

# A snapshot of songbird banding on Calvert Island, British Columbia

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**Abstract:** Calvert Island is located approximately 60 km north of Vancouver Island on the B.C. Central Coast and is a potential stopover site for migratory birds using the Pacific Flyway. The Vancouver Island University (VIU) Bird Banding Project, in partnership with the Hakai Institute and Tula Foundation, conducted a songbird banding project to assess this. It included 33 days of banding throughout three 2-week sessions: 11-22 June 2015, 12-24 August 2015, and 5-16 May 2016. A total of 492 individuals of 27 species were banded and 254 birds were recaptured (11 were recaptures in 2016 of 2015 birds). The three most abundant species were: Orange-crowned Warbler (*Oreothlypis celata*), Oregon Junco (*Junco hyemalis oregonus*) and Golden-crowned Kinglet (*Regulus satrapa*). During the June 2015 banding session, a high proportion of hatch-year (HY) birds indicated that the breeding season was well underway. In the August 2015 banding session, the low proportion of after-hatch-year (AHY) individuals suggested that most birds may have dispersed or migrated out of the area early. The strongest indication of migration occurred during the May 2016 banding session, with a high proportion of birds carrying high fat loads, no HY birds and a pulse of after-second-year (ASY) birds. Despite a small sample size, several bird species appear to use Calvert Island during northward and southward migration and as a breeding location.

**Key Words:** Calvert Island, bird banding, migration, VIU Bird Banding Project, Hakai Institute, Pacific Flyway, songbirds.

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## Introduction

A gap exists in the knowledge of coastal bird migratory patterns between Alaska and southwestern British Columbia, a section of the corridor known as the Pacific Flyway. There are bird monitoring stations in the B.C. Interior (Tatlayoko Lake Bird Observatory, Vaseux Lake Bird Observatory, Mackenzie Nature Observatory) and on the South Coast (Rocky Point Bird Observatory, Iona Island Bird Observatory, Vancouver Avian Research Centre, Vancouver Island University (VIU) Bird Banding Project) (Figure 1). There is no established monitoring station located anywhere on the B.C. Coast north of Nanaimo.

Calvert Island, which is situated approximately 60 km north of Vancouver Island on the B.C. Central Coast, has the potential for being an important stopover site for migratory birds using the Pacific Flyway. In 2015 and 2016, the VIU Bird Banding Project, in partnership with the Hakai Institute and Tula Foundation, conducted a bird banding project on Calvert Island. The objectives were to

monitor migrant and resident birds on Calvert Island, to assess the suitability of the site as a potential long-term

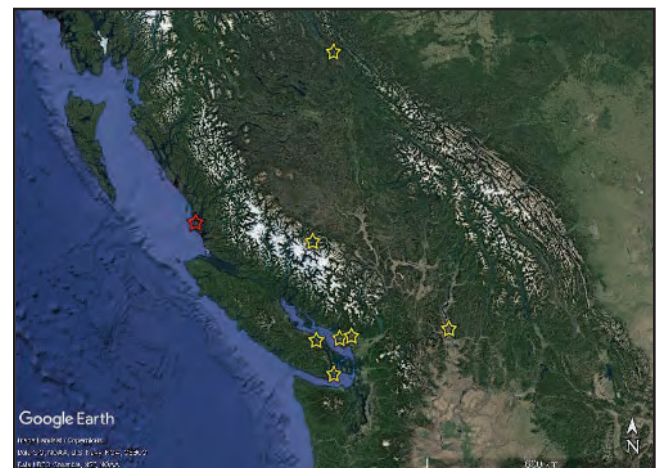


Figure 1. Satellite image of British Columbia showing established migration monitoring bird banding stations (yellow stars) and the Calvert Island banding site (red star). Image courtesy of Google Earth © 2015.

monitoring station, and to increase understanding of coastal migration patterns.

Methods

Songbird banding was conducted over three 2-week banding sessions: 11–22 June 2015, 12–24 August 2015, and 5–16 May 2016. All activities were conducted following procedures and guidance established in the VIU Bird Monitoring and Banding Manual (Demers 2015), the North American Banding Council (NABC 2001a,b), and the Institute for Bird Populations (DeSante *et al.* 2017). During each banding session, 24 mist net locations were established around the Calvert Island Field Station. During any given banding day, a maximum of 13 nets were in use. These nets were rotated among locations to ensure broad coverage of available habitats. Each mist net consisted of a 12 m long by 2.6 m high panel, made of polyester yarn, with 30-mm mesh size.

Bird banding was conducted for 11 days per 2-week session, for a total of 33 days. During each banding day, nets were operated from 30 minutes before sunrise and for a period of up to 6 hours (*i.e.* until 5.5 hours after sunrise). Timing of net opening / closing was weather dependent as no banding was conducted during rainy periods.

Banding involved the following steps: species identification, band application (if unbanded), age and sex determination, fat score (scale: 0 (no fat) to 5 (maximum fat load)), and biometrics (wing chord and tail length to the nearest 1 mm; weight to the nearest 0.1 g). Each bird was examined for the presence of breeding characteristics (brood patch in females; cloacal protuberance in males). Hummingbirds were not banded due to permit specifications and were recorded as unbanded birds. Birds already banded (recaptures), were fully processed; however same-day recaptures were released immediately after net extraction.

During each banding day all birds detected by sight and sound (other than individuals captured in mist-nets) were

recorded. These observations were especially important to account for species that were not targeted by mist netting operations (*e.g.* waterfowl, raptors, *etc.*). The combination of banding totals and incidental observations provided an estimate of the number of species and individuals present at the site. These estimated totals (ET) were submitted daily to the online, public eBird database (eBird 2012).

Results

A total of 746 birds of 27 species were captured over the 33 days of banding during 2015 and 2016 (Table 1). Of these captures, 492 birds were banded and 254 were recaptures of previously banded birds. A total of 2,027 net-hours was conducted with an average daily effort of 60.9 net-hours/day. Variation in daily effort and net-hours were affected by weather, season and the number of nets active per day.

The overall average capture rate, excluding unbanded birds, was 36.8 birds per 100 net-hours (Table 1). The highest and lowest capture rates occurred during the June 2015 and May 2016 sessions, respectively. On average 22.6 birds were captured each day. The highest and lowest daily catches were 53 birds (14 June 2015) and 6 birds (16 May 2016).

All 109 birds captured and released unbanded were Rufous Hummingbirds (*Selasphorus rufus*) (Table 1). The highest numbers of hummingbird capture were in June 2015 (*n* = 55) and May 2016 (*n* = 48). Only 6 hummingbirds were caught during the August 2015 banding session. Although Anna’s Hummingbirds (*Calypte anna*) have been observed along much of the B.C. Coast to Alaska, none were seen or captured during any of the banding sessions.

Throughout the project, a total of 27 species was captured (Tables 1, 2). The highest number of species was captured during the June 2015 session (21 species). The

Table 1. Summary of mist net capture statistics at Calvert Island during the June 2015, August 2015, and May 2016 banding sessions.

Parameter	Value			
	June 2015	August 2015	May 2016	Total
Capture effort (net-hours)	835	661	531	2027
Average daily effort (net-hours / day)	69.5	60.1	53.1	60.9
Number of birds banded	222	144	126	492
Number of recaptures	132	87	35	254
Total processed	354	231	161	746
Number of unbanded	55	6	48	109
Recapture rate (%)	37.3	37.7	21.7	34
Number of species	21	16	18	27
Capture rate (birds per 100 net-hours)	42.4	34.9	30.3	36.8

most captured species was Orange-crowned Warbler (*Oreothlypis celata*) ( $n = 186$ ), followed by Oregon Junco (*Junco hyemalis oregonus*) ( $n = 129$ ), Golden-crowned Kinglet (*Regulus satrapa*) ( $n = 91$ ), Song Sparrow (*Melospiza melodia*) ( $n = 62$ ), and Pacific Wren (*Troglodytes pacificus*) ( $n = 52$ ). Orange-crowned Warbler and Song Sparrow were the only two species among the top five most

captured species for each banding session (Table 2).

The overall recapture rate throughout the banding sessions was 34% of birds caught (254 out of 746) (Table 1). The lowest recapture rate occurred during the May 2016 session (22%), while similar recapture rates were observed in June 2015 and August 2015 (37% and 38%, respectively). These typically consisted of individuals re-

Table 2. List of all species captured in mist nets at Calvert Island during the June 2015, August 2015, and May 2016 banding sessions. Subspecies are included in parentheses where applicable. The species names follow the American Ornithological Society (2017).

Species Common Name	June 2015		August 2015		May 2016		Total
	Number banded	Number recaptured	Number banded	Number recaptured	Number banded	Number recaptured	
Orange-crowned Warbler	66	35	15	11	46	13	186
Dark-eyed Junco (Oregon)	33	33	27	34	2	0	129
Golden-crowned Kinglet	40	15	24	12	0	0	91
Song Sparrow	12	23	8	9	1	9	62
Pacific Wren	11	3	19	13	3	3	52
American Robin	13	14	11	0	3	3	44
Yellow Warbler	8	0	5	0	27	1	41
Wilson's Warbler	3	2	4	4	18	0	31
Steller's Jay	8	4	3	1	1	0	17
Hermit Thrush	2	0	8	2	5	0	17
Pacific-slope Flycatcher	7	1	6	0	2	0	16
Fox Sparrow	1	2	2	1	2	4	12
Townsend's Warbler	0	0	7	0	4	0	11
Golden-crowned Sparrow	0	0	0	0	7	1	8
Swainson's Thrush	4	0	1	0	1	0	6
Hairy Woodpecker	5	0	0	0	0	0	5
Chestnut-backed Chickadee	3	0	0	0	1	1	5
Belted Kingfisher	0	0	3	0	1	0	4
Eurasian Collared-dove	1	0	0	0	0	0	1
Common Raven	1	0	0	0	0	0	1
Brown Creeper	0	0	1	0	0	0	1
Varied Thrush	1	0	0	0	0	0	1
Gray Catbird	1	0	0	0	0	0	1
Cedar Waxwing	1	0	0	0	0	0	1
Yellow-rumped Warbler (Audubon's)	1	0	0	0	0	0	1
Warbling Vireo	0	0	0	0	1	0	1
Pine Siskin	0	0	0	0	1	0	1
<b>Total</b>	<b>222</b>	<b>132</b>	<b>144</b>	<b>87</b>	<b>126</b>	<b>35</b>	<b>746</b>

Table 3. Age structure of birds banded at Calvert Island during the June 2015, August 2015, and May 2016 banding sessions. Ages based on definitions provided by Pyle (1997).

Period	Hatch Year (HY)	Second Year (SY)	After Hatch Year (AHY)	After Second Year (ASY)	Other Ages (TY, ATY)	Total
June 2015	95	76	9	39	3	222
August 2015	132	2	9	1	0	144
May 2016	0	70	12	79	0	161
<b>Total</b>	<b>227</b>	<b>148</b>	<b>31</b>	<b>119</b>	<b>3</b>	<b>527</b>

caught during the same 2-week banding session. Only 11 individuals were recaptured year-to-year (*i.e.* banded in 2015 and re-caught in 2016). These individuals were Song Sparrow (4), Orange-crowned Warbler (4), Pacific Wren (2), and American Robin (*Turdus migratorius*) (1). All year-to-year recaptures were originally banded in June 2015.

The highest recapture rates occurred for Song Sparrow, Fox Sparrow and Oregon Junco (71%, 60%, and 50% of banded birds captured, respectively) (Table 2). All three species are known to breed on Calvert Island. Oregon Junco was the only species for which there were more recapture events than birds banded (67 recaptures of 62 banded birds), however the 67 recapture events consisted of only 31 individuals.

The age composition of birds captured varied between banding sessions and reflected the changes in age assignment associated with the annual moult that occurs after the breeding season, as well as the recruitment of young birds (hatch-year birds) to the population (Table 3). Hatch-year (HY) birds were the dominant age class during the June (43%) and August (92%) 2015 banding sessions. No HY birds were caught in May 2016 as most species had yet to

breed and fledge young. All individuals aged third year (TY) or older were Hairy Woodpeckers (*Picoides villosus*).

The number of individuals displaying breeding characteristics varied between banding sessions (Table 4). In June 2015, 74% of after-hatch-year (AHY) individuals captured displayed a brood patch (45 of 133) or cloacal protuberance (54 of 133). In contrast, only 30% of AHY birds displayed breeding characteristics in May 2016, and 80% of these individuals were males. In August 2015, only two females still displayed breeding characteristics, specifically the re-feathering of brood patches. These results suggest that: the June 2015 banding session occurred during the active breeding season for most of the species captured, the May 2016 banding session occurred during the early stages of male territorial defense and courtship displays, and the August 2015 session occurred after most species had finished breeding.

Most birds banded (53%) displayed no visible fat (score = 0) (Table 5). Of the birds that displayed fat ( $n = 229$ ), a higher proportion (76%) were carrying only small amounts (fat score = 1 or 2). The highest proportion of high fat scores were observed during the May 2016 banding session (19%) compared to the June (9%) and

Table 4. Breeding characteristics of birds banded at Calvert Island during the June 2015, August 2015, and May 2016 banding sessions. Females and males were determined to be in breeding condition based on the presence of a brood patch (BP) or cloacal protuberance (CP), respectively. Only after-hatch year (AHY) birds are included since hatch-year (HY) birds do not develop breeding characteristics. Hummingbirds were not examined for brood patch or cloacal protuberance.

Month	Females with BP	Males with CP	No breeding characteristics	Total
June 2015	45	54	34	133
August 2015	2	0	10	12
May 2016	9	37	108	154
<b>Total</b>	<b>56</b>	<b>91</b>	<b>152</b>	<b>299</b>



Table 5. Fat scores measured from birds banded at Calvert Island during the June 2015, August 2015, and May 2016 banding sessions. Fat scores are determined by examination of the furcular hollow on the upper breast. Fat scores: 0 = 0%, no fat; 1 = 1-5% fat as scattered patches; 2 = 5-33% fat as a thin layer; 3 = 33-66% fat half-filling the furcular hollow; 4 = 66-100% fat filling the furcular hollow; 5 = >100% fat bulging from the furcular hollow.

Month	Fat score			Total
	0	1-2	3-5	
June 2015	140	62	19	221
August 2015	59	74	11	144
May 2016	63	39	24	126
<b>Total</b>	<b>262</b>	<b>175</b>	<b>54</b>	<b>491</b>

August (8%) 2015 banding sessions, suggesting that there were more actively-migrating individuals captured during May 2016.

Although banding was the primary activity for this project, incidental observations were conducted throughout banding activities to provide a more complete view of species composition. A total of 72 species were observed during banding activities. Of all species observed during banding, 39% were captured in mist nets. Several near-passerine and passerine species were observed frequently during banding activity, but were never captured; these species included Northern Flicker (*Colaptes auratus*), Downy Woodpecker (*Picoides pubescens*), Western Tanager (*Piranga ludoviciana*), and Red Crossbill (*Loxia curvirostra*).

Banding efforts resulted in a few interesting and noteworthy species-specific results. First, a single Gray Catbird (*Dumetella carolinensis*), which is considered rare on the B.C. central coast (Davidson *et al.* 2015), was captured June 2015. Second, two different subspecies of Song Sparrow were banded (subspecies *rufina* and subspecies *kenaiensis*). Subspecies identification based on photographs was confirmed by Peter Pyle of the Institute of Bird Populations. Subspecies *rufina* is partially migratory and is found all over the central coast of B.C., but subspecies *kenaiensis* is mainly resident in southcentral Alaska (Patten and Pruett 2009). All individuals from the *kenaiensis* subspecies were HY birds caught in August 2015, which may indicate juvenile dispersal of this subspecies along the coast.

## Discussion

Bird migration along the B.C. central coast has been understudied. Some bird banding has been conducted near Haida Gwaii (e.g. Sealey 2017), however this banding project on Calvert Island appears to be the first to examine spring and fall migration over more than one year on the

B.C. central coast. These data provide a reference or baseline for any future studies on coastal migration of passerines. Since millions of birds use the west coast of North America for migration, any understanding of how they use the landscape is important for conservation.

Based on banding data and incidental observations, migration may have been underway during the May 2016 session. This was supported by several data sets. High fat loads were noted in 19% of birds; increased fat storage is indicative of migration since birds need to store energy for long flights and most cannot reliably forage while in flight (Jenni and Jenni-Eiermann 1998). There was also a low percentage of birds showing breeding characteristics (30%) and a low recapture rate (22%), the latter possibly indicating that banded birds are not staying long in the area. One specific event in May also supported this claim: on 12 May 2016, a substantial increase in capture rate was observed and most birds caught were after-second year (ASY) male Yellow Warbler (*Setophaga petechia*). During this May banding session, no Yellow Warblers had yet been banded until this date. Migratory banding efforts across North America have indicated that ASY males are normally the first to migrate north to establish territories before females arrive (Maggin and Bairlein 2012).

Although the intent of banding in June 2015 was to band during spring migration, our results indicate that this session coincided more with the breeding season on Calvert Island. The MAPS (Monitoring Avian Productivity and Survivorship) program, which assesses breeding birds in North America, suggests that the main passerine breeding season begins by the end of May on the B.C. central coast (DeSante *et al.* 2017). This is supported by the high proportion of breeding characteristics observed in June 2015 (74% of AHY birds) compared to August 2015 and May 2016 (17% and 30%, respectively). The presence of a brood patch is a more reliable indicator of breeding timing than cloacal protuberances since brood patches only form when a female is incubating eggs, whereas a cloacal protuberance may be formed early and maintained by males throughout the breeding season.

Fat scores and HY bird numbers can also help indicate breeding versus migration. Only 37% of birds displayed any fat during June 2015. A large proportion (66%) of these birds were juveniles carrying fat for growth purposes and not for migration. Since most AHY birds banded were not carrying fat, it is likely that these birds were breeding; birds are less likely to carry fat while breeding since extra energy is allocated to maintaining territories, copulation, egg production, and offspring care. Also, the high number of HY birds in June 2015 compared to the May 2016 session ( $n = 95$  and  $n = 0$ , respectively) indicates that the June banding session was conducted well into the breeding season. Unlike the June 2015 banding session, the August 2015 session occurred after the breeding season was over, when only a few females still displayed a brood patch in the process of re-feathering. Also, the higher proportion of birds carrying some fat compared to June 2015 is indicative of the beginning of fall migration.

A somewhat unexpected observation was the reduction in capture rate between June and August 2015 ( $n = 354$  and  $n = 232$ , respectively). Most bird banding stations experience higher catch rates during August-September mainly due to the capture of dispersing hatch-year birds (e.g. Bartels 2016; Demers and Wetten 2017). This result could suggest that the local abundance of some species may decline due to early post-breeding dispersal or early onset of fall migration. This is supported by the low proportion of AHY birds captured in August (8%), which may indicate that older birds disperse or migrate away early after breeding, while the HY individuals stay longer to undergo their juvenal and pre-formative moults.

Migration timing can be impacted by environmental factors (e.g. wind; Mitchell *et al.* 2015) so assessing the migratory potential of an area with only short sessions is difficult. Future banding activities would benefit from sessions of longer duration (4 to 6 weeks) to increase the chances of observing migration of most passerine species. Since data collected on Calvert Island seems to indicate a spring migration timing in mid-May, the most worthwhile effort would be to band around that period.

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