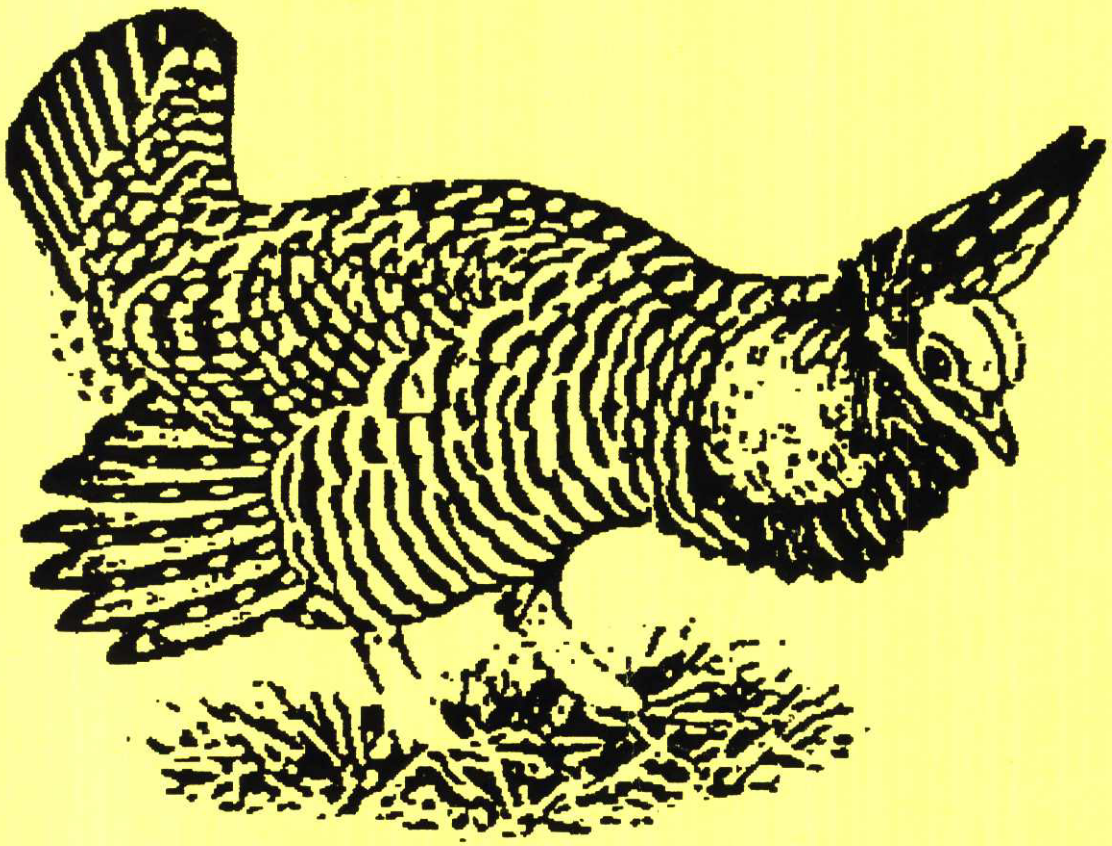
ATTWATER'S PRAIRIE CHICKEN RECOVERY PLAN



U.S. FISH & WILDLIFE SERVICE

DEPARTMENT OF THE INTERIOR

1993

ATTWATER'S PRAIRIE CHICKEN

(Revised)

RECOVERY PLAN

(Original Approved: December 12, 1983)

Prepared by the Attwater's Prairie Chicken Recovery Team

Nova J. Silvy, Leader
Department of Wildlife and Fisheries Sciences
Texas A&M University
College Station, TX

Dennis L. Brown
Texas Parks and Wildlife Department
Victoria, TX

Stephen E. Labuda, Jr.
U.S. Fish and Wildlife Service
Eagle Lake, TX

James G. Teer
Welder Wildlife Foundation
Sinton, TX

Dennis Williams
O'Connor Brothers Ranches
Victoria, TX

for
Region 2
U.S. Fish and Wildlife Service
Albuquerque, New Mexico

Approved: _____
Regional Director, U.S. Fish and Wildlife Service

Date: Feb 8, 1993

DISCLAIMER

Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, state agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approvals of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service **only** after they have been signed by the Regional Director or Director as **approved**. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Costs and task duration as listed in Part II are estimates. Duration of some research tasks are unknown because they are experimental in nature and it is difficult to predict the time required to complete the task or to attain required data sets for statistical analysis. Costs of some management tasks are uncertain because they involve activities for which there exists no previous cost experience. Cost estimates include estimated expenditures for all involved agencies and groups and current budgeted amounts as well as additional dollars needed to accomplish full recovery.

LITERATURE CITATIONS

Literature Citations should read as follows:

U.S. Fish and Wildlife Service. 1992. Attwater's Prairie Chicken Recovery Plan. Albuquerque, NM. vii + 48 pp.

Additional copies may be purchased from:

Fish and Wildlife Reference Service:
5430 Grosvenor Lane, Suite 110
Bethesda, MD 20814

301/492-6403

or

1-800-582-3421

The fee for the plan depends on the number of pages.

ACKNOWLEDGEMENTS

Several individuals have provided substantial input to the recovery team in preparation of the originally approved plan and this revision. Attwater Prairie Chicken National Wildlife Refuge staff provided logistical and technical support in the preparation of both documents. Royce W. Jurries, Texas Parks and Wildlife Department, continues to provide valuable input both in plan preparation and implementation. Others providing input regarding rangewide habitat assessment include Fred Smeins, Lloyd B. McKinney, and Marcus Peterson of Texas A&M University. Participants at the 2nd Annual Attwater's Prairie Chicken Workshop in Victoria, Texas also provided input on proposed revisions.

EXECUTIVE SUMMARY

Current Species Status: The Attwater's prairie chicken (APC) is currently listed as endangered. Historically, an estimated 1 million APC's occupied over 6 million acres of coastal prairie habitat. In 1992, an estimated 456 individuals remained in 4 populations located in 5 Texas counties. If current rates of population decline continue, the APC will be extinct by the year 2000.

Habitat Requirements and Limiting Factors: The APC once inhabited coastal prairie grasslands of Louisiana and Texas. Habitat loss, due to range degradation, agriculture, and urban expansion, is the primary factor contributing to its decline.

Recovery Objective: Delisting

Actions Needed:

1. Acquire 22,000 acres of habitat through fee simple acquisitions or easements (from willing sellers/participants only). Protect and restore an additional 40,000 acres of prairie grasslands through extension and cooperative efforts.

2. Increase public outreach efforts to raise the public's awareness of this species and its problems.

3. Encourage and coordinate legislative and regulatory programs to provide private landowners incentives to maintain endangered species habitat on their properties.

4. Implement captive propagation and reintroduction programs.

5. Determine limiting factors and their interactions.

Costs ($000's):

Year	Need 1	Need 2	Need 3	Need 4	Need 5
1993	12,655	370	75	245	450
1994	6,663	8,370	75	245	450
1995	6,663	8,370	75	245	450
1996	1,663	370	75	245	450
1997	1,663	370	75	245	450
1998	1,663	370	75	245	450
1999	1,663	370	75	245	450
2000	2,155	540	75	205	450
Total	34,296	18,960	600	1,960	3,600

Date of Recovery: Downlisting could be initiated by the year 2000, if recovery criteria are met.

TABLE OF CONTENTS

ATTWATER'S PRAIRIE CHICKEN RECOVERY PLAN

I. INTRODUCTION AND BACKGROUND

A. TAXONOMIC CLASSIFICATION AND DESCRIPTION

The Attwater's prairie chicken (Tympanuchus cupido attwateri) (APC) was listed as endangered on March 11, 1967 (32 FR 4001) when about 1,070 birds were thought to remain in the wild. It was described by Bendire (1894) as follows:

> **Smaller than T. americanus [greater prairie chicken], darker in color, more tawny above, usually with more pronounced chestnut on the neck; smaller and more tawny light colored spots on the wing coverts, and much more scantily feathered tarsus, the latter never feathered down to the base of toes, even in front; a broad posterior strip of bare skin being always exposed, even in winter, while in summer much of the greater part of the tarsus is naked.**

In weight, the APC is not perceptibly lighter than the greater prairie chicken (T. c. pinnatus). Physical differences between the Attwater's and the greater prairie chicken are minor. However, smaller measurements of wing, tail, bill, and total length and differences in general ruddiness and buffiness of the underparts are characteristic and can be used to separate the APC as a subspecies (Lehmann 1941).

B. DISTRIBUTION AND POPULATION ESTIMATES

Historically, an estimated 1 million APC occupied some 6 million acres (2.4 million ha) of coastal prairie grasslands from southwestern Louisiana to the Nueces River in Texas (Lehmann 1941, 1968) (Fig. 1). In 1937, when the first in depth study was conducted, this subspecies had become extirpated in Louisiana, and approximately 8,700 remained in Texas. By 1992, 4 Attwater's populations remained in 5 Texas counties (Fig. 1). Since approval of the original recovery plan, the APC has become extirpated from Aransas, Fort Bend, and Goliad counties.

Refugio-Goliad-Aransas Population:

Seventy-two percent of the rangewide APC population was located in Refugio County during 1992 (Table 1). In Refugio County, APC populations have declined from 838 birds in 1984

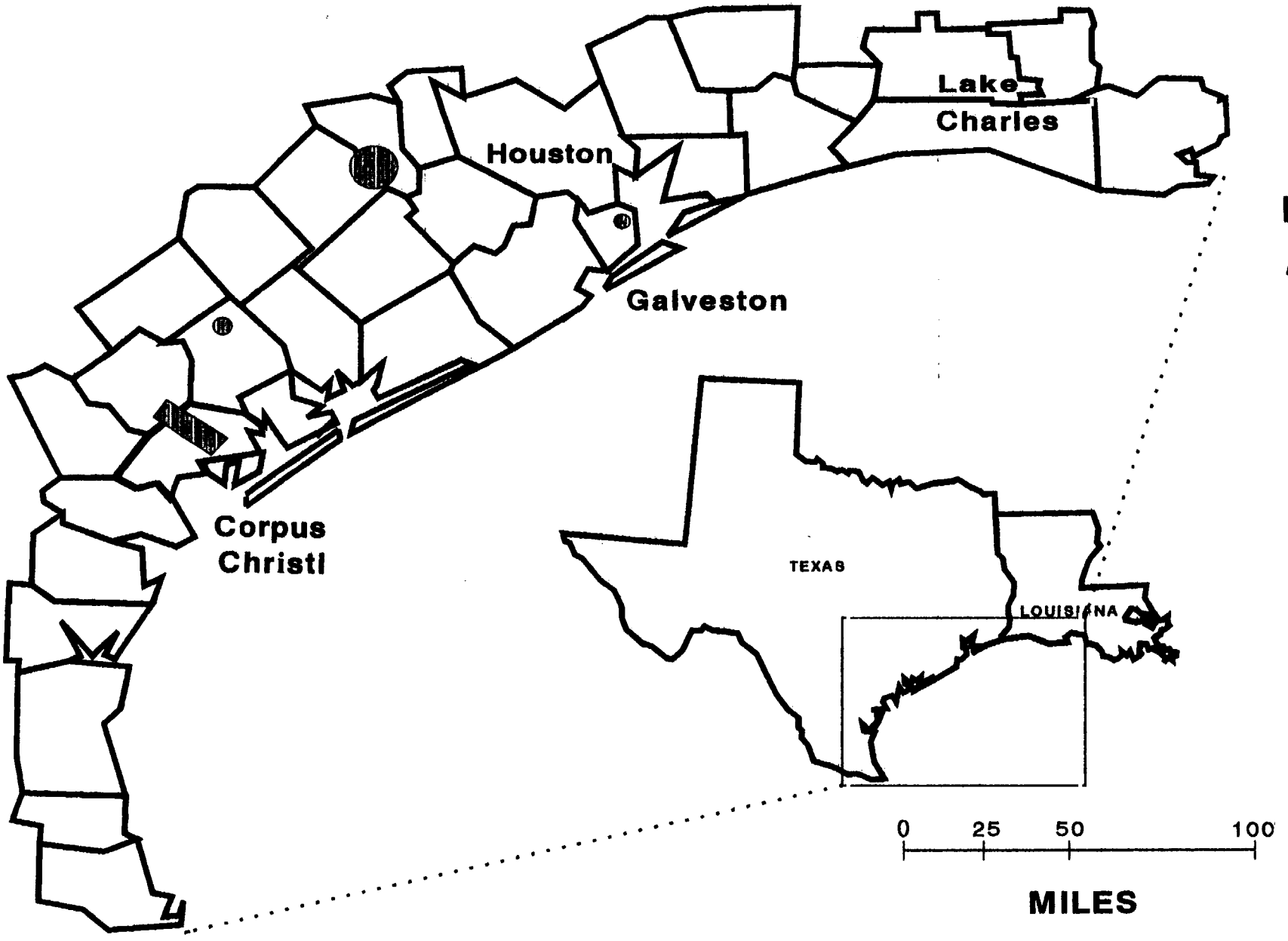


Figure 1. Boundaries of counties historically occupied by Attwater's prairie chicken and present range (shaded).

LIST OF FIGURES AND TABLES

Table 1. Attwater's prairie chicken population estimates by Texas county.

County	Population estimates							
	1967	1981	1983	1985	1987	1989	1991	1992
Aransas	0	20	22	16	10	6	2	0
Austin	200	234	292	114	150	46	56	48
Brazoria	0	20	0	0	0	0	0	0
Calhoun	10	0	0	0	0	0	0	0
Chambers	10	0	0	0	0	0	0	0
Colorado	175	184	320	246	242	90	70	50
Fort Bend	35	44	54	32	16	4	0	0
Galveston	130	110	66	36	38	16	30	26
Goliad	75	100	84	78	16	4	8	0
Harris	120	4	0	0	0	0	0	0
Jefferson	10	0	0	0	0	0	0	0
Refugio	175	658	646	810	582	246	310	330
Waller	0[a]	0	0	0	0	0	0	0
Wharton	40	0	0	0	0	0	0	0
Victoria	90	64	112	94	54	20	8	2
TOTALS	1,070	1,438	1,596	1,426	1,108	432	482	456

[a]A small population of 10-30 APC's was observed in Waller County during 1970-77.

to 330 birds in 1992. Much of this loss is attributed to a 3-year drought that ended in 1991.

Currently, no APC remain in Aransas County (Table 1). Habitat management initiated in 1976 on the Tatton Unit of the Aransas National Wildlife Refuge had helped to maintain a resident population there. However, brush invasion on the refuge and adjoining private lands has caused a continued decline in APC numbers on the Tatton Unit.

Eight APC existed in Goliad County during 1991, but none were observed on booming grounds in 1992. Historically, dramatic swings have been observed in Attwater's numbers in Goliad County (Table 1). For example, Lehmann (1941) reported only 4 birds in Goliad County during his 1937 census, whereas 486 birds were observed there during the 1974 census of this county. It is hypothesized that sandier soils of Goliad County are more susceptible to drought conditions such as occurred in the 1930's and the 1980's. However, when these soils receive high rainfall such as during and after a hurricane, they provide high quality grassland cover required by prairie chickens. Conversely, during periods of high rainfall, the poorly drained soils of Refugio and Aransas counties become less suitable for prairie chickens. Therefore, populations in these 3 contiguous counties appear to be intertwined. Lehmann (1968) and Lawrence and Silvy (1980) also referred to APC in these 3 counties as a single population.

This relationship was apparently expressed in years following hurricane Beulah, which occurred in 1967. Populations in Goliad County increased following Beulah, and were as great or higher than those in Refugio County from 1972-1974. On the other hand, the Refugio County population crashed following Beulah (Lehmann 1968).

Austin-Colorado Population:

The next largest APC population currently exists in Austin and Colorado counties with a population estimate of 98 birds (Table 1). This represents 22% of the rangewide population. The Attwater Prairie Chicken National Wildlife Refuge, located in Colorado County, provides relatively stable habitat for this population. However, population estimates for this area have declined from 360 in 1985 to its current (1992) level. As was the case rangewide, severe drought conditions during the late 1980's resulted in drastic reductions in habitat quality.

Galveston County Population:

The Galveston County 1992 estimate was 26 birds, or 6% of the total population (Table 1). All of this population occurred on a 1,730-acre ranch (700 ha) near Texas City. This habitat is surrounded by Galveston Bay, petrochemical, and urban development, making prospects for its long-term existence extremely tenuous.

Victoria County Population:

The Victoria County 1992 population estimate was only 2 individuals, a decline of 98% since 1967 (Table 1). This population is in imminent danger of becoming extirpated. Invasion of the prairie by running live oak (Quercus virginiana), huisache (Acacia farnesiana), and mesquite (Prospis glandulosa), overgrazing, increased rice cultivation, and urban expansion of the city of Victoria have all contributed to the decline of this population.

C. HABITAT/ECOSYSTEM

The historic habitat of Attwater's prairie chicken was the gulf coastal prairies of what is now Louisiana, Texas, and possibly Tamaulipas (based on historical records of "prairie chickens" (species not identified) from Brownsville, Texas). This broad belt of plains and marshes interlaced with wooded streams supported a broad variety of plant and animal life. Examples of larger mammals which contributed to this biodiversity were gulf-coast hog-nosed skunk (Conepatus mesoleucas), red wolf (Canis rufus), pronghorn (Antilocapra americana), plains bison (Bison bison), and Coushatta and Karankawa Indians. Other bird species included tundra swans (Cygnus columbianus), wood storks (Mycteria americana), Eskimo curlews (Numenius borealis), black terns (Childonias niger), whooping cranes (Grus americana), Carolina parakeets (Conuropsis carolinensis), peregrines (Falco peregrinus), prairie (Falco mexicanus) and Aplomado falcons (Falco femoralis), bald eagles (Haliaeetus leucocephalus), burrowing owls (Athene cunicularia), short-eared owls (Asio flammeus), and a host of neotropical migrants, such as the dickcissel (Spiza americana). Smaller vertebrates included species such as the Houston toad (Bufo houstonensis) and Texas horned lizard (Phrynosoma cornutum).

Maintenance of native gulf coastal prairie habitat is essential for the survival of the APC (Lehmann 1941, Cogar et al. 1977, Horkel 1979). Vegetation comprising APC habitat has 3 basic components: species composition, height, and density.

Obstruction of vision (OV) (Robel et al. 1970) will be used as an index to vegetation density in this discussion.

Several types of cover are used throughout the year to meet APC life requisites. However, properly grazed native prairie grasslands in good to excellent range condition (i.e., > 50% climax grass species composition) generally provide all APC habitat requirements. These grasslands are dominated in the climax community by perennial bunchgrass species such as little bluestem (Schizachyrium scoparium), Indiangrass (Sorghastrum nutans), switchgrass (Panicum virgatum), and big bluestem (Andropogon gerardii).

In terms of specific structural characteristics, light cover (< 25 cm height, < 1.5 dm OV), artificially maintained short grass areas (e.g., mowed rights-of-way), and hardpan areas are used for courtship, feeding, and avoidance of moisture during heavy dew or after rains (Lehmann 1941, Horkel 1979, Morrow 1986). Grasslands with light to medium-light cover (25-40 cm height, 1-2 dm OV) are used for roosting and feeding by adults and broods (Lehmann 1941, Horkel 1979, Morrow 1986). Eighty-two percent of the roost forms found by Cogar et al. (1977) were in native prairie grasslands of this structure. Medium to heavy cover (40-60 cm height, 1.5-3 dm OV) is used for nesting, loafing, feeding, and escape cover. Heavy cover (>60 cm, >3 dm OV) is generally avoided, but is used as protection from inclement weather and predators (Lehmann 1941, Cogar et al. 1977, Morrow 1986). Cover that consist of significant amounts of trees or brush is usually avoided.

Nests are generally located in clumps of grass with OV's averaging 2.1-2.8 dm (Cogar et al. 1977, Lutz 1979, Lawrence 1982, Morrow 1986). It is important that grass cover between these clumps be relatively open to facilitate movement by hens and especially young chicks. Grassland habitat with OV's ranging from 0.5-3.0 dm, and averaging approximately 1.7 dm appear to provide the proper interspersion of grass clumps and open areas needed for nesting and early brood cover (Attwater Prairie Chicken National Wildlife Refuge, unpubl. data).

Brood cover should have sufficient canopy to provide shade during summer, but be open enough at ground level to allow uninhibited chick movement (Lehmann 1941, Kessler 1978). Forb-dominated areas often provide appropriate structure for brood habitat, and typically support high insect populations which constitute the bulk of the chick's diet (Jones 1963). Morrow (1986) found that broods used grassland habitats of moderate density (2 dm OV) early in the brooding period (prior

to 15 June), and more open habitats (0.5-1 dm OV) during the latter half of the brooding period.

Diversification within the coastal prairie grassland is required so that all APC cover requisites are readily available within its home range (Lehmann 1941, Cogar et al. 1977). Historically, minor variations in topography and soil type were responsible for habitat interspersion (Lehmann 1941). However, on relatively small, isolated areas characteristic of today's APC habitat, active management is often necessary to produce the required habitat interspersion. Management practices which can be used to achieve and maintain the desired habitat include proper grazing (i.e., use of grazing systems and intensities such that grassland communities are maintained in good to excellent range condition) and prescribed fire (Chamrad and Dodd 1972, Cogar et al. 1977, Morrow 1986).

D. LIFE HISTORY/ECOLOGY

Food Requirements:

Potential food sources for APC vary by season, location, and availability. Lehmann (1941) identified 50 species of plants and 65 species of insects as food sources. Cogar (1980) identified foliage from 56 plant species, seeds from 19 species, and remains from 12 families of insects in adult APC droppings.

Native plants, especially forbs, are the most important food source for adult APC (Lehmann 1941, Kessler 1978, Cogar 1980). APC's are mostly herbivorous, eating more green foliage and flowers than seeds or insects (Cogar 1980). However, Lehmann (1941) found that seeds and seed pods comprised over 50% of the diet. Ruellia (Ruellia sp.) is an important component of the APC diet (Lehmann 1941, Cogar 1980). Other species commonly found include foliage of yellow falsegarlic (Nothoscordum bivalve), upright prairie-coneflower (Ratibida columnaris), Leavenworth vetch (Vicia leavenworthii), stargrass (Hyposix sp.), bedstraw (Gallium sp.), doveweed (Croton sp.), and perennial ragweed (Ambrosia psilostachya) (Lehmann 1941, Cogar 1980). Kessler (1978) found that grass and grass-like plants were present in the diet throughout the year.

Seed use, including those of cultivated crops, is greatest during fall and winter (Lehmann 1941, Kessler 1978, Cogar 1980). Seeds of cultivated crops used by APC include peanuts, hegari (haygrazer), rice, corn, milo, soybeans, and mung beans (Lehmann 1941, Kessler 1978, APCNWR unpubl. data). However,

due to potentially lethal levels of aflatoxins commonly present in peanuts and corn, these crops are not recommended for APC management (APCNWR unpubl. data). Cogar (1980) found little use of nearby milo fields.

Insects are most prevalent in the APC diet during summer and fall (Lehmann 1941, Kessler 1978, Cogar 1980). Kessler (1978) found that insects comprised 71% of the diet in June. Cogar (1980) found greatest insect use in autumn (21%). Lehmann (1941) found insects to be extremely important in the diet of APC chicks.

Free water has not been established as a dietary requirement for prairie chickens during normal rainfall conditions (Lehmann 1941).

Reproductive Requirements:

Prairie chicken breeding activity occurs on or near leks. A lek or booming ground is an area typically used traditionally as display grounds. Males gather on these areas in early morning and late evening to establish individual territories and to attract females. Attendance is sporadic in the fall (October-November), but attendance and intensity of territorial defense increases by late winter (January). In early spring (late February - early March), females visit booming grounds and select a male to mate with. Studies on greater prairie chicken have shown that males occupying territories near the center of the lek are generally the most dominant, and usually perform the majority of copulations (Robel 1970). After the female has mated, she leaves the booming ground to initiate egg laying. She does not return to the booming ground to mate again unless her nest is subsequently destroyed. A detailed description of behaviors and vocalizations associated with booming grounds is provided by Lehmann (1941).

Booming grounds vary in size from about one-eighth acre to several acres. They may be naturally occurring short grass flats or artificially maintained areas such as roads, airport runways, oil well pads, and drainage ditches (Horkel 1979). Active booming grounds are usually in close proximity to stands of midgrass habitat (Horkel 1979). Due to the large number of artificially maintained areas currently available within the APC's range, sufficient booming areas are generally available to all males (Horkel 1979). However, leks found on such areas are sometimes less stable than ancestral leks. For example, Kessler (1978) found that recently established booming grounds on fallow rice fields had poor territorial hierarchy when compared to ancestral grounds. Similarly,

Horkel and Silvy (1980) found that leks formed on narrow, linear areas such as roads and pipeline rights-of-way were less stable than the more typical circular-shaped leks.

Breeding commences in late February, peaks in early March, and gradually decreases through April and early May (Lutz 1979). Typically, nests are found in native prairie grasslands within 1.6 km of a booming ground (Horkel 1979). Kessler (1978) and Jurries (1979) found a small number of nests in fallow rice fields, although these nests were generally unsuccessful.

Horkel (1979) reported that clutch size ranged from 4-15 eggs. The earliest date reported for initiation of incubation was 1 April (Horkel 1979), and the latest initiation of incubation was the 3rd week in May (Morrow 1986). Hatching dates ranged from 24 April (Horkel 1979) to the third week in June (Morrow 1986). Data from Lehmann (1941), Brownlee (1973-74), Horkel (1979), Lutz (1979), and Morrow (1986) indicated that APC nest success ranged from 15.8-42.0%, and averaged 31.2% Nest predators include skunks (Mephitis mephitis, Spilogale putorius), opossum (Didelphis virginianus), raccoon (Procyon lotor), coyote (Canis latrans), snakes, and domestic dogs and cats. Heavy precipitation during nesting and brood-rearing seasons can result in poor reproductive success and subsequent low populations (Lehmann 1941).

The first weeks after hatching, are typically spent in grasslands near the nest (Lehmann 1941). Starting about 4-6 weeks after hatching, broods use more open habitats associated with midgrass nesting cover (Cogar et al. 1977, Horkel 1979, Morrow 1986). Mortality of broods is typically high. Lehmann (1941) observed a 50% mortality by 4-6 weeks, and Morrow (1986) observed a 66% mortality of brood units by 8 weeks. Morrow (1986) discussed the importance of interspersing appropriate brood habitats with quality nesting cover as a possible method for reducing mortality associated with brood movements.

E. REASONS FOR LISTING

The number of APC's has decreased from an estimated 8,700 birds in 1937 (Lehmann 1941) to 456 birds in spring 1992. This represents a 95% decline in numbers since 1937 and extirpation from 14 counties. If past trends continue, it is projected that the APC will become extinct by the year 2000 (Fig. 2).

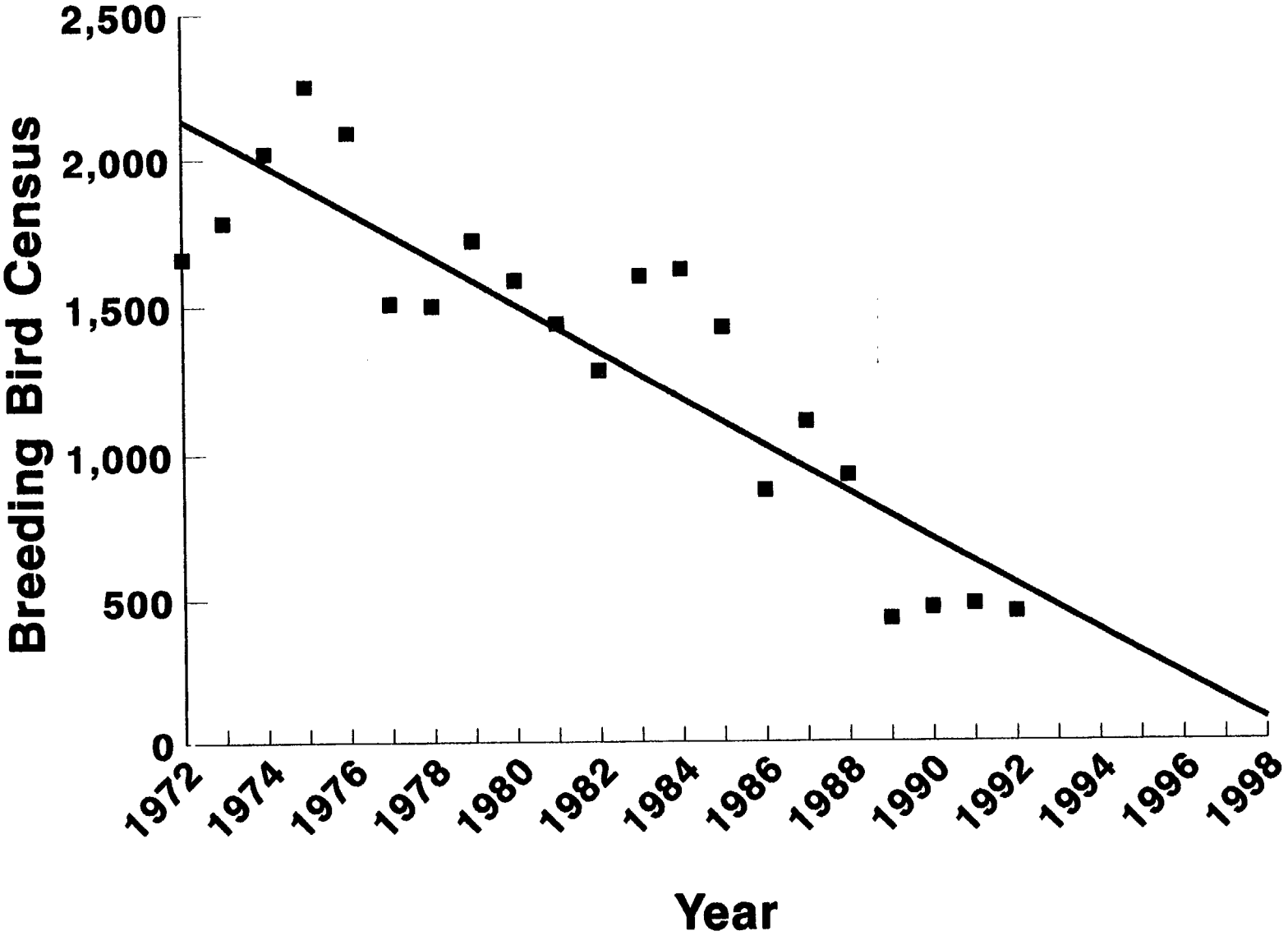


Figure 2. Population and projected trend of Attwater's prairie chic' n, 1972-1999.

Habitat loss is the greatest threat to existing APC populations. Agriculture, urban and industrial expansion, invasion of prairie habitat by woody species, and overgrazing have resulted in a dramatic decline in the tallgrass prairie habitat required for survival of the Attwater's. By 1979, only 1.2 million acres (486,000 ha) of coastal prairie remained out of the approximately 7 million acres that originally existed (Jurries 1979). However, significant portions of this 1.2 million acres were probably salt marsh grasslands which were historically of marginal quality for prairie chickens (Lehmann 1941). Some grasslands farther inland were probably of insufficient quality to support prairie chickens due to overgrazing, brush encroachment, and habitat fragmentation. In 1937, Lehmann (1941) estimated that the Attwater's were found on only 460,000 acres of suitable range. By 1967, APC were found on approximately 234,000 acres of acceptable habitat (Lehmann 1968).

Currently, less than 198,000 acres (80,200 ha) of suitable habitat remain. This decline represents a 97% loss of habitat within APC historic range, and a 57% loss since 1937. The impacts of long-term habitat declines have been further accentuated by drought in recent years. Drought led to drastic overgrazing on some ranges that ordinarily provided suitable habitat. It is imperative that habitat conditions be improved on both existing public and privately owned lands if the APC is to be retrieved from the brink of extinction.

In the near future only 3 geographic areas will provide habitat for the APC (Austin and Colorado counties; Aransas, Goliad, and Refugio counties; and Victoria County). APC in Galveston County probably will disappear due to urbanization and industrial expansion associated with growth of the Houston, Texas metropolitan area. The land on which this population resides is currently for sale. Habitat alteration and disturbance in this area could cause drastic changes in the APC population stability and lead to disastrous consequences.

Although habitat conditions are expected to remain relatively stable in Refugio and Goliad counties, the Austin-Colorado and Victoria County populations will face major threats in the near future. The Attwater Prairie Chicken National Wildlife Refuge is expected to maintain relatively stable habitat; however, APC numbers on the refuge (Colorado County) and on private land in adjacent Austin County have declined dramatically in recent years.

As long as rice continues to be the dominant cash crop in Colorado County, and to a lesser extent in Austin County,

further expansion of this population is doubtful unless satellite areas of nesting habitat can be developed. Section 6 projects recently initiated by the Texas Parks and Wildlife Department (TPWD) to restore nesting habitat in Austin County offer promise for improved habitat conditions in the near term.

The Victoria County population consists of an estimated 2 birds and may not survive until the proposed second refuge can be obtained in Victoria County. Section 6 monies are currently being used by TPWD to reduce grazing pressure on properties supporting this population. Although these efforts may be too late to save the existing population, such efforts will pave the way for future reintroduction efforts.

In addition to habitat loss, predation of adults, young, and/or nests by some wild and feral animals negatively impact some populations, especially those that occupy degraded habitats. The potential also exists for competition with geese for winter food supplies. Nest parasitism by ring-necked pheasants (Phasianus colchicus), which have been unsuccessfully introduced periodically by private individuals within APC range, have caused significant problems for greater prairie chicken recovery efforts in Illinois (Westemeier 1986). The role of parasites, diseases, and genetic anomalies in the population dynamics of increasingly fragmented APC populations is not known, but must be considered as potential limiting factors.

F. CONSERVATION MEASURES

Until recently, APC conservation measures consisted of annual rangewide population censuses, public land management, and research on APC life history and management. Failed attempts have been made at captive propagation and transplants of APC's from one area to another. Beginning in 1990, more emphasis was placed on providing technical assistance and financial incentives to private landowners for APC management.

Population Census:

Annual population censuses have been conducted rangewide in a cooperative effort by TPWD, the Service, and Texas A&M University since 1972. Males are counted during spring on historical booming grounds and, assuming a 50:50 sex ratio, numbers are doubled to produce an estimate of the total population. Historical booming grounds are surveyed, and attempts are made to locate new or previously unknown grounds.

Public Land Management:

Management programs for the APC began in the mid-1960's with the purchase of prairie chicken habitat in Colorado County, by the World Wildlife Fund-U.S., and a private donation to the U.S. Fish and Wildlife Service of chicken habitat adjoining Aransas National Wildlife Refuge.

Two national wildlife refuges (Attwater Prairie Chicken and Aransas National Wildlife Refuges) currently have management programs for the APC. The Hoskins Mound Unit of Brazoria National Wildlife Refuge, acquired in February 1991, also contains prairie habitat occupied by APC as recently as 1982. Hoskins Mound has been targeted as a potential release site for future APC reintroductions.

The Attwater Prairie Chicken National Wildlife Refuge was transferred to the U. S. Fish and Wildlife Service from the World Wildlife Fund-U.S. in 1972. Recent land acquisition has increased the size of the refuge to 7,934 acres (Fig. 3). Management programs have included burning, mowing, herbicide treatments, controlled grazing, food plots maintenance, and construction and maintenance of drainage ditches. The 1992 population estimate for this refuge was 50 APC.

The 7,000-acre Tatton Unit of Aransas National Wildlife Refuge, donated to U. S. Fish and Wildlife Service by Mr. and Mrs. J. M. Tatton in 1967, contains approximately 2,000 acres of marginal quality coastal prairie habitat. Much of this area was farmed and is poorly drained. Brush encroachment by baccharis (Baccharis halimifolia) is a major problem. Current management programs consist of prescribed burning and grazing deferral. Two chickens used the area in 1991, but none were seen in 1992.

The overriding objective of management is to maintain or improve native prairie grasslands required for APC survival. Active management is used to create favorable habitat. APC avoid ungrazed coastal prairie because vegetation becomes too dense (Lehmann 1941, Kessler and Dodd 1978). Moderate grazing removes excess vegetation and maintains winter and nesting cover. Fall-early spring burns or mowing stimulates forb growth, providing a winter food source and open areas for booming grounds (Kessler and Dodd 1978). Summer mowing has been used to remove dense vegetation and control excessive forb growth. Herbicides and prescribed fire are used to control invading brush species. Planting food plots provides winter foods and habitat heterogeneity which historically proved beneficial to APC (Lehmann and Mauermann 1963). Ditching reduces flooding that can be a problem during nesting and brood-rearing (Lehmann and Mauermann 1963).

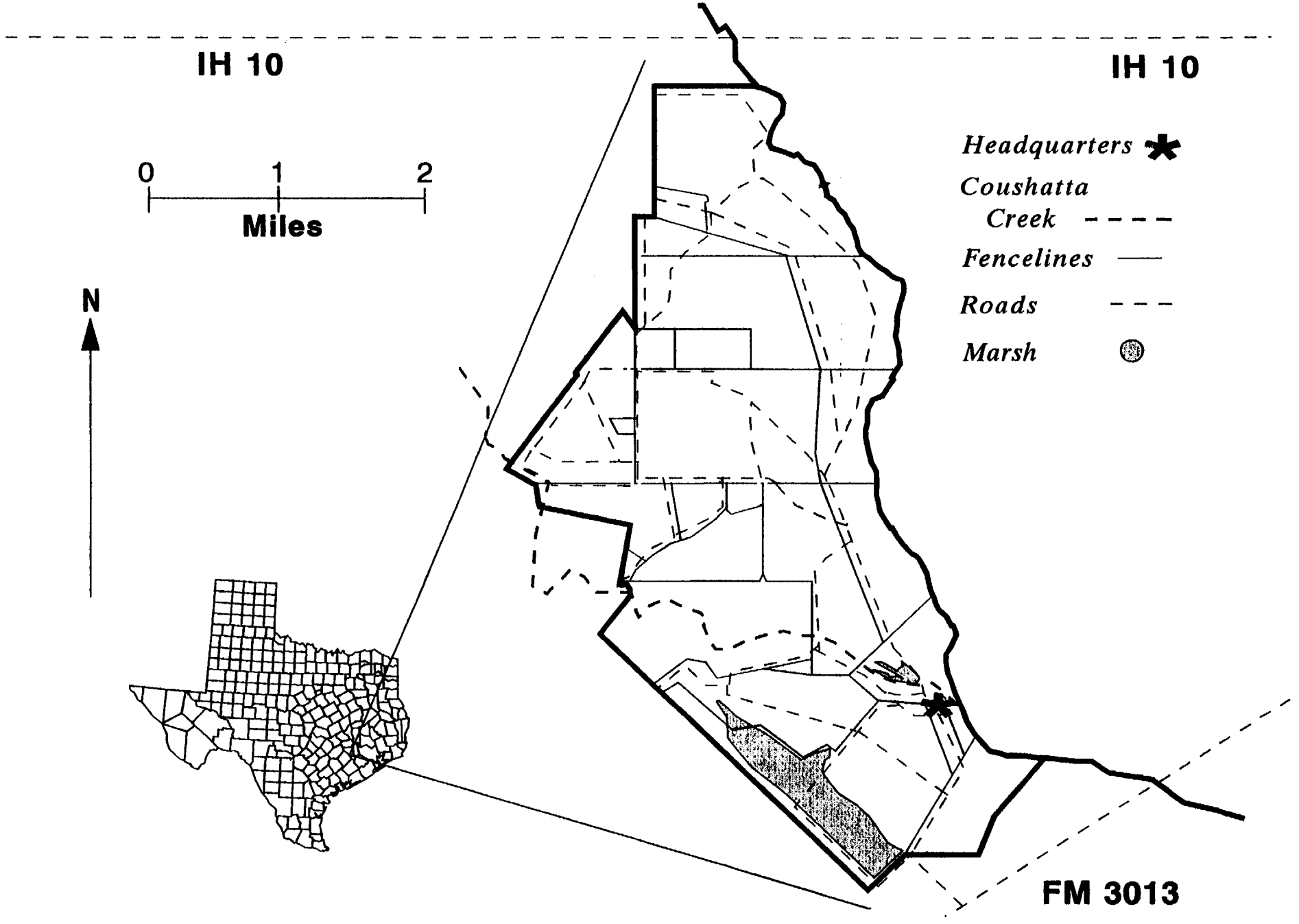


Figure 3. Attwater Prairie Chicken National Wildlife Refuge.

Transplants and Captive Propagation:

APC were transplanted from 2 areas where their habitat was appropriated for other uses. Several were relocated in 2 transplant efforts from Ellington Air Force Base in Harris County, Texas. Seventy chickens were moved in 1967 and 44 in 1970 (McCune 1970). Sixty-one of these birds were released in Refugio and Goliad counties, and 53 were taken to Texas A&M University to establish a captive rearing program (Lehmann 1971). This propagation attempt proved unsuccessful due to poultry diseases and improper rearing facilities (Watkins 1971).

In 1979, 34 birds were transplanted from Gulf Airport in Galveston County to the 6,000-acre Gonzales Ranch in Victoria County. The transplant was unsuccessful. Of 25 radio-tagged birds, 14 were found dead, 6 lost transmitters, and 5 could not be located at the end of the 12-month study. No nesting or booming activity was observed, and movements of most birds were erratic. The birds ranged over 40,000 acres. No sex-specific differences were noted in movement or size of areas used. The last known prairie chicken on the release site was a female which lost her transmitter 255 days after release.

Several factors appeared to contribute to the failure of this transplant attempt. First, only adults were available for transplanting. Second, drought followed the transplant and much of the prairie habitat became overgrazed. Third, the population in Victoria County had declined for several years. Release habitat may have been lacking some critical component necessary for APC survival. Fourth, a fall release may have been inappropriate.

Efforts are currently underway to develop captive propagation and reintroduction methods for APC using greater prairie chickens as surrogate research birds. Fossil Rim Wildlife Center near Glen Rose, Texas, received 15 wild-trapped greater prairie chickens from Kansas in spring 1991 for the purpose of developing captive propagation techniques. Twelve birds survived shipment and initial handling, and booming behavior was observed in spring 1992. Fertile eggs were produced but due to problems with incubators, only one chick survived. Fossil Rim was able also to obtain 19 greater prairie chicken eggs from a breeder in Minnesota in 1991. Seventeen hatched successfully, and 5 survived until the next spring.

By spring 1992 Fossil Rim was deemed ready to receive APC eggs (49) taken from wild populations in Colorado (1 nest of

18 eggs) and Galveston (3 nests totalling 31 eggs) counties. Eggs were collected in March and early April to maximize the probability for successful renesting by the wild hens from which the eggs were taken. Forty-three of the 49 eggs were fertile, 42 hatched, but by the end of August 1992, only 7 survived. All chicks (17) from the Colorado County (refuge) nest exhibited leg and foot deformities, commonly referred to as "spraddled-legs" (legs which will not bend at the knee, but are held out stiffly, interfering with normal walking) and "curly toes" (toes which are constantly curled under). A variety of techniques were attempted to correct these deformities, but none were successful. By late August only one refuge chick survived. These deformities may be attributed to one of three possible causes: (1) temperature and/or other anomalies during transport or incubation, (2) a vitamin deficiency in the hen prior to laying, specifically of the B-complex vitamins, and/or (3) a genetic anomaly due to inbreeding. Plans for 1993 are to recover a total of 50-70 eggs from Refugio, Galveston, and Colorado counties. This collection will optimize genetic diversity in the captive flock.

Texas A&M University received 10 wild-trapped greater prairie chickens from Kansas in spring 1991 for the purpose of developing reintroduction techniques. Problems with stress induced by disturbance at the pens, possible disease, predation, and unusually heavy rainfall resulted in the death of all birds. Two males and a brood of 16 greater prairie chicken and sharp-tailed grouse poults < 1 week old were obtained from a Minnesota breeder. Efforts to maintain these birds were also unsuccessful. Texas A&M University continued its work with greater prairie chicken surrogates in the spring of 1992, when Cliff Steinhauer, a Wisconsin prairie grouse breeder with extensive experience visited Texas A&M, at Dr. Nova Silvy's invitation. Mr. Steinhauer offered many helpful suggestions, and with expansion of facilities, provision of shade and dust baths, and other subtle improvements, problems uncovered during the first year's work were resolved.

Research:

Several research projects aimed at determining habitat requirements and management techniques have been undertaken since 1968. TPWD conducted a series of studies from 1968-77, examining ranges, activities, vegetative requirements, and population numbers (Brown 1968, Brownlee 1971-74, 1973-74, 1974, 1977, Jurries 1979). Jurries (1979) investigated differences between habitat use and APC movement in native prairie and ricebelt regions of Texas. In general, ricebelt booming grounds were less stable than those in the native

prairie region. Brood movements appeared to be related to food supply, with broods in the native prairie region moving greater distances than those in the ricebelt. Brown (1981) described the use of the helinet to capture prairie chickens. Current work consists of censuses at yearly intervals.

The Patuxent Wildlife Research Center Field Station at Victoria, Texas, examined a few chickens from the Attwater Prairie Chicken National Wildlife Refuge for pesticide residues. The chickens had trace levels (usually under 1 ppm) of DDE (U.S. Fish and Wildlife Service 1979) which were unlikely to present health problems.

Effects of agricultural and range management practices on prairie chicken habitat have been examined by the Range Science Department at Texas A&M University. Chamrad (1971) and Chamrad and Dodd (1972) studied the effects of prescribed burns and grazing management on APC habitat. Kessler (1978) and Kessler and Dodd (1978) examined the response of coastal prairie vegetation to fall and winter prescribed burns and mowing treatments.

Dodd et al. (1975) determined the proper application rate of the herbicide 2,4-D to diminish forbs and increase grass herbage production and reported on APC use of fallow rice fields. Prairie chicken use appeared to be a function of the herbicide's ability to accelerate plant succession, thereby providing more cover.

The Department of Wildlife and Fisheries Sciences at Texas A&M University initiated a series of research projects in 1975 on the ecology of the APC in Refugio County, Texas. Cogar et al. (1977) and Horkel (1979) examined vegetative preferences and cover requirements. They recognized 8 cover types on their study area, and utilizing radio-telemetry techniques, they noted that 90% of all APC locations were in the clumped midgrass vegetative type. The clumped midgrass vegetative type was dominated by tall dropseed (Sporobolus asper), little bluestem, sumpweed (Iva frutescens), broomweed (Xanthocephalum texanum), ragweed, Indiangrass, and big bluestem.

Lutz (1979) studied the effects of petroleum development on the APC and found no major detrimental effects. Horkel et al. (1978) reported on factors affecting success of APC nests and dummy nests. Dummy nesting success appeared to be influenced by the density of the nests, distance of the nests from development, and date of initiation. Cogar (1980) described food habits and noted that adults fed mostly on forb foliage and seeds.

Lawrence (1982) found APC nests were more successful in areas where small mammalian predators had been removed (82% success) than in areas of no predator control (33% success). However, adult hens had greater mortality (63%) in areas of predator control than did hens (41%) in areas where predators had not been removed. Reasons for this differential mortality could not be determined, but the possibility of an indirect effect from predator reduction should be considered.

Morrow (1986) studied APC ecology in relation to habitat management practices used on the Attwater Prairie Chicken National Wildlife Refuge. He recommended that management be focused on providing clumps of native grass species in the 2.5-dm range as nesting cover. Morrow (1986) observed a shift in habitats preferred by broods as the brooding period progressed. Early in the period, broods used grasslands stands similar to those used for nesting. Beginning in mid-June, broods used much more open habitats such as those found on first-year burns and coarse sand range sites. Morrow (1986) recommended that habitats satisfying all brood requirements be well interspersed with nesting habitat in order to reduce brood movements.

Private Land Initiatives:

Increases in chicken numbers without acquisition of additional public lands must result from: (1) improved management on existing public lands and/or (2) new management efforts on private lands. Control of brush and increased extension efforts to reduce overgrazing on private lands represent the greatest potential for increasing APC numbers rangewide. Recently, increased efforts have been made to provide technical assistance and economic incentives to landowners for providing improved range conditions for APC's. Agreements have been signed between the Service and large land holders to provide technical assistance on APC management. TPWD has also obtained grazing rights to approximately 4,600 acres of APC habitat in Victoria and Austin counties in exchange for monetary payments or brush control work. Monies for these projects have been provided to TPWD on a 75:25 matching basis by the Service as authorized by Section 6 of the Endangered Species Act. From 1990 to 1992, TPWD committed approximately $40,000/yr for APC habitat restoration on private lands.

G. STRATEGY OF RECOVERY

Recovery will be organized around 5 major thrusts:

(1) Maintain and restore high quality coastal prairie grasslands. This effort will include acquisition of a second refuge with high-quality APC habitat which is geographically separated from APCNWR. Also included in this effort are habitat enhancements on existing public lands, and providing assistance and incentives to private landowners to maintain prairie grasslands.

(2) Raise the public's awareness of the APC and its endangered prairie ecosystem.

(3) Encourage and coordinate legislative and regulatory programs that provide incentives to private landowners who maintain endangered species habitat. Examples include providing information to landowners about programs that provide economic incentives such as tax breaks or monetary payments for endangered species management (Fritz 1985, Internal Revenue Service Regulations 1991, State of Texas 1991). An important part of this strategy includes assisting landowners in solving problems associated with endangered species management.

(4) Develop and implement captive propagation and reintroduce into suitable habitats.

(5) Conduct management-oriented research designed to identify limiting factors and develop procedures for their removal.

II. RECOVERY

A. OBJECTIVES AND CRITERIA

OBJECTIVE: To ensure the survival of the Attwater's prairie chicken and to remove it from the endangered and threatened species list using the following criteria:

1. Downlist to threatened status when the population reaches 3,000 birds. These birds should be split between 2 or more geographically separated populations.

2. Delist when there is a minimum population of 5,000 birds and approximately 30,000 acres of suitable habitat are being managed for APC restoration.

B. NARRATIVE OUTLINE FOR RECOVERY ACTIONS ADDRESSING THREATS

1. Protect and manage habitat.

Unquestionably, habitat is the major factor currently limiting APC populations. The APC's prairie grassland habitat has been reduced by an estimated 97% of historic levels. Remaining habitat is fragmented, making isolated APC populations more susceptible to localized weather extremes, land use changes, predation, and disease. Strategies for habitat protection and enhancement will require acquisition and management of 2 (15,000 acres each) areas. These two land units will be core APC habitats. Private lands initiatives will be used to develop nesting habitat within an ecologically-patterned system of smaller satellite grassland habitats radiating from the two core areas.

Lands with 15% permanent grassland cover have supported approximately 10 greater prairie chickens/mi^2 (Hamerstrom et al. 1957). Assuming statewide APC populations will return to 1,000 birds on existing habitat after recovering from the 1987-90 drought, an additional 40,000 acres of nesting habitat will be needed to attain the 5,000-bird level required for delisting. Private lands initiatives offer the best opportunity to provide this habitat without public acquisition.

11. Public land management.

111. Manage refuges.

Manage existing national wildlife refuges to maintain, improve, and/or restore native prairie grasslands as APC habitat.

1111. Manage grazing.
Manage grazing to maintain good-excellent range condition (>50 percent climax grass species).

1112. Implement burning.
Implement prescribed burning program while adhering to appropriate Texas Air Control Board regulations.

1113. Control brush.
Control invading brush species.

1114. Maintain/improve drainage.
Reduce nest flooding.

1115. Maintain food plots.
Provide supplemental winter foods.

1116. Implement mowing.
Implement mowing as necessary to control vegetation density.

1117. Manage problem wildlife species.

11171. Implement predator control.
Implement predator control/management as necessary.

11172. Control exotic birds.
Control exotic game birds, including ring-necked pheasants.

11173. Control fire ants.
Control/manage imported fire ants (Solinopsis spp.) as necessary, after conducting research to determine (1) if fire ants are a major limiting factor for APC populations and, (2) if so, what the most effective methods are to minimize their impacts.

11174. Manage waterfowl.
Manage waterfowl, especially geese, to minimize competition and potential for disease transmission.

1118. Restore prairie.
Restore formerly farmed fields to native prairie species.

1119. Control public use.

112. Acquire lands.
Acquire additional public lands from willing sellers for APC management.

1121. Acquire second refuge.
Acquire a second, geographically separated refuge of 15,000 acres through a combination of fee simple and long-term easement acquisitions.

1122. Add to existing refuge.
Add an additional 7,000 acres to the existing 8,000-acre APCNWR through a combination of fee simple and long-term easement acquisitions.

113. Survey bird numbers annually.

1131. Survey spring leks (booming grounds)
Use helicopters, and biologists on foot (where practical) to annually survey all known display areas.

1132. Survey brood survival
Use helicopters and rope dragging to annually survey selected sites for brood survival in late June and early July.

12. Private lands assistance.

121. Provide technical assistance.
Provide technical assistance with APC and native prairie management. Use expertise from government and private sources such as the Service, TPWD, Texas Agricultural Extension Service, U.S. Soil Conservation Service, and the Gulf Coastal Prairies Foundation.

122. Provide economic incentives.
Provide economic incentives for improved range management.

13. Protect essential habitat.
Protect essential habitat Figs. 4, 5, 6, and 7) and counties with extant prairie chicken populations.

Essential habitat in this document is a planning term used to describe areas of current or former prairie which are considered important for recovery of APC. Essential habitat includes areas which are not occupied by APC. Inclusion of such areas not currently inhabited does not mean they should be subject to increased regulation or that they are targeted for acquisition. Areas indicated as wooded on USGS topographic maps are excluded from essential habitat.

Essential habitat should not be confused with critical habitat as defined by the Endangered Species Act. Critical habitat has not been designated for the APC.

131. Implement ESA.
Implement appropriate provisions of the Endangered Species Act.

132. Use EPA Authority.
Use Environmental Protection Agency authority regarding use of pesticides and hazardous chemicals.

133. Use State authority.

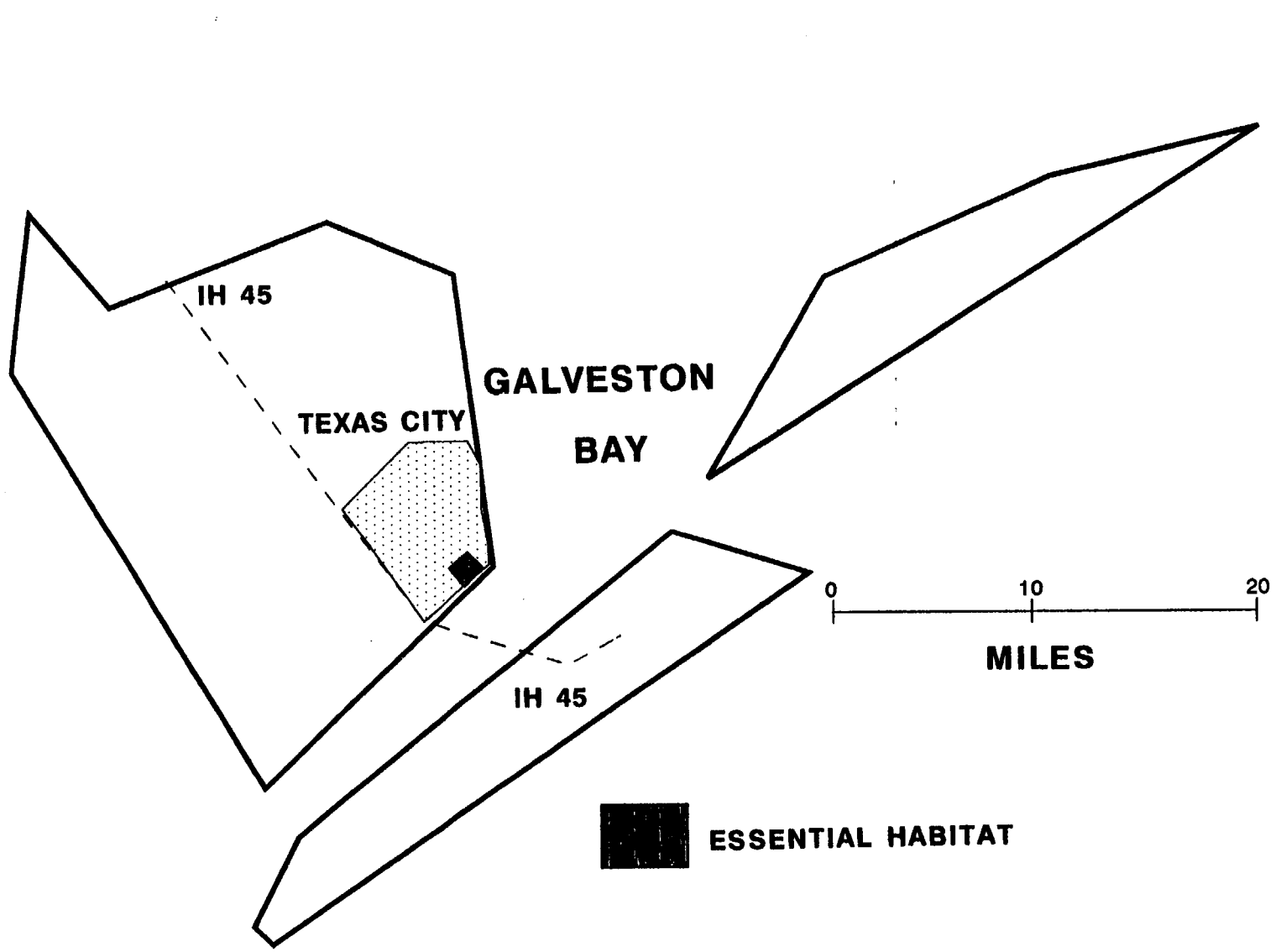


Figure 5. Essential habitat in Galveston County, Texas.

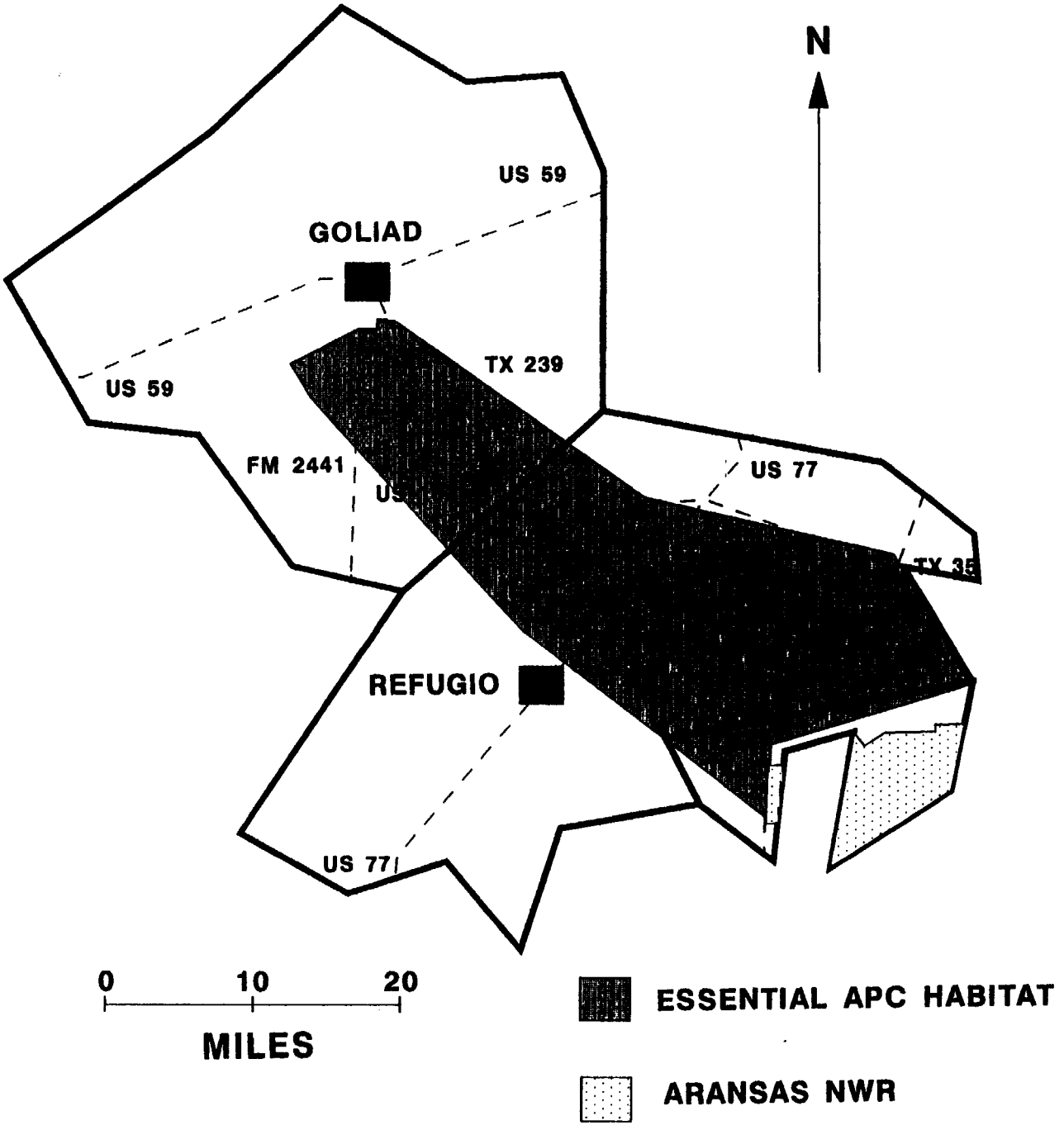


Figure 6. Essential habitat in Goliad, Refugio, and Aransas counties, Texas.

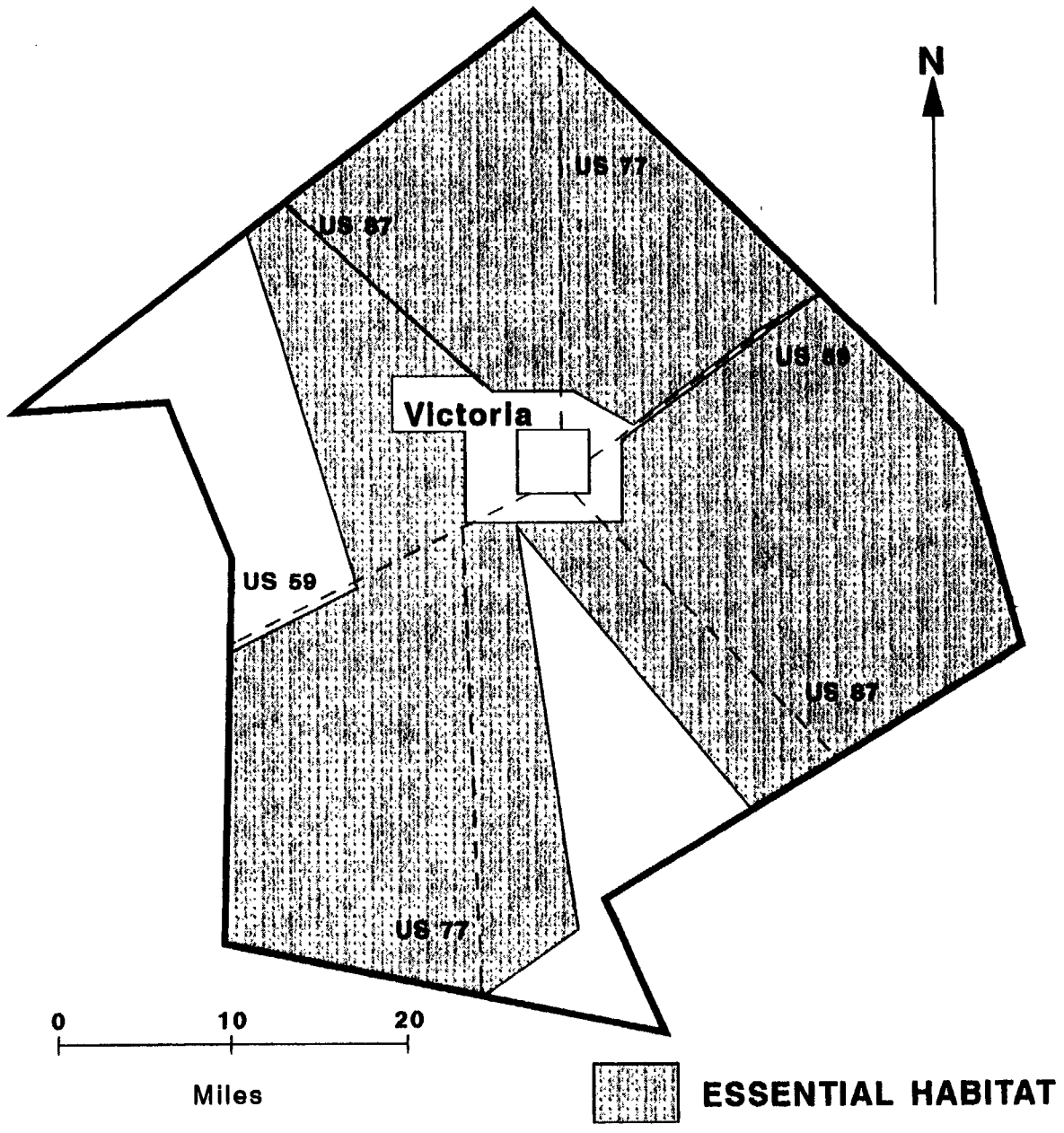


Figure 7. Essential habitat in Victoria County, Texas.

134. Use ASCS authority.
Use U.S. Agricultural Stabilization and Conservation Service authority.

14. Protect species.
Protect species from take.

141. Enforce laws.
Enforce current legislation and regulations.

1411. Federal.

1422. State.

2. Public education.

Increase public outreach to raise the public's awareness of the plight of the APC and their endangered ecosystem. A lack of understanding currently exists among the general public concerning the perilous condition of APC populations. This lack of awareness has resulted in generally low levels of public support for APC recovery programs. Increased extension efforts are needed to provide land managers with information on native prairie management.

21. Enhance media coverage of population status.
Enhance media coverage of issues related to the APC's population status.

22. Encourage media coverage of recovery efforts.
Encourage media coverage of ongoing recovery efforts.

23. Enhance public use.
Enhance public use facilities and staff on the APCNWR.

24. Increase educational activities
Increase educational activities with school groups and environmental organizations.

25. Continue newsletter.
Continue publication of the "Attwater's Prairie-Chicken Status Report" or a similar publication.

26. Continue annual APC or Gulf Coastal Prairies symposium.

27. Increase extension efforts.
Increase extension efforts with landowners.

271. Produce publications.
Produce extension publications and a video tape promoting sound range management practices.

272. Utilize demonstration areas.
Utilize existing management efforts as demonstration areas.

28. Prevent shooting loss.

281. Increase hunter awareness.

282. Prepare media announcements.

283. Educate hunters.
Educate hunters in areas of pheasant introductions.

3. Encourage landowner incentives.

Encourage and coordinate legislative and regulatory programs which provide incentives to landowners who maintain APC habitat.

31. Inform landowners.
Provide information about the availability of such programs to landowners.

32. Encourage feedback from landowners.
Gather information on any hardships to landowners caused by implementation of legislative and regulatory programs.

4. Implement captive propagation and reintroduction.

Implement captive propagation and reintroduction into suitable habitats within the historic

range. Acceptable techniques should be developed using greater prairie chickens as surrogates before APC are taken into captivity.

41. Develop two propagation facilities. Implement APC captive propagation programs in at least two locations following Service policies.

42. Identify release sites. Develop and implement a reintroduction program which includes identifying sites which maximize the probability for success.

43. Prevent introduction of other grouse. Prevent establishment of other grouse species within the APC historic range.

5. Research management techniques.

Although considerable research has been conducted on the APC, most studies focused on general ecology and habitat use. Much remains unknown regarding potential limiting factors and their interaction. Specific information gaps include the relative importance of predation, disease, and genetic anomalies, particularly in small populations, as APC limiting factors. Information is also needed on the distribution and availability of habitat rangewide to facilitate site selection for potential reintroduction sites.

51. Identify limiting factors. Identify limiting factors and solutions for removing them.

511. Rangewide habitat assessment.

512. Mortality factors.

5121. Disease.

5122. Predation.

513. Demography and genetics.

5131. Assess population dynamics.
Assess reproduction and mortality in the context of the APC's life history.

5132. Assess genetic variability.
Assess and document genetic variability within remaining APC populations.

5133. Identify thresholds.
Identify thresholds for population intervention.

52. Develop propagation and reintroduction techniques.
Conduct research necessary to implement captive propagation and reintroduction programs. Such activities should include gathering information on behavior, physiology, disease, and genetics.

C. LITERATURE CITED

Bendire, C. B. 1894. Tympanuchus americanus attwateri Bendire. Attwater's or southern prairie hen. Auk 11:130-132.

Brown, D. L. 1968. Prairie chicken range appraisal. Texas Parks and Wildl. Dept. Job Prog. Rept., W-92-R-4. 12 pp.

_____. 1981. The helinet: A device for capturing prairie chickens and ring-necked pheasants. Proc. Ann. Conf. Southeastern Assoc. Fish and Wildl. Agencies 35:92-96.

Brownlee, W. C. 1971-74. Seasonal territorial ranges of Attwater's prairie chicken. Texas Parks and Wildl. Dept., Job Prog. Repts., W-100-R-2, 3, 4, and 5. 13 pp.

_____. 1973-74. Activities of the prairie chicken within its seasonal range. Texas Parks and Wildl. Dept., Job Prog. Rept., W-100-R-4 and 5. 2 pp.

_____. 1974. Vegetative requirements of the Attwater' s prairie chicken. Texas Parks and Wildl. Dept., Job Prog. Rept., W-100-R-5. 2 pp.

_____. 1977. Attwater's prairie chicken population census. Texas Parks and Wildl. Dept., Job Prog. Rept., W-100-R-5. 2 pp.

Chamrad, A. D. 1971. Effects of fire and grazing on coastal prairie rangeland and Attwater's prairie chicken habitat. Ph.D. Thesis, Texas A&M Univ., College Station. 120 pp.

_____, and J. D. Dodd. 1972. Prescribed burning and grazing for prairie chicken habitat manipulation in the Texas coastal prairie. Proc. Tall Timbers Fire Ecol. Conf. 12:257-276.

Cogar, V. F., J. D. Horkel, and N. J. Silvy. 1977. Vegetation type preference of Attwater's prairie chicken in coastal prairie. Proc. Southeastern Assoc. Fish and Wildl. Agencies 31:41-50.

_____. 1980. Food habits of Attwater's prairie chicken in Refugio County, Texas. Ph.D. Thesis. Texas A&M Univ. College Station. 119 pp.

Dodd, J. D., R. Jurries, and A. T. Weichert. 1975. Stimulating native forage production for livestock and wildlife on fallow riceland. Progress Rept., Texas Agri. Exp. Stn. 8 pp.

Fritz, E.C. 1985. Another way to save nature: conservation easements. Texas Land Use J. (summer) pp. 4-5

Hamerstrom, F.N., Jr., O.E. Mattson, and F. Hamerstrom. 1957. A guide to prairie chicken management. Wisconsin Conserv. Dept. Tech Wildl. Bull. 15. 128 pp.

Horkel, J. D. 1979. Cover and space requirements for Attwater's prairie chicken (Tympanuchus cupido attwateri) in Refugio County, Texas. Ph.D. Thesis, Texas A&M Univ., College Station. 96pp.

_____, R. S. Lutz, and N. J. Silvy. 1978. The influence of environmental parameters on nesting success of upland game birds. Proc. Southeastern Assoc. Fish and Wildl. Agencies. 32:234-241.

_____, and N. J. Silvy. 1980. Evolutionary considerations in creating artificial leks for Attwater's prairie chicken. Pages 42-47 in P. A. Vohs, Jr. and F. L. Knopf, eds. Proc. Prairie Grouse Symp. Oklahoma State Univ., Stillwater.

Internal Revenue Service. 1991. Internal Revenue Service regulations. Section 1.170 A-1:763-768.

Jennings, W. S. 1950. Abundance distribution and present status of Attwater's prairie chicken. Final Rept. to the Texas Coop. Wildl. Unit., Texas A&M Univ. College Station. 37pp. (mimeogr.)

Jones, R. E. 1963. Identification and analysis of lesser and greater prairie chicken habitat. J. Wildl. Manage. 27:757-777.

Jurries, R. W. 1979. Attwater's prairie chicken. Texas Parks and Wildl. Dept. Series F. A., No. 18. P-R Project W-100-R. 36pp.

Kessler, W. B. 1978. Attwater's prairie chicken ecology in relation to agricultural and range management practices. Ph.D. Thesis, Texas A&M Univ., College Station. 158pp.

_____, and J. D. Dodd. 1978. Responses of coastal prairie vegetation and Attwater's prairie chicken to range management practices. Proc. Int. Rangeland Congr. 1:473-476.

Lawrence, J. S. 1982. Effect of predator reduction on the reproductive success of Attwater's prairie chicken. M.S. Thesis, Texas A&M Univ. College Station. 105pp.

_____, and N. J. Silvy. 1980. Status of the Attwater's prairie chicken--an update. Proc. Prairie Grouse Symp. 1:29-33.

Lehmann, V. M. 1941. Attwater's prairie chicken, its life history and management. U. S. Dept. Interior, Fish and Wildl. Serv., Washington, D.C. N. Am. Fauna 57. 63 pp.

_____. 1968. The Attwater's prairie chicken, current status and restoration opportunities. Trans. N. Am. Wildl. Conf. 33:398-407.

_____. 1971. Attwater's prairie chicken. Natl. Parks and Conserv. Mag. 45:1-4.

_____, and R. G. Mauermann. 1963. Status of Attwater's prairie chicken. J. Wildl. Manage. 27:713-725.

Lutz, R. S. 1979. The response of Attwater's prairie chicken to petroleum development. M.S. Thesis, Texas A&M Univ., College Station. 82 pp.

McCune, R. A. 1970. Prairie chicken moving days. Texas Parks and Wildl. Mag. 18:12-15.

Morrow, M. E. 1986. Ecology of Attwater's prairie chicken in relation to land management practices on the Attwater Prairie Chicken National Wildlife Refuge. Ph.D. Thesis, Texas A&M Univ., College Station. 100 pp.

Robel, R. J. 1970. Possible role of behavior in regulating greater prairie chicken populations. J. Wildl. Manage. 4:306-312.

_____, J. N. Briggs, A. D. Dayton, and L. C. Hulbert. 1970. Relationships between visual obstruction measurements and weight of grassland vegetation. J. Range Manage. 34:286-306.

State of Texas. 1991. Conservation easements. Texas Nat. Resour. Code, Chap. 183:163-166.

U.S. Fish and Wildlife Service. 1979. Attwater's prairie chickens have low pesticide residues. Pages 34-35 in T. G. Scott et al., eds. Fisheries and Wildlife Research, 1978.

_____. 1983. Attwater's prairie chicken recovery plan. U.S. Fish Wildl. Serv., Albuquerque, NM. 48 pp.

Watkins, R. M. 1971. The propagation of the Attwater prairie chicken in captivity. M.S. Thesis, Texas A&M Univ., College Station. 38 pp.

Westemeier, R. L. 1986. Endangered prairie-chickens and some species interactions. Illinois Nat. Hist. Surv. Rep. No. 286:1-2.

III. IMPLEMENTATION SCHEDULE

The implementation schedule outlines actions and estimated costs for recovery. It is a guide for meeting the objectives discussed in Part II of this plan. This schedule indicates task priority, number, description, duration, responsible agencies, and estimated costs. These actions should bring about the recovery of the species and protect its habitat. Estimated monetary needs for all parties are identified. Part III reflects the total estimated financial requirements for recovery of this species through the year 2000.

A. Task Priority - Tasks in the Implementation Schedule are arranged in priority order. Priorities are assigned using the following guidelines:

Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.

Priority 3 - All other actions necessary to meet the recovery objectives.

Key to Acronyms Used in Implementation Schedule

Fossil Rim Wildlife Center (FR)
Louisiana Department of Fish and Game (LAFG)
Gulf Coastal Prairies Foundation (GCPF)
Texas Agricultural Extension Service (TAES)
Texas A&M University (TAMU)
Texas Animal Damage Control (ADC)
Texas Department of Agriculture (TDA)
Texas Parks and Wildlife Department (TPWD)
Texas Tech University (TTU)
U.S. Department of Agriculture (USDA)
U.S. Fish and Wildlife Service Endangered Species (SE)
U.S. Fish and Wildlife Service Law Enforcement (LE)
U.S. Fish and Wildlife Service Legislative Affairs (LA)
U.S. Fish and Wildlife Service Public Affairs (PA)
U.S. Fish and Wildlife Service Refuges and Wildlife (WR)
U.S. Fish and Wildlife Service Research (RSCH)
U.S. Soil Conservation Service (SCS)

PRIORITY	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES ($000)			COMMENTS
				FWS						
				REGION	PROGRAM	OTHER	FY93	FY94	FY95	
1	1111	Manage grazing	ongoing	2	WR	TPWD, SCS	50	50	50	Public lands only
1	1112	Implement burning	ongoing	2	WR	TPWD, SCS	100	100	150	4 refuges, 20K acres
1	1113	Control brush	ongoing	2	WR	TPWD, SCS	100	100	50	Public lands only
1	1114	Maintain/improve drainage	ongoing	2	WR	TPWD, SCS	5	5	5	Public lands only
1	1118	Restore prairie	ongoing	2	WR	TPWD, SCS	100	100	100	Public lands only
1	1121	Acquire second refuge	3 years	2	WR		6,000	8	8	Victoria County
1	1122	Add to existing refuge	3 years	2	WR		5,000	5,000	5,000	Austin and Colorado counties
1	121	Use available expertise	ongoing	2	WR,SE	TPWD, SCS	500	500	500	Historic range
1	122	Provide economic incentives	ongoing	2	WR,SE	TPWD, GCPF	330	330	330	Private lands
1	21	Enhance media coverage of population status	ongoing	2	WR,PA	TPWD	10	10	10	
1	22	Encourage media coverage of recovery efforts	ongoing	2	WR,PA	TPWD	10	10	10	

PRIORITY	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES ($000)			COMMENTS
				FWS						
				REGION	PROGRAM	OTHER	FY93	FY94	FY95	
1	23	Enhance public use	ongoing	2	WR		150	8,150	8,150	Staff 2 visitor sites
1	24	Increase educational activities	ongoing	2	WR	TPWD	50	50	50	
1	25	Continue newsletter	ongoing	2	WR	GCPF	8	8	8	Quarterly publication
1	26	Continue APC Symposium	ongoing	2	WR	GCPF	10	10	10	
1	271	Produce publications	ongoing	2	WR,PA	TAES, GCPF	100	100	100	
1	272	Utilize demonstration areas	ongoing	2	WR,PA	TPWD	20	20	20	
1	31	Inform landowners	ongoing	2,4	PA	GCPF	50	50	50	Extension
1	32	Encourage feedback from landowners	ongoing	9	LA	GCPF	25	25	25	Promote landowner incentives for SE
1	41	Develop two propagation facilities	ongoing	2	WR	TAMU, FR	120	120	120	
1	42	Identify release sites	ongoing	2	WR	TAMU, FR	120	120	120	
1	43	Prevent introduction of other grouse	ongoing	2	WR,LE	TPWD	5	5	5	Education

PRIORITY	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES ($000)			COMMENTS
				FWS						
				REGION	PROGRAM	OTHER	FY93	FY94	FY95	
1	511	Rangewide habitat assessment	ongoing	2,8	WR,SE	TAMU	60	60	60	Texas and Louisiana
1	5121	Disease research	ongoing	2,8	WR,SE	TAMU	60	60	60	
1	5122	Predation research	ongoing	2,8	WR,SE	TTU	60	60	60	
1	5131	Assess population dynamics	ongoing	2,8	WR,SE	TAMU	150	150	150	
1	5132	Assess genetic variability	ongoing	2,8	WR,SE	TAMU, TTU	60	60	60	
1	5133	Identify thresholds	ongoing	2,8	WR,SE	TAMU, TTU	10	10	10	
1	52	Develop propagation and reintroduction techniques	ongoing	2,8	WR,SE	TAMU, FR	50	50	50	Research
2	1116	Implement mowing	ongoing	2	WR	TPWD, SCS	20	20	20	Public lands only
2	11171	Implement predator control	ongoing	2	WR	TPWD, ADC	50	50	50	4 refuges, 50K acres
2	11172	Control exotic birds	ongoing	2	WR,SE	TPWD	50	50	50	Within 40km of existing populations
2	11173	Control fire ants	ongoing	2	WR	USDA, TDA	100	100	100	Research & management
2	11174	Manage waterfowl	ongoing	2	WR	TPWD	50	50	50	Avian cholera

PRIORITY	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES ($000)			COMMENTS
				FWS						
				REGION	PROGRAM	OTHER	FY93	FY94	FY95	
2	131	Implement ESA	ongoing	2	WR,LE	TPWD	10	10	10	
2	132	Use EPA authority	ongoing	2	SE	TDA	20	20	20	
2	133	Use State authority	ongoing	2	WR	TPWD	20	20	20	
2	134	Use ASCS authority	ongoing	2	SE	ASCS	20	20	20	
2	1411	Enforce Federal laws	ongoing	2	WR,LE	TPWD	10	10	10	
2	1422	Enforce State laws	ongoing	2	LE	TPWD	10	10	10	
2	281	Increase hunter awareness	ongoing	2	WR,PA,LE	TPWD	5	5	5	Minimal threat
2	282	Prepare media announcements	ongoing	2	WR,PA	TPWD	2	2	2	Spring and Fall
2	283	Educate hunters	ongoing	2	WR,PA	TPWD	5	5	5	Minimal threat
3	1115	Maintain food plots	ongoing	2	WR	TPWD, SCS	10	10	10	Public lands only
3	1119	Control public use	ongoing	2	WR,PA		100	100	100	4 refuges

IV. APPENDIX I. COMMENTS

A. PRINCIPAL COMMENTS RECEIVED ON THE ATTWATER'S PRAIRIE CHICKEN TECHNICAL/AGENCY DRAFT RECOVERY PLAN

Twenty-eight individuals or agencies requested copies of the plan for review. Five responses were received, each containing relevant and helpful remarks. All comments were considered when revising the draft. The authors appreciate the time contributed by each reviewer. Comments discussed below represent a composite of those received. Comments of similar content are combined into general groups. Only critical comments, those raising a question, or suggestions are included in this discussion. Comments were received from the following individuals:

Sidney A. Gauthreaux, Jr.
Department of Biological Sciences
Clemson University
Clemson, SC 29634-1903

Brandt Mannchen
Wildlife Committee
Lone Star Chapter of the Sierra Club
627 Euclid
Houston, TX 77009

Michael B. Muse
Rt. 1, Box 363-F
Byhalia, MS 38611

Rob R. Reid
Espey, Huston & Associates, Inc.
P.O. Box 519
Austin, TX 78767

Dennis Williams
2804 Loma Vista
Victoria, TX 77901

Comment 1. The plan implies that captive breeding is not a viable option. There are several experienced grouse breeders in the United States who would do a great job of breeding the APC and provide more birds for release. The Service should strongly consider a "Breeder Loan" or "Sharing Agreement" with a few carefully selected individuals who have been successful raising greater prairie chickens, and provide funding to support this effort.

Service Response. Captive breeding is a priority issue. APC are successfully being raised in captivity at a private wildlife center in Texas. Texas A&M University is also working with surrogate greater prairie chickens (GPC) to develop techniques for future APC reintroductions. The Service is also communicating with both the Fort Worth and Houston Zoos regarding captive propagation.

Comment 2. The re-mapping of "essential habitat", and its revised definition, is inappropriate and will cause confusion and possible abuse of the term. The essential habitat as mapped contains not only high-quality habitat, but also marginal habitat and large areas of non-prairie habitat (e.g., woodlands, farmland with crops, petrochemical facilities, large areas with varying degrees of encroachment by woody vegetation). Habitats should be classified as they exist at present, or at the very least delimited as "former prairie" and "current prairie" to indicate what is currently suitable habitat for APC. Other possible designations are "historic habitat" and "good/high-quality habitat." Truly high-quality habitat should be designated as "critical habitat." Mapping should also show areas currently occupied by APC.

Service Response. "Essential" habitat is all potential habitat necessary to recover the APC (i.e. provide for 5,000 birds in the wild). Critical habitat has a specific designation under the Endangered Species Act and may be designated in the near future.

Comment 3. A public education program should be developed immediately to inform the public that the APC is near extinction and to gain their support for saving this species. The program should identify the need for another refuge and ways private landowners can help with recovery.

Service Response. We agree. A private foundation is presently implementing such a program. The refuge is also pursuing a public outreach program with limited resources (no Outdoor Recreation Planner). Coordination with other agencies and organizations is desirable.

Comment 4. More emphasis should be placed on public acquisition of additional lands by willing seller, willing buyer, fee purchase or conservation easements. Areas not prone to flooding should be acquired near APC habitat prone to flooding to provide an escape area. A specific plan should be drawn up that shows where possible refuge sites are; the positive and negative aspects of each site; and habitat connecting public, proposed public, and private APC habitat. This plan should include some form of long-term land use

protection (such as "in perpetuity") to ensure that farming and ranching compatible with recovery is guaranteed in a buffer zone around the core private and public refuges. Commitments should be sought from interested groups and individuals for passage of land protection legislation. Programs should also be utilized under which private landowners agree to use farming and ranching methods that protect the APC in return for monetary support from the government.

Service Response. USFWS has identified a second refuge site in Victoria County where topography and soils are good and a willing seller exists. Private lands efforts include memoranda of understanding with landowners and Section 6 leases between private landowners and the TPWD. All these efforts are coordinated to provide contiguous habitat for the birds where they persist.

Comment 5. Acquisition by TPWD of the Texas City site in Galveston County should be encouraged, and a buffer purchased to ensure protection from land uses outside this area.

Service Response. We agree. USFWS and TPWD are working cooperatively to recover the APC, as well as other projects.

Comment 6. The objectives for downlisting and delisting the species are too optimistic. For threatened, the population level should be 5,000 in at least 3 separate populations in 3 geographic areas. For delisting, the population level should be 10,000 in 5 separate populations in at least 3 geographic areas.

Service Response. The USFWS accepts the recommendation of the Recovery Team and other experts on APC management (3,000/5,000/2 areas).

Comment 7. The statement made about the Tatton Unit is incorrect. The Tatton Unit was not managed correctly for APC; private landowners should not be blamed.

Service Response. We agree. Statements made about the Tatton Unit have been modified to reflect past management practices.

Comment 8. The assertion that linear leks are less stable than circular leks needs further evaluation. There are few natural circular leks still in use, and if linear leks are so bad, why do we (Refugio County) have all the birds?

Service Response. At least 2 independent research projects have indicated specific problems associated with linear leks. However, size and quality of habitat are more important than lek structure.

Comment 9. If moderate grazing removes excess vegetation, etc., why are there no cattle at the Tatton unit?

Service Response. Abusive grazing practices in the past have eliminated many desirable grasses. Use of cattle as a management tool will be considered after these grasses have been restored.

Comment 10. Too much emphasis is put on burning as a brush management method. There have been no major burns, either planned or wild, in the Refugio County area in the last 35 or 40 years. Old ranch records do not reference any planned burns on land now occupied by the APC in Refugio County.

Service Response. The literature supports the use of burning as a management tool; however - alternative methods of brush control such as use of chemicals, combined with proper grazing management may reduce the need for an intensive burning program.

Comment 11. Have wetlands rules been considered in plans to maintain/improve drainage?

Service Response. All drainage maintenance/improvement will comply with pertinent policies and regulations.

Comment 12. What conclusive evidence is there that maintaining food plots benefits the Attwater's prairie chicken and is not just a further disruption of native prairie?

Service Response. Although the necessity of food plots for APC is undocumented, use of such areas indicates that may provide dietary requirements that are otherwise limiting. The USFWS shares the concern that excessive amounts of native prairie not be destroyed in producing such food plots.

Comment 13. Why not use cows instead of mowing?

Service Response. Mowing is only an emergency technique for removing excess growth in periods of unusually high rainfall. Grazing is the preferred tool.

Comment 14. If managing waterfowl is so important, why are there lakes and/or ponds at the Attwater Prairie Chicken

National Wildlife Refuge? Consideration should given to draining them.

Service Response. Lakes and ponds support a diverse wildlife fauna. The refuge staff has considered the potential impacts of geese on refuge APC, and have taken steps to reduce/prevent such impacts.

Comment 15. To get more dollars for recovery efforts, APC need to be made more available to the public instead of less accessible.

Service Response. We agree as long as appropriate actions are taken to ensure the associated disturbance does not impede recovery.

Comment 16. The use of EPA authority should be reconsidered. This causes more hard feelings than it does good. Is there any proof that pesticides are a problem?

Service Response. An agriculture/wildlife coexistence committee for the Texas rice belt is developing guidelines for EPA using local, grassroots input from ranchers, farmers, and businessmen.

Comment 17. The map of essential habitat in Goliad, Refugio, and Aransas counties should be changed to show brush encroachment.

Service Response. We agree. GIS maps are complete for northern Victoria, Austin, and Colorado counties. Additional maps are being developed for remaining ranges.

Comment 18. The Victoria County map should be changed to show only a small area between US 87 and across US 77 (both north of US 59); the remaining area consists of brush, houses, and farms.

Service Response. We agree. Note the GIS-generated map for northern Victoria County. Further mapping will delineate additional prairie sites in southern Victoria County, believed essential for recovery. The designation of prairie habitat does not imply that birds are present now on these essential areas.

Comment 19. Water should be made available to aid APC during drought.

Service Response. Cattle watering systems should provide enough water in times of drought.

Comment 20. The Service should help build leks with roads, herd grounds, well pads or watering areas.

Service Response. Leks have not been identified as a limiting factor (Horkel 1979).

Comment 21. The Service should give high priority to cleaning up brush and building escape areas on the Tatton Unit.

Service Response. We agree.

Comment 22. Breaks should be made in the underlining for the scientific names of plants and animals between genus, species, and subspecies.

Service Response. We agree. Recommended changes are incorporated in document.

Comment 23. The reference to historic range by Lehmann found on page 1 is incorrect as stated. Page 1 of the Lehmann (1941) document states "...and in Texas west and south to Cameron County, near Port Isabel." Additionally, Page 5 (second paragraph) of the draft recovery plan also states Attwater's prairie chickens were found south to Tamaulipas, Mexico.

Service Response. Lehmann (1941:3) states "There are no authentic records of the occurrence of any species of prairie chicken in Texas south of northern Aransas County, except for one bird reported near Brownsville...". Lehmann (1968:398) refers to the APC as "...once common on Gulf coastal prairies from southwestern Louisiana southward the Nueces River in Texas."

Comment 24. Based upon the census results of the last few years, it is inappropriate to state that the very few birds, if any, located in Goliad and Aransas counties are a part of 67% of the rangewide population. Almost all (if not all) of the APC occur in Refugio County. Therefore, it would be more appropriate to state that 67% of the rangewide population occurs in Refugio County.

Service Response. County lines do not separate wildlife populations. Specific census data are listed by county in which the birds occurred (Table 1).

Comment 25. The 1992 population estimates should be incorporated.

Service Response. We agree. The 1992 data have been incorporated.

Comment 26. The statement that Goliad and Refugio populations appear to be intertwined is only a hypothesis and is not supported by data.

Service Response. The plan states it as a hypothesis and cites reasons for this hypothesis.

Comment 27. The discussion concerning the intertwined relationship of Goliad and Refugio populations following hurricane Beulah in 1967 is not supported by population data. Following the hurricane in 1967, populations increased in both counties until 1971, decreased in both counties until 1972, showed slight changes in both counties in 1973, and then increased in both counties in 1974. The data do not support the statement that the Refugio County population "crashed" following hurricane Beulah. To allude to a theory that the birds moved back and forth between counties over a 4-7 year period because of a hurricane is not supported and may more likely be a response to habitat conditions and population dynamics.

Service Response. Regarding the impacts of Hurricane Beulah on the Aransas-Refugio-Goliad prairie, Lehmann (1968:402) states "In what historically has been the best chicken range, however, Hurricane Beulah was followed by sharp decline-from an estimated 1,200 to 1,500 birds in July to about 250 in late October." We did not "allude to a theory that birds moved back and forth between counties...". Rather, as suggested by the author of this comment, we hypothesized that the birds responded to changes in habitat condition resulting from climatic changes.

Comment 28. The Horkel (1979) reference cited on page 6 does not state that APC avoid cover types consisting of more than 25% trees and brush. It is clear from the Horkel reference that APC prefer habitat with no presence of brush or trees. Page 75 (first paragraph) of the Horkel (1979) reference states "No use was made of the selected cover types (clumped midgrass, spiney aster and transition) that had been invaded by trees or brush on the pasture." The avoidance of habitat containing woody species is also stated in Cogar, et al. (1977). The statement regarding the 25% brush cover should be removed or an accurate reference provided.

Service Response: We agree. However, APC have been recorded perching in trees (Silvy, pers. comm.), and APC in Galveston County have been observed nesting in grasslands in early

stages of brush encroachment (USFWS unpubl. data). This does not imply that trees or brush are a desirable component of APC habitat, only that APC can tolerate minimal woody plants in their habitat. The statement has been changed accordingly.

Comment 29. Service efforts to enter into MOUs with private landowners are very worthwhile, but should be concentrated in areas of high-quality habitat capable of supporting APC populations and not in marginal habitat which may become more degraded conditions even with landowner participation in the program.

Service Response. This has been and is being done.

Comment 30. A statement should be added stating that the term "essential habitat" has been redefined since the 1983 recovery plan.

Service Response. We agree. Item 13 in the Narrative Outline has been modified to clarify use of essential habitat.

Comment 31. The increase in the area mapped for Victoria County from about 10% of the county in the 1983 recovery plan to 75-80% of the county in the new revised plan is inappropriate for the inclusion within the term "essential habitat," even considering the revised definition.

Service Response. Large tracts of native prairie are needed to recovery the APC.

Comment 32. Predator control should be considered, specifically avian and skunks.

Service Response. Skunk control is implemented on the refuge. Proposed research will examine the relationship between predator control and predator/prey relationships (buffer prey species, alternative prey selection, etc.).