**Supplemental Information 2 (for Appendix 4.7)**

**Metadata for listed avian species library used by TIM and MCnest**

This document includes the model parameters used by the Terrestrial Investigation Model (TIM) and Markov Chain nest productivity model (MCnest). At this time, model parameters have been selected for 14 listed bird species (**Table 1**), including 1 in the Cucliformes order, 4 in the Galliformes order and 9 in the Passeriformes order. Model parameters are designed to be representative of the diets, body weights and reproductive timing associated with each species. For some species it is necessary to create separate library entries in order to represent the reproductive timing of birds at the north and south ends of the range (*e.g.,* yellow-billed cuckoo). **Tables 3-16** include the parameter values proposed for use in TIM and MCnest to represent the listed species included in **Table 1**.

**Table 1. Species included in current listed avian species library.**

|  |  |  |
| --- | --- | --- |
| **Order** | **Scientific Name** | **Common Name** |
| Cucliformes | *Coccyzus americanus* | Yellow-billed Cuckoo |
| Galliformes | *Centrocercus minimus* | Gunnison sage-grouse |
| *Colinus virginianus ridgwayi* | Masked bobwhite (quail) |
| *Tympanuchus cupido attwateri* | Attwater's greater prairie-chicken |
| *Tympanuchus pallidicinctus* | Lesser prairie-chicken |
| Passeriformes | *Ammodramus savannarum floridanus* | Florida grasshopper sparrow |
| *Amphispiza belli clementeae* | San Clemente sage sparrow |
| *Dendroica chrysoparia* | Golden-cheeked warbler (=wood) |
| *Empidonax traillii extimus* | Southwestern willow flycatcher |
| *Pipilo crissalis eremophilus* | Inyo California towhee |
| *Polioptila californica californica* | Coastal California gnatcatcher |
| *Setophaga kirtlandii* | Kirtland's Warbler |
| *Vireo atricapilla* | Black-capped Vireo |
| *Vireo bellii pusillus* | Least Bell's vireo |

This document includes the input parameter values to represent each species and the source information associated with each species. Primary sources used for each species included: Birds of North America species accounts (http://bna.birds.cornell.edu/bna/) and documentation generated by the Fish and Wildlife Service (*e.g.,* recovery plans, 5- year reviews, and federal register documents). When necessary, data were obtained from other sources in the scientific literature. These metadata will be sent to species experts in academia and government for review.

Table 4 includes metadata for draft parameters for the gunnison sage grouse. These data are primarily based on available information from a closely related species, the sage grouse (*Centrocercus urophasianus).* This species was not included in the listed species library file used in the integrated TIM/MCnest models due to uncertainty in several of the parameters. These parameters will be refined.

One important consideration for determining the likelihood that a species will be on a treated field is its habitat. This is used to determine whether a species is an edge or field resident and its frequency on field. Table 2 includes the habitat information gathered for the 14 species included in Table 1. This table also discusses any information available (e.g., diet, observations) that would suggest that these species would use potential pesticide use sites. It should be noted that the habitats used by a species during migration may be different than that of the breeding habitat (e.g., Kirtland’s warbler breeds in pine forests. While migrating, individuals stop in scrub/shrub habitats).

**Table 2. Habitat description and potential pesticide use sites visited by species.**

| **Scientific Name** | **Common Name** | **Habitat description\*** | **Migratory?\*** | **Potential pesticide use site description** | **Comments on pesticide use sites** |
| --- | --- | --- | --- | --- | --- |
| *Coccyzus americanus* | Yellow-billed Cuckoo | Woodland and scrubs associated with watercourses. Breeds in riparian areas. | Yes | None identified | Based on diet (includes fruit) and habitat, perhaps species will visit orchards adjacent to riparian areas. |
| *Centrocercus minimus* | Gunnison sage-grouse | Sagebrush ecosystems | No | Agricultural fields, e.g., alfalfa | From: Schroeder et al. 1999 |
| *Colinus virginianus ridgwayi* | Masked bobwhite (quail) | Savanna grasslands | No | Corn, soybeans, wheat | Fall diet includes these grains. From: Brennan et al. 2014 |
| *Tympanuchus cupido attwateri* | Attwater's greater prairie-chicken | Grassland, woodland, brushland, fallow land, cultivated land | No | Corn, peanuts, rice | From USFWS 1993 |
| *Tympanuchus pallidicinctus* | Lesser prairie-chicken | Mixed shrub-grass prairie | No | Agricultural fields | Species may use areas treated with herbicides as lek sites. From Giesen 2005 |
| *Ammodramus savannarum floridanus* | Florida grasshopper sparrow | Grasslands (without trees) | No | Overgrown pastures | From USFWS 1999 |
| *Amphispiza belli clementeae* | San Clemente sage sparrow | Scrub community | No | None identified |  |
| *Dendroica chrysoparia* | Golden-cheeked warbler (=wood) | Forest | Yes | Forestry | See habitat |
| *Empidonax traillii extimus* | Southwestern willow flycatcher | Forested wetlands, scrub-shrub wetlands, dense riparian habitat (of rivers, swamps, wetlands, lakes) | Yes | Forestry | See habitat |
| *Pipilo crissalis eremophilus* | Inyo California towhee | Riparian areas and adjacent upland areas | No | Row crop fields (oats, barley and wheat), orchards | Diet may include oats, barley, wheat and cultivated fruit. (from Kunzmann et al. 2011) |
| *Polioptila californica californica* | Coastal California gnatcatcher | Costal scrub vegetation | No | None identified |  |
| *Setophaga kirtlandii* | Kirtland's Warbler | Pine forests, stops in scrub areas when migrating | Yes | Forestry (pine), orchards, ground fruit | Species nests in jack and red pine forests. During migration, may stop in scrub/shrub habitats. Has been observed during migration in orchards. |
| *Vireo atricapilla* | Black-capped Vireo | Forest grassland ecotone, deciduous/evergreen shrubland | Yes | Forestry | See habitat |
| *Vireo bellii pusillus* | Least Bell's vireo | Woodland (cotton wood willow forest, oak woodland, scrub), breed in riparian areas | Yes | Hedgerows associated with ag fields and residential areas | From USFWS 1998 |

\*See Attachment 1-16 for source info.

**Table 3. Yellow-billed cuckoo (***Coccyzus americanus***)**

| **Species life history parameters** | **Model Code** | **Typical value** | **Rationale/Comments** |
| --- | --- | --- | --- |
| Initiation probability | p |  |  |
| daily mortality rate during laying & incubation | m1 | 0.9632 | Annual reproductive success highly variable. Four nests in California all fledged young; however, only 64% of eggs hatched, 57% of eggs fledged young, and 43% of offspring survived ≥1 wk. Mean number of eggs laid/nest 3.5 ± 1.0 SD (range 3–5); mean number of surviving young/nest 1.5 ± 0.56 SD (range 1–2; [Laymon 1980](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/418/articles/species/418/biblio/bib071)). Nine of 15 eggs hatched in 7 Indiana nests, but only 1 nest fledged 2 young; 22.2% of hatched eggs survived to fledge, and 13.3% of laid eggs survived to fledge ([Nolan 1963](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/418/articles/species/418/biblio/bib082)). No information on lifetime reproductive success.  naïve overall nest survival = 4/4 + 1/7 = 5/11 = 0.455  length of nest cycle = 9 + 8 + 2\*2 = 21 |
| daily mortality rate during nestling rearing | m2 | 0.9632 | see above |
| date of first egg of first nest (dd-mmm) | T1 | 24 June | Western populations breed Jun–Aug, with peak occurring mid-Jul to early Aug (Bent 1940, Howe 1986). Extreme egg dates in Arizona: 24 Jun–24 Aug (Groschupf 1987). In s. California, extreme egg dates: 15 May–20 Aug (55 records; Bent 1940). |
| date of first egg of last nest (dd-mmm) | Tlast | 24 Aug |
| length of rapid follicle growth period (RFG) for each egg (days) | rfg | 6 | Mass of fresh egg: eastern populations, mean 9.1 g (n = 100); western populations, mean 9.4 g (n = 60; Schönwetter 1967). Egg mass in proportion to body mass (about 14%) among largest known for nidicolous birds. Large egg allows for rapid development of both embryo and nestling, but costly for female to produce. Energy cost required for egg production ≥30% of female’s daily intake (Nolan and Thompson 1975). |
| mean clutch size | clutch | 3.1 | 1-5 eggs (3.1 in Kansans = mean clutch size) |
| mean intra-egg laying interval (days) | eli | 2 | typical 2 days, range 1-5. |
| egg on which female typically begins incubation–penultimate (1) or last (0) | penult | penult | First egg. (Hughes 1999) |
| duration from start of incubation to hatch (days) | I | 9 | by subtraction 17 – 8 = 9 days, (Hughes 1999) |
| duration from hatch to fledging of nestlings (days) | N | 8 | 7-9 days (asynchronous) |
| duration since nest failure due to other reasons until female initiates new nest (days) | We | 15 | Place holder value. |
| duration since successful fledging until female initiates new nest (days) | Wf | 100 | Not double-brooded. |
| female body weight (g) during breeding season | BdyWt | Mean: 63  SD: 4.6  Min: 42  Max: 96 | Mean from Hughes 1999 (n = 3)  SD, min and max based on defaults assumptions for TIM |
| diet composition during breeding season |  | 100% insects | Hughes 1999 |
| Feeding category |  | Insectivore |  |
| mean number of nest attempts/ female/ season |  |  | USFWS critical habitat document 2-3 nest attempts, p48551 Fed Register. |
| mean number of successful broods/ female/ season |  |  |  |
| mean number of fledglings/ successful nest | fpsn | 2 | Place holder value. |
| mean number of fledglings/ female/ season (ARS) | ARS |  |  |
| Annual adult survival | phi | 0.997 | Place holder value. |
| Frequency on field |  | Mean: 0  Min: 0.1  Max:0.2 | Low frequency on field is expected for agricultural habitats because species habitat is riparian trees and shrubs. Individuals may forage on agricultural fields. |
| Residency |  | Edge | Species nests in riparian areas (Hughes 1999) |
| Passerine? |  | No |  |
| Precocial/ altricial |  | Altricial |  |

**Table 4. Gunnison sage grouse[[1]](#footnote-1).**

| **Species life history parameters** | **Model Code** | **Typical value** | **Rationale/Comments** |
| --- | --- | --- | --- |
| Initiation probability | p | 0.25 | default |
| daily mortality rate during laying & incubation | m1 | 0.432 | Value selected for gunnison sage grouse (from Young 1994)  Nest Success. Proportion of all nests that hatch ≥1 egg averages 15–86% (Table 1). Nest success also may vary annually within areas (Schroeder 1997, Sveum et al. 1998b), perhaps because of variation in weather, habitat quality, and/or predator abundance. Schroeder et al. 1999  Factors Associated with Nest Success. Nest success is higher in areas of big sagebrush and/or antelope bitterbrush, and/or relatively tall and thick grass, forb, and shrub cover (Bean 1941, Pyrah 1971, Wallestad and Pyrah 1974, Connelly et al. 1991, Gregg et al. 1994, Hanf et al. 1994, Young 1994, DeLong et al. 1995, Sveum et al. 1998b). Nest success is lower in areas where shrub cover is reduced by spraying (Klebenow 1969), plowing (Trueblood 1954), and burning (Connelly et al. 1994, Fischer 1994, Fischer et al. 1996a). Nest success appears to be inversely correlated with density of Common Ravens (Batterson and Morse 1948, Autenrieth 1981) and positively correlated with Apr–Jun precipitation (Gill 1966). Nest success may (Wallestad and Pyrah 1974, Wallestad 1975a, Braun 1984, Young 1994) or may not (Connelly et al. 1993, MAS) be positively correlated with age of hen. Schroeder et al. 1999 |
| daily mortality rate during nestling rearing | m2 | 0.38 | Survival of juveniles between hatching and autumn was 38% in Wyoming (n = 2,196 banded juveniles; J. W. June 1963). Low survival of juveniles is reflected by declines in average brood size (by 18.4–68.4%) during summer (Bean 1941, Keller et al. 1941, Wallestad 1975a, Rothenmaier 1979). Lack of residual cover, drought, fire, and poor land man-agement practices may increase rate of predation (Batterson and Morse 1948, Klebenow 1972, Braun et al. 1977, Gregg et al. 1993, Young 1994, Fischer et al. 1996b). Schroeder et al. 1999 |
| date of first egg of first nest (dd-mmm) | T1 | April 15 | Average copulation date is late Mar–early Apr in California (Bradbury et al. 1989a), mid-Apr in Colorado (Petersen 1980, Young 1994), early Apr in Idaho and Utah (Rasmussen and Griner 1938, Autenrieth 1981, Wakkinen 1990), late Mar in Oregon (Batterson and Morse 1948), mid- to late Apr in Montana (Martin 1965, Wallestad 1975a, Jenni and Hartzler 1978), early–late Mar in Washington (Hofmann 1991, Sveum 1995, Schroeder 1997), and mid- to late Apr in Wyoming (Rothenmaier 1979, Goebel 1980; Fig. 3). Annual variation in weather causes fluctuations of about 1–2 wk in date of nest initiation (Batterson and Morse 1948, Petersen 1980, Young 1994, Schroeder 1997). Yearlings appear to copulate later than adults (Petersen 1980, Schroeder 1997). Copulations for renesting attempts occur about 3–6 wk after first copulation (Hofmann 1991, Petersen 1980, Schroeder 1997). Schroeder et al. 1999  Incubation starts about 3 wk after copulation (Patterson 1952; see Fig. 3). Schroeder et al. 1999 |
| date of first egg of last nest (dd-mmm) | Tlast | June 15 |  |
| length of rapid follicle growth period (RFG) for each egg (days) | rfg | 9 days | Average preincubation weight was 46.1 g for 217 eggs in Colorado (Petersen 1980). Schroeder et al. 1999  Use allometric equation. RFG = 9.4 days. |
| mean clutch size | clutch | 8 | Average 6.6–9.1 eggs (Table 1). Clutch size for adults tends to be 0.2–2.1 eggs greater than for yearlings; clutch size of first nests is 0.2–0.9 egg greater than for renesting attempts (Wallestad and Pyrah 1974, Wallestad 1975a, Petersen 1980, Schroeder 1997). Clutch size also may vary on annual basis (Sveum 1995, Schroeder 1997). Schroeder et al. 1999 |
| mean intra-egg laying interval (days) | eli | 2 eggs/3 d | First egg is laid 3–14 d after copulation (Girard 1937, Scott 1942, Patterson 1952, Dalke et al. 1963, Petersen 1980). Eggs are laid at rate of 2 eggs/3 d (Batterson and Morse 1948, Patterson 1952, Petersen 1980). Egg-laying hens cover their eggs with leaves when they leave the nest and feed 0.2–1.0 km from their nests, often at regular locations (Petersen 1980, MAS). Schroeder et al. 1999 |
| egg on which female typically begins incubation–penultimate (1) or last (0) | penult |  | Incubation commences when last egg is laid or 1–2 d after last egg is laid (Petersen 1980). Schroeder et al. 1999 |
| duration from start of incubation to hatch (days) | I |  | Lasts 25–29 d (Batterson and Morse 1948, Patterson 1952, Nelson 1955, Pyrah 1963, Wallestad 1975a, Petersen 1980, Schroeder 1997); some estimates as low as 20–24 d (Keller et al. 1941, Bendire 1892, Girard 1937, Griner 1939). Clutches initiated later in breeding season may have shorter incubation periods, possibly because clutches contain fewer eggs and/or weather is warmer (MAS). One female incubated an infertile clutch for 76 d (Schroeder 1997). Schroeder et al. 1999 |
| duration from hatch to fledging of nestlings (days) | N |  | Broods break up about 10–12 wk after eggs hatch, but process is poorly understood (Patterson 1952, Oakleaf 1971, Browers and Flake 1985). Juveniles may flock together, disperse, and/or move toward winter habitats after brood breakup (Wallestad 1975a, Browers and Flake 1985). Schroeder et al. 1999 |
| duration since nest failure due to other reasons until female initiates new nest (days) | We |  | First/Only Brood Per Season  Incubation starts about 3 wk after copulation (Patterson 1952; see Fig. 3). Eggs for replacement clutches (renests) are laid 2–15 d after destruction and/or abandonment of previous nests (Patterson 1952, Petersen 1980, Schroeder 1997). Relatively short delays (2–5 d) in renesting occurred when first nests were predated during egg-laying period; long delays occurred when females lost their nests during incubation and returned to leks to copulate. The likelihood of nesting and renesting varies throughout range (Table 1). Females in Washington may renest twice (Sveum 1995, Schroeder 1997). Timing of initiation and rate of predation on first nests may be related to renesting potential of Sage Grouse (Bergerud 1988b, Bergerud and Gratson 1988). Adults renest more commonly than yearlings (Dalke et al. 1963, Petersen 1980, Connelly et al. 1993, Sveum 1995, Schroeder 1997). Frequent presence of >15 ovulated follicles (Dalke et al. 1963, CEB) and secondary peak of female attendance at leks (Eng 1963) indicate that renesting rates may be underestimated. Schroeder et al. 1999 |
| duration since successful fledging until female initiates new nest (days) | Wf | 125 | Females rear only 1 brood/season. If first clutch is depredated or abandoned, some females may renest (see Table 1; Connelly et al. 1993, Schroeder 1997). Schroeder et al. 1999 |
| female body weight (g) during breeding season | BdyWt | Mean: 1200  SD: 87.6  Min: 792  Max: 1800 | Mean based on BNA account for gunnison sage grouse (from Young 1994 and Hupp and Braun 1991).  SD, min and max based on TIM default assumption (0.073xMean, 0.66xMean and 1.52\*Mean, respectively). |
| diet composition during breeding season |  | 50% broadleaves, 50% insects | Diet includes forbes and insects during the breeding season (Schroeder et al. 1999). The proportion is unknown, so it is assumed that the two are equally represented. |
| Feeding category |  | Omnivore |  |
| mean number of nest attempts/ female/ season |  |  |  |
| mean number of successful broods/ female/ season |  |  |  |
| mean number of fledglings/ successful nest | fpsn |  |  |
| mean number of fledglings/ female/ season (ARS) | ARS |  |  |
| Annual adult survival | phi |  | Survival rate may vary by year, sex, and age (Zablan 1993). Most results indicate that females survive at higher rate than males, possibly because of sexual dimorphism (Swenson 1986): 55% for 1,800 banded females, 52% for 1,892 banded yearling males, and 38% for 1,935 banded adult males in Colorado (Zablan 1993); 75% for 262 radio-marked females and 60% for 76 radio-marked males in Idaho (Connelly et al. 1994); and 67% for 1,609 banded females and 59% for 1,565 banded males in Wyoming (J. W. June 1963). The lower survival rate of males is the reason why male:female sex ratio declines as birds age (Patterson 1952, Braun 1984). The low survival rate of males also appears to be reflected in the 15–47% return rate of territorial males on leks between years (Dunn and Braun 1985, Hartzler and Jenni 1988, Gibson 1992). Schroeder et al. 1999 |
| Frequency on field |  | Mean: 0.5  Min: 0  Max: 1 | Frequency on field of this species is unknown. Individuals may visit agricultural fields (e.g., alfalfa; Schroeder et al. 1999). Low (0.1), Medium (0.5) and High (0.9) mean frequency on field values should be considered in a sensitivity analysis of this species. |
| Residency |  | Edge | Based on habitat (see Table 2) |
| Passerine? |  | No |  |
| Precocial/ altricial |  | Precocial |  |

**Table 5. Masked bobwhite (*Colinus virginianus ridgwayi*)[[2]](#footnote-2),[[3]](#footnote-3).**

| **Species life history parameters** | **Model Code** | **Typical value** | **Rationale/Comments** |
| --- | --- | --- | --- |
| Initiation probability | p | 0.25 | default |
| daily mortality rate during laying & incubation | m1 | 0.039 | Nesting success is related to the amount of ground cover. It also is correlated with the amount and distribution of summer precipitation and with male calling activity. USFWS 1995.  Egg fertility (= an egg containing a living embryo) averages about 86% (Stoddard 1931: 39). Hatching success (= emergence of a live chick from the egg) is greatly influenced by predators, human disturbance, and weather. Hatching success in Illinois: 33% (n = 793 nests; Roseberry and Klimstra 1984). In Florida, 45% of 54 nests were successful; chick loss estimated at 62% for first 2 wk and 71% for first month (DeVos and Mueller 1993). BNA  In Missouri (Burger et al. 1995b), 44% of 69 nests were successful; 66% of females (n = 112) alive on 15 Apr incubated ≥1 nest, but only 40% hatched ≥1 nest. Nests incubated by males were the second most important component of production (28% of all nests, 29% of successful nests). Renesting, second clutches, and incubation by males provide an array of alternative reproductive strategies that this species can use, depending on the fate of initial and subsequent nests (Burger et al. 1995b: 425). BNA  Current value is from the Northern Bobwhite species profile in MCnest library |
| daily mortality rate during nestling rearing | m2 | 0.016 | Current value is from the Northern Bobwhite species profile in MCnest library |
| date of first egg of first nest (dd-mmm) | T1 | 15 June | The onset of the breeding season is heralded by the well known “bob-white” call of the male. Call-counts by Tomlinson (1972b) showed that males began calling between June 25 and July 15, and terminated calling between September 4 and 20 for the years 1968 through 1970. Calling frequency in Sonora typically reached a maximum between August 10 and 24, after which it declined rapidly. USFWS 1995  Hatching begins in late July, peaks during the period September 5-20, and ends by late October to  early November (Tomlinson 1 972b). The earliest broods were seen in late September, and most  broods consisted at that time of very small chicks (Tomlinson 1 972b). Breeding, nesting, and hatching cycles are timed to exploit the availability of plant food and cover and invertebrate prey produced in response to summer rains. USFWS 1995  Hernandez et al. (2006) discussed the differences between  reproduction in masked bobwhites and other subspecies. As a bird that is adapted  to a semi-arid environment characterized by pronounced precipitation peaks in  late summer, the masked bobwhite initiates breeding much later in the year and  experiences a much shorter breeding season than its eastern counterparts. In  masked bobwhites, breeding typically commences in June and the season lasts  only about 90 days, corresponding to the monsoonal rains. Eastern subspecies  initiate breeding in March and have approximately 120 days to complete the  breeding season. Northern bobwhites, in general, require 47-55 days to lay and  incubate their first clutch, and require 20-34 days between clutches (Burger et al.  1995). Mathematically speaking, re-nest attempts by masked bobwhite following  nest destruction or abandonment are not likely due to the short duration of  monsoon. This significantly reduces the reproductive potential and associated  productivity of masked bobwhite as compared to other bobwhite subspecies. USFWS 2014 |
| date of first egg of last nest (dd-mmm) | Tlast | 15 Sept | see above |
| length of rapid follicle growth period (RFG) for each egg (days) | rfg | 6 | RFG = 2.852\*E^0.31 (r2=0.62). E = Egg mass = Fresh mass 8.2–8.8 g. BNA  Equation from Alisauskis and Ankney 1992  Use mean = 8.5g, RFG = 5.53 days (round up to 6) |
| mean clutch size | clutch | 13 | Newly hatched broods 5 – 15 young (USFWS 1995)  Rangewide, average 12–14 eggs/clutch (range 7–28). Average clutch size decreases as nesting season progresses and renesting attempts occur (Stoddard 1931, Simpson 1972, Dimmick 1972, Klimstra and Roseberry 1975, Lehmann 1984). BNA |
| mean intra-egg laying interval (days) | eli | 1 | Place holder value. |
| egg on which female typically begins incubation–penultimate (1) or last (0) | penult | penult | Place holder value. |
| duration from start of incubation to hatch (days) | I | 23 | By subtraction: 47-55 days required for incubation (mean 51) – 13 for egg-laying (mean clutch size) = 38 days for incubation.  The value for Northern Bobwhite has been substituted (23 days) |
| duration from hatch to fledging of nestlings (days) | N | 14 | Current value is from Northern Bobwhite spp profile. |
| duration since nest failure due to other reasons until female initiates new nest (days) | We | 27 | 20-34 days. USFWS 2014  Within-year intervals between breeding, under ideal conditions, are very short. In some situations, a female may renest 1–2 d after her first clutch hatches if she pairs with a new mate, and her original mate broods the chicks (Curtis et al. 1993). In less-than-ideal conditions (i.e., drought or poor habitat), intervals between breeding can be much longer (e.g., 43 d in Texas (Taylor 1992), or breeding will cease (Hernández et al. 2005). In Missouri, time between loss of one nest and initiation of another averaged 9 d (range 1–45; L. W. Burger pers. comm.). BNA |
| duration since successful fledging until female initiates new nest (days) | Wf | 100 | 100 days (assumed double-brooding impossible) |
| female body weight (g) during breeding season | BdyWt | Mean: 162.4  SD: 2  Min: 107  Max: 247 | Female mean and SD from Lehmann 1953. Min and max based on TIM default assumption (0.66xMean and 1.52\*Mean, respectively). |
| diet composition during breeding season |  | Spring: 50% grass, 50% broadleaves  summer:  females = 20% insects; 80% seeds  Males = 5% insects, 95% seeds | Fall diet may include corn, soybeans, wheat. Brennan et al. 2014. |
| Feeding category |  | omnivore |  |
| mean number of nest attempts/ female/ season |  |  |  |
| mean number of successful broods/ female/ season |  |  |  |
| mean number of fledglings/ successful nest | fpsn | 4.3 | value is from Northern Bobwhite spp profile. |
| mean number of fledglings/ female/ season (ARS) | ARS |  |  |
| Annual adult survival | phi | 0.9967 = 0.3^(1/365) | Annual mortality rates for the masked bobwhite, though little studied, are believed similar to the rates (about 70 percent) for other bobwhite races (Rosene 1069). Mortality of 18 adult birds in the early Buenos Aires Ranch population was attributed to avian (14) and mammalian (4) predators (Goodwin 1982). Later studies of reintroduced bobwhites on the BANWR documented 51 mortalities (42 masked bobwhites and 9 Texas bobwhites). Raptors killed 21 bobwhites and mammals killed 5. Four [of?] 14 birds were believed to have succumbed to hypothermia. Survival and nesting success are believed to depend heavily on availability of herbaceous cover. When cover is insufficient, birds are more vulnerable to predation, and forced to disperse. A covey in Arizona, maintained its numbers for three months in a well vegetated pasture (Goodwin 1982). The covey then moved as a consequence of overgrazing and the associated base loss of cover, losing six members to predation within the first few weeks after their move. USFWS 2014 |
| Frequency on field |  | Mean: 0.53  Min: 0  Max: 1 | Mean value is max from field studies where bobwhite quail were observed (Appendix D of TIM manual) |
| Residency |  | Edge | Nests on the ground. Locations within 15–20 m of open ground (e.g., fields, disked strips, or roads) (Brennan et al. 2014). |
| Passerine? |  | No |  |
| Precocial/ altricial |  | Precocial |  |

**Table 6. Attwater's greater prairie-chicken (*Tympanuchus cupido attwateri*).**

|  |  |  |  |
| --- | --- | --- | --- |
| **Species life history parameters** | **Model Code** | **Typical value** | **Rationale/Comments** |
| Initiation probability | p |  |  |
| daily mortality rate during laying & incubation | m1 | 0.031 | “Average apparent nest success (% nests that hatch ≥1 egg), uncorrected for the age of the nest when it was found, using data collected between 1937 and 1985: 32.2 % ± 4.3 (SE) based on 143 nests for Attwater’s Prairie-Chicken (range 0-83%; see Table 3 in Peterson and Silvy 1996)” as quoted in Johnson et al (2011). Assuming an apparent nest success of 32.2% is typical, the daily nest mortality rate over a 36 d nest period (i.e., 25+12-1) is 0.031. |
| daily mortality rate during nestling rearing | m2 | 0.018 | Peterson and Silvy (1996) reviewed studies with radio-marked hens to determine the proportion of Attwater’s prairie-chicken broods surviving (i.e., ≥1 chick/brood). Horkel (1979:61) report 1 of 3 broods survived to 6 weeks, and Morrow (1986:56-59) reported 3 of 8 broods survived to 8 weeks. Assuming that the successful brood in the Horkel study survived to 8 weeks and that 36.4% (4 of 11) brood success to fledging at 8 weeks is typical, the daily brood mortality rate is 0.018. |
| date of first egg of first nest (dd-mmm) | T1 | 15-Mar | “The earliest date for a nest containing eggs was reported by Waddell near Egypt, Wharton County, February 25, 1925; the latest record is that of a nest in Colorado County in which the clutch was completed May 29, 1938. In both 1937 and 1938, however, the peak of the laying season in Colorado County was late March and early April” as quoted in [Lehmann (1941](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/036/biblio/bib076)). Assume typical dates for initiating egg laying range from March 15 to April 15. |
| date of first egg of last nest (dd-mmm) | Tlast | 15-Apr |
| length of rapid follicle growth period (RFG) for each egg (days) | rfg | 7 | Based on allometric equation from Alisauskas and Ankney (1992), assume rfg = 7 d. |
| mean clutch size | clutch | 12 | “11.6 ± 0.21 eggs for Attwater’s Prairie-Chicken, range 5-19 eggs for 12 studies and 131 clutches with 1,520 eggs (see Table 3 in Peterson and Silvy 1996). Clutch size of first nests tends to be greater than renests ([Hamerstrom 1939](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/036/articles/biblio/bib049), [Drobney and Sparrowe 1977](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/036/articles/biblio/bib034), McNew et al. 2010a); average of 12.6 vs. 9.7 eggs for T. c. pinnatus ([Schroeder and Braun 1991](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/036/articles/biblio/bib113)) and 12.1 vs. 9.5 eggs for T. c. attwateri (Peterson and Silvy 1996)” as quoted in Johnson et al (2011). |
| mean intra-egg laying interval (days) | eli | 1 | “Females lay 1 egg/d with occasional skips of 1–2 d” as quoted in Johnson et al (2011). |
| egg on which female typically begins incubation–penultimate (1) or last (0) | penult | 1 | “Incubation commences with laying of the penultimate egg, or as long as 4 d after last egg is laid ([Gross 1930](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/036/articles/biblio/bib045), [Lehmann 1941](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/036/articles/biblio/bib076))” as quoted in Johnson et al (2011). |
| duration from start of incubation to hatch (days) | I | 25 | “23–25 d ([Gross 1930](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/036/articles/biblio/bib045), [Lehmann 1941](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/036/articles/biblio/bib076), [Svedarsky 1988](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/036/articles/biblio/bib135)). Clutches initiated later in the breeding season may have incubation periods 2 d shorter than early clutches, possibly because the clutches contain fewer eggs, the eggs are smaller in size, and/or the weather is warmer ([Svedarsky 1988](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/036/articles/biblio/bib135)). In Kansas, Greater Prairie-Chickens incubated nests for 25.0 d on average (range 22-29 days, n = 38 nests) with duration not affected by study site, date of nest initiation or nesting attempt, but positively related to clutch size (McNew et al. 2010a)” as quoted in Johnson et al (2011). Assume typical duration is 25 d. |
| duration from hatch to fledging of nestlings (days) | N | 56 | “Intersibling distance increases with age, progressing toward eventual brood break-up. Although chicks can survive without the brood hen at 40 d of age, normal brood break-up occurs when chicks are about 80–84 d ([Bowman and Robel 1977](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/036/articles/biblio/bib019))” as quoted in Johnson et al (2011). Two studies following survival of broods report success rates at 6 or 8 weeks post-hatching. Based on the brood survival studies, we define fledging as broods surviving to 8 weeks or 56 d. |
| duration since nest failure due to other reasons until female initiates new nest (days) | We | 9 | “If a female’s first nest of the season is depredated, she may start laying eggs for a second clutch 8–9 d later ([Robel 1970](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/036/articles/biblio/bib104), [Svedarsky 1988](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/036/articles/biblio/bib135), MAS)” as quoted in Johnson et al (2011). |
| duration since successful fledging until female initiates new nest (days) | Wf | 100 | Only one successful brood possible in a breeding season. The value for Wf will not influence the model outcome due to the short egg laying period and is a placeholder. |
| female body weight (g) during breeding season | BdyWt | Mean: 874  SD: 63.8  Min: 577  Max: 1328 | Mean from USFWS 2007  SD, min and max based on TIM default assumption (0.073xMean, 0.66xMean and 1.52\*Mean, respectively). |
| diet composition during breeding season |  | Spring:  6% insects, 59% seeds, 35% broadleaves  Summer:  29% insects, 45% seeds, 26% broadleaves | The Atwater’s prairie chicken diet is composed of leaves, seeds and insects[[4]](#footnote-4). According to the US Fish and Wildlife’s recovery plan for this species[[5]](#footnote-5), the relative proportions of these food items vary over time. Foliage is dominated by broadleaf plants, but may also include grass (young). The proportion of insects in the diet increases in the summer months. Seeds are from native plants as well as cultivated crops, including corn, peanuts and rice. Data were available from Lehmann (1941)[[6]](#footnote-6) to determine spring and summer diets. |
| Feeding category |  | omnivore |  |
| mean number of nest attempts/ female/ season |  |  |  |
| mean number of successful broods/ female/ season |  |  |  |
| mean number of fledglings/ successful nest | fpsn | 4.23 | Table 5 of Peterson & Silvy (1996) calculated the weighted mean for the number of chicks/brood prior to brood breakup to be 4.23 from multiple sources during the period from 1937 to 1994. |
| mean number of fledglings/ female/ season (ARS) | ARS |  |  |
| Annual adult survival | phi |  |  |
| Frequency on field |  | Mean: 0.5  Min: 0  Max: 1 | Frequency on field of this species is unknown. Individuals may visit agricultural fields. Low (0.1), Medium (0.5) and High (0.9) mean frequency on field values should be considered in a sensitivity analysis of this species. |
| Residency |  | Edge | Based on habitat (see Table 2) |
| Passerine? |  | No |  |
| Precocial/ altricial |  | Precocial |  |

**Table 7. Lesser prairie-chicken (*Tympanuchus pallidicinctus*).**

| **Species life history parameters** | **Model Code** | **Typical value** | **Rationale/Comments** |
| --- | --- | --- | --- |
| Initiation probability | p | 0.25 | default |
| daily mortality rate during laying & incubation | m1 | 0.28^(1/35) = 0.9643  1-0.9643 = 0.0357 | Percent of clutches that hatch >1 egg averaged 28% (range 0-67%) for 10 studies (Copelin 1963, Donaldson 1969, Riley 1978, Candelaria 1979, Davis et al. 1979, Sell 1979, Ahlborn 1980, Merchant 1982, Haukos 1988, KMG); however, observer disturbance may have increased nest abandonment and nest depredation in these studies. Nest success in native sand sagebrush prairie was lower (26%) than nests in mixed-grass prairie and CRP fields (54%) in Kansas (Fields 2004, Pitman et al. 2005b). (Hagen and Giesen 2005) |
| daily mortality rate during nestling rearing | m2 | 0.018 | Reported age ratios from hunter harvest in fall in New Mexico were 53-55% juveniles, with average of 3.7 young/female (n = 923, Lee 1950; n = 2,447, Campbell 1972) and 0.44-3.00 young/adult (n = 37; Merchant 1982). Pitman (2003) estimated survival of chicks from hatch to first breeding at 11% in sw. Kansas; chick mortality occurred mostly within 14 d of hatch, and brood sizes in Kansas were smaller than those reported elsewhere. However, it was suggested that previous estimates of brood size were biased high because they did not account for total brood loss. (Hagen and Giesen 2005)  Current value is from Attwater’s Greater Prairie Chicken. |
| date of first egg of first nest (dd-mmm) | T1 | 15 April | Females attend leks from late Mar through May. On average, female attendance on leks (and their copulations) peak during second and third weeks of Apr in Colorado (Hoffman 1963, KMG), New Mexico (Campbell 1972, Suminski 1977, Riley 1978, Candelaria 1979, Davis et al. 1979, Ahlborn 1980), Oklahoma (Davison 1940, Copelin 1963, Jones 1964a, Donaldson 1969), and Texas (Crawford and Bolen 1975, Haukos 1988; Fig. 3). However, female attendance at leks as estimated from captured birds: 81% of captured females had attended at least one lek by 9 Apr from 1998–-2002 in sw. Kansas (CAH). Annual variation as result of extreme weather conditions; drought or late snowstorms may delay peak of female attendance 1–2 wk (Merchant 1982, Haukos 1988, Jamison 2000, KMG). Females that are observed at leks after early May may be renesting after failure of initial clutch (Pitman 2003, KMG). (Hagen and Giesen 2005)  Nests are initiated mid-Apr through late May, usually within 2 wk of lek attendance and copulation (Bent 1932, Copelin 1963, Snyder 1967, Merchant 1982, Haukos 1988, KMG). No information on differences among populations. Hatching peaks late May to mid-Jun throughout range (Copelin 1963, Merchant 1982, KMG, Pitman 2003). Second nesting attempts (after first clutch destroyed) initiated mid-May to early Jun, with hatching mid-Jun to early Jul (Merchant 1982, KMG, Pitman 2003, Patten et al. 2005). (Hagen and Giesen 2005) |
| date of first egg of last nest (dd-mmm) | Tlast | 7 June |  |
| length of rapid follicle growth period (RFG) for each egg (days) | rfg | 3 days | Average eggshell mass 1.69 g (n = 11; L. Kiff pers. comm.). (Hagen and Giesen 2005). |
|  | clutch | 10 | Commonly 10-12 eggs in complete clutches. Average of 10.4 eggs (range 8-14) in 60 complete clutches reported in 6 studies (Bent 1932, Copelin 1963, Sutton 1968, Merchant 1982, Haukos 1988, KMG). Patten et al. (2005) has documented geographic variation in clutch size between populations in New Mexico (8.7) and Oklahoma (10.8), and attributed this difference to life history strategies adapted to variations in habitat fragmentation and land-use. In captivity, may produce about 25 eggs/female (Coats 1955); hybrid Greater x Lesser Prairie-Chicken produced 26 eggs (Crawford 1978). Clutches of renesting females may have fewer eggs (Pitman 2003, KMG). Clutch size may decrease with later initiation date (Copelin 1963). In Kansas, yearling females had similar clutch sizes (11.8 eggs, n = 61) in first nests as adults (12.3 eggs, n = 81), but slightly larger clutch size in renests (8.3 eggs, n = 11 vs. 7.1 eggs, n = 14; Pitman 2003). (Hagen and Giesen 2005) |
| mean intra-egg laying interval (days) | eli | 1 | 1 day is a typical value. BNA account suggests 1 egg/day, but occasionally skipping a day. |
| egg on which female typically begins incubation–penultimate (1) or last (0) | penult | last egg | Incubation by female only. Incubation begins after last egg is laid. (Hagen and Giesen 2005) |
| duration from start of incubation to hatch (days) | I | 25 | Lasts 24–26 d (Coats 1955, Sutton 1968). (Hagen and Giesen 2005) |
| duration from hatch to fledging of nestlings (days) | N | 13.5 weeks | Brood breaks up and gains independence from hen at 12–15 wk; coincides with fall dispersal (Pitman 2003). (Hagen and Giesen 2005) |
| duration since nest failure due to other reasons until female initiates new nest (days) | We | 12 | if female’s first clutch is depredated, she may begin second clutch within 2 wk (KMG). In Kansas, on average second clutches initiated 12.3 d (range = 3-26 d, n = 17) after first nest was lost (J. C. Pitman, Indiana Department of Fish and Wildlife, unpublished data). (Hagen and Giesen 2005) |
| duration since successful fledging until female initiates new nest (days) | Wf | 125 | Only 1 successful brood/season. If first clutch is depredated or abandoned, some females may lay replacement (renest) clutch (Merchant 1982, KMG, Pitman 2003). |
| female body weight (g) during breeding season | BdyWt | Mean: 727  SD: 53.1  Min: 676  Max:761 | From Dunning 1984  These data are consistent with mean values from Hagen and Giesen 2005: 679-749  SD based on default assumption for TIM |
| diet composition during breeding season |  | 55% insects, 22% seeds,  11.5% grass,  11.5% broadleaf | Spring and summer diet (Hagen and Giesen 2005).  50:50 split assumed for portion of diet represented by vegetation |
| Feeding category |  | omnivore |  |
| mean number of nest attempts/ female/ season |  |  |  |
| mean number of successful broods/ female/ season |  |  |  |
| mean number of fledglings/ successful nest | fpsn | 3.5 – 7.8 | In Oklahoma and New Mexico, average brood size (as determined from roadside counts) in late summer (Jul to Aug) ranged from 3.5 to 7.8 chicks; size influenced by annual precipitation patterns, declining in drought years (Schwilling 1955, Copelin 1963, Merchant 1982). Average brood size of radio-marked females was slightly greater in Oklahoma (4.5) than in New Mexico (3.7), and was negatively correlated with survival rates of females (Patten et al. 2005). Average brood size slightly greater in Oklahoma (4.5) than in New Mexico (3.7), and negatively correlated with survival rates of females (Patten et al. 2005). (Hagen and Giesen 2005) |
| mean number of fledglings/ female/ season (ARS) | ARS |  |  |
| Annual adult survival | phi | 0.9973 = 0.37^(1/365) | From Campbell 1972 . Maximum life span in the wild estimated at 5 yr, based on recoveries of banded birds in New Mexico. In New Mexico, percent subadults in spring trap samples suggests average annual adult mortality of 53% for males and females; estimated annual survival rate of banded individuals 35-45% for adult males, 31-32% for subadult males. Live recapture data of banded birds indicated that annual survival was greatest for males between their first and second years (60%) and decreased as birds aged (36-44%; Hagen et al. 2005a). Annual survivorship of females as determined from radiotelemetry was greater in yearlings (52%) than adults (37%), differences attributed in part to nesting activity (Hagen 2003). (Hagen and Giesen 2005) |
| Frequency on field |  | Mean: 0.5  Min: 0  Max: 1 | Frequency on field of this species is unknown. Individuals may visit agricultural fields. Low (0.1), Medium (0.5) and High (0.9) mean frequency on field values should be considered in a sensitivity analysis of this species. |
| Residency |  | Edge | Based on habitat (see Table 2) |
| Passerine? |  | No |  |
| Precocial/ altricial |  | Precocial |  |

**Table 8. Florida grasshopper sparrow (*Ammodramus savannarum floridanus*).**

| **Species life history parameters** | **Model Code** | **Typical value** | **Rationale/Comments** |
| --- | --- | --- | --- |
| Initiation probability | p | **0.25** | Place holder value. |
| daily mortality rate during laying & incubation | m1 | 0.9363 | Naïve overall rates = 0.11 Avon Park AFR and 0.33 at Three Lakes WMA. Split the difference and call it 0.22  0.22^(1/23) |
| daily mortality rate during nestling rearing | m2 | 1-0.9363 =0.0637 |  |
| date of first egg of first nest (dd-mmm) | T1 | 1 march | March –June 1st peak and 2nd peak July-September  Late March – September.  Seee shriver et al. 1996 for multimodal breeding season. |
| date of first egg of last nest (dd-mmm) | Tlast | 30 June |
| length of rapid follicle growth period (RFG) for each egg (days) | rfg | **3** | Place holder value. |
| mean clutch size | clutch | 3.71 | USFWS Multispecies recovery plan.  clutch size declines over season (Vickery 1996) +/- 0.47 |
| mean intra-egg laying interval (days) | eli | **1** | Place holder value. |
| egg on which female typically begins incubation–penultimate (1) or last (0) | penult | 1 | (Vickery 1996) probably penultimate |
| duration from start of incubation to hatch (days) | I | 12 | (Vickery 1996) 11-13 days |
| duration from hatch to fledging of nestlings (days) | N | 8 | 8-9 michigan & pennslyvania  6-8 days nebraska |
| duration since nest failure due to other reasons until female initiates new nest (days) | We | 11 | USFWS 1999 |
| duration since successful fledging until female initiates new nest (days) | Wf | 13.5 | USFWS 1999 |
| female body weight (g) during breeding season | BdyWt | Mean:18.38  SD: 0.39  Min: 12.1  Max: 27.9 | From Vickery 1996  Min and max based on defaults assumptions for TIM |
| diet composition during breeding season |  | 69% insects, 31% seeds | USFWS 1999 |
| Feeding category |  | Omnivore |  |
| mean number of nest attempts/ female/ season |  |  | 3-4 nests attempts per year.See shriver et al. 1996 Fla Field Nat. 24(3): 68-73. |
| mean number of successful broods/ female/ season |  |  | see Multispecies recovery plan: Bimodal season may allow up to 4 broods (Vickery 1996) |
| mean number of fledglings/ successful nest | fpsn | **2** | Place holder value. |
| mean number of fledglings/ female/ season (ARS) | ARS |  | see Multispecies recovery plan |
| Daily adult survival | phi | 0.9986 | Multispecies recovery plan annual adult survival = 0.598 |
| Frequency on field |  | Mean: 0  Min: 0.1  Max:0.2 | Based on habitat (Table 2), low frequency on field is expected for agricultural habitats. Individuals may forage on agricultural fields. |
| Residency |  | Edge | Based on habitat (see Table 2) |
| Passerine? |  | Yes |  |
| Precocial/ altricial |  | Altricial |  |

**Table 9. San Clemente sage sparrow (*Amphispiza belli clementeae*)[[7]](#footnote-7).**

| **Species life history parameters** | **Model Code** | **Typical value** | **Rationale/Comments** |
| --- | --- | --- | --- |
| Initiation probability | p | 0.25 | default |
| daily mortality rate during laying & incubation | m1 | 1-0.98 =0.02 | From Willey 1990: Table 1  But also: “All but one nest fledged at least one individual. The single nest failure resulted from abandonment before egg laying. This pair did not renest in the 1986 season.” Willey 1990. |
| daily mortality rate during nestling rearing | m2 | 1-0.98 =0.02 | From Willey 1990: Table 1 |
| date of first egg of first nest (dd-mmm) | T1 | 7 April | [Figure 5](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/326/articles/species/326/galleries/figures/figure-5) . A. b. belli egg dates indicated full clutches by 18 Mar in San Luis Obispo Co., CA; by 25 Mar in San Diego Co., CA; and by 26 Mar in Baja California. In Riverside Co., CA, first egg date 11 Mar (M. Misenhalter pers. comm.); last clutch laid usually by mid-Jun. In Idaho, (nevadensis), egg dates 6 Apr–16 Jun. In Kern Co., CA (canescens), earliest date for full clutch, 14 Mar; 14 May is latest date. Latest date 4 Jul in Mono Co., CA.  Based on Figure 5 of Martin and Carlson 1998 |
| date of first egg of last nest (dd-mmm) | Tlast | 7 July | See note above |
| length of rapid follicle growth period (RFG) for each egg (days) | rfg | 4 | Data collected in Oregon and Nevada; 196 eggs weighed from nests using a Pesola scale to nearest 0.1 g: mean 2.3 g (15.8% of female weight, range 1.1–4.0; J. Rotenberry pers. comm.).  Allometric eqn of Alisauskis give 3.7 days  NOTE: egg weight data probably from sagebrush sparrow. |
| mean clutch size | clutch | 3 | mean = 3.4 (Willey 1990) |
| mean intra-egg laying interval (days) | eli | 1 | Martin and Carlson 1998: Females of all subspecies usually lay 1 egg/d until clutch is complete. |
| egg on which female typically begins incubation–penultimate (1) or last (0) | penult | penult |  |
| duration from start of incubation to hatch (days) | I | 13 | Martin and Carlson 1998: Incubation lasts 10–16 d from completion of clutch ([Linsdale 1938](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/326/articles/species/326/biblio/bib035), [Reynolds 1981](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/326/articles/species/326/biblio/bib064), [Willey 1990](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/326/articles/species/326/biblio/bib107), J. Rotenberry pers. comm., M. Misenhalter pers. comm.).  13.3 days (Willey 1990) |
| duration from hatch to fledging of nestlings (days) | N | 14 | 13.5 days (Willey 1990) (note, allocated the 0.3 extra days of incubation to nestling here). |
| duration since nest failure due to other reasons until female initiates new nest (days) | We | 7 | Current value from Vesper Sparrow profile in MCnest library (following Carson et al. 2003) |
| duration since successful fledging until female initiates new nest (days) | Wf | 7 | By observing nesting behavior and chronology, renesting was observed for 10 nesting pairs of San Clemente Island sage sparrows; five of these pairs renested a third time. During a moist spring, the boxthorn habitat provides excellent nesting opportunities for sage sparrows which continue to renest until arid summer conditions develop and lower the probability of producing a successful clutch. Ultimately, the reproductive output of the San Clemente sage sparrow appears to be controlled by climatic influence on habitat condition but proximately may be a response to low population size and to the level of habitat saturation occurring on San Clemente Island.. Willey 1990.  Current value from Vesper Sparrow profile in MCnest library (following Carson et al. 2003) |
| female body weight (g) during breeding season | BdyWt | Mean: 14.9  SD: 0.96  Min: 12.7  Max: 16.2 | Females from CA. Martin and Carlson 1998. |
| diet composition during breeding season |  | 75% seeds,  25% arthropods | Martin and Carlson 1998 indicate that diet is predominantly seeds (grasses, pigweeds and mustards) in April, July and August. During may and June, they consume a wide variety of arthropods. |
| Feeding category |  | granivore | Majority of diet is seeds |
| mean number of nest attempts/ female/ season |  |  |  |
| mean number of successful broods/ female/ season |  |  |  |
| mean number of fledglings/ successful nest | fpsn | 2.05 | Willey 1990. Not stated whether fpsn or fpn. Assume former. |
| mean number of fledglings/ female/ season (ARS) | ARS |  |  |
| Annual adult survival | phi | 0.5 | From Martin and Carlson 1998: No data on survivorship. Regarding life span, a 6-yr-old nevadensis was found in 1 study (Wiens 1985). For belli, 7-yr-old and 2.5-yr-old color-banded males were recorded. Life span of 3 yr is not uncommon for males, 2 yr for females (BAC).  Assuming geometric survival, 2^(-1) = 0.5 = mean female survivorship? Very coarse estimate! |
| Frequency on field |  | Mean: 0  Min: 0.1  Max:0.2 | Based on habitat (Table 2), low frequency on field is expected for agricultural habitats. Individuals may forage on agricultural fields. |
| Residency |  | Edge | Based on habitat (see Table 2) |
| Passerine? |  | Passerine |  |
| Precocial/ altricial |  | Altricial |  |

**Table 10. Golden-cheeked warbler (=wood) (*Dendroica chrysoparia*).**

| **Species life history parameters** | **Model Code** | **Typical value** | **Rationale/Comments** |
| --- | --- | --- | --- |
| Initiation probability | p | 0.25 | default |
| daily mortality rate during laying & incubation | m1 | 0.08 | USFWS 1992: Hatching success for 55 eggs laid in 33 GCW nests was 36.4% (or 20 eggs; Pulich 1976). Then, taking incub to last 12 days, survival during incubation can be estimated as:  36.4^(1/12) = 0.9192. |
| daily mortality rate during nestling rearing | m2 | 0.028 | USFWS 1992: Fledgling success was 27% (15 fledglings from 55 eggs) for 33 nests studied by Pulich (1976). Thus survival during nestling phase must be 27/36.4 = 74.18%  Assuming nestling phase lasts 10.5 days (middle of range) then survival during nestling phase can be estimated as 0.7418^(1/10.5) = 0.972 |
| date of first egg of first nest (dd-mmm) | T1 | 7 April | USFWS 1992: Females begin building nests the first week of April (Pulich 1976).  Estimated from phenology figure in Ladd and Grass 1999 |
| date of first egg of last nest (dd-mmm) | Tlast | 21 May | Estimated from phenology figure in Ladd and Grass 1999 |
| length of rapid follicle growth period (RFG) for each egg (days) | rfg | 3.17 days | Few measurements available; 1 egg weighed 1.4 g after 2 d of incubation, when it was deserted by female (Pulich 1976). Allometric eqn gives 3.17 days |
| mean clutch size | clutch | 4 | USFWS 1992: Female warblers produce clutches of 3-4 (and rarely 5) creamy white eggs |
| mean intra-egg laying interval (days) | eli | 1 | Ladd and Grass 1999: Lays 1 egg/d, in early morning (first hour after sunrise; Pulich 1976). |
| egg on which female typically begins incubation–penultimate (1) or last (0) | penult | penult | USFWS 1992: Incubation begins on the day before the last egg is laid and lasts 12 days (Pulich 1976). |
| duration from start of incubation to hatch (days) | I | 12 | USFWS 1992: Incubation begins on the day before the last egg is laid and lasts 12 days (Pulich 1976).  Ladd and Grass 1999: Lasts 10–12 d (Pulich 1976, Gass 1996). |
| duration from hatch to fledging of nestlings (days) | N | 11 | Ladd and Grass 1999: Young fledge 9–12 d after hatching…(Pulich 1976, Gass 1996). |
| duration since nest failure due to other reasons until female initiates new nest (days) | We | 6 | Ladd and Grass 1999: Frequently lays second clutch if first is destroyed (Bent 1953, Pulich 1976).  mean of four warbler species in MCnest library = 6 days |
| duration since successful fledging until female initiates new nest (days) | Wf | 15 | Ladd and Grass 1999: On basis of average timing of first brood, second brood probably is initiated in May (Pulich 1976, LG).  Ladd and Grass 1999: Usually 1 brood/season; under good conditions, may rear 2 broods in a season (Pulich 1976). Evidence of double broods is mostly circumstantial. Observations include dependent fledglings on same territory early and late in breeding season, a pair simultaneously nesting and feeding fledglings, and a pair simultaneously feeding older and younger fledglings (Bolsinger and Hayden 1992, Weinberg et al. 1996, L. Jetté pers. comm., D. Hernandez pers. comm., LG).  Set slightly longer than average among warbler species in MCnest library (12.7 days) |
| female body weight (g) during breeding season | BdyWt | Mean: 9.4  SD: 2.8  Min:8.7  Max: 12.1 | Dunning 1984 |
| diet composition during breeding season |  | 100% insects | USFWS 1992 |
| Feeding category |  | insectivore |  |
| mean number of nest attempts/ female/ season |  |  |  |
| mean number of successful broods/ female/ season |  |  |  |
| mean number of fledglings/ successful nest | fpsn | 2.68 | Calculated using the modal clutch size (4 eggs) together with the typical ratio of FPSN/clutch =0.67 for other warblers in MCnest library |
| mean number of fledglings/ female/ season (ARS) | ARS |  | Ladd and Grass 1999: At Fort Hood, TX (1993–1996), number of young produced/successful male/year averaged 2.23 (n = 118 males, 263 fledglings; Jetté et al. 1998). In Travis Co. (1993–1997), mean brood size/successful male was 2.19 (n = 142 broods; D. Keddy-Hector unpubl.). |
| Annual adult survival | phi |  | Ladd and Grass 1999: Measures of survivorship rates based on return rates for fledglings are undoubtedly underestimated because of their long dispersal distances (see Range, below); those of females are also underestimated, because of their obscurity and relative silence, compared to males. On basis of returns of banded birds to breeding areas, minimum survivorship of **fledgling males to next breeding season at Fort Hood averages 17% (n = 148);** of second-year males, 49% (n = 53); and of all older males, 49% (n = 70). Minimum survivorship for all adult males is 46% (n = 268). On basis of resightings, minimum survivorship of fledgling females averages 9% (n = 78), while that of adult females averages 18% (n = 60; Jetté et al. 1998). In Travis Co., 14% of fledgling males (n = 14), 37% of second-year males (n = 54), and 49% of all older males (n = 81) that were banded returned to same breeding area (D. Keddy-Hector unpubl.). |
| Frequency on field |  | Mean: 0  Min: 0.1  Max:0.2 | Based on habitat (Table 2), low frequency on field is expected for agricultural habitats. Individuals may forage on agricultural fields. |
| Residency |  | Edge | Based on habitat (see Table 2) |
| Passerine? |  | Yes |  |
| Precocial/ altricial |  | Altricial |  |

**Table 11. Southwestern willow flycatcher (*Empidonax traillii extimus*)[[8]](#footnote-8).**

| **Species life history parameters** | **Model Code** | **Typical value** | **Rationale/Comments** |
| --- | --- | --- | --- |
| Initiation probability | p | 0.25 | default |
| daily mortality rate during laying & incubation | m1 | 0.0275 | Sedgwick 2000: In sw. New Mexico (1997–1999), 43.3% of 298 nests fledged ≥1 young (S. Stoleson and D. Finch pers. comm.), and in Sierra Nevada, 60% (n = 25) and 50% (n = 64) of nests fledged ≥1 young in 1997 and 1998, respectively (H. Bombay pers. comm.). Taking the nest cycle to last 13+14+3 days gives 30 days. So 43.3^(1/30) =0.9725 |
| daily mortality rate during nestling rearing | m2 | 0.0275 | See above |
| date of first egg of first nest (dd-mmm) | T1 | 25 May | See Figure 2 from USFWS 2002 (copied below). Incubation occurs from late May through very early August. |
| date of first egg of last nest (dd-mmm) | Tlast | 31 July |  |
| length of rapid follicle growth period (RFG) for each egg (days) | rfg | 3.3 | USFWS 2002: Eggs are approximately 18 mm long and 14 mm wide (0.45 x 0.35 in), and weigh about 1.6 g (0.05 oz) (McCabe 1991). NOTE: MCCABE PUB IS NOT SPECIFCALLY ABOUT SOUTHWESTERN WILLOW FLYCATCHER  Sedgwick 2000: Mean fresh egg mass: 1.7 g (n = 168 eggs); no difference in egg mass according to sequence of egg laid (Holcomb 1972a, 1974); 1.67 g (n = 83; Walkinshaw 1966). |
| mean clutch size | clutch | 3 | USFWS 2002: Females typically lay one egg per day, until the nest contains 3 or 4 eggs.  Sedgwick 2000: In s. New Mexico, mean clutch size reported as 3.06 ± 0.63 SE (n = 50; includes second and later nestings; S. Stoleson pers. comm.). E. t. extimus first nests in Arizona (1996–1999, unparasitized nests only) had average clutch of 2.92 ± 0.73 SD (n = 321; T. McCarthey pers. comm.). |
| mean intra-egg laying interval (days) | eli | 1 | USFWS 2002: Females typically lay one egg per day, until the nest contains 3 or 4 eggs. |
| egg on which female typically begins incubation–penultimate (1) or last (0) | penult | last | USFWS 2002: Incubation begins after the last egg is laid, and lasts 12 to 13 days. |
| duration from start of incubation to hatch (days) | I | 13 | USFWS 2002: Incubation begins after the last egg is laid, and lasts 12 to 13 days. |
| duration from hatch to fledging of nestlings (days) | N | 14 | USFWS 2002: Nestlings fledge 12 to 15 days after hatching  BNA: Nestling period 14–15 d (Berger and Hofslund 1950, McCabe 1991). Berger (1967) reported 13–16 d for 45 young. Five family groups in s. Michigan fledged after an average of 13.8 d in nest (n = 13 young; Walkinshaw 1966); in a Nebraska and Ohio study, 82 young fledged between 11 and 14 d (mean 12.3 d ± 0.1 SE; Holcomb 1972a). |
| duration since nest failure due to other reasons until female initiates new nest (days) | We | 7 | USFWS 2002: Renesting is regularly attempted if the first nest is lost or abandoned due to predation, parasitism, or disturbance; a female may attempt as many as four nests per season (Smith et al. 2002).  From Willow Flycatcher profile in MCnest library |
| duration since successful fledging until female initiates new nest (days) | Wf | 100 | USFWS 2002: Second clutches within a single breeding season are uncommon if the first nest is successful. Most attempts at renesting occur if the young fledge from the first nest by late June or very early July.  Sedgwick 2000: Normally only 1 brood/season except in cases of predation or nest loss. Renesting after successfully fledging a brood is rare in northern populations (1 instance, n = 882 pairs, n = 1,168 nests; 1988–1997; se. Oregon; JAS), somewhat more common farther south (M. Whitfield pers. comm.).  From Willow Flycatcher profile in MCnest library |
| female body weight (g) during breeding season | BdyWt | Mean: 12.7  SD: 1.2  Min: 10.3  Max: 15.9 | Sedgwick 2000 |
| diet composition during breeding season |  | 100% insects | USFWS 2002 |
| Feeding category |  | insectivore |  |
| mean number of nest attempts/ female/ season |  |  |  |
| mean number of successful broods/ female/ season |  |  |  |
| mean number of fledglings/ successful nest | fpsn | 3.14 | From Willow Flycatcher profile in MCnest library |
| mean number of fledglings/ female/ season (ARS) | ARS |  |  |
| Annual adult survival | phi |  | Based on returns of 611 breeding Willow Flycatchers captured on Malheur NWR study areas in Oregon (1988–1997) that subsequently returned and bred, mean life span (not taking dispersal into account) of males was 1.08 yr ± 0.11 SE; females 0.97 yr ± 0.10 SE (Sedgwick and Iko 1999). |
| Frequency on field |  | Mean: 0  Min: 0.1  Max:0.2 | Based on habitat (Table 2), low frequency on field is expected for agricultural habitats. Individuals may forage on agricultural fields. |
| Residency |  | Edge | Based on habitat (see Table 2) |
| Passerine? |  | Yes |  |
| Precocial/ altricial |  | Altricial |  |

**Table 12. Inyo California towhee (*Pipilo crissalis eremophilus*).**

| **Species life history parameters** | **Model Code** | **Typical value** | **Rationale/Comments** |
| --- | --- | --- | --- |
| Initiation probability | p | 0.25 | default |
| daily mortality rate during laying & incubation | m1 | 0.968^(1/25) = 0.0013  0.932^(1/25) = 0.0028 | In 1996, 0.932 and 0.968 in 1997 (Ellison 1999). Significantly higher daily success rate in grazed habitat (0.971) than in ungrazed (0.926; Purcell and Verner 1998). |
| daily mortality rate during nestling rearing | m2 | 0.968^(1/25) = 0.0013  0.932^(1/25) = 0.0028 |  |
| date of first egg of first nest (dd-mmm) | T1 | 1 April | The breeding season generally starts early in spring, with courtship and nest building commencing in March. The first clutches are laid in April, but can be laid as early as late March USFWS 1998 |
| date of first egg of last nest (dd-mmm) | Tlast | 31 May | replacement clutches may be laid as late as May or early June.USFWS 1998 |
| length of rapid follicle growth period (RFG) for each egg (days) | rfg | 4.4 d | 4.05 g/egg Hanna 1924. Use allometric eqn of Alisauskas |
| mean clutch size | clutch | 4 | 3.69 (Benedict et al. 2011), 4 eggs = modal clutch size (USFWS 1998) |
| mean intra-egg laying interval (days) | eli | 1 | Benedict et al. 2011 |
| egg on which female typically begins incubation–penultimate (1) or last (0) | penult | penult | Benedict et al. 2011 |
| duration from start of incubation to hatch (days) | I | 14 | 14 days (USFWS 1998) |
| duration from hatch to fledging of nestlings (days) | N | 8 | 8 days (USFWS 1998) |
| duration since nest failure due to other reasons until female initiates new nest (days) | We | 8.5 d | BNA: Birds begin building replacement nests as soon as 1 day after nest loss (LB). [New nest]  Initiated 5.8 d after nest construction observed in one population (n = 19; KE), 11.3 d after the onset of nest construction in another (n = 6; LB). mean = 8.5 days. Very short. |
| duration since successful fledging until female initiates new nest (days) | Wf | 100 | If the first clutch fails the pair will recycle, but breeding behavior usually ceases for the pair when the first clutch is successful.USFWS 1998. Second brood had first egg laid 14d after fledging first brood (Benedict et al. 2011) |
| female body weight (g) during breeding season | BdyWt | Mean: 51.8  SD: 3.78  Min: 46.3  Max: 61.2 | Dunning 1984  SD estimated using default assumption from TIM |
| diet composition during breeding season |  | 14% insects, 79% seeds,  4% fruit,  1.5% grass, 1.5% broadleaves | Kunzmann et al. 2011  Diet may include oats, barley, wheat and cultivated fruit. |
| Feeding category |  | granivore | Majority of diet is composed of seeds |
| mean number of nest attempts/ female/ season |  |  |  |
| mean number of successful broods/ female/ season |  |  |  |
| mean number of fledglings/ successful nest | fpsn |  |  |
| mean number of fledglings/ female/ season (ARS) | ARS |  |  |
| Annual adult survival | phi | 0.4931^(1/365)=  0.9981 | Maximum recorded age 12 yr, 10 mo (http://www.pwrc.usgs.gov/BBL/homepage/long4930.htm). Of 432 individuals banded at Hastings Natural History Reservation in Monterey Co., CA, 184 were known to survive 1 yr, 83 for 2 yr, 51 for 3 yr, then rapidly declining to 3 for 6 yr, 2 for 7 yr, and none for 8 yr between Nov 1937 and Jun 1948 ([Linsdale 1949](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/632/articles/biblio/bib089)).  This gives expected lifespan of 2.0279 years or survival = 1/2.0279 = 0.4931 |
| Frequency on field |  | Mean: 0  Min: 0.1  Max:0.2 | Based on habitat (Table 2), low frequency on field is expected for agricultural habitats. Individuals may forage on agricultural fields. |
| Residency |  | Edge | Based on habitat (see Table 2) |
| Passerine? |  | Yes |  |
| Precocial/ altricial |  | Altricial |  |

**Table 13. Coastal California gnatcatcher (*Polioptila californica californica*)[[9]](#footnote-9).**

| **Species life history parameters** | **Model Code** | **Typical value** | **Rationale/Comments** |
| --- | --- | --- | --- |
| Initiation probability | p | 0.25 | default |
| daily mortality rate during laying & incubation | m1 | 0.957 | Grishaver et al. 1998. Table 4 |
| daily mortality rate during nestling rearing | m2 | 0.981 | Grishaver et al. 1998. Table 4 |
| date of first egg of first nest (dd-mmm) | T1 | 22 March | 22 March is extreme early date. Grishaver et al. 1998. |
| date of first egg of last nest (dd-mmm) | Tlast | 13 July | Grishaver et al. 1998: season lasts 113 days. |
| length of rapid follicle growth period (RFG) for each egg (days) | rfg | 3 | Atwood and Bontrager 2001: Egg Mass: Mean 0.99 g (range 0.82–1.11, n = 38; [Hanna 1934](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/574/articles/species/574/biblio/bib072)); about 17% of adult female body weight (JLA). Gives an estimate of rfg = 2.8 days. |
| mean clutch size | clutch | 4 | Atwood and Bontrager 2001: Mean 3.8 ± 0.57 SD (mode 4, range 2–5, n = 61; [Atwood 1988](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/574/articles/species/574/biblio/bib007)) from nests in s. California;  USFWS 2010. Clutch size = 4 |
| mean intra-egg laying interval (days) | eli | 1 | Atwood & Bontrager 2001 |
| egg on which female typically begins incubation–penultimate (1) or last (0) | penult | penult |  |
| duration from start of incubation to hatch (days) | I | 14 | Grishaver et al. 1998. |
| duration from hatch to fledging of nestlings (days) | N | 13 | Grishaver et al. 1998 |
| duration since nest failure due to other reasons until female initiates new nest (days) | We | 1 | Grishaver et al. 1998 |
| duration since successful fledging until female initiates new nest (days) | Wf | 15 | Atwood and Bontrager 2001: 6 pairs that fledged 2 juveniles began next nest average of 16 d ± 10.1 SD later; 9 pairs that fledged 4 juveniles began next nest average of 14 d ± 10.1 SD later (JLA). Number of days between successful fledging and initiation of next nest significantly correlated with date of fledging (n = 27); initiation of subsequent nesting attempts late in season occurs more rapidly than early in season (JLA). |
| female body weight (g) during breeding season | BdyWt | Mean: 5.9  SD: 0.26  Min:5.3  Max: 6.4 | Atwood and Bontrager 2001 |
| diet composition during breeding season |  | 100% insects | Federal register on designation of critical habitat for Costal California Gnatcatcher  Atwood and Bontrager 2001 |
| Feeding category |  | insectivore |  |
| mean number of nest attempts/ female/ season |  |  |  |
| mean number of successful broods/ female/ season |  |  |  |
| mean number of fledglings/ successful nest | fpsn | 2.24 | From Table 2 of Grishaver et al. 1998, calculated as mean of product of eggs hatched/eggs laid \* clutch size over all four years (last column) |
| mean number of fledglings/ female/ season (ARS) | ARS |  |  |
| Annual adult survival | phi |  |  |
| Frequency on field |  | Mean: 0  Min: 0.1  Max:0.2 | Based on habitat (Table 2), low frequency on field is expected for agricultural habitats. Individuals may forage on agricultural fields. |
| Residency |  | Edge | Based on habitat (see Table 2) |
| Passerine? |  | Yes |  |
| Precocial/ altricial |  | Altricial |  |

**Table 14. Kirtland's Warbler (*Setophaga kirtlandii*).**

| **Species life history parameters** | **Model Code** | **Typical value** | **Rationale/Comments** |
| --- | --- | --- | --- |
| Initiation probability | p | 0.25 | default |
| daily mortality rate during laying & incubation | m1 | 0.46 | Probabilities of survival at successive stages of nesting may be combined as follows: survival of eggs during incubation 0.54, hatching of eggs present at hatching time 0.78, survival of nestlings until fledging 0.76, combined survival of eggs until fledging 0.32. |
| daily mortality rate during nestling rearing | m2 | 0.4074 | Taking 0.32/0.54 = 0.5926 |
| date of first egg of first nest (dd-mmm) | T1 |  | First nests may be started as early as 11 May or as late as 18 Jun (Bocetti 1994). Date determined by arrival time on the nesting ground, and by weather. Arrival time is linked to winter habitat conditions (Rockwell et al. 2013). All nesting activities suspended by cold, wet weather (Mayfield 1960).  First eggs appear in the third week of May (earliest 20 May, Bocetti 1994), but most clutches are not started until the first week in June (Mayfield 1960). First eggs usually hatch between 9 Jun and 26 Jun (Mayfield 1960, Bocetti 1994).  If nest is destroyed or deserted, building of replacement may begin in 1–2 d. If first brood is fledged by late June, a second nesting may be attempted (Berger and Radabaugh 1968, Mayfield 1960). Latest second nest initiation 2 Jul (Bocetti 1994). |
| date of first egg of last nest (dd-mmm) | Tlast |  |  |
| length of rapid follicle growth period (RFG) for each egg (days) | rfg | 3.42 | Mean mass 1.79 g (1.47–2.21; n = 50) weighed within two days of laying and all subsequently hatched (Mayfield 1960). Allometric eqn gives 3.42 days |
| mean clutch size | clutch | 5 | 3–6, mean 4.63, n = 67. First nest of the season usually 5 eggs, occasionally 6; replacement nests usually 4 (Mayfield 1960, Walkinshaw 1983). Bocetti (1994) found mean 4.59, n = 46 in all habitats combined (because no difference between habitats), and Rockwell (2013) found mean 4.58, n = 279 in plantation-regenerated habitat. Rockwell (2013) also found a nest with 7 eggs in one clutch, and a nest with 9 eggs that were laid in 2 clutches (5 and 4) in the same nest (no eggs hatched). |
| mean intra-egg laying interval (days) | eli | 1 | First egg laid on day following completion of nest. All eggs laid soon after sunrise on successive days. |
| egg on which female typically begins incubation–penultimate (1) or last (0) | penult | penult | Incubation begins on day before laying of the last egg. |
| duration from start of incubation to hatch (days) | I | 14 | Mean 14.2 d (13–15, n = 21) from laying of last egg to hatching of last egg (Walkinshaw 1983). |
| duration from hatch to fledging of nestlings (days) | N | 9.4 | Young leave the nest at a mean age of 9.4 d, but may do so at 8 d if disturbed. |
| duration since nest failure due to other reasons until female initiates new nest (days) | We |  |  |
| duration since successful fledging until female initiates new nest (days) | Wf |  |  |
| female body weight (g) during breeding season | BdyWt | Mean: 13.8  SD:0.31  Min:12.3  Max:16 | Dunning 1984 |
| diet composition during breeding season |  | 100% insects | It is assumed that birds consume primarily invertebrates during the breeding season, however, they will also consume fruit (e.g., blueberries). (Mayfield 2014) |
| Feeding category |  | insectivore |  |
| mean number of nest attempts/ female/ season |  |  |  |
| mean number of successful broods/ female/ season |  |  |  |
| mean number of fledglings/ successful nest | fpsn |  | After cowbird control was institutionalized in 1972, several studies estimated productivity: Shake and Mattson (1975) reported 2.84 young fledged per nest in 1972, on average; Kelly and DeCapita (1982) reported 2.76 young fledged per nest per year from 1972-1981; Bocetti (1994) found 3.59 young fledged per nest attempt in 1990-1992; Rockwell (2013) reported 2.72 fledglings per nest attempt from 2007-2009. |
| mean number of fledglings/ female/ season (ARS) | ARS | 2.2 | Productivity varies from year to year, but estimates over early decades (cowbirds present in area) show production of young per pair without interference by cowbirds was about 2.2 fledglings, vs. 0.8 in parasitized nests. |
| Annual adult survival | phi | 0.65 | Survival rate of adults from one June to the next is about 65% (Mayfield 1960, Walkinshaw 1983; C. Bocetti, C. Kepler, and P. Sykes, unpubl. data.). |
| Frequency on field |  | Mean: 0  Min: 0.1  Max:0.2 | Based on habitat (Table 2), low frequency on field is expected for agricultural habitats. Individuals may forage on agricultural fields. |
| Residency |  | Edge | Based on habitat (see Table 2) |
| Passerine? |  | Yes |  |
| Precocial/ altricial |  | Altricial |  |

**Table 15. Black-capped Vireo (*Vireo atricapilla*).**

| **Species life history parameters** | **Model Code** | **Typical value** | **Rationale/Comments** |
| --- | --- | --- | --- |
| Initiation probability | p | 0.25 | default |
| daily mortality rate during laying & incubation | m1 | 0.035 | Pease & Grzybowski 1995 daily background failure rate (does not include abandonment due to nest parasitism) of 0.035. |
| daily mortality rate during nestling rearing | m2 | 0.035 |  |
| date of first egg of first nest (dd-mmm) | T1 | 20 April | difference between Tlast and T1 is 68 days (Pease & Grzybowski 1995). Suggest using phenology diagram in BNA account to come up with T1 and then add 68 days. |
| date of first egg of last nest (dd-mmm) | Tlast | 27 June | See entry above for T1 |
| length of rapid follicle growth period (RFG) for each egg (days) | rfg | 3.3 | Mean of whole fresh egg 1.59 g (n = 21; about 17% of female mass). By allometric eqn = 3.3 days |
| mean clutch size | clutch | 4 | Grzybowski 1995 |
| mean intra-egg laying interval (days) | eli | 1 | Grzybowski 1995 |
| egg on which female typically begins incubation–penultimate (1) or last (0) | penult | penult | Grzybowski 1995First chick hatches approximately 14–17 d after second or third egg is laid (incubation through night begins after these eggs are laid); mean of range=15.5 |
| duration from start of incubation to hatch (days) | I | 16 | Grzybowski 1995First chick hatches approximately 14–17 d after second or third egg is laid (incubation through night begins after these eggs are laid); mean of range=15.5 |
| duration from hatch to fledging of nestlings (days) | N | 11 | USFWS 1991 |
| duration since nest failure due to other reasons until female initiates new nest (days) | We | 6 | Median number of days from nest failure to fledging for second or subsequent nesting attempts estimated at 35 d (Pease and Grzybowski in press). Thus P&G assume they immediately begin construction of new nest upon failure and thus the renest interval for our purposes should just be the time required for nest construction, which in P&G terminology is approximated by the onset of susceptibility to nest parasitism (approx coinciding with the first egg) |
| duration since successful fledging until female initiates new nest (days) | Wf | 17.5 | Pease & Grzybowski 1995: *tr* = 46.5 subtract *tf* = 35 to get 11.5, then add *te* to get 17.5 |
| female body weight (g) during breeding season | BdyWt | Mean:8.5  SD: 0.62  Min:8.0  Max:9.2 | Dunning 1984. SD based on TIM default. |
| diet composition during breeding season |  | 100% insects | USFWS 2007 |
| Feeding category |  | insectivore |  |
| mean number of nest attempts/ female/ season |  |  |  |
| mean number of successful broods/ female/ season |  |  |  |
| mean number of fledglings/ successful nest | fpsn | 3.4 | P&G 1995 cite 3.4 for unparasitized nests, but 0.2 for parasitized nests |
| mean number of fledglings/ female/ season (ARS) | ARS |  |  |
| Annual adult survival | phi | 0.65^(1/365)=0.9988 | Returns of color-banded adult males (>1 yr old) in thoroughly searched areas of a 2,590-ha study site in central Texas indicate annual survivorship between 0.55 and 0.75 (Grzybowski 1991). |
| Frequency on field |  | Mean: 0  Min: 0.1  Max:0.2 | Based on habitat (Table 2), low frequency on field is expected for agricultural habitats. Individuals may forage on agricultural fields. |
| Residency | Edge |  | Based on habitat (see Table 2) |
| Passerine? | Yes |  |  |
| Precocial/ altricial | No |  |  |

**Table 16. Least Bell's vireo (*Vireo bellii pusillus*).**

| **Species life history parameters** | **Model Code** | **Typical value** | **Rationale/Comments** |
| --- | --- | --- | --- |
| daily probability of nest initiation | p | 0.25 | Default used. See USFWS 5 yr plan – adults arrive earlier on breeding grounds than juveniles |
| daily mortality rate during laying & incubation | m1 | 0.9770 | from USFWS 5yr plan see Hendricks and Rieger 1989. Nest success ranges from 33-89 % long-term average 41-74%.  Kus et al. 2010: 51% +/- 0.2 Mayfield. Assuming a 29-day nest cycle (14 days of incubation + 12 days of nestling + 3 days. Latter 3 days comes from assuming a 4-egg clutch with 1-day egg-laying interval + onset of incubation with penultimate egg). Therefore, assuming 51% overall nest survival rate, daily survival must be the 29th root of 0.51 = 0.9770 |
| daily mortality rate during nestling rearing | m2 | 0.9770 | refs to B. Kus. In USFWS 5 yr plan. See calculation above for m1. |
| date of first egg of first nest (dd-mmm) | T1 | 28 March | 28-March first egg of first nest.  9 July 91%, whereas extreme date = 25 July. |
| date of first egg of last nest (dd-mmm) | Tlast | 25 July |
| length of rapid follicle growth period (RFG) for each egg (days) | rfg | 3 | Average mass of 30 fresh eggs 1.47 ± 0.03 (SE) g; range 1.15-1.85 (Budnik et al. 2000), from Kus et al. 2010. RFG calculated using equation in Alisauskas and Ankney 1993 using egg weight from Budnik et al. 2000 (rfg = 3.2138) |
| mean clutch size | clutch | 3.4 +/- 0.3 | 3.1-3.9 USFWS 5-yr plan. See Table 2 in USFWS recovery plan  Numbers from Kus et al. 2010 for unparasitized nests |
| mean intra-egg laying interval (days) | eli | 1 | 1 day (Kus et al. 2010) |
| egg on which female typically begins incubation–penultimate (1) or last (0) | penult | penult | incub begins with penultimate. |
| duration from start of incubation to hatch (days) | I | 14 | 14 days (Kus et al. 2010) |
| duration from hatch to fledging of nestlings (days) | N | 12 | 12 days (Kus et al. 2010) |
| duration since nest failure due to other reasons until female initiates new nest (days) | We | 6 | Look in Kus 2002 condor, and Budnik et al. 2000 Auk.  4-8 days – see Kus et al. 2010 |
| duration since successful fledging until female initiates new nest (days) | Wf | 14 | care of young up to 30d post-fledging. Contact BEK for numbers on average renest interval.  nest attempts per pair in CA?:  CA: 1.7 broods/ pair. Best guess, needs input from species experts. |
| female body weight (g) during breeding season | BdyWt | Mean:8.5  SD:0.55  Min:7.4  Max:9.8 | from Dunning (1984) |
| diet composition during breeding season |  | 100% insects | USFWS 1998 |
| Feeding category |  | insectivore |  |
| mean number of nest attempts/ female/ season |  |  |  |
| mean number of successful broods/ female/ season |  |  |  |
| mean number of fledglings/ successful nest | fpsn | 2.4 | Vireo fledglings per nest: Oklahoma: 1.2 (n = 16 nests, Byre and Kuhnert 1996), Arizona: 1.7 (n = 23) and 0.3 (n = 21) during 2 yr (SLH). Fledglings/pair/yr: Missouri: ranged from 1.0 ± 0.4 (SE) to 1.8 ± 0.3 over 3 yr, with an overall annual average of 1.6 ± 0.1 (Budnik et al. 2000). In California, 1.2 - 4.5, for an annual average of 2.4 ± 0.8 (SD) (BEK). NOTE: PROBABLY TOO HIGH. Look deeper. |
| mean number of fledglings/ female/ season (ARS) | ARS | 2.6 | USFWS 5-year review. 1.8 – 3.2 from USFWS recovery plan. |
| Annual surv. | phi | 0.9978 | 47% annual survival (adult) 44% female. USFWS recovery plan. Using 44% adult survival rate, take 365th root: |
| Frequency on field |  | Mean: 0  Min: 0.1  Max:0.2 | Based on habitat (Table 2), low frequency on field is expected for agricultural habitats. Individuals may forage on agricultural fields. |
| Residency |  | Edge | Based on habitat (see Table 2) |
| Passerine? |  | Yes |  |
| Precocial/ altricial |  | Altricial |  |

**References cited:**

Atwood, Jonathan L. and David R. Bontrager. 2001. California Gnatcatcher (*Polioptila californica*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/574

Benedict, Lauryn, M. R. Kunzmann, K. Ellison, K. L. Purcell, R. R. Johnson and L. T. Haight. 2011. California Towhee (Melozone crissalis), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/632>

[doi:10.2173/bna.632](http://dx.doi.org/10.2173/bna.632)

Bocetti, Carol I., Deahn M. Donner and Harold F. Mayfield. 2014. Kirtland's Warbler (Setophaga kirtlandii), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/019>

[doi:10.2173/bna.19](http://dx.doi.org/10.2173/bna.19)

Brennan, Leonard A., Fidel Hernandez and Damon Williford. 2014. Northern Bobwhite (Colinus virginianus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/397>

[doi:10.2173/bna.397](http://dx.doi.org/10.2173/bna.397)

Dunning, J.B. 1984. Body weights of 686 species of North American Birds. Western Bird Banding Association. Monograph number 1. May 1984.

Federal Register /Vol. 72, No. 243 Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Coastal California Gnatcatcher (*Polioptila* *californica californica* <http://www.gpo.gov/fdsys/pkg/FR-2007-12-19/pdf/07-6003.pdf#page=1>

Grishaver et al. 1998. Breeding behavior of the California Gnatcatcher in Southwestern San Diego County, California. Western Birds 29:299-322.

Grzybowski, Joseph A. 1995. Black-capped Vireo (Vireo atricapilla), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/181>

[doi:10.2173/bna.181](http://dx.doi.org/10.2173/bna.181)

Hagen, Christian A. and Kenneth M. Giesen. 2005. Lesser Prairie-Chicken (Tympanuchus pallidicinctus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/364>

[doi:10.2173/bna.364](http://dx.doi.org/10.2173/bna.364)

Hughes, Janice M. 1999. Yellow-billed Cuckoo (Coccyzus americanus), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/418>

[doi:10.2173/bna.418](http://dx.doi.org/10.2173/bna.418)

Johnson, Jeff A., M. A. Schroeder and L. A. Robb. 2011. Greater Prairie-Chicken (Tympanuchus cupido), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/036>

[doi:10.2173/bna.36](http://dx.doi.org/10.2173/bna.36)

Kus, Barbara, Steven L. Hopp, R. Roy Johnson and Bryan T. Brown. 2010. Bell's Vireo (Vireo bellii), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/035>

[doi:10.2173/bna.35](http://dx.doi.org/10.2173/bna.35)

Ladd, Clifton and Leila Gass. 1999. Golden-cheeked Warbler (Setophaga chrysoparia), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/420>

[doi:10.2173/bna.420](http://dx.doi.org/10.2173/bna.420)

Lehmann, V. W. 1953. Bobwhite population fluctuations and vitamin A. Trans. N. Am. Wildl. Conf. 18:201-246.

Martin, John W. and Barbara A. Carlson. 1998. Sage Sparrow (Artemisiospiza belli), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/326>, doi:10.2173/bna.326

Schroeder, M. A., J. R. Young and C. E. Braun. 1999. Greater Sage-Grouse (*Centrocercus urophasianus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/425>

[doi:10.2173/bna.425](http://dx.doi.org/10.2173/bna.425)

Sedgwick, James A. 2000. Willow Flycatcher (Empidonax traillii), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/533>

[doi:10.2173/bna.533](http://dx.doi.org/10.2173/bna.533)

USFWS. 1992. Golden-cheeked warbler recovery plan. United States Fish and Wildlife Service. Available online at: http://ecos.fws.gov/docs/recovery\_plan/920930f.pdf

USFWS. 1993. Attwater’s prairie-chicken recovery plan (*Tympanuchus cupido attwateri*), second revision. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/recovery_plan/100426.pdf>

USFWS. 1995. Masked Bobwhite Recovery Plan. United States Fish and Wildlife Service, Region 2.Available online at: <http://ecos.fws.gov/docs/recovery_plan/950421.pdf>.

USFWS. 1998. Draft recovery plan for the least bell’s vireo. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/recovery_plan/980506.pdf>

USFWS. 1999. South Florida Multi-species Recovery Plan. United States Fish and Wildlife Service. Available online at: <http://www.fws.gov/verobeach/MSRPPDFs/FloridaGrasshopperSparrow.pdf>

USFWS. 2002. Final recovery plan, southwestern willow flycatcher (Empidonax traillii extimus). United States Fish and Wildlife Service, Region 2. Available online at: http://ecos.fws.gov/docs/recovery\_plans/2002/020830c.pdf

USFWS. 2007. Black-capped vireo (*Vireo atricapilla*) 5-year review: summary and evaluation. United States Fish and Wildlife Service. Available online at: <http://ecos.fws.gov/docs/five_year_review/doc1073.pdf>

USFWS. 2014. Masked Bobwhite (Colinus virginianus ridgwayi) 5-year review: summary and evaluation. United States Fish and Wildlife Service. Available online at: http://ecos.fws.gov/docs/five\_year\_review/doc4370.8.14.pdf

Vickery, Peter D. 1996. Grasshopper Sparrow (Ammodramus savannarum), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/239>

[doi:10.2173/bna.239](http://dx.doi.org/10.2173/bna.239)

Willey, D. W. 1990. Nesting success of San Clemente Sage Sparrows. Southwest. Nat. 35:28-31

1. Editor's Note 01/06: Based on differences in size, behavior, genetics and plumage, Gunnison Sage-Grouse (Centrocercus minimus) has been recognized as a species distinct from the Greater Sage-Grouse by the 42nd supplement to the AOU Checklist. See Systematics of this current account. Future revisions of this account will reflect this change. BNA Recent work has shown that an unnamed population of significantly smaller birds with distinct genetic and behavioral differences exists within the range of nominate urophasianus, from sw. Colorado to se. Utah (Hupp and Braun 1991, Young 1994, Young et al. 1994, Welch et al. 1995, Kahn et al. 1999, Oyler-McCance et al. 1999). The possibility that this population represents a distinct species has been suggested (Am. Ornithol. Union 1998; see below). Hereafter referred to as Gunnison Sage Grouse, these birds are geographically isolated, substantially smaller (shorter tarsus, culmen, and carpal; see Table 2), and lighter (male body mass at least 400 g less; see Table 3) than other populations of Sage Grouse, thus far examined; Gunnison Sage Grouse males also have considerably longer and thicker filoplumes and shorter rectrices with more relatively distinct bars (Hupp and Braun 1991, Young 1994, Young et al. 1994). Male Gunnison Sage Grouse perform Strutting Display at lower rate (see Behavior: sexual behavior, below) and utter more Plops during display (see Sounds: array of sounds, below; Young 1994, Young et al. 1994, Welch et al. 1995). [↑](#footnote-ref-1)
2. *C. v. ridgwayi* Brewster, 1885, the Masked Bobwhite. Rare resident in s. Arizona (where it was re-introduced after its extirpation there) south to n.-central Sonora (where Endangered) [type locality = 29 km (18 mi.) southwest of Sasabe, Sonora]. Head, throat, and breast black; ventrum otherwise uniform cinnamon-rufous (Brennan et al. 2014). [↑](#footnote-ref-2)
3. Recent survey results, in both the U.S. (BANWR) and Mexico, indicated that occurrence of wild masked bobwhite is essentially non-existent. As of 2011, occurrence of the masked bobwhite is nearly completely restricted to the captive flock occurring on the BANWR. USFWS 2014 [↑](#footnote-ref-3)
4. https://tpwd.texas.gov/huntwild/wild/species/apc/ [↑](#footnote-ref-4)
5. http://www.fws.gov/southwest/docs/apcrecoveryplansecondrev.pdf [↑](#footnote-ref-5)
6. http://www.fwspubs.org/doi/pdf/10.3996/nafa.57.0001 [↑](#footnote-ref-6)
7. Sage Sparrow recently split into two species: Bell’s Sparrow and Sagebrush Sparrow. See 54th Supplement to AOU Checklist. San Clemente Sage Sparrow, formerly a recognized subspecies of Sage Sparrow, is now (presumably?) a subspecies of Bell’s Sparrow, *Artemisiospiza belli clementeae*. Nominate species is *A belli belli*, distributed along coast ranges of California and western Sierra Nevada. [↑](#footnote-ref-7)
8. E. t. extimus Phillips, 1948: Breeds in the Southwest, including s. California, Arizona, New Mexico west of the Rio Grande, sw. Utah, s. Nevada, and possibly sw. Colorado (Unitt 1987, Browning 1993). Paler on back and especially on head than either E. t. adastus or E. t. brewsteri; breast-band less distinct and paler gray than in other subspecies (Browning 1993). Northern extent of pure forms of E. t. extimus in New Mexico remains unclear, as does whether E. t. extimus occurs as far north as sw. Colorado (JAS); song forms intermediate to adastus and extimus occur in n. New Mexico and possibly in w. Colorado (Sedgwick in press). (BNA) [↑](#footnote-ref-8)
9. Three subspecies recognized based on subtle morphological differences ([Am. Ornithol. Union 1957](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/574/articles/species/574/biblio/bib003), [Paynter 1964](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/574/articles/species/574/biblio/bib111), [Phillips 1991](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/574/articles/species/574/biblio/bib114)). Nominate californica occurs from s. California south in nw. Baja California to 30°N; pontilis in central Baja California; and margaritae south of 27°N in s. Baja California. Grinnell ([1926](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/574/articles/species/574/biblio/bib067)) and Atwood ([1991](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/574/articles/species/574/biblio/bib008)) identified 30°N as southern limit of nominate race, with margaritae in central Baja California south to 24°N, and abbreviata south of 24°N. Different analyses of the same morphological data support recognition of break near 30°N, or a pattern of smooth clinal variation ([Hays and Kramer 1995](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/574/articles/species/574/biblio/bib077)). Based primarily on plumage coloration of females, Mellink and Rea ([1994](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/574/articles/species/574/biblio/bib094)) restricted nominate race to north of international border, and described P. c. atwoodi in nw. Baja Cali-fornia from Ensenada south to 30°N.Analysis of mtDNA shows little geographic structure throughout species’ range, suggesting no support for recognition of evolutionary-based subspecies ([Zink et al. 2000](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/574/articles/species/574/biblio/bib155)). Pattern of nucleotide diversity indicates northern part of range was rapidly colonized from a late Pleistocene refugium located south of 30°N ([Zink et al. 2000](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/574/articles/species/574/biblio/bib155)); other taxa also show genetic breaks in Baja California between 28° and 30°N ([Upton and Murphy 1997](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/574/articles/species/574/biblio/bib136), [Zink et al. 1997](http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/574/articles/species/574/biblio/bib156)). [↑](#footnote-ref-9)