCAs within the states of Oklahoma, Kansas, Nebraska, and South Dakota, including expansion of the Upper Red River and Upper Canadian River NFCAs of Texas into western Oklahoma (Figure 3). Prioritization of NFCAs in the eastern and southern portions of Texas was subsequently completed in 2015 (Birdsong et al., in press), identifying nine additional conservation priority areas: Northeast Texas Rivers NFCA, Southeast Texas Rivers NFCA, San Gabriel River NFCA, Middle Brazos River NFCA, Lower Brazos River NFCA, Lower Colorado River NFCA, Guadalupe and San Antonio Rivers NFCA, Central Coast Rivers and Streams NFCA, and Lower Rio Grande NFCA (Figure 3). The collective value of these multispecies aquatic assessments is that the groundwork has now been laid for strategic conservation planning and delivery to be focused within a set of watersheds recognized as critically important in the preservation of regional freshwater fish diversity.

Conservation Planning within Native Fish Conservation Areas of the Southwestern USA

Critically important to the success of Fish Habitat Partnerships has been the ability to facilitate communication and cooperative planning among local, state, and federal natural resources management agencies, non-governmental organizations, and other stakeholders. Collaborative planning allows for identification of shared geographic (e.g., ecoregions, watersheds) and thematic (e.g., dam removal, flow restoration, riparian restoration) priorities and supports strategic investments and leveraging of available technical and financial resources, often allowing for significant expansion of the scope and scale of local conservation projects (e.g., extent of watershed restored, inclusion of project-based monitoring or applied research necessary to evaluate and improve restoration designs). The Fish Habitat Partnerships have supported implementation of numerous successful case studies in multi-jurisdictional, watershed-scale conservation planning and delivery that have demonstrated holistic, integrated, and multi-species approaches to conservation of aquatic

resources (e.g., Birdsong et al. 2015). Those case studies highlight the value of a watershed-based approach in assembling and integrating interdisciplinary perspectives and expertise (e.g., aquatic biology, terrestrial ecology, fluvial geomorphology, public policy, fundraising, and advocacy) and in integrating formerly disjunct planning efforts such as state-based conservation planning activities that may only consider the portion of a multi-jurisdictional watershed or species range contained within that state. As Fish Habitat Partnerships expand this landscape-scale approach to other watersheds, assessments and decision support tools, such as those referenced above, are needed that help prioritize watersheds based on value in preservation of regional fish diversity and that help facilitate cooperation, foster collaboration, and guide strategic investments of available resources toward science-based conservation delivery.

Since prioritization of the initial 11 Texas NFCAs in 2013 (i.e., northwestern portion of Texas), TPWD, SARP, DFHP, and the U.S. Fish and Wildlife Service Science Applications Program have invested significant technical and financial resources toward conservation planning and delivery within those watersheds. This has included investments in habitat restoration (e.g., focal watersheds of the TPWD Landowner Incentive Program and SARP Aquatic Habitat Restoration Program), habitat preservation (e.g., targeted watersheds for conservation easements supported through the TPWD Farm and Ranch Lands Conservation Program), research (e.g., funding priorities of the State Wildlife Grants Program and Great Plains Landscape Conservation Cooperative), and biological assessments (supported through the joint TPWD and University of Texas at Austin gap sampling program). Those investments have contributed toward achieving the NFCA vision of restoring and preserving freshwater systems to the level that native fishes thrive as stable components of diverse ecological communities, simultaneously providing clean water, outstanding outdoor recreation, and a stable economic base for present and future citizens. This vision was adapted from the vision established for the Little Tennessee River NFCA (Harris et al., in press), which is considered the first NFCA officially designated in the USA.

Conservation planning and delivery within NFCAs of Texas has involved a diverse group of conservation partners from non-governmental organizations, state and federal agencies, and universities with a shared vision of collaborative stewardship and a shared mission to restore and preserve wild and native fishes and the habitats they need to thrive. Partners have focused on guiding strategic investments and leveraging available technical and financial resources to achieve scale-appropriate and transformative actions for conservation of native fishes, their habitats, and other freshwater resources. The critical

elements of NFCAs described by Williams et al. (2011), outlined previously in this report, have been adopted as the core principles of the Texas NFCAs. To facilitate conservation planning and align specific conservation actions undertaken within Texas NFCAs with those core principles, eight goals and related implementation strategies were established (Table 4).

Table 4 - Goals and implementation strategies established for Native Fish Conservation Areas of Texas.

Goal 1 - Protect and maintain intact, healthy habitats
- Determine locations and extent of healthy habitats
- Assess degree of threats and limiting factors present in healthy habitats
- Develop a priority list of stream segments for protective actions
- Organize Technical Advisory Teams for individual stream segments to analyze current data, define challenges, determine conservation methods and engage public support
- Develop action plans for addressing the objectives, select the best watershed management alternatives, list strategies for implementing alternatives, and determine appropriate milestones for measuring progress
- Maintain floodplain functions such as aquifer recharge, natural flow regime, base flows, spring flows, water quality, soil moistening, habitat diversity and, sediment transport
- Maintain appropriate sediment transport and avoid channel narrowing
- Maintain native vegetation throughout stream segments, including riparian corridors, floodplains, and upland areas
- Develop voluntary, non-regulatory tools such as financial incentives, conservation easements, landowner agreements, and targeted acquisition
- Seek appropriate easements, water rights acquisitions, and flow agreements to maintain appropriate hydrologic conditions
- Adopt conservation approaches that are cost-effective and sustainable over time
- Convene stakeholder groups to foster support of action plans
- Monitor conservation efforts and assess benefits to focal species populations
Goal 2 - Restore impacted habitats
- Determine locations, extent, and type of impacted habitats
- Assess degree of threats and limiting factors present in impacted habitats
- Develop a priority list of stream segments for restoration actions
- Organize Technical Advisory Teams for individual stream segments to analyze data, define challenges, determine restoration methods, and engage public support

- Develop action plans for addressing the objectives, select the best watershed management alternatives, list strategies for implementing alternatives, and determine appropriate milestones for measuring progress
- Where feasible, restore floodplain functions such as aquifer recharge, natural flow regime, base flows, spring flows, water quality, soil moistening, habitat diversity, and sediment transport
- Restore appropriate sediment transport and reduce channel narrowing
- Restore native vegetation throughout stream segments, including riparian corridors, floodplains, and upland areas
- Develop voluntary, non-regulatory tools such as financial incentives, conservation easements, landowner agreements, and targeted acquisition
- Seek appropriate easements, water rights acquisitions, and flow agreements to improve appropriate hydrologic conditions
- Adopt conservation approaches that are cost-effective and sustainable over time
- Convene stakeholder groups to foster support of action plans
- Monitor restoration efforts and assess benefits to focal species populations
Goal 3 - Restore stream and habitat connectivity
Inventory fish passage barriers and delineate impacts on ecology of focal species
Where feasible, diminish or remove fish passage barriers and restore aquatic connectivity
Goal 4 - Mitigate effects of invasive species
- Assess current status of focal species affected by invasive species
- Develop methods for reducing non-native species in targeted areas
- Develop methods to prevent introductions of invasive species and minimize impacts of existing invasive species
- Restore or improve the ecological balance in habitats negatively affected by non-native, invasive or problem species
- Reestablish genetic integrity of hybridized populations in targeted areas
Goal 5 - Organize and facilitate conservation partnership networks
- Provide technical guidance workshops, newsletters, social media, etc. to facilitate development and expansion of local citizen-based partnerships
- Landowner networks should be committed to the cooperative conservation of land and water resources within the watershed
- Landowner networks should promote values of functional upland, riparian, and stream systems and emphasize the conservation of native fish communities and supporting habitats

- Landowner networks should work to reduce or eliminate activities on the landscape that degrade water quality, reduce water quantity, degrade riparian systems, favor non-native species or fragment stream systems
- Landowner networks should encourage an array of sustainable land-use activities that are compatible with aquatic resource conservation
- Landowner networks should promote collaboration across jurisdictional and land ownership boundaries
Goal 6 - Establish conservation demonstration areas
- Provide fishing, paddling, and hiking opportunities
- Promote sustainable public use of rivers
- Describe benefits to other native species
- Demonstrate best management practices
- Highlight restoration actions through educational kiosks
Goal 7 - Conduct research to fill critical science needs
- Identify knowledge gaps critical to restoration and conservation of the focal species
- Design and conduct research as needed to enhance conservation efforts outlined in Goals 1-4
- Initial sampling at representative locations within each NFCA should be quarterly and include:
- Biological characteristics of focal species: population size, population structure (genetics & demographics), fecundity, food habits, habitat selectivity, flow-ecology relationships, associated species
- Habitat structure: flow and discharge rates, channel width, channel morphology, substrate types, depth, cover, trends in surrounding land use
- Water quality: temperature, pH, dissolved oxygen, conductivity, total dissolved solids, alkalinity, hardness, chemical and biological oxygen demand
- Threats and limiting factors for the focal species will determine the scale at which the monitoring is designed. As baseline data are developed, monitoring parameters can be modified and streamlined to address critical issues and needs for the focal species
Goal 8: Monitor Conservation Outcomes and Perform Adaptive Management
- Develop annual and long-term reporting requirements to document acquired data, departures from plan, and evaluations necessary for adaptive management
- Determine research needs for refining restoration and management actions
- Periodically modify strategies based on monitoring, evaluation, and research results
- Share information with the public in an easy to use and understandable format

Adoption of the eight goals outlined in Table 4 was intended to promote the restoration of watershed functions, emphasizing actions that curtail or eliminate activities on the landscape that degrade water quality, reduce water quantity, degrade riparian systems, favor non-native species, or fragment river systems, while encouraging a wide array of sustainable land-use and water-based recreational activities that are compatible with freshwater fish conservation. Furthermore, those goals have served as thematic topics used to facilitate cooperative planning and identification of NFCA-specific conservation needs, related conservation strategies, project-level conservation actions, and research and monitoring needs.

To plan and coordinate conservation delivery within NFCAs of Texas, watershed-based conservation partnerships were formed. To initiate the partnerships, local, state, and federal natural resources management agencies, universities, non-governmental organizations, and other local conservation partners were invited to participate in conservation planning webinars, workshops, and field days. Webinars were used to present an overview of the conceptual underpinnings of NFCAs, review the eight NFCA goals and related implementation strategies (Table 4), and to review the geographic extent of the freshwater systems recommended as NFCAs (Figure 3). The subsequent workshops and field days were used to engage partners in identification of desired outcomes for populations of freshwater fish SGCN and their habitats, with an emphasis on potential strategies to support maintenance of watershed processes, restoration of degraded habitats, preservation of intact habitats, and local capacity-building to ensure that conservation actions are sustainable long-term. During 2015-2018, workshops and field days were organized and conducted for the Upper Canadian River, Upper Red River, Upper Brazos River, Lower Colorado River, Central Edwards Plateau Rivers, Upper Big Bend, Lower Big Bend, Guadalupe Mountains Streams, Davis Mountains Streams, Pecos River, and Devils River NFCAs (Figure 4), for the purpose of facilitating development of NFCA-specific conservation action plans. In partnership with the Great Plains Fish Habitat Partnership, conservation planning workshops were also conducted in the U.S. Great Plains for four additional NFCAs proposed by Labay et al. (in press; i.e., Arkansas, Kansas, Platte, and White rivers; Figure 4).

Conservation planning workshops were attended by 132 fish and wildlife conservation professionals representing state and federal resource management agencies, universities, and conservation non-profits. Participants were tasked with identification and prioritization of specific conservation projects that could be implemented to conserve native fishes and their habitats within the NFCAs (e.g., improved land management practices within associated

watersheds, barrier removal, water rights acquisition, flow agreements, research). Workshop participants identified and prioritized 176 individual conservation actions, which are outlined in Tables 5-9 and identified in Figure 5 by location and by the corresponding NFCA goal addressed. Priority conservation actions are summarized below for each of the 11 NFCAs for which conservation planning workshops were conducted, along with a characterization of each of the 11 NFCAs.

Additional webinars and conservation planning workshops are scheduled to occur during 2019-2020 within the Northeast Texas Rivers, Southeast Texas Rivers, Guadalupe and San Antonio Rivers, Central Coast Rivers and Streams, San Gabriel River, Middle Brazos River, Lower Brazos River, Southern Edwards Plateau Rivers, and Lower Rio Grande NFCAs (supported through the State Wildlife Grants Program). Workshop outcomes, including lists of priority conservation actions identified by stakeholders, will be made accessible at: http://nativefishconservation.org/

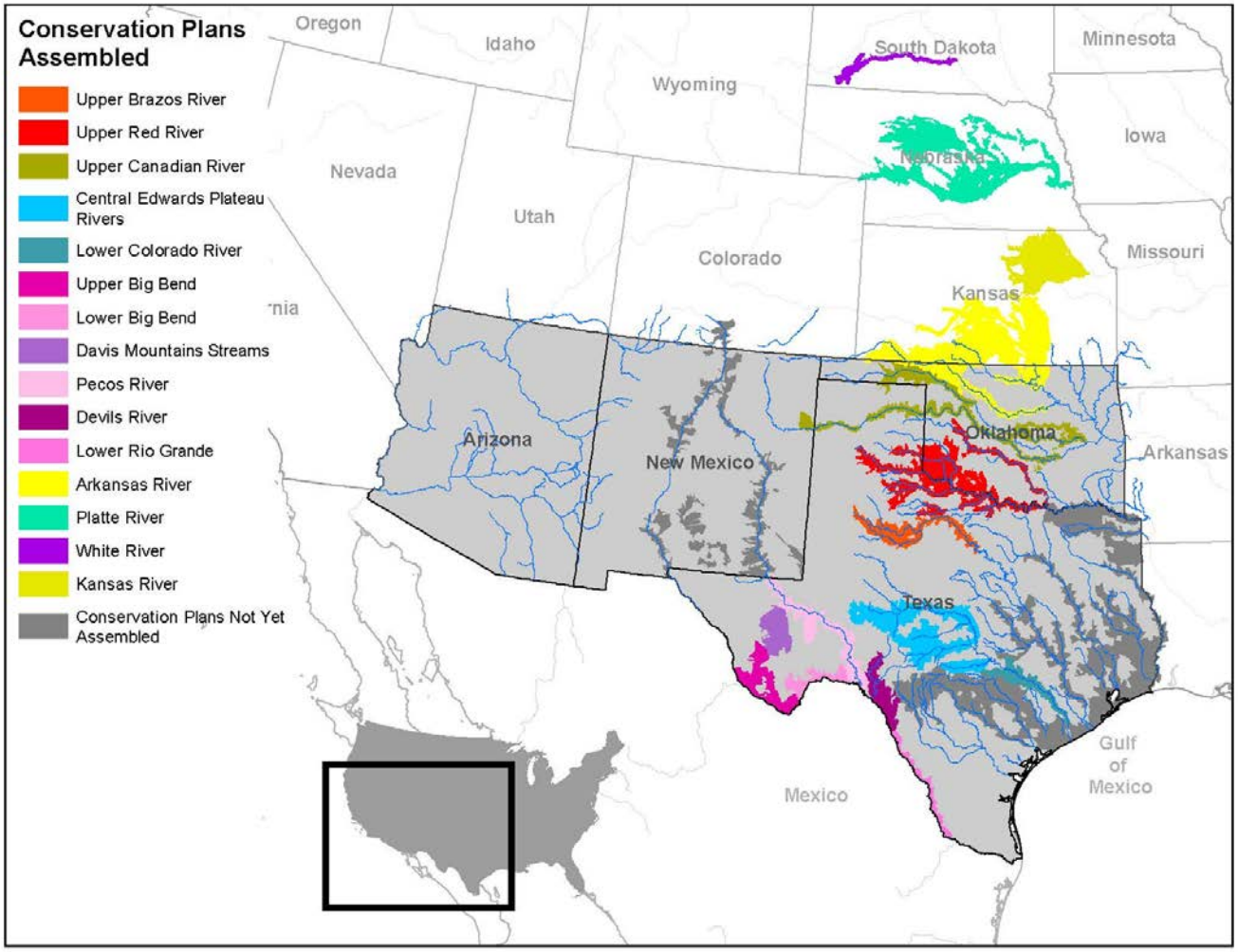


Figure 4 - Native Fish Conservation Areas of the U.S. Southwest and U.S. Great Plains for which conservation planning workshops have been conducted and conservation action plans assembled.

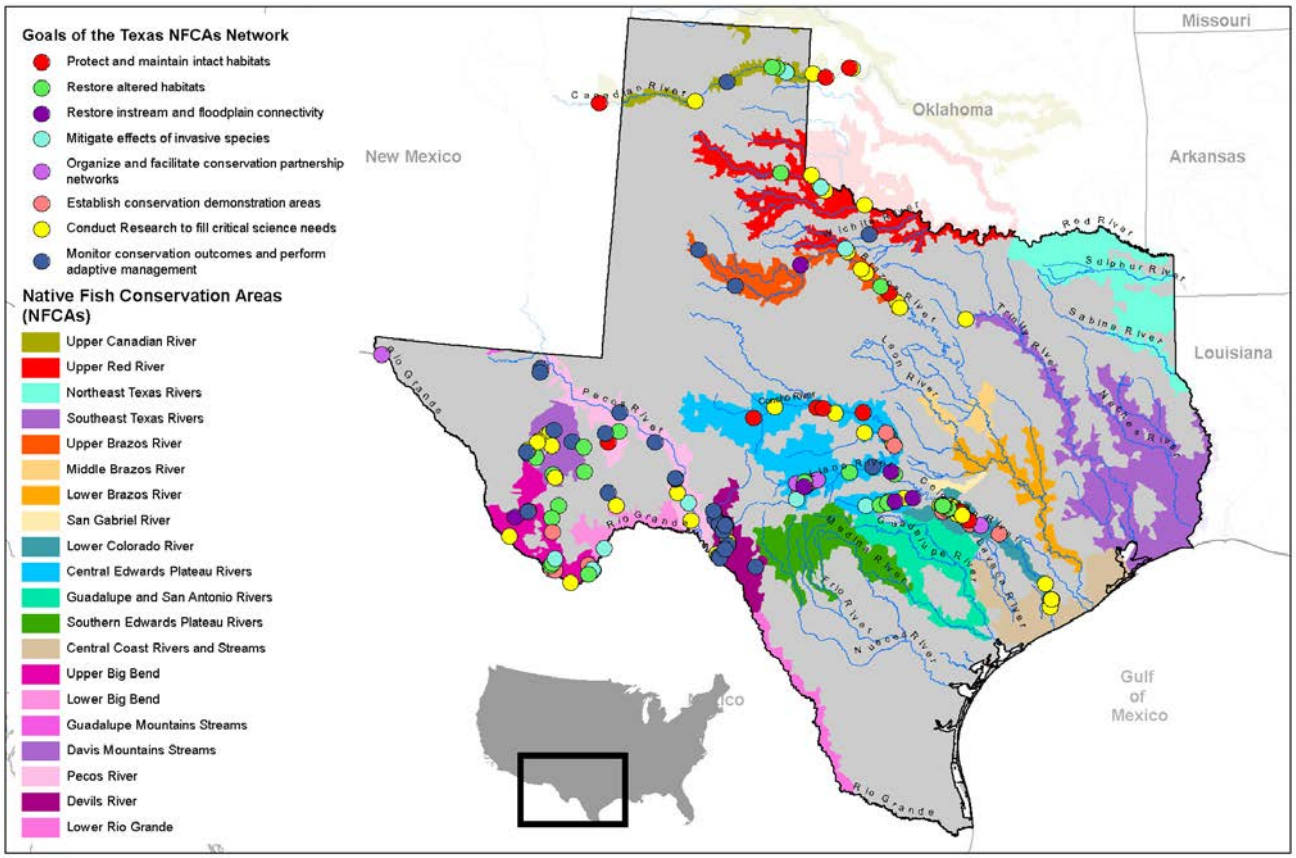


Figure 5 - Conservation actions, identified by location and NFCA goal, recommended by conservation practitioners at conservation planning workshops.

Conservation Action Plan for Native Fish Conservation Areas of the Chihuahuan Desert Ecoregion of Texas

In the Chihuahuan Desert ecoregion of Texas, 40 of the 93 native freshwater fishes documented to have occurred in the ecoregion were selected as focal species for the multispecies aquatic assessment and NFCA prioritization (Appendix A; Garrett et al., in press). The NFCA prioritization resulted in selection of six NFCAs (i.e., Guadalupe Mountains Streams, Davis Mountains Streams, Pecos River, Upper Big Bend, Lower Big Bend, and Devils River NFCAs), which have since been adopted by DFHP, TPWD, and local partners as priorities for conservation investments. The Chihuahuan Desert NFCAs contain a diversity of habitats with many uniquely adapted plants and animals. In addition to flows from the Rio Grande, Río Conchos, Pecos River, and Devils River, three major (Hueco-Mesilla Bolsons, Pecos Valley, and Edwards-Trinity Plateau) and six or more minor aquifers provide water to the region.

Freshwater systems of the Chihuahuan Desert ecoregion (and desert ecosystems in general) are fragile and slow to recover from perturbations. Some disruptions may not be

recoverable. Deep downcutting of streams by erosion from overgrazing and deforestation (Ohmart and Anderson 1982), reduced instream flow, introductions of non-native species, and extinction of native species may cause irreversible damage to these ecosystems. Under such conditions, droughts are even more devastating and amplify anthropogenic impacts. Droughts not only reduce rainfall magnitude and frequency, but also cause an increase in groundwater pumping for agricultural and municipal uses as surface waters abate. Such extreme conditions put stress on fish community equilibrium with more tolerant species gaining a competitive and numerical advantage. Tributary creeks tend to be impacted more severely yet are critical to the breeding and rearing of young of many of the endemic species (e.g., Mexican Stoneroller *Campostoma ornatum*, Chihuahua Shiner *Notropis chihuahua*, Big Bend Gambusia *Gambusia gaigei*, Conchos Pupfish *Cyprinodon eximius*; Hubbs 1990). These changes have been gradual and long-term, taking place since the mid-1800s (Miller 1961), but their effects have been compounded over time and are now becoming dramatic. While perturbations such as pollution, reduced groundwater, and dam construction are theoretically fixable, recovery to a pristine state is unlikely.

Although many data gaps exist, what is known about Chihuahuan Desert fish and other aquatic organisms is distressing. Approximately half of the native fishes of the Chihuahuan Desert ecoregion are threatened with extinction or are already extinct (Hubbs 1990). Likely extinctions from this area include: Maravillas Red Shiner *Cyprinella lutrensis blairi*, Phantom Shiner *Notropis orca*, Rio Grande Bluntnose Shiner *Notropis simus simus* and Amistad Gambusia *Gambusia amistadensis* (Miller et al. 1989). Extirpations include Rio Grande Shiner *Notropis jemezanus* in the New Mexico portion of the Rio Grande (Propst et al. 1987) and Shovelnose Sturgeon *Scaphirhynchus platorynchus*, Rio Grande Silvery Minnow *Hybognathus amarus*, Rio Grande Cutthroat Trout *Oncorhynchus clarkii virginalis*, and Blotched Gambusia *Gambusia senilis* in Texas (Hubbs et al. 2008). Endemic species, such as mussels, are being lost as well (Rio Grande Monkeyface *Quadrula couchiana*, False Spike *Quincuncina mitchelli*, and Mexican Fawnsfoot *Truncilla cognata*; Howells and Garrett 1995). Left unchecked, this trend of species extirpation and extinction is likely to continue.

Another significant threat to a substantial portion of the Chihuahuan Desert NFCAs is the establishment of invasive Giant Reed *Arundo donax* and Saltcedar *Tamarix spp.* These non-native plants have effectively channelized stream segments and the resulting constricted flow has reduced shallow, backwater habitat and changed bottom sediments from a mixture of sand and gravels to one of primarily larger gravels and cobble. The dense stands have also armored and stabilized the riverbanks thus preventing natural sediments and sand from

being available within the river itself, impacting important habitat for many species (Garrett and Edwards 2014).

The streams of the Chihuahuan Desert NFCAs hardly resemble their natural state where many of the original water courses were once lined with gallery forests and diverse riparian zones. Of the more than 100 moderate (2.8 - 28 L/s) and major (>28 L/s) historical springs, 50% are no longer extant (Brune 1981; Garrett et al., in press). Early records, some as far back as 1583, mention expansive ciénegas and abundant fishes (Brune 1981). Exploitation of limited resources, particularly groundwater pumping, has degraded that environment, caused extirpation and extinction of species, and ultimately perpetuated the loss of habitats and ecosystems (Smith and Miller 1985). The few relatively natural faunas and reasonably intact ecosystems that remain need careful management if they are to be preserved.

Upper Big Bend and Lower Big Bend Native Fish Conservation Areas

The Upper Big Bend NFCA (Figure 6) and Lower Big Bend NFCA are located along the international border in Presidio, Brewster, and Terrell counties. They represent two contiguous, but very different stream segments (upstream and downstream of Mariscal Canyon) with distinct differences in base flow, sediment movement, and water quality. These differences are primarily due to reduced base flow and water quality in the Upper Big Bend NFCA and considerable spring flow inputs and improved water quality in the Lower Big Bend NFCA (Bennett et al. 2014). As a result, the Lower Big Bend NFCA remains somewhat ecologically intact and still supports a high diversity of native aquatic species (Bennett and Urbanczyk 2014). However, more than half of the 42 native fish species in the two Big Bend NFCAs are imperiled and of those, almost 50% are already extirpated or extinct (Garrett et al., in press). In addition, 29% of the fish species that currently occur in these two NFCAs are non-native (Appendix A).

Bennett et al. (2014) noted that numerous threats to aquatic resources have been documented within the two Big Bend NFCAs, including channel narrowing and sediment accumulation (Dean and Schmidt 2011; Dean et al. 2011), deteriorating aquatic habitat (Heard et al. 2012), invasive and non-native species (Everitt 1998), water-quality deterioration (Sandoval-Solis et al. 2010; Bennett et al. 2012), elevated concentrations of mercury, arsenic, and selenium in fishes (Schmitt et al. 2005), groundwater extraction (Donnelly 2007), and climate change (Ingol-Blanco 2011). The combination of regional water management and invasive, non-native riparian species has changed stream flow, sediment dynamics, and riparian vegetation cover (Everitt 1998; Schmidt et al. 2003; Dean and Schmidt 2011). The

Figure 6 - Upper Big Bend Native Fish Conservation Area at the confluence of Terlingua Creek and the Rio Grande.

once wide and shallow channel of the Rio Grande has become narrow and deep. Non-native riparian plants (primarily Giant Reed and Saltcedar) affect channel sediment dynamics, aquatic habitat, and riparian communities by covering up and eliminating backwaters and side channels, diminishing channel conveyance capacity, and increasing flooding frequency (Dean and Schmidt 2011; Garrett and Edwards 2014). Feral pigs *Sus scrofa*, burros *Equus africanus asinus*, horses *Equus ferus caballus*, and cattle *Bos spp.* occur in the area and have negatively impacted natural resources within the river corridor by further degrading riparian habitats.

The focal fishes of the two Big Bend NFCAs include four undescribed taxa, Conchos Roundnose Minnow *Dionda sp. 1*, Rio Grande Blue Sucker *Cycleptus sp.*, Chihuahua Catfish *Ictalurus sp. 1*, and Rio Grande Blue Catfish *Ictalurus sp. 2*. In addition to the focal fish species, other aquatic species of concern include Salina Mucket *Potamilus metnecktayi*, Tampico Pearlymussel *Cyrtonaias tampicoensis*, Texas Hornshell *Popenaias popeii*, Big Bend Rough-

footed Mud Turtle *Kinosternon hirtipes murrayi*, Big Bend Slider *Trachemys gaigeae*, American Beaver *Castor canadensis*, and Pecos River Muskrat *Ondatra zibethicus ripensis*.
Areas being actively managed for conservation of species and habitats include Big Bend National Park, Rio Grande Wild and Scenic River, Big Bend Ranch State Park, Black Gap Wildlife Management Area, Chinati Mountains State Natural Area, and the Terlingua and Alamito Creek watersheds (through significant investments by resource management agencies, private landowners, and conservation non-profit organizations).

Pecos River Native Fish Conservation Area

The Pecos River NFCA encompasses a wide variety of habitat quality. Agricultural and municipal water diversions have greatly diminished water quantity in the upper reaches and increased salinity (as high as 12,000 mg/L). High salinity has resulted in the loss of many fish species and the repeated occurrence of toxic golden alga *Prymnesium parvum* blooms. Freshwater inputs from Independence Creek (Figure 7) and other springs greatly improve water quality and quantity in the lower Pecos River. Other threats include groundwater extraction, oil and gas development, and invasive species. In addition to the focal fish species (Appendix A), other aquatic species of concern include the Rio Grande Cooter *Pseudemys gorzugi*, American Beaver, and Pecos River Muskrat. An 8,000-ha preserve along Independence Creek is owned by The Nature Conservancy with an adjacent 280 ha under conservation easement (Karges 2014a).

Figure 7 - Independence Creek immediately upstream of the confluence with the lower Pecos River within the Pecos River Native Fish Conservation Area.

Davis Mountains Streams Native Fish Conservation Area

The Davis Mountains Streams NFCA includes desert habitats such as the Balmorhea Springs Complex, as well as streams in the Davis Mountains. The mountain streams harbor at least two species of conservation concern: Rio Grande chub *Gila pandora* and Chihuahua catfish. The Balmorhea Springs Complex is considered one of the largest and most important of the remaining desert spring systems in West Texas (Karges 2014b). The main springs

include Phantom Lake, San Solomon, Giffin, Saragosa, Toyah Creek, East Sandia, and West Sandia springs. This was once a massive, interconnected network of ciénegas fed by cumulative spring discharges of approximately 130,000,000 L/day (White et al. 1941). Groundwater pumping and draining of ciénegas for agriculture has reduced flow by more than one-third and disconnected the ciénega network (Garrett et al., in press). All that remains for aquatic habitat are three small springs (East Sandia, West Sandia, and Giffin), artificial refuge ciénegas (Figure 8), and irrigation canals (Garrett 2003). These remaining habitats are essential for the survival of the two federally endangered fishes, Pecos Gambusia *Gambusia nobilis* and the endemic Comanche Springs Pupfish *Cyprinodon elegans*. In addition to the focal fishes (Appendix A), other aquatic species of concern in this NFCA include the Diminutive Amphipod *Gammarus hyalleloides*, Phantom Cave Snail *Pyrgulopsis texana*, Phantom Springsnail *Tryonia cheatumi*, Rio Grande Cooter, and Pecos sunflower *Helianthus paradoxus*. Areas being actively managed for species and habitat conservation include Davis Mountains State Park, Balmorhea State Park, Phantom Lake, and The Nature Conservancy's Sandia Springs and Davis Mountains preserves.

Figure 8 - Artificial ciénega, located within the Davis Mountains Streams Native Fish Conservation Area at the TPWD Balmorhea State Park.

The Davis Mountains Streams NFCA also includes Comanche, Leon, and Diamond-Y springs in Pecos County near Fort Stockton. Comanche Springs no longer flow and as Gunnar Brune (1981) noted, "failure of Comanche Springs was probably the most spectacular example in Texas of man's abuse of nature." Flowing at 1,200 - 1,900 L/s, this spring was one of the largest in Texas, but flow completely ceased in 1962 due to aquifer pumping for irrigation from a well field up-gradient of the springs during the drought of the 1950s (Mace 2001). The outflow from the springs, Comanche Creek, supported a vast ciénega of approximately 25 km in length. The drying of the springs extirpated the Pecos Gambusia and Comanche Springs Pupfish and was not only an ecological disaster, but also had severe impacts on the more than 100 farmers who had, since the 1860s, depended on waters flowing

from Comanche Springs and the ciénega for irrigation of approximately 2,500 ha of cropland (Brune 1981).

Leon Springs, up-gradient and in the same aquifer as Comanche Springs, were also modified to provide irrigation for farming. Originally the springs were deep and up to 30 m in diameter and supported a large ciénega that extended for many kilometers downstream (Brune 1981). During the 1920s, a stone and earth dam created Lake Leon (Scudday 2003) that backed water up to, or over, Leon Springs. Unfortunately, this modification likely led to the extirpation of both Pecos Gambusia and Leon Springs Pupfish *Cyprinodon bovinus* as none were collected by Carl Hubbs in his 1938 survey of this type locality for the Leon Springs Pupfish (Hubbs 1980, Minckley et al. 1991). The same groundwater pumping that led to the demise of Comanche Springs also dried Leon Springs in 1958 (Brune 1981). Although Diamond-Y Springs were not as large as Comanche and Leon springs, they continue to flow, so far, and provide habitat for the federally endangered Pecos Gambusia and Leon Springs Pupfish as well as several other species; however, the flow is greatly reduced from historical levels (Scudday 2003). Fortunately, the Diamond-Y Springs ecosystem does not derive all of its flow from the same aquifer as Comanche and Leon springs (Sharp et al. 2003). Other rare species in this system include federally endangered invertebrates: Diamond Tryonia *Pseudotryonia adamantina*, Gonzales Tryonia *Tryonia circumstriata*, Pecos Amphipod *Gammarus pecos*, and Pecos Assiminea *Assiminea pecos*, and the federally threatened Pecos Sunflower. Some degree of protection is afforded the inhabitants of the ciénega at Diamond-Y Springs in that The Nature Conservancy owns 1,600 ha that encompass it and is committed to its maintenance and perpetuation. Although state water law recognizes that The Nature Conservancy "owns" the water beneath their land, it does not allow them to protect this "owned" water from pumping. Additionally, the Diamond-Y Springs is adjacent to an active oil and gas extraction field (with some of the active pumps located on the preserve). Working wells are within 100 m of surface water, a natural gas refinery is 30 m upslope from the spring, and old brine pits are just a few meters away (Garrett et al., in press).

Guadalupe Mountains Streams Native Fish Conservation Area

The Guadalupe Mountains Streams NFCA (Figure 9) is unique in that it supports a population of introduced Rainbow Trout *Oncorhynchus mykiss* and might have had a native population of Rio Grande Cutthroat Trout *O. clarkii virginalis* (Garrett and Matlock 1991; Petersen 2002). The creek is fully protected within the Guadalupe Mountains National Park and by conservation easements held by The Nature Conservancy, and could provide a viable

option for establishment of refuge populations of Rio Grande Cutthroat Trout and Rio Grande Chub.

Figure 9 - McKittrick Creek in the Guadalupe Mountains Streams Native Fish Conservation Area.

Devils River Native Fish Conservation Area

The Devils River NFCA includes the Devils River (Figure 10), which extends 100 km from its headwaters at Pecan Springs to Amistad International Reservoir, and San Felipe Creek located in the City of Del Rio. The springs of the Devils River and surrounding area are fed by the Edwards-Trinity Plateau Aquifer, which produces the largest number of springs in Texas, with 46 occurring in Val Verde County alone, as well as the third (Goodenough Springs) and fourth (San Felipe Springs) largest springs in the state (Brune 1981). Goodenough Springs, now covered by Amistad Reservoir, still maintain a significant discharge under the lake surface (Ashworth and Stein 2005). Amistad Gambusia was endemic to the headsprings and the 1.3-km spring run downstream to its confluence with the Rio Grande (Peden 1973) but inundation by the reservoir resulted in its extinction.

Figure 10 - Devils River Native Fish Conservation Area at the Dan Allen Hughes Unit of the TPWD Devils River State Natural Area.

The Devils River occurs at the juncture of the Chihuahuan Desert, Southern Texas Plains, and Edwards Plateau ecoregions (TCEQ 2014). This unique intersection of arid desert, brushland, and karst topography provides a diversity of habitat types, which support numerous aquatic and terrestrial species, including several regionally endemic species classified as threatened or endangered by TPWD and the U.S. Fish and Wildlife Service. The Devils River, and its major tributary Dolan Creek (Figure 11), are home to four state threatened fish species: Proserpine Shiner *Cyprinella proserpina*, Conchos Pupfish *Cyprinodon eximius*, Rio Grande Darter *Etheostoma grahami*, and Devils River Minnow *Dionda diaboli* (El-Hage and Moulton 2001). The Devils River Minnow was also listed as federally threatened in 1999 based on documented population declines attributed to a loss of habitat within the species range due to the construction of Amistad Reservoir, spring dewatering, and stream modifications (USFWS 1999). Other focal fishes that occur in the Devils River NFCA include the Mexican Blindcat *Prietella phreatophila*, Spotfin Gambusia *Gambusia krumholzi*, Blotched Gambusia, Manantial Roundnose Minnow *Dionda argentosa*, Tamaulipas Shiner *Notropis braytoni*, Rio Grande Shiner, West Texas Shiner *Notropis megalops*, Longlip Jumprock *Moxostoma albidum*, Headwater Catfish *Ictalurus lupus*, and Rio Grande Largemouth Bass *Micropterus salmoides nuecensis*.

Figure 11 - Devils River Native Fish Conservation Area at the confluence of Dolan Creek and the Devils River at the interface of The Nature Conservancy's Dolan Falls Preserve and the Del Norte Unit of the TPWD Devils River State Natural Area.

In addition to the focal fish species (Appendix A), other species of concern include the Texas Hornshell *Popenaias popeii*, Rio Grande Cooter, Spring Salamander *Eurycea spp.*, and endemic spring invertebrates. The Texas Hornshell, the only native mussel species known to occur in the NFCA (Howells 2014; Randklev et al. 2018), was listed as federally endangered in 2018 due to the threat imposed by habitat degradation in the form of hydrologic alteration, sedimentation, predation, instream fish passage barriers, and water quality impairment (USFWS 2018). American Beaver also inhabit the river, but suffer from habitat loss, changes to the natural hydrological regime, competition with non-native Nutria *Myocastor coypus*, decreased food supply, and the presence of the invasive Giant Reed and Saltcedar (Garrett et al. 2014). The river and riparian corridor are utilized by several state and federally listed bird species including black-capped vireo *Vireo atricaplla*, tropical parula *parula pitiayumi*, interior least tern *Sterna antillarum athalassos,* and zone-tailed hawk *Buteo albonotatus* (El-Hage and

Moulton 2001). The Devils River corridor is also home to rare plants including the Texas snowbell *Styrax platanifolius texanus*, a riparian shrub (USFWS 2008), and the Tobusch fishhook cactus, a cacti known to occur in flood-prone riparian areas (TPWD 1995). Additionally, the Devils River watershed is located along a major migratory path for monarch butterfly *Danaus plexippus* (Reppert et al. 2010), which is under review for federal listing. The watershed is also home to Fern Cave, which serves as a maternity roost for approximately 10 million Mexican free-tailed bats *Tadarida brasiliensis* from May through October each year (TNC 2008).

Arguably the largest threat currently facing the river and the many species that depend on it is the potential for declining groundwater supplies, which in turn impact spring discharge and river flows (TPWD 2012a). Water quality in the Devils River has historically ranked as excellent when compared to water quality standards established by the Texas Commission on Environmental Quality (TCEQ 2004). This high-quality surface water can be partially attributed to the many mapped and unmapped springs along the river's length (Brune 1981) and the rural, undeveloped nature of the watershed (Anderson et al. 2014). These springs supply the river with up to 75% of the baseflow and, via Amistad Reservoir, provide approximately 15% of the water needed for municipal and agricultural water supplies in the Lower Rio Grande Valley (Green et al. 2014). While these spring discharges provide an oasis of pristine water in an otherwise arid environment for numerous rare and endemic taxa, they also make the Devils River vulnerable to reductions in baseflows from reduced groundwater availability. In addition to a predicted 73% increase in human populations between 2020 and 2070, Texas is projected to suffer a 24% decrease in groundwater availability over the same time period (TWDB 2017).

In addition to the potential for reduced river flows from declining groundwater availability, other current threats to the Devils River include watershed alteration, introduction and expansion of invasive species, and increased recreational use. Land use within the watershed has historically been comprised of large-acreage cattle, sheep, and goat ranches. Continued overgrazing in portions of the watershed has led to changes in terrestrial ecosystems, with a shift from native grassland prairie habitats to bare soil and shrubland (Brune 1981; TPWD 2010). With an increase in the surface area of bare ground, there has been an increase in surface runoff and a decrease in infiltration for groundwater recharge (Brune 1981). This, coupled with increasing groundwater withdrawals, has contributed to declines in the discharge of springs that support river baseflows.

In recent decades, some of the historically large ranches in the Devils River watershed have been subdivided and sold for home sites. Those housing developments have limited regulation and pose potential threats to the river, such as point source pollution from faulty septic systems (McQuillan 2004). Other ranches have shifted from domestic livestock production to exotic game ranches. Escapement of non-native ungulates from these ranches has led to the establishment of feral populations of, most notably, axis deer *Cervus axix* and aoudod or Barbary sheep *Ammotragus lervia*. The addition of non-native ungulates to the Devils River landscape has increased the abundance of foraging species in an already sensitive and overgrazed system. The proliferation of these non-native grazing species can lead to further habitat reduction through reduced forage diversity for native species and increased runoff (TPWD 2010), contributing to further reductions in groundwater infiltration rates and increased potential for sedimentation in the river. In addition to non-native terrestrial species, several non-native aquatic species have been introduced to and become established in the river including Blue Tilapia *Oreochromis aureus*, Common Carp *Cyprinus carpio*, Asian Clam *Corbicula fluminea*, and Red-rimmed melania *Melanoides tuberculata*. Red-rimmed melania serve as an intermediate host for an nonindigenous digenetic trematode gill parasite *Centrocestus formosanus*, which is known to cause mortality in fish with high infestation rates (McDonald et al. 2006) and has been documented in Devils River fish populations, including Devils River Minnow (McDermott, et al. 2014).

Although most of the Devils River flows adjacent to private property, several conservation areas and initiatives exist within the watershed. TPWD currently protects 15,000 ha in the Devils River State Natural Area (Figures 10 and 11). In addition, The Nature Conservancy owns and manages the 1,900-ha Dolan Falls Preserve (Figure 11) and a total of 63,000 ha of private and public lands are currently under conservation easements (Garrett et al. 2014). The Devils River is considered one of the last true wilderness paddling experiences in Texas and is revered for its biological, aesthetic, cultural, and recreational values (El-Hage and Moulton 2001; NPS 2018). It has been nominated as a National Wild and Scenic River and is recognized as an Ecologically Significant Stream Segment (El-Hage and Moulton 2001).

Conservation Planning within Chihuahuan Desert NFCAs

In order to restore and protect the six NFCAs described above, conservation partners intend to employ a multispecies, habitat-based approach to species conservation that provides an improved method for addressing the common nature and magnitude of threats facing these ecosystems and their component species. It also improves efficiency, cost

effectiveness, and is more likely to be implemented (Knight et al. 2006). This approach is designed to coordinate projects to improve water quality, increase water quantity, restore natural habitats, reduce impacts of non-native species, diminish stream system fragmentation, and restore proper function of springs, ciénegas, creeks, rivers, and riparian areas. It will only be effective if it is able to inform and influence water management, land-use planning and zoning, and land-management decisions that will determine current and future conditions of rivers and streams and the associated habitat quality for native fishes. Additionally, to provide long-term benefits to focal species populations, conservation actions must be coordinated at sufficient scales to meet all life history stages of these species and must adopt conservation approaches that are cost-effective and sustainable over time.

To accomplish this goal, it is necessary to develop a holistic, habitat-oriented approach to conservation of focal species, restore and protect habitat, restore habitat connectivity, and reduce deleterious effects of non-native species. Threat factors need to be delineated and prioritized based on threat level and what can be managed. Currently known threats in the Chihuahuan Desert NFCAs include:

a. habitat fragmentation
b. barriers to migration
c. loss of natural flow regime
d. reduced stream flow
e. spring flow declines and aquifer depletion
f. channel narrowing and sediment accumulation
g. groundwater pollution
h. habitat loss
i. non-native species – habitat modification, hybridization, competition and predation

In order to develop and refine conservation actions plans for the six NFCAs in the Chihuahuan Desert ecoregion of Texas, an interdisciplinary team of 55 individuals, representing TPWD Inland Fisheries Division, TPWD Wildlife Division, TPWD State Parks Division, U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program and Texas Fish and Wildlife Conservation Office, National Park Service, University of Texas at Austin, Texas Tech University, Fort Worth Zoo, The Nature Conservancy of Texas, World Wildlife Fund, Desert Fish Habitat Partnership, Big Bend Conservation Alliance, and Devils River Conservancy formed the Chihuahuan Desert Native Fish Conservation Network (NFCN). The Chihuahuan Desert NFCN met by webinar in fall 2016 and then through workshops in

spring 2017 and spring 2018. Cooperators were tasked with: 1) identifying priority research, monitoring, and restoration actions for preservation of native fishes, their habitats and other aquatic resources in the Chihuahuan Desert of Texas; 2) catalyzing cooperation, collaboration, and leveraging of technical and financial resources among local, state and federal natural resource management agencies, universities, non-governmental organizations, and other local partners that contribute to the conservation of native fishes and other aquatic resources in the watersheds of the Chihuahuan Desert; and 3) facilitating local implementation of the NFHAP and Texas Conservation Action Plan in the Chihuahuan Desert NFCAs.

Priorities for research, monitoring, and restoration were identified by the Chihuahuan Desert NFCN. Those actions focused on addressing the eight NFCA goals outlined previously (Table 4). The Chihuahuan Desert NFCN met initially by webinar to familiarize cooperators with the rationale and approach used in identification of the NFCAs, and to review the proposed process for development of a joint conservation action plan. The NFCN then held in-person workshops to identify and prioritize research, monitoring and restoration projects that need to be initiated. These discussions resulted in the identification of 77 priority actions that serve as the basis for a multi-year conservation action plan now being used to guide cooperative conservation by the Chihuahuan Desert NFCN (Table 5). Funding and other means of support for delivery of these actions are now being assembled by cooperators.

Table 5 - Conservation Action Plan for the six Native Fish Conservation Areas of the Chihuahuan Desert ecoregion of Texas (i.e., Guadalupe Mountains, Davis Mountains, Pecos River, Upper Big Bend, Lower Big Bend, and Devils River Native Fish Conservation Areas).

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Monitoring and Adaptive Management	BMPs for stream corridor restoration	Conduct research and monitoring to evaluate restoration strategies and techniques being used throughout the region and determine what works well, what does not work and why	Improved efficiency and success of restoration and conservation projects
Research	Data/information clearinghouse for research, monitoring, and restoration actions that have occurred within the Chihuahuan Desert	Conduct data/information mining/sharing project and collate/summarize relevant research, monitoring, and restoration actions that have occurred within the Chihuahuan Desert over the past 10 years; assemble a historical summary of regional conservation efforts (as far back as possible)	Provide access to recent and historical information relevant to fish and wildlife conservation in the Chihuahuan Desert ecoregion

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Research	Groundwater-surface water interactions and environmental flows targets	Develop science to increase understanding of groundwater-surface water interactions; assemble environmental flows targets	Increased understanding of groundwater-surface water interactions and establishment of environmental flows targets
Research	Effective groundwater management in Chihuahuan NFCAs	Develop strategies to effectively manage groundwater to achieve specific targets for spring discharge and instream flows	Development and implementation of strategies to effectively manage groundwater to achieve specific targets for spring discharge and instream flows
Research	Biological monitoring and riparian restoration	Meet with Sul Ross State University to explore programmatic partnership to increase involvement in biological monitoring and riparian restoration in the region	Increased and enhanced biological monitoring and riparian restoration in the region
Partnerships	Rio Grande/ Bravo Water Forum	Bring together teams of folks who are working on water and natural resource conservation to learn from one another and enhance collaboration for greater impact	Enhanced collaboration on regional conservation issues
Habitat Protection / Habitat Restoration	Ciénega Research and Management	Develop research recommendations and BMPs for ciénegas	Increase understanding of flow alteration, marsh encroachment, and other changes to the system; establish benchmarks based on historical conditions; develop strategies to inform effective management
Habitat Restoration	Assessment of of stream restoration potential	Determine, on a regional-scale, where conditions are appropriate and conducive for restoration of riparian plant communities	Effective restoration of riparian zones
Habitat Restoration / Connectivity	Regional assessment of water table in ephemeral streams	Conduct a GIS-based regional assessment (w/ the possibility of a field-based component) of water table in ephemeral streams of the region to determine restoration potential (use of ground-penetrating LIDAR or other remote sensing data/techniques); model/project likelihood of restoration success given environmental conditions identified that influence restoration	Determine likelihood of restoration success and prioritize efforts to restore ephemeral streams

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Monitoring and Adaptive Management	Fish monitoring in the Devils River and Dolan Creek	Continue regular fish monitoring in the Devils River and Dolan Creek	Effective conservation of fish SGCN
Monitoring and Adaptive Management	Streamflow gauge operation on Dolan Creek	Continue the streamflow gauge operation on Dolan Creek for at least 5 years	Ensures effective conservation and understanding of spring and streamflow effects on native fauna and flora
Monitoring and Adaptive Management	Streamflow gauge operation on Devils River at Bakers Crossing	Explore transfer of Devils River Bakers Crossing gauge from IBWC to USGS	Ensures effective conservation and understanding of spring and streamflow effects on native fauna and flora
Monitoring and Adaptive Management	Additional groundwater well recorder	Add at least one more groundwater well recorder on the Devils River and ensure location in best areas	Ensures effective conservation and understanding of aquifer / streamflow interactions
Monitoring and Adaptive Management	Water quality monitoring in the Devils River	Add water quality monitoring sites throughout the river	Ensures effective conservation and monitoring of water quality
Monitoring and Adaptive Management	Reestablish/ repatriate native fish communities in Pinto Creek	Develop a plan to reestablish/ repatriate native fish communities in Pinto Creek utilizing hatchery stock of Devils River Minnow (after genetic assessment) and wild source for other native fishes	Reestablish/repatriate native fish communities in Pinto Creek including Devils River Minnow
Monitoring and Adaptive Management / Research	Water budget in the Devils River basin	Science to understand water budget in the Devils River basin including the full area of groundwater contributions in the basin	Improved ability to evaluate effects of pumping on Devils River flow and springs in the Devils River basin
Monitoring and Adaptive Management / Research	Modeling of aquifer flow paths in the upper Devils River	Develop models of aquifer flow paths in the upper Devils River	Improved ability to evaluate effects of pumping on Devils River flow and springs in the Devils River basin
Monitoring and Adaptive Management / Research	Flow reduction effects on Devils River Minnow and other biota and water quality	Develop predictive models of flow reduction effects on Devils River Minnow and other biota and water quality	Improved ability to evaluate effects of pumping on Devils River flow and springs in the Devils River basin
Monitoring and Adaptive Management / Research	Devils River contributions to salinity budget of Lake Amistad	Science to increase understanding of Devils River contributions to salinity budget of Lake Amistad	Improved understanding of effects and value of Devils River flows

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Monitoring and Adaptive Management / Research	Importance of Devils Riveron downstream agricultural and municipal water supply	Examine water availability and importance of Devils River in meeting downstream agricultural and municipal water supply needs in the lower Rio Grande	Improved understanding of effects and value of Devils River flows
Monitoring and Adaptive Management / Research	Habitat and flow-ecology needs of Texas Hornshell	Assess specific habitat and flow-ecology needs of Texas Hornshell (soon to be federally listed) in the Devils River; biology/habitat requirements may make this the best indicator species for environmental health; incorporate biology/habitat requirements into water management framework (e.g., groundwater-flows management plan currently being examined jointly by TWDB, TCEQ and TPWD through a Legislative directive)	Enhanced conservation of Texas Hornshell
Monitoring and Adaptive Management / Research	Spring- and aquifer-associated communities in the Devils River basin	Assess spring- and aquifer-associated communities throughout the basin, especially Pecan Springs	Enhanced conservation of SGCN
Monitoring and Adaptive Management / Research	Groundwater levels, spring discharge, instream flows, and habitat availability effects	Examine relationships among groundwater levels, spring discharge, instream flows, and habitat availability for focal fishes and Texas Hornshell in the Devils River	Enhanced conservation of SGCN

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Monitoring and Adaptive Management / Research	Devils River monitoring	Spring ecosystem, salamander monitoring; Continue the streamflow gage operation on Dolan Creek for at least 10 years; Add at least one more groundwater well recorder and ensure location in best areas; Re-establish TCEQ water quality recorder; Improved ability to evaluate effects of pumping on Devils River flow and springs in the Devils River basin; Water budget in the Devils River basin, including the full area of groundwater contribution to the basin; Understanding and modeling of aquifer flow paths in the upper Devils River; Better understanding of flow reduction effects on Devils River minnow and other biota and water quality	Effective conservation of aquatic and riparian habitats
Monitoring and Adaptive Management / Habitat Protection	Spring ecosystem / salamander monitoring	Continue and expand monitoring of spring ecosystems and salamander populations	Conservation of spring habitats and SGCN
Research	Data/information clearinghouse for research, monitoring, and restoration actions that have occurred within the Devils River watershed	Conduct pilot project in the Devils River watershed to serve as a proof of concept and lessons learned to guide a work plan for the entire Chihuahuan Desert	Provide access to recent and historical information relevant to conservation in the Devils River watershed
Research / Habitat Protection	Assessment of subterranean fauna in Devils River NFCA	Determine locations and range extent of subterranean fauna, including blindcatfish and salamanders, in the Devils River NFCA	Effective conservation of subterranean fauna and protection of cave and aquifer habitats

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Conservation Demonstration / Habitat Restoration	Riparian restoration project downstream of Dolan Falls	Conduct a riparian restoration project downstream of Dolan Falls (25 mi downstream; 100-m reach has been cleared); initial outreach/ education to landowner by Devils River Conservancy, and explore possible riparian restoration workshop and planting project	Increased landowner awareness of benefits and importance of riparian habitats
Conservation Demonstration / Habitat Restoration	Riparian restoration project downstream of Bakers Crossing	Conduct a riparian restoration project on west bank, six miles downstream of Bakers Crossing – address 2 miles of riparian degradation and road construction that brought gravel from Nueces (possible introduction of Arundo?)	Increased landowner awareness of benefits and importance of riparian habitats
Conservation Demonstration / Habitat Restoration	Riparian restoration projects at Blue Sage and Rock Canyon subdivisions	Conduct riparian education and explore opportunities for septic system replacement/redesign Blue Sage and Rock Canyon subdivisions	Increased landowner awareness of benefits and importance of riparian habitats
Monitoring and Adaptive Management	Leon Springs Pupfish monitoring and response guidelines.	Monitor status and trends of refuge population (continue Dr. Itzkowitz's research/monitoring), establish additional refuge populations (possibly at Dexter or San Marcos National Fish Hatcheries), and assemble plans for water quality monitoring and disaster response in the event that oil and gas activity impacts the springs and pupfish population	Security and conservation of Leon Springs Pupfish
Monitoring and Adaptive Management	Genetic management/ restoration plan for Pecos Pupfish	Develop a genetic management and restoration plan for Pecos Pupfish including the potential and criteria for using the refuge population at the Ft Worth Zoo	Conservation of Pecos Pupfish
Monitoring and Adaptive Management	Pecos Pupfish refuge populations	Assess potential for establishing refuge populations of Pecos Pupfish on shrimp farms and other similar off-channel sites	Conservation of Pecos Pupfish

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Monitoring and Adaptive Management	Pecos Pupfish in Salt Creek	Continue monitoring genetic integrity of Pecos Pupfish in Salt Creek and assure that the upper 2-3 miles of Salt Creek does not have Sheepshead Minnow hybrids. Also, document that the existing barrier continues to prevent upstream movement; determine what would serve as an effective barriers if the need existed to construct them to protect Pecos Pupfish from hybridization	Conservation of Pecos Pupfish
Monitoring and Adaptive Management	Balmorhea State Park Monitoring	In response to increased oil/gas activity near Balmorhea, a USGS gauge has been installed, water quality monitoring is being conducted, and fish/invertebrate communities are being monitored	Assure survival of native organisms and environmental compliance by oil and gas industry
Monitoring and Adaptive Management	Phantom Lake Springs Monitoring and Management	Develop a plan for long-term management of organisms and infrastructure as the ownership changes from the Bureau of Reclamation to another entity	Assure survival of native organisms
Monitoring and Adaptive Management	Restoration of native beavers, muskrats and otters	Develop a restoration plan for Rio Grande beavers, Pecos River muskrats, and otters	Restore native mammals to aquatic ecosystems
Monitoring and Adaptive Management / Research	Independence Creek monitoring	Determine if monitoring Caroline Springs (T5) flow is feasible; Ensure adequate well monitoring on the preserve and throughout the watershed; Determine approach to monitoring stream cross-sections, determine if riparian monitoring is needed; Determine local and regional groundwater flow paths, what areas contribute flow to the creek and springs and identify any threats to the aquifer system	Effective conservation of aquatic and riparian habitats

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Monitoring and Adaptive Management / Research	Diamond Y monitoring	Establish baseline and regular monitoring of rare fishes, invertebrates and Pecos sunflower; Re-establish USGS springflow gage; Establish additional flow monitoring of the downstream reach; Ensure adequate aquifer level monitoring; Determine if riparian/ marsh monitoring is needed and, if so, develop method; Contribute to understanding of the groundwater system feeding Diamond Y Spring; Assess small scale connectivity within each reach	Effective conservation of aquatic and riparian habitats
Monitoring and Adaptive Management / Research	Sandia Springs monitoring	Pecos sunflower assessment and monitoring; Ensure adequate aquifer level monitoring; Determine if riparian/wetland monitoring is needed, develop method; Contribute to overall understanding of the groundwater system that feeds the Balmorhea Springs complex; Mapping of watercourse, dams and habitats; Ongoing stewardship needs, primarily saltcedar removal	Effective conservation of aquatic and riparian habitats

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Monitoring and Adaptive Management / Research	Davis Mountains monitoring	Establish baseline and regular monitoring of Rio Grande chub and evaluate need to monitor Little Aguja pondweed, Davis Mountains snail and other aquatic species; Establish approach to map Little Aguja pools and monitor both flow and water quality; Ensure adequate aquifer level monitoring to track aquifer health; Evaluate need for regular water quality sampling in springs; Determine if riparian monitoring is needed and, if so, develop method; Evaluate effects of historical land use change, drought and wildfires on Madera Creek watershed conditions, flow and biota, includes baseline aquatic biological inventory and flow monitoring	Effective conservation of aquatic and riparian habitats
Monitoring and Adaptive Management / Habitat Protection	Davis Mountains wildfire fuel reduction	Establlish a wildfire fuel reduction program similar to the one underway in the Davis Mountains Preserve	Reduce the amount and intensity of habitat loss from fires
Research	Life history of Pecos Pupfish	Use refuge population at Ft Worth Zoo for lab-based, captive studies of life history attributes of Pecos Pupfish	Conservation of Pecos Pupfish
Research	Status of Rio Grande Chub and Chihuahua Catfish	Determine status of Rio Grande Chub and Chihuahua Catfish	Improve understanding of current status and conservation needs
Research	Hydrology and water quality in Davis Mountains streams	Assess hydrology and water quality in Davis Mountains streams	Improve understanding of current status and conservation needs
Research	Invertebrates, plants, etc. in Davis Mountains streams	Assess diversity and status of invertebrates, plants, etc. in Davis Mountains streams	Improve understanding of current diversity, status and conservation needs

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Researh	Access in Davis Mountains streams	Improve access through roadway improvements on private lands	Enable access for assessments, monitoring, and restoration
Research / Invasive Species Management	Riparian plant communities assesment	Conduct large-scale assessment of riparian plant communities to inform control of riparian invasive plants	Planning for conservation of native riparian plants and removal of invasive species
Research / Habitat Restoration	Habitat enhancement/ restoration to address immediate needs for Leon Springs Pupfish	Research to understand changes in vegetative communities (potentially associated with hydrologic changes) and actions that can be taken to better manage these wetlands systems through fire or other actions. Includes monitoring/ evaluation to generate guidelines for vegetation management in ciénegas (e.g., hydrology/water management, use of fire, grazing, etc.)	Improved management of ciénega complexes
Research / Habitat Restoration	Effects of wildfire on condition of stream habitats in Davis Mountains streams	Research to understand changes in faunal and floral communities (potentially associated with hydrologic changes) and actions that can be taken to better manage these streams before and after wildfires	Improve understanding and develop guidelines for post-fire restoration
Conservation Demonstration	Alpine Creek conservation demonstration area	Develop a conservation demonstration area on Alpine Creek, incorporating the existing birding trail, and implement riparian restoration and flow improvements	Raise awareness of value of riparian and stream habitats in desert environments; possible native fish refuge
Conservation Demonstration / Partnerships	River conservation workshops for landowners	Conduct river conservation workshops for landowners, including creation of landowner partnerships to support possible reintroduction of RGSM to the lower Pecos River	Develop landowner support for riparian conservation as well as assure understanding of benefits of RGSM establishment
Invasive Species Management / Partnerships	Riparian restoration through control of Arundo and other riparian invasive plants	Engage landowners in large-scale riparian restoration through control of Arundo and other riparian invasive plants	Large-scale riparian restoration through control of Arundo and other riparian invasive plants

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Habitat Restoration	Saltcedar control at Diamond Y Refuge	Remove, control and monitor saltcedar infestation	Enhance restoration of cienega habitats
Habitat Restoration	Riparian fencing of Limpia Creek	Work with landowners on Limpia Creek to protect sensitive riparian areas	Reduce landowner cost-share to increase participation in protecting sensitive riparian zones
Habitat Restoration	Calamity Creek bank stabilization and riparian restoration	Initiate bank stabilization and riparian restoration on Calamity Creek at Elephant Mountain WMA	Restore inpacted riparian areas to promote habitat integrity and reduce erosion
Habitat Restoration	Riparian restoration in Pecos County	Develop opportunities with willing landowner in Pecos County to conduct riparian restoration and artificial wetlands projects	Restore impacted habitats and develop new locations for refuge populations
Habitat Restoration	Riparian plant sources	Develop sources for plant materials (particularly cottonwood trees) to be used in riparian restoration projects	Enable more effective restoration of riparian zones
Conservation Demonstration / Habitat Restoration	Tornillo Creek riparian/spring restoration	Conduct riparian/spring restoration in Tornillo Creek watershed and use as a case study in planning/ conservation of ephemeral streams in the region	Restore inpacted riparian areas to promote habitat integrity and reduce erosion and use as conservation demonstration areas for grazing practices and other management actions
Monitoring and Adaptive Management	Rio Grande Silvery Minnow repatriation	Explore a programmatic relationship with Sul Ross (or another university) to support/ involve faculty, post-docs, graduate students, etc. in research/ monitoring efforts for Rio Grande Silvery Minnow	Restore native faunal element to the Rio Grande and Pecos Rvier
Monitoring and Adaptive Management / Research	Monitoring subsurface water levels/flows in Alamito Creek watershed.	Establish long-term monitoring sites to evaluate effects of management actions in Alamito Creek watershed on subsurface water levels/flows	Improved understanding of effects and value of riparian restoration in Chihuahuan Desert
Research	Conchos Pupfish assessement	Range-wide genetics, habitat, and flow-ecology assessment for Conchos Pupfish	Effective conservation of Conchos Pupfish

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Research	Ecology of Mexican Fawnsfoot and Salina Mucket	Determine temperature tolerances, distribution, and fish-hosts for Mexican Fawnsfoot and Salina Mucket	Enhance conservation efforts for Mexican Fawnsfoot and Salina Mucket
Conservation Demonstration / Invasive Species Management	River trails to promote river conservation	Conduct river trails assessment for the Big Bend Reach of the Rio Grande (to identify a network of single-day paddling opportunities); examine opportunities to enhance outreach and education efforts associated with Arundo control, RGSM reintroduction, and other conservation projects; use the river trails to promote river conservation	Engage public in conservation efforts
Conservation Demonstration / Partnerships	Conservation-oriented recreation on the Big Bend Reach of the Rio Grande.	Conduct an assessment of the recreational and economic value of paddling, wildlife viewing, and other conservation-oriented recreation on the Big Bend Reach of the Rio Grande	Engage public in conservation efforts
Conservation Demonstration / Partnerships / Habitat Restoration	Riparian restoration in Big Bend tribs	Build capacity for riparian restoration in Big Bend tribs through partnerships with non-profits to administer a large-scale riparian restoration program including riparian restoration workshops, volunteer coordination, planning/ delivery of service projects (explore opportunities to hire a full-time biologist to provide support)	Long-term, large-scale riparian restoration in the Big Bend region
Conservation Demonstration / Habitat Restoration	Riparian restoration at the Alamito Creek	Continue riparian restoration at the Alamito Creek Preserve and other areas of Alamito Creek including Big Bend Ranch SP and use as conservation demonstration areas for grazing practices and other management actions	Restore inpacted riparian areas to promote habitat integrity and reduce erosion and use as conservation demonstration areas for grazing practices and other management actions

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Habitat Restoration / Connectivity	Revegetation of riparian habitats on Terlingua Creek	Determine to what extent revegetation is benefiting groundwater systems, channel morphology, and habitat conditions for focal species; also need to identify additional landowners to expand riparian restoration efforts on Terlingua Creek	Improved sediment management and overall habitat conditions
Invasive Species Management /	Arundo control in the Big Bend Reach of the Rio Grande	Add a component that evaluates biotic response to ongoing Arundo control efforts to restore riparian plant communities along the Big Bend Reach of the Rio Grande; monitoring of riparian plant communities and channel morphology is ongoing	Improved sediment management and overall habitat conditions; provide the conditions to restore channel morphology upon ideal flow conditions
Invasive Species Management / Habitat Restoration / Partnerships	Arundo biocontrols in the Big Bend Reach of the Rio Grande	Explore opportunities for use of Arundo biocontrols and the potential to expand the ongoing USDA Arundo biocontrol program that is active in the lower Rio Grande. Education/outreach to landowners is needed in advance of a biocontrol program	Improved sediment management and overall habitat conditions; provide the conditions to restore channel morphology upon ideal flow conditions
Invasive Species Management / Habitat Restoration / Partnerships	Arundo control in the Black Gap reach of the Rio Grande	Explore opportunities to expand partnerships and expand Arundo control downstream into the Black Gap reach	Improved sediment management and overall habitat conditions; provide the conditions to restore channel morphology upon ideal flow conditions
Habitat Restoration	Grasslands restoration and riparian restoration at O2 Ranch	Conduct grasslands and riparian restoration on hundreds of thousands of acres at the O2 Ranch and adjacent ranches and include monitoring/evaluation; evaluation of effects/appropriateness of fire for specific soil types in the region should be included as a component of a research/monitoring plan	Restore inpacted grasslands and riparian areas to promote habitat integrity and reduce erosion
Habitat Restoration	Riparian fencing for tributaries	Explore potential for fencing riparian areas in Rio Grande tributaries	Restore inpacted riparian areas to promote habitat integrity and reduce erosion

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Habitat Restoration	Riparian restoration in Terlingua Creek	Continue to deliver/expand large-scale riparian restoration in Terlingua Creek and explore opportunities in other tributaries in the Big Bend Reach of the Rio Grande	Restore inpacted riparian areas to promote habitat integrity and reduce erosion
Habitat Restoration / Connectivity	Flow restoration targets to improve sediment management and habitat conditions	Examine flow regimes and develop a sediment budget in order to identify flow restoration targets to improve sediment management and overall habitat conditions	Improved sediment management and overall habitat conditions
Connectivity	Ciénega Creek dam removal	Conduct a small dam removal project at Ciénega Creek in Big Bend Ranch State Park	Restore stream and habitat connectivity

The partnerships and collaborations forged during the Chihuahuan Desert NFCN conservation planning process are expected to enable leveraging of funding and other resources to initiate and complete priority projects. The Chihuahuan Desert NFCN intends to hold annual meetings to review progress in implementation of the Conservation Action Plan. Furthermore, the Conservation Action Plan is expected to guide partner investments over the next 5-10 years in cooperative, watershed-scale conservation of native fishes and other aquatic resources in the six NFCAs. Additional information on the Chihuahuan Desert NFCN and Conservation Action Plan for NFCAs of the Chihuahuan Desert ecoregion can be found at http://nativefishconservation.org/.

Conservation Action Plan for Native Fish Conservation Areas of the Colorado River Watershed (TX)

Edwards Plateau Rivers Native Fish Conservation Area and Lower Colorado River Native Fish Conservation Area

The Colorado River (Figure 12) originates in northwest Texas and flows in a southeasterly direction for approximately 965 km, eventually flowing into Matagorda Bay and the Gulf of Mexico. The watershed drains 103,341 square kilometers and flows through six ecoregions (Clay and Kleiner 2010), including the Edwards Plateau ecoregion, a karst landscape home to 14 endemic freshwater fishes (Bowles and Arsuffi 1993; Hubbs 2008). The portion of the mainstem Colorado River and tributaries located in the 4.4 million-ha Edwards

Plateau ecoregion, including the Concho, San Saba, Llano, and Pedernales rivers (Figure 13), are contained within the Central Edwards Plateau Rivers NFCA.

In the middle portion of the Colorado River watershed, immediately upstream of the City of Austin, a chain of six mainstem impoundments (referred to as the Highland Lakes) fragment and inundate approximately 322 km of the mainstem Colorado River. Management of the Highland Lakes to meet downstream water demands has substantially altered the natural flow regime and water quality throughout the middle and lower portions of the watershed (Mosier and Ray 1992). The Lower Colorado River NFCA encompasses the 470-km reach of the mainstem Colorado River and its tributaries from Austin to the Gulf of Mexico. The Lower Colorado River NFCA is home to two focal flow-dependent fishes, Guadalupe Bass *Micropterus treculii* (Figure 14) and Blue Sucker *Cycleptus elongatus*. Guadalupe Bass are a highly sought after sport fish for river anglers (Thomas et al. 2015), and are a species of conservation concern due to habitat degradation (Hurst et al. 1975; Edwards 1978) and hybridization with non-native Smallmouth Bass *Micropterus dolomieu* (Edwards 1980). Habitat degradation, resulting from urbanization in central Texas, is a chronic threat to the conservation of Guadalupe Bass populations (Bean et al. 2013; Curtis et al. 2015; Pease et al. 2017). Blue Sucker is listed as State Threatened in Texas and of Special Concern in North America (Jelks et al. 2008), with early life history stages hypothesized as vulnerable to flow alteration (Adams et al. 2006).

Threats to these focal fishes and other flow-dependent aquatic species in the Central Edwards Plateau Rivers and Lower Colorado River NFCAs are largely associated with increasing human populations and associated demands for surface and groundwater. Human populations are expected to more than double in portions of the watershed by 2050 (Hoque et al. 2014; Colby and Ortman 2015). The population of the City of Austin's five-county metropolitan area has increased 37.7 % over the decade preceding 2016, and now exceeds two million people; Austin is the fastest growing metropolitan area in the state and is ranked ninth in the USA. The Edwards Plateau ecoregion, located west of the City of Austin, is undergoing unprecedented population growth, increasing from approximately 800,000 in 1950 to 2.6 million in 2000, and is projected to grow to 4.3 million by 2030 (HCA 2008). Future demands on surface and groundwater for municipal and industrial uses are expected to continue to increase (TWDB 2016). Land use in the Central Edwards Plateau Rivers NFCA, which historically consisted of farming and ranching, has shifted to developments of single-family homes, as residents from Austin and San Antonio relocate to affordable housing in what are increasingly considered suburban areas (HCA 2008).

Groundwater withdrawals and stream habitat alteration are of particular concern for Guadalupe Bass populations in the Central Edwards Plateau Rivers NFCA given recent and projected human population growth, concomitant changes in watershed land uses, and increased demands on water resources (Birdsong et al. 2010). Changes to population dynamics (i.e., reproduction, recruitment, and growth) resulting from changing hydrology have been hypothesized (Grabowski 2014), but are largely unstudied with a few exceptions (e.g., Edwards 1978; Groeschel 2013, Pease 2017). The clear and fast-flowing headwater streams of the Central Edwards Plateau Rivers NFCA meet the habitat requirements of Guadalupe Bass, while river base flows are largely dependent on spring discharge from groundwater that is under increased threat of pumping due to human development pressures. Numerous springs and streams throughout Texas have experienced general declines in annual flows, or ceased to flow permanently as a result of groundwater pumping (Bowles and Arsuffi 1993). Long-term reductions in base flow could decrease growth of Guadalupe Bass (Groeschel 2013), and change their population structure (Pease et al. 2017). Reduction of spring flow would also likely negatively impact the thirteen endemic species of fish in the Edwards Plateau ecoregion that are considered spring-associated obligates (Craig et al. 2016).

River flows in the Lower Colorado River NFCA downstream of the City of Austin are largely dependent on controlled releases from the upstream Highland Lakes. Unlike the fast flowing, narrow and clear headwater streams located in the Central Edwards Plateau Rivers NFCA, this portion of the river is relatively wide and slow moving with intermittent pools, riffles, occasional rapids, and intermittent boulder fields (Magnelia 2018). Chute and rapid habitats with bedrock substrate strewn with boulders provide quality habitats for Blue Sucker (Mosier and Ray 1992). The reach also supports a unique Guadalupe Bass population, which is much higher density than typical populations found on the Central Edwards Plateau Rivers NFCA (Pease et al. 2017). Individuals also exhibit faster growth rates (Pease et al. 2017), which provides opportunity for growth to a large size. A new world record Guadalupe Bass (1.68 kg, 43 cm) was caught in the Lower Colorado River NFCA in 2014, and the reach of river from Austin to Columbus, TX is considered the premier fishery for trophy size (> 381 mm; Cummings and DeJesus 2018) Guadalupe Bass (Bean 2017).

Blue Sucker are associated with big river ecosystems (Mettee 2000) like that found in the Colorado River downstream of Austin, and are considered vulnerable throughout their range (Jelks et al. 2008) as many of these systems have been highly altered. Their spawning requirements and factors affecting juvenile survival are poorly understood (Mosier and Ray

Figure 12 - TPWD biologists conduct fish population surveys in the Lower Colorado River Native Fish Conservation Area.

1992). Early life history stages are hypothesized as vulnerable to flow alteration (Adams et al. 2006) and, as with Guadalupe Bass, changes in hydrology may affect population dynamics (Grabowski 2014). Instream flows for providing adequate Blue Sucker spawning habitat were recommended (Mosier and Ray 1992) and incorporated into the Lower Colorado River Water Management Plan, which provides guidance for releases from the Highland Lakes system to, in part, maintain a healthy aquatic community in the lower Colorado River, and healthy ecological environment in Matagorda Bay (Mosier and Ray 1992). Long-term changes to the timing, magnitude, and duration of releases in the Lower Colorado River NFCA resulting from increasing demand for water from the Highland Lakes and/or increased frequency of drought, would likely change the structure of Guadalupe Bass (Pease et al. 2017) and Blue Sucker (Grabowski 2014) populations.

In fall 2015, a series of conservation planning workshops were held involving 32 fish and wildlife conservation professionals representing conservation non-profits, universities, and state and federal agencies from throughout the Colorado River watershed for the purpose of assembling a Conservation Action Plan (Table 6) for the Central Edwards Plateau Rivers and Lower Colorado River NFCAs. The initial workshop was held in Austin, TX in September 2015. Participants identified 113 project-level research, monitoring, and restoration

Figure 13 - Pedernales River within the Central Edwards Plateau Rivers Native Fish Conservation Area.

actions needed to preserve native fishes of the Colorado River watershed. At a second workshop held in Junction, TX in October 2015, those same partners began to integrate and formulate these actions into a multi-year work plan. Actions were prioritized and specific project cooperators and potential funding sources were identified to support delivery. Priority actions compiled in Table 5 represent a Conservation Action Plan that will guide partner investments over the next 5-10 years in cooperative, watershed-scale conservation of native fishes and other aquatic resources in the Colorado River watershed.

Priority science needs identified within the Central Edwards Plateau Rivers NFCA and Lower Colorado River NFCA primarily centered on the need for development of river reach-specific data and decision support tools that can be used to inform the conservation of environmental flows (through mechanisms such as inclusion of prescribed releases in water rights permits and dam operations plans or leases of existing water rights for instream uses). Another area of interest focused on the need for data and decision support tools to guide and prioritize restoration and preservation of riparian and floodplain habitats (through mechanisms such as conservation easements or other landowner incentives). Three highest-priority projects emerged during the Colorado River conservation planning process. Those three projects are listed below, all three of which are currently underway or recently completed through support from TPWD and the U.S. Fish and Wildlife Service State Wildlife Grants Program.

Figure 14 - Guadalupe Bass collected from the Pedernales River, located within the Central Edwards Plateau Rivers Native Fish Conservation Area.

1) Examine flow-ecology relationships to inform instream flow prescriptions in the Lower Colorado River Water Management Plan to conserve Guadalupe Bass and Blue Sucker
2) Application of the Texas Ecological Indices Project to prioritize riparian buffers for protection through landowner incentives and conservation easements supported by the Texas Farm and Ranch Lands Conservation Program and TPWD Landowner Incentive Program
3) Examine opportunities for water leases, water rights acquisition, and voluntary incentive-based programs to achieve flow restoration targets for conservation of Guadalupe Bass in the Central Edwards Plateau Rivers NFCA

Table 6 - Conservation Action Plan for Native Fish Conservation Areas of the Colorado River watershed, TX (i.e., Central Edwards Plateau Rivers and Lower Colorado River Native Fish Conservation Areas).

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Monitoring and Adaptive Management	Conservation outcomes of South Llano River Conservation Demonstration Areas	Develop and implement a monitoring program to evaluate the ecological outcomes of conservation actions implemented through the South Llano River Conservation Demonstration Area Master Plan	Documentation of ecological outcomes of conservation actions

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Monitoring and Adaptive Management	Genetic integrity of Guadalupe Bass populations	Monitor genetic introgression of Guadalupe Bass populations and identify conservation strategies to preserve intact populations and ameliorate genetic introgression in hybridized populations	Guadalupe Bass conservation
Monitoring and Adaptive Management	Population assessment of Hill Country focal species	Conduct baseline assessments of population size and structure of focal species of the Hill Country Rivers NFCA and establish routine monitoring programs	Information on focal species status
Research	Alligator Gar assessment	Assess Alligator Gar populations	Information on assemblages
Research	American Eel assessment and barrier impacts	Assessment American Eel populations and barrier impacts	Determine distribution, abundance, genetics, and movement patterns
Research	Annual economic impact of paddling, angling, and other water-based recreation	Complete a study of the annual economic impact of paddling, angling, and other water-based recreation in the lower Colorado River and specifically the Guadalupe Bass Fishery and the Texas Paddling Trails network	Understanding use patterns and use for justification for protecting the resource
Research	Blue Sucker habitat use	Identify habitat use patterns by Blue Sucker	Additional informaiton on habitat associations
Research	Dam influence on fish passage	Determine influence of dams on fish passage, accessibility? (considering the Altair dam and the one in Bay City)	Assess connectivity and influence on focal species
Research	Effects of Water Supply Enhancement projects on groundwater, surface water and aquatic ecosystems	Conduct applied research to examine the effects of projects supported through the Texas State Soil and Water Board's Water Supply Enhancement Program on groundwater, surface water and aquatic ecosystems	Improved understanding of project impacts on groundwater, surface water and aquatic ecosystems

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Research	Effects of riparian invasive plants on fluvial processes and habitat conditions	Characterize the effects of riparian invasive plants (e.g., giant reed, elephant ear, salt cedar) on fluvial processes (e.g., channel morphology, flow velocity, sediment transport) and habitat conditions for Species of Greatest Conservation Need	Documentation of effects of riparian invasive plants on fluvial processes and habitat conditions for Species of Greatest Conservation Need
Research	Fish population dynamics at the fresh and estuarine interface	Assess dynamics of fish populations at the fresh and estuarine interface	Information on assemblages
Research	Flow ecology of Guadalupe Bass	Assess Guadalupe Bass pouplations and flow-ecology relationships	Additional informaiton on habitat associations
Research	Focal species presence and habitat use	Determine focal species presence and habitat use - Altair to Bay City	Information on assemblages
Research	Linkages among land use, upland vegetation, watershed processes, and focal species	Examine linkages among land use cover, upland vegetative communities, physical watershed processes, and status of focal species and their habitats	Better understanding of linkages among land use cover, upland vegetative communities, physical watershed processes, and status of focal species and their habitats
Research	Linkages among riparian buffer, instream habitat, and use by focal species	Examine linkages among riparian buffer intactness, instream habitat quality, and use by focal species	Better understanding of linkages among riparian buffer intactness, instream habitat quality, and use by focal species
Research	Macrobrachium assessment	Assess Macrobrachium populations	Information on assemblages
Research	Restoration of natural bank/riparian conditions	Develop strategies, guidelines, and restoration designs to stabilize erosional cut-banks and restore natural bank/riparian conditions	Stabilization of erosional cut-banks and restoration natural bank/riparian conditions
Research	Restoration of the North Llano River sand and gravel mining area	Conduct a geomorphic assessment to inform the development of restoration design options for the North Llano River sand and gravel mining area (including potential stormwater management wetland for surface runoff from I-10)	Restoration of the North Llano River sand and gravel mining area

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Research	Use of tributary streams by focal species	Examine use of tributary streams by focal species (this can apply throughout Lower Colorado)	Determine contribution of tributaries to populations
Research / Habitat Restoration	Water leases and rights acquisition	Complete an analysis of existing water rights and patterns of water use to identify available water and explore opportunities for water leases, water rights acquisition, and voluntary incentive-based programs to achieve flow restoration targets	Influence environmental flows, decision support tool
Conservation Demonstration	Enhance management of river access at the Colorado River Sanctuary	Collaborative with the Pines and Prairies Land Trust to enhance management of the river access area at the Colorado River Sanctuary (immediately upstream of Tahitian Village) for use as a riparian conservation demonstration area	Increased access and public awareness
Conservation Demonstration	Incorporate river access into new bridge design	Coordinate with Travis County to incorporate river access into the design of the new bridge crossing at FM 973	Increase access, public engagement
Conservation Demonstration	Leased access at the County Road 150 bridge	Explore leased fishing access opportunities at the County Road 150 bridge crossing on the South Llano River (including opportunities for use of the access area to support upstream expansion of the South Llano River Paddling Trail)	Increase access, public engagement
Conservation Demonstration	Leased access, riparian restoration, and sustainable use	Establish leased fishing access agreements, implement riparian restoration, and develop sustainable use management plans on private riverside properties in strategic locations throughout the Central Edwards Plateau Rivers NFCA	Increase access, public engagement
Conservation Demonstration	Prioritize conservation actions in the South Llano River Conservation Demonstration Area Master Plan	Prioritize conservation actions identified in the South Llano River Conservation Demonstration Area Master Plan, and develop a phased approach for implementation	Increased public awareness, improved watershed function

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Conservation Demonstration	Provide additional public access	Coordinate with public entities etc. to provide additional public access	Increase access, public engagement
Conservation Demonstration	River access for new bridge from FM 969 to XS Ranch	Collaborate with XS Ranch (planned subdivision located on the Colorado River between the Wilbarger Creek and Sandy Creek confluences), TxDOT and Bastrop County to ensure that river access is incorporated into the design of the new bridge that will provide access from FM 969 to XS Ranch	Increase access, public engagement
Conservation Demonstration	Secure leased river access to expand the paddling trail network	Explore opportunities to secure leased river access for anglers/ paddlers across private lands to create additional launch areas that will allow expansion of the current Colorado River paddling trail network from Tahitian Village to the City of Smithville	Increase access, public engagement
Conservation Demonstration	South Llano River Paddling Trail link to South Llano River Conservation Demonstration Area Master Plan	Ensure that the South Llano River Paddling Trail is considered and linked to nature trails and other recreational enhancements identified in the South Llano River Conservation Demonstration Area Master Plan, including trails at the South Llano River State Park and Texas Tech University Llano River Field Station	Access and opportunity for public recreation in the South Llano River
Conservation Demonstration	Special harvest regulations for Guadalupe Bass	Examine potential use of special harvest regulations for Guadalupe Bass in the lower Colorado River	Information to make harvest recommendations
Conservation Demonstration	Special harvest regulations for overexploited fishes	Explore special harvest regulations for potentially overexploited sportfishes, especially regionally endemic sport fishes such as Guadalupe Bass	Information to make harvest recommendations

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Conservation Demonstration	Sustainable access and use of park lands along the Onion Creek corridor	Coordinate with TPWD McKinney Falls State Park, City of Austin Parks and Recreation, and Travis County Parks and Recreation to develop strategies for sustainable access and use of the network of park lands and creekside trails being established along the Onion Creek corridor from the state park to the Colorado River confluence	Increase access, public engagement
Conservation Demonstration	Sustainable use plan for riverside parks along Onion Creek and the Colorado River	Coordinate with City of Austin and Travis County Parks and Recreation to develop a sustainable use management plan for riverside parks along Onion Creek and the Colorado River in Travis County	Increase access, public engagement
Invasive Species Management	Aquatic and riparian invasive species on the Llano and Pedernales rivers	Continue aquatic and riparian invasive species monitoring program on the Llano and Pedernales rivers to support adaptive management of ongoing invasive species control efforts (with a particular focus on control/ management of elephant ear and giant reed)	Improved management of invasive species
Invasive Species Management	Elephant ear eradication in the Llano River watershed	Continue implementation of elephant ear management efforts throughout the Llano River watershed, w/ emphasis on headwaters region	Control of elephant ear infestation
Invasive Species Management	Giant reed management in the Pedernales River watershed	Continue implementation of giant reed management efforts throughout the Pedernales River watershed	Control of giant reed infestation in the Pedernales River watershed
Partnerships	Fishing guide services for conservation messaging and outreach	Establish and strengthen partnerships with fishing guide services (e.g., All Water Guides) to assist in conservation messaging and angler/public outreach campaigns	Increased public awareness, improved management of guadelupe bass fisheries

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Partnerships	Landowner conservation network to support collaborative conservation	Explore opportunities to form a landowner conservation network to support collaborative conservation of the Colorado River downstream of Smithville	Engage public, increase awareness
Partnerships	Promote trophy Guadalupe Bass fishery	Promote trophy Guadalupe Bass fishery to garner public support for conservation of the lower Colorado River, with a particular emphasis on the value of prescriptive releases of flows into the lower Colorado River from the Highland Lakes (consistent with the Lower Colorado River Authority's Water Management Plan)	Increased public awareness, improved management of guadelupe bass fisheries
Partnerships	Support for Llano River Watershed Alliance and Hill Country Alliance	Continue to support local stewardship and advocacy efforts of the Llano River Watershed Alliance and Hill Country Alliance	Increased public awareness, improved participation in stewardship
Partnerships	Upper Llano River Watershed Protection Plan	Facilitate implementation of the Upper Llano River Watershed Protection Plan	Increased public awareness, improved watershed function
Habitat Protection	TPWD permitting decisions	Expand efforts by Inland Fisheries to consider focal species, particularly endemic fishes and sensitive aquatic plant species (e.g., springrun whitehead), in permitting decisions (e.g., introduction of Grass Carp, stocking of sport fishes or forage fishes)	Conservation and restoration
Habitat Protection	Beneficial instream barriers	Identify beneficial instream barriers (i.e., that prevent introduction/ expansion of non-native species and/or that serve as refugia for native species) and develop proactive messaging that delineates the differences between beneficial and harmful instream barriers	Improved understanding of effects of instream barriers
Habitat Protection	Blue Sucker spawning habitats	Develop conservation strategies for protection of Blue Sucker spawning habitats	Influence water management plan & enhance blue sucker populations

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Habitat Protection	Conservation easement opportunities	Conduct a riparian assessment to determine conservation easement opportunities	Identification of riparian areas for preservation and restoration
Habitat Protection	Conservation strategies for species and habitats threatened by land use changes	Develop conservation strategies for protection of unique and sensitive aquatic species and habitats threatened by land use changes, including recommended measures to consider in land use planning and zoning (e.g., recommended minimum width of riparian buffers, stormwater management techniques/measures, use of pervious paving materials and other low impact development strategies)	Increased public awareness, improved watershed function
Habitat Protection	Riparian buffer assessment	Assess condition of riparian buffers along Hill Country rivers and tributaries, and prioritize areas for restoration and protection (through acquisition, conservation easements or other landowner incentives)	Improved watershed function
Habitat Restoration	Degraded water quality in the North Llano River	Develop strategies and best management practices to address urban runoff and degraded water quality in the North Llano River associated with land use practices along the I-10 highway corridor	Reduced effects of urban runoff and degraded water quality in the North Llano River
Habitat Restoration	Herbivory and habitat degradation by native and non-native species	Develop conservation strategies to address herbivory by native and non-native ungulates and degradation of sensitive habitats by feral hogs	Reduced harmful impacts of herbivory and degradation of sensitive habitats
Habitat Restoration	Natural flow patterns for native aquatic communities	Examine flow-ecology relationships of Guadalupe Bass, Blue Sucker, and other focal species, and explore opportunities to adapt/refine current flow prescriptions in the Lower Colorado River Authority's Water Management Plan to support natural flow patterns that meet the needs of native aquatic communities	Inform water management plan and enhance blue sucker populations

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Habitat Restoration	Restoration and preservation of riparian plant diversity	Restore and preserve riparian plant diversity through planting of native species and use of exclusion fencing (to prevent overgrazing by ungulates and cattle)	Restoration and preservation of riparian plant diversity
Habitat Restoration	Restoration of sand and gravel pits	Characterize sand and gravel pits, assess jurisdictional authorities, and examine opportunities to restore habitation condition and river channel integrity, and/or enhance the value of the pits as adjacent wetland habitats	Characterization of function and status and how they influence riverine conditions, determine if remediation is necessary
Habitat Restoration	Status of off-channel sand and gravel pits	Coordinate with the General Land Office to evaluate the ownership and jurisdictional status of off-channel sand and gravel pits (i.e., considered public streambed vs private ownership?), particularly those with a continuous hydrologic connection to the lower Colorado River	Clarify status of properties
Habitat Restoration	Support water use efficiencies on private lands	Develop landowner incentives with the potential to provide water use efficiencies including replacement of outdated irrigation equipment and livestock watering facilities	Improved water use efficiencies
Habitat Restoration	Technical guidance on best management practices	Provide science-based technical guidance (to public and private landowners) on best management practices for conservation of natural landscapes, with a particular emphasis on preservation of instream habitats, riparian buffers, springs, aquifer recharge features, and upland landscapes (to maintain ground filtration and water quality)	Improved watershed function and aquatic resource conservation
Connectivity	Bridge at South Llano River State Park	Redesign and construct a new fish- and river-friendly bridge crossing at the South Llano River State Park that restores fluvial processes, restores fish passage, and enhances river recreation by allowing passage for paddlers	Improved stream function, improved biological connectivity, improved public access

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Connectivity	Conservation guidelines for low-water crossings	Develop conservation strategies, guidelines and designs for low-water crossings and low-head dams that restore fluvial processes, restore fish passage, and enhance river recreation by allowing passage for paddlers	Improved stream function, improved biological connectivity, improved public access
Connectivity	Design considerations for bridges	Develop design considerations and best management practices for use by the Texas Department of Transportation and county/local transportation authorities in bridge designs that preserve natural fluvial processes, allow for fish passage, and that maintain recreational access and use for paddlers	Improved stream function, improved biological connectivity, improved public access
Connectivity	Inventory and characterization of low-head dams	Conduct an inventory and characterization of low-head dams (not included in the current national inventory of dams)	Improved stream function, improved biological connectivity

Conservation Action Plan for the Upper Canadian River Native Fish Conservation Area

The Canadian River arises in Colorado, just north of the New Mexico border, and flows 1,220 km through New Mexico, Texas, and Oklahoma before joining the Arkansas River in eastern Oklahoma. The river is characterized by a shallow, sandy, braided channel. The Canadian River watershed totals 312,221 square km and contains four major impoundments: Conchas Lake and Ute Reservoir (NM), Lake Meredith (TX), and Eufaula Lake (OK). Portions of the Canadian River upstream of Conchas Lake in New Mexico have been recognized by the Nationwide Rivers Inventory for having remarkable scenic, recreational, geologic, wildlife, and historic value (NPS 2010). In Texas, the Canadian River flows through the Southwestern Tablelands ecoregion of the panhandle, with parts of the basin occurring in the High Plains ecoregion. Canadian River segments upstream and downstream of Lake Meredith were nominated by TPWD (2016a) as Ecologically Significant Stream Segments based upon riparian conservation areas and the presence of imperiled species and unique biological communities.

The Upper Canadian River NFCA is home to several imperiled fishes that, when coupled with close proximity to universities conducting aquatic research, have made it the location of numerous fish community studies. Research in the Texas portion of the NFCA includes studies on historical trends in relative abundance, life history of imperiled species, and the larval fish assemblage (Lewis and Dalquest 1955; Larson et al. 1991; L.W. Reed Consultants, Inc. 1995; TPWD unpublished data 1995; Bonner and Wilde 2000; Wilde et al. 2001; Durham and Wilde 2005; Durham and Wilde 2006; Durham and Wilde 2008). Historical fish collections from the Canadian River in Texas included three fishes currently identified by TPWD (2012) as SGCN: Red River Pupfish *Cyprinodon rubrofluviatilis*, Peppered Chub *Macrhybopsis tetranema*, and Arkansas River Shiner *Notropis girardi* (Hendrickson and Cohen 2015). Arkansas River Shiner is concurrently listed as federally and state threatened, although no critical habitat is defined in Texas (USDOI 2005). The current listing status of the Peppered Chub is under review and information indicates that listing as threatened or endangered may be warranted (USDOI 2009). It appears that the only remaining population of Peppered Chub is in the 220-km reach of the Canadian River upstream of Lake Meredith in New Mexico and Texas as it now appears to be extirpated from Colorado, Oklahoma, and Kansas (Pennock et al. 2017). No freshwater mussel SGCN have been collected from the Canadian River in Texas (TPWD 2008).

The Texas Commission on Environmental Quality has reported a number of water quality concerns for the Canadian River (TCEQ 2014a). Concerns downstream of Lake Meredith (Segment 0101), specifically within the section from the confluence with White Deer Creek upstream to the confluence with Dixon Creek (Segment 0101_03), include elevated levels of bacteria. Elevated chloride levels upstream of Lake Meredith (Segment 0103) have resulted in that segment being placed on the state list of impaired waters. There are no fish consumption advisories currently in place for the Canadian River in Texas; however, mercury is listed as a concern for fish from Lake Meredith and it is recommended that people limit consumption of Walleye (TPWD 2016e).

Historical accounts of the Canadian River riparian corridor indicate the river valley was broad and comprised of vegetation that was “more verdant” than that of the plains above. On a visit to the region in 1601, Don Juan Onate recorded the Indians offered them tasty plums that were found in the valley groves. He also recorded there were “springs of good water and groves of trees” that occurred fairly frequently. Other accounts through the 1800s spoke of good spring flow, cottonwood trees, wild fruits, and tall grasses along the Canadian River corridor. In 1839, Josiah Gregg investigated the Canadian corridor as a

possible trade route and stated that the Canadian Valley was "one of the most magnificent sights I have ever beheld" (TSSWCB 2000). Over time, land management practices such as harvesting of trees for timber, overgrazing, flow alteration, and other disturbances have changed the composition and structure of the riparian habitat and allowed the establishment of non-native invasive species such as Saltcedar and Russian Olive *Elaeagnus angustifolia*, which can out-compete and displace native vegetation.

River fragmentation, hydrologic alteration, drought, habitat degradation, and an increasing abundance of native and non-native invaders all continue to pose threats to Upper Canadian River NFCA and other rivers of the U.S. Great Plains. Increasing salinity in the Canadian River due to Saltcedar and decreased water availability has already contributed to fish kills attributed to golden alga blooms in Lake Meredith. Declines of fluvial specialist fishes (e.g., Arkansas River Shiner, Flathead Chub, Plains Minnow, and Peppered Chub) have been documented in the Upper Canadian River NFCA, particularly downstream of Lake Meredith where none were collected during recent surveys (Robertson et al. 2017).

Conservation planning to assemble a Conservation Action Plan for the Upper Canadian River NFCA was conducted in winter 2016 via a webinar and an in-person workshop involving participants from Oklahoma and Texas. Because of similarities in the life history of focal species, conservation challenges, and conservation partners across the Upper Brazos River, Upper Canadian River, and Upper Red River NFCAs, the decision was made to integrate the planning processes for those three watersheds. An initial joint conservation planning webinar was conducted for these three watersheds in December 2015. Webinar participants were provided with an introduction to the watershed-based NFCAs approach; the NFCA prioritization; the watershed-based conservation planning process and NFCA goals and implementation strategies; and selected regulatory, policy and voluntary conservation programs, resources, and tools available to support implementation of the NFCAs approach. Finally, webinar participants were provided with a brief tutorial on completion of a survey (Google Form) developed to elicit input from subject matter experts on project-level research, monitoring, and conservation actions to be undertaken by conservation partners to conserve focal fishes and their habitats in the NFCAs.

A follow-up conservation planning workshop was held in February 2016 in Oklahoma City (in conjunction with the Oklahoma Natural Resources Conference). The workshop was attended by an interdisciplinary team of 45 conservation professionals representing conservation non-profits, universities, and federal and state agencies including the Great Plains Fish Habitat Partnership, Southeast Aquatic Resources Partnership, Great Great Plains

Landscape Conservation Cooperative, Oklahoma Department of Wildlife Conservation, Oklahoma Water Resources Board, Oklahoma State University, The Nature Conservancy, Texas Parks and Wildlife Department, Texas Tech University, University of Oklahoma, University of Texas at Austin, and U.S. Fish and Wildlife Service Science Applications, Ecological Services, and Fish and Aquatic Conservation programs. Workshop participants presented overviews of their organizations' recent and ongoing research, monitoring and conservation actions in the NFCAs. Participants then reviewed and refined the draft list of project-level research, monitoring and conservation actions (submitted through the Google Form referenced above), which are outlined in Tables 7-9. Those tables represent Conservation Action Plans that are expected to guide partner investments over the next 5-10 years in cooperative, watershed-scale conservation of native fishes and other aquatic resources in the NFCAs.

Table 7 - Conservation Action Plan for the Upper Canadian River Native Fish Conservation Area.

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Monitoring and Adaptive Management	LIDAR imagery of the Canadian River	Acquire LIDAR natural color and infrared imagery of the Canadian River	Will allow for more accurate surveys to detect barriers for fish that hinder upstream migrations. It will also allow for more accurate vegetation surveys for finding saltcedar and other problematic plant species
Monitoring and Adaptive Management	Off-road vehicle impacts on fishes	Assess impacts of off-road vehicles on fishes of Canadian River	Understand affects of off-road vehicles on fish and other aquatic species, especially during periods of no flow, and riparian vegetation
Research	Migration of Arkansas River Shiner and Peppered Chub in the Canadian River	Document migration of Arkansas River Shiner and Peppered Chub in the Canadian River using stable isotopes; this also will allow determination of the spawning sites and nursery areas	This is critical in understanding the potential effects of instream barriers, low flows, and fragmentation on these species

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Research	Movement by pelagic broadcast-spawning fishes over multiple spatial scales	Stream connectivity during low-flow conditions over an appropriate stream length that allows for successful egg and larvae development appear to be the most pressing flow need (Mills and Mann 1985; Nunn et al. 2003; Durham and Wilde 2006, 2008, 2009; Perkin and Gido 2011); however, it is unclear the role higher flows play in facilitating spawning migrations; this study would assess movement by pelagic broadcast-spawning fishes over multiple spatial scales (mesohabitat, segment) before, during, and following the spawning period	Understanding the movement of these fishes is necessary to prescribe appropriate conservation and management actions; for example, if some flow conditions facilitate upstream movements at certain times of the year, water releases during that period may be enough to prevent isolating populations that can no longer reproduce successfully
Research	Propagation and grow-out methods for broadcast-spawning minnows	Develop propagation and grow-out methods for broadcast-spawning minnows, including hatchery and field propagation techniques	This will provide a source of individuals for repatriation and mitigation of proposed projects; also, fish can be used for experimental and other purposes
Research	Propagation for Arkansas River Shiner and Peppered Chub	Improve propagation techniques for the federally-listed Arkansas River Shiner and imperiled Peppered Chub; these two fish reside in the South Canadian River where drought is affecting population numbers and threatens extirpation in certain stretches of the river; future supplementation in stretches of the river may be necessary; additionally, propagated fishes will be used for research purposes, including experimental populations and in-situ fish movement studies	Refined propagation techniques will allow for larger production of Arkansas River shiner and peppered chub, which will aid in possible supplementation efforts, experimental populations, and research studies such as fish movements

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Reearch	Relationship between pelagophilic fishes and flow elements	Pelagic broadcast-spawning fishes (pelagophils) are considered susceptible to flow alteration because eggs and larvae drift passively in suspension for several days until they become free swimming (Battle and Sprules 1960; Balon 1975; Platania and Altenbach 1998); this project would develop statistical models that describe the relationship between pelagophils (e.g., Arkansas River Shiner) and flow elements; the data were previously compiled by a SARP project; in conjunction, status surveys will be reviewed and follow up surveys would be completed in areas where data were lacking	Flow-ecology models across the region could be used to develop possible flow standards for Great Plains rivers; at a minimum, these efforts would benefit a recovery plan; these data would also be useful to better understand the likely implications of reduced flows on pelagic broadcast spawning fishes
Research	Slackwater habitats and reproductive success of pelagic broadcast-spawning fishes	Lateral connectivity to floodplains is fragmented when structures prevent water and aquatic organisms from accessing the floodplain, such that floodplain habitats are lost (Schlosser 1991); in this context, flow alterations that reduce discharge magnitudes and compromise floodplain inundation create a special case of habitat fragmentation and loss for pelagophils (Costigan and Daniels 2012; Hoagstrom and Turner 2015); this project would determine the relative importance of slackwater habitats (available at both low and high flows) to the reproductive success of pelagic broadcast-spawning fishes (e.g., Arkansas River Shiner)	Understanding survival related to spawning habitat and flow conditions would seem important prerequisites to being able to successfully model population responses to flow alteration; stream connectivity during low-flow conditions over an appropriate stream length that allows for successful egg and larvae development have been suggested (Mills and Mann 1985; Nunn et al. 2003; Durham and Wilde 2006, 2008a, 2009a; Perkin and Gido 2011) but the role of floodplains and other habitats that increase egg retention (Worthington et al. 2014) remain largely unexplored and have important implications for flow management
Research	Tolerances of larval and juvenile pelagic-spawning fishes	Develop information on physical and chemical tolerances of larval and juvenile pelagic-spawning fishes to assess adequacy of nursery habitat, which may be independently affected by dewatering and climate change	Understand affects of habitat modifications (dewatering) and climate change on young-of-year fishes; also, will help assess affects of invasive species.

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Invasive Species Management	Saltcedar management within Canadian River drainages	Conduct an inventory and characterization of saltcedar (SC) coverage, potential refugia, and fish passage barriers; develop plan for prioritized, stepwise, sustainable SC management within Canadian River drainages including SOPs for SC surveying and monitoring; implement prioritized, large-scale SC management that is adaptive to periodic reevaluation based on monitoring results	Plan for prioritized, stepwise, sustainable saltcedar management within basin; Maps of saltcedar coverage, potential refugia, and fish passage barriers; SOPs for surveying saltcedar coverage consistently over time and across basins; framework for evaluation and prioritization of treatment efforts (with periodic reevaluation/ reprioritization); SOPs for monitoring effects of treatment; mitigation of impacts of an invasive species likely to be synergistically increased by climate change; improvements in geomorphic processes, habitat, and connectivity at a scale relevant for long-term persistence of native fish populations
Habitat Protection	Fish refuge areas along the Canadian River	Assess fish refuge areas with aerial photography along the Canadian River during drought periods	Refugia areas for fishes in the Canadian River will be identified to better inform management decisions and conservation actions
Habitat Protection	Phragmites encroachment	Document the extent of Phragmites encroachment on the Canadian River, which has entrenched some 60 miles of river and initiate removal; Phragmites has restricted the wetted channel to one-third of its 2000 width and threatens populations of Arkansas River Shiner and Peppered Chub	Remove Phragmites and restore river to its original broad channel, which supports Arkansas River Shiner and Peppered Chub; reduce water loss due to transpiration by dense Phragmites stands
Habitat Protection	Species status assessment	Develop a species status assessment for imperiled fishes in the Canadian River; assessment will include species needs, current and future condition, and viability; information from assessment will be utilized for future management decisions and conservation actions in the Canadian River watershed	Development of species status assessment to inform on the ground conservation actions

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Habitat Restoration	Flow-ecology relationships of pelagic broadcast-spawning fishes	Examine flow-ecology relationships of pelagic broadcast-spawning fishes and explore opportunities to identify flow prescriptions in the South Canadian River to support natural flow patterns that meet the needs of native aquatic communities	Influence water management in the Canadian River and protect imperiled fish populations
Habitat Restoration	Identify available water to achieve flow restoration targets	Complete an analysis of existing water rights and patterns of water use to identify available water and explore opportunities for water leases, water rights acquisition, and voluntary incentive-based programs to achieve flow restoration targets	Influence water management and provide a decision support tool

Conservation Action Plan for the Upper Red River River Native Fish Conservation Area

The Red River flows 2,188 km through the states of Texas, Oklahoma, Arkansas, and Louisiana before reaching its confluence with the Mississippi River (Huser 2000). The mainstem Red River begins in Texas where the Prairie Dog Town Fork gives way to the Red River at the eastern edge of the Texas panhandle. The south bank of the river then goes on to form the Texas-Oklahoma border (Huser 2000), followed by the Texas-Arkansas border, before entering Louisiana (Huser 2000). The watershed drains an area of 169,900 square km and spans several Texas ecoregions: Western High Plains, Southwestern Tablelands, Texas Blackland Prairies, Central Oklahoma/Texas Plains, and South Central Plains (Griffith et al. 2004). Major tributaries to the Red River in Texas include several forks (Prairie Dog Town Fork, Salt Fork, and North Fork), the Wichita River, the Pease River, Big Cypress Bayou, and the Sulphur River. Only one major reservoir impounds the Red River within Texas, Lake Texoma (Huser 2000), which serves as the downstream extent of the Upper Red River NFCA.

Within the Upper Red River NFCA, the Prairie Dog Town Fork (Figure 15) has been recognized by the Nationwide Rivers Inventory for having remarkable cultural, geologic, historic, recreational, and scenic value (NPS 2010). Two segments of the Prairie Dog Town Fork have been nominated by TPWD as Ecologically Significant Stream Segments: Upper Prairie Dog Town Fork Red River (Texas Commission on Environmental Quality Segment 0229) and Lower Prairie Dog Town Fork Red River (0207; TPWD 2018a). The upper segment

was recognized as having a riparian conservation area (i.e., Palo Duro Canyon State Park) and for high water quality, high aesthetic value, and exceptional aquatic life (TPWD 2018a). Both segments of the Prairie Dog Town Fork and two segments of the mainstem Red River (0205 and 0206) have been recognized for providing habitat for the federally threatened interior least tern *Sterna antillarum* (TPWD 2018a). Several additional tributaries of the Red River have been nominated, including the Pease (0220) and Middle Pease (0221) rivers as having riparian conservation areas (i.e., Copper Breaks State Park and Matador Wildlife Management Area, respectively; TPWD 2018a).

The University of Texas Biodiversity Collections has historic records for 66 species of freshwater fishes from the Upper Red River NFCA (Hendrickson and Cohen 2015); however, many reaches have not been surveyed. Ongoing fish data collection efforts in the Upper Red River NFCA at the TPWD Matador Wildlife Management Area beginning in 2004 by West Texas A&M University (WTAMU) have documented 20 fish species (personal communication, Richard Kazmaier, WTAMU). Historical fish collections from the Upper Red River NFCA included 11 SGCN: Goldeye *Hiodon alosoides*, American Eel *Anguilla rostrata*, Blue Sucker *Cycleptus elongatus*, Prairie Chub *Machrybopsis australis*, Silver Chub *Macrhybopsis*

Figure 15 - Headwaters of the Prairie Dog Town Fork of the Red River located within the Upper Red River Native Fish Conservation Area.

storeiana, Red River Shiner *Notropis bairdi*, Sharpnose Shiner *Notropis oxyrhynchus*, Chub Shiner *Notropis potteri*, Silverband Shiner *Notropis shumardi*, Red River Pupfish *Cyprinodon rubrofluviatilis*, and Orangebelly Darter *Etheostoma radiosum* (Hendrickson and Cohen 2015). Additionally, the Plains Minnow *Hybognathus placitus*, Shoal Chub *Macrhybopsis hyostoma*, and Suckermouth Minnow *Phenacobius mirabilis* are proposed for inclusion on the Texas Conservation Action Plan SGCN list (Cohen et al. 2018) and have been reported from the Upper Red River NFCA.

The same conservation planning process (and stakeholders) described above for the Upper Canadian River NFCA was also used for the Upper Red River NFCA conservation planning process. Conservation planning resulted in development of the Upper Red River Conservation Action Plan (Table 8), which is expected to guide partner investments over the next 5-10 years in conservation of native fishes.

Table 8 - Conservation Action Plan for the Upper Red River NFCA.

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Monitoring and Adaptive Management	Wichita River mussel survey	Survey the Wichita River for mussels, including imperiled species	This study will locate extant populations of freshwater mussels in the Wichita River and determine if imperiled species occur and how they might be conserved
Research	Life history of the Prairie Chub	Conduct basic life history study on the Prairie Chub	This information is necessary to management of the species, determination of its status, and how to mitigate ongoing habitat change
Research	Migration of Prairie Chub, Plains Minnow, and Red River Shiner in the Red River and tributaries	Document migration of Prairie Chub, Plains Minnow, and Red River Shiner in the Red River and tributaries using stable isotopes; this also will allow determination of the relative importance of the Red River and its tributaries as spawning sites and nursery areas	This is critical in understanding the potential effects of instream barriers, low flows, and fragmentation on these species

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Research	Physical and chemical tolerances of larval and juvenile pelagic-spawning fishes	Develop information on physical and chemical tolerances of larval and juvenile pelagic-spawning fishes to assess adequacy of nursery habitat, which may be independently affected by dewatering and climate change	Understand affects of habitat modifications (dewatering) and climate change on young-of-year fishes; also, will help assess affects of invasive species
Research	Propagation and grow-out methods for broadcast-spawning minnows	Develop propagation and grow-out methods for broadcast-spawning minnows, including hatchery and field propagation techniques	This will provide a source of individuals for repatriation and mitigation of proposed projects; also, fish can be used for experimental and other purposes
Invasive Species Management	Saltcedar management in the Red River	Conduct an inventory and characterization of saltcedar (SC) coverage, potential refugia, and fish passage barriers; develop plan for prioritized, stepwise, sustainable SC management within Red River drainages including SOPs for SC surveying and monitoring. Implement prioritized, large-scale SC management that is adaptive to periodic reevaluation based on monitoring results	Plan for prioritized, stepwise, sustainable saltcedar management within basin; Maps of saltcedar coverage, potential refugia, and fish passage barriers; SOPs for surveying saltcedar coverage consistently over time and across basins; framework for evaluation and prioritization of treatment efforts (with periodic reevaluation/reprioritization); SOPs for monitoring effects of treatment; mitigation of impacts of an invasive species likely to be synergistically increased by climate change; improvements in geomorphic processes, habitat, and connectivity at a scale relevant for long-term persistence of native fish populations
Habitat Restoration / Habitat Protection	Restoration and protection of riparian buffers along Red and Canadian rivers	Assess condition of riparian buffers along Red and Canadian rivers and tributaries, and prioritize areas for restoration and protection (through acquisition, conservation easements or other landowner incentives)	Identified Priority Areas for riparian restoration, increased efficiency and benefit for restoration activities

Conservation Action Plan for the Upper Brazos River Native Fish Conservation Area

The Upper Brazos River NFCA comprises the Brazos River and its tributaries (Salt Fork Brazos River and Double Mountain Fork Brazos River) upstream of Lake Possum Kingdom. This watershed is largely free-flowing and characterized by shallow, sandy, and braided stream channels. The Salt Fork Brazos River is fed by numerous Permian brine springs and at times leads to salinities greater than the Gulf of Mexico (Baker et al. 1964; Brune 2002) and very clear waters. The Salt Fork Brazos River contributes over 85% of the chloride load (850 tons daily average) to the Brazos River (Baker et al. 1964) and the volume of these brine springs created a great saline lake evident on 19th century maps of Texas. The White River, a tributary of the Salt Fork, was once fed by the fresher Ogallala Aquifer at the rate of 49,210 m3/day and was impounded in 1963 with the construction of White River Reservoir. Leakage from the dam forms a small trickle and groundwater pumping for irrigation has dried up nearly all springs fed by the Ogallala in the Salt Fork watershed. Lake Alan Henry, constructed by the City of Lubbock, impounds the Double Mountain Fork Brazos River before its confluence with the North Fork Double Mountain Fork Brazos River. Portions of the Double Mountain Fork are also underlain by the Ogallala. A long-standing invasion by Saltcedar has contributed to channel-narrowing with potential consequences on hydraulic habitat and use by native fishes.

River fragmentation and hydrologic alteration associated with reservoir development has led to substantial changes in fish communities including extirpations and assemblage shifts across the Upper Brazos River NFCA and other rivers of the U.S. Great Plains (Perkin et al. 2015). Water extractions reduce base flows, altering instream habitat and water quality and contributing to increased duration, severity, and frequency of drying/intermittency; during drought the effects of reduced base flows are intensified. While some fishes are more tolerant of the harsh environmental conditions in intermittent pools others perish as temperatures and salinities increase and dissolved oxygen levels decline (Ostrand and Wilde 2004).

Since its introduction to the Brazos River watershed in the first half of the 1900s, Saltcedar has expanded and is typically found in high density stands along the river's edge; new growth is often found in the river channel and in lines along high water marks. Saltcedar colonizes stream floodplains and terraces, armoring river terraces and reducing the ability of a stream to meander. As the channel narrows, stream depth increases and temperature decreases (Nagler et al. 2010; Dean et al. 2011). Saltcedar may be more drought tolerant than

native species (Glenn and Nagler 2005) and is becoming the dominant woody species in riparian areas throughout the western USA. In the Brazos River between Lake Possum Kingdom and the confluence of the Double Mountain Fork, phreatophytic, woody vegetation in the floodplain increased from 39% in 1969 to 57% by 1979 (Blackburn et al. 1982). Saltcedar dominated areas where the floodplain was narrow and the stream channel was straight, providing optimum water table conditions for their growth and regeneration (Busby and Schuster 1973). Saltcedar invasion caused 3 m of sediment accumulation, reduced Brazos River width by approximately 90 m, reduced sediment input to Lake Possum Kingdom, and resulted in higher flood stages.

All riparian vegetation transpires large volumes of water and Saltcedar is no exception. However, the supposition, based on limited research, that Saltcedar uses considerably more water than other riparian vegetation has led to management efforts in west Texas and other areas of the southwestern USA. Some studies, including efforts on the Pecos River, have found that Saltcedar management produced negligible water gains due to old stand age and high flows following abatement (McDonald et al. 2015). Saltcedar transpiration on a reach of one Texas river was estimated to use 44,000 acre-feet per year (Busby and Schuster 1973), but substantial water yields have not yet been observed at watershed scales (Wilcox 2002; Wilcox et al. 2006; Doody et al. 2011). Furthermore, the impacts of salinity pulses on fish communities following Saltcedar treatments is largely unknown (Hart et al. 2005) and the geomorphic impacts to native fishes and instream habitat and evaluation of the change in geomorphology remain a key challenge for management of invasive plants in riparian areas.

The native fishes of the Upper Brazos River NFCA are structured by spatial and temporal variations in environmental conditions such as salinity and hydraulic habitat (Echelle et al. 1972; Ostrand and Wilde 2002) as well as isolating constraints from downstream dams. In the saline reaches, such as most of the Salt Fork Brazos River, salt-tolerant Red River Pupfish *Cyprinodon rubrofluviatilis* and Plains Killifish *Fundulus zebrinus* dominate assemblages, while in fresher reaches fish richness is greater due to the presence of numerous cyprinids (Moss and Mayes 1994; Ostrand and Wilde 2002). Using data from Moss and Mayes (1994) and more recent fish collections (Wilde 2015) from the upper Brazos River basin, Mayes et al. (In Press) assessed temporal changes in fish populations. Cyprinids in the pelagic-broadcast spawning reproductive guild showed declines in relative abundance (Smalleye Shiner *Notropis buccula*, Sharpnose Shiner *N. oxyrhynchus*, Chub Shiner *N. potteri* and Plains Minnow *Hybognathus placitus*) while Red Shiner *Cyprinella lutrensis* a crevice-

spawning minnow, Red River Pupfish a nest-builder, and the live-bearer Western Mosquitofish *Gambusia affinis* increased. Silver Chub *Macrhybopsis storeriana* (a broadcast spawner) has not been collected in the upper Brazos River since the early 1990s. Fishes that showed the greatest declines were pelagic, broadcast-spawning cyprinids. These cyprinids are characteristic of prairie streams such as the Brazos River and subject to great vulnerability due to their complex reproductive strategies and life history requirements (Durham and Wilde 2014; Worthington et al. 2017). Flowing water is essential to their successful reproduction and the survival of eggs and larval fish. Relatively long unobstructed river reaches are required to allow their semi-buoyant eggs enough distance to drift with the river's current. Once hatched, larval fish must stay suspended in the current (to prevent larval settlement) until they become strong enough to swim against currents. During times of sufficient flow, their populations expand while populations decline when flows are insufficient or rivers dry. This boom and bust cycle reflects the harsh yet cyclical nature of Great Plains prairie ecosystems (Dodds et al. 2004) and the opportunistic life history strategy of these cyprinids (Worthington et al. 2017). Further, when storm-driven high flow events occur during the reproductive season (~April–September), pelagic, broadcast-spawning minnows spawn simultaneously (i.e., synchronized spawning of more than one species; Durham and Wilde 2009a). Because these fishes only live for one to two years (rarely three), successful reproduction and survival of eggs and larval fish must occur on a frequent basis in order to maintain viable, resilient populations.

Two endemic pelagic-broadcast spawning cyprinids, Smalleye Shiner and Sharpnose Shiner, were historically found throughout the Brazos River basin, but are now found only in the Upper Brazos River NFCA (USFWS 2014b). Given this reduced distribution, which is constrained from downstream emigration and upstream colonization due to the presence of Lake Possum Kingdom, one adverse event such as a persistent drought of two consecutive years

Figure 16 - Double Mountain Fork Brazos River within the Upper Brazos River Native Fish Conservation Area.

could lead to extinction. This concern was amplified in 2011 when a record-setting drought and heatwave resulted in the driest 12 months (October 2010–September 2011) in Texas history (Hoerling et al. 2013). The long duration of intermittency in the upper Brazos River watershed resulted in complete reproductive failure by Smalleye Shiner, Sharpnose Shiner, and other broadcast-spawning minnows. The flow intermittency, high air and water temperatures, and reproductive failure led to a coordinated rescue effort. TPWD and Texas Tech University personnel collected several thousand Sharpnose Shiner and Smalleye Shiner from drying pools in mid-September 2011 and transported them to the Possum Kingdom State Fish Hatchery for over-wintering. Plans to collect additional shiners were halted when rains returned in late September 2011. In 2012, the pond was harvested; fifty of each species were taken to the Texas Tech University campus for captive spawning research and the remaining fishes (~370 of each) were repatriated to the lower Brazos River near Hearne, Texas. Although fish sampling has been conducted in the area, no occurrences of either species have been reported from the lower Brazos River.

To facilitate continued cooperation among universities and agencies actively engaged in conservation of native fishes in the Upper Brazos River NFCA, conservation planning was conducted in winter 2016 in conjunction with the planning processes for the Upper Canadian River and Upper Red River NFCAs. The planning process culminated in the development of a Conservation Action Plan (Table 9), which is expected to guide partner investments over the next 5-10 years in multispecies, watershed-based conservation of native freshwater fishes.

Table 9 - Conservation Action Plan for the Upper Brazos River Native Fish Conservation Area.

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Monitoring and Adaptive Management	Middle Brazos River mussel survey	Survey mussels in the middle Brazos River, downstream from Possum Kingdom Reservoir; recent collection of a freshly dead Texas fawnsfoot suggest this river may support an important population of that, and other, species of imperiled freshwater mussel	Document the size and status of the imperiled Texas fawnsfoot and other freshwater mussels in the middle Brazos River
Monitoring and Adaptive Management	LIDAR imagery of the Upper Brazos River	Acquire LIDAR natural color and infrared imagery of the Upper Brazos River	Will allow for more accurate surveys to detect barriers for fish that hinder upstream migrations; it will also allow for more accurate vegetation surveys for finding saltcedar and other problematic plant species

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Monitoring and Adaptive Management	Long-term monitoring across Great Plains basins	Develop protocols and implement long-term monitoring sites across Great Plains basins	Multidisciplinary framework for monitoring hydrology, water quality, geomorphology, biology, and connectivity to support long-term science needs in Great Plains basins; benefits of standardized and comprehensive sampling would accrue across scales (e.g. regional flow-ecology; e-flow standards); across protection/restoration efforts (large scale invasive control; flow manipulation/restoration) and adaptive management strategies (where do you get most return); data needed for science gaps, listing and delisting processes, etc.
Monitoring and Adaptive Management	Upper Brazos River mussel survey	Survey the upper Brazos River for mussels, including imperiled species; populations of at least two species are known to occur based on finds of freshly dead material; these populations are 500 km upstream from the closest neighboring populations	This study will locate extant populations of freshwater mussels in the Upper Brazos River- 500 km upstream from other populations- and determine whether imperiled species occur and how they might be conserved
Research	Upper Brazos River basin of Texas	To understand how water resource development in the Upper Brazos River basin of Texas quantitatively affects spawning flows needed for Sharpnose Shiner (Notropis oxyrhynchus) and Smalleye Shiner (N. buccula) reproductive success by: (1) evaluating groundwater-surface water interactions with trends in baseflow and groundwater level, streamflow measurements during spawning, and hydrograph separation with conductivity, and (2) assessing changes in natural flow regime from reservoir operation using minimum-flow, high flow pulse, and bank storage metrics	This study will increase our understanding of how groundwater and surface water use—exacerbated by droughts and climate change—threaten current and future shiner habitat in the Upper Brazos River basin of Texas; this can inform Recovery Plan development, particularly research and management actions leading to restoration of spawning flows. Results can also be used to understand threats to other species of greatest conservation need in the Upper Brazos basin (TPWD, 2012, 2014)

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Research	Environmental flow releases to support natural flow regimes and habitat conditions	Characterize and prioritize Great Plains reservoirs for environmental flow releases (physically, financially, ecologically) to support more natural flow regimes and habitat conditions in prairie rivers; implement experimental releases to support science needs of prairie streams/validate hypotheses; modify reservoir operating rules where appropriate	A screening and characterization (pros/cons) of Great Plains reservoirs for making e-flow releases (see Grantham et al. 2014); improved flow regimes through changes in reservoir operating rules where feasible; long-term implementation strategy; pre- and post-release data to inform/validate/refine hypotheses; restore biotic integrity, geomorphic processes, water quality conditions, connectivity.
Research	Migration of Sharpnose Shiner and Smalleye Shiner in the upper Brazos RIver	Document migration of Sharpnose Shiner and Smalleye Shiner in the upper Brazos River using stable isotopes; this also will allow determination of the relative importance of the Salt Fork, Double Mountain Fork, and Brazos River mainstem as spawning sites and nursery areas	This is critical in understanding the potential effects of instream barriers, low flows, and fragmentation on these species
Research	Physical and chemical tolerances of larval and juvenile pelagic-spawning fishes	Develop information on physical and chemical tolerances of larval and juvenile pelagic-spawning fishes to assess adequacy of nursery habitat, which may be independently affected by dewatering and climate change	Understand affects of habitat modifications (dewatering) and climate change on young-of-year fishes; also, will help assess affects of invasive species
Research	Propagation and grow-out for broadcast-spawning minnows	Develop propagation and grow-out methods for broadcast-spawning minnows, including hatchery and field propagation techniques	This will provide a source of individuals for repatriation and mitigation of proposed projects; also, fish can be used for experimental and other purposes.

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Research	Spawning flows for Sharpnose Shiner and Smalleye Shiner	To understand how water resource development in the Upper Brazos River basin of Texas quantitatively affects spawning flows needed for Sharpnose Shiner (Notropis oxyrhynchus) and Smalleye Shiner (N. buccula) reproductive success by: (1) evaluating groundwater-surface water interactions with trends in baseflow and groundwater level, streamflow measurements during spawning, and hydrograph separation with conductivity, and (2) assessing changes in natural flow regime from reservoir operation using minimum-flow, high flow pulse, and bank storage metrics	This study will increase our understanding of how groundwater and surface water use—exacerbated by droughts and climate change—threaten current and future shiner habitat in the Upper Brazos River basin of Texas; this can inform Recovery Plan development, particularly research and management actions leading to restoration of spawning flows; results can also be used to understand threats to other species of greatest conservation need in the Upper Brazos basin (TPWD, 2012, 2014)
Invasive Species Management	Inventory, characterization and management of saltcedar	Conduct an inventory and characterization of saltcedar (SC) coverage, potential refugia, and fish passage barriers; develop plan for prioritized, stepwise, sustainable SC management within upper Brazos River drainages including SOPs for SC surveying and monitoring. Implement prioritized, large-scale SC management that is adaptive to periodic reevaluation based on monitoring results	Plan for prioritized, stepwise, sustainable saltcedar management across the Southern Great Plains NFCA; Maps of saltcedar coverage, potential refugia, and fish passage barriers; SOPs for surveying saltcedar coverage consistently over time and across basins; framework for evaluation and prioritization of treatment efforts (with periodic reevaluation/reprioritization); SOPs for monitoring effects of treatment; mitigation of impacts of an invasive species likely to be synergistically increased by climate change; improvements in geomorphic processes, habitat, and connectivity at a scale relevant for long-term persistence of native fish populations
Habitat Protection	Inventory of point and non-point source discharges impacting water quality	Conduct an inventory of point and non-point source discharges impacting water quality in the upper Brazos River (above PK); prioritize discharges of highest concern to listed shiners and develop recommended management actions to address or otherwise ameliorate those impacts	Improved water quality to maintain healthy ecosystem in support of shiners

NFCA Goal Addressed	Project Title	Project Description	Expected Outcomes
Habitat Restoration	Suitability of Brazos River segments for repatriation of extirpated species	Assess Brazos River segments for suitability of repatriation of locally extirpated species; this will use a combination of GIS, existing data sets, and expert knowledge; this project also will provide a general model for similar studies in other river basins	Local populations of a growing number of fishes are disappearing to prevent these from becoming imperiled, there is a need to repatriate fish to suitable habitat reaches, thus maintaining continuity in their historic range; this also will aid recovery efforts for listed species
Connectivity	Fish barriers for Sharpnose Shiner and Smalleye Shiner	Identify partial fish barriers in occupied habitat for the Sharpnose Shiner and Smalleye Shiner and work with private landowners to design and replace water crossing structures; funding from USFWS through the Partners for Fish and Wildlife Program and National Fish Passage Program could support this effort	restore connectivity of habitat; facilitate larval recruitment to adulthood and enhance reproductive success

Case Study in Conservation Delivery within Native Fish Conservation Areas of Texas

During 2013-2018, TPWD, SARP, DFHP, U.S. Fish and Wildlife Service, and numerous local conservation partners cooperated to deliver strategic conservation projects throughout NFCAs of Texas. A case study in conservation delivery within NFCAs of Texas is provided below. This case study is adapted from Birdsong et al. (in press), and describes conservation investments toward achieving each of the eight NFCA goals previously outlined in Table 4.

NFCA Goal 1 – Protect and Maintain Intact Habitats

Effective January 2016, the Texas Legislature authorized and provided funding for TPWD to administer the Texas Farm and Ranch Lands Conservation Program (TFRLCP), a grant program designed to provide cost-share funding to land trusts for the purchase of conservation easements on private lands in support of the following objectives: (1) conserve water or protect water quality, (2) conserve native wildlife species through protection of their habitat, (3) conserve rare or sensitive species, (4) demonstrably contribute to preservation of a landscape of conservation lands, or (5) protect productive open-space land threatened by fragmentation or development. Specific project scoring, ranking, and selection criteria were

assembled by TPWD and approved by the Governor-appointed Texas Farm and Ranch Lands Council, which provides leadership and oversight of the TFRLCP.

The 100 possible points awarded to grant applications submitted to the TFRLCP consider the following scoring criteria: (1) threat of development (20 points), (2) value and cost-effectiveness (20 points), (3) value in protection of watershed processes and aquatic habitats (20 points), (4) value in protection of habitats for SGCN (20 points), (5) contributions to protection of a conservation landscape such as a wildlife migration route or riparian corridor (10 points), and (6) terms of the conservation easement (10 points). Application scoring criteria 3-5 for the TFRLCP directly relate to variables considered in selection of freshwater systems designated as NFCAs in Texas. Grant applications to the TFRLCP that proposed conservation easements on private lands located within the Texas NFCAs scored considerably higher than those located elsewhere in the state. As such, the Texas NFCAs prioritization substantially influenced scoring of individual applications, and 13 of the 14 grants awarded by the TFRLCP in 2016-2018 supported preservation of private lands within the Texas NFCAs (Table 10).

Those 13 conservation easements funded by the TFRLCP protected 10,563 ha of springs and instream, riparian, and upland habitats within the Central Coast Rivers and Streams, Central Edwards Plateau Rivers, Guadalupe Mountains Streams, Guadalupe and San Antonio Rivers (Figure 17), Lower Colorado River (Figure 18), San Gabriel River, Southeast Texas Rivers, Southern Edwards Plateau Rivers, and Upper Red River NFCAs. Conservation biologists from the TPWD Inland Fisheries Division conducted site visits to the private properties selected for funding and consulted with landowners and partnering land trusts on the terms and conditions of the conservation easements to maximize their benefit and value in long-term protection of native fishes, their habitats, and other freshwater resources within those nine NFCAs.

The Western Association of Fish and Wildlife Agencies Crucial Habitat Assessment Tool (CHAT; www.wafwachat.org) identifies important fish and wildlife habitats and corridors across the 17 western states of the USA, including Texas. The purpose is to incorporate and inform consideration of fish and wildlife habitats in land use planning, zoning, and development decisions, such as planning of new energy or transportation corridors. Habitats identified as priorities within the CHAT were selected by cooperating state fish and wildlife agencies. Each state agency utilized a standard set of definitions, guidelines, and criteria to achieve a consistent regional approach. In 2018, TPWD finalized the CHAT input layers for Texas, including the Aquatic CHAT layer (Figure 19), which incorporated priority freshwater

systems of the Texas NFCAs Network as a top tier priority for conservation of native fishes and other freshwater SGCN. As is the intent of the CHAT, this is expected to encourage land developers toward increased consideration, avoidance, and protection of freshwater systems contained within the Texas NFCAs Network.

Table 10 - Conservation easements secured within Native Fish Conservation Areas of Texas through the Texas Farm and Ranch Lands Conservation Program (2016-2018).

Native Fish Conservation Area	Number of Conservation Easements	Area Protected (Hectares)	Habitat Types Protected
Central Coast Rivers and Streams	2	2,276	Wetlands
Central Edwards Plateau Rivers	1	554	Riparian Habitats of the Mainstem Colorado River
Guadalupe Mountains Streams	1	2,925	Tributary Streams and Riparian Buffers of McKittrick Creek
Guadalupe and San Antonio Rivers	1	85	Tributary Streams and Riparian Buffers in the Blanco River Watershed
Lower Colorado River	3	635	Tributary Streams and Riparian Buffers in the Barton Creek and Onion Creek Watersheds
San Gabriel River	1	248	Tributary Streams and Riparian Buffers in the San Gabriel River Watershed
Southeast Texas Rivers	1	2,230	Tributary Streams and Riparian Buffers in the Neches River Watershed
Southern Edwards Plateau Rivers	2	953	Tributary Streams and Riparian Buffers in the Nueces River Watershed
Upper Red River	1	656	Riparian Habitats of the Mainstem Red River

Figure 17 - Riparian corridor of Wanslow Creek, preserved through a conservation easement, within the Guadalupe and San Antonio Rivers Native Fish Conservation Area.

NFCA Goal 2 – Restore Altered Habitats

Actions to restore altered habitats within Texas NFCAs have primarily centered on restoration of habitats for Guadalupe Bass *Micropterus treculii*, a SGCN and the official state fish of Texas (Birdsong et al. 2015; Garrett et al. 2015; Bean et al. In Press; Magnelia et al., in press). Supported through grants provided by SARP, National Fish and Wildlife Foundation, and U.S. Fish and Wildlife Service Texas Partners for Fish and Wildlife Program, TPWD and partners have restored 3,199 ha of springs, creeks, and riparian buffers within the Central Edwards Plateau Rivers NFCA, improving habitat conditions for native fishes in approximately 89 km of the James, Llano, and Pedernales rivers and their tributaries. Additionally, TPWD has provided technical guidance to approximately 850 landowners and other local stakeholders on recommended stewardship practices for management of instream and riparian habitats. Stewardship practices to maintain or restore physical watershed processes have been implemented on approximately 42,389 ha of ranchlands. Habitat

Figure 18 - Riparian corridor of Onion Creek, preserved through a conservation easement, within the Lower Colorado River Native Fish Conservation Area.

restoration was conducted in conjunction with Guadalupe Bass genetic restoration efforts, which involved the production and stocking of more than 793,629 genetically-pure Guadalupe Bass fingerlings to ameliorate hybridization between Guadalupe Bass and non-native, introduced Smallmouth Bass *Micropterus dolomieu* (Garrett et al. 2015; Fleming et al. 2015; Lutz-Carrillo et al. 2015).

Within the Southern Edwards Plateau Rivers NFCA, TPWD collaborated with private landowners and nongovernmental organizations to restore 209 ha of grasslands, riparian buffers, and instream habitats (Table 11). Biologists from TPWD cooperated with landowners to implement conservation best management practices on 9,930 ha of the Frio, Medina, Nueces, and upper Guadalupe rivers watersheds. Additionally, a partnership was formed among TPWD, The Nature Conservancy, U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program, and the Texas Master Naturalists Program to provide landowners and citizen scientists with technical guidance on watershed stewardship practices, aquatic species identification, and aquatic resources monitoring strategies.

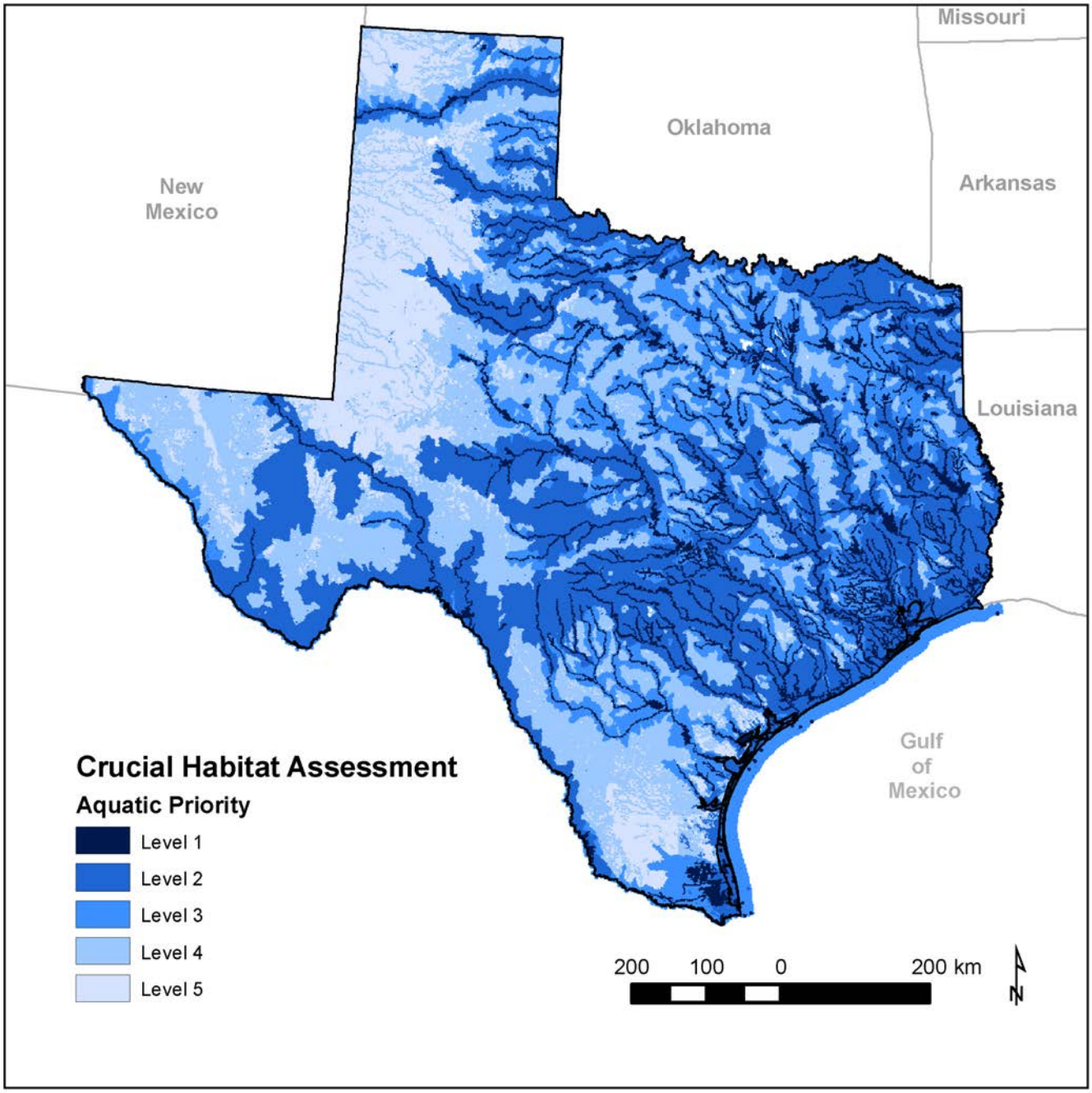


Figure 19 - Aquatic Crucial Habitat Rank for Texas freshwater systems identified in the Western Association of Fish and Wildlife Agencies Crucial Habitat Assessment Tool (Level 1 = Perennial streams and estuarine/coastal habitats with known occurrences of fish SGCN; Level 2 = Texas Native Fish Conservation Areas, Texas springs, and estuarine/coastal habitats known to support fish SGCN; Level 3 = Perennial streams within the modeled ranges of fish SGCN; Level 4 = All other perennial and intermittent streams; Level 5 = All other areas of the state).

In the Guadalupe and San Antonio Rivers NFCA, TPWD and partners organized eight riparian habitat restoration workshops attended by 525 riparian landowners and other local stakeholders. A landowner restoration manual was assembled that identifies strategies for accommodating recreational access to rivers while maintaining riparian functions (Asher et

al. 2017). Similar to conservation efforts in the Central Edwards Plateau Rivers NFCA, the Southeast Aquatic Resources Partnership provided funding to TPWD and partners to deliver restoration of 142 ha of riparian buffer along the Blanco River (Table 11). Restoration included planting of 3,300 native riparian saplings and 15,000 riparian sedges to support revegetation of erosional river banks denuded of vegetation following catastrophic flooding. Habitat restoration was completed in conjunction with a non-native Smallmouth Bass removal and Guadalupe Bass stocking program, which successfully repatriated Guadalupe Bass to a fragmented reach of the Blanco River (Magnelia et al., in press).

Table 11 - Landowner technical guidance and habitat restoration completed within Texas Native Fish Conservation Areas (2013-2018).

Native Fish Conservation Area	Area of Ranchlands that Received Prescriptive Guidance on Best Practices for Watershed Management (Hectares)	Quantity of Habitats Restored (Hectares)	Habitat Types Restored
Central Edwards Plateau Rivers	42,389	3,199	Grasslands, Springs, Riparian and Instream Habitats
Guadalupe and San Antonio Rivers	472	142	Riparian and Instream Habitats
Pecos River	5,036	0.4	Springs, Instream Habitats
Southern Edwards Plateau Rivers	9,930	209	Grasslands, Riparian and Instream Habitats
Upper Big Bend	120,343	16,596	Grasslands, Springs, Riparian and Instream Habitats
Upper Brazos River	2,711	2,711	Riparian and Instream Habitats

Texas NFCAs have also been adopted as geographic priorities for investments by multiple conservation funding programs administered by federal agencies and foundations. The most recent 5-year strategic plan of the U.S. Fish and Wildlife Service Texas Partners for Fish and Wildlife Program (2017-2021) adopted the Davis Mountains Streams, Pecos River, Upper Big Bend, Lower Big Bend, Devils River, Central Edwards Plateau Rivers, Southern Edwards Plateau Rivers, Guadalupe and San Antonio Rivers, and Lower Colorado River NFCAs as “Geographic Focus Areas” for investments in habitat restoration and species

conservation (Figure 20). The USFWS Texas Partners for Fish and Wildlife Program has an active partnership with the TPWD Landowner Incentive Program focused on restoration of grasslands, riparian buffers, and instream habitats. From 2013-2018, the two organizations cooperated on restoration of 1,793 ha of grasslands and 11 km of instream habitats and riparian buffers within the Upper Big Bend NFCA (Figures 3 and 6). Comparable investments are expected to continue across the Texas NFCAs.

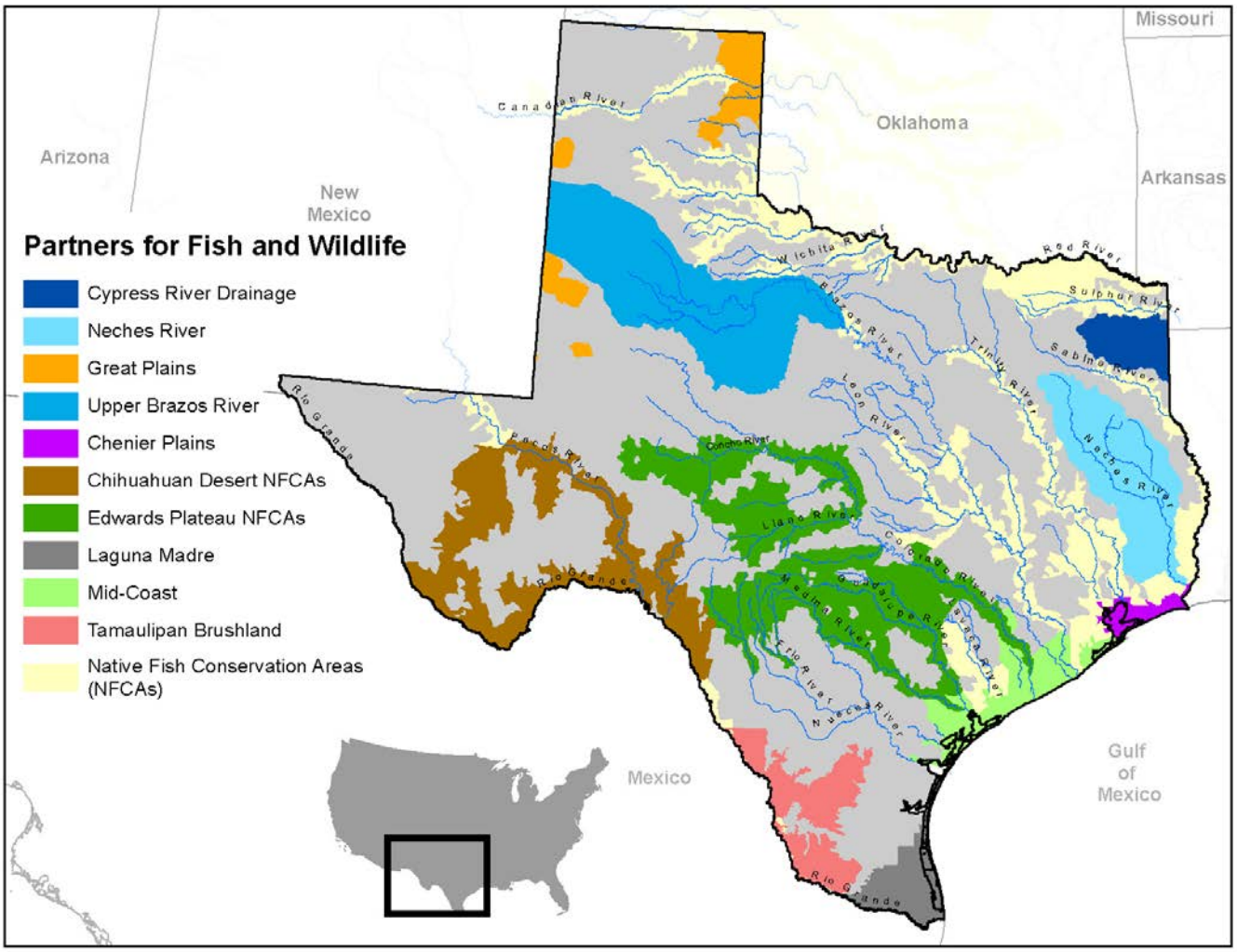


Figure 20 - Areas identified as priorities for conservation investments in the U.S. Fish and Wildlife Service Texas Partners for Fish and Wildlife Program 2017-2021 Strategic Plan.

The Texas Parks and Wildlife Foundation (TPWF) is the official non-profit partner of TPWD, and in 2013, TPWD and TPWF partnered to establish the Conserving Texas Rivers Initiative (CTRI), a fundraising program that has supported habitat restoration, native fish conservation, river access, and conservation demonstration within Texas NFCAs. The CTRI represents a public-private partnership, in which private donations have been leveraged with

public funding available to TPWD (e.g., state fishing license revenues, federal grants through the Wildlife and Sport Fish Restoration Program, federal grants through the National Fish Habitat Partnership). During 2013-2018, private donors contributed $190,000, which was leveraged against approximately $1.2 million in state and federal funding to implement conservation projects in the Central Edwards Plateau Rivers, Guadalupe and San Antonio Rivers, and Devils River NFCAs. In 2017, TPWD designed a new vehicle license plate with artwork that features a Texas river (Figure 21). An annual fee of $30 is paid by Texas drivers to display the plate, with $22 allocated to the CTRI. Nearly 1,000 plates were sold in the initial 12 months that the plate was available for purchase, and efforts to market and raise public awareness of the plate are ongoing. The CTRI continues to address a critical need of providing non-federal funds to meet the cost-share requirements of grants that support conservation projects within Texas NFCAs.

Figure 21 - Vehicle license plate sold to raise funding for investments in Native Fish Conservation Areas.

The National Fish and Wildlife Foundation Southwest Rivers Program was established in 2017 to "fund effective conservation projects that achieve measurable outcomes and fill knowledge gaps where they exist, reinvigorating habitats throughout this unique American landscape" (www.nfwf.org/swrivers). The NFCAs located in the Chihuahuan Desert ecoregion of Texas (i.e., Davis Mountains Streams, Guadalupe Mountains Streams, Pecos River, Devils River, Upper Big Bend, and Lower Big Bend NFCAs) were adopted as "Focal

Watersheds" in the initial request for proposals of the Southwest Rivers Program. Grants totaling $1,535,755 were subsequently awarded by the National Fish and Wildlife Foundation in 2018 to TPWD, TPWF, and Sul Ross State University for restoration of streams, riparian buffers, and grasslands in those six NFCAs. A 10-year business plan is currently being assembled for the Southwest Rivers Program. The NFCAs of the Chihuahuan Desert ecoregion of Texas, and the associated freshwater fish SGCN, are being considered by the National Fish and Wildlife Foundation as strategic priorities are formalized within the plan.

State Technical Advisory Committees (STACs) serve in an advisory capacity to the Natural Resources Conservation Service (NRCS) and other agencies within the U.S. Department of Agriculture on the implementation of the natural resources conservation provisions of the U.S. Farm Bill legislation. The Texas STAC includes an active Wildlife Sub-Committee that informs consideration of fish and wildlife conservation needs, and that recommends geographic (e.g., focal watersheds, species ranges) and thematic priorities (e.g., riparian restoration, instream habitat improvements) for conservation initiatives supported through the U.S. Farm Bill in Texas. Since the statewide Texas NFCAs Network prioritization was completed in 2015, TPWD has recommended that the Texas STAC adopt the Texas NFCAs Network as geographic priorities for a variety of programs including the Conservation Stewardship Program, Environmental Quality Incentives Program, and Agricultural Conservation Easement Program. Additionally, the Texas STAC Wildlife Sub-Committee initiated establishment of an ad-hoc working group in 2018 to identify riparian habitat conservation priorities in Texas, and TPWD has encouraged the working group to consider inclusion of Texas NFCAs within that prioritization.

Also occurring in 2018, the NRCS awarded $5,150,000 through the Regional Conservation Partnership Program for habitat restoration and protection (i.e., conservation easements) in portions of the Central Edwards Plateau Rivers, Lower Colorado River, and Guadalupe and San Antonio Rivers NFCAs. The NRCS also selected the Lower Colorado River NFCA as a 2018 strategic priority for aquatic species conservation through the Working Lands for Wildlife Program. These NRCS-funded initiatives are expected to support restoration and preservation of instream and riparian habitats, benefiting the 54 species of native freshwater fishes historically known to occur in those three NFCAs (Appendix A).

NFCA Goal 3 – Restore Instream and Floodplain Connectivity

Efforts to restore instream connectivity (i.e., longitudinal connectivity) within Texas NFCAs has primarily centered on the removal of low-head dams and the redesign or removal

of culverted bridge crossings. In 2014, TPWD and the Texas Commission on Environmental Quality cooperated on removal of a 1.2-m tall low-head dam spanning a 55-m wide reach of the North Fork Guadalupe River (Figure 22), which is located within the Southern Edwards Plateau Rivers NFCA. In 2016, the U.S. Fish and Wildlife Service, TPWD, and local partners cooperated on the removal of Ottine Dam, a 4-m tall and 30-m wide low-head dam on the San Marcos River, located within the Guadalupe and San Antonio Rivers NFCA. Removal of Ottine Dam restored instream connectivity in 63 km of the San Marcos River. Also occurring in 2016, TPWD cooperated with the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, and Texas Commission on Environmental Quality on removal of a 2.4-m tall and 30-m wide culverted bridge crossing in the Upper Brazos River NFCA on the Double Mountain Fork of the Brazos River (Figure 23). Removal of the crossing restored instream connectivity for the last remaining populations of Sharpnose Shiner and Smalleye Shiner, two highly migratory prairie minnows currently listed as federally endangered. Additionally, TPWD has consulted on the redesign of several culverted bridge crossings planned for renovation in the Central Edwards Plateau Rivers and Southern Edwards Plateau Rivers NFCAs.

Figure 22 - Dam being removed from the North Fork Guadalupe River located in the Southern Edwards Plateau Rivers Native Fish Conservation Area.

Figure 23 - Culverted crossing removed from the Double Mountain Fork Brazos River located in the Upper Brazos River Native Fish Conservation Area.

To undertake a more proactive, strategic approach to restoration of instream connectivity, TPWD is currently partnering with SARP to complete a barrier inventory and prioritization for a portion of the Southern Edwards Plateau Rivers NFCA. Initiated in 2017, this project is expected to serve as a pilot program for possible expansion of the Southeast Aquatic Connectivity Project into Texas (Graham et al., in press). The goal of the Southeast Aquatic Connectivity Project is to restore connectivity, habitat, and ecological functions to streams by identifying and removing dams and other barriers to aquatic species passage.

Restoration of floodplain connectivity (i.e., lateral connectivity) in rivers and streams contained with Texas NFCAs has been primarily limited to the Northeast Texas Rivers NFCA, where The Nature Conservancy, U.S. Army Corps of Engineers, Northeast Texas Municipal Water District, TPWD, Caddo Lake Institute, and numerous other local conservation partners cooperated on a flow agreement to restore a more natural flow regime in Big Cypress Bayou downstream of Lake O' the Pines. The flow regime included prescriptions for high flow pulses and overbank flows intended to reconnect the river to its natural floodplain and benefit floodplain spawning fish SGCN, including Ironcolor Shiner *Notropis chalybaeus* and Taillight Shiner *Notropis maculatus*. Instream flow recommendations for high flow pulses and overbank flows to support longitudinal and lateral connectivity

within the Texas NFCAs are also expected to result from research described within the summary for Goal 7.

NFCA Goal 4 – Mitigate Effects of Invasive Species

Efforts to address the negative effects of invasive species within Texas NFCAs have focused on identification and implementation of regulatory and permitting measures to mitigate impacts of invasive Tilapia *Oreochromis spp.* (McGarrity, in press) and control of invasive riparian plants that form dense, monotypic stands and degrade riparian habitat quality (Bell 1997; Di Tomaso et al. 1998). Efforts to control invasive riparian plants have primarily focused on management of Saltcedar and Giant Reed. These species have been shown to accumulate sediment, narrow stream channels, isolate floodplains, reduce instream flow, degrade water quality, increase erosion, and alter instream habitats (Birken and Cooper 2006; Blackburn et. al. 1986; Dean and Schmidt 2011; Dean et. al. 2011; Merritt and Poff 2010; Shafroth et. al. 2010; Stromberg et. al. 2007).

In the Guadalupe and San Antonio Rivers, Central Edwards Plateau Rivers, and Southern Edwards Plateau Rivers NFCAs, TPWD has partnered with The Nature Conservancy, Hill Country Alliance, Texas Department of Transportation, river authorities, local municipalities, and more than 400 cooperating riparian landowners to implement large-scale management of Giant Reed along 200 km of the Blanco, Guadalupe, Medina, Nueces, and Pedernales rivers and their tributaries. In the Blanco and Pedernales rivers, the scope of these efforts was expanded to include mapping of other invasive plants and restoration planting to augment passive recolonization. Biological monitoring sites were also established along Barons Creek, a tributary of the Pedernales River, to evaluate effects of control efforts on riparian plant communities, fish and invertebrate communities, water quality and quantity, and channel morphology. Similar efforts to implement large-scale control of river cane and to reestablish native riparian vegetation are being implemented by the National Park Service, World Wildlife Fund, Rio Grande Joint Venture, and TPWD in the Upper Big Bend and Lower Big Bend NFCAs.

In the Upper Brazos River NFCA, TPWD has partnered with the U.S. Fish and Wildlife Service Partners for Fish and Wildlife Program, Texas A&M AgriLife, Texas Tech University, University of Texas at Austin, and approximately 50 riparian landowners to manage 2,711 ha of Saltcedar, focusing initial efforts along 286 km of the Double Mountain Fork of the Brazos River. Aerial surveys of Saltcedar were completed throughout the entire Upper Brazos River NFCA, and control efforts were expanded to the Salt Fork of the Brazos River in 2018, with

restoration planting of cottonwood *Salix populus* currently in the planning stages. Research is being conducted in partnership with the University of Texas at Austin Bureau of Economic Geology to evaluate the effects of Saltcedar control on water budget, water quality, river channel morphology, and riparian plant communities (Mayes et. al., in press).

In the Central Edwards Plateau Rivers NFCA, TPWD has partnered with the Texas Tech University Llano River Field Station, Llano River Watershed Alliance, cooperating landowners, and volunteers to implement management of invasive elephant ear *Colocasia esculenta* along more than 80 km of the Llano River and Gorman Creek. Partners have also implemented management of Giant Reed at the South Llano River State Park. Restoration plantings and changes to stewardship practices implemented at the South Llano River and Colorado Bend state parks will be used to provide demonstration sites for outreach to increase awareness of the negative impacts of invasive riparian plants.

NFCA Goal 5 – Organize and Facilitate Conservation Partnership Networks

Conservation partnerships formed to help deliver conservation actions within NFCAs of Texas were previously described above within the section profiling conservation planning within NFCAs of the southwestern USA.

NFCA Goal 6 – Establish Conservation Demonstration Areas

Through a partnership among TPWD, Texas Council of Fly Fishers International, Keep Texas Beautiful, Devils River Conservancy, Llano River Watershed Alliance, Hill Country Alliance, All Water Guides, Colorado River Alliance, and other local partners, an extensive list of service-oriented river stewardship projects has been organized and conducted within Texas NFCAs. River stewardship projects have consisted of river-wide trash cleanups (Figures 18 and 19), invasive fish and plant removal, planting of native trees and reseeding of erosional banks, establishment of nature trails, installation of educational kiosks, and creation of paddler manuals and other educational resources for river users. Partners have hosted river stewardship workshops for landowners and local communities in order to demonstrate and promote best management practices for conservation of riparian and instream habitats.

River stewardship projects have primarily been conducted in reaches of river where public river access is supported through partnerships with local communities or through lease agreements with willing riparian landowners (Figure 24). The intent of the TPWD-supported river access areas is to facilitate nature-oriented recreation on Texas rivers (e.g., paddling, kayak fishing, wildlife-viewing) and to demonstrate and encourage best practices

in the management and conservation of instream and riparian habitats. During 2016-2018, lease payments and habitat improvements were funded through a grant provided by the U.S. Department of Agriculture's Voluntary Public Access and Habitat Incentive Program. Lease agreements between TPWD and cooperating landowners supported public river access and conservation demonstration at 15 riparian properties within Texas NFCAs. These properties enabled paddling and kayak fishing within approximately 274 km of the NFCAs and served as a catalyst for grassroots involvement in river stewardship activities.

Partnering landowners cooperated with TPWD and local conservation organizations to assemble resource conservation plans and deliver habitat improvements and recreational enhancements (e.g., trail maintenance, development of primitive campsites for river users) at the riparian properties. In partnership with All Water Guides, a central Texas flying fishing guide service, and Keep Texas Beautiful, a state-based non-profit organization with numerous local chapters, 25 community outreach and service projects were conducted at the

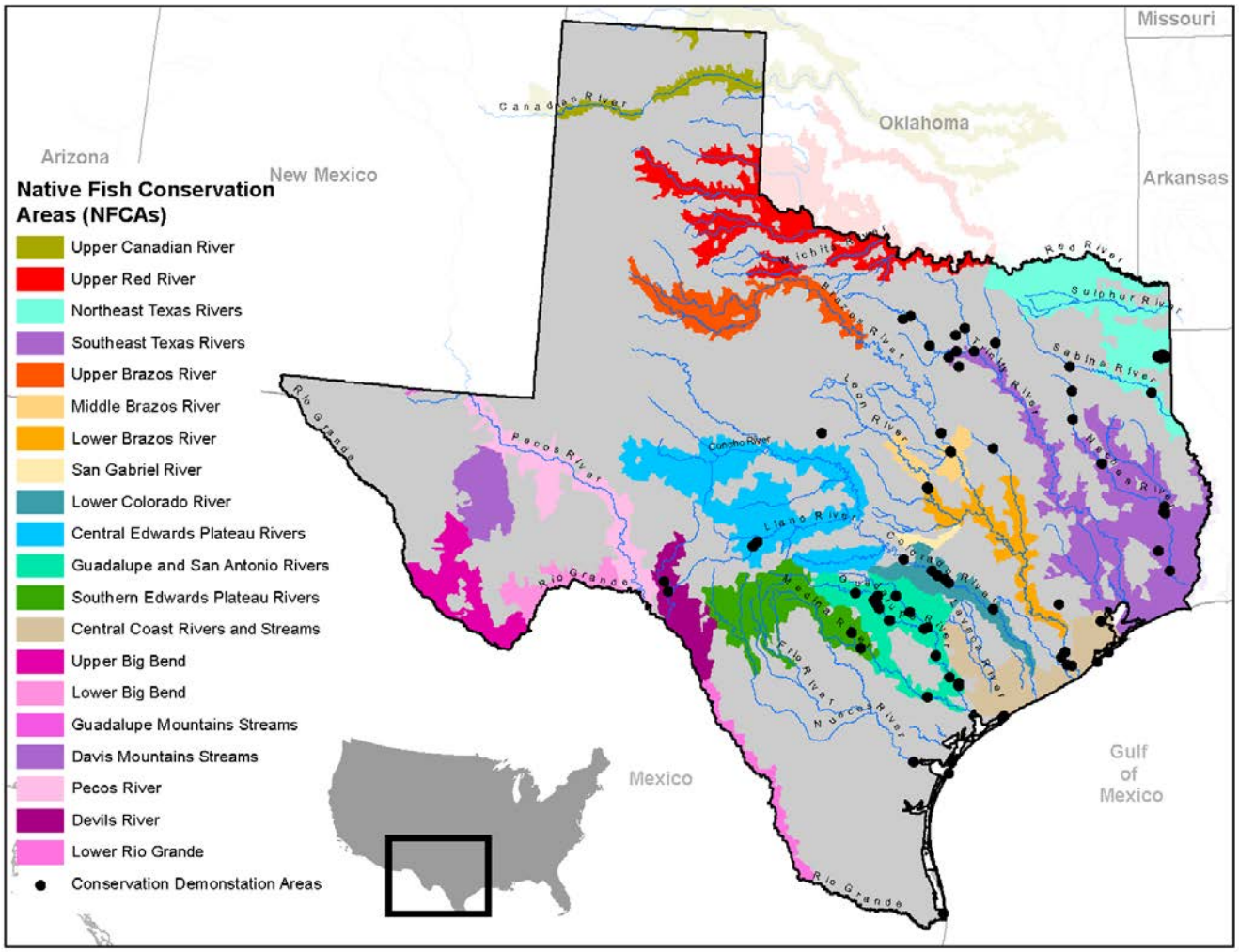


Figure 24 - Public river access sites that serve as conservation demonstration areas for engaging, demonstrating, and promoting river stewardship to landowners, recreational users, and the public.

river access areas located within the Lower Colorado River (Figures 25 and 26), Guadalupe and San Antonio Rivers, and Southeast Texas Rivers NFCAs. Outreach events promoted river stewardship to 611 attendees. Service projects were supported by 364 volunteers and resulted in removal of 682 tires and approximately 2,500 kg of litter and 450 kg of recyclables.

In the Central Edwards Plateau Rivers NFCA, TPWD partnered with the Hill Country Alliance, Llano River Watershed Alliance, and Texas Council of Fly Fishers International to conduct river-wide trash cleanups, install an informational kiosk and monofilament fishing line recycling bin, install protective caging to support recruitment of native riparian seedlings and saplings (decimated by herbivory by non-native ungulates), and broadcast native riparian seed mix on bare, erosional river banks. A series of public "town hall" conversations were also organized in the Central Edwards Plateau Rivers NFCA. These aired on Texas Public Radio, and involved a dialogue among the general public, landowners, elected officials, and subject matter experts on river conservation topics such as groundwater management, invasive species management, riparian restoration, conservation easements, and ecosystem services. Partners also produced a 14-minute video on the importance of effective riparian management in promoting river resilience, hosted workshops on riparian management, rotational grazing of livestock, and preservation of natural landscapes (through conservation easements), and organized a series of Wild and Scenic Film Festivals that further promoted river conservation through inspirational videos on topics such as protection and restoration of wild lands and waters and biodiversity conservation.

In the Guadalupe and San Antonio Rivers NFCA, a riparian conservation demonstration area was established on the Blanco River in partnership with the Lady Bird Johnson Wildflower Center and cooperating landowners. Stewardship practices implemented at the site have included native plant seeding and installation; extensive tree plantings; invasive species control; assimilation of woody debris and root wads into site design; soil compaction remediation for seep restoration; and installation of native turf grasses for access areas. Guided tours of the site began in spring 2018 and are expected to continue, with 50 land managers to date having received hands-on instruction in riparian stewardship practices.

In the Devils River NFCA (Figure 27), TPWD partnered with the Devils River Conservancy to conduct four river-wide trash cleanups, invasive fish removal, and outreach to paddlers and landowners. Outreach included production of a Devils River paddler manual and accompanying video that promote recreational etiquette and river stewardship practices. Partners also organized two river stewardship workshops that engaged Devils River

Figure 25 - TPWD staff remove trash during a cleanup of the Lower Colorado River Native Fish Conservation Area.

Figure 26 - Trash removed by TPWD and partners during a cleanup of the Lower Colorado River Native Fish Conservation Area.

landowners in demonstration of riparian and land management practices that support healthy rivers.

Figure 27 - Devils River Native Fish Conservation Area, located near Del Rio, TX.

The Texas Council of Fly Fishers International played an active role in supporting identification of specific reaches of rivers where anglers desired improved access, and in establishing and maintaining positive relationships with cooperating landowners of the leasing program. The organization also distributed 5,000 citrus fruit bags (used for river trash cleanups) to their network of 20 local fly fishing clubs located throughout the state. The clubs conducted river trash cleanups in conjunction with routine club fishing trips to the access areas.

In 2018, TPWD was awarded a grant from the U.S. Fish and Wildlife Service Sport Fish Restoration Recreational Boating Access Grant Program in the amount of $240,000 dollars that will allow for establishment of additional river access and conservation demonstration

areas on rivers throughout the state. The grant is expected to support 20 lease agreements with private riparian landowners, opening approximately 322 km of rivers for paddling and kayak fishing. The grant will also add 20 new and maintain 133 existing river access areas supported through partnerships with local communities, providing 1,081 km of paddling and kayak fishing on Texas rivers. More than half of those river access areas occur within Texas NFCAs, and through cooperation with local communities, TPWD intends to utilize these access areas (riparian properties) and the recreationally-accessible reaches of river as conservation demonstration areas. In addition to the variety of service-oriented stewardship projects referenced above, these reaches of river were recently prioritized by TPWD for management of invasive riparian plants, with an emphasis on management of the problematic species referenced within the summary for Goal 4.

NFCA Goal 7 – Conduct Research to Fill Critical Science Needs

Since completion of the initial Texas NFCAs prioritization in 2013, TPWD has invested approximately $3 million dollars in State Wildlife Grant funding to fill critical science needs for conservation of freshwater fish SGCN in Texas NFCAs. A primary emphasis of this research has been to quantify flow-ecology relationships for flow-dependent fishes, freshwater mussels, and riparian productivity within highly managed and regulated river reaches (i.e., downstream of reservoirs). This research is ongoing in the Guadalupe and San Antonio Rivers, Middle Brazos River, Lower Brazos River, Lower Colorado River, and Southeast Texas Rivers NFCAs. Results (see TIFP 2018 and SARA 2017) are expected to inform strategies for environmental flow restoration and protection, adaptive management of environmental flow standards, and related management of river flows and reservoir water levels.

In the Devils River NFCA, similar investments of State Wildlife Grant funding have been made to improve understanding of the relationships among groundwater levels, spring discharge, river flows, and habitat conditions for fish and freshwater mussel SGCN (Robertson et al., in press). Potential establishment of a Groundwater Management District for the portion of the Edwards-Trinity Aquifer that is the source of spring discharge and base flows in the Devils River NFCA has been contemplated by the Texas State Legislature. Meanwhile, the comprehensive science needed to inform such actions has historically been lacking. Over the past five years, TPWD and partners have prioritized investments of State Wildlife Grant funding within the Devils River NFCA to provide the science needed to

ensure consideration of the instream flow needs of native fishes and mussels, their habitats, and river recreation in water management decisions for this spring-dominated system.

In the Guadalupe Mountains Streams NFCA, TPWD partnered with Trout Unlimited and the U.S. Geological Survey New Mexico Cooperative Fish and Wildlife Research Unit in 2013-2014 to assess the potential for repatriation of Rio Grande Cutthroat Trout *Oncorhynchus clarki virginalis* and Rio Grande Chub *Gila pandora* into McKittrick Creek (Zeigler and Caldwell 2017), a stream that currently hosts a non-native population of Rainbow Trout *Oncorhynchus mykiss* (Garrett and Matlock 1991).

Additional research supported by State Wildlife Grants within Texas NFCAs has centered on filling critical science needs in the life history, distribution, and status of freshwater fish SGCN. This included ongoing research to address the status and distribution of American Eel *Anguilla rostrata* in the Central Coast Rivers and Streams NFCA and the status of Chihuahua Catfish *Ictalurus sp.* and other regionally endemic fish SGCN in the Central Edwards Plateau Rivers, Southern Edwards Plateau Rivers, Devils River, Pecos River, Davis Mountains Streams, Upper Big Bend, and Lower Big Bend NFCAs.

Priority research needs identified at NFCA conservation planning workshops have also been communicated to other science funding programs. For example, priority research needs identified during the conservation planning workshops held for the Central Edwards Plateau Rivers, Upper Brazos River, Upper Canadian River, and Upper Red River NFCAs (conducted in fall 2015 and winter 2016) were presented to the Steering Committee of the Great Plains Landscape Conservation Cooperative in spring 2016. The Great Plains Landscape Conservation Cooperative adopted a subset of those priority research needs for their spring 2016 request for proposals, emphasizing the desire to receive proposals for projects that would examine opportunities for water leases, water rights acquisition, and voluntary incentive-based programs to achieve flow restoration targets within those four NFCAs.

NFCA Goal 8 – Monitor Conservation Outcomes and Perform Adaptive Management

To fill data gaps and monitor status and trends of fish SGCN within Texas NFCAs, TPWD and the University of Texas at Austin collaborated on development and implementation of an aquatic gap sampling program. Initiated in 2013 in conjunction with the pilot phase of the Texas NFCAs prioritization, the partnership has surveyed 187 locations within Texas NFCAs (Figure 28). This has resulted in 46,617 museum-vouchered fish specimens and 316 corresponding tissue samples deposited and permanently housed at the

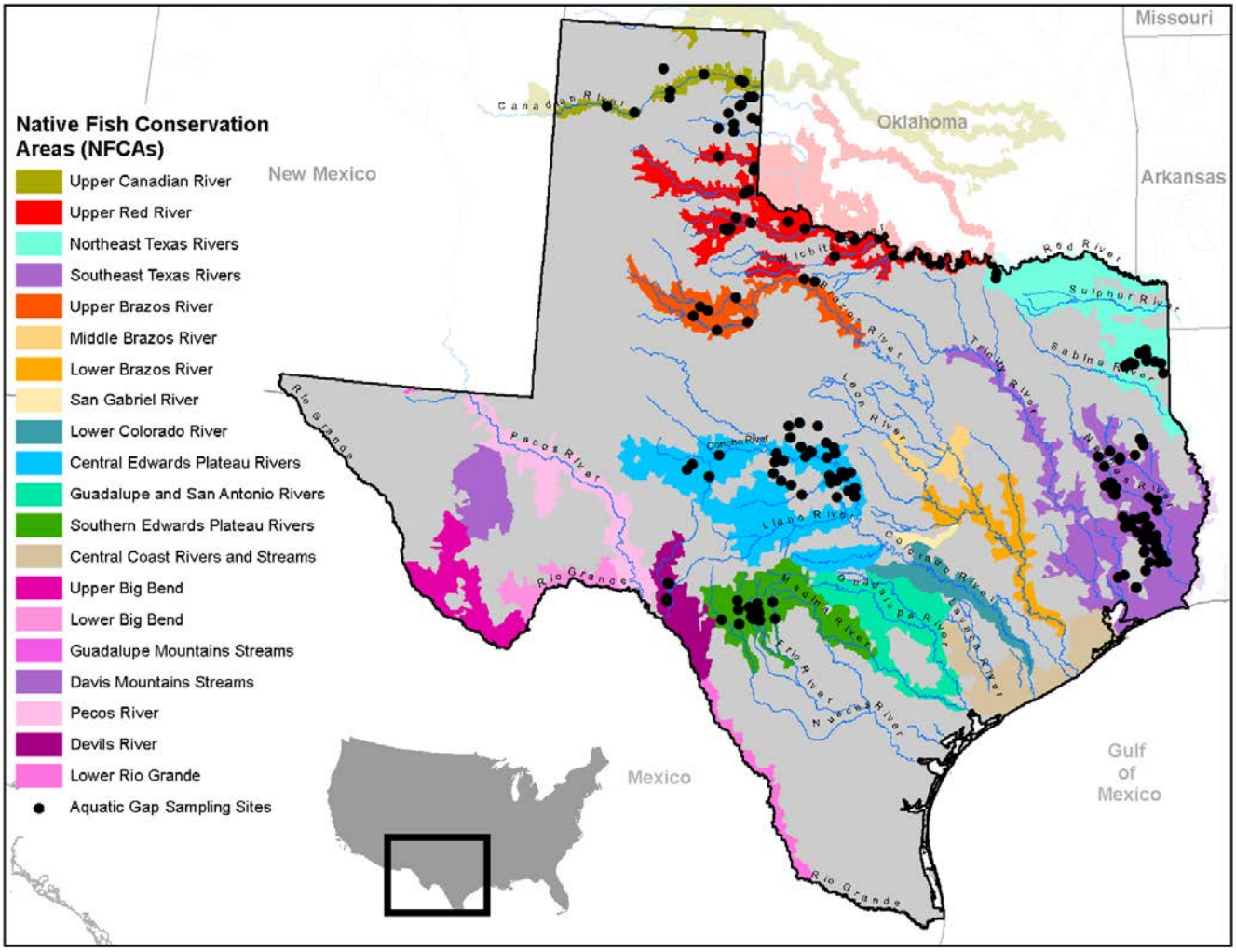


Figure 28 - Locations of aquatic gap sampling conducted by TPWD and the University of Texas at Austin within Texas Native Fish Conservation Areas.

University of Texas at Austin Biodiversity Collections. Surveys resulted in the addition of one new species to the state's faunal list (i.e., Bigeye Shiner *Notropis boops*), records of rarely collected fishes (e.g., Pallid Shiner *Hybopsis amnis*, Cypress Minnow *Hybognathus hayi*, Emerald Shiner *Notropis atherinoides*, Arkansas River Shiner *Notropis girardi*), and records representing range expansions for native (i.e., Least Killifish *Heterandria Formosa*) and invasive species (i.e., Sheepshead Minnow and Gulf Killifish in the Red River). Surveys have also provided evidence of range reductions (e.g., Suckermouth Minnow *Phenacobius mirabilis*, Red River Pupfish *Cyprinodon rubrofluviatilis*, Pallid Shiner, and Emerald Shiner) and possible extirpations (e.g., Flathead Chub *Platygobio gracilis*) from the state.

Aquatic gap sampling has supported data-driven recommendations to multiple TPWD-managed State Parks (i.e., Colorado Bend, Garner, and Village Creek) and Wildlife Management Areas (i.e., Alabama Creek, Alazan Bayou, Gene Howe, and Matador),

increasing consideration of native fishes and their habitats in site management plans (TPWD 2015, 2016, 2017, 2018; Cohen et al. 2018). Surveys conducted in the Northeast Texas Rivers NFCA supported monitoring and evaluation of the effectiveness of the Cypress Basin Flows Agreement, which was previously referenced under Goal 3. Restoration of the natural flow regime in the Cypress Basin is expected to improve instream and riparian habitats, support repatriation of Paddlefish, and benefit conservation of other fish SGCN.

Aquatic gap sampling reports are accessible from the TPWD River Studies Reports web page (https://tpwd.texas.gov/landwater/water/conservation/fwresources/reports.phtml) for portions of the following NFCAs: Upper Canadian River NFCA, Northeast Texas Rivers NFCA (Cypress Basin), Southeast Texas Rivers NFCA (Neches River and Village Creek), and Southern Edwards Plateau Rivers NFCA (Frio River and North Fork Guadalupe River). Aquatic gap sampling reports for the Upper Red River NFCA and San Gabriel River NFCA are expected to be posted to the web page by 2019.

Native Fish Conservation Areas as a Climate Adaptation Strategy

The purpose of the U.S. National Fish, Wildlife and Plants Climate Adaptation Strategy (National Climate Adaptation Strategy; NFWPCAP 2012) is to inform and enable natural resource professionals and other decision makers to take action to conserve fish, wildlife, plants, and ecosystem functions, as well as the human uses, values and benefits those natural systems provide, in a changing climate. The National Climate Adaptation Strategy details the current and expected future impacts of climate change on the eight major ecosystem types in the USA. Additionally, it identifies actions that can be taken to enhance the resiliency of fish, wildlife, and their habitats under changing conditions. Those actions are organized under the seven primary goals of the National Climate Adaptation Strategy outlined in Table 12.

The National Climate Adaptation Strategy emphasizes management of habitats for resiliency as a primary strategy for supporting fish and wildlife adaptation to climate change. Consistent with the recommendations of the National Climate Adaptation Strategy, the NFCA goals and implementation strategies (Table 4) emphasize management of watersheds and habitats for ecological resiliency. Summaries provided above of efforts to address NFCA Goals (e.g., protect and maintain intact habitats, restore altered habitats, restore instream and floodplain connectivity) offer insights into the types of activities being undertaken by

cooperators within NFCAs of the southwestern USA to enhance the resiliency of freshwater systems and conserve native fishes in the face of climate change.

As natural resources managers plan and prepare for the current and anticipated effects of climate change, the NFCAs approach offers a case study in engagement of the broader community of conservation practitioners to "scale up" investments in conservation planning and delivery to enhance resiliency of ecological systems. Many of those investments represent proactive, voluntary measures to address threats to fish and wildlife resources, emphasizing conservation and management of natural landscapes, watershed processes, habitats, species, and ecosystems in a manner that enhances their resiliency and adaptive capacity. This holistic approach has been adopted by TPWD and conservation partners in Texas in response to the multitude of interrelated natural and anthropogenic stressors affecting fish and wildlife resources, including climate change.

Table 12 - Goals of the National Climate Adaptation Strategy (NFWPCAP 2012).

(1) Conserve habitat to support healthy fish, wildlife, and plant populations and ecosystem functions in a changing climate
(2) Manage species and habitats to protect ecosystem functions and provide sustainable cultural, subsistence, recreational, and commercial use in a changing climate
(3) Enhance capacity for effective management in a changing climate
(4) Support adaptive management in a changing climate through integrated observation and monitoring and improved decision support tools
(5) Increase knowledge and information on impacts and responses of fish, wildlife, and plants to a changing climate
(6) Increase awareness and motivate action to safeguard fish, wildlife, and plants in a changing climate
(7) Reduce non-climate stressors to help fish, wildlife, plants, and ecosystems adapt to a changing climate

Transferability to Other States and Regions of the USA

NFCAs represent a strategic, science-based approach to planning and delivery of multispecies, watershed approaches to freshwater fish conservation. The NFCAs prioritization and conservation planning processes have served as the impetus for increased, focused, and sustained investments (e.g., research, monitoring, habitat restoration and protection) in native fish conservation within priority freshwater systems of the southwestern USA. Furthermore, NFCAs have enhanced communication and fostered collaboration among non-governmental organizations, universities, and state and federal agencies, and have facilitated the leveraging of staff, expertise, project funding, and other resources toward delivery of proactive, voluntary conservation projects.

As state fish and wildlife agencies and their partners plan and prepare for an anticipated increase in available funding for conservation of SGCN through the Recovering America's Wildlife Act (H.R. 4647), Texas NFCAs offer a successful case study in engagement of the broader community of conservation practitioners to increase investments in conservation planning and delivery. The voluntary investments in habitat restoration, habitat protection, invasive species management, and other conservation actions within Texas NFCAs have complemented traditional state-based native fish conservation efforts, which have primarily involved reactive, regulatory activities (e.g., permitting of non-game fish collection, permitting of fish stocking in public waters, permitting of dredging and other instream habitat disturbances) and consultation with other agencies on water management and watershed development projects seeking state or federal permits through requirements of the U.S. Clean Water Act, U.S. National Environmental Policy Act, or other state and federal laws (e.g., water rights permitting, hydropower relicensing, dam construction, urban development). The majority of the technical and financial resources that have supported the conservation actions within Texas NFCAs are accessible to fish and wildlife agencies throughout the USA. As such, this report offers a case study that we believe to be transferable to other U.S. states, and that is particularly relevant to those states that, similar to Texas, consist predominately of privately-owned lands.

Native Fish Conservation Network Website

To learn more about the NFCA approach, please visit http://nativefishconservation.org. The website offers additional insights into the multispecies aquatic assessments and conservation planning process referenced in this report, further characterizes NFCAs of the U.S. southwest and U.S. Great Plains, offers an interactive map of priority conservation projects identified during conservation planning workshops, and outlines additional project-specific information including cooperators, expected results and benefits, estimated project cost, and project status (i.e., suggested, ongoing, or completed).

Acknowledgements

We thank the numerous cooperators who actively contributed to the conservation outcomes described in this report. Your interest, dedication, and substantive contributions are appreciated and we look forward to building upon our shared vision and partnership to move conservation and restoration goals forward within NFCAs of the southwestern USA.

Devils River Native Fish Conservation Area

Photo: T. Birdsong, TPWD

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Appendix A

Fish Diversity within Native Fish Conservation Areas of the Southwestern USA

Taxa	Native Fish Conservation Area																			
	Upper Brazos River	Upper Red River	Upper Canadian River	Central Edwards Plateau Rivers	Guadalupe and San Antonio Rivers	Southern Edwards Plateau Rivers	Upper Big Bend	Lower Big Bend	Guadalupe Mountains Streams	Davis Mountains Streams	Pecos River	Devils River	Lower Rio Grande	Central Coast Rivers and Streams	Lower Colorado River	Middle Brazos River	San Gabriel River	Lower Brazos River	Southeast Texas Rivers	Northeast Texas Rivers
Ichthyomyzon castaneus Chestnut Lamprey																			C	C
Ichthyomyzon gagei Southern Brook Lamprey																			C	C
Dasyatis sabina Atlantic Stingray														C					C	
Scaphirhynchus platorynchus Shovelnose Sturgeon							FL	FL			FL									FL
Polyodon spathula Paddlefish																			FL	FL
Atractosteus spatula Alligator Gar					F	F	F	F			F	F	F	F	F	F		F	F	F
Lepisosteus oculatus Spotted Gar	C	C			C	C	C	C		C	C	C	C	C	C	C	C	C	C	C
Lepisosteus osseus Longnose Gar	C	C		C	C	C	C	C		C	C	C	C	C	C	C	C	C	C	C
Lepisosteus platostomus Shortnose Gar		C																		C
Amia calva Bowfin														C	C			C	C	C
Hiodon alosoides Goldeye		F																		F
Elops saurus Ladyfish														C					C	
Megalops atlanticus Tarpon														F					F	
Anguilla rostrata American Eel	F	F	F	F	F	F	F	F		F	F	F	F	F	F	F	F	F	F	F
Myrophis punctatus Speckled Worm Eel																			C	
Anchoa hepsetus Striped Anchovy														C					C	
Anchoa mitchilli Bay Anchovy														C				C	C	
Alosa chrysochloris Skipjack Herring														C				C	C	
Brevoortia gunteri Finescale Menhaden														C					C	

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Brevoortia patronus **Gulf Menhaden**														C				C	C	
Dorosoma cepedianum **Gizzard Shad**	C	C		C	C	C	C	C		C	C	C	C	C	C	C	C	C	C	C
Dorosoma petenense **Threadfin Shad**	C			C	C	C	NN	NN				NN	C	C	C		C	C	C	C
Harengula jaguana **Scaled Sardine**														C						
Campostoma anomalum **Central Stoneroller**	C	C	C	C	C	C				C	C	C	C	C	C	C	C	C	C	C
Campostoma ornatum **Mexican Stoneroller**							FL	FL												
Campostoma spadiceum **Highland Stoneroller**																				FR
Carassius auratus **Goldfish**	NN			NN			NN	NN		NN	NN				NN	NN	NN	NN	NN	NN
Ctenopharyngodon idella **Grass Carp**													NN	NN	NN					NN
Cyprinella lepida **Plateau Shiner**						F														
Cyprinella lutrensis **Red Shiner**	C	C	C	C	C	C	C	C		C	C	C	C	C	C	C	C	C	C	C
Cyprinella lutrensis blairi **Maravillas Red Shiner**								F												
Cyprinella proserpina **Proserpine Shiner**											FL	FL								
Cyprinella sp. **Nueces River Shiner**						F														
Cyprinella venusta **Blacktail Shiner**	C	C		C	C	C	NN	NN		NN	NN	C	C	C	C	C	C	C	C	C
Cyprinella whipplei **Steelcolor Shiner**																				C
Cyprinus carpio **Common Carp**	NN	NN	NN	NN	NN	NN	NN	NN		NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN
Dionda argentosa **Manantial Roundnose Minnow**											F	F								
Dionda diaboli **Devils River Minnow**												FL								
Dionda episcopa **Roundnose Minnow**										F	F									
Dionda flavipinnis **Guadalupe Roundnose Minnow**				FR	FR															
Dionda nigrotaeniata **Medina Roundnose Minnow**						F														
Dionda serena Frio **Roundnose Minnow**						F														

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Dionda sp. 1 **Conchos Roundnose Minnow**							FR													
Dionda sp. 3 **Colorado Roundnose Minnow**				FR																
Dionda texensis **Nueces Roundnose Minnow**						FR														
Gila pandora **Rio Grande Chub**									FL	FL										
Hybognathus amarus **Rio Grande Silvery Minnow**							FL	FL			FL		FL							
Hybognathus hayi **Cypress Minnow**																				C
Hybognathus nuchalis **Mississippi Silvery Minnow**																FR		FR	FR	FR
Hybognathus placitus **Plains Minnow**	FR	FR	FR	FR	NN							NN				FR	FR	FR		
Hybopsis amnis **Pallid Shiner**					FR									FR	FR	FR	FR	FR	FR	FR
Luxilus chrysocephalus **Striped Shiner**																				C
Lythrurus fumeus **Ribbon Shiner**					C									C	C			C	C	C
Lythrurus umbratilis **Redfin Shiner**																			C	C
Macrhybopsis aestivalis **Speckled Chub**							F	F			F	F	F							
Macrhybopsis australis **Prairie Chub**		F																		
Macrhybopsis hyostoma **Shoal chub**	FR	FR		FR										FR	FR	FR	FR	FR	FR	FR
Macrhybopsis marconis **Burrhead Chub**				FR	FR	FR									FR					
Macrhybopsis storeriana **Silver Chub**	F	F														F		F		F
Macrhybopsis tetranema **Peppered Chub**			FR																	
Notemigonus crysoleucas **Golden Shiner**	NN	NN	NN	NN	C	C	NN	NN		NN	NN		NN	C	C	NN	NN	C	C	C
Notropis amabilis **Texas Shiner**				CR	CR	CR				CR	CR	CR	CR		CR					
Notropis atherinoides **Emerald Shiner**		C	C												NN			NN	C	C
Notropis atrocaudalis **Blackspot Shiner**																		F	F	F

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Notropis bairdi **Red River Shiner**		F																		
Notropis blennius **River Shiner**		F																		F
Notropis boops **Bigeye Shiner**		C																		
Notropis braytoni **Tamaulipas Shiner**							F	F			F	F	F							
Notropis buccula **Smalleye Shiner**	FL			FL											FL	FL	FL	FL		
Notropis buchanani **Ghost Shiner**	C	C		C	C	C					C	C	C	C	C	C	C	C	C	C
Notropis chalybaeus **Ironcolor Shiner**					F														F	F
Notropis chihuahua **Chihuahua Shiner**							FL	FL												
Notropis girardi **Arkansas River Shiner**			FL																	
Notropis jemezanus **Rio Grande Shiner**							F	F			F	F	F							
Notropis maculatus **Taillight Shiner**																				F
Notropis megalops **West Texas Shiner**											FR	FR								
Notropis orca **Phantom Shiner**							F	F			F		F							
Notropis oxyrhynchus **Sharpnose Shiner**	FL			FL											FL	FL	FL	FL		
Notropis potteri **Chub Shiner**	F	F												F		F	F	F	F	F
Notropis sabinae **Sabine Shiner**														F					F	F
Notropis shumardi **Silverband Shiner**	F	F												F	F	F	F	F	F	F
Notropis simus pecosensis **Pecos Bluntnose Shiner**											FL									
Notropis simus simus **Rio Grande Bluntnose Shiner**							F	F												
Notropis stramineus **Sand Shiner**	C	C	C	C	C	C	C	C			C	C			C	NN	NN	NN	NN	
Notropis texanus **Weed Shiner**				C	C	C								C	C	NN				C
Notropis volucellus **Mimic Shiner**	C			C	C	C								C	C	C	C	C	C	C
Opsopoeodus emiliae **Pugnose Minnow**				C	C	C								C	C	C	C	C	C	C

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Phenacobius mirabilis **Suckermouth Minnow**		FR	FR	FR											FR				FR	FR
Pimephales promelas **Fathead Minnow**	C	C	C	C	C	C	C	C		C	C			C	C	C	C	C	C	C
Pimephales vigilax **Bullhead Minnow**	C	C	NN	C	C	C	NN	NN		NN	NN	C	C	C	C	C	C	C	C	C
Platygobio gracilis **Flathead Chub**			FR																	
Pteronotropis hubbsi **Bluehead Shiner**																				FL
Rhinichthys cataractae **Longnose Dace**							F	F			F		F							
Scardinius erythrophthalmus **Rudd**													NN							
Semotilus atromaculatus **Creek Chub**																			C	C
Carpiodes carpio River **Carpsucker**	C	C		C	C	C	C	C		C	C	C	C	C	C	C	C	C	C	C
Carpiodes cyprinus **Quillback**																				C
Carpiodes sp. **Llano River Carpsucker**				FR																
Cycleptus elongatus **Blue Sucker**		FL		FL											FL	FL	FL	FL	FL	FL
Cycleptus sp. **Rio Grande Blue Sucker**							FL	FL			FL	FL	FL							
Erimyzon claviformis **Western Creek Chubsucker**														FL				FL	FL	FL
Erimyzon sucetta **Lake Chubsucker**					C									C				C	C	C
Ictiobus bubalus **Smallmouth Buffalo**	C	C		C			C	C		C	C		C	C	C	C	C	C	C	C
Ictiobus cyprinellus **Bigmouth Buffalo**																			C	C
Ictiobus niger **Black Buffalo**		NN					NN	NN			NN	NN							NN	
Minytrema melanops **Spotted Sucker**				F										C		C	C	C	C	C
Moxostoma albidum **Longlip Jumprock**											FR	FR								
Moxostoma austrinum **Mexican Redhorse**							F	F			F		F							
Moxostoma congestum **Gray Redhorse**	C			C	C	C	C	C		C	C	C	C		C	C	C	C		

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Moxostoma duquesnii **Black Redhorse**																				C
Moxostoma erythrurum **Golden Redhorse**																				C
Moxostoma poecilurum **Blacktail Redhorse**														C					C	C
Astyanax mexicanus **Mexican Tetra**				NN	NN	C	C	C		C	C	C	C		NN		NN	NN	NN	
Ameiurus melas **Black Bullhead**	C	C	C	C	C	C			C	C	C	C	C	C	C	C	C	C	C	C
Ameiurus natalis **Yellow Bullhead**	C	C		C	C	C	NN	NN						C	C	C	C	C	C	C
Ictalurus furcatus **Blue Catfish**	C						C	C			C	C	C	C		C	C	C	C	C
Ictalurus lupus **Headwater Catfish**				F	F	F	F	F		F	F	F	F							
Ictalurus punctatus **Channel Catfish**	C	C	C	C	C	C	C	C		C	C	C	C	C	C	C	C	C	C	C
Ictalurus sp. **Chihuahua Catfish**							F	F	F	F	F	F								
Ictalurus sp. **Rio Grande Blue Catfish**							FR	FR			FR	FR								
Noturus gyrinus **Tadpole Madtom**	C				C								NN	C	C	C	C	C	C	C
Noturus nocturnus **Freckled Madtom**	C													C		C	C	C	C	C
Prietella phreatophila **Mexican Blindcat**											FL									
Pylodictis olivaris **Flathead Catfish**	C	C	C	C	C	C	C	C			C	C	C	C	C	C	C	C	C	C
Satan eurystomus **Widemouth Blindcat**					FL	FL														
Trogloglanis pattersoni **Toothless Blindcat**					FL	FL														
Ariopsis felis **Hardhead Catfish**														C					C	
Bagre marinus **Gafftopsail Catfish**														C					C	
Hypostomus sp. **Armadillo Del Rio**												NN	NN							
Pterygoplichthys anisitsi **Southern Sailfin Catfish**														NN						
Pterygoplichthys disjunctivus **Vermiculated Sailfin Catfish**					NN															
Pterygoplichthys multiradiatus **Orinoco Sailfin Catfish**														NN						
Esox americanus **Redfin Pickerel**														C				C	C	C

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***Esox niger* Chain Pickerel**																				C
***Oncorhynchus clarkii virginalis* Rio Grande Cutthroat Trout**									F	F										
***Oncorhynchus mykiss* Rainbow Trout**						NN			NN										NN	
***Aphredoderus sayanus* Pirate Perch**														C			C	C	C	C
***Agonostomus monticola* Mountain Mullet**													FR	FR	FR	FR	FR	FR	FR	
***Mugil cephalus* Striped Mullet**													C	C	C			C	C	
***Mugil curema* White Mullet**														C					C	
***Labidesthes sicculus* Brook Silverside**	NN	NN														C	NN		C	C
***Membras martinica* Rough Silverside**														C				C	C	
***Menidia beryllina* Inland Silverside**	NN	NN	NN	NN	C	NN	NN	NN		NN	NN	NN	NN	C	C	C	NN	C	C	NN
***Menidia clarkhubbsi* Texas Silverside**														F					F	
***Menidia peninsulae* Tidewater Silverside**														C					C	
***Strongylura marina* Atlantic Needlefish**														C		C	C	C	C	
***Adinia xenica* Diamond Killifish**														C					C	
***Fundulus blairae* Western Starhead Topminnow**														C				C	C	C
***Fundulus chrysotus* Golden Topminnow**														C				C	C	C
***Fundulus grandis* Gulf Killifish**		NN		NN	NN	NN	NN	NN		NN	NN		NN	C	C	C	NN	C	C	
***Fundulus jenkinsi* Saltmarsh Topminnow**														F					F	
***Fundulus kansae* Northern Plains Killifish**			C																	
***Fundulus notatus* Blackstripe Topminnow**	C	C		C	C	NN								C	C	C	C	C	C	C
***Fundulus olivaceous* Blackspotted Topminnow**														C		C	C	C	C	C
***Fundulus pulvereus* Bayou Killifish**														C					C	

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Fundulus similis **Longnose Killifish**														C						
Fundulus zebrinus **Plains Killifish**	C	C		C			NN	NN		C	C	C			C	C	C	C	C	
Lucania goodei **Bluefin Killifish**														NN						
Lucania parva **Rainwater Killifish**					NN				C	C	C		C	C					C	
Belonesox belizanus **Pike Killifish**						NN														
Gambusia affinis **Western Mosquitofish**	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Gambusia amistadensis **Amistad Gambusia**											F									
Gambusia gaigei **Big Bend Gambusia**								FL												
Gambusia geiseri **Largespring Gambusia**				NN	C	NN				NN	NN	NN								
Gambusia georgei **San Marcos Gambusia**					FL															
Gambusia heterochir **Clear Creek Gambusia**				FL																
Gambusia krumholzi **Spotfin Gambusia**												FL								
Gambusia nobilis **Pecos Gambusia**										FL										
Gambusia senilis **Blotched Gambusia**												FL								
Gambusia speciosa **Tex-Mex Gambusia**										C	C	C								
Heterandria formosa **Least Killifish**																			C	
Poecilia formosa **Amazon Molly**					NN	NN							C					NN		
Poecilia latipinna **Sailfin Molly**				NN	NN	NN						NN	C	C	C	NN		C	C	
Poecilia reticulata **Guppy**						NN														
Xiphophorus hellerii **Green Swordtail**						NN														
Xiphophorus variatus **Variable Platyfish**															NN					
Cyprinodon bovinus **Leon Springs Pupfish**										FL										
Cyprinodon elegans **Comanche Springs Pupfish**										FL										

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Cyprinodon eximius **Conchos Pupfish**							FL					FL								
Cyprinodon pecosensis **Pecos Pupfish**											FL									
Cyprinodon rubrofluviatilis **Red River Pupfish**	F	F	F	NN																
Cyprinodon variegatus **Sheepshead Minnow**	NN			NN	NN					NN	NN	NN	C	C					C	
Microphis brachyurus **Opossum Pipefish**														FL					FL	
Syngnathus floridae **Dusky Pipefish**														C					C	
Syngnathus louisianae **Chain Pipefish**														C					C	
Syngnathus scovelli **Gulf Pipefish**														C					C	
Morone chrysops **White Bass**	NN	C	C	NN			NN	NN		NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	C
Morone mississippiensis **Yellow Bass**														C					C	C
Morone saxatilis **Striped Bass**	NN			NN										NN				NN	NN	NN
Ambloplites rupestris **Rock Bass**					NN															
Centrarchus macropterus **Flier**														C					C	C
Lepomis auritus **Redbreast Sunfish**	NN	NN		NN	NN	NN	NN	NN		NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN
Lepomis cyanellus **Green Sunfish**	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Lepomis gulosus **Warmouth**	C	C		C	C	C	C	C		C	C	C	C	C	C	C	C	C	C	C
Lepomis humilis **Orangespotted Sunfish**	C	C	C	C	NN									C	C	C	C	C	C	C
Lepomis macrochirus **Bluegill**	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Lepomis marginatus **Dollar Sunfish**														C				C	C	C
Lepomis megalotis **Longear Sunfish**	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Lepomis microlophus **Redear Sunfish**	C	C	C	C	C	C	NN	NN		NN	NN	NN	NN	C	C	C	C	C	C	C
Lepomis miniatus **Redspotted Sunfish**	C			C	C	C						C		C	C	C	C	C	C	C
Lepomis symmetricus **Bantam Sunfish**														C	C			C	C	C

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Micropterus dolomieu **Smallmouth Bass**				NN	NN	NN						NN			NN	NN	NN	NN	NN	
Micropterus punctulatus **Spotted Bass**	C	C			C									C	C	C	C	C	C	C
Micropterus salmoides **Largemouth Bass**	C	C	C	C	C									C	C	C	C	C	C	C
Micropterus salmoides floridanus **Florida Largemouth Bass**	NN	NN	NN	NN	NN	NN	NN	NN		NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN
Micropterus salmoides nuecensis **Rio Grande Largemouth Bass**						FR	FR	FR		FR	FR	FR	FR							
Micropterus treculii **Guadalupe Bass**				F	F	F									F	F	F			
Pomoxis annularis **White Crappie**	NN	C		C	NN	NN	NN	NN					NN	C	C	C	C	C	C	C
Pomoxis nigromaculatus **Black Crappie**	NN			NN	NN								NN	C	C	C	C	C	C	C
Ammocrypta clara **Western Sand Darter**																			F	F
Ammocrypta vivax **Scaly Sand Darter**																			C	C
Etheostoma artesiae **Redspot Darter**																			C	C
Etheostoma asprigene **Mud Darter**																				C
Etheostoma chlorosoma **Bluntnose Darter**					C									C	C			C	C	C
Etheostoma fonticola **Fountain Darter**					FL															
Etheostoma fusiforme **Swamp Darter**																			C	
Etheostoma gracile **Slough Darter**					C									C	C	C	C	C	C	C
Etheostoma grahami **Rio Grande Darter**											FL	FL	FL							
Etheostoma histrio **Harlequin Darter**																			C	C
Etheostoma lepidum **Greenthroat Darter**				C	C	C														
Etheostoma parvipinne **Goldstripe Darter**														C	C			C	C	C
Etheostoma proeliare **Cypress Darter**														C	C				C	C

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Etheostoma pulchellum **Plains Orangethroat Darter**	C	C		C	C	C									C	C	C			
Etheostoma radiosum **Orangebelly Darter**																				F
Etheostoma stigmaeum **Speckled Darter**																			C	
Etheostoma thompsoni **Gumbo Darter**																			FR	FR
Perca flavescens **Yellow Perch**			NN																	
Percina apristis **Guadalupe Darter**					F															
Percina caprodes **Logperch**		C																		C
Percina carbonaria **Texas Logperch**	C			C	C	C									C	C	C	C	C	
Percina macrolepida **Bigscale Logperch**	C	C		C								C	C	C	C	C	C	C	C	C
Percina maculata **Blackside Darter**														FL						FL
Percina phoxocephala **Slenderhead Darter**																				C
Percina sciera **Dusky Darter**	C			C										C	C	C	C	C	C	C
Percina shumardi **River Darter**		FR			FR														FR	FR
Sander canadensis **Sauger**		NN																		NN
Sander vitreus **Walleye**	NN		NN		NN															
Caranx hippos **Crevalle Jack**																			C	
Oligoplites saurus **Leatherjacket**														C					C	
Eucinostomus argenteus **Spotfin Mojarra**																			C	
Eucinostomus gula **Silver Jenny**																			C	
Eucinostomus harengulus **Tidewater Mojarra**														C						
Eucinostomus melanopterus **Flagfin Mojarra**														C					C	
Archosargus probatocephalus **Sheepshead**																			C	
Lagodon rhomboides **Pinfish**																			C	
Polydactylus octonemus **Atlantic Threadfin**																			C	

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Aplodinotus grunniens **Freshwater Drum**	C	C		C	C	C	C	C		C	C	C	C	C	C	C	C	C	C	C
Bairdiella chrysoura **Silver Perch**														C						
Cynoscion arenarius **Sand Seatrout**														C					C	
Cynoscion nebulosus **Spotted Seatrout**														C					C	
Cynoscion nothus **Silver Seatrout**																			C	
Leiostomus xanthurus **Spot**														C					C	
Micropogonias undulatus **Atlantic Croaker**														C					C	
Pogonias cromis **Black Drum**														C					C	
Sciaenops ocellatus **Red Drum**														C					C	
Stellifer lanceolatus **Star Drum**																			C	
Elassoma zonatum **Banded Pygmy Sunfish**														C				C	C	C
Herichthys cyanoguttatus **Rio Grande Cichlid**	NN			NN	NN	NN	C	C		C	C	C	C	NN	NN	NN	NN	NN		
Oreochromis aureus **Blue Tilapia**	NN			NN	NN	NN	NN	NN		NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	
Oreochromis mossambicus **Mozambique Tilapia**					NN						NN	NN								
Tilapia zillii **Redbelly Tilapia**					NN															
Dormitator maculatus **Fat Sleeper**														C				C	C	
Eleotris amblyopsis **Largescaled Spinycheek Sleeper**														C					C	
Gobiomorus dormitor **Bigmouth Sleeper**														C						
Ctenogobius boleosoma **Darter Goby**														C					C	
Ctenogobius shufeldti **Freshwater Goby**														C					C	
Evorthodus lyricus **Lyre Goby**																			C	
Gobioides broussonetii **Violet Goby**														C					C	
Gobionellus oceanicus **Highfin Goby**														C					C	
Gobiosoma bosc **Naked Goby**														C					C	

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Gobiosoma robustum Code Goby														C					C	
Microgobius gulosus Clown Goby														C					C	
Citharichthys macrops Spotted Whiff																			C	
Citharichthys spilopterus Bay Whiff														C					C	
Paralichthys lethostigma Southern Flounder														F					F	
Achirus lineatus Lined Sole														C					C	
Trinectes maculatus Hogchoker														C					C	
Sphoeroides parvus Least Puffer																			C	

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