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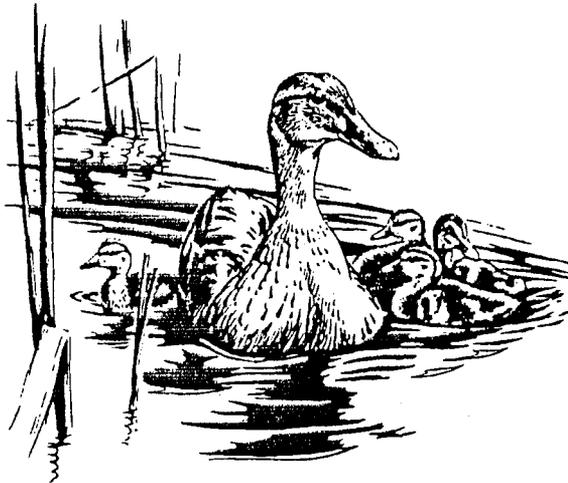
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# ILLINOIS NATURAL HISTORY SURVEY

CENTER FOR WILDLIFE ECOLOGY



Mallard Investigations

W-130-R-1

Annual Federal Aid Performance Report

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21 August 1998



## Executive Summary

The nesting biology of mallards (*Anas platyrhynchos*) was studied at Banner Marsh State Fish and Wildlife Area and the Metropolitan Water Reclamation District of Greater Chicago in west-central Illinois during the period of March through July, 1998. The objectives of this study were to develop data sets of basic nesting information of mallards in Illinois and evaluate recruitment. In order to achieve these objectives, 38 resident female mallards were livetrapped (Sharp and Lokemoen 1987) during spring migration and fitted with radio transmitters (Pietz et al. 1995). Females were located daily (IWWR 1996) throughout the nesting season and broods were also located daily for 20 days posthatch (Orthmeyer and Ball 1990).

Twenty-eight (73.7%) radio-marked females made a minimum of 49 nest attempts (1.8 nest attempts/female) from 4 April to 28 June. Nests were found in areas dominated by smooth brome (*Bromus inermis*). Peaks in nest initiation occurred on 15 April and 7 May. Clutch sizes ranged from 1 to 12 eggs and averaged 8 eggs per nest. Hens incubated their clutches from 24 to 29 days and averaged 25.8 days to hatch.

Nests hatched between 10 May and 22 June. Simple nest success estimates revealed that 20.4 percent of the nests (10 of 49) had at least 1 egg hatch. Nest depredation impacted 63.3 percent of the monitored nests. Coyote (*Canis latrans*) and raccoon (*Procyon lotor*) represented the most important nest predators. Egg hatchability in successful nests was 97.6 percent. Successful females hatched an average of 8.2 ducklings, and 40 percent of the broods survived to at least 20 days posthatch.

SEGMENT PERFORMANCE REPORT - FY 1998  
Mallard Investigations  
Federal Aid in Wildlife Restoration  
W-130-R-1

Study I: THE NESTING BIOLOGY OF MALLARDS IN ILLINOIS

During the first segment of this study, two study areas were selected - Banner Marsh State Fish and Wildlife Area and the Metropolitan Water Reclamation District of Greater Chicago. Site visits were conducted to become familiar with the habitats available for nesting mallards and accessibility. Pertinent literature on waterfowl nesting biology and radio telemetry was obtained and reviewed, and researchers conducting relevant studies were consulted. The protocol for handling and attaching radio transmitters to female mallards was submitted to and approved by the University of Illinois Animal Care Committee. Radio telemetry equipment was purchased, and personnel were trained in radio attachment and tracking procedures. Study area maps were created from aerial photos at the University of Illinois, and field data forms were prepared. Game-farm hen mallards were purchased for decoy trapping, and the first field season of trapping and tracking hen mallards and their broods was completed.

JOB NO. I.1. Nesting History and Reproductive Success of Mallards in Illinois.

STUDY AREAS

Two study areas were selected for mallard investigations: 1) Banner Marsh State Fish and Wildlife Area (Banner) and 2) Metropolitan Water Reclamation District of Greater Chicago (MSD). Banner is located on the Illinois River in Fulton and Peoria counties from river mile 138 to 144 between the towns of Banner and Kingston Mines, Illinois. Banner was isolated from the Illinois River for agricultural purposes by the Banner Special Drainage and Levee District between

1910 and 1917 (USACOE 1995). In 1958, the United Electrical Coal Companies, Inc. purchased the drainage and levee district and subsequently surface mined coal until 1974. The Illinois Department of Natural Resources acquired the property in the 1980s and manages it as a public fish and wildlife area. Banner is currently isolated from the Illinois River by a 50-year flood event levee and consists of 5,524 acres of non-forested wetlands, upland forests, grasslands, pastures, old fields, and row crops.

MSD is located in Fulton County between Cuba and Canton, Illinois and is owned by the City of Chicago. The property consists of 15,249 acres of reclaimed surface-mined lands (Lawrence 1987, Prairie Plan 1998). MSD is currently managed as a disposal site for biosolids (sludge) received from Chicago. The biosolid is transported in dry form and spread over agricultural fields where it is incorporated into the soil. Major land uses at MSD include approximately 4,000 acres of agricultural row crops, 1,700 acres of hay and pasture land, 300 acres of biosolid application with the remainder composed of a variety of wetland types ranging from large final-cut lakes to small ponds and marshes (Prairie Plan 1998).

## MATERIALS AND METHODS

### Trapping

Female mallards were captured from 23 March to 11 April using 9 decoy traps (Sharp and Lokemoen 1987, Ringelman 1990). Decoy traps were constructed of 1-2 inch welded wire mesh with dimensions of 60 (l) x 60 (w) x 24 inches (h). Traps were round with 3 capture compartments equipped with spring-loaded doors and trip mechanisms surrounding a center decoy compartment in which a game-farm hen mallard was placed (Fig. 1).

Field crews were on the study areas beginning 9 March searching wetlands for isolated

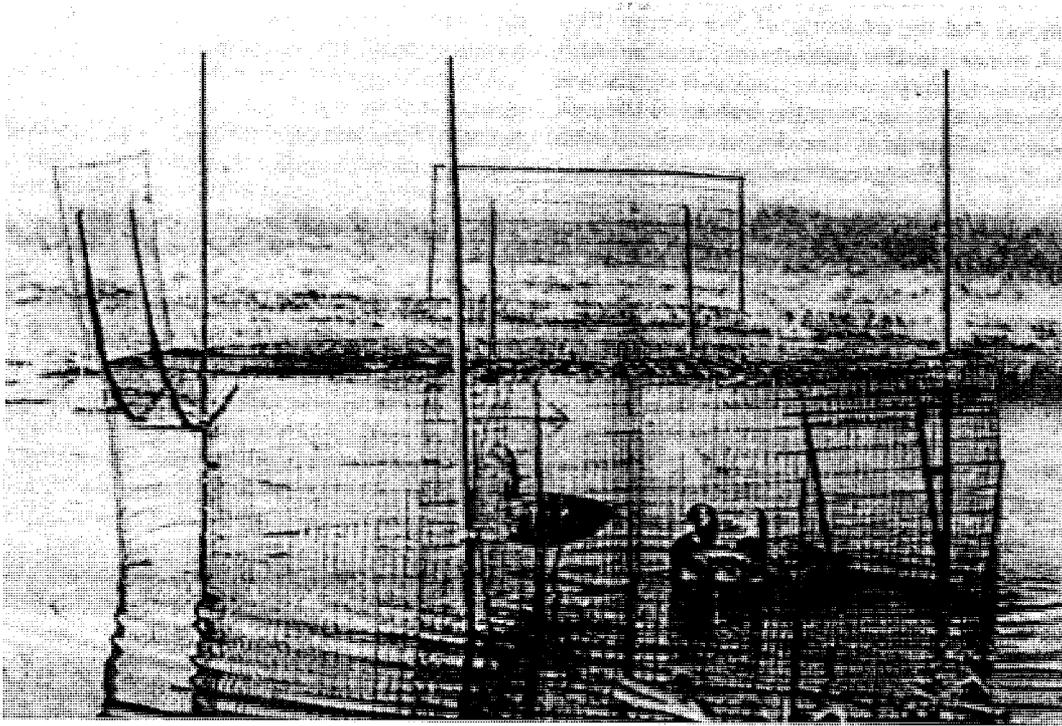


Figure 1. Decoy trap used for capturing resident mallards during spring 1998 at Banner Marsh State Fish and Wildlife Area and the Metropolitan Water Reclamation District of Greater Chicago (Sharp and Lokemoen 1987).

pairs of mallards or pairs defending a territory. Territorial pairs were noted and a trap with a decoy hen was placed in the defended wetland. Traps were supported by 7 ft metal fence posts attached to the trap with 2 in hose clamps which allowed the trap to be set at various water depths. Wild mallards were captured when they entered a trap compartment to drive away the decoy hen and in the process tripped the spring door behind them (Fig. 1). Traps were checked approximately 3 times each day while other potential trap sites were continually monitored. Once a female was captured and processed, the trap was moved to another wetland. Thirty game-farm hen mallard decoys were rotated from the traps to holding pens at Forbes Biological Station every third day except during unfavorable weather conditions when decoys were rotated more frequently.

When captured, all mallards, including drakes, were banded, aged, weighed, and measured. Mallards were tagged with USFWS no. 7 aluminum leg bands. The greater secondary covert no. 2 was collected from females and used for aging by measuring the amount of black and white area ( $\text{mm}^2$ ) (Krapu et al. 1979). Morphological measurements taken on each bird included wing chord length measured to the nearest 1 mm (IWWR 1996, Fig. 2), and bill length at 2 points (culmen1 and culmen2), bill width, tarsus length, tarsus width, and total tarsus were measured to the nearest 0.1 mm (Byers and Cary 1991, Fig. 3).

#### Radio Design

Captured female mallards were fitted with a prong and suture radio transmitter designed by Advanced Telemetry Systems, Inc. (ATS), Isanti, Minnesota (Pietz et al. 1995, Fig. 4). This transmitter design was modified from miniature radios attached to 1-day-old ducklings in California (Mauser and Jarvis 1991). The radio transmitters, equipped with 70-day batteries,

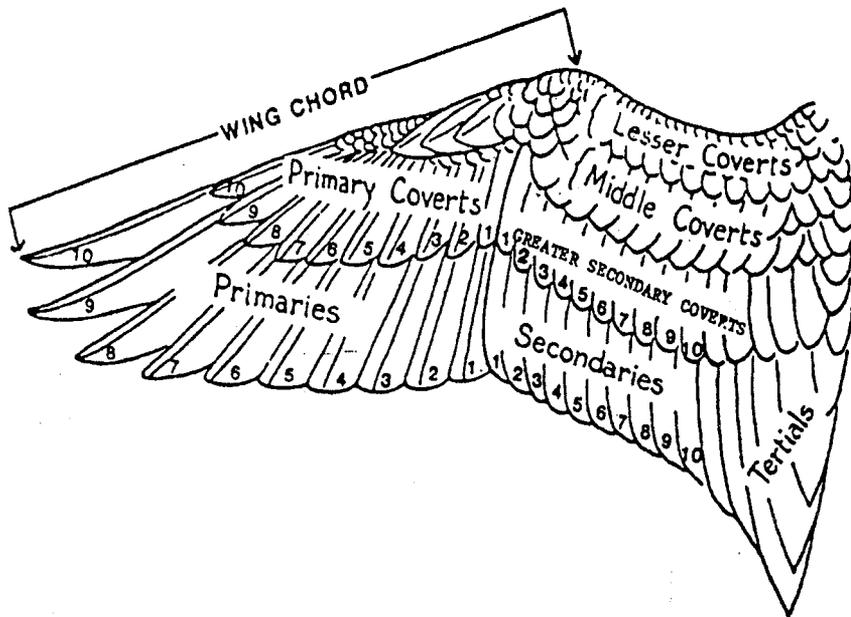
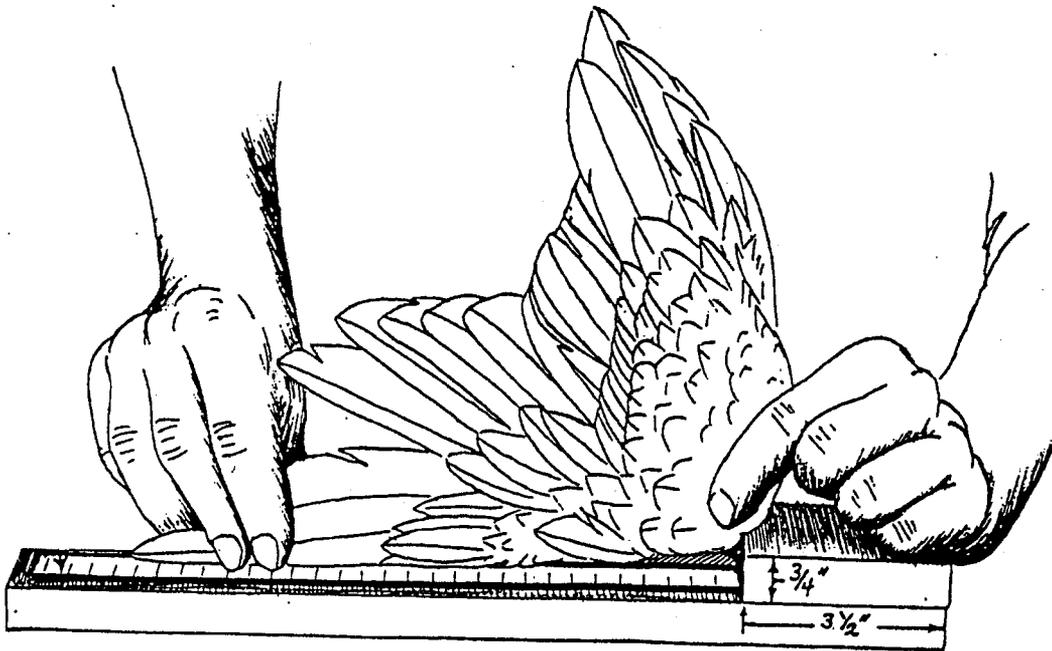


Figure 2. Procedure for measuring wing chord length and description of wing feathers for mallards captured at Banner Marsh State Fish and Wildlife Area and the Metropolitan Water Reclamation District of Greater Chicago (IWWR 1996).

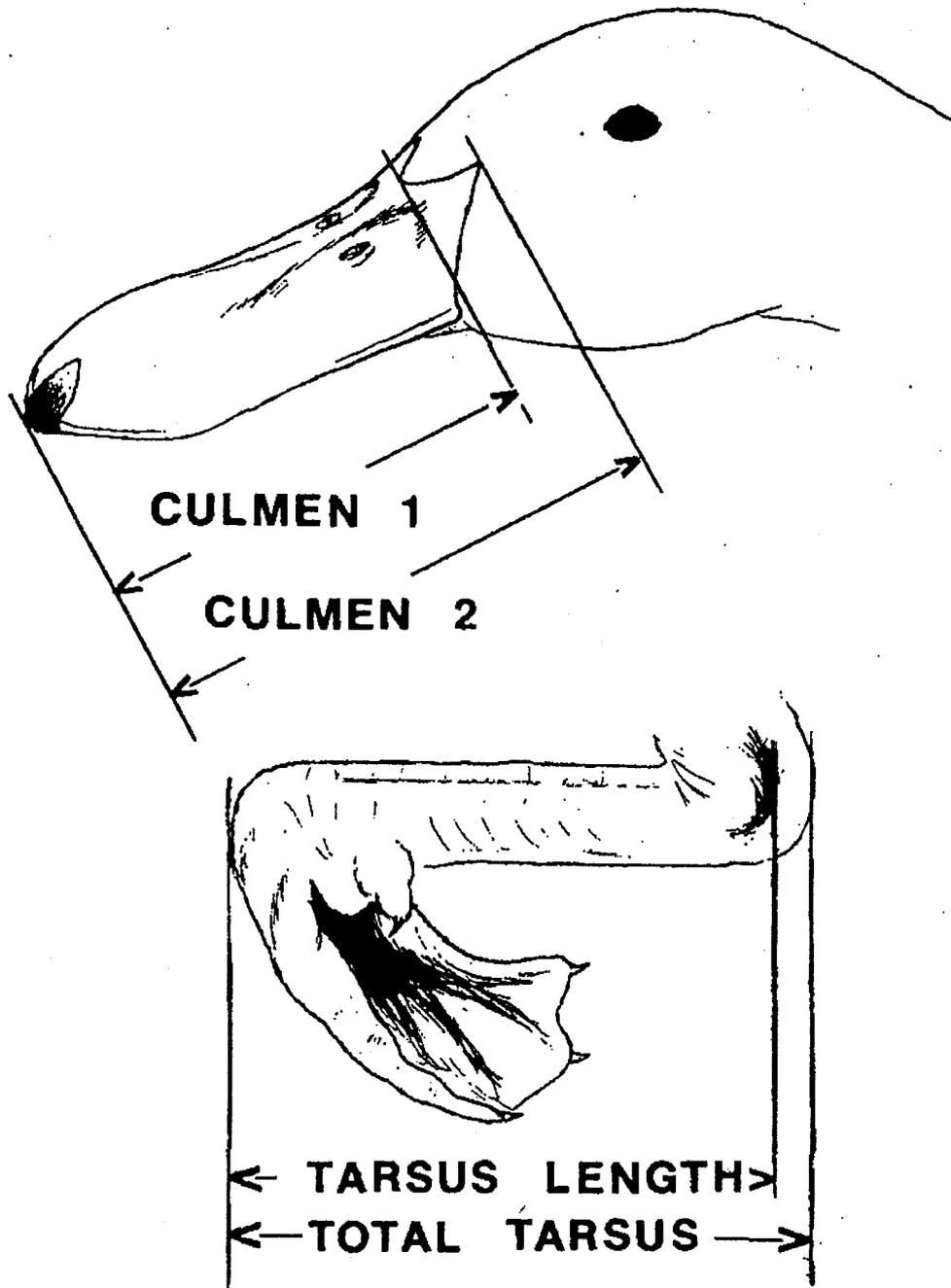


Figure 3. Morphological variables recorded from mallards captured at Banner Marsh State Fish and Wildlife Area and the Metropolitan Water Reclamation District of Greater Chicago (Byers and Cary 1991).

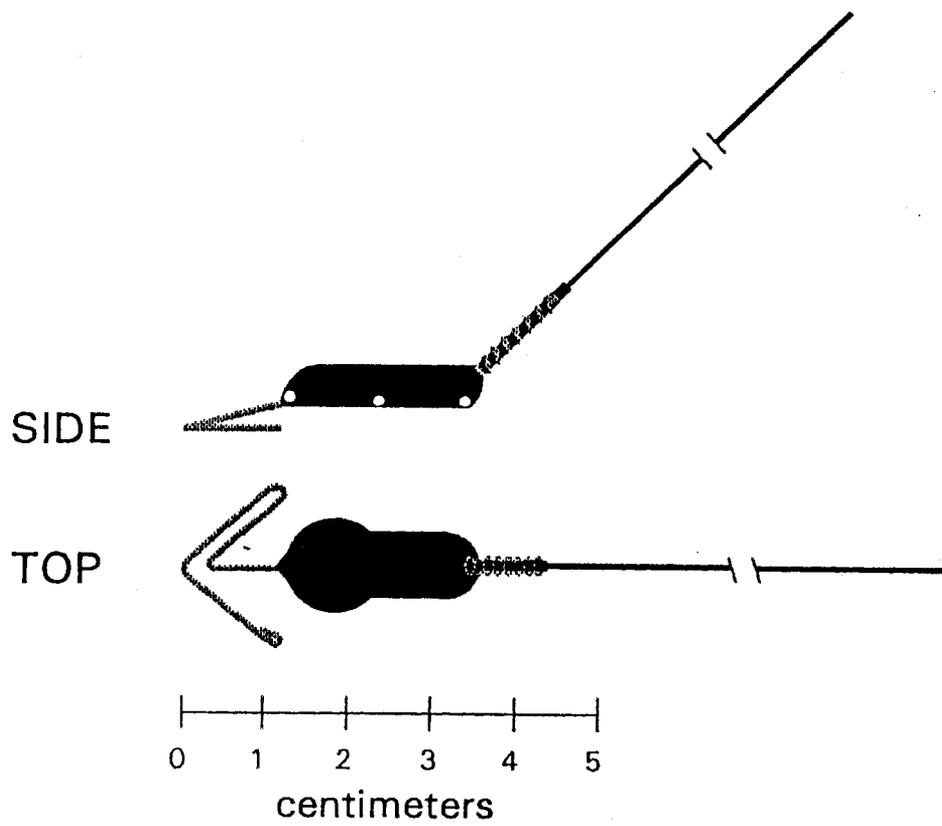


Figure 4. Prong and suture radio transmitter attached to female mallards nesting on Banner Marsh State Fish and Wildlife Area and the Metropolitan Water Reclamation District of Greater Chicago (Pietz et al. 1995).

were encapsulated in a potting material forming the 1.2 x 1 inch body of the unit. Three cylindrical tubes ran through the potting material for suture attachment. Protruding from the anterior end of the transmitter body was a 0.4 x 0.8 inch stainless steel wire anchor (prong), and the antenna was made of a black nylon-coated stainless steel wire extending 8.7 inches from the posterior end of the transmitter. The entire transmitter unit weighed approximately 0.3 oz, or about 1 percent of the body weight of a hen mallard.

#### Radio Attachment

Radio transmitters were attached mid-dorsally just above the shoulder joints with 3 nylon, 2-0 monofilament sutures and with the wire prong inserted subcutaneously (Pietz et al. 1995). The attachment site was prepared by trimming feathers from the skin in an area slightly larger than the body of the transmitter, and the locations of the incision and suture points were marked. The skin was then sterilized with isopropyl alcohol or Betadine, and, using a 23 ga. needle, 0.5 ml of lidocaine was injected subdermally at the incision and suture sites. The surgical tools and transmitter were sterilized with isopropyl alcohol. A 0.1 inch incision was made in the skin perpendicular to the body axis with a no. 10 surgical blade, and a blunt probe was used to detach the skin from the underlying tissue. The 3 sutures were then run through the skin at the marked reference points but not tied. Next, the wire prong was inserted under the skin through the incision, and each suture was secured using a surgeon's knot coated with clear nail polish.

#### Radio Telemetry

Radio-marked hens were located by triangulation (White and Garrott 1990) using 2, 4x4 vehicles equipped with null array antenna systems (ATS, Inc., Isanti, Minnesota). Hand-held Yagi antennas were also used for tracking on foot. ATS Model R2000 receivers were programmed to

receive transmitter signals from 150.000 to 151.999 MHZ. These frequencies were scanned at the study areas prior to the field season to verify that they were clear, and they were authorized by the USFWS to avoid complication with other telemetry studies in the Midwest. Radios were equipped with mortality sensors which delivered a signal at about twice the pulse rate of the normal signal. Mortality signals were activated after the radio was immobile for approximately 8 hours.

Tracking of the radio-marked females occurred between 23 March and 10 July. Tracking began the day following capture and radio attachment. Most hens were located at least twice daily ( $\geq 6$  days/week). All locations were usually obtained between 0600 h and 1300 h, which is the period when laying hens are most likely to be on their nests (Gloutney et al. 1993). Daily locations for each female were marked on photocopies of aerial photographs (Figs. 5 and 6) from the University of Illinois' Map and Geography Library. Hens found in potential nesting cover for 3 consecutive days, or 2 of the last 3 days, were triangulated on foot using the hand-held Yagi antennas (IWWR 1996). Females in nesting cover were pinpointed by taking 2 to 4 bearings using natural land features and orange flags as markers and by making detailed notes of their locations. All precautions were taken to prevent the hen from flushing and possibly causing nest abandonment. When females were absent from their nest site, searches to locate the nest were conducted in the area where the bearings intersected.

Upon discovery of a nest, the date of nest initiation and a description of the habitat at the nest site were recorded. A sample of the eggs were candled to determine the stage of incubation (Hanson 1954, Weller 1956). Daily locations of nesting hens were continued to monitor the status of the nests. Nest sites were not revisited until the late stages of incubation ( $\geq 18$  days)

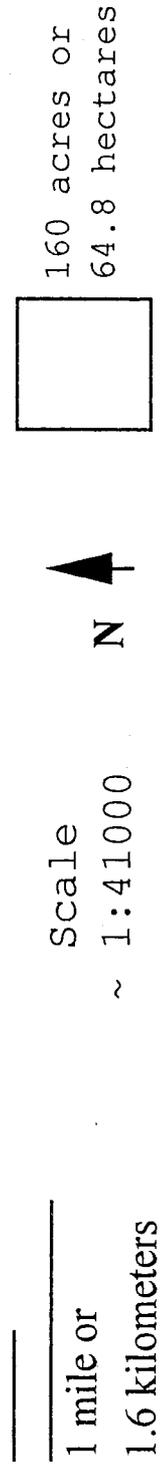


Figure 5. The Metropolitan Water Reclamation District of Greater Chicago and adjacent lands in Fulton County. Aerial photographs were taken in March 1993.

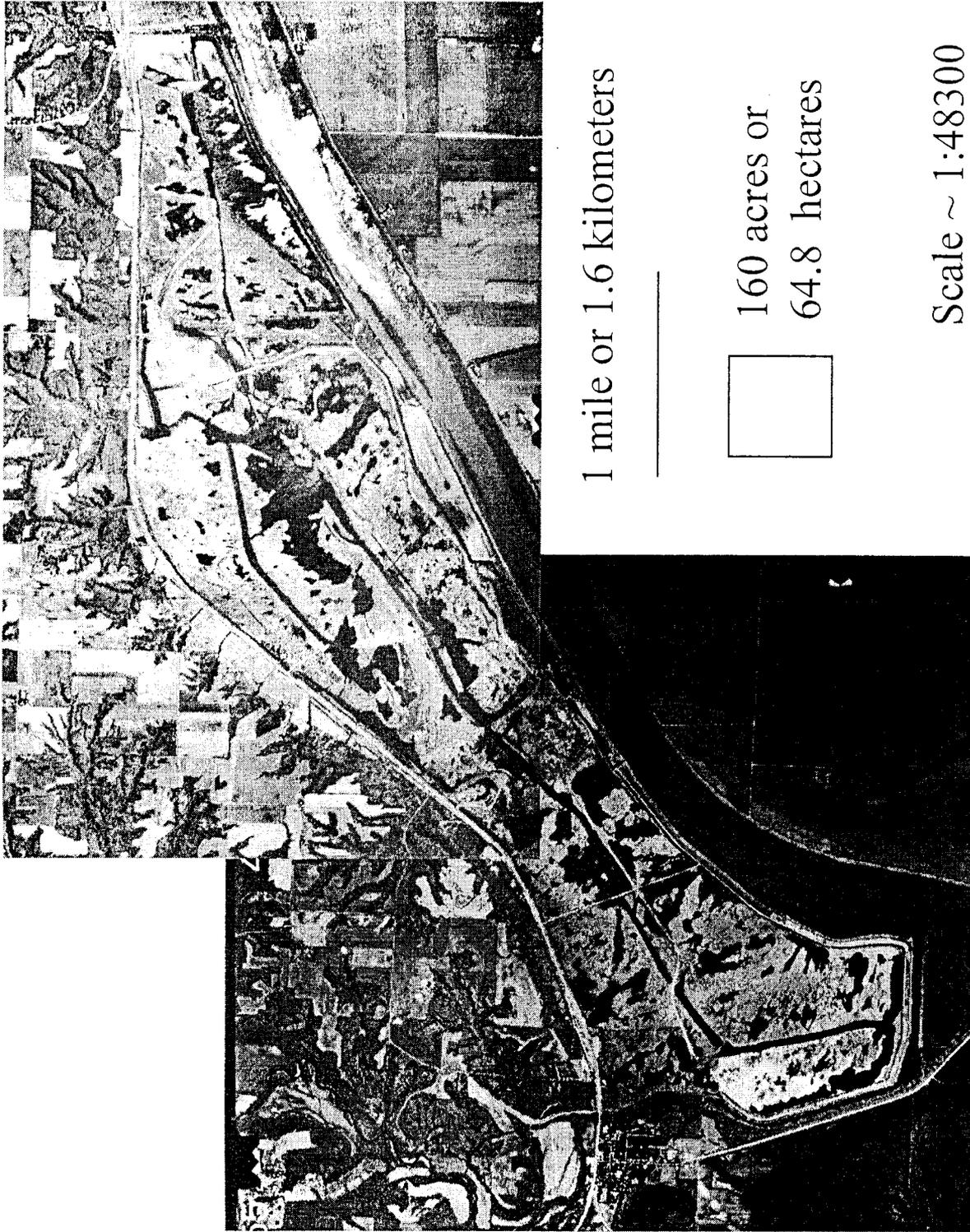


Figure 6. The Banner Marsh State Fish and Wildlife Area and adjacent lands in Fulton and Peoria counties. Aerial photographs were taken in April 1993.

unless radio locations indicated that females were no longer attending their nests or the mortality sensor was activated. The nests were then checked to determine their fate (depredated or abandoned) and the cause of nest failure (Sovada et al. 1996). When mortality signals were detected, radios were recovered, and the site was investigated to determine the cause of death.

On approximately the 18th day of incubation, nests were examined again to determine 1) clutch size, 2) the length and width of each egg ( $\pm 0.1$  mm), 3) the incubation stage of each egg (Hanson 1954, Weller 1956), and 4) hatch date. When incubating females nearing hatch were located away from their nests, the nests were examined to confirm hatching and the number of successful eggs. Successful females and their broods were located daily, and attempts were made to count the ducklings each day for at least 20 days posthatch to ascertain duckling and brood survival (Orthmeyer and Ball 1990).

As a result of time constraints between the end of the field season and report submission, statistical analyses were not performed for this report. The findings contained herein should be considered preliminary. Results in forthcoming reports may differ from those presented here after more thorough data analysis and the collection of additional information.

## RESULTS

Thirty-eight female and 50 male mallards were livetrapped at Banner and MSD between 23 March and 11 April. Only 4 (10.5%) of the females were migrants that left the study areas shortly after capture. Twenty-eight (73.7%) radio-marked hens attempted to nest on the 2 study areas, and an additional 2 hens were suspected of nesting at MSD, but their nests were not found before abandonment. The remaining 4 females did not nest on the study areas, but they were located in the region during an aerial search. Nearly 90 percent of the hens captured remained in

the region during the nesting season, indicating that decoy trapping was an effective method for catching resident female mallards.

A minimum of 49 nest attempts were initiated between 4 April and 28 June with an average nest initiation date of 6 May. Peaks in nest initiation occurred on 15 April and 7 May. The number of nest attempts averaged 1.8 per female with 4 being the most attempts by any one hen. Clutch sizes ranged from 1 to 12 eggs and averaged 8. The 3 dominant habitat types at nest sites were 1) smooth brome (*Bromus inermis*); 2) smooth brome/alfalfa (*Medicago sativa*); and 3) smooth brome/multiflora rose (*Rosa multiflora*). During egg laying, females appeared to have a set pattern of activity at both study areas. Early locations (approximately 0600-0800) would typically reveal that the hen and her drake were on feeding/loafing sites. Locations taken mid- to late morning indicated that the hen was at the nest site with the drake loafing on a nearby wetland. Once the female laid an egg, the pair would usually return to their feeding/loafing area for the remainder of the day.

After completion of a clutch, incubation ranged from 24 to 29 days and averaged 25.8 days to hatch. At least 1 egg hatched in 10 of 49 nests yielding a simple nest success estimate of 20.4 percent. Nests hatched between 10 May and 22 June with an average hatch date of 31 May. The resulting hen success (percent of females producing a successful nest) was 35.7 percent (10 of 28 nesting females).

Egg hatchability (number of eggs hatched/number of eggs laid) in successful nests was high (97.6%; 82 of 84 eggs). A total of 82 ducklings hatched for an average of 8.2 ducklings per successful female. The average number of ducklings per nesting female was 2.9. Attempts were made to estimate daily survival of ducklings during the 20-day posthatch period. However, as a

result of visibility constraints due to the dense vegetation in many brood-rearing wetlands and the secretive nature of the females and their broods, our ability to accurately estimate duckling numbers each day was more difficult than anticipated. Thus, for this report emphasis is placed on brood survival data rather than duckling survival estimates. Efforts will be made in subsequent years of this study to increase our sample sizes for estimating duckling survival.

Of the 10 nests that hatched, 2 (20%) hens completely lost their broods within the first two nights following nest exodus, 4 (40%) of the broods survived to at least 20 days posthatch, and the radios of 4 females (40%) failed prior to the end of the 20-day brood tracking period, thereby further complicating the determination of both brood and duckling survival.

Thirty-nine of the 49 (79.6%) nest attempts at Banner and MSD were unsuccessful. Predation influenced 63.3 percent ( $n = 31$ ) of all nest attempts. Coyotes (48.4%; 15 of 31 depredated nests) were the most important nest predators followed by raccoons (25.8%; 8 of 31 depredated nests). Other possible nest predators included mink (*Mustela vison*), opossum (*Didelphis marsupialis*), striped skunk (*Mephitis mephitis*), weasel (*Mustela spp.*), and an unknown species of snake. The predators of 3 nests could not be identified. The remainder of failed nests were caused by human disturbance (6), mowing (1), and an unknown factor (1). Coyotes (5) and mink (1) were believed to be responsible for the deaths of 6 (21.4%) nesting hens.

#### JOB NO. I.2. Assessment of Mallard Recruitment.

A review of the scientific literature was completed to compare the results from Job No. I.1 with those of similar studies conducted elsewhere in the United States and Canada. The review

was important for assessing the significance of mallard recruitment on the Banner and MSD study areas.

Bellrose (1980) reported that mallards began nesting between 10 and 30 April in much of their northern breeding range, and except for the far north, continued their nesting effort for about 60 days. The average clutch size of mallards was 9 eggs and required 26 to 30 days (average of 28 days) for incubation (Bellrose 1980). Hen mallards at Banner and MSD began nesting earlier (4 April) and sustained nesting for a longer period (86 days) than mallards further north. The average clutch size (8 eggs) from this study was similar to that reported by Bellrose (1980), but the incubation period was slightly less (24-29 days, average of 26 days).

Nest success (20.4%) during the first year of this study was higher than most studies on the northern breeding grounds. Cowardin et al. (1985) reported mallard nest success of only 8 percent during 1977 to 1980 in North Dakota. These researchers suggested that prairie nesting mallards required nest success of 15 percent and hen success of 31 percent to maintain a stable breeding population. Similarly, Klett et al. (1988) found that 7 percent of the mallard nests were successful in North Dakota from 1966 to 1984. In the Prairie Pothole Region of North and South Dakota and Minnesota, nest success ranged from 6 to 20 percent for mallards during 1966 to 1989 (Shaffer and Newton 1995). Greenwood et al. (1995) reported that mallard nest success averaged 11 percent in the prairie provinces of Canada from 1982 to 1985. Hen mallards fitted with prong and suture radio transmitters from 1993 to 1995 in portions of Manitoba, Saskatchewan, and Alberta exhibited a comparable nest success rate (21%; Paquette et al. 1997) to hens in our study.

Most nest attempts (79.6%) during our study failed as a result of mammalian predation

(63.3%). Greenwood et al. (1995) reported that 89 percent of the mallard nests were unsuccessful, and 72 percent fell victim to predation during their study in the Prairie Pothole Region of Canada. Correspondingly, 93 percent of mallard nests failed in North Dakota during 1966 to 1984 and predation accounted for 82 percent of the loss (Klett et al. 1988). Cowardin et al. (1985) also found that predation was responsible for the majority (69.7%) of the total nest loss (76.7%) during their study in central North Dakota. Coyotes accounted for most of the nest depredation (48.4%) and hen mortality (83.3%) at Banner and MSD. In contrast, red fox (*Vulpes vulpes*) appeared to be the most important predators of ducks nesting on the northern prairies (Sargeant et al. 1984, Cowardin et al. 1985, Klett et al. 1988, Greenwood et al. 1995).

First-year results of our study revealed that at least 40 percent of the successful hens still had broods 20 days after hatch. Rotella and Ratti (1992) found 49 percent of their mallard broods survived 30 days in southwestern Manitoba. Similarly, Talent et al. (1983) reported that 48 percent of the mallard broods fledged at least 1 duckling in south-central North Dakota. Orthmeyer and Ball (1990) tracked mallard broods in north-central Montana and found that 63 percent of them fledged young. Cowardin et al. (1985) estimated mallard brood survival to be 74.1 percent in North Dakota. However, their estimate was based on broods less than 2 weeks old, and studies indicate that most duckling mortality occurs within their first 2 weeks of life (Ball et al. 1975, Talent et al. 1983, Orthmeyer and Ball 1990). Rotella and Ratti (1992) reported that studies in the north-central United States have estimated mallard brood survival (up to 60 days posthatch) to range from 48 to 87 percent. Compared with other studies, brood survival at Banner and MSD was low; however, 4 (40%) of 10 radios on successful females failed prior to completion of the 20-day, brood-tracking period. Thus, actual brood survival on our study areas

may have been higher. Radios with longer life expectancy will be used during the remainder of our study.

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SUBMITTED BY:

A handwritten signature in cursive script that reads "Stephen P. Havera". The signature is written in black ink and is positioned to the left of the typed name.

Stephen P. Havera  
Professional Scientist  
Illinois Natural History Survey

DATE: 21 August 1998