INSIDE: Sage Grouse Candidate for the Endangered Species List

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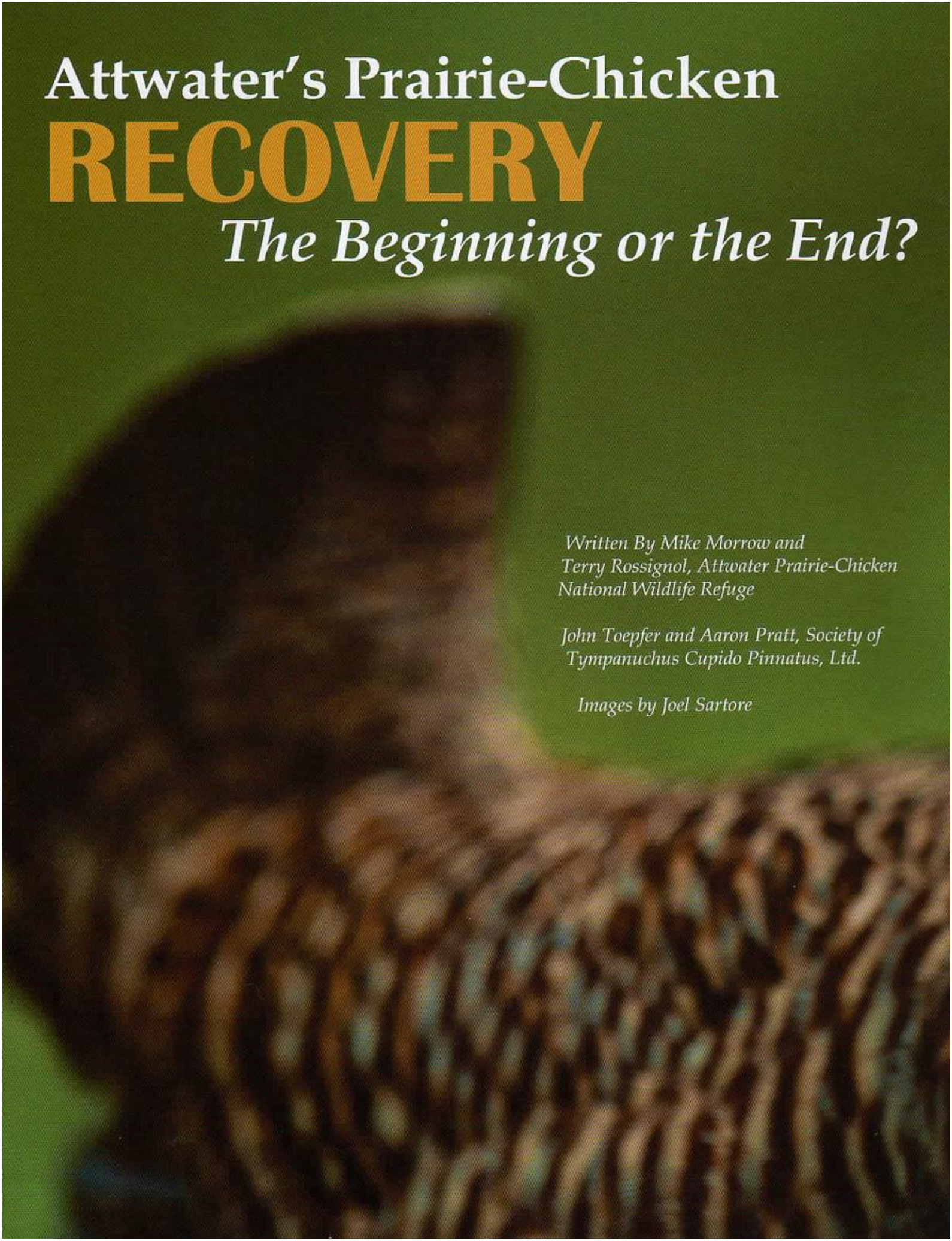
Attwater's Prairie-Chicken
RECOVERY
The Beginning or the End?



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Images by Joel Sartore

The Attwater's prairie-chicken (APC) (Tympanuchus cupido attwateri) was federally listed as endangered with extinction in 1967. The APC represents the southern-most subspecies of T. cupido, and currently occurs in the wild at only three locations — the Attwater Prairie-Chicken National Wildlife Refuge (APCNWR) (Colorado County, Texas), the Texas City Prairie Preserve (TCPP) (Galveston County, Texas), and private ranches in Goliad County, Texas. Just under 100 birds were found in these three populations as of March 2009 (Figure 1). In addition, approximately 135 individuals are being held in captivity. Almost all of the individuals in the free-ranging populations came from release of captive birds or are the progeny of released birds.

Obviously, given population levels as low as they are, the APC remains perilously close to extinction. With populations that close to extinction, some believe that we should abandon the effort to recover the APC and let nature take its course. However, we feel this would be irresponsible for the following reasons:

(1) we do not have a good understanding as to why APC populations declined from over 1,000 individuals in the mid-1980's to functionally extinct just a short decade later (Figure 1); (2) we do not have a good understanding as to why APC populations are not responding to intensive and focused recovery efforts; (3) because it is listed both federally and by the State of Texas as an endangered species, there are legislative mandates for continued conservation efforts; and probably most important (4) we believe, based on recent events and availability of tens of thousands of acres of suitable permanent grassland habitat, that there is a good chance of returning the APC to viable population levels. The APC is fortunate to have over 25 recovery partners in the form of government agencies, non-governmental organizations, and private landowners who are not yet willing to give up on this critically endangered resident of Texas coastal grasslands.

The APC Recovery Team has drafted a revised recovery plan which is currently in the final stages of approval (the final plan, once approved, may be downloaded at *www.fws.gov*). This plan lays out specific and measurable, albeit ambitious, criteria and strategies for ultimately removing the APC from the endangered species list.

Obviously, we have a long way to go to reach the delisting criteria of 6,000 breeding adults annually for 10 years distributed over a linear distance of 100 miles. However, this plan provides a framework for evaluating progress and for highlighting priorities. The plan focuses on three recovery strategies: (1) habitat restoration and management, (2) captive population management, and (3) wild population management. Each of these will be addressed individually. Finally, it is important for the scientific community and especially the public to understand how far the current APC Recovery effort has come relative to other recovery efforts using pen-reared birds.

HABITAT RESTORATION AND MANAGEMENT

Since prairie-chickens are obligate residents of suitable permanent grasslands, the plan places key importance on putting enough suitable grass on the landscape to support APC populations. Further, enough grass must be available to sustain the APC not only during the highs, but also the lows that are common to prairie grouse. To achieve this goal, the plan recommends 300,000 acres of suitable grass be distributed over 100 linear miles (to minimize risk of catastrophic events like hurricanes). Further, the plan recommends that management focus on multiple core areas of at least 25,000 acres capable of supporting 500 breeding birds each. While we are not close to achieving the 300,000-acre target, considerable resources have been targeted in recent years on restoration and maintenance of the APC's coastal prairie ecosystem. Currently, the 10,538-acre APCNWR and the 2,396-acre TCPP focus management activities on restoration and maintenance of habitat specifically for the APC. Additionally, cost share assistance has been provided to private landowners for restoration of approximately 67,000 acres of APC habitat. We estimate that more than 65,000 acres of suitable grassland are currently available for APC. This amount of grass should support far more than the 100 individuals currently existing in these habitats.

CAPTIVE POPULATIONS

The APC captive breeding program was initiated in 1992 at Fossil Rim Wildlife Center, and presently supports a breeding flock of 100-150 breeding individuals distributed among five institutions: Abilene Zoo, Caldwell Zoo, Fossil Rim, Houston Zoo, Inc., and the San Antonio Zoo and Aquarium. In addition to these five facilities, two institutions focus primarily on APC captive breeding research. Sea World of Texas is currently researching techniques for artificial insemination; Texas A&M University has been involved in APC captive breeding research from near the inception of the program. This combined breeding program currently produces more than 300 chicks annually for maintenance of the captive flock and for release into suitable habitat. Goals specified in the revised recovery plan for captive population management include: (1) maintenance of 90% of founder population gene diversity, and (2) maintenance of at least 100 breeding pairs on an annual basis, with no more than 25% of the flock located at any one facility (to minimize risks of catastrophic loss). We have done quite well with genetic management of the captive flock thus far. A 2006 assessment conducted by Dr. Jeff Johnson (University of North Texas) found no statistical difference in

A mother watches over a juvenile Attwater's prairie-chicken at a captive breeding facility.

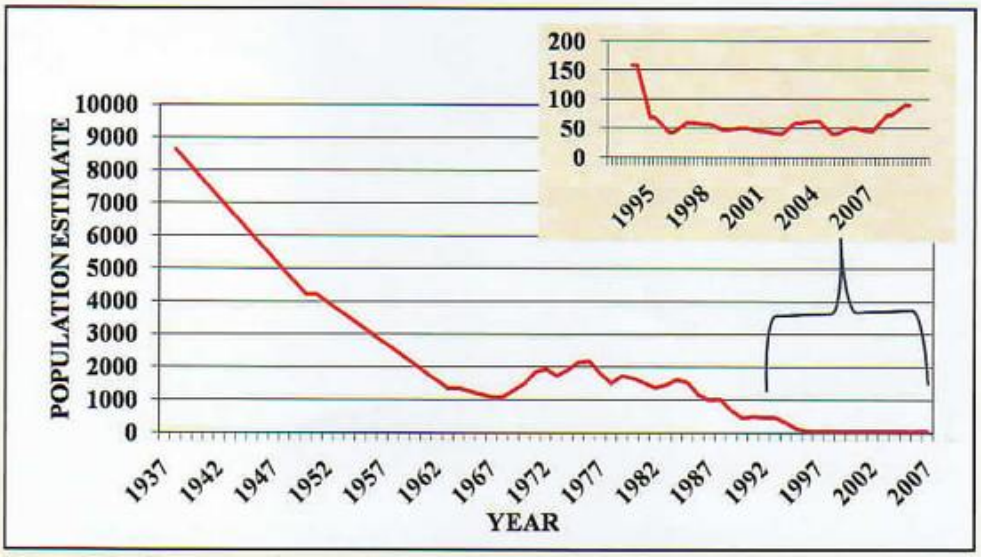

Figure 1 by Terry Rossignol. Attwater's prairie-chicken population trends.

allelic richness or heterozygosity between the wild founder population and the 2006 captive population. However, in 2009 the breeding flock contained only 49 pairs, and 50% of the flock was located at one institution—Fossil Rim Wildlife Center. The size of the captive flock needs to be doubled and be spread out more to meet the recovery plan targets. Fossil Rim is currently the only institution with permanent, full-time staff dedicated to APC propagation, producing more than 50% of APC chicks reared in captivity. Therefore, it would not be prudent to take breeding pairs from Fossil Rim for the sake of achieving a more equitable distribution of breeding individuals among institutions. Further, capacity for expansion is limited at other institutions. A new facility needs to be established to address these needs. A proposal to build such a facility at the Sutton Avian Research Center is currently pending funding.

WILD POPULATION MANAGEMENT

Goals established for wild populations include establishing multiple core populations of at least 500 birds, and ensuring that these populations have sufficient connections to facilitate gene flow among the core populations. At this time we are not even close to these targets. Currently, the release of birds produced in captivity provides the source stock to reestablish wild populations. Since 1995, over 1,700 captive-reared APC have been released. Initially, all birds were released at APCNWR and TCPP. However since 2007, birds have also been released on private ranches in Goliad County, Texas.

In general, APC selected for release, mostly chicks hatched during the previous April-June, undergo a rigorous health screen to ensure that healthy birds are being released. Once cleared for release, the birds are moved to acclimation pens at the release site where they spend the next 14 days recovering from the stress of transfer and beginning the transition to wild food items. After release, food and water are provided outside the acclimation pens to further facilitate the transition to the wild environment. The target release period is from early July (chicks at least 6 weeks old) to mid-September (before arrival of migratory raptors). Most birds released to date have been equipped with radio transmitters to allow for evaluation and modification of rearing and release protocols as needed.

Movements and habitat use of released pen-reared APC have been similar to those reported in studies on wild APC (Lockwood 1998, Lockwood et al. 2005). Through the use of predator deterrent fences around nests, nest success for released birds has averaged 66% compared to 32% reported for historic wild APC (Peterson and Silvy 1996). However, post-hatch is where APC recovery has hit a brick wall in that only 1 of 27 broods (3.7%) monitored from 2003-2008 successfully fledged chicks. Of the remaining 26 broods, most failed during the first 14 days post-hatch. The results were the same for all three sites where APC currently exist. Trouble-shooting this brood survival issue is complicated by the fact that immature prairie-chicken hens are about half as productive as adults when it comes to fledging chicks, and most of the released APC are less than one year old (J. Toepfer, unpublished data).

The only way we have been able to get broods to survive to fledge chicks until 2009, has been to confine the hen and chicks at hatch at the nest site in a "brood box". These are free-ranging radioed hens that have been allowed to nest on their own, hatch and then the box placed over the hen and chicks at night. Insects swept from the prairie are then provided to the hen and chicks every two hours during the day. In addition to the insects, food supplements are also provided for the hen. At two weeks post-hatch, the hen and brood are released and allowed to fend for themselves. Survival of chicks held in brood boxes to

'Frankie' the male Attwater's prairie chicken boomed and strutted outside a pen at the APC NWR for weeks, hoping to get a chance to mate. His persistence paid off; he was eventually let inside the pen and mated successfully.

Left: Just hatched, an exhausted Attwater's prairie-chicken rests in the hands of a biologist after freeing itself from its egg in the Fossil Rim Wildlife Center's incubator room. Right: A heat lamp serves as a surrogate mother for this juvenile Attwater's prairie-chicken at the Fossil Rim Wildlife Center. Captive breeding efforts are the species' only hope for survival.

release at two weeks has averaged 84%, much higher than two-week survival in captivity (65%). Survival of broods managed in this manner (head-start broods) to fledging of at least one chick has averaged 35%, comparable to that observed for wild APC and greater prairie-chickens (GPC) (Morrow [1986]), J. Toepfer, unpublished data).

Due to the fact that survival of these head-started brood units has been reasonably good, and that we have found dead and dying chicks with hens allowed to fend for themselves at hatch (thereby eliminating predation as the sole cause of brood loss), we suspected that insect availability for chicks and hens was a potential limiting factor, especially for very young chicks. When we compared insect samples collected from APC range with those collected from a stable to increasing population of Minnesota GPCs, we found that while insect biomass did not differ between the areas, many times more insects were collected/sample in Minnesota compared to APC range (Pratt et al., unpublished manuscript). Therefore, insects from the Minnesota GPC range were smaller, but much more numerous. Despite implementing practices traditionally recommended for increasing insect abundance (e.g., disking, patch burning, cover crops), we have not been successful in increasing insect abundance at APCNWR.

This indicated that some other dominant environmental factor was likely affecting insect numbers, size and diversity. This caused us to examine the potential impacts of the exotic red imported fire ant (RIFA) on insect populations within APC range. The disruptive impacts of RIFA to wildlife and insect communities are well documented in the literature. RIFA invaded APC range during the mid-1970's, a few years before APC populations began their final slide toward extinction (Figure 1). In April 2009, we treated 760 acres of prairie on the APCNWR with Extinguish Plus (donated by Wellmark International) to control RIFA. By September, RIFA activity was reduced by 75% compared to untreated areas, and insect numbers were significantly higher in the RIFA control area. These results, though preliminary, are very encouraging.

Also extremely encouraging was that 5 of 18 broods (27.8%) in 2009 allowed to fend for themselves beginning at hatch (i.e., were not head-started) still had chicks past the critical two week point, and two successfully fledged chicks (one each at APCNWR and Goliad County). One of these hens fledged 5 chicks. Consistent with the insect availability hypothesis discussed above, insect samples collected at APCNWR yielded lower weight/insect (i.e., more smaller insects) in 2009 compared to 2003 (the last time more than one or two broods were allowed to try it on their own at APCNWR). Extreme drought conditions experienced recently at APCNWR and Goliad County typically results in increased grasshopper availibilty and reduced RIFA activity (B. Drees, Texas AgriLife extension, personal communication). Also consistent with the insect availability hypothesis is that 5 of the 9 broods (55.6%) head-started in 2009 fledged at least one chick. The highest rate documented for radioed wild prairie-chickens so far has been 50% (J. Toepfer, unpublished data). Survival of fledged chicks from head-started broods is also good. Telemetry data indicates that survival of these chicks from fall to the following breeding season has

been 75% (12/16) which is almost exactly that seen in wild fledged GPC chicks (67-76%, J. Toepfer, unpublished data).

APC RECOVERY VERSUS PAST EFFORTS—USE OF PEN-REARED BIRDS

Many with only a vague familiarity with the APC recovery program have concluded that APC recovery efforts are failing because of the inability of pen-reared birds to survive in the wild. That is not true. While there has been considerable year-to-year variation in survival of released APC, Kaplan-Meier estimates of survival to one year post-release have averaged 20%, ranging from 8-43%. Survival of other pen-reared gallinaceous birds reported in the literature has not been that good, ranging from 0% for GPCs, 0-3% for bobwhites, and 1-8% for pheasants (Toepfer 1988). Similarly, Siano et al. (2006) reported a median post-release survival of only 18 days for pen-reared capercaillies. Median post-release survival for pen-reared APC to date is 82 days, ranging from 0-1,774 days. The best annual post-release survival for ground-dwelling birds that we are aware of is 65% for Houbara bustards released in Morocco (Y. Hingrat, Emirate's Center for Wildlife Propagation, personal communication). While the annual survival observed for Houbaras sounds fantastic compared to the 20% average for APCs, one has to evaluate post-release survival with respect to species life history. Since annual survival reported for prairie-chickens in multiple studies through the years is around 50%, an average 65% annual survival is unattainable even for wild prairie-chickens. Wild houbara are long-lived, experiencing only approximately 4% mortality/year (Y. Hingrat, Emirate's Center for Wildlife Propagation, personal communication). So relative to wild survival, the 35% mortality observed for released pen-reared houbara is 7.8 times that observed by wild birds. For APC, the 80% mortality for released pen-reared birds is only 1.6 times that of wild birds.

A more realistic way to look at all this is to compare what percentage of eggs laid and incubated end up in the breeding population the following spring. Selection will occur somewhere for wild and pen-reared birds alike. For pen-reared birds, the eggs and chicks are maintained in a protected environment and therefore, selection is less for those stages compared to wild birds. In the wild, only about half of the nests are successful; hence half of the eggs are destroyed before incubation is complete. Therefore, it is not surprising that selection is heavier for pen-reared birds after release compared to wild cohorts. Standardized comparisons based on the number of eggs incubated indicates that the current APC recovery effort using a gentle release protocol is establishing a post-release breeding population of immature APC at a level higher or comparable to that seen in wild prairie-chickens and that reported for other released pen-reared birds. This includes quail, pheasants, partridge, turkeys, ruffed grouse, whooping cranes and peregrine falcons. Of the birds listed, only the release of hand-reared peregrine falcons has consistently reestablished self-sustaining populations in the wild. This model, based on one hundred eggs laid using current life equation data, indicates that wild prairie-chickens recruit 12-16 individuals per 100 eggs laid, while released pen-reared APC recruit 20 individuals per 100 eggs laid. It takes 8 wild prairie-chicken hens to produce 100 eggs. Figure 2 compares standardized survival of 100 eggs laid by captive APC with wild greater prairie-chickens to the following breeding season. Similar comparisons for other wild and pen-reared birds listed above showed that as a general rule, whether wild or pen-reared, 100 eggs laid results in 10-20 individuals in the breeding population.

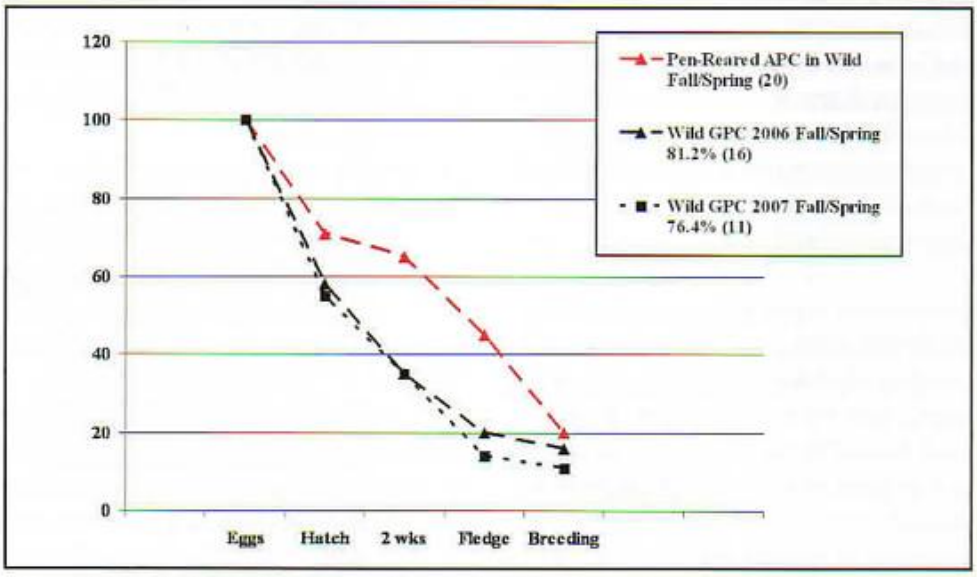

Figure 2 by John Toepfer. Comparison of production and survival from 100 eggs to breeding season for pen-reared APC with wild radio-marked GPC in northwestern Minnesota 2006 and 2007.

An endangered male Attwater's prairie chicken booms inside a pen at the Attwater Prairie Chicken NWR. Captive-raised males are allowed to breed and then turned loose while the females incubate their eggs in the pen.

The success rate of efforts to reestablish populations using pen-reared birds is dismal. This long history of failure of released pen-reared quail, pheasants, turkeys and even whooping cranes to reestablish populations likely relates to the failure to recruit young. The fact that released pen-reared galliformes have not been able to reestablish populations where RIFA are absent suggests that there are other factors involved. One that relates to the condition of the hen is supported by the head-started broods. The hen also receives supplemental food along with the insects provided for chicks. Most of these hens have maintained or gained weight while in the boxes. The fact that captive-reared raptors such as falcons and eagles released into the wild have regularly reestablished populations suggests the possibility of a hidden limiting factor—quality of food? All of the successful species seem to be meat-eaters and the unsuccessful species omnivores that are fed processed commercial food thought to contain all of the necessary nutrients and vitamins necessary for birds to develop properly and successfully produce healthy eggs and young—but does it?

Other factors may be playing a role as well (e.g., genetics, inadvertent selection in the captive environment, etc.). Each of these must be dealt with in turn, and either confirmed as a possibility or wiped from the table. However, after many frustrating years of dismal results, the pieces of the APC puzzle are finally beginning to come together. We feel we are at the beginning of really understanding not only why the APC population declined so rapidly, but why pen-reared APC and so many other pen-reared birds cannot reestablish wild populations. What now? We will continue with the releases and evaluation and plan to expand the RIFA control to the other release sites, examine insect abundance and brood survival, and look at the physical attributes of pen-reared APC.

Hopefully, with this paper we have dispelled the perception of many biologists that the APC recovery effort using pen-reared birds is a dead-end. In reality, the limiting factor is not in getting enough released pen-reared birds to survive to breed, but the failure of released pen-reared APC to fledge enough young on their own. It appears that this may indeed be a major obstacle in using pen-reared galliformes to reestablish populations in vacant habitat. Finally, contrary to what many think, released pen-reared APC are capable of doing everything that wild prairie-chickens do. This means that with the current amount of coastal prairie habitat available, and armed with the knowledge obtained so far from some very basic field research, the recovery of the Attwater's prairie-chicken has reached a new beginning. ■

The findings and conclusions in this article are those of the authors and do not necessarily represent the views of the U.S. Fish and Wildlife Service.

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