

1 **Impact of reproductive effort on survival of Rio Grande wild turkey hens in Texas**

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26 **Abstract**

27 The southeastern portion of the Edwards Plateau of Texas, historically a stronghold of Rio

28 Grande wild turkeys (*Meleagris gallopavo intermedia*), has seen the numbers of turkeys
29 declining since the 1970s. Because hen survival is a key parameter affecting turkey
30 population dynamics, we monitored radio-tagged Rio Grande wild turkey hens on the
31 Edwards Plateau during 2001–2007 to compare survival during the breeding season in areas
32 where turkey abundance has declined versus areas with stable populations. Breeding season
33 survival was best predicted by a model that allowed variation during different periods of the
34 reproductive season (initial nesting; 25 March–21 April, renesting; 22 April–12 June, and
35 post-nesting; 13 June–2 July) and differences between stable and declining regions. Model-
36 averaged estimates of breeding season survival were higher in the stable region (0.88, 95% CI
37 = 0.78–0.94) than in the declining region (0.67, 95% CI = 0.55–0.78). Data collected on
38 nests and hens during the intensive monitoring portion of the study conducted during 2005–
39 2007 indicated that breeding season survival was negatively affected by the amount of
40 reproductive effort each season; that is, the number of days a hen spent incubating a nest.
41 Breeding season (25 March to 2 July) survival (0.86) was higher for non-nesting hens than
42 for hens that nested (0.68; average of 15 days spent nesting). Our results suggest differences
43 in productivity between stable and declining Rio Grande wild turkey populations in the
44 Edwards Plateau of Texas were associated with differences in breeding season survival due to
45 variable reproductive effort, which, when combined with precipitation-dependent boom-bust
46 dynamics common to galliforms in this region, could limit long-term population productivity
47 and maintenance.

48

49 **Introduction**

50 Wildlife conservation is grounded on an understanding of how variation in biotic and abiotic
51 factors influence dynamics of populations of interest. Identifying demographic patterns is
52 central to understanding how survival and recruitment contribute to life history variation and

53 population dynamics in avian populations (Montgomerie and Weatherhead 1988, Martin
54 1995, Ghalambor and Martin 2001). The interaction between individual reproductive effort
55 and mortality of breeding individuals underlies population dynamics research and
56 management of populations (Stearns 1976). Under this perspective, high mortality of
57 breeding individuals favors increased reproductive effort whereas high mortality of offspring
58 favors lower reproductive efforts (Martin 2002). Determining the relationship between
59 population trajectory and population demography is necessary for conservation planning and
60 implementation of management actions.

61 The Edwards Plateau of Texas has long been the historic stronghold for Rio Grande
62 wild turkeys (Walker 1954, Beasom and Wilson 1992). Since the late 1970s, however,
63 surveys conducted by the Texas Parks and Wildlife Department, as well as anecdotal
64 observations by landowners, documented a decline in wild turkey numbers in the
65 southeastern portion of the Edwards Plateau (Randel et al. 2005, Collier et al. 2007a). The
66 reason for this decline was unknown, so we initiated a research program in 2001 to determine
67 whether population demography differed between areas characterized by stable vs. declining
68 turkey abundance.

69 Variability in abundance of a wide variety of avian populations often is attributed to
70 changes in reproductive output. Based on 7 years of research on the reproductive ecology of
71 Rio Grande wild turkeys in this region, we found limited variation between populations
72 classified as stable vs. declining in such reproductive parameters as clutch size (\bar{x} = 10.9 ±
73 3.44 SE and \bar{x} = 10.8 ± 2.73 SE), daily nest survival (0.92 ± 0.02 SE and 0.94 ± 0.005 SE),
74 nesting rates (65% and 58%), rates of nest predation (65 and 67%) nest abandonment (18 and
75 22%) and poult survival (18% survival for first 2 weeks across sites) (Melton 2007,
76 Dreibelbis et al. 2008). Breeding season survival of both male and female Rio Grande wild
77 turkeys was lower than non-breeding season survival and there was preliminary evidence that

78 differences might exist between populations classified as stable vs. declining (Collier et al.
79 2007a).

80 Avian reproduction is physiologically and behaviorally expensive, thus optimal life
81 history strategies must maximize survival of adults relative to reproductive output (Stearns
82 1976). Mortality of wild turkey hens typically is higher during the breeding season as
83 compared to the rest of the year (Vangilder 1992, Vangilder et al. 1987, Palmer et al. 1993)
84 due to increased predation during reproductive activities (incubation and brooding; Palmer et
85 al. 1993). Loss of hens during reproductive activities influences populations in 2 ways:
86 reduction in the number of females producing offspring and reduction in population size.
87 Thus, while reproductive parameters were similar between regions characterized of stable vs.
88 declining turkey abundance, it is plausible that differences in adult female mortality during
89 the reproductive period could contribute to differences in population size and trajectory.
90 Precocial, ground-nesting species (e.g., Orders Galliformes and Anseriformes) exhibit both
91 high reproductive output and high mortality of breeding birds, suggesting an advantageous
92 life-history strategy would be to delay or limit breeding until conditions are optimal for
93 reproduction (Murdoch 1966; but see Jönsson et al. 1991, Sandercock et al. 2005). Collier et
94 al. (2007a) found that breeding season survival of adult wild turkeys differed between stable
95 and declining populations on the Edwards Plateau of Texas. Because survival of breeding
96 female galliforms is intrinsically tied to recruitment (Stearns 1976, Alerstam and Hogstedt
97 1984, Martin 2002), we hypothesized that population declines in the southeastern portion of
98 the Edward Plateau could be due to comparatively low breeding season survival of females.

99 We used radio-telemetry to study female Rio Grande wild turkeys captured on the
100 Edwards Plateau before each breeding season to evaluate factors that could contribute to
101 differences in breeding season survival between areas characterized of stable vs. declining
102 turkey abundance. Specifically, was evaluated whether precipitation-based environmental

103 variation drove hen nesting intensity, whether hen survival differed between stable and
104 declining populations, how differences between juvenile and adult nesting rates affected hen
105 survival, how reproductive phenology and timing of reproductive events (e.g., nesting,
106 renesting, reproductive senescence) affected hen survival, and what affect increasing the
107 amount of time incubating on a seasonal basis have on mortality.

108 **Species and study area**

109 The breeding season of Rio Grande wild turkeys in Edwards Plateau of Texas begins
110 during late February and continues through mid-July/early August, with the majority of
111 reproductive activities occurring April through June. After breeding, hens typically search
112 out clumps of grass or brush offering visual obstruction for use as nest sites (Randel et al.
113 2005). Clutch sizes average 11 eggs (range = 8–16 eggs) (Melton 2007). Hens commonly
114 reneest when initial nests are destroyed. Two nesting attempts are common, but we have
115 documented as many as 4 renesting attempts (5 total nesting attempts). Incubation lasts ~28
116 days. Poults are restricted to ground roosting at night until approximately 2 weeks post-hatch
117 when flight feathers replace natal down. Consequently, poult mortality is much higher during
118 this flightless period as young are much more vulnerable to predators (Hubbard et al. 1999b).

119 We conducted our breeding season study from January 2001 through August 2007 at
120 four research sites on the Edwards Plateau of Texas (Fig. 1). Two sites were located in
121 regions where declines in turkey abundance had occurred (Bandera and Medina counties),
122 and two sites were located in areas where there was no trend in abundance (Kerr and Real
123 counties) (Randel et al. 2005, Collier et al. 2007a). Each site was characteristic of Edwards
124 Plateau topography—rolling divides with limestone bedrock and outcrops with rocky soils
125 (Gould 1975). Our study sites (private ranches or public areas) individually ranged from 9.84
126 to 88.58 km² and all were managed for native and exotic ungulate hunting; livestock grazing
127 occurred on three of the sites (Kerr, Medina, Bandera Counties). Limited turkey hunting

128 occurred on one study site (Real County), and while several properties bordering each site
129 allowed male turkey hunting, harvest over the study was minimal (8 females harvested from
130 >400 radio-tagged individuals).

131

132 **Methods**

133 We captured wild turkeys in each study region between December and March, 2001–
134 2007, using walk-in funnel traps (Davis 1994, Peterson et al. 2003) or drop nets (Glazener et
135 al. 1964) baited with cracked corn (*Zea spp.*) and milo (*Sorghum spp.*). Age was determined
136 for captured individuals as juveniles (individuals entering first breeding season) or adults
137 (second year of breeding or older); sex was determined according to primary molt pattern and
138 feather coloration (Pelham and Dickson 1992). Turkeys classified as juveniles were 6–10
139 months of age at capture. Each individual was weighed and fitted with a uniquely numbered
140 Texas Parks and Wildlife Department aluminum leg band. We radio-tagged turkeys with
141 mortality-sensitive radio-transmitters (69.0–95.0 g; Advanced Telemetry Systems, Isanti,
142 Minnesota, USA), using a modified backpack harness around the wings (Kenward 1987). We
143 tracked radio-tagged individuals daily for the first 2 weeks post-capture to evaluate capture-
144 related loss and located birds visually twice weekly during this period to ensure that radio-
145 tags remained attached.

146 We monitored radio-tagged individuals ≥ 3 times per week from January through
147 August throughout the study (2001–2007) using triangulation, homing, and visual
148 observation (White and Garrott 1990) employing vehicle-mounted 4-element Yagi antennas
149 or a 3-element handheld Yagi antennas. We increased radio tracking to ≥ 5 times per week
150 beginning 1 April to monitor reproductive activities (Randel et al. 2005, Melton et al. 2008).
151 During this period we monitored all individuals until transmitter failure, mortality, or
152 emigration to properties with access restrictions. During the 7 years of radio tracking, we did

153 not observe any adult or juvenile radio-tagged individuals moving between study populations,
154 thus we considered each population demographically distinct.

155 We used data from 2001 through 2007 collected as part of a larger study on Rio
156 Grande wild turkey population dynamics (Collier et al. 2007a,b; Randel et al. 2005, Melton et
157 al. 2008, Dreibelbis et al. 2008) to evaluate spatial, seasonal, and annual variation in hen
158 survival. Randel et al. (2005) evaluated basic reproductive parameters for hens (e.g., nest
159 success); however, we collected more intensive reproductive data (e.g., nest survival, clutch
160 size, poult survival) during 2005–2007 based on additional research objectives. For each hen
161 we determined date of initiation by hen movement patterns (Ransom et al. 1987, Paisley et al.
162 1998, Nguyen et al. 2004) and located nests <3 days after hens had begun incubating to
163 determine nest location and approximated nest age in days by floating eggs (Westerskov
164 1950). We monitored nesting hens by triangulating ≥ 3 times weekly from a distance of ≥ 100
165 m to prevent nest disturbance and assumed the nest was still active if hen locations remained
166 constant. We approached the nest to determine fate only when the hen was no longer in the
167 general area of the nest and used these data to determine time hens spent incubating. In
168 addition, we used motion activated trail cameras (Game Spy 100 and Outfitter Cam, Moultrie
169 Feeders, Alabaster, Alabama, USA) to assist with documentation of nest fate on 21 of 47 and
170 31 of 71 active nests during 2006 and 2007, respectively (Dreibelbis et al. 2008).

171 **Statistical Analyses**

172 For analysis, we considered our known-fate data as ragged telemetry data (Rotella et
173 al. 2004) because our interest was to model changes in survival probabilities over time and
174 across the range of individual-level data (Dinsmore et al. 2002, Rotella et al. 2004). Thus, we
175 estimated probability of daily survival for Rio Grande wild turkey hens during the breeding
176 season using the nest survival approach (Dinsmore et al. 2002), which is a general model for
177 known fate data as implemented in program MARK (White and Burnham 1999). This

178 approach to analyzing known-fate data has increased recently (Hartke et al. 2006, Mong and
179 Sandercock 2007) given its flexibility and ability to incorporate groups and individual
180 covariates that vary over time (Rotella et al. 2004). When estimating survival, we based
181 encounter histories on reproductive phenology. We coded our encounter histories for each hen
182 in the dataset using a 118-day period equivalent to the breeding season (25 March–20 July)
183 based on our 7 years of radio-tracking data. We entered each radio-tagged hen into the
184 dataset at the start of the breeding season (if alive) on 25 March each year ($k=1$). We
185 recorded the last day each radio-tagged hen was known to be alive (l), the final date that
186 either 1) we checked the hen and found mortality had occurred, or 2) a transmitter failure
187 occurred or the hen was lost (e.g., censoring), or 3) the hen was still alive at the end of the
188 study (m), the fate of the hen where 1 = mortality and 0 = survived to end of each breeding
189 season or were censored (f), and the number of unique individual birds that had the same
190 exact encounter history (n). We used an information theoretic approach to model selection
191 and assessed model strength based on AIC_c and Akaike weights (w_i ; Burnham and Anderson
192 2002). When we found evidence of model selection uncertainty ($w_i < 0.8$; Mong and
193 Sandercock 2007), we used multimodel inference and provide model-averaged estimates of
194 survival (Burnham and Anderson 2002).

195 We developed models (Table 1) for the entire period (2001–2007) that focused on
196 broad scale assessment of trends in survival. Production in gallinaceous birds in the semi-
197 arid regions of Texas typically is characterized by regular boom–bust cycles (e.g., quails;
198 Bridges et al. 2001, Hernández and Peterson 2007, Lusk et al. 2007). During our study, we
199 characterized 2001 and 2007 as good years for Rio Grande turkey production based on
200 precipitation amount and timing in the region (Schwertner et al. 2007, Texas Parks and
201 Wildlife Department, unpubl. data). To evaluate whether survival would decline based on
202 increased reproductive activities (days incubating, nesting attempt; Miller et al. 1995), we

203 developed competing models; one model with good years (2001 and 2007) versus poor years
204 (2002–2006) for comparison with models evaluating variation across all years and a model
205 with no variation among years (Table 1). Based on work by Melton (2007), we divided the
206 breeding season into three unequal segments based on nesting chronology of hens on the
207 Edwards Plateau to evaluate seasonal variation in survival due to hen nesting frequency
208 (number of hens actively nesting at any given time). The first period was from 25 March to
209 21 April (28 days), which represented 61% (63/103) of initial nesting attempts (Melton
210 2007). The second period was from 22 April to 12 June (51 days), which represented fewer
211 initial nesting (39% [40/103]), but a majority (89% [53/59]) of renesting attempts for hens
212 available to renest. The final period was from 13 June to 2 July (38 days), representing
213 breeding senescence when hen nesting/renesting attempts declined. We also developed
214 models to evaluate whether there was evidence for regional differences in seasonal survival.
215 In addition, as we hypothesized that juveniles were more likely to nest a single time and then
216 forego renesting attempts (hence reducing overall mortality risk associated with nesting), so
217 we evaluated models to test for this contingency. We used the delta method to calculate
218 standard errors for the model-averaged estimates from the 2001 through 2007 data (Seber
219 1982).

220 We used data collected from 2005 to 2007 to evaluate hen- and nest-specific effects on daily
221 survival of hens. We developed a candidate model set (Table 2) to evaluate individual level
222 factors we hypothesized would explain variation in hen survival. As nesting has been shown
223 to influence hen survival (Martin 1995, Miller et al. 1998), we evaluated impact of the
224 number of days spent incubating using an approach akin to nest–age models (Dinsmore et al.
225 2002). For each individual in our study, in addition to the information required by program
226 MARK, we included covariates for hen age (Juv=1, Ad=2), hen age since initial capture (0–7
227 years), nesting event (nested that year =1, did not nest that year=0), and the cumulative (total)

248 breeding season, 241 individual hens were radio-tagged and available during ≥ 1 breeding
249 season. We tracked 55, 73, 91, 34, 56, 55, 45 hens during the reproductive season each year
250 (2001–2007). We tracked 135 hens for 1 year, 61 for 2, 32 for 3, 10 for 4, and 3 for 5. No
251 hens were tracked consecutively for >5 breeding seasons, although several hens were
252 recaptured after transmitter failure and were re-entered in the dataset the year following
253 capture.

254 The odds of a Rio Grande wild turkey hen initiating a nest during 2007 (good year)
255 were 4.55 (95% CI = 1.78–11.66) times higher than the odds of a hen initiating a nest during
256 2005–2006 (poor years). We found no evidence of differences in odds of a hen initiating a
257 nest between stable versus declining regions (odds ratio: 1.51, 95% CI = 0.587–3.857) and no
258 difference in the odds that adult hens initiated more nests than juveniles during good vs. poor
259 years (odds ratio: 2.92; 95% CI = 0.907–3.69).

260 The best-approximating model indicated that hen survival varied according to a 3-
261 period trend within the breeding season (Table 1). Model averaged daily survival estimates
262 (with unconditional standard errors) for the first period (daily survival within initial nesting
263 period; 25 March–21 April) were 0.9992 (0.00058) and 0.9971 (0.00093) for stable and
264 declining regions, respectively. Daily survival estimates for the second (daily survival within
265 the re-nesting period; 22 April–12 June) and third (daily survival within senescence period; 13
266 June–20 July) were 0.9986 (0.00061) and 0.9990 (0.00040) for the stable, and 0.9968
267 (0.0010) and 0.9961 (0.00099) for the declining regions. Model-averaged breeding season
268 survival was much higher for birds in the stable region (0.88, 95% CI = 0.78–0.94) than birds
269 in the declining region (0.67, 95% CI = 0.56–0.78).

270 Using data collected during the intensive reproductive study focused on nest- and hen-
271 specific variation (2005–2007), we documented 31 mortality events and the best fitting model
272 was one where hen survival was associated with the number of days spent incubating (Table

273 2). While we tested for both age and regional differences based on this model, none were
274 evident based on the ΔAIC_c values. Based on our fixed breeding period of 118 days, hens that
275 did not nest (e.g., DN = 0) had a daily survival estimate of 0.99, with expected breeding
276 season survival of 86%. The number of non-nesting juveniles and adults varied during 2005–
277 2007 across the total number of hens radio-tracked for breeding season (Table 3). Average
278 number of days per nesting attempt during this period was 13 (SE = 1.01) for the stable
279 region vs. 18 (SE = 1.24) for the declining region. Juvenile and adult hens in the stable
280 region spent an average of 22.31 (SE = 10.12) and 21.26 (SE = 11.96) total days on nests,
281 while juvenile and adult hens in the declining region spent 16.50 (SE = 15.96) and 28.56 (SE
282 = 14.71) total days on nests.

283 **Discussion**

284 Our results indicate that differences in breeding season survival of female Rio Grande
285 wild turkeys on regions of the Edwards Plateau of Texas that exhibited stable vs. declining
286 turkey abundance since the late 1970s are due to the amount of time each hen spends
287 incubating. Variation in hen survival was best accounted for by partitioning the breeding
288 season into general periods of nesting activity (initial nesting, renesting, and post-nesting
289 periods; Melton 2007). Differences in breeding season survival over these periods were
290 largely attributable to our regional classification, as those regions characterized by
291 historically stable populations had much higher breeding season survival (0.88) than locations
292 where abundance had declined since the late 1970s (0.67). Our definition of the breeding
293 season (25 March–20 July; 118 days)—based on 7 years of data—was shorter than that
294 defined by Miller et al. (1995), who included the pre-breeding dispersal period through the
295 end of brooding activities (15 March–15 August; 154 days). Using the period from Miller et
296 al. (1995), and assuming the daily survival from our study, survival in our declining region
297 (0.59) was similar to that (0.62) documented by Miller et al. (1995), whereas our estimate for

298 the stable region (0.87) was much higher. Survival of hens during the breeding season on our
299 stable region is among the highest reported for Rio Grande wild turkeys (Miller et al. 1995),
300 but is similar to values reported for eastern wild turkeys (*M. g. silvestris*) [e.g., 0.81 (Palmer
301 et al. 1993), 0.74–0.86 (Roberts et al. 1995), 0.72 (Wright et al. 1996)].

302 Life history theory predicts that in variable environments, such as the semi-arid
303 regions of Texas (Riskind and Diamond 1988), limiting or foregoing reproduction (i.e.,
304 environmental constraint hypothesis; Gasparini et al. 2006) may in turn decrease mortality
305 risk (Stearns 1976). Exposure of turkeys to potential causes of mortality is highest during the
306 reproductive season due to nesting activities (Vangilder 1992, Vangilder et al. 1987, Vander
307 Haegen et al. 1988, Palmer et al. 1993). Speake (1980) identified the period of incubation
308 and the first 2 weeks of brooding as the most likely time for hen predation to occur; however,
309 Hubbard et al. (1999a) and Vangilder and Kurzejeski (1995) found no relationship between
310 eastern wild turkey hen survival and nest-specific activities. We found that differences in hen
311 survival within a study area, but not between regions, were attributable to hen-specific
312 characteristics (e.g., days spent incubating).

313 During good years for reproduction (2001 and 2007), we predicted that the number of
314 breeding individuals would increase, and that survival would subsequently decline (Murdoch
315 1966, Charnov 1993). Although the number of Rio Grande wild turkey hens that nested
316 during 2005–2007 followed this general pattern, our prediction that hen survival would differ
317 between unproductive and productive seasons was not supported by data. We found that hens
318 were more likely to nest during years with higher precipitation than in years with limited
319 precipitation, as did Miller et al. (1995). Adult females also had a higher probability of
320 nesting than juveniles across all years. Juvenile hens may forego the physiological expense
321 of renesting in favor of increasing their likelihood of survival (Stearns 1976, Martin 2002),
322 and this contention was supported by our modeling results ($w_i = 0.332$). Thus, we suggest

323 that maximizing survival of breeding hens relative to reproductive output on the Edwards
324 Plateau of Texas seems to be driven by the reproductive season phenology; these differences
325 in turn are driven by environmental variation related to precipitation timing and amount
326 (Moran 1953, Miller et al. 1995, Schwertner et al. 2007).

327 Although further research is needed to determine exactly why these differences in hen
328 survival exist, it is likely that these answers ultimately will be tied to differences in habitat
329 and related land uses as climatic and edaphic factors are essentially identical across our study
330 sites. Because the oak-juniper savannah in the Edwards Plateau is a disturbance-maintained
331 community (Fuhlendorf et al. 2008, Taylor 2008), creating and maintaining ample usable
332 space for reproductive activities (Badyev 1995, Guthery 1997) should diminish nest
333 predation, hence reducing the need for long distance movements by hens between nesting
334 attempts. Should managers wish to implement habitat management practices designed to
335 increase hen survival during the reproductive season prior to completion of further research,
336 we suggest long-term monitoring of population responses to these habitat changes. Because
337 precipitation cannot be experimentally controlled, but can provide suitable habitat nearly
338 anywhere within our study regions during good years, it is critically important to evaluate
339 management practices over the long term in these semiarid regions so that population
340 responses to habitat manipulation can be differentiated from those caused by the boom-bust
341 dynamics common to galliforms in this region.

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Table 1. Candidate models used to examine the effects of region (stable or declining), age (juvenile or adult) on 3 delineated periods of breeding activity; initial nesting; 25 March–21 April, re-nesting period; 22 April–June–2 July) in breeding chronology on daily survival of radio-tagged Rio Grande wild turkey hens on the between 2001–2007. Numbers in each model (1, 2, 3) denote the 3 breeding period above and models which denoted at the end of each equation otherwise are considered constant across those factors.

	Model notation	No. of parameters
	S [Juv(1)=Ad(1); Juv(2)=Ad(2); Juv(3)=Ad(3)] Different by Region	6
	S [Juv(1)=Ad(1); Juv(2)≠Ad(2); Juv(3)=Ad(3); Juv(2)=Juv(3)] Different by Region	6
	S [Juv(1)=Ad(1); Juv(2)≠Ad(2); Juv(3)=Ad(3); Juv(2)=Juv(3); Ad(1)=Ad(2)] Different by Region	4
	S [Juv(1)=Ad(1); Juv(2)≠Ad(2); Juv(3)=Ad(3)] Different by Region	8
	S [Juv(1)=Ad(1); Juv(2)=Ad(2); Juv(3)=Ad(3)] 2001=2007, 2002=2003=2004=2005=2006 (Good versus Bad Years)	6
	S (Constant)	1
	S [Juv(1)=Ad(1); Juv(2)=Ad(2); Juv(3)=Ad(3)]	3
	S [Juv(1)=Ad(1); Juv(2)≠Ad(2); Juv(3)=Ad(3)]	4
	S [Juv(1)≠Ad(1); Juv(2)≠Ad(2); Juv(3)=Ad(3)] Different by Region	5
	S [Juv(1)=Ad(1); Juv(2)=Ad(2); Juv(3)=Ad(3)] Different by Year	18
518	a. Minimum $-2\ln L = 730.4868$	

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Table 2. Candidate models used to examine the effects of nest- and hen-specific information on daily survival of radio-tagged Rio Grande wild turkey hens on the Edwards Plateau of Texas between 2005–2007.

Model notation	No. of parameters	Deviance	ΔAIC_c^a	w_i
S _{Days on Nest}	2	237.11	0	0.420
S _[Juv (Days on Nest) ≠ Ad (Days on Nest)]	3	235.82	0.71	0.297
S _[Stable (Days on Nest) ≠ Declining (Days on Nest)]	3	236.28	1.17	0.236
S _[Nest Attempt]	2	242.53	5.42	0.028
S _(Constant)	1	247.89	8.78	<0.01
S _[Hen Age]	2	246.77	9.66	<0.01
S _[Age Since Capture]	2	246.80	9.69	<0.01
S _[Cumulative Days on Nest]	2	247.61	10.50	<0.01
S _[Nested]	2	247.88	10.77	<0.01

522 a. Minimum $-2\ln L = 237.1138$

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Table 3. Percentage of Rio Grande wild turkey hens that nested (*N*) by age class (Juv, Ad) of 156 total radio-tagged hens tracked on the Edwards Plateau of Texas during 2005–2007.

Population status	Age Class	2005	2006	2007	Pooled
Stable	Juv	47 (30)	100 (1)	50 (2)	48.5 (33)
	Ad	68.8 (16)	84.8 (26)	88.9 (18)	81.7 (60)
Declining	Juv	0 (0)	40 (15)	100 (4)	52.6 (19)
	Ad	60 (10)	33 (12)	85 (20)	64.3 (42)

535 List of Figures:

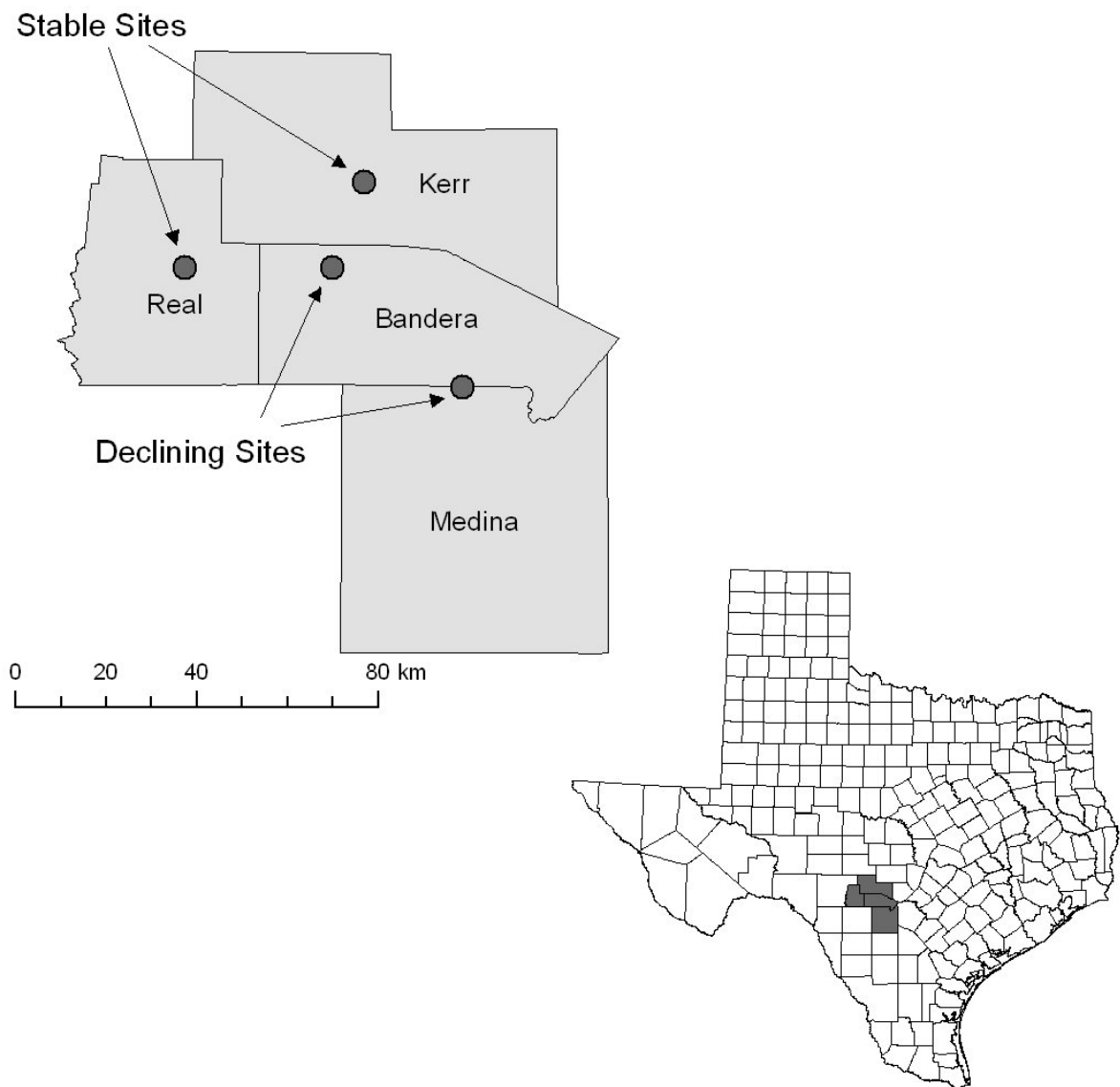
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537 Figure 1: Study site locations in the Edwards Plateau of Texas, USA.

538 Black areas shown on the state map represent the 4 counties in the

539 southeastern Edwards Plateau where research on Rio Grande wild

540 turkey survival was conducted from 2001 through 2007.



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