Recovery of the Western Purple Martin bordering the 'Salish Sea' – the Georgia Basin of British Columbia and Puget Sound, Washington

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Abstract

The Western Purple Martin (*Progne subis arboricola* Behle 1968) population in British Columbia increased from about five breeding pairs in 1985 to 350 pairs in 2004 as a result of a volunteer-led nest box program. Similarly, in Washington the population increased from remnant colonies totalling few known pairs in the mid-1970s to over 500 pairs in the Puget Trough and an additional ~200 pairs on the Columbia River in 2004, in response to provision of artificial nest structures. Banding nestlings and documenting productivity began in the late 1990s, with both jurisdictions showing similar results. In BC, where a smaller more localised population allowed closer monitoring, population growth rate varied widely between years (-5% to +60%), likely due to effects of weather on survival and nesting success. Fledgling production per pair remained stable during 1998-02 but increased in later years with more favourable weather conditions. Band returns showed 80% of nestlings selected different breeding colonies than their natal colony and most exhibited site fidelity once a breeding colony was selected. Birds dispersed from north Puget Sound to BC and less often the reverse, over distances up to 245 km (150 mi). These results indicate the importance of cross-border, multi-jurisdictional communication, data sharing and development of a regional recovery strategy and action plan, as well as the need for continuation of the recovery effort for the foreseeable future.

Introduction

The Western Purple Martin, (Prog*ne subis arboricola* Behle 1968; Cannings 1998) is Red-listed (as *P. subis*) in British Columbia (B.C.), a candidate for Threatened status under the B.C. *Wildlife Act*, and is a Candidate Species for listing in Washington State (WA), as a result of widespread population decline in the mid-late 1900s. [The western subspecies is not yet afforded separate at-risk status at federal, provincial or state levels, though it is the only martin subspecies breeding in BC and WA (Campbell et al 1997; Cannings 1998; Kostka and McAllister (in prep.)]. This subspecies reaches its northern breeding limit in southwestern BC at the northern end of the Georgia Depression Ecoprovince ('Georgia Basin'), near Campbell River, and is considered at risk throughout its breeding range. A member of the swallow family, it is a colonial secondary cavity-nester originally utilizing abandoned woodpecker nest cavities in snags and live trees and is entirely dependent on a supply of suitable nest cavities for breeding (Fraser et al 1997). As an obligate aerial insectivore, its annual survival, nesting success and productivity are also considered to be strongly influenced by adverse weather conditions during the nesting season that negatively affect the availability of its flying insect food supply, as for other swallows (Finlay 1971, 1976).

Large scale recovery efforts in the form of volunteer naturalist-based nest box programs began in southern Puget Sound, Washington in 1975 (Davis 1995), along the lower Columbia River forming the Washington - Oregon border in 1985 (Fouts 1996) and in BC at Cowichan Bay in 1985 (Fraser et al 1997); localized use of nest boxes occurred in

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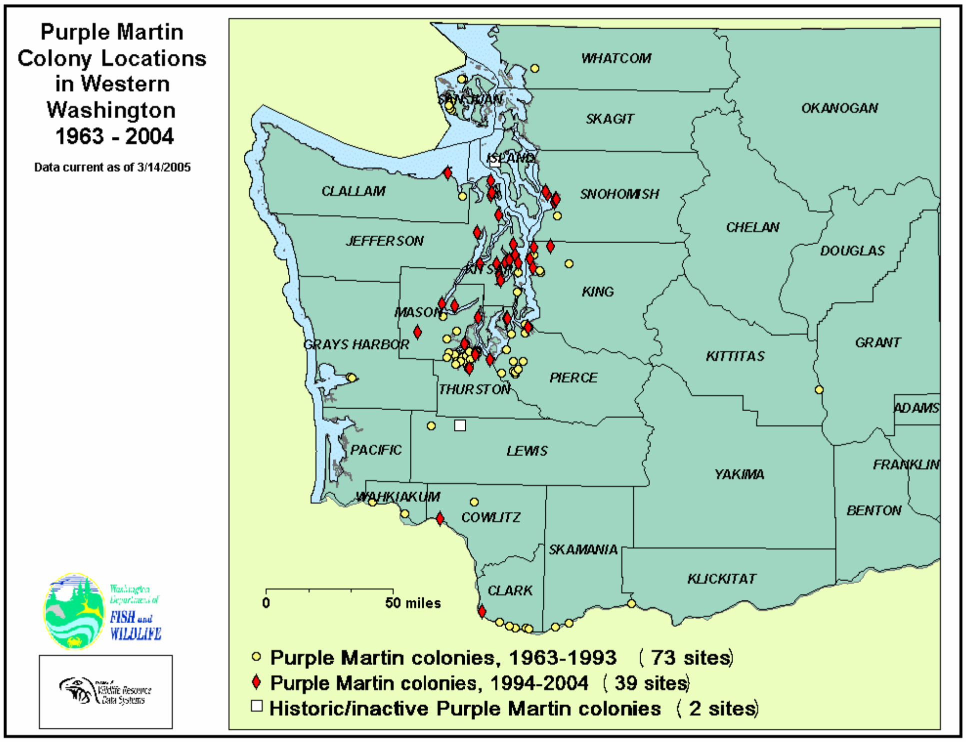

Figure 1 . Location of known active Purple Martin colony sites in Washington State, 2004.

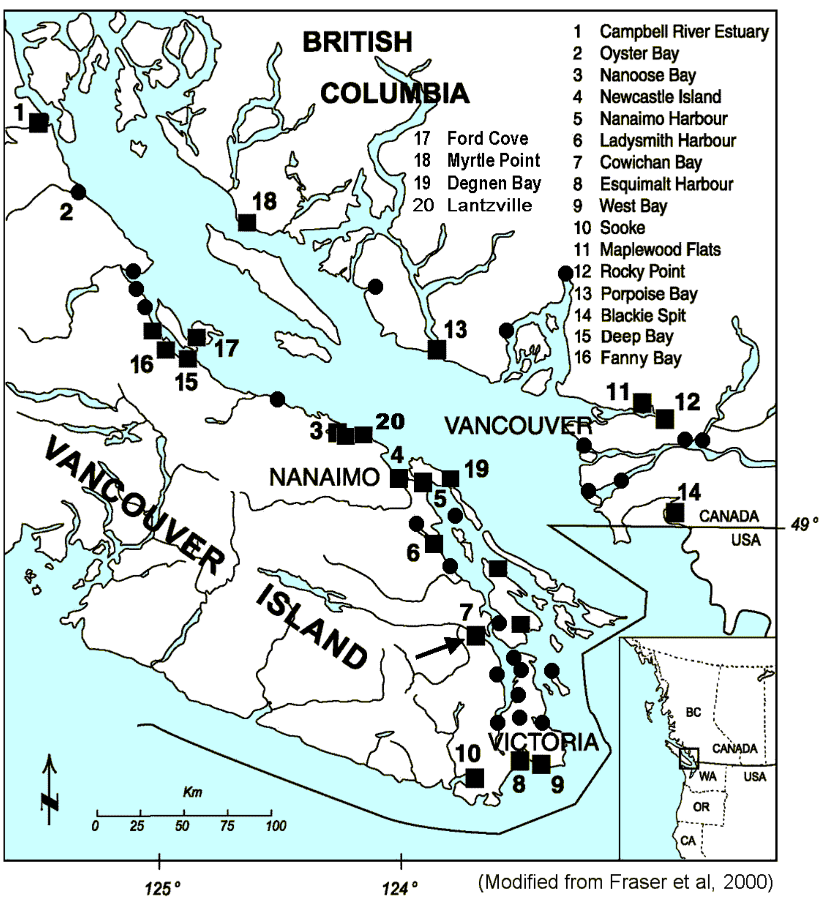

Figure 2. Location of known active (square) and unoccupied (circle) Purple Martin nest box colony sites in the Georgia Basin of southwest British Columbia, 2004. The arrow indicates the location of the initial nest box colony at Cowichan Bay.

southern WA in the 1970s (Milner 1987). Early results of these recovery efforts were monitored by those directly involved but documented to varying degrees in the literature. As Western Purple Martin populations increased in both jurisdictions, more intensive formal monitoring studies were undertaken in the late 1990s to better understand the recovery potential of this species and provide information for continued management of the recovery programs.

This paper reports the changes in abundance and distribution as a result of volunteer-based nest box programs in Washington and British Columbia over the three decades between 1975 and 2004. In addition, nesting success, productivity and banding and band re-sighting studies in both jurisdictions are discussed.

Historical Background

Reports of historic distribution and abundance of the Western Purple Martin have been summarized for British Columbia by Fraser et al (1997), Copley et al (1999) and Campbell et al (1997) and for Washington by Jewett et al (1953), Larrison (1981), Milner (1987) and Kostka and McAllister (in prep.). Common to these areas of the Pacific Northwest (and parts of Oregon and California) is a near absence of information about this species in the mid-late 1800s, prior to development of an association with human habitation and the use of cavities in buildings and other structures in cities for nesting in the early 1900s. In the earliest accounts of Purple Martins in Washington, Suckley (Suckley and Cooper 1860) called the species uncommon in Washington Territory, but mentioned seeing it in scrub-oak stands of the Nisqually plains. Cooper never observed martins in the Territory and speculated that it must be rare. Most reports are from the coastal lowlands near human habitation in the lower Columbia River valley and Puget Trough of western Washington (Fig. 1) and the Georgia Basin of southwest British Columbia, which marks the historic northern breeding limit of the subspecies (Fig. 2). On the basis of these sparse early reports, it is extremely difficult to reliably estimate the pre-European arrival and early post-arrival distribution and abundance of this localized colonial cavity-nesting species dispersed in a pre-industrial landscape influenced by natural and First Nations-driven ecological processes.

During the first half of the twentieth century martins increased in abundance in many Pacific Northwest cities, with increasing use of cavities in buildings and other structures for nesting (Fraser et al 1997; Richmond 1953; Kitchin 1934; Jewett et al 1953), despite reported competition for nest sites from introduced House Sparrows (*Passer domesticus*). Population trends in the wild during this period are uncertain, so it is unclear whether the increased abundance in urban areas represented a shift away from use of natural snag cavities in the wild or an independent increase in a 'new' habitat type, or both. However, results of recent recovery efforts in BC, WA and elsewhere indicate that Purple Martin abundance is strongly related to availability of suitable clusters of nest cavities.

The apparent initial success in urban areas may have been the result of benefits such as reduced predation in close association with humans and/or reduced nest predation in cavities in man-made structures, resulting in higher productivity, longer colony persistence with less nest predation-related site abandonment and development of larger colonies than usually seen in the wild (i.e. many of the same factors operating at nest box colonies today). Near the height of this period, a pre-migratory roost variously reported as containing between 7,000 and 12,500 birds was documented in Seattle in the mid-1940s (Higman 1944; Larrison 1945). Assuming the observed long term mean of three fledged young per pair, this roost alone equates to 1400-2500 nesting pairs, or up to 70% of the birds found today in the entire western subspecies population between BC and California (3,500 known pairs; WPMWG 2005).

Shortly thereafter the urban populations (and presumably any remaining wild-nesting birds as well) experienced a steady decline, coincident with arrival in the mid-1940s and subsequent population explosion of the European Starling (*Sturnus vulgaris*) on the west coast (Myers 1958; Brown 1981; Campbell et al 1997; Smith et al 1997). Though less well documented, a contributing factor to this decline was likely modification of building design and construction after the WW II years to eliminate cavities suitable for nesting, both to discourage starlings and other cavity-nesting pest species and possibly also to improve building insulation to reduce oil central heating costs. As well, ongoing habitat loss due to landscape level changes in coastal lowland areas, including clearing for agricultural and urban development, large scale timber harvest, snag removal and salvage for lumber and firewood, and fire suppression measures that resulted in fewer fire-killed snag stands likely also contributed to the decline.

Concurrent extirpation of Lewis's Woodpecker from its historic breeding range in coastal lowland areas of the Pacific Northwest as a result of habitat loss and possibly competition with starlings for remaining net sites *may* also

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have been a factor in the decline, due to loss of a continuing supply of new nest cavity clusters. Supporting documentation is lacking, though this mid-sized cluster-nesting open woodland species has similar historic distribution and habitat requirements to the Purple Martin and martins still nest in abandoned colony sites of the similar Acorn Woodpecker at remnant snag stands in CA (Hill et al 2004).

By the early-mid 1970s martins had disappeared from most of their previous range in the Pacific Northwest, including the BC lower mainland, much of southeast Vancouver Island and most of western WA. A few known nesting pairs remained on southeast Vancouver Island, approximately 12 nesting pairs were reported in southern Puget Sound near Olympia (reports for the northern Sound are few and inconclusive) and an unknown number of pairs nested along the lower Columbia River (Copley et al 1999; Davis 1995). Most remaining martins were nesting in natural cavities in decaying offshore pilings, which may have provided a refuge from competition with starlings and House Sparrows for cavity nest sites. A small snag-nesting population persisted and was later found at Fort Lewis near Olympia, which remains the northern limit of western martins still nesting in snag cavities in the wild.

The first widespread volunteer recovery efforts began in WA in the mid 1970s, with confirmed records of Western Purple Martins utilizing nest boxes placed on pilings in southern Puget Sound in 1975 (Davis 1995) (Fig. 1), while numbers remaining in the northern Sound continued to decline. A similar volunteer-based recovery effort began in BC about a decade later when only 5 known nesting pairs remained in the province, with the first use of nest boxes documented at Cowichan Bay on southeast Vancouver Island in 1985 (Fraser et al 1997; Copley et al 1999) (Fig. 2). At this time another volunteer-based recovery effort was initiated along the lower Columbia River in WA and OR, where an estimated 80 nesting pairs then remained (Fouts 1988, 1996), following localized and poorly documented volunteer nest box projects along the Columbia River in the late 1970s (Milner 1987). See Cousens et al (2005) for a more complete description of the Purple Martin stewardship and recovery program in BC from 1985-2004.

Methods

Studies of the recovery process in BC and WA involved four methodologies: (1) banding nestlings to track dispersal, recruitment and nest site fidelity, (2) monitoring arrival timing, observation of banded birds and reading of coloured leg bands to identify individuals, (3) nest inspection to document nest box use, nesting success/failure rate and productivity, and (4) blood collection and DNA analysis to clarify genetic biodiversity characteristics and taxonomic relationships with other *P. subis* subspecies (not reported herein; Baker et al, in prep.).

Over 5300 nestlings and 100 adults and subadults (captured on nests incidentally during inspections or by box-trapping while roosting at night) were banded throughout the Georgia Basin in BC and in (mainly) northern Puget Sound, WA, during 1996-2004, using standard size 1A U. S. Fish and Wildlife aluminum ('federal') bands. Roughly 80% (4300) of these were banded in BC and 20% (1100) in WA. Over 80% of these birds were also banded on the opposite leg with a uniquely numbered coloured plastic or aluminum leg band for identification of individuals without re-capture, by reading the colour band code with a spotting scope, allowing multi-year tracking of individuals. In BC a number of band colours were used, so that when a colour band could not be read it was often possible to determine the banding year (year class) from the band colour and leg to which it was applied. An additional nearly 300 uncoded colour bands (5%) were applied in south and central Puget Sound in 1998-99, using a unique band color per colony rather than unique numbering of bands for monitoring dispersal.

Arrival timing of adult and later-migrating subadult birds was determined from a combination of direct observations by study members at major colony sites and first sighting reports from the wider birding community. Observations of banded birds at nesting colonies were made with spotting scopes (required for reading bands) and binoculars throughout the breeding season. Band re-sighting effort was greatest at readily accessible wharf and inter-tidal colonies and was least successful where nest boxes were mounted on offshore pilings because viewing bands from a distance on shore or from a moving boat was extremely difficult and reading band codes was not possible.

Nesting colonies were visited two to four times from late June to late August to determine nesting timing, apply bands and assess nest productivity. Early visits identified active nests and determined the stage of egg laying and incubation for the colony as a whole. Banding took place during later visits as the nestlings matured. The following productivity data were recorded at all visits to a nest: box number, sign of nesting activity, number of eggs, number and estimated age of nestlings and number of nestlings banded. In some cases the minimum number of eggs in a nest

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was back-calculated from the known number of nestlings in a nest. A small proportion of eggs may have been lost prior to the first nest check, especially in some small colonies that were not checked prior to banding time. In 2002 nest checks were later than in other years due to funding constraints - undoubtedly some un-hatched eggs and dead nestlings were lost (removed by adult birds) prior to the nest checks. The number of nestlings banded in the nest was used as an estimate of the number of nestlings that fledged from a nest; we recorded very few losses of banded nestlings when we re-checked nests or cleaned nest boxes later in the season.

Monitoring methodologies differed in intensity between BC and WA. In BC a complete inventory of active and inactive colony sites was maintained, nearly all active nests were inspected and most fledglings (>95%) were banded since 1996, except in 2002 (~70%). Due to this effort, accurate counts of nesting pairs, active nests and fledgling production for the geographically bounded southwest BC breeding population were obtained. In WA, with a larger number of more widely distributed colony sites and fewer state and volunteer resources, this was not possible. The results reported for WA are primarily for a sub-sample of breeding colonies in northern Puget Sound monitored since 1999, with an estimate of state-wide population abundance derived from a variety of monitoring sources.

Results

Abundance

During the 20 years since the start of volunteer nest box based recovery efforts in BC at Cowichan Bay on east Vancouver Island in 1985, the number of active colonies in the Georgia Basin has increased from 1-3 sites to 26, with another 26 still inactive sites and almost 1100 nest boxes available for use (Figs. 1, 3). The number of known breeding pairs has increased from 5 to 336 at monitored sites and over 350 in total in 2004, a 150% increase since the monitoring study began in 1998 and a 95% increase since 2002 (Fig. 4). This is higher than population estimates for 1900-1950 (152-190 pairs) proposed by Campbell et al (1997) but lower than estimated by Siddle et al (1991) (300-600 pairs) for the same period.

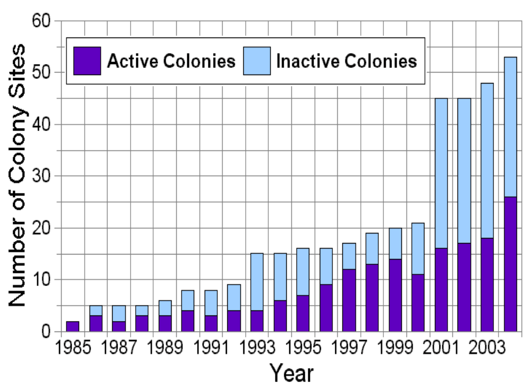

Figure 3. Number of active and inactive Purple Martin colony sites in BC, 1985 – 2004.

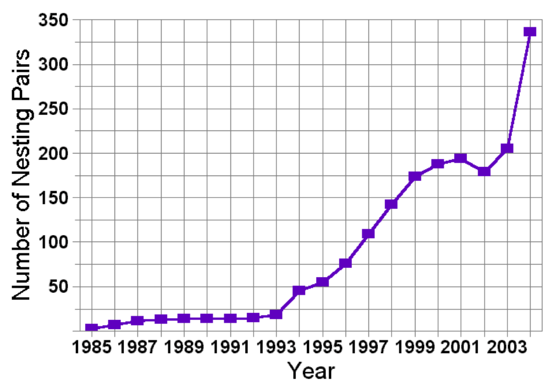

Figure 4. Number of confirmed nesting pairs of Purple Martins in BC, 1985 – 2004.

Recovery was gradual for most of the first decade and then abruptly accelerated after 1993 for reasons that are not yet completely clear, but may have been partly related to weather as well as the increased nest box supply. The temporary interruption of population growth and reduction of reproductive success in 2001-2002 were likely partly related to unfavourable weather trends during the breeding season near the northern limit of distribution, perhaps in combination with variations in post-breeding survival during migration and over-wintering in South America. This recovery response is primarily the result of providing starling and predator-resistant nest boxes on pilings at marine shoreline locations on east Vancouver Island, the Gulf Islands, the lower mainland and Sunshine Coast of BC, in combination with dispersal and recruitment from the earlier recovery in WA (below). Purple Martins returned to nest in the Vancouver area in 1994, after an absence of over 2 decades, and in 1997 returned to the historic northern breeding range limit at Campbell River after a range retraction to the southern Georgia Basin for a similar period (Copley et al 1999).

During the nearly 30 years since the start of a similar but less well documented and monitored recovery effort in southern Puget Sound circa 1975, the number of known active colony sites has increased dramatically from perhaps 5-6 to over 100 (Fig. 1). While the population decline continued initially in northern Puget Sound, the recovery spread northward with the proliferation of nest box sites, reaching the northern end of the Sound in 2003, with over 1000 nest boxes and gourds available and many nests in cavities in decaying pilings. The number of breeding pairs has increased from the "dozen pairs" reported by Davis (1995) – though anecdotal reports suggest small numbers of additional pairs elsewhere in Puget Sound – to an estimated 500 pairs in 2004. Following early recovery efforts in Oregon and a few sites in southern Washington in the 1970s, a volunteer nest box program which began along the lower Columbia River in WA and OR in 1985 with approximately 80 known nesting pairs, had increased the population to 400 pairs by 1995 (Fouts 1996). In 2004 there were at least 20 active colonies on the WA side of the lower Columbia River (Fig. 1), supporting an estimated 200 nesting pairs (D. Fouts pers. comm..). There were thus an estimated 700 nesting pairs in the State using a total of 138 known colony sites.

Breeding Chronology

Adult Western Purple Martins first returned from their winter migration to southwestern British Columbia and northwestern Washington typically during the second or third week of April (mean date: 19 April), rarely earlier (April 1 in BC) (Figure 5). Sub-adults were not seen until three or four weeks later, typically in mid-May. Adults and sub-adults continued arriving through the end of May and some sub-adults arrived as late as late June. Egg laying began on average in early June (earliest estimated date: 20 May) and was complete by mid-July (latest date: 19 July).

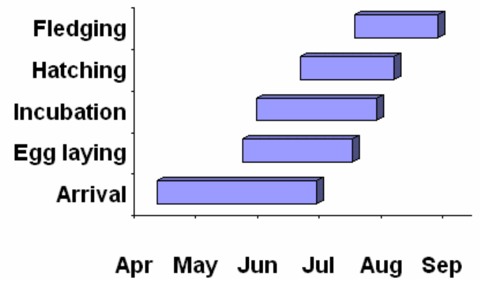

Figure 5. Breeding chronology of Purple Martins in the Pacific Northwest.

An incubation period of 19 days was consistently observed in all years for all sampled nests. Typically in this region observers found nests in the incubation phase for a six-week period from early June to late July (earliest start date 5 June, latest completion date 7 August), but in 2000 clutch initiation was delayed (probably by cool, wet weather) and the egg-laying phase and incubation were compressed into a four-week period ending by mid-July. Estimated hatching dates ranged from 16 June to 9 August, with most hatching completed by the third week of July. Very late nests (late subadult or re-nesting pairs) with hatching dates after late July often failed to fledge young. Young fledged on average from late July (earliest date: 20 July) to late August (latest date: 6 September). Typically, the period from first egg laying to last fledging, the period our colonies were producing young, was about 90 days.

Productivity

Between 1998 and 2004 the number of eggs produced and number of nestlings fledged in BC followed similar patterns (Fig. 6), generally reflecting the population growth curve. As well, over this period both productivity (number of eggs per pair: mean 1998-'03 = 4.1 ± 0.04[se], n = 1011) and fledging success (number of young fledged per pair: mean 1998-'03 = 2.9 ± 0.06) show a similar fluctuating pattern, with a depression in 2002 and a net increase overall (Fig. 7). Egg survival rate (egg-to-fledging success) and nesting success (proportion of nests producing at least one fledged young, not shown) also appeared to increase over the study period. These productivity increases over time were most pronounced at the six larger older colonies, though there was no significant overall relationship between colony size and mean fledging success per pair – they had equal success on average in colonies ranging from 1-2 to 50 pairs (Cousens et al, unpub. data).

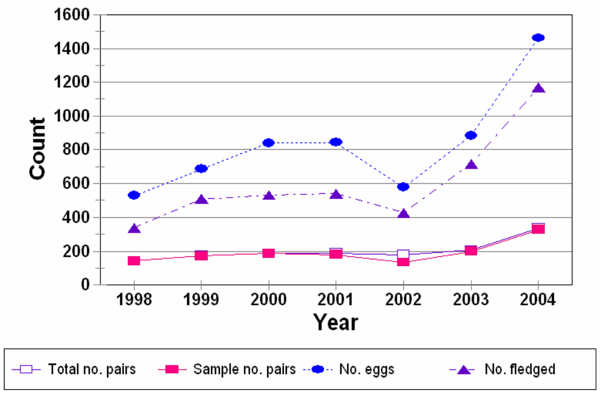

Figure 6. Number of Purple Martin breeding pairs, number of eggs and fledged nestlings produced in BC, 1998-04.

The annual fluctuations in egg and fledgling production per pair probably reflect the effects of stochastic weather events (e.g. cool wet spring weather causes failure of early nests due to reduced food availability and smaller clutch sizes of second nesting attempts) and perhaps changing demographics of the population (e.g. as the population moves toward stability, the proportion of adults – which lay larger clutches than subadults – may increase). However, the latter was not evident in BC in 2004, with >60% of the population composed of subadult birds and no reduction in mean clutch size. There were also among-colony differences in nestlings fledged per pair, which were likely a consequence of local variations in weather-related foraging conditions and predation pressures. Productivity per pair was slightly lower than reported for other western North American populations, possibly reflecting the influence of a more northerly maritime climate (Finlay 1971; Brown 1997; Fraser et al 1999; Horvath 2000).

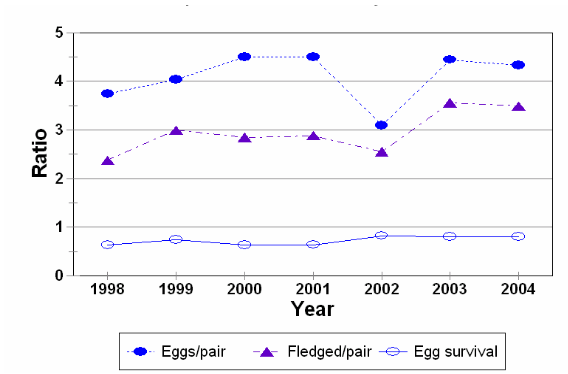

Figure 7. Mean number of eggs and fledged nestlings produced per pair by lilac Martins in BC, 1998-04. "Egg survival" is proportion of eggs that produce a fledged nestling.

Productivity data for the entire WA population during this period are not available due to lack of a state-wide nest box inventory, but the results from a sample of nest box inspections at 1 – 8 colonies in northern Puget Sound show similar patterns for egg production per pair (mean 1998-'03 = 4.4 ± 0.1[se], n = 120), fledging success (mean 1998-'03 = 3.4 ± 0.1) and egg survival rate, with increases over the 1998 – 2003 period and a less pronounced decrease in egg production with no decrease in fledging success in 2002 (Fig. 8). Egg production and fledging success per pair overall were slightly higher in WA than in BC for the same period, perhaps again a climate-related effect.

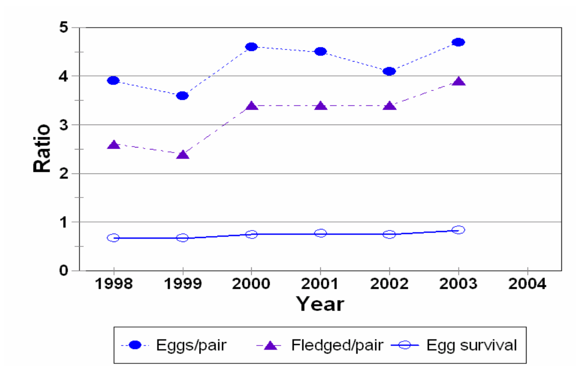

Figure 8. Mean number of eggs and fledged nestlings produced per pair by Purple Martins in WA, 1998-03.

Inter-colony Movement and Site Fidelity

Returns of banded birds per year from 10 to 23 colony sites in BC (20%; n = 634 re-sights) and 10 to 15 colony sites in northern Puget Sound, WA (15%; n = 128 re-sights) show that about 80% of Western Purple Martins select other sites than their natal colonies to breed (post-breeding dispersal and recruitment). (A re-sight is defined as at least one occurrence per colony per year – some birds were recorded repeatedly in successive years and a few were recorded at more than one colony in a season; >95% are breeding records.) The majority of re-sightings were within 100-120 km of the natal colony, with some birds breeding up to 150-180 km north/south of their birth site. One bird banded as a nestling in BC nested near Portland, OR, 510 km south of its natal colony. Conversely, a bird banded at Bellingham, WA, nested at Campbell River, BC, 245 km from its natal colony, at the historic northern breeding range limit for the subspecies. As a result, the entire BC population throughout the Georgia Basin is genetically homogenous (mixed) and regularly experiences a low level of recruitment from (at least) northern Puget Sound.

A total of 11 (of 3130) birds banded in BC prior to 2004 have been reported breeding to the south in Puget Sound, with several additional reports of post-breeding migrants moving through WA, OR and CA. An equal number of birds (of 450) banded in north Puget Sound have been recorded nesting in BC. Another 300 un-coded (blank) coloured bands were also applied to birds in southern Puget Sound and the lower Columbia River Basin in 1998-99, a few of which were recovered in northern Puget Sound and northern Oregon, but none of these were reported in BC. The southern extent of recruitment to BC is thus unknown due to lack of sufficient nestling banding in southern WA to date. However, in most years there is a substantial northward bias in dispersal, with between 60% and 80% of re-sighted banded birds (from all banding years) found north of their natal colony. This was also evident in trans-boundary sighting reports (BC-banded birds reported in WA and vice versa) in 2004 (Fig. 9), and may explain how the northern breeding range limit is maintained and extended, particularly during periods of favourable weather.

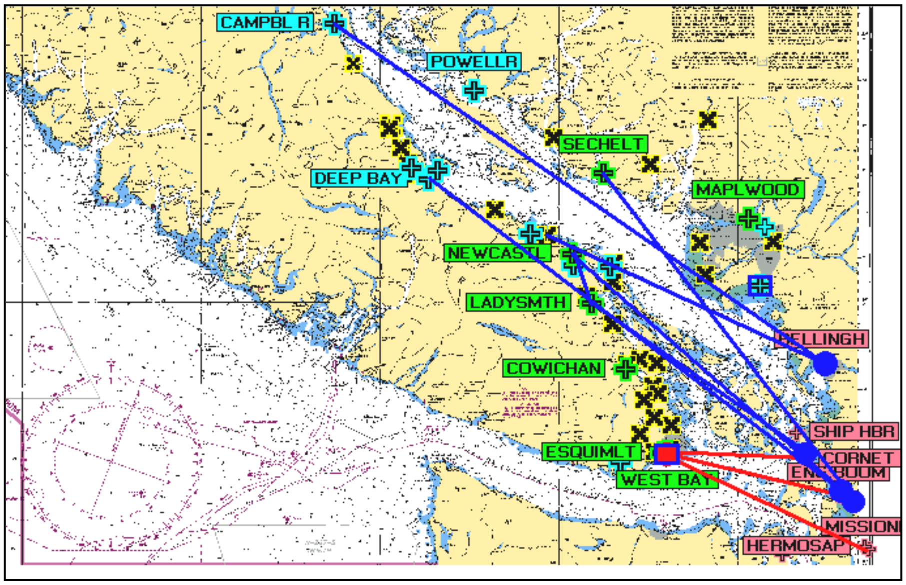

Figure 9. Trans-boundary dispersal of birds banded as nestlings at natal colonies in BC (red) and northern WA (blue) in 2001-03 and recovered as recruits at nesting colonies in 2004. Solid circle is banding origin; blue rectangle = WA-banded bird of unknown natal origin (band not read); + = active nest box colony site, x = inactive nest box site.

No eastern Purple Martins (*P. subis subis*) banded east of the Rocky Mountains have been observed in BC or WA (or elsewhere west of those mountains) during this study or previously to our knowledge and none of the birds banded in BC or WA have been reported east of 'the Rockies' (or east of the Coast/Cascade Range in the 'Great Basin'), supporting other evidence that the eastern and western subspecies are geographically and reproductively isolated on their breeding grounds in North America (Brown 1997; Baker et al, in prep.). It's not yet known whether they occur together during migration in Central America or on the wintering grounds in South America.

Band returns also indicate a fairly high degree of site fidelity once a breeding colony is selected, as widely reported in eastern martin banding studies, particularly as adults in their second nesting year. Relocation of adult birds was observed mainly between the first (subadult) and second nesting seasons. Two year-old birds returning earlier in the season than as subadults may relocate from sites newly colonized the previous year to an established colony.

Genetic differentiation

Preliminary results indicate substantial differences between the eastern and western subspecies and substantial genetic variation within the separate western population (Baker et al, in prep.).

Discussion and Management Implications

The Western Purple Martin population in the Pacific Northwest has recovered substantially from severe decline and has shown a dramatic increase to >1000 pairs in recent years (2002-'04). This recovery is primarily a result of volunteer provision of nest boxes in marine foreshore areas to replace natural cavity nesting sites that have been lost over the past century due to a variety of habitat impacts. Measures of productivity (eggs per pair, fledged nestlings per pair, egg survival and nesting success) have also increased over the study period, which is promising, though these parameters have finite biological limits and are highly vulnerable to stochastic weather events. Substantial numbers of unoccupied nest boxes are available to martins for recruitment and thus limited capacity is available for population growth in the short term. In Washington, whether due to opportunity or local saturation of the nest box supply, we are beginning to see a shift to other structures (wharves, bridges), which we hope to see in BC as well within the next few years if population growth continues. In summary, this is one of the longest running, most extensive and most successful species recovery programs in the Pacific Northwest.

However, the recovery challenge is far from over and the longevity and ultimate success of this recovery will require continued monitoring and vigilance. Only a few snag nesting sites supporting a small number of pairs remain in Washington (none remain in BC), with almost complete dependence on human-supplied and maintained nest boxes and a small declining reservoir of cavities in aging and decaying pilings. Site fidelity results from the banding studies highlight the importance of maintaining and repairing nest boxes and colony sites as they age. Dispersal results from the banding studies highlight the importance of having a number of colony sites available for selection when birds return on spring migration. The nest box program should therefore continue, particularly regarding maintenance, until the martins become securely established in alternate nesting substrates, perhaps indefinitely.

As monitoring of these recovery programs (and similar nest box programs elsewhere) clearly indicates, martin populations are limited primarily by availability of suitable nest cavity sites and secondarily by factors such as weather-related food availability, predation and possibly parasites and disease. We can expect that as colonies expand and the population continues to increase, these other ecological limiting factors will play a greater role in regulating population. As well, as the nest box inventory saturates and the birds use an increasing proportion of natural and other cavities without the starling access and nest predation resistance features of nest boxes, they may become more vulnerable to nest predation and competition for nest sites, causing overall productivity to decrease.

The ultimate goal of managing the Western Purple Martin population is to restore population size, dynamic stability and sustainability so that the species can be removed from at-risk status. To do this we need to reduce or remove the threats to long-term survival of the population. Placing large numbers of nest boxes on pilings at a wide variety of foreshore and offshore sites and maintaining these boxes has temporarily addressed nesting habitat loss issues, reduced competition for nest sites from Starlings and House Sparrows and minimized nest predation, maximizing productivity. To reduce the species at-risk status, we need to reduce reliance on humans and man-made nest boxes.

Purple Martins in the Pacific Northwest are in the northern portion of the species' breeding range and subject to cataclysmic or stochastic weather events that may drastically reduce the breeding population. Observation of banded birds combined with nest check data show that a proportion of early-arriving adult pairs initiate egg laying before the majority and that in years of cool wet spring weather the early breeders may fail, have reduced egg production or die of starvation. It may be necessary to consider that fluctuations in population and productivity are likely to occur, and that a drastic population reduction to mid-1980 levels may occur again. Complete reproductive failure and massive die-offs have been reported elsewhere in North America, usually followed by eventual re-colonization and population rebound (Brown 1997). Thus there is a need to manage conservatively, maintain a careful watch and ensure that key support mechanisms such as the current nest box program remain in place.

Results of banding studies and preliminary results of DNA analysis indicate that we cannot rely on immigration or transplants from east of the Rocky Mountains to supplement the population in the Pacific Northwest. Naturally occurring dispersal and recruitment is directed entirely north-south, mostly west of the Cascade/Coast Range Mountains. This highlights the need to support and foster cross-border, multi-jurisdictional communication, data sharing and preparation of a region-wide cross-border recovery strategy and action plan for the Western Purple Martin.

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