



The Conflict between Endangered Species and the State Water Plan: Will New Listings under the Endangered Species Act Thwart the State Water Planning Process?

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April 2014

ENERGY CENTER

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Research Paper No. 2014-01
April 2014

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Abstract

The U.S. Fish and Wildlife Service (the "Service") -- the primary federal agency charged with implementing the Endangered Species Act[1] -- is required by a court order to decide the regulatory fate of more than 700 species of plants and animals by the end of 2018. As part of a 2011 settlement agreement between the Service and environmental groups, the agency must decide whether to list certain species as "endangered" or "threatened," thereby invoking the suite of federal protections that apply to listed species. Approximately twenty of the species on the Service's list (the "work plan") occur in Texas; sixteen of them are aquatic species living in the rivers and springs of Texas.[2]

As a result of voters approving Proposition 6, the state has new resources with which to fund water infrastructure projects to address projected future water demands. This paper examines whether water projects included in the Regional Water Plans and the State Water Plan and certain potential surface and groundwater withdrawals could impact any of the sixteen aquatic species in Texas that may be listed by the Service. The question, in broad terms, is whether the listings of the species could throw a wrench in the State Water Plan.

The bulk of the water projects recommended in the State Water Plan and the Regional Plans focus on surface water, and the majority of the work plan species depend on groundwater for survival. For those projects that involve groundwater, the projects are in locations where species on the work plan are not found. Consequently, the authors conclude that, overall, the listing of aquatic species on the work plan will not impede the State water planning process, as the listings will only impact a small number of water projects recommended in the State Water Plan. The authors found that intersections between the listing of a species and a potential water project are limited to those projects planned in the upper Brazos River, where the possible listing of the sharpnose and smalleye shiners could affect construction of several reservoirs recommended in the State Water Plan, and in the Rio Grande River, where the possible listing of the Texas hornshell could impact construction of a low water weir.

I. Background

In September 2011, the U.S. District Court for the District of Columbia approved a settlement agreement between the Service and environmental groups that had filed suit against the Service for its failure to decide whether to list certain species under the Endangered Species Act ("ESA"). As part of the settlement agreement, the Service developed a work plan, which set deadlines for the Service to decide whether or not to list over 770 specific species and designate critical habitat for them by 2018.

Once the Service lists a species as threatened or endangered, the species is covered by the ESA's protective measures. Most importantly, Section 9 of the ESA prohibits the "take" of listed species by any "person."[3] "Person" is defined broadly to mean "an individual, corporation, partnership, trust, association, or any other private entity; or any officer, employee, agent, department, or instrumentality of the Federal Government, *of any State, municipality, or political subdivision of a State*, or of any foreign government; *any State,* municipality, or political subdivision of a State; or any other entity subject to the jurisdiction of the United States."[4]

"Take" is also defined broadly in the statute. It means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."[5] Joint Service regulations define "harm" as "an act which actually kills or injures wildlife," including "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering."[6] The United States Supreme Court upheld that regulatory definition in *Babbitt v. Sweet Home Chapter of Communities for a Great Oregon*,[7] thereby affirming the Service's position that harm to a species' habitat can constitute "take" under the ESA.

In addition to avoiding the take of listed species, federal agencies must consult with the Service to insure that any action they fund, authorize, or undertake avoids jeopardizing the continued existence of the species.[8] Section 7 of the ESA's consultation requirement is triggered when a federal agency determines that an activity it proposes to carry out, provide funding for, or authorize may affect a listed species. Through the consultation process, the Service produces a "biological opinion," which contains measures designed to minimize the take of the species and avoid jeopardy.

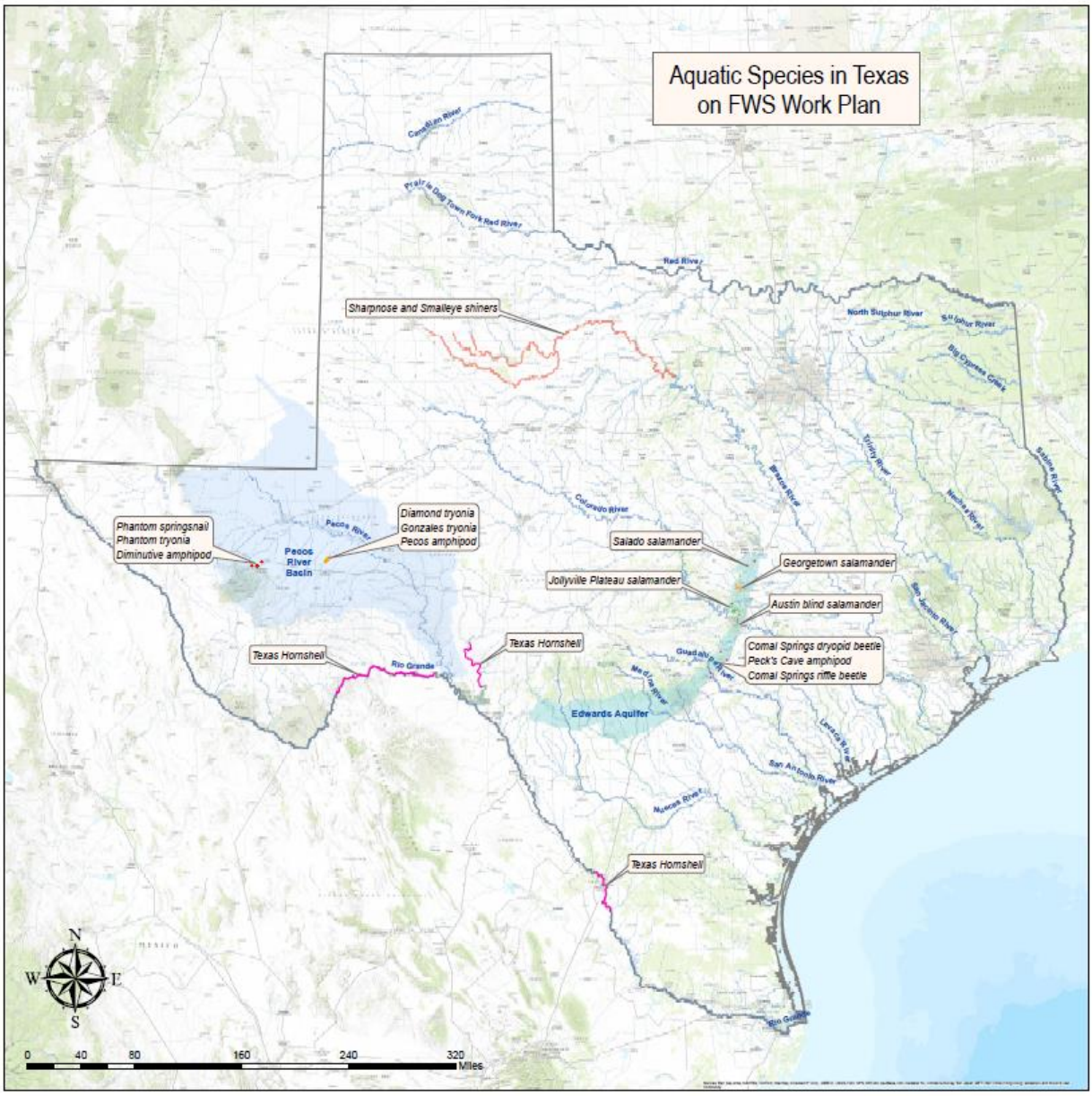
Texas is home to about twenty species that the Service is currently reviewing under the work plan for listing under the ESA. Some stakeholders in Texas claim that there would be substantial negative economic impacts associated with listing more species. According to the Texas Comptroller, for example, "[w]hen the federal government lists a species as threatened or endangered under the ESA, the law can limit and prohibit the use of land and water, decrease

property values, diminish military preparedness, and add regulatory hurdles and costs to otherwise lawful activities."[9]

Sixteen of the species that have listing dates on the Service work plan are aquatic species living in the rivers and springs of Texas.[10] With the passage of Proposition 6 by voters, which allocates $2 billion from Texas' Rainy Day Fund for the Texas Water Development Board to use toward financing water projects, the state has significant new resources with which to push water projects forward to address projected future water demands.

The listing of aquatic species that could be impacted by a proposed project would trigger the ESA's requirement for federal approval, a process that can be cumbersome and lengthy. It is important, therefore, to examine whether water supply projects proposed in the State Water Plan will impact any of the aquatic species the Service either has recently listed or is considering for listing in the near future.

FIGURE 1. AQUATIC SPECIES IN TEXAS ON FWS WORK PLAN



MAP CREDIT: LAURA EVANS, NATHANIEL BYARS, AND ARTHUR REYNA, III.

The exact location of the population of Texas hornshell in the Devil's River is unavailable. The map depicts the location of the Devil's River and is not indicative of the exact locations of the Texas hornshell.

*To see a high-resolution, large-format version of the map in Figure 1, visit http://www.utexas.edu/law/centers/energy/aquatic-species-in-texas-map/.

II. Aquatic Species in Texas

There are sixteen aquatic species in Texas included in the Service's work plan.[11] For some of these species, such as the Georgetown and Salado salamanders, the Service has recently issued final decisions; for others, the Service must make final decisions between now and 2018. Following is a description of the status of the species at issue and the likelihood that a listing as "endangered" or "threatened" would have a regulatory impact on projects in the State Water Plan. We analyze the impact of listings on the groups of species included in the work plan, beginning with the species for which listings will have no effect on proposed water projects (the salamanders and invertebrate species) and then describing the potential impact of listing two fish species (the sharpnose and smalleye shiners) and six rare mussels.

Central Texas Salamanders

Four species of salamanders are included in the Service work plan. They are all found in Central Texas. *See* Figure 1 and Table 1. In accordance with the timeline set out in the work plan, in August of 2013, the Service issued a final determination listing the Austin blind salamander, which lives in Barton Springs, as "endangered," and listing the Jollyville Plateau salamander, which is found in the Northern Segment of the Edwards Aquifer, as "threatened."[12] For the remaining two salamander species -- the Georgetown salamander and the Salado Salamander, both of which are found in the Northern Segment of the Edwards Aquifer -- the Service published a six-month extension to reach a final determination, citing disagreement in the public comments regarding the sufficiency and accuracy of the data relevant to the Service's determination.[13] After the conclusion of a fourth comment period, on February 24, 2014, the Service issued a final determination listing the Georgetown salamander and the Salado salamander as "threatened" under the ESA.[14]

According to the Service, the primary threat to the salamander species is "habitat modification in the form of degraded water quantity and quality."[15] The problem is urbanization, which "is one of the most significant sources of water quality degradation that can affect the future survival of Central Texas salamanders."[16] Urbanization also impacts the amount of water available in springs and spring-fed surface water bodies, as growing populations in central Texas pump more and more groundwater and spring flows are reduced. The Northern Segment of the Edwards Aquifer is the primary supply of water for the Jollyville Plateau, Georgetown, and Salado Salamander habitat, and the human population in that region is rapidly increasing. The Service states, "[u]rbanization and rapid population growth in the Northern Segment of the Edwards Aquifer may contribute to reduced spring flows due to increases in groundwater pumping.[17] From 1980 to 2000, groundwater pumping in the Northern Segment of the Edwards Aquifer

nearly doubled.[18] Total water use for Williamson County was 73,532 acre feet in 2010 and is projected to increase to 98,268 acre feet by 2020.[19]

There are no proposed groundwater or surface water conveyance projects in the State Water Plan that would appear likely to impact salamander habitat directly, but increased groundwater pumping from private wells across the region will impact salamander habitat by reducing spring flows. According to the Brazos G Regional Planning Group, "the Trinity and Edwards-BFZ (Northern Segment) are heavily relied upon in the IH-35 corridor and to the west. Both of these aquifers are being pumped in excess of their estimated sustainable yield in some counties."[20] Although the Texas Water Development Board suggests that in the future there will be a shift toward surface water use in the area,[21] the Service predicts that the shift away from groundwater reliance may not necessarily improve habitat conditions and spring flow for the salamanders. The Service indicates that increased impervious cover, associated with growth, will reduce groundwater recharge, so that any reductions in pumping will not necessarily lead to improved spring flows.[22]

The Service suggests that salamander habitat can be protected through pumping restrictions enforced by groundwater conservation districts. For example, the Barton Springs/Edwards Aquifer Conservation District permits and regulates wells in the Barton Springs segment of the Edwards Aquifer. It has established "desired future conditions" meant to "assure an adequate supply of freshwater for well users and adequate flow for endangered species."[23]

While it may be technically true that groundwater conservation districts can protect habitat through pumping regulations, there are two problems with the Service's suggestion. First, currently, there is no groundwater conservation district in northern Travis County and southern Williamson County.[24] As a result, groundwater pumping is unregulated in those areas. Second, the Texas Fourth Circuit Court of Appeal's decision in *Edwards Aquifer Authority v. Bragg* suggests that groundwater conservation districts may have to compensate landowners for limiting their right to pump.[25] Groundwater conservation districts are concerned about the impact that the ruling may have on their practical ability to impose pumping limits for any reason.

TABLE 1: CENTRAL TEXAS SALAMANDER SPECIES IN TEXAS ON FWS WORK PLAN

Species	Location	Primary Threats	Federal Action	Potential Water Supply Intersection
Austin Blind Salamander	Barton Springs segment of the Edwards Aquifer	Habitat modification in the form of degraded water quality and quantity and disturbance of spring sites	Final Listing Endangered; Final Critical Habitat Designation; August 20, 2013	Unlikely; covered by Barton Springs Habitat Conservation plan and Barton Springs/Edwards Aquifer Conservation district regulations
Georgetown Salamander	Northern segment of Edwards Aquifer; known from springs along five tributaries (South, Middle, and North Forks; Cowan Creek; and Berry Creek) to the San Gabriel River and from two caves in Williamson County	Habitat modification in the form of degraded water quality and quantity and disturbance of spring sites	Final Listing Threatened; February 24, 2014 Proposed Listing Endangered and Proposed Critical Habitat; August 22, 2012	Groundwater pumping
Salado Salamander	Northern segment of Edwards Aquifer; known from spring sites near the village of Salado, Bell County, Texas: Big Boiling Springs (also known as Main, Salado, or Siren Springs), Lil' Bubbly Springs, Lazy Days Fish Farm Springs (also known as Critchfield Springs), Robertson Springs, Solana Spring #1, Cistern and Hog Hollow Springs	Habitat modification in the form of degraded water quality and quantity and disturbance of spring sites	Final Listing Threatened; February 24, 2014 Proposed Listing Endangered and Proposed Critical Habitat; August 22, 2012	Groundwater pumping
Jollyville Plateau Salamander	Northern segment of Edwards Aquifer (Jollyville Plateau and Brushy Creek)	Habitat modification in the form of degraded water quality and quantity ad disturbance of spring sites	Final Listing; Threatened; Final Critical Habitat Designation; August 20, 2013	Groundwater pumping

Comal Springs Species

The work plan required the Service to revise the critical habitat designation for three aquatic invertebrate species found in Comal Springs -- the Comal Springs dryopid beetle, the Comal Springs riffle beetle, and the Peck's cave amphipod -- by FY 2013. The Service published its designations on October 23, 2013.[26] All three of these species live in Comal Springs and nearby springs in Comal and Hays Counties. *See* Figure 1 and Table 2. The Service previously listed the Comal Springs dryopid beetle, Comal Springs riffle beetle, and the Peck's cave amphipod as "endangered" on December 18, 1997 and designated critical habitat for the three species on July 17, 2007.[27] Pursuant to the work plan, the Service was required to revise its prior critical habitat designations.[28] Last October, the Service designated subsurface critical habitat for the dryopid beetle and the Peck's cave amphipod and added approximately 24 acres of surface critical habitat for the riffle beetle. According to the Service, the main threats to the three species are a reduction of available water and impaired water quality due primarily to withdrawals from the San Antonio segment of the Edwards Aquifer.[29]

It is unlikely that water management strategies recommended in the State Water Plan will be impacted by the Service's revision of critical habitat for the three Comal Springs species. According to the Texas Water Development Board, because the region has "limited local water resources, the region will rely on water supplies from outside the region to meet its future needs."[30] Additionally, the Region L Water Planning Group states, "[d]evelopment of new water supply sources for Bexar, Comal, and Hays Counties" will reduce "reliance on the Edwards Aquifer during drought thereby contributing to maintenance of spring flow and protection of endangered species."[31]

Perhaps most important, the Service recently approved a habitat conservation plan formulated by stakeholders in the Edwards Aquifer Recovery Implementation Program ("EARIP"), which includes the Edwards Aquifer Authority and the San Antonio Water System.[32] The Service issued an "incidental take permit" that authorizes harm to the Comal Springs dryopid beetle, Comal Springs riffle beetle, and the Peck's cave amphipod if the harm is caused by otherwise lawful activities, including groundwater pumping. With the Service's approval of the permit and habitat conservation plan, there is no apparent risk of additional restrictions on the Edwards Aquifer Authority or San Antonio Water System as a result of the species' listings and critical habitat designations.

TABLE 2: COMAL SPRINGS SPECIES IN TEXAS ON FWS WORK PLAN

Species	Location	Primary Threats	Federal Action	Potential Water Supply Intersection
Comal Springs Dryopid Beetle	Comal Springs and Fern Bank Springs	Reduction or loss of water of adequate quantity and quality due primarily to human withdrawal of water in the San Antonio segment of the Edwards Aquifer	Revised Critical Habitat; October 23, 2013; Critical Habitat changed from 39.5 to 39.4 ac of surface habitat and 139 ac of subsurface habitat added	Unlikely; no groundwater projects planned in Edwards Aquifer and species included in the EAHCP
Comal Springs Riffle Beetle	Comal Springs and San Marcos Springs	Reduction or loss of water of adequate quantity and quality due primarily to human withdrawal of water in the San Antonio segment of the Edwards Aquifer	Revised Critical Habitat; October 23, 2013; 30.3 ac changed to 54 ac of Critical Habitat	Unlikely; no groundwater projects planned in Edwards Aquifer and species included in the EAHCP
Peck's Cave Amphipod	Comal Springs and Hueco Springs	Reduction or loss of water of adequate quantity and quality due primarily to human withdrawal of water in the San Antonio segment of the Edwards Aquifer	Revised Critical Habitat; October 23, 2013; changed from 38.5 ac of surface habitat to 38.4 ac of surface; 138 ac of subsurface habitat added	Unlikely; no groundwater projects planned in Edwards Aquifer and species included in the EAHCP

West Texas Invertebrates

Six of the aquatic species listed on the Service work plan are found in spring systems in the Pecos River drainage basin in West Texas. The Pecos Amphipod (a freshwater crustacean), the Gonzales Springsnail, and Diamond Tryonia snail live in the Diamond Y Spring System. The Amphipod Diminutive (a freshwater crustacean), the Phantom Springsnail, and Phantom Tryonia snail are located in the San Solomon Spring System. *See* Figure 1 and Table 3. On July 9, 2013, the Service issued a final ruling listing these species as "endangered" under the ESA and designating critical habitat for the species.[33] The Service states that the primary threats to these species are spring flow decline, water quality contamination, and modification of spring channels.[34]

This paper focuses on the first threat -- spring flow decline -- as it is directly related to groundwater pumping and water supply projects. Although the modification of spring channels for agricultural and human use in the past continues to contribute to the species' vulnerability, particularly in the San Solomon Spring System, the Service does not anticipate any future modifications to spring channels, as the property upon which the spring sites are located is now owned by The Nature Conservancy. In addition, the primary threat of contamination in the San

Solomon Spring system is related to herbicide and pesticide use in nearby agricultural areas.[35] In the Diamond Y Spring system, the Service states that contamination stems from "activities related to oil and gas exploration, extraction, transportation, and processing."[36] This assertion has been a source of concern for the oil and gas industry, which voiced disagreement with the Service's position throughout the rulemaking process.[37]

The Service notes that groundwater pumping contributes to a reduction in spring flow for these two spring systems. According to the Service, the reduction in spring flow is likely related to a combination of groundwater pumping for agricultural irrigation and a lack of natural recharge to the underlying aquifer.[38] The Service explains that groundwater pumping has had a "measurable effect on groundwater levels in the areas that likely support the spring flows" in the San Solomon Spring system and that "historic pumping from the Rustler aquifer in Pecos County" (which is thought to be the partial water source for the Diamond Y Spring system along with the Edwards-Trinity Aquifer) may have contributed to a reduction of spring flows in the past but has not been "substantial enough to cause the main springs to cease flowing."[39] Continued groundwater pumping from the aquifers supporting the San Solomon Spring system and the Diamond Y Spring system to support irrigated agriculture in the future, as described in Region F's Water Plan and by Groundwater Management Areas 4, 3, and 7 may impact spring flow in the region.[40]

In the listing decision, the Service points out that local ground water conservation districts can offer "some protection to the spring flows for these species,"[41] but the Service is critical of the districts' efforts to date. Four groundwater conservations districts west of San Solomon Springs -- Culberson County Groundwater Conservation District, Jeff Davis County Underground Water Conservation District, Presidio County Underground Water Conservation District, and the Hudspeth County Underground Water District No.1 -- have jurisdiction over groundwater pumping and could impose restrictions to protect spring flows.[42] For the Diamond Y Spring system, one groundwater conservation district -- the Middle Pecos Groundwater Conservation District -- could manage groundwater pumping to protect flows in the Diamond Y Spring system. The Service finds fault, however, with the Middle Pecos Groundwater Conservation District's management plan because it "does not provide specific objectives to maintain spring flow at the Diamond Y Spring."[43] The Service disagrees with language in the management plans for Culberson County Groundwater Conservation District, Jeff Davis County Underground Water Conservation District, and Presidio County Underground Water Conservation District claiming that within the districts' boundaries there are "no documented occurrences of endangered or threatened species dependent upon groundwater resources."[44] In the Service's opinion, among these groundwater conservation districts there is a "lack of acknowledgement of the relationship between the groundwater resources under the Districts' management to the

conservation of the spring flow habitat" at both the San Solomon Spring system and the Diamond Y Spring system.[45]

The Texas Comptroller disagrees with the Service's finding that the groundwater conservation districts' regulations do not provide adequate protection for the species. In its public comments on the Service's proposal to designate critical habitat for the species, the Comptroller wrote, "[The Service] indicates that groundwater management in the region is not adequate because there are no direct references to protecting the species or springs. Benefits may be provided to these species even though they are not specifically mentioned in the management plans."[46]

The listing of the West Texas invertebrates may lead to restrictions on groundwater pumping in the region, but there is currently no potential linkage between the species and a project in the State Water Plan.

TABLE 3: WEST TEXAS INVERTEBRATES SPECIES IN TEXAS ON FWS WORK PLAN

Species	Location	Primary Threats	Federal Action	Potential Water Supply Intersection
Pecos Amphipod (freshwater crustacean)	Diamond Y Spring System of Pecos River Basin	Spring flow decline, water quality changes and contamination, and modification of spring channels	Final Listing Endangered; Final Critical Habitat Designation; July 9, 2013	Groundwater pumping
Amphipod Diminutive (freshwater crustacean)	San Solomon Spring System of Pecos River Basin	Spring flow decline, water quality changes and contamination, and modification of spring channels	Final Listing Endangered; Final Critical Habitat Designation; July 9, 2013	Groundwater pumping
Diamond Tryonia (snail)	Diamond Y Springs, in small lateral spring seeps of upper watercourse, disconnected from the main spring flow channel; lower watercourse in the outflow of Euphrasia Spring	Spring flow decline, water quality changes and contamination, and modification of spring channels	Final Listing Endangered; Final Critical Habitat Designation; July 9, 2013	Groundwater pumping
Phantom Springsnail and Phantom Tryonia (snails)	Four remaining spring outflow channels associated with the San Solomon Spring System (San Solomon, Phantom, Griffin, and East Sandia Springs)	Spring flow decline, water quality changes and contamination, and modification of spring channels	Final Listing Endangered; Final Critical Habitat Designation; July 9, 2013	Groundwater pumping
Gonzales Springsnail (snail)	Outflow from Euphrasia Spring, upper Diamond Y Spring	Spring flow decline, water quality changes and contamination, and modification of spring channels	Final Listing Endangered; Final Critical Habitat Designation; July 9, 2013	Groundwater pumping

Sharpnose Shiner and Smalleye Shiner

The sharpnose shiner and smalleye shiner (shiners) are two fish species that are found in the upper portions of the Brazos River above Possum Kingdom Reservoir.[47] *See* Figure 2 and Table 4. Prior to their decline, the small minnows inhabited the entire Brazos River and parts of the Colorado River.[48] According to the Service, the primary threats to the shiners' survival are river fragmentation and alterations of the natural stream flow caused by impoundments, groundwater withdrawal, drought, and salt cedar encroachment.[49] On August 6, 2013, the Service issued a proposal to list the shiners as "endangered." Under the work plan, the Service must make a final decision on the listing in fiscal year 2014.[50] Unlike the species discussed previously, the listing of the shiner species could impact proposed new surface water projects. In addition, there appears to be a connection between groundwater pumping and surface water flows in the upper Brazos, suggesting that proposed new desalination projects designed to make brackish groundwater usable could also impact shiner habitat.

IMPOUNDMENTS

In the Species Status Assessment Report for the smalleye and sharpnose shiners, the Service discusses in detail the impact dams and impoundments have on fish populations and reproduction.[51] According to the Service, "the impact of impoundment likely extends for hundreds of kilometers both upstream and downstream of impoundments," and the "[n]egative impacts to these species may be immediate or occur over long periods of time depending on the scale and location of impoundment."[52] The Service explains that "dams and other impoundments create physical barriers to the movement of fish," isolating their populations and limiting the stream lengths needed for successful reproduction.[53] Dams and impoundments are especially concerning for the shiners' survival because the small size and limited swimming ability of the fish make it extremely difficult for them to pass upstream and downstream of impoundments.

The Service cites a study analyzing the impact that the construction of Lake Allen Henry had on a population of smalleye shiners in the South Double Mountain Fork of the upper Brazos. Prior to construction of Lake Allen Henry, the smalleye shiner population comprised 26.5 percent of the fish collected at South Double Mountain Fork. According to the study, "following impoundment of Lake Alan Henry, shiners isolated upstream of the lake had insufficient stream reach length to support reproduction and could not move downstream to avoid drought conditions." Consequently, the smalleye shiner population is now extirpated upstream of Lake Allen Henry.[54] In another example cited by the Service, "[f]ollowing impoundment of the middle Brazos River by several dams, eight fish species of the lower Brazos River were identified as having decreasing population trends, including the sharpnose and smalleye shiners … ."[55]

In addition to physically obstructing the movement of fish, among other things, dams and impoundments negatively impact shiner reproduction by reducing the magnitude and frequency of high flows in the Brazos River, and, when lake-bottom water is released from a reservoir, lowering water temperatures immediately downstream of a dam.[56]

According to the Service, "[t]he Army Corps of Engineers recognizes at least 135 dams in the Brazos River basin," and the Service reports twenty-six dams, impoundments, or fish barriers currently in the upper Brazos.[57] The 2012 State Water Plan recommends several new reservoirs in the Brazos River basin as strategies to increase water supply. According to the Service, "[t]hese new reservoirs would have possible impacts to sharpnose and smalleye shiners."[58] The Service noted, "[e]ight of the twenty reservoir construction or modification projects that the Brazos River regional water groups identified were included as recommended new major reservoirs in Texas' 2012 State Water Plan. Of these eight reservoirs, two would be impoundments on rivers known to currently be inhabited by both species in the upper Brazos River: Jim Bertram Lake 7 and Post Reservoir."[59] *See* Figure 2.

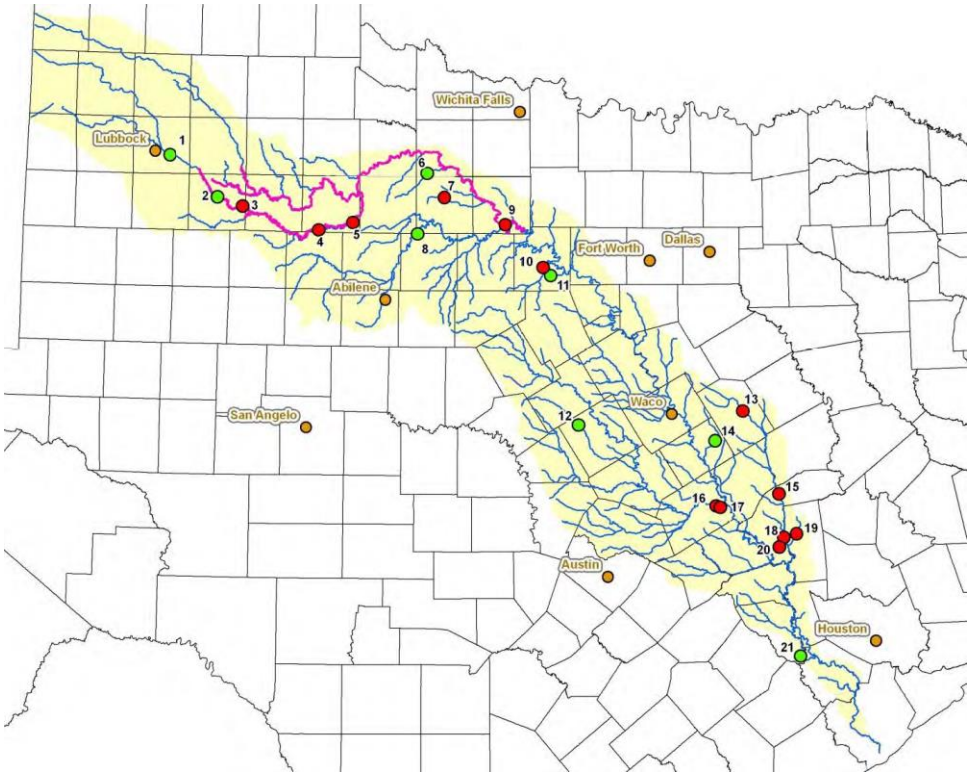


FIGURE 2, FROM THE SERVICE'S SPECIES STATUS ASSESSMENT REPORT FOR THE SHARPNOSE AND SMALLEYE SHINER, PAGE 46.

Reservoir projects within the Brazos River basin as determined by Water Planning Regions G, H, and O. Red and green circles represent projects determined to be feasible at the region level; however, only green circles are included in the 2012 Texas State Water Plan. The Brazos River basin (yellow shading) and its rivers and large streams (blue lines) are also shown. Currently occupied sharpnose and smalleye shiner habitat is shown with a pink line. Reservoir projects are labeled as follows: 1) Jim Bertram Lake 7, 2) Post Reservoir, 3) Lubbock North Fork Diversion, 4) Double Mountain Fork Reservoir (West), 5) Double Mountain Fork Reservoir (East), 6) Millers Creek Reservoir Augmentation, 7) Throckmorton Reservoir, 8) Cedar Ridge Reservoir, 9) South Bend Reservoir, 10) Lake Palo Pinto Off-channel Reservoir, 11) Turkey Peak Reservoir, 12) Coryell County Off-channel Reservoir, 13) City of Groesbeck Off-channel Reservoir, 14) Brushy Creek Reservoir, 15) Millican-Bundic Reservoir, 16) Little River Reservoir, 17) Little River Off-channel Reservoir, 18) Millican Reservoir Panther Creek Site, 19) Gibbons Creek Reservoir, 20) Peach Creek Off-channel Reservoir, and 21) Allens Creek Reservoir.

Under Region O Water Planning Group's proposal, Jim Betram Lake 7 Reservoir will be constructed on the North Fork Double Mountain Fork of the Brazos River upstream of Buffalo Springs Lake in Lubbock County. While the smalleye and sharpnose shiners do not inhabit this specific area, the Service maintains that the construction of additional impoundments would impact fish habitat downstream. Construction of the Post Reservoir, which would be located on the North Fork Double Mountain Fork in Garza County, moreover, would have "substantial" impacts to the shiners, both upstream and downstream of the impoundment, as the fish inhabit the reach of stream where the Post Reservoir would be constructed.[60]

According to the Service, the stretch of river south of Lubbock's Lake Bertram System and north of the proposed Post Reservoir would be too short to support shiner populations in the future. While the downstream section of the proposed Post Reservoir would be long enough to support populations of shiners, the Service is uncertain how the proposed impoundment would impact flow regime, water quality, and channel morphology, among other factors. The Service states, "[a]t the very least, it is likely that a considerable stretch of the river would become less suitable immediately downstream of the impoundment."[61]

Although the remaining six reservoirs recommended in the State Water Plan all occur on rivers and tributaries that are not occupied by shiners, each of these may negatively impact the shiners by reducing water availability for fish use downstream of the impoundments.[62] Additionally, the Service states that the Millers Creek Reservoir Augmentation would capture flow that would otherwise discharge into the *occupied* segment of the upper Brazos River main stem.[63] According to Region G, however, "[a]lthough there would be impacts in the immediate vicinity of the project site and downstream, it appears that this project, alone, would have minimal influence on total discharge in the Brazos River … ."[64]

As part of the environmental evaluation for proposed projects in the Brazos River basin, both Region G and Region O identified the existence of sharpnose and smalleye shiners in the vicinity of proposed projects. Region O recognized that the "effects of impoundments," such as the proposed [Post] reservoir," are the most serious threats to the shiner species,[65] and Region G noted that "[v]ariability in flow is important to the instream biological community."[66]

ENVIRONMENTAL FLOWS

While there are potential impacts to the smalleye and sharpnose shiners from proposed impoundments in the upper Brazos River basin, the Service indicates that these impacts can be minimized. One method the Service suggests to minimize the impacts of impoundments is reservoir management of dam releases to provide for adequate environmental flows.[67] The concept of "environmental flows" describes the flows of water necessary to protect the ecological health of rivers. Environmental flow standards establish requirements that govern when a water right holder may remove water from a stream or a river (instream flow requirements), thus protecting that water for instream and bay or estuary environmental needs.

There is a regulatory process underway in Texas designed to protect environmental flows in the state's major river basins. In 2007, Senate Bill 3 amended the Water Code to require regional stakeholder groups (referred to as Basin and Bay Area Stakeholder Committees or BBASCs) to develop consensus-based environmental flow recommendations and strategies to meet the environmental flow requirements of specific rivers and bay systems and to submit the recommendations to the Texas Commission on Environmental Quality ("TCEQ") for adoption.[68] The stakeholder committees relied on information provided by teams of scientists appointed for each river basin (referred to as Basin and Bay Expert Science Teams or BBESTs).[69] The Water Code directs the TCEQ, after considering the stakeholder committees' recommendations, to adopt environmental flow standards "adequate to support a sound ecological environment."[70] The BBASC for the Brazos River Basin submitted its environmental flows recommendation report to the TCEQ in September of 2012. TCEQ adopted environmental flow standards for the Brazos River Basin on March 6, 2014.[71]

The BBEST for the Brazos River Basin used the shiners as indicator species in crafting a recommended environmental flow regime for the Brazos River Basin. According to the BBEST, "[t]he first major evaluation of proposed environmental flows was analysis of species life histories and population recruitment. The life history strategies and flow pulse requirements of fluvial specialists, in particular species of minnows, shiners, and chubs of the family Cyprindae, were of particular concern in this regard."[72]

According to the Service, because sharpnose and smalleye shiners are known to synchronize spawning during elevated stream flow events, "water releases from new and existing reservoirs that provide a minimum mean discharge exceeding 227 cubic feet per second (cfs) in occupied downstream habitat during the shiners' spawning season (April – September) may minimize impacts to both species."[73] The BBEST recommended environmental flow standards that included a number of high flow pulses in the upper Brazos River basin during the shiners' spawning season. The number of high flow pulses included in the plan prepared by the BBASC

and submitted to TCEQ, however, was fewer than the scientists' recommendation. TCEQ adopted the BBASC's recommendations for high flow pulses in the upper Brazos.[74]

The members of the Brazos BBASC disagreed over whether pulse flows in the upper Brazos should be designed to protect water suppliers, as the majority contended, or designed to protect the sharpnose and smalleye shiners -- the position held by the minority. As a result of this disagreement, the BBASC was unable to develop a consensus-based recommendation for pulse flows in the upper Brazos River basin. The minority members of the BBASC wrote a separate report asserting that the level of environmental flow protection recommended by the majority of the BBASC for the upper Brazos River would "severely harm and, quite likely, extirpate the two candidate shiner species found in these river reaches."[75] The minority argued that standards providing for more frequent high pulse flows were necessary in the upper Brazos River to protect the fish.

The goal of the state's efforts to protect environmental flows in the rivers is to protect the ecology of the river systems. According to the minority members of the BBASC, the environmental flow standards submitted to and recently adopted by the TCEQ will not do enough to protect the shiners. If this is true, perhaps the standards will need to be changed. The Texas Legislature included an adaptive management requirement in the development of environmental flow standards.[76] The BBEST noted that, if the Service lists the shiner species as "threatened" or "endangered," the environmental flow regime may require additional review.[77] The Service has warned that "[i]f flow regimes of the upper Brazos River are not carefully managed, particularly if additional reservoirs are created or existing reservoirs are expanded, sharpnose and smalleye shiner reproduction could be negatively impacted, leading to their possible extinction."[78]

GROUNDWATER WITHDRAWAL

Groundwater depletion in the upper Brazos River basin is also a significant threat to shiner populations. The State Water Plan suggests that statewide groundwater supplies will decrease up to 30 percent by 2060, primarily due to depletion of the Ogallala Aquifer. In the upper Brazos region, 90% of the region's water supply comes from the Ogallala Aquifer, and 94% of this water is used for irrigation.[79] Although groundwater and surface water interactions in the upper Brazos are not well understood, there is evidence that groundwater levels impact surface water flows. In the Species Status Assessment Report for the sharpnose and smalleye shiners, the Service cites a 2010 example in which stream gains in the Salt Fork and Double Mountain Fork of the Brazos River were attributed to potential contributions from the underlying Dockum, Blaine, Seymour, Ogallala, or Edward-Trinity Aquifers, suggesting that hydrological connections between groundwater and surface water contribute to shiner habitat.[80] The Service asserts that

"[t]he increased use of water withdrawals from aquifers, coupled with the presence of an unsustainably declining groundwater supply, may have severe, detrimental impacts to surface water availability throughout Texas, including areas supporting sharpnose and smalleye shiners."[81]

Despite waning groundwater supplies, according to the Service, "groundwater withdrawal and groundwater desalination projects, including within the Brazos River basin, are proposed to remove three times more volume of water in 2060 than in 2010."[82] The Llano Estacado Regional Water Planning Group (Region O) is considering the removal of brackish groundwater from underlying aquifers to treat and supply the City of Lubbock.[83] According to Region O, the project would produce an estimated four million gallons per day of groundwater, or approximately 3,360 acre-feet per year of potable water.[84] It is noteworthy that the only environmental issues related to the proposed desalinization project that Region O mentions in its water plan relate to pipeline right of ways and disposal of brine. In fact, the plan states that because "the project is located within an existing well field or city property, there are no known wildlife habitat or cultural resources that would be affected."[85] The Service appears to disagree with this conclusion.

TABLE 4: SHARPNOSE SHINER AND SMALLEYE SHINER SPECIES IN TEXAS ON FWS WORK PLAN

Species	Location	Primary Threats	Federal Action	Potential Water Supply Intersection
Sharpnose and Smalleye Shiners (minnows)	Contiguous Segments of upper Brazos River, above Possum Kingdom Lake	River fragmentation by impoundments and alterations of the natural stream flow regime (by impoundments, drought, groundwater withdrawal, and salt cedar encroachment)	Proposed Listing Endangered; August 6, 2013. Final listing decision to be made in FY 2014	- Jim Betram Lake 7 - Post Reservoir - Millers Creek Reservoir Augmentation -Desalinization in upper Brazos through groundwater pumping

Texas Mussels

The Service has identified six species of freshwater mussels in Texas as candidate species under review for potential listing under the ESA. Of these six, one -- the Texas hornshell, which is found in the Devils River and a segment of the Rio Grande River -- is included in the work plan. *See* Figure 1 and Table 5. Under the work plan, the Service is required to issue a listing decision for the Texas hornshell in FY 2015. The hornshell may be impacted by a proposed low-water diversion dam near Laredo. The other five mussel species, which are found in several Central Texas Rivers and tributaries, would be impacted by reductions in stream flow. Should any of those species be listed in the future, water projects that would impact their habitat would require federal approval.

In its recent annual review of candidate species, the Service reiterates the common threats that these freshwater mussels in Texas face. The primary threat for all the mussels is destruction and modification of their habitat through the construction of impoundments. Impoundments scour riverbeds, decrease water quality, modify stream flows, and prevent host fish migration and the distribution of freshwater mussels.[86] In addition to impoundments, specific threats to the Texas hornshell include diversions for agriculture and flood control, contamination of water by oil and gas activity, alternations in the natural riverine hydrology, and increased sedimentation and flood pulses from prolonged overgrazing and loss of native vegetation.[87]

The Service is particularly concerned about the impact a proposed low-water diversion dam near Laredo may have on the Texas hornshell. The Dos Laredos Low-Water Weir, described in Region M's Regional Water Plan and recommended in the State Water Plan, would create higher water elevations for the Rio Grande River downstream of the impoundment and supply Nuevo Laredo and the City of Laredo's future water treatment plants upstream of the weir. The plan recognizes, however, that construction of the impoundment is controversial, primarily because of the resulting environmental impacts. According to Region M, the environmental issues associated with construction of the weir include "impacts on water quality (i.e., increased salinity) within and downstream of the reservoir; impacts to aquatic and riparian habitat as a result of changes in downstream flow; potential impacts to habitat from reservoir construction and inundation; and increased risk of flooding."[88]

Although not cited by the Service as a current threat to the Texas hornshell, a proposal to pump groundwater from the Edwards-Trinity Aquifer in Val Verde County has raised concerns among local landowners that surface water flows in the Devils River, where the Texas hornshell's habitat is located, could be reduced. The project, which is proposed by the Val Verde Water Company, calls for pumping millions of gallons of groundwater a year to sell to various cities

across Texas. The proposal has created significant controversy among environmentalists, local landowners, and the water supply company.[89]

Despite these potential threats, the Service has determined that the magnitude of the threats to the Texas hornshell is "moderate," as numerous conservation measures in New Mexico (where the species is also located) are in place and are being initiated in Texas on the Big Bend reach of the Rio Grande.

In contrast to the Texas hornshell, the Service predicts a grim future for the Texas fawnsfoot and the Texas pimpleback, two federal candidate mussel species that had historically lived throughout riverbeds in central Texas but are now on the verge of extinction. The Texas pimpleback is found in four streams in the Colorado and Guadalupe-San Antonio River basins.[90] The Texas fawnsfoot, once prevalent in both the Colorado and Brazos Rivers, is now found in only five locations, primarily in the Brazos River.[91] The Service has determined that the threats to these species are of high magnitude. These two species are not listed on the work plan; however, and therefore do not have specific listing deadlines.

The possible listing of these mussel species under the ESA prompted the Texas Comtproller's Office to ask the Bureau of Economic Geology ("BEG") to analyze the potential economic impacts of listing one or more of the species. The BEG notes in its report that, because of the law's prohibition on "take," "the [ESA] would require preservation of their aquatic habitat. Preserving habitat may necessitate the guarantee of environmental flows … in certain streams and rivers, especially in Central Texas, where the highest diversity of mussels is found. Reserving this water for habitat preservation may further constrain the supply of water for human usage."[92]

Although the BEG report describes the importance of environmental flow protections, the BEG concludes that the overall economic impact on the state would be moderate because the flows would have minimal impact on water diversions.[93] The BEG maintains that to mitigate the economic impact that could be caused by environmental flow-induced water availability reductions, and to increase water supplies, Texas should consider a range of water management strategies, many of which are found in the State Water Plan, including desalination, conservation, and other water supply projects.

TABLE 5: CANDIDATE MUSSEL SPECIES IN TEXAS

Species	Location	Primary Threats	Federal Action	Potential Water Supply Intersection
Texas Hornshell	Devils River and Rio Grande (main stem of Rio Grande in the Rio Grande Wild and Scenic River segment downstream of Big Bend National Park and near Laredo)	Habitat alterations such as streambank channelization, impoundments, and diversions for agriculture and flood control; contamination of water by oil and gas activity; alterations in the natural riverine hydrology; increased sedimentation and flood pulses from prolonged overgrazing and loss of native vegetation	FY 2015 Proposed Listing, Proposed Critical Habitat	Laredo Low Water WEIR
Texas Fawnsfoot	Once prevalent in both the Colorado and Brazos Rivers, now found in only five locations, primarily in the Brazos River	Habitat destruction and modification	Not included in work plan	Any project affecting stream flow
Texas Pimpleback	Found in four streams in the Colorado and Guadalupe-San Antonio basins	Habitat destruction and modification	Not included in work plan	Any project affecting stream flow

III. Protection under the Endangered Species Act

As discussed in Section I, once the Service lists a species as "threatened" or "endangered," the species is protected under the ESA. The statutory mandate to avoid harming ("taking") a listed species could impact plans to construct water supply projects located in or near a species' habitat.

Section 7 of the ESA requires that federal agencies consult with the Service prior to authorizing, funding, or carrying out an activity that could affect a listed species. [16 U.S.C. Section 1536(a)(2)] Certain reservoirs recommended in the State Water Plan, including the Post Reservoir and Jim Betram Lake 7 Reservoir, would require a permit from the U.S. Army Corps of Engineers, a federal agency. That permitting process would trigger the ESA's Section 7

consultation process. The outcome of that process would be a "biological opinion" containing conditions for the construction and operation of the water projects designed to minimize the impact to the listed species.

Non-federal entities -- including state agencies -- are subject to the ESA's Section 9 take prohibition but not to the consultation requirement in Section 7. Section 10 of the ESA provides that nonfederal entities may obtain "incidental take" authorization from the Service for take associated with an activity that would be legal, but for the impact on a listed species.[94] To obtain an incidental take permit, the applicant must prepare a "habitat conservation plan" ("HCP") that meets certain statutory requirements, including measures that are designed to minimize and mitigate the impact to the species to the "maximum extent practicable."[95]

State agencies, including groundwater management districts, river authorities, and the TCEQ, may be liable for authorizing activities such as groundwater pumping or surface water diversions that result in a take.[96] The central issue in *Aransas Project v. Shaw*[97] is whether the TCEQ may be held liable under the ESA for harm caused to the endangered whooping crane as a result of water withdrawals permitted by the agency. A similar argument could be made against the agency in association with harm to the shiners or mussel species caused by water withdrawals.

As discussed above, in 2013 the Service issued an incidental take permit to the Edwards Aquifer Authority, San Antonio Water System, City of San Marcos, and Texas State University to authorize take of the Comal Springs species associated with the "*regulation and use of the aquifer.*"[98] Implicit in the HCP is the acknowledgement of the Edwards Aquifer Authority's potential liability under the ESA should it issue permits that authorize pumping at levels that deplete spring flows and result in harm to the listed species in the Edwards Aquifer region.[99]

To resolve the growing conflict between its permitting decisions and potential harm to listed species, the TCEQ could work with the Service to formulate an HCP that would cover its water permitting program, allowing the agency to administer the program in a manner that would optimize the benefits for the state's citizens, while ensuring protection for listed species. In addition, groundwater conservation districts in areas with listed species, such as the West Texas invertebrates, could work with the Service to obtain incidental take permits.

IV. Conclusion

Overall, the listing of aquatic species on the Service's work plan will not impede the State water planning process, as the listings will likely only impact a small number of water projects recommended in the State Water Plan. This is because the bulk of the water projects recommended in the State Water Plan focus on surface water, and the majority of the work plan species depend on groundwater. According to the State Water Plan, "[s]urface water strategies, excluding desalination and non-traditional strategies, compose about 51 percent of the recommended volume of new water, compared to 9 percent from groundwater strategies in the 2012 State Water Plan."[100] Additionally, for the majority of groundwater projects recommended in the State Water Plan, the projects, with the exception of the proposed plan to pump brackish groundwater in the upper Brazos, are in locations where no species in the work plan are found. For several of the groundwater-dependent species, such as the salamanders and the Comal Springs species, protections -- in the form of habitat conservation plans -- are either already in place or are being developed.

The State of Texas will continue to rely on groundwater to support some of its population growth and most of its agricultural irrigation needs. It is not yet clear whether continued groundwater pumping in West Texas and in the newly listed salamander habitat will jeopardize listed species or influence local groundwater conservation district restrictions on pumping. Except for the Dos Laredos Low-Water Weir, described in Region M's Regional Water Plan, there are no proposed surface water projects in West Texas that would affect a species on the Service's work plan. The weir may affect the Texas hornshell.

The most likely clash between proposed water supply projects and the ESA would occur from plans to construct new reservoirs on the upper Brazos in habitat occupied by the sharpnose and smalleye shiners. While it appears obvious that the proposed new projects would impact shiner habitat in some way, it is not possible to predict the extent to which the listing of the species would impact the projects' design or operational requirements. In any event, the ESA includes a process whereby the project proponent could receive authorization for take of the shiner from the Service.

— *Endnotes* —

[1] The U.S. Fish and Wildlife Service has jurisdiction over terrestrial and freshwater species that are listed as "threatened" or "endangered." The National Oceanic and Atmospheric Administration -- Fisheries has jurisdiction over listed marine species.

[2] *See* http://www.fws.gov/endangered/improving_esa/listing_workplan_FY13-18.html (viewed on March 6, 2014).

[3] 16 U.S.C. § 1538.

[4] 16 U.S.C. § 1532(13) (emphasis added).

[5] 16 U.S.C. §1532(19).

[6] 50 C.F.R. § 17.3 (2012).

[7] 515 U.S. 687 (1995).

[8] 16 U.S.C. § 1536(b)(3)(A).

[9] Texas Comptroller of Public Accounts, Endangered Species Act and the Economy, Update 2013 at 1 (2013) *available at* http://texasahead.org/texasfirst/species/pdf/Texas_response_EPA.pdf (viewed on November 10, 2013).

[10] *See* http://www.fws.gov/endangered/improving_esa/listing_workplan_FY13-18.html (viewed on March 6, 2014).

[11] In October 2013, the Service proposed to list the Western Yellow-billed Cuckoo, a riparian bird found in the Western United States and west of the Pecos River drainage basin in Texas, as "threatened" under the ESA. *See* 78 Fed. Reg. 61,622 (October 13, 2013). Under the work plan, the Service must make a final listing determination in fiscal year 2014. The bird relies on woodland riparian habitat for nesting, and in Texas, it is often found in areas with springs or earthen ponds. The Service maintains that the decline of the Western Yellow-billed Cuckoo is a result of loss and degradation of riparian habitat. As there are no surface water projects in West Texas recommended in the State Water Plan, the authors chose not to discuss the Western Yellow-billed Cuckoo in detail. However, continued groundwater pumping and drought could reduce spring levels and stream flow, negatively impacting riparian vegetation in habitat supporting the Western Yellow-billed Cuckoo populations in West Texas.

[12] 78 Fed. Reg. 51,278 (August 20, 2013). Pursuant to Section 4 of the ESA, the Service may find that a species is "endangered" or "threatened" based on five factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) the inadequacy of existing regulatory mechanisms; or (5) other natural or manmade factors affecting its continued existence. 16 U.S.C. § 1533(a). An "endangered" species is a species which is in danger of extinction throughout all or a significant portion of its range. *Id.,* §1532(6) and a "threatened" species is a species "which is likely to become an endangered species within the foreseeable future." *Id.* at §1531(20). The ESA gives the Service more flexibility with respect to regulating threatened species than it does for endangered species.

[13] 78 Fed. Reg. 51,279 (proposed rule; reopening of comment period August 20, 2013) and 79 Fed. Reg. 800 (proposed rule; notice of availability and reopening of comment period January 7, 2014).

[14] 79 Fed. Reg. 10,236 (final rule February 24, 2014).

[15] *Id.* at 51,297.

[16] *Id.*

[17] 77 Fed. Reg. 50,785 (proposed August 22, 2012).

— Endnotes Continued —

[18] *Id.*

[19] *Id.*

[20] Region G Water Plan, page ES.10 (2011), *available at* http://www.twdb.texas.gov/waterplanning/rwp/plans/2011/index.asp#region-g (viewed on November 18, 2013).

[21] 77 Fed. Reg. 50,785 (proposed August 22, 2012).

[22] *Id.*

[23] *See* Desired Future Conditions for the Barton Springs Segment of the Edwards Aquifer, *available at:* http://www.bseacd.org/uploads/Financials/DFCs_for_District_Aquifers_Adopted.pdf (viewed on December 8, 2013).

[24] *Id.* at 50,793.

[25] *Edwards Aquifer Authority v. Bragg*, 2013 WL 4535935 (Tex. App.--San Antonio Aug. 28, 2013). In *Edwards Aquifer Authority v. Bragg*, the Braggs (owners of two pecan orchids), brought a takings claim against the Edwards Aquifer Authority (EAA), arguing that the EAA's denial of the full amount of groundwater they sought in their permit application constituted a regulatory taking. The Fourth Court of Appeals held that the reduction in the Bragg's permitted groundwater use constituted a compensable taking. *See* also http://www.utexas.edu/law/centers/energy/blog/2013/09/managing-texas-ground-water-more-difficult-than-ever/ *and* http://www.texasobserver.org/texas-court-upholds-takings-claim-landmark-water-case/ (viewed on November 11, 2013).

[26] 78 Fed. Reg. 63,100 (October 23, 2013).

[27] *See* 62 Fed. Reg. 66,295 (December 18, 1997) and 72 Fed. Reg. 39,248 (July 17, 2007).

[28] 77 Fed. Reg. 64,273 (proposed October 19, 2012).

[29] 62 Fed. Reg. 66,299 (December 18, 1997).

[30] *See* Texas Water Development Board, http://www.twdb.texas.gov/waterplanning/rwp/regions/l/ (viewed on January 3, 2014).

[31] Region L Water Plan, page ES 19 (September 2010).

[32] *See* http://www.eahcp.org/index.php (viewed on December 2, 2013).

[33] 78 Fed. Reg. 41,228 (July 9, 2013).

[34] *Id.* at 41,239-41243, 41,248-41,251.

[35] *Id.* at 41,242.

[36] *Id.* at 41,250.

[37] *See* Texas Oil and Gas Association, Supplemental Comments to Proposed Rule for Listing as Endangered and Designation of Critical Habitat for Six West Texas Aquatic Invertebrate Species, 77 Fed. Reg. 49602 (proposed August 16, 2012) (March 22, 2013).

[38] 78 Fed. Reg. 41240, 41248 (July 9, 2013).

— Endnotes Continued —

[39] *Id.* at 41,241, 41,249.

[40] *Id.* at 41,241-41,242, 41,249.

[41] *Id.* at 41,245, 41,252.

[42] *Id.* at 41,245.

[43] *Id.* at 41,253.

[44] *Id.* at 41,245.

[45] *Id.* at 41,249.

[46] Texas Comptroller of Public Accounts, Comments to FWS Proposed Rule for Listing as Endangered and Designation of Critical Habitat for Six West Texas Aquatic Invertebrate Species, 77 Fed. Reg. 49,602 (August 16, 2012) at 2 (March 21, 2013) *available at* http://texasahead.org/texasfirst/species/pdf/Combs_aquatic_comments_3_21_%202013.pdf (viewed on November 18, 2013).

[47] 78 Fed. Reg. 47,582 at 47,585 (proposed August 6, 2013).

[48] *Id.* at 47,585.

[49] *Id.*

[50] *See* http://www.fws.gov/endangered/improving_ESA/FY13-18_ESA_Listing_workplan.pdf (viewed on March 6, 2014).

[51] Draft Species Status Assessment Report for the Sharpnose Shiner and Smalleye Shiner 37 (U.S. Fish and Wildlife Service June 28, 2013) *available at* http://www.regulations.gov/#!documentDetail;D=FWS-R2-ES-2013-0083-0002 (viewed on April 4, 2014) [hereinafter SSA].

[52] SSA at 44.

[53] *Id.* at 38.

[54] *Id.* at 39 *citing* Wilde GR and Ostrand KG, Changes in the fish assemblage of an intermittent prairie stream upstream from a Texas impoundment, Texas Journal of Science 51(3) 203, 208 (1999).

[55] *Id.* at 43 *citing* Bonner TH and Runyan DT. *Fish assemblage changes in three western Gulf slope drainages* 11 (2007).

[56] *Id.* at 40.

[57] *Id.* at 37 and 38.

[58] *Id.* at 44.

[59] *Id.* at 47.

[60] *Id.*

[61] *Id.*

[62] *Id.*

— Endnotes Continued —

[63] *Id.* at 48

[64] Region G 2011 Regional Water Plan, page 4B. 7-34, *available at* http://www.twdb.texas.gov/waterplanning/rwp/plans/2011/index.asp#region-g (viewed on November 11, 2013).

[65] Llano Estacado Region-Region 0 2011 Regional Water Plan, page 4-225, *available at* http://www.twdb.texas.gov/waterplanning/rwp/plans/2011/O/Region_O_2011_RWP.pdf (viewed on December 2, 2013).

[66] Region G 2011 Regional Water Plan, page 48. 7-34.

[67] SSA at 94.

[68] Tex. Water Code § 11.02362(o). Stakeholder committees are appointed by the Environmental Flows Advisory Group (EFAG), a nine-member committee created under Tex. Water Code §11.0236. *See* Tex. Water Code §11.02362 (d) & (f). The EFAG also appoints members of the Science Advisory Committee (SAC). Members of the SAC provide recommendations and advice to the EFAG regarding environmental flow methodologies and other science based issues. *See* Tex. Water Code §11.02361 (a) & (e).

[69] Under Tex. Water Code § 11.02362(c)(2)-(3), the Stakeholder Committees for each river basin must appoint an expert science team that must submit a set of environmental flow recommendations to the Stakeholder Committee.

[70] Tex. Water Code §11.1471(a)(1).

[71] 30 Tex. Admin. Code Ch. 298, Subchapter G.

[72] Brazos BBEST Environmental Flow Regime Recommendation Report, page 4-11 (March 1, 2012) [hereinafter Brazos BBEST Report], *available at* http://www.tceq.texas.gov/permitting/water_rights/eflows/brazos-river-and-associated-bay-and-estuary-system-stakeholder-committee-and-expert-science-team (viewed on December 15, 2013).

[73] SSA at 94.

[74] *See* 30 Tex. Admin. Code § 298.480 and Brazos BBASC Recommendations Report 56-58 (2012) [hereinafter Brazos BBASC Report], *available at* http://www.tceq.texas.gov/permitting/water_rights/eflows/brazos-river-and-associated-bay-and-estuary-system-stakeholder-committee-and-expert-science-team. (viewed on December 15, 2013).

[75] Brazos BBASC Report 87 (2012).

[76] *See* Tex. Water Code § 11.02362(p).

[77] Brazos BBEST Report at 8-13.

[78] SSA at 95.

[79] *Id.* at 49.

[80] *Id.* at 49 *citing* Baldys III S and Schalla FE. 2011. *Base flow (1966-2009) and streamflow grain and loss (2010) of the Brazos River from New Mexico-Texas state line to Waco, Texas,* USGS Scientific Investigations Report 2011-5224 at 34-35.

[81] *Id.* at 50.

[82] *Id.*

[83] Llano Estacado Region-Region 0 2011 Regional Water Plan, page 4-232.

— Endnotes Continued —

[84] *Id.*

[85] *Id.*

[86] Endangered and Threatened Wildlife and Plants; Review of Native Species That are Candidates for Listing as Endangered or Threatened, 78 Fed. Reg. 70,104, 70,128 (November 22, 2013).

[87] 78 Fed. Reg. 70,129 (November 22, 2013).

[88] Region M 2011 Regional Water Plan page 4-75 *available at* http://www.twdb.texas.gov/waterplanning/rwp/plans/2011/M/Region_M_2011_RWP.pdf (viewed on December 4, 2013).

[89] *See* http://www.texastribune.org/2013/11/28/texas-last-pristine-river-could-be-under-threat/?utm_source=texastribune.org&utm_medium=alerts&utm_campaign=News%20Alert:%20Subscriptions (viewed on December 5, 2013).

[90] 78 Fed. Reg. 70,129 (November 22, 2013).

[91] *Id.* at 70,128

[92] Bureau of Economic Geology, Potential Economic Impacts of Environmental Flows for Central Texas Freshwater Mussels 2 (April 2013)

[93] *Id.* at 39.

[94] 16 U.S.C. § 1539.

[95] 16 U.S.C. §1539(a)(1)(B).

[96] *See, e.g., Strahan v. Coxe,* 127 F.3d 155 (1st Cir. 1997); *Aransas Project v. Shaw,* 2013 U.S. Dist. LEXIS 33258 (S.D. Tex. Mar. 11, 2013).

[97] The district court held that the TCEQ had caused a "take" of whooping cranes in 2007-08 by issuing water permits and not taking measures to protect inflows into the Aransas National Wildlife Refuge during drought conditions.

[98] Recon Environmental, et al., Edwards Aquifer Recovery Implementation Program Habitat Conservation Plan (November 2012), *available at* http://www.eahcp.org/files/uploads/Final%20HCP%20November%202012.pdf (viewed on 9/15/13). (emphasis supplied).

[99] The incidental take permit for the Edwards Aquifer covers take of eleven species that occur in the region and depend on flows from Comal and San Marcos Springs. *Id.*

[100] Texas Water Development Board 2012 State Water Plan, Section 7 at 190 *available at* https://www.twdb.texas.gov/publications/state_water_plan/2012/07.pdf. (viewed on January 4, 2014).