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This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion (BO) on the effects of Transwestern Pipeline Company's (TPC) proposed open cut across the Pecos River for the purpose of installing a natural gas pipeline, on the Pecos bluntnose shiner (*Notropis simus pecosensis*) (shiner) and its designated critical habitat in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq*.). The project is located in Chaves County, New Mexico in the NE 1/4, Section 29, Township 7 South, Range 26 East. The Service received the Army Corps of Engineers' (Corps) request for consultation on October 27, 2006. The Corps determined that the proposed project "may affect, is likely to adversely affect" the shiner but will not destroy or adversely modify critical habitat.

Information required for this consultation was provided through initial correspondence received from TPC on June 26, 2006, supplemental information provided September 8, 2006, in the October 11, 2006 Biological Assessment (BA), or was gathered through meetings on July 14 and October 16, 2006, and the site visit on November 3, 2006. A complete administrative record of this consultation is on file in the Service's New Mexico Ecological Services Field Office (NMESFO).

Consultation History

The Service received a project proposal from TPC on June 26, 2006. On July 14, personnel from TPC met with Service staff to discuss the project in more detail. At that meeting the Service requested that TPC provide a Spill Prevention Control Plan and a BA for the project. The Spill Prevention Control Plan was received on September 8 and the BA was received on October 11, 2006. Formal consultation was initiated on October 27, with the receipt of the Corps request.

BIOLOGICAL OPINION

I. Description of the Proposed Action

The purpose of the proposed action is to replace two existing pipelines with a single larger diameter pipe that can be internally examined using in-line inspection tools ("smart pig"), improving the capability for detection of conditions that could lead to leaks. A single 24 inch-diameter natural gas pipeline, approximately 2,400 feet in length, would be installed parallel, but 15 feet south of the existing pipeline. All work would be conducted within an existing 200-foot wide pipeline right-of-way at the project site. An open cut excavation would be used to cross the Pecos River. Trenching activities across the Pecos River would not exceed 150 feet. The width of the disturbed area would be approximately 85 feet.

Work would begin on one side of the river with the placement of water-filled bladders that would extend across about 60 percent of the river channel. A second bladder barrier would extend in a downstream direction. Stream flow would be diverted around half of the in-channel open cut work area in this manner. Several small-diameter sand point wells (perforated pipe driven into the stream substrate) would be placed in the enclosed area and water will be pumped from the sand points to de-water the work area. Water pumped from the work area would be discharged into shallow settling basins located adjacent to the work area on the floodplain and within the pipeline right of way. Silt fences would be placed around the settling basin and spoil stockpile area to prevent movement of sediment into the Pecos River.

Once the in-channel area has been dewatered, a trench would be excavated using a Caterpillar 330DL or similar type of track hoe with a long reach. Equipment would be kept on construction mats to minimize soil disturbance. The pipeline trench would be about six feet deep to allow four feet of soil covering over the top of the pipe. Sediment excavated from the trench would be stockpiled on the adjacent floodplain in an area enclosed by silt fence or hay bales to prevent sediment transport into the Pecos River. Once the trench is excavated, a pre-fabricated, concrete-coated pipe would be placed in the trench. The pipe would be temporarily capped at the end. The trench would be backfilled and the water-bladder barriers removed, beginning at the downstream side of the enclosure. The process would then be repeated on the opposite side of the river to excavate the other half of the trench. Construction equipment would be moved to the other side of the river using existing roads. Once the trench is excavated through the remaining half of the river, the second segment of prefabricated, concrete-coated pipe would be placed in the trench and connected to the previously installed segment to complete the crossing. Soil removed from the trench line will be used to form a crown over the trench centerline to compensate for soil settlement. The abandoned pair of existing 20-inch diameter pipes would be left in place, capped, and filled with nitrogen gas.

Trenching will be done in November or December 2006, after the monsoon season, reducing the probability of an unexpected storm. Flows in the Pecos River are typically low during these months (30-60 cfs). Low flows will make water diversion and control much easier and faster. It is anticipated that construction will take no more than 5 days to complete.

II. Status of the Species/Critical Habitat

A. Species/Critical Habitat Description

Description of the Species
Historically, bluntnose shiner, *Notropis simus* (Cope), was found in main channel habitats of the Rio Grande, Rio Chama, and Pecos River, New Mexico and Texas (Cope and Yarrow 1875, Evermann and Kendall 1894, Koster 1957, Chernoff et al. 1982, Hatch et al. 1985, Bestgen and Platania 1990). Concern for the species began in the 1970s, when it was listed as endangered by the American Fisheries Society (Deacon et al. 1979, Williams et al. 1989), and by the Texas Organization for Endangered Species (Anonymous 1987). Concern proved valid for the Rio Grande subspecies (*Notropis simus simus*) which was last collected in 1964, and determined to be extinct during the 1970s (Chernoff et al. 1982, Williams et al. 1985, Miller et al. 1989, Bestgen and Platania 1990, Sublette et al. 1990, Hubbs et al. 1991). As a result, the Pecos River subspecies (*Notropis simus pecosensis* Gilbert and Chernoff), was given formal protection by the state of New Mexico in 1976 and the state of Texas in 1987. In 1987, the shiner was federally listed as threatened with critical habitat by the Service (1987).

The shiner is a relatively small, moderately deep-bodied minnow, rarely exceeding 3.1 inches (in) (80 mm) total length (TL) (Propst 1999, Hoagstrom 2003a). It has a deep, spindle-shaped silvery body and a fairly large mouth that is overhung by a bluntly rounded snout and a large subterminal mouth. The fish is pallid gray to greenish brown dorsally and whitish ventrally. Adult shiners do not exhibit sexual dimorphism except during the reproductive period, when the female's abdomen becomes noticeably distended and males develop fine tubercles on the head and pectoral fin rays.

The historic range of the shiner in the Pecos River was 392 river mi (631 km) from Santa Rosa, New Mexico to the New Mexico-Texas border (Delaware River confluence). At the time of listing (1987), the shiner was confined to the mainstem Pecos River from the town of Fort Sumner to Major Johnson Springs, New Mexico (roughly 202 river mi, 325 km) (Hatch et al. 1985, Service 1987). In 2003 (Service 2003a), the range of the shiner was from Old Fort Sumner State Park to Brantley Reservoir (194 mi, 318 km), or about 23 percent of the historical range of the species. The current occupied range of the shiner is from the confluence of Taiban Creek with the Pecos River to Brantley Reservoir. Shiners have not been found in the reach above Taiban Creek since 1999, even though there are no apparent barriers limiting shiner access to this area (S. Davenport, Service, electronic message, 2006a). This change in boundary, eliminating approximately 5 mi (8 km) between the Old Fort Sumner State Park and Taiban Creek, reduces the occupied range to 186 mi (298 km).

For purposes of surveys and habitat considerations, the Pecos River from Sumner Dam to Brantley Reservoir was divided into three reaches (Figure 1) (Hoagstrom 2003a,b). The first is the Tailwater reach, which extends from Sumner Dam to the confluence of the Pecos River and Taiban Creek. The second is the Rangelands reach, which extends from Taiban Creek to the

Middle Tract of the Bitter Lake National Wildlife Refuge (BLNWRMT). The third reach is from the BLNWRMT to Brantley Reservoir. These reaches will be used throughout the remainder of this BO to describe the population status of the shiner and its habitat. The "stronghold" for the species occurs in the Rangelands reach (Hoagstrom 2003a). Habitat availability and suitability are the best within this reach of the river, all size classes of shiner are found, and population numbers are relatively stable (Hoagstrom 2003a,b).

Critical Habitat
Shiner critical habitat is divided into 2 separate reaches designated as upper and lower critical habitat (Figure 2) (Service 1987). Upper critical habitat is a 64 mi (103 km) reach extending from 0.6 mi (1 km) upstream from the confluence of Taiban Creek (river mi 668.9) downstream to the Crockett Draw confluence (river mi 610.4). Upper critical habitat is encompassed within the Rangelands reach (shiner stronghold), but approximately 36 mi (58 km) are contiguous with, but downstream of, upper designated critical habitat. This area is referred to as "quality habitat," even though it is not designated as critical habitat. Lower critical habitat is a 37 mi (60 km) reach extending from Hagerman to Artesia (Service 1987). This portion of the critical habitat is located in the Farmlands reach. These two areas were chosen for critical habitat designation because both sections contained permanent flow and had relatively abundant, self-perpetuating populations of shiner.

Primary constituent elements of the critical habitat are clean, permanent water; a main river channel with sandy substrate; and low water velocity (Service 1987). At the time of listing, sporadic water flow in the river was identified as the greatest threat to the shiner and its habitat. Water diversions, ground and river water pumping, and water storage had reduced the amount of water in the channel and altered the hydrograph with which the shiner evolved. Although block releases maintain the current channel morphology (Tetra Tech 2003), since the construction of Sumner Dam, the peak flow that can be released is much less than the historical peak flows (U.S. Geological Survey historical surface flow data). The altered hydrograph encourages the proliferation of non-native vegetation, such as salt cedar, which armors the banks and causes channel narrowing. Channel narrowing increases water velocity, reduces backwater areas, and leads to the removal of fine sediments such as sand. Consequently, in areas dominated by salt cedar, the habitat becomes less suitable or unsuitable for shiners. Lack of permanent flow and an altered hydrograph continue to be the greatest threats to the shiner and its habitat.

B. Life History

Habitat
Typical of other members of the subgenus *Alburnops* (Etnier and Starnes, 1993), the shiner inhabits big rivers (Chernoff et al. 1982, Bestgen and Platania 1990). It has survived only within perennial stretches of the middle Pecos River, New Mexico (Hatch et al. 1985, Service 1987). In conjunction with perennial flow, the shiner is found in wide river channels with a shifting sand-bed and erosive banks (Tashjian 1993, 1994, 1995, 1997; Hoagstrom 2003b). The highly erosive bed and banks allow channel configurations to change in response to flow events (Tashjian 1997, Tetra Tech 2000).

Flood inflows from numerous uncontrolled tributaries contribute to favorable river channel conditions in the Pecos River in the Rangelands reach. Although flood flows from uncontrolled tributaries occur too infrequently to maintain a wide channel, the combination of sediment and floodwater inflows are important for the maintenance of a sand-bed. Throughout the remainder of the historic bluntnose shiner range, closely spaced impoundments that control floods and block sediment transport have virtually eliminated these features (Lawson 1925, Lane 1934, Woodson and Martin 1965, Lagasse 1980, Hufstetler and Johnson 1993, Collier et al. 1996).

Although the shiner is found in the deeply incised lower river stretch that constitutes the Farmlands reach, the population there is dominated by small YOY (Hatch et al. 1985, Brooks et al. 1991, Brooks et al. 1994, Brooks and Allan 1995, Hoagstrom et al. 1995, Hoagstrom 1997, 1999, 2000, 2001, 2003a). Lack of growth, reduced survival, and reduced recruitment in this reach is attributed to poor habitat conditions related to the narrow, incised river channel and silt-armored bed. The predominance of YOY shiner in this reach is explained by periodic downstream displacement of eggs, larvae, and small juveniles (Brooks and Allan 1995, Hoagstrom et al. 1995, 1997, 1999, 2000; Platania and Altenbach 1998, Dudley and Platania 1999).

Kehmeier et al. (2004a) evaluated mesohabitat (discrete habitat types such as riffles, backwaters, runs) use and availability in the Rangelands reach between May 2002 and October 2003. While several of the minnow species they observed were described as habitat generalists, they determined that the shiner was a habitat specialist preferring mid-channel plunge-pool habitats. The research did not differentiate among age/size classes of shiner and it is assumed (based on the velocities and depths recorded) that these habitats were primarily adult habitat. Runs, flat-water areas, and pools with low or no velocity were avoided by the shiner. Based on volumetric calculations of the mesohabitats, the authors concluded that the availability of the preferred plunge habitats was less altered by low flows than other types of mesohabitats (Kehmeier et al. 2004a). The importance of maintaining a mosaic of habitat types for movement between the preferred habitat types was also noted (Kehmeier et al. 2004a).

Velocity and Depth Preference

A habitat preference study was conducted from 1992 to 1999, to determine the effects of dam operations and variable flows on habitat availability. Velocity association varies with shiner size; larger fish are found in higher velocities (Hoagstrom 2003b). Adults most frequently utilized velocities between 0.7 and 0.9 feet/second (ft/s) (21 and 28 centimeters/s [cm/s]). These velocities were typically found in open-water runs, riffles, and shallow pools (Hoagstrom 2002). Large adults (2.1-2.5 in, 55-65 mm) were found in velocities that ranged from 0.15-1.5 ft/s (4.7 to 47 cm/s) with a mean of 1.0 ft/s (30.8 cm/s) (Hoagstrom 2003b). These large adults were primarily found in run habitats (Hoagstrom 2003b). Although Kehmeier et al. (2004a) did not specify the age class of shiner caught, the velocities they recorded in preferred mesohabitats ranged from about 0.6-0.7 ft/s (19-22 cm/s). Juveniles most frequently utilize velocities between 0.2 and 0.5 ft/s (7 and 17 cm/s), which are most commonly associated with shoreline areas (Hoagstrom 2003b). Larvae presumably utilize backwater habitats with negligible velocity, relatively high water temperature, and high water clarity (Platania and Altenbach 1998). Thus, a range of velocities is necessary to support all shiner life stages.

Adult shiners most frequently utilize depths between 9.0 and 10.6 in (23 and 27 cm) (Hoagstrom 2003b). Juvenile shiners utilize a variety of depths from 8.7 to 11 in (22 to 28 cm) (Hoagstrom 2003b). Such depths are generally associated with run, riffle, and shallow pool habitat. Use of a variety of depths may be caused by the need to avoid high velocity areas. However, shallow, low-velocity habitat may be most favorable (Platania and Altenbach 1998). Depths used most often by larvae are unknown. Kehmeier et al. (2004a) recorded average depths of approximately 9.8 in (25 cm) in mesohabitats preferred by shiner, which agrees with the preferred depths recorded for adults and juveniles by Hoagstrom (2003b).

Reproduction (Spawning)
The shiner is a member of the pelagic spawning minnow guild found in large plains rivers (Platania 1995a, Platania and Altenbach 1998). These minnows release non-adhesive, semi-buoyant eggs (Platania and Altenbach 1998). Because these minnow inhabit large sand bed rivers where the substrate is constantly moving, semi-buoyant eggs are a unique adaptation to prevent burial (and subsequent suffocation) and abrasion by the sand (Bestgen et al. 1989). Shiners begin spawning as one-year-olds, once they reach 1.6 in (41 mm) standard length (SL) (Hatch 1982). The spawning season extends from late April through September, with the primary period occurring from June to August (Platania 1993, 1995a). Spawning is cued by substantial increases in discharge, including flash floods and block releases of water (Platania 1993, Dudley and Platania 1999).

Food Habits
A short intestine, large terminal mouth, silvery peritoneum, and pointed, hooked pharyngeal teeth indicate that the shiner is carnivorous (Hubbs and Cooper 1936, Bestgen and Platania 1990). Although Platania (1993) found both animal and vegetable matter within shiner intestines, it is possible that vegetation is ingested incidental to prey capture. It is uncertain whether vegetation can be digested in such a short intestine (Hubbs and Cooper 1936, Marshall 1947). Young shiners likely consume zooplankton primarily, while shiners of increasing size rely upon terrestrial and aquatic insects (Platania 1993, Propst 1999). In a cursory analysis of 655 shiner stomachs, Platania (1993) found terrestrial insects (ants and wasps), aquatic invertebrates (mainly fly larvae and pupae), larval fish, and plant seeds (salt cedar). Other studies have also documented *Notropis* species consuming seeds during winter (Minckley 1963, Whitaker 1977) and it could be that shiners are primarily carnivorous, but utilize less favorable forage such as seeds when animal prey is scarce or that they indiscriminately ingest anything that is of the appropriate size.

The shiner diet is indicative of drift foraging (a feeding strategy where individuals wait in a favorable position and capture potential food items as they float by) (Starrett 1950, Griffith 1974, Mendelson 1975). Drift foragers depend upon frequent delivery of food to offset the energy required to maintain a position in the current (Fausch and White 1981). Water velocity must be adequate to deliver drift (Mundie 1969, Chapman and Bjornn 1969) but low velocity refugia where the fish can rest within striking distance of target items is also necessary (Fausch and White 1981, Fausch 1984). Habitat structure that creates adjacent areas of high and low velocity (e.g., bank projections, debris, bedforms) may be important for shiner feeding. Alluvial bed forms may be the most abundant form of habitat structure in sand-bed rivers (Cross 1967) and these bedforms require a certain velocity for formation and maintenance (Simons and Richardson 1962, Task Force on Bed Forms in Alluvial Channels 1966). Thus, shiner rely upon flow both for delivering food items and for maintaining favorable habitat.

Age and Growth

Based on seine collections, shiner population structure is bimodal (two distinct length classes) from May through August (Hoagstrom 2003a). The smaller size class includes YOY and juveniles; the larger size class, adults. In the spring (January through April) the population is unimodal (one size class) as first year individuals complete a growth spurt and third year individuals decline in abundance (Hoagstrom 2003a). Large juveniles and adults dominate the population at this time. Young-of-the-year present in May and June are not collected with the seine because they are small enough to pass through the mesh.

First year and second year individuals are most common in the shiner population, comprising 97 percent of captures. Third year individuals are much less prevalent (Hatch et al. 1985). First year individuals grow rapidly, reaching 1.0 to 1.2 in (26 to 30 mm) standard length (SL) within 60 days (S. Platania, University of New Mexico pers. comm. 2002). Hatch et al. (1985) reported that age-0 (first year) shiners ranged from 0.75 to 1.3 in (19.0 to 32.5 mm) SL, age-1 (second year) individuals ranged from1.28 to 1.77 in (32.6 to 45.0 mm) SL, and that age-2 (third year) individuals ranged from 1.77 to 2.22 in (45.1 to 56.5 mm) SL.

Competition and Predation

Non-native fish species, including the plains minnow (*Hybognathus placitus*) and the Arkansas River shiner (*Notropis girardi*) are now established members of the Pecos River fish community. They are also part of the guild defined as broadcast spawners to which the shiner belongs (Platania 1995a). Members of this guild spawn during high flow events in the Pecos River and have semi-buoyant eggs that are distributed downstream to colonize new areas (Bestgen et al. 1989). As a result of the non-native introductions, interspecific competition may be a factor in the reduction in shiner abundance and distribution. Young fishes of these species that also use low velocity backwater areas may compete directly with young shiner for space and food (if food is limited); however, competitive interactions among Pecos River fishes have not been studied.

Large-bodied piscivorous fishes in the Pecos River are uncommon in currently occupied shiner habitat between the Taiban Creek confluence and Brantley Reservoir (Hoagstrom 2000, Larson and Propst 2000). This is primarily because the majority of available habitat is shallow and unsuitable for large fish. High turbidity likely inhibits sight-oriented predators such as the sunfishes (Centrarchidae). Predators that occupy the most suitable shiner habitat include the native longnose gar (*Lepisosteus osseus*), flathead catfish (*Pylodictis olivaris*), and green sunfish (*Lepomis cyanellus*), and the non-native channel catfish (*Ictalurus punctatus*), white bass (*Morone chrysops*), and spotted bass (*Micropterus punctulatus*) (Larson and Propst 2000).

C. Population Dynamics

Population sampling has been conducted three times or more per year at 10-20 sites on the Pecos River since 1992. The timing of sampling is geared to the life history of the shiner. January-April (first trimester) is an indicator of over-winter survival. May- August (second trimester) occurs within the spawning season. Because the larval fish are too small to be caught by the seines this trimester is a reflection of the breeding population. September-December (third trimester) represents post-spawning and is when YOY are most abundant. In addition, because this time period occurs after intermittency is most likely to happen, it is an indicator of the population's response to this stressor.

In 1999, New Mexico entered a period of sustained drought (Liles 2000a,b). By 2001, there was a reduction in reservoir storage to 60 percent of normal and river intermittency occurred (4 days) for the first time since 1991 (Table 1). Conditions in 2002 were even worse, with April 1 reservoir storage at 26 percent of normal. Intermittency was extensive that year with 49 days of no flow at the Acme gage and 63 days with flow less than 1 cfs (Table 1). Severe drought conditions persisted into 2003, with reservoir storage on April 1, 35 percent of normal, 44 days of 0 flow recorded at Acme gage, and 97 days of less than 1 cfs (Table 1).

From the long-term population surveys, it appears that the prolonged and extensive intermittency that occurred from 2002-2004, in combination with limited spawning opportunities had a negative impact on the shiner population (Figures 3 & 4 Tables 2,3,4) (NMFRO 2006, Fagan 2006). No other physical or biological factors have been identified that would lead to such a pronounced decline in population density. Both the relative abundance and shiner density dropped precipitously in the Rangelands reach, where the habitat is the best and where we would expect the population to be the most resilient.

D. Status of Species and Distribution

The historic trend in shiner abundance indicates a decline since the 1940s (Hatch et al. 1985, Brooks et al. 1991, Propst 1999). For example, Koster (1957) collected 818 shiners on September 3, 1944, at the U.S. Highway 70 Bridge (University of New Mexico Museum of Southwestern Biology records). In comparison, at the same site between 1992 and 1999, the NMFRO collected a total of 815 shiners in 39 trips (Hoagstrom 2000). In pre-1950 collections the shiner achieved its greatest relative abundance, 37.5 percent of the cyprinid guild, compared to collections made from 1950-1975, 1976-1985, and 1985-1994 (Platania 1995b). It has never reached that level subsequently (Platania 1995b, Hoagstrom 2003). The number of shiner per sample in this time frame was 1-1,492, with a mean of 433 per sample (Platania 1995b). The mean number/sample caught in Rangelands reach in 2004 and 2005, was 7.4 and 6.3, respectively with a range of 3-12 (S. Davenport,Service, pers.comm., 2006)

Collections between 1986 and 1990 indicated a further decline in abundance and a reduction in range, although the species still existed within the designated critical habitat reaches (Brooks et al. 1991). Brooks et al. (1991) found that the shiner comprised 3.7 percent of the total number of all shiners collected (5 species) from the Pecos River during 1990, compared to 22.4 percent for all collections prior to 1980 (4 species). The Service had the population monitoring data collected through 2004 peer-reviewed by Dr. Fagan, University of Maryland. He concluded that "Regardless of the spatial or temporal scales involved, the population of the Pecos bluntnose shiner has exhibited a steep, severe decline over the period 2002-2004. Measured in terms of abundance (CPUE), the database suggests the PBS was far scarcer in 2004 than it has been over the last decade, with a population structure far more similar to that of 1992 than of any other year in recent history" (Fagan 2006). Flow was continuous throughout 2005 and 2006, and the third trimester of sampling in 2005 showed the first signs of a rebound by the shiner. The data for 2006 have not yet been processed but results from trimester one of 2006, show that the number of fish per site ranged from 4-32 (mean 14.5 fish/site), indicating that the shiner has continued to respond to improved habitat conditions (continuous flow).

E. Analysis of the Species/Critical Habitat Likely to be Affected

The shiner is the only threatened and endangered species that will be affected by the proposed project.

III. Environmental Baseline

The environmental baseline includes past and present impacts of all federal, state, or private actions in the action area; the anticipated impacts of all proposed federal actions in the action area that have undergone formal or early section 7 consultation; and the impact of state and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

A. Status of the species within the action area

The action area affects only a very small proportion of shiner habitat (85 feet of river out of 101 miles of critical habitat and 186 mi of total occupied river miles). Constituent elements (sandy substrate, slow water velocity) of critical habitat will be temporarily disrupted (5 days or less) but it is anticipated that the river will return to its pre-project conditions soon after the project is completed. The project will occur in critical habitat where density of shiner is typically relatively high. However, precautions taken as part of the project will minimize direct impacts to shiner.

B. Factors affecting species environment within the action area

Currently, six dams (Santa Rosa, Sumner, FSID Diversion Dam, Brantley, Avalon, and Black River) largely control the flow of the Pecos River in New Mexico (Figure 1). The construction of the dams has had many adverse effects on the Pecos River ecosystem over the last 100 years. Although there are no dams in the immediate vicinity of the proposed project, dams have far-ranging effects and are therefore discussed here. Dams have many downstream effects on the physical and biological components of a stream ecosystem (Williams and Wolman 1984). Some of these effects include a change in water temperature, a reduction in lateral channel migration, channel scouring, blockage of fish passage, channel narrowing, changes in the riparian community, diminished peak flows, changes in the timing of high and low flows, and a loss of connectivity between the river and its flood plain (e.g., Sherrard and Erskine 1991, Power et al. 1996, Kondolf 1997, Friedman et al. 1998, Polzin and Rood 2000, Collier et al. 1996, Shields et al. 2000).

The Pecos Bluntnose Shiner Recovery Plan stated that the operation of Sumner Dam had significantly altered flow regimes in the upper Pecos River (Service 1992). During the period 1913 to 1935, prior to dam operation, flows were never less than 1 cfs (0.03 m^3/s) at the Sumner Dam Gage. For the period after dam operation began, 1937 to 1990, flows less than 1 cfs (0.03 m^3/s) occurred an average of 55 days per year. After Sumner Dam was completed, it prevented all movement between the shiner population above and below the dam. Shiners were last collected above Sumner Dam in 1963 (Platania and Altenbach 1998). Sumner Dam also traps sediment that would maintain the sandy river bed that shiner prefer. The release of sediment-free water leads to channel scour below the dam, creating unsuitable habitat (Kondolf 1997).

The effect of upstream water storage and diversion on the downstream reaches of the Pecos River was to reduce the frequency and magnitude of floods (Table 5), reduce winter flows (Table 6), and reduce summer flows (Table 7). These Tables and the implications for the shiner and its habitat are described in detail below.

The maximum release capacity of Sumner Dam is 1,400 cfs (40 m^3/s). Prior to the completion of Sumner Dam, flows greater than 1,400 cfs (40 m^3/s) occurred an average of 7 days per year and the lowest annual peak mean daily discharge was 2,020 cfs (57 m^3/s) (Table 5). By comparison, only two of 18 post-Sumner Dam years had mean daily discharge greater than 1,400 cfs (40 m^3/s) for an average of 1 day per year. Large floods are an important component of riverine ecosystems because they maintain channel width and complexity, limit colonization of non-native vegetation, maintain native riparian vegetation, recharge the alluvial aquifer, increase nutrient cycling, and maintain the connection between the aquatic and riparian ecosystems (Ward and Stanford 1995, Schiemer 1995, Power 1996, Shafroth 1999). Floods would occur more often if Sumner Dam were not in place. Reduced peak discharge has caused the channel to become narrower, less braided, and to have less complex fish habitat (Tashjian 1993, 1994, 1995, 1997; Hoagstrom 2000, 2001, 2002).

Before the construction of Sumner Dam, mean daily discharge in the non-irrigation season (winter), was 97 cfs (3 m^3/s) with a minimum flow of 41 cfs (1.2 m^3/s) (Table 6). After the dam was built (1962 to 1979), mean daily discharge in the winter was 6 cfs (0.2 m^3/s), a reduction of 94 percent. The storage of winter season base flows in Sumner Reservoir reduced the amount of water and habitat available to the shiner. Beginning 1998/1999, the winter season operation of Sumner Dam was modified to divert water to storage only when not required to meet downstream flow targets at the Acme gage. Water was passed through Sumner Reservoir in the winter to target approximately 35 cfs at the Acme gage.

During the irrigation season (March 1 to October 31), prior to Sumner Dam, the mean daily discharge flows exceeded 100 cfs (2.8 m^3/s) 147 days per year compared to 69 days per year after the completion of Sumner Dam (Table 7). Discharge adequate to overflow (greater than 100 cfs [2.8 m^3/s]) the FSID Diversion Dam during the irrigation season was recorded more than twice as often in the years prior to Sumner Dam, than in the post-Dam period. Overflow of the FSID Diversion Dam was less frequent and of greater magnitude after Sumner Dam was built because of block releases of water from Sumner Dam.

The Bureau of Reclamation (Reclamation) diverts water to storage at Sumner Reservoir for the Carlsbad Project and then releases the stored water for the CID. The release of water occurs in "blocks" where large amounts of water (usually a minimum of 1,000 cfs [28 m^3/s]) are released. Blocks of water are used because less water is lost to evaporation and groundwater seepage during transport. Sumner Dam block releases occurred between one and four times per year from 1990 to 2006. The block release durations ranged from 7 to 30 days, with an average of 15.7 days. Since 1999, the Sumner Dam irrigation season operations have been modified to: 1) limit the block release duration to a maximum of 15 days; and 2) limit block release timing and frequency.

Block releases can provide a cue for spawning, help maintain channel morphology, and if timed correctly, can alleviate intermittency (Tetra Tech 2003). Block releases that occur during the spawning season from May through September transport semi-buoyant shiner eggs and larvae out of the favorable habitat reach of the Rangelands, and into the less suitable Farmlands reach or Brantley Reservoir. The eggs require water velocity to remain suspended in the water column. In the reservoir, the eggs sink to the bottom and likely perish when they are covered with sediments and suffocate or are eaten by predators. Larval fish are likely eaten by predatory fish.

Eggs and larvae drift downstream for a total of 3 to 5 days; the distance they travel depends on habitat complexity, the rate of egg and larvae development, and water velocity (Platania and Altenbach 1998, Kehmeier et al. 2004b). Swifter currents and a more uniform channel carry the eggs and larvae a greater distance. Block releases exceeding 65 days per year result in the transport of many age-0 shiners into the Farmlands reach (Hoagstrom 2002). The effect on size class distribution between the Rangelands and Farmland reaches is not as pronounced when the total is less than 65 days per year. Although eggs and larvae are lost into Brantley Reservoir during natural flood events, the number is less because the peak of a flood hydrograph lasts for a very short time (several hours). In contrast, the peak flow in a block release is maintained for 10-15 days. The narrow channel and lack of slack and backwater habitat in the lower reach of critical habitat results in fewer eggs and larvae being retained in that reach, poor survival and growth of the juveniles, and greater transport of eggs and larvae into the reservoir (Hoagstrom 1997, 1999, 2000, Dudley and Platania 1999, Kehmeier et al. 2004b).

Historically, groundwater pumping has reduced Pecos River base-flow. Local pumping reduced seepage inflows from Truchas Creek, near Fort Sumner (Akin et al. 1946) and along the Pecos River between Fivemile Draw and Acme (Shomaker 1971). Inflows from the Roswell Artesian

Basin (from the Pecos River near Acme to McMillan Dam) were severely reduced during the 1920s to 1950s (Fiedler and Nye 1933, Thomas 1959). At the turn of the century the natural discharge of groundwater to the river was approximately 235,000 af per year (Fiedler and Nye 1933). This equals a flow of 325 cfs entering the river. Groundwater development of the Roswell basin aquifers reduced the amount of natural discharge into the Pecos River by 80 to 90 percent (Reynolds 1989 as cited in Reclamation 2002). In 1966, a Partial Final Decree adjudicated all groundwater rights in the Roswell artesian basin in Chaves and Eddy counties, and meters were installed on wells. Metering helped regulate use but in 2002, total pumping in the Roswell artesian basin still equaled 376,885 af (Miller 2006). In 1975, water levels in the Roswell artesian basin were at their lowest recorded levels, approximately 70 feet below their original level (Balleau 1999). By 1995, the aquifer had recovered approximately 30 feet, but is still 40 feet below its original level (Balleau 1999).

Based on historical evidence and population monitoring conducted since 1992, river intermittency is considered the primary environmental factor that led to the recent decline of the shiner (Service 1987, Hoagstrom 2003a). Although intermittency is unlikely to occur in the vicinity of the proposed project, because intermittency affects population numbers as a whole and the status of the species, it is discussed here. The Acme gage is downstream from the project area and is in the quality habitat reach of river that provides excellent shiner habitat when the river is flowing. Acme gage is also in the reach of river that is susceptible to intermittency. Annual mean runoff at the Acme gage is an indicator of flow through this important reach of river (Table 1). The 2003 mean is the lowest for the period of record (1938-2003), with the 2002 mean being the 4th lowest on record. The lowest annual mean recorded prior to 2003 was in 1964 (56.5 cfs). The annual mean runoff is reflected in the number of days of intermittency that occurred at Acme (Table 1); 4 days in 2001, 49 days in 2002, 44 days in 2003 and 8 days in 2004. In 2005 and 2006, there were no days of intermittency and shiner density began to increase (Tables 1-4).

IV. Effects of the Action

The Service must consider the direct and indirect effects, as well as the effects of interdependent and interrelated actions to the shiner. Indirect effects are those that are caused by, or result from, the proposed action, and are later in time, but are reasonably certain to occur.

The proposed project will affect a very small proportion of occupied shiner habitat (85 feet of river out of 101 miles of critical habitat and 186 mi of total occupied river miles). Fish within the project zone are expected to flee from the area as the bladder barriers are placed in the river. Therefore, direct mortality from the bladders is not anticipated. The flight response will cause a temporary increase in energy expenditure and displacement from habitat that they were using. There will be increased energy expenditure as they seek new suitable habitat that is either unoccupied or underutilized that they can occupy. Because of the human activity and increase in water velocity, it is not expected that shiner will occupy the restricted channel between the bladder barrier and the bank.

Movement of shiner to a new location may temporarily increase their risk of predation. Because of the human presence and activity in the area it is not expected that terrestrial predators would be a factor because they will likely be scared away. However, there is a possibility that shiner may become more susceptible to opportunistic piscivores as they move into new habitat.

The aquatic invertebrates living on or in the substrate within the work zone will either be dislocated or killed. However, the shiner is a drift feeder and is not thought to feed on the substrate (see Food Habits section above). Drift may increase below the work site, temporarily increasing food availability to shiner and other species downstream. Because aquatic invertebrates will recolonize the affected habitat quickly, because shiner also use drifting terrestrial invertebrates, and because the amount of affected substrate is very small compared to area of production upstream, disruption of the invertebrate food source within the project area is not anticipated to affect the shiner.

Conducting the work during November or December when flows are typically low, will minimize the amount of channel affected by the project. There will be localized removal of terrestrial vegetation to facilitate access to the site and an approximately 3 foot high cut-bank will be graded back to provide access to the river on the east side. However, to the extent that these activities destabilize the banks and allow the river to migrate normally, they are viewed as positive actions.

There will be a temporary disruption of water flow. However, flow will remain continuous and will be redirected within the existing channel. No changes in water quality or quantity are anticipated. Water velocity in the partial channel will be greater than what exists in the unaltered channel. It is not anticipated that the velocity would be so fast as to become a barrier to fish movement but for the period of construction (no more than 5 days) the habitat most likely will be unsuitable for shiner because of the water velocity.

The project will not occur during spawning or any other critical life stage of the species.

Effects to Critical Habitat

The proposed project will not occur in critical habitat; therefore, it will not be modified. Effects of the project are expected to be very localized and are not anticipated to have any effect on the critical habitat which is over 50 miles downstream from the project.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this BO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Although many adverse effects have occurred to the shiner, it appears that river intermittency is the primary threat to the continued existence of the shiner.

Cumulative effects include:

- Capture of sediment by dams on streams tributary to the Pecos River. There are many flood control dams built to protect municipalities that effectively stop the input of fine sediments into the Pecos River. The shiner prefers a silt/sand substrate. Reduction of these fine materials can alter the substrate composition over time.

- The water quality of irrigation return flows to the Pecos River is unknown. However, irrigated agriculture amounts to 84 percent of total water use in De Baca, Chaves, and Eddy counties (Department of Interior 1989). Typically, irrigation return flows are higher in salts than freshwater and may also contain pesticides, herbicides, and elevated amounts of nutrients (nitrogen and potassium) from fertilizers used on crops (http://www.fao.org/docrep/W2598E/w2598e04.htm). When irrigation return flows are diluted by natural flows water quality is not usually a problem. However, in situations where return flows provide a large portion of the total water available to the shiner (i.e., below the FSID return canal) and the pesticides, herbicides, and nutrients from fertilizers become further concentrated as the water evaporates, it is possible that water quality could negatively affect the shiners, particularly in times of very low flow. Cattle grazing could have a localized effect on water quality especially during low flow periods when cattle tend to congregate in the river.

- Oil and gas development. There is extensive development of oil and gas wells between Artesia and Carlsbad with associated roads and pipelines. Most of the pipelines are laid on top of the ground. Many pipelines cross ravines and some cross the Pecos River. Leaks and breaks in the lines have been documented (Steve Belinda, Bureau of Land Management, pers. comm. 2002). Delivery of petroleum products to the Pecos River either directly or by storm runoff, could have a negative impact on the shiner.

In summary, human activities have had many adverse effects on the Pecos River ecosystem in the last 100 years. Although many adverse effects have occurred, it appears that lack of permanent flow and an altered hydrograph (diminished peak flows and sustained block flows) are the primary threats to the continued existence of the shiner.

V. Conclusion

After reviewing the current status of the shiner, the environmental baseline for the action area, the effects of the proposed project, and the cumulative effects, it is the Service's biological opinion that the proposed project, is not likely to jeopardize the continued existence of the shiner, and is not likely to destroy or adversely modify designated critical habitat. We found that the proposed action is not likely to have adverse effects to designated critical habitat or alter the function and intended conservation role of shiner critical habitat.

The Service reached this conclusion because:

1) The spatial extent of the project is small (85 feet of 185 miles of occupied habitat).
2) Disturbance to the channel and the shiner will be temporary (less than 5 days).
3) Direct mortality to shiner is not anticipated.
4) Work will not occur during a critical life stage of the shiner.
5) The project does not occur in critical habitat.
6) Water quantity and water quality should not be affected.
7) No long term effects to either the shiner or critical habitat have been identified
8) All terms and conditions developed in the Army Corps of Engineers 404 Permit will be followed.
9) A Spill Prevention Control Plan has been developed and will be implemented if needed.

VI. Incidental Take Statement

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of an incidental take statement.

The measures described below are non-discretionary, and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued to any applicants, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If Reclamation (1) fails to assume and implement the terms and conditions, or (2) fails to require applicants to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(i)(3)]

Amount or Extent of Take

A swath approximately 85 feet wide will be disturbed across the Pecos River. The length of wetted habitat disturbed will depend on the amount of discharge when the construction occurs; however, it is anticipated to not be greater than 100 feet. Consequently, about 8,500 square feet of habitat may be disturbed. Monitoring at the Highway 70 bridge, the closest monitoring site to the proposed project (12 miles downstream), conducted by the Service's Fisheries Resources Office, showed 1.1 shiner/100 feet^2 in November 2005 and 0.46 shiner/100 feet^2 in December 2005. Based on these values approximately 40-95 shiner could potentially be harassed or harmed by the proposed project.

Effect of the Take

In the accompanying biological opinion, the Service determined that the level of anticipated take is not likely to result in jeopardy to the shiner or destruction or adverse modification of critical habitat.

VII. Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measure is necessary and appropriate to minimize impacts of incidental take of the shiner.

1) A crew will be present to observe operations and to seine fish if needed from the location where the bladders will be placed and from any work area that is dewatered.

Terms and Conditions

In order to be exempt from prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

The following actions implement reasonable and prudent measure 1:

1.1) A crew consisting of at least two people permitted to capture Pecos bluntnose shiner will be present at the work site when placement of the bladder barriers begins. At least one crew member will be a Service employee. The crew will observe the operation and evaluate the potential for fish to be trapped beneath the bladder. If deemed necessary by the crew, the site where the bladder will be placed will be seined to remove fish from the area.

1.2) Once the bladder barriers are in place and dewatering of the area to be trenched begins, the crew will salvage all fish that become trapped in isolated pools. Dewatering will be managed so that fish are not stranded on the substrate. In other words, dewatering should occur slowly enough that the crew has time to collect any fish that are trapped in isolated pools and should be slow enough that fish have the opportunity to follow the receding water out of the area.

1.3) Collected fish will be held in buckets not longer than an hour and moved upstream at least 100 yards and released back into slow velocity habitat (pool or connected side channel) in the Pecos River.

VIII. Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. To help maintain unarmored banks, remove all salt cedar within TCPs right away within 100 yards of the Pecos River. The preferred habitat of the shiner is a wide-sand bed river. Salt cedar, an invasive plant, armors the banks and prevents them from eroding and shifting in a normal manner.
2. Inform TCP employees involved with the project about the Pecos bluntnose shiner and why specific activities are being conducted to lessen the project's impact on the species.

Reporting Requirements

The nearest Service Law Enforcement Office must be notified within 24 hours in writing should any listed species be found dead, injured, or sick. Notification must include the date, time, and location of the carcass, cause of injury or death (if known), and any pertinent information. Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. If necessary, the Service will provide a protocol for the handling of dead or injured listed animals. In the event Reclamation suspects that a species has been taken in violation of Federal, State, or local law, all relevant information should be reported in writing within 24 hours to the Service's New Mexico Law Enforcement Office (505/883-7814) or the New Mexico Ecological Services Field Office (505/346-2525).

IX. Reinitiation Notice

This concludes formal consultation on the proposed project described in the October 11, 2006, BA. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) The amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this BO; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this BO; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation. Any questions regarding this BO should be directed to Marilyn Myers (505) 761-4754 or David Campbell (505) 761-4745.

Sincerely,

Cyndie Abeyta

Cyndie Abeyta
Acting Field Supervisor

cc:
Regional Section 7 Coordinator, U.S. Fish and Wildlife Service, Region 2 (ES), Albuquerque, New Mexico
Larry Campbell, Transwestern Pipeline, 6381 North Main Street, Roswell, New Mexico 88201

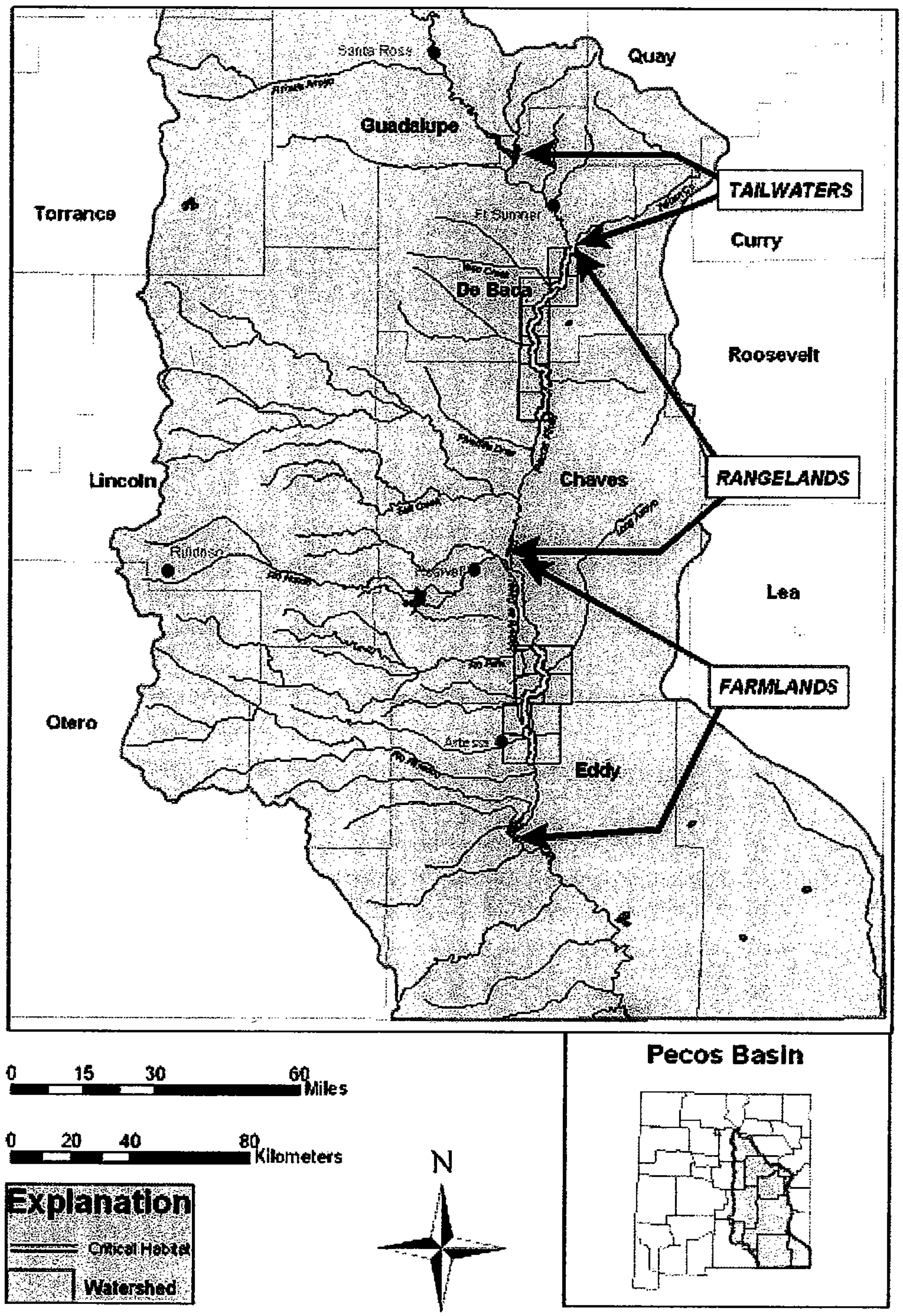


Figure 1. River reaches of similar character designated for Pecos bluntnose shiner research.

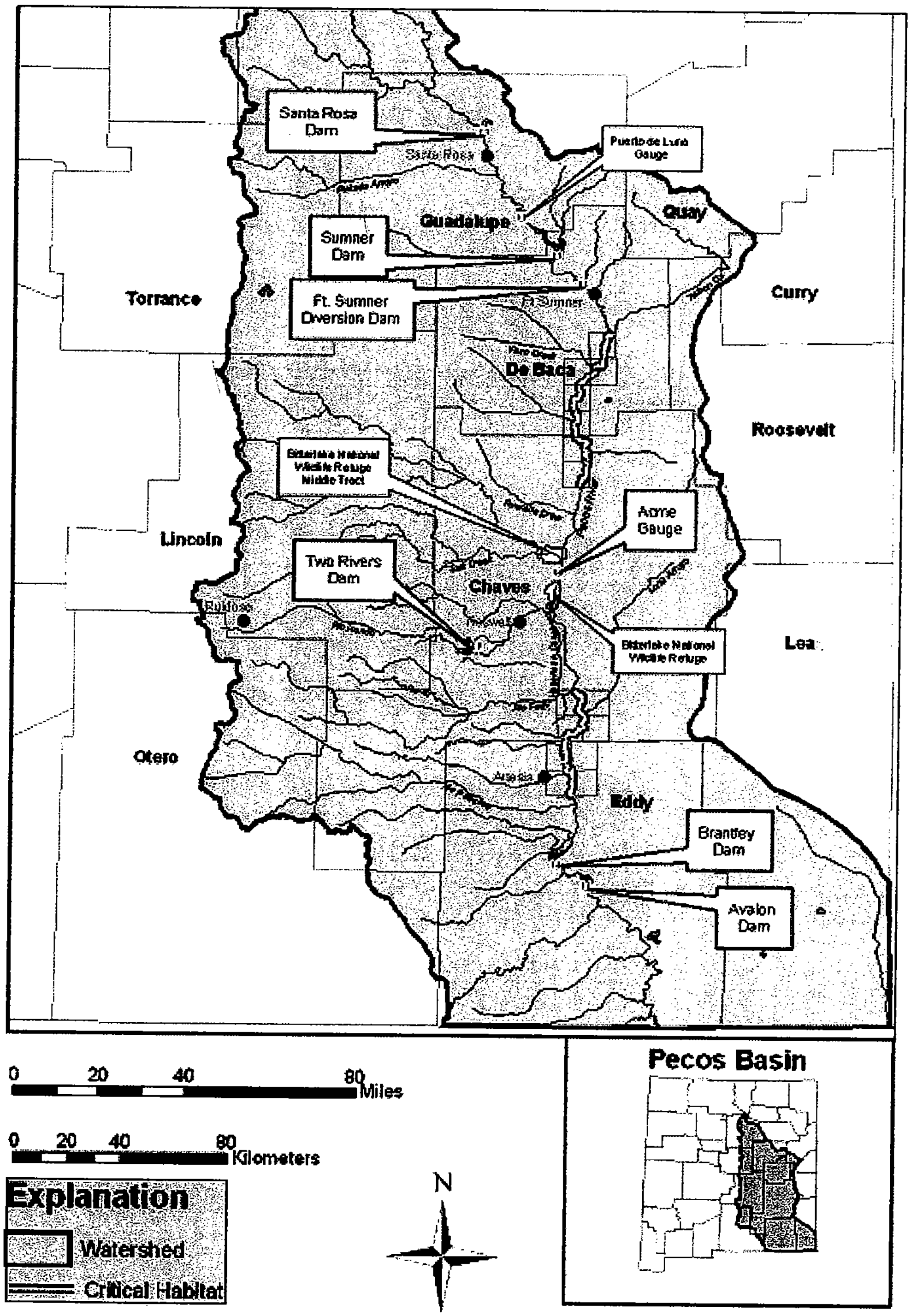
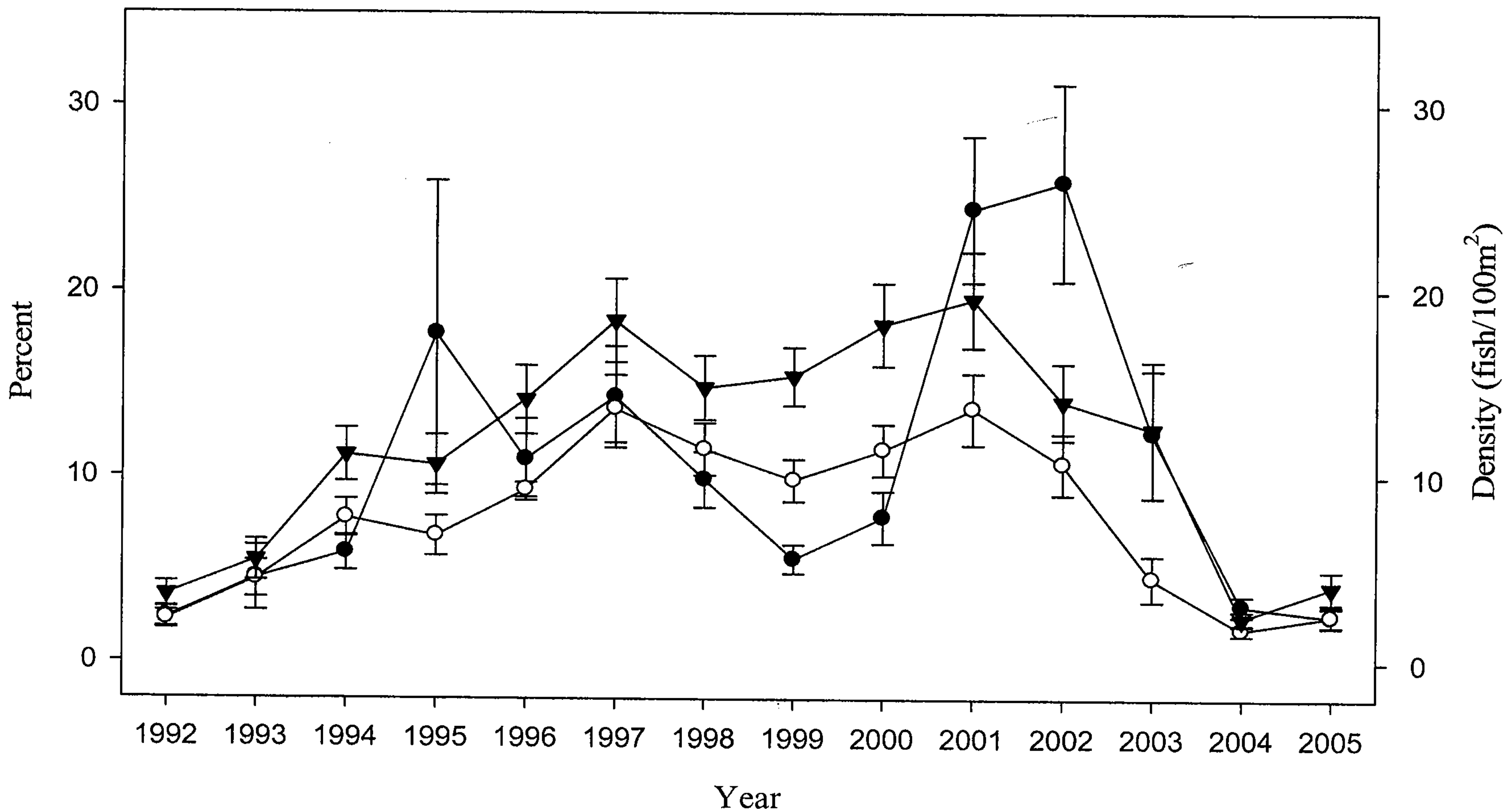


Figure 2. Pecos bluntnose shiner critical habitat, dams and two gauging stations on the Pecos River, New Mexico.

Figure 3. All abundance metrics used to track status and trends of Pecos bluntnose shiner including: density, percent of total fish community, and percent of shiner guild for the years 1992 through 2005. All river sections and trimesters are combined and data is presented with ± one standard error. Filled in circles = density (fish/100m2), open circles = percent shiner within the total fish community, filled in triangles = percent shiner within the shiner guild. Source: New Mexico Fishery Resources Office 2006.

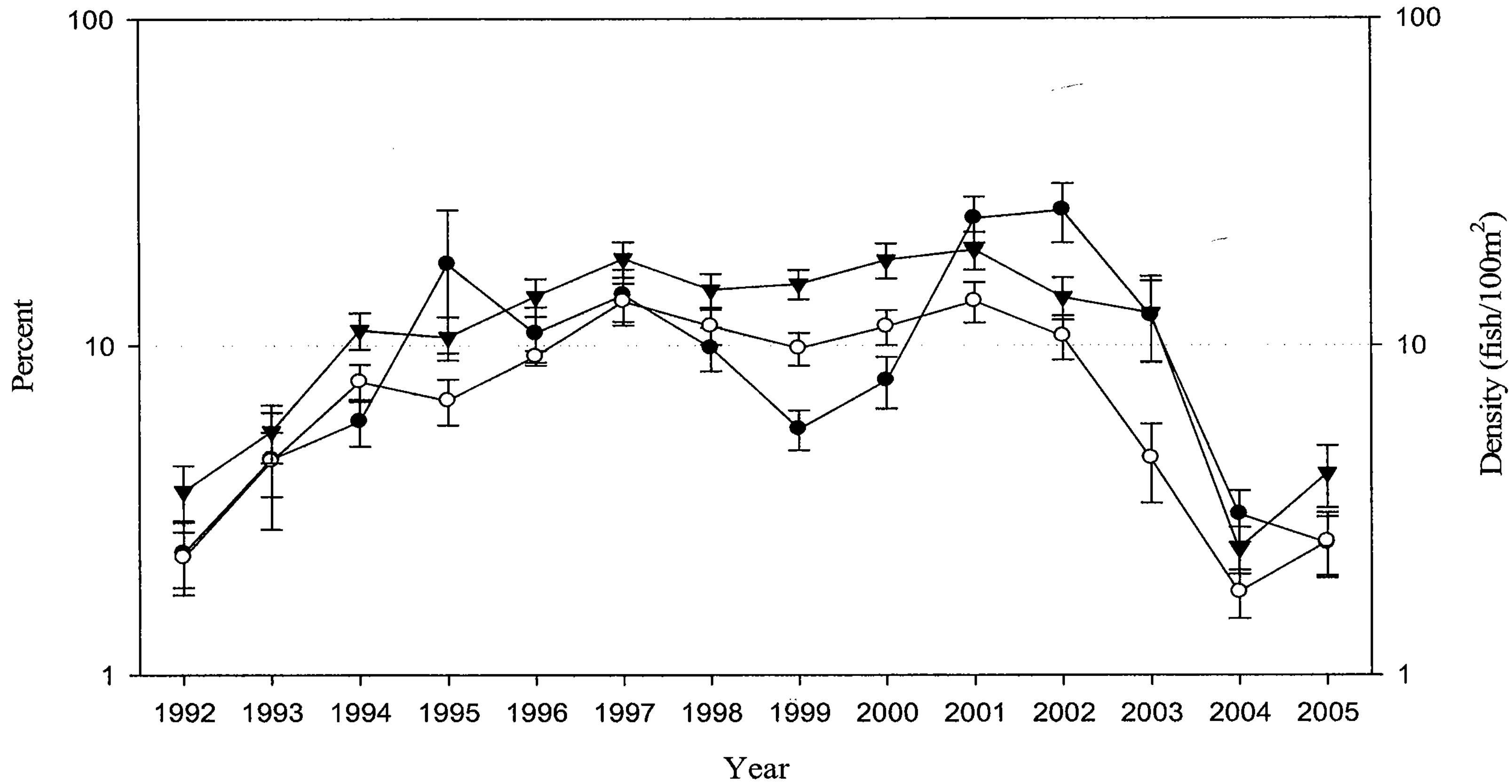
Figure 4. All abundance metrics used to track status and trends of Pecos bluntnose shiner including: density, percent of total fish community, and percent of shiner guild for the years 1992 through 2005. All river sections and trimesters are combined and data is presented with ± one standard error, and data is log transformed. Filled in circles = density (fish/100m2), open circles = percent shiner within the total fish community, filled in triangles = percent shiner within the shiner guild. Source: New Mexico Fishery Resources Office 2006.

Figure 3



Percent
30
20
10
0
Density (fish/100m2)
30
20
10
0
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year

Figure 4



Percent
Density (fish/100m^2)
100
10
1
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
Year

Table 1. Annual mean flow (calendar year), days of intermittency (0 flow), days less than one cfs, and days less than 5 cfs as recorded at the Acme gage, New Mexico and total reservoir storage as of April 1 of each year (summarized from U.S. Geological Survey records and Natural Resources Conservation Services, State Basin Outlook Reports).

	2000	2001	2002	2003	2004	2005
Annual mean flow	173	92	72	51	141*	146*
Days of intermittency	0	4	49	44	8	0
Days less than one cfs	0	13	63	97	15	0
Days less than 5 cfs	14	21	75	110	26	0
April 1 reservoir storage	136,600	79,500	35,200	47,100	29,200	115,000

* Provisional

Table 2. Total abundance of Pecos bluntnose shiner (n), seining effort (effort), and mean Pecos bluntnose shiner density (mean density = mean number of Pecos bluntnose shiner divided by area seined x 100). Data presented by four month trimester; Tri 1 = Jan-Apr, Tri 2 = May-Aug, Tri 3 = Sep-Dec for 1992 through 2005. In 2005 only trimester 1 and 2 are presented. **All three river sections (Tail-water, Rangeland and Farmland) are combined.**

	n				effort				mean density							
	Tri 1	Tri 2	Tri 3	**Total**	Tri 1	Tri 2	Tri 3	**Total**	Tri 1	se	Tri 2	se	Tri 3	se	**Total**	**se**
1992	32	83	218	**333**	3,156	6,828	6,123	**16,107**	1.26	0.9	1.3	0.4	3.6	1.2	**2.3**	**0.6**
1993	103	149	384	**636**	4,712	8,530	3,128	**16,370**	1.75	1.0	1.9	0.5	14.6	7.8	**4.5**	**1.7**
1994	105	238	473	**816**	5,543	5,772	6,314	**17,629**	2.54	0.8	5.3	1.4	8.8	2.0	**5.8**	**0.9**
1995	96	1,534	657	**2,287**	4,361	9,103	6,128	**19,592**	2.37	1.3	28.7	18.9	14.1	3.8	**17.7**	**8.2**
1996	338	384	1,110	**1,832**	5,034	7,040	6,905	**18,979**	9.45	4.9	5.7	1.6	16.4	4.2	**10.9**	**2.2**
1997	381	346	1,224	**1,951**	2,307	3,875	8,034	**14,216**	19.1	9.8	9.1	1.7	15.6	3.4	**14.3**	**2.7**
1998	302	613	866	**1,781**	3,201	6,732	9,558	**19,491**	9.5	2.9	11.1	3.0	8.9	2.0	**9.8**	**1.5**
1999	411	471	999	**1,881**	11,730	9,684	11,082	**32,496**	3.2	0.8	5.2	1.3	8.9	1.7	**5.5**	**0.7**
2000	445	415	1,527	**2,387**	9,417	11,340	11,163	**31,920**	4.7	1.5	3.5	0.7	14.5	3.3	**7.8**	**1.4**
2001	931	1,102	1,241	**3,274**	9,379	2,868	3,390	**15,637**	12.5	4.6	38.7	7.2	35.9	8.7	**25.9**	**4.1**
2002	1,843	504	585	**2,932**	8,056	1,960	3,780	**13,796**	27.4	7.2	31.7	15.6	17.6	5.3	**25.8**	**5.3**
2003	379	286	151	**828**	1,947	1,798	1,708	**5,453**	19.7	7.7	19.5	7.0	12.5	9.9	**17.4**	**4.6**
2004	114	248	118	**480**	4,718	5,709	6,011	**16,438**	2.4	0.8	4.8	1.1	2.3	0.9	**3.2**	**0.6**
2005	90	117	174	**381**	7,648	8,059	4,388	**20,095**	1.2	0.4	1.7	0.6	4.2	1.0	**2.3**	**0.4**
Total	**5,570**	**6,490**	**9,899**	**21,935**	**81,209**	**89,338**	**87,712**	**258,219**	**8.36**	**2.2**	**12.01**	**3.3**	**12.8**	**2.2**	**10.8**	**2.2**

Table 3. Total abundance of Pecos bluntnose shiner (n), seining effort (effort), and mean Pecos bluntnose shiner density (mean density = mean number of Pecos bluntnose shiner divided by area seined x 100). Data presented by four month trimester; Tri 1 = Jan-Apr, Tri 2 = May-Aug, Tri 3 = Sep-Dec for 1992 through 2005. In 2005 only trimester 1 and 2 are presented. **Rangeland River Section only.**

	n				effort				mean density							
	Tri 1	Tri 2	Tri 3	**Total**	Tri 1	Tri 2	Tri 3	**Total**	Tri 1	se	Tri 2	se	Tri 3	se	**Total**	**se**
1992	12	54	64	**130**	1,391	2,616	2,823	**6,830**	0.7	0.7	2.0	0.4	2.3	5.8	**1.9**	**0.3**
1993	21	65	76	**162**	1,932	2,623	583	**5,138**	1.1	0.5	2.6	0.6	13.0	0.8	**3.4**	**0.9**
1994	60	116	85	**261**	2,109	1,602	2,117	**5,828**	3.2	1.0	7.5	1.3	4.8	1.9	**5.1**	**0.9**
1995	62	148	56	**266**	1,484	3,162	1,635	**6,281**	5.1	4.1	4.7	0.8	4.0	0.9	**4.6**	**1.1**
1996	117	161	364	**642**	1,546	2,223	2,382	**6,151**	10.1	3.3	7.9	3.2	15.7	5.2	**11.8**	**2.6**
1997	110	272	850	**1,232**	1,002	1,862	3,795	**6,659**	15.4	5.4	14.3	2.3	23.6	5.8	**18.6**	**2.1**
1998	237	392	574	**1,203**	1,692	3,444	6,012	**11,148**	14.3	3.5	15.6	5.1	10.2	2.2	**12.8**	**1.6**
1999	385	246	505	**1,136**	8,346	4,689	6,066	**19,101**	4.3	1.1	5.6	1.4	8.5	2.0	**5.8**	**0.9**
2000	232	279	585	**1,096**	5,061	5,565	5,985	**16,611**	4.8	1.7	5.0	1.0	10.9	2.4	**7.1**	**1.1**
2001	560	456	413	**1,429**	4,083	1,561	1,389	**7,033**	18.0	8.2	30.4	7.5	30.8	8.3	**24.8**	**4.8**
2002	1,541	127	219	**1,887**	3,405	1,116	2,319	**6,840**	46.6	11.2	11.8	3.4	9.6	1.9	**28.0**	**6.4**
2003	352	206	22	**580**	1,245	896	912	**3,053**	29.1	10.1	25.7	10.4	2.4	0.6	**20.2**	**5.8**
2004	79	190	57	**326**	2,936	3,306	3,855	**10,097**	2.9	1.1	6.4	1.3	1.5	0.3	**3.6**	**0.6**
2005	65	48	121	**234**	4,809	5,115	2,960	**12,884**	1.1	0.5	1.0	0.2	4.5	2.4	**2.2**	**0.6**
Total	**3,833**	**2,760**	**3,991**	**10,584**	**41,041**	**39,780**	**41,398**	**123,654**	**11.2**	**3.5**	**10.0**	**2.4**	**10.3**	**2.4**	**10.7**	**2.3**

Table 4. Total abundance of Pecos bluntnose shiner (n), seining effort (effort), and mean Pecos bluntnose shiner density (mean density = mean number of Pecos bluntnose shiner divided by area seined x 100). Data presented by four month trimester; Tri 1 = Jan-Apr, Tri 2 = May-Aug, Tri 3 = Sep-Dec for 1992 through 2005. In 2005 only trimester 1 and 2 are presented. **Farmland River Section only.**

	n				effort				mean density							
	Tri 1	Tri 2	Tri 3	**Total**	Tri 1	Tri 2	Tri 3	**Total**	Tri 1	se	Tri 2	se	Tri 3	se	**Total**	**se**
1992	20	27	154	**201**	971	2,853	2,344	**6,168**	2.7	2.6	1.3	0.8	6.5	2.8	**4.0**	**1.5**
1993	82	70	308	**460**	2,422	4,518	1,619	**8,559**	2.5	1.9	1.8	0.8	20.7	13.5	**6.1**	**3.1**
1994	45	112	388	**545**	2,342	3,262	3,081	**8,684**	2.8	1.5	5.1	2.2	13.6	3.0	**7.8**	**1.6**
1995	34	1385	601	**2,020**	2,184	4,077	3,401	**9,663**	1.5	0.7	54.7	37.4	21.5	5.7	**29.9**	**14.7**
1996	221	223	746	**1,190**	2,358	3,209	3,496	**9,063**	13.0	9.2	7.1	2.5	22.0	7.2	**14.5**	**3.8**
1997	271	74	374	**719**	1,074	1,713	3,423	**6,210**	28.0	22.8	4.4	2.1	11.2	4.3	**13.2**	**5.8**
1998	65	221	292	**578**	1,254	2,796	2,817	**6,867**	5.5	5.5	7.7	3.1	9.6	4.8	**7.9**	**2.4**
1999	26	225	492	**743**	2,697	3,954	4,083	**10,734**	1.1	0.6	6.2	2.5	11.9	3.5	**6.7**	**1.7**
2000	213	136	942	**1,291**	3,990	4,734	4,182	**12,906**	5.1	2.8	2.7	1.0	22.7	7.0	**10.3**	**3.0**
2001	371	646	828	**1,845**	4,558	1,084	1,860	**7,503**	9.1	5.5	58.1	9.5	45.3	15.2	**31.7**	**7.2**
2002	302	377	366	**1,045**	4,030	541	1,461	**6,033**	9.3	6.3	74.4	41.5	27.0	10.4	**26.8**	**9.8**
2003	27	80	129	**236**	701	671	570	**1,944**	4.0	3.4	13.4	10.2	28.4	24.5	**16.0**	**8.9**
2004	35	58	61	**154**	1,233	1,829	1,773	**4,835**	2.4	1.4	3.5	2.2	4.1	2.4	**3.4**	**1.2**
2005	25	69	53	**147**	2,554	2,700	1,287	**6,541**	1.5	0.9	2.8	1.3	4.0	2.2	**2.7**	**0.7**
Total	**1,737**	**3,703**	**5,896**	**11,351**	32,368	37,940	35,398	105,710	**6.3**	**1.9**	**17.3**	**6.6**	**17.7**	**3.0**	**12.9**	**2.6**

Table 5. Summary of change in frequency and magnitude of flows > 1400 ft^3/s (maximum Sumner Dam release) at the Pecos River Below Sumner Dam Gage. The Fort Sumner gage represents inflow into the Pecos bluntnose shiner range. The pre-Dam summary was completed using mean daily discharge data for the 18 calendar years with complete records. The post-Dam summary was completed using the calendar years 1962 through 1979 (18 years). This period was chosen because it represented flow conditions after the 1950s drought, pre-Santa Rosa Dam, and pre-1980s and 1990s wet years. In other words, this 18-year period was the most 'normal' for the post-Sumner Dam period.

Period	Days	Days > 1400 ft^3/s	Mean Days per Year > 1400 ft^3/s	Years With Flows > 1400 ft^3/s	Maximum Discharge (ft^3/s)
Pre-Dam	6574	128	7.1	18	26200
Post-Dam	6574	18	1.0	2	1980

Table 6. Summary of winter flows (i.e., flows reported for the typical FSID non-irrigation season, 1 November to 14 February) at the Pecos River Below Sumner Dam Gage. The Fort Sumner gage represents inflow into the Pecos bluntnose shiner range. The same records were used in this Table as described in Table 5.

Period	Days	Mean ft^3/s	Minimum ft^3/s	Maximum ft^3/s
Pre-Dam	1908	97.3	41	265
Post-Dam	1908	6.0	0	99

Table 7. Summary of flows at the Pecos River Below Sumner Dam Gage during the FSID irrigation season (March through October). The same records were used in this Table as described in Table 5.

Period	Days	Days > 100 ft^3/s	Mean Days per Year > 100 ft^3/s	Mean Overflow (ft^3/s)
Pre-Dam	4666	2649	147.2	355.7
Post-Dam	4666	1238	68.8	594.2

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