



Summary of Interior Least Tern Research and Monitoring Workshop

PURPOSE: This technical note summarizes the results of a national workshop on the federally endangered Interior Least Tern (ILT) (*Sterna antillarum athalassos*) (Figure 1) held April 15-16, 2004, in South Sioux City, Nebraska. The purpose of the workshop was to assemble an interagency group of ILT experts that could provide input to the development of a range-wide monitoring protocol to assess the status, distribution, and abundance of the species. The information presented herein is derived from presentations made during the workshop by representatives of the U.S. Army Corps of Engineers (Corps), U.S. Fish and Wildlife Service (USFWS), U.S. Geological Survey (USGS) (Biological Resources Division), American Bird Conservancy (ABC), and various state agencies and universities.



Figure 1. The Endangered Interior Least Tern (*Sterna antillarum athalassos*) breeds primarily on sandbars associated with river systems

BACKGROUND: The U.S. Army Corps of Engineers (Corps) is responsible for managing and maintaining navigable coastal and inland waterways of the United States. Activities associated with waterways maintenance, including dredging, dike construction, dredged material disposal operations, beach nourishment, and variable dam discharge actions, often conflict with federal and interagency mandates to protect populations of the endangered Interior Least Tern. These conflicts often result in a lack of flexibility and increased costs in waterways maintenance. The specific impacts of Corps operations on ILT populations are poorly understood. Without this information, management options to mediate Corps impacts are severely limited, and efforts to meet recovery goals for the ILT are compromised.

In December 2002, representatives from three Corps Divisions (Northwestern, Southwestern, and Mississippi Valley), Corps Headquarters, and seven Corps Districts attended a meeting in Tulsa, OK, and identified several actions to facilitate the ability of Corps managers to resolve conflicts of waterways operations while protecting ILT populations. One major concern noted during the 2002 meeting was the current lack of coordination and infrastructure that hampers efforts to effectively monitor and assess the status of ILT populations.

The current status of the ILT population, relative to recovery goals published in the ILT Recovery Plan (Sidle and Harrison 1990), is of considerable concern to the Corps. Currently, the total numbers of birds range-wide may exceed recovery goals established in 1990, although goals for

many specific river reaches have not yet been met. There is a need to develop a comprehensive, range-wide, and scientifically defensible monitoring protocol to determine the status and population trends of the interior population of the Least Tern. Numerous federal, state, and non-governmental organizations are involved in monitoring federally endangered Interior Least Terns. At present, however, the various monitoring efforts are not organized or coordinated. As a result, survey methods vary, data storage is not centralized, and comprehensive analyses are rarely performed. In addition, preliminary surveys on reaches of the Red, Canadian, and Cimarron Rivers suggest that some populations, perhaps including as many as 2,000 birds, are not regularly surveyed at all. The lack of a comprehensive monitoring plan with mechanisms for data storage and regular analyses limits opportunities to increase management flexibility through negotiations with the USFWS and progress towards delisting is slower than it might otherwise be.

Proposed action items from the Corps' 2002 Tulsa meeting to assist in remedying these problems included:

- Hosting a national workshop consisting of professionals directly involved in managing ILT populations.
- Creating a team of ILT experts to identify research needs pertaining to ILT ecology and management.
- Addressing issues concerning monitoring methodologies (e.g., protocol development) needed to determine range-wide distribution and long-term status of ILT populations.

The April 2004 workshop constituted the first phase of these actions, and represented a collaborative effort among the Corps, USFWS, ABC, and USGS. The primary focus was to begin the process of developing a comprehensive monitoring protocol for ILT populations. The monitoring plan will allow for regular and scientifically credible assessments of the status and trends of ILT populations.

Other research needs that might facilitate improved management of tern populations were also discussed. Specific issues concerning the current federal listing and the status of the ILT Recovery Plan were not on the agenda. The workshop revolved around several guest speakers who discussed specific topics pertinent to management and conservation of ILTs, followed by group discussions. This document provides brief synopses of presented talks, and outlines important ideas, issues, and action items addressed in the group discussions.

A CONCEPTUAL FRAMEWORK FOR DEVELOPMENT OF AN INTERIOR LEAST TERN MONITORING PROGRAM (Dr. Jon Bart, USGS): The approach of the North American Coordinated Bird Monitoring (CBM) Plan provides a basis for developing a comprehensive monitoring program applicable for the ILT. Regional CBM plans are comprehensive, efficient, and well coordinated among states, conservation groups, and federal agencies. The process involves identifying management issues, clearly stating survey objectives, establishing rigorous methods of data collection, and developing a plan of action to initiate the monitoring effort. Several examples were outlined, including:

- Evaluation of riparian restoration projects in Nevada.
- Importance of Aspen forests in the west.
- Identification of important forest areas for mid-Atlantic bird communities.

Elements common to these efforts include description of the pertinent issues, identification of study areas, identification of statistical populations to be sampled, sampling plan and field methodology, plan for data management, analysis and reports, specific roles and responsibilities of participants, and a clear schedule of activities during the monitoring effort.

Using the ideas of the CBM plans, and information from the recent 2003 supplemental biological opinion on ILT issues for the Missouri River, it may be possible to develop the initial basis for ILT monitoring efforts. Pertinent issues discussed throughout the workshop included:

- Estimating annual “take” during management operations.
- Evaluating effects of flooding events on nesting birds.
- Restoring quality habitat.
- Reducing human disturbance impacts.

Collecting information such as population size and sub-regional productivity that may be useful for any potential future delisting decisions. Specific study areas may include all known areas used by nesting ILT; therefore, the monitoring effort should be conducted throughout the entire ILT breeding range. The period of monitoring needs to occur from onset of the breeding season through departure from breeding sites, with focus primarily on ILT; however, the potential exists to simultaneously monitor other species, including Piping Plover (*Charadrius melodus*), Snowy Plover (*C. alexandrius*), American Avocets (*Recurvirostra americana*), and other species. The biological population includes breeding individuals (but may also include non-territorial birds or “floaters”). Important parameters to monitor will be the number of breeding adults and sub-regional productivity. Methods of sampling need to be finalized, but will include surveys for adults to define the breeding population and more focused nest monitoring to quantify productivity by sub-regions, such as river reaches. Sample size requirements can be determined by analysis of past data. Considerable work remains in developing a comprehensive ILT monitoring program. Coordination among participating individuals and agencies needs to improve; all need to agree on issues of field protocols, data management, analysis and reports, specific roles and responsibilities of all involved, and establishing a detailed schedule of long-term monitoring efforts.

Corps of Engineers Survey and Monitoring Efforts (Richard Fischer, USACE): Currently, each Corps District with ILTs utilizes different monitoring protocols, with little or no coordination among Districts or with USFWS personnel from the three regions with ILT populations. The range-wide population status of the ILT is poorly understood and there is a perceived need to develop a statistically rigorous, coordinated monitoring program to assess current status and population trends. ILT monitoring efforts by several Corps Districts are outlined below:

Memphis/Vicksburg Districts: The Memphis District has been instrumental in undertaking long-term ILT surveys along the middle and lower Mississippi River (Cape Girardeau, MO, to Vicksburg, MS) during the past 19 years. Survey efforts, which are conducted under contract with Mr. Ken Jones, Dyersburg State Community College, include small boat surveys since 1985, towboat surveys until 1995, and aerial surveys between 1985 until 1997. Vicksburg personnel from the Monroe, LA, Navigation Field Office and local Audubon members also participated. Results suggest a significant population increase during the monitoring period (< 1000 adults in 1985 to 8,082 adults in 2003), but the percentage of the increase due to habitat improvement versus improvement in observer efficiency, survey timing, and other factors was unknown. Future survey plans include extending efforts below Vicksburg to, or near Baton

Rouge, LA. A one-time survey by the Corps' Engineer Research and Development Center (ERDC) in 2000 on the Red River from Texarkana, TX to Shreveport, LA, recorded over 400 birds.

Tulsa District: The Tulsa District utilizes airboats during survey efforts. Surveys are conducted along 150 miles of the Arkansas River (92 miles between Kaw Dam and Keystone Lake, and 58 miles between Tulsa and Muskogee, OK) from mid-June to early August by personnel from the Corps, USFWS, and the Audubon Society. Data collected include productivity and counts of nests. Over 500 individuals were counted in 2003.

Omaha District: The District has conducted population surveys, habitat restoration, habitat mapping, water release modification, and some captive rearing since 1992. Small boat surveys are conducted weekly from early May to late August, with focused adult surveys during mid- to late-June, on eight separate reaches, covering approximately 750 miles of the Missouri River.

Albuquerque District: The District developed an ILT management plan to comply with a USFWS Biological Opinion regarding the impacts of recreation activities on ILT populations. Annual surveys have been conducted from mid-May through July for 15 years using a small boat or on foot. Surveys have been conducted at John Martin Reservoir, Adobe Creek Reservoir, and Neenoshe Reservoir. In 2003, 24 nesting pairs were observed, along with 33 nests (including re-nests), and 76 eggs.

Little Rock District: The Little Rock District developed an ILT management plan for the McClellan-Kerr Arkansas River Navigation System in 1986. The plan provides details of efforts to protect and create habitat, and conduct population surveys; however, no data were available for the workshop.

Louisville District: The District contracts annual surveys of the Lower Ohio River with the Kentucky State Nature Preserves. Recent efforts to use dredged material from the Ohio River to create temporary mid-channel islands have been successful in providing significant nesting habitat (> 100 nests/year).

Kansas City District: ILT surveys are conducted annually for the Kansas City District by Dr. Roger Boyd, Baker University, using boat surveys along a 125-mile reach of the Kansas River. These surveys identified new colonies and 34 nests in 2003.

Fort Worth District: Little information is available regarding surveys within the Fort Worth District. Some survey information may be available from the Rio Grande, but was not available during the workshop. No Corps reservoirs are present along the Lower Rio Grande, and no efforts are being made by Corps personnel to conduct ILT surveys. However, ILT are known to be nesting on a Corps-funded restoration project within this District.

Current Non-COE Survey and Monitoring Efforts (Eileen Kirsch, USGS): Non-Corps efforts to monitor ILT populations are occurring in many states, but surveys are not entirely comprehensive. Some examples include:

- **Montana:** Yellowstone River, Fork Peck Reservoir.
- **Nebraska:** Platte, Niobrara, and Loup Rivers.

- **Iowa:** Missouri River, at fly ash deposits near power plants.
- **Kansas:** Kansas River, Quivira National Wildlife Refuge (NWR) at the Cimarron River.
- **Oklahoma:** Canadian River, Salt Plains and Optima NWRs.
- **Texas:** Trinity River, Rio Grande reservoirs.
- **Indiana:** Fly ash deposits near power plants.
- **New Mexico:** Bitter Lake NWR.
- **Colorado:** Arkansas River reservoirs.

Non-Corps monitoring efforts are being conducted by state and contractual biologists, universities, private corporations, non-governmental organizations, volunteers, and other government agencies. Availability of funding is the most important feature limiting the extent and quality of the monitoring efforts. Other important issues include coordination of efforts and methods, accessibility to the sites, impacts of human disturbance on the nesting grounds, and environmental factors influencing quality of counts. Basic counts and distribution data are the most commonly recorded data; however, some sites do measure productivity. Most surveys are conducted by boat, although nest counts by foot are not uncommon on some sites. The type and timing of monitoring may vary widely; for example, colonies may be observed at variable distances or colonies may be counted at different times during the nesting cycle. Furthermore, inconsistencies exist during data collection regarding habitat conditions and disturbance and predation impacts. In some cases, this information is not collected at all. Although significant portions of the ILT range are being monitored by Corps and non-Corps entities, the comparability of counts is questionable (within and outside the Corps) because of the variety of methods used.

Some states practice limited management protection for ILT and may post signs and barriers on beaches used by nesting ILT colonies. Sometimes electrical fences may be established, and areas may be monitored by law enforcement. Active habitat management is sometimes practiced, and may include the construction of islands and beaches (usually by dredged material deposition) and the use of nesting deterrents and attractants. Most nesting sites are in river systems with altered hydrology, and vegetative encroachment on nesting sites is a common problem throughout the range.

Corps Perspective on Interagency Coordination (Mark Harberg, USACE): Conclusions from the meeting of Corps personnel in Tulsa during December 2002 included a recognition of the necessity of implementing a regional approach to ILT conservation within Corps Districts, more interaction among monitoring efforts along different river systems, the sharing of data and specific data requirements, a need to identify cost-effective conservation measures, a consistent policy regarding Section 7 consultations, and coordinated efforts among districts for the recovery of the ILT population. Specific recommended actions from this meeting were focused on Corps objectives for coordinating ILT conservation efforts throughout the range, and to develop interagency collaborative agreements to establish research and monitoring needs necessary to successfully recover ILT populations.

USFWS Perspective on Interagency Coordination (Jane Ledwin, USFWS): Although the USFWS has a Team Leader (Jane Ledwin) for the ILT, no functioning recovery team has ever been established. Most personnel working on ILT populations are also involved with conservation of Piping Plover populations. Also, the original ILT recovery plan is over 10 years old and out of date. With no designated recovery team in place, and no funding available, this

situation is not likely to change soon. The Piping Plover recovery team was disbanded in the mid-1990's and the current recovery plan also needs updating. The USFWS would like to link efforts for recovery of both species, but funds are not available. In some areas, ranges of the two species overlap and coordinated monitoring is possible; in other areas, such as the lower Mississippi ILT populations, or Alkalai Lake populations of Piping Plovers, ranges do not overlap and species-specific monitoring is necessary.

MONITORING PROGRAM PROTOCOLS AND IDEAS FOR INTERIOR PIPING PLOVER MONITORING THAT MAY APPLY TO ILT

A Standardized Protocol for Monitoring Interior Least Terns on the Missouri River: Field Protocols, Data Management, and Computerized Data Storage (Greg Pavelka, USACE): The Corps of Engineers, Omaha District, has established an ILT monitoring program along the Missouri River, from Gavin's Point near the Nebraska state line, north to Fort Peck Lake in Montana. Monitoring efforts were initiated in response to the USFWS Biological Opinion for the Missouri River in USFWS Regions 3 and 4. The monitoring effort begins with intensive training on all issues pertinent to ILT life history, data collection protocols, and boater safety (e.g., float plan, boat safety check). The focus of survey efforts changes depending on the nesting stage. From early May to mid-June, efforts focus on nest searches. Surveyors focus on nests and chicks from mid-June through mid-July, and on chicks and fledglings from mid-July through mid-August.

Surveyors use hand-held computers (personal digital assistants) and Geographic Positioning Systems (GPS) units and enter data in the field. Data collected include:

- Location, date and time.
- Nest ID.
- Habitat type.
- Nest status.
- Nest fate.
- Nest elevation.
- Management activities.
- Chick numbers and age.
- Fledgling numbers.

When these data are entered, they are checked for accuracy, then uploaded onto an Internet site (U.S. Army Corps of Engineers Threatened and Endangered Species Data Management System [TESDMS]). Access to the TESSDMS site is restricted.

Reports generated from TESSDMS provide information on productivity, census and fledgling ratio reports, field journal accounts, nests at-risk due to rising water levels, the nesting season timeline, and a nest fate report. Furthermore, these reports can produce expectation lists, time and date of the last survey efforts, plus provide detailed historic maps on the distribution of ILT nesting colonies along the Missouri River. The TESSDMS site is capable of receiving and storing vast amounts of data. The potential exists to expand survey efforts throughout the entire range of the ILT, and to have surveyors upload standardized data onto PDAs and GPS units that would be uploaded directly to the TESSDMS site. The TESSDMS site could become a centralized warehouse of data on range-wide ILT populations. Further development depends on customizing the

TESDMS site to allow input of data from monitoring sites with different protocols for data collection and to clearly identify and assign responsibilities for data management, summary, and report production.

Ideas from a Comprehensive Piping Plover Monitoring Plan (Mike Larson, USGS):

The International Piping Plover Census provides an example of a range-wide monitoring effort potentially applicable to the ILT. Surveys are conducted every five years, and began in 1991 (1991, 1996, 2001). Surveys are completed during 2 weeks in June, all sites selected for surveys are known to be occupied by plovers, or contain suitable habitat, and all adults are counted exactly once during the surveys. Benefits of the international census include the coverage of many sites, documentation of changes in distribution, basic habitat assessment, and the generation of interest and participation from the public.

However, there is a strong need to provide scientifically defensible estimates of Piping Plover abundance in the Great Plains. Census efforts are often inadequate for several reasons:

- Most census efforts assume every bird at a site is counted (detection probability = 1), which rarely occurs.
- Counts do not adequately account for issues of scale (i.e., not all sites within a region can be visited, and imperfect counts within a site).
- Most methods do not account for issues of spatio-temporal scales (i.e., evolutionary time, annual redistributions, and variations during the breeding season).

Other census methods exist that are better suited for monitoring Piping Plovers in the Great Plains.

Aspects of Piping Plover Monitoring: The basic issues involved in monitoring Piping Plover populations are common to all monitoring efforts. First, the purpose of the monitoring effort must be clearly stated and the population to be monitored should be clearly defined. Then, decisions must be made on what specific aspects of the population are to be monitored (i.e., adult counts, productivity, or both). Sampling efforts should be designed to account for issues concerning the variable detectability of individuals, and to systematically sample regions to account for geographic variation within the populations. Numerous methods are available to account for the spatial context of the populations (i.e., stratified, systematic, cluster, dual-frame, adaptive), but samples should be randomized when possible, and may include areas where birds are not present. Finally, clear protocols must be developed that will obtain all pertinent data and that are reproducible in a scientific context.

Dealing With Variation in Detection Probability (p): Most survey techniques assume that counts (C) equals abundance (N) of a population (i.e., $N = C$). But abundance is really a function of the count and the variation in detections ($N = C/p$). Variation in detectabilities can be controlled by using standardized protocols that can identify and control potential sources of error. Modeling covariates within the data will provide insights into the amount of variation of detectability among individuals within the population. Similarly, specific methods can be employed that will estimate the variation of detection probabilities. These methods include:

- Capture/recapture of marked birds (requires banding effort before each survey, so this is difficult logistically; but good statistical methods are available to analyze the data).
- Multiple-observer approaches (provides a good balance between effectiveness and feasibility).

- Distance sampling.
- Removal modeling.

One potential approach to consider in the development of an ILT monitoring plan is a double-observer method to estimate and control for variations in detectability among individuals in the population. The basic idea of this method is to have a primary observer who detects birds and conveys this information to a secondary observer. The secondary observer records all birds detected by the primary observer, plus any additional detections. Both observers sample many different areas, reversing the primary and secondary roles. Although birds will be counted at sites throughout the range, p can be estimated at a subset of sites stratified according to basic habitat types used by breeding ILT's (e.g., small versus large sandbars, reservoir shorelines, fly-ash deposits). This method will account for variation in p attributable to differences among habitat types. Detectability can be estimated at approximately 10-20 percent of the sites sampled, and the estimated variation in detectability can be used to estimate population size. Data from this monitoring effort could then be used to estimate parameters for demographic modeling and to evaluate the impacts of management activities. The type of monitoring plan could potentially provide a better estimate of population size, yield scientifically sound protocols and data sets, and permit robust hypothesis testing of issues concerning population distribution and trends.

DEVELOPING A COMPREHENSIVE ILT MONITORING PLAN: A series of facilitated discussions followed formal presentations and these discussions focused on survey objectives and identifying the specific parameters that should be components of a standardized ILT monitoring effort.

What should we count?

- Count adult birds—change in numbers over years might provide insights into productivity. Problems associated with this include mobility of birds and the potential movement of individuals between coastal and inland areas.
- Count nests and multiply by 2—assumes that all adults are mated. Most researchers in attendance suggested that approximately 95 percent of adults are breeding.
- Count both nests and adults (and use the higher of the two values).

Regardless of what method is ultimately used, counts of adults should include estimates of detectability so that final breeding population numbers can be reliably estimated from counts and accompanied by standard errors. There needs to be long-term consistency in data collection among years at individual sites.

Where should monitoring be conducted?

It will be almost impossible to count every reach of every river where ILT are known or suspected to breed. Efforts may have to focus on monitoring a representative subset of suitable ILT breeding habitat. Moreover, the sampling methodology may need to be somewhat flexible depending on size of area or colonies being sampled. For example, in the lower Mississippi River, colonies are too large to count all adults or nests. Methods on small colonies may be more easily standardized. A focus on area sampling may provide flexibility in the use of different sampling methods to count individuals, but timing of the surveys must be coordinated, and difference in accuracy of counts between different areas must be quantified. The final monitoring

protocol will be peer-reviewed by monitoring experts associated with the North American Bird Conservation Initiative (NABCI) Monitoring Working Group chaired by Dr. Jon Bart (USGS).

When should monitoring be conducted?

Early season counts may offer the best population estimate; however, nesting birds are usually asynchronous, therefore counting only nests may underestimate the population. Timing of surveys will also be impacted locally by flood events and other weather conditions. Perhaps the standardized method may need to require both an early and mid/late season survey. Current discussion assumes that monitoring will be conducted annually.

Further discussion established the need to clearly state population-wide objectives for ILT monitoring efforts (i.e., meet objectives of the Recovery Plan), state local survey objectives (i.e., conserve ILT populations in specific Corps projects), and establish a population-wide monitoring plan and protocol that can be established at the national level.

How should productivity be measured?

Several issues were raised concerning the importance of measuring productivity and how it can be standardized. The following were major points that need to be investigated:

- Assess the relative merits of frequent visits to a colony (once a week or more frequently) to estimate productivity using survival analyses versus infrequent visits (as few as two per season) to provide productivity indices. Habitat quality often varies considerably among years, and even within a season, because of factors like flood events and plant growth. However, birds may become stressed if visits occur too frequently.
- Compatibility among data derived via differing procedures should be evaluated relative to different objectives for analyses of productivity data. Some projects measure the number of fledglings per breeding pair (FBR); however, few areas are collecting this data and methods are inconsistent. Timing is very important when counting fledglings, because young will move around more as the season progresses.
- Measure egg and chick survivorship with some type of survival analysis (e.g.: Mayfield method).
- The term “fledging” needs a specific definition and should be measured consistently. Usually, the definition of a fledgling is a young bird that is easily discernable from adults, is greater than 15 days old, and can sustain flight for relatively long distances.
- Detectability of nests and young must be considered when assessing productivity.
- Demographic models should be designed to allow effective use of range-wide productivity data.

How should habitat be monitored?

- Compose a set of explicit questions regarding habitat and develop hypotheses that address those questions, then design experiments to test those hypotheses.
- Coordinate experiments among regions (Corps Districts) in order to draw more general conclusions.

- Recommend standardized habitat categories and subsequent descriptions to provide consistency among regions and/or Districts.
- Include habitat data (e.g. water levels at USGS gauges, estimates of sandbar habitat availability, reduction of island “bridging” with the mainland, nest elevations in relation to water flows) as part of the monitoring database.
- Measures of vegetative cover (basic habitat/foraging conditions), nest locations, and standardized habitat types (e.g., lake, reservoir, river).

How should large-scale population dynamics be assessed?

- Can survival (particularly juvenile survival) be measured for population modeling?
- What can we learn about dispersal from ongoing genetics studies? Current genetics studies should be fully supported as they may provide information critical to a comprehensive monitoring effort.
- How can we investigate connections among breeding populations of ILTs?
- Would a banding program help answer questions about survival, dispersal, and population connectivity?

Monitoring-related Research Needs for the ILT (Eileen Kirsch, USGS): This discussion focused on identifying specific research needs for improving understanding of ILT population status and basic ecology. Basic research efforts should be tied to issues needed to be resolved concerning establishment of a standardized monitoring protocol. Goals need to focus on general abundance and distribution of the ILT population, productivity increases or declines (relationship with habitat quality), and population sustainability.

With these goals in mind, the following questions were proposed:

- How do we obtain reliable data?
- What is the spatial extent of the monitoring effort?
- What is the temporal schedule of survey efforts: every year, every 3 to 5 years?
- How many surveys per year?
- How do we obtain sufficient funding and personnel?

Additional research topics on abundance, distribution, and productivity were presented and discussed that are relevant to development of a monitoring protocol as well as understanding ILT life history:

- The influence of “floaters” in the population (distribution).
- The relationship between river flood stage/flow, sandbar area, and ILT population size in a given locality (distribution).
- How are movements among breeding areas related to hydrology? (distribution).
- How important are areas not currently covered by monitoring efforts? (abundance).

- How important are areas that support low numbers of ILTs? (abundance).
- What is the relative accuracy of different count methods currently in use? (abundance).
- How many visits are necessary and what methods are needed to estimate the number of fledglings? (productivity).
 - To what extent is dispersal information necessary and how do we obtain that information? (distribution and productivity).
 - What is the relative value of having information on post-fledgling dispersal, survival, and habitat needs? How might this information be obtained? (distribution and productivity).
 - How much interchange is there between coastal and inland populations?
 - What is the status of winter populations? Virtually nothing is known about wintering individuals.

Several methodologies exist that may provide estimates of the number of visits necessary to obtain good information on productivity. Information on dispersal is also needed, but birds are wide-ranging and difficult to resight. Information on post-fledgling dispersal, survivorship, and habitat needs may be necessary for use in a population viability analysis (PVA), but it will be difficult to obtain this information cheaply, easily, or reliably. Such efforts will require extensive banding (and even more extensive resighting) efforts and detailed information on movement of individual birds. These data may be useful in determining whether the interior population is sustained by (or growing due to) immigration of birds from coastal areas.

Questions raised: How valid is modeling if coverage is not complete? Can modeling be conducted using only count data? These questions are not easily answered, but by sub-sampling the population, good estimates of breeding adults and good productivity data can be obtained and used in population modeling. However, if a complete census of the population can be obtained, then population modeling may not be necessary, because all pertinent information on the population status would already be available. The ILT population presents an opportunity to obtain a complete census, although this would require an increase from current survey efforts.

Some answers may be obtained by analyzing existing long-term data sets to determine best protocols. This could be accomplished by comparing data sets from large and small colonies, and areas utilizing different productivity protocols. However, productivity is highly variable; measuring productivity per nesting attempt is probably useless because birds may attempt to nest many times during the season. Conducting surveys two or more times a season will likely be insufficient to accurately assess an individual bird's productivity. Furthermore, lifetime reproductive success of individuals is difficult, if not impossible, to obtain. Yet, useful data can still be obtained from both detailed coverage of abundance and distribution, and cursory methods to estimate productivity (perhaps conducting two visits per colony on a subset of colonies).

Development of an Interior Least Tern Monitoring Working Group: To facilitate the development of a standardized monitoring protocol for ILT populations, an ILT Monitoring Working Group (WG) was established (Table 1). This group includes individuals from government agencies (Corps, USFWS, and USGS), the ABC, and several state agencies and universities. A small subset of these individuals agreed to act as an Executive Working Group (EWG)

whose primary function is to achieve a final document that outlines a standardized monitoring protocol for the ILT. The process will begin with the designation of an overall coordinator who will develop a monitoring plan under the direction of the EWG. Version 1 of the plan will accomplish the following:

- Consolidate and present all current information on ILT monitoring efforts range-wide.
- Document site-specific survey protocols.
- Identify high-priority tasks for monitoring ILTs.
- Propose a schedule for regular analyses and presentations of range-wide monitoring data.

Table 1 Interior Least Tern Monitoring Working Group¹	
Eileen Kirsch – USGS (Chair)² David Pashley – American Bird Conservancy Rich Fischer – USACE ERDC-EL Casey Kruse – USACE Omaha Greg Pavelka – USACE Omaha Mark Harberg – USACE SW Division Michael Guilfoyle – USACE ERDC-EL Dan Erickson – USACE St. Louis Champe Green – USACE Albuquerque David Hoover – USACE Kansas City John Rumancik – USACE Memphis Mark Doles – USACE Fort Worth Bob VanHoff – USACE Louisville	Christopher Brantley – USACE New Orleans Maryetta Smith – USACE MVD Sandy Stiles – USACE Tulsa Mike Larson – USGS Jane Ledwin – USFWS Region 3 Erika Wilson – USFWS Region 6 Kevin Stubbs – USFWS Region 2 Carol Aron – USFWS Region 6 John Dinan – Nebraska (State Rep.) Rochelle Renkin – Missouri (State Rep.) Mark Howry – Oklahoma Dept. Wildlife Ken Jones – Dyersburg St. Comm. College Roger Boyd – Baker University
Support Staff: Dr. Jonathan Bart – Technical Advisor, USGS Casey Lott – Interior Least Tern Monitoring Program Coordinator, <i>American Bird Conservancy</i> Bruce Vanderlee - Database and GIS technical support, USACE Yankton	
¹ Working group established during the Interior Least Tern Research and Monitoring Workshop, April 15-16, 2004, The Mariana Inn, South Sioux City, NE. ² Those noted in bold represent the ILT Executive Working Group focused on finishing this document.	

For example, reports on range-wide ILT monitoring efforts will be distributed each year, with major analyses of trends and progress toward recovery every five years. Version 1 of the plan will allow all WG and EC members to look at ILT monitoring data comprehensively. This plan will create several mechanisms for the coordinator to interact with agencies and individuals involved in monitoring ILTs at a large spatial scale. This will be an important outreach role of the coordinator. The plan will need periodic updating to reflect increased participation and insights gained through analyses. Thus, the plan will be an evolving document with several versions.

During preparation of the plan, a centralized database for all current monitoring data will be developed to incorporate existing data on tern numbers and productivity. This database will be integrated with the USACE Omaha District’s existing ILT and Piping Plover monitoring database (housed in Yankton, SD). Centralized data storage will allow regular analyses of ILT numbers and productivity data at various spatial scales. This database and a number of built-in summary routines will be accessible via the Internet (with password protection) to all members of the working group.

Draft Version 1 of the plan (and the database) will be completed during the fall and winter of 2004-2005 and will be made available for review by the full WG. Following this review, the US Monitoring Working Group of the North American Bird Conservation Initiative (NABCI) will arrange an independent scientific peer review of the plan.¹ The plan will be revised thereafter and will be distributed prior to the 2005 ILT breeding season. The first annual report will be prepared by the coordinator by December 2005, reviewed by the working group, and distributed to all interested parties by March of 2006.

Once the ILT monitoring plan has been completed and reviewed, the next phase will be the implementation of monitoring efforts. Corps districts will need to contribute time and funding to achieve monitoring implementation, and efforts should continue as collaborative efforts with other agencies and organizations.

SUMMARY: The Corps, the ABC, and the USFWS organized a workshop on April 14-15, 2004 at which, among other accomplishments, attendees initiated the formation of an “Interior Least Tern Monitoring Working Group.” The working group was created to allow widespread participation in the development and execution of a comprehensive monitoring plan, while incorporating the technical expertise of working group members from areas throughout the range of the ILT in this process. Participation in the working group will help to ensure coordination at large spatial scales. Workshop participants identified four major topics that need to be discussed in detail and addressed in the monitoring plan: 1) survey methods for counting adults; 2) productivity data collection; 3) incorporation of habitat data; and 4) investigation of large-scale population dynamics. In all cases, relevant information on these topics will be presented in the plan and a database will be designed to query the data necessary to address these concerns.

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¹ Personal Communication. J. Bart, Chair, NABCI Working Group, USGS.

REFERENCE:

Sidele, J. G., and Harrison, W. F. (1990). "Recovery plan for the interior population of the least tern (*Sterna antillarum*)," U.S. Fish and Wildlife Service, Washington, DC.

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