

Field Data Summary 2015: Monitoring and Research on Ring-Necked Pheasant (*Phasianus colchicus*) in the Sacramento Valley and Sacramento-San Joaquin River Delta of California

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Disclaimer: This document is a data summary specifically related to monitoring and research objectives for the Central Valley ring-necked pheasant research project during the 2015 season as of 1 November. This document does not represent a completed data analysis and findings. Instead, the purpose of this update is to provide you with a summary of our efforts, as well as observations regarding movements, reproduction, habitat, and predators from the field perspective. This information is preliminary and is subject to revision. It is being provided to meet the need for timely best science. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government may be held liable for any damages resulting from the authorized or unauthorized use of the information.

Introduction

The U.S. Geological Survey (USGS), Pheasants Forever, Mandeville Island duck club, and the California Department of Fish and Wildlife (CDFW) participated in a reconnaissance study to monitor populations of ring-necked pheasant using radio-telemetry in the Sacramento Valley and the Sacramento-San Joaquin River Delta. Wild pheasant populations were monitored across four different study sites from 2013 – 2015: Yolo Bypass Wildlife Area (YBWA), Gray Lodge Wildlife Area (GLWA), Roosevelt Ranch duck club, and Mandeville Island duck club (Figure 1). However, in 2015 we did not monitor radio-marked pheasants at Mandeville Island duck club because pen-reared pheasants could not be distinguished from wild pheasants during winter trapping efforts.

Since 2013, we radio- or GPS-marked 115 female pheasants across the four study sites, which includes fall trapping efforts in 2015. Data collection focused primarily on investigating habitat selection, predator composition, and estimating population vital rates. The data presented here represents a short summary of data collected in the field in 2015 and should be interpreted with caution as these findings are preliminary. More in-depth analyses will be included in the 2013 – 2015 annual report to reflect all years of data collection.

Trapping and Telemetry Monitoring

We captured pheasants in the winter and early spring during January to March of 2015. To avoid disturbing nesting females, we concluded our trapping efforts when pheasants began to nest in late March and early April. We captured and marked 38 females with VHF ($n = 37$) or GPS ($n = 1$) transmitters (Table 1). In addition, one male was captured and outfitted with a GPS transmitter at YBWA, and 13 males were captured across all sites for the purpose of drawing blood for disease analysis. Females captured and marked with VHF transmitters during fall (September –

November) of 2015 ($n = 20$) were not included in data analyses because telemetry relocations and survival data were limited.

We conducted intensive on-the-ground monitoring of pheasant movements, survivorship, and reproduction following release of marked birds. Throughout the nesting and brood-rearing seasons (March – August), we attempted to locate females at least twice per week. Relocation frequency was scaled down to one location per week for females with a brood to minimize disturbance, and was reduced to one location per month during fall (September – November) to monitor seasonal movements and survival rates. We monitored a total of 43 VHF and two GPS-marked pheasants via ground telemetry, which includes the surviving marked females captured in 2014. In addition, two GPS-marked females at Roosevelt Ranch were monitored remotely via satellite. Overall, we collected 982 telemetry and 3,716 GPS relocations throughout the field season (Figure 2).

Pheasant Crowing Counts

Pheasant (rooster) crowing counts were conducted at all four field sites during April and May of 2015. Individual rooster crows were counted for 2- and 3-minute intervals at each station along the route, and visual detections of males or females were recorded in the notes. Average rooster crow counts per station at Mandeville Island were 26 for two-minute intervals and 41 for three-minute intervals. The high for crow counts heard at a single station at Mandeville was 74 for two-minute intervals and 103 for three-minute intervals. The average crow count per station at GLWA was three with a high of eight for two-minute intervals and three-minute counts were not conducted. Roosevelt Ranch had an average crow count of seven with a high of 21 for two-minute intervals, and an average crow count of 12 with a high of 26 for three-minute intervals. Lastly, YBWA averaged seven crow counts per station with a high of 15 for two-minute

intervals, and averaged 14 crow counts per station and had a high of 21 for three minute intervals.

Adult Survival

We developed a monthly encounter history for adult pheasants using telemetry data that included the date of capture, last date known to be alive, and fate (confirmed mortality or censored). A censored bird is either still alive or its fate is unknown. We used these data to calculate cumulative annual survival probabilities. We estimated monthly survival probability using generalized linear models with a binomial error distribution (logit link function) and maximum likelihood estimation in Program RMark. We derived cumulative survival probabilities across a 12-month period (annual) using the estimated coefficients. We report point estimates with a 95% confidence interval (95% CI).

Average monthly adult survival probability across all study areas was 91.1% (95% CI, 91.2 - 97.4%) and cumulative annual adult survival probability from the 2015 field season (March – August) was 55.0% (95% CI, 33.1 - 72.6%; Figure 3). We have recovered 28 marked pheasant mortalities since January 2015, including females marked during the 2014 field season. Diagnostic remains of pheasants and transmitters were used to classify cause of mortality as avian or mammalian. We classified as unknown when evidence was unclear. We suspected depredation by mammalian ($n = 7$), avian ($n = 3$), and unknown predators ($n = 16$). The majority of the remains were limited to pieces of bone and feathers, which suggests that many of the carcasses were scavenged by a mammal before being recovered. One female was recovered as an intact carcass indicating that she may have died from stress-related causes.

The frequency of adult mortalities varied depending on the total number of birds trapped and the length of time that collars were deployed at the site (Table 1). The average monthly adult

survival probability for GLWA was 96.0% (95% CI, 88.2 - 98.7%), and the cumulative adult survival probability was 61.1% (95% CI, 22.3 - 85.4%; Figure 4A). The average monthly adult survival probability for Roosevelt Ranch was 94.9% (95% CI, 87.1 - 98.1%), and the cumulative adult survival probability was 53.2% (95% CI, 19.1 - 79.1%; Figure 4B). The average monthly adult survival probability for YBWA was 94.3% (95% CI, 83.9 - 98.2%), and the cumulative adult survival probability was 49.7% (95% CI, 12.1 - 80.1%; Figure 4C).

Nest Survival

We estimated cumulative average nest survival probability over the 37-day egg laying and incubation phase using a similar modeling technique as adult survival. Nests were not verified visually until the nest was depredated or the eggs hatched to minimize nest abandonment. After females were found in the same location on two consecutive observations, we assumed they were nesting. Each nest was then monitored ≥ 2 times per week until its fate was determined. A nest was considered successful if ≥ 1 chick hatched, ascertained by visual assessment of eggshell remains or observing ≥ 1 chick in the nest bowl. Nests were considered unsuccessful when the entire clutch failed to hatch. Failed nests were scored as depredated or abandoned. We developed an encounter history of individual nests based on the date each nest was found, last checked, and the fate determined.

We located 42 nests in 2015, of which 26 were successful and 16 failed. The cumulative average nest survival probability across all study sites for the 37-day egg laying and incubation phase was 44.2% (95% CI, 27.4% - 59.8%; Figure 5). Of the 16 failed nests, 12 were depredated (suspected as avian or mammalian); one nest within a seasonal wetland was flooded; two failed due to female mortality; and one was abandoned. We included the abandoned nest in the nest

survival analysis. All other females that were inadvertently flushed off their nest in 2015 were found to have returned during the subsequent nest visit.

A total of 18 nests were located at GLWA, of which eight were successful and 10 failed, and the cumulative survival probability was 28.2% (95% CI 10.8 - 48.8%; Figure 6A). At Roosevelt Ranch, 14 nests were located, of which 10 were successful and four failed. Cumulative average nest survival at Roosevelt Ranch was 57.1% (95% CI, 22.7 - 81.1%; Figure 6B). We also located 10 nests at YBWA in 2015, of which eight were successful and two failed. The cumulative average nest survival probability was 69.1% (95% CI, 23.1 - 91.2%; Figure 6C). GLWA had the highest number of nest attempts per bird, and the lowest rate of nest survival. YBWA had the highest rate of nest survival and the lowest number of nest attempts per bird, largely because females did not initiate another nest unless their brood failed early in the season.

Brood Survival

Following the completion of a successful nest, we monitored brood-rearing pheasants once per week (every seven days) for 50 or more days. During our observations, we took extra precautionary approaches as to minimize disturbance to the brood, such as minimizing flushing or brood break-up. A brood was considered successful if at least one chick survived to 50 days post-hatch. During some surveys, we counted the number of surviving chicks in the brood. However, the accuracy of these counts is uncertain as it was often challenging to detect chicks in dense cover. To confirm unsuccessful broods and prevent false negative counts, an additional search for chicks was conducted in subsequent days or weeks. We reported preliminary findings by estimating cumulative brood survival probabilities using the same methods as was used to determine nest survival. Our preliminary results include estimated survival probabilities for a 7-day interval and cumulative across the 50-day period.

We monitored 26 broods between three field sites in 2015, of which 13 were successful (≥ 1 chick survived to 50 days post-hatch) and 13 failed (Table 2). The 7-day interval brood survival probability was 90.6% (95% CI, 84.5% - 94.5%), and the cumulative average survival probability for the 50-day brood rearing period across all study sites was 49.7% (95% CI, 29.8% - 66.8%; Figure 7). Many of the unsuccessful broods were not confirmed as failed until at least 50 days post-hatch because of the difficulty in observing chicks. Females with broods tended to run away from the observer and leave their brood behind or would flush a short distance before returning to her chicks. Hence, we had to assume a brood was still present until no chicks were found for at least two weeks. We also had difficulty counting chicks until they were capable of flight and could be flushed, so chicks were rarely seen before 20 days of age. Occasionally, we were able to hear chicks calling after the female had moved away or flushed.

Overall, brood success varied little between sites, but was lower compared to nest success. We tracked eight broods at GLWA, of which four were successful, and the cumulative survival probability was 43.7% (95% CI, 10.9 - 73.6%; Figure 8A). Roosevelt Ranch had five successful broods, five failed broods, and the cumulative survival probability was 51.4% (95% CI, 20.0 - 76.0%; Figure 8B). Lastly, eight broods were tracked at YBWA, of which four were successful, and the cumulative survival probability was 52.6% (95% CI, 18.0 - 78.8%; Figure 8C).

Avian Predator Monitoring

We followed USGS predator survey protocol for common raven (*Corvus corax*; hereafter ravens) and raptor surveys (USGS 2014) conducted between mid-April and late-August 2015. We conducted visual surveys (using binoculars and unaided eyes) for each pheasant location (nest, brood, general) from a distance of approximately 50 – 100 m. Surveys were conducted over a 10-

min period wherein all four directional quadrants around the survey point were scanned for an equal amount of time. For each avian predator detected, the time, bearing, and distance from the survey point when first detected (determined with a rangefinder) was recorded, and all birds were classified to species. The same survey technique was carried out at dependent and independent random points as well. Dependent random points were assigned at the individual level between 100 – 250 m from the used point, and independent random points were located at the population level within the study area and not associated with the used points.

We conducted a total of 300 raptor and raven surveys during March – August 2015 across all four field sites. Raptors and/or ravens were detected in 293 of these surveys (97.7%), and we recorded 1,577 raptor and 109 raven detections throughout the study period. Raptor species included Red-tailed hawk (*Buteo jamaicensis*; $n = 90$), American kestrel (*Falco sparverius*; $n = 6$), Turkey vulture (*Cathartes aura*; $n = 1032$), Northern harrier (*Circus cyaneus*; $n = 18$), Swainson's hawk (*Buteo swainsoni*; $n = 59$), White-tailed kite (*Elanus leucurus*; $n = 13$), and unidentified raptors ($n = 39$). Raptor species identified only once include the Bald eagle (*Haliaeetus leucocephalus*), Great horned owl (*Bubo virginianus*), Osprey (*Pandion haliaetus*), Red-shouldered hawk (*Buteo lineatus*), and peregrine falcon (*Falco peregrinus*). Other avian species detected included American crow (*Corvus brachyrhynchos*; $n = 78$), unidentified bird species ($n = 314$), and seven surveys detected no birds.

Acknowledgements

This research was part of a cooperative effort with USGS, Pheasants Forever, and the CDFW. We thank D. Connelly with Pheasants Forever and S. Gardner, M. Meshriy, B. Burkholder, L. Souza, J. Stoddard, A. Atkinson, and D. Van Baren with CDFW for their expertise and logistical support. We thank R. Buer, G. Riggs, S. Haynes, J. Juanitas, E. Greene, and J. Atkinson for their time spent entering data and performing analyses. We thank Mandeville Island and Roosevelt Ranch for providing access onto their private lands. Finally, we are extremely grateful to S. Haynes, J. Juanitas, R. Buer, and D. Munoz for their diligence collecting data in the field.

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Preliminary

Tables:

Table 1. The number and sex of pheasants outfitted with VHF and GPS transmitters during the winter (December – February) and spring (March – April) 2015 trapping season in the Sacramento Valley and the Sacramento-San Joaquin River Delta, CA.

		Winter		Spring	
		VHF	GPS	VHF	GPS
GLWA	F	6	0	6	0
	M	0	0	0	0
Roosevelt	F	14	0	0	0
	M	0	0	0	0
YBWA	F	11	0	0	1
	M	0	0	0	1
Total	F	31	0	6	1
	M	0	0	0	1

Table 2. The number of successful and failed broods by site during the 2015 field season in the Sacramento Valley and the Sacramento-San Joaquin River Delta, CA.

	Successful	Failed
GLWA	4	4
Roosevelt	5	5
YBWA	4	4
Total	13	13

Preliminary

Maps and Figures:

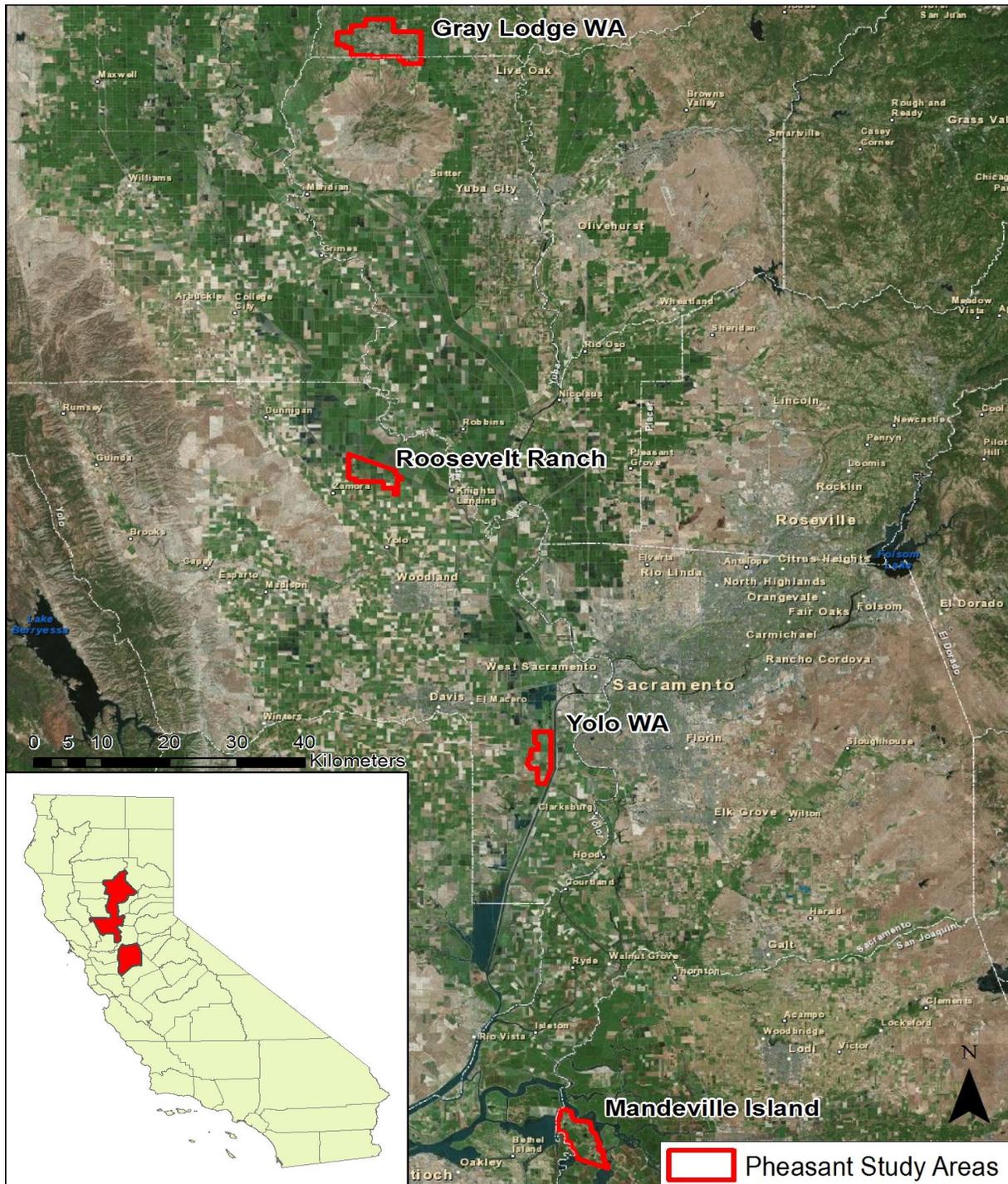


Figure 1. The pheasant study areas located in San Joaquin, Yolo, Sutter, and Butte counties in the Sacramento Valley and the Sacramento-San Joaquin River Delta, CA, 2013-2015.

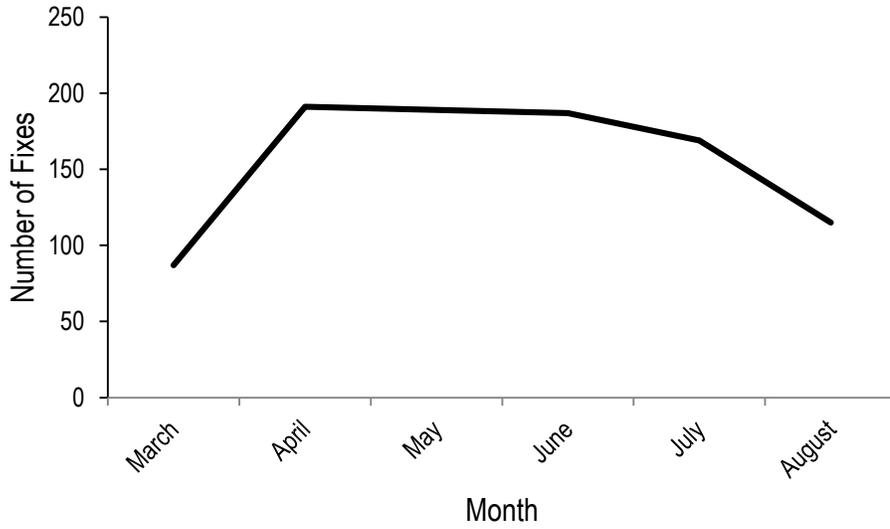


Figure 2. Number of VHF relocations by month (March – August) in the Sacramento Valley and the Sacramento-San Joaquin River Delta, CA, 2015.

Preliminary

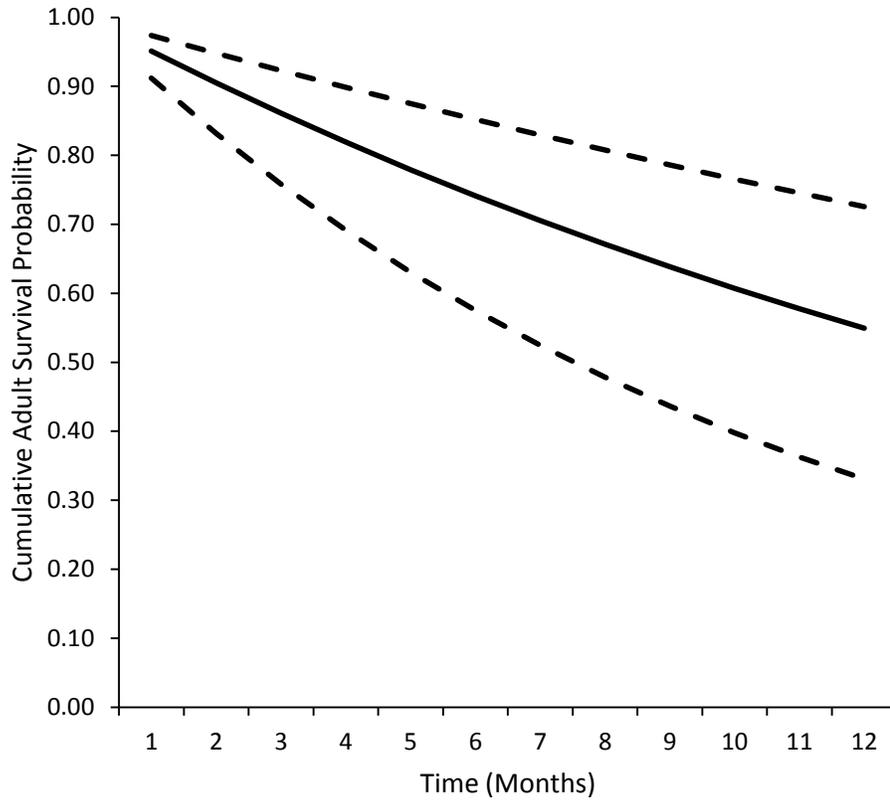


Figure 3. Cumulative average monthly adult survival probabilities for pheasant in the Sacramento Valley and the Sacramento-San Joaquin River Delta, CA during 2015. Solid line represents survival estimate while dashed lines represent 95% confidence intervals. This information is preliminary and subject to revision.

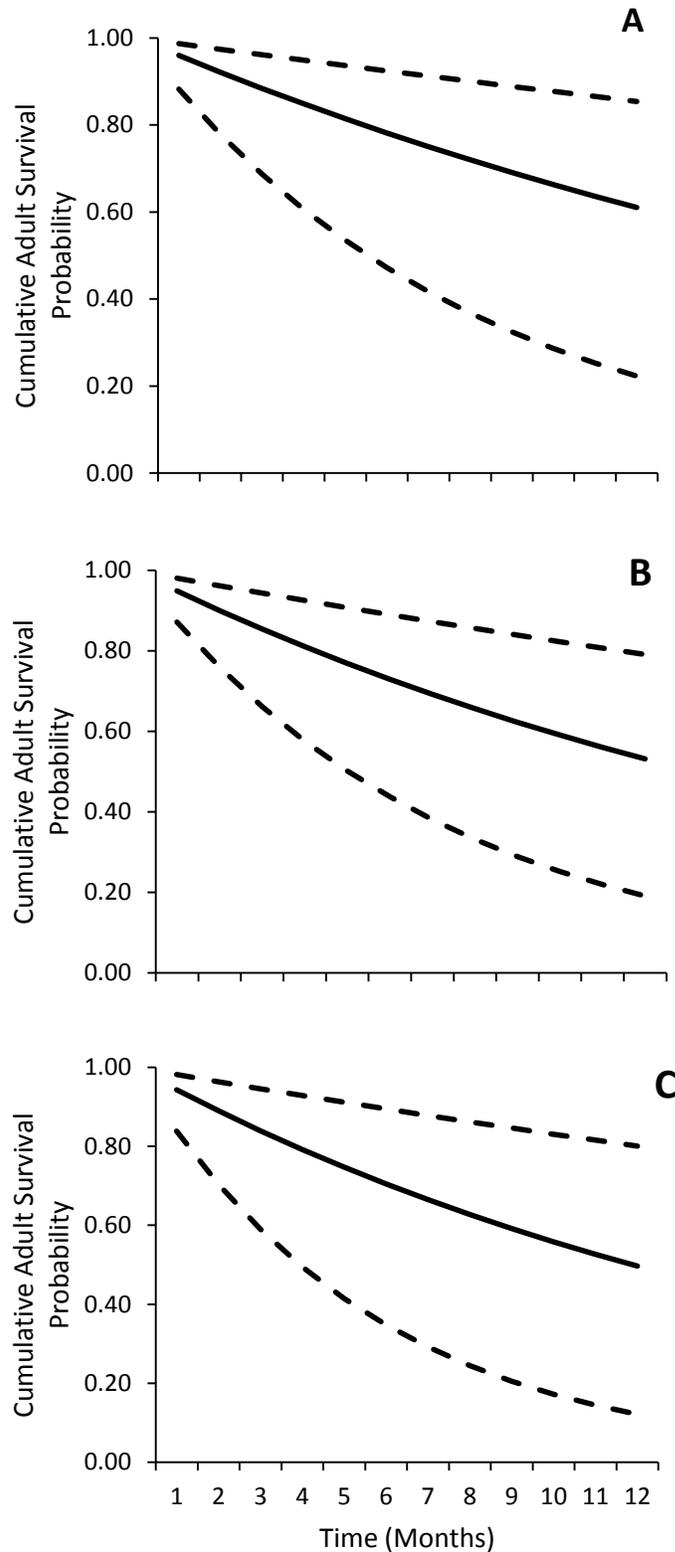


Figure 4. Cumulative average monthly adult survival probabilities for pheasant at each study area in the Sacramento Valley and the Sacramento-San Joaquin River Delta, CA, 2015: (A) GLWA; (B) Roosevelt Ranch; (C) YBWA. Solid line represents survival estimate while dashed lines represent 95% confidence intervals. This information is preliminary and subject to revision.

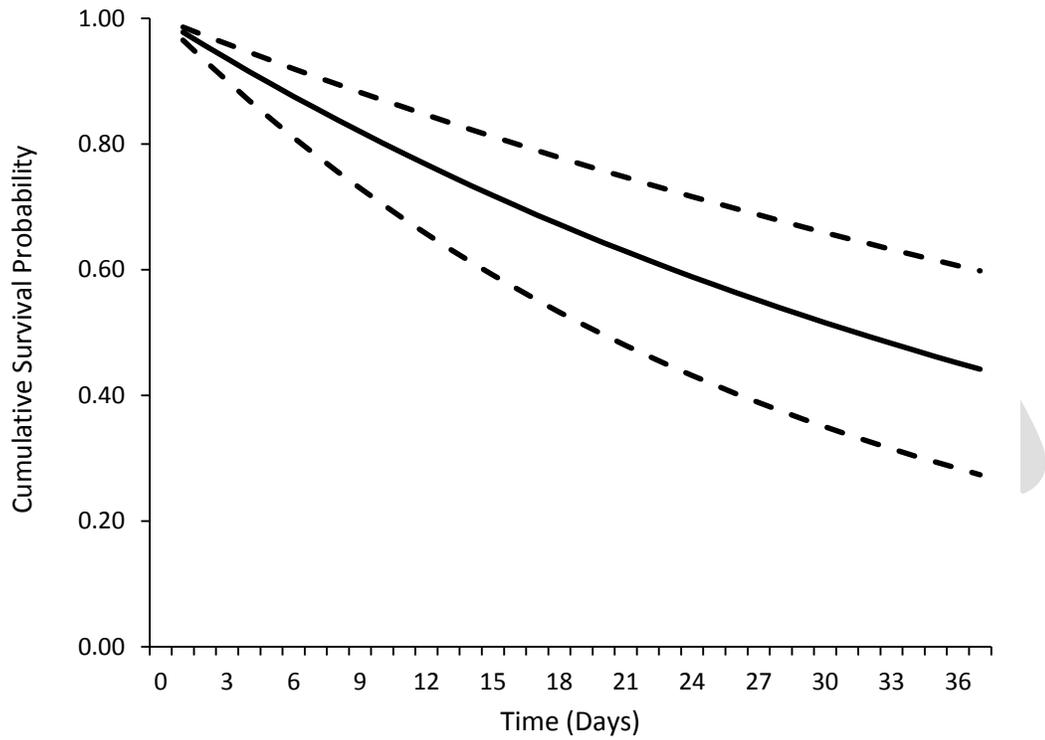


Figure 5. Cumulative average nest survival probabilities for pheasant over the 37-day laying and incubation period in the Sacramento Valley and the Sacramento-San Joaquin River Delta, CA, 2015. Solid line represents survival estimate while dashed lines represent 95% confidence intervals. This information is preliminary and subject to revision.

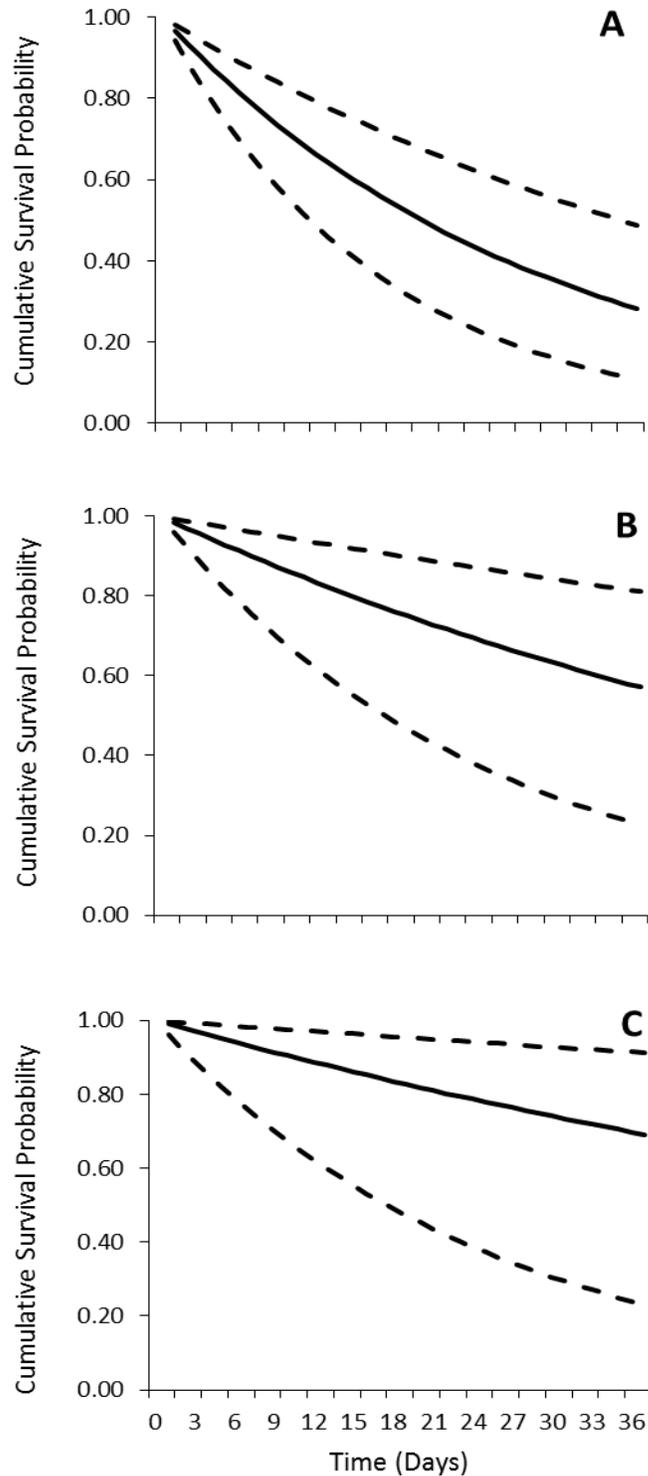


Figure 6. Cumulative average nest survival probabilities for pheasant over the 37-day laying and incubation period at each study site in the Sacramento Valley and the Sacramento-San Joaquin River Delta, CA, 2015: (A) GLWA; (B) Roosevelt Ranch; (C) YBWA. Solid line represents survival estimate while dashed lines represent 95% confidence intervals. This information is preliminary and subject to revision.

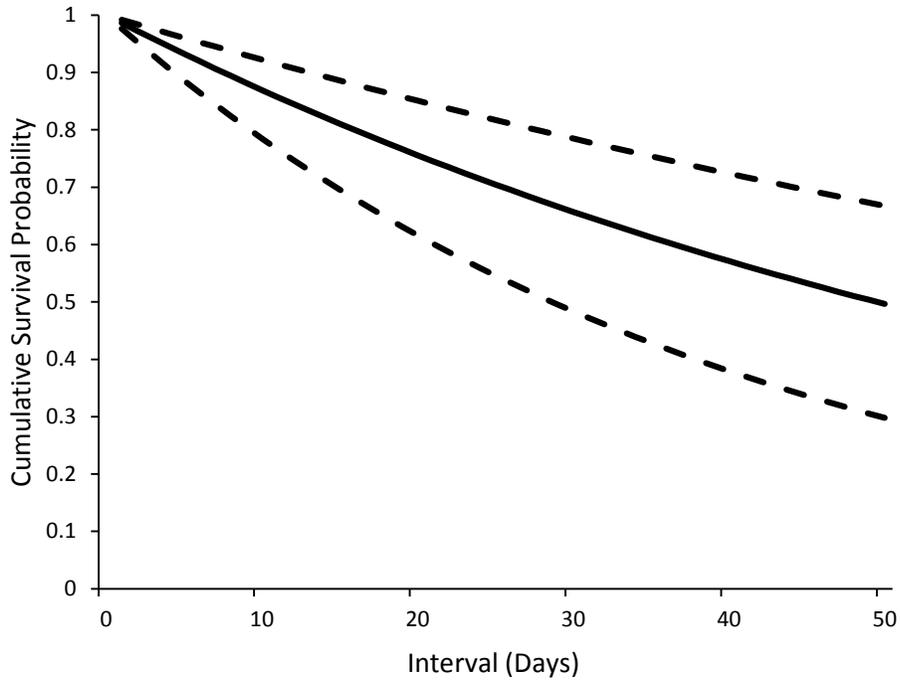


Figure 7. Cumulative average survival probability for the 50-day brood rearing phase across age of brood in the Sacramento Valley and the Sacramento-San Joaquin River Delta, CA, 2015. Dashed line represents 95% confidence interval. This information is preliminary and subject to revision.

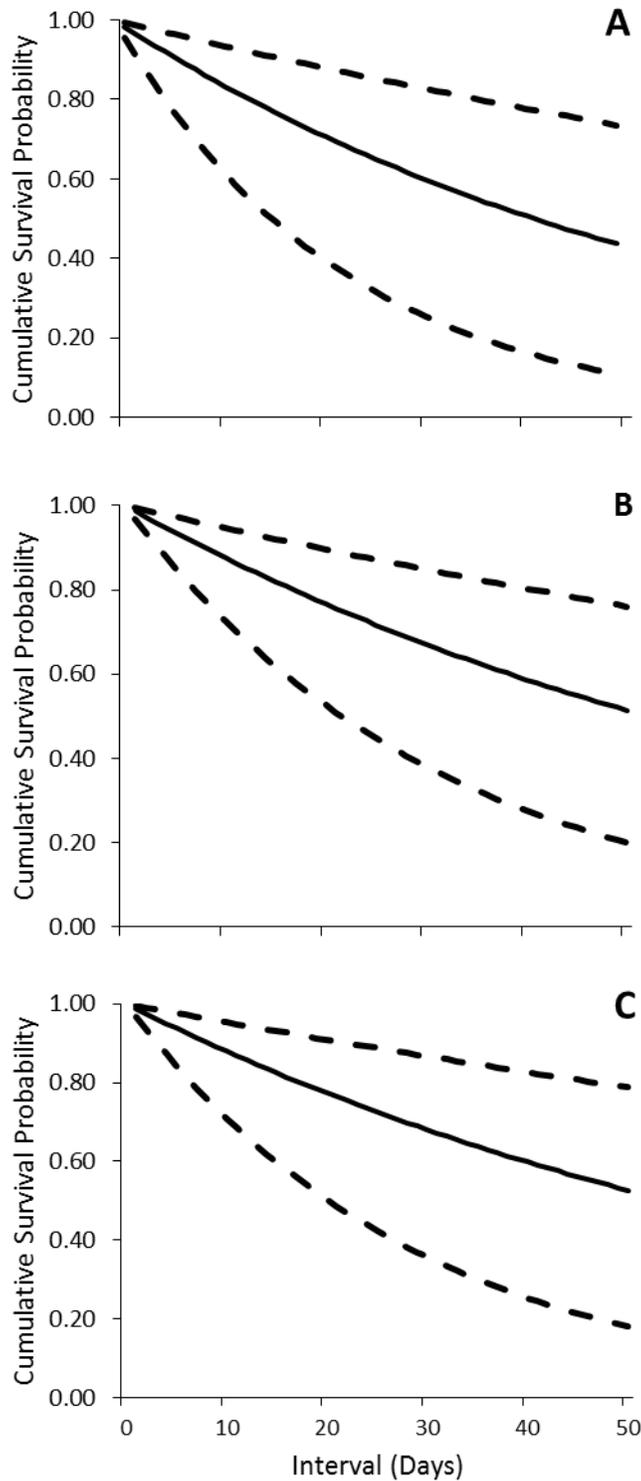


Figure 8. Cumulative average survival probability for the 50-day brood rearing phase across age of brood in the Sacramento Valley and the Sacramento-San Joaquin River Delta, CA, 2015: (A) GLWA; (B) Roosevelt Ranch; (C) YBWA. Dashed line represents 95% confidence interval. This information is preliminary and subject to revision.