

FINAL REPORT

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Regional and long-range movements of female gadwalls along the Gulf Coast – a pilot study

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Introduction

Greater than 75 percent of the North American gadwall population may annually overwinter in the marshes and flooded agricultural fields along the Louisiana and Texas Gulf Coasts. Gadwalls are one of the most abundant duck species in these areas during winter and typically rank first or second in terms of numbers harvested. Despite their significance to hunters and habitat managers in this region, waterfowl biologists have a relatively poor understanding of gadwall habitat use, regional and long-range movements, and survival rates during winter. Gadwalls spend extensive time feeding

during winter because their diet is dominated by submersed aquatic vegetation that is generally low in nutritional value. Consequently, habitat quality, habitat quantity, and disturbance may be important factors influencing choice of wintering areas, local foraging habitats, regional movements, and winter survival rates of gadwalls. Wetland conservation strategies may directly affect each of these factors.

Partners of the Gulf Coast Joint Venture (GCJV) including Ducks Unlimited (DU), Louisiana Department of Wildlife and Fisheries, Louisiana State University, Texas Parks and Wildlife Department, and US Fish and Wildlife Service have initiated a cooperative research effort to better understand habitat use, movements, and survival of female gadwalls along the Louisiana and Texas coasts. This information will be used to evaluate and possibly refine wetland conservation strategies and priorities for gadwalls during winter. Because few previous studies of gadwall have been conducted during winter, we embarked on a pilot study during autumn – winter 2006 – 2007 to gain insight into logistical and financial needs of a larger, full-scale telemetry study of gadwall wintering ecology. We identified 4 objectives to be addressed by this pilot study: 1) determine if adequate numbers of gadwalls can be captured during autumn – winter for a full-scale study, 2) gain general insight into the extent and timing of regional and long-range movements of female gadwalls during winter, 3) determine whether satellite or conventional (i.e., VHF) telemetry methods are more appropriate for a full-scale study, and 4) use information gained from this pilot study to more precisely estimate financial and logistical needs for a full-scale study.

Study areas

We selected Rockefeller State Wildlife Refuge in southwest Louisiana, J. D. Murphree Wildlife Management Area in southeast Texas, and Matagorda Island State Wildlife Management Area along the Texas mid-coast as potential study sites for this

pilot study. We believed these sites would provide good opportunities to capture gadwalls and represent the areas in which a full-scale study would likely be conducted.

Methods

We captured gadwalls using rocket nets fired from portable platforms over sites pre-baited with corn, barley, and crushed oyster shells. We were interested in marking only adult female gadwalls because this will be the age-sex cohort studied during a full-scale study. We used 22g, backpack satellite transmitters (i.e., Model 100 Platform Transmitter Terminal [PTT], Microwave Telemetry, Inc., Columbia, MD, USA) because available logistical resources were insufficient to enable the use of VHF transmitters. LeSchack et al. (1997) estimated mean body mass of adult female gadwalls during winter to be 866g (range = 720 – 980g). Although the mass of a 22g PTT represents only 3.1% of the body mass of a 720g duck, we were concerned that the physical size and shape of the PTT may affect flight aerodynamics, energy expenditure, and movement patterns. Thus, we attempted to radiomark only adult female gadwalls whose body mass exceeded 785g. We believed this cutoff point represented a reasonable tradeoff between minimizing potential impacts and ensuring an adequate supply of captured birds would be available for marking. Nevertheless, we recognized that poor capture success may necessitate deviation from this plan, and we reserved the option if necessary to expand our marking criteria to include juvenile females whose body mass exceeded 805g (i.e., estimated mean body mass of juvenile female gadwalls during winter [LeSchack et al. 1997}).

After capture we transported female gadwalls in poultry crates to a temporary field laboratory in preparation for PTT attachment procedures. We attached PTTs using 0.47cm Teflon ribbon (Bally Ribbon, Bally, Pennsylvania) following the method of Miller et al. (2005).

Each attachment was performed by M. Brasher and assisted by J. Linscombe or LSU graduate assistants Paul Link and Bruce Davis. Following the marking procedure, gadwalls were returned to poultry crates until released (<14 hours).

We configured PTTs with multi-season duty cycles expected to produce an effective transmitter life of 240 days (8 months). The first season operated for approximately 6 months under a repeating cycle of 6 hours 'on' and 72 hours 'off.' The second season began thereafter and operated on a repeating cycle of 4 hours "on" and 82 hours "off" until the battery expired. We expected this duty cycle configuration to provide ≥ 2 locations per week for each gadwall during the first season and ≥ 1 location per week during the second season. Data from PTT transmissions was delivered by CLS America, Inc., every 25 hours to project analysts at the Ducks Unlimited Southern Regional Office, Ridgeland, MS. Project analysts integrated the data into a web-based mapping application that enabled research partners to monitor movements and status of marked gadwalls during the pilot study. We monitored radiomarked female gadwalls until the transmitter battery expired, transmissions were not detected for >3 consecutive weeks, or females were determined to have died.

Results

Capture success

We initiated during early November 2006 efforts to capture female gadwalls. Unfortunately, heavy rains during November caused flooding of many coastal wetlands and delayed successful capture until early December. We captured 17 female gadwalls (9 juveniles, 8 adults) on 8 December 2006 at Rockefeller State Wildlife Refuge. Because of initial difficulties capturing gadwalls, we chose to attach PTTs to 16 of the 17 captured females. We marked 8 adult and 8 juvenile females, and only 3 of these failed to meet our minimum body mass criteria (i.e., 3 juveniles weighing 760g, 780g, and 800g). The overall mean body mass of the 16 radiomarked females was 848g (SE =

14), while that for the 8 radiomarked adult and juveniles was 881g (SE = 19) and 815g (SE = 14), respectively. We were unsuccessful during November and December capturing gadwalls in Texas, and we consequently resumed efforts during January to capture additional gadwalls in Louisiana. Because of continued difficulty capturing large numbers of gadwalls during late winter when gadwalls became less gregarious, we decided on 26 January 2007 to cease trapping efforts for this pilot study. Although our original plan was to radiomark 25 female gadwalls, we ended our pilot study capture efforts with only 16 radiomarked.

Female survival

Within 2 weeks following capture and radiomarking, we failed to receive data transmissions from 5 PTTs. Although unconfirmed, we presumed these females died shortly after release and the PTT came to rest in a position not conducive to effective transmission. From 8 December 2006 to 19 June 2007 we confirmed 2 mortalities caused by waterfowl hunting and 4 mortalities caused by unknown factors. We confirmed the harvest mortalities (1 each on 27 December 2006 and 9 January 2007) through contact with the responsible hunters and the other 4 mortalities from PTT activity sensor data.

Of the 4 mortalities confirmed via activity sensors, 2 occurred within 1 week following radiomarking and the other 2 occurred in April during northward migration. One of the 2 mortalities occurring in April appeared to result from energetic exhaustion. In this case the mortality immediately followed the arrival (3 – 4 April) of a strong cold front on the northern Great Plains soon after this female's apparent non-stop 1,300 mile flight from Louisiana to North Dakota (24 – 25 March). We received data on the day after the arrival of the cold front indicating the female reversed migration and began heading south. It appears this female made it no farther than southern North Dakota because we confirmed from subsequent transmissions that she died on approximately 6

April 2007. We lost transmissions from one PTT during the first week of May and did not receive additional transmissions from that PTT for the life of the pilot study. We are uncertain of the fate of this female, but mortality due to avian or mammalian predation offers a plausible explanation. Battery failure seemed unlikely because voltage measures were high immediately prior to this date. Four females were known to remain alive at the time of this report (20 June 2007). Hence, at least 6 (37.5%), and possibly 12 (75.0%), of the 16 radiomarked females died during the pilot study (Table 1). Nevertheless, 9 radiomarked female gadwalls remained alive long enough to collect data for satisfying the objectives of this pilot study.

Winter movements and spring departure

Eight female gadwalls monitored during this pilot study provided data on movement patterns, and none made significant long-range or erratic movements during winter. Estimated locations received from PTTs indicated that the surviving females moved off of Rockefeller Refuge shortly after release and established localized movement patterns mostly within the coastal marsh habitats of Cameron and Vermilion Parish, LA (Figure 1). One female (PTT 34245) moved on 9 January 2007 from coastal LA to the northern edge of Red River Wildlife Management Area in Concordia Parish, LA (Figure 1). This female remained near the Red River Wildlife Management Area until she initiated spring migration on 20 April 2007. Only 7 females survived long enough to provide data on spring departure dates. The median date of departure from Louisiana was 22 April 2007 and the mean date of departure was 18 April 2007. The 2 earliest departures occurred on 23 – 24 March 2007. Four females departed during 20 – 28 April 2007 and the final female departed on 21 May 2007.

Spring migration paths

Seven females provided data on spring migration paths. Six females traveled north through Arkansas, Missouri, Iowa, and North and South Dakota (Figure 2). Of

these 6 females, at least 3 made temporary stopovers in Iowa and at least 4 made temporary stopovers in North Dakota. One female departed Louisiana in a northwesterly direction, making brief stopovers in southern Kansas en route to her ultimate destination of central Montana (Figure 2).

Only 1 female (PTT 34452) made a significant non-stop, long-distance flight during northward migration. We received data on 23 March indicating this female was located in Vermilion Parish, LA, and 3 days later we received data showing her position approximately 10 miles northwest of Devils Lake, ND. Hence, this female flew greater than 1,300 miles in less than 72 hours. The northward migration of all other females occurred at a more leisurely pace with periodic stopovers along the way (Figure 2). Of the 4 females that remained alive at the time of this report (20 June 2007), 3 were located in Saskatchewan and 1 in central Montana (Figure 3).

Accuracy of estimated locations

Locations received from PTTs are classified into 1 of 7 categories by Service Argos according to their estimated level of accuracy (Table 2). We summarized data by location class to gain a better understanding of the overall accuracy of estimated locations obtained from satellite telemetry. We used data only from females that remained alive beyond 31 December 2006 because very little data was generated by females that died prior to this date. Antenna positioning, habitats used, time of day, and inherent performance variation among PTTs likely affects the number and quality of locations received from each PTT. To prevent our summary of locational accuracy from being disproportionately affected by PTTs performing at the extremes (e.g., PTT transmitting a large number of exceptionally high or low quality locations), we treated PTTs as the sampling unit. We calculated for each PTT the percent occurrence of locations in the 7 location classes and averaged these percentages across PTTs to calculate mean percent occurrence of locations in different location classes (Table 2).

On average, 33% of locations had an estimated accuracy of <350m, and 62% had an estimated accuracy of <1000m.

Individual PTTs frequently provide multiple locations during a given transmission cycle. These locations are generated within a narrow time frame (e.g., 4 - 6 hours) of one another and may consequently exhibit a high degree of temporal autocorrelation. One may thus question the legitimacy of using multiple locations collected during a shared transmission cycle to assess habitat use. We observed from regular reviews of our data that the distribution of high and low quality locations was not uniform among transmission cycles. In other words, because of factors affecting signal transmission and reception, the occurrence of 1 high (or low) quality location during a transmission cycle was often accompanied by ≥ 1 additional high (or low) quality location. As a result, our estimate of mean percent occurrence of locations in different accuracy classes could be disproportionately affected by a large number of high (or low) quality locations occurring during a small number of transmission cycles. Moreover, because such locations may exhibit a high degree of autocorrelation and not all be suitable for a habitat use analysis, our summary of locations by accuracy class may not provide a valid assessment of the potential for satellite telemetry to satisfy habitat use data needs during a full-scale study. We believed that for satellite telemetry to be effective at defining gadwall habitat use, it must be capable of providing ≥ 1 high accuracy location (i.e., Location Class 3 or 2, <350m) during a large percentage of the total number of transmission cycles. We opined that a more informative statistic would be one describing the mean percent of all transmission cycles that contained ≥ 1 high accuracy location (i.e., Location Class 3 or 2).

For this analysis we again treated PTTs as the sampling unit. We calculated overall and monthly estimates because overhead satellite coverage and reception quality increases at higher latitudes, and radiomarked females were generally located at

more northerly latitudes during the latter months (May – June) of this pilot study. Moreover, we were specifically interested in data quality in winter months during which we will conduct the full-scale study. We observed on average that during the months most important for a winter habitat use study and for which we collected data (i.e., December – April), greater than 60% of all transmission cycles contained ≥ 1 high accuracy (<350m) location.

Effects of backpack PTTs on female gadwalls

We encountered during the pilot study several lines of evidence that suggested the 22g backpack PTTs and/or our attachment method adversely affected behaviors and survival probabilities of female gadwalls. Those lines of evidence included the following: 1) 5 (31%) radiomarked females died within 1 week of marking, 2) both female gadwalls killed by hunters were flying as single birds when shot (confirmed via conversation with hunters), 3) one of the harvested females lost 200g of body mass (original body mass = 900g) between time of radiomarking and harvest (2 week time span – mass loss confirmed by physical examination of harvested female), 4) mortality of female PTT 34452 presumably caused by energetic exhaustion after 1,300 mile non-stop northward migration, and 5) later than expected mean date of departure from Louisiana (18 April 2007). We recognize that this PTT model and attachment method have been used successfully with other species of dabbling ducks (e.g., northern pintail, mallard) and that one possible explanation may relate to our relative inexperience with this PTT attachment method. It should be noted, however, that we practiced the attachment procedure on captive mallards >12 times prior to launching this pilot study. During this pilot study, gadwalls apparently exhibited a high level of sensitivity either to the PTT, the harness-based attachment method, our attachment capabilities, or some combination thereof.

Status of pilot study

Four PTTs continued to transmit data at the time this report was written (Figure 3). Based on duty cycle configurations we expect these PTTs to continue transmitting for approximately 1 additional month. We failed to capture and radiomark our intended sample of 25 female gadwalls during autumn – winter 2006 – 2007. Because of this and our retrieval of PTTs from the 2 harvested birds, we have 11 backpack PTTs available for deployment during a full-scale study. Our primary intent of deploying these PTTs will be to further assess the potential impacts of backpack PTTs on behavior and survival of female gadwalls.

Implications for Full-scale Study

Capturing adequate sample of female gadwalls

Our failure to capture large numbers of female gadwalls during this pilot study was primarily related to weather complications and lack of staff or technicians assigned full-time to capture duties. Based on conversations with individuals extensively experienced in capturing ducks in Louisiana wetlands during autumn and winter (e.g., Paul Link, Bruce Davis), we believe that capturing an adequate number of female gadwalls for a full-scale study is entirely possible if we assign sufficient human resources to this duty. Indeed, that is our plan for the full-scale study.

Regional and long-range movements of female gadwalls

Assuming data collected from female gadwalls equipped with backpack PTTs is representative of the larger population of female gadwalls, it appears that long-range movements during winter are infrequent and unlikely to preclude the use of VHF radiotelemetry technology during a full-scale study. However, our choice of telemetry technology for a full-scale study will depend on multiple factors (see below).

Conventional vs. satellite telemetry for full-scale study

Because of potential adverse effects of backpack transmitters on female gadwalls, we have decided to use neither VHF nor satellite backpack transmitters. Abdominal implant transmitters with percutaneous (i.e., external) antennas are available in VHF and satellite telemetry technology, and these transmitters have been used successfully (with comparatively minor adverse effects) with numerous species of ducks and geese. We previously did not consider satellite telemetry for a full-scale study because of perceived low resolution of estimated locations. However, our analyses of locational accuracy data suggested that satellite telemetry may indeed provide a sufficient number of high accuracy (i.e., <350m) locations for winter habitat use studies.

We also recognize that financial considerations are important when deciding between VHF and satellite telemetry for a full-scale study. The cost of individual satellite transmitters used in this pilot study was approximately 13 times what we would expect to pay for individual VHF transmitters (i.e., \$2,550 vs. \$200). However, female gadwalls monitored during this pilot study spent a majority of their time in the vast coastal marshes of southwest Louisiana. The limited detection range afforded by VHF telemetry and poor vehicular access throughout the coastal marshes would combine to likely necessitate monitoring females equipped with VHF transmitters primarily from fixed-wing aircraft. Prevailing aircraft and pilot rental rates available from flying services in southwest Louisiana are currently substantial. Consequently, our budget estimate for a full-scale study employing satellite telemetry is comparable to that for a full-scale study employing VHF telemetry.

We continue to engage partners and external professionals in our discussion of the appropriate telemetry technology for the full-scale study, but we are currently leaning heavily towards using implant satellite transmitters. More detailed information related to this and other aspects of project planning for the full-scale study will be forthcoming to our research partners.

Acknowledgments

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Literature Cited

- LeSchack, C. R., S. K. McKnight, and G. R. Hepp. 1997. Gadwall (*Anas strepera*). In A. Poole and F. Gill, editors. The birds of North America, No. 283. Academy of Natural Sciences, Philadelphia, Pennsylvania, and American Ornithologists' Union, Washington, D. C. 28pp.
- Miller, M. R., J. Y. Takekawa, J. P. Fleskes, D. L. Orthmeyer, M. L. Casazza, and W. M. Perry. 2005. Spring migration of Northern Pintails from California's Central Valley wintering area tracked with satellite telemetry: routes, timing, and destinations. Canadian Journal of Zoology 83:1314-1332.

Table 1. Age, fate, and date of departure from Louisiana of 16 female gadwalls captured on Rockefeller State Wildlife Refuge in Cameron Parish, LA and equipped with 22g satellite transmitters (i.e., Platform Transmitter Terminals [PTTs]).

PTT No	Date marked	Female age	Fate	Date of fate	Comments	Date of departure from Louisiana
33231	8-Dec-06	Juvenile	Likely dead	25-Dec-06	Lost signal	Not applicable
33670	8-Dec-06	Adult	Likely dead	27-Dec-06	Lost signal	Not applicable
33245	8-Dec-06	Juvenile	Dead	26-Apr-07	Confirmed via sensor	20-Apr-07
34293	8-Dec-06	Juvenile	Alive	20-Jun-07	Remains alive	22-Apr-07
34446	8-Dec-06	Juvenile	Dead	9-Jan-07	Harvested	Not applicable
34447	8-Dec-06	Adult	Likely dead	3-May-07	Lost signal	28-Apr-07
34448	8-Dec-06	Juvenile	Likely dead	14-Dec-06	Lost signal	Not applicable
34451	8-Dec-06	Adult	Dead	27-Dec-06	Harvested	Not applicable
34452	8-Dec-06	Adult	Dead	6-Apr-07	Confirmed via sensor	24-Mar-07
68110	8-Dec-06	Juvenile	Likely dead	15-Dec-06	Lost signal	Not applicable
68112	8-Dec-06	Juvenile	Likely dead	15-Dec-06	Lost signal	Not applicable
68113	8-Dec-06	Adult	Dead	15-Dec-06	Confirmed via sensor	Not applicable
68114	8-Dec-06	Juvenile	Alive	20-Jun-07	Remains alive	25-Apr-07
68117	8-Dec-06	Adult	Alive	20-Jun-07	Remains alive	23-Mar-07
68119	8-Dec-06	Adult	Alive	20-Jun-07	Remains alive	21-May-07
68120	8-Dec-06	Adult	Dead	15-Dec-06	Confirmed via sensor	Not applicable

Table 2. Number and mean percent of geographic locations received during 8 December 2006 – 2 May 2007 and assigned to Argos location classes from 9 female gadwalls captured in Cameron Parish, LA and equipped with 22g satellite transmitters (i.e., Platform Transmitter Terminals [PTTs]).

Argos location class	Estimated accuracy ^a	<i>n</i> ^b	\bar{x} % ^c	SE	95% CI
3	<150m	229	14.3	2.6	8.2 - 20.3
2	150m - 350m	306	19.3	2.3	13.9 - 24.6
1	350m - 1000m	442	28.7	1.4	25.3 - 32.1
0	>1000m	434	26.9	5.4	14.3 - 39.6
A	no estimate	58	3.8	0.7	2.1 - 5.4
B	no estimate	80	5.7	0.9	3.4 - 8.1
Z	invalid location	23	1.4	0.3	0.6 - 2.1

^a Estimates of locational accuracy provided by Service Argos, CLS America Inc.

^b Number of locations received and assigned to an Argos location class.

^c Estimated by calculating for each female the percentage of all locations in each class and averaging these percentages across individual females.

Table 3. Mean percent of transmission cycles during 8 Dec 2006 – 13 May 2007 containing ≥ 1 estimated locations in Argos accuracy location classes 3 (LC3) or 2 (LC2) for 9 female gadwalls captured in Cameron Parish, LA and equipped with 22g satellite transmitters (i.e., Platform Transmitter Terminals [PTTs]).

Time period	<i>n</i> PTTs	No. transmission cycles with ≥ 1 LC3 or LC2 location	Total no. transmission cycles	\bar{x} % transmission cycles with ≥ 1 LC3 or LC2 location ^a
December 2006	9	35	52	67.6
January 2007	8	43	70	61.1
February 2007	7	42	61	68.5
March 2007	7	43	61	73.1
April 2007	7	42	62	65.3
May 2007	6	16	20	85.0
Dec 2006 - May 2007	9	221	326	67.2

^a Estimated by calculating for each PTT the percent of transmission cycles with ≥ 1 LC3 or LC2 location, and then averaging across PTTs to generate mean percent of transmission cycles with ≥ 1 LC3 or LC2 location. One transmission cycle equals one complete "on" period in the PTT duty cycle.

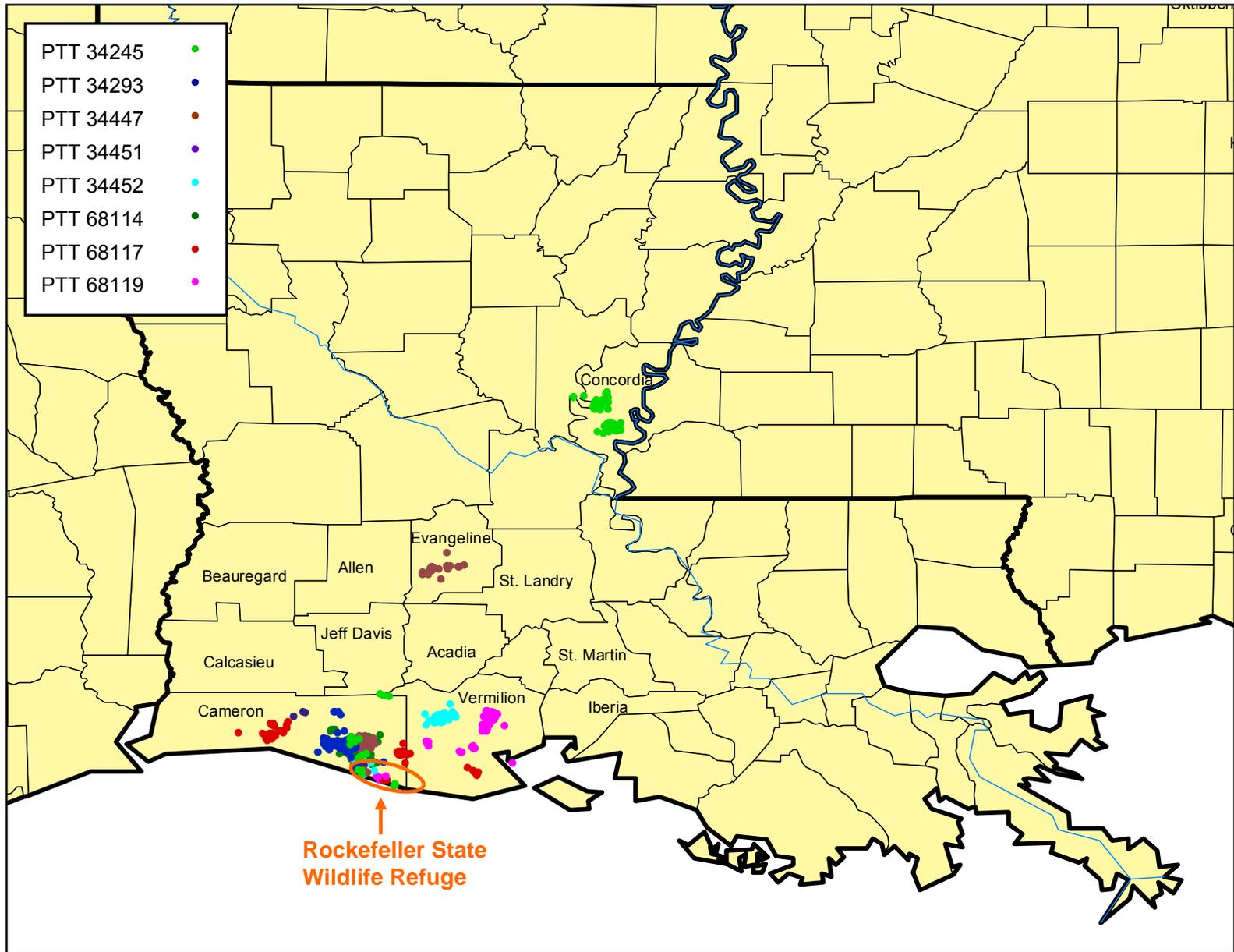


Figure 1. Estimated locations during winter 2006 – spring 2007 of 8 female gadwalls captured at Rockefeller State Wildlife Refuge in Cameron Parish, LA and equipped with 22g satellite transmitters (i.e., Platform Transmitter Terminals [PTTs]).



Figure 2. Estimated spring migration paths of 7 female gadwalls captured at Rockefeller State Wildlife Refuge in Cameron Parish, LA and equipped with 22g satellite transmitters (i.e., Platform Transmitter Terminals [PTTs]). Dates of departure from Louisiana varied among individuals but ranged from 24 March – 21 May 2007.



Figure 3. Estimated spring migration paths and current locations of 4 female gadwalls that remained alive at the time of this report (20 June 2007). Females were captured at Rockefeller State Wildlife Refuge in Cameron Parish, LA and equipped with 22g satellite transmitters (i.e., Platform Transmitter Terminals [PTTs]).

Appendix 1

Periodic updates from Gadwall Tracking Web Site

Dec 11, 2006 -

Ducks Unlimited biologist, Louisiana Department of Wildlife and Fisheries biologists, and Louisiana State University graduate students captured and radiomarked 16 hen gadwalls at Rockefeller State Refuge on the evening of Dec 8, 2006. Birds were released at capture site on Rockefeller Refuge the following morning.

Dec 18, 2006 –

We have quickly lost the signal of 4 radiomarked hens. From previous radiotelemetry studies we know that mortality risk for marked birds increases immediately following attachment procedures. Possible causes for increased risk during this time include capture and stress-induced mortality and lower vigilance for predators as birds adjust to the transmitter. Our failure to detect signals from these transmitters could be an indication that the hens have died, but without period signals definitive conclusion about the status of these birds will be elusive. We are receiving data from 1 of the remaining hens that is beginning to suggest a definite mortality. The satellite transmitters used in this study employ an 'activity sensor' to determine if a transmitter is completely stationary or otherwise experiencing regular motion. Currently this data is suggesting this bird may be dead and lying motionless. Examination of subsequent data from this bird will confirm or correct our suspicions. All other marked hens are moving around the general area where they were captured.

Dec 26, 2006 –

We received word this morning from a hunter in southwest Louisiana indicating that a member of his hunting party harvested Gadwall 01 on Christmas day near

Lacassine National Wildlife Refuge. It appears this bird traveled north and west from Rockefeller and had only been in the area where it was harvested for fewer than 2 days. We congratulate these hunters on a successful day afield and thank them for reporting this vital information. We remain unable to detect signals from the 4 missing hens mentioned in our Dec 18 update. Further examination of data received over the past week has confirmed that 1 of the remaining hens is dead and has likely been so since Dec 15. We are uncertain of the cause of death but suspect either predation or capture and stress-induced mortality. The remaining 11 hens are alive and although the majority remain near Rockefeller, some are beginning to exhibit larger movements into coastal marsh and rice fields north and east of Rockefeller.

Jan 02, 2007 –

Happy New Year to all our gadwall trackers! Since our last update we have lost signals from gadwalls Melissa and Jamie. The transmitters used in this study are programmed to transmit signals for only 6 out of every 78 hours, with this cycle systematically repeating until battery life expires (approximately 6 – 7 months). Because of this short transmission period and the fact that satellite coverage is poor for southern latitudes in North America, periodic missing signals may not be unusual. More time must pass before we speculate about their status. All other hens continue to move around southwest Louisiana. Visit the tracking map for more details on the movement of individual birds. Ducks Unlimited and other Gulf Coast Joint Venture partners will subsequently summarize these movement and habitat use data to better inform waterfowl needs and wetland conservation strategies along the Louisiana and Texas coasts.

Jan 10, 2007 –

We were contacted earlier this week and informed that another marked gadwall

hen was harvested over the weekend. Lou was shot and retrieved on Sunday, January 7 by hunters in the marsh area north of Rockefeller Refuge. As you can see from the map, Lou had spent a few days during late December in the vicinity of Cameron Prairie National Wildlife Refuge. Over the past 2 weeks she had spent much of her time in the marshes just north of Rockefeller. This was the area where she was ultimately harvested. Congratulations to these hunters and thanks for reporting this information. Matilda becomes the first of our gadwall hens marked with satellite transmitters to make a large move out of the Louisiana coastal zone. Last night (Jan 10) we collected three locations for Matilda near the northern border of Red River Wildlife Management Area in Concordia Parish. We eagerly await Matilda's next data transmission (Jan 13 – 14) to see if she remains in this area or returns to the Louisiana coastal marshes. Larwen has also moved recently and returned to an area west of Abbeville where she spent much time during late Dec. We still have not regained signals from Melissa or Jamie.

Jan 18, 2007 –

After nearly a month without detecting signals from Melissa and Jamie, we believe it is likely that they have succumbed to unknown mortality factors. Consequently, we have removed their labels from the map. We will post any additional information we learn about Melissa and Jamie. Matilda appears to have found suitable habitat near the northern edge of Red River Wildlife Management Area as all recent locations are clustered in that vicinity. All other active birds remain in southwest Louisiana. Use the “previous locations” feature and activate the different layers on the interactive map site to explore the interesting movement patterns that are beginning to emerge for certain birds. We have spent considerable amounts of time this past week on Rockefeller State

Wildlife Refuge and Cameron Prairie National Wildlife Refuge trying to capture our remaining sample of birds. Our efforts have thus far been unsuccessful and persistent, heavy rain across southwest Louisiana continues to challenge our efforts.

Feb 02, 2007 -

Effective Jan 26, we officially ceased efforts to capture and mark the remaining 11 female gadwalls. This decision was collectively made in light of the continued difficulty we were experiencing with capturing gadwalls during late winter. Most gadwalls are paired by January and consequently less likely to gather in large concentrations, which are necessary to effectively capture gadwalls with the methods used in this study. We furthermore made this decision the hunting season in Louisiana and Texas is now over and ducks will soon be migrating northward. Because a primary objective of this pilot study was to monitor movements of female gadwalls during winter, which are likely influenced by hunting disturbance, information collected after the hunting season and during spring is less valuable for providing guidance for the full-scale study. We will refurbish the batteries in the remaining 11 PTTs and prepare for their deployment during the full-scale study that is expected to begin Oct - Nov 2007.

We continue to monitor the movements and status of 7 marked females in Louisiana. We have not detected any additional mortalities or significant movements over the past few weeks. We are eager to learn when and along which paths these females will begin their northward migration.

Feb 20, 2007 -

Not much movement has occurred since our last update. Gray recently moved eastward into Vermillion parish, but all other birds remain in the general vicinity of their previous locations. With warmer temperatures expected in south Louisiana

over the next few weeks, it won't be a surprise if a few birds start moving northward.

March 8, 2007 -

Still nothing very exciting to report from our marked gadwalls in south Louisiana. Despite the occurrence of warmer temperatures in south Louisiana, we have yet to see any major movements. We have, however, observed over the past few weeks an increase in the frequency of short-range movements by our marked gadwalls. There could be several reasons for this. Prior to spring migration, ducks (and other migratory birds) usually increase the amount of time spent feeding to accumulate fat reserves necessary to fuel their long journey back to the breeding grounds. The short movements we are observing from our marked birds could indicate that they are trying to locate and take advantage of high quality foraging areas across south Louisiana. Conversely, these movements may simply be a response to lower disturbance in the marsh since the closing of the 2006 - 07 duck hunting season. Regardless, these movements are not terribly surprising. Average to slightly above average temperatures across south Louisiana are forecast for the next 2 weeks. Please stay tuned for spring migration.

March 26, 2007 -

We were beginning to wonder if the satellite transmitters were impacting the long-range flight capabilities of our marked birds, because for the past month few months we have observed virtually no long-range movements. Then voila - data arrived this morning and revealed that marked female Gray has departed southwest Louisiana and traveled to Cross County, Arkansas. Visits by DU and Gulf Coast Joint Venture staff and partners to the marshes of southwest Louisiana over the past few weeks have confirmed that large concentrations of

ducks (mostly blue-winged and green-winged teal and northern shovelers, but some gadwall) remain in the areas where the majority of our marked females are currently located. Gray's recent movement into Arkansas coupled with the large number of ducks still in Louisiana has eased some of our concerns about potential impacts of satellite transmitters on long-range flight capabilities of gadwalls. None of the other females have yet made significant northward movements, but we expect them to do so in the next few weeks.

April 5, 2007 –

As you can see from the interactive map, we observed over the past week more radiomarked gadwalls beginning their spring migration back to the breeding grounds. The most impressive move came from Muriel. On Friday, March 23 Muriel was located near the town of Abbeville in Vermillion Parish, Louisiana. Just three days later on Monday, March 26 Muriel was located approximately 10 miles northwest of Devils Lake, North Dakota. Hence, Muriel flew greater than 1,300 miles in less than 72 hours. Although we have long known ducks, geese, and other migratory birds make these long-distance flights twice each year, our ability to track them for individually marked ducks seems to make them even more amazing. You may also notice that Dorothy recently made a short move north to Evangeline Parish, Louisiana.

April 25, 2007 –

The latest news this week is that Matilda recently made a short flight north into the rice-growing region of Arkansas. She is currently located in Prairie County, Arkansas, just a few miles north of Stuttgart. Those of you following closely may have also noticed that we recently lost contact with Muriel after her trek to North Dakota. We went through a period of about 2 weeks during which we received no signal from her transmitter. The good news is that we recently received a signal

from Muriel which indicates she is still in North Dakota. However, some of the data received along with that location seems to suggest she may be dead. We'll simply have to wait until more data has been acquired before we can confirm that suspicion. All other birds remain in the general area of their previous locations.

April 27, 2007 –

As you can see from the interactive map, several radiomarked gadwalls made big moves within the past few days. Only Dorothy and Larwen now remain in Louisiana. Evelyn Gay's move is somewhat unique from all previous long-range movements because she traveled farther west and has temporarily settled in Kansas. Gray and Sandy are both currently in Iowa, with Gray having stopped in Mills County and Sandy in Wright County. Unfortunately, we did confirm with today's data that Muriel is dead. Muriel was last known to be alive on April 5, but we believe she perished shortly thereafter. We are uncertain about what may have lead to her death. Stay tuned for more updates as we expect additional movements by these birds over the next few weeks.

May 15, 2007 –

With Muriel's recent death, we now have only 6 radiomarked female gadwalls remaining. Unfortunately, we have lost contact with Dorothy and Matilda. We last detected Dorothy's signal on May 3, at which time she was located in south central North Dakota. Matilda was last detected on May 6 with her signal originating from east-central Missouri. We are uncertain what, if anything, may have happened to these birds. Stay tuned to see if these birds show up again. Gray has moved quite rapidly to the prairie breeding grounds since departing eastern Arkansas shortly after April 17. She also becomes the first of our radiomarked gadwalls to reach Canada. Larwen continues to buck the trend and is still located in Vermillion parish, Louisiana. Activity sensors in Larwen's

transmitter suggest she remains alive, but for some reason has chosen to hang around in Louisiana longer than expected. Recent calculations indicate we have about 1 month left on the batteries in these transmitters, so we still have some time remaining to figure out if Larwen plans to leave Louisiana for the summer.

June 27, 2007 –

We confirmed since our last update that Matilda is dead. We are uncertain what caused her death, but her data suggest she died sometime around April 26. We continue to suspect that Dorothy is also dead. We lost her signal during the first week of May and have not yet received any additional transmissions. Battery failure seems unlikely because voltage measures from the battery were high immediately prior to losing the signal. Although we're uncertain of the exact cause of mortality, we believe avian or mammalian predation offers the most plausible explanation. Numerous studies have documented that nesting ducks each year face high predation pressures on prairie breeding grounds, and gadwalls are no exception to these findings. Four females remain alive and 3 of these (Larwen, Sandy, and Gray) have settled in the heart of the gadwall breeding range in southern and central Saskatchewan. Evelyn Gay has settled outside of the traditional breeding area for gadwalls and other prairie nesting ducks, but such occurrences are not at all unusual. These areas may well provide good nesting habitat for ducks, but because the habitat is more widely scattered they simply support lower densities of ducks than the wetland rich prairie pothole region. And speaking of the prairies....reports on breeding habitat conditions in the US and Canadian prairies have thus far been very positive, and biologists are hoping for a strong breeding effort this year. Stay tuned over the next few weeks because we will continue to monitor the movements of these 4 females until the transmitter batteries expire. Also, be on the lookout for the final

report from our pilot study. We will soon post a download link on this site for those interested in reading it.