Annual Adult Survivorship of Loggerhead Shrikes in Southeastern Alberta

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ABSTRACT

The western Canadian population of Loggerhead Shrike (Lanius ludovicianus excubitorides) *occurs in southeastern Alberta, southern Saskatchewan and southwestern Manitoba and is classified as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Special Concern under the Alberta Wildlife Act, and listed on Schedule 1 of the Canadian Species at Risk Act. This study quantifies year-to-year adult survivorship from 1992 to 1993 in highly suitable habitat in southeastern Alberta. The study area (corridor along Highway 555 between Jenner and Bindloss) offers a unique opportunity to estimate adult survivorship accurately as it is an isolated linear strip of optimal habitat surrounded by sub-optimal habitat all easily searched. Apparent adult annual survivorship was 38% and 27% for males and females, respectively. Although the study area remained saturated with breeding shrikes during 1992 and 1993, the majority of the adults present in 1993 were new birds. High adult annual mortality may be an important factor in the decline of the Loggerhead Shrike in southeastern Alberta and resulting in a collapse of the species into optimal breeding habitat leaving sub-optimal areas unoccupied.*

INTRODUCTION

Two populations of the Loggerhead Shrike are recognized in Canada. The eastern population (*Lanius ludovicianus migrans*) is confined to southern Ontario and southern Quebec and is classified as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and listed on Schedule 1 of the Canadian Species at Risk Act. The western population (*Lanius ludovicianus excubitorides*) occurs in southeastern Alberta, southern Saskatchewan and southwestern Manitoba and is classified as Threatened by COSEWIC, Special Concern under the Alberta Wildlife Act, and listed on Schedule 1 of the Canadian Species at Risk Act.

The Alberta population estimate is approximately 7700 pairs (Prescott 2009) with one of the highest shrike concentrations in the province occurring in a west-to-east corridor along Highway 555 between Jenner and Bindloss, approximately 80 km north of Medicine Hat (Telfer et al.1989; pers. obs.)

The ultimate cause of the decline of the Loggerhead Shrike in Alberta and elsewhere is not clear. Although many factors have been hypothesized as contributing to declines, a single primary cause has not been documented. Factors implicated include pesticide contamination (Busbee 1977, Anderson and Duzan 1978, Morrison 1979), and an increase in human disturbance (Cadman 1985, Hands et al. 1989). Reduction of suitable habitat is felt by most researchers to be an important consideration. The availability of breeding, wintering and stop-over habitat has been declining in most areas of North America, primarily because of intense agricultural practices which have resulted in the removal of shrubs and shelterbelts (Cadman 1985, Fraser and Luukkonen 1986, Hands et al. 1989, Bellar and Maccarone 2002). Telfer (1989) attributed the severe decline in shrike numbers in Alberta to the loss, between 1946 and 1986, of 39% of unimproved pasture coupled with the loss of 79% of pre-settlement pasture area, the majority converted to cultivation.

There has been little direct investigation of habitat suitability and availability to Loggerhead Shrikes, and it is difficult to assess whether habitat limitation, if it occurs, is most important to populations during the breeding or non-breeding seasons or during migration. To date, most investigations have concluded that the availability of suitable breeding habitat does not limit the size of Loggerhead Shrike populations (Luukkonen 1987, Gawlik 1988, Brooks and Temple 1990b; Yousif and Grubb 1993). However, an examination of occupied versus apparently suitable but unoccupied shrike territories in southeastern Alberta clearly demonstrated that, at least in the study area, no suitable Loggerhead Shrike habitat was unoccupied (Prescott and Collister 1993). This result suggests that either a shortage of habitat may be limiting the Loggerhead Shrike on its Alberta breeding grounds or shrikes may only be occupying the highest quality habitat.

Climate change has potential to impact Loggerhead Shrikes and other species at the edges of their ecological tolerance, particularly if the rate of changes exceeds adaptive capacity. Changes in timing of production of insect and other prey items may be a problem for Loggerhead Shrikes in Alberta and elsewhere if arrival on the breeding grounds and requirement for peak prey production no longer correlate with prey availability (Finch et al. 2012).

The Loggerhead Shrike population in the corridor along Highway 555 between Jenner and Bindloss in southeastern Alberta appears to be doing well with a full complement of breeding birds each year. However, even if Loggerhead Shrikes in this area are holding their own, the species may be declining in other less suitable habitat in the province.

Annual adult survivorship is an important demographic parameter to understand population trend and viability. Quantifying survivorship of adults is difficult, as individuals not found and assumed to have died may, in fact, have emigrated out of the study area and nested elsewhere. The corridor along Highway 555 between Jenner and Bindloss offers a unique opportunity to accurately estimate year-to-year adult (annual) survivorship, as it is an isolated linear strip of high quality habitat surrounded by sub-optimal habitat (Fig.1) (all easily searched) that encompasses the expected dispersal distance of emigrating adults (Collister and De Smet 1997).

METHODS

Study Area - The study area comprises an isolated 36-km x 1-km strip of habitat along the Canadian Pacific (CP) Rail/Hwy 555 right-of-way between the abandoned Atlee townsite (50°50' N, 111°00' W) and Cavendish (50°48' N, 110°28' W) within the Dry Mixedgrass Natural Subregion of the Grassland Natural Region of Alberta (AEP 1994).

The study area consists of two major sub-areas. The core is made up of an approximately 100-m wide ungrazed right-of-way consisting of disturbed prairie now dominated by crested wheat grass (*Agropyron cristatum*) and brome (*Bromus* spp.). The 450 m on either side of the right-of-way is blue grama (*Bouteloua gracilis*), needle-and-thread (*Stipa comata*) and northern and western wheatgrass (*Agropyron dasystachyum, A. smithii*) mixed grass prairie, utilized by local ranchers to graze cattle. Fig. 1 illustrates the juxtaposition of the grazed native pasture and the ungrazed right-of-way.

Loggerhead Shrikes in this area nest in shrubby areas, mainly thorny buffaloberry (*Shepherdia argentea)*, interspersed with areas of grass and forbs. Such habitat is concentrated near the railway/ highway right-of-way. Shrub growth is promoted in the lower lying ditch areas due to the collection of rainwater and the absence of cattle grazing which minimizes shrub mortality due to rubbing and trampling.

The study area falls within the Prairie climatic regime (Strong 1992) and is subject to extremes in temperature and precipitation during the breeding season. Precipitation frequently occurs as violent summer storms and strong prevailing westerly winds are common. The study area is at the northern limit of Loggerhead Shrike range in North America. As regards one or more of environmental

Fig. 1. Loggerhead Shrike habitat along Highway 555 between Jenner and Bindloss in southeastern Alberta, Canada.

influences, shrikes in Alberta are living closer to their limits of tolerance than in most other areas of their range.

Field data were collected from 21 May to 15 Jul 1992 and 25 May to 7 Jul 1993. These periods span the bulk of the Loggerhead Shrike breeding season in Alberta. The birds arrive in early May, apparently already paired (pers. obs.). Woodchat Shrikes (*Lanius senator*) in Germany also arrive on breeding grounds already paired (Ullrich 1971). Most Loggerhead Shrikes have departed Alberta by the end of August (Salt and Salt 1976; pers. obs.)

Field Methods - Habitat within the study area was systematically searched for Loggerhead Shrike nests during the first week of the field season in both 1992 and 1993. Shrikes arrive in Alberta during the first week of May and begin nest-building soon thereafter. Additional nests, missed during the initial search and re-nests due to failure of the first attempt, were located as the breeding season progressed. The first nest found in each territory was assumed to be a first nesting attempt, but it is possible that failed first attempts may have been missed.

During the 1992 breeding season, adult shrikes were captured near nest sites using a variety of trapping techniques: bal-chatri, modified Tordoff trap, Potter traps and mist nets (Collister and Fisher 1995). Trapping was not conducted during early incubation to reduce abandonment risk. Males, determined by the presence of a cloacal protruberance, were banded with a unique aluminum United States Fish & Wildlife Service (USFWS) band on the left tarsus and an unnumbered yellow metal band on the right tarsus. Females, determined by the presence of a brood patch, were banded with a unique aluminum

USFWS band on the right tarsus and an unnumbered yellow metal band on the left tarsus. This scheme was designed to allow 1992 adults returning in 1993 to be visually differentiated by sex. Nestlings were banded with a unique aluminum USFWS band on the right tarsus and an unnumbered dark green plastic band on the left tarsus.

Several recaptures early in the season and in previous years indicated that plastic color bands were not a reliable method of marking birds, particularly adults. The plastic appears to become brittle and often overlap, resulting either in the plastic color band falling off itself or enabling the shrike to worry it off. Of eighteen recaptures (14 banded as nestlings and four as adults) between 1989 and 1993, plastic color bands were missing on 14 (10 banded as nestlings and all four as adults).

In 1993, adults in the study area were examined with binoculars and spotting scope to determine their band status. Birds were identified as 1992 adult female, 1992 adult male, 1992 nestling, banded other than 1992, unbanded or band status unknown. Trapping of adults was attempted at viable nest sites concurrent with banding of nestlings. Unbanded adults were banded with a unique aluminum USFWS band on the right tarsus and an unnumbered orange metal band on the left tarsus. Additional trapping effort was allocated to territories occupied by 1992 adults. Nestlings were banded with a unique aluminum USFWS band on the left tarsus and an unnumbered dark green plastic band on the right tarsus.

A 5-km buffer zone around the study area was searched intensively for 1992 adults during the last week of June and the first week of July of 1993. Recaptures indicate that 95% of adults can be expected to be within 4.7 km of their previous year's breeding territory (Collister and De Smet 1997). In addition, determination of the band status of Loggerhead Shrikes in areas greater than 5 km from the study area was carried out on as many birds as possible. Potential identification of 1992 adults > 5 km from the study area was further enhanced through collaboration with the 1993 provincial survey carried out concurrent to this study. Adult year-to-year survivorship was calculated by dividing the number of 1992 adults re-sighted in 1993 by the total number of 1992 adults banded.

RESULTS

The number of breeding pairs of Loggerhead Shrike located in the study area during 1992 and 1993 was 66 and 70, respectively. One territory occupied by a lone male was found in 1993. A female was alone during the nestling phase in 1992, and a male lost his mate in 1993 but successfully fledged young. The number of nesting attempts in each year was the same at 74. The number of fledglings (16 day-old young) produced in the study area was 176 in 1992 and 92 in 1993 (Collister and Wilson 2007).

During 1992, trapping resulted in the capture and color banding of 96 (48 male and 48 female) adult shrikes (73% of the 132 present) in the study area. Of the 140 adult shrikes present in the study area during 1993, 135 were observed well enough to determine band status. Of these, 28 were identified as 1992 adults. Another three adults from 1992 were found in the 5-km buffer zone surrounding the study area out of 77 birds observed and their band status determined. The band status of an additional 110 shrikes was determined outside of the buffer zone without the detection of any 1992 banded adults. Despite intensive effort, although 31 (18 males and 13 females) of the 1992 adults were located in 1993, only six were recaptured. For the most part, these birds had moved only minor distances from where they bred in 1992 (Collister and De Smet 1997).

Apparent adult annual survivorship from 1992 in southeastern Alberta was 38% (18 of 48) and 27% (13 of 48) for male and female Loggerhead Shrikes, respectively.

DISCUSSION

This study is a rigorous attempt to quantify Loggerhead Shrike annual adult survivorship. The study area is conducive to such an undertaking due to its relative isolation and a surrounding area that is easily surveyed and encompasses the maximum

expected dispersal distance of adult shrikes between years (Collister and De Smet 1997).

Adult survivorship is generally low among small land birds (40% to 60% in most temperate passerines (Ricklefs 1973, Martin and Li 1992). Although the data presented in this study encompasses only one year, the annual adult survival rates of 38% and 27% for males and females, respectively, appear low. Survival estimates in local populations are open to some uncertainty and tend to be low as the disappearance of a bird may be due to emigration rather than mortality. However, the present study has minimized the probability of not locating emigrated adults by completely searching an appropriate area surrounding the study area based on Collister and De Smet (1997) and collaborating with the concurrent provincial population survey.

Other studies have reported annual adult survivorship. P. James et al. (unpublished data) reported annual adult survivorship in the Burrowing Owl (*Athene cunicularia*) over a seven-year study in Saskatchewan ranged from 37% to 51%. This was much lower than survivorship results from the following studies conducted on more stable populations. Thomsen (1971) reported 81% annual survivorship from1965-1966 and 77% from 1966-1967 for a 1965 adult cohort of non-migratory Burrowing Owls in California, suggesting age-constant mortality. Mortality of juveniles from1965-1966 was 70%. Payne and Payne (1990) found that Indigo Buntings (*Passerina cyanea*) evidenced no decrease in annual survival after their first year; annual survivorship was in the range of 50%-60%. Most birds exhibit a pattern of heavy mortality in their first year and some more or less constant mortality thereafter (Welty 1979). For example, a 21-year study of Mourning Doves (*Zenaida macroura*) indicated that they suffered an annual mortality of about 80% in their first year and 55% per year thereafter (Austin in Welty 1979). Nolan (1978) found through banding that Prairie Warblers (*Setophaga discolor*) in Indiana had an annual survival rate of 65%. During a study of an isolated population of Smith's Longspur (*Calcarius pictus*) near Churchill, Manitoba, 87% of 15 banded males returned to breed in a least one additional year and 91% of banded females returned the subsequent year (Briskie 1993). Birds that did not return, were not found in adjacent populations, and were thought to have died. Pinkowski (1971) found that 47% of adult Eastern Bluebirds (*Sialia sialis)* survived to breed the following year. In view of these results, it is reasonable to expect that Loggerhead Shrikes should have a higher average annual survivorship than this study suggests. Of course, it is possible that demographic stochasticity resulted in 1992-1993, being an unusually poor year for survival of adult shrikes from southeastern Alberta, and for that reason even 38% survivorship is not representative of average adult annual survivorship over time.

Cadman (1985) notes that predation on adult Loggerhead Shrikes has rarely been reported. Adult mortality does not seem to be high on the breeding grounds (Brooks and Temple 1990a, pers. obs.). Cadman (1985) suggested that collision with vehicles is a major cause of shrike mortality. During the breeding season in southeastern Alberta, this does not appear to be the case even though the study population was associated with a major paved roadway (Hwy 555) and a railway right-of-way. Working in this area since 1987, I am only aware of two adult shrikes being road-killed. Blumton (1989) documented four cases of winter mortality in Virginia due to collision with vehicles. K. De Smet and M. Conrad (unpublished report) suggested road kills may occasionally contribute to substantial losses during the post-fledging period in Manitoba. Gawlik and Bildstein (1990) recorded one adult and one juvenile road-killed in South Carolina. In Virginia the remains of three road-killed juveniles were found (Luukkonen 1987). Robertson (1930) in Miller (1931) describes 10 Loggerhead Shrikes found dead during one year on roads bounding a 26-km^2 area in southern California. This was estimated to represent 7% of the shrike population. Novak (1986), in New York, did not observe any road-killed shrikes even though roads were used for foraging. Nevertheless, he suggests that the impact of vehicular collisions on

shrike populations that are at low densities should not be overlooked. However in Indiana, although several fledglings were hit by cars, fledgling survival was higher near roads indicating road mortality is not significant at this age (Burton 1990). Linsdale (1929) argued that the benefits birds derive from roadways in terms of nesting sites, foraging areas and casual water outweigh any negative effect due to mortality from collisions.

Predation may be a significant source of adult shrike mortality and is not easily quantified. Blumton (1989) documented eight cases of winter mortality in Virginia by raptors. Walter (1979) found that the shrike genus was selected by Eleonora's Falcon (*Falco eleonorae*) during migration. Fully 18.2% of all prey remains from his study nests belonged to three shrike species, and the Red-backed Shrike (*Lanius collurio*) was the most abundant prey species of Eleonora's Falcon. Shrikes are predators themselves but seem to be average or poor flyers when confronted by high-altitude migration and a deadly chase by Eleonora's Falcon. Miller (1931) mentions the remains of Loggerhead Shrikes being found in Great Horned Owl (*Bubo virginianus*) nests. Yosef and Yosef (1992) reported Crested Caracara (*Polyborus plancus*) predation of Loggerhead Shrike nests in Florida.

Historically, shooting was a significant cause of mortality but appears to have diminished in recent years, at least in Canada, relative to other factors (Cadman 1985). However, the possible significance of this source of mortality on potential wintering grounds in Mexico cannot be discounted.

Mortality during migration may be significant considering migration could be up to 3360 km from the northern Prairie Provinces to Mexico (Miller 1931). There are no known migratory concentration areas for shrikes; they appear to migrate singly (Cadman 1985). Miller (1931) states that there is no evidence that shrikes group together and travel in flocks over narrowly defined migration routes or that North American shrikes migrate at night. Anecdotal evidence of single birds seen for a day or two feeding at localities not normally frequented by the species suggests that shrikes move short distances at a time feeding along the way.

Kridelbaugh (1983) suggested that although Loggerhead Shrike populations show great variability from year to year, nesting success is relatively high for an open-nesting altricial species. This suggests that reduced nesting success is not responsible for the decline of the species. Scott and Morrison (1990) suggested that high mortality and low recruitment were more significant problems than lack of fecundity based on their result that the number of nestlings per nesting attempt did not significantly change over the course of their 1984 to 1988 study. Adult survivorship in southeastern Alberta appears to be low and suggests mortality on migration routes and/or wintering grounds may be an important cause of the species decline. A six-year study of a Red-backed Shrike population in Great Britain found that the decline was due either to an increase in juvenile mortality or to reduced annual adult survivorship or site fidelity rather than reduced productivity (Ash 1970). Brooks and Temple (1990a) concluded that declines in midwestern populations of Loggerhead Shrikes were probably due to reduced adult and juvenile overwinter survival.

Loss of habitat on breeding, migration and wintering grounds is thought by many workers to be an important factor in shrike decline. Habitat loss could contribute directly to adult and juvenile mortality. Lymn and Temple (1991) found that the Loggerhead Shrike and other grassland birds that winter in the Gulf Coast region have lost large areas of habitat and that even remaining areas of habitat are of reduced value because of fire ants and the associated insecticide control methods. Brooks and Temple (1990a) hypothesized that resident shrike populations in the southern U.S. are habitat limited resulting in migrant birds from the north being forced into sub-optimal habitat and thereby increasing mortality. In Florida, Yosef and Grubb (1995) found that Loggerhead Shrikes in citrus groves suffered nutritional deficiencies relative to shrikes in native, urban and pasture habitats.

Global climate change has also been suggested as a factor in the decline of shrike populations. In Germany, a study of the Woodchat Shrike concluded that changes in the breeding status of this species on the northern limits of its ranges are mainly related to weather. The weather directly affected breeding and the rate of survival among young birds. It was felt that a few years of low survival rate might be bridged by longer lived adults but a deterioration in climate for a longer duration than this must inevitably lead to a rapid decline or extinction of the population (Ullrich 1971). Additionally, European researchers have suggested that climatic change may be contributing to declines of the Red-backed Shrike in Europe, a species ecologically similar to the Loggerhead Shrike. Presumably wetter summer weather reduces the availability of insect prey. Ash (1970) found 10 times as many large flying insects in good weather conditions as in poor weather conditions. Certainly the Loggerhead Shrike in Alberta is on the northwestern edge of the species range and likely sensitive to even minor climatic changes. Weather appears to be the most significant factor limiting nesting success in southeastern Alberta (Collister and Wilson 2007).

CONCLUSION

The results of this study suggest that the Loggerhead Shrike population in the corridor along Highway 555 between Jenner and Bindloss in southeastern Alberta may not be sustaining itself. It is possible that annual adult survivorship has been underestimated due to birds that left the study area and were not detected subsequently. However, this is unlikely to be a significant confounding factor due to the search intensity for returning birds along with the intrinsic ease of search within the study area.

Population stability depends on many factors that may vary through time. Food supply and weather are probably the most dominant environmental factors controlling populations but predation, disease, availability of nest sites, and other limiting factors may also influence population dynamics (Welty 1979). The stochasticity of these variables may profoundly affect a study such as the present one and the uncertainty thus imposed must be kept clearly in mind when the application of results is considered.

The current study has shown that, although the right-of-way remained saturated during 1992 and 1993, a majority of the adults present in 1993 were new birds. High adult mortality may have resulted in a collapse of the species into optimal breeding habitat leaving sub-optimal areas unoccupied. Therefore, by the time a decline in the population of the corridor along Highway 555 between Jenner and Bindloss occurs, shrikes may have disappeared from most of their Alberta range.

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Loggerhead Shrike
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