

Mottled Duck Use of Managed Wetlands in the ACE Basin, South Carolina
Project Summary
2011-2013

The Mottled Duck in South Carolina has become an important species particularly to waterfowl hunters since its introduction into the state in the 1970's and 80's. However, our knowledge of the life cycle and habitat needs of this resident bird are poorly known, and precludes the development of specific management plans for this species. As a result of this knowledge gap, research activities for the Mottled Duck were initiated by the Nemours Wildlife Foundation and the South Carolina Department of Natural Resources (SCDNR) and supported by Ducks Unlimited, Delta Waterfowl, and the Flyway Foundation, with further cooperation from USFWS and private landowners. The goals of this research are to examine the general habitat use and movements during the fall and winter and to conduct more intensive monitoring during the spring and summer seasons to characterize nesting and brood rearing habitat selection. An additional goal is to increase the number of banded Mottled Ducks so that accurate estimates of population size, harvest rate, and movement from band return data can be enhanced.

Activities to date:

Radio Telemetry

In August and September from 2010 to 2012, we radio-marked a sample of 189 Mottled Duck hens (Table 1) captured on two different properties within the ACE Basin region. Hens were captured from an airboat at night using spotlights and dip nets. In 2010, 45 hens were fitted with backpack transmitters using a "Dwyer" style harness attachment while the remaining 40 hens were surgically implanted with transmitters. In 2011 and 2012 we used only surgically implanted transmitters due to the low retention rate experienced with the backpack transmitters used the first year. Nemours Wildlife Foundation staff and Mississippi State University students worked jointly with SCDNR staff and their airboats to fill our quota of Mottled Duck hens. Ron Bielefeld with the Florida Fish and Wildlife Conservation Commission served as the primary consultant on the set-up and operation of the surgical center. Ron has been the project leader for the Florida Mottled Duck research project which has recently completed an intensive telemetry project on the birds. Ron, SCDNR veterinarian Al Segars and others helped us obtain the supplies and equipment needed to set up the surgical facility at Nemours Plantation. Many hospitals, vet clinics, and equipment manufacturers were invaluable in their assistance by donating or loaning supplies, equipment, and services. Also, three local veterinarians volunteered their expertise and endured long, late night hours performing the surgeries. After the completion of the surgeries, the radio-marked birds were released at their respective capture sites.

Following their release, we tracked the birds from the ground and from an aircraft with antennas mounted on each wing strut. Aerial surveys were conducted from late August through early May once per week if possible. Every 4th to 5th flight would extend beyond the ACE Basin to search for birds that may have moved outside of the study area. Unfortunately, in 2013 unforeseen circumstances such as the plane grounded for mechanical reason, pilot recertification, weather,

and issues regarding workers compensation insurance greatly reduced the number of flights conducted and the location sample size for individual birds.

It is important to note that no mortality signals from implanted ducks, except one resulting from avian predation, were detected until 4 weeks after their release suggesting that these mortalities did not result from complications due to capture or surgery

In the 2010-2011 season aerial surveys conducted in late August through Mid-November detected the greatest number of radio-marked ducks although we were beginning to observe a decline in ducks detected during October and November (Figure 1). This decline continued and accelerated into December and January. We felt the decline in number of ducks detected was too great to be accounted for by predation and developed two possible theories: equipment failure or an unexplained long-distance movement away from the study area. We discussed our experiences with researchers in Florida and Louisiana and learned they had had similar results during the first year of their Mottled Duck research. Based on our data and the experience of other researchers we now believe the problem was likely due to a shorter than expected transmitter battery life rather than birds leaving the survey area. Further, neither the hunter harvest band return data nor our extended flight surveys showed evidence of large numbers of ducks moving beyond our survey area.

We conducted 6 extended aerial surveys from September 2010 to April 2011. Areas covered during these flights include the SC coast north through Georgetown County, inland along the Santee and Edisto River systems, Lakes Marion, Moultrie, and Murray, and south along the Georgia coast through the Savannah NWR and Altamaha WMA's. These surveys located only 4 radio-marked Mottled Ducks outside of the ACE Basin area, 3 in the Santee Coastal Reserve area and 1 in the Santee River near Lake Moultrie. Interestingly, since early March, 5 ducks have been heard (3 in the ACE and 2 near Santee) which were not heard during the previous 4 months.

Although, we did not have sufficient data to calculate accurate home range estimates, the locations we have obtained show movements of individual birds within the ACE Basin covering between 25 and 100 square miles and the longest distance moved from the release sight by a radio-marked bird is approximately 90 miles (Combahee River to N. Santee River).

In the 2011-2012 season aerial surveys conducted in late August through October were successful in locating a large portion of our radio-marked sample (Figure 1). As we progressed into our survey period we began to experience declines in the number of birds detected during our flights. This decline was not as dramatic as in 2010-2011 especially when considering the differences in sample sizes. We believe the declines experienced in 2010-2011 were largely due to shorter than expected transmitter battery life. The less precipitous declines during the 2011-2012 surveys may be explained by a combination of factors however we believe the change in transmitter manufacturer and specifications was the principal factor contributing to our higher retention rate for this year's sample. We maintained contact with approximately 30-35% of our radio-marked birds 9- 10 months after release which is similar to what Mottled Duck researchers in Florida have experienced.

Again in 2011-2012, we conducted 6 extended aerial surveys from September 2011 to May 2012. Areas covered during these flights include the SC coast north through Georgetown County, inland along the Santee and Edisto River systems, and south along the Georgia coast through the Savannah NWR and Altamaha WMA's. These surveys located only 2 radio-marked Mottled Ducks outside of the ACE Basin area, 1 in the Santee Coastal Reserve area near the South Santee River and 1 in the Altamaha WMA. These locations would represent straight-line movements of approximately 75 and 100 miles respectively.

Once again, our aerial surveys alone did not provide a sufficient number of locations to calculate accurate home range estimates for most of our radio-marked ducks. However, when combined with locations obtained through ground based telemetry, we should be able to include accurate home range estimates for 40-50% of our radio-marked sample in our final report. The locations we have obtained through our aerial surveys show movements of individual birds within the ACE Basin covering between 30 and 60 square miles and up to 100 to 125 square miles for those birds that were located outside of the ACE Basin study area.

In 2012-2013, aerial surveys were conducted from late August through May, although less frequently than in the previous 2 years resulting from the previously mentioned unforeseen circumstances. We were able to locate and follow some radio-marked birds from the ground throughout the fall/winter and into the following nesting season.

Mortality of Radiotransmitted Ducks

In 2010-2011, we detected 23 mortality signals, 7 from implants and 16 from backpacks (Table 1). From the transmitters we have recovered, the implants showed signs of avian predation and the backpacks had no visible marks and were likely slipped. Six of our Mottled Ducks have been reported as harvested through band return data. Four of these ducks were killed in Colleton County, 1 in Beaufort County, and 1 in Georgetown County.

In 2011-2012 we confirmed 7 mortalities; however there was still a sample of radio-marked MODU's with unknown fates. These missing birds could be undetectable due to factors including unreported harvest, transmitters destroyed or under water as a result of predation or harvest, or transmitter failure.

The hunter harvest band return data for the 2011-2012 hunting season contained 4 reports of Mottled Ducks associated with our study, but none were from the 2011 radio-marked sample. Three of the harvest reports were from birds banded in 2010 with 2 of these harvested in Colleton County, SC and the other harvested in Jasper County, SC. The fourth bird was banded in 2011 but was too small at the time of capture to be implanted with a transmitter. This bird was also harvested in Colleton County.

Habitat Use/Movements

Analysis is currently ongoing on locations collected over the past three years. Banding data and radio locations of female mottled ducks show some individual birds will make large movements to other parts of South Carolina and Georgia, but overall the majority of mottled ducks remained within the ACE Basin. Preliminary results show > 95% of Mottled Duck locations collected

occur within managed tidal wetlands and < 5% occur within natural tidal marsh (Table 2). Locations have also shown radio-marked mottled ducks occur most frequently in brackish (2-20 ppt.) wetlands and wetlands where natural vegetation occurs as opposed to agricultural crops. Home range sizes for mottled ducks appear to be fairly small as compared to other duck species, with some small scale dispersal occurring during the breeding and nesting season.

Nest Searching

During the spring and summer of 2011 and 2012, Clay Shipes, graduate student with Mississippi State University, conducted nest searches in the study area. Search techniques include walking searches, rope dragging, and airboat searches. Over both years 53 nests were found, 36 in 2011, and 17 in 2012. Clutch size averaged 7.6 eggs in 2011, 9.4 eggs in 2012, and 8.4 eggs overall. Average nest initiation date was significantly different between the two years; April 27 in 2011 and March 24 in 2012 (Fig. 2). Nest success rates were 18% in 2011, 20% in 2012, and 19% overall. For both years raccoons were the primary nest predator.

Analysis was done comparing nest success with several different habitat and time covariates such as vegetation height and date of nest initiation. The only important factor that appeared to affect nest success is the size of the island on which a mottled duck nest occurs (Fig 3). The relationship shows that as island area increases so does nest success. Not all nests that were found occurred on islands, overall 27 nests occurred on islands of vegetation. The average area of islands on which nests occurred was 11m² and ranged from 1m² – 45m².

Over the three years of the study only 2 of the radio-marked females initiated nests. These two nests were initiated during the spring of 2012. During the spring of 2013 roughly 25 radio-marked females were present within the ACE Basin and were tracked rigorously. Of these females none appeared to initiate nests showing a very low propensity and resulting in very little data obtained from the sample of radio-marked birds.

Broods

During the spring and summer of 2013, Molly Kneece, graduate student with Mississippi State University tracked previously radio-marked females and conducted nest searches within the study area. Her intentions were to follow the radio-marked females after ducklings had left the nest to determine habitat use and survival by mottled duck broods. However, none of the previously radio-marked females initiated a nest. Therefore, nest searches were conducted to discover nests by non-instrumented females. When a nest from a non-instrumented hen was located, the eggs were examined to determine an estimated hatching date. At 3 days prior to the estimated hatching date a drop-style trap was placed over the nest to capture the hen. The captured hen was outfitted with a harness style backpack transmitter. Using this method, 7 hens were successfully trapped and 5 of these successfully hatched. These females were tracked daily and the broods were monitored to estimate habitat use and survival. Of the 5 broods, 3 were successful in fledging at least one duckling.

General habitat observations show broods utilize wetlands which have steady water levels that are >0.5 and <6 inches in depth. We consistently saw broods abandoned wetlands when water

levels dropped below 0.5 inches or increased above 6 inches. They utilize fresh to brackish wetlands and areas with an open water: vegetation ratio of about 40%-60% respectively.

Banding Activity

Mottled Duck banding by the SCDNR has been underway since 2008. Banding effort was increased in 2010, but decreased in 2011 as a result of tropical storm threats in August with ducks captured and banded at sites within the Santee Coastal Reserve and the ACE Basin (Table 3). Birds are captured during their molt from an airboat at night which enables researchers to band a larger number of birds at each site. As the number of banded birds and band returns increase, the accuracy of estimates of population size and harvest rate will improve. The statewide population estimate calculated from existing band data is 20,600 Mottled Ducks (D. Harrigal, SCDNR, personal communication). Information from band reports on harvested birds also provides more information on Mottled Duck movements. Recent band reports have shown that some Mottled Ducks in South Carolina move further inland within the state than previously expected. This information is also helpful in targeting areas to conduct flights to search for missing birds.

Future Activities

Broods

During the fall of 2013 analysis will continue on nesting success and habitat use by females and broods. Molly Kneece will return to Mississippi State University in the fall to continue taking classes and return in January to start her second field season. We have decided to discontinue capturing and radio-marking female mottled ducks in the summer due to the low nesting propensity of females and the lack of data obtained from these marked females. Instead more effort will be put into nest searching and radio-marking females on the nest, as this has proven to be a more effective method for marking hens which potentially produce a brood. Also attempts will be made to decoy trap and radio-mark females prior to the nesting season to have a random sample of hens that may attempt to nest.

Satellite Transmitters

Additional activities scheduled for the fall of 2013 will include capture and radio-marking of mottled ducks (n=18) using satellite transmitters. Microwave Telemetry, Inc. in Columbia, Maryland is constructing the Solar GPS/GSM 20 gram transmitters for use on mottled ducks. Our plans are to expand the current study to include birds captured in the Santee Coastal region of the state in addition to the ACE Basin. Of the 18 units ordered, 14 of them will be attached to mottled ducks captured at the Santee Coastal Reserve and the remaining four will be deployed in the ACE Basin region. These units send GPS locations by email once per day and with a solar panel recharging the battery will likely provide a greater quantity and quality of data than that obtained through conventional VHF transmitters. We believe these marked birds will provide greater insights into the seasonal movements of Mottled Ducks than what we could develop using conventional telemetry systems.

Figure 1. Number of Mottled Ducks located during aerial surveys by year and time period.

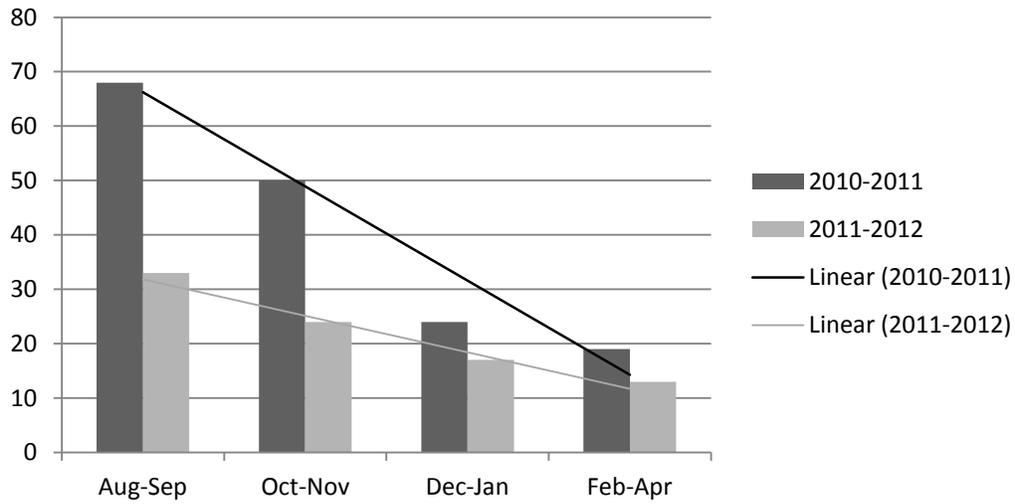


Table 1. Status of Radio-Marked Mottled Ducks by Transmitter Type and Time Period in 2010-2011

	Live Signal		Mortality Signal		Harvested		Unknown	
	Implant	Backpack	Implant	Backpack	Implant	Backpack	Implant	Backpack
Aug-Sep	28	34	2	3			10	3
Oct-Nov	20	21	2	8			16	8
Dec-Jan	15	0	2	4	3	3	16	22
Feb-Apr	15	3	1	1			15	18
Current Totals	15	3	7	16	3	3	15	18

Table 2. Percent of radio-marked mottled duck locations by wetland characteristics in 2011-2012

Wetland Characteristics	Mean % locations by regime
Non-refuge	94%
Natural Vegetation	94%
Managed Wetlands	95%
Brackish Wetlands	79%

Figure 2. Number of mottled duck nests initiated by year and time period.

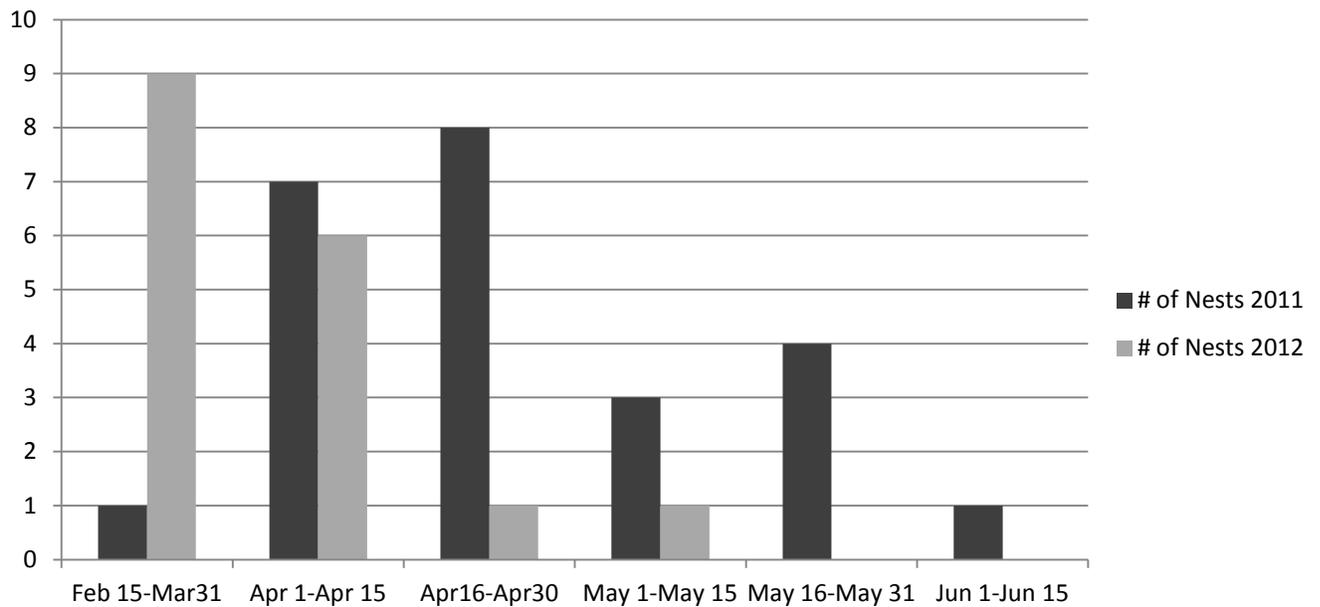


Figure 3. Relationship between the Daily Survival Rate of nests and the Area of Island (ISLA) where the nest occurred

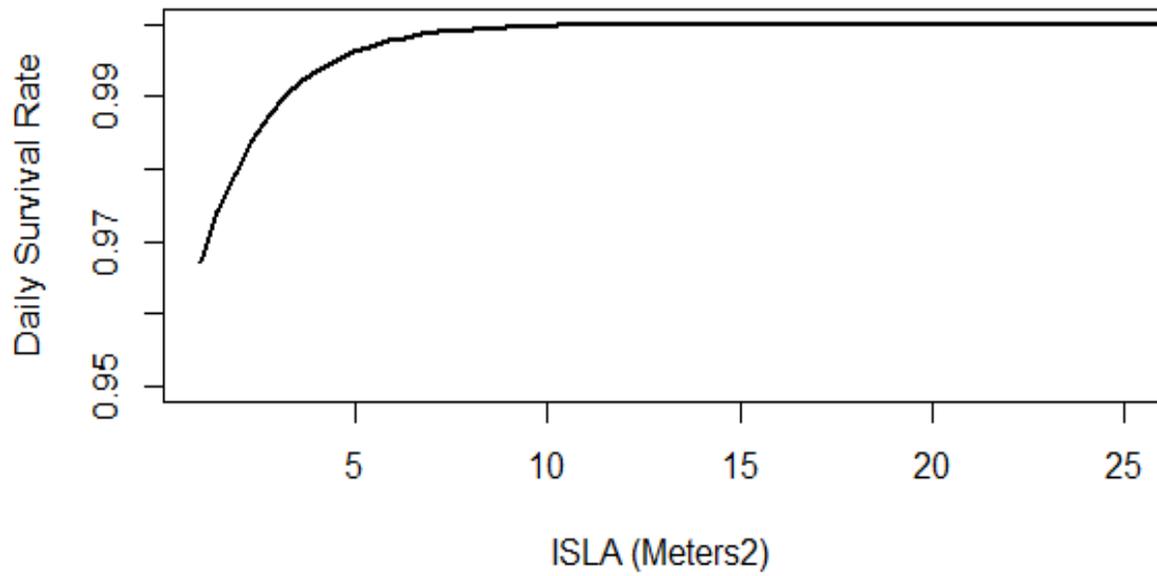


Table 3. Mottled Duck Banding Activity and Harvest Rates in South Carolina 2008-2011.

Year	New Bands	Direct Recoveries	Recovery Rate	Reporting Rate	Harvest Rate
2008	198	8	0.0404	0.74	0.0546
2009	357	26	0.0728	0.74	0.0984
2010	1129	56	0.0496	0.74	0.0670
2011	295	17	0.0576	0.74	0.0779
Total	1979	107	0.0541	0.74	0.0731