

# Cal/Ecotox Exposure Factors for Loggerhead Shrike (*Lanius ludovicianus*)\*

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| Endpoint Type                           | Endpoint Value   | Error   | Range     | Units           | Sex | Life Stage | Location        | Note | Reference |
|---|--|---------|-----------|-----------------|-----|------------|-----------------|------|-----------|
| Age at Fledging, Metamorphosis, Weaning |  |         | 15.6-15.8 | d               | NR  | Fledgling  | FL              | a    | 1         |
| Age at Fledging, Metamorphosis, Weaning | 17   |         |           | d               | NR  | Fledgling  | CO              | b    | 2         |
| Age at Fledging, Metamorphosis, Weaning |  |         | 14-19     | d               | NR  | Fledgling  | ID              | c    | 3         |
| Age at Fledging, Metamorphosis, Weaning | 16.8   |         |           | d               | NR  | Fledgling  | OK              | d    | 4         |
| Age at Fledging, Metamorphosis, Weaning |  |         | 14-16     | d               | NR  | Fledgling  | CANADA          | e    | 5         |
| Age at Sexual Maturity                  | 1  |         |           | yr              | NR  | Adult      | ID              | f    | 6         |
| Body Weight - Mean                      | 33.0   | 2.6 SD  | 28.5-37.1 | g               | NR  | Nestling   | FL              | g    | 7         |
| Clutch or Litter Size                   | 3.8  | 0.8 SD  | 2-5       | eggs/clutch     | F   | Adult      | FL              | h    | 1         |
| Clutch or Litter Size                   | 5.3  | 0.6 SD  |           | eggs/clutch     | F   | Adult      | SC              | i    | 8         |
| Clutch or Litter Size                   |  |         | 5-7       | eggs/clutch     | F   | Adult      | Santa Clara; CA | j    | 9         |
| Clutch or Litter Size                   | 6.39   |         | 5-8       | eggs/clutch     | F   | Adult      | CO              | k    | 2         |
| Clutch or Litter Size                   | 6.1  | 0.8 SD  |           | eggs/clutch     | F   | Adult      | ID              | l    | 3         |
| Clutch or Litter Size                   | 5.8  |         | 5.6-5.9   | eggs/clutch     | F   | Adult      | OK              | m    | 4         |
| Clutch or Litter Size                   | 5.65   | 1.17 SD | 3-7       | eggs/clutch     | F   | Adult      | MN              | n    | 10        |
| Clutch or Litter Size                   |  |         | 4.91-5.56 | eggs/clutch     | F   | Adult      | CANADA          | o    | 5         |
| Clutch or Litter Size                   | 3.8  | 0.9 SD  |           | eggs/clutch     | F   | Adult      | FL              | p    | 7         |
| Clutches or Litters per year            |  |         | 1-2       | clutches/yr     | B   | Adult      | FL              | q    | 1         |
| Clutches or Litters per year            |  |         | 1-2       | clutches/yr     | B   | Adult      | SC              | r    | 8         |
| Clutches or Litters per year            | 1  |         |           | clutches/yr     | B   | Adult      | CO              | s    | 2         |
| Clutches or Litters per year            |  |         | 1-2       | clutches/yr     | B   | Adult      | OK              | t    | 4         |
| Clutches or Litters per year            |  |         | 1-2       | clutches/yr     | B   | Adult      | MN              | u    | 10        |
| Clutches or Litters per year            |  |         | 1-2       | clutches/yr     | B   | Adult      | CANADA          | v    | 5         |
| Clutches or Litters per year            |  |         | 1-2       | clutches/pair   | B   | Adult      | FL              | w    | 7         |
| Dietary Composition                     | Odonata (12.1), Hemiptera (23.0), Coleoptera (22.3), Lepidoptera (7.3), Orthoptera (16.8), Hyla cinerea (7.6), H. squirella (1.7), Gastrophyne carolensis (0.9), Rana spenocephala (0.4), Anolis carolinensis (2.8), Scincella lateralis (4.1), Eumeces inexpectatus (1.0) |         |           | %               | B   | Adult      | FL              | x    | 11        |
| Dietary Composition                     | Orthoptera (59); Lepidoptera (15); Coleoptera (10); arthropod larvae (8); mammals; reptiles and amphibians (4); unident. arthropods (3)  |         |           | %               | NR  | Nestling   | SC              | y    | 12        |
| Dietary Composition                     | Mollusca (0.00), Crustacea (0.27), Arachnida (0.14), Insecta (14.77), Reptilia (53.29), Mammalia (27.66), Aves (3.86)  |         |           | %               | NR  | NR         | CA              | z    | 13        |
| Duration of Incubation or Gestation     | 16.9   |         | 16.6-17.1 | d               | B   | Embryo     | OK              | aa   | 4         |
| Duration of Incubation or Gestation     |  |         | 14.7-15.1 | d               | NR  | Embryo     | FL              | ab   | 1         |
| Duration of Incubation or Gestation     | 16   |         |           | d               | NR  | Embryo     | CO              | ac   | 2         |
| Duration of Incubation or Gestation     | 17   |         | 15-20     | d               | NR  | Embryo     | CANADA          | ad   | 5         |
| Fledging or Weaning Rate                | 1.4  | 1.7 SD  |           | fledglings/nest | NR  | Fledgling  | FL              | ae   | 1         |

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| Endpoint Type            | Endpoint Value | Error   | Range                         | Units                       | Sex | Life Stage | Location | Note | Reference |
|--------------------------|----------------|---------|-------------------------------|-----------------------------|-----|------------|----------|------|-----------|
| Fledging or Weaning Rate | 4.7            | 1.3 SD  |                               | fledglings/nest             | NR  | Fledgling  | SC       | af   | 8         |
| Fledging or Weaning Rate | 5.40           |         | 4.36-5.88                     | fledglings/nest             | NR  | Fledgling  | CO       | ag   | 2         |
| Fledging or Weaning Rate | 5.1            | 1.5 SD  |                               | fledglings/pair             | NR  | Fledgling  | ID       | ah   | 3         |
| Fledging or Weaning Rate | 60             |         | 46-83                         | %                           | NR  | Fledgling  | OK       | ai   | 4         |
| Fledging or Weaning Rate | 3.02           | 2.07 SD |                               | fledglings/nest             | NR  | Fledgling  | MN       | aj   | 10        |
| Fledging or Weaning Rate |                |         | 3.90-4.17                     | fledglings/nest             | NR  | Fledgling  | CANADA   | ak   | 5         |
| Fledging or Weaning Rate | 1.1            |         |                               | fledglings/nest             | NR  | Fledgling  | FL       | al   | 7         |
| Fledging or Weaning Rate | 2.33           | 0.34 SD |                               | fledglings/nest             | NR  | Fledgling  | CA       | am   | 14        |
| Foraging Distance        | 9.2            |         |                               | m                           | NR  | Adult      | FL       | an   | 15        |
| Foraging Distance        | 6.5            |         |                               | m                           | NR  | Adult      | FL       | ao   | 15        |
| Hatching Success         | 1.8            | 2.0 SD  |                               | hatchlings/nest             | NR  | Hatchling  | FL       | ap   | 1         |
| Hatching Success         | 4.4            | 1.8 SD  |                               | hatchlings/nest             | NR  | Hatchling  | SC       | aq   | 8         |
| Hatching Success         | 5.69           |         | 5.07-6.26                     | eggs/nest                   | NR  | Hatchling  | CO       | ar   | 2         |
| Hatching Success         | 84             |         | 69-95                         | %                           | NR  | Hatchling  | OK       | as   | 4         |
| Hatching Success         | 4.18           | 2.33 SD |                               | hatchlings/nest             | NR  | Hatchling  | MN       | at   | 10        |
| Hatching Success         |                |         | 4.20-5.42                     | hatchlings/nest             | NR  | Hatchling  | CANADA   | au   | 5         |
| Hatching Success         | 33.8           | 47.6 SD |                               | %                           | NR  | Hatchling  | FL       | av   | 7         |
| Longevity                | 3              |         |                               | yr                          | F   | Adult      | CA       | aw   | 14        |
| Longevity                | 12-6           |         |                               | yr-mo                       | NR  | Adult      | OK       | ax   | 16        |
| Population Density       |                |         | 1 pair/8.9 ha to 1 pair/25 ha |                             | B   | Adult      | ID       | ay   | 6         |
| Population Density       |                |         | 1/4.3 to 1/11.6               | pairs/km                    | B   | Adult      | CA       | az   | 14        |
| Population Density       | 90-96          |         |                               | individuals/12 study blocks | NR  | Adult      | CANADA   | ba   | 17        |
| Survival/ Mortality      | 0.47           |         |                               |                             | B   | Adult      | MN       | bb   | 10        |
| Survival/ Mortality      | 13.0           | 0.2 SD  |                               | %                           | NR  | Embryo     | FL       | bc   | 1         |
| Survival/ Mortality      | 64.0           | 30.1 SD |                               | %                           | NR  | Embryo     | FL       | bd   | 1         |
| Survival/ Mortality      | 46             |         |                               | %                           | NR  | Fledgling  | OK       | be   | 4         |
| Survival/ Mortality      | 45             |         |                               | %                           | NR  | Fledgling  | CA       | bf   | 14        |
| Survival/ Mortality      |                |         | 29-100                        | %                           | NR  | Juvenile   | WA       | bg   | 18        |
| Survival/ Mortality      | 67.0           | 1.8 SD  |                               | %                           | NR  | Nestling   | FL       | bh   | 1         |
| Survival/ Mortality      | 73.0           | 28.8 SD |                               | %                           | NR  | Nestling   | FL       | bi   | 1         |
| Survival/ Mortality      | 64             |         |                               | %                           | NR  | Nestling   | OK       | bj   | 4         |
| Territory Size           | 9.3            | 3.8 SD  |                               | ha                          | B   | Adult      | FL       | bk   | 7         |
| Territory Size           | 8.35           | 0.66 SD | 5.3-9.6                       | ha                          | B   | Adult      | FL       | bl   | 11        |

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| Endpoint Type          | Endpoint Value                 | Error | Range      | Units | Sex | Life Stage | Location        | Note | Reference |
|------------------------|--------------------------------|-------|------------|-------|-----|------------|-----------------|------|-----------|
| Territory Size         | 34                             | 12 SD |            | ha    | B   | Adult      | CA              | bm   | 14        |
| Territory Size         |                                |       | 0.17-14.59 | ha    | NR  | Adult      | FL              | bn   | 15        |
| Time of Mating/ Laying | Apr-mid Aug                    |       |            |       | B   | Adult      | ID              | bo   | 3         |
| Time of Mating/ Laying | late Feb (begin), April (peak) |       |            |       | B   | Adult      | OK              | bp   | 4         |
| Time of Mating/ Laying | late Feb-early Apr             |       |            |       | F   | Adult      | Santa Clara; CA | bq   | 9         |

Notes

- a range of average nestling periods, in two habitats, for successful nests; N=64 clutches; Archbold Biological Station
- b normal fledging period; N=232 fledged birds; Pawnee National Grassland
- c age at which young left nests; N=65 pairs; Ada, Elmoor, Owyhee Counties; Newly fledged young were often still incapable of flight.
- d N=28 nests; Lawton, Comanche County
- e N=27-52 pairs/yr; eastern Ontario, Quebec
- f N=4 birds; Ada, Elmore, Owyhee Counties; Birds bred successfully at approximately 1 year of age.
- g mean body weight of 10 day old nestlings; N=18 nestlings; Archbold Biological Station, Highlands County
- h average clutch size; N=64 clutches; Archbold Biological Station
- i mean clutch size, 2 years; N=20 nests; York County
- j N=9 clutches; Dataset includes second, third and fourth clutches laid within a season (due to egg removal).
- k average clutch size, 4 years; N=77 pairs; Pawnee National Grassland
- l average number of eggs per clutch, 2 years; N=84 clutches; Ada, Elmoor, Owyhee Counties
- m average clutch size, 4 years; N=101 nests; Lawton, Comanche County
- n average clutch size, 2 years; N=46 clutches; southern Minnesota
- o average clutch sizes, 2 years; N=27-52 pairs/yr; eastern Ontario, Quebec
- p mean clutch size; N=24 clutches; Archbold Biological Station, Highlands County
- q number of second clutches laid per season; N=27 pairs; Archbold Biological Station; Twenty three percent of pairs laid second clutches after successfully raising first brood.
- r N=49 nests; York County; 8.2% of nests found were second nests following initial successful nests.
- s N=77 pairs; Pawnee National Grassland; No occurrence of double brooding reported.
- t N=122 pairs; Lawton, Comanche County; 19.1% of pairs attempted second broods.
- u N=48 pairs; southern Minnesota; 10% of pairs attempted second broods.
- v N=27-52 pairs/yr; eastern Ontario, Quebec; Double brooding was rarely observed.
- w number of clutches laid per season per pair; N=10 pairs; Archbold Biological Station, Highlands County
- x percent of total prey items caught by observed pairs; N=6 territories; Archbold Biological Station near Lake Placid; No differences observed in diet composition after pasture was mown.
- y percent of total identified prey items delivered to the nest; N=1 pair, 155 identified prey; Apr, May; York County; 17% of all delivered prey items were identified during observations.
- z percent of total prey found in pellets by biomass; N=1238 pellets; San Clemente Island; See citation for more detailed taxonomic analysis and energetic values of prey items.
- aa average incubation period, 4 years; N=55 nests; Lawton, Comanche County
- ab range of average incubation periods, in two habitats, for successful nests; N=64 clutches; Archbold Biological Station
- ac incubation period; N=330 hatched eggs; Pawnee National Grassland
- ad average incubation period, 2 years; N=27-52 pairs/yr; eastern Ontario, Quebec
- ae average number of fledglings produced per nest; N=64 clutches, 245 eggs; Archbold Biological Station; 37% percent of eggs laid survived to fledging.
- af average number of fledglings produced per successful nest, 2 years; N=32 nests; York County; Overall fledging success was 88.3%.
- ag average number of fledglings produced per nest; N=65 successful nests; Pawnee National Grassland; 66.2% of all observed nests fledged at least one young.
- ah average number of fledglings per successful pair; N=65 pairs; Ada, Elmoor, Owyhee Counties
- ai average percent of nests that fledged at least 1 young, 4 years; N=133 pairs; Lawton, Comanche County
- aj average number of fledglings produced per nesting attempt; N=60 nesting attempts; southern Minnesota; 83% of pairs successfully fledged at least one young.
- ak average number of young surviving to fledge per nest, 2 years; N=27-52 pairs/yr; eastern Ontario, Quebec; 2.3 to 2.5 fledglings per nest survived to independence.
- al mean number of fledglings produced per nesting attempt; N=24 clutches; Archbold Biological Station, Highlands County; Mean number of fledglings/pair was 3.1 (2.9 SD) in experimental areas with increased # of perch sites.
- am mean number of fledglings produced per successful nest; N=29 nests; San Clemente Island
- an maximum distance travelled from a cabbage palm to a prey item on ground; N=21 territories; Jun-Aug; Archbold Biological Station, Lake Placid
- ao maximum distance travelled from a fence post to a prey item on ground; N=21 territories; Jun-Aug; Archbold Biological Station, Lake Placid

|    |  |
|----|--|
| ap | average number of hatchlings per nest; N= 64 clutches, 245 eggs; Archbold Biological Station; 46% of eggs hatched of those that were laid.                         |
| aq | average number of young hatched per nest, 2 years; N=37 nests; York County; Overall hatching success was 94.7%.  |
| ar | average number of eggs hatched per successful nest; N=65 successful nests; Pawnee National Grassland; 79.5% of all eggs hatched.                                   |
| as | average percent of nests that hatched at least 1 young, 4 years; N=133 pairs; Lawton, Comanche County  |
| at | average number of eggs hatched per nest; N=51 nests; southern Minnesota  |
| au | average number of hatchlings per nest, 2 years; N=27-52 pairs/yr; eastern Ontario, Quebec  |
| av | percent of eggs that produced hatchlings by the day after the first hatch; N=24 clutches; Archbold Biological Station, Highlands County                            |
| aw | adult life expectancy based on duration of home range occupancy; N=NR; San Clemente Island   |
| ax | age of oldest identified banded individual; N=NR   |
| ay | range of nesting density, 2 study areas; N=10-19 pairs/study area; Ada, Elmore, Owyhee Counties  |
| az | range in density of pairs, 4 years; N=5-13 pairs/year; San Clemente Island   |
| ba | range of densities over 2 sampling years; N=2 sample years; June-July; southeastern Alberta; Each study block was 6.4 square kilometers.                           |
| bb | annual adult survival (based on reoccupancy rate from the previous year), over 3 years; N=16-37 territories/year; southern Minnesota                               |
| bc | estimated probability of an egg surviving to hatch in fenceline areas; N=39 clutches; Archbold Biological Station; See citation for daily survival estimates.      |
| bd | estimated probability of an egg surviving to hatch in pasture areas; N=25 clutches; Archbold Biological Station; See citation for daily survival estimates.        |
| be | calculated probability of survival of any nest from incubation onset to end of fledging; N=109 nests; Lawton, Comanche County                                      |
| bf | percent of fledglings that died before reaching independence from parents; N=29 nests; San Clemente Island   |
| bg | survival rate of juveniles prior to dispersal from the breeding territory; N=36 nests; Yakima Training Center  |
| bh | estimated probability of a nestling surviving to fledge in fenceline areas; N=39 clutches; Archbold Biological Station; See citation for daily survival estimates. |
| bi | estimated probability of a nestling surviving to fledge in pasture areas; N=25 clutches; Archbold Biological Station; See citation for daily survival estimates.   |
| bj | overall nestling survival rate; N=90 nests; Lawton, Comanche County  |
| bk | N=10 pairs; Archbold Biological Station, Highlands County; Mean territory size was 2.3 ha in experimental areas with increased # of perch sites.                   |
| bl | mean territory size in pasture habitat; N=6 territories; Archbold Biological Station near Lake Placid  |
| bm | mean pair foraging area during breeding season, 4 years; N=12 territories; San Clemente Island   |
| bn | range of post-breeding territory size; N=21 territories; Archbold Biological Station, Lake Placid  |
| bo | period from clutch initiations to chicks fledging; N=98 pairs; Ada, Elmore, Owyhee Counties  |
| bp | time of nesting activity; N=133 pairs; Lawton, Comanche County   |
| bq | period of egg laying; N=1 pair, 4 years  |

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