



The Eastern Migratory Population of Whooping Cranes: FWS Vision for the Next 5-year Strategic Plan



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In 2001, state and federal agencies and non-profit organizations created the Whooping Crane Eastern Partnership (WCEP) to reintroduce a self-sustaining migratory population of whooping cranes (hereafter, the Eastern Migratory Population, EMP) to the eastern United States. Despite 15 years of dedicated effort and many successful aspects of the reintroduction, it remains uncertain if the EMP will eventually achieve a self-sustaining population. The primary factor limiting the EMP's contribution to the species' recovery is the population's low reproductive success (i.e., hatching and fledging of young)^{1,2}; however, uncertainties about this limiting factor exist. The U.S. Fish & Wildlife Service (hereafter, The Service) is dedicated to building partnerships and continuing the reintroduction program. As we approach the renewal of WCEP's 5-year strategic plan, it is important to applaud the progress our partnership has made and critically evaluate the path forward.

The Service relies upon contributions and recommendations from partners to achieve our recovery goals for whooping cranes and efficient collaboration requires clear communication. This document was drafted to provide guidance regarding the next 5-year strategic plan and several aspects of the reintroduction effort. We recognize there is uncertainty surrounding this reintroduction effort, as well as the importance of an adaptive management approach to continually incorporate new information into the decision-making process. Therefore, we expect to revise this guidance as new information is received or recommendations are made by partners (e.g., Population Viability Analysis (PVA) for the species, sandhill crane breeding ecology research, etc.). The guidance the Service provides in this document should be considered when updating WCEP's 5-year strategic plan.

The Biological Scorecard

- Since 2001, nearly 250 whooping cranes have been released into the Eastern Migratory Population (EMP).
- 93 whooping cranes survive in the EMP today (52 males and 41 females) and 27 reproductive pairs exist.
- The EMP has had 197 nests and hatched at least 63 colts, of which 7 survived to fledge.
- 2 wild fledged cranes survive today and both have nested successfully.

The following are high priority strategies that the Service values for implementation. These strategies are discussed in more detail in this document.

1. Minimize the potential deleterious effects whooping cranes may incur (i.e. learn) through captivity by using rearing and release methods that subject whooping crane chicks to the least artificial conditions for the shortest duration of time. Work with our partners to explore the potential effects of captive breeding on whooping cranes. (*Strategy 1*)
2. Remove eggs from early whooping cranes nests at Necedah NWR. This practice (i.e. forced re-nesting) is intended to increase nest success by reducing black fly caused nest abandonment. The eggs removed could provide propagules for continued release efforts within the EMP. The Service will also work with partners to explore potential management actions to reduce black fly abundance in the Yellow River. (*Strategies 2, 3*)
3. Identify potentially suitable whooping crane habitat within the EMP’s breeding range that is spatially-isolated from current release areas. Work with partners to implement short-duration release efforts to spatially distribute groups of nesting whooping cranes. (*Strategy 4*)
4. Plan and implement wetland management actions to increase prey availability, roosting habitat conditions and improve reproductive success on Necedah NWR. (*Strategy 5*)

Goals & Objectives for Whooping Crane Recovery

The goal of the International Whooping Crane Recovery Plan is to “*protect the whooping crane and its habitat, and allow the overall population to reach a level of ecological and genetic stability so that it can be reclassified to threatened status (down-listed). The ultimate goal is to recover the whooping crane and remove it from the lists of Threatened and Endangered Species (delist)*”³. The Service considers the EMP as one potential *means* to hasten the recovery of whooping cranes. The basis for reevaluating the objectives and strategies for the EMP is to reaffirm that they are realistically attainable and efficiently hasten the Service’s ability to reach the fundamental goal.

The Objective #1 (hereafter, the Objective) in the International Whooping Crane Recovery Plan is to, “*Establish and maintain self-sustaining populations of whooping cranes in the wild that are genetically stable and resilient to stochastic environmental events*”³. The recovery plan describes three potential conditions through which the objective would be achieved. These conditions are based on the size and number of distinct whooping crane populations. With approximately 100 individuals and 25 breeding pairs, the EMP has nearly reached the criterion required to meet the demographic parameters for reintroduced populations in criterion 1.

Table 1. Down-listing Criterion for meeting Objective 1 in the whooping crane recovery plan

Criterion	No. of Populations	No. of Individuals	Productive Pairs
1	AWBP + 2 additional	160 (1996) / 100 / 100	40 / 25 / 25
1A	AWBP + 1 additional	400 (~ 2020 ⁴) / 120	100 / 30
1B	AWBP	1000 (not before 2040 ⁴)	250

* Arkansas Wood Buffalo Population (AWBP)

The recovery plan's objective requires that any additional population be self-sustaining. To quantify this, WCEP adopted a persistence-based criterion for the EMP. That is, when in the absence of additional releases, the EMP has an acceptably small probability of going extinct over a mutually-acceptable timeframe (e.g., 50-100 years)^{2,5,6}. Although the details of this criterion have not yet been fully defined, the EMP clearly falls short of this criterion^{1,2}. Recent population models, conducted as part of the 2014 WCEP Structured Decision Making Process, predicted that, the EMP will be declining or extinct under all evaluated scenarios within 75 years². **It appears that, without substantive changes, the EMP is unlikely to meet the Objective.**

If the EMP has a reasonably high probability of becoming self-sustaining:

1. We will continue to work toward the objective as it is currently written but refocus our efforts towards implementing strategies that will increase the probability of the EMP attaining a persistence-based criterion (i.e., reproductive success).

If the EMP has an unacceptably low probability of becoming self-sustaining:

2. We recognize the EMP is valuable to the recovery of the species even in the absence of meeting the self-sustaining criterion. We will pursue strategies that maximize the value of the EMP to species recovery and formally modify the objectives for the EMP to reflect this strategic change.

At this time we do not know the probability of the EMP becoming self-sustaining, and it is premature to abandon working towards attaining the Objective. However, the results of the PVA behoove us to identify the substantive changes that may allow the EMP to become self-sustaining and to begin thinking about potential ways to maximize the value of a non-self-sustaining EMP.

Strategies for Achieving the Objective

By all indications, reproductive success (i.e., hatching and pre-fledge survival of young) is the factor limiting the persistence of the EMP. To meet the objective, priority should be placed on strategies that attempt to increase the hatching and fledging rate of the EMP. Until the EMP is found to be limited by different factors, we should avoid allocating resources toward strategies that are unlikely to affect hatching or fledging success. Several possible causes (i.e., hypotheses) of poor reproductive success have been identified, each of which suggest different management strategies.

Artificial Selection and Rearing Conditions May Have Unforeseen Long-term Effects

Rearing techniques influence the behavior of captive birds including whooping cranes, and may have prolonged effects^{7,8,9}. Current captive rearing techniques may not instill whooping cranes with the characteristics that allow them to successfully reproduce in the wild. Behavioral deficiencies may include, but, may not be limited to: inappropriate response to predators^{10,11,12},

inability to cope with biting insects, poor nest or offspring attentiveness or defense, poor nest site selection, poor foraging ability, etc. In addition, artificial selection through captive breeding has been shown to cause traits that are deleterious in the wild^{12,13}. Although there is substantial uncertainty surrounding how captive breeding/rearing influences whooping cranes, the Service feels it is prudent to attempt to minimize the potential influences of captivity.

Strategy 1: Reduce the potential deleterious effects of captive rearing on whooping cranes intended to be released into the EMP by minimizing the artificiality of techniques whenever possible and minimizing the duration individuals spend in captivity. Minimize the duration individuals are exposed to costumed-humans, as well as the types of interactions individuals have with costumed humans. Increase the similarities between captive rearing environments and those experienced by wild whooping cranes. This may include implementing predator aversion training using live animals, parasite exposure, limiting rearing groups to 1-2 individuals or any other revision that would increase the similarity between the conditions encountered by captive and wild-reared whooping cranes.

Rearing/Release Method	Artificiality	Costume Duration	Preference
Adoption (currently untested)	Low	Low	Pending Testing
Parent Rearing (in development)	Low	None	High
Direct Autumn Release	Moderate	Moderate	Medium
Ultralight-led	High	High	Low

Avian-feeding Black Flies Reduce Whooping Crane Reproduction

Although the mechanism through which avian-feeding black flies reduce whooping crane reproduction is not certain, a strong correlation exists between high black fly abundance and near-synchronous nest abandonment. Captive-reared whooping cranes may not possess the behaviors required to tolerate biting insects. Whooping cranes may be exceptionally attractive to black flies and therefore endure a greater burden than other species. In either event, it appears that under the current conditions, whooping crane nest success will be low when avian feeding black fly populations are high during whooping crane incubation.

Strategy 2: If forced-renesting is found to be a successful management action to temporally isolate whooping crane nesting from periods of higher black fly abundance, revise and implement the action on all whooping crane nests on and around Necedah NWR.

The Yellow River is a relatively fast flowing river with low turbidity that parallels the eastern boundary of the Necedah NWR and is managed with dams located in Dexterville and Necedah, WI. Black flies and their predators are sensitive to water quality variables such as temperature, turbidity, and water flow rates^{14,15}. Modifying the management strategies of the Yellow River could reduce black fly populations. Understanding which management actions exist and how they could influence the conditions in the Yellow River may reveal additional tools for whooping crane conservation.

Strategy 3: Work with the WDNR, and other partners, to identify management actions within the Yellow River to naturally decrease black fly populations.

Habitat Conditions May Limit Whooping Crane Reproduction

Uncertainty exists regarding the historic distribution of nesting whooping cranes and their habitat in the eastern United States. This uncertainty is compounded by the dramatic changes in land use practices and vegetation communities that have occurred since whooping cranes were extirpated. It is difficult to predict the ecology (e.g., behavior, reproduction, habitat needs, viability, etc.) of a population of captive-reared whooping cranes, from AWBP genetic stock, in the current and substantially altered landscape. Factors that influence the quality of whooping crane breeding habitat likely vary spatially¹⁶. Future release efforts should incorporate this uncertainty and consider a release strategy that would maximize the probability of releasing birds into suitable habitat.

Strategy 4: Alter the ongoing release strategies to encourage birds within the EMP to establish breeding territories in a variety of potentially suitable areas. Identify biologically and logistically suitable sites for potential breeding areas of whooping cranes within the Non-Essential Population area that are supported by partners. Given the low reproductive success realized at Necedah NWR, the International Whooping Crane Recovery Team advised discontinuing releasing in that location until the source(s) of low reproductive success were better understood. The Service recommends evaluating the possibility of using high-intensity, short-duration release programs to establish a core population of whooping cranes in a variety of suitable areas. We recognize there is uncertainty surrounding this release strategy (e.g., social interactions, quantity and duration of releases necessary). However, if this release strategy appears feasible, the Service recommends implementing the strategy as soon as logistically possible. The propagules for these reintroductions could come from captive facilities and/or be obtained as a byproduct of implementing a forced re-nesting strategy at Necedah NWR (Strategy 3).

Necedah NWR has substantial habitat management capabilities through manipulation of water levels and control of undesirable vegetation by burning and physical removal. Management actions could decrease predator cover and increase the food availability and quality of crane chick-rearing habitat. Examination of available data and photography on water levels and vegetation cover in past territories containing chicks is currently underway to attempt to identify relationships between these habitat characteristics and chick survival. Additional data, may be collected during the 2015 chick-rearing season to facilitate investigation of these relationships and result in management recommendations to improve reproductive success.

Strategy 5: Plan and implement wetland management actions to increase prey availability, improve whooping crane roosting habitat conditions and increase the reproductive success of whooping cranes on the Necedah NWR.

Strategies to Maximize the Recovery Value of a Non-Self-Sustaining EMP

The Service believes the EMP may yet become self-sustaining through the application of strategies 1-5. However, if the Service, and our partners, find the probability of the EMP becoming self-sustaining too low to warrant further efforts to make it so, then alternative strategies need to be considered. The following strategies are intended to maximize the value of the EMP to the recovery of whooping cranes, if the EMP is unable to meet the Objective.

Strategy 6: Pairing, nesting, and fertility rates of the EMP are generally high. If future reintroduction efforts would benefit from more propagules than the captive population can produce, the EMP could be used as a source for fertile whooping crane eggs. Currently the EMP includes approximately 30 nesting pairs. Assuming a moderate egg production rate of 1.25 viable eggs/nest, the EMP could produce 37 eggs from first nests. With no additional releases or natural reproduction, the EMP, and hence the eggs they produce, would decline annually. Assuming a 10% mortality rate, the EMP would produce less than 10 eggs annually in 15 years.

Strategy 7: The premise for creating additional populations is to guard against extinction of the species caused by a catastrophic event affecting the AWBP. Although the Objective requires the EMP to be self-sustaining, management intervention could, at least momentarily, create an artificially sustainable population. Eggs from the EMP could be salvaged from nests, hatched and reared in captivity then released back into the EMP. Although an artificially sustained population would not meet the Objective, it would create a free-ranging population of whooping cranes to offset the risk of extinction to the species.

Strategy 8 (*Research & Development*): The EMP is the largest free-ranging population of whooping cranes after the AWBP. The EMP's status as a Non-essential Experimental Population provides the latitude to utilize the population to test and evaluate conservation and management actions relevant to whooping crane recovery. Scientists working on the EMP have already provided meaningful scientific contributions and this population could continue to provide opportunities to learn as long as it persists.

Additional Strategies Examined but Not Presently Supported

Some strategies are not presently supported by the Service. Through this planning process these strategies were considered, but did not appear to be the most efficient means to achieve the Objective.

Application of *Bti*: Use of the biological control agent (*Bti*) in rivers and tributaries near Necedah NWR was conducted as an experiment to determine if reducing black fly abundance would increase whooping crane nesting success and identify if additional limiting factors (e.g., predation rates) were being masked by black fly-induced nest abandonment. Although the application of *Bti* appeared to decrease nest abandonment and increase hatching success, it did not appear to increase the reproductive success of whooping cranes because of poor survival of chicks to fledging. The Region 3 Service's policy precludes the application of *Bti* on Service lands. For this reason, and the uncertainty surrounding unintended consequences of the use of *Bti*, the Service does not currently support its use to annually manage black fly populations.

Ultralight-Led Rearing and Release Method: Operation Migration has made an invaluable contribution to the effort to establish the EMP by pioneering novel reintroduction methods, recreating a whooping crane migration route, engaging communities and educating thousands of people about whooping crane conservation. Ultralight-led rearing and release of whooping cranes began in 2001 with the understanding that as the project proceeded, we would use release methods that seem most reasonable in light of the present understanding of whooping crane biology. Over the past 14 years, 181 whooping cranes have undergone ultralight-led rearing and release methods. Ultralight-led rearing and release is more artificial and costly than any other currently used release method and does not appear to yield substantially better results. The Service supports minimizing anthropogenic effects of captive rearing on whooping cranes by using methods that mimic the conditions experienced by wild whooping cranes as closely as practicable.

The Service will work closely with our partners to phase out ultralight-led rearing and release methods and revise other rearing and release methods to more closely mimic the conditions experienced by wild hatched whooping cranes. In WCEP's next 5-year strategic plan, the Service will prioritize the allocation of eggs for use in methods with shorter periods of captivity and more limited exposure to costumed humans (e.g., DAR, parent rearing, etc.). The Service values the contributions of Operation Migration and recognizes their ability to continue to make important contributions to WCEP. The Service looks forward to working with Operation Migration to help refine and carry out the strategies presented in this guidance document.

WCEP's accomplishments have captured the imagination of people around the world. Through further cooperation and focused effort, the partnership can help ensure that the birds in the EMP contribute as effectively as possible to whooping crane recovery.

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