High incidence of vehicle-induced owl mortality in the Lower Mainland and Central Fraser Valley, British Columbia

Michael I. Preston[1] and Gerry A. Powers[2]

[1] 106 - 991 Cloverdale Ave., Victoria, BC, V8X 2T5

[2] 30955 Downes Rd., Mt. Lehman, BC, V4X 1Y6

Abstract

Vehicle induced mortality of owls in British Columbia is poorly known, and of available literautre, scant information is available for North American owls except Barn Owl. Here we report on nearly 1,000 mortality records of 10 species from the Lower Mainland and Central Fraser Valley collected between 1987 and 2005. We discuss these findings in the context of geography and seasonality, and present options for mitigation.

Introduction

In many terrestrial communities owls are among the top predators, often having profound effects on the regulation of small mammal populations such as voles, shrews, mice, and rats (Johnsgard 1988). It has been estimated that a single Barn Owl (*Tyto alba*) may consume as many as 11,000 mice per year (Johnsgard 1988), and in recognition of being such effective predators, they have been introduced to places such as Jahore, Malaysia to help combat

a prolific agricultural pest, the Malayan Wood Rat (*Rattus tiomanicus*) (Wood and Liau 1984). So far however, it seems no work has been done to quantify the potential impacts that losing owls from ecosystems would have, despite reports of declining populations (Colvin 1985, Cannings 1993, Cannings and Angell 2001, Wiggins 2006). In other predator-prey systems, the cascading detrimental effects to ecosystems as a result of predator loss is becoming increasingly understood (*e.g.,* Creel et al. 2005).

In the Lower Mainland and Central Fraser Valley of British Columbia, the status of most owls is largely unknown. The Barn Owl is perhaps the best studied. Prior to the 1940s numbers of Barn Owls were naturally low, but with a proliferation of nest sites, foraging areas, and prey as result of agricultural development, numbers increased substantially from the mid-1940s to the late 1970s (Campbell et al. 1990). However, with the gradual replacement of agricultural lands with urban developments, and the replacement of traditional wooden barns with modern steel silos, numbers appeared to be decreasing in the early 1980s (Campbell and Campbell 1984). Presently, the Barn Owl is "blue-listed" in British Columbia (BC Conservation Data Centre 2006). The Short-eared Owl (*Asio flammeus*) and Western Screech-Owl (*Megascops kennicottii*), also once fairly common breeding predators in the Lower Mainland, are now greatly reduced and subsequently "blue-listed" (BC Conservation Data Centre 2006). Other species of owl, particularly those with restricted ranges in British Columbia, those dependent on old-growth forests, and those requiring nest cavities and foraging areas created by natural fire regimes, may also be declining.

Quantifying the various causes of mortality in birds is difficult, and suppositions about population declines are often related to habitat availability, prey abundance, and breeding success. Some examples where decline is more quantifiable, and perhaps more easily controlled, include oil and chemical contamination of water bodies, collisions with windows of buildings, predation by domestic cats, and collisions with vehicles. In British Columbia, vehicle-induced mortality among owls is poorly understood, but evidence from some European countries and American states suggest that for some species, mortality resulting from collisions with vehicles may have a substantial impact on local, and perhaps regional, populations. From one study in the United Kingdom, Barn Owl collision rates increased from 6 - 50% during the period 1910 – 1996, with some regions having extinction within 0.5 to 2.5 kms of major roadways (Ramsden 2003).

With the exception of Barn Owl, quantifiable information for vehicle-induced mortality among other owl species is generally lacking for North America. Hence, the purpose of this paper is to document what appears to be a high-incidence of vehicle-induced owl mortality in the Lower Mainland and Central Fraser Valley of British Columbia. We present numerical comparisons among species, regional differences, and opportunities for mitigation. Where data is sufficient, we attempt to provide this information in the context for improving conservation efforts and maintaining viable populations.

Study Area and Methods

All of the field data was collected by G. Powers (Figure 1) and subsequently donated to the Biodiversity Centre for Wildlife Studies for analysis. The study area includes the municipalities of Delta, Surrey, Langley, Aldergrove, Abbotsford, and Chilliwack, as well as Highway 11 north from Abbotsford to Mission, east along Highway 7 to Agassiz, and south along Highway 9 to Highway 1, including Popkum. Within those areas, surveys were mainly along Highways 1, 1A, 9, 10, 11, 15, 99 and 99A, although records were also from some secondary roads.

The first survey year was in 1987, and then after a 7-year hiatus, surveys occurred annually from 1995 to 2005. Mortality records were documented by driving along roadside shoulders, searching for birds that were both on the road and in the ditch. Surveys were mainly conducted from October through April, although incidental records were noted for other months of the year.

To make meaningful comparisons among species, regions, and months, occurrence records were converted to percentages. This method helps reduce errors introduced by underlying patterns of abundance among species (*i.e.,* the most abundant owl in the region is expected to be found most often, yet mortality rates may be disproportionate among species). To evaluate potential mortality hotspots, we

Figure 1. Gerry Powers picking up a Barn Owl killed by a collision with a vehicle on Highway 1 near Abbotsford, BC. 15 August 2006 (Randy and Donna Giesbrecht).

used data gathered for Barn Owl in the Abbotsford region because that area had the most intense and consistent survey effort.

Results

Summary of Findings

A total of 952 owls representing 10 species were collected. All were found dead as a result of vehicular collisions except for two that were electrocuted by powerlines, 10 that were alive and taken to recovery, and two that were alive but later died or were euthanized as a consequence of severe injury. The Barn Owl (n = 542 birds) and the Northern Saw-whet Owl (*Aegolius acadicus*; Figure 2) (n = 278 birds) were the two most frequently collected species. The Barred Owl (*Strix varia*), although not recorded in 1987 or 1996, was the third most frequently recorded owl with 45 birds collected, of which 30 were from the Abbotsford region. The Great Horned Owl (*Bubo virginianus*) was the fourth most frequently observed bird with 30 individuals collected, of which 18 were from the Abbotsford area. The Long-eared Owl (*Asio otus*), Western Screech-Owl, and Short-eared Owl were less frequently observed, with 17, 16, and 13 observations of each, respectively. The smallest of the owls, the Northern Pygmy-Owl (*Glaucidium gnoma*), was found at eight locations, of which five were from the Mission area. There was one observation of a Great Gray Owl (*Strix nebulosa*) at the junction of Arnold Road and Old Yale Road in Abbotsford, and one observation of a Boreal Owl (*Aegolius funereus*) at the junction of Highway 1 and Ross Road in Abbotsford.

Geographic Variability in Species Recoveries

The Barn Owl was the most frequently encountered owl found throughout the study area. However, there were distinct regional differences in the percentage abundance of dead owls that this species comprised (Figure 3). In Abbotsford, Delta,

Figure 2. The Northern Saw-whet Owl is a fairly common winter visitor to the Lower Mainland and Central Fraser Valley, and was the second-most frequently killed owl in this study. Geroge C. Reifel Migratory Bird Sanctuary, Delta BC. 8 January 1995 (Michael I. Preston). BC Photo 3318.

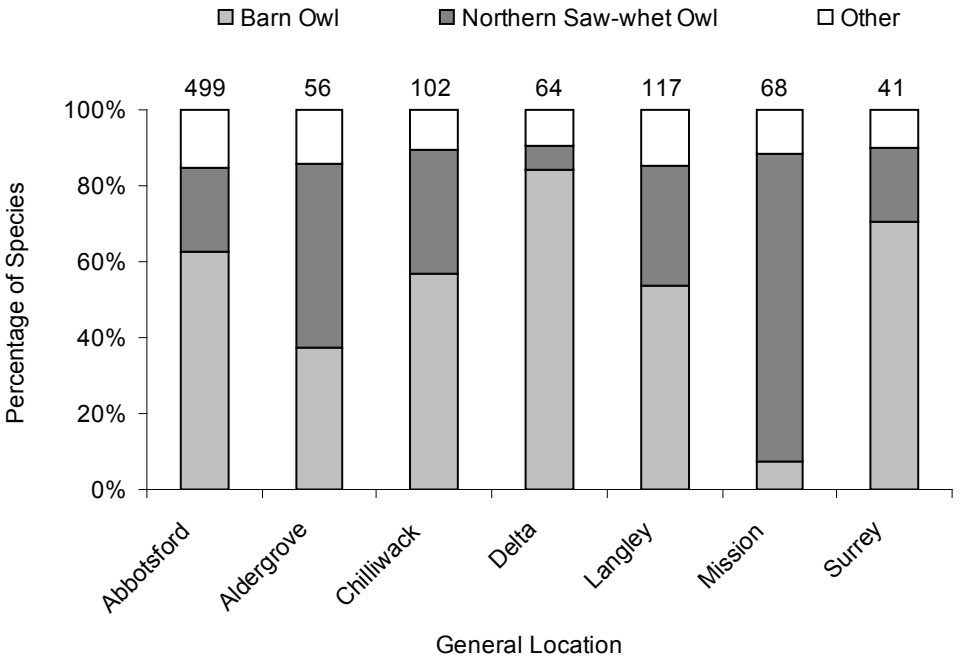

Figure 3. Percentage abundance of owls collected from different regions of the Lower Mainland and Central Fraser Valley of British Columbia as a result of vehicular collisions. Numbers above each bar represent the total number of all owls collected in that region.

and Surrey, the Barn Owl accounted for > 60% of all dead owls found in that region, compared to Aldergrove and Mission where it accounted for < 40% of the owls in each region. Where the Barn Owl was relatively common the Northern Saw-whet Owl was uncommon, and in regions where the Barn Owl was uncommon the Northern Saw-whet Owl was common. Such opposing relationships are almost certainly a result of differences in habitats among regions, although for this study, habitat was not quantified. In the regions of Abbotsford, Delta, and Surrey, the area and abundance of agriculture and old barns, respectively, appear greater than for other regions that are largely dominated by woodlands, riparian areas, and forested slopes. There was no detectable difference in geographic location among the other species because of small sample sizes, although it is noteworthy that among 16 Western Screech-Owls collected, six were found along Highway 1 between 200st and 256st in Langley. There were no observations of either Western Screech-Owl or Short-eared Owl after 2002.

Monthly and Seasonal Variability

Monthly and seasonal variation in mortality among species was difficult to assess owing in large part to differences in survey intensity. However, when a route was surveyed, we assumed that the probability of detecting each species was equal. Consequently, any major differences among months and across species may be attributed to temporal variation (*i.e.,* monthly, seasonal). In Table 1 we summarize the percentage abundance of Barn Owls and Northern Saw-whet Owls found dead by month. Knowing that survey intensity was generally lower from May to September, it appears at least for the other months that the number of Barn Owls colliding with vehicles was relatively constant. By comparing the pattern of percentage mortality (November to April) of Northern Saw-whet Owls to that observed

Table 1. Percentage abundance of Barn Owl (BNOW) and Northern Saw-whet Owl (NSWO) collected by month as a result of vehicular collisions in the Lower Mainland and Central Fraser Valley of British Columbia.

Month	BNOW (%)	NSWO (%)
January	11.1	22.3
February	14.4	14.4
March	14.2	5.0
April	13.3	1.1
May	8.7	0.4
June	3.7	0.0
July	1.3	0.4
August	1.1	0.0
September	2.4	0.0
October	4.1	4.3
November	10.3	15.1
December	15.5	37.1

for Barn Owls, there was strong seasonal variation, with 88.9% of all Northern Saw-whet Owls found between November and February. Comparatively few Northern Saw-whet Owls were found from March through October. Monthly and seasonal variation could not be evaluated reliably for the remaining species, although all records of Short-eared Owl were from November to March, compared to Barred Owl, Great Horned Owl, Long-eared Owl, and Western Screech-Owl, which all had one or more summer records.

Barn Owl Mortality in Abbotsford

Despite differences in sample effort among regions, it is apparent in Figure 3 that Barn Owls suffered the greatest rate of vehicle-induced mortality in some regions. The region of Abbotsford did not have the highest percentage mortality for the study area, but it did have the greatest number of Barn Owls collected (299 of 542 birds). Hence, we were able to partition those records with some confidence to specific areas to evaluate potential mitigation "hotspots". Of the 299 birds collected in the Abbotsford region, all were along a section of Highway 1 that measured 31.7 km (Lefeuvre Road east to Vedder River). Within that region, 62% (n = 184 owls) were collected from 28% of the length (9 km). The intersection with the greatest number of mortalities was at #3 Road (n = 46), followed by Whatcom Road (Figure 4; n = 30), #4 Road (n = 24), Fooks Road (n = 23), and Cole Road (n = 20).

Discussion

Despite reports of decline in many North American owls, we were surprised to learn that few studies have quantified incidents of road mortality in any meaningful manner. The most comprehensive report anywhere appears to be from the United Kingdom, where Ramsden (2003) intensively studied the impacts of roads on local and regional populations of Barn Owl, and considered such aspects of juvenile dispersal, nesting biology, feeding behaviour, and response to mitigation efforts. In British Columbia, our study is the first to report large numbers of vehicle-induced mortality for ten species of owl.

Several factors may have biased the kinds of information that could be extracted from the data. First, owl size and the perpendicular distance it is thrown from the road may have affected the ability to find smaller birds as they may have been thrown further from the road compared to larger owls. Second, smaller birds may be disproportionately scavenged, as species such as Common Raven (*Corvus corax*) are functionally more capable of carrying a Northern Saw-whet Owl or a Northern Pygmy-Owl than they are in carrying a Barn Owl. Third, seasonal differences, which is certainly related to the height of roadside vegetation, may reduce detection of smaller species. And finally, each of the different highways surveyed have varying numbers of lanes, widths, speed limits, and numbers of cars, all of which can influence the probability of a collision. Overall, our calculation of the total number of owls killed by vehicles is likely underestimated, but by how much, we do not know. What we do know, is that the collection of nearly 1,000 owls in 12 years is both remarkable and alarming.

The Barn Owl, of which its population in southwestern British Columbia appears to be declining (Campbell and Campbell 1984), was the most frequently collected bird. It was recorded

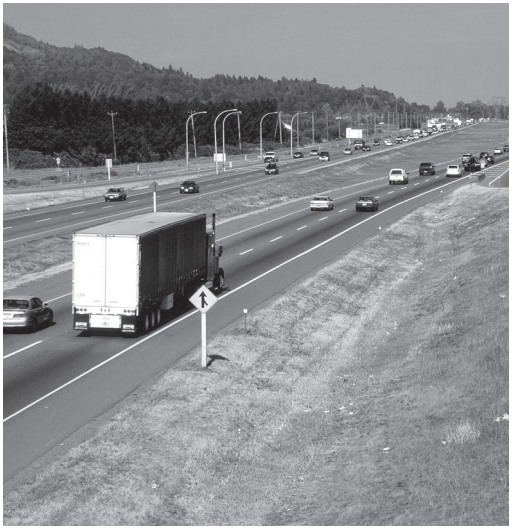

Figure 4. This stretch of Highway 1 near the Whatcom Road intersection had the second highest number of reported Barn Owl fatalities as a result of vehicular collision. 24 August 2006 (R. Wayne Campbell).

from all regions in our study area, but was most prevalent in Abbotsford, Delta, and Langley. The number of birds that were hit appeared relatively constant throughout much of the year, although an observed decline during the summer months is likely a reflection of reduced sampling effort at that time.

We were particularly surprised at both the number of Northern Saw-whet Owls collected, and in the time of year they were observed. We expected that peak numbers of Northern Saw-whet Owls would occur during migration, as numbers appear to be at least locally abundant in September on southern Vancouver Island (Levesque 2002) and in Mackenzie (Lambie 2003). Campbell et al. (1990) states that the southward migration period may extend through November, but in light of new information, this is most certainly near the end of the migration period. That so many Northern Saw-whet Owls are being hit in winter is suggestive that the Central Fraser Valley may be an important overwintering area for this species, especially when prey is locally abundant.

Presently, there is considerable interest regarding the cause of a perceived decline in Western Screech-Owls in the Lower Mainland of British Columbia. Cannings and Angell (2001) implicate habitat loss, road mortality, and predation by Barred Owls that invaded the area in the late 1980s. Remarkably, despite limited quantifiable information, it appears the latter receives greater attention as evidenced by a Raptor Workshop at G.C. Reifel Bird Sanctuary in March 2003, an on-line status report by the Committee on the Status of Endangered Wildlife in Canada, and in a recent paper by Elliott (2006). Other possible causes of decline may include competition with non-native Eastern Gray Squirrels (*Sciurus carolinensis*) (Elliott 2006), nest predation by a burgeoning Common Raccoon (*Procyon lotor*) population, and low colonization rates of "habitat islands" in highly developed areas. Thus, given the relative "rarity" of Western Screech-Owls, we were then surprised, and concerned, when we tallied 16 killed by vehicles. The Lower Mainland is not the first location reported to have high incidence of road mortality for this species. In Pacific Rim National Park on western Vancouver Island, vehicles hit seven birds between January 1971 and February 1972 (Hatler et al. 1978). It is unfortunate that we did not have mortality data for the period 1988 – 1994, but from our data, and considering the possible biases that may have reduced the number of birds collected, road mortality may be a significant factor in the decline of the Western Screech-Owl.

Mitigation to Reduce Barn Owl Collisions

There are a number of potential mitigative efforts that can be employed to reduce the incidence of Barn Owl collisions with vehicles. We present three methods that have been reviewed by Ramsden (2003), but note that any attempt to implement mitigation should first include a professional assessment for estimating the probability of a successful outcome, and also an evaluation of potential negative effects for other native species as a result of mitigating. The methods presented below will almost certainly require cooperation among federal, provincial, and municipal governments, as well as with private landowners.

1) Roadside vegetation mowing: In the United Kingdom, Garland (2002) assessed the possibility of mowing roadside vegetation to reduce small

mammal populations, and hence, Barn Owl foraging and subsequent vehicular collisions. The project was based on one mowing per year, which in turn reduced field vole (*Microtus agrestis*) abundance by 40%, but increased wood mouse (*Apodemus sylvaticus*) abundance by 14%. Although it was initially anticipated that roadside verges would only have to be mowed once every three years, Garland (2002) later concluded that they would have to be mown more often, which was considered neither economically feasible nor desirable. As an alternative to mowing, Ramsden (2003) suggested creating high density prey areas to draw birds away from roadways. This approach appears ecologically counter-intuitive for two reasons: 1) adults would likely dominate the better areas and juveniles would be forced to hunt roadside verges and suffer higher mortality rates; and 2) a higher prey base would support higher numbers of Barn Owls but not diminish the probability of roadside foragers being hit.

2) Planting dense shrubbery: Baudvin (1997) suggested that by planting dense shrubs along roadside verges, access to small mammals by Barn Owls would be greatly reduced. However, the general consensus in reducing wildlife mortality on roads is to reduce vegetative cover (Singleton and Lehmkuhl 2000). Ramsden (2003) agreed that although Barn Owl mortality may be reduced, this method would likely have consequences for many other species.

3) Forcing Barn Owls to fly high: In France, road mortality of Barn Owls was always lower when the road was sunken rather than level or raised (Massemin and Zorn 1998), and in the United Kingdom when a hedgerow (a narrow band of tall trees or shrubs) was present (Garland 2002). Garland (2002) recommended a minimum hedgerow height of 4 m, which we assume is meant to be above the height of the road surface. Ramsden (2003) acknowledged that regardless of whether trees or shrubs are used, any continuous low-flight obstruction (*e.g.,* fence) would force birds to fly higher over roads and reduce mortality, regardless of prey availability, how often the roadway was used by the owl, or how many vehicles there were. For much of the Central Fraser Valley, we urge a note of caution with this method because Highway 1 is a divided highway, which may result in birds dropping down to forage in the median, and possibly becoming trapped or confused with no readily accessible escape route.

Conclusion

Owl mortality as a result of collision with vehicles in the Lower Mainland and Central Fraser Valley of British Columbia appears to be of some major consequence to several species, especially Barn Owl, Northern Saw-whet Owl, and Western Screech-Owl. In this paper we have quantified the impact of vehicles on the mortality of several species, evaluated regional differences, identified mortality "hotspots" (Figure 5) and have provided potential options for assessing mitigation options. We conclude by noting that this problem should be investigated more seriously, especially considering that three of the ten owls we identified are regular victims and are of conservation concern in British Columbia.

Figure 5. The Great Horned Owl was the fourth most frequently collected owl in this study, with more than 50% of all observations from the Abbotsford region. Near Rock Creek, BC. 24 Septermber 1994 (R. Wayne Campbell).

Literature Cited

Baudvin, H. 1997. Barn Owl (*Tyto alba*) and Long-eared Owl (*Asio otus*) mortality along motorways in Bourgogne-Champagne: report and suggestions. Pages 58-61 *in* J.R. Duncan, D.H. Johnson, and T.H. Nicholls, eds. Biology and conservation of owls in the northern hemisphere. U.S.D.A. Forest Service General Technical Report.

NC-190, St. Paul, MN. 635 pp.

BC Conservation Data Centre. 2006. BC Species and Ecosystems Explorer. B.C. Ministry of Environment. Victoria, BC. Available: http://srmapps.gov.bc.ca/apps/eswp/ (accessed 31 July 2006).

Campbell, E.C., and R.W. Campbell. 1984. Status report on the Barn Owl (*Tyto alba*) in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON.

Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, and M.C.E. McNall. 1990. The birds of British Columbia. Volume 2: nonpasserines (diurnal birds of prey through woodpeckers). Royal British Columbia Museum, Victoria, BC. 636 pp.

Cannings, R.J. 1993. Northern Saw-whet Owl (*Aegolius acadicus*). *In* The birds of North America, No. 42 (Poole, A. and F. Gill, eds.). The birds of North America. Philadelphia, PA.

Cannings, R. J., and T. Angell. 2001. Western Screech-Owl (*Otus kennicottii*). *In* The birds of North America, No. 597 (Poole, A., and F. Gill, eds.). The birds of North America. Philadelphia, PA.

Colvin, B.A. 1985. Common Barn Owl population decline in Ohio and the relationship to agricultural trends. Journal of Field Ornithology 56:224–235.

Creel, S., J. Winnie, B. Maxwell, K. Hamlin, and M. Creel. 2005. Elk alter habitat selection as an antipredator response to wolves. Ecology 86:3387-3397.

Elliott, K. 2006. Declining numbers of Western Screech-Owl in the Lower Mainland of British Columbia. British Columbia Birds 14:2-11.

Garland, L. 2002. Microhabit ecology of small mammals on grassy road verges. Ph.D. dissertation. University of Bristol, Bristol, UK.

Hatler, D.F., R.W. Campbell, A. Dorst. 1978. Birds of Pacific Rim National Park. Occasional Papers of the British Columbia Provincial Museum No. 20. Victoria, BC. 194 pp.

Johnsgard, P. 1988. North American owls: biology and natural history. Smithsonian Institution Press, Washington D.C. 295 pp.

Lambie, V. 2003. Mackenzie nature observatory 2003 annual birding report. Prepared by the Mackenzie Nature Observatory, Mackenzie, BC. 35 pp.

Levesque, P. 2002. Nocturnal owl monitoring at Rocky Point Bird Observatory, Fall 2002. Unpublished report available on-line at: www.islandnet.com/~rpbo. 27 pp.

Massemin, S., and T. Zorn. 1998. Highway mortality of Barn Owls in northeastern France. Journal of Raptor Research 32:229-232.

Ramsden, D.J. 2003. Barn owls and major roads: Results and recommendations from a 15-year research project. Barn Owl Trust, Ashburton, Devon, UK. 109 pp.

Singleton, P.H., and J.F. Lehmkuhl. 2000. Wildlife-roadway interactions: a bibliography and review of roadway and wildlife interactions. USDA. Forest Service, Wenatchee Forestry Sciences Laboratory report submitted to the Washington Department of Transportation.

Wiggins, D.A. 2006. Short-eared Owl (*Asio flammeus*). *In* The birds of North America online (Poole, A., and F. Gill, eds.). Cornell Laboratory of Ornithology, Ithaca, NY.

Wood, B.J., and S.S. Liau. 1984. A long-term study of *Rattus tiomanicus* populations in an oil palm plantation in Johore, Malaysia: III. Bionomics and natural regulation. Journal of Applied Ecology 21:473-495.

About the Authors

Michael recently graduated from Simon Fraser University with a Master of Science degree in biology. His ornithological interests, while greatly varied, are primarily on community composition of forest songbirds and their response to alternate forest management techniques, as well as issues around mitigation to reducing anthropogenic causes of wildlife mortality and the identification and monitoring of indicator species and their habitats. In his spare time he enjoys photography and mountain biking.

Gerry was born in Delburne, Alberta and first became interested in birds by starting an egg collection. At 15 years old he worked with the oil industry, with Western Geophysical, in the muskeg region of the Peace River, and later had a career driving a concrete truck. He moved to Abbotsford in 1963 where he started enjoying nature again. He is an active member of the Central Valley Naturalists, president of the Orphaned Wildlife Rehabilitation

Society (OWL), and serves as a volunteer for the Burrowing Owl Society and the Mountain View Conservation Centre. He is also a taxidermist and many of the roadkills he salvages are prepared as full mounts and donated to schools in the Lower Mainland.