Duck Nest Monitoring at Grizzly Island Wildlife Area: 2009 Report

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BACKGROUND

The Grizzly Island Wildlife Area is a 3,600 ha wildlife refuge managed by the California Department of Fish and Game. It resides in the Suisun Marsh of California (38º08' N, 121º59' W), and contains roughly 1,600 ha of uplands managed for waterfowl and pheasant production. Within these fields, dabbling ducks have historically nested at very high densities; however, current nesting densities and nest success rates have declined to low levels (**Figures 1 and 2**). In the past decade, nest success has often been lower than the 20% nest success estimated to maintain a stable population. This significant decline of nest success over time could be attributed to several factors, but the most likely explanation involves the interaction between predators and habitat quality.

In an attempt to reverse this decline in dabbling duck nest densities and nest success, the California Department of Fish and Game, Wildlife Conservation Board, California Waterfowl Association, and USGS implemented a multi-year plan to restore habitat quality and monitor duck breeding response. This plan includes (1) baseline nest monitoring in 2008, (2) habitat and water delivery improvements to the nesting fields in 2008-2010, and (3) monitoring duck breeding response in 2011-2013. Please see our 2008 report for further details about the habitat restoration project (*Ackerman et al. 2009*).

In 2009, Kevin Ringelman began working on his dissertation project at Grizzly Island. Kevin is a Ph.D. student working with John Eadie at UC Davis on a project involving duck habitat selection and nest predator behavior. This report summarizes duck nest monitoring activities in 2009, and presents preliminary data on waterfowl and predator behavior.

DUCK NEST MONITORING

During 2009, we monitored duck nesting in 16 fields (321 ha total) within the 13 Field Complex (13D, 13E, 13F, 13G, 13I, and 13M) and 14 Field Complex (14E, 14G, 14J, 14K, 14M, 14N, 14P), as well as two other fields within the wildlife area (11 and 15). The habitat in many of the 13 and 14 fields was poorly suited for nesting waterfowl this year due to habitat manipulation activities associated with the multi-year restoration plan (**Figure 3**) that were put on hold due to the California state budget crisis, and halted restoration grants. As a consequence, only 13 and 14 fields that were not manipulated in the prior year were searched, and fields 11 and 15 were included to increase sample sizes.

We searched for duck nests from April 1st to July 1st following standard nest searching procedures (*Klett et al. 1986*). Each field was searched four or five times at 3-week intervals until July 1st, or until no new nests were found. Nest searches began at least two hours after sunrise and were finished by 1400 hours to avoid missing nests due to incubation recesses by females. We searched for nests using standard ATV rope-drag techniques, candled eggs to determine incubation stage, marked nest locations with bamboo stakes 4 m north of the nest bowl, and rechecked nests every week until nest termination.

DUCK NEST SITE VEGETATION

For each real duck nest, we randomly picked a potential nesting site by randomly selecting an azimuth (1-360°) and distance (1-30 m) from the real nest. At both the real nest and paired random nest sites we used a Robel pole to measure the vegetation's average visual obstruction height.

DUCK NEST ANALYSIS

Duck nest success was calculated using Mayfield (1975) methods, as modified by Johnson (1979) for waterfowl. We considered a nest successful if at least one egg hatched. Nests that were abandoned due to researcher disturbance, and nests that were found partially depredated were excluded from analyses. Mayfield nest success rates were used to estimate nesting densities.

DUCK NEST MONITORING RESULTS

Nest Density

In total, we found 369 nests in 2009, including 230 Mallard, 135 Gadwall, 3 Cinnamon Teal, and 1 Northern Pintail nests (**Figure 4**). We also found 15 Northern Harrier and 1 Short-eared Owl nests. Mallard nest densities remained low, at only 0.88 nests per ha. Gadwall nest densities were also low, at 0.66 nests per ha. These densities are still well below the long term average of nests per ha for Mallards (**Figure 1**) and Gadwall.

Nest Initiation Dates

The mean Mallard nest initiation date in 2009 was 25 April (range: 11 March to 17 June) with a central span of 53 days. The mean Gadwall nest initiation date was 14 May (range: 12 April to 16 June) with a central span of 41 days (**Figure 5**). This was likely due to the relatively cool temperatures we enjoyed throughout May and early June.

Nest Success
Mean Mallard nest success in 2009 was 28.7%, close to the long-term average nest success observed at Grizzly Island, and well above the 15-20% nest success required to maintain a stable population. Gadwall nest success was similarly high at 24.5%, which is slightly above the long-term average.

Variation Among Fields
Nest densities and nest success were highly variable among fields. Densities ranged from 0.36 nests/ha (Field 15) and 0.43 nests/ha (14M) to 7.16 nests/ha (13G). Nest success ranged from 2.7% (14K) to 56.8% (Field 15) and 55.0% (14P). In particular, fields 13D-13G supported high densities of ducks, perhaps because these fields formed a contiguous block of undisturbed habitat (**Figure 3**). Table 1 describes in detail nest densities and nest success by field.

Table 1. Nesting summary by field.

Field	Hectares	# Mallard Nests	# Gadwall Nests	# Cinnamon Teal Nests	# Northern Pintail Nests	# Total Ducks	Average Nest Success	Average Nest Density per ha
13D	10.21	19	10			29	41.0%	3.11
13E	12.91	14	10			24	36.2%	2.14
13F	13.73	22	18			40	17.8%	5.31
13G	13.73	42	16			58	16.3%	7.16
13I	12.91	7	7			14	41.1%	1.13
13L	5.83	5	2			7	39.3%	1.31
13M	11.33	34	11			45	39.5%	4.47
14E	23.97	14	15		1	30	28.4%	1.32
14G	21.26	11	4			15	27.0%	0.87
14J	23.17	8	2	1		11	14.4%	0.60
14K	20.44	6	1			7	2.7%	1.81
14M	20.5	8	1			9	45.1%	0.43
14N	19.21	6	5			11	21.0%	0.99
14P	23.02	3	7	1		11	55.0%	0.63
15	53.2	7	13	1		21	56.8%	0.36
11	35.24	24	13			37	10.1%	2.81
ALL	**320.66**	**230**	**135**	**3**	**1**	**369**	**26.7%**	**1.56**

Nest Site Vegetation
Both Mallard and Gadwall females tended to select taller vegetation than what was considered available. Nest site vegetation at Mallard nests (66.65±1.32 cm) was taller than vegetation at random paired sites (56.56±1.53 cm; t_{230}=7.63, p<0.0001). Similarly, nest site vegetation at Gadwall nests (60.12±1.75 cm) was taller than at paired random sites (51.45±1.83 cm; t_{135}=4.94, P<0.0001) (**Figure 6**). Additionally, there was a significant negative relationship between the difference between nest vegetation height and random vegetation height and random vegetation height for both Mallards (N=230, R^2=0.44, P<0.0001) and Gadwall (N=135, R^2=0.38, P<0.0001). Hens selected relatively tall vegetation in short-grass areas, and relatively shorter vegetation in tall-grass areas (**Figure 7**).

Hen Banding
To assess year-to-year habitat selection decisions made by individual hens, efforts were made in 2009 to capture and band hens on the nest. A total of 74 hens (38 Mallards, 35 Gadwall, 1 Northern Pintail) were captured on the nest by using long-handled dipnets (63 birds), Weller-style cage traps (9 birds), and 2 birds were captured by hand. Of 74 captured, 9 had been previously banded.

Incubation Behavior
In 2009, iButton temperature loggers were used to collect detailed information on female incubation behavior and timing of nest fate. iButtons were attached to golf tees and placed in the bottom of the nest bowl, and recorded nest temperature every five minutes. 469 weeks of data were collected in 214 different nests. These data can be gleaned for many useful pieces of information: (1) timing of depredation events (or other fate), and therefore nest predator type (avian vs. mammal) can usually be determined, (2) latency to return after disturbance, (3) timing of incubation recesses - incubating females at GIWA seem to go on recesses at "unusual" times of the day (e.g. 0000 hrs. to 0400 hrs., instead of typical afternoon nest breaks), (4) spatial synchrony of recesses or spatial flushing synchrony when a predator is in the area. An example of iButton incubation data is presented in **Figure 8**.

Predator Telemetry Results
2009 was a pilot year for studying nest predator behavior. Over 577 trap nights, we captured 4 skunks, 15 raccoons (approximately 5-8 different animals), 2 opossums, and 1 feral cat (**Figure 9**). Striped skunks are the targeted species for this predator study: of the 4 skunks captured, 1 was not collared, 2 received VHF-only collars, and 1 died during handling. VHF tracking on foot revealed useful basic information on home range size and den locations. In 2010 we plan to build on this pilot year's successes to deploy GPS equipped collars on skunks to track movements minute-by-minute. As an example of this technology's potential, we affixed a skunk with a GPS collar along Putah Creek just outside of Davis, CA (**Figure 10**).

LITERATURE CITED

Ackerman, JT, J Kwolek, R Eddings, D Loughman, and J Messerli. 2009. Evaluating upland habitat management at the Grizzly Island Wildlife Area: effects on dabbling duck nest density and nest success, year 1 baseline report. Administrative Report, U. S. Geological Survey, Western Ecological Research Center, Davis, CA and California Waterfowl Association, Sacramento, CA; 26 pp.

Johnson, DH. 1979. Estimating nest success: the Mayfield method and an alternative. Auk 96:651-661.

Klett, AT, HF Duebbert, CA Faanes, and KF Higgins. 1986. Techniques for studying nest success of ducks in upland habitats in the prairie pothole region. U. S. Fish and Wildlife Service Resource Publication Number 158:24 pp.

Mayfield, HF. 1975. Suggestions for calculating nest success. Wilson Bulletin 87:456-466.

Figure 1. Nest densities for Mallards at GIWA from 1985-2009.

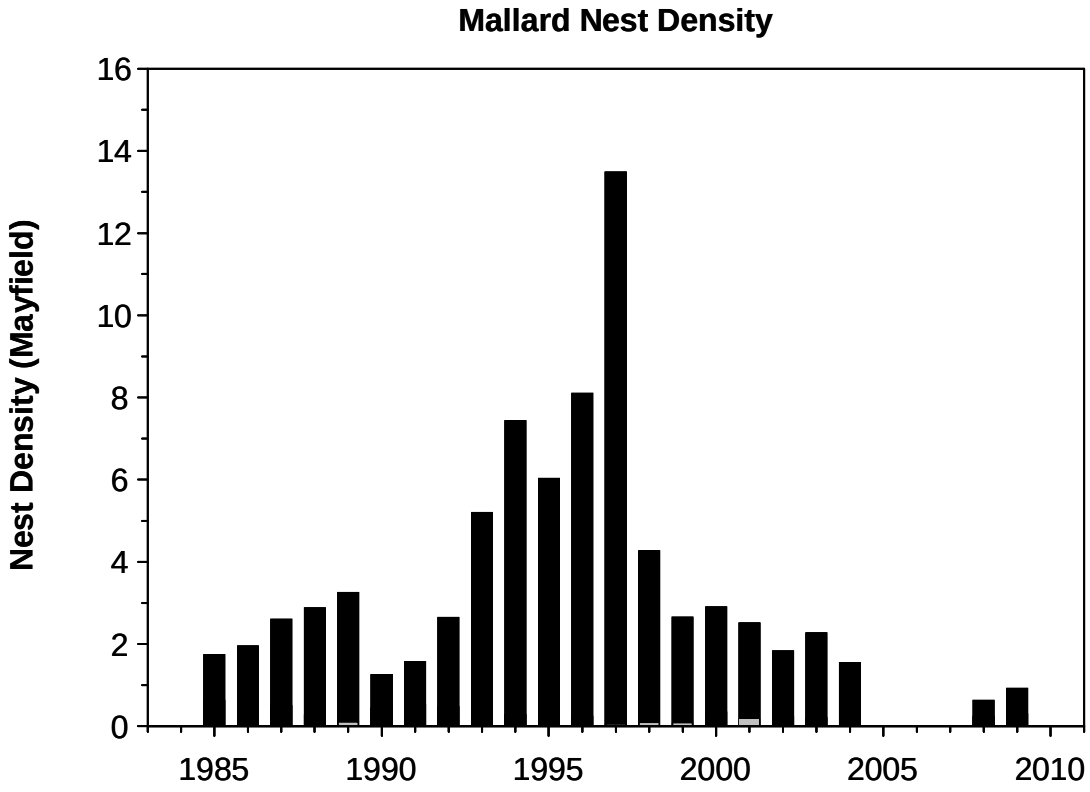


Figure 2. Nest success for Mallards at GIWA from 1985-2009.

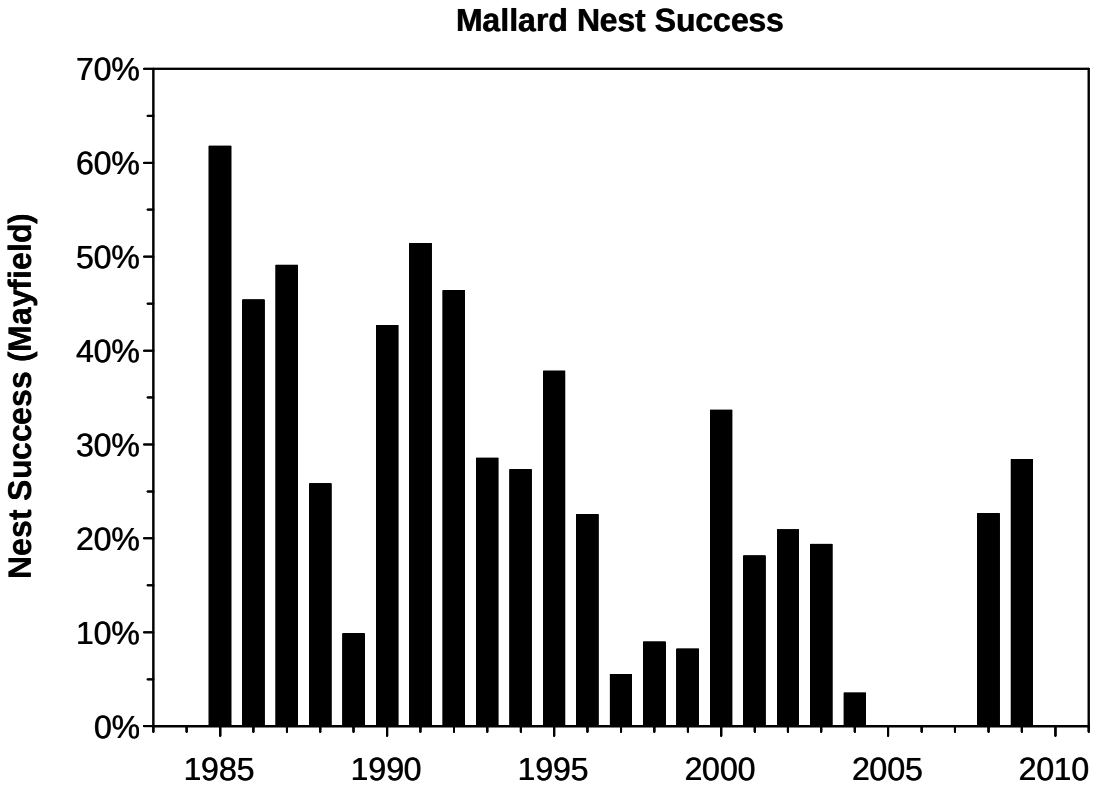


Figure 3. Study area map of GIWA designating fields that are part of the habitat restoration program initiated in 2008.

Grizzly Island WA Enahncement Project, Phase II

Upland Restoration/Enhancement Project

Cereal Grain
Control
Native
DNC

CALIFORNIA WATERFOWL

Figure 4. Locations of nests found at GIWA in 2009. Red=MALL, Blue=GADW, Yellow=CITE, Green=NOPI, White=NOHA, Purple=SEOW

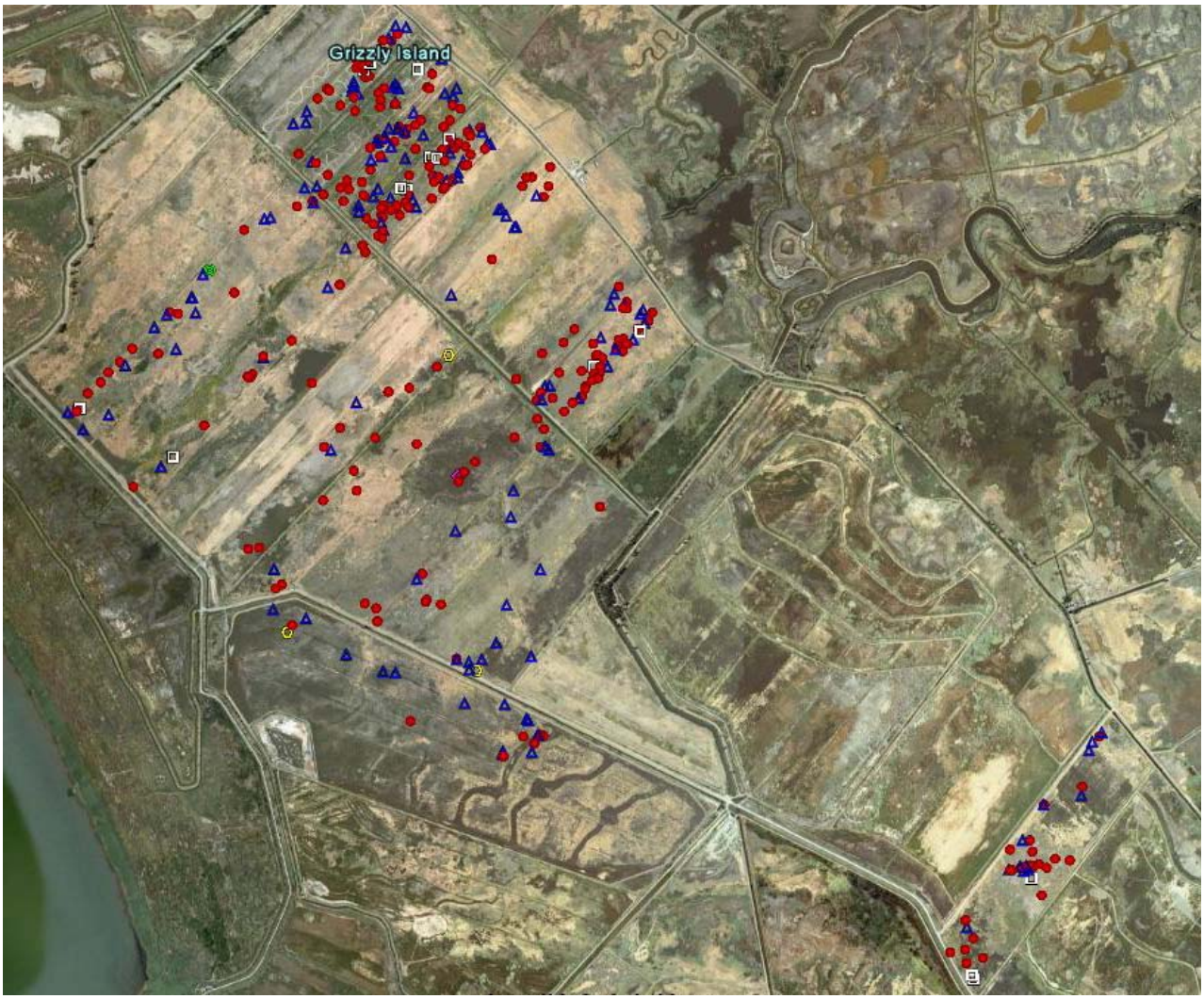


Figure 5. Distribution of Julian laydates for Mallards and Gadwall. (Julian date 121=May 1st).

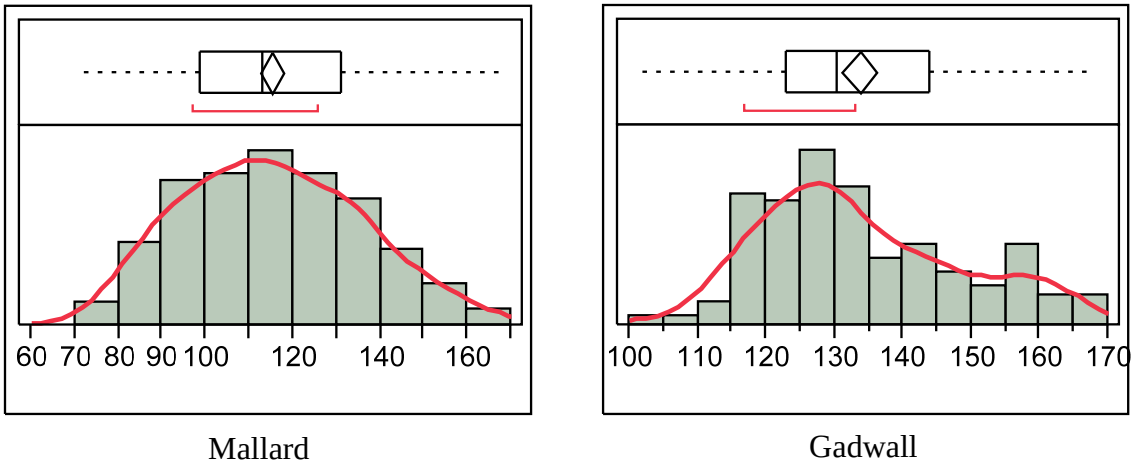


Figure 6. Nest site vegetation height at Mallard (t_{230}=7.63, P<0.0001) and Gadwall (t_{135}=4.94, P<0.0001) nests was higher than at paired random potential nest sites.

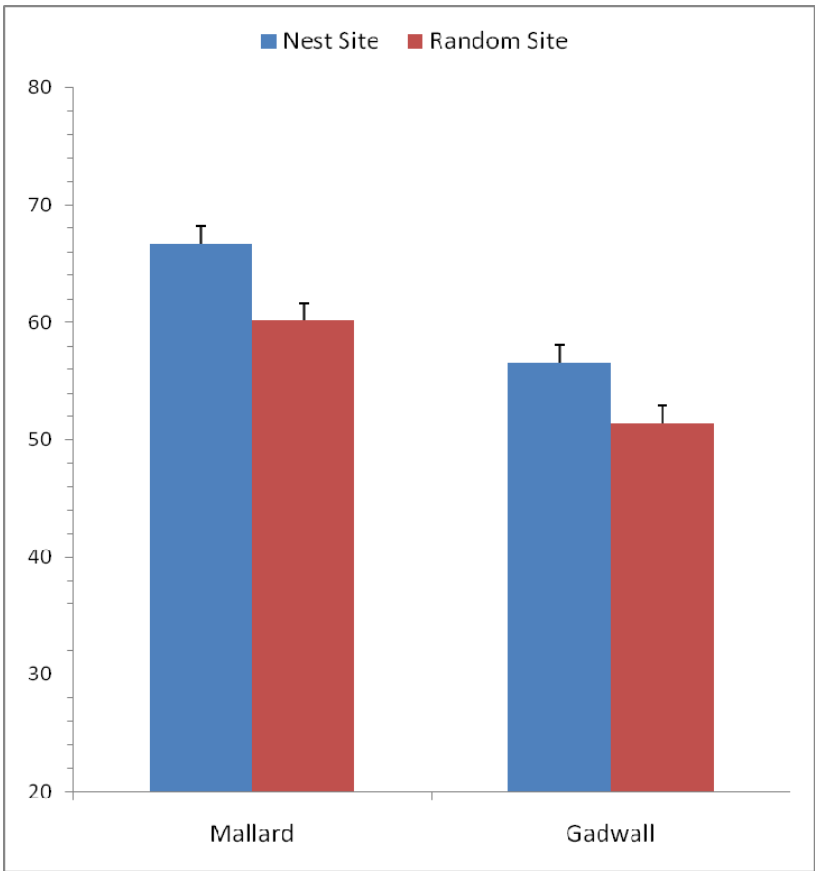
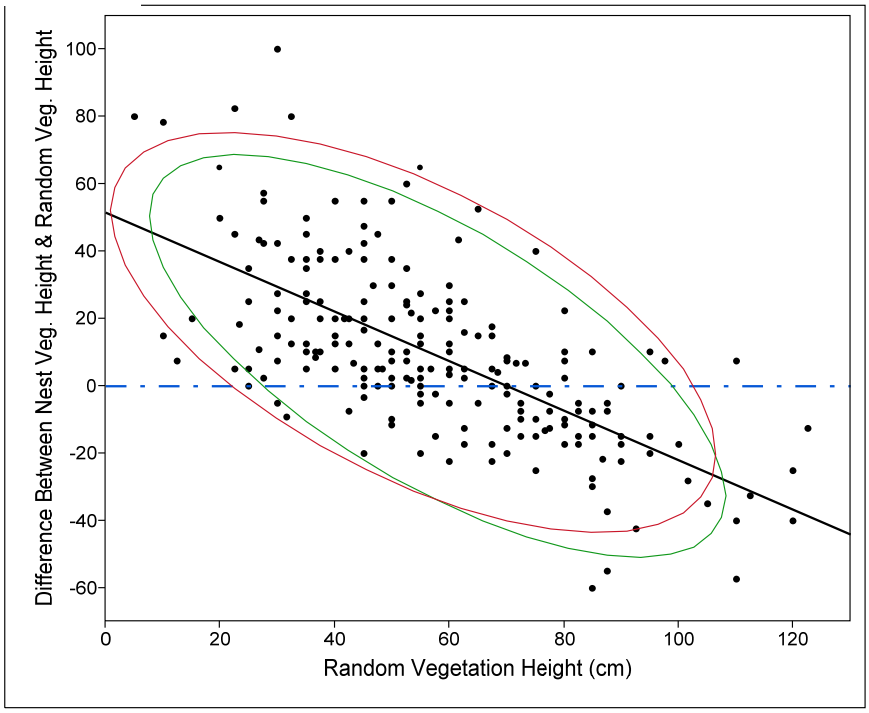


Figure 7. Nest site vegetation height minus vegetation height at a paired random potential nest location. Positive values indicate selection for taller vegetation and negative values indicate selection for shorter vegetation. 90% density ellipses: green=hatched nests, red=depredated nests.

Mallard



Gadwall

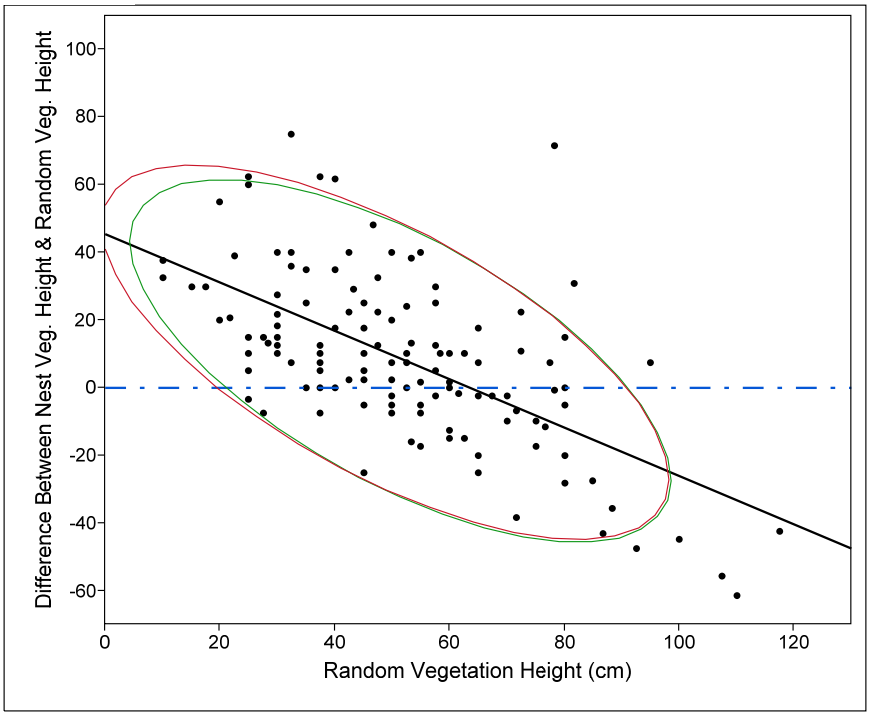


Figure 8. Complete iButton data from Gadwall nest 38 in field 13F.

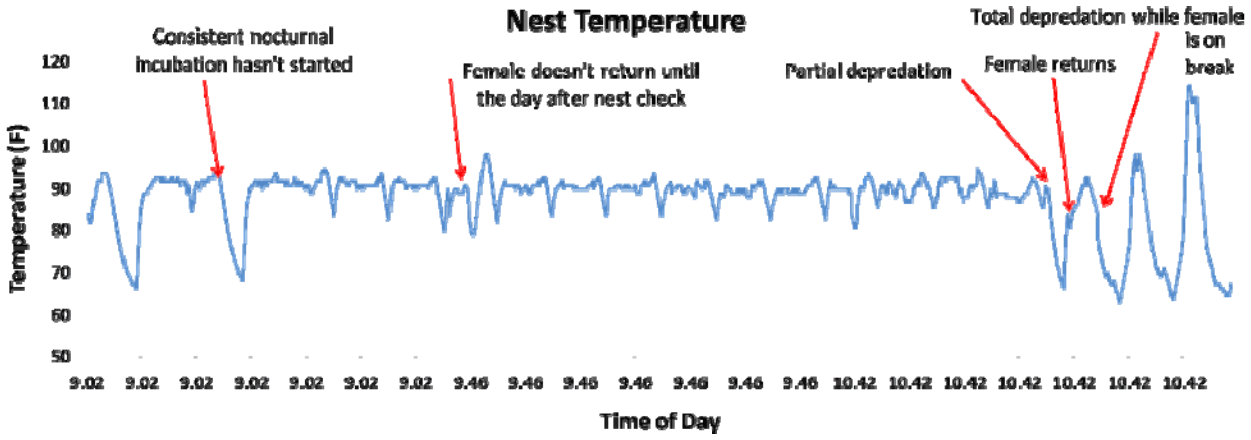


Figure 9. Trapping locations (yellow) and locations of skunk captures (green) with number of trap nights it took to capture the skunk.

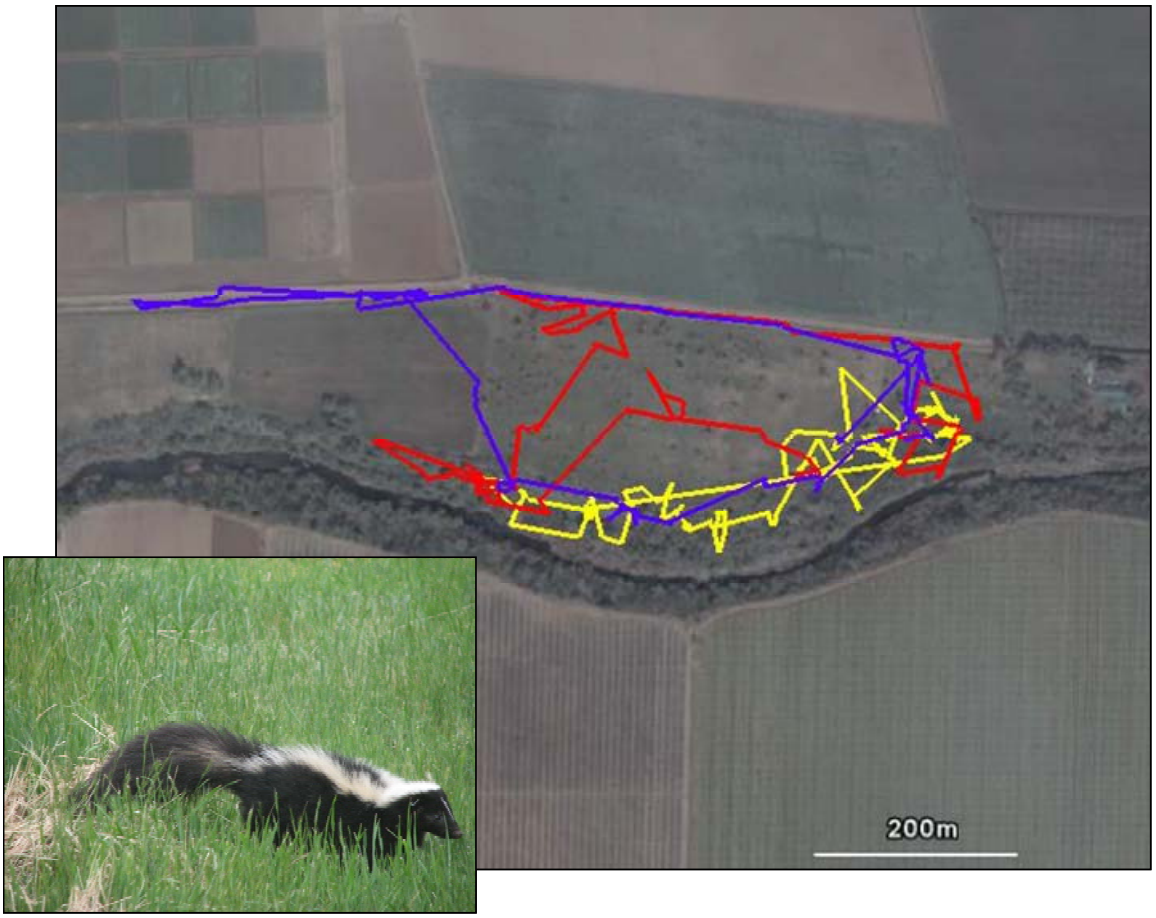



Figure 10. GPS track for a single skunk in Davis, CA over three nights (each night is a different color). Data are location averages every 10 minutes from approximately 2100 to 0500.