



**Garry Oak
Ecosystems
Recovery Team**

WESTERN BLUEBIRD
STEWARDSHIP ACCOUNT

For the Garry Oak Ecosystems of Southwestern British Columbia



Photo: Mark Nyhof

Prepared by:
Suzanne M. Beauchesne
Paul Chytk
and
John M. Cooper
Manning, Cooper and Associates
P.O. Box 646, Errington, BC V0R 1V0

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The Vertebrates at Risk Recovery Action Group
of the Garry Oak Ecosystems Recovery Team
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Executive Summary

Western Bluebirds are at the northern extent of their range in southern British Columbia. Populations have declined severely in the Pacific Northwest west of the Cascade Range, since the 1950's, but may have increased east of the Cascades. In the Georgia Depression of British Columbia, the Western Bluebird was formerly a common summer resident; however, today it is presumed extirpated from the lower Fraser River valley, the Gulf Islands and southeastern Vancouver Island. Breeding has not been documented since the late 1960s or early 1970s in the lower Fraser River valley and since the early 1990s on Vancouver Island and the Gulf Islands. There are no known Western Bluebird occurrences on Vancouver Island over the past five years.

Western Bluebirds are songbirds and secondary cavity-nesters that breed in open coniferous and deciduous woodlands, farmlands, burned or moderately logged stands, and edge habitats. Throughout their range, the greatest threat to the species continued survival is thought to be habitat loss. Urban sprawl, intensive logging, industrial agricultural practices, and fire suppression have all had an adverse impact on habitat availability. Climate effects and the use of pesticides may also have contributed to declines in coastal areas.

Protection of the existing habitat and the restoration of additional habitat are critical for future conservation efforts in coastal British Columbia. Cataloguing and mapping of potential nesting habitat are required.

Western Bluebird breeding habitat exists in a variety of land ownership situations. Effective management of the species therefore should involve a variety of land managers. Forest company biologists, transmission right-of-way vegetation managers, private landowners, and urban planners should all be encouraged to adopt habitat stewardship practices. Suggested stewardship actions include: retain wildlife trees wherever safely practical; control tree and exotic shrub encroachment into open areas through controlled burning, grazing, mowing techniques; control feral cat populations; and control European Starling and House Sparrow populations.

A nest box program may be necessary to initiate the recovery of the extirpated coastal populations. Nest boxes should be placed in suitable breeding habitat and these boxes ideally should be maintained on an annual basis.

Artificial relocation to re-colonize Western Bluebirds in coastal British Columbia is probably not necessary, as populations may begin to recover through immigration from populations in Washington. By establishing and maintaining large numbers of nest boxes suitable nest sites would be available to accommodate dispersing birds. If the appropriate conservation actions are taken, the re-colonization of Western Bluebirds in coastal British Columbia seems possible.

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1. Introduction

The Garry Oak Ecosystems Recovery Team (GOERT) has established a list of plant, invertebrate and vertebrate species that are a priority for future research and recovery efforts in the Georgia Depression Ecoprovince (i.e., southeastern Vancouver Island and the lower Fraser River valley) of southwestern British Columbia. The species selected rely on the Garry oak (*Quercus garryana*) or associated ecosystems (e.g., coastal bluffs, sparsely vegetated areas) in coastal British Columbia for the majority or an important part of their lifecycle and are either in decline or extirpated from the region.

The Western Bluebird, a priority vertebrate species as identified by GOERT, has been extirpated from the Garry oak ecosystems of British Columbia. This stewardship account has been prepared for GOERT to summarize available information about this species and to make management recommendations. The account is an initial step towards the development of a recovery plan, with the long-term objective of restoring this species to its former coastal range in the Garry oak ecosystems of British Columbia.

a) Taxonomy

Two subspecies of Western Bluebird (*Sialia mexicana*) are recognized in North America (AOU 1957). *S. m. occidentalis* is the subspecies that occurs in British Columbia (Cannings 1998). The British Columbia Conservation Data Centre (BC CDC) recognizes two populations of this subspecies, the “interior” population and the “Georgia Depression” population (BC CDC 2002). The Georgia Depression population of this taxon is the focus of this stewardship account.

The genus *Sialia* is endemic to North America and includes 2 other species, Eastern Bluebird (*S. sialis*) and Mountain Bluebird (*S. currucoides*: Guinan et al. 2000). The Mountain Bluebird is a common breeder in the southern interior of British Columbia, but occurs on the coast only as a rare transient, whereas the Eastern Bluebird does not occur in British Columbia (Campbell et al. 1997).

2. Range and Known Distribution

a) Global range

The Western Bluebird breeds in western North America from southern British Columbia and southwestern Alberta, south to northern Baja California and central Mexico. The subspecies *S. m. occidentalis* breeds from southern British Columbia south to northern Baja California and as far east as northern Idaho, northwestern Montana and Nevada (AOU 1957; Howell and Webb 1995; Guinan et al. 2000).

In the winter, Western Bluebirds shift to the south, occupying areas where other conspecifics occur during the breeding season, as well as suitable foraging habitat outside of the breeding regions. On the coast, this species winters as far south as

northern Baja California (AOU 1957; Howell and Webb 1995; Guinan et al. 2000).

b) Canadian range

In Canada, the Western Bluebird occurs during the breeding season in southern British Columbia (see below; Campbell et al. 1997) and southwestern Alberta (Semenchuk 1992).

c) Provincial range

The Western Bluebird breeds in suitable habitat across the southern portion of British Columbia from the Southern Interior east to the Alberta border. It is a former breeding species from the Georgia Depression (Campbell et al. 1997: see Fig. 1 for historic breeding sites).

In the winter, a few Western Bluebirds occur in the southern Okanagan valley (Cannings et al. 1987). Western Bluebirds from the Georgia Depression probably migrated south along the coast to suitable habitat in Oregon and California, as few birds were ever recorded overwintering in this region (Campbell et al. 1997).

d) Range changes

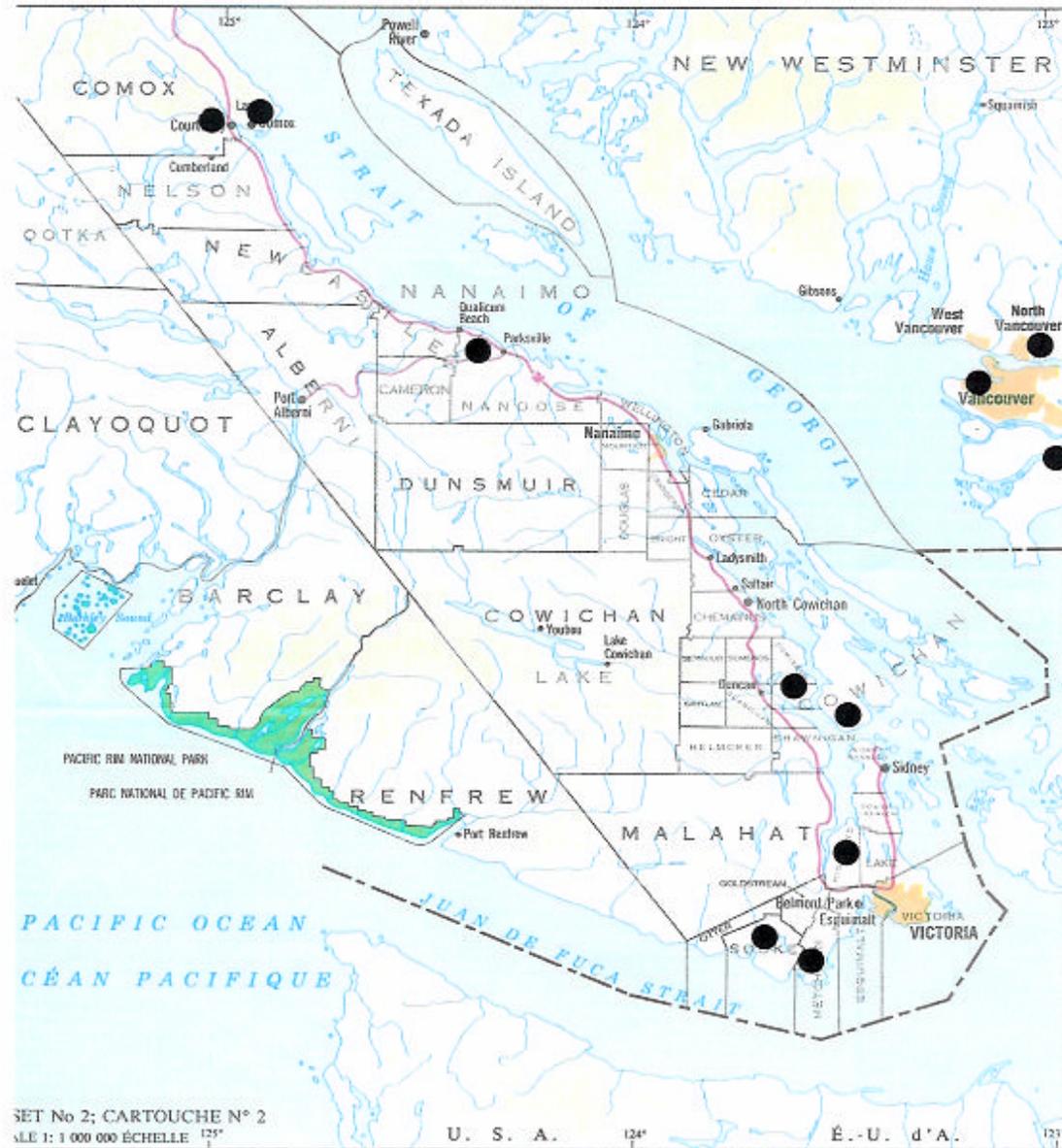
The Western Bluebird is now presumed to be extirpated from its former range in the lower Fraser River valley, southeastern Vancouver Island and the Gulf Islands (BC CDC 2002). Distribution in the coastal areas of Washington and Oregon has also contracted severely in recent decades (Rogers 2000). In Washington State, the last reported breeding record for the Olympic Peninsula was 1953, while the last breeding record for the San Juan Islands was 1964 (cited in Rogers 2000). It still occurs in other parts of the state (e.g., Fort Lewis) where nest box programs have maintained breeding populations.

3. Status of Species

a) Population size

In the Georgia Depression of British Columbia, there are no remaining Western Bluebird breeding pairs (Fraser et al. 1999). The total, range-wide population size is unknown, however the Western Bluebird is common in parts of its range, including the southern interior of British Columbia (Guinan et al. 2000; JMC unpublished notes).

Figure 1: Historic breeding sites in the Georgia Depression, British Columbia. Base map from the Gazetteer of Canada, Vol. British Columbia, 1985.



Former breeding localities ●

b) Population trends

Range-wide population trend data are inconclusive, but populations in some regions are thought to be in decline (Guinan et al. 2000). British Columbia Breeding Bird Survey (BBS) data sample sizes are too small for statistical analysis (Sauer et al. 1997).

In the early 1900s, the Western Bluebird was a common resident or summer breeder west of the Cascade Range in the Pacific Northwest (Guinan et al. 2000), including south

coastal British Columbia (Munro and Cowan 1947). Populations seemed abundant in the 1930s and 1940s but, from the 1950s to 1980s, populations declined throughout the western part of the range until the species was virtually extirpated in the region (ODFW 1991; Rogers et al. 2000; Guinan et al. 2000; B. Altman pers. comm.). Early declines were not quantified and mainly occurred prior to the initiation of the Breeding Bird Surveys program (ODFW 1991; Guinan et al. 2000).

In British Columbia, population declines were noted on Vancouver Island in the 1940s and in the Vancouver area in the 1950s (Campbell et al. 1997). By the 1970s, the Western Bluebird no longer bred on the southwest mainland coast. Small breeding populations continued to occur at some locations on southeastern Vancouver Island and Gulf Islands through the 1980s and early 1990s. The highest number of nests recorded was 16 in 1988, all of which were in nest boxes. Initial success with nest boxes on the coast was short-lived. Numbers dwindled rapidly after 1988 until the mid 1990s when only 1 or 2 pairs were present (Campbell et al. 1997; C. Palmateer pers. comm.). None of the local naturalists or biologists interviewed knew of a record of even a transient bird in the past five years (D. Allinson; N. Dawe; M. McNicholl; G. Monty; C. Palmateer; R. Toochin pers. comm.).

In western Washington, after becoming virtually extirpated by the early 1980s, it is now locally uncommon through parts of the region and locally common in the Fort Lewis area, at the south end of Puget Sound. The success of the Fort Lewis population is attributed to an intensive nest box program. This population has recovered from 1 pair in 1981 to 160-175 pairs throughout the 1990s (Rogers 2000).

In western Oregon, the species has also apparently benefited from intensive nest box programs and populations there are thought to have increased since the 1980s although they are still not recovered to the level they were at in the 1960 (ODFW 1991; Guinan et al. 2000; B. Altman pers. comm.). In the Willamette Valley, south of Portland, the Prescott Western Bluebird Recovery Project has enjoyed considerable success with a steady increase in the number of nestlings banded from 493 in 1995 to 1962 in 2001 (PWBRP 2002).

c) Global, Canadian, and provincial rank

The Western Bluebird is considered globally secure (G5), but varies from ‘apparently secure’ to ‘threatened’ in different jurisdictions within its range (see Table 1). In British Columbia, the interior population is on the provincial yellow-list for species considered to be “not at risk”. The provincial ranking of S4, however, indicates that they are considered to be “of conservation concern because they have a small range or low abundance, have shown provincial declines, or there are perceived long-term threats. Thus, the list of S4 species is a watch list of species to be actively monitored and otherwise studied.” The Georgia Depression population is on the provincial red-list for threatened or endangered species and it is presumed extirpated (BC CDC 2002).

Table 1. Status of the Western Bluebird (BC CDC 2002, COSEWIC 2002, NatureServe 2002).

Jurisdiction	Rank	Qualifier
British Columbia (Interior population)	Yellow List S4B SZN	Not at Risk Apparently Secure but on the Watch List
British Columbia (Georgia Depression population)	Red List SHB SZN	Threatened or Endangered Presumed Extirpated
Washington	S3B, SZN	Vulnerable
Oregon	S4B, S4N	Apparently Secure
COSEWIC	Not Assessed	
US Endangered Species Act	Not listed	

d) Related forms threatened

Subspecies or populations other than the Pacific coast population are apparently secure (Guinan et al. 2000; NatureServe 2002).

e) Special scientific interest

The Western Bluebird is a cavity nesting bird. Cavity nesters are sometimes considered indicator species because they require structural features that are often lost in modern forest management and urban development (Backhouse 1995). This open woodland species was formerly associated with the Garry oak ecosystems of the Georgia Depression (Fuchs 2001; BC CDC 2002; GOERT 2002). It is now considered extirpated from this region.

Sustainable breeding populations of cavity nesting species indicate healthy woodland ecosystems and help to maintain general avifauna diversity (Guy et al. in press). Restoration of an extirpated species presents a great challenge for wildlife managers.

4. Life History

a) General

Very few studies document the ecology of Western Bluebirds in the Georgia Depression, therefore most of the following is inferred from studies undertaken in other regions.

b) Diet and foraging behaviour

The diet of Western Bluebirds consists primarily of invertebrates during the breeding season and small fruits and some seeds during winter. Invertebrate prey includes grasshoppers, crickets, caterpillars, moths, beetles, ants, termites, wasps and bees, spiders and flies (summarized in Guinan 2000). In the winter, Western Bluebirds forage for small fruits along tree branches and on the ground (Guinan et al. 2000). In coastal British

Columbia, it may forage along marine shorelines for intertidal and upper beach invertebrates (Campbell et al. 1997).

Breeding adults are known to alter their consumption of prey between the pre-nestling and nestling stages, typically consuming lighter prey items themselves and feeding heavier ones to nestlings (Guinan et al. 2000).

During the breeding season, the Western Bluebird frequently hunts from a low perch, dropping to the ground to seize arthropods with its bill. They also flycatch, using short flights from a perch, hover-forage, glean prey from vegetation or tree trunks, and hop on the ground in pursuit of prey (summarized in Guinan et al. 2000).

c) Reproduction

The Western Bluebird is socially monogamous, but some females may produce offspring outside of the pair bond. Pairing occurs within a week of arrival on breeding grounds (Guinan et al. 2000).

Nests are built in natural or man-made cavities with the female doing most of the construction (Guinan et al. 2000). Nests are neatly woven and are constructed of a variety of materials (Baicich and Harrison 1997). In British Columbia, grass was the most frequently used nest material province-wide (93% of nests, n=523), followed by feathers, conifer needles, plant stems, mosses, mammal hair, fine rootlets, string and plant down (Campbell et al. 1997).

In British Columbia, the typical clutch size reported was five or six eggs (Campbell et al. 1997). In British Columbia, the nests with eggs have been found between 15 April and 3 August but the majority of clutches province-wide (52%, n=565) were found between 17 May and 27 June (Campbell et al. 1997). The initiation of egg laying may be delayed during wet, cold springs (Guinan et al. 2000).

The female alone incubates for 13-14 days (Baicich and Harrison 1997). The male feeds the incubating female. Young hatch synchronously and both parents feed nestlings (Guinan et al. 2000). The male will take over feeding the first brood if the female initiates a second clutch (With and Balda 1990; Baicich and Harrison 1997). The Western Bluebird normally has one or two broods per season across much of its range; but three broods have been documented in Oregon (Baicich and Harrison 1997; Guinan et al. 2000).

Dates for nests with young in British Columbia ranged from 1 May to 24 August, with the majority (52%, n=601) recorded between 1 June and 3 July (Campbell et al. 1997). Range-wide, nestlings fledge after approximately 20 days (Baicich and Harrison 1997). In British Columbia, fledging occurred between 17-24 days (n=24; Campbell et al. 1997). Fledglings are independent after 2 weeks, but may continue to solicit food from parents for over one month post-fledging (Guinan et al. 2000).

Occasionally, pairs have helpers that aid with feeding and defending nests. Helpers are frequently adult males, but may be juveniles from former broods (Guinan et al. 2000).

d) Site fidelity

Site fidelity appears to be relatively high. In Arizona, over 3 years, 62% of banded adult males and 46% of females returned to their breeding sites in subsequent years. In Washington, only 11% of adult banded birds appeared to re-use former nesting areas (Guinan et al. 2000). In the Willamette Valley, individual banded birds have been recorded nesting in the same box for up to six consecutive years (PWBRP 2002).

Philopatry (return of yearlings to natal areas) appears to be lower. In California, 26% of banded males and 6% of females returned to natal sites (Koenig and Dickinson 1996). In Arizona, 24% of banded males and 2% of females returned to natal sites (Guinan et al. 2000). Site fidelity is generally unknown for British Columbia (Campbell et al. 1997), but one bird banded as a nestling on Saltspring Island was found breeding the next year on Mount Tzouhalem, near Duncan (C. Palmateer pers. comm.).

e) Territory

Territories are established around the nest site and are defended against conspecifics. There are no data for territory size in British Columbia. In Arizona, territory size ranged from 0.29 ha to 0.79 ha (Guinan et al. 2000). In linear distance, Western Bluebirds rarely nest within 90m on one another (Purcell et al. 1997; Berner 1998).

f) Causes of mortality

Depredation may be a major cause of nest failure, although the amount may vary geographically and possibly between years (Guinan et al. 2000). Depredation of eggs and nestlings by cavity-nesting birds and mammals may be a by-product of interspecific competition for cavities (Guinan et al. 2000). House Wrens (*Troglodytes aedon*) were noted to destroy bluebird nests on Saltspring Island in nest boxes by pecking the eggs and building their nests over top of bluebird eggs and young (C. Palmateer pers. comm.). Northern Flying Squirrels (*Glaucomys sabrinus*), Deer Mice (*Peromyscus maniculatus*: Guinan et al. 2000) and Red Squirrels (*Tamiasciurus hudsonicus*: SMB unpublished data) may usurp nest boxes, destroying bluebird nests in the process. Direct predators of eggs and nestlings may include weasels, snakes, and raccoons (*Procyon lotor*; summarized in Guinan et al. 2000).

In coastal British Columbia, reported predators of adult Western Bluebirds are Cooper's Hawks (*Accipiter cooperii*: Trotter 1986 in Guinan et al. 2000) and domestic cats (*Felis catus*: Pollock 1986 in Guinan 2000).

Nestlings are prone to exposure from cold, wet weather. Adults may have difficulty providing sufficient food if insects become inactive during poor weather, resulting in starvation of the nestlings (Guinan et al. 2000). In British Columbia, nestlings were found

dead in nest boxes on Saltspring Island after cold wet weather (C. Palmateer pers. comm.) as has been noted for other cavity nesting species (J.C. Finlay pers. comm.). Inability to survive unseasonably cold weather may have been detrimental for the remnant population in the Georgia Depression, the northern extremity of their range in the 1990s (C. Palmateer pers. comm.).

Parasites and bacterial infections are also known to cause death of adults and nestlings (Guinan et al. 2000). The cleaning of nest boxes annually is thought to improve nesting success by reducing nest lice occurrence (Purcell et al. 1997). Western Bluebirds are rarely parasitized by Brown-headed Cowbirds (*Molothrus ater*; Guinan et al. 2000). In British Columbia, 2 out of 767 nests province-wide were parasitized by cowbirds (Campbell et al. 1997); there are no other instances for North America (Guinan et al. 2000).

Collisions with vehicles and electrocution from perching on electric distribution lines are other likely causes of mortality in British Columbia (Campbell et al. 1997).

g) Migration

Western Bluebird migration routes are unknown. These short- to medium distance partial migrants have been reported to form mixed flocks with other species including Mountain Bluebird, American Robin (*Turdus migratorius*) and Yellow-rumped Warbler (*Dendroica coronata*; Guinan et al. 2000). In British Columbia, most bluebirds migrate, but in mild winters, some may remain as year-round residents in the southern interior (Campbell et al. 1997), particularly, in the southern Okanagan valley (Cannings et al. 1987). In the Georgia Depression, a few birds formerly wintered between Comox and Victoria, on Vancouver Island and near Vancouver on the lower mainland (Campbell et al. 1997).

In the Georgia Depression, spring migrants were formerly documented arriving as early as the third week of February and numbers peaked from early March to early April. Fall migration in the Georgia Depression began in August, continued through October and sharply declined in November.

5. Habitat Description

a) General habitat requirements

Western Bluebirds breed in open coniferous and deciduous woodlands (including Garry oak), wooded riparian areas, grasslands, farmlands, burned forest, moderately logged stands and edge areas with scattered trees and snags. They prefer an open under story and are often associated with partially disturbed areas, including moderately logged forests (Guinan et al. 2000).

In British Columbia, breeding habitat includes sparsely forested slopes and summits of low hills, Garry oak woodlands, logged lands, burned forest, farms and pasturelands

(Campbell et al. 1997). On southeastern Vancouver Island, the last breeding populations occurred more often on sparsely forested ridges than in low-lying Garry oak woodlands (C. Palmateer pers. comm.) however this habitat selection may have been based on avoiding disturbance rather than a true preference, as Garry oak ecosystems became more populated. Foraging habitat included flower fields, weedy areas, logged or burned forests, farms, Garry oak ecosystems and log-strewn or stony beaches (Campbell et al. 1997).

In British Columbia, Western Bluebirds occur from sea level to 1,200 m elevation, favouring open forest communities. In the Georgia Depression, they formerly nested from 30-600 m elevation.

In western Washington, Western Bluebirds favour glacial outwash prairies and oak woodlands (Rogers 2000), habitat that most closely resembles habitat used in coastal British Columbia. In western Oregon, Western Bluebirds have been recorded nesting in areas with small farms that had diverse agricultural uses, as well as clearcuts with standing snags (ODFW 1991; B. Altman pers. comm.).

The Western Bluebird readily accepts artificial nest boxes (Guinan et al. 2000). Nest boxes are often placed in “trails” of boxes set out at variable distances along fence lines, power lines or on trees in farmland or in other appropriate areas. Plans for building nest boxes, nest box placement, mounting systems and predator guards can be found in many publications and on the internet (see NABS 2002). Annual maintenance is generally required or nest boxes will fall into disrepair until they are no longer functional for bluebirds (NABS 2002). The drawbacks of artificial nest boxes are that building, mounting and maintenance are labour-intensive and, although a dedicated group of volunteers may provide the labour free-of-charge, there are also material costs to consider. In some areas (e.g., western Oregon and western Washington: Smith et al. 1997; Rogers 2000) nest boxes are credited with re-establishing Western Bluebird populations in areas where they were locally endangered or nearly extirpated (see Population Trends section).

Over 4,600 nest boxes were erected in British Columbia by 1993, 9% of which were occupied by Western Bluebirds, and 16% by Mountain Bluebirds (Pollock 1994; summarized in Campbell et al. 1997). An unknown number of nest boxes were established and maintained on southern Vancouver Island and the Gulf Islands from 1961 to the early 1990s (Campbell et al. 1997).

b) Habitat availability and net trends in habitat change

Historically, on the south coast of British Columbia, suitable habitat would likely have occurred in drier sites or disturbed areas created by fire and in Garry oak ecosystems, open ridges and summits, and moderate-to-steep slopes that have open canopied forests (Fuchs 2001; GOERT 2002). These habitats are currently very scarce due to urbanization, agricultural development, and fire suppression. Ridge tops and steeper slopes may provide some of the most suitable remaining habitat, since these areas typically do not have the same development pressures as more level areas. Human population growth for

the south coast is projected to climb steadily, creating even greater pressures on remaining habitat (Campbell et al. 2001).

In western Washington, suitable habitat is also in decline (Rogers et al. 1997). In western Oregon, suitable natural habitat has almost entirely disappeared, however clearcuts and some agricultural areas currently provide some good quality substitute habitat (B. Altman pers. comm.).

6. Threats to the Species

Habitat loss, alienation and alteration that reduces the number of potential nest sites and adversely impacts foraging areas are the primary threat to this species. Urbanization, modern agriculture practices, intensive logging and fire suppression are the main causes of habitat degradation (Bock et al. 1993; Rodenhouse et al. 1993; Guinan et al. 2000).

Urbanisation permanently removes potential nesting habitat from the land base (Jones and Bock 2002). For example, a small fraction (estimated 1-5%) of the Garry oak ecosystem that was formerly found in the Greater Victoria region still exists (Fuchs 2001). Although habitats that occur adjacent to urban areas are used by Western Bluebirds as the species can tolerate some human disturbance, urban areas typically have higher densities of domestic pets, particularly cats, which can be a major predator for both adults and young (Guinan et al. 2000).

Recent agricultural practices including large-scale monoculture crops typically require the expansion of field sizes. The subsequent conversion of marginal lands and the removal of shrubby fencerows, snags and small forested areas eliminate important habitat features for a number of wildlife species including Western Bluebird (Rodenhouse et al. 1993). Insect control and pesticide applications were, and may continue to be, harmful to bluebird populations. (Guinan et al. 2000).

Logging practices that leave few remaining snags and cutting of snags in rural areas for firewood reduces the number of nest sites available (Smith et al. 1997; Rogers 2000).

Historically in the Georgia Depression, wildfire was a regular, naturally occurring event that maintained open areas by killing encroaching trees (Fuchs 2001). Also, in some areas, First Nations used controlled burning to improve growing conditions for Common Camas (*Camassia quamash*), an important food staple (Pojar and MacKinnon 1994). These controlled burns undoubtedly created open woodland areas that provided suitable Western Bluebird habitat. Currently, fire suppression is practised for public safety reasons as well as the protection of private property and forest resources. Therefore few fires have recently occurred along the south coast, with the result that no new habitat has been created. In addition, existing habitat is not maintained by fire and native and introduced plants (i.e., Scotch broom *Cytisus scoparius*, gorse *Ulex europaeus* and Himalayan blackberry *Rubus discolor*) are changing the structure of these open spaces (Fuchs 2001).

Competition for potential nest cavities, from both native and non-native species, may have been a factor in the decline of Western Bluebirds, particularly in settled areas that support a high concentration of introduced cavity-nesting birds (Campbell et al. 1997). In the Georgia Depression, possible competitors would have included Violet-green Swallows (*Tachycineta thalassina*), Tree Swallows (*T. bicolor*), Red-breasted nuthatches (*Sitta canadensis*), Black-capped Chickadee (*Parus atricapillus*), Chestnut-backed Chickadee (*P. rufescens*), and at one time, Lewis's Woodpecker (*Melanerpes lewis*; summarized in Guinan et al. 2000). However, the competitors that had the most impact are thought to have been European Starlings (*Sturnus vulgaris*), House Sparrows (*Passer domesticus*: Campbell et al. 1997) and House Wrens (*Troglodytes aedon*: C. Palmateer pers. comm.).

Campbell et al. (1997) note that the decline in Western Bluebirds in the Georgia Depression coincides with the arrival of European Starling. In other areas, Western Bluebirds are able to coexist with these species (e.g. in a single tree in the Okanagan, Western Bluebirds, Lewis's Woodpeckers and European Starlings were nesting simultaneously; SMB unpublished notes). However, where there are few remaining cavities and a very large population of competitors (i.e., European Starling and House Sparrow), as is found in the Georgia Depression, competition may be more intense, and the cumulative effect may be detrimental (Campbell et al. 1997; Campbell et al. 2000).

7. Management Recommendations

a) Current habitat ownership and protection

On the south coast of British Columbia, various regional and provincial parks and federal crown lands protect potential habitat in the lower Fraser River valley, the east coast of Vancouver Island and Gulf Islands. However, the quality of habitat and size of protected areas are currently unknown. Most suitable habitat is probably on privately owned land and management and stewardship of these lands are at the discretion of individual landowners. It is therefore important to work with landowners and promote good stewardship practices.

Development and urbanization pressures on the south coast are projected to increase in the future. Several private conservation organizations (e.g., The Nature Trust of British Columbia, The Nature Conservancy, The Land Conservancy and Habitat Acquisition Trust) are currently involved in purchasing habitat areas that would provide suitable nesting habitat for Western Bluebirds. The federal government is also planning to create a National Park Reserve within the Gulf Islands, and this may protect additional suitable Western Bluebird habitat.

b) Current management policies and actions

There are no current management initiatives for the Georgia Depression population of Western Bluebirds in British Columbia. Nest box programs have been discontinued on the British Columbia coast, but have proven effective in other regions of the Pacific Northwest. In other regions, some silvicultural practices such as controlled burns, selection logging, and snag retention seem to improve nesting suitability for Western Bluebirds (Brawn and Balda 1988).

c) Recommended prescriptions

Areas with highly suitable habitat for Western Bluebirds should be secured as part of the goal of establishing a network of protected areas that represent the full diversity of woodland ecosystems and grassland habitats (Fuchs 2001). Protected areas should be of sufficient size to maintain ecological integrity.

In addition, historical breeding sites should be managed to ensure that Western Bluebird habitat features are maintained (Fuchs 2001). Invasive, exotic plant species, in particular, Scotch broom (*Cytisus scoparius*), gorse (*Ulex europaeus*) and Himalayan blackberry (*Rubus discolor*) should be controlled to maintain open understories. Controlled burning, mowing and grazing may be used to maintain open understories in woodlands; however, treatment should be on a rotational schedule to provide mosaics of successional stages. Snag retention should be adopted wherever it is safe to do so.

A nest box program may be the most effective short-term measure for enhancing Western Bluebird nesting habitat (Guinan et al. 2000). Local conservation and naturalist groups should be contacted and organized to participate in establishing and maintaining a nest box program in areas historically used by Western Bluebird. Although nest box programs require intensive management, and in some regions involve the provision of food during periods of poor weather, the results are sometimes favourable.

Because Western Bluebird habitat is not restricted to protected areas, a variety of land managers should be involved to increase the potential of their recovery. These include forest company biologists, utility company vegetation managers, private landowners and urban planners. Forest companies should be encouraged to adopt silvicultural practices that favor cavity nesters (i.e., retention of as many wildlife trees as safety consideration allow). Utility corridors can be important refuges for birds of open forest (Manning et al. 2000; King and Byers 2002). Therefore, utility companies (e.g., BC Hydro) should be encouraged to place nest boxes along utility corridors and to maintain vegetation structure to mimic natural Garry oak ecosystem characteristics. Private landowners should be encouraged to manage woodlands and adjacent openings to maintain and enhance existing nesting habitat. Conservation covenants could be used to protect good breeding habitat on private lands. Urban planners should be encouraged to incorporate green spaces that could provide potential nesting habitat or act as a buffer to other habitat areas.

Specific prescriptions for all land managers include:

- Retain wildlife trees and dead limbs where they do not present a safety hazard as these structures are essential for cavity nesting species. Where snags have been removed, replacements could be ‘planted’ to provide potential nest sites. In mixed open forest, individual live trees of other species (i.e., Douglas-fir) may be selected for topping or fungal inoculation, in an effort to accelerate wildlife tree development (E.T. Manning pers. comm.).
- Incorporate a nest box program in areas with suitable habitat where wildlife trees have been removed.
- An active feral cat control should be adopted in nesting areas, possibly in conjunction with animal welfare agencies such as the SPCA.
- Measures to control or reduce population size of European Starling and House Sparrow should be considered as pressure from competition might impact nesting success of this and other rare cavity nesting birds.
- Avoid pesticide application during the breeding season (May to July).
- Scotch broom (*Cytisus scoparius*) and other invasive shrubs should be replaced with native berry producing shrubs, to provide a late summer food source.

d) Potential to stabilise or reverse decline

If the appropriate conservation efforts are taken, the re-colonization of Western Bluebirds on Vancouver Island, the Gulf Islands and parts of the lower Fraser River valley is possible. Their return to former breeding areas in the Georgia Depression will require the direct intervention of establishing and maintaining large numbers of artificial nest boxes during the short-term. Although nest box programs are labour intensive, the involvement of volunteer organizations, particularly natural history and conservation groups, could assist with providing required resources for establishing and maintaining nest box trails.

Western Bluebirds have not been reported on Vancouver Island in the past 5 years. However, immigration of a few birds from Washington seems possible as those populations continue to recover. If after several years of establishing nest boxes and enhancing habitat there are no tangible results, the feasibility of re-introducing bluebirds should be investigated. In the interim, management, maintenance and enhancement of potential nesting habitat is critical. These efforts should be concentrated in those areas that historically had the highest population densities and have the greatest possibility of future re-colonization. Provision for retention or creation of snags on private and public lands is paramount for ensuring suitable habitat availability over the longer term.

e) Recommended further work

Potential Western Bluebird nesting habitat in the Georgia Depression should be surveyed, described, catalogued and mapped to develop a permanent record. Priority for this effort should be given to those sites with the most recent Western Bluebirds breeding records. Because nest cavities are considered an essential habitat feature, habitat descriptions should include quantification of available cavities. Other important features that should be documented include the amount of tree canopy closure, percent cover of shrub layer, and an estimation of the number of tree stems per hectare. In addition, ownership of land with high suitability habitat should be determined.

Where habitat enhancement procedures are undertaken, the site should be monitored to determine the effectiveness of the prescription applied. An adaptive habitat management strategy may then evolve.

The feasibility of resuming a nest box program should be investigated. The recommended habitat survey work would indicate the areas that have the highest suitability, both in terms of quality of habitat for bluebirds and cooperation of landowners. In addition, local naturalists should be contacted to determine if volunteer effort is available.

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- Allinson, D. September 2002. President, Rocky Point Bird Observatory Society, Victoria, BC. E-mail: goshawk@telus.net.
- Altman, B. October 2002. American Bird Conservancy, Northern Pacific Rainforest BCR Coordinator, 311 NE Mistletoe Circle, Corvallis, OR 97330 Phone: 541 745-5339 baltman@abcbirds.org
- Dawe, N.K. June 2002. Senior Wildlife Technician, Canadian Wildlife Services, Environment Canada, E-mail: Neil.Dawe@ec.gc.ca.
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- Palmateer, C. September 2002. Former Western Bluebird trail coordinator.
- Toochin, R. Naturalist, Vancouver, BC.