1992

AN EVALUATION OF THREE AREAS FOR POTENTIAL POPULATONS OF WHOOPING CRANES

Janet L. McMillen
Ohio State University

Stephen A. Nesbitt
Florida Game and Fresh Water Fish Commission

Mary A. Bishop
University of Florida

Alan J. Bennett
University of Georgia

Laurel A. Bennett
University of Georgia

AN EVALUATION OF THREE AREAS FOR POTENTIAL POPULATONS OF WHOOPING CRANES

[1]JANET L. MCMILLEN, *Ohio Cooperative Fish and Wildlife Research Unit, Ohio State University, Columbus, OH 43210*
STEPHEN A. NESBITT, *Florida Game and Fresh Water Fish Commission, Gainesville, FL 32601*
[2]MARY A. BISHOP, *Department of Wildlife and Range Sciences, University of Florida, Gainesville, FL 32611*
ALAN J. BENNETT and [3]LAUREL A. BENNETT, *Georgia Cooperative Fish and Wildlife Research Unit, University of Georgia, Athens, GA 30602*

Abstract: Sandhill crane (*Grus canadensis*) populations were evaluated on the Seney NWR, Michigan, the Okefenokee Swamp, Georgia, and in southcentral Florida to evaluate their suitability to support introduced whooping cranes (*G. americana*). This paper compares data collected at these sites and additional data collected in northcentral Florida. The length of the egg-laying period varied from 4.5 months in central Florida to 1 month at Seney, but egg-laying ceased at all sites from mid-May to early June. Mean clutch sizes were similar (1.7-1.9). Renesting ranged from 79% in northcentral Florida to ≤ 5% at Seney. These dates and values are consistent with nesting successes that ranged from 48% in northcentral Florida to 80% at Seney. Average annual recruitment, 12.3 juveniles/100 adults, was highest on the Kissimmee Prairie in southcentral Florida. Average annual home range size for the non-migratory populations were 1 km^2 on the Okefenokee and 6.6 km^2 on the Kissimmee. Nesting season home range sizes ranged from 0.5 km^2 on the Okefenokee to 1.8 km^2 at Seney. All candidate populations successfully satisfied most of the guidelines for potential whooping crane populations as established by the Whooping Crane Recovery Team. Once reintroduction techniques have been refined, any or all of the study sites have the capacity to accommodate a flock of whooping cranes commensurate with Whooping Crane Recovery Team recommendations.

Proc. 1988 N. Am. Crane Workshop

The United States and Canadian Whooping Crane Recovery Plans (U.S. Fish and Wildlife Service 1986; Canadian Wildlife Service 1988) have as objectives a minimum of 40 breeding pairs of whooping cranes in the Wood Buffalo population and at least 25 breeding pairs in 2 additional disjunct populations before the species might be downlisted from endangered to threatened. The increase in the Wood Buffalo population has been significant in the 1980s, and in autumn 1988 this population contained about 145 individuals, including 30-32 breeding pairs. If the growth trend continues the 40-pair minimum will likely be attained in the early 1990s.

The Grays Lake experimental whooping crane population (Drewien & Bizeau 1978; U.S. Fish and Wildlife Service 1986) represents the first attempt to establish a disjunct population. From 1984 through 1988, the U.S. Fish and Wildife Service funded 3 studies in eastern North America to evaluate a population of migratory greater sandhill cranes (*G.C. tabida*) and non-migratory Florida sandhill cranes (*G. c. pratensis*) to determine the suitability of these populations to simultaneously support populations of sandhill and introduced whooping cranes. The areas investigated were the Upper Peninsula of Michigan and adjacent areas of Ontario, the Okefenokee Swamp in southern Georgia, and 3 disjunct areas in southcentral Florida (Fig. 1). Additional studies were conducted in northcentral Florida. Various portions of the studies were conducted from 1981 to 1988 (Fig. 2). Our

[1]*Present address: Chemistry Dept, U.S. Naval Academy, Annapolis, MD 21402*
[2]*Present address: Copper River Delta Institute, P.O. Box 1460, Cordova AK 99574*
[3]*Present address: Agassiz NWR, Middle River, MN 56737*

purpose here is to provide a comparative summary of those eastern study sites.

STUDY AREAS

The Upper Peninsula study was conducted by J.L. McMillen through the Ohio Cooperative Fish and Wildife Research Unit. The study was centered on the Seney NWR and dealt with migratory greater sandhill cranes. Seney is a 386 km^2 refuge, 66% of which is wetland. Its typical topography consists of sand islands dominated by jack (*Pinus banksiana*) and red pine (*P. resinosa*) interspersed with sedge meadows. The objectives for the Upper Peninsula work were to:

1. Determine the breeding population size of greater sandhill cranes on Seney and to measure the reproductive success of nesting pairs.
2. Identify and characterize habitats used by greater sandhill crane chicks.
3. Monitor movements of marked greater sandhill cranes to identify staging areas, migration routes, migration stopovers and wintering areas.
4. Evaluate the suitability of the greater sandhill crane population of Seney for a cross-fostering program with whooping cranes.

The Georgia work was conducted by A.J. and L.A. Bennett through the Georgia Cooperative Fish and Wildlife Research Unit. The study took place within the 1890 km^2 Okefenokee which is a marsh/cypress swamp complex containing approximately 14% open marsh. The objectives of the Okefenokee study were to:

1. Evaluate the potential of the Okefenokee to simultaneously support resident populations of Florida sandhill cranes, whooping cranes and a wintering population of greater sandhill cranes.
2. Describe the ecology and annual behavior patterns of the resident Florida sandhill cranes and the wintering greater sandhill cranes.

The southcentral Florida study was conducted by M.A. Bishop through the Department of Wildlife and Range Sciences, University of Florida. The objectives were to:

1. Evaluate and rank the 3 potential reintroduction sites (Kissimmee Prairie, Myakka River State Park, and Webb Wildlife Management Area) on the basis of vegetation, land use status and trends, and breeding Florida sandhill crane populations.
2. Estimate the size of the Florida sandhill crane breeding population and of the annual juvenile recruitment, and determine factors influencing productivity on each of the 3 sites.
3. Determine habitat use, movements, and social behavior of marked Florida sandhill cranes residing on the Kissimmee Prairie.

The Kissimmee was ranked as Florida's first choice for whooping crane reintroduction. This prairie is 1200 km^2 and includes both public and private lands. It is characterized by flat terrain with pine flatwoods and open expanses of broad saw palmetto (*Serenoa repens*) prairie interspersed with shallow herbaceous and wooded wetlands. On private ranch lands, much of the prairie has been converted to improved pasture.

The objectives of the northcentral Florida studies, conducted by S.A. Nesbitt of the Florida Game and Fresh Water Fish Commission, were to:

1. Evaluate soft-release of captive-reared greater sandhill cranes as a potential method for establishing a non-migratory population of whooping cranes.
2. Evaluate foster-rearing as a potential method for establishing a non-migratory population of whooping cranes.
3. Evaluate the migratory propensity of introduced greater sandhill cranes.

METHODS

Cranes captured on all study sites were individually color-marked and/or radio-tagged. Rocketnetting was the primary capture technique used at Seney and on the Okefenokee; an oral tranquilizer was used to capture cranes in Florida. At Seney cranes were marked with a combination of 1.9 cm red, green and white bands placed above the tibiotarsal joint, and for selected individuals solar-powered radio transmitters were incorporated into the color-marking scheme. Alpha numeric coded neck collars were used to individually color-mark cranes in the Okefenokee. Alpha numeric coded leg bands and solar and battery leg-

mounted transmitters were also used. In Florida, cranes were individually marked using multiple colored 3 cm leg bands above and below the tibiotarsal joint. Radio transmitters were also attached to leg bands or backpacks.

Helicopters were the primary method used to search for nests at Seney and the Okefenokee. Ground monitoring of summer flocks and known pairs was used in northcentral Florida, whereas fixed wing aircraft was used in southcentral Florida.

RESULTS AND DISCUSSION

The number of radiotagged cranes monitored for 1 year or more varied from 5 on the Kissimmee to 31 at Seney (Table 1). At Seney crane nests were typically found in herbaceous emergent vegetation such as sedge (*Carex* spp.) and cattail (*Typha* spp.) marshes. In the Okefenokee, most nests were situated along emergent marsh-scrub/shrub ecotones; and on the Kissimmee Prairie cranes nested in relatively small shallow herbaceous wetlands dominated by pickerelweed (*Pontederia lanceolata*) and maidencane (*Panicum hemitomon*).

The length of the laying period extended from early January to 20 May in southcentral Florida, it extended from 26 February to 9 June in the Okefenokee, and from 10 April to 15 May at Seney (Fig. 3). Despite the disparity in beginning dates, the final laying dates were similar. Approximately 79% of the pairs that lost nests renested in northcentral Florida, 65% renested in the Okefenokee, but at Seney less than 5% renested.

Mean clutch size was similar at all 3 sites (Table 2). Nesting successes, however, ranged from 48% in northern Florida to 80% at Seney (Table 3). This is consistent with a longer laying period and the large number of renesting attempts in Florida and Okefenokee vs. the restricted laying period and low percentage of renesting attempts at Seney. The major cause of egg loss at Seney and Okefenokee was predation, whereas it was flooding at the northcentral Florida sites. The annual recruitment of juveniles into the population or the number of fledged young per 100 adults were also similar at all sites (Table 4). The highest average annual juvenile recruitment, 12.3 juveniles/100 adults (n = 3), as well as the greatest range, 9.9 - 14.9 juveniles/100 adults, were noted on the Kissimmee.

Comparison of the densities of nesting pairs is difficult because of differences in habitat and methodology. In Okefenokee and northcentral Florida the nesting territories are typically aggregated in expanses of wetland habitat. In these homogeneous situations nesting densities varied from 70 pairs/100 km^2 in the Okefenokee to 67/100 km^2 in northcentral Florida. At Seney and the Kissimmee the habitat is more heterogeneous with interspersed wetlands. Densities were based on total habitat, hence nesting densities were reduced to 39 and 25 pairs/100 km^2, respectively (Table 5).

Home range on each area was defined per Burt (1943) as the area occupied by an individual in its normal activities of food gathering, mating and caring for young. For purposes of comparison, all home ranges were computed using the minimum convex polygon method (Southwood 1966). We acknowledge that it produces larger home ranges than some other methods (Ford & Meyers 1981), such as the harmonic mean (Dixon & Chapman 1980).

Annual home ranges were not computed for the Seney population because it is migratory. For the non-migratory cranes mean annual adult home ranges varied from 1 km^2 on the Okefenokee (n = 15) to 6.6 km^2 (n = 6) on the Kissimmee. The mean home range sizes for the nesting season varied from 0.5 km^2 on the Okefenokee and northcentral Florida to 1.8 km^2 (n = 8) at Seney (Table 6). In all cases, subadult home ranges were considerably larger than those of adults. One of the most commonly used habitats during the pre-fledging period at all study sites was herbaceous emergent wetlands. Other important habitats and their characteristic flora are summarized in Table 7.

The Whooping Crane Recovery Team (1980) established 9 guidelines (Appendix A) for evaluating potential reintroduction sites for whooping cranes. The sites are evaluated below in consideration of those 9 guidelines.

1. All 3 potential reintroduction sites are within some portion of the original whooping crane range.
2. None of the studies resulted in detection of any disease sources that affect sandhill cranes on a wide-spread scale. However, potential for exposure to equine encephalitis is a possibility anywhere east of the Mississippi and may be greater in some areas than in others.
3. Aerial hazards do not appear to be a major problem at any of the potential sites.
4. Interspecific competition between sandhills and whooping cranes is not foreseen as a problem at any of the proposed sites.

5/6. All 3 potential reintroduction areas have both suitable habitat and ample protected lands to adequately support and protect reintroduced whooping cranes.
7. There is compatability between the nesting chronology of greater sandhill cranes at Seney and the whooping crane populations at Wood Buffalo and Patuxent Wildlife Research Center. This compatibility does not exist for the Florida sandhill crane populations.
8. It is unknown whether reintroduction of whooping cranes would create conflicts with other projects at any of the sites.
9. There is no crane hunting east of the Mississippi, and the only other eastern species that might be visually confused with the whooping crane are the snow goose (*Chen caerulescens*), wood stork (*Mycteria americana*), and white herons (*Ardeidae*). Of these, only the snow goose is hunted east of the Mississippi. Snow goose hunting is not permitted in Florida or Georgia, but it is permitted in Michigan, Wisconsin, Indiana, Kentucky, and Tennessee. However, populations of snow geese in these states are small, and any conflicts would, at this time, be more perceptual than actual.

There were several other concerns and considerations that we identified relative to a future whooping crane release. 1) If whooping cranes are to be released at any eastern site, they should be given management priority which could necessitate adjustments in management strategies. For example, changes in hydrological management are needed on the Kissimmee to recreate a more natural hydroperiod, and it would be valuable to ensure the maintenance of compatible management on adjacent private lands. On the Okefenokee there is a need for restoration of a fire regime through controlled burns. Hunter education programs would also be needed, especially along flyways, if the flock is to be migratory. 2) It should be determined that whooping cranes placed in southern latitudes such as Georgia and Florida would adjust and breed successfully at the appropriate season. 3) There are several aspects of gentle-release that still need to be investigated, for both the migratory and non-migratory situations. 4) If cross-fostering is to be a viable option for either Okefenokee or Kissimmee, mechanisms will have to be developed to produce eggs as early as possible in the nesting season. 5) Additional research needs to be conducted on adult survival and behavior and on dispersal of subadults at any potential release site.

POSTSCRIPT

Since this paper was prepared, the U.S. Whooping Crane Recovery Team has recommended that the next experimental reintroduction of whooping cranes be in Florida with the goal of establishing a self-sustaining, non-migratory flock. The U.S. Fish and Wildlife Service has accepted that recommendation. The Canadian Whooping Crane Recovery Team has said that if the next flock is to be non-migratory, that it be established in Florida.

Soft-release of captive-reared birds will be the primary release technique. The first release is expected in the mid-1990s with the goal of releasing a minimun of 20 birds annually for at least ten years. In the interim, studies of potential disease factors and other mortality hazards will continue in the proposed release area. Additional captive-reared sandhill cranes will be released in Florida and studied to refine soft-release methods and improve survival and pair formation. Research also is underway at Seney to refine a soft-release technique for migratory cranes.

LITERATURE CITED

Burt, W.H. 1943. Territoriality and home range concepts as applied to mammals. J. Mamm. 24:346-352.

Canadian Wildlife Service. 1988. Canadian whooping crane recovery plan. Can. Wildl. Serv. (Ottawa, Ont.), 56p.

Dixon, K.R., & J.A. Chapman. 1980. Harmonic mean measure of animal activity areas. Ecol. 61:1040-1044.

Drewien, R.C. & E. Bizeau. 1978. Cross-fostering whooping crane to sandhill crane foster parents. Pp. 201-222 *in* S.A. Temple (ed.), End. Birds: Manage. Tech. for Preserving Threatened Species, Univ. Wis. Press.

Ford, R.G. & J.P. Myers. 1981. An evaluation and comparison of techniques for estimating home range and territory size. Stud. Avian Biol. 6:461-465.

Southwood, T.R. 1966. Ecological methods. Methuen, London, 391p.

U.S. Fish and Wildlife Service. 1986. Whooping crane recovery plan. U.S. Fish & Wildl. Serv., Albuquerque, N.M., 283p.

Whooping Crane Recovery Team. 1980. Working

guidelines: biological criteria that all third whooping crane populations studies need to address. U.S. Fish & Wildl. Serv., Albuquerque, N.M., 2p. (mimeo).

APPENDIX A.

The Whooping Crane Recovery Team's working guidelines concerning the biological criteria that third whooping crane populations studies need to address.

Guideline 1

The potential whooping crane area is within the original range of the whooping cranes, determined from the extant historical information.

Guideline 2

The potential whooping crane area is free of avian disease pathogens to which whooping cranes are susceptible, pesticides, heavy metals, and other contaminants adverse to their reproduction and general welfare.

Guideline 3

The aerial environment of all life stages (nesting, wintering, and other use areas) of the whooping crane is relatively safe from aerial line hazards (i.e., electric powerlines, fences, and telephone lines).

Guideline 4

Habitat quality of potential transplant areas (summer, winter, resident) will be assessed through studies designed to determine critical aspects of the biology of resident sandhill crane populations, including: average population size and structure, nesting success, annual recruitment of young, average nesting density, average pair productivity and seasonal movements and patterns of dispersal. (On a non-biological basis, the sandhill crane nesting density should promote economy during monitoring, banding, and egg-transfer operations).

Guideline 5

The area under consideration should be of sufficient size to have the capacity to support self-sustaining sandhill and whooping crane populations without unacceptable adverse competition between these species. For migratory populations, this criterion would apply to breeding, staging, and wintering areas.

Guideline 6

The area under consideration should include ample national and/or state wildlife refuges or other protected lands in order to provide adequate protection to whooping cranes during all life stages.

Guideline 7

If the cross-fostering of eggs is to be used as a reintroduction method, the nesting chronology of potential sandhill crane populations should be compatible with whooping crane populations in captivity at the Patuxent Wildlife Research Center (PWRC) and/or in the wild Wood Buffalo National Park, Canada.

Guideline 8

Proposed reintroduction efforts should not have the potential for adversely affecting the number of PWRC-origin whooping crane eggs available for augmentation of the Rocky Mountain whooping crane population (Grays Lake-Bosque del Apache flock).

Guideline 9

This population should not be subject to adverse disturbances and other conflicts with waterfowl and crane hunting.

Table 1. Comparison of the number of radiotagged sandhill cranes monitored for more than 1 year in the studies to evaluate areas for potential populations of whooping cranes in eastern North America.[1]

Study site	Number of radio-tagged cranes	
	Adults	Subadults
Seney NWR	25	6
Okefenokee NWR	16	9
Northcentral Florida	17	11
Kissimmee Prairie	4	1

[1]Some data reported here are part of ongoing studies and in their ultimatly reported form may change slightly but the competitive values will not change appreciably.

Table 2. Comparison of the mean clutch size for sandhill crane populations used to evaluate areas for potential populations of whooping cranes in eastern North America.

Study site	Mean clutch size
Seney NWR	1.9
Okefenokee NWR	1.9
Northcentral Florida	1.7

Table 3. Comparison of the nesting success and primary cause of nest failure in the sandhill crane populations used to evaluate areas for potential populations of whooping cranes in eastern North America.

Study site	Nesting success (%)	Main cause of failure
Seney NWR	80	Predation
Okefenokee NWR	55	Predation
Northcentral Florida	48	Flooding

Table 4. Comparison of the annual recruitment of juveniles into the sandhill crane populations used to evaluate areas for potential populations of whooping cranes in eastern North America.

Study site	Fledged young per 100 adults	
	Mean	Range
Seney NWR	10.1	8.4 - 11.2
Okefenokee NWR	9.4	7.7 - 11.6
Northcentral Florida	10.2	8.5 - 13.0
Kissimmee Prairie	12.3	9.9 - 14.9

Table 5. Comparison of the estimated nesting densities for sandhill crane populations used to evaluate areas for potential populations of whooping cranes in eastern North America.

Study site	Estimated number of pairs/100km^2	
	Heterogeneous habitat (wetlands and uplands)	Homogeneous habitat (wetlands only)
Seney NWR	39	—
Okefenokee NWR	—	70
Northcentral Florida	—	67
Kissimmee Prairie	25	—

Table 6. Comparison of mean annual home range sizes and mean nesting season home range sizes for breeding sandhill cranes in populations used to evaluate areas for potential populations of whooping cranes in eastern North America. The method used to determine home range size was the minimum convex polygon.

Study site	Home range (km^2)			
	Annual		Nesting season	
	Mean	Range	Mean	Range
Seney NWR	Not applicable		1.8	0.3 - 4.0
Okefenokee NWR	1.0	0.6 - 1.5	0.5	0.3 - 0.7
Northcentral Florida	1.4	0.7 - 2.4	0.5	0.2 - 0.7
Kissimmee Prairie	6.6	2.9 - 11.4	1.4	0.2 - 4.4

Table 7. Important habitats and their characteristic flora used by sandhill crane families during the prefledging period in the populations used to evaluate areas for potential populations of whooping cranes in eastern North America.

Study site	Habitat	Characteristic flora
Seney NWR	Herbaceous emergent	*Thypa* spp. *Carex* spp. *Sphagnum* spp.
	Scrub/shrub	*Chamaedaphne calyculata* *Alnus rugosa* *Salix* spp.
	Drawn-down pools	*Eleocharis* spp. *Sagittaria* spp. *Polygonum* spp.
Okefenokee NWR	Herbaceous emergent	*Panicum hemitomon* *Andropogon virginicus* *Woodwardia virginica* *Carex* spp.
Northcentral Florida	Improved pastures	*Cynodon dactylon* *Paspalum notatum*
	Herbaceous emergent	*Carex* spp. *Pontederia cordata* *Panicum hemitomon* *Bidens* spp.
	Marsh/pasture transition	*Panicum hemitomon* *Juncus effusa* *Eleocharis* spp.
Kissimmee Prairie	Improved pastures	*Paspalum notatum* *Digitaria decumbens* *Aeschynomene americana*
	Herbaceous emergent	*Pontederia cordata* *Panicum hemitomon* *Carex* spp.
	Marsh/pasture transition	*Juncus effusa* *Eleocharis* spp.

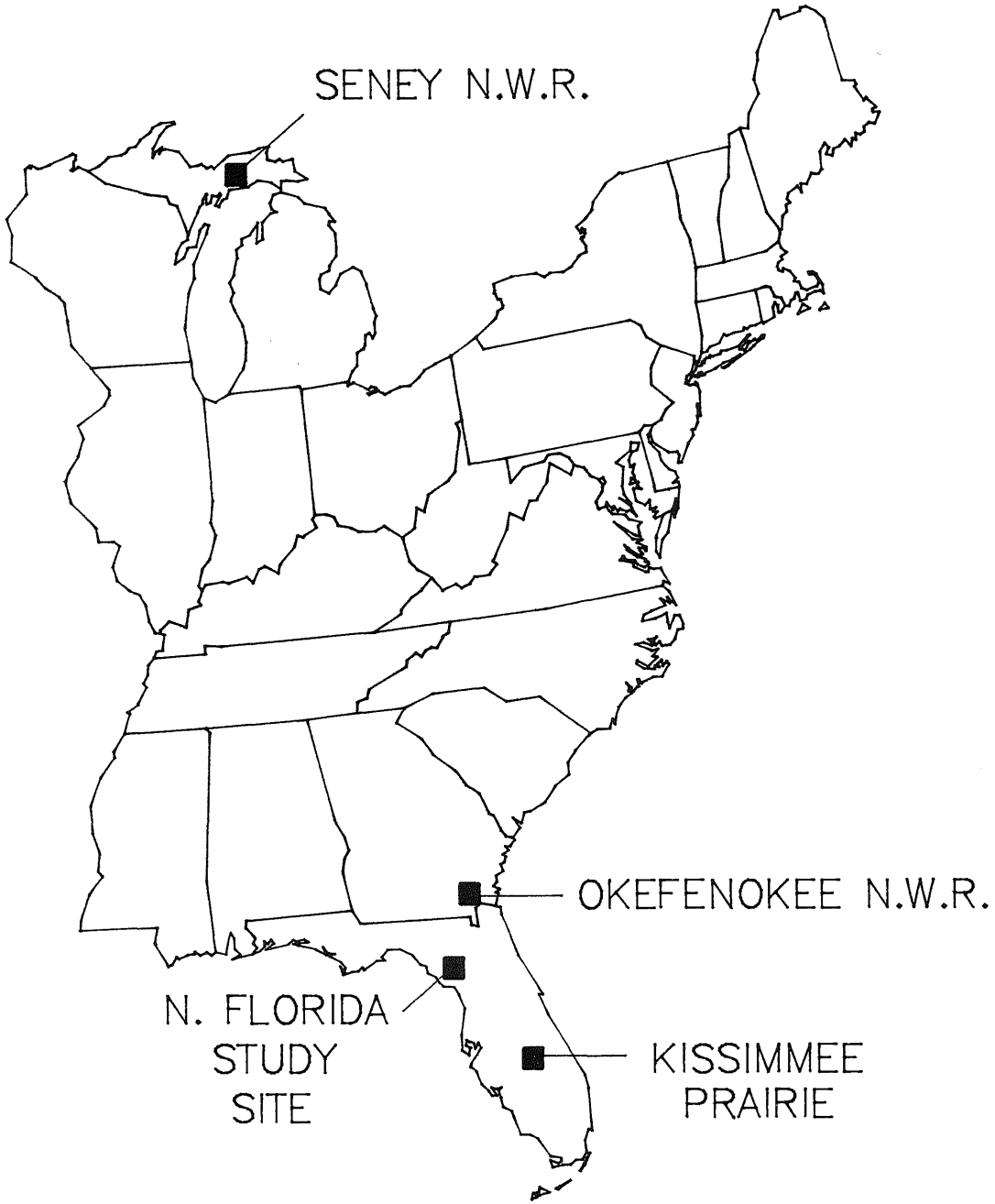

Figure 1. Study site locations for work relative to the reintroduction of whooping cranes in eastern North America.

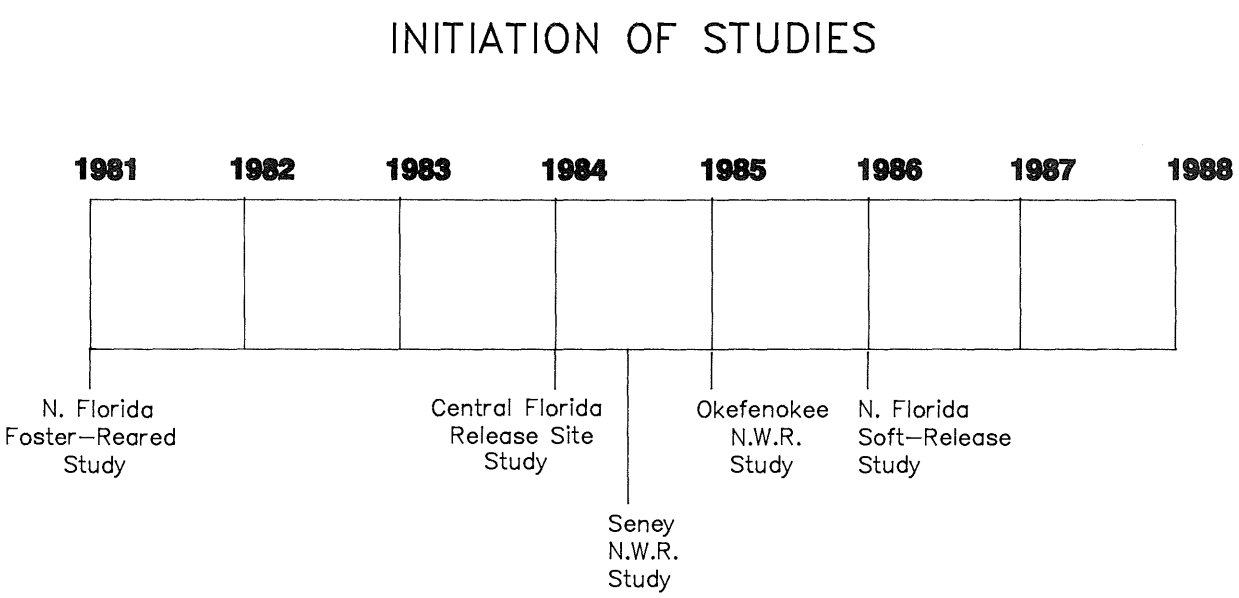

Figure 2. Start-up dates for studies relative to the reintroduction of whooping cranes in eastern North America.

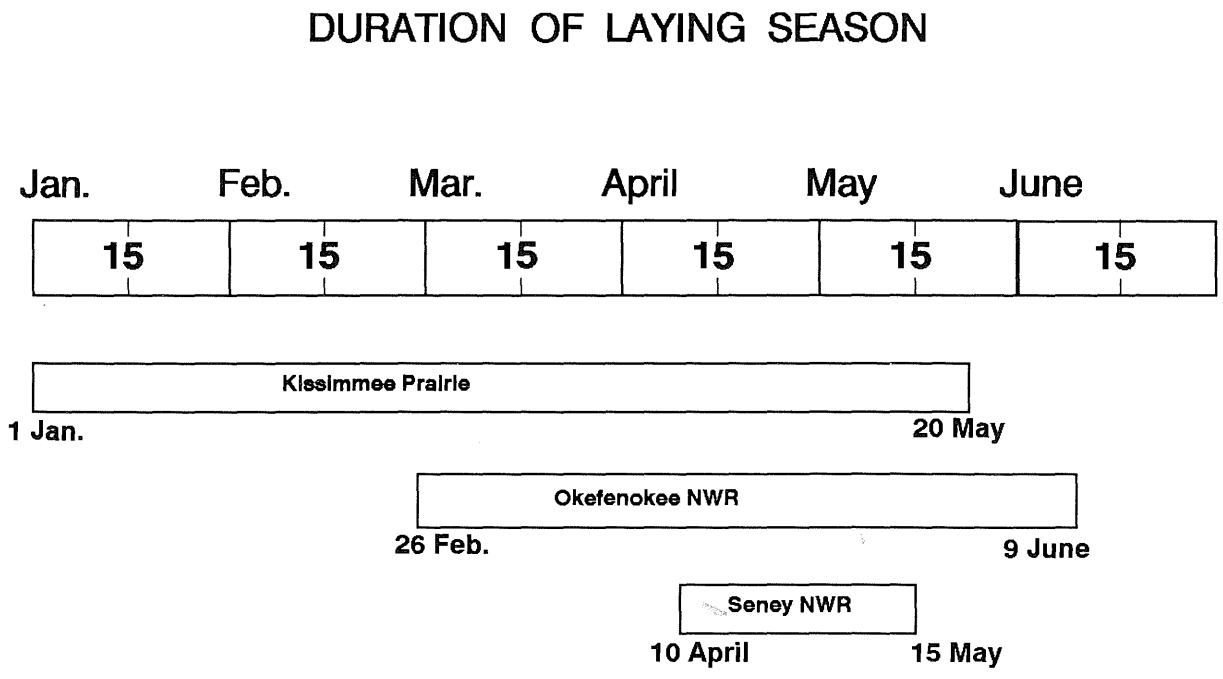

Figure 3. Comparison of the duration of the sandhill crane egg laying season on the Kissimmee Prairie in southcentral Florida, the Okefenokee NWR in southeast Georgia, and the Seney NWR in the Upper Peninsula of Michigan.