4. Species Description, Federal Listing Status and Life History

4.1 Rio Grande Silvery Minnow

4.1.1 Species Description

The Rio Grande silvery minnow (*Hybognathus amarus*) (silvery minnow) is a small-bodied minnow reaching a maximum size of approximately 4 inches (Sublette et al. 1990). The silvery minnow are part of the genus *Hybognathus* that has at least seven recognized species, which are very similar morphometrically (Bestgen and Propst 1996). The taxonomic status of silvery minnow has changed several times since its original description by Girard in 1856 in the vicinity of Brownsville, Texas. Pfliger (1980) was the first to separate out the silvery minnow as its own species, *H. amarus.* This status has been supported by several publications investigating morphometric and genetic characteristics (Cavender and Coburn 1988, Hlohowskyj et al. 1989, Mayden 1989, Cook et al. 1992, Schmidt 1994, Bestgen and Propst 1996).

4.1.2 Distribution

Historically, silvery minnow occurred in the Rio Grande from Española, NM, to the gulf coast of Texas and in larger tributaries including the Pecos River encompassing more than 1,500 river miles (2,400 kilometers [km]). There are few early sampling records in the Rio Chama. There is also some historic information from tribal sources that silvery minnow may have occupied the Rio Chama up to approximately Abiquiu (Parametrix 2010). Today, silvery minnow are restricted to the reach of the Rio Grande in New Mexico, much of which is susceptible to drying, from the vicinity of Bernalillo downstream to the headwaters of Elephant Butte Reservoir. The occupied distance is approximately 10% of its presumed historic range (approximately 150 river miles [241 km]). This area is mainly encompassed within the action area for this consultation. The last silvery minnow collected outside the Middle Rio Grande was in the Pecos in 1968 (Museum of Southwestern Biology Records). There have been no silvery minnow collected in the Big Bend reach of the Rio Grande since 1961; however, silvery minnow from the propagation facilities supported by the Collaborative Program were stocked in the Big Bend reach in 2008, 2009, and 2010. Initial surveys have found evidence of reproduction, though it is too early to determine if the population will become self-sustaining.

The portion of river between Cochiti Dam and Angostura Diversion Dam is still considered to be occupied, but very few surveys have been conducted in this reach to confirm this. Egg monitoring was conducted in the Angostura Canal, just downstream from the Angostura Diversion Dam, over the past decade. During this time, only three eggs were reported (in 2003), and those were not preserved for confirmation. The lack of eggs in the Angostura Canal suggests that silvery minnow density upstream of Angostura Diversion Dam is extremely low if present (Service 2009).

4.1.3 Listing Status – Critical Habitat

Silvery minnow is currently listed as endangered on the New Mexico State list of endangered species, having first been listed May 25, 1979, as an endangered endemic population of the Mississippi silvery minnow (*Hybognathus nuchalis*). On July 20, 1994, the Service published a final rule to list the silvery minnow as an endangered species with proposed critical habitat (Federal Register [FR] 1994). The Service initiated a 5-year review of the status of the species in 2010 (75 FR 15454–15456). Current science was submitted to the Service for consideration by many entities, including MRGCD and NMISC; but the review has not been published at this time.

Critical habitat was designated for silvery minnow in 1999 (64 FR 36274-36290), with revisions published February 19, 2003 (68 FR 8088-8135). Designated critical habitat in the Rio Grande extends through Sandoval, Bernalillo, Valencia, and Socorro Counties, New Mexico, generally beginning at Cochiti Dam downstream to the utility line crossing the Rio Grande at the upstream end of the Elephant Butte Reservoir full pool. This marks the southern boundary of the action area for this consultation and the beginning of Reclamation's Rio Grande Project. The lateral extent of critical habitat includes those areas bounded by existing levees. In areas without levees, the lateral extent of critical habitat, as proposed, is defined as 300 feet (91.4 meters [m]) of riparian zone adjacent to each side of the river.

The critical habitat designation also includes a 5-mile segment of the Jemez River from Jemez Canyon Dam to the upstream boundary of Santa Ana Pueblo, Sandoval County. Pueblo lands in Santo Domingo, Santa Ana, Sandia, and Isleta Pueblos are excluded from critical habitat. The Service considered the Rio Grande around Big Bend National Park and the Pecos River between Ft. Sumner Dam and Brantley Reservoir as essential to conservation but did not designate them as critical habitat.

The Service identified four primary constituent elements (PCE) in the critical habitat designation (68 CFR 8114–8117):

1. A hydrologic regime that provides sufficient flowing water with low to moderate currents capable of forming and maintaining a diversity of aquatic habitats, such as, but not limited to, the following: Backwaters (a body of water connected to the main channel, but with no appreciable flow), shallow side channels, pools (that portion of the river that is deep

with relatively little velocity compared to the rest of the channel), eddies (a pool with water moving opposite to that in the river channel), and runs (flowing water in the river channel without obstructions) of varying depth and velocity—all of which are necessary for each of the particular silvery minnow life-history stages in appropriate seasons. The silvery minnow requires habitat with sufficient flows from early spring (March) to early summer (June) to trigger spawning, flows in the summer (June) through fall (October) that do not increase prolonged periods of low or no flow, and a relatively constant winter flow (November through February).

2. The presence of low-velocity habitat (including eddies created by debris piles, pools, or backwaters, or other refuge habitat (e.g., connected oxbows or braided channels) within unimpounded stretches of flowing water of sufficient length (i.e., river miles) that provide a variety of habitats with a wide range of depth and velocities.
3. Substrates of predominantly sand or silt.
4. Water of sufficient quality to maintain natural, daily, and seasonally variable water temperatures in the approximate range of greater than 1 degree Celsius (°C) (35 degrees Fahrenheit[°F]) and less than 30 °C (85 °F) and reduce degraded water quality conditions (decreased dissolved oxygen, increased pH, etc.).

4.1.4 Life History and Ecology

Historically, the occupied range of silvery minnow included a broad range of environmental parameters from those typical of the arid Southwest to the gulf coast of Texas. Current knowledge of silvery minnow life history and requirements are based on studies that have been conducted within the species' contemporary range, an environment that has been dramatically altered over historic times. It is unknown how the minnow's life history attributes may have differed in now unoccupied portions of its range.

In the Middle Rio Grande, silvery minnow generally spawn in the spring, from late April through June (Platania and Dudley 1999–2010). Peak egg production typically occurs in mid- to late-May, coinciding with high spring discharge produced by snowmelt runoff. Spawning also is thought to be sometimes triggered by summer flow spikes in years with negligible snowmelt runoff. It is likely that several environmental variables influence the timing of silvery minnow spawning (e.g., photoperiod, temperature, and water turbidity).

Reproductively mature females are typically larger than males. Each female produces several clutches of eggs during spawning, ranging from 2,000–3,000 (Age 1) to 5,000+ eggs (Age 2) per female (Platania and Altenbach 1996). The majority of the population captured by population monitoring during prespawn seining surveys is comprised of Age 1 fish (1 year old) with older, larger fish (Age 2+) constituting less than 10% of the spawning population (Platania and Altenbach 1996, Horwitz et al. 2011). In paired sampling trials, the mean size of silvery minnow captured during spring sampling of inundated overbank habitats with fyke nets is slightly larger than the mean of those collected with seines (SWCA 2011).

Age determination for museum specimens collected in 1874 based on scales (Cowley et al. 2006) indicated minnows may live up to 5 years. However, more recent analysis of the same museum material and contemporary specimens indicate a maximum age of 3 (Horwitz et al. 2011). In most years, few adult silvery minnows are captured by late summer. In October 2009, the majority (greater than [>] 99%) of silvery minnows collected were Age 0 and 1 fish (Horwitz et al. 2011). Captive minnows can live much longer. Some preliminary estimates of survival from the 1993–1999 monitoring data were developed and presented to the PVA workgroup (R. Valdez PowerPoint to PVA, March 31, 2010). However, these analyses were based upon five age classes and the Cowley et al. age determinations from scales which may not be as accurate as the otolith based comparisons.

Silvery minnow are generally found in schools, so sampling results and habitat studies are often affected by this grouping behavior. Dudley and Platania (1997) studied habitat preferences of the silvery minnow in the MRG at Rio Rancho and Socorro. Both juvenile and adult silvery minnow primarily used mesohabitats with moderate depths (15–40 centimeters [cm]), low water velocities (4–9 centimeters per second [cm/sec]) and silt/sand substrates. Young-of-year silvery minnow are generally found in shallower and lower velocity habitats than adult individuals. During winter months, silvery minnow become less active and seek habitats with cover such as debris piles and low water velocities. During spring sampling, large concentrations of reproductively mature silvery minnow are often collected on inundated lateral overbank habitats (Hatch and Gonzales 2008, LL Study).

Adult, silvery minnow are strong swimmers capable of moving upstream during high flow events (Bestgen et al. 2010). However, studies conducted tracking hatchery fish indicate that there is not likely a population wide migration behavior for silvery minnow. It appears that movement is somewhat random with a net downstream trend for marked individuals though a few individuals moved upstream substantial distances (25 km). The distance traveled by recaptured fish ranged from 0.26 km (0.16 mile [mi]) to over 25 km (15.54 mi) (Platania et al. 2003). More recently, passive implant transponder (PIT) tags were implanted into hatchery fish to study the utilization of a fish passage structure built around the water treatment facility in Albuquerque (Archdeacon and Remshardt 2012). They found that the tagged silvery minnow moved through the facility from both upstream (19 km) and downstream (13 km) stocking locations.

Silvery minnow are thought to be omnivorous or herbivorous consuming a variety of diatoms and algae. A study of historic (1874) and more recent (1978) preserved specimens revealed a variety of diatoms as well as allochthonous organic matter present in the gut contents (Shirey 2004, Cowley et al. 2006). Magana (2009) found that larval silvery minnow showed preference for certain species of diatoms that may be based on the growth form of the diatom. A study of silvery minnow in outdoor hatchery ponds found insects were present in 66% of fish, followed by formulated feed (60%), diatoms (40%), cladocerans (36%), rotifers (35%), filamentous algae (32%), bryozoan statoblasts (19%), copepods (11%), protozoa (9%), plant material (9%), ostracods (6%), detritus (5%), and sand (4%). Among size groups, small and medium fish consumed a greater variety of foods than large fish (Watson et al. 2009).

Silvery minnow are pelagic spawners producing numerous semi-buoyant nonadhesive eggs typical of the genus *Hybognathus* (Platania and Altenbach 1998). Further hypothesis testing to determine if silvery minnow exhibit preferential use of lateral habitat (including overbank) for spawning is underway. Surveys of inundated overbank habitats often capture large numbers of gravid females (Gonzales and Hatch 2009). The specific gravity of silvery minnow eggs ranges from 1.012–1.00281 as a function of time postfertilization (Cowley et al. 2005). Egg hatching time is temperature-dependent, occurring in 24–48 hours at water temperatures of 20–30 ºC (Platania 2000). Recently hatched silvery minnow larvae are approximately 3.7 millimeters [mm] in length.

Eggs and larvae are vulnerable to downstream displacement by the current until larvae are able to actively seek out low velocity habitats, which generally occurs within 3–5 days. Many eggs incubate as they drift downstream (Dudley and Platania 2007, SWCA 2011). The distance that eggs and larvae may be displaced downstream is highly correlated with the level of discharge and habitat structure (Dudley and Platania 2007, Widmer et al. 2012). Habitat complexity is associated with discharge stage; at discharge levels that inundate the associated flood plain, there is a dramatic increase in available low velocity habitats. Retention of gellan beads was higher in the Isleta Reach than the Angostura Reach, likely due to the greater habitat complexity and flood plain connectivity at the discharge tested (Widmer et al. 2012). The proximity of spawning to the habitat also may determine how far eggs may disperse. Retention of propagules in upstream reaches is important to maintain the species within the upper portions of the range, especially in river systems that have been fragmented and where fish have reduced opportunity to move upstream.

The availability of nursery habitat appears to be determined by spring runoff with higher flows inundating terrestrial surface used as nursery areas (Porter and Massong 2004). Overbank habitats often provide low velocity, higher temperature, and high primary productivity habitats for larval fish development (Pease et al. 2006). Data indicate that most years with flow that inundates overbank habitats have much greater recruitment of larval fish into the fall population. However, flood pulse inundation may have negative implications for water quality such as decreased dissolved oxygen due to increased respiration in areas that are infrequently flooded (Valett et al. 2005). Contributions from the stagnant floodwaters into the main channel also would be expected to decrease the oxygen content within the Rio Grande downstream. For example, Abeyta and Lusk (2004) reported a fish kill due to low oxygen in a large stagnant flood plain pool after overbank flooding along the Middle Rio Grande. Therefore, the frequency of inundation also may play a role in creating the type and quality of habitats for larval fish development.

4.1.5 Reasons for Decline

The silvery minnow was historically one of the most abundant and widespread fishes in the Rio Grande Basin including the Pecos River. Similar to many fish species in the western portions of North America, silvery minnow likely started to decline concurrent with human encroachment and development along the Rio Grande and its tributaries. Though small scale water development was present in the drainage for more than 500 years, major water development projects and flow modifications began in the late 1800s in the San Luis Valley and in 1913 with the completion of Elephant Butte Reservoir (Service 2003). By 1993, when the silvery minnow was proposed for listing, there were upwards of 20 large dams and irrigation structures along the Rio Grande and its major tributaries (Pecos, Rio Chama, and Jemez River). Additionally, demands for water increased greatly in the 20th century.

Trevino-Robinson (1959) documented the early 1950s "cosmopolitan" occurrence of silvery minnow in the Rio Grande downstream from its confluence with the Pecos River. Due to the extended drought, they noted a portion of the lower Rio Grande went dry in 1953. It is unknown how much drying occurred after this event. Extended drying also was documented between El Paso and the Rio Conchos (Chernoff et al. 1982). Increased agricultural and municipal water demands have increased the magnitude and duration of low flow conditions. In addition to low water conditions, poor water quality conditions were noted in the lower portions of the Rio Grande, including increased salinity and the presence of agricultural chemicals in fish tissues (White et al. 1983, Andreason 1985). Silvery minnow have not been documented below Elephant Butte Dam on the Rio Grande since the mid-1950s (Hubbs et al. 1977, Sublette et al. 1990, Edwards and Contreras-Balderas 1991). Prior to the recent stocking in Big Bend National Park, silvery minnow had not been documented from this lower portion of the Rio Grande since the mid-1950s (Edwards and Contreras-Balderas 1991). Silvery minnow were last sampled above Cochiti Dam near Velarde 5 years after the closing of Cochiti Dam in 1973 (Bestgen and Platania 1991).

Hybridization and/or competition with nonnative congener species operated to displace the silvery minnow from its formerly occupied range in the Pecos River.

The silvery minnow was displaced in the Pecos River of New Mexico by its congener *H. placitus* (plains minnow) that was probably introduced during 1968 into the Pecos drainage from the Canadian drainage (Cowley 1979). The displacement that ensued was complete in less than one decade (Hoagstom et al. 2010). Initial studies to investigate hybridization of plains minnow and silvery minnow did not produce viable offspring (Caldwell 2003), but the results were not conclusive for whether the species could produce viable offspring or not. The study did demonstrate that, under hatchery conditions, the species would mate with each other. Further research is warranted to determine if some type of competitive reproductive interference may have occurred. Heterospecific matings and hybridization are types of reproductive interference that can lead to fitness losses for species due to wasted reproductive effort and in viable offspring (Groning and Hochkirch 2008).

Predation and competition with other fish species has also been cited as a factor possibility contributing to the decline of the species (Service 1999, Service 2003). A wide range of fish species are native to the Rio Grande and Pecos Rivers and coevolved with silvery minnow. Accidental or intentional releases of fishes outside of their native ranges, have established numerous exotic fish species in the Rio Grande Basin (Sublette et al. 1990) representing potential competitors or predators with the silvery minnow outside of those that silvery minnow evolved with. Lotic conditions, created by dams and diversions, often favor large predatory species such as bass. Avian predation is also a factor especially during periods of low or no flow. Very few studies have been conducted to determine the effect of predation or interspecific competition on silvery minnow by the various species that now exist within the Rio Grande.

The entrainment of silvery minnow (primarily eggs and larvae) in the infrastructure of irrigation systems that derive water directly from the Rio Grande has been cited as a factor contributing to the decline silvery minnow (Service 1999). Egg entrainment in irrigation canals has been monitored since 2001. Low numbers of eggs have been found in the sampling. Management strategies at the diversions have likely minimized the number of eggs that are currently entrained. Low densities of silvery minnow likely persist within the permanently watered channels such as the low flow conveyance channel and MRGCD drains (Cowley et al. 2007, Lang and Altenbach 1994, Reclamation Data 2010). These channels may provide some refuge for silvery minnow during extreme dry periods though it is unlikely that they can complete their life cycle within canals due to very limited habitat and high numbers of nonnative predators.

Historically, river engineering projects to manage geomorphic processes have variable effects on silvery minnow habitat quality and area depending on how they are implemented. Traditional river engineering activities within the Rio Grande in combination with regulated flows have confined the Rio Grande to a narrower channel and reduced the connectivity with overbank habitat to reduce depletions of water. Upstream reservoirs also stop sediment transport that often results in channel incision further reducing flood plain connectivity. Contemporary river engineering projects incorporate features (point bars, side channels, islands) that decrease the impacts to, or increase, silvery minnow habitat.

The original listing of the species as endangered (58 FR 11823) cited the presence of mainstream dams; growth of agriculture and cities in the Rio Grande Valley; overutilization for commercial, recreational, scientific, or educational purposes; disease or predation, particularly during periods of low or no flow; inadequacy of existing regulatory mechanisms including the lack of recognition that instream flows are a beneficial use of State waters; dewatering of a large percentage of its habitat, including dewatering downstream from San Acacia. In the revised recovery plan, the Service (2010) reassessed the pressures or threats to the species that can threaten its continued existence in the MRG. These are dewatering and water diversion, water impoundment, river modification, water pollutants, disease, predation and competition, and loss of genetic diversity.

4.2 Southwestern Willow Flycatcher

4.2.1 Species Description

The southwestern willow flycatcher (*Empidonax traillii extimus*) is a small passerine bird, approximately 15 cm (5.75 inches) in length. Phillips (1948) described the Southwestern subspecies as *E. t. extimus*. The flycatcher is one of four subspecies of the willow flycatcher currently recognized (Hubbard 1987, Unitt 1987), though Browning (1993) suggests a possible fifth subspecies (*E. t. campestris*) in the Central and Midwestern United States. The willow flycatcher subspecies are distinguished primarily by subtle differences in color and morphology and by habitat use. Recent research (Paxton 2000) concluded that *E. t. extimus* is genetically distinct from the other willow flycatcher subspecies.

4.2.2 Distribution

The species occurs in southern California, Arizona, New Mexico, southern portions of Nevada and Utah, and possibly southwestern Colorado (50 CFR 10693). No reporting from standardized surveys has been received from the state of Texas (Durst et al. 2008). In 2007, the population along the Gila River drainage was the largest with 30.1% of all territories rangewide followed by the population along the Rio Grande drainage with 23.3% (Durst et al. 2008).

In New Mexico, the flycatcher has been observed in the Rio Grande, Rio Chama, Zuni, San Francisco, Pecos, Canadian, and Gila River drainages. Flycatchers were first reported at Elephant Butte State Park in the 1970s, although the exact locations of the sightings were not documented (Hubbard 1987). Because surveys were not consistent or extensive prior to the listing of this species, a comparison of historic numbers to current status is not possible; however, the available native riparian habitat overall along the Rio Grande has declined, and it is assumed populations may have declined from historic numbers as well.

A standardized survey protocol and consistent reporting system have been followed since 1994 using guidelines provided by the Service. The fundamental principles of the standardized methodology for presence/absence surveys have remained the same since the original protocol development and have proven to be an effective tool for locating flycatchers rangewide (Sogge et al. 2010).

In the MRG, surveys for flycatchers in selected areas occurred because of environmental compliance activities for various projects. Although a systematic survey effort throughout the entire riparian corridor of the MRG has not occurred, reaches of the river with the most suitable habitat for flycatchers have been surveyed. Presence/absence surveys and nest monitoring along selected areas of the Rio Grande have been conducted from 1993–2011. With expanded or increased survey efforts during this 18-year period, several sites have been located where flycatcher territories have consistently been established. Once located, most of these core breeding areas have been monitored annually.

Since the initial surveys of the Rio Grande Valley in the 1990s, breeding pairs have been found within the MRG Project area from Elephant Butte Reservoir upstream to the vicinity of Taos. Several locations along the Rio Grande have consistently held breeding flycatchers. These areas have one or more flycatcher pairs that have established a territory in an attempt to breed, with most birds returning annually. In some locations, these local populations appear to be expanding with an increased number of territories being detected. Some local populations have remained small (10–15 territories, or fewer) but stable; other sites have been abandoned and no longer contain territorial flycatchers.

Five general locations of flycatcher populations have been established throughout the MRG (figure 5). These areas consistently have held several territories; however, the number of territories, pairs, nest attempts and successful nests has varied through the years.

4.2.3 Listing Status and Critical Habitat

A final rule was published in the February 27, 1995, Federal Register to list the Southwestern United States population of the flycatcher as an endangered species under the ESA with proposed critical habitat. However, the final rule of July 22, 1997, designating critical habitat in for the species rangewide did not include the Rio Grande (62 CFR 39129). A proposal to re-designate critical habitat was published October 12, 2004, (69 CFR 60706), with a final designation published October 19, 2005, (70 CFR 60886).

Figure 5. Five general locations of flycatcher populations within the MRG.

The 2005 final designation of critical habitat defines two units located along the Rio Grande: the Upper Rio Grande Management Unit that includes 664 hectares (ha) (1,640 acres), encompassing 66 km (41 miles), and the Middle Rio Grande Management Unit designates 13,410 ha (33,137 acres) along 135 km (84 miles).

The segments mentioned above are characterized as follows (figure 6):

Upper Rio Grande Management Unit:

- The Upper Rio Grande New Mexico Segment is considered the area from the Taos Junction Bridge to the upstream boundary of Ohkay Owingeh Pueblo.

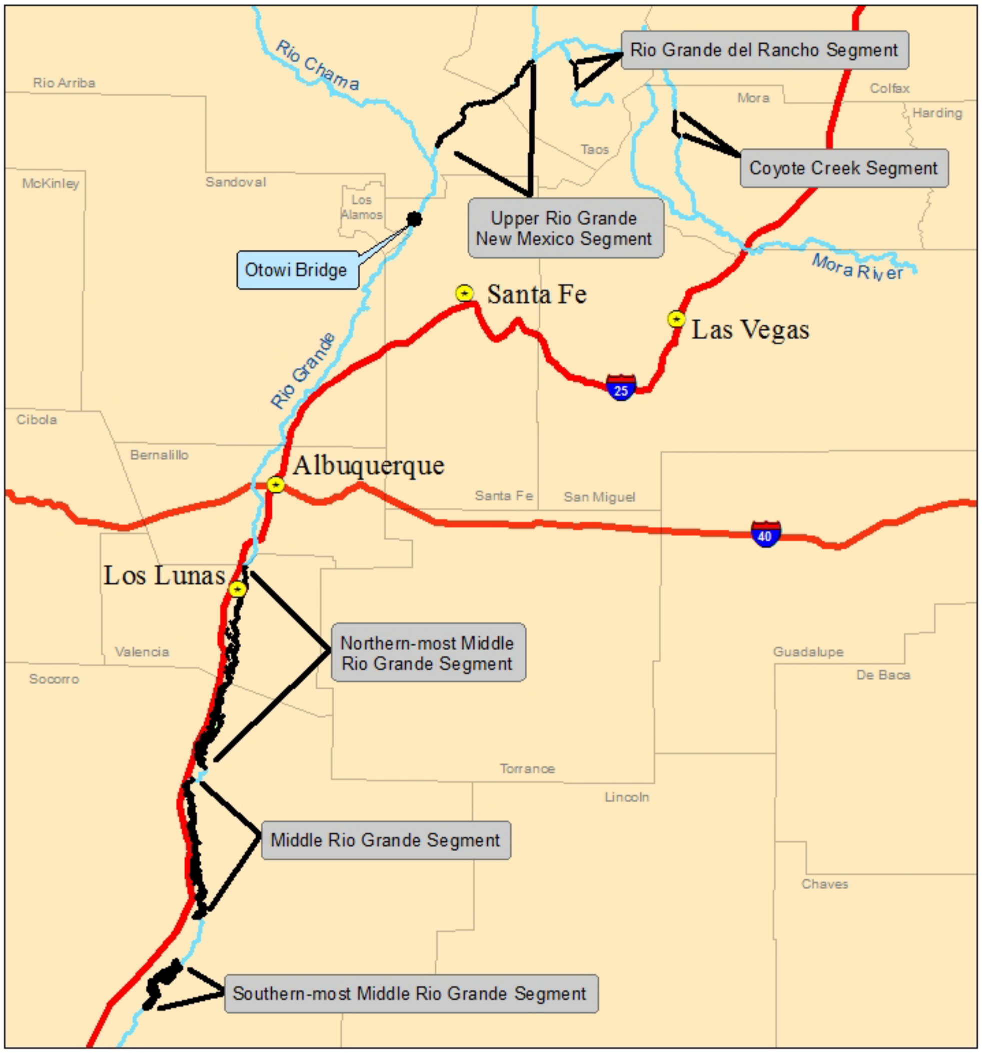

Figure 6. 2005 final critical habitat designations

- The Rio Grande del Rancho Segment is considered the area from Sarco Canyon downstream to the Arroyo Mirando confluence.

- The Coyote Creek Segment is considered the area from 2 km (1.2 miles) above Coyote Creek State Park to the second bridge on State Route 518.

Middle Rio Grande Management Unit:

- The northern-most Middle Rio Grande Segment is considered the area from the southern boundary of the Isleta Pueblo to the northern boundary of the Sevilleta National Wildlife Refuge (NWR).

- The central Middle Rio Grande Segment is considered the area from the southern boundary of the Sevilleta NWR to the northern boundary of the BDANWR.

- The southern-most Middle Rio Grande Segment is considered the area from the southern boundary of the BDANWR to the overhead power line near Milligan Gulch at the northern end of Elephant Butte Reservoir (approximately river mile 62).

The Service released a new proposal for critical habitat in August 2011 (76 CFR 50542). Along the Rio Grande in New Mexico (and within our project boundaries), the proposed revision would include all areas historically listed as critical habitat with the addition of:

- The Rio Fernando area (.25 mi) in the Upper Rio Grande Management Unit (just upstream of the Rio Lucero confluence) near Taos and an extended area from the north boundary of Ohkay Owingeh Pueblo downstream to Otowi Bridge.

- An extended area within the Middle Rio Grande Unit. With the new proposed rule, the southern boundary of the Middle Rio Grande Unit would extend farther south into Elephant Butte Reservoir to approximately just south of river mile 36 (or about 9 river miles north of the dam). The previously designated habitat within this Unit also excluded the BDANWR and the Sevilleta NWR because they have specific flycatcher management plans that outline actions they undertake to benefit the species. Both refuges are proposed for critical habitat designation at this time.

Several areas within the Upper and Middle Rio Grande Units will be considered for exclusion from the final designation of flycatcher critical habitat under section 4(b)(2) of the ESA. Those areas include:

- Tribal lands within the San Ildefonso Pueblo, the Santa Clara Pueblo, and the Ohkay Owingeh Pueblo. These will be considered for exclusion due to their tribal management plans and partnerships.

- The water storage area of Elephant Butte Reservoir. This area will be considered due to the development of plans for the operation of the reservoir as well as a flycatcher management plan. This area also is being considered for exclusion based on initial evaluation of potential impacts of water operations of the dam and reservoir.

In both the final 2005 critical habitat designation (70 CFR 60886) as well as the newly proposed critical habitat designation in 2011 (76 CFR 50542), the Service identified two PCEs that were recognized as the physical or biological features essential to the conservation of the flycatcher. Those PCEs are as follows:

PCE 1—Riparian Vegetation

Riparian habitat in a dynamic river or lakeside, natural or manmade successional environment (for nesting, foraging, migration, dispersal, and shelter) that is comprised of trees and shrubs (that can include Gooddings willow, coyote willow, Geyers willow, arroyo willow, red willow, yewleaf willow, Pacific willow, boxelder, tamarisk, Russian olive, buttonbush, cottonwood, stinging nettle, alder, velvet ash, poison hemlock, blackberry, seep willow, oak, rose, sycamore, false indigo, Pacific poison ivy, grape, Virginia creeper, Siberian elm, and walnut) and some combination of:

a. Dense riparian vegetation with thickets of trees and shrubs that can range in height from about 2–30 m (about 6–98 ft). Lower-stature thickets (2–4 m or 6–13 ft tall) are found at higher elevation riparian forests, and tall-stature thickets are found at middle and lower-elevation riparian forests,

b. Areas of dense riparian foliage at least from the ground level up to approximately 4 m (13 ft) above ground or dense foliage only at the shrub or tree level as a low, dense canopy.

c. Sites for nesting that contain a dense (about 50–100%) tree or shrub (or both) canopy (the amount of cover provided by tree and shrub branches measured from the ground).

d. Dense patches of riparian forests that are interspersed with small openings of open water or marsh or areas with shorter and sparser vegetation that creates a variety of habitat that is not uniformly dense. Patch size may be as small as 0.1 ha (0.25 acre) or as large as 70 ha (175 acre).

PCE 2—Insect Prey Populations

A variety of insect prey populations found within or adjacent to riparian flood plains or moist environments, which can include: flying ants, wasps, and bees (Hymenoptera); dragonflies (Odonata); flies (Diptera); true bugs (Hemiptera); beetles (Coleoptera); butterflies, moths, and caterpillars (Lepidoptera); and spittlebugs (Homoptera).

4.2.4 Life History and Ecology

Flycatchers are neotropical migrant birds that overwinter in such places as southern Mexico, Central America, and likely South America for about 8 months before migrating back to the Southwestern United States (76 CFR 50542). Unfortunately, little is known about the ecology and distribution of flycatcher populations during migration. However, it appears flycatchers use a wide range of habitat types in their wintering grounds (Schuetz et al. 2007). In general, winter habitat is a combination of four main habitat components including standing or slow moving water and/or saturated soils, patches or stringers of trees, woody shrubs, and open areas (Schuetz et al. 2007, Koronkiewicz and Sogge 2000). The main body of knowledge of flycatchers surrounds breeding and nesting success in its summer range.

Flycatcher breeding chronology is presented in figure 7 and falls within the generalized breeding chronology expected of Southwestern willow flycatchers (based on Unitt 1987, Brown 1988, Whitfield 1990, Skaggs 1996, Sogge 1995, Maynard 1995, Sferra et al. 1997, Sogge et al. 2010, Service 2002).

Each stage of the breeding cycle represents a greater energy investment in the nesting effort by the flycatcher pair and may influence their fidelity to the nest site or their susceptibility to abandon if the conditions in the selected breeding habitat become adverse.

Extreme dates for any given stage of the breeding cycle may vary as much as a week from the dates presented. Egg laying begins as early as late-May but more often starts in early- to mid-June. Chicks can be present in nests from mid-June through early-August. Young typically fledge from nests from late-June through mid-August but remain in the natal area 14–15 days. Adults depart from breeding territories as early as mid-August but may stay until mid-September in later nesting efforts. Fledglings likely leave the breeding areas 1-2 weeks after adults. Most flycatchers only live 1 or 2 years as adults, but there have been rare occurrences of flycatchers living at least 9 years (Paxton et al. 2007).

The flycatcher is an obligate riparian species occurring in habitats adjacent to rivers, streams or other wetlands characterized by dense growths of willows (*Salix* sp.), seepwillow (*Baccharis* sp.), arrowweed (*Pluchea* sp.), saltcedar (*Tamarix* sp.), or other species (50 CFR 10693). Species composition, however, appears less important than plant and twig structure (Moore and Ahlers 2011). Slender stems and twigs are important for nest attachment. Nest placement is highly variable as nests have been observed at heights ranging from 0.6–20 m and generally occur adjacent to or over water (Sogge et al. 2010). Along the MRG, breeding territories have been found in young and mid-age riparian vegetation dominated by dense growths of willows at least 15 feet high, as well as in mixed native and exotic stands dominated by Russian olive and saltcedar (Moore and Ahlers 2009).

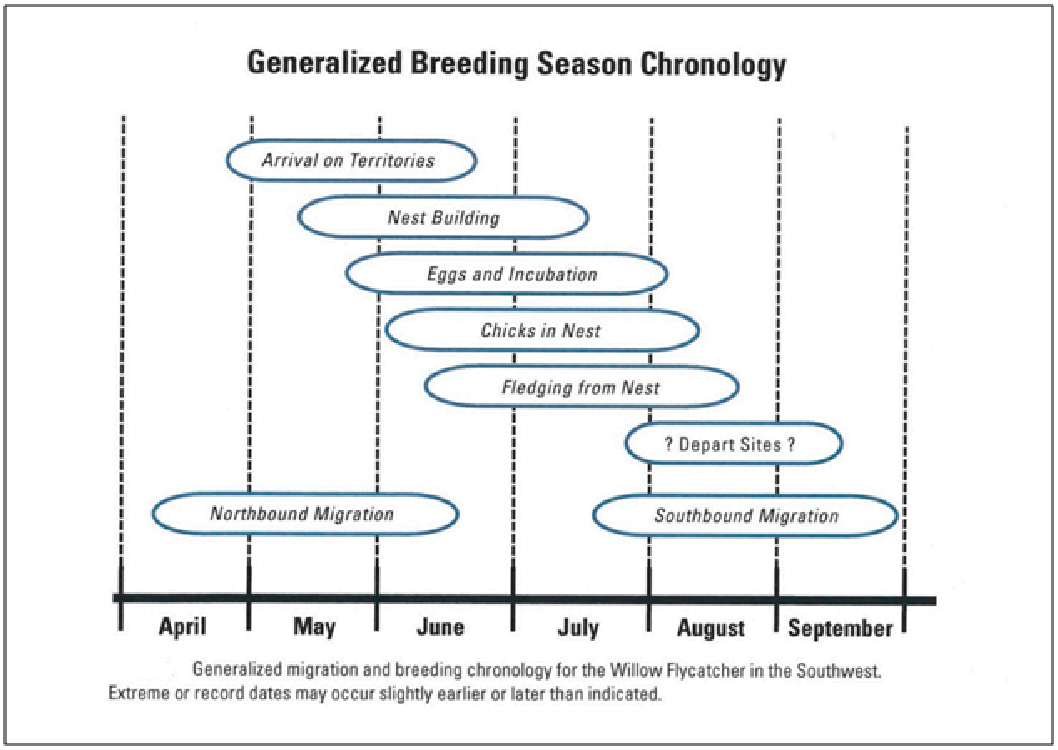

Figure 7. Generalized breeding chronology of the Southwestern willow flycatcher (from Sogge et al. 2010).

A majority of the birds within the MRG select habitat patches dominated by native species, usually dense willows, for nesting. Within these willow patches, nests have been found on individual saltcedar plants, especially in older, taller willow patches where an understory of saltcedar provides suitable nesting substrate. It appears that the tree species with the vertical structure of more slender stems and twigs on younger plants in the understory vegetation is selected for nest placement (Moore and Ahlers 2011). Most recently, nests located at the Sevilleta NWR and La Joya State Wildlife Management Area have been established in areas adjacent to the river dominated by saltcedar and Russian olive; however, the overall vegetation type of most of the flycatcher territories established in the MRG is dominated by native species and not saltcedar (Moore and Ahlers 2011).

A critical component for suitable nesting conditions is the presence of water, usually provided by overbank flooding or some other hydrologic source. Reclamation has found that 97% of all flycatcher nests in the Reclamation-surveyed areas of the MRG from 2004–2010 (n=1,429), occur within 100 m of surface water, and 94% occur within 50 m (Moore and Ahlers 2011). The presence of surface water at the onset of nest site selection and nest initiation is likely critical, though not absolutely necessary. For example and particularly observed in reservoir sites, a flycatcher territory may have vegetation completely immersed in water during a wet year or thoroughly dry and hundreds of meters away from surface water in drought years (76 CFR 50542).

Flycatchers and many other species of neotropical migrant land birds also use the Rio Grande riparian corridor as stopover habitat during migration. Studies have shown that, during the spring and fall migration, flycatchers are more commonly found in willow habitats than in other riparian vegetation types, including the narrow band of coyote willows that line the LFCC above the BDANWR (Finch and Yong 1997). During presence/absence surveys in May and early June, migrating flycatchers are frequently observed throughout the project area. These birds use a variety of vegetation types during migration, many of which are classified as “low suitability” for breeding habitat (Ahlers and White 1997).

Evidence gathered during multiyear studies of color-banded flycatcher populations show that, although most male flycatchers return to former breeding areas, flycatchers regularly move among sites within and between years (Ellis et al. 2008). Between 1997 and 2005, of the 1,012 relocated banded flycatchers rangewide, 595 (59%) banded flycatchers in Arizona returned to the breeding site of the previous year, while 398 (39%) moved to other breeding areas within the same major drainage; and 19 (2%) moved to a completely different drainage (Paxton et al. 2007). Overall distance moved among adults and returning nestlings ranged from 0.03–444 km with mean distance moved by adults (9.5 km) much less than the mean fledgling dispersal distance (20.5 km) (Paxton et al. 2007). Although most returning flycatchers showed site fidelity to breeding territories, a significant number move within and among sites. Movement patterns are strongly influenced by reproductive success. The age class of habitat patches also may be of consideration (Paxton et al. 2007).

Flycatcher prey base is relatively understudied, but it does appear that flycatcher food availability may be largely influenced by density and species of vegetation, proximity to and type of water, saturated soils, and temperature and humidity (76 CFR 50542). The flycatcher is an insect generalist and can feed on a variety of different prey. Prey includes, but is not limited to, wasps and bees (Hymenoptera), flies (Diptera), beetles (Coleoptera), butterflies, moths and caterpillars (Lepidoptera), and spittlebugs (Homoptera) (76 CFR 50542). In a comparison between native, exotic, or mixed habitat types, it appears that the arthropod community is statistically indistinguishable among habitats (Durst 2004). The difference in relative quality among the habitat types also was indistinguishable (Durst 2004). In the same study and between years (drier in 2002 versus wetter year in 2003), prey base was believed to be driven by differences in relative insect abundances (2003 yielded a five-fold increase in total arthropod biomass). In the drier year with less relative humidity, greater distance to water, and less food availability, flycatcher nest success in this area of the study decreased substantially (Smith et al. 2003).

4.2.5 Reasons for Decline

During the last two centuries, human-induced hydrological and ecological changes have heavily influenced the composition and extent of flood plain riparian vegetation along the MRG (Bullard and Wells 1992, Dick-Peddie 1993). Introduction of exotic species, such as saltcedar, has decreased the availability of dense willow and associated desirable vegetation and habitat important to flycatchers. The destruction and fragmentation of forested breeding habitat also may play a role in population reduction of migratory birds (Lynch and Whigham 1984, Wilcove 1988). In addition, the rapid rate of deforestation in tropical areas has been cited as a possible reason for population declines in forest-dwelling migrant land birds (Lovejoy 1983, Rappole and McDonald 1994, Robbins et al. 1989).

Brood parasitism by brown-headed cowbirds (*Molothrus ater*)(cowbird), has been implicated in the decline of songbirds, including those found in the Western riparian habitats (Gaines 1974, 1977, Goldwasser et al. 1980, Laymon 1987). Cowbirds have increased their range with the clearing of forests and the spread of intensive grazing and agriculture. Flycatchers are more susceptible to cowbird nest parasitism because of the ease of egg laying in the flycatcher's open cup nest design. Habitat fragmentation and forest openings allow cowbirds easy access to host nests located near these edges. Nest parasitism, combined with declining populations and habitat loss, has placed this species in a precarious situation (Mayfield 1977, Rothstein et al. 1980, Brittingham and Temple 1983, Laymon 1987). Grazing cattle often are associated with cowbird activity; however, in a recent report (Broadhead et al. 2007), parasitism by cowbirds was more closely associated with habitat types, particularly vegetation, patch size and edge effect.

4.3 Pecos Sunflower

4.3.1 Species Description

Pecos sunflower is an annual, herbaceous plant. It grows 1–3 m (3.3–9.9 ft) tall and is branched at the top. The leaves are opposite on the lower part of the stem and alternate at the top, lance-shaped with three prominent veins, and up to 17.5 cm (6.9 inches) long by 8.5 cm (3.3 inches) wide. The stem and leaf surfaces have a few short, stiff hairs. Flower heads are 5-7 cm (2.0–2.8 inches) in diameter with bright yellow rays around a dark purplish brown center (the disc flowers). Pecos sunflower looks much like the common sunflower (*Helianthus annuus*) seen along roadsides throughout the West but differs from the common sunflower by having narrower leaves, fewer hairs on the stems and leaves, smaller flower heads, and narrower bracts (phyllaries) around the bases of the heads. The prairie sunflower (*Helianthus petiolaris*) also has narrow leaves and phyllaries, but is distinguished from Pecos sunflower by having white cilia in the dark center of the flower head and a branching pattern from the base of the plant that imparts a bushy appearance. Common sunflower and prairie sunflower usually bloom earlier in the season (May–August depending on location) than Pecos sunflower (September and October), and neither occupies the wet, saline soils that are typical of Pecos sunflower habitats. Pecos sunflower has a highly disjunctive distribution, yet there appears to be very little phenotypic variation between populations.

4.3.2 Status and Distribution

Pecos sunflower was known only from a single population near Fort Stockton, Pecos County, Texas, when it was proposed as a candidate for listing as endangered under the ESA on December 15, 1980 (45 FR 82480). Subsequent field surveys for this plant found additional populations in New Mexico and Texas on a variety of State and Federal lands and several private land holdings. The species faces a moderate degree of threat. The plant is associated with spring seeps and desert wet meadows (cienegas) habitats, which are very rare in the dry regions of New Mexico and Texas. Little is known about the historic distribution of the Pecos sunflower, but there is evidence these habitats have historically, and are presently, being reduced or eliminated by aquifer depletion or severely impacted by agricultural activities and encroachment by alien plants (Poole 1992, Sivinski 1996).

Pecos sunflower is presently known from only seven populations—two in west Texas and five in New Mexico (figure 8). The type of locality (location from which the species was first described) is near Fort Stockton in Pecos County, Texas. Near Fort Stockton, a large population with several hundred thousand plants currently exists at The Nature Conservancy's (TNC) Diamond Y Spring Preserve, with a smaller group of plants downstream at a nearby highway right-of-way. A second Texas population occurs at Sandia Spring Preserve (TNC) in the Balmorhea area of Reeves County, Texas.

Most Pecos sunflower habitats are limited to less than 2 hectares (5 acres) of wetland. Some are only a small fraction of a hectare; however, one near Fort Stockton and another near Roswell are more extensive. The number of sunflowers per site varies from less than 100 to several hundred thousand. Because Pecos sunflower is an annual, the number of plants per site can fluctuate greatly from year to year with changes in precipitation and depth to ground water. Stands of Pecos sunflower can change location within the habitat as well (Sivinski 1992). If a wetland habitat dries out permanently, even a large population of Pecos sunflower would disappear (Service 2005).

Figure 8. Distribution of Pecos sunflower.

In New Mexico, the five Pecos sunflower populations are located in the Roswell/Dexter region, Santa Rosa, two locations in the Rio San Jose Valley, and on the MRG. In the Roswell/Dexter region of the Pecos River valley in Chaves County, Pecos sunflower occurs at 11 spring seeps and cienegas. Three of these wetlands support many thousands of Pecos sunflowers, but the remainder are smaller, isolated occurrences. Springs and cienegas within and near the town of Santa Rosa in Guadalupe County have eight wetlands with Pecos sunflower—one of which consists of a few hundred thousand plants in good years. Two widely separated areas of spring seeps and cienegas in the Rio San Jose valley of western New Mexico each support a population of Pecos sunflower. One occurs on the lower Rio San Jose in Valencia County and the other is in Cibola County in the vicinity of Grants. Neither are especially large populations. Another larger population on the Rio Grande at La Joya Waterfowl Management Area in Socorro County occurs near the confluence of the Rio Puerco, which has the Rio San Jose as a tributary stream. This large population is managed by the New Mexico Department of Game and Fish (NMDGF) and is the only population within the MRG water management action area.

Additionally in 2008, a cooperative effort established a reintroduced population on private property in Socorro County. This population has expanded its range in the short time since establishment, but no population estimates are available. Additionally this population currently has not been proposed as critical habitat.

4.3.3 Listing Status and Critical Habitat

Pecos sunflower (*Helianthus paradoxus* Heiser) was listed as a threatened species by the Service on October 20, 1999 (64 FR 56582-56590). Critical habitat for the species was designated effective May 8, 2008 (73 FR 17762-17807), with PCEs for the species identified as desert wetland or riparian habitat components that provide:

1. Silty clay or fine sand soils that contain high organic content, are saline or alkaline, are permanently saturated within the root zone (top 50 cm of the soil profile), and have salinity levels ranging from 10 to 40 parts per thousand.
2. Low proportion (less than 10%) of woody shrub or canopy cover directly around the plant.

The State of New Mexico lists Pecos sunflower as endangered under the regulations of the New Mexico Endangered Plant Species Act (19 New Mexico Administrated Code 21.2). This species is also listed as threatened by the State of Texas (31 Texas Administrative Code 2.69(A)).

The population of Pecos sunflower on the Rio Grande (Valencia County, La Joya Waterfowl Management Area) contains all of the PCEs in the appropriate spatial arrangement and quantity, and is threatened by encroachment of nonnative vegetation. The site was determined to be essential to the conservation of the species because it is occupied by a very large (estimated between 100,000 and 1,000,000 individuals) stable population and is sufficiently distant (over 40 mi (64 km)) from other populations to serve as an additional locality that contributes to the conservation of genetic variation (Service 2005). This population was excluded from critical habitat designation because the NMDGF (2008) has developed a habitat management plan for the Pecos sunflower. The management plan was developed to support conservation of the species on the La Joya WMA by: controlling invasive species, protecting the natural spring in Unit 5 from motorized vehicles and heavy equipment, monitoring core populations by digitizing these areas annually, and restoring native habitat through revegetation. The Service concluded that the plan was complete and provided for the conservation and protection of the physical and biological features essential to the conservation of the species (73 FR 17762-17807).

4.3.4 Life History and Ecology

Pecos sunflower grows in areas with permanently saturated soils in the root zone. These are most commonly desert springs and seeps that form wet meadows called cienegas. These are rare wetland habitats in the arid Southwest region (Hendrickson and Minckley 1984). This sunflower also can occur around the margins of lakes, impoundments, and creeks. When Pecos sunflowers grow around lakes or ponds, these are usually impoundments or subsidence areas within natural cienega habitats. The soils of these desert wetlands are typically saline or alkaline because the waters are high in dissolved solids, and high rates of evaporation leave deposits of salts, including carbonates, at the soil surface. Soils in these habitats are predominantly silty clays or fine sands with high organic matter content. Studies by Van Auken and Bush (1995) and Van Auken (2001) showed that Pecos sunflower grows in saline soils, but seeds germinate and establish best when precipitation and high water tables reduce salinity near the soil's surface. Like all sunflowers, this species requires open areas that are not shaded by taller vegetation.

Plants commonly associated with Pecos sunflower include *Distichlis spicata* (saltgrass), *Sporobolus airoides* (alkali sacaton), *Phragmites australis* (common reed), *Schoenoplectus americanus* (chairmaker's bulrush), *Juncus balticus* (Baltic rush), *Muhlenbergia asperifolia* (alkali muhly), *Limonium limbatum* (southwestern sea lavender), *Flaveria chloraefolia* (clasping yellowtops), *Cirsium wrightii* (Wright's marsh thistle), *Tamarix* sp. (saltcedar), and *Elaeagnus angustifolia* (Russian olive) (Poole 1992, Sivinski 1996). All of these species are indicators of wet, saline, or alkaline soils. Pecos sunflowers often occur with saltgrass between the saturated soils occupied by bulrush and the relatively drier soils with alkali sacaton (Van Auken and Bush 1998).

4.3.5 Reasons for Decline

Spring seeps or cienega habitats are very rare in the dry regions of New Mexico and Texas. There is evidence that these habitats have historically, and are presently, being reduced or eliminated by aquifer depletion or severely impacted by agricultural activities and encroachment by alien plants (Poole 1992, Sivinski 1996). The Southwestern United States is currently experiencing a period of prolonged drought that is exacerbating this habitat degradation. The trend of decreasing habitat availability and suitability justified listing Pecos sunflower as a threatened species. Recovery actions to reverse or stabilize this trend and ensure the long-term sustainability of this species include identifying the ecological parameters of Pecos sunflower habitat and enlisting the cooperation of the various habitat owners in the long-term conservation of the species (Service 2005).

4.4 Interior Least Tern

4.4.1 Status and Distribution

The interior least tern (*Sternula antillarum athalassos*, tern) was listed as endangered by the Service in 1985 (50 CFR 21784). This subspecies historically bred along the Colorado (in Texas), Red, Rio Grande (in Texas), Arkansas, Missouri, Ohio, and Mississippi River systems and has been found on braided rivers of southwestern Kansas, northwestern Oklahoma, and southeastern New Mexico (American Ornithologists' Union 1957). In New Mexico, the tern was first recorded (including nesting) at Bitter Lake NWR in 1949; and since then, it remained present essentially annually (Marlatt 1984, NMDFG 2008). The species also occurs as an occasional breeder in Eddy County, New Mexico (Moore 2011). The tern has been observed as a 'vagrant' or 'highly unusual' species among the 377 avian species detected on the BDANWR since 1940 (Service 1995). In 2005, a rangewide survey of terns was completed, and the Rio Grande/Pecos River systems collectively made up 0.8% of the population (Lott 2006). Historically, tern nesting has been confirmed on six reservoirs along the Rio Grande/Pecos reach at Bitter Lake NWR, Brantley Lake, and Imperial Reservoir on the Pecos; and Lake Casa Blanca, Amistad Reservoir, and Falcon Reservoir on the Rio Grande in Texas (Lott 2006) (figure 9).

4.4.2 Life History and Ecology

Breeding habitat requirements for this species include the presence of bare or nearly bare ground on alluvial islands, shorelines, or sandbars for nesting, the availability of food (primarily small fish), and the existence of favorable water levels during the nesting season so nests remain above water (Ducey 1981). Breeding colonies contain from 5–75 nests. Although most nesting occurs along river banks and reservoirs, the tern also nests on barren flats of saline lakes and ponds. Nests are constructed by scraping a depression within the sand.

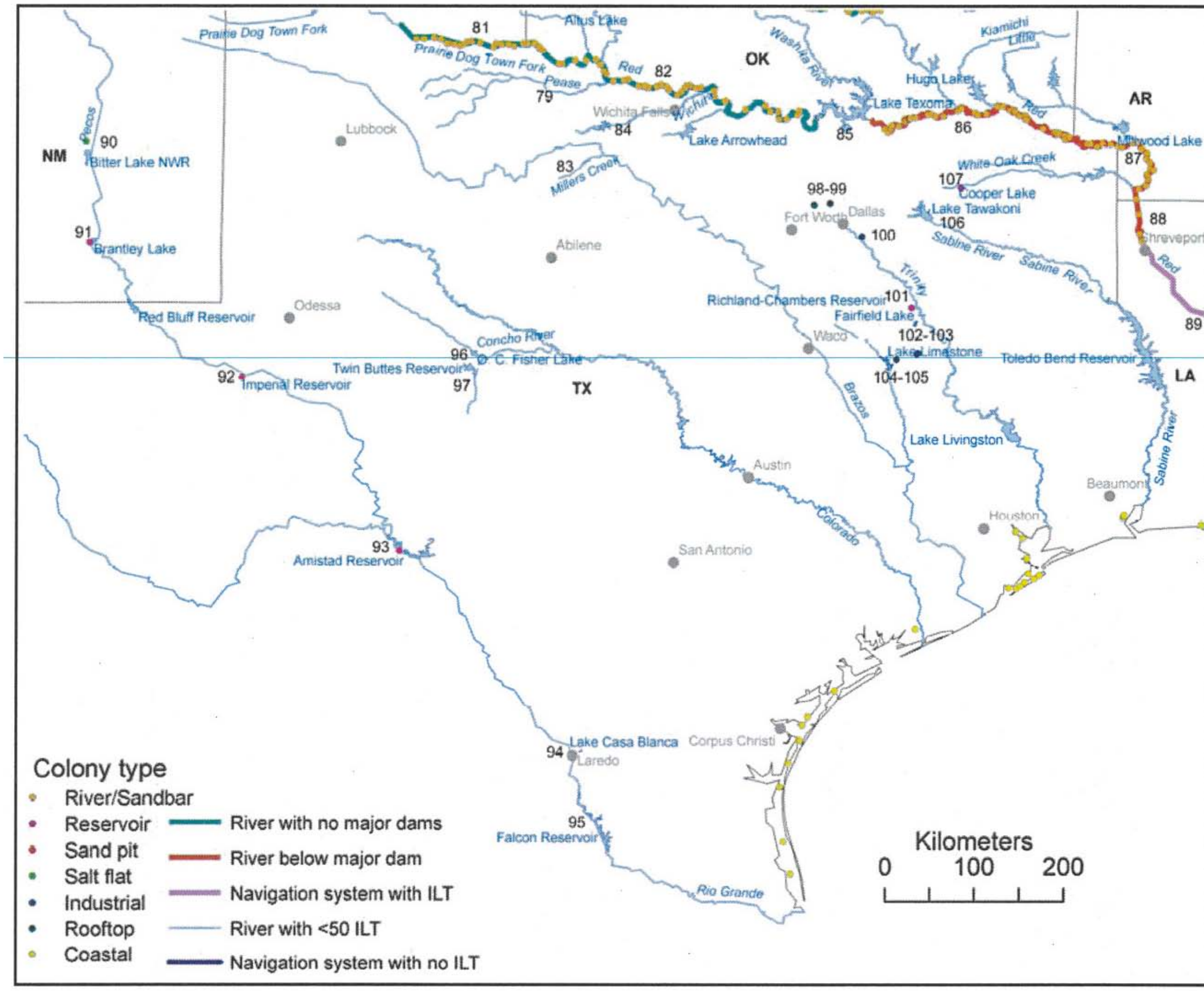

Figure 9. Distribution of the 2005 tern (ILT in figure) breeding colonies within New Mexico and Texas (Lott 2006).

Eggs are typically a pale to olive beige color and specked with chocolate marks, blending in with the sand or mudflat habitat. Little is known about the wintering areas occupied by the tern, but it is believed that they can be found along the Central American coast and the northern coast of South America from Venezuela to northeastern Brazil (Service 1990).

4.4.3 Reasons for Decline

Loss of nesting areas through permanent inundation or destruction by reservoir and channelization projects was identified as the major threat to the species (Service 1995). Alteration of natural river or lake dynamics has caused unfavorable vegetation succession on many remaining islands, curtailing their use as nesting sites by terns. Recreational use of sandbars, releases of water from upstream reservoirs, and annual spring floods often inundate nests.