Interior Least Tern
(*Sternula antillarum*)

5-Year Review:
Summary and Evaluation

Photo courtesy of Bill Stripling

U.S. Fish and Wildlife Service
Southeast Region
Mississippi Field Office
Jackson, Mississippi

5-YEAR REVIEW

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Interior least tern (*Sternula antillarum*)

1. GENERAL INFORMATION

1.1. Methodology used to complete the review:

The U.S. Fish and Wildlife Service (Service) conducts status reviews of species on the List of Endangered and Threatened Wildlife and Plants (50 CFR 17.11 and 17.12) as required by section 4(c)(2)(A) of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 *et seq*.). The Service provided notice of this status review in the *Federal Register* (73 FR 21643) on April 22, 2008. In the notice, we requested new scientific or commercial data and information regarding the Interior least tern (*Sternula antillarum*) and its status.

Information contained herein is derived from published reports in peer-reviewed literature, printed and draft gray literature (e.g., various state reports, Federal grant reports, theses and dissertations by graduate students), and data received through personal communications involving electronic mail from various individuals representing non-governmental organization, universities, and State and Federal agencies involved in Interior least tern monitoring, research and/or management. Presentations and summaries derived from a Workshop on Research and Monitoring for the Interior Population of least terns, held in Alton, Illinois, April 4-5, 2012, by the U.S. Army Engineer Research and Development Center, Environmental Laboratory, and sponsored by the U.S. Army Engineer District, Omaha, were also utilized.

A draft review was provided to affected Southeast Region field offices and the field office leads for the Interior least tern in the Southwest, Midwest, and Mountain Prairie Regions, for review and comment. We also provided the draft review to nine peer reviewers with known expertise in the Interior least tern and/or its habitats. We requested their independent review on the general and scientific information presented in this document and our evaluation of factors affecting this species. Field office and peer review comments received were evaluated and incorporated as appropriate (see Appendix A for peer review comments).

All literature and documents used for this review are cited herein, and are on file at the Service's Mississippi Field Office.

1.2. Reviewers:

Lead Region: **Southeast Region**
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Lead Field Office: Mississippi Field Office, 601-965-4900
Contacts: Paul Hartfield, Lead Biologist; Cary Norquist, Endangered Species Coordinator

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1.3. Background:

1.3.1. *Federal Register* notice announcing initiation of this review: 73 FR 21643, April 22, 2008

1.3.2. Listing history:

<u>Original Listing</u>

Federal Register notice:	50 FR 21784
Date listed:	May 28, 1985
Entity listed:	Population
Classification:	Endangered

1.3.3 Associated rulemakings: N/A.

1.3.4 Review history:

- May 28, 1985: The Service published a Final Rule (50 FR 21784) listing the Interior population of the least tern as endangered.
- October 19, 1990: The Service released a Recovery Plan for the Interior Population of the Least Tern (*Sterna antillarum*)
- The USFWS conducted a 5-year review for *Sterna antillarum* in 1991 (56 FR 56882). In that review, the status of many species was simultaneously evaluated with no in-depth assessment of the five factors as they pertain to the individual species. The notice stated that the USFWS was seeking any new or additional information reflecting the necessity of a change in the status of the species under review. The notice indicated that if significant data were available warranting a change in a species' classification, the USFWS would propose a rule to modify the species' status. No new information or additional data was received for this bird. Therefore, no change in the bird's listing classification was found to be appropriate.
- Recovery Data Call: annually from 2000 – 2012.

1.3.5 Species' Recovery Priority Number at start of 5-year review (48 FR 43098): 3 (3 is defined as a species that has a high degree of threat and high recovery potential)

1.3.6 Recovery Plan:

Name of plan: Recovery Plan for the Interior Population of the Least Tern (*Sterna antillarum*)
Date issued: October 19, 1990

2. REVIEW ANALYSIS

[*Note: reference maps of the tern's historic and current ranges are on pages X and Y*]

2.1 Application of the 1996 Distinct Population Segment (DPS) Policy

2.1.1 Is the species under review a vertebrate? Yes.

2.1.2 Is the DPS policy applicable?

Section 3 of the Endangered Species Act (Act) defines "species" to include subspecies and "any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." Due to taxonomic uncertainty surrounding least tern subspecies, the Interior least tern (ILT) (*Sternula antillarum athalassos*) was treated as a distinct population of Eastern least tern (*S. antillarum antillarum*) at the time of listing in 1985. This taxonomic uncertainty persists (e.g., Draheim *et al*. 2010).

In 1996, the U.S. Fish and Wildlife Service and National Marine Fisheries Service (Services) published a joint policy guiding the recognition of Distinct Population Segments (DPS) of vertebrate species (61 FR 4722). The DPS policy specifies three elements to assess whether a population segment may be recognized as a DPS: (1) the population segment's discreteness from the remainder of the species to which it belongs, (2) the significance of the population segment to the species to which it belongs, and (3) the population segment's conservation status in relation to the Act's standard for listing (61 FR 4725). Protection of the ILT under the Act as a population predated the Services' 1996 DPS policy (61 FR 4722). Therefore, below we assess evidence for recognition of the interior population of least tern under the elements (above) of the Services DPS policy (61 FR 4722).

(1) Discreteness:

A vertebrate population segment may be considered discrete if it satisfies either of the following two conditions:

> 1. It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors. Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation.
> 2. It is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Endangered Species Act.

The listed population includes only those least terns that breed and nest within the boundary of the continental U.S. on interior rivers and other water bodies. ILT breeding populations are associated with large river habitats from Montana southward through North Dakota, South Dakota, Nebraska, Colorado, Iowa, Kansas, Missouri, Illinois, Indiana and Kentucky to eastern New Mexico, Oklahoma, Arkansas, Tennessee, central Texas, central Louisiana, and central Mississippi (see **Figure 15**, below). Other breeding populations of least terns are found along coastal and estuarine habitats in the U.S. from Texas to Maine, and along islands of the Gulf of Mexico, Atlantic Ocean, and Caribbean Sea. The ILT is separated from coastal populations by a combination of physical and ecological factors unique to their nesting habitats. Coastal habitats are created and maintained by daily and seasonal tidal and storm surges, while inland habitats of ILT are primarily created and maintained by fluctuating riverine hydrologic conditions. Foraging habitats and species differ markedly as well, with coastal least terns foraging on fish and invertebrate prey species associated with brackish and salt water habitats (e.g., anchovy, silversides), while ILT forage on freshwater prey species (e.g., shad, minnows). The ILT and Eastern least tern are geographically separated from the California least tern (*S. antillarum brownii*), which nest and forage in brackish and marine habitats of the Pacific coast of the U.S. and Mexico.

Kirsch and Sidle (1999) observed that ILT population increases were not supported by available fledgling success estimates, and hypothesized that ILT increases since listing were due to immigration surges from least terns inhabiting the Gulf Coast. Lott (2006) has hypothesized a wide least tern metapopulation which includes the Gulf Coast and interior populations. Genetic studies indicate at least some degree of interbreeding and genetic exchange between populations of ILT, eastern least tern, and California least tern (Draheim *et al*. 2010). However, there are few banding or other observational data directly supporting the interchange of breeding individuals between interior and Gulf Coast populations.

Therefore, since the extent and frequency of dispersal and interbreeding between interior and coastal populations is unknown, for the purposes of this review we will consider that the ILT population is discrete and meets Condition 1 of the 1996 DPS policy based upon ecological and physical differences in coastal and interior riverine summer nesting habitats.

(2) Significance:

Under the DPS policy (61 FR 4722), if a population segment is determined to be discrete, we then consider its biological and ecological significance relative to the larger taxon to which it belongs. This consideration may include, but is not limited to, the following factors:

1. Persistence of the discrete population segment in an ecological setting unusual or unique for the taxon,
2. Evidence that loss of the discrete population segment would result in a significant gap in the range of the taxon,
3. Evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historic range, or
4. Evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics.

As noted previously, ILT populations are associated with freshwater, primarily riverine, habitats, which are unique ecological settings in contrast to the brackish and marine habitats of coastal populations. Additionally, ILT colonies were reported from more than 5,500 river and shoreline miles (8,851 km) and 190,180 acres (77,000 hectares) of inland riverine and lake habitats during the latest range-wide count (Lott 2006). These nesting colonies encompass >18 degrees of longitude (>1,440 km (900 mi)) and >21 degrees of latitude (>2300 km (1,450 mi)). Loss of the ILT populations would, therefore, result in a significant gap in the range of least terns.

We determine that the ILT population may be considered significant due to the unique ecological setting and extensive area that they inhabit.

(3) Conservation Status

Under the DPS policy (61 FR 4722), if a population segment is determined to be discrete and significant, we consider its conservation status in relation to the Act's standard for listing. Our review of the conservation status of the ILT (see section ***2.3.5 Five Factor Analysis***, below) found the species is resilient to existing and potential threats, the amelioration of threats throughout much of its range due to increased population size and range and by the implementation of beneficial management practices, and changes in existing regulatory mechanisms that are more protective of migratory birds. Therefore, the Services DPS policy is not applicable to the ILT under the conservation element of the policy.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

Yes, in part. The 1990 recovery plan contains objective and measurable numerical recovery criteria to delist the ILT; however, criteria for protecting and managing "essential habitats" are undefined.

2.2.2 Adequacy of recovery criteria:

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

No. Since publication of the 1990 recovery plan, considerable new information regarding the species distribution, density, population dynamics, natural history, habitat quantity and quality, and threat levels has been developed (see *2.3 Updated Information and Current Species Status*, and *2.3.5 Five Factor Analysis*, below).

2.2.2.2 Are all of the 5 listing factors relevant to the species addressed in the recovery criteria (and is there new information to consider regarding existing or new threats)?

No. The recovery objectives described below include targets for distribution, drainage population levels, and persistence, but offer no direct measure of whether the five listing factors have been addressed. Numerical recovery criteria are discussed below; new information on threats is presented under section *2.3.5 5-Factor Analysis*, below.

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:

Recovery Criteria: In order to be considered for removal from the endangered species list, ILT essential habitat will be properly protected and managed, and populations will have increased to 7,000 birds (U.S. Fish and Wildlife Service (USFWS) 1990).

Numerical Criteria

The ILT range-wide numerical recovery criterion (7,000 birds) has been met, and has been exceeded for 18 years (1994 – 2012) (Kirsch and Sidle 1999; Lott 2006; Table 1, below).

Using range-wide seasonal count data from 1984 (722 ILT) thru 1995 (8,859 ILT), Kirsch and Sidle (1999) demonstrated achievement of the numerical recovery criterion, and a positive population growth trend. However, they noted that most of the ILT increase had occurred on the Lower Mississippi River (LMR); observed that population increases were not supported by available fledgling success estimates; and hypothesized that ILT increases were possibly due to immigration surges from a more abundant least tern population inhabiting the Gulf Coast (Kirsch and Sidle 1999).

Lott (2006) organized, compiled, and reported a synchronized range-wide count for ILT in 2005, finding ILT numbers had doubled since 1995 (e.g., Lott 2006 : 17,591 ILT range-wide). The majority of birds continue to be reported from the Lower Mississippi River (Lott 2006: 62% of the 2005 range-wide count from the LMR), and ILT counts now equal or exceed population estimates for least tern along the U.S. Gulf Coast (Lott 2006). Lott (2006) hypothesized a wider least tern metapopulation which includes Gulf Coast and interior subpopulations, and the possibility of a shift of birds from the Gulf Coast to inland habitats due to the presence of better nesting conditions on the LMR. However, there are few data directly supporting the Kirsch and Sidle (1999) or the Lott (2006) immigration hypotheses as a factor in the 20+ year increase in the ILT counts.

There has not been a complete or organized range-wide count since 2005, however, a number of geographic segments have been annually monitored. Available monitoring data compiled for 2010-2012 show that the combined partial counts of ILT continue to exceed the range-wide population recovery criteria by a factor of three in 2010 and by a factor of two in 2011 and 2012 (see annual totals for 2010-2012 in Table 1: based on Aron *in litt*. 2012, Baasch *in litt*. 2012, Brown *in litt*. 2012, Cope *in litt*. 2012, Hensley *in litt*. 2012, Hicks *et al*. 2012, Jones 2012, McCoy *in litt*. 2012, Mulhern *in litt*. 2012, Pavelka *in litt*. 2012, Stinson *in litt*. 2012, Yager *in litt*. 2012b).

Some proportion of the increase in ILT numbers over the past three decades can be attributed to improved survey efforts, extending surveys over wider geographical areas, and/or discovery of new subpopulations (Lott 2006). Examples include the Mississippi River where changes in survey methods and extending survey reaches correlate to some degree with increased ILT counts; the Red River and Arkansas River drainages where high numbers of ILT were encountered in areas not previously surveyed; and extension of ILT range into reservoirs constructed in central and western Texas, New Mexico and Colorado. However, increasing ILT numbers in the Mississippi, Red, Arkansas, and Ohio river drainages may correlate to varying degrees with the identification and implementation of conservation efforts by the U.S. Army Corps of Engineers (see **Habitat Criteria**, below).

Drainage System and Subsystem ILT Population Targets:

The 1990 Recovery Plan identified numerical population targets for ILT in 5 major River drainages throughout its range: Missouri River, Mississippi River, Arkansas River, Red River, and Rio Grande (see Table 1). The Recovery Plan also established 19 numerical population targets for distinct geographic areas in two drainages: 12 in the Missouri River drainage, and 7 in the Arkansas River Drainage (U.S. Fish and Wildlife Service 1990). Numerical targets in the Missouri River drainage included four States, five rivers, and three river segments (see Table 1, Missouri River Drainage). In the Arkansas River drainage, targets were also identified for two reaches of the Arkansas River, three tributaries to the Arkansas, and two National Wildlife Refuge populations (see Table 1, Arkansas River Drainage).

Kirsch and Sidle (1999) found only the Mississippi River drainage had achieved the numerical drainage target in 1994 and 1995. They documented achievement of numerical targets in 3 geographic segments of the Missouri River system and 1 geographic segment of the Arkansas River system (Table 1). They also noted substantial fluctuation of ILT numbers within breeding populations due to annual or periodic habitat changes, and/or variation in annual emigration, immigration, or recruitment rates (Kirsch and Sidle (1999).

In 2005, Lott (2006) found numerical targets exceeded in 3 of the 5 major drainages, as well as in 7 of the 19 geographic segments identified in the Missouri and Arkansas river drainages (Table 1). Lott (2006) also identified a total of 56 occupied geographic segments throughout the range of ILT, including 24 in the Missouri River drainage, 6 in the Mississippi River drainage, 13 in the Arkansas River drainage, 3 in the Red River drainage, and 10 in drainages of Texas and New Mexico. These collectively supported 489 ILT colonies.

The Mississippi River drainage numerical population target has been met and exceeded every year of record since 1990 (Figure 8). Partial annual counts show population targets for the Arkansas River drainage were exceeded during 5 of the past 8 years (Figure 10), and met or exceeded in 9 of 12 survey years in the Oklahoma segment of the Red River drainages (Figure 1: 2010-2012; Figure 11: 2000-2010).

ILT counts in the Missouri River drainage continue to fall short of that population target, even though extensive recovery efforts have occurred in that drainage over the past decade (see **Habitat Criteria**, below). However, this drainage has been extensively impounded and modified, and population size of ILT in the Missouri River drainage remains at or near levels that were present in 1990, despite a high investment in habitat manipulation and management. This indicates that the population has been stable, estimated recoverable carrying capacity of available habitat in the Missouri River drainage (i.e., the drainage population target) was likely overestimated in the 1990 recovery plan, and was not biologically achievable under the existing habitat baseline.

Population targets have also never been met for the Rio Grande drainage; however, ILT populations in this drainage have only been periodically and partially surveyed since listing. Additionally, there are no historical records of ILT from natural river segments in the drainage, all populations occur on anthropogenic habitats, and it appears probable that reservoir construction provided an opportunity for least tern range expansion into the Rio Grande (see **Habitat Criteria**, below).

In summary, monitoring data indicates that the range-wide ILT population size has increased substantially, and has exceeded range-wide numerical criteria for 18 years. Drainage system population size targets have been exceeded in three of the five major drainages (Mississippi, Red, and Arkansas rivers). ILT population size has remained relatively stable in the Missouri River drainage, and may be at the carrying capacity of the available habitat. ILT population size is currently unknown in the Rio Grande drainage, however the reservoirs occupied by ILT in this drainage are neither historical habitats or within the historical range of the species. Although, monitoring efforts have been inconsistent among drainages, existing data indicate that downward trends documented in a few drainage subpopulations have been offset by upward trends in others, as well as by the discovery of numerous subpopulation segments throughout the Interior Basin which were not present or were unknown at the time of listing or recovery plan development (Table 1). The ILT clearly reflects metapopulation dynamics (Lott et al. 2013). No reported extirpation of any ILT geographic segment population has occurred since the species was listed in 1985.

Table 1: ILT drainage population targets and counts, 1985 to present. Numbers for 1985 are extracted from USFWS 1985a, Final Rule; 1988 data are from the Recovery Plan (USFWS 1990); 1995 data from Kirsch and Sidle (1999); 2005 data are taken from Lott (2006); 2010-2012 are compiled from a variety of sources (see *Numerical Criteria*, paragraph 3, above). Geographic recovery segments from the Recovery Plan can be identified by numerical recovery targets enclosed in parentheses; * indicates achievement of annual numerical recovery targets; *italics* indicates new population or population segments identified since 1985.

Drainage (1990 Recovery Target)	**1985 Listing Data**	**1990 Recovery Plan (1988 Data)**	**1994/95 (Kirsch & Sidle 1999)**	**2005 (Lott 2006)**	**2010 Partial**	**2011 Partial**	**2012 Partial**
TOTAL (7,000)	**1,970**	**5,099**	**7,430***	**17,591***	**21,855**	**15,403**	**13,855**
Missouri River System							
State Targets							
Montana (50)		32	**70***	**50***			
North Dakota (250)		180	214	225			
South Dakota (680)		385	399	649			
Nebraska (1520)		990	1,166	1,038			
States Without Recovery Targets							
Iowa		22		33			
Kansas				45			
River Targets							
Missouri River (400)		**556***	**640***	**904***	**660***	273	**742***
Cheyenne River (80)		27	24	4			5
Niobrara River (200)		**200***	**217***	**289***	**257***	194	161
Loup River (170)		155	121	87	47	58	60
Platte River (750)		635	567	**556**	374	460	665
Rivers Without Recovery Targets							
Yellowstone		36	24	16			
Kansas				45			26
Elkhorn River			21	74		10	
River Segment Targets							
River below Gavins Pt (400)		297	200	**476***	159	0	208
Lake Oahe (100)		61	114	89	46	39	**100***
River below Ft. Randall (80)		?	21	76	10	0	**87***
Missouri River System (2,100)							
Total	**740**	**1,609**	**1,590**	**2,044**	**1,338**	**995**	**1,659**
Mississippi and Ohio River Population Target (2,500)							
Mississippi River **(2,500)**	350-450	2,356	**4,283***	**10,960***	**18,419***	**12,315***	**10,150***
Ohio River	10		15	172	70	50	40
Other							
Wabash River	NA		12	99	150	280	185
Total	**460**	**2,356**	**4,310***	**11,231***	**18,572***	**12,577***	**10,315***
Arkansas River System							
Population Targets							

Drainage (1990 Recovery Target)	**1985 Listing Data**	**1990 Recovery Plan (1988 Data)**	**1994/95 (Kirsch & Sidle 1999)**	**2005 (Lott 2006)**	**2010 Partial**	**2011 Partial**	**2012 Partial**
Arkansas River (**400**)	30	319	**505***	**931***			
AR (**150**)			104	**319***	**417***	**504***	**523***
OK (**250**)		210	**401***	**600**	**693***	**561***	**541**
Cimarron (**400**)	150	132	280	**428***			
Canadian (**300**)	80	62	152	**590***	Incl in OK	Incl in OK	Incl in OK
Beaver/North Canadian (**100**)		38	24	6			
Salt Plains NWR (**300**)	180-300	210	161	90	65	23	28
Quivira NWR (**100**)	50	54	53	40			
			Other				
Adobe Creek		10					
3 Upper AR Valley Res				44	26		
			Arkansas River System (1,600)				
Total	**610**	**825**	**1,175**	**2,129***	**1,201**	**1,088**	**1,092**
			Red River System (300)				
Upper Red, TX-OK				394			NA
Lower Red, AR				1,376	744	743	643
Red River, LA				51			146
Total	**<80**	**16**	**22**	**1,821***	**744***	**743***	**789***
			Trinity				
North Dallas rooftops				58	NA	NA	NA
South Dallas WWT & pits			20	28			
Richland-Chambers Res.				5			
Big Brown Mine				38			
Jewet Mine				50			
Total				**179**	NA	NA	NA
			Rio Grande/Pecos River System (500)				
Bitter Lake NWR	20	6	9	28			
Brantley Lake NM				11			
Imperial Res.				14			
Lake Casa Blanca		50	28				
Falcon Res.	60	222	238				
Amistad Res.		14	18	85			
Total	**80**	**292**	**313**	**138 (Partial)**	NA	NA	NA
			Other				
Cooper Lake, TX				49			
Total			**20**	**228**	NA	NA	NA
	1985	**1990**	**1995**	**2005**	**2010 Partial**	**2011 Partial**	**2012 Partial**
RANGE-WIDE TOTAL (7,000)	**1,970**	**5,099**	**7,430***	**17,591***	**21,855***	**15,403***	**13,855***

Habitat Criteria

Recovery plan delisting criteria also called for the protection, enhancement, and restoration of essential ILT breeding habitats (U.S. Fish and Wildlife Service 1990). Beyond the identification of specific river reaches as "essential," habitat parameters were not defined, nor were specific objective and measurable criteria for their protection identified. The recovery plan did outline several tasks to protect and enhance ILT habitat, including managing water flows, modifying construction activities, and developing management plans across the species range (U.S. Fish and Wildlife Service 1990).

For more than two decades, efforts have been conducted to identify, manage, and monitor ILT and their breeding habitats. At the time of recovery plan development, ILT nesting colonies were primarily known from jurisdictional waters with a strong Federal nexus, mostly from navigation systems, reservoirs, national wildlife refuges, and national scenic river reaches. ILT habitat protection and enhancement efforts within jurisdictional waters have generally sought to maintain or modify local hydrological variability necessary to maintain the suite of conditions required for ILT nest initiation and successful recruitment. Therefore, to various degrees, ILT habitats have been considered, managed, protected, and/or monitored under the conservation (section 7(a)(1)) and/or consultation (section 7(a)(2)) requirements of the Act since the species was listed.

In order to determine the success of habitat management and protection we must first identify an appropriate quantifiable variable and a benchmark with which to compare it. Riverine habitat for ILT is not static, and clearly experiences dramatic local or regional annual (at times, daily) variation in location, quantity, and quality (see section **2.3.1 Biology and Habitat**, below). Describing and quantifying habitat quality is difficult, given the wide variety of conditions the bird is known to exploit (i.e., rivers to reservoirs to rooftops). Physical and biological conditions for ILT nesting and successful reproduction have been described by Lott and Wiley (2012; also Lott *et al*. 2013) as: 1) nest sites that are not inundated during egg laying and incubation; 2) nesting sites that are not inundated until chicks can fly; 3) nesting sites with <30% ground vegetation; 4) nesting sites that are >250 ft. from large trees; and, 5) availability of prey fishes to support chick growth until fledging. While these conditions can be used to qualitatively assess condition of a specific patch of ILT breeding habitat, they cannot be collectively or individually used to quantify habitat quality due to their variability between sites and within sites over time. Nonetheless, trends in available suitable habitat on regional and range-wide scales may demonstrate that the threat of habitat degradation has been and will continue to be adequately addressed.

ILT are well adapted to accommodate and exploit the variability in habitat location, quantity, and quality, and can abandon unsuitable nesting sites and emigrate to other areas. Although annual numbers of ILT may vary greatly at sites or within drainages between years, the persistent use of habitat over time by ILT is a quantifiable indication of habitat suitability (i.e., number of years utilized).

Population trends (i.e., decreasing, stable, increasing number of terns/year) can also be used to quantify the success of habitat management and protection over time. Available monitoring data are highly variable between, and even within ILT populations and colonies, and the "significance" of most population trends cannot be meaningfully evaluated statistically (e.g., see Table 1, above). However, the extensive monitoring record (25+ years in some areas) provides inferences to apparent population trends.

For the purpose of determining whether protection, enhancement, and restoration of essential ILT breeding habitats have been achieved, we compare ILT persistence and apparent population trends within the identified river segments for the period of record, to the corresponding population data benchmark provided in the recovery plan (1985-1988, U.S. Fish and Wildlife Service 1990).

Missouri River System

The recovery plan identified population benchmarks and targets for 5 rivers, 3 river segments, and 5 States in the Missouri River system (U.S. Fish and Wildlife Service 1990). These cumulatively are higher (State targets), or lower (river segment targets) than the overall Missouri River system recovery target of 2,100 ILT. Therefore, for the purposes of this analysis, we are considering protection and management of the five major rivers identified in the recovery plan (Missouri, Cheyenne, Niobrara, Loup, and Platte rivers) which encompass both State and river segment targets.

Conservation management of ILT and its habitat throughout much of the Missouri River are based upon a Jeopardy Biological Opinion (U.S. Fish and Wildlife Service 2000) and amendment (U.S. Fish and Wildlife Service 2003). Additionally, conservation efforts to implement the Biological Opinion have been funded under the USACE Missouri River Recovery Program (MRRP). The Missouri River Recovery and Implementation Committee is a collaborative Federal/State/Tribal initiative, authorized and funded under the Water Resources Development Act of 2007, which provides stakeholder guidance to the USACE in implementing the MRRP.

Management actions for ILT in the Missouri River include habitat management, habitat creation, flow modification, population and habitat monitoring, predator and vegetation control, applied scientific studies, and public education (U.S. Fish and Wildlife Service 2003). Despite an intensive management investment, ILT counts on two reaches of the Missouri River (Upper Missouri River North (above Oahe Dam) and Upper Missouri River South (below Fort Randall Dam); see Figure 16), have remained near levels reported at the time of listing and recovery plan development (Figures 1 and 2). While the Upper Missouri River North population tern counts appear to have experienced a declining trend over the period of record (Figure 1), it is offset by an apparent increasing trend in the Upper Missouri River South reach (Figure 2); however, neither trend can be reliably evaluated statistically due to variability in counts.

Much of the count fluctuation in both the Upper and Lower reaches of the Missouri River appears to be directly influenced by discharge (Figure 3). ILT numbers decrease during high water years when nesting habitats are flooded, and increase during low water years with greater exposure of the river bottom (Pavelka *in litt*. 2012). Over time, however, suitable nesting habitat is lost to vegetation and erosion. In recent years, declining habitat trends have been reversed by rare major flow events (a 100-year flood event in 1995-1996 and a 200-year flood event in 2011) which have reset both the nesting habitat and the forage base.

Dams have interrupted coarse sediment transport in the Missouri River. The sediment that does get transported through the dams is often finer and not suitable for ILT nesting habitat (USACE 2013). A USACE modeling exercise evaluating the potential for moving sediment through Gavins Point dam (the lowest dam on the system) determined that a single flushing event without infrastructure changes to the dam would be unlikely to transport coarse sediment through the dam (USACE 2013a, USACE 2013b). This modeling suggests that repeated flushing events, especially in conjunction with dredging to mobilize sediment and infrastructure changes to the spillway, may result in better sediment transport (USACE 2013b).

The USACE has attempted to provide additional nesting and brood-rearing habitat on the Missouri River by constructing sandbars and managing vegetation both in-channel and on reservoirs (Pavelka *in litt*. 2012). Between 2004 and 2011, the amount of habitat lost to erosion was greater than the approximately 870 acres of habitat constructed during the same period (USACE 2012b, USACE 2012c). River habitat losses may be offset to some degree by lower reservoir levels exposing suitable nesting habitat along the shorelines; however, reservoir nesting areas are subject to flooding as the reservoirs capture spring runoff (USFWS 2003, USACE 2006). Reservoirs support about 15 percent of the ILT within the Missouri River system (Pavelka *in litt*. 2012). As noted above, declining habitat trends are periodically reversed by major flow events; the 2011 flood event created >14,000 acres of sandbar habitat on the Missouri River (USACE 2013).

Overall, the available information suggests that ILT habitat availability and quality in the Missouri River is primarily affected by periodic events of large habitat forming floods and intervening years of comparatively low flows. The combined data for the Upper and Lower reaches of the Missouri River indicate a stable, possibly increasing ILT population in the Missouri River over the period of record (Figure 3) relative to the 1988 population estimate cited in the recovery plan (556 birds). ILT populations have persisted with relative population stability for more than two decades under this management system, given periodic major flood events.

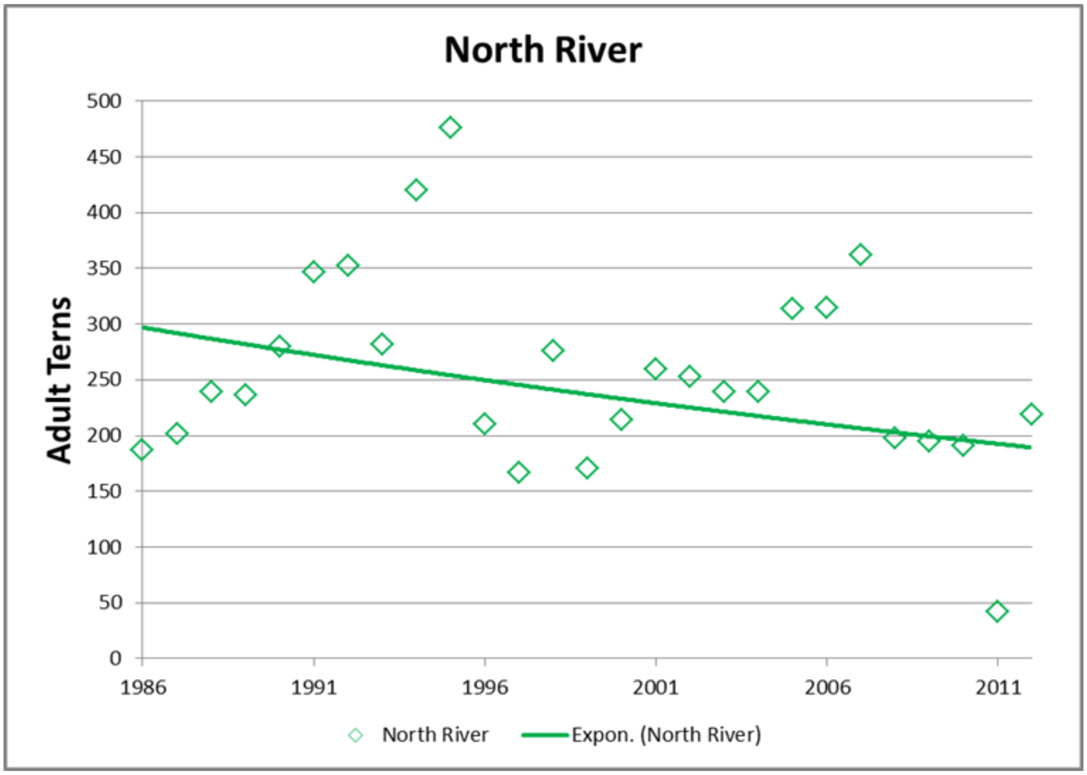

Figure 1: Annual ILT counts and trend line, 1986 - 2012, Upper Missouri River North (above Oahe Dam) (from Pavelka *in litt*. 2012).

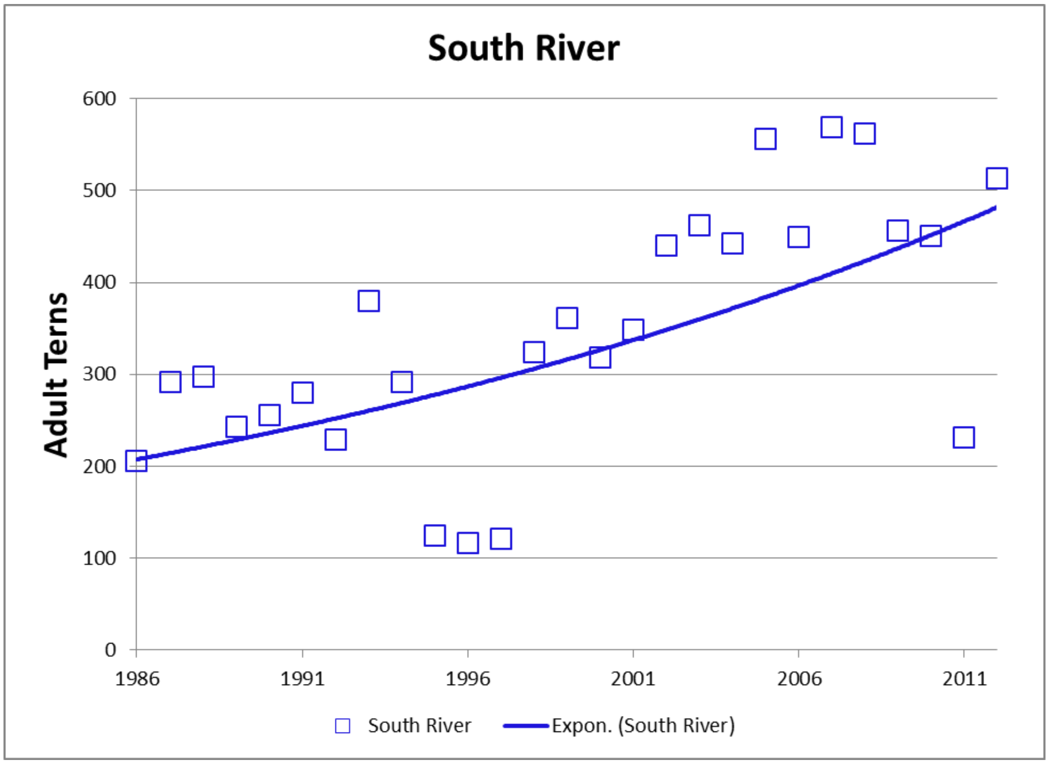

Figure 2: Annual ILT counts and trend line, 1986 - 2012, Upper Missouri River South (below Fort Randall Dam) (from Pavelka *in litt*. 2012).

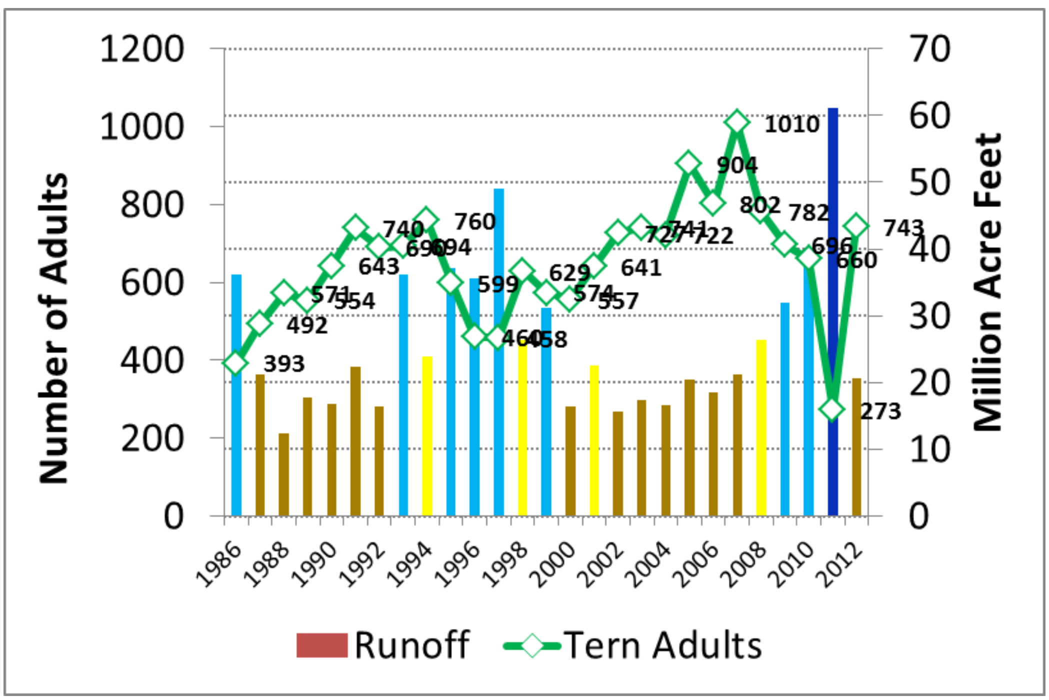

Figure 3: ILT annual adult counts and runoff in the Missouri River above Sioux City, Iowa, 1986 - 2012 (from Pavelka *in litt*. 2012). [The bars reflect runoff: yellow represents average runoff (+/- 10%); brown represents lower than average (90% or

less); blue represents higher than average (110% or more); dark blue represents the highest recorded runoff on the Missouri River]

We are unaware of any dedicated management program for ILT in the Cheyenne River. Intermittent annual ILT surveys between 1986 through 2012 (Figure 4), show that this population has declined significantly relative to the recovery plan benchmark (80 birds), however, it continues to persist at one or two sites at very low numbers (Schwalbach 2012). No ILT management issues were received or brought to our attention for the Cheyenne River during this 5-year review.

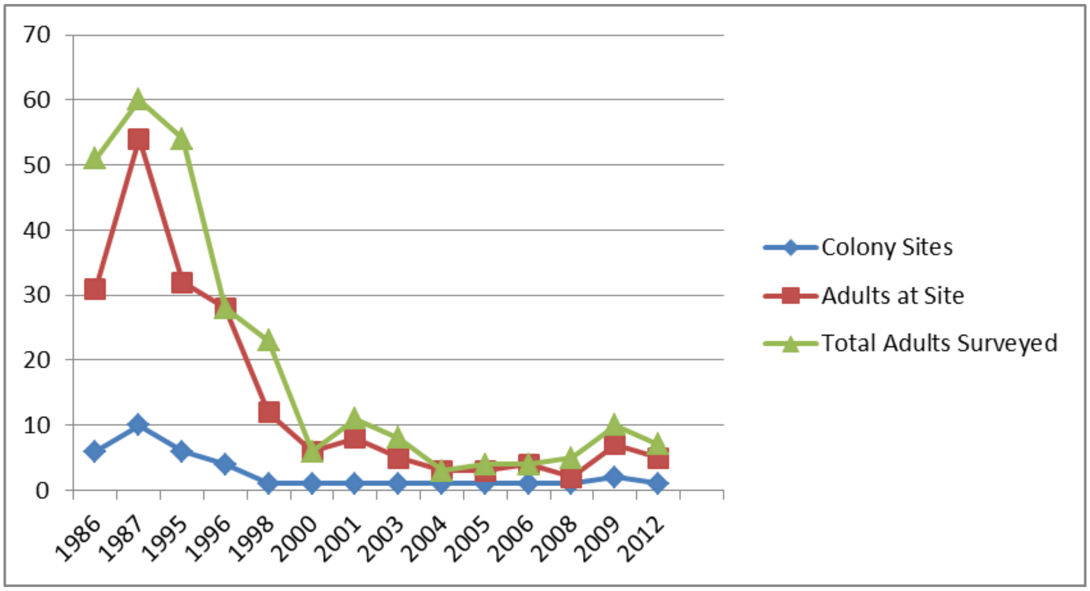

Figure 4: Annual ILT colony and adult tern counts, 1986 - 2012, Cheyenne River (from Schwalbach *in litt.* 2012).

There is no active management for ILT on the Niobrara River, and agencies involved in monitoring the river have identified no immediate management needs due to that river's natural hydrograph, which maintains habitat conditions for ILT (Yager *in litt*. 2012a). The Niobrara River has been monitored in three segments: lower, middle, and upper Niobrara. We received monitoring data from 2003 to present from the lower Niobrara, 2005 to present for the middle river, and 2007 to present for the upper reach (Hicks *et al*. 2012, Yager *in litt*. 2012b, Jenniges *in litt*. 2012). These data show persistence of ILT in the Niobrara River, with annual variation in counts (attributed to annual flow and habitat condition in the Niobrara River), and relatively stable numbers for the period of record in comparison to the recovery plan benchmark (~200 birds) (Figure 5).

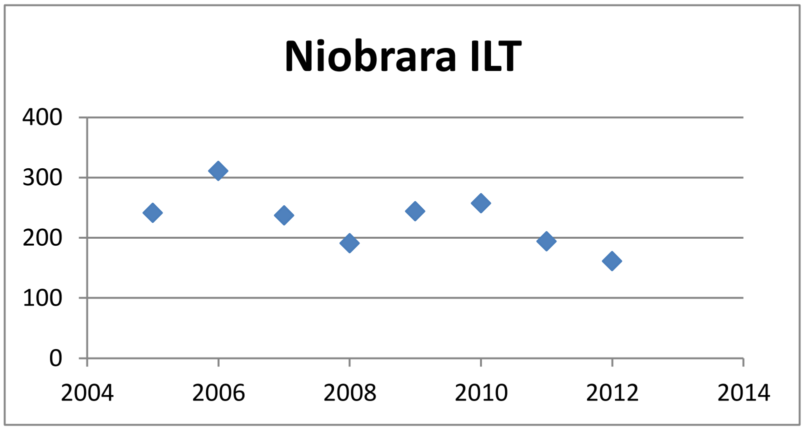

Figure 5: ILT counts on the Niobrara River, 2000 - 2012 (compiled from Yager *in litt*. 2012b, Hicks *et al*. 2012, Jenniges *in litt*. 2012, Lott 2006).

ILT management actions on the Loup River include annual monitoring by the Nebraska Game and Parks Commission (NGPC), creation of a Memorandum of Understanding and an Adaptive Management Plan to protect ILT and piping plovers in the Loup River drainage, establishment of an Active Habitat Zone at a mining area in the Loup River, dredging and discharge windows to protect nesting ILT, and other actions (Loup Power District 2012).

The recovery plan quantified the Loup River ILT population as 155 birds in 1988, based upon NGPC data (USFWS 1990). Lott (2006) reported 87 ILT from the Loup River in 2005. However, ILT count data by NGPC from 1986 to present that was received during this review are considerably lower for both of these years (61 in 1988, 35 in 2005; Loup Power District 2012). Loup River nesting areas include river reaches, as well as multiple off-channel mining sites. NGPC surveys for ILT in the Loup have been inconsistent and only partial during some years over the period of record (Loup Power District 2012), and are likely the cause of count discrepancies. Using the NGPC annual count data received during this review, however, indicates a smaller, relatively stable ILT population, with years of low abundance offset by years of higher abundance during the period of record (Figure 6).

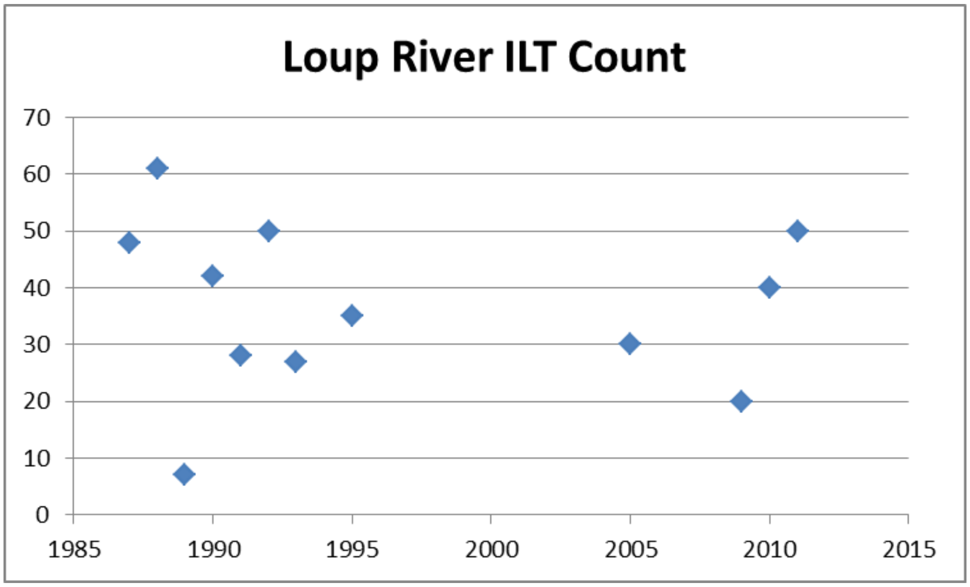

Figure 6: ILT counts on the Loup River, 1985-2011 (NGPC data from: Loup Power District 2012).

ILT management actions on the Platte River include monitoring, posting and protection, predator control, research, and public education. An active ILT and Piping Plover Conservation Partnership has been established to implement management actions, and conduct annual monitoring of both river and off-river nesting sites (e.g., Brown *et al*. 2012).

The 1988 Platte River population size was identified as 635 birds by the recovery plan. Lott (2006) reported the existence of many sources of historical data for ILT on the Platte River system, but also noted a large number of inconsistencies in count totals that could not be reconciled. During this review we received ILT partial count data from the central and lower Platte River from 2010 through 2012 (Table 1: Basch *in litt*. 2012, Brown *in litt*. 2012). Additional available data show high annual variability in ILT use of on-river and off-river nesting sites (Figure 7). However, the ILT have persisted in the Platte River drainage since listing, and the 2012 count (665 birds) exceeded the 1988 recovery plan benchmark (635 birds) (Table 1). Therefore, we conclude that the Platte River ILT habitat has been successfully managed and protected for the period of record.

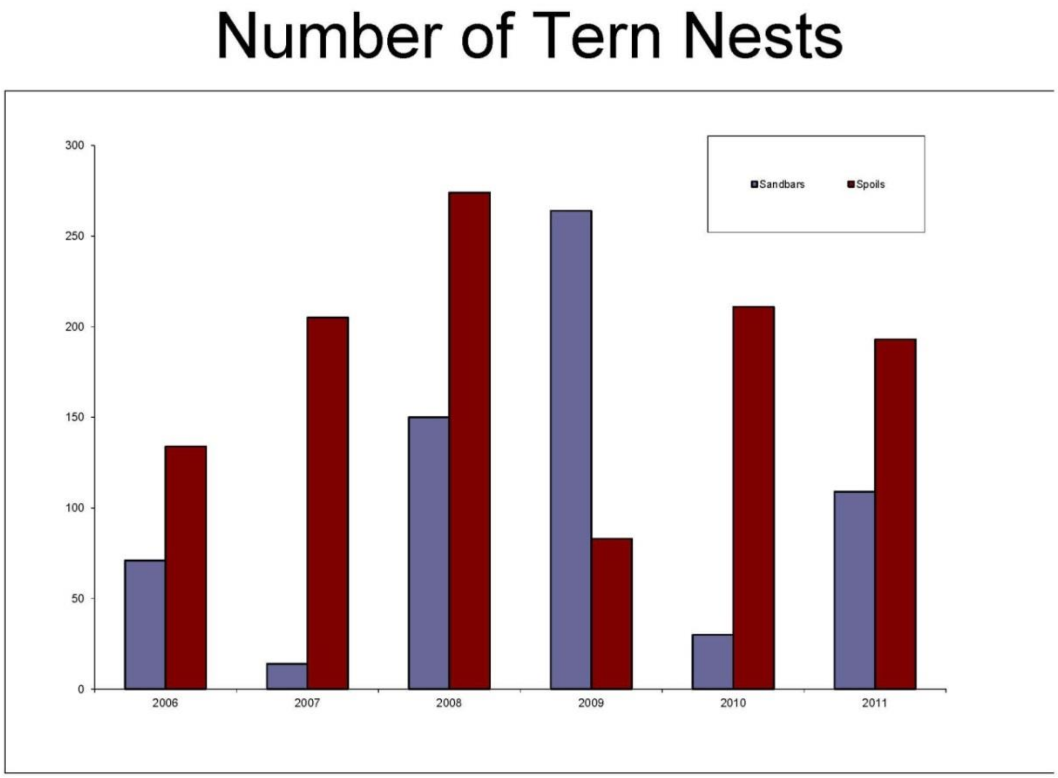

Figure 7: Number of ILT nests on sandbars v. sand mine spoil on the lower Platte River, 2006 – 2011 (from Jorgensen and Brown 2012).

In summary, management programs have been successfully implemented in three rivers within the Missouri River drainage (Missouri, Loup, and Platte rivers) that were identified in the recovery plan as "essential." There are currently no habitat management issues in the Niobrara River due to its natural hydrograph (Yager 2012a). ILT have persisted in these four rivers at population levels at, or above, those reported in the 1990 recovery plan. While the Cheyenne River population of ILT has declined significantly, we are unaware of any management issues related to this decline. The highest population level recorded from the Cheyenne River (27 birds in 1990; see Table 1) represented less than 2% of the Missouri River drainage ILT population during that year, and based upon current distribution and abundance of ILT, both in the Missouri River drainage and range-wide, this population is not likely essential to the continued existence of either. Management programs in the Missouri, Loup, and Platte rivers, and conditions maintained by a natural hydrograph in the Niobrara River are protective of habitats supporting approximately 93% of Missouri River drainage ILT summer residents, and ~10% of the listed population (Table 1; Lott 2006).

Mississippi River Drainage

An informal management program for ILT was initiated on the Lower Mississippi River (LMR) immediately after listing by the U.S. Army Corps of Engineers, Mississippi Valley Division (USACE-MVD). Between 1985 and 2000, ILT management and protection in the LMR navigation system by the USACE-MVD primarily consisted of monitoring to quantify numbers of birds and the location of breeding colonies, and prohibiting nesting season disturbance of these areas by construction, maintenance, or permitted activities (USACE 2008, p. 3). Under this management scenario, ILT numbers increased from <1,000 birds in 1985, to ~6000 birds in 2000 (Figure 8). In 2001, a cost-effective channel design approach was incorporated into USACE-MVD channel construction and maintenance programs (USACE 2008, DuBowy 2011, U.S. Fish and Wildlife Service 2012). ILT counts have since increased to ~10,000 birds/year since 2004 (Figure 8).

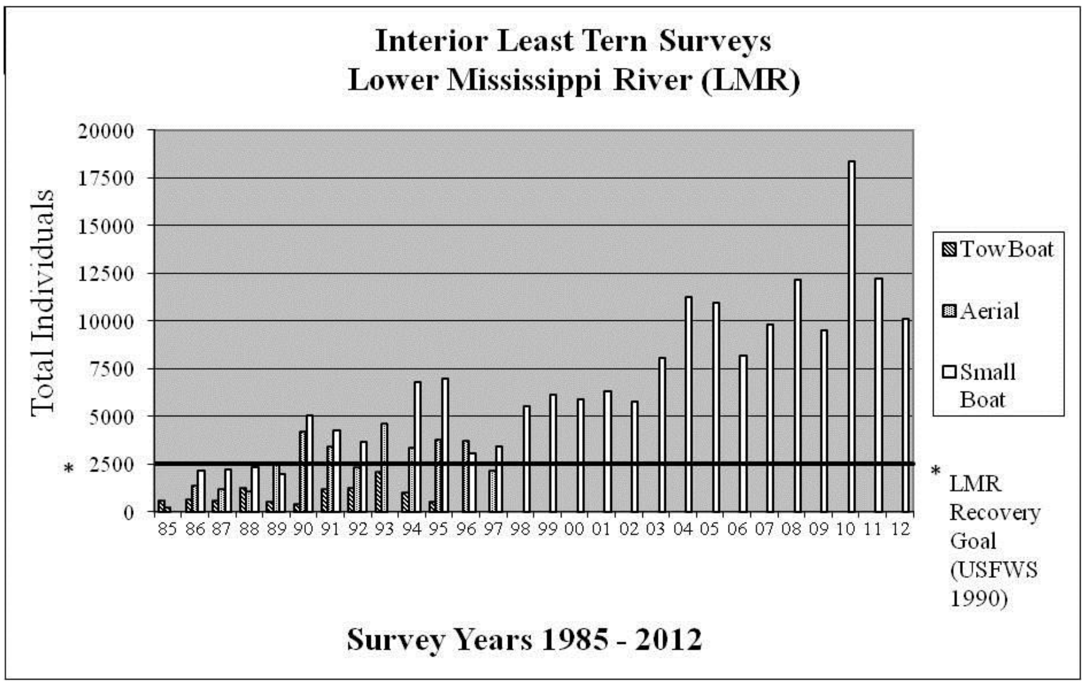

Figure 8: Interior least tern survey results, 1985 – 2012 (from Mississippi Valley Division, U. S. Army Corps of Engineers).

ILT from the LMR have also expanded into the Ohio River drainage. The 1986 colonization by a nesting pair of ILT at an industrial site adjacent to the Wabash River, Gibson County, Indiana, led to site monitoring, protection, increasing numbers of terns, and expansion of nesting colonies to multiple sites on public and private properties (Hayes and Pike 2011). In 1999, management was formalized by development of a Habitat Conservation Plan by Duke Energy Corporation. (Hayes and Pike 2011). The conservation plan includes monitoring, habitat construction and maintenance, as well as seasonal protection of nesting birds by fencing and other methods. In response, the ILT population has continued to grow in the Wabash, and at last count (2011) these sites supported more than 300 birds (Figure 9).

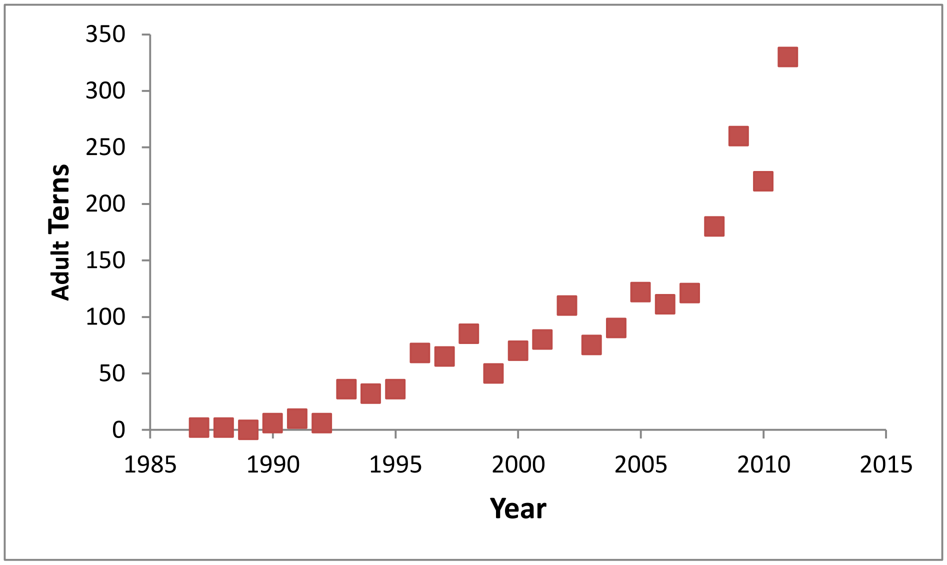

Figure 9: Interior least tern Ohio/Wabash River drainage survey results, 1987 – 2011 (data from McCoy *in litt*. 2012).

In 2002, observation of ILT attempting to nest on dredged material deposited in the lower Ohio River led the USACE Louisville District to develop and initiate a dredged-material disposal methodology that constructs sandbars conducive to nesting ILT (e.g., Van Hoff 2007, Fischer and Van Hoff 2009, Fischer 2011). This voluntary dredged-material habitat creation program has served to create and enhance habitat in an area where few other options for ILT nesting exist. Disposal islands now support 120 to 160 adult ILT (0.1% of birds range-wide) during the nesting season (Fischer 2012).

In summary, the response of ILT to habitat management programs by USACE-MVD in the LMR navigation system, Duke Energy Corp. in the Wabash River drainage, and USACE Louisville District in the lower Ohio River, demonstrates successful management and protection of essential habitats for the period of record. These areas currently support >60% of the ILT listed population.

Southern Plains Rivers: Red and Arkansas River drainages
Management guidelines have been developed and implemented by USACE Southwest Division (USACE-SWD) in reaches of the Red and Arkansas rivers (USACE 2002, USACE 2012). These include habitat evaluation, beneficial use of dredged material, vegetation control, periodic monitoring of birds, reservoir management (i.e., flood storage during high flows, minimum releases during low flows), predator control, coordination meetings, and public information (USACE 2002,; USACE 2012). Additionally, some rooftops used for nesting by ILT during high water levels along the Arkansas River are periodically monitored (e.g., Nupp and Watterson 2010). Management actions in reaches of the Red and

Arkansas rivers (USACE 2002, USACE 2012) are correlated with relatively stable ILT populations for more than a decade (Figures 10-12).

ILT were first observed nesting on rooftops in Arkansas in 2007, a summer in which Arkansas River levels inundated most if not all potential sandbar habitat during the nesting season (Nupp and Watterson 2007). Habitat conditions in many reaches of the Arkansas and Red rivers improved after the 2007 high flows, but have declined due to drought conditions in recent years (K. Stubbs, USFWS, pers. comm. 2013). Numbers of terns using rooftops for nesting in Arkansas appears to be related to availability of riverine habitat as there is an inverse relationship between numbers of terns at rooftops and nearby riverine colonies (Nupp and Petrick 2013).

Reported ILT counts have declined somewhat in recent years, however, some occupied reaches of these drainages have not been monitored or have been only infrequently monitored (e.g., Canadian and Cimarron rivers in the Arkansas River drainage and the Red River upstream of Lake Texoma). Comparison of the 1990 recovery plan benchmarks (Table 1, 1990: 825 birds in the Arkansas drainage, 16 in the Red River drainage) with the latest comprehensive survey (Table 1, 2005: 2,129 birds in the Arkansas, 1,821 in the Red) indicate an overall positive response of ILT to management during the period of record.

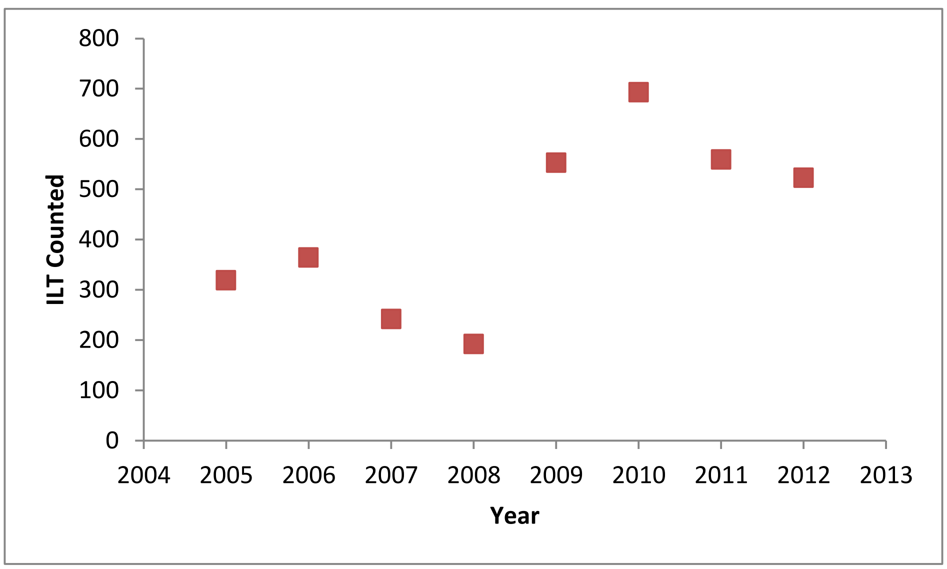

Figure 10: Interior least tern survey results for the Arkansas segment of the Arkansas River, 2005 – 2012 (data from Lott 2006, Nupp 2006, Nupp and Watterson 2007- 2009, Nupp and Petrick 2010-2011, Leone *in litt*. 2012).

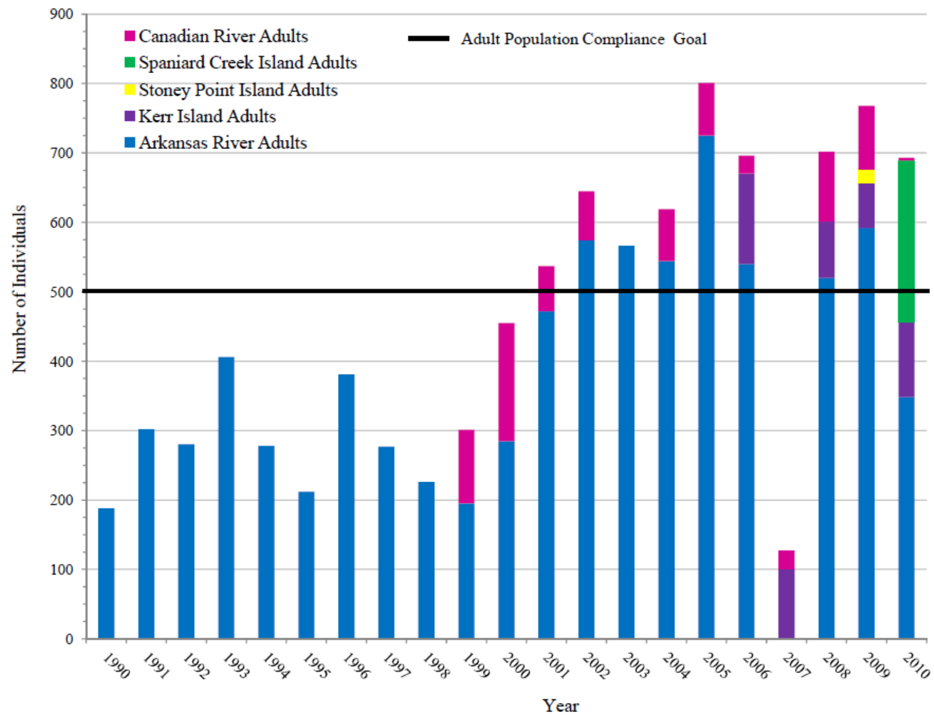

Figure 11. Interior least tern survey data available for the Oklahoma segment of the Arkansas River drainage, 1990 - 2010 (from U.S. Fish and Wildlife Service 2012b).

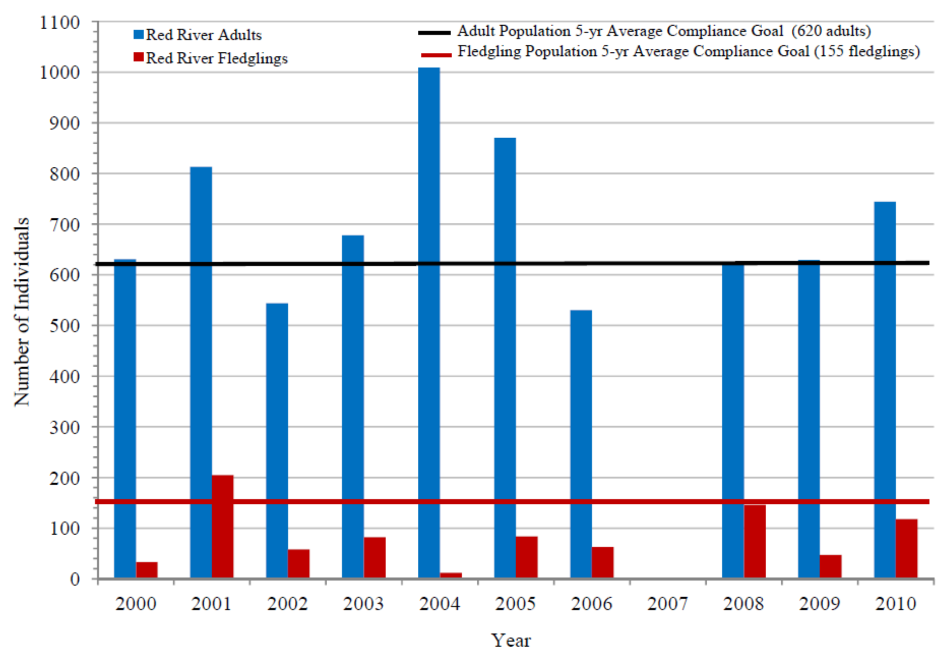

Figure 12: Survey results for Interior least tern adults and fledglings along the Red River, Oklahoma and Texas, from Denison Dam to Index, Arkansas, 2000 - 2010 (from U.S. Army Corps of Engineers 2012).

Breeding populations of ILT are known from salt flats in the Arkansas River drainage; two occur on National Wildlife Refuges (NWR) (see Table 1; Salt Plains and Quivara NWR). Refuge management plans include periodic surveys, and vegetation and predator control. Available monitoring data show persistence of ILT on both refuges during the period of record. While data suggests that the Quivara NWR population has remained relatively stable, the Salt Plains NWR population has declined (Table 1), due in part to vegetation encroachment. Data were not provided for other previously documented salt flat ILT populations.

Many anthropogenic habitats occupied by ILT, including rooftop and industrial sites in the Trinity River drainage, and Colorado reservoir and industrial sites in the Upper Arkansas, have also been identified, and have received some level of monitoring, management, and protection in the Southern Plains for more than a decade (e.g., Butcher 2007, Boylan 2008, Nelson 2010, e.g., Figure 13).

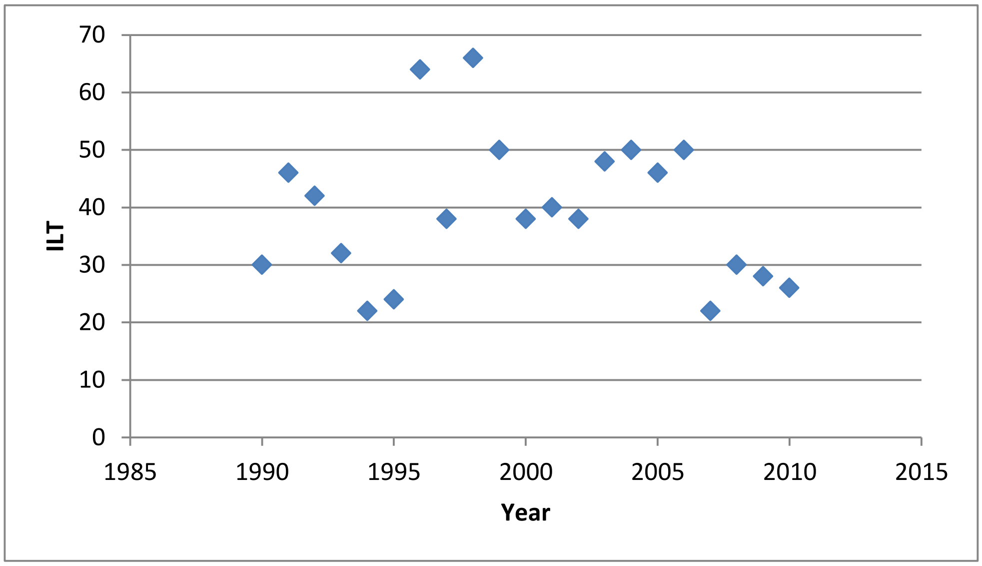

Figure 13: Annual ILT counts, 1990 – 2010, Colorado (data from Nelson 2010, p. 22).

In summary, a comparison of the available data from the 1990 recovery plan to the most recent comprehensive survey for ILT in the Southern Plains (Lott 2006, and above) show a large increase in both number of birds and colonies, followed by a relatively stable population size under the current management scenario over the period of record. Collectively, >22% of the listed ILT population is benefitted by USACE-SWD management of reaches of the Red and Arkansas rivers (Table 1).

Rio Grande/Pecos River System

We received no recent data of ILT numbers or surveys on the Rio Grande/Pecos river systems during our request for information; therefore, our most recent source of information is Lott (2006). ILT were first reported from the drainage in 1974 (Downing 1980), occupying salt flats on Bitter Lake NWR, adjacent to the Pecos River. Lott (2006) provided monitoring records showing persistence and an increase in numbers of ILT on the refuge from 1987 through 2006. In the Rio Grande, ILT are known to nest only on reservoirs (Lott 2006**).** These have been only periodically and partially surveyed during the period of record, and while persistence is likely, data are insufficient to indicate trends. There are no data to demonstrate historical occupation of natural rivers in the Rio Grande drainage by ILT. It is possible that the Rio Grande is outside of the historical range of the species, and that reservoir construction during the 20th century provided an opportunity for ILT range expansion into the drainage. It is also possible that the source of the Rio Grande colonization was eastern least terns from the Gulf of Mexico (e.g., Whittier 2001).

In conclusion, criteria for the protection, enhancement, and restoration of essential ILT breeding habitats has been achieved in substantial portions of the Missouri, Mississippi, Red, and Arkansas river drainages identified as essential by the recovery plan, based upon the persistent use of these habitats and evidence of population stability or increase during the period of record. Additionally, the ILT has expanded its range beyond the boundaries of these identified river and reservoir reaches, and active management is being successfully implemented in many of these areas. Collectively, drainages with active protection and management, support >90% of the listed population.

2.3 Updated Information and Current Species Status

2.3.1 Biology and habitat

The least tern is the smallest of the North American terns, growing to a length of 21 to 23 cm (8 to 9 in) and a wingspan of 48 to 53 cm (10 to 21 in) (Thompson *et al*. 1997). Their plumage and coloration is similar for both sexes and all ages. ILT are the inland reproductive population of least tern that nests on or adjacent to the major rivers of the Great Plains and the Lower Mississippi Valley. The listed range of ILT is defined as the Mississippi River and tributaries north of Baton Rouge, Louisiana; and all drainages in Texas more than 50 miles inland from the coast (50 FR 21789). This portion of the range is only used for nesting and foraging during the spring/summer reproductive season (May – August). ILT are strong fliers, migrating as far as 2000 miles between their summer nesting habitats and winter habitats in Central and South America (Thompson *et al*. 1997).

Life Span

ILT are long-lived, with records of recapture more than 20 years following banding (Thompson *et al*. 1997), however, the average life span is probably less.

Most begin breeding at 2 or 3 years of age, and breed annually throughout their lives (Thompson *et al*. 1997).

Nesting Habitat and Behavior

ILT generally nest on the ground, in open areas, and near appropriate feeding habitat (Lott and Wiley 2011, Lott *et al*. 2013). Nests are simple scrapes in the sand, and nesting sites are characterized by coarser and larger substrate materials, more debris, and shorter and less vegetation compared to surrounding areas (Smith and Renken 1991, Stucker 2012). Typical least tern clutch size is reported as 2 to 3 eggs (Thompson *et al*. 1997), however clutch size may vary by location and year (e.g., Szell and Woodrey 2003; Jones 2012), especially in response to varying availability of prey (Massey et al. 1992).

Vegetation free sand or gravel islands are preferred for nesting, although, sand banks, point bars, and beaches may also be utilized (Lott *et al*. 2013). Natural nesting habitat features are maintained and influenced by magnitude and timing of riverine flood events (Sidle et al. 1992; Renken and Smith 1995; Pavelka in litt. 2012). However, flooding was historically, and remains a primary cause of ILT nest failure in both unregulated and regulated river channels (e.g., Szell and Woodrey 2003, Sidle et al. 1992).

ILT prefer areas remote from trees or other vegetation that may hide or support predators (Lott *et al*. 2013). Least terns will also nest on anthropogenic sites (Jackson and Jackson 1985; Lott 2006) near water bodies with appropriate fish species and abundance, including industrial sites (Ciuzio *et al*. 2005; Mills 2012), dredged-material deposition sites (Ciuzio *et al*. 2005); sand pits (Smith 2008), created habitats (Stucker 2012), and rooftops (e.g., Boyland 2008, Watterson 2009).

Lott and Wiley (2012) described five physical and biological conditions that are necessary for ILT nest initiation and successful reproduction: 1) nest sites that are not inundated during egg laying and incubation; 2) nesting sites that are not inundated until chicks can fly; 3) nesting sites with <30% ground vegetation; 4) nesting sites that are >250 ft. from large trees; and, 5) availability of prey fishes to support chick growth until fledging.

Least terns are colonial nesters. Colony size may vary from a few breeding birds to > 1200 (e.g., Jones 2012). Some drainage populations may be limited by annual availability of nesting habitat (e.g., Missouri River; Stucker 2012), while potential nesting habitat is generally abundant and underutilized in others (e.g., Mississippi River; USCOE 2008). Nesting site conditions (e.g., habitat suitability, flood cycles, forage fish abundance, predation pressure) can vary significantly year to year in all drainages, resulting in wide fluctuations in bird numbers (e.g., Jones 2012) and/or nesting success (e.g., Smith and Renken 1993; Lott and Wiley 2012). However, least terns may re-nest, or relocate and re-nest if nests or chicks are destroyed early in the season (Massey and Fancher 1989;

Thompson *et al*. 1997). Least tern chicks leave their nests within a few days of hatching (semiprecocial), but remain near the nests and are fed by their parents until fledging (Thompson *et al*. 1997).

Food and Foraging Habitat

ILT are primarily opportunistic piscivores, feeding on small fish species or fingerlings of larger species (<52 mm [2 in] total length for adults and <34 mm [1.3 in] total length for young chicks) (Stucker 2012). Surveys of nesting colonies on the lower Mississippi River have identified 21 fish species dropped by foraging terns (USACE 2008). These include native species such as shad (*Dorosoma* spp.), carps and minnows (*Cyprinidae*), freshwater drum (*Aplodinotus grunniens*), largemouth bass (*Micropterus salmoides*), white bass (*Morone chrysops*), sunfish (*Lepomis* spp.) and top minnows (*Fundulus* spp.); as well as invasive species such as silver and bighead carp (*Hypophthalmichthys* spp.). On the Missouri River, prey species include emerald shiner (*Notropis atherinoides*), sand shiner (*Notropis stramineus*), spotfin shiner (*Cyprinella spiloptera*), and bigmouth buffalo (*Ictiobus cyprinellus*) of appropriate size (Stucker 2012). Least tern will also occasionally feed on aquatic or marine invertebrates (Thompson *et al*. 1997). Riverine foraging habitats and fish abundance may be influenced by stochastic hydrological conditions and events (i.e., flow, and flood timing and magnitude), and geomorphic modification (Schramm 2004).

In the Missouri River drainage, ILT have been documented foraging for fish in shallow water habitats <12 km (7 mi) from colony sites (Stucker 2012). In the Lower Mississippi River, foraging terns have been observed feeding in a variety of habitats within 3 km (2 mi) of colony sites (Jones 2012).

Migration and Winter Habitat

Fall ILT migrants are believed to generally follow major river basins to their confluence with the Mississippi River and then south to the Gulf of Mexico, however, late summer observations of least terns >150 km (93 mi) from major river drainages suggests some birds migrate cross-country (Thompson *et al*. 1997). ILT exhibit distinct migration staging in August prior to migration. Once they reach the Gulf Coast, they cannot be distinguished from other least tern populations en route to, or within their winter habitats (i.e., Gulf of Mexico, Caribbean islands, Central and South America), therefore the limited information on migration and winter habitat is inclusive of other populations (i.e., Caribbean, Gulf Coast, East Coast). Least terns appear to migrate in small, loose groups along or near shore, feeding in shallows and resting onshore (Thompson *et al*. 1997). Very little is known of least tern winter habitats, other than the birds are primarily observed along marine coasts, in bays and estuaries, and at the mouths of rivers (Thompson *et al*. 1997). Atwood and Casioppo (2011) summarized known information about the distribution of wintering least terns; none of the approximately 50 recoveries of banded birds (through 2004) obtained south of the U.S. were from ILT breeding colonies.

Breeding/Natal Site Fidelity and Dispersal
Breeding-site fidelity for least terns appears to vary in different populations and breeding areas. Thompson *et al*. (1997) summarized reports of return rates of banded adults to sites where banded as 36 to 86% in California colonies, 42% on the Mississippi River, 28% on the central Platte River, Nebraska, and 81% at Quivira National Wildlife Refuge in Kansas and on the Cimarron River in Oklahoma. Fidelity to natal site is also difficult to estimate because re-sightings or recaptures of terns banded as chicks have been limited. Estimates of natal site fidelity have varied from 5% on the Mississippi River, to 82% in Kansas and Oklahoma (Thompson *et al*. 1997).

Site fidelity in least tern may be affected by physical habitat variables or the extent and type of predation (Atwood and Massey 1988, p. 394). As noted above, least terns are strong fliers and can re-locate if conditions on natal or previous year nesting grounds become unfavorable. In a study of eastern least terns, Burger (1984, p. 66) found an average 22% turnover rate in nesting colony sites, primarily due to changes in habitat condition or disturbance. Where the physical characteristics of nesting sites are relatively stable from year-to-year (e.g., California), least terns exhibit higher levels of site fidelity than in areas where nesting sites may be annually reconfigured by the impacts of winter storms (e.g., Massachusetts).

Lott *et al*. (2013) used data from published mark/recapture studies (e.g., Atwood and Massey 1988, Akçakaya et al. 2003) and a large number of unpublished band recovery records to assess least tern dispersal and site fidelity. Their analysis found that 50 to 90% of reported recaptures occurred <26 km (16 mi) from the original banding sites, while >90% dispersed <96 km (59 mi). These data seem to suggest that most birds show a high degree of adult site fidelity and natal site philopatry (remaining near their point of origin), rarely dispersing far from nesting areas. However, most banding study designs focus recapture or re-sighting efforts at or near banding locations, and have a low probability of documenting long distance dispersal (Lott *et al*. 2013). Long distance dispersal (up to 1,000 km) has been documented (e.g., Renken and Smith 1995; Boyd and Sexson 2004, Lott *et al*. 2013), and may not be uncommon (Boyd and Thompson 1985).

Predation
ILT eggs, chicks and adults are prey for a variety of mammal and bird predators. Reported predators include fish crow (*Corvus ossifragus*), American crow (*C. brachyrhynchos*), common raven (*C. corax*), boat-tailed grackle (*Quiscalus major*), gulls (*Larus* spp.), great blue heron (*Ardea herodias*), black-crowned night heron (*Nycticorax nycticorax*), ruddy turnstone (*Arenaria interpres*), sanderling (*Calidris alba*), great horned owl (*Bubo virginianus*), peregrine falcon (*Falco peregrinus*) , American kestrel (*F. sparverius*), northern harrier (*Circus cyaneus*), loggerhead shrike (*Lanius ludovicianus*), red fox (*Vulpes vulpes*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), striped skunk (*Mephitis*

mephitis), opossum (*Didelphis virginiana*), feral hog (*Sus scrofa*), catfish (*Ictalurus* sp.), and domesticated and feral dogs and cats (Thompson *et al*. 1997). Cryptic coloration of eggs and chicks, and secretive behavior of chicks, and mobbing behavior of adult birds protect eggs and chicks from predators (Thompson *et al.* 1997).

Location and size of nesting colonies also has a significant influence on degree of predation. In several studies, ILT reproductive success has been higher on island colonies v. connected sandbar colonies, and when water levels maintained isolation of islands and nesting bars from mammal predators (e.g., Smith and Renken 1993; Szell and Woodrey 2003). Burger (1984) found significantly higher rates of predation in larger colonies compared to smaller least tern colonies in New Jersey.

2.3.2 Distribution and Abundance

Historical Distribution and Abundance

The historical distribution and abundance of ILT is poorly documented. Hardy (1957) provided the first information on least tern distribution on large, interior rivers, documenting records of occurrence and nesting in the Mississippi, Ohio, Missouri, Arkansas, and Red river drainages. Downing (1980) published results from a rapid aerial/ground survey of a subset of the rivers, identifying additional nesting populations within the range, and estimated the interior population at ~1,250 adult birds. Ducey (1981) doubled the number of known nesting sites including areas between the scattered observations reported in Hardy (1957). He also extended the northern distribution of ILT to include the Missouri River below Garrison Dam in North Dakota and Fort Peck dam in Montana. These three publications (Hardy 1957, Downing 1980, Ducey 1981) provide the primary historical sources of information about ILT geographic range (Figure 14), and were used to quantify a range-wide population size of 1,400 to 1,800 adults in the listing rule (50 FR 21789).

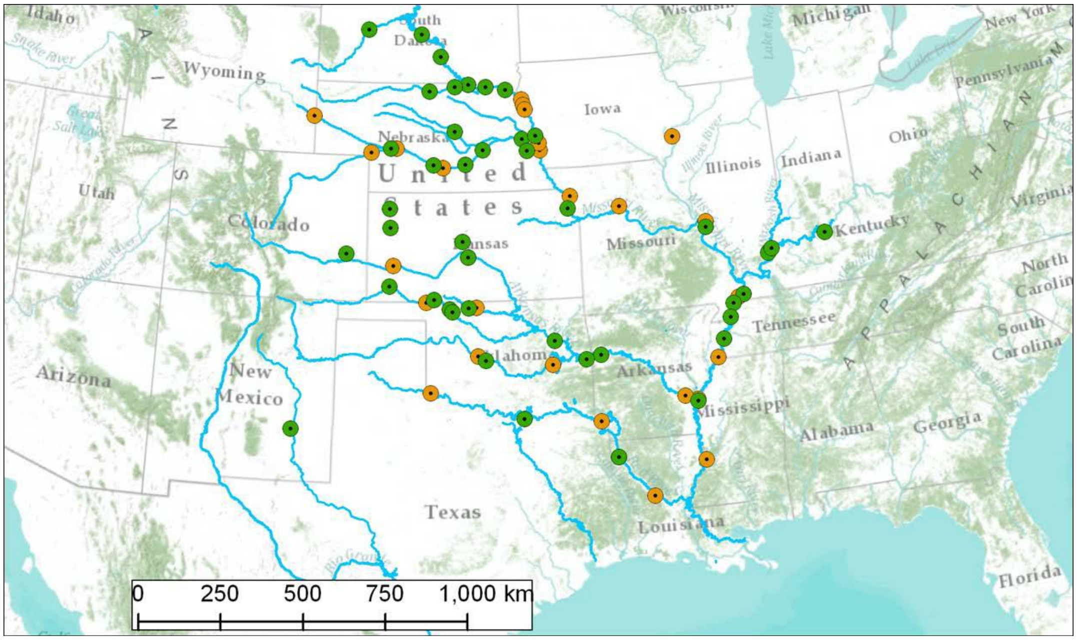

Figure 14: Historical knowledge of the distribution of Interior least tern nesting areas. Brown circles = Hardy (1957); Green = Ducey (1981). Reproduced with permission from Lott (*in litt*. 2012a).

Sidle *et al*. (1985) reported on observations from a number of extensive, regional tern surveys, and increased the range-wide minimum population estimate to ~4,500 adults. This reference, along with the previous summaries, provided the background for regional recovery goals presented in the recovery plan for ILT (U.S. Fish and Wildlife Service 1990). Hill (1992, 1993) subsequently reported extensive observations of ILT from the Southern Plains, particularly from the Arkansas, Cimarron, Canadian, and Red Rivers.

Current Distribution and Abundance

The current documented east to west distribution of summer nesting ILT encompasses >18 degrees of longitude (>1,440 km (900 mi)) from the lower Ohio River in Indiana/Kentucky, west to the Upper Missouri River, Montana (Figure 15). The north to south distribution encompasses >21 degrees of latitude (>2300 km (1,450 mi)) from Montana to southern Texas (Figure 15). ILT currently nest along >4,600 km (2,858 mi) of river channels across the Great Plains and the Lower Mississippi Valley (Lott *et al*. 2013).

In 2005, Lott (2006) coordinated the only simultaneous survey to date of the geographic range of ILT during a 2-week window of the breeding season. Summarized counts from this survey indicated a minimum adult population size of ~17,500, with nesting occurring in >480 colonies spread across 18 states (Lott 2006) (Figure 15; also see Table 1, above, for river system distribution). Lott (2006) also provided counts for 21 populations or population segments unknown at the time of listing, which collectively supported over 2,000 ILT (Table 1). Lott

(2006) considered that both total population size and the distribution and number of colonies from this survey were biased low, since counts lacked methods to account for imperfect detection of adults, and many areas potentially supporting ILT colonies were not surveyed.

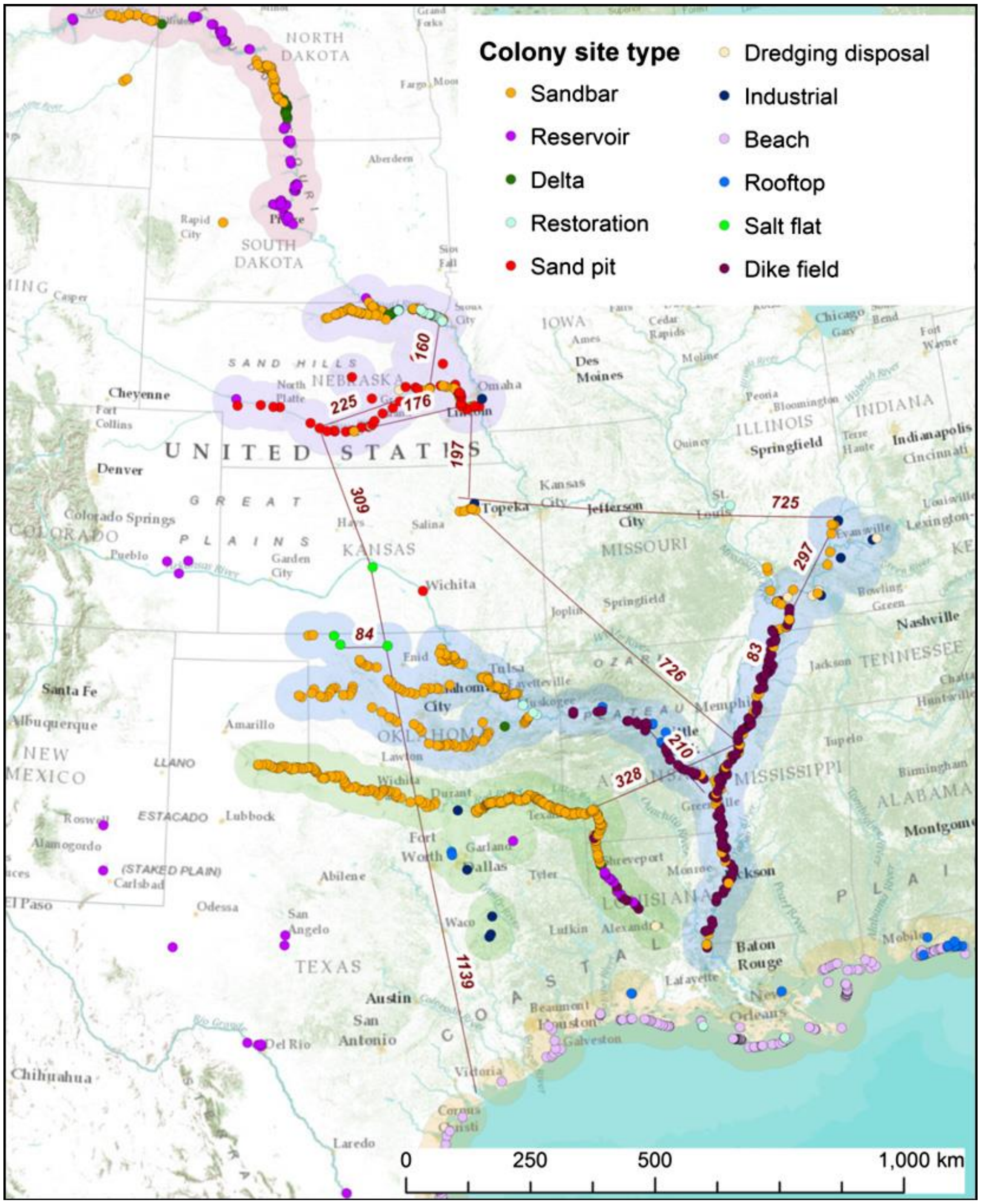

Figure 15: Current range of Interior and coastal populations of least tern. Brown lines labeled by brown numbers illustrate 13 ILT band recoveries reflecting dispersal distances >80 km (unpublished data from the U.S. Geological Survey, Patuxent Wildlife Research Center, Bird Banding Laboratory). Reproduced with permission from Lott *et al*. 2013.

2.3.3 Productivity and Population Trends

Productivity

Productivity (generally measured as fledgling success per breeding adult pair) considered necessary to maintain stable or increasing populations of ILT has been estimated at 0.51 fledglings/pair or higher (Kirsch and Sidle 1999). However, estimates of productivity have been highly variable within and between ILT drainage populations (Kirsch and Sidle 1999; Dugger *et al*. 2000), and do not appear sufficient to support observed increases in local or range-wide populations (Kirsch and Sidle 1999).

Discrepancies between productivity and population trends have also been observed for California least terns. The California Least Tern Recovery Plan identified productivity levels averaging at least 1.0 fledglings/pair as necessary to maintain a stable or growing population of terns (U.S. Fish and Wildlife Service 1985b). However, California least terns have experienced an overall positive population trend even when productivity levels have been substantially lower (e.g., 0.23 to 0.36 fledglings/pair; U.S. Fish and Wildlife Service 2006)

There is strong evidence that ILT productivity naturally varies dramatically by year, and among sites within years (e.g., Sidle *et al*. 1992; Dugger *et al*. 2000). Factors other than fledgling success affecting long-term productivity include post-fledging juvenile survival, adult annual survival, longevity, and/or emigration and immigration (Kirsch and Sidle 1999), all of which are poorly documented for least terns. Models developed by Whittier (2001) found that ILT breeding populations at Salt Plains National Wildlife Refuge, Oklahoma, and Quivira National Wildlife Refuge, Kansas would persist despite low productivity. In these models, longevity and periodic high recruitment counteracted low productivity estimates. However, this was not the case for the Missouri River population, due to low overall productivity, and no peaks in productivity during the monitoring record analyzed (1991-1998, Whittier 2001). Since that time, however, higher fledgling ratios (>1.0) have been occasionally observed in the Missouri River, likely as a result of habitat increases that developed following 1996-97 high flow years (Pavelka *in litt*. 2012).

Dispersal of individuals between populations is an important factor in the persistence of unstable peripheral populations (e.g., Taylor 1990). In such cases immigration of individuals into the population can reduce the magnitude of population fluctuations and even prevent extirpation of the population (Taylor 1990). Dispersal between ILT populations has been poorly documented, but it appears to be an important factor in maintenance of peripheral populations such as the upper Missouri River (Lott *et al*. 2013).

Population Trends

Much of the increase in both ILT counts and colonies may be related to increase in survey efforts and geographical extent of the surveys. Additionally, timing and methods of surveys have varied by drainage, have not been consistent within drainages over the period of record (e.g., Kirsch and Sidle 1998; Lott 2006), and the quality of the available data does not permit us to quantify actual population increase (or trends) over the range of ILT (e.g., Lott 2006). Therefore, below we consider observed trends based upon the available data.

The listed population of ILT has demonstrated a positive observed population trend, increasing by almost an order of magnitude since listing (see **2.2.3**, above). As both the geographical extent and effort of ILT surveys increased after listing, sufficient ILT count data became available to analyze population trends for several river reaches supporting persistent ILT breeding colonies. Kirsch and Sidle (1999) reported a range-wide population increase to >8,800 adults in 1995 and found that 29 of 31 ILT locations with multi-year monitoring data were either increasing or stable. Lott (2006) reported an increase to >17,500 adult birds in 2005, forming 489 colonies in 68 distinct geographic sites.

Lott (2006) conceptualized the ILT functioning as a large meta-population (a group of spatially separated populations of the same species which interact at some level), which might also include least terns on the Gulf Coast. Using available information on dispersal of least tern, Lott *et al*. (2013) defined 16 discrete breeding populations of ILT, with four major geographical breeding populations (population complexes) accounting for >95% of all adult birds and nesting sites throughout the range (Figure 16). Portions of these four population complexes have experienced multi-year monitoring to different degrees. Observed trends for these geographical breeding populations have been addressed under **2.2.3**, **Habitat Criteria**, above.

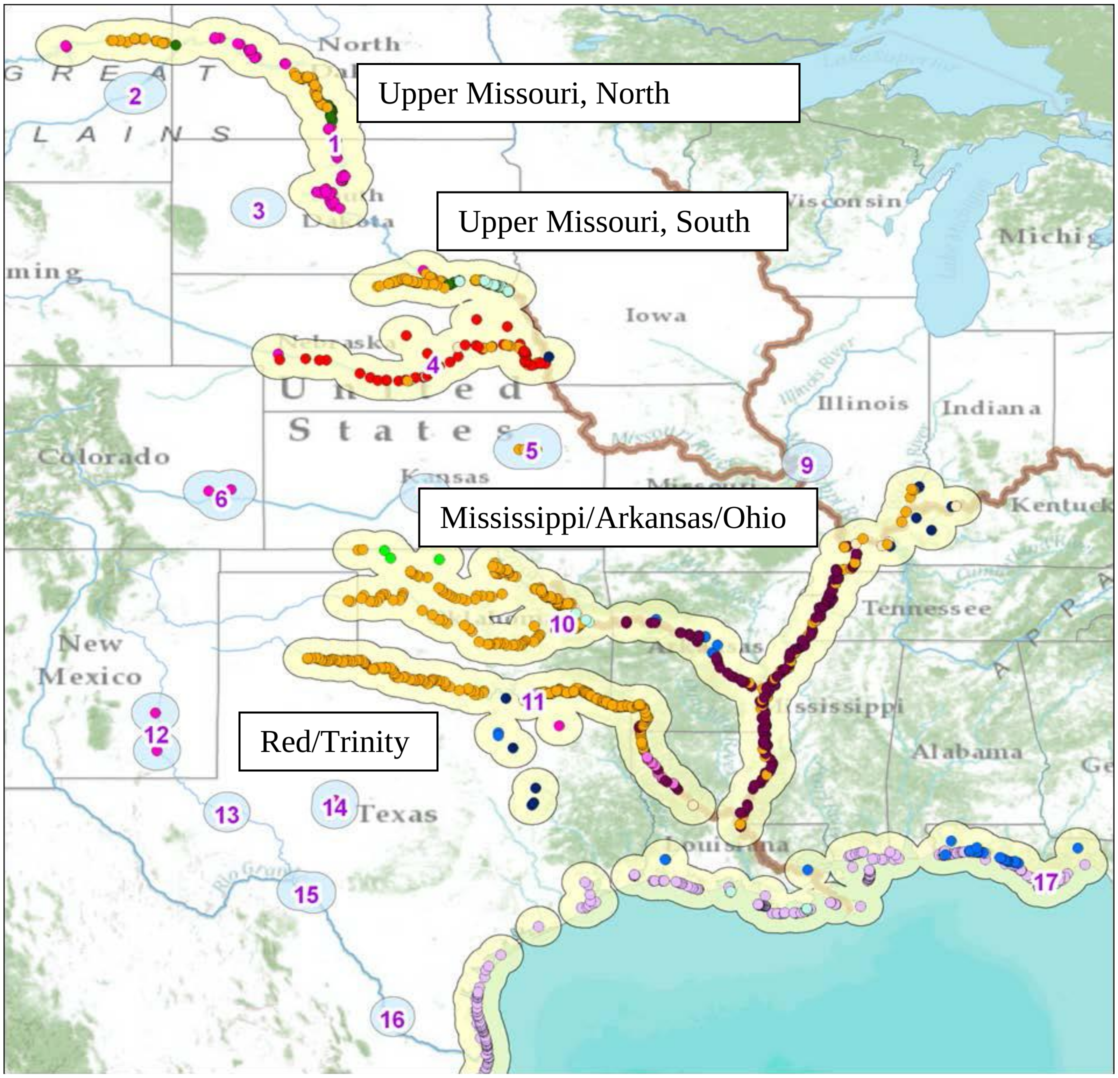

Figure 16: Major populations of Interior least tern. Reproduced with permission from Lott (*in litt.* 2012b).

2.3.4 Taxonomy and Genetics

Least terns within the Interior Basin of North America were described as *Sterna antillarum athalassos* (Burleigh and Lowery 1942). In 2006, the American Ornithologist's Union recognized least terns under a previously published genus (*Sternula*), based on mitochondrial DNA phylogeny (Bridge *et al*. 2005).

Genetic analyses of North American populations of least tern find no evidence of differentiation warranting subspecies recognition (e.g., Whittier 2001; Draheim *et al*. 2010; Draheim *et al*. 2012). Data indicate that genetic exchange between eastern least terns and ILT is occurring at a rate greater than 3 migrants per generation between populations (Whittier *et al*. 2006).

Whittier *et al*. (2006) noted that the general lack of genetic diversity in least tern and other Charadriiformes (shorebirds, gulls, auks and allies) might be an inherent trait, and not the result of a population bottleneck (evolutionary event where a significant proportion of a species is eliminated; or where a population becomes reproductively isolated) or expansion. However, in a comparison of museum specimen DNA with contemporary specimens, Draheim *et al*. (2012) found a reduction in contemporary genetic diversity in both Eastern and California least terns since the 1960's, potential evidence of a past bottleneck possibly related to overexploitation during the 20th century.

2.3.5 Five Factor Analysis

2.3.5.1 Factor A: The present or threatened destruction, modification, or curtailment of its habitat or range.

The primary threats identified for ILT in the listing rule and the recovery plan were the destruction of habitat and curtailment of range due to channel engineering practices on large rivers of the Interior Basin (i.e., damming, channelization, and channel stabilization), and low numbers of surviving birds throughout the range (U.S. Fish and Wildlife Service 1985a; U.S. Fish and Wildlife Service 1990). The 1985 Factor A threat analysis found that reservoirs had inundated hundreds of miles of historical or potential ILT riverine habitat in many drainages of the Mississippi River Basin; reduced sediment input into channels below dams had resulted in channel constriction and loss of ILT nesting islands; and channel training structures (dikes) and bank stabilization measures in the Missouri, Mississippi, and Ohio rivers had prevented natural geomorphic response to loss of sediments, resulting in deepened and narrowed channels, and loss or terrestrialization (vegetation encroachment) of nesting sandbars and islands. Reservoir releases for hydropower, navigation, and flood control also were found to adversely affect ILT populations surviving below these same dams (U.S. Fish and Wildlife Service 1990).

These factors were identified and considered in context with the known historical range and abundance of ILT in 1985 (i.e., Hardy 1957, Downing 1980, and Ducey 1981), and a lack of evidence of the bird in potential range, including most of the lower Mississippi, lower Missouri, and lower Red, Ouachita, and White rivers, as well as on significant portions of the Ohio, Platte, and Arkansas rivers (see Figure 14, above). Trends of habitat degradation were expected to continue throughout most of the ILT's fragmented range (e.g., Smith and Stuckey 1988).

While river channel engineering, including reservoirs, channelization, channel training structures, and bank stabilization, continue to be factors affecting the ILT, reported numbers of nesting ILT have expanded by almost an order of magnitude from <2,000 to ~ 18,000 since the species was listed, and the range has increased significantly (see **2.3.2 Distribution and Abundance**, above). Currently, multiple ILT colonies are known to occur in all major drainages where ILT historically nested, and available monitoring data indicate most of these drainage populations are stable or increasing (see, **2.3.3 Productivity and Population Trends**, Figure 3, above). Additionally, river channel engineering have provided opportunities for ILT range expansion, as well as for positive ILT local management (see, *Habitat Management*, below). Therefore, while factors related to river channel engineering may result in local negative impacts to ILT, and/or limit the size of local subpopulations, there is no evidence that they represent a threat to the continued existence of the species.

Habitat Management: Habitat management has been outlined in some detail under section **2.3.3, Habitat Criteria**, above. At least some proportion of ILT range-wide increase is due to increased awareness, survey efforts, management, and protection. ILT have colonized numerous anthropogenic sites (~15% of sites throughout their range, such as sand pits, rooftops, reservoirs, industrial sites), and the persistence of some of these are reliant upon aggressive management (e.g., predator or vegetation control) and protection (e.g., seasonal avoidance) (see Factors D & E, below). However, ILT have also expanded significantly in range and numbers in flowing portions of the Mississippi, Red, and Arkansas River channels since the 1985 listing baseline (Lott 2006), even in the absence of aggressive management in many of these areas.

ILT nesting habitat availability and quality are primarily controlled by stochastic events (droughts and floods) affecting river flow and habitat quantity and quality (e.g., Sidle *et al*. 1992; Renken and Smith 1995; Lott and Wiley 2012). Productivity peaks may also be influenced by stochastic drought events or cycles in some drainages (e.g., Pavelka *in litt*. 2012). For example, despite severely altered flow regimes and aggressive ILT habitat management in the Missouri River, ILT distribution and population size have remained relatively stable over the period of record. Evidence suggests that habitat condition in this drainage, as well as annual ILT numbers and productivity, are strongly influenced by current hydrologic patterns (see Figure 3, above). While periodic major flow events reset nesting habitat and the forage base, annual reservoir operations can provide some ILT habitat suitability during drought years.

On the Mississippi River, channel training structures (dike fields) and their potential to lead to vegetation encroachment of ILT sandbar habitat were considered causes of decline and imminent threats to the species (e.g., Smith and Stuckey 1988). However, population estimates have increased from <500 birds occupying a short reach of the river in 1985, to >10,000 nesting birds/year along >800 mi of river channel over the past decade (e.g., Jones 2012). Most ILT colonies on the Mississippi River are associated with dike fields, which create higher sandbars with less exposure to flooding during the summer nesting season. Current management practices on the Mississippi River include new dike designs incorporating notches toward the landward end, allowing flow to isolate nesting bars through most of the nesting season (USACE 2008, USFWS 2012, USACE 2013). Additionally, there is an aggressive program to build notches into existing dikes during maintenance activities (DuBowy 2011, USACE 2013).

In other navigation systems that require maintenance dredging (e.g., lower Ohio, Red, and Arkansas rivers), it is becoming standard practice to use the dredged material to build or replenish islands, which are being utilized for nesting by ILT (e.g., Ciuzio *et al*. 2005, Fischer 2012).

Reservoir storage and releases have also been modified to minimize impacts and benefit ILT. In the Arkansas and Red river drainages, seasonal pool plans are considered to allow extended water storage to provide minimum flow requirements during the late ILT nesting season (USACOE 2002). On the Loup River, ILT forage species are benefitted by the maintenance of minimum flows into a channel bypass reach (Loup Power District 2012). In the Missouri River, the USACE has historically monitored and managed ILT nesting areas and reservoir releases to reduce impacts to nesting birds (USACE 2007).

Anthropogenic changes in some river drainages supporting ILT may also have benefited the bird in ways that have partially compensated for habitat losses. For example, in the Lower Mississippi River, impoundment of the major tributaries and channelization of the river have resulted in earlier and shorter duration spring and summer high water events (e.g., Schramm 2004), possibly reducing egg and chick flood related mortality events, extending the nesting season, and increasing re-nesting opportunities. Dam construction in arid regions unsuitable for the species allowed expansion of the ILT range.

Summary of Factor A

Although loss of ILT summer nesting habitat may have occurred on a local or regional scale (e.g., lower Missouri River), we have found no evidence that nesting habitat loss is currently limiting ILT populations on a range-wide scale. The listed population is currently more abundant and wide-spread than historically documented, self-sustaining, and with no evidence of significant regional decline or drainage extirpation over the period of record. ILT are well adapted to annual variability in local habitat availability, quality, and quantity due to their long lives, ability to renest, and dispersal capability (e.g., Thompson *et al*. 1997). The species has been capable of adapting to and utilizing a variety of anthropogenic habitats such as navigation systems, reservoirs, sand mines, etc., allowing the ILT to not only survive, but to thrive in some drainages, and even expand its range into areas without historic occurrence records.

While future conditions within some portion of ILT range may deteriorate due to natural changes (e.g., climate change), or human demands (e.g., water needs in the western plains), the wide range of the inland population of least terns, and the birds ability to emigrate to areas with better conditions reduces the unknown degree of threat (see ***2.3.5.5 Factor E***, below). Because of its listed status, management practices conducive to maintaining ILT nesting habitats and protecting breeding colonies have also been developed and implemented in a substantial portion of the range (see ***2.2.3, Habitat Criteria***, above, and ***2.3.5.4 Factor D***, below). Therefore, based upon the ILT's representation throughout its historical range, its resilience to anthropogenic changes in its habitat, and the redundancy provided by hundreds of breeding colonies in multiple drainages, we conclude that the various activities that can affect and are affecting the habitats of ILT, are not of sufficient magnitude to lead to a curtailment of its range.

2.3.5.2 Factor B: Overutilization for commercial, recreational, scientific, or educational purposes.
Least terns were exploited by egg collectors and for feathers for the millinery trade during the late 19^{th} century (Thompson *et al*. 1997; Draheim *et al*. 2012). We are unaware of any current commercial exploitation of the ILT in any portion of its range.

Least terns may be killed for sport or food on their wintering ground (Thompson *et al*. 1997); however, the three decade increase in abundance on the interior U.S. nesting grounds suggests overutilization on winter grounds, while unknown, may not be significant.

Factor E, below addresses issues of human disturbance by recreational activities unrelated to utilization of ILT. We do not have any information to indicate that overutilization for commercial, recreational, scientific, or educational uses is occurring now or will occur in the future. Therefore, we do not believe overutilization is a factor affecting the ILT.

2.3.5.3 Factor C: Disease or Predation.
Little is known about diseases in least tern, however, infection with paramyxovirus (Jackson and Jackson 1985) and mallophagan ectoparasites have been reported (Thompson *et al*. 1997). An autopsy of a dead bird on the Missouri River recently confirmed West Nile virus (USGS *in litt*. 2012).

ILT eggs, chicks, and adults are susceptible to a wide variety of avian and terrestrial predators (see *Predation*, under 2.3.1, above). While predation is a high natural source of mortality, ILT eggs and chicks are cryptically colored to avoid detection, chicks exhibit "freeze" behavior when threatened, and adults cooperate in alarm calls and attack flights on potential predators to the colonies (Thompson *et al*. 1997). During the period of monitoring on the Missouri River (25 years), the greatest cause of egg loss was predation (3%) (unpublished USACE excel spreadsheet provided by Aron *in litt*. 2012). On the Mississippi River, predation was the 2^{nd} highest cause of ILT egg, chick, and adult mortality (Smith and Renken 1993).

Location of nesting colonies also has a significant influence on degree of predation. Reproductive success has been higher on island colonies than on land connected sandbar colonies on the Mississippi River (e.g., Smith and Renken 1993, pg 42; Szell and Woodrey 2003), and in river colonies than in terrestrial sand pit colonies in the Platte River (Jorgensen and Brown 2012).

Summary of Factor C

While diseases in ILT have been documented, there is no evidence that they are a widespread or significant cause of mortality on nesting areas. The level and effect of predation can be locally high and significant in some colonies and in some years, however, the exponential growth of ILT breeding numbers since listing indicates locally high levels of predation is not currently a threat to the survival of the species. ILT are long-lived, and current population trends indicate that sporadic local breeding failures caused by disease, predation, or parasites are unlikely to be having a significant effect on long-term stability of the listed population. ILT are also adapted to predation by their ability to relocate and re-nest when nests are depredated. Therefore, we have no evidence indicating that disease, parasites, and predation are significant threats to ILT.

2.3.5.4 Factor D: The inadequacy of existing regulatory mechanisms

ILT are found on private, State, and Federal lands throughout their range. ILT are listed as endangered by the States of South Dakota, Nebraska, Colorado, Iowa, Illinois, Missouri, Kansas, Mississippi, Arkansas, Louisiana, Kentucky, Tennessee, Illinois, Indiana, New Mexico, and Texas. Most State laws protect native wildlife (including ILT) from take, and require State permits, in addition to Federal permits to collect, harm, or harass migratory bird species such as the ILT. Many of the States listed above actively manage ILT, including seasonal posting to prevent disturbance (e.g., Kentucky), facilitating cooperative partnerships to protect and manage the bird (e.g., Nebraska), developing State management plans for ILT (e.g., South Dakota; Aron 2005), conducting site-specific research (e.g., Mississippi), and participating in multi-agency planning, management, and monitoring programs (e.g., Missouri River Recovery Implementation Committee).

Contamination of water or the fish prey species of ILT could have a deleterious effect on the species. Under the Clean Water Act (CWA), States establish and maintain water-use classifications through issuance of National Pollutant Discharge Elimination System permits to industries, municipalities, and others that set maximum limits on certain pollutants or pollutant parameters. For water bodies that fail to meet water-use classification standards, States are required under the Clean Water Act to establish a total maximum daily load for the pollutants of concern that will bring water quality into the applicable standard. Current State and Federal regulations regarding pollutants are considered to be protective of shorebird species and contamination of water and fish is not currently known to be a threat to ILT (see ***Factor E***, below).

ILT are covered by The Migratory Bird Treaty Act (MBTA) (16 USC. 703 et seq.), which protects the bird and its parts, nests, and eggs from taking and trade. Federal permits are required under MBTA for certain actions like scientific collecting, falconry, and relocation. The 1985 listing rule identified the inadequacy of existing regulatory mechanisms to prevent habitat loss, as the main threat and cause of decline to ILT (U.S. Fish and Wildlife Service 1985), noting that while ILT was protected from harm or harassment by the MBTA, it did not provide a mechanism to address habitat threats.

At the time of listing and recovery plan development, ILT nesting colonies were primarily known from jurisdictional waters with a strong Federal nexus, i.e., navigation systems, reservoirs, national wildlife refuges, national scenic river reaches, etc. Since listing, these ILT habitats have to various degrees been considered, managed, protected, and/or monitored under the conservation (section 7(a)(1)) and/or consultation (section 7(a)(2)) requirements of the Endangered Species Act. For example, management guidelines, monitoring and conservation strategies, and operating plans in the Missouri, Loup, Platte, Arkansas, and Red rivers have been developed and implemented following formal consultation under section 7(a)(2) of the Act. Management actions in other drainages (e.g., Mississippi, Ohio rivers) have developed through informal consultation under section 7(a)(1) of the Act.

There is concern that absent the protection of the Endangered Species Act, Federal habitat management actions will cease, or decline. However, since ILT was protected under the Act in 1985, national policy concerning the protection, restoration, conservation and management of ecological resources has been enhanced through executive orders and Federal regulations. These include provisions emphasizing the protection and restoration of ecosystem function and quality in compliance with existing Federal environmental statutes and regulations (e.g., National Environmental Policy Act (NEPA), CWA, MBTA). They also endorse Federal efforts to advance environmental goals, and declare it national policy that full consideration be given to opportunities which Federal projects afford to maintain or enhance ecological resources. Recent water resources authorizations have also enhanced opportunities for USACE and other Federal agencies involvement in studies and projects to specifically address objectives related to the restoration of ecological resources.

Executive Order (EO) 13186 (66 FR 3853), enacted in 2001 (entitled: Responsibilities of Federal Agencies to Protect Migratory Birds), requires all Federal agencies to use their authorities and conduct their actions to promote the conservation of migratory bird populations. Actions authorized by EO 13186 include: avoiding and minimizing adverse impacts to migratory birds; habitat restoration and enhancement, and preventing pollution or detrimental alteration of migratory bird environments; designing habitat and population conservation principles, measures, and practices into agency plans and planning processes; promoting research and information exchange, including inventorying and monitoring; and ensuring full environmental consideration of migratory birds such as the ILT under NEPA.

The Civil Works Ecosystem Restoration Policy (CWERP) (USACE ER 1165-2-501) identifies ecosystem restoration as one of the primary missions of the USACE Civil Works program. This policy requires a comprehensive examination of the problems contributing to ecosystem degradation, and the development of alternative means for their solution, with the intent of partially or fully reestablishing the attributes of a naturalistic, functioning, and self-regulating system.

Implementation of actions authorized under EO 13186 and CWERP are discretionary, contingent upon opportunity, as well as annual appropriations and other budgetary constraints (as are the conservation requirements of section 7(a)(1) of the Act). However, many Federal action agencies now have a history of managing and restoring ILT habitats in compliance with the Act, EO 13186, and CWERP. Many conservation activities have become standard operating practices (e.g., monitoring, avoidance, and channel construction design in the Lower Mississippi River, USACE 2013; dredge material disposal in the Ohio River, Fischer 2012), while some actions developed and conducted under formal consultations are adaptable to becoming standard operation practices for continued compliance of EO 13186 and CWERP (e.g., reservoir control and dredge practices in the Red and Arkansas rivers, USACE 2003, 2012). It is also in the interest of Federal agencies, and conservation partnerships (e.g., Platte River Conservation Partnership) to continue management of ILT habitats in order to remain in compliance of executive orders and Federal regulations other than the Act.

Summary of Factor D

ILT are protected under State laws and by the MBTA throughout their range. Activities that may adversely affect ILT and its habitats are currently subject to numerous regulatory mechanisms, including the MBTA, CWA, Fish and Wildlife Coordination Act (FWCA), and NEPA. Federal actions to conserve and enhance ILT habitats are now authorized by executive orders and Federal regulations enacted since the ILT was listed, addressing the inadequacy of regulatory mechanisms identified in the listing rule. As noted in this 5-year review and in particular the five factor analysis, recovery actions (including management, land acquisition, monitoring) undertaken across the range of this bird have resulted in substantial conservation of the ILT along many rivers. Based on our evaluation of authorities and regulations under this factor, we determine that the inadequacy of existing regulatory mechanisms is no longer a threat to the ILT. In addition, as described under section 5.0, we are working with partners to pursue and develop long term management commitments along some of these rivers.

2.3.5.5 Factor E: Other natural or manmade factors affecting its continued existence

Climate Change Effects

Our analyses under the Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change (IPCC). "Climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2012). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2012). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

The distributions of many terrestrial organisms, including birds, are shifting in latitude in response to climate warming (Chen *et al*. 2011). Population declines, apparently in response to climate change, have been reported for long distance migrant bird species in both Europe and North America (Knudson *et al*. 2011). However, negative effects of climate change at one life or migratory stage may be compensated at another stage, e.g., by increased survival or reproduction on winter or breeding grounds (Knudson *et al*. 2011).

The ability of migratory birds to cope with rapid climate change depends upon the rate of adaptive response to the changes (Knudson *et al*. 2011). Phenotypic plasticity (i.e., the ability to shift dates of migration, breeding, fledgling, etc.) may allow rapid adaptation to climate change in some species (Charmantier *et al*. 2008). While there is little information on ILT phenology (i.e., life cycle events and how they are influenced by climate variation), their adaptations to habitats controlled by stochastic events, including high mobility and utilization of anthropogenic habitats, indicates that they will be resilient to predicted climate changes.

Most climate change models predict increased extreme weather events (i.e., floods and droughts) throughout the ILT breeding range (e.g., Lubchenco and Karl 2012). In the absence of clear knowledge of least tern wintering distributions, potential impacts of climate change on the species when it is away from its breeding range are unknown. The ILT is well adapted to cope with extreme hydrologic changes, and its habitat and productivity are closely tied with stochastic weather events. For example, while extreme high flow events may result in annual recruitment loss, such events are also the primary factor in creating and maintaining high quality ILT nesting habitats (Sidle *et al*. 1992,). On the other hand, extreme drought events that connect nesting islands to the mainland and result in increased predation of some ILT colonies, may be offset by higher abundance of available nesting areas, increased dispersal of reproductive efforts, and higher local recruitment rates of some colonies during low flow periods (e.g., see Figure 3, above). Rooftop nesting birds are susceptible to catastrophic recruitment failure due to high summer temperatures (see Watterson 2009, Nupp and Petrick 2010), and colonies on natural habitats may also become negatively affected by increasing summer temperatures. However, ILT are dispersed along a wide latitudinal and longitudinal gradient of climate conditions, and are unlikely to experience range-wide catastrophic recruitment failure due to high summer temperatures. Therefore, while ILT colonies may be locally or regionally affected by changes in frequency and duration of extreme discharge events and droughts, or high temperatures, the dispersal of the ILT over a wide geographical area encompassing a variety of latitudinal and longitudinal gradients, its long life, and its ability to move long distances make the species resilient to future patterns of predicted climate change.

Habitat Loss and Fragmentation and Climate Change

Hof *et al*. (2011) noted that habitat destruction and fragmentation may reduce the likelihood of species surviving climate change, in part because smaller habitat patches sustain smaller populations, which may result in lower genetic and phenotypic variability. Habitat fragmentation can also impede the dispersal ability of species (Hof *et al*. 2011). While ILT has possibly been affected by loss of significant reaches of riverine habitat (e.g., lower Missouri River, lower Red River, etc.), the species has also increased its longitudinal range by exploiting anthropogenic habitats (e.g., reservoir populations in central Texas, Colorado, and the Rio Grande; industrial sites in the Wabash). Additionally, known population size has also increased by an order of magnitude since the range became fragmented (see 2.3.2 Distribution and Abundance, above), and genetic studies have demonstrated gene flow within ILT populations and between other least tern populations (see, 2.3.4 Taxonomy and Genetics, above). Decreases in annual rainfall, overuse and depletion of aquifers, coupled with increased human water demands are occurring in the Southern and Northern Plains rivers (e.g., Roy *et al*. 2012), possibly to the future detriment of ILT habitat and forage availability in those drainages. However, Caldwell *et al*. (2012) noted that increases in impervious cover may offset the impact of climate change in some watersheds, while human demand (consumptions, industrial utilization and irrigation) could either offset or exacerbate climate change impacts in others. Due to the wide longitudinal and latitudinal distribution of the ILT, any potential localized or regional reduction in habitat quantity or quality may be offset by new opportunities in other portions of its range.

Decline of Fish Prey

California least tern chick starvation has been reported due to El Nino effects on fish abundance (Massey and Fancher 1989, Massey *et al*. 1992). Decreased fish prey availability has been linked to reduced ILT egg weights, clutch size, and chick weights, and may influence chick survival and fledgling rates (Dugger 1997). Declines in fish prey have been noted on the Missouri River (Stucker 2012), and in some years on the Mississippi River (Dugger 1997). Fish prey abundance has also been linked to cyclic river conditions (e.g., river stage during nesting season; Dugger 1997). ILT, however, are strong flyers, capable of exploiting a large variety of aquatic habitats and fish species, including exotic species that may invade river systems (e.g., see *Food and Foraging Habitat*, under 2.3, above). These characteristics, coupled with the birds long life, its ability to re-nest, and its ability to relocate to more productive areas, likely enable it to cope with local periodic cycles of fish prey abundance.

Other Factors

Thompson *et al*. (1997) documented the mortality of ILT eggs, chicks, and/or adults due to a number of factors. These included flooding of nesting areas during heavy summer rains and high water events, exposure to pesticides (Jackson and Jackson 1985) and other contaminants, burial of eggs by sand, hailstorms, heat, cold, sandspurs, fire ants, fireworks, airboats, off-road vehicles (ORV), and human recreationists. Cattle trampling has been documented in the Red (Hervey 2001) and Niobrara rivers (Yager *in litt*. 2012). Nupp (2012) has documented mortality of eggs and chicks from heat exposure in rooftop colonies.

As noted previously, ILT are adapted to effects of potential flooding of nesting areas. Sampling for contaminants in ILT has been concentrated in the Missouri River drainage, where sub-lethal amounts of arsenic, mercury, chlorinated hydrocarbon, selenium, and PCBs have been documented in the species (Fannin and Esmoil 1993, Ruelle 1993, Allen *et al*. 1998), however, no incidences of death or decreased fitness due to contaminants have been reported to date. ORV impact has been documented in most drainages where ILT nest (Red, Mississippi, Arkansas, Ohio, and Missouri river drainages). ORV access to nesting areas is usually limited to flow conditions which provide access to nesting areas. In some areas, ORV access is managed by posting and/or fencing, while in more remote areas, it is uncontrolled. While other threats (i.e., sandstorms, hailstorms, heat, cold, sandspurs, fire ants, fireworks, airboats, etc.) may increase in frequency and severity in some portions of the range, most are site-specific and sporadic, or otherwise limited in scope.

Summary of Factor E

Mortality of ILT has been documented to occur locally throughout the range of ILT due to a variety of natural or man-made factors. However, the wide distribution of the species, currently high numbers, its long life span, and its ability to emigrate and re-nest (see sections ***2.2*** and ***2.3***, above) make the ILT resilient to occasional or periodic sources of mortality, and possible effects due to climate change. The increase in range and population size over the past three decades indicates that sources of mortality on localized colonies are compensated by these traits of resiliency, as well as by the potential of high recruitment rates in other ILT colonies or populations. Therefore, we have no evidence that other natural or man-made factors are detrimentally affecting the ILT throughout all of its range.

3. Synthesis

ILT continues to be represented throughout most of its historical latitudinal summer nesting range. The species has demonstrated resilience, expanding its longitudinal summer nesting range by colonizing reservoirs constructed in drainages where this species in not known to have historically occurred, and by adapting to a variety of other suitable anthropogenic habitats. Range-wide numerical recovery criteria have been met and exceeded for more than a decade. ILT regional and range-wide population persistence and increases in numbers of birds and nesting colonies demonstrate successful protection and management of its habitat.

While some portions of the potential historical range may have become periodically or permanently unsuitable for ILT nesting, the species has increased in abundance and nesting colonies in geographical areas where habitat conditions are more accommodating. Threats and sources of threats to ILT are primarily localized (e.g., predation, vegetation of habitat, human disturbance, reservoir releases), regional (e.g., water table and flow declines), and/or stochastic (e.g., floods and droughts), and are not significant to the range-wide status of the species. ILT has expanded in population size, number of breeding colonies, and range, showing resilience to these threats, and response to continued and ongoing local management.

As a result of the ILTs protected status, some Federal management actions (i.e., seasonal avoidance of nesting areas, habitat protection and improvement) have become standard practice in much of the range of the species, while other management actions can be continued or initiated under existing regulatory mechanisms such as the MBTA, CWA, FWCA, NEPA, and State regulations (e.g., colonies affected by reservoir releases). Some local or regional areas may require intensive management to maintain persistent ILT nesting colonies over time (e.g., anthropogenic colony sites along the Platte River and in other watersheds). While we encourage continued management of such areas, these represent a relatively small proportion of range-wide nesting sites and birds.

Based upon our review of the best available scientific and commercial information, which demonstrate an increase in abundance, number of breeding sites, and range of the ILT; and the 5-factor analysis, which demonstrates resiliency to existing and potential threats, the implementation of beneficial management practices, and changes in existing regulatory mechanisms that are protective of migratory birds, we conclude the Interior population of least tern is recovered, and no longer qualifies for recognition as a Distinct Population Segment of vertebrate species under the conservation element of the Services DPS policy (61 FR 4722). Therefore, we recommend that the ILT be considered for delisting upon completion of the recommended actions identified under section 5, below.

4. RESULTS

4.1. Recommended Classification:

Delist, due to recovery.

As described in this analysis of the best available information, we conclude that the ILT is biologically recovered. However, we are not recommending initiation of a delisting proposal of the ILT at this time for three reasons. First, we will complete and review the rangewide population model to determine if it further confirms our assessment of the status and trends of the DPS. Second, prior to delisting, we intend to seek and obtain commitments to maintain management through conservation agreements. Finally, prior to delisting we must prepare a range-wide monitoring strategy and plan. These three actions are in progress (see, **5.0 RECOMMENDATIONS FOR FUTURE ACTIONS**, below).

4.2 New Recovery Priority Number: 14 (This number indicates a species with a low degree of threat and a high recovery potential. With successful partnerships developed to help this bird, recovery progress documented for this animal, and our progress so far on remaining recovery actions, we believe "high recovery potential and low threat" is justified for this bird.)

4.3 Reclassification Priority Number: 2 (This number reflects that clarifying this bird's appropriate listing status would have a high management impact and that it is an unpetitioned action.)

5.0 RECOMMENDATIONS FOR FUTURE ACTIONS

5.1 Complete a habitat driven metapopulation model, incorporating regional data on habitat availability, river stage inputs, nesting behavior and productivity, and dispersal characteristics of the ILT.

A range-wide, spatially explicit metapopulation model is currently under development by a multiagency, multidisciplinary team. This model is being designed to test questions and assumptions regarding ILT regional and range-wide status. Estimated completion: 2014.

5.2 Develop conservation agreements for post-listing monitoring and management.

A USACE conservation plan for the Lower Mississippi River has been developed by the Mississippi Valley Division (USACE 2013) which identifies beneficial management practices for conservation of ILT and other endangered species as standard operating procedures and Best Management Practices. Discussions have been initiated with the USACE Louisville District on a similar plan for the Ohio River, and will be initiated during 2013 with Districts within the range of ILT in the USACE Southwestern and Northwestern Divisions. These conservation plans will be developed with the understanding that they may be modified as post-delisting management agreements. Agreements for post-delisting monitoring and management will also be solicited from NGOs and industries currently conducting ILT habitat management (e.g., Loup Power District, Interior Least Tern and Piping Plover Conservation Partnership, and Duke Energy Corporation Habitat Conservation Plan).

5.3 Develop a post-delisting monitoring strategy and plan.

Since the ILT was listed, monitoring has consisted primarily of bird counts as a means to measure population size and trend. Methodology and frequency of counts have been inconsistently applied throughout the range. Data reporting has been inconsistent. A small number of studies have shown detection ratios for counts to be variable among locations and years (and almost always biased low). Even where counts have been consistent their value for trend detection is limited due to high annual variability in counts and incomplete coverage of the whole range (since ILT move among regions in response to changing habitat conditions). The Service is currently considering alternative monitoring strategies that can be adjusted for different watersheds throughout the range of ILT, and provide a viable mechanism for adaptive management. Such strategies may consider habitat quantity, quality, and distribution, and/or ILT distribution (e.g., regional group size distributions and numbers of colonies) and responses to management. Development of a cost-effective range-wide monitoring strategy for ILT is scheduled for 2014, and will be described in a proposed rule to delist the species.

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Yager, L. 2012b. Re: Niobara tern counts. Missouri National Recreational River, Yankton, SD. Spreadsheet emailed to P. Hartfield, U.S. Fish and Wildlife Service, Jackson, Mississippi.

APPENDIX A: Summary of peer review for the 5-year review of Interior least tern (*Sternula antillarum*)

A. Peer Review Method:

The 5-year review was emailed to nine reviewers with known expertise and interest in the Interior least tern and/or its habitats, along with a request for peer review. Peer reviewers included State, Federal, University, and non-governmental agency biologists.

B. Peer Review Charge:

As you may be aware, in 2008, the U.S. Fish and Wildlife Service announced the initiation of a 5-year review of the status of the Interior population of least tern. The purpose of a 5-year review is to summarize new information for the Interior least tern, ensure that the classification of the species as endangered is accurate and reflects the best available information, and to identify actions that may be required to conserve the species. Our review of the Interior least tern is in its final stages. In order to ensure the best biological and commercial information is being used in the decision making process, as well as to ensure that reviews by recognized experts are incorporated into the review process, we solicit independent peer review on the general and scientific information presented in this document and our evaluation of factors affecting this species.

You have been identified as knowledgeable about the Interior least tern, its range, or its habitat. In order to ensure that the best available information has been used to conduct this 5-year review, we now request your peer review of the attached draft document.

The format is standardized, and we are specifically seeking comments on the accuracy of the data used, and identification of any additional new information on the species that has not been considered in this review. Also note that this review will not be published, but it will be posted on the internet, and become a part of the species' administrative record.

We appreciate your interest in furthering the conservation of rare plants and animals by becoming directly involved in the review process of our Nation's threatened and endangered species. You can be certain that your information, comments, and recommendations will receive full consideration, and will also become a part of the administrative record for this species.

Because this is such a wide-ranging species, multiple levels of inter- and intra-agency review will be necessary prior to release of a final document. In order to accomplish this in a timely manner, we would appreciate receiving your scientific review and comments before the end of February, 2013, if possible.

We hope that you view this peer review process as a worthwhile undertaking. Please give me a call if you have any questions (601-321-1125). Also feel free to respond by email (paul_hartfield@fws.gov) or letter, whichever is most convenient.

Thank you for your assistance.

C. Peer Review Comments and Response to Peer Review Comments

Comments were received from four of the nine peer reviewers solicited. All reviews contained minor editorial comments, which were incorporated where appropriate. Comments and our response to comments from each peer reviewer are provided below.

T. Nupp, Ecologist, Arkansas Tech University, Russellville, AR:

General Comment: Overall I found it (*the draft document*) to be well-written. I corrected a few minor things within the text and made some comments and suggestions. Just by reading my comments you may get the impression that I am not in favor of the delisting process, but that is not true. I would agree that the sheer numbers of terns logically leads to discussion about delisting, but I also want to proceed with an abundance of caution. Two things concern me the most; first *(1)* the lack of a comprehensive population model that describes the contribution of various subpopulations (parts of the metapopulation complex), and secondly *(2)* the unknowns of future threats (mainly climate change). Prior to the last couple of years I wouldn't have thought climate change was a significant threat, but seeing firsthand the loss of colonies on rooftops following some of the hottest summers on record makes me wonder. Regarding the population model, several authors have suggested that the growth in ILT populations might be largely due to production on the lower Mississippi. If true, that also points to a potential vulnerability should anything happen to that population. That's all I have for now. Thanks for your work and I hope my comments help.

Response: Because this was a pre-decisional document, section 4.0 (Recommended Status) was purposefully left blank. The recommended change in status, which was not discussed in the peer review draft, has been herein elucidated.
1) A range-wide, spatially explicit metapopulation model is currently being developed (see 5.1, above), and will be completed and used to test many questions and assumptions regarding ILT prior to any proposal to change the conservation status. This model, along with other actions that should occur prior to a change in ILT conservation status are addressed in section 5.0: Recommended Actions, above.
2) As you note, future threats due to climate change are largely unknown. We have considered available projections of climate change in regard to the ecology, distribution, and abundance of ILT (see Factor E, Climate Change Effects). We have also included consideration of effects of higher summer temperatures in this draft.

Specific Comments:

Pg. 27: I would like to suggest that somewhere in your discussion of habitat you would mention that rooftop nesting birds are susceptible to catastrophic colony failure due to high summer temperatures (see Watterson 2009, Nupp and Petrick 2010). This also has implications for climate change as high summer temperatures have been identified as a mortality factor even on ‘natural’ habitats (Overstreet and Rehak 1980). Also, numbers of terns using rooftops for nesting in Arkansas appears to be related to availability of riverine habitat as there is an inverse relationship between numbers of terns at rooftops and nearby riverine colonies. Also, terns were first observed nesting on rooftops in Arkansas in 2007, a summer in which flooding Arkansas River levels inundated most if not all potential sandbar habitat.

Response: This information has been incorporated (see Habitat Criteria, Southern Plains Rivers).

Pg. 29. Counts from these aerial surveys (*Downing 1980*) severely underestimated the numbers of terns.

Response: We concur. Downing (1980) conducted the first attempt at a breeding season range-wide survey that included field efforts and multiple collaborators. His effort, while limited, produced the first estimate of the size of the interior population of least tern. While Downing described the survey as "rough, subjective" it provided the basis for a status assessment of the ILT. In this, he noted factors affecting the species abundance and distribution (i.e., channel modifications, water withdrawal, vegetation encroachment, predation, etc.) considered in the 1985 listing, the 1990 recovery plan, and in this 5-year review.

Pg. 31: Although Lott (2006) was likely biased low, it was the first systematic count and the estimates provided are likely more realistic than the numbers provided in Sidle and Kirsch (1999) and the numbers included in the recovery plan. My concern here is that this section reads like there have been tremendous increases in numbers of terns. I believe numbers have increased, but I'm afraid that the early counts were so severely biased, that it gives the impression that tern populations are growing fantastically and more likely we're doing a much better job counting them. We have seen an increase in counts on the Arkansas River since 2001, but part of that is also due to increased survey effort. It's a good thing that we are putting more effort into studying terns, but I'm afraid it makes it really difficult (*to assess*) if counts represent actual population increases.

Response: That much of the increase in both ILT counts and colonies is related to increase in survey effort and geographical extent of efforts is very evident within the administrative record. We also recognize that relationships between abundance and recovery are strongly affected by extrinsic threats to the species. Therefore, we have evaluated abundance in the context of threats to the ILT throughout its range (see **2.3.5 Five Factor Analysis***, above). We have also clarified our use of the data in consideration of apparent population trends and threats in this draft.*

The primary source for this statement (*fledge ratio of 0.51 to maintain stable population*) is Kirsch (1996). Kirsch and Sidle (1999) also mention that required productivity to achieve positive growth in some populations would be somewhat higher than 0.51 fledglings per pair.

Response: In order to assess fledge ratios required to maintain a stable population, they must be considered relative to other factors affecting recruitment, including post-fledging *juvenile survival, adult survival and longevity, and/or emigration and immigration, all of which are poorly documented for least terns. The discussion following this statement notes that these factors determine the fledge ratios necessary to achieve long-term productivity and colony growth.*

Pg. 35: (*ILT have colonized numerous anthropogenic sites*). This certainly points to the adaptability of ILT, but does it also relate to a lack of suitable 'natural' habitat? Are these anthropogenic sites ecological traps?

Response: Within large metapopulations of mobile species, small subpopulations (or colonies within subpopulations) may occur in habitats where recruitment is not consistent, or which may not exceed mortality, i.e., population sinks. While exploitation of anthropogenic habitats may indicate a lack of suitable habitat in the area, they also may be an indication of overall population or subpopulation expansion. Sink colonies may also play important roles in metapopulations by providing opportunities for range expansion, and/or redundancy from episodic stochastic impacts to preferred natural habitats. While some anthropogenic colony sites may be periodic or consistent population sinks, there is no evidence that they are detracting from range-wide survival of ILT, considered in light of the substantial increase in the known number and size of ILT colonies in natural habitats over the past two decades, and the colonization of numerous anthropogenic sites, particularly outside of the historical range of the species (i.e., Illinois, New Mexico, Colorado). The role and effect of sink populations on ILT are being considered in the metapopulation model currently being developed.

Pg. 36: Different subject that deserves its own paragraph (*flow releases below dams*). I've seen little evidence that flow releases have been managed for the benefit of terns in Arkansas. In fact low elevation sandbars are subject to inundation after just moderate increases in flow. I think it would be relevant to spend more time discussing flow regimes as part of habitat management because this is an area where great improvements could be made. Flooding remains the most important cause of nest failure in many drainages.

Response: Flooding was historically, and remains a primary cause of ILT nest failure in both regulated and unregulated river channels. However, flooding is a natural event that is necessary to maintain natural habitat features (see **2.3.1 Biology and Habitat;** *Nesting Habitat and Behavior, above). ILT appear to compensate for flooding vulnerability by various mechanisms, including their longevity, mobility, and potential to re-nest (up to 3 nesting attempts/season). We've provided examples of reservoir management modifications (including the Arkansas River drainage) that are used to reduce impacts to ILT.*

Please see Knoll (2006). She documented a 31% decline in suitable habitat on the Arkansas River between 1984 and 2001.

Response: Similar patterns, i.e., habitat deterioration between habitat-forming flood events occur in other drainages. In the Arkansas River, sandbar nesting habitats were restored after high flows of 2007-2008.

Pg. 41: This (*latitudinal shift in range in response to climate change*) would be a hard thing for ILT to do because drainages go from N to S in North America and the best and largest habitats occur in the lower Mississippi.

Response: The referenced text refers to observed shifts in bird distribution in response to climate change. ILT have both a large latitudinal (north to south) and longitudinal (east to west) nesting range. This wide range provides redundancy in the event of regional climate changes.

Pg. 41: *(ILT) adaptations to habitats controlled by stochastic events, including high mobility and utilization of anthropogenic habitats, indicates that they will be resilient to predicted climate changes*. I don't follow the logic. Because ILT will use unnatural habitats and they are highly mobile they will be able to adapt to climate change? We have demonstrated that high summer temperatures lead to catastrophic nest failure on rooftops in Arkansas. What would happen if the frequency of extremely hot summers increased over all of central North America. I don't know what effect, if any, climate change will have on ILT, but I'm uncomfortable saying that they are resilient to climate change effects.

Response: The referenced text discusses the role of phenotypic plasticity (i.e., the ability to shift dates of migration, breeding, fledgling, etc.) in adaptation to predicted climate change. While little is known about how ILT life cycle will be influenced by climate variation, their mobility and adaptation to and exploitation of a wide range of anthropogenic habitats (including reservoirs, industrial sites, and sand mine in addition to rooftops), is an indication of resiliency.

Pg. 41: *Most climate change models predict increased extreme weather events (i.e., floods and droughts) throughout the ILT range (e.g., Lubchenco and Karl 2012). The ILT is well adapted to cope with extreme hydrologic changes, and its habitat and productivity are closely tied with stochastic weather events. For example, while extreme high flow events may result in annual recruitment loss, such events are also the primary factor in creating and maintaining high quality ILT nesting habitats (Sidle et al. 1992). On the other hand, extreme drought events that connect nesting islands to the mainland and result in increased predation of some ILT colonies, may be offset by higher abundance of available nesting areas, increased dispersal of reproductive efforts, and higher local recruitment rates of some colonies during low flow periods (e.g., see Figure 3, above). Additionally, the dispersal of the ILT over a wide geographical area encompassing a variety of latitudinal and longitudinal gradients, its long life, and its ability to move long distances make the species less vulnerable to future patterns of predicted climate change.* I think other reviewers will likely have problems with this section. I don't think you can say for sure what will happen to ILT if North America experience more extreme weather events. You could imagine a circumstance where increased frequency of floods on the Mississippi River limits the productivity over several years and ILT populations take a nosedive. I don't know anyone knows if that would or could happen, but you should acknowledge the lack of information. What we need are predictive models that tell us what would happen if the frequency of floods or droughts increases. Until we have that kind of model we would just be guessing about likely effects of climate change.

Response: We agree that local, regional, or range-wide patterns and impacts of climate change on ILT are unknown. We have evaluated broad predictions of climate change models (i.e., increased frequency of floods and droughts) in light of the distribution and ecology of ILT, as well as relative to observed responses of local and regional subpopulations to drought and flood cycles. The metapopulation model currently under development may provide additional insight to the effects of climate change, which we will evaluate prior to proposing a change in conservation status.

Pg. 44: *Some local or regional areas may require intensive management to maintain persistent ILT nesting colonies over time (e.g., anthropogenic colony sites). While we encourage continued management of such areas, these represent a relatively small proportion of range-wide nesting sites and birds, and there is no evidence that their persistent annual occupation by ILT is essential to the survival of the listed population*. Lack of evidence is not evidence itself. I'm not sure we've gotten to the point of saying which portions of the overall population are important and which are not. Many of the most successful breeding locations on the Arkansas River are dredge spoil islands. I'd personally hate to see mgmt. of those habitats go away because we think they're unimportant.

Response: Anthropogenic colonies currently support <5% of the ILT population. Some of these persist without any management, and some which are currently highly managed would likely persist without management. However, should ILT be delisted, least terns will remain protected under the Migratory Bird Treaty Act (see Factor D, above), which provides the USACE with the authority to protect and manage migratory bird habitats (see Factor D, above). Additionally, we are working with USACE and other agencies, NGOs, and industries to develop management agreements to ensure continued protection and management of both natural and anthropogenic habitats for ILT (see Recommendation 5.3, above).

Pg. 46: Recommendation 5.1: This is a good recommendation. We really need more information on the contribution of various portions of the range to the overall growth of the population. If it's true, as several authors have suggested, that the Mississippi River contributes greatly to the overall population growth, then we might be concerned about future management on that section. If that is the key population then we need to be extra careful about potential threats there.

J. Atwood, Ornithologist, Antioch College, Yellow Springs, Ohio:

I am uncomfortable with concluding that "the Interior population of least tern no longer warrants protection under the Act as a DPS". Granted, the analysis as presented in section 3.0 Synthesis appears to support this conclusion, but it seems to me that the first two 'Recommendations for Future Actions' (5.1 Complete a habitat driven metapopulation model, incorporating regional data on habitat availability, river stage inputs, nesting behavior and productivity, and dispersal characteristics of the ILT and 5.2 Develop standardized protocols for monitoring ILT population trends) should be completed prior to, not after, a recommendation that the ILT be delisted. Especially troubling is the high degree of variability in censusing/monitoring methodologies used among different regions or states (pp. 11 & 15); while the document does a good job of identifying how such survey differences might influence resulting population estimates, to then use the resulting uncertain estimates as one of the important bases for delisting seems premature.

Response: The recommended change in status, which was not discussed in the peer review draft, has been herein elucidated. As noted under **4.1. Recommended Classification**, *above, announcing the conclusion of the review for the ILT allows the Service to remain in compliance with our policy to complete 5-year reviews in a timely manner, and to prioritize this possible recommended change in status as appropriate. It also will allow ample time to complete recommended actions, already in progress, which will further support a delisting proposal (see,* **5.0 RECOMMENDATIONS FOR FUTURE ACTIONS**, *above). The 5-year review finding will also encourage our Federal, State, and private partners to cooperate in planning actions for post-delisting monitoring and management.*

We have tried to fully recognize the variability and limitations of available monitoring data. However, in the consideration of recovery, information on the current abundance of ILT must be considered in the context of threats. Therefore, we have used the best available scientific and commercial information to evaluate regional and range-wide ILT abundance in the context of threats to the ILT throughout its range (see **2.3.5 Five Factor Analysis**, *above) to reach our conclusion.*

C. Lott, Ornithologist, American Bird Conservancy, Boise, ID

American Bird Conservancy (ABC) would like to commend the FWS on a very thorough 5-year status review for Interior Least Terns (ILT). We agree with the final status determination and, in general, with the final recommendations (although we have specific comments on these, below). We are familiar with the state of the science for this species and believe that the 5-year review meets the standard of using the best available information to come to the conclusions that were reached via the 5-factor analysis, which we think is very strong. In particular, we strongly agree that ILT populations exhibit resiliency, representation, and redundancy. In addition, we agree that the ecological processes that maintain ILT habitat, while affected by extensive civil engineering across their range, are still functioning to create ample high-quality habitat for ILT in a number of locations across their range.

Since many of the federal projects responsible for habitat alteration have been present for >50 years, we are comfortable with the FWS inference that, despite this alteration, we expect that many ILT populations will continue to experience favorable habitat conditions for the foreseeable future. Much of the literature on this species has claimed that river engineering and regulation has created a perilous situation for ILT. While this has been true for some areas (e.g., river reaches that were inundated as reservoirs filled, the Lower Missouri River Navigation System, and parts of the Platte River where the river bed has become forested due to water over-appropriation), we disagree with previous studies that have claimed that river regulation jeopardizes the existence of the listed entity. We have never seen support for these claims and have disagreed strongly with the underlying assumptions associated with the publications and documents that have made them, in particular the USFWS jeopardy opinion for ILT on the Missouri River, which we believe has very little basis in reality.

While we have specific comments on the 5-year review (below), we also have one general comment that we feel should be addressed as this review moves forward. That is, we feel this document frequently implies, or states, causation in situations where causal links are not clear. For example, in the numerical criteria section, it is stated that "…increasing ILT numbers in the Mississippi, Red, Arkansas, and Ohio river drainages also correspond with… conservation efforts." We think that the use of the word "correspond" here implies that conservation measures were responsible for population increases. The word "correlate" would be more appropriate, since there have been few studies that have directly linked specific conservation actions with population increases. While we agree that conservation efforts have been extensive in some areas, there have been other areas where population increases have occurred in the absence of direct conservation measures. The metapopulation modeling effort that is recommended at the end of the 5-year review (recommendation 5.1) was designed, in part, to help understand how much specific management actions may lead to population increases or what might happen to ILT populations in the absence of this management, which in some cases is quite costly. Another example of the overstatement of causation can be found in the "Southern Plains" section of the "Habitat Criteria" section, with the statement "management actions in reaches of the Red and Arkansas Rivers have resulted in stable or increasing ILT populations…". Again, not all portions of these river systems have been directly managed, and it is unclear if population increases are closely related to management actions or if they would have happened in their absence. In this case, it seems like the words "resulted in" should be replaced by "correlate with". Rather than pointing out all instances in the review where too much causation is implied, we suggest that a revised version should be consistently edited to fix this.

Response: Suggested changes have been incorporated.

One small point... The second paragraph of Section 2.3.5.1, in the 5-factor analysis, lists the Ouachita and White Rivers as part of the historic range of ILT. No historic evidence has been presented that these rivers have ever contained ILT nesting populations and ILT have not nested on these rivers in the years since listing. We disagree that these two rivers should be considered part of the historic range of ILT.

Response: We concur. These are identified with other rivers in a list of potential (but mostly undocumented) historical range.

Similarly, we agree with the suggestion in the 5-year review that current nesting on reservoirs of the Rio Grande/Pecos system may reflect a recent population expansion of ILT into this river system rather than vestigial nesting populations of a more formerly widespread breeding population on the Rio Grande (as implied in the recovery plan). While pre-alteration conditions on parts of the Rio Grande may have supported some suitable ILT habitat, there is no historic record of ILT nesting on the river aside from reservoir shorelines. Similarly, post-alteration flow regimes on this river are entirely inimical to ILT habitat development or successful nesting. We believe that successful nesting in the Rio

Grande/Pecos drainage should not be expected outside of reservoirs. We also believe that progress towards recovery targets in this system (Rio Grande/Pecos) cannot be evaluated due to the absence of survey data in ANY one year since the species has been listed for all known reservoirs with nesting populations.

Regarding the population size targets in the 1990 recovery plan, it is our opinion that these had an extremely limited empirical basis and were developed using professional opinion supported by limited information at the time of listing, rather than any sort of quantitative analyses or objective criteria that could be defended today. Consequently, we do not view the failure to consistently exceed, for example, the population target for the Missouri River drainage as a reliable indicator that the species has not recovered to where it no longer needs the protections of the Act. Rather, we believe that ILT populations in the Northern Plains have demonstrated resilience and maintain a representative and redundant distribution despite the most extensive river alteration across the range of ILT. Of course, management actions for the benefit of ILT (e.g., sandpit management on the Platte River and habitat restoration on the Missouri River) may be responsible for some of this population's observed dynamics. We believe these are issues to explore via simulations of different scenarios in the metapopulation model that is being developed (e.g., how much has habitat restoration helped progress towards recovery, what would happen if restoration activities in the Omaha district came to an end?). We agree with the FWS' conclusions of ILT status despite the fact that some of the recovery plan's targets have not been consistently met, since ILT population size is large, distribution is extensive, and the ecological processes that support habitat renewal are also extensive. We do not see threats that were previously identified in the recovery plan (e.g., nesting habitat quantity or quality, human disturbance) as widespread or severe enough to be potentially limiting factors. While some hot-spots of poor habitat quality and high disturbance occur, these are minor compared with the number of locations where habitat quality is high and disturbance is low across the range of the listed entity.

The "Population Trends" section of section 2.3.3 includes several graphs that plot tern counts by year. Some of these include trend lines, although none include confidence intervals and the "significance" of population trends is not evaluated statistically. Given the high annual variability in Least Tern counts for each area that is being considered, we suspect that if actual trend estimates were calculated they would be quite imprecise for all areas, and for many areas large confidence intervals would overlap a flat trend line representing no clear population change.

Response: Trend lines have been removed.

Page ii of the 1990 Recovery Plan states that populations must be "stable or increasing" above population thresholds for at least 10 years. Given the high variability of ILT counts, we suggest that quantitative evaluation of these criteria would result in conclusions of no significant positive or negative trend for most areas. We also point out that it is not possible to statistically determine if a population trend is "stable". Quantitative trend analyses typically conclude with the determination if population trends are significantly positive, significantly negative, or not statistically significant (if confidence intervals for a trend estimate overlap zero).

Response: We concur, and have modified the text relative to apparent population trends.

When counts are highly variable, there is very rarely adequate statistical power to detect anything other than extreme positive or negative trends at short time horizons like 10 years. We believe this has two consequences for the 5-year review. First, we do not think that population trend analyses are particularly sensitive or valuable indicators of ILT population status, given historical data. Second, we think the FWS should re-consider the utility of recommendation 5.2: "develop standardized protocols for monitoring population trends." We think it may be rushing to conclusions to think that this type of monitoring program would provide valuable feedback on population status. While it may be worth exploring the feasibility of developing such a program, we suspect that the most likely outcome of such a program would be an imprecise trend estimate with confidence intervals that overlap zero. Is this adequate to provide feedback on population status? Recommendations 5.2, 5.3, and 5.4 all relate to monitoring after delisting, with recommendations 5.2 and 5.4 being two specific alternatives. In fact, recommendation 5.3 may be removed if options 5.2 or 5.4 are pursued since recommendation 5.3 is implicit in recommendations 5.2 and 5.4.

We suggest that it may be more valuable to forego the development of a population trend detection monitoring program and focus on developing post-listing monitoring plans in connection with the conservation management agreements/MOUs listed as recommendation 5.4. Over the 28 years that ILT have been listed, most resources have been expended towards counting birds with the objectives of measuring progress towards the two recovery targets of population size and trend. This has been very costly and has produced pretty unsatisfying results. One consequence of focusing historical monitoring investments on these 2 targets is that we have learned very little about the direct effects of management on ILT. ABC believes that ILT populations can persist and perhaps grow into the future with the development of regional conservation management agreements between USFWS and USACE. In order for these management programs to be both effective and cost-effective, we suggest that future, post-listing monitoring efforts should be focused on evaluating the effects of management and learning how to manage more effectively over time.

Response: Recommendations have been incorporated into the text.

R. Fischer, Research Biologist, U.S. Army Engineer Research and Development Center, Environmental Laboratory

I appreciate the opportunity to comment on the 5-year review (Review) of the status of the Interior population of least tern. I have completed my review and am providing several comments below. From an editorial standpoint, I made only a few suggestions within the attached document. One minor point of note-- the term "migration" is used throughout the Review to describe birds that leave a colony because of poor nesting conditions and move to another site. The term is also used in the Review to describe annual movements to and from breeding and wintering ranges. For the former, I believe a more appropriate term to use is "emigration."

Response: The term "migration" has been changed to emigration or immigration, as appropriate.

1. The document is compelling and provides a convincing and logical framework to support a future status determination by the U.S. Fish and Wildlife Service (Service). The review of data and literature, including that in the General Review, Review Analysis, and Synthesis, are sufficiently thorough, and more than adequate to describe ILT population status, distribution, and trends; current habitat conditions throughout the range; threats; and conservation measures and activities being conducted with, or by, partners.

2. The Service has done an excellent, though not exhaustive, job of acquiring and reviewing available data on ILT. Unfortunately, there have been no successful attempts to archive all range-wide ILT data in a central repository, though this was a recommendation made nearly a decade ago at a range-wide monitoring workshop sponsored by the U.S. Army Corps of Engineers (USACE). Acquiring all ILT data for this Review from such a wide range of federal and state agencies, and other organizations, and from such a long timeframe of data collection (25+ years), is a monumental task. Nonetheless, additional supporting data are currently being compiled by American Bird Conservancy (ABC) through contract with the USACE. ABC has been, and with assistance from the U.S. Army Engineer Research and Development Center (ERDC), Environmental Laboratory (EL), requesting and receiving additional data from USACE Districts and other agencies, universities, and private contractors. These additional data, however large or small when compiled, can only strengthen the conclusions of this Review regarding population stability, distribution, and future persistence.

3. The USACE has a vested interest in, as well as long-term history with, recovery of the ILT. The presence of federally listed species along navigable rivers, as well as at reservoir and coastal projects, has impacts on the agency missions. The USACE has demonstrated significant effort, and invested significant financial resources, in monitoring ILT, managing and conserving habitat, reducing chronic threats (e.g., predation, human disturbance), and developing conservation agreements that promote species persistence. This is true for USACE Districts that conduct mission activities on rivers under a Biological Opinion, as well as those do not and act in "good faith" by working cooperatively with Service Field Offices and in complying with our agencies' Environmental Operation Principles (EOP) for the benefit of the species. Because the USACE has an ecosystem restoration mission, and operates under the EOP's (as well as complying with MBTA, NEPA, and Executive Order 13186), I believe that these conservation activities that have assisted with habitat conservation will continue regardless of the future Act status of the ILT. Formal Conservation Plans (see below) between the USACE and the Service will serve to provide long-term commitments by the USACE to continue acting in good faith.

4. The ERDC-EL is working directly with the USACE Mississippi Valley Division (MVD) to develop a Conservation Plan, pursuant to Section 7(a)(1) of the Endangered Species Act,

as amended. The purpose of this Plan is to describe the MVD use of the Channel Improvement Feature of the Mississippi River and Tributary Project, to conserve ILT and other federally endangered species in this portion of their ranges. This civil works project encompasses approximately 950 miles of the Mississippi River within the jurisdiction of the MVD and the USACE Memphis, Vicksburg, and New Orleans Districts. This Plan also describes results of the MVD's efforts to implement monitoring and other conservation efforts in the LMR. The ERDC-EL is also working with the USACE Louisville District on a similar Plan, and intends to attempt the same with Districts in our Southwestern and Northwestern Divisions within the range of ILT. These Agreements should include management actions that already are being undertaken as part of the USACE mission that provide significant benefits to ILT (e.g., maintenance dredging and deposition of material for habitat, creation or modification of engineered in-river structures that promote sandbar habitat). Collectively, these Plans should provide significant support to Recommendation 5.4 in the Review.

5. The USACE's new initiative termed "Engineering With Nature" (EWN) provides another opportunity, especially when considered with the conservation agreements above, to assist with the long-term sustainability of ILT. The USACE has recognized that recent advances in the fields of engineering and ecology provide opportunities to combine these fields of practice into a single collaborative and cost-effective approach for infrastructure development and environmental management. The EWN concept seeks to intentionally align both natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits through collaborative processes.

6. Based on results of the 2012 ILT Research and Monitoring Workshop in Alton, IL (which was cited in the Review as an information source), there has long been a lack of consensus or understanding of the importance and persistence of subpopulations on the periphery of the ILT range. Concurrent with this understanding has been a significant and disproportionately large allocation of funding for research, monitoring, and habitat management and creation on the Missouri River (which currently has <5% of the known ILT range-wide population). The Review very clearly makes a strong case that this sub-population is peripheral, contributes a very small fraction of individuals to the overall population, has exhibited stable numbers regardless of significant management intervention and cost, and should be subject to population regulation that results from river processes (e.g., periodic flooding, sediment transport that creates habitat) rather than significant management intervention. Similar conclusions are drawn for other peripheral populations of ILT. To support such statements about peripheral populations, as well as many other management questions of interest to biologists, there clearly is need (and the Review notes this in Section 5.1) to develop a range-wide metapopulation model. This recommendation in the Review likely is derived from the 2013 Alton Workshop where a majority of participants, as well as an independent science panel at the meeting, identified the primary ILT research need as the construction of a population model that could synthesize much of the research that has been assembled to date, and test pertinent questions regarding local, regional, and range-wide population interactions and status. The recommendation was for such a model that could cover the entire range of ILT and account for the processes of

immigration and emigration so that metapopulation dynamics could be incorporated into the evaluation of the effects of alternative management actions for ILT.

7. ERDC-EL research activities should provide significant support to Recommendations 5.1-5.3 in the Review. To meet the priority modeling needs identified at the Alton Workshop, the ERDC-EL is assisting with leading the construction of a range-wide ILT metapopulation model. Through partial funding from the USACE Dredging Operations and Environmental Research (DOER), and Dredging Operations Technical Support (DOTS) Programs (as well as funds and in-kind services from the Service and USGS), we have assembled a detailed Project Management Plan that includes plans for (a) identification of a multi-agency ILT Modeling Working Group, (b) assembly of an Interdisciplinary ILT Metapopulation Modeling Team, (c) a recommended approach for development, implementation, and verification of a metapopulation model for ILT, and (d) development of a cost-effective range-wide Monitoring Plan for ILT.

Again, I thank you for providing this opportunity to comment on the draft Review, and appreciate the extensive amount of work that was required to complete this effort. Based on the information provided, the distribution and abundance of least terns throughout their range, the status of current and future known threats to terns and their habitats, current and future mission needs of the USACE, and my personal knowledge of least terns, I concur with the findings in the Review that the ILT is not presently endangered or likely to become endangered within the foreseeable future throughout all or a significant portion of its range. I also concur that the ILT no longer warrants protection under the Act as a Distinct Population Segment.

U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW of Interior Least Tern (*Sternula antillarum*)

Current Classification Endangered

Recommendation resulting from the 5-Year Review

____ **Downlist to Threatened**

____ **Uplist to Endangered**

_X_ **Delist**

____ **No change is needed**

Review Conducted By Paul Hartfield, Jackson, MS, Ecological Services Field Office

FIELD OFFICE APPROVAL:

for **Lead Field Supervisor, Fish and Wildlife Service, Jackson, MS**

Approve Cary Norquist Date 4/26/13

REGIONAL OFFICE APPROVAL:

Regional Director, Fish and Wildlife Service, Southeast Region

for Approve [signature] Date 5/16/13

Cooperating Regional Director, Ecological Services, Fish and Wildlife Service, Southwest Region

✓ Concur ____ Do Not Concur

Acting

Signature Joy E. Nicholopoulos Date 9/27/13

Cooperating assistant Regional Director, Ecological Services, Fish and Wildlife Service, Midwest Region

X Concur ____ Do Not Concur

Signature Lynn M. Lewis Date 10/23/13

Cooperating Regional Director, Ecological Services, Fish and Wildlife Service, Mountain Prairie Region

X Concur ____ Do Not Concur

Signature [illegible] Date 10/4/13