Recovery of the Purple Martin in British Columbia: More Than a Nest Box Program

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Abstract: The purple martin (*Progne subis arboricola*)[1] population in British Columbia has increased from a low of about five pairs in 1985 to over 200 breeding pairs in 2003 as a result of a volunteer-led nest box program; however, the species remains on the provincial Red List. We began banding nestlings and documenting productivity in the late 1990s. The number of eggs produced and nestlings fledged exhibited synchronous growth during the study. The mean number of eggs produced per pair during 1998–2003 (4.1 ± 1.1 SD) fluctuated annually; low values were probably a reflection of cool, wet spring weather and subsequent failures of early nests. The mean number of nestlings fledged per pair during 1998–2003 (2.9 ± 1.8 SD) remained stable. Productivity per pair was slightly lower than reported for other populations. Band returns showed that 80% of nestlings selected different breeding colonies than their natal colony, and that most exhibited site fidelity once a breeding colony was selected. Inter-colony between-year mixing regularly extends to/from northern Washington, and typically occurs within 120 km of the natal colony, but sometimes occurs up to 180 km. One nestling, however, was subsequently found breeding in Oregon at a site 510 km south of its natal colony. Preliminary results of a mitochondrial DNA study indicate that we cannot count on immigration or transplants from east of the Rocky Mountains to supplement the population: we must rely on populations from the south. Along with the band return results, this indicates the importance of cross-border, multi-jurisdictional communication, data sharing, and development of a regional recovery strategy and action plan.

Key Words: Purple martin, *Progne subis arboricola*, *Progne subis,* British Columbia, population, recovery, nesting chronology, productivity, banding, site fidelity, dispersal

[1]Currently, the BC Species and Ecosystems Explorer (September 2004) and NatureServe Explorer (version 4.0, July 2004) do not list subspecies for the purple martin.

Introduction

The western subspecies of the purple martin (*Progne subis arboricola*: Behle 1968; Cannings 1998) is on British Columbia's (B.C.) Red List. It is also a candidate for Threatened status under the B.C. *Wildlife Act* because its population declined in the mid-1980s, its current population is small, it is threatened by ongoing habitat degradation and loss, and it apparently has become dependent on humans to provide nesting cavities (Fraser et al. 1999). The subspecies is not listed federally by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Purple martin numbers in British Columbia, Washington, and Oregon declined from the mid-1900s until the late 1980s (Smith et al. 1997; Copley et al. 1999; Horvath 2000). In 1985, as few as five breeding pairs of purple martins were observed in British Columbia (Fraser et al. 1997; Copley et al. 1999). Since then, with limited funding and contributions from local businesses, volunteers have exerted substantial effort to provide nest boxes at sites where potential breeders were observed, to provide nesting opportunities at suitable alternate sites, to monitor and maintain existing nest boxes, and to foster a stewardship program (Fraser et al. 2000; Cousens et al. 2005). These efforts have undoubtedly contributed to a population increase.

Nest box colonies have been established on pilings and dolphins abandoned by logging and shipping businesses in marine estuaries, harbors, and coves, and at active wharves and marinas. In 2003, there were 18 active colonies (Fig. 1), six of which had 15–41 breeding pairs during the study. Nest boxes were single-nest units rather than condominium-like structures familiar in eastern North America.

The location, physical characteristics, and condition of the nest boxes and colonies provided an opportunity for observing and formally studying purple martin biology, and for gathering information about purple martins as their population responded to nest box placement and colony establishment. In 1996, a nestling banding program was initiated (by Finlay) as a means of determining migration routes, location of wintering grounds, and colony fidelity. Beginning in 1998, in conjunction with banding activities, a study of nest boxes and their contents was initiated. From this work we expected to (1) document breeding timing and chronology, (2) develop a firm estimate of the number of breeding pairs in British Columbia, (3) assess production of eggs and fledged young from nests at known colonies, and (4) monitor between-year inter-colony dispersal of banded birds. Structured nest checks at readily accessible nest boxes also allowed us to collect blood samples from nestlings for mitochondrial DNA analysis to assess the genetic differentiation of purple martins in British Columbia from consubspecifics to the south and from the *subis* subspecies from east of the Rocky Mountains. The purpose of this paper is to present some of the findings of this research.

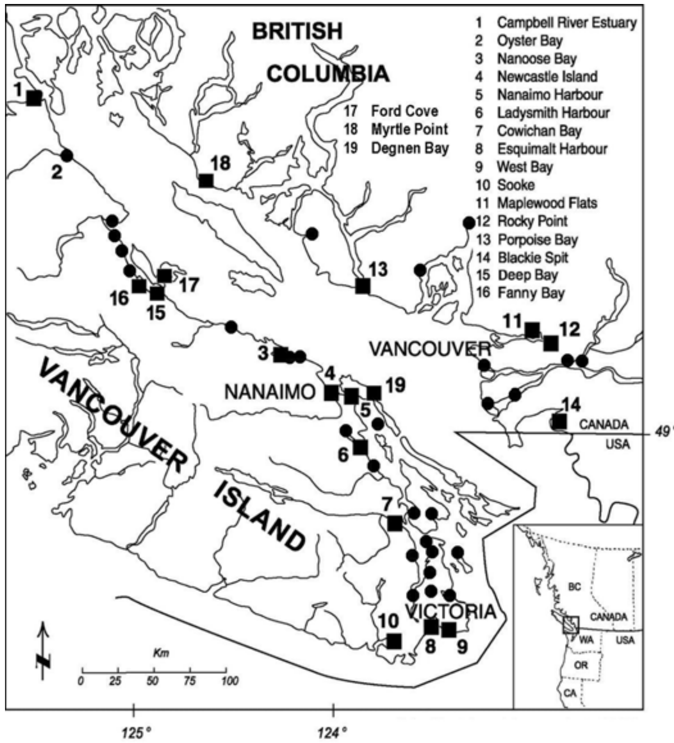

Figure 1. Location of known active purple martin nest box colonies (squares) in British Columbia in 2003 and unoccupied nest box colonies (circles) erected through a nest box stewardship program (modified from Fraser et al. 2000).

Methods

Our studies involved four methodologies: (1) banding, (2) arrival monitoring and observations of banded birds during the breeding season, (3) nest checks to document productivity, and (4) blood collection and DNA analyses (methods to be described by Baker et al., in preparation). We focused on six older, larger colonies (particularly for statistical analyses) that at the start of the study included 90% of all known nests. We also collected data from smaller colonies where it was logistically feasible to do so.

Over 2400 nestlings (and 19 subadults and adults on nests) were banded with standard U.S. Fish and Wildlife aluminum bands during 1996–2002; this represented 70–98% of the annual nestling production in those years. About 2/3 of these birds were also banded with a number-coded colour band. If the colour band could not be read, banding year could be derived from the colour of the band and the leg to which it was applied.

The wider birding community documented arrival of adult and subadult purple martins in the region and at colonies in the spring. Observations of banded birds at colonies were made with binoculars and spotting scopes during the breeding season. Efforts at resighting were greatest at wharf colonies, and were least successful where nests were attached to offshore pilings because viewing from a distance or from a boat was difficult.

Colonies were visited two to four times from late June to late August to apply bands and assess nest productivity. Early visits determined the stage of egg laying and incubation for the colony as a whole, and banding usually 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 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. In 2002, due to funding constraints, our nest checks were done later than in other years; consequently, some eggs and nestlings were undoubtedly lost (removed) prior to the nest check. 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 few losses of banded nestlings when we rechecked nests.

Results

Breeding Chronology

Adult purple martins returned to southwestern British Columbia and northwestern Washington from their winter migration during the second or third week of April (mean date: 19 April) (Fig. 2). Subadults were not seen until about three or four weeks later. Adults and subadults continued arriving until the end of May, but some subadults arrived in late June. Egg laying began, on average, in early June (earliest estimated date: 31 May) and was complete by mid-July (latest date: 19 July) (Fig. 2). 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 over a six-week period (early June to late July; earliest start date 5 June, latest completion date 24 July) (Fig. 2), but in 2000, clutch initiation was delayed (probably by cool, wet weather), and egg laying and incubation were compacted into a four-week period that ended by mid-July. Estimated hatching dates for all years ranged from 23 June to 9 August, with most hatching completed by the third week of July (Fig. 2). Young fledged on average from late July (earliest date: 20 July) to late August (latest date: 6 September) (Fig. 2). Typically, in this region the period from first egg laying to last fledging, the period during which our colonies were producing young, was about 90 days.

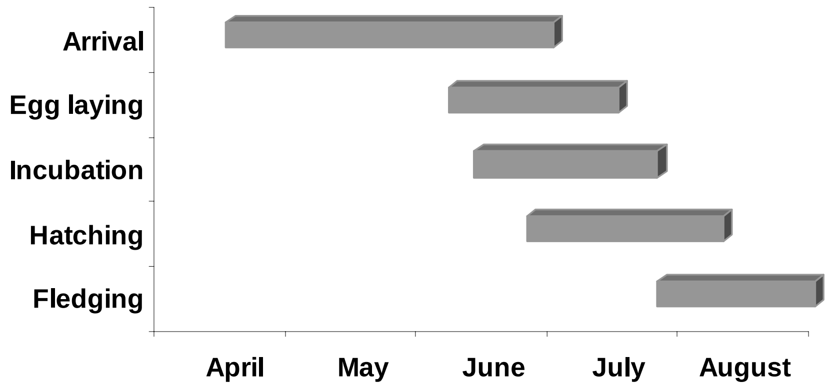

Figure 2. Breeding chronology of purple martins in British Columbia, 1998–2003.

Productivity

The number of known colonies increased from one in 1985 to 11 in 1998, and to 18 in 2003. The number of known breeding pairs has increased since 1985 (Fig. 3). From 1998 to 2003, the number of breeding pairs increased by 45% to 205 pairs (Figs. 3 and 4). This number is higher than population estimates for 1900–1950 (152–190 pairs) reported by Campbell et al. (1997), but is lower than estimates reported by Siddle et al. (1991) (300–600 pairs) for that same time period. From 1998 to 2003, the number of eggs produced generally followed a similar pattern of increase to the number of nestlings fledged (Fig. 4). At the six larger, older colonies, productivity per pair and the nest success rate (proportion of nests with eggs that produce at least one fledged nestling) appears to have risen also (Fig. 5). The annual fluctuation in egg production per pair probably reflects the effects of stochastic weather events (e.g., cool, wet spring weather causes failure of early nests and smaller clutch sizes of second nests), 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, will increase). There were among-colony differences in nestlings fledged per pair, which was a reflection of greater predation at some sites. Productivity per pair was at a slightly lower level than reported for other populations (Finlay 1971; Brown 1997; Fraser et al. 1999; Horvath 2000).

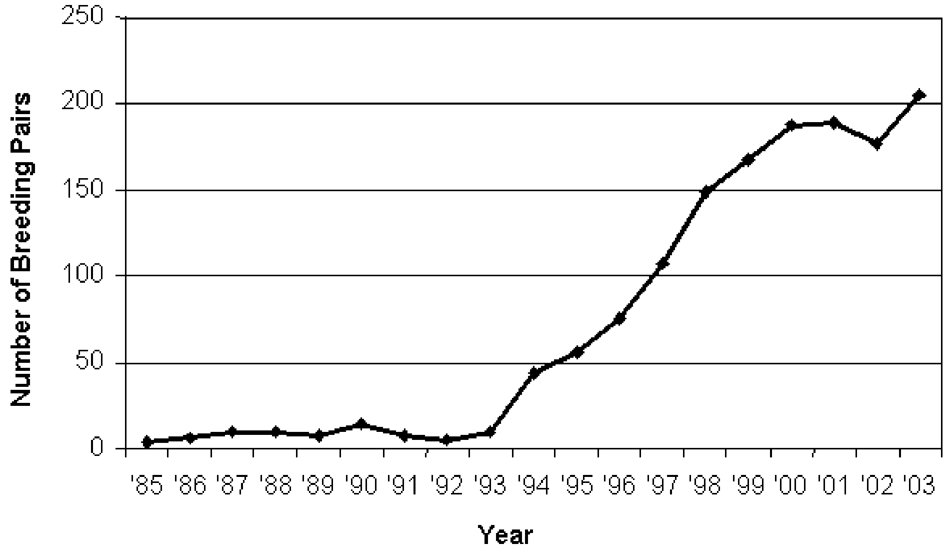

Figure 3. Purple martin population size (number of breeding pairs) in British Columbia, 1985–2003. Data from 1985 to 1997 from Copley et al. (1999).

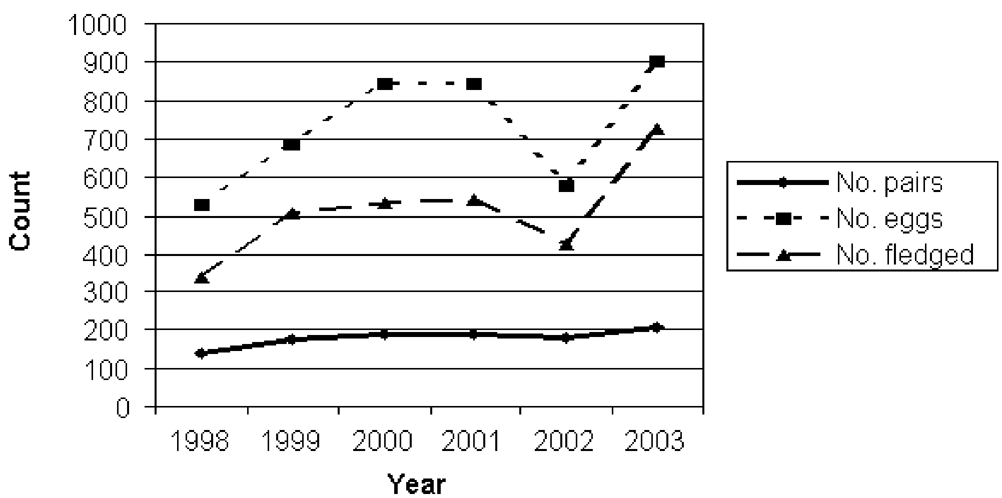

Figure 4. Number of purple martin breeding pairs, and number of eggs and fledged nestlings produced, 1998–2003.

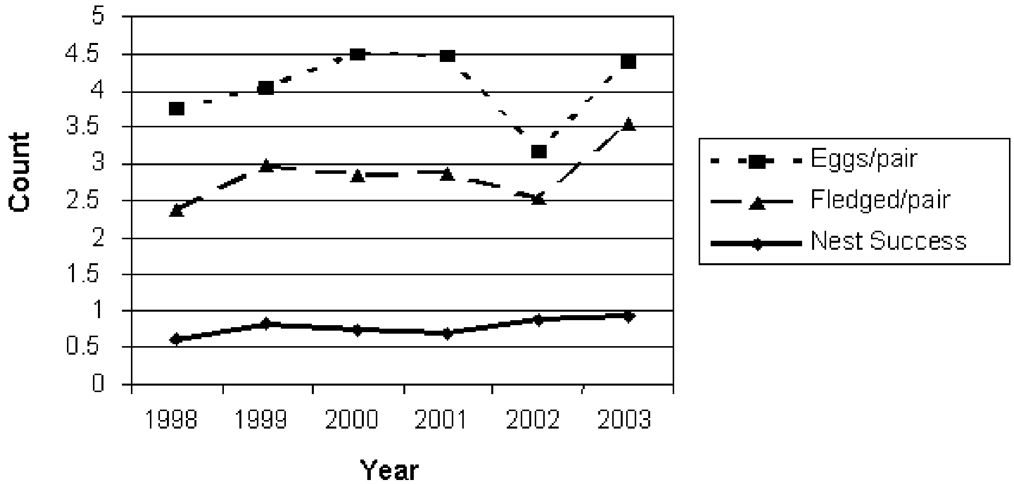

Figure 5. Mean annual number of eggs and fledged nestlings produced per pair by purple martins in British Columbia, 1998–2003. Nest success is the proportion of nests that produce at least one fledged nestling.

Banding

Returns of colour-banded birds per year at 12–18 colonies in British Columbia show that about 80% of purple martins select different colonies than their natal colonies to breed. Band returns also indicate some site fidelity once a breeding colony is selected. Most of the resightings were within 100–120 km of the natal colony. This inter-colony mixing extends to/from northern Washington (Puget Sound area), with banded nestlings reported breeding 150–180 km south/north of their natal colony (one bird from British Columbia was reported nesting in Oregon, 510 km south of its natal colony). Our return rates are higher than reported for purple martins in eastern North America, but the dispersal distances fall within observed values (Brown 1997; J. Hill, pers. comm., Aug. 2001).

Genetic Differentiation

Preliminary results indicate substantial genetic differences between the eastern and western subspecies of the purple martin, and substantial genetic variation within the western population (Baker et al., in preparation).

Management Implications

The purple martin population in British Columbia is continuing to increase, and more eggs and nestlings are being produced than in previous years. The measures of productivity (eggs per pair, fledged nestlings per pair, nest success rate) appear to be on the rise. The number of nest boxes available for breeding has been increased greatly in the past six years, and managers might think we can reduce our efforts to assist the recovery of the population; however, the longevity of this recovery will require continued monitoring and vigilance.

Through nest checks we documented a 30–70% occupancy rate for nest boxes that were available in the major colonies. Our data (unpublished) do not show this is a factor of nest box design or age. It may be a social requirement to have a surfeit of cavities on the landscape to support the population. Currently, there are about 1100 boxes available at 52 sites. Although some boxes require repair or replacement, the number of boxes is likely sufficient for the ~200 pairs of purple martins that currently occupy 18 sites; therefore, it may be some time before occupancy rates increase. Availability of nest boxes is not a limiting factor in the recovery of the population.

Site fidelity results obtained from the banding project highlight the importance of maintaining and repairing nest boxes and colony sites as they age. Dispersal results obtained from the banding project highlight the importance of having a number of colony sites available for selection when birds return on spring migration. The nest box program needs to continue, and in particular, boxes and colonies need to be maintained.

The ultimate goal of managing the purple martin in British Columbia is to remove the species from the provincial Red List. To do this, we need to reduce or address the threats to long-term survival of the population. Placing nest boxes offshore and engaging colony stewards has reduced cavity competition from European starlings (*Sturnus vulgaris*) and house sparrows (*Passer domesticus*) at some sites. Loss of nesting habitat and opportunity is addressed by ample nest box placement and replacement at a variety of potential colony sites; however, to reduce the species' at-risk status, there is also a need to reduce its reliance on humans and man-made nest boxes.

Because purple martin in British Columbia are at the northern edge of the species' range, cataclysmic or stochastic events could drastically reduce the breeding population. Observations of banded birds combined with nest check data show that some 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. It may be necessary to consider any underlying population-level strategies in management decisions. It may also be necessary to consider that fluctuations in population and productivity are likely to occur, and that a drastic reduction to mid-1980s levels may occur again. Complete reproductive failure and massive die-offs have been reported elsewhere in North America, followed by eventual recolonization and population rebound (Brown 1997). In B.C., there is a need to manage conservatively, maintain a careful watch, and keep all support mechanisms, like the current nest box program, in place.

The preliminary results of the DNA analysis show that we cannot count on immigration or transplants from east of the Rocky Mountains to supplement the population in British Columbia. Naturally occurring dispersal from natal colonies in northern Washington likely resulted in the recovery of the population in British Columbia in the last decade, and will be required again should a drastic reduction occur. 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.

Acknowledgments

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