FLIGHT CHARACTERISTICS OF PEN-REARED AND WILD PRAIRIE-CHICKENS AND AN EVALUATION OF A GREENHOUSE TO REAR PRAIRIE-CHICKENS

A Thesis

by

MARC FREDERICK HESS

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

May 2004

Major Subject: Wildlife and Fisheries Sciences

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Approved as to style and content by:

Nova J. Silvy (Chair of Committee)	Roel R. Lopez (Member)
Donald S. Davis (Member)	Clifton P. Griffin (Member)
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May 2004

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ABSTRACT

Flight Characteristics of Pen-Reared and Wild Prairie-Chickens and an Evaluation of a Greenhouse to Rear Prairie-Chickens.

(May 2004)

Marc Frederick Hess, B.S., Texas A&M University

Chair of Advisory Committee: Dr. Nova J. Silvy

The introduction of pen-reared Attwater's prairie-chickens (APC, *Tympanuchus cupido attwateri*) into the wild to supplement existing populations has met with marginal success. Flight characteristics, predator avoidance behavior, and rearing methods are possible factors contributing to post-release mortality of pen-reared birds.

To evaluate flight characteristics and predator avoidance behavior of pen-reared APC's released onto the Attwater Prairie Chicken National Wildlife Refuge, flight characteristics and predator avoidance behavior of pen-reared APC's was compared to wild greater prairie-chickens (GPC, *T. c. pinnatus*) in Minnesota and Kansas using a radar gun and a trained dog. There was no difference ($P = 0.134$) in flight speed for pen-reared APC and wild GPC. However, wild GPC had greater ($P < 0.001$) flight distances than did pen-reared APC. Wild GPC and pen-reared APC that had survived in the wild for at least a year flushed at a greater ($P < 0.001$) distance from an approaching human than did pen-reared APC that had been released for less than 3 months. A trained dog was able to approach closer ($P < 0.001$) to APC than GPC before birds flushed, and APC

did not fly as far as GPC after being flushed by the dog. Pen-reared APC displayed flight endurance deficiencies and were more approachable by humans and a dog before they flushed when compared to wild GPC, which could explain their increased mortality when released into the wild.

To determine if APC chicks could be reared without daily human contact, pelleted food, and water in founts, a greenhouse was used to rear chicks in a semi-natural environment. Planted vegetation and commercial insects provided hiding cover and a food source for the APC chicks. An underground heat source provided chick warmth, and water misters and a sprinkler system simulated dew (a water source for chicks) and rain. The greenhouse provided chicks protection from predators and adverse weather conditions (before they could thermo-regulate) while exposing chicks to natural sunlight, day length, and temperature fluctuations. This technique allowed chicks to be reared in a semi-natural environment which reinforced their natural foraging behavior for food and water, and reinforced their hiding and avoidance behaviors, creating a wilder pen-reared bird.

DEDICATION

To

Jennifer and Freddie

Thank you for the sacrifices you made while I completed my Master's degree. I love the both of you very much.

ACKNOWLEDGEMENTS

Many people have helped in some form or fashion on this project, and for this I am grateful. I thank Seth McGinnis and Dane McGinnis for their dedicated work at the pens and for their many hours spent on the greenhouse. I especially thank Keith Rector for his idea of creating a hot spot on the ground to provide the needed brood heat, and his help with all aspects of building the greenhouse. I thank Jody Schaap, Nils Peterson, and Dustin Jones for helping move the greenhouse frame onto the foundation. I enjoyed sharing my office with Jody Schaap and the "heated" discussions that we had (I still think my project is better). I thank Dustin Jones and Collin McCannon for helping collect data, and Erin Knoll and Colleen Buccieri for locating birds to flush and for the long hours in the summer heat chasing chickens. I thank Frank Loncarich for taking the time to spend a week with me in Kansas, away from his family, to locate and flush birds.

I am grateful to have had the opportunity to work with Dr. John Toepfer. The time spent with him flushing birds was an educational experience, and I thank him for his friendship, guidance, help, and for sticking up for me at recovery team meetings. John was one of the few people that always knew what I was trying to accomplish with this project.

I thank Drs. Roel Lopez, Clifton Griffin, and Don Davis for serving on my committee. I especially thank Clifton for his guidance through out my tenure at the pens; he has always been there when I had questions about raising prairie-chicken chicks. I thank Roel for his help and for allowing me the opportunity to gain experiences with species other than chickens.

I don't know how to thank Dr. Silvy. Dr. Silvy is not only my academic advisor but also my mentor and friend. I would not be where I am today without his support and help. I am deeply indebted for the opportunities that Dr. Silvy has provided me. He believed in my ideas and allowed me to test them. I am a better person and biologist for having the opportunity to know and work with him. Thank you, Dr. Silvy. I thank Val Silvy for her support and recognition throughout my tenure at the pens. The 2 times that I have been speechless in my life have followed her compliments of my work at the pens. Thank you, Val. Also, I thank the Silvy family for treating my family as their own. I cannot thank you enough for all you have done for not only me but also for Jennifer and Freddie.

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CHAPTER I

INTRODUCTION

The Attwater's prairie-chicken (APC, *Tympanuchus cupido attwateri*) once numbered approximately 1 million birds and inhabited large portions of tall grass coastal prairies from southwest Louisiana to south Texas (Lehmann 1941). Lehmann (1941) stated APC were once so abundant the deep booming reverberated with force and monotony to pain sensitive eardrums. Most people have a genuine appreciation for the color and charm of the APC (Lehmann 1941). It is rare to find someone who does not enjoy the sight of a male booming or a brood of downy chicks (Lehmann 1941). Currently <50 birds can be found in 2 isolated populations (U.S. Fish and Wildlife Service, unpublished data). The APC can be considered the heath hen (*T. c. cupido*) of the south (Lehmann 1941) and is currently one of the most endangered birds in the United States (Lockwood 1998).

Captive propagation techniques for APC were initiated in 1991 at Texas A&M University, College Station, Texas and Fossil Rim Wildlife Center, Glen Rose, Texas using greater prairie-chickens (GPC, *T. c. pinnatus*) (Lockwood 1998). The GPC was used as a research surrogate due to the endangered status of APC (Drake 1994). By 2002, there were 7 captive propagation facilities in Texas: Fossil Rim Wildlife Center; Houston Zoological Gardens, Houston, Texas; San Antonio Zoo, San Antonio, Texas; Sea World Texas, San Antonio, Texas; Abilene Zoo, Abilene, Texas; Caldwell Zoo,

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Tyler, Texas; and the Small Upland-bird Research Facility (SURF), Texas A&M University. All facilities had at least 1 year of experience rearing GPC before being supplied with APC to start their captive flocks (Griffin 1998). Captive propagation has become a necessity in the recovery of the APC (Griffin 1998).

In summer 1995, the first pen-reared APC were released into the wild at the Attwater Prairie Chicken National Wildlife Refuge (APCNWR) near Eagle Lake, Texas (Lockwood 1998). Since 1995, birds have been released every summer, with mortality averaging about 44% and 76% during the first 30-and-180-days post-release, respectively (U.S. Fish and Wildlife Service, personal communication). Currently, most APC raised in captivity are hand-reared. This involves placing chicks in small (0.6 – 0.7 m^2) brood boxes until they are large enough (3 – 4 weeks of age) to be moved into larger (5.6 m^2) brood pens (APC Recovery Team, personal communication). At 8 – 10 weeks of age, they are then moved to ≈ 74- – 116-m^2 flight pens until they weigh 500 g, at which time they are radio-tagged and moved to 139-m^2 acclimation pens at the release sites, then released into the area 14 days later (APC Recovery Team, personal communication). To help control disease, most of the small brood boxes have wire floors and the larger brooding pens have little or no natural vegetation.

Chicks are primarily fed a "salad mix" (kale, lettuce, etc.) with supplementation from game bird chick starter and mealworms. Chicks also are provided water in commercial water founts (Drake 1994, Griffin 1998). Insects are the primary food consumed by wild prairie-chicken chicks (Lehmann 1941) and are considered a limiting factor in many gallinaceous birds (Johnson and Boyce 1990). Insects are the primary

food consumed by hand-reared prairie-chicken chicks and are an important factor in their growth and development (Drake 1994, Griffin 1998).

The diet and method of feeding (feed bowls) used in a captive setting may establish a foraging strategy that is inappropriate once birds are released into the wild (Haensly et al. 1985). For example, pen-reared northern bobwhite (*Colinus viginianus*) had problems finding and adapting to natural food when liberated which probably increased mortality (Klimstra and Scott 1973). Liukkonen-Anttila et al. (1999) noted that released pen-reared gray partridge's (*Peridix peridix*) inability to quickly adapt to natural foods resulted in birds with lower body mass.

Another limiting factor for pen-reared birds might include water sources used in captivity. Pen-reared birds may become accustomed to using water founts in a captive setting, and as a result they may be ill adapted to using water once in the wild. Wild prairie-chickens rarely drink from free-standing water (Lehmann 1941, Toepfer 1988, and Schroeder and Robb 1993), however, pen-reared prairie-chickens require free-standing water (Drake 1994, Griffin 1998). The lack of free-standing water in the wild and the time needed for pen-reared birds to adapt to this situation may lead to low survival.

The current method of hand rearing allows for constant monitoring of the chicks for health problems but involves intensive human contact with the chicks. Intensive human contact and lack of natural vegetation in brood boxes or holding pens may retard the development of proper predator avoidance/hiding behavior. Several studies (Pierce 1951, Hessler et al. 1970, Krauss et al. 1987, Roseberry et al. 1987, Leif 1994) have

shown that pen-reared birds had less fear of humans, were more approachable, and displayed improper hiding behavior (were more often seen in open areas) than their wild counterparts. The visibility of liberated pen-reared birds to human observers suggests these birds also may be less fearful and more approachable by predators (Krauss et al. 1987). Cusato and Morrow (2003) found that 1 – 2 week old APC chicks that displayed a greater level of fear had better post-release survival. APC chicks reared in a semi-natural environment showed greater levels of fear than chicks traditionally reared in brood boxes (Cusato and Morrow 2003). Rearing APC chicks in a semi-natural environment may increase post-release survival (Cusato and Morrow 2003).

Raising APC in captivity may retard proper avoidance/hiding behavior. However, retarded avoidance/hiding behavior may not be the only concern when liberating pen-reared APC. Toepfer (1988) found pen-reared GPC were more hesitant in flushing and flying than wild GPC, and pen-reared GPC had retarded weight development and smaller breast circumference than wild GPC caused by reduced flying in captivity. This inability of pen-reared birds to develop flight muscles may affect survival once the birds are released into the wild. Several studies (Frye 1942, Pierce 1951, Putaala et al. 1997, Perez et al. 2002) noted pen-reared birds had slower flight speeds than wild birds. Pen-reared quail do not fly as far after they flush when compared to wild quail (Frye 1942, Pierce 1951, Perez et al. 2002). Intensive human contact, inappropriate feeding behavior, inadequate hiding behavior, retarded flight speed, and shorter flight and flush distances may make pen-reared birds more susceptible to predators.

OBJECTIVES

The objective of this study was to: (1) compare flight characteristics and predator avoidance behavior of pen-reared APC to wild GPC and (2) test if APC chicks can be reared in a semi-natural environment (greenhouse) with minimal human intervention and without pelleted food and water provided in bowls.

CHAPTER II

DIFFERENCES IN FLIGHT CHARACTERISTICS OF PEN-REARED AND WILD PRAIRIE-CHICKENS

INTRODUCTION

Attwater's prairie-chicken (APC, *Tympanuchus cupido attwateri*) once numbered approximately 1 million birds and inhabited large portions of tall grass coastal prairies from southwest Louisiana to south Texas (Lehmann 1941). Currently <50 birds can be found in 2 isolated populations (U.S. Fish and Wildlife Service, unpublished data). The APC is currently one of the most endangered birds in the United States (Lockwood 1998).

Captive propagation has become a necessity in the recovery of the APC due to low population numbers (Griffin 1998). Captive propagation techniques for APC were initiated in 1991 at 2 facilities in Texas. Since 1995, birds have been released every summer, but mortality (mostly by avian predators) has been about 44% during the first 30-days post-release (U.S. Fish and Wildlife Service, personal communication).

Currently, APC raised in captivity are hand-reared. This involves raising chicks in brood boxes (Drake 1994, Griffin 1998). At 8 – 10 weeks of age, the chicks are moved to flight pens until they weigh 500 g, at which time they are radio-tagged and moved to acclimation pens at the release sites, then released into the area 14 days later (APC Recovery Team, personal communication). This rearing method involves intensive human contact with APC chicks.

Intensive human contact and lack of natural vegetation in brood boxes and flight pens may retard the development of proper predator avoidance/hiding behavior. Several studies (Pierce 1951, Hessler et al. 1970, Krauss et al. 1987, Roseberry et al. 1987, Leif 1994) have shown that pen-reared birds had less fear of humans, were more approachable, and displayed improper hiding behavior (were more often seen in open areas) than their wild counterparts. The visibility of liberated pen-reared birds to human observers suggests these birds also may be more approachable by predators (Krauss et al. 1987). Pen-reared birds also may develop inadequate escape and hiding behavior (Dowell 1990*a*, Dowell 1990*b*).

Toepfer (1988) found pen-reared greater prairie-chickens (GPC, *T. c. pinnatus*) were more hesitant in flushing and flying than wild GPC and had reduced breast muscle development caused by reduced flying in captivity. This inability of pen-reared birds to develop flight muscles may affect survival once the birds are released into the wild. Several studies (Frye 1942, Pierce 1951, Putaala et al. 1997, Perez et al. 2002) noted pen-reared birds had slower flight speeds than wild birds. Pen-reared quail did not fly as far after they flush when compared to wild quail (Frye 1942, Pierce 1951, Perez et al. 2002). Retarded flight speed, shorter flight distances, and being more approachable may make pen-reared birds more susceptible to predators. I tested the following hypothesis; flight speed, minimum straight-line flight distance, and flush distance for pen-reared APC would be slower and shorter than observed for wild GPC.

METHODS

Flight Characteristics

In summer 2002, I recorded flight characteristics of pen-reared APC released onto the Attwater Prairie Chicken National Wildlife Refuge (APCNWR) near Eagle Lake, Texas, and flight characteristics of wild GPC (control) in western Minnesota (Norman and Clay counties). Flight characteristics for pen-reared APC were recorded from 1-day to 1-week post-release from the 14-day acclimation pens. In addition, I recorded flight characteristics on other pen-reared APC that had been released in summer 2001. All data were recorded on the first flush and all birds were flushed only once.

Using radio telemetry, radio-collared APC and GPC were located and approached on foot until the bird was flushed. Flush distance (how close I could approach the bird before it flushed), flight speed (Stalker pro radar gun, Applied Concepts, Inc, Plano, Texas, USA), minimum straight-line flight distance (Bushnell laser rangefinder, Forestry Suppliers, Jackson, Mississippi, USA), and flight direction (azimuth reading) were recorded for each bird flushed. At the flush site, I recorded wind speed, with a Kestrel 2000 weather station (Forestry Suppliers) and used a compass to determine wind direction (azimuth reading). Finally, I recorded vegetation horizontal obstruction of vision (OV; Robel et al. 1970) at the flush site in the 4 cardinal directions.

Predator Avoidance

In fall 2002, I tested predator avoidance behavior for APC at APCNWR and wild GPC in Chase County, Kansas. I used a trained dog to simulate a mammalian predator.

Radio-collared APC and GPC were located using radio telemetry. Once a bird was located, the dog was allowed to approach and flush the bird. I then recorded the flush distance (how close the dog approached before the bird flushed), minimum straight-line flight distance, and OV at the flush site and in the 4 cardinal directions.

Data Analysis

To determine if wind speed had an effect on flight speeds, I subtracted wind direction (azimuth) from flight direction (azimuth) and then set all wind directions to 0˚. I then assigned all APC and GPC flushed into 1 of 5 groups; against wind (birds flying against the wind), quarter against wind (birds flying at 45˚ against the wind), quarter with wind (birds flying at 45˚ with the wind, with wind (birds flying with the wind behind them), and no wind (when there was no wind blowing when the bird flushed). I used an ANOVA (Ott and Longnecker 2001) to determine if there were any differences in flight speed in relation to flight direction. If a difference was found, the mean difference in flight speed between birds not affected and birds affected by wind speed was added to each bird's flight speed that was affected by wind speed..

All APC and GPC flushed were assigned to 1 of 5 groups: (1) resident adult APC (RAAPC, APC released in summer 2001), (2) adult APC released in summer 2002 (AAPC02), (3) juvenile APC released in summer 2002 (JAPC02), (4) adult GPC (AGPC), and (5), juvenile GPC (JGPC). The presence or absence of tail feathers was used to determine adult from juvenile GPC, tail feathers were visible for adults and tail feathers for juveniles were not (John Toepfer, personal communication).

Because flight characteristic and predator avoidance behavior data were non-normal and had unequal variances, a non-parametric ANOVA (Conover and Iman 1981) was used to test for differences between the 5 groups of birds for flight speed, flight distance, and flush distance. Similarly, a Mann-Whitney test (Ott and Longnecker 2001) was used to test for differences in predator avoidance behavior (flush distance) and flight distance between APC and GPC.

RESULTS

Flight Characteristics

A total of 37 APC and 25 GPC was flushed during the study, however, flight distance for 1 APC (the bird flew behind a structure and could not be seen) and flight speed for 1 GPC (equipment malfunction) could not be recorded. There was no difference ($F = 1.84$, $df = 4$, $P = 0.134$,) in flight speed (Fig. 2.1) for adult pen-reared APC released as juveniles in 2001 ($\bar{x} = 46$ kph), adult pen-reared APC released in 2002 ($\bar{x} = 36$ kph), juvenile pen-reared APC released in 2002 ($\bar{x} = 42$ kph), wild adult GPC ($\bar{x} = 45$ kph), and wild juvenile GPC ($\bar{x} = 46$ kph). Both wild adult GPC ($\bar{x} = 391$ m) and wild juvenile GPC ($\bar{x} = 250$ m) had greater ($F = 14.06$, $df = 4$, $P < 0.0001$) flight distances (Fig. 2.2) than did any of the pen-reared APC groups ($\bar{x} = 76 – 97$ m). Wild adult ($\bar{x} = 10$ m) and juvenile ($\bar{x} = 9$ m) GPC and pen-reared adult APC ($\bar{x} = 3$ m) that had survived in the wild for at least a year flushed at a greater ($F = 15.78$, $df = 4$, $P < 0.001$) distance from an approaching human than did pen-reared adult ($\bar{x} = 2$ m) and juvenile ($\bar{x} = 0.5$ m) APC that had been released for less than 3 months (Fig. 2.3). There was no difference ($t = -0.83$, $df = 60$, $P = 0.410$) in the OV of vegetation at flush sites for

APC (n = 37, $\bar{x}$ =3.0 dm, SD =1.5) and GPC (n = 25, $\bar{x}$ =3.3 dm, SD = 1.5), therefore, vegetation probably did not add to any observed difference in flush distance between APC and GPC. In addition, 18 (49%) of APC had to be chased to get them to flush, whereas none of the GPC needed pursuit to flush.

Predator Avoidance

A total of 14 APC and 10 GPC was flushed by the dog, however, only 9 flight distances for APC were recorded due to equipment malfunction, and only 3 distances were recorded for GPC as most flew long distances over ridges and were lost from sight. A trained dog was able to approach closer (W = 116, df = 1, P < 0.001) to APC ($\bar{x}$ = 5 m) than GPC ($\bar{x}$ = 17) before birds flushed (Fig. 2.4). There was no difference (t = -1.09, df = 22, P = 0.287) in OV of vegetation at the flush site for APC (n = 14, $\bar{x}$ =1.3 dm, SD = 0.6) and GPC (n = 10, $\bar{x}$ =1.6 dm, SD = 0.6). Also, APC ($\bar{x}$ = 129 m) did not fly as far as GPC ($\bar{x}$ = 1,000 m) after being flushed by the dog (Fig 2.5).

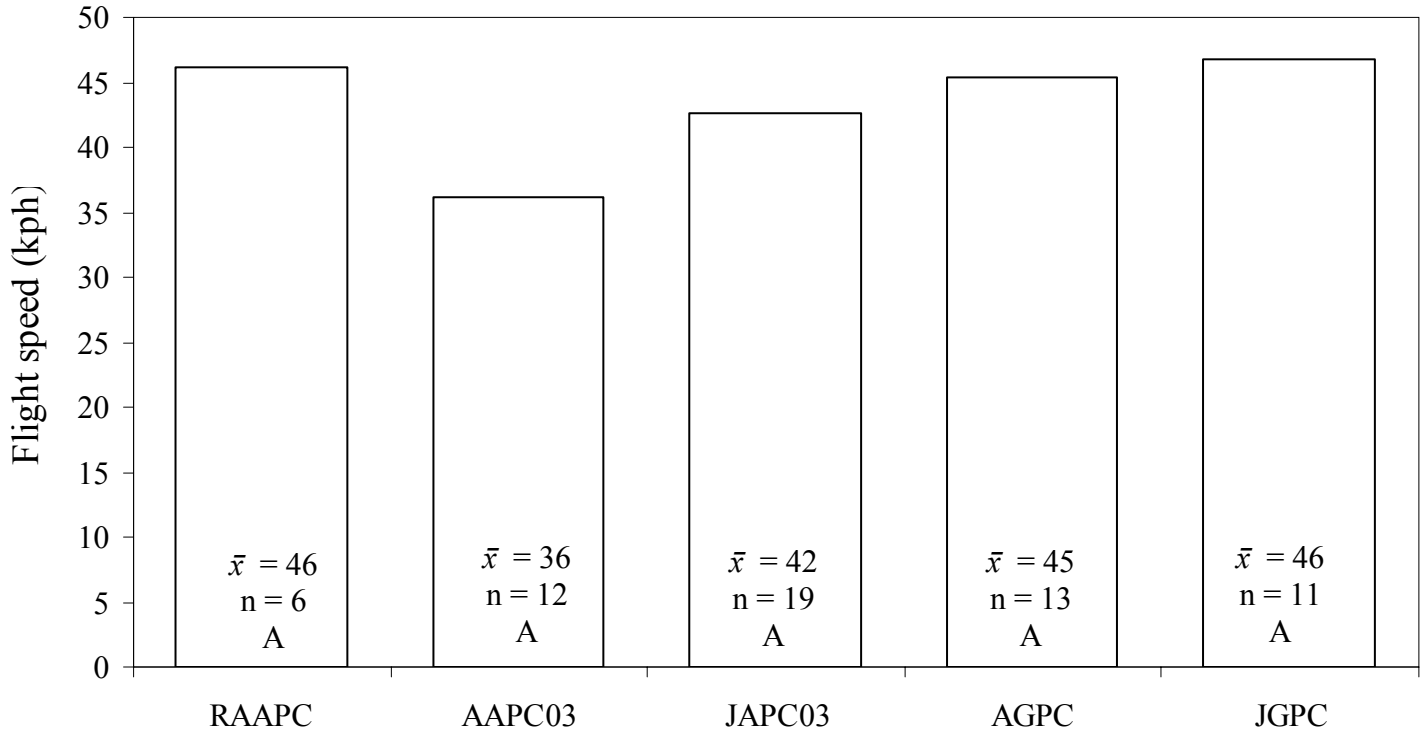

Fig. 2.1. Mean flight speed (kph) for resident adult Attwater prairie-chickens (RAAPC, APC released in 2001), adult Attwater prairie-chickens released in 2002 (AAPC02), juvenile Attwater prairie-chickens released in 2002 (JAPC02), adult greater prairie-chickens (AGPC), and juvenile greater prairie-chickens (JGPC). Like letters represent no significant ($P > 0.05$) difference.

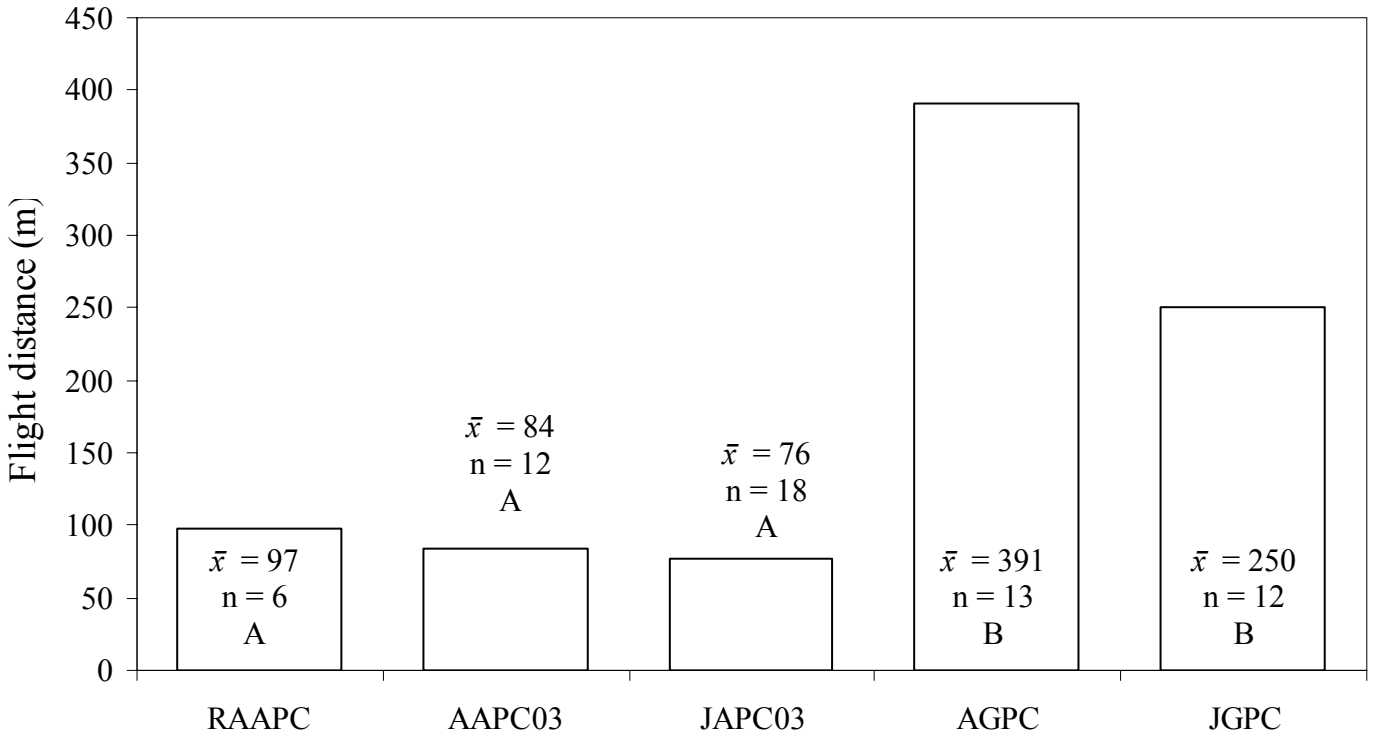

Fig. 2.2. Mean flight distance (m) for resident adult Attwater prairie-chickens (RAAPC, APC released in 2001), adult Attwater prairie-chickens released in 2002 (AAPC02), juvenile Attwater prairie-chickens released in 2002 (JAPC02), adult greater prairie-chickens (AGPC), and juvenile greater prairie-chickens (JGPC). Like letters represent no significant ($P > 0.05$) difference.

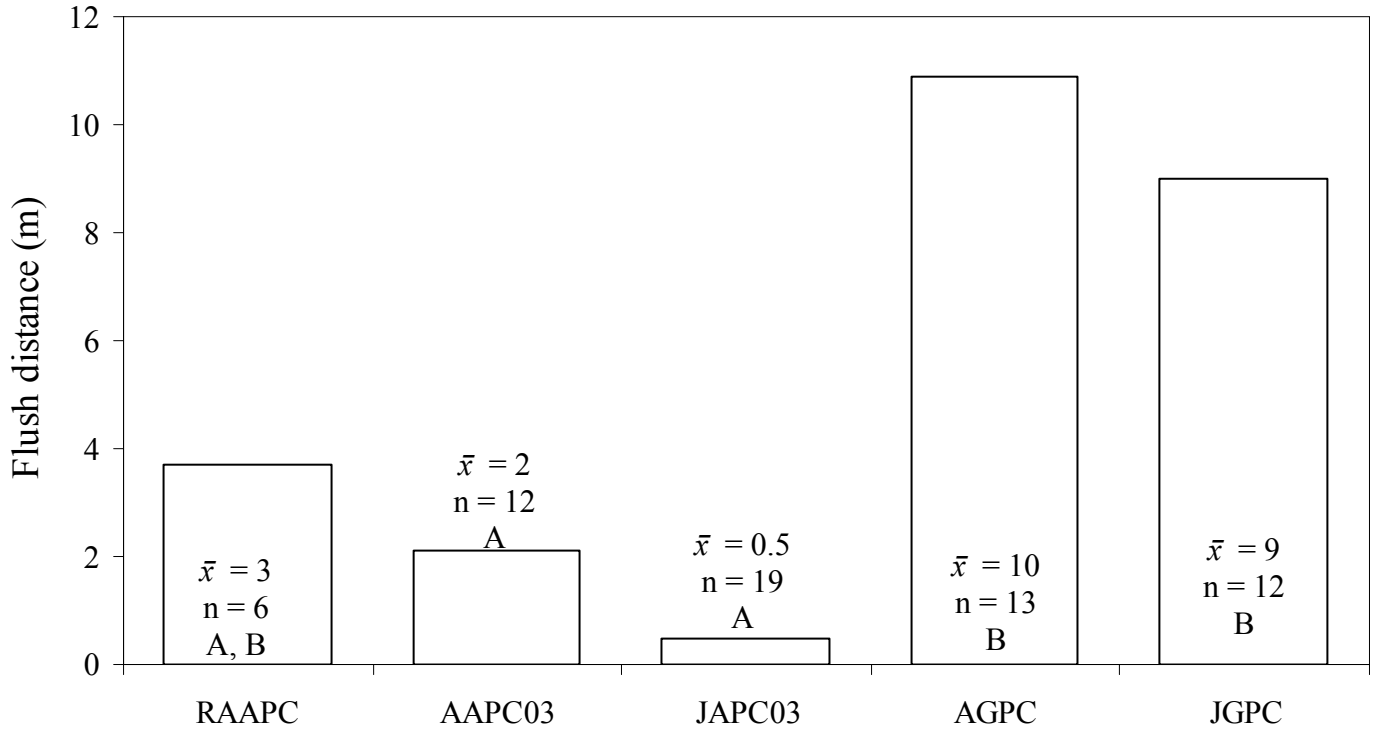

Fig. 2.3. Mean flush distance (m) from humans for resident adult Attwater prairie-chickens (RAAPC, APC released in 2001), adult Attwater prairie-chickens released in 2002 (AAPC02), juvenile Attwater prairie-chickens released in 2002 (JAPC02), adult greater prairie-chickens (AGPC), and juvenile greater prairie-chickens (JGPC). Like letters represent no significant ($P >$ 0.05) difference.

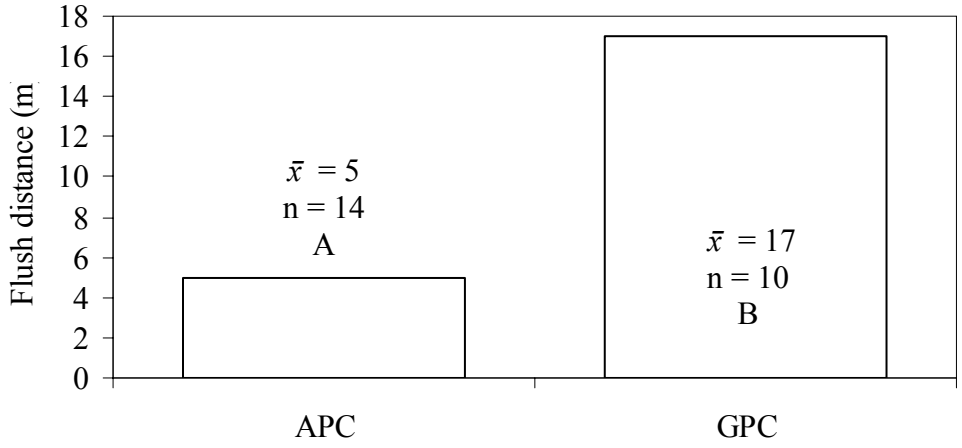

Fig. 2.4. Mean flush distance (m) from a dog for greater prairie-chickens (GPC) and Attwater's prairie-chickens (APC). Like letters represent no significant ($P > 0.05$) difference.

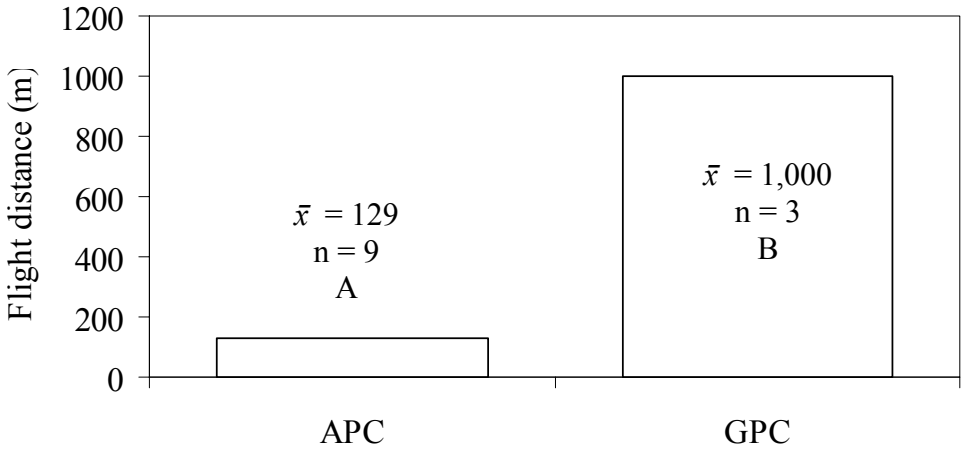

Fig. 2.5. Mean flight distance (m) from a dog for greater prairie-chickens (GPC) and Attwater's prairie-chickens (APC). Like letters represent no significant ($P > 0.05$) difference.

DISCUSSION

Pen-reared APC did not appear to have the same endurance (flight distance) when compared to GPC. This phenomenon has been observed with other species (Frye 1942, Pierce 1951, Roseberry et al. 1987, Perez et al. 2002). The differences in flight endurance may make APC more susceptible to predators because they may not be able to sustain flight long enough to get away from a predator.

The mean flight distance for APC was considerably shorter than wild GPC. Mohler (1952) recorded mean flight distances of 497 – 587 m for wild GPC in 2 different areas. These flight distances are longer than distances observed for both APC and GPC, however, the differences could be seasonal. Survival of pen-reared birds released for either "put and take" hunting or restocking purposes has historically been low (Frye 1942, Pierce 1951, Anderson 1964, Burger 1964, Hessler et al. 1970, Haensly et al. 1985, Krauss et al. 1987, Roseberry et al. 1987, Dowell 1990*a*, Dowell 1990*b*, Brittas et al. 1992, Robertson et al. 1993, Leif 1994, DeVos and Speake 1995, Perez et al. 2002). Retarded flight endurance and shorter flush distances may play a vital role in the increased mortality of pen-reared birds. Birds unable to fly strong are vulnerable to avian predators (Pierce 1951, Hessler et al. 1970, Robertson et al. 1993, Perez et al. 2002).

The majority of the pen-reared APC tested in my study were reluctant to fly when approached by humans. Toepfer (1988:225) noted that prairie-chickens were mobile birds and mainly escape predators by flying. Chicks, 3-weeks old, can fly 37 m or more and by 4 – 5 weeks of age can fly 91 m or more (Lehmann 1941). The confined

areas in which APC are reared may reduce the ability for "flight exercise", and could be responsible for short flight distances (Robertson et al. 1993). Toepfer (1988) found a decline in muscle size due to reduced flying for wild birds placed in pens. APC that survived >1 year were able to fly as fast as a wild GPC. It is possible that after 1 year the APC had better developed flight muscles through exercise.

Flight conditioning of pen-reared APC could increase their flight endurance, thus increasing survival once released. Carpenter et al. (1991) used a call-box system for the reintroduction of masked bobwhites (*Colinus virginianus ridgwayi*) in which all but a few birds were released from a call-back box. Dogs were then used to harass the birds to encourage them to exercise their flight muscles. Flight conditioning using a trained dog to encourage APC to use their muscles could improve APC flight endurance and flush distance.

Flight conditioning also may reinforce predator avoidance behavior by making APC less approachable by mammalian predators. The flush distance was shorter for APC than for GPC. In addition, 49% of APC had to be pursued to make them flush while none of the GPC needed pursuit to flush. Several APC that flushed without pursuit, flushed <1 m from the observer. Toepfer (1988) found pen-reared GPC would run rather than fly and would only fly if pursued and forced to flush.

The deficiencies in flight characteristics that pen-reared APC exhibit when compared to wild GPC may be a factor that is contributing to high post-release mortality. Developing new rearing and/or flight conditioning techniques that would overcome these deficiencies could increase the post-release survival of pen-reared APC.

CHAPTER III

THE USE OF A GREENHOUSE AS A CHICK REARING FACILITY FOR ATTWATER'S PRAIRIE-CHICKEN CHICKS

INTRODUCTION

The Attwater's prairie-chicken (APC, *Tympanuchus cupido attwateri*) once numbered approximately 1 million birds and inhabited large portions of tall grass coastal prairies from southwest Louisiana to south Texas (Lehmann 1941). Currently <50 birds can be found in 2 isolated populations (U.S. Fish and Wildlife Service unpublished data). The APC is currently one of the most endangered birds in the United States (Lockwood 1998). As a result, captive propagation has become a necessity in the recovery of the APC (Griffin 1998).

Currently, most APC raised in captivity are hand-reared. This involves placing chicks in small (0.6 – 0.7 m^2) brood boxes until they are large enough (3 – 4 weeks of age) to be moved into larger (5.6 m^2) brood pens (APC Recovery Team, personal communication). At 8 – 10 weeks of age, they are then moved to ≈ 74 – 116-m^2 flight pens until they weigh 500 g, at which time they are radio-tagged and moved to 139-m^2 acclimation pens at the release sites, then released into the area 14 days later (APC Recovery Team, personal communication). To help control disease, most of the small brood boxes have wire floors and the larger brooding pens have little or no natural vegetation. This method of rearing allows for constant monitoring of the chicks for health problems but involves intensive human contact with the chicks.

Chicks are primarily fed a "salad mix" (kale, lettuce, etc.) with supplementation from game bird chick starter and mealworms. Chicks also are provided water in commercial water founts (Drake 1994, Griffin 1998). Insects are an important food item for prairie-chicken chicks (Lehmann 1941) and are considered a limiting factor in many gallinaceous birds (Johnson and Boyce 1990). Insects are the primary food consumed by hand-reared prairie-chicken chicks and are an important factor in their growth and development (Drake 1994, Griffin 1998). In captive propagation programs the diet and method of feeding (feed bowls) used may establish a foraging strategy that is inappropriate once birds are released into the wild (Haensly et al. 1985). For example, pen-reared northern bobwhite (*Colinus viginianus*) had difficulty in finding natural food, when liberated, which probably increased mortality (Klimstra and Scott 1973). In addition, Liukkonen-Anttila et al. (1999) noted that released pen-reared gray partridge's (*Peridix peridix*) inability to quickly adapt to natural foods resulted in birds with lower body mass. Pen-reared birds also may become accustomed to using free-standing which is normally not available in the wild (Lehmann 1941, Toepfer 1988, and Schroeder and Robb 1993). The lack of free-standing water and the in ability to quickly adapt to natural foods might account for the low survival of pen-reared birds.

Intensive human contact and lack of natural vegetation in brood boxes or holding pens may retard the development of proper predator avoidance/hiding behavior In the APC. Several studies (Pierce 1951, Hessler et al. 1970, Krauss et al. 1987, Roseberry et al. 1987, Leif 1994) have shown that pen-reared birds had less fear of humans, were more approachable, and displayed improper hiding behavior (were more often seen in

open areas) when compared to their wild counterparts. Furthermore, the exposure of pen-reared birds to human observers suggests these birds also may be less fearful and more approachable by predators (Krauss et al. 1987:588). Cusato and Morrow (2003) found that 1 – 2 week old APC chicks that displayed a greater level of fear had better post-release survival. APC chicks reared in a semi-natural environment showed greater levels of fear than chicks reared traditionally in brood boxes (Cusato and Morrow 2003). I tested the following hypothesis; APC chicks can be reared in a semi-natural environment with minimal human intervention and without pelleted food and water provided in bowls.

METHODS

This research was conducted at Texas A&M University, Small Upland-bird Research Facility (SURF), located in College Station, Texas. A 42-m^2 garden-grower greenhouse (International Greenhouse Company, Sidell, Illinois, USA) constructed on concrete footing (0.3 m wide and buried 0.6 m in the ground) was used to raise APC chicks. The floor of the greenhouse was planted with a food plot mix (Monster Mix, Tecomate Wildlife Systems, McAllen, Texas, USA) to (1) provide natural cover for the chicks, and (2) serve as a food source for the chicks. A misting system (International Greenhouse Company, Sidell, Illinois, USA) was installed to allow "dew" to form on the vegetation, and provide water to the chicks. An overhead sprinkler system was installed to simulate rainfall which conditioned chicks to adverse weather conditions and watered the vegetation. The greenhouse was equipped with exhaust fans (0.5 X 0.5 m) and vents (0.8 X 0.8 m) located on the opposite ends. The exhaust system was designed to keep

the temperature inside the greenhouse similar to the ambient temperature. All controls for the exhaust, misting, and sprinkler systems were located on the outside of the greenhouse to facilitate their control without disturbing or having contact with the chicks.

Chicks for the greenhouse were acquired from 2 sources: (1) a breeding pair of APC located at the SURF, and (2) an abandoned nest found at Atwater Prairie Chicken National Wildlife Refuge (APCNWR). Incubation and hatching techniques as described by Griffin (1998) were used. Chicks were left in the hatcher for at least 24 hours after hatching (Drake 1994).

Fifteen chicks were removed from the hatcher after the 24-hour period and into a 0.5 m^2 (1 X 0.5 X 0.5 m) enclosure placed on the floor of the greenhouse among the standing vegetation. Water was provided in the enclosure with a mister placed over vegetation. A timer turned the mister on every hour for 1 min during the day. A ceramic heat lamp (no light was emitted) provided brood heat at night. Commercial crickets (Rainbow Mealworms, Compton, California, USA) were placed in the enclosure to provide food to APC chicks. The chicks remained in this enclosure until 1 week of age at which time they were moved to a 1.2 m^2 (1.6 X 0.75 X 0.5 m) enclosure similar to the smaller enclosure. Chicks remained in the larger enclosure until approximately 2 weeks of age, at which time the enclosure was removed giving chicks access to the entire greenhouse. After the chicks were given the entire greenhouse to roam, brood heat was provided by an underground heat source creating a “hotspot” for chicks to brood on. This heat source was removed when chicks were 4 weeks of age. An

automatic timer was used to control the duration and frequency of the misting system (Table 3.1). When chicks were 3 weeks of age the overhead sprinklers were turned on for approximately 1-2 minutes per day. This was done at random times during the day and random days in the week. The exhaust fans were turned on in the morning and turned off in the evening for the first 5 weeks. At 6 weeks the fans were left on constantly due to temperatures at night not dropping below 21° C and chicks were fully feathered. Eight-week old chicks were transferred to a 245-m^2 (7 X 35 m) flight pen to condition them to outdoor conditions. At 12 weeks of age 5 chicks were turned over to U. S. Fish and Wildlife Service personnel.

RESULTS

Eight chicks were successfully reared in the greenhouse for 8 weeks at which time they were transferred to the 245-m^2 flight pen. Chicks successfully reared in the greenhouse until 8 weeks of age were able to survive and continue normal growth (Drake 1994) for 4 weeks in the flight pen under similar conditions as in the greenhouse (no pelleted food and no free-standing water).

DISCUSSION

There are several benefits to raising prairie-chicken chicks in a greenhouse. Chicks in the greenhouse were exposed to natural sunlight, day length, and temperature fluctuations, as opposed to the traditional rearing method. In addition to these benefits the chicks were protected from adverse weather (at an early and vulnerable age) and protected from predators (snakes, ants). Prairie-chicken chicks reared under

Table 3.1. The duration in minutes and frequency in hours the misting system was activated in relation to the number of weeks chicks were held in the greenhouse.

Weeks	Duration (min)	Interval between misting (hr)
1	1	1
2	1	1
3	3	2
4	3	3
5	3	4
6	5	12
7	5	12
8	5	12

traditional methods are kept in climate controlled buildings, exposed to artificial light (from fluorescent bulbs), and the heat lamps that provide brood heat also provide light 24 h a day. The chicks reared in the greenhouse also were conditioned to adverse weather (simulated rain) as early as 3 weeks of age, many of the traditionally reared chicks are not placed in outdoor pens until 2 weeks before transfer to APCNWR and may not be exposed to adverse weather until their release into the wild (APC Recovery Team, personal communication).

Another benefit of raising prairie-chicken chicks in the greenhouse environment is that human contact with the chicks is reduced. The amount of time spent in the greenhouse was ≤ 30 min a day, whereas chicks reared traditionally in brood boxes can

have up to 12 hours of human exposure per day (APC Recovery Team, personal communication). Chicks in the greenhouse could use the vegetation as hiding cover, however, there is no hiding cover in brood boxes. Northern bobwhite and red-legged partridges (*Alectoris rufa*) chicks reared in isolation or with minimal human contact/handling had higher survival and displayed superior field performance (Moore 1977, Csermely et al. 1984). Intensive human contact with chicks can dull their sense of wildness, wariness, and cause taming (Brakhage 1953, Csermely et al. 1984, Draycott et al. 1998). The birds raised in the greenhouse behaved wilder and were more flighty than were traditionally reared birds.

The feeding and watering methods use in the greenhouse reinforced the natural foraging behavior of prairie-chicken chicks. Coats (1955) found that lesser prairie-chicken (*T. pallidicinctus*) chicks looked for food at eye level, instinctively reacted to moving objects, and were more likely to find water in droplet form. Prairie-chickens get necessary moisture from dew (Schroeder and Robb 1993). Chicks must also be taught to expect food on the floor and they learn to associate food with humans and a food dish (Coats 1955, Price 1999). The food and water systems for captive animals has resulted in unfamiliarity to natural foods, a hard time adjusting to natural foods, and exploratory feeding (Buss 1946, Klimstra and Scott 1973, Griffin 1998, Liukkonen-Anttila et al. 1999, Liukkonen-Anttila et al. 2002). "Feeding techniques can cause a relaxation of natural selection on traits associated with food selection, ability to locate food, and motivation to explore and investigate natural environment" (Price 1999:250). Prairie-chicken chicks require a main diet of insects (Lehmann 1941, Drake 1994,

Griffin 1998), and should be fed a natural diet (Liukkonen-Anttila et al. 2000, Liukkonen-Anttila et al. 2002). However, little attention has been paid to the natural diet of pen-raised animals (Studholme 1948).

Captive rearing is expensive (Snyder et al. 1996) and rearing chicks in the greenhouse is a "hands-off" approach that would allow a reduction in staff time and funds needed to care for and raise chicks. Raising prairie-chicken chicks in a simulated natural environment has the potential to produce birds that could survive better once released into the wild. Rearing APC chicks in a semi-natural environment could increase post-release survival, as they have a greater level of fear (Cusato and Morrow 2003). Biggins et al. (1998) found that post-release survival of black-footed ferrets (*Mustela nigripes*) reared in a natural environment increased significantly. Chicks need exposure to the natural environment during the rearing process (Powell et al. 1997), this can be provided in the greenhouse. The vegetation in the greenhouse allowed the chicks areas to escape and hide, was a food source, and using crickets as the main food source, the chicks don't associate food with humans or food dishes. Roseberry et al. (1987) found that game farm and semi-wild quail were similar in survival and behavior suggesting that rearing method is more important to survival of pen-reared birds. Rearing methods that improve the quality of the birds are needed (Roseberry et al. 1987). Scott and Carpenter (1987) suggested that testing different rearing and releasing methods was needed to make captive rearing a viable option for endangered species. It is important that the rearing techniques for APC continue to improve (Griffin 1998). Most facilities are only concerned with mass production and not concerned with the

quality of the product produced (Studholme 1948). The goal of raising APC in captivity is to reestablish populations in the wild, however, the value of such operations depend on ability of released birds to adapt to wild conditions and reproduce (Baumgartner 1944), and it is not sound management to release birds that do not have the capability to survive long enough produce offspring (Brakhage 1953). Efforts should focus on producing quality chicks not just quantity.

CHAPTER IV

SUMMARY, CONCLUSIONS, AND MANAGEMENT RECOMMENDATIONS

FLIGHT CHARACTERISTICS

Pen-reared APC displayed behavioral deficiencies when compared to wild GPC, which could explain their increased mortality when released into the wild. These deficiencies were:

1. Pen-reared APC did not have the flight endurance that wild GPC had.
2. Pen-reared APC were approached closer by humans and a dog before flushing than GPC.

Efforts need to be made to improve the flight characteristics of APC. Flight conditioning techniques using dogs to scare and harass the birds could increase the post-release survival by improving their predator avoidance behavior. These techniques also would allow APC to improve their flight endurance by allowing birds to exercise their flight muscles. If the recovery of the APC is to become a reality, these behavioral deficiencies should be addressed.

GREENHOUSE

Chicks were successfully reared in the greenhouse. This indicated APC chicks can be reared without intensive human contact, pelleted food in a bowl, water in a fount, and in a semi-natural environment.

MANAGEMENT RECOMMENDATIONS

Recommendations for raising prairie-chicken chicks in a greenhouse to release into the wild are:

1. Confine chicks from hatch to 2 weeks of age to a small area that incorporates the vegetation, supply the area with crickets, and use a misting system to provide water in droplet form.
2. Once chicks are 2 weeks old and start to fly give them access to the entire greenhouse. Still provide crickets and water in droplet form using misters.
3. At 3 weeks of age the sprinkler system (simulated rain) can be used to condition chicks to adverse weather. This should be done at random times of the day and random days of the week. This can be done every day, however, it is recommended to condition chicks to artificial rain 2 – 3 days per week.
4. At 6 weeks of age, chicks should be moved to a flight pen were they will be subjected to no food in dishes or water in founts, and exposed to the "real" environment. This will allow chicks to acclimate to the outdoors prior to release into the wild.
5. Once chicks are moved to the flight pen, a trained dog should be used to flight condition birds. This will encourage chicks to use their flight muscles and improve their flight endurance.

6. Chicks should be released into the wild at 10 – 12 weeks of age. In the wild, 10 – 12 weeks of age is when wild broods would normally begin to break up (Bowman and Robel 1977).
7. Chicks should be placed near resident birds (birds that survived > 1 year post release) to increase post-release survival.
8. Various types of bird seed can be broadcasted in the greenhouse and flight pen as an additional food source for the chicks throughout the rearing process. It is important to scatter seeds to encourage chicks to forage naturally.

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