Studying and Conserving Bird Species at Risk in Pemberton, British Columbia

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Cover Photos[1]

Volunteer assisting with checking Western Screech-Owl nest boxes (top left).

Volunteer assisting with monitoring a Western Screech-Owl nest site (top right).

Western Screech-Owl young in nest (bottom left).

Volunteer collecting data at a Great Blue Heron observation site (bottom right).

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Executive Summary

The Pemberton area is an important region of southwestern British Columbia, climatically, physically and biologically. Ecologically it still supports a diversity of ecosystems, habitats and species that have disappeared or declined in other parts of the South Coast Region. However, historical changes, such as dyking and forestry, and increasing pressures from development and recreation due to a rapidly growing community are known to be threatening the biodiversity of the area.

During the spring and summer of 2019, the Pemberton Wildlife Association and Stewardship Pemberton Society partnered to help address current and growing threats to the area species and habitats by undertaking local on-the-ground actions to further the conservation of four bird species at risk: Western Screech-Owl, Great Blue Heron, Barn Swallow and Common Nighthawk. Project activities focused on understanding the status (e.g., distribution, relative abundance), specific needs (e.g., critical habitats) and threats to these species through collaboratively working with others to conduct inventory, monitoring and outreach.

Citizen-based surveys, following standard methodology, and outreach were undertaken to understand the distribution, relative abundance and critical habitats of target species in the Pemberton area and foster stewardship. The following is the results of those efforts.

Western Screech-Owl

Nighttime call-playback surveys: 128 surveys were completed over 73 stations; 10 people contributed 46 hours and 43 minutes of survey effort; 42 owls, comprising 5 species, were detected, 9 of which were Western Screech-Owl, which was estimated to be 5 unique individuals; and 6 Barred Owls exhibited aggressive (4) and predatory (2) responses to surveys.

Daytime call-playback surveys: 95 surveys were completed over 72 stations; 5 people contributed 15 hours and 21 minutes of survey effort; and 1 adult at a nest site and 2 adults in a territory were detected, with followed up monitoring of the nest site.

Nest box surveys: 31 nest boxes were assessed by 2 people, none were used.

Great Blue Heron

Stand watch surveys: 30 surveys were completed over 12 stations; 6 people contributed 90.5 hours of survey effort; and 30 Great Blue Herons were observed, 97% in proximity to the north end of Lillooet Lake.

Incidental sightings: 41 incidental sightings of 86 Great Blue Herons were received from the public, which resulted in the identification of 2 active nest sites and a potential nest site.

Incidental sightings and stand watch surveys resulted in the identification of 4 raptor nests and 5 potential raptor nesting areas.

Barn and Other Swallow Species

Transect surveys: 5 transects were surveyed, involving 19 hours of survey effort; 135 swallows, comprising 4 species, were detected, 24 of which were Barn Swallows; and no Barn Swallow nest sites were detected but 7 likely or potential sites were identified and 5 other swallow nest sites/boxes were detected.

Incidental sightings: 19 sightings of swallow species were received, 2 of which were for active Barn Swallow nesting sites on private property and 3 were for areas where Barn Swallows could potentially be nesting; a known Barn Swallow nest was monitored and successful; and 7 nests for other swallow species were detected or reported.

Common Nighthawks

Transect surveys: 4 transects were surveyed by 2 people over 4 nights; Common Nighthawks were observed along 3 transects, with a total of 13 birds detected.

Outreach

Involved a variety of tools, with social media being the most efficient and effective;

- materials produced included a project summary and poster;
- training and support was provided to volunteers and others throughout the project;
- a number of collaborative partnerships were formed;
- an undergraduate student was trained, educated and involved in the majority of project activities;
- presentations were provided to two local governments; and
- two educational walks were provided to community members.

Work undertaken through this project has greatly increased our understanding and conservation of target species and their habitats, helping to protect their intrinsic rights and extrinsic ecological, social and economical values for the local, regional and global community. Data collected and shared through this project has contributed to, and will continue to contribute to, a greater awareness of these species and their needs. Actions to conserve identified critical habitats, such as outreach to and education of local stakeholders, have occurred and will continue to occur as a result of this project. Work to further our understanding of the status and ecology of target species (e.g., ongoing monitoring and research) and their management is planned for the future.

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1 Introduction

Ensuring the survival of species and ecosystems at risk has become one of the key priorities in the fight to conserve biodiversity. British Columbia (BC) has the greatest biodiversity of any Canadian province (Cannings et al. 2005, Austin et al. 2008) and also the most species at risk of extinction (1,807 species of animals and plants) (Martin et al. 2019). Unfortunately the location, status and needs of many of these species and ecosystems are unknown. Without this information, little can be done to help conserve and recover them and the habitat they require to survive. Obtaining this information is critical for those species and ecosystems most at risk, where we have limited understanding of their status and/or where threats to their existence are high or will increase.

Pemberton is an important ecological region of southwestern BC, comprised of a variety of ecosystems and habitats that still support a diversity of species (Figure 1). Increasing pressure from local population growth and human activities and regional and global changes are threatening a number of species at risk. To protect these species from these pressures, it is essential that work be undertaken to understand and inform others about their status and needs and work immediately towards short and long-term management solutions and actions.

Figure 1. Overview of project location.

To work towards biodiversity conservation in the Pemberton area and beyond, this project targeted four at risk bird species:

- Western Screech-Owl *kennicottii* subspecies (*Megascops kennicottii kennicottii*) (Committee on the Status of Endangered Wildlife in Canada [COSEWIC] 2012);
- Great Blue Heron *fannini* subspecies (*Ardea herodias fannini*) (COSEWIC 2008, Environment Canada 2016a);
- Barn Swallow (*Hirundo rustica*) (Heagy et al. 2014); and
- Common Nighthawk (*Chordeiles minor*) (COSEWIC 2007, Environment Canada 2016b).

All species are of national conservation priority, have high recognition and appeal among the general public (symbols of wildness, social connection, ecological services, environmental quality/health) and provide excellent opportunities for education, citizen science, stewardship and conservation.

The overall goal of this project was to undertake hands-on outreach, inventory, monitoring and research activities necessary to increase local and regional understanding, appreciation and conservation of these four bird species and their habitats in the Pemberton area.

This report summarizes the results of project activities conducted on these four target bird species during the spring and summer of 2019 in the Pemberton area. It is hoped that this report and associated data will inform management actions, such as threat prevention and habitat protection, by decision makers, researchers and others that will result in the survival and recovery of these four species.

2 Methods

2.1 Overall

The majority of work on this project took place between April and July 2019. Project activities focused on the Pemberton area and public/crown land, with permission from landowners obtained where access to private property was required to undertake project activities. Applicable government agency staff and professionals were contacted to discuss requirements for specific activities and/or sites and to obtain expert advice. No birds were handled and damage to their and other species habitat was avoided or minimized.

Standard survey methods were used to further our understanding of the distribution, relative abundance and critical habitats of target species. All activities were completed by the project coordinator and/or volunteers. The project coordinator provided hands-on training and

ongoing support to volunteers involved in project activities, including sighting maps, individual training, and equipment. Incidental sightings of target species or other species at risk reported by surveyors, the general public and others were recorded by the project coordinator. Data was compiled, analyzed and a report prepared, all of which was submitted to applicable programs, agencies and individuals.

2.2 Western Screech-Owl

2.2.1 Background

The *kennicottii* subspecies of Western Screech-Owl has experienced significant declines, possibly up to 90%, in the southwestern part of BC (Metro Vancouver, Victoria and the Gulf Islands) over the last 10 to 15 years (Elliott 2006). In May 2012, this subspecies was listed as Threatened by COSEWIC (2012). The main threats to this subspecies include the loss and fragmentation of riparian habitat and low elevation forests, including the removal of dead trees and wildlife trees, which provide nest and roost sites. The majority of degraded areas are associated with urban, agricultural and forestry development. The spread in distribution and subsequent predation on Western Screech-Owls by Barred Owls (*Strix varia*) is tied to the loss of intact habitat (COSEWIC 2012).

On February 3 2017, the Governor General in Council, on the recommendation of the Federal Minister of the Environment, up-listed the *kennicottii* subspecies from Special Concern to Threatened, re-classifying it to Schedule 1 of the Federal *Species at Risk Act* (Government of Canada 2017a). This reclassification now requires Environment and Climate Change Canada (ECCC) to publish a recovery strategy for this subspecies and the interior subspecies, which will include the identification of critical habitat (the habitat that is necessary for the survival or recovery of a listed wildlife species) using best available information.

This report and survey data collected was shared with the following agencies to increase our understanding and conservation of owls, particularly Western Screech-Owl:

- BC Wildlife Species Inventory system and Conservation Data Centre (CDC),
- Bird Studies Canada BC-Yukon Nocturnal Owl Survey Program,
- applicable staff from the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), Ministry of Environment and Climate Change Canada (ECCC),
- Squamish Lillooet Regional District (SLRD),
- applicable staff with Lil'wat and N'Quatqua Nations and Village of Pemberton (VoP) who are involved in or responsible for monitoring and managing Western Screech-Owl and their habitat.

2.2.2 Call-playback Surveys

Call-playback surveys were the primary method used to assess the presence/not detected status of the *kennicottii* subspecies, increasing our understanding of its distribution, relative abundance and habitat use in under surveyed areas of southwestern BC. Surveys were focused on low to mid-elevation, mature and old growth deciduous and coniferous forest habitats and riparian areas on private and public lands in the Pemberton area. Surveys followed previously used standard methods, which are outlined below.

Target areas were visited during the day to visually assess the suitability of habitat for Western Screech-Owl. Habitat deemed most suitable consisted of areas with mature and old growth trees, in particular Black Cottonwood (*Populus trichocarpa*), that was near water bodies. Stations were established in proximity to these habitats for follow up surveys during the evening.

Western Screech-Owls are known to defend their territories year-round (Cannings and Angell 2001) and respond to the broadcast of their territorial call (Kissling et al. 2010). Call-playback surveys were used to elicit responses to document the species' presence/not detected status and habitat use. Surveys followed a combination of the BC Ministry of Environment Resource Information Standards Committee (RISC) methods (RISC 2006) and the BC-Yukon Nocturnal Owl Survey Program protocols (Takats et al. 2001), which included the following procedures:

1. The territorial call of the Western Screech-Owl was played for one minute, for a total of eight individual calls, through a FOXPRO NX4 megaphone or UE BOOM 2 wireless bluetooth speaker, which were pointed in a different cardinal direction during each call.

2. Four minutes of silent listening followed each calling session (procedure 1).

3. Procedures 1 and 2 were repeated three times for a total survey effort of at least 15 minutes.

4. The time of detection, duration of call, and distance, direction and corresponding location (Universal Transverse Mercator (UTM) coordinate) of owls seen or heard was recorded.

5. The movement of owls following detection and other behaviour was noted.

Only the territorial call of the Western Screech-Owl was played at survey stations, as broadcasting the calls of larger owl species at one sample station within the same night may inhibit the response of other owl species (Olson et al. 2005). Broadcasting of this call was discontinued if a larger owl species (Barred or Great Horned (*Bubo virginianus*)) was detected to minimize possible predation of Western Screech-Owls by these species. Other significant or unusual wildlife species observed during surveys or while traveling between stations were recorded as incidental observations.

Call-playback stations were established along survey routes in priority habitats at a distance of approximately 400 m apart. A global positioning system (Garmin GPSMAP 60CSx or Garmin GPSMap 64S), set to North American Datum (NAD) 83, was used to record and find the location of each station. Stations were surveyed one to three times and sequentially. Surveys were completed between April 7 and May 7, which is considered a high activity period of the breeding season (enhanced territorial response) (J. Hobbs, pers. comm. 2019). The majority of surveys started half an hour after sunset or shortly after and ended before midnight, as owl call rates tend to be lowest in the middle of the night (i.e., between midnight and 4:00 AM) (Takats et al. 2001). Surveys were completed by trained individuals that had good hearing.

Environmental conditions, such as weather and noise, were recorded at each station during surveys. Surveys were not conducted if the wind speed was over a Beaufort scale of 3, during moderate to heavy precipitation events or when the temperature was below -10 C. Surveys under these conditions reduces the likelihood of detecting owls (Palmer 1987, Hardy and Morrison 2000) and increases safety risks to surveyors.

The actual number of owls detected (i.e., unique birds/individuals) versus the total number detected was estimated based on survey observations (distance between detections, response times to call-playback and dates of detection).

2.2.3 Nest and Roost Surveys and Monitoring

Surveys and detections of nest and roost sites for Western Screech-Owl play an important role in increasing our limited understanding and conservation of this species at risk in southwestern BC. For example, locating an active nest can allow for the monitoring of adult behaviour (e.g., pair status, movement, call types and rates, parental care), breeding success (e.g., number and hatching of eggs, nestling survival, fledgling dispersal and survival) and the location and habitat conditions of selected sites. Foundationally, locating nest and roost sites allows land managers to identify threats to these areas, such as logging and recreational activity, and work to protect these critical habitats through actions such as the establishment of Wildlife Habitat Areas or Features and landowner and user group education.

A combination of call-playback surveys and cavity searches were completed during various times of the day to try and locate Western Screech-Owls and their nest and/or roost sites. The optimal times to conduct nest and roost call-playback surveys are 1 hour before sunrise and 1 hour after sunset, however, surveys can be performed during the day but responses from owls will likely be lower (J. Hobbs, pers. comm. 2019).

Surveys occurred in a select number of areas where Western Screech-Owls have been heard, seen or believed to be present (habitats in proximity to detections that are believed to be suitable). Surveys were completed between April 9 and June 5, which was believed to be a relatively high period of activity during the breeding season (e.g., likelihood of nesting, enhanced response rate, adults may be feeding young or young may be vocal [begging] and active [learning to fly and forage]).

Day surveys for locating Western Screech-Owls and their nest and roost sites involved the following methods:

- Surveyors walked slowly, quietly and within 10 to 30 m of each other through select areas to establish call-playback stations in suitable habitat and to enhance visual and auditory detection of owls, their sign (e.g., pellets, whitewash) and suitable nesting cavities in trees, such as cavities 3 inch diameter or larger or chimney structures.

- Potential nesting cavities were examined using binoculars to identify the presence of cobwebs over the entrance, presence of flies or signs of owl use, such as feathers, white wash and/or pellets. A wireless cavity peeper camera mounted to a long extendable pole was used to look into suitable cavities to determine their occupancy.

- Call-playback stations were established approximately 75 m or more apart based on the suitability of habitat for Western Screech-Owl.

- The 'te-te-do' call of the Western Screech-Owl was broadcast at a quiet volume, heard between 50 to 100 m, for 1 minute at each station. This call is meant to elicit a response from the male, but females will occasionally look out of nest cavities in response to this call.

- Call broadcasting was stopped if a Western Screech-Owl or its predators (e.g., Barred or Great Horned Owl, Northern Goshawk [*Accipiter gentilis*], Common Raven [*Corvus corax*]) were detected to avoid alarming or potentially causing the Western Screech-Owl to abandon its roost or nest site and/or to minimize the risk of predation.

- Calls were followed by at least 2 minutes of silent listening and observation. Surveyors paid close attention to passerine response, such as calling and mobbing, following calls as their reaction can provide important clues to the presence of owls.

- Following a response, surveyors moved through vegetation slowly and silently, without talking and discretely to the position of the owl, stopping only to re-affirm its location. Great care was taken when approaching the location an owl called from to avoid flushing it, as important clues to the location of a nest or roost site can be lost if it flies off.

- Only basic data (e.g., location, number, activity, sign) was recorded at the time of detection, especially if owls were agitated or predators were in the area. A follow up site visit during the daytime/afternoon was used to collect further data at a time when disturbance to owls is believed to be reduced.

- A Garmin GPSMAP 60CSx or Garmin GPSMap 64S, set to NAD 83, was used to record a UTM coordinate for each station, any detections and a track log to document the survey route and effort, with the latter being saved for half of the areas surveyed.

The active nest found was monitored to collect data on its status using a combination of a wireless cavity peeper camera, Browning Spec Ops Advantage infrared cameras, a Song Meter SM4 Acoustic Recorder and visually. Monitoring nests using a wireless cavity peeper camera allows surveyors to look inside the nest cavity and collect short video and photo evidence, providing the best confirmation of activity. This camera was critical for collecting specific information on the status of the nest, such as presence/absence and number and status of adults and young.

Trail cameras and the autonomous/automated recording unit (ARU) were established on trees near the nest to allow for semi-continuous visual and acoustic monitoring of owl activity outside the nest cavity without the presence of surveyors. ARU data will be analyzed by FLNRORD biologists with Kaleidoscope Pro Analysis Software using existing Western Screech-Owl call recordings (classifiers) to find matches with field recordings.

It is recommended that active Western Screech-Owl nest sites be checked no more than once every three weeks, with two visits spaced by one week when the chicks are close to fledging (Tripp and Welstead 2019). Overall, site visits to the nesting area were kept to a minimum to reduce disturbance to the area habitat and especially the birds from surveyors and potentially other humans or species. This was balanced with the need to visit the area enough times to collect adequate monitoring data, including tracking nesting chronology and status.

Data collected at the active nest found included a UTM location, photos, the activity of adults and young, general habitat type, decay stage of nest tree and an estimate of tree height, diameter, nest cavity height and cavity aspect.

2.2.4 Nest Box Surveys

The Fraser Valley Conservancy (FVC) in collaboration with others started a nest box program for Western Screech-Owl in the South Coast Region in 2016. The placement of nest boxes is meant to improve habitat quality for Western Screech-Owl by providing nesting cavities where this habitat is depleted. Western Screech-Owls are secondary cavity nesters that depend on woodpeckers, namely Pileated Woodpeckers (*Dryocopus pileatus*) and Northern Flickers (*Colaptes auratus*) whom are primary cavity nesters, to excavate nest cavities in suitable trees (e.g., trees old and large enough, those experiencing decay). Nest boxes have the potential to help reduce population declines, especially in areas where trees with suitable cavities are currently lacking. The overall goal of this program is to improve short to medium-term habitat conditions to provide the opportunity for increases in population growth of Western Screech-Owls over the longer-term.

Nest boxes (31) have been erected across three sites in the Pemberton area:

- 9 in the Riverlands Wildlife Management Area during the spring of 2018;
- 12 in the 3 Rivers Wildlife Management Area during the fall of 2017; and
- 10 along the Upper Lillooet Forest Service Road in the fall of 2017.

These boxes have been erected with at least 200 others in the South Coast Region.

The assessment of nest boxes was undertaken to support of the provincial Owl Monitoring Group and FVC in their regional initiative to understand and enhance Western Screech-Owl nesting habitat and populations. The location of each nest box was obtained and downloaded onto a Garmin GPSMAP 60CSx or Garmin GPSMap 64S, set to NAD 83, for use in the field to find each box. Private landowners with boxes on their property were contacted to obtain permission to access boxes. Nest boxes were checked once in mid to late May. This was close to the recommended checking time of mid-April to mid-May, which is meant to avoid missing active nests when only one check is conducted (Tripp and Welstead 2019).

A wireless cavity peeper camera was obtained from the FVC and mounted to a long extendable pole to allow for the effective and efficient checking of nest boxes (no use of a ladder, no opening of nest boxes during sensitive periods). A standard nest box monitoring form from the Owl Monitoring Group was used by surveyors to record activity in boxes and their status, such as moisture, cleanliness and overall condition. Data was entered and submitted to the coordinator of the nest box program with the FVC for entry into the Western Screech-Owl nest box project database and submission to Project NestWatch, the Canadian national repository for nesting data.

2.3 Great Blue Heron

2.3.1 Background

Great Blue Herons that occur in the Pemberton area are considered to be the *fannini* or coastal subspecies, as they are non-migratory and confined to the northeast coast of the Pacific Ocean. This subspecies is considered vulnerable in BC (BC CDC 2018) and is of Special Concern in Canada (COSEWIC 2008) due to a small population size and many individuals concentrated at a few breeding sites, declining productivity (perhaps as much as 50% since the 1970s) and threats from Bald Eagle (*Haliaeetus leucocephalus*) predation, habitat loss and human disturbance. A management plan has been completed for the subspecies with the objective of ensuring that all four recognized Pacific Great Blue Heron Conservation Regions in coastal BC have stable or locally increasing numbers of Pacific Great Blue Herons (Environment Canada 2016a).

During the breeding season, adult herons range within approximately 30 km of their colonies, although most stay within 10 km (Butler 1991, 1997) and even as close as 8 and 3 km, as they

require abundant and accessible prey near their breeding location (Butler and Baudin 2000). Butler et al. (1995) recorded heron nesting colonies an average of 2.9 km from foraging locations in BC. Important foraging habitats include aquatic areas such as tidal mudflats, riverbanks, lakeshores and wetlands (Butler 1992). Shallow water fish species are the most important prey group for herons during breeding and non-breeding seasons (Butler 1992). In addition to being in relatively close proximity to their nesting site and foraging areas during the breeding season, Great Blue Herons often return to their former breeding site if they and/or the habitat they require for nesting is not disturbed.

This breeding home range and habitual nature to nest sites provides a yearly opportunity to monitor known breeding colonies and find new ones. In the Pemberton area, the location of where herons are breeding is unknown. A key objective of work on this species was to further define its distribution and relative abundance in the Pemberton area, with the goal of locating active nesting sites and important foraging areas for monitoring and conservation. Based on existing data from citizen sightings and eBird, it is believed that two or more nesting colonies, in addition to important foraging areas, exist in the Pemberton area.

Great Blue Heron observations were entered into a database of sightings maintained by the author. This database and report was shared with the following agencies to increase our understanding and conservation of Great Blue Herons:

- BC CDC,
- COSEWIC birds subcommittee and
- applicable staff from FLNRORD, ECCC, SLRD, Lil'wat and N'Quatqua Nations and VoP who are responsible for or involved in monitoring and managing Great Blue Herons and their habitats.

2.3.2 Stand Watch Surveys

A stand watch is a survey method that involves watching an area from a designated location (station) for the occurrence, behaviour and habitat use of a species, often for a defined period of time. This method is suitable for surveying Great Blue Herons as they are large birds that can be seen on the ground but even more readily flying above the tree canopy from great distances. As noted, Great Blue Herons often return to previously used nesting sites, which can consist of more than one pair, some of several hundred pairs (Vennesland and Butler 2011). This habitual nature and need to fly, likely on regular flight paths, to their colonies for nest building and breeding (courtship, egg laying, raising young) make stand watches an important survey method for locating new nesting colonies (Kenyon 2006).

Existing sighting data from the public and eBird was reviewed and mapped to better identify areas, such as foraging locations and movement/flight paths, which Great Blue Herons use during the breeding season in the Pemberton area. This information was then used, along with local knowledge and on the ground site assessments, to define fifteen stations (i.e., vantage points above the surrounding tree canopy and valley where surveyors could see long distances

over as wide a search radius as possible) for stand watch surveys. Finding areas that are frequently used by herons during the breeding season is critical in determining the importance of these areas as foraging sites and to greatly increase the number of herons seen and flight bearings obtained so nesting locations can be found.

Stand watches were completed at as many stations and times as possible based on available time, support and weather conditions. It was the intent to complete surveys at least once every two weeks from stations during the nest building season (March and April when herons can be seen carrying nesting material) and during the chick rearing period (June and July when adults are flying to and from nests to feed young). It was also the intent to have each survey be at least three hours in duration. Ideally surveys would be completed at dawn and dusk when lighting is best to see birds (i.e., not too bright or direct). These times were also believed to be periods of low disturbance to birds from human activities such as recreation. Surveys were not completed during poor weather conditions, such as heavy rain, strong wind or reduced visibility.

Surveys consisted of one observer watching for Great Blue Herons from defined stations, primarily with binoculars, but at times with a spotting scope when needed and available. Surveyors also watched for raptors/birds of prey, such as eagles and Osprey (*Pandion haliaetus*), and other species at risk (e.g., Barn Swallow). Surveyors continuously scanned habitats surrounding stations and recorded the time, number, age, location and flight path (i.e., direction bird flew in and/or away from) of Great Blue Herons or other target species observed and any additional notes/comments, such as activity, interactions, threats, more specific location details and environmental conditions. Birds sighted during a stand watch were watched carefully, particularly their flight to or away from stations, in an attempt to locate active nest sites. Text messages and cell phone calls were used among observers at nearby stations to inform each other of herons or other target species that were flying towards or into the area they could see from their station.

An estimate of heron location, either stationary or in flight (appearance and/or vanishing) was obtained by collecting a compass bearing and distance to its position or by describing a landmark it was observed near or in relation to. In the office, a Garmin GPSMAP 60CSx or Garmin GPSMap 64S, set to NAD 83, and/or online mapping websites (Google Maps, Geoplaner, GeoMidpoint) were used to obtain a UTM coordinate for the location herons were observed. Location and flight direction (i.e., vanishing bearing) data of herons observed was used to define new stand watch locations, based on furthest observed flight point, add additional observers and/or to investigate potential nesting habitat where applicable.

2.3.4 Nest Surveys

The intent was to survey nesting sites reported by the public and/or those found during stand watch surveys. Surveys were to be completed by trained surveyors to minimize disturbance as herons at nesting colonies in remote or undisturbed settings often do not tolerate or are sensitive to the presence of humans (Butler and Baudin 2000). Standard survey methods for

measuring the nesting productivity at Great Blue Heron nesting colonies were to be followed, which recommends completing three surveys once per month during the nest building and breeding season of April, May and June to count and monitor the number of nests, adults and young present and document any threats (Vennesland and Norman 2006). Post-nesting surveys were planned to map and collect habitat data at identified nesting sites. Overall, knowing where nests are and collecting baseline information facilitates future monitoring efforts to collect data on annual occupancy, reproductive success and productivity and any changes in habitat or threats, all of which contribute to broader regional population monitoring and management efforts by Provincial, Federal and Indigenous governments.

Where possible, fresh genetic material, such as feathers, pellets, scat, egg shells and membranes and carcasses, were collected at nest sites for future deoxyribonucleic acid analysis to further our understanding of the genetic characteristics and range of the two Great Blue Heron subspecies in BC. Genetic material was to be given to the BC Government or Beaty Biodiversity Museum for storage and future analysis.

2.4 Swallows

2.4.1 Background

The Barn Swallow is one of four swallow species that has been documented in the Pemberton area. Swallows are part of group of birds known as aerial insectivores; birds that specialize their feeding on flying insects. This guild of birds has experienced steep declines in their populations across North America, particularly in the last 20 years (McCracken 2008, Nebel et al. 2010, Spiller and Dettmers 2019). The Barn Swallow was assessed as Threatened in Canada in 2011 (COSEWIC 2011) and added to Schedule 1 of Canada's *Species at Risk Act* in 2017 (Government of Canada 2017b). Its Threatened status is the result of significant declines in populations across Canada (i.e., 76% over the last 40 years) believed to be primarily caused by the loss of nesting and foraging habitat, large-scale declines in insect populations and direct and indirect mortality due to an increase in climate perturbations on their breeding grounds.

No formal surveys for Barn Swallows or their nest sites have been completed in the Pemberton area. However, there are a number of sightings in eBird, with the majority being reported within the last ten years. A number of residents in the area report that Barn Swallows have declined in general and there is an absence of birds at former nesting sites. One nesting site in the Pemberton area is known from 2014.

The goal of surveys was to document the presence and distribution of swallows and their nesting sites, with an emphasis on Barn Swallows because of their status and tendency to return annually to previously used structures and nests. Data collected is meant to provide a baseline for swallows in the Pemberton area that can be built upon in the future.

Swallow observations were entered into a database of sightings maintained by the BC Swallow Conservation Project. This report and database was shared with the following agencies to increase our understanding and conservation of swallows, particularly Barn Swallow:

- BC CDC,
- COSEWIC birds subcommittee,
- Bird Studies Canada Nestwatch Program and
- applicable staff from FLNRORD, ECCC, SLRD, Lil'wat and N'Quatqua Nations and VoP who are responsible for or involved in monitoring and managing swallows and their habitats.

2.3.2 Transect Surveys

A transect is a linear sampling feature, such as a road, river or bearing, that a survey is completed along to collect relevant data. In the case of surveys for Barn and other swallow species in the Pemberton area, roads were used as transects as they allowed for easy access to a large area and a variety of habitats that swallows are known to or may be present in. All transects occurred in low elevation valley bottom areas and were safe to survey.

Surveys occurred during mid July, which was considered within the peak breeding period for Barn Swallows. June to July is when the majority of nest building and nestling rearing occurs. Incidental sightings of swallows were sought throughout the project. Surveys were not completed during poor weather conditions such as reduced visibility, heavy rain or strong wind. Clear days with high air pressure and low winds are preferred conditions for swallows and their insect prey, leading to greater foraging activity and thus detectability. The early morning or late afternoon are preferred times for surveys as birds are generally more active during these periods of the day. However, swallows can be actively flying and visible during the entire day if weather conditions are appropriate.

Driving was used to complete surveys along transects; travelling at speeds slow enough to hear and observe swallows. In addition to travelling slow, surveyors frequently stopped to look and listen for swallows for five or more minutes. Conducting these informal stand watches was very important as it allowed surveyors enough time to look over long distances and wide areas with binoculars for swallows. This was particularly relevant, as much of the area surveyed consisted of large, open agricultural fields and properties with livestock and potential swallow nesting structures, such as barns and sheds, nest boxes, tree cavities and lock blocks.

Surveyors used their hearing, sight and binoculars to detect swallows. When a swallow was seen or heard, surveyors would watch these individuals to define the species of swallow, number and behaviour. As Barn Swallows are known to forage within 400 m of their nesting site (Snapp 1976, Turner 1980, Bryant and Turner 1982), they were watched for breeding activities such as the collection of nesting materials or the travelling to a nest site with food to feed

young. Nest sites were noted based on the presence of adult or juvenile birds flying in or out of an artificial or natural structure that could support nesting.

A potential nest site was noted when swallows were observed flying around these former structures. A compass bearing and estimate of the distance from the location of the surveyor to the sighting location of a swallow or nest site was recorded. This data was then used to project a UTM coordinate to the observation location using a Garmin GPSMAP 60CSx or Garmin GPSMap 64S, set to NAD 83. Any additional observation information was recorded as comments.

Landowners with potential or known nesting sites were not contacted about surveys or stewardship at the time of surveys. If nests were expected or known to occur on public property (e.g., under a bridge, inside a culvert), then these sites were investigated further for breeding activity.

2.5 Common Nighthawk

2.5.1 Background

The Common Nighthawk is a crepuscular (i.e., most active at dawn and dusk) aerial insectivore that is listed as Threatened in Canada due to long and short-term population declines (i.e., 49% over the last three generations in areas surveyed) believed to be caused by natural system modifications (e.g., reduced insect prey and fire suppression), habitat loss and degradation, climate change and severe weather, accidental mortality, pollution and/or problematic native and invasive non-native species (COSEWIC 2007, Government of Canada 2010). A federal recovery strategy for the species was published in 2016 with objectives of halting the national population decline to no more than 10% by 2025 and ensuring a positive 10 year population trend after this, while also maintaining the current distribution of the species in Canada (Environment Canada 2016b).

The Common Nighthawk is a fairly common bird observed during summer evenings in the Pemberton area. The only known surveys for this species in the Pemberton area are through the North American Breeding Bird Survey, which is a morning/daytime survey, and one nocturnal survey completed by the author in 2014. Therefore, little is known about the local distribution, relative abundance, population trend and habitat use of Common Nighthawks. The goal of this project was to undertake standard surveys that would contribute to our local and national understanding of status of this species.

Common Nighthawk survey results were entered into WildResearch Nightjar Survey database, which is a publicly available dataset that is used to further our understanding of the distribution of the species, determine current population trends and identify landscapes that are important for conservation of nightjar populations in Canada.

2.5.2 Road-side Point Count Surveys

Surveys for Common Nighthawk in the Pemberton area followed the 2019 Canadian Nightjar Survey Protocol, an annual standardized citizen-science survey designed to increase our understanding of nightjar species in Canada. Four valley bottom transects on main public roads in the Pemberton area, which consisted of ten point count stations each, spaced 1.6 km apart, were surveyed in 2014. A number of Common Nighthawks were detected, but unfortunately annual surveys were not continued. These transects were reduced to 2 with 12 consecutive road-side stations each by WildResearch in 2017, which were surveyed during this project.

Each transect was surveyed once in late June, within the standard timeframe of June 15 to July 15 for Common Nighthawk. Surveys started 30 minutes prior to sunset and ended within two hours as Common Nighthawks are known to become active approximately 30 minutes before sunset and remain active until 60 or 90 minutes after sunset (Knight 2019). Surveyors drove to stations, locating them with a Garmin GPSMAP 60CSx or Garmin GPSMap 64S set to NAD 83, based on previously recorded UTM coordinates.

Surveys were completed by the project coordinator with the assistance of one volunteer who was trained in survey methods and species identification. The following features and characteristics were used by surveyors to help detect Common Nighthawks:

- bright white wing bars that are visible during flight;
- “peent” or “beerb” calls frequently made in flight;
- mechanical wing-boom ‘calls’ made by the male at the bottom of a steep vertical dive; and
- distinct body and wing shape and flight pattern.

Calls and wing-booms were the only means of species detection once it was too dark to see. Surveyors stayed together throughout surveys and communicated about all Common Nighthawk detections.

Surveyors stood outside on the side of the road in a safe location at each station and listened and watched for Common Nighthawks quietly. Each survey period was divided into 6 one minute intervals and the following information was recorded for each individual Common Nighthawk detected during these intervals:

- highest rank of the following detection type: wing-boom, call, visual, not detected;
- distance (< 100 m or > 100 m) and direction/compass bearing to the first location the bird was detected; and
- occurrence of wing-booms repeated three or more times in the same location.

Surrounding conditions such as wind strength, cloud cover, moon visibility, level of precipitation, noise and number of passing vehicles were recorded at each station. Surveys

were discontinued if winds were level 3 or greater on the Beaufort scale or if precipitation was stronger than a light drizzle. Other data collected included survey start and end times and comments such as specific call times and number, estimated distances to birds and their behaviour and other wildlife sightings.

2.6 Outreach

Outreach to stakeholders, including the Pemberton Wildlife Association (PWA) and Stewardship Pemberton Society (SPS) members, the public and naturalists about project activities (e.g., surveys, incidental sightings, volunteering) and the status, ecology and stewardship of target species was ongoing throughout this project. This education utilized a variety of communication tools including social and print media, networking, word of mouth and meetings (presentations, walks). Volunteers interested in assisting with field activities for target species were provided with hands-on training in survey methods and supported throughout their involvement.

3 Results

3.1 Western Screech-Owl

3.1.1 Call-playback Surveys

Survey Effort

Call-playback surveys totaling 15 nights were completed for Western Screech-Owl between April 7 and May 7, 2019, which does not include nights where multiple surveys were completed at different stations. The number of transects surveyed was 13, with two of these transects having only one station. Ten of these transects were new and three were previously surveyed between 2015 and 2017. Of these transects, six were surveyed one time, three of which were surveyed in previous years, three were surveyed two times and four were surveyed three times.

A total of 73 stations were surveyed, not double counting stations surveyed multiple times (Figure 2). The total number of nighttime call-playback surveys completed at all stations for Western Screech-Owl during the project was 128, which includes surveys of stations multiple times. A survey was defined as the broadcasting of one or more call-playback recording or listening silently for spontaneous calling.

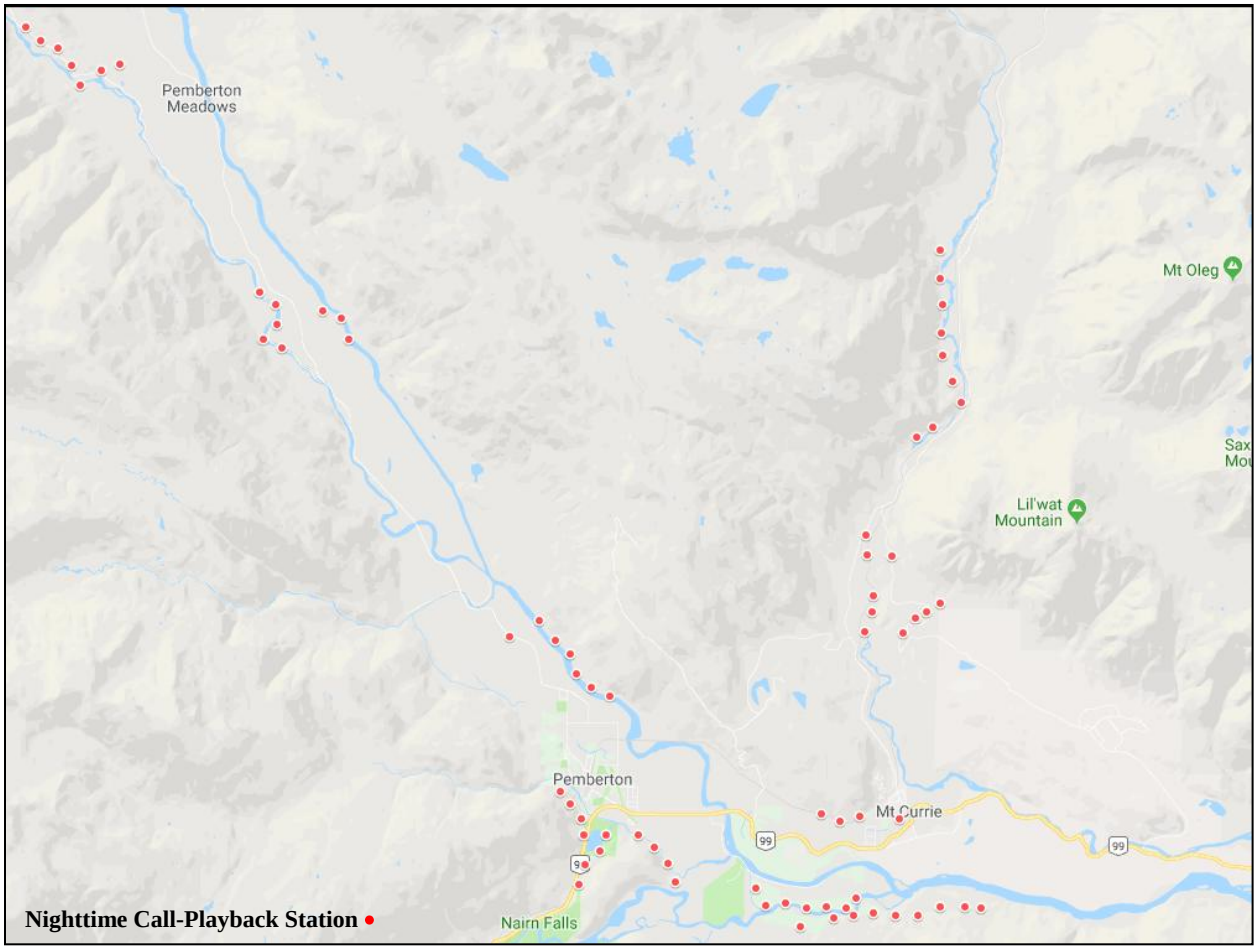


Figure 2. Location of spring 2019 nighttime call-playback stations for Western Screech-Owl in the Pemberton area.

Including the project coordinator, 10 people assisted with nighttime call-playback surveys. The time surveyors contributed to surveys was 46 hours and 43 minutes (i.e., sum of the differences between the start and end times for each survey), which includes time for travel between stations, data collection, etc. Most transects completed involved volunteers walking between stations, increasing the likelihood of incidental auditory detection. The actual time surveyors spent completing nighttime call-playback surveys at stations was 33 hours and 38 minutes (i.e., sum of time conducting surveys, not including time for travel between stations, etc.). The average survey time per station was 15 minutes and 46 seconds, while the maximum time spent at one station was 30 minutes and the minimum time was 5 minutes.

Survey Results

Nighttime call-playback surveys resulted in the detection of 42 owls comprising five species (Table 1). This includes owls that were very likely double counted and seven that called spontaneously (3 Northern Saw-whet Owls (*Aegolius acadicus*), 2 Great Horned Owls, 1 Northern Pygmy Owl (*Glaucidium californicum*) and 1 Barred Owl). The location of owls detected was associated with the location of certain call-playback stations but not others (Figure 3).

Table 1. Total number and percentage by species of owls detected during spring 2019 nighttime call-playback surveys for Western Screech-Owl in the Pemberton area[2].

Species	Number Detected	Percentage of Detections
Barred Owl	18	38
Great Horned Owl	6	13
Northern Pygmy Owl	1	2
Northern Saw-whet Owl	12	26
Western Screech-Owl	9	19
Unknown Owl species	1	2
Total	47	

[2] Double counting of the same individual(s) is highly likely either during the same survey night or a subsequent night (i.e., multiple detections could be of the same individual).

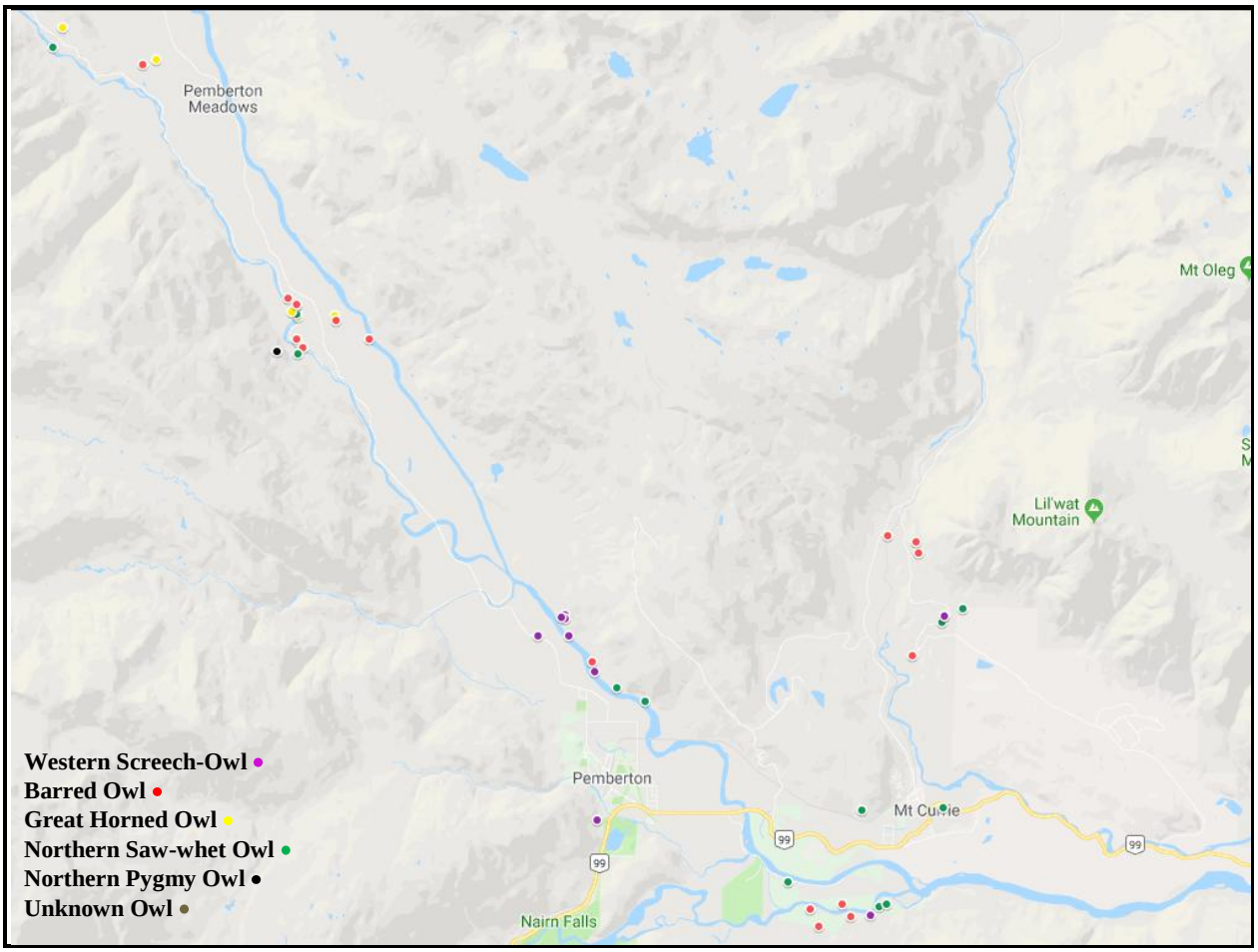


Figure 3. Location of owl detections during spring 2019 nighttime call-playback surveys for Western Screech-Owl in the Pemberton area[3].

An attempt was made to define the actual number of owls detected during surveys to eliminate double counting of individuals during a survey night or a subsequent survey night. This was done based on species and the distance between detection locations and the timing of detection (date, time of day and response time to call-playback). The result was the detection of an estimated 30 individual owls (Table 2, Figure 4).

[3] Figure 3 does not include two locations where Western Screech-Owl was detected during daytime call-playback surveys.

Table 2. Estimated number of owls detected by species during spring 2019 call-playback surveys for Western Screech-Owl in the Pemberton area[4].

Species	Number Detected
Barred Owl	9
Great Horned Owl	5
Northern Pygmy Owl	1
Northern Saw-whet Owl	11
Western Screech-Owl	3
Unknown Owl species	1
Total	30

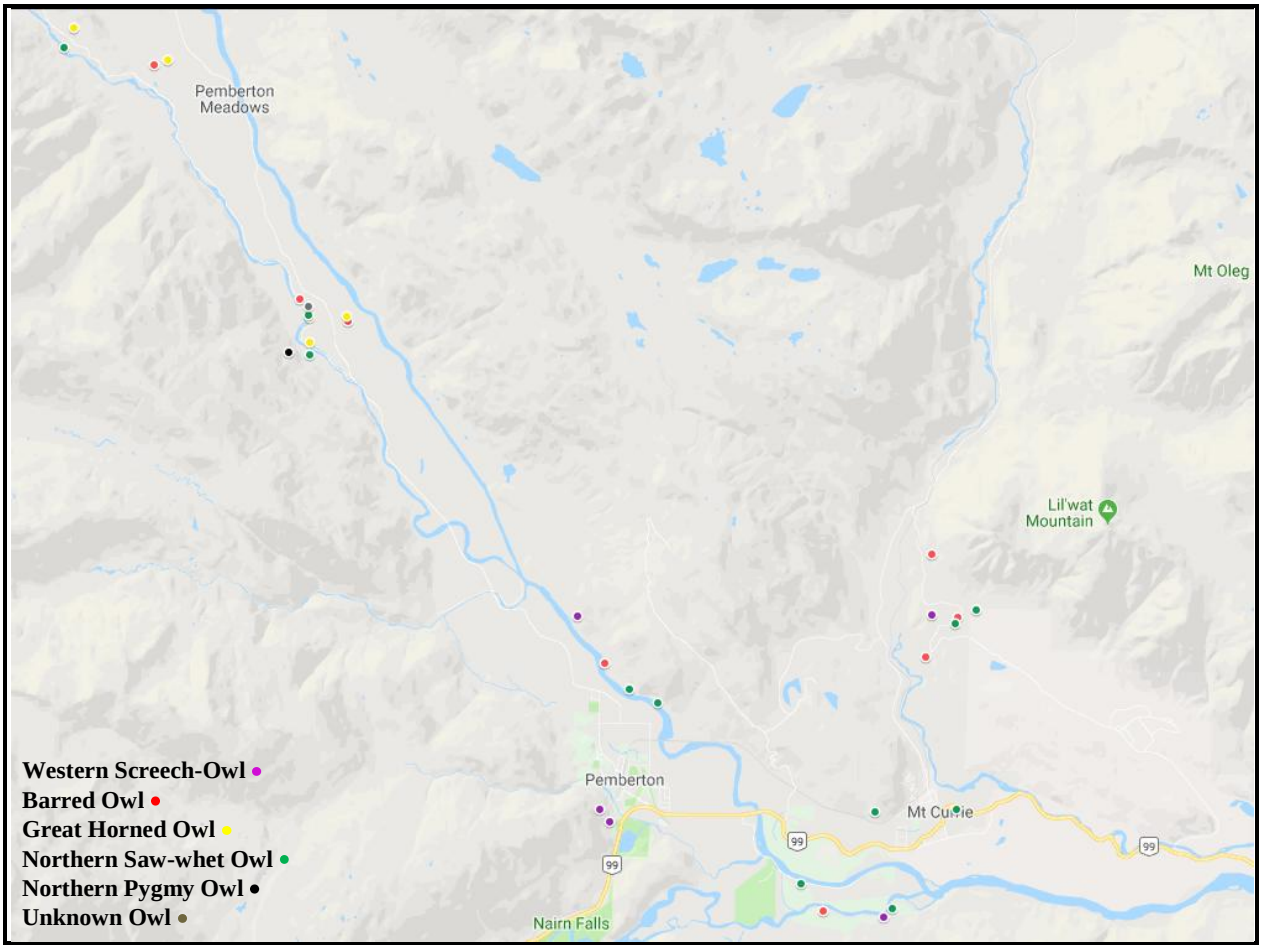


Figure 4. Location of the estimated number of owls detected during spring 2019 call-playback surveys for Western Screech-Owl in the Pemberton area[5].

[4] Number reflects an attempt to eliminate the double counting of individuals during a survey night or a subsequent survey night based on species and the location and timing of detection.

[5] Figure 4 does include two locations where Western Screech-Owl was detected during daytime call-playback surveys.

Owls that responded to the territorial call of Western Screech-Owl (i.e., detection rate) during the 128 nighttime surveys are summarized in Table 3.

Table 3. Detection rate of owl species during spring 2019 nighttime call-playback surveys for Western Screech-Owl in the Pemberton area[6].

Species	Detection Rate (%)
Barred Owl	13
Great Horned Owl	3
Northern Pygmy Owl	7
Western Screech-Owl	7
Unknown Owl Species	1

The following results were obtained when analyzing the response of Western Screech-Owls to nighttime call-playback surveys: the range of response times was from 2 to 15 minutes, with an average of 6 minutes and 24 seconds; response durations ranged from 10 to 600 seconds; and the time of day of responses ranged from 41 to 176 minutes after sunset, with an average of 87 minutes.

Six Barred Owls exhibited what was believed to be aggressive responses towards Western Screech-Owl during or following the broadcasting of its territorial call during nighttime call-playback surveys. Responses consisted of four individuals flying in silently and landing close to the call-playback station (10 to 20 m away), classified as territorial, and two individuals swooping at the speaker used to broadcast the Western Screech-Owl territorial call, classified as predatory.

One Barred Owl was detected at the same nighttime call-playback station and two were detected at a preceding or subsequent call-playback station to where Western Screech-Owl was also detected. No Great Horned Owls, the other potential predatory owl of Western Screech-Owl, exhibited aggressive responses or were detected at the same, preceding or subsequent nighttime call-playback station to where a Western Screech-Owl was detected.

3.1.2 Nest Surveys and Monitoring

Survey Effort

Call-playback surveys totaling 14 days were completed between April 9 and June 5, 2019 to look for Western Screech-Owl and its nest or roost sites during the daytime. This does not include the number of days where multiple surveys were completed at different stations. The number

[6] Analysis does not include six spontaneously calling owls (one Barred, two Great Horned and three Northern Pygmy).

of transects surveyed was 12, with two of these transects having only one station. Ten of these transects were new and two were previously surveyed in 2016 and 2017, respectively. Of the new transects surveyed, there were an additional two new areas along the Birkenhead River where no daytime call-playback surveys were conducted but the areas were visually surveyed for owls and potential nesting cavities or roost sites. In terms of survey repetition, nine transects were surveyed one time, two of which were surveyed in previous years, two were surveyed two times and one was surveyed three times.

Daytime call-playback surveys were completed at 72 stations along established transects, not double counting stations surveyed multiple times (Figure 5). A total of 95 daytime call-playback surveys were completed for Western Screech-Owl and its nest or roost sites at all stations during the project, which includes surveys of stations multiple times. A survey was defined as the broadcasting of one round of call-playback recordings and listening and watching silently for Western Screech-Owl.

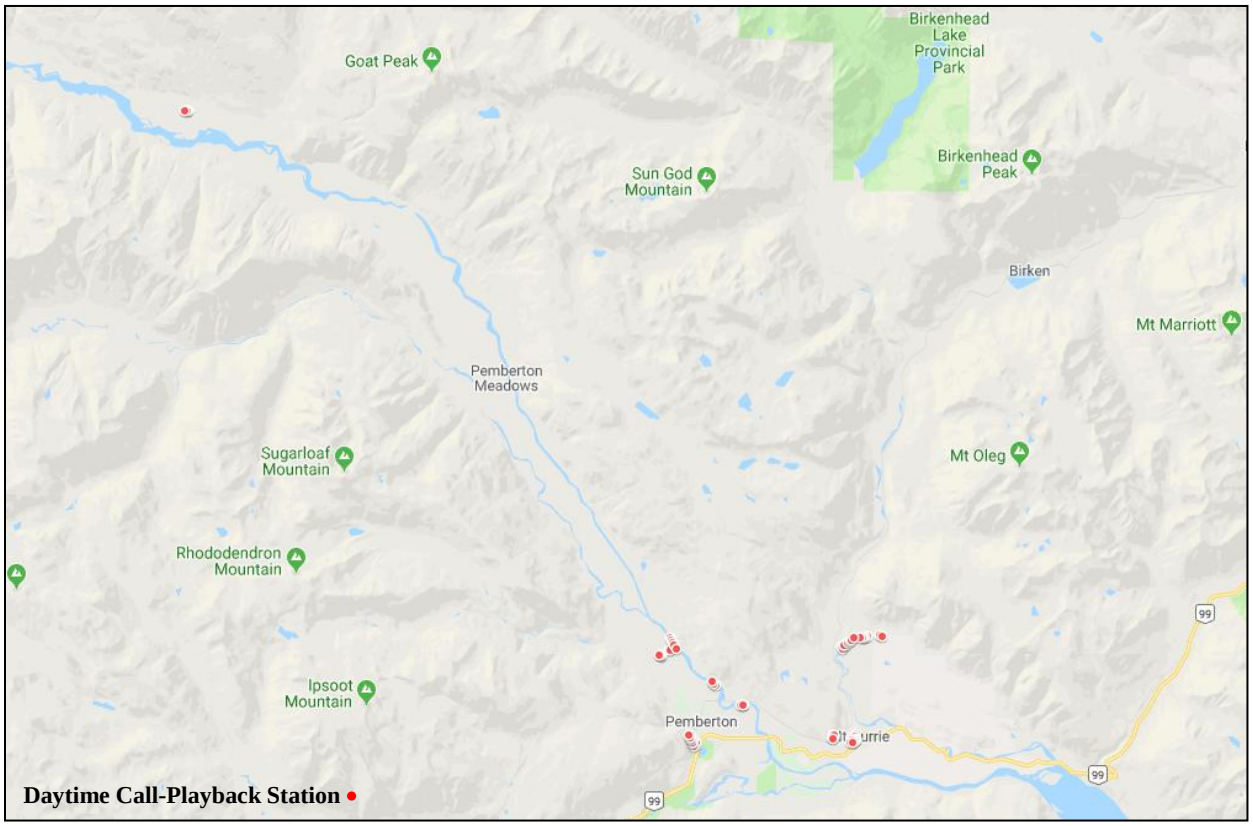


Figure 5. Location of spring 2019 daytime call-playback stations for Western Screech-Owl and nest or roost sites in the Pemberton area.

Four people assisted with daytime call-playback surveys, which included the project coordinator. The time surveyors contributed to daytime call-playback surveys was 15 hours and 21 minutes (i.e., sum of the differences between the start and end times for each survey),

which includes time for travel between stations, data collection, etc. Most transects completed involved volunteers walking between stations, increasing the likelihood of incidental auditory or visual detection. The actual time surveyors spent completing daytime call-playback surveys at stations was 4 hours and 42 minutes (i.e., sum of time conducting surveys, not including time for travel between stations, etc.). The average survey time per station was 3 minutes.

Survey Results

Three Western Screech-Owls were detected during daytime call-playback surveys, a detection rate of 3% based on the 95 daytime call-playback surveys completed for the species. One individual was detected on April 10, 2019 near the community of Creekside and the other two, a pair, were detected on April 20, 2019 near the community of Owl Ridge.

Creekside Western Screech-Owl

A pair of Western Screech-Owls were first heard and reported near the community of Creekside on March 14, 2019 by a local resident. This prompted nighttime call-playback surveys to be undertaken in the area during the spring of 2019. The first of these surveys resulted in a detection on one Western Screech-Owl on April 8, 2019. Two early daytime call-playback surveys were then completed on April 9 and 10, 2019, with a Western Screech-Owl flying in silently from an unknown location and seen at 6:31 AM on the second morning of surveys. The owl responded approximately one minute after the call-playback and was first seen perched in a small tree approximately 5 m away from the call-playback station. It began giving quiet territorial calls at 6:34 AM and continued calling for 26 minutes. During this time it flew once to another nearby tree and then into its nest cavity at 6:39 AM. Following calling the owl stayed in its nest cavity entrance watching.

No other Western Screech-Owls or fresh genetic material, such as feathers, pellets, scat, egg shells and membranes or carcasses, were detected at the nest site during this or subsequent visits. The nest site was approximately 387 m and 312 m from the March 14 and April 8, 2019 detections, respectively. This was the only Western Screech-Owl nest site found in the South Coast Region during 2019.

The following monitoring of the nest site was completed after its initial detection:

- April 24, 2019, 6:45 AM: placed 2 motion sensor cameras on 2 nearby trees pointed at the nest cavity. An adult Western Screech-Owl was seen looking out of cavity at the time.

- May 3, 2019, 7:15 AM: an adult Western Screech-Owl poked its head out of the nest cavity upon arrival. Owl went back in after about 1 minute and did not see again. Replaced motion sensor camera memory cards. Left nest site at 7:30 AM.

- May 14, 2019, late morning: checked nest cavity with FLNRORD biologists using wireless cavity peeper camera and saw 1 adult, 2 chicks, 1 opened egg (from 1 of chicks) and 1 dead

rodent. Adult attacked camera shortly after it was placed in cavity. One Song Meter SM4 Acoustic Recorder was placed on nearby tree.

- May 28, 2019, 6:20 AM: replaced motion sensor camera memory cards. An adult Western Screech-Owl was seen looking out of nest cavity.

- May 30, 2019, 20:45 PM: an adult Western Screech-Owl was seen looking out of nest cavity and looked to be sitting high in cavity. Left site at 21:00 PM and owl was still present in cavity entrance.

- June 12, 2019, 12:05 PM: FLNRORD biologists checked nest with wireless cavity peeper camera and saw 2 chicks that looked ready to fledge. No other owls seen in cavity or area.

- June 17, 2019, 20:00 PM: replaced motion sensor camera memory card. Did not check nest with wireless cavity peeper camera or see any owls in nest cavity or area.

- July 4, 2019, 11:30 AM: checked nest with FLNRORD biologists using wireless cavity peeper camera and found it was empty, the 2 young assumed to have fledged. Took down motion sensor camera.

- July 24, 2019, 18:30 PM: took down Song Meter SM4 Acoustic Recorder. No owls seen in cavity or area. ARU data collected at this nest site was not analyzed by FLNRORD biologists at the time of this report.

Owl Ridge Western Screech-Owls

Western Screech-Owls have likely existed in the Owl Ridge area for a number of years. They were first reported calling by landowners in the spring of 2016 and again in the spring of 2017, followed by a response to nighttime call-playback surveys on April 2, 2017. Daytime call-playback surveys were completed at eight stations in 2017 but no owls were detected.

For three nights in early April (around April 1) and on April 12, 2019, a landowner in the Owl Ridge area heard what he believed was a Western Screech-Owl calling spontaneously in the general direction of the valley formed by the creek that comes out of Owl Ridge pond. On April 14, 2019 a Western Screech-Owl was heard during a nighttime call-playback survey and again on April 19, 2019 spontaneously calling at 15:45 PM.

Daytime call-playback surveys were completed on April 18 and 20, 2019, with a pair of Western Screech-Owls detected on the second day of surveys. One of the owls gave a territorial call at 17:17 PM, approximately 1 minute after the call-playback and 40 m away. Surveyors approached the owl sensitively and it was seen perched in and calling from a small tree approximately 5 m up and on the south side of Owl Creek. A second Western Screech-Owl was

then observed perched approximately 5 m up near the stem of a young conifer that was approximately 10 m away and on the north side of Owl Creek.

Neither owl flew while surveyors were in the area. A large diameter, dead topped Black Cottonwood tree was near the owls and had a suitable nesting cavity high up. Surveyors did not stay in the area long to minimize disturbance to the birds and planned to revisit the site to check the cavity with appropriate equipment at more suitable time.

Initially, attempts were made to mount a motion sensor camera pointing at the suspected nest cavity, but due to the small size of surrounding trees and the location of the cavity it was too difficult to get a clear sightline. The cavity was checked on May 14, 2019 with FLNRORD biologists using a wireless cavity peeper camera but was empty and no Western Screech-Owls were detected in the area.

One Song Meter SM4 Acoustic Recorder was placed on a tree near the initial detection location at this former time and removed on June 12, 2019. FLNRORD biologists reported that recordings on the ARU were not suitable for analysis due to sound from the nearby creek. Additional daytime call-playback surveys and nest and roost searching was completed in the area on May 26, 2019 but no detections were made.

3.1.3 Nest Box Surveys

The 31 Western Screech-Owl nest boxes erected in the Pemberton area were assessed on May 17 (Riverlands and 3 Rivers Wildlife Management Areas) and 23 (Upper Lillooet Forest Service Road) 2019 (Figure 6). This was the second year of assessment of these boxes during the breeding season since their installation. Surveys were completed by the project coordinator and one volunteer using a wireless cavity peeper camera to see and record the status of each box.

Assessment of nest boxes found the following information about their status:

- Use: none were occupied by Western Screech-Owl or any other owl species.
- Moisture: all 31 were dry.
- Sign of use: 2 had spider webs, 1 had feathers (grouse) and 1 had squirrel use.
- Material added to box: 3 had leaves, 1 had grass and 11 had other material (e.g., small mammal scat).
- Depth of material: 29 were less than 1/3 full (appropriate depth) and 2 were half full.
- Need for cleaning: 21 required cleaning and 10 did not.
- Overall condition: 27 were in good condition and 4 were useable.

In addition to general cleaning required for 21 of the boxes, the following 9 boxes were also found to require minor to moderate maintenance (e.g., closure, repair):

- 3 Rivers: RL1, RL2, RL3 and RL4;
- Riverlands: 3R1, 3R4 and 3R10; and
- Upper Lillooet Forest Service Road: ULFS4 and ULFS5.

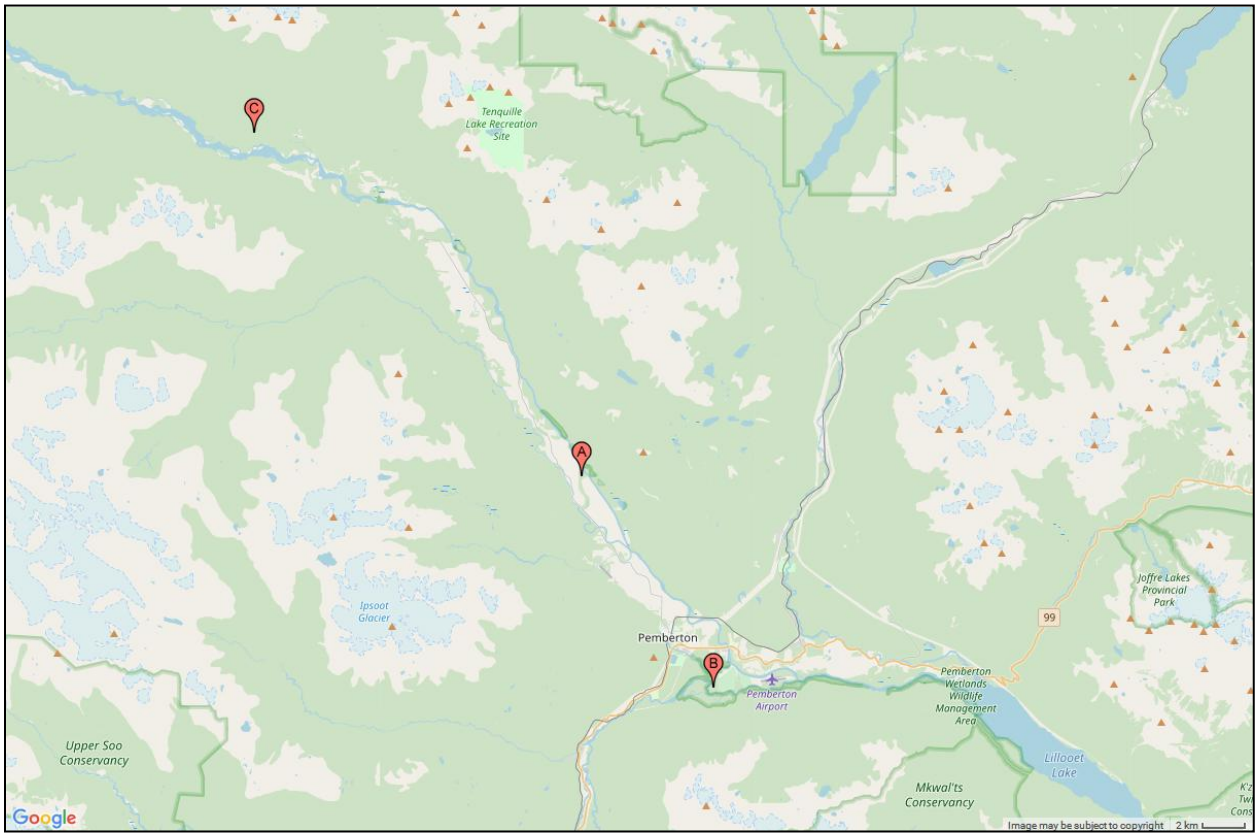


Figure 6. General location of Western Screech-Owl nest boxes assessed in 2019 in the Pemberton area[7].

3.2 Great Blue Heron

3.2.1 Stand Watch Surveys

Initially 15 stations were identified as suitable locations for stand watch surveys, with 12 of these surveyed in 2019, and 7 areas were later identified as potential future stations (Figure 7). Of the 15 stations established and 12 surveyed, 4 of these (Lillooet Lake 3 to 6) were established between July 17 and 19, 2019, after or very late in the breeding season. Establishing

[7] A = Riverlands Wildlife Management Area; B = 3 Rivers Wildlife Management Area; and C = Upper Lillooet Forest Service Road.

these stations was in response to the detection of Great Blue Herons flying south along Lillooet Lake, providing surveyors with a greater ability to detect herons closer to their furthest recorded flight locations.

Stand watches were completed between April 16 and July 20, 2019, involving 30 unique survey days during the nest building (April = 5) and breeding season (May = 2, June = 8 and July = 13). Six people, including the project coordinator, conducted surveys. Surveys ranged from 30 to 230 minutes in duration with an average of 107 minutes. The total amount of time spent surveying at stand watch stations was 5,440 minutes or approximately 90.5 hours. Survey effort and detection results are summarized below (Table 4 and 5, Figure 8). It should be noted that the water level of Lillooet Lake stayed high until approximately June 9, 2019, after which time it started to come down (D. Eslake, pers. comm. 2019).

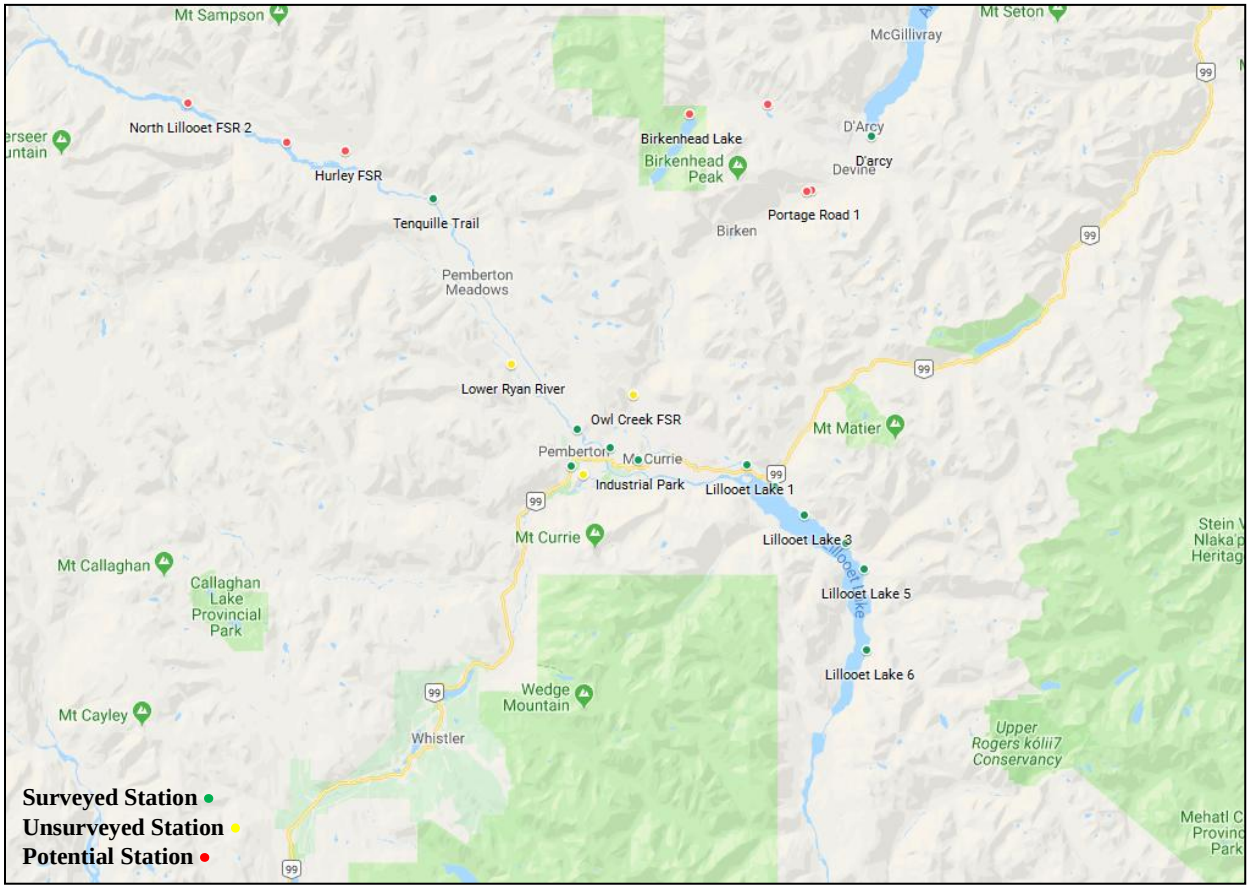


Figure 7. Location of spring 2019 surveyed, unsurveyed and potential stand watch stations for Great Blue Heron in the Pemberton area[8].

[8] Unsurveyed stations are suitable locations for future surveys while potential stations still require further assessment (verification).

Table 4. Survey effort for Great Blue Herons and raptors during 2019 stand watches in the Pemberton area.

Station	Number of Surveys	Duration of Surveys (Minutes)
D'Arcy	2	248
Industrial Park	7	555
Lillooet Lake 1	8	1967
Lillooet Lake 2	4	570
Lillooet Lake 3	3	365
Lillooet Lake 4	3	310
Lillooet Lake 5	2	105
Lillooet Lake 6	1	120
MacKenzie	5	330
North Fulton	3	300
One Mile Lake	6	390
Tenquille Trail	1	180
Total	45	5,440

Table 5. Number of Great Blue Herons and raptors detected during 2019 stand watch surveys in the Pemberton area[9].

Station	Great Blue Heron	Bald Eagle	Osprey
D'Arcy	1 (Juvenile)		3 (Adult)
Industrial Park	0	2 (Adult)	0
Lillooet Lake 1	17 (8 Adult, 6 Juvenile, 3 Unknown)	15 (Adult)	2 (Adult)
Lillooet Lake 2	5 (Adult)	6 (Adult)	5 (Adult)
Lillooet Lake 3	9 (2 Adult, 7 Unknown)	3 (Adult)	0
Lillooet Lake 4	0	0	5 (Adult)
Lillooet Lake 5	0	0	3 (Adult, 2 (Juvenile)
Lillooet Lake 6	0	0	2 (Adult)
MacKenzie	0	0	1 (Adult)
North Fulton	0	0	0
One Mile Lake	0	2 (Adult)	2 (Adult)
Tenquille Trail	0	3 (Adult)	0
Total	32 (15 Adult, 7 Juvenile, 10 Unknown)	31 (Adult)	25 (23 Adult, 2 Juvenile)

[9] Numbers are overall species sightings and very likely includes counts of the same individual(s) multiple times during surveys.

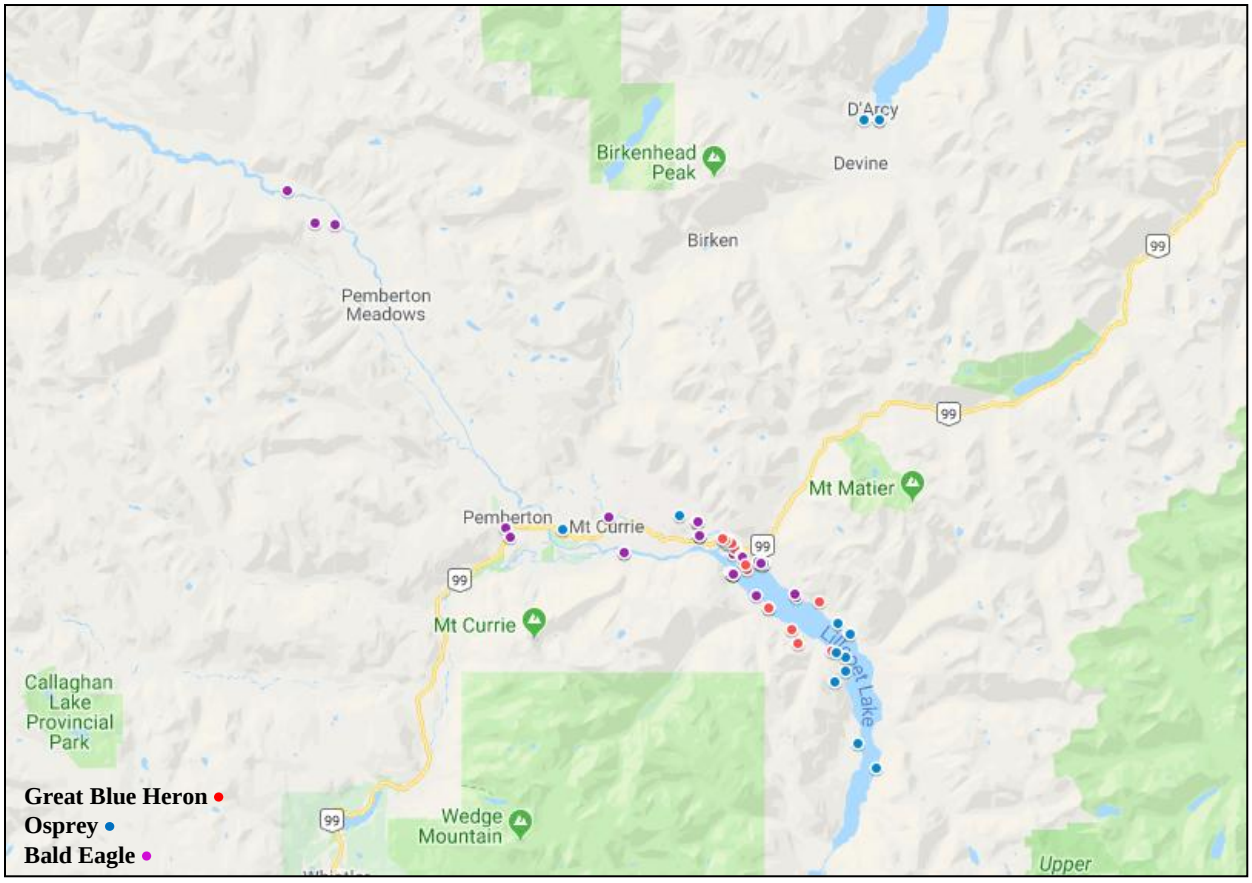


Figure 8. Location of Great Blue Herons and raptors of interest detected during 2019 stand watch surveys in the Pemberton area[10].

Of the Great Blue Herons detected, 97% were from three stand watch stations (Lillooet Lake 1 to 3) with 53% of these from the Lillooet Lake 1 station. All three stations are in proximity to the convergence of the Lillooet and Birkenhead Rivers at the north end of Lillooet Lake, which results in the formation of large shallow areas that are suitable foraging habitat for herons.

Of the detections in this area there were five different observations of a total of 12 Great Blue Herons flying from the north end of Lillooet Lake south/southeast along the southwest shore of the lake between July 11 and 18, 2019. The two longest flight distances observed from the north end of Lillooet Lake south were 7.2 and 9 km (Figure 8). The D'arcy stand watch station was the only other site where a Great Blue Heron was detected.

The number of Great Blue Herons detected at stand watch stations during the core breeding period (i.e., nest building starting in mid-March to an estimated fledge date of approximately July 9 based on field observations) was one in April, none in May or June and six on July 4, or

[10] Due to the scale of the map and proximity of sightings, not all species observations are visible due to overlapping map points.

22% of the total number of herons detected. The first juvenile Great Blue Heron observed in the Pemberton area that was believed to have fledged from a nest in 2019 was on July 9 during a stand watch survey at the north end of Lillooet Lake. The individual was photographed resting and grooming on one of the old wood pylons. This observation was followed by incidental sightings of seven and at least eight juvenile herons, of a group of 26, sighted at the north end of Lillooet Lake on July 13 and 14.

Based on the duration of surveys at each station (i.e., minutes surveyed) and the number of times herons were detected, it took the following average times to detect a Great Blue Heron at applicable stations:

- Lillooet Lake 3 = 41 minutes;
- Lillooet Lake 2 = 114 minutes;
- Lillooet Lake 1 = 116 minutes;
- D'Arcy = 248 minutes.

Equally relevant to this and future survey efforts is the time spent surveying at remaining stand watch stations where no Great Blue Herons were detected. Stations ranked in order of the lowest likelihood of detecting Great Blue Herons, based on total survey effort, are as follows:

1. Industrial Park,
2. One Mile Lake,
3. North Fulton,
4. McKenzie Forest Service Road,
5. Tenquille Trail,
6. Lillooet Lake 4,
7. Lillooet Lake 6 and
8. Lillooet Lake 5.

Of these stations, herons were particularly absent from the first 4 based on the time spent surveying and proximity of these stations to where herons were observed.

3.2.2 Incidental Sightings

There were 41 incidental sightings of 86 Great Blue Herons received from the public between February 15 and September 12, 2019 (Figure 9). Three of these sightings were from the D'Arcy area but lacked specific location information and therefore were not mapped. Of all sightings 53% were reported via Facebook and 32 came from unique individuals (74%). The percentage of sightings reported by season was 5% during the winter (December to February), 16% during the spring (March to May), 46% during the summer (June to July) and 33% during the fall (August to November).

Considering the number of Great Blue Herons reported incidentally during the core breeding season (i.e., nest building starting in mid-March to an estimated fledge date of approximately

July 9 based on field observations), there were seven in early spring, none between late April and early July and 5 in early July, which equates to 14% of the total number of incidental sightings received.

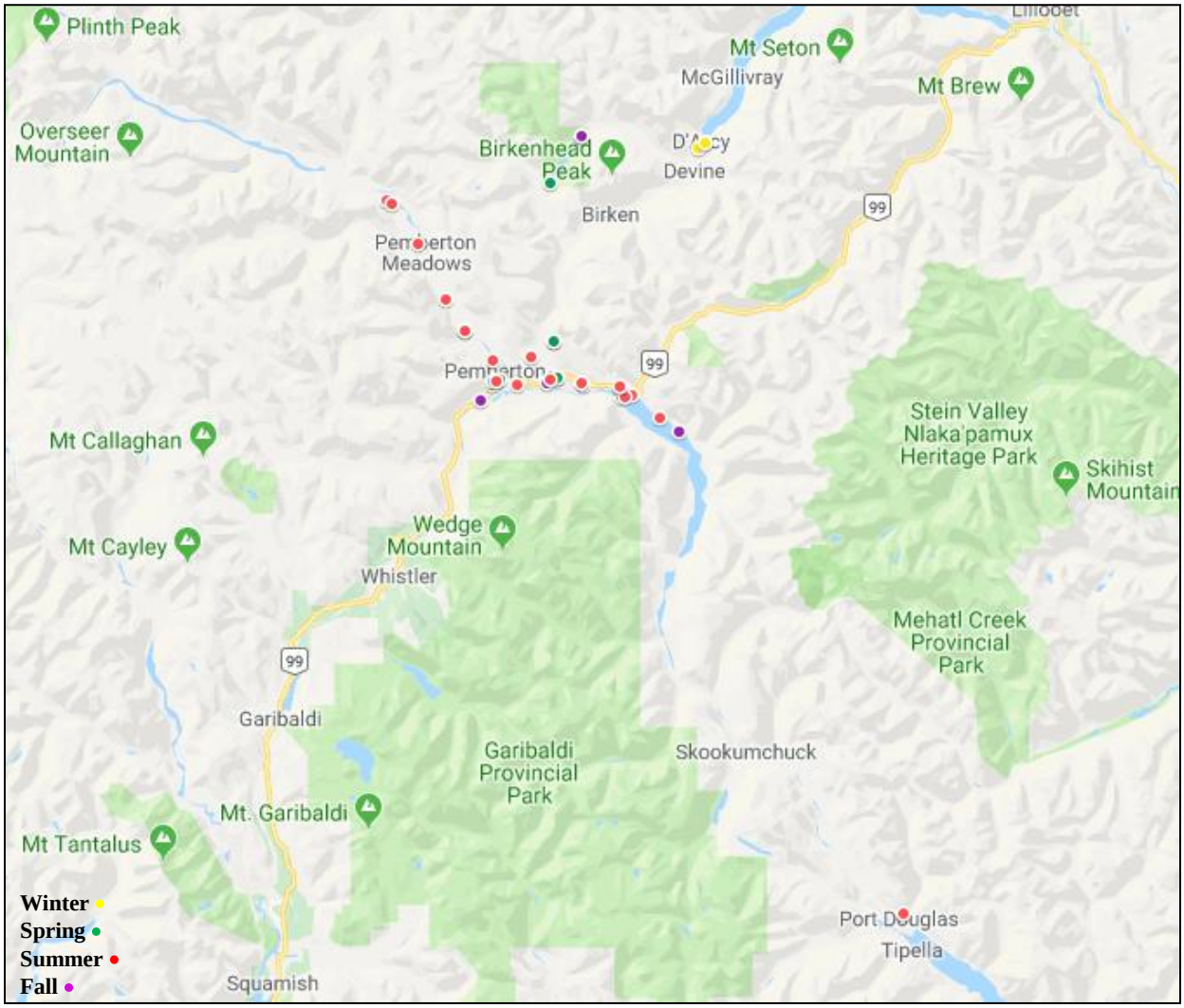


Figure 9. Seasonal location of incidental sightings of Great Blue Herons reported by the public during 2019 in the Pemberton area.

3.2.3 Nest Surveys

Surveyors did not detect a nest site for Great Blue Herons in the Pemberton area during stand watches in 2019. However, there were reports received from three Pemberton area residents of two active nest sites, one outside the project area and a potential nest site.

A single Great Blue Heron nest and egg was found by a landowner on their property in the Owl Ridge area of Pemberton. This sighting was received on September 13, 2019. Specific location

and status/history information for the nest and birds and landowner contact information have been requested. Further discussion with the landowner will occur, with a request to share information with Provincial and Federal staff involved in the management and monitoring of Great Blue Herons in southwestern BC.

A pair of Great Blue Herons was seen building a nest in a tall conifer near the BC Ferry Terminal in Horseshoe Bay on May 2, 2019. Herons have previously nested in this area but were not known to be active again. This nesting site was outside of the project survey area. Sighting information was sent to Provincial and Federal staff involved in the management and monitoring of Great Blue Herons in southwestern BC.

A potential nesting site was reported in the area around the north end of Little Harrison Lake (aka. Douglas Lake) on July 8, 2019 (Figure 10). The citizen reported having seen a mating pair of Great Blue Herons and others in the area and along the lake to the south every summer since 2013. They also reported routinely seeing them catching fish by the dock and provided a location for a possible nesting site.

In addition to the above Great Blue Heron nesting sites, the following four raptor nesting sites were detected, two during stand watch surveys, one incidentally and one from a citizen report.

- A Peregrine Falcon (*Falco peregrinus anatum*) nesting area was detected during stand watch surveys from station Lillooet Lake 3. A juvenile and adult were seen flying and calling frequently from a nearby cliff area. This species is red-listed provincially and of special concern federally and its nests and eggs are protected year around.

- An active Osprey nest and a potential inactive nest were detected on the southwest side of Lillooet Lake from stand watch station Lillooet Lake 6. The nest is in an area of large conifers, which is adjacent to younger, previously logged forest. Viewing and accessing the nesting area would be best by boat. The nest and eggs of this species are also protected year around.

- A Bald Eagle nest was incidentally detected on April 26, 2019 along the west side of the Birkenhead River. At the time of observation there were no eagles present in the nest or area so it is uncertain if it was active in 2019.

- An active Osprey nest was reported by a citizen on March 31, 2019. It is located between the north side of the Green River and south side of Signal Hill in the top of a Douglas-fir (*Pseudotsuga menziesii*) and has been active for a number of years.

Five areas are believed to support the nesting of Peregrine Falcon (1), Osprey (1) and Bald Eagles (3) based on observations made during stand watch surveys and incidental reports (Figure 10).

- Peregrine Falcon: 1) area consists of a number of moderately sized cliffs on the southwest side of Pemberton Meadows Road near the junction with the North Lillooet Forest Service Road. An adult was observed flying in the area on April 10 and one killed a duck in the general area on April 13. On July 18 a juvenile was heard calling from the area. Additional reports from local birders of Peregrine Falcons in this area also exist.

- Osprey: 1) area is north of Xetólacw Lake and likely before the community of Xetólacw. One adult seen flying with fish in this area on July 4.

- Bald Eagles: 1) area is on the south side of the Lillooet River near the Green River Forest Service Road where two adults were seen July 7; 2) area is on the east side of the Birkenhead River and around, mostly west, of Xetólacw Lake where adult Bald Eagles were observed during five different stand watch surveys; and 3) area is on the southwest side of Lillooet Lake near the outflow of the Lillooet River where an 'island' is present. Adults were observed in this area during seven different stand watch surveys.

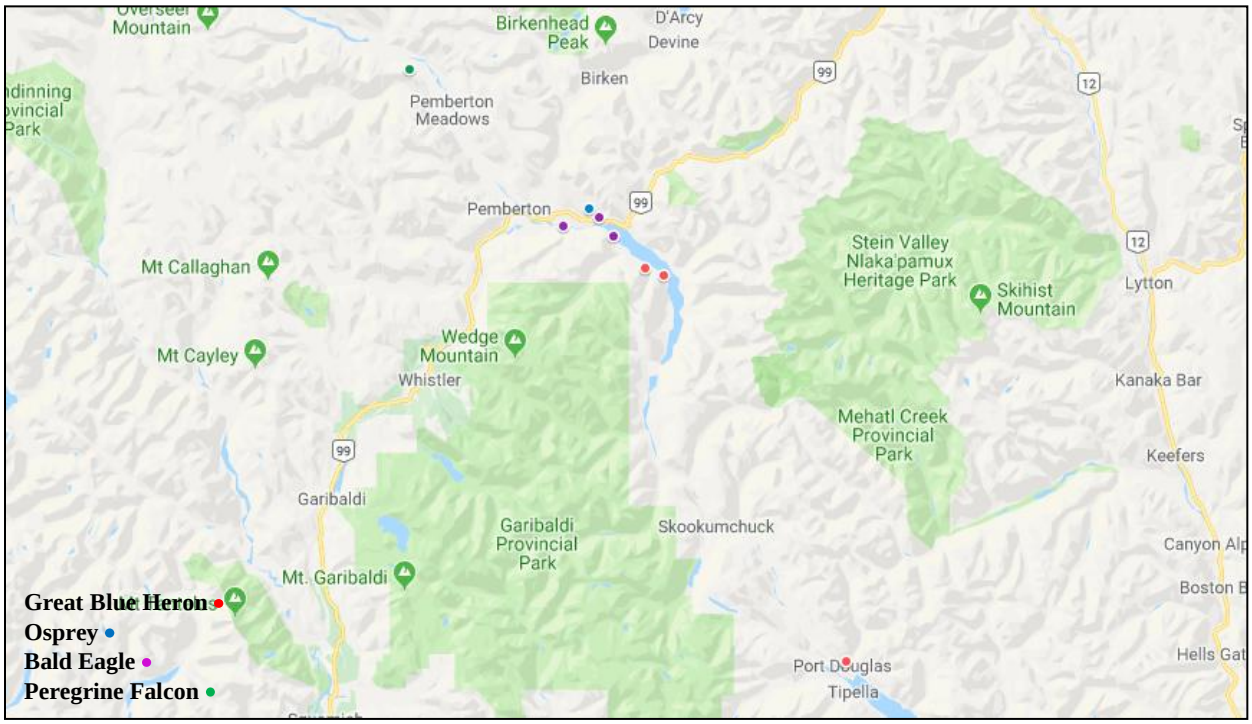


Figure 10. Likely or potential nesting areas for Great Blue Heron, Peregrine Falcon, Osprey and Bald Eagle reported or detected during 2019 stand watch surveys in the Pemberton area[11].

[11] Two red points for Great Blue Heron along the southwest side of Lillooet Lake are the furthest southern flight locations where herons were seen during 2019 stand watch surveys.

3.3 Swallows

3.3.1 Transect Surveys

Five transects, totaling 86.3 km, were surveyed for swallows by one person between July 8 and 21, 2019 in the Pemberton area (Figure 11). Four swallow species were detected during 19 hours of surveys, in addition to Vaux's Swift (*Chaetura vauxi*), which is another migratory and daytime aerial insectivore that nests in the area but is not considered of conservation concern at this time in BC or Canada (BC CDC 2019) (Table 6, Figures 12 and 13).

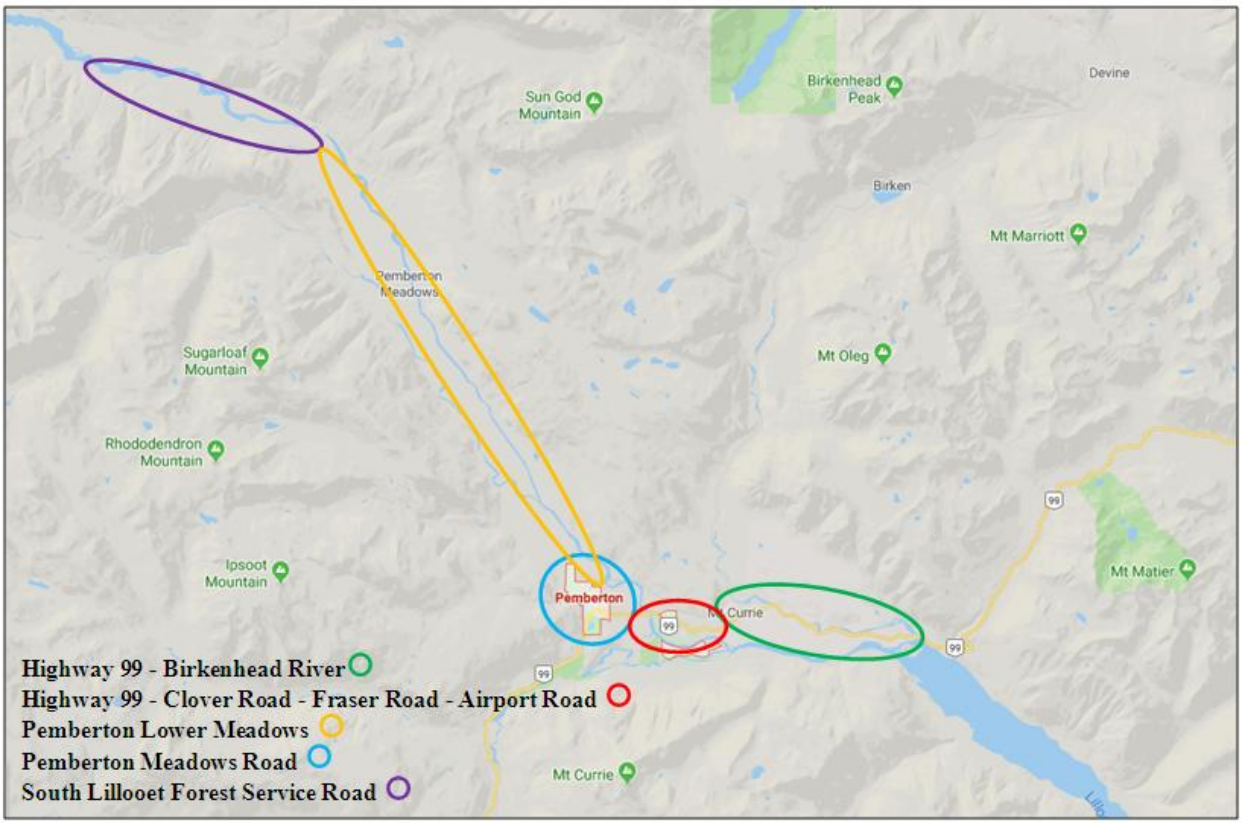


Figure 11. General location of transects surveyed for swallows species during July 2019 in the Pemberton area.

Table 6. Number and age category of swallow species detected during 2019 transect surveys in the Pemberton area.

Species	**Number Detected**
Barn Swallow	24 (6 Adult, 18 Unknown)
Northern Rough-winged (*Stelgidopteryx serripennis*)	34 Adults
Tree Swallow (*Tachycineta bicolor*)	32 (13 Adults, 19 Unknown)
Violet-green Swallow (*Tachycineta thalassina*)	45 (4 Adults, 41 Unknown)
Total	135 (57 Adults, 78 Unknown)

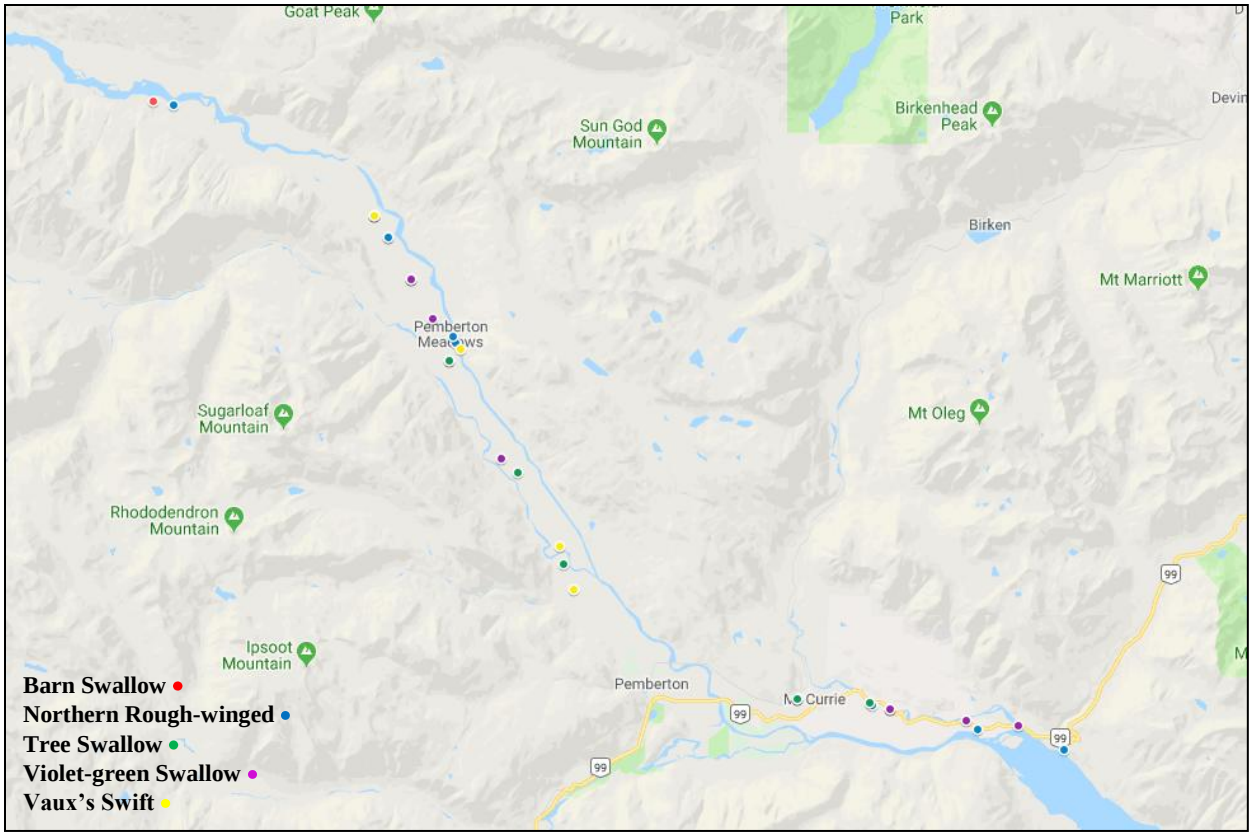


Figure 12. Location of swallow species detected during 2019 transect surveys in the Pemberton area[12].

[12] Not all swallow detections are visible due to the proximity of swallow sightings, scale of map and overlapping map points.

Figure 13. Location of Barn Swallows detected during 2019 transect surveys in the Pemberton area.

Although no active Barn Swallow nests were found during transect surveys, there are likely swallows nesting in structures within 400 m of sighting locations. Swallow nest boxes were observed on five private properties, four of which had Tree Swallows and one had Violet-green Swallows flying nearby.

3.3.2 Incidental Sightings

There were 19 incidental sightings of swallow species were made by members of the public, private landowners or volunteers. Eight of these were received through Facebook following a public request.

Two active Barn Swallow nesting sites on private lands were reported by members of the public. Both sites are known to have supported Barn Swallow nesting in the past, with one landowner reporting the historical presence of many nests but now only two.

Additional public sightings of Barn Swallows resulted in three general areas where birds could potentially be nesting: near a private property up the Pemberton Meadows Road, in the area

around the old community centre playing fields and park and around the industrial park. Barn Swallows were also reported flying around the Village of Pemberton near the Pony/Animal Barn and above the housing complex behind the ambulance station. These latter sightings may be the swallows that are known to nest in the underground parking lot of the Pemberton Gateway Village Suites Hotel. One landowner who had Barn Swallows nesting in 2018, reported them being absent in 2019, although some were seen flying around earlier in the summer.

A structure found in 2014, which supported one Barn Swallow breeding pair, was revisited in 2019. A pair of adults and an active nest was present. Surveys found that three young fledged from the nest in mid July and the adults were raising a second brood of at least two young in August. Previous discussions with the property manager indicated that he is supportive of allowing the swallows to nest in the parking area, which was confirmed indirectly by their continued presence this year.

Incidental sightings of nesting sites for other swallow species in the Pemberton area included Tree or Violet-green Swallows present in nest boxes on five private properties; three active Violet-green Swallow nests under the Highway 99 bridge over the Birkenhead River and the active and potential nesting of Tree, Violet-green and/or Northern Rough-winged Swallows in between lock blocks in the Pemberton industrial park.

3.4 Common Nighthawk

Four former transects were surveyed for Common Nighthawks in the Pemberton area on June 24, 25, 26 and 27 2019:

- Lillooet Lake (In-SHUCK-ch Forest Service Road);
- Highway 99; South Pemberton Meadows Road; and
- North Pemberton Meadows Road (Figure 14).

Communications with the Canadian Nightjar Survey Program Coordinator post-surveys revealed that only two of these transects were still relevant (Lillooet Lake - In-SHUCK-ch Forest Service Road and South Pemberton Meadows Road, Figure 15). Below is a summary of detections from the four routes surveyed (Table 7).

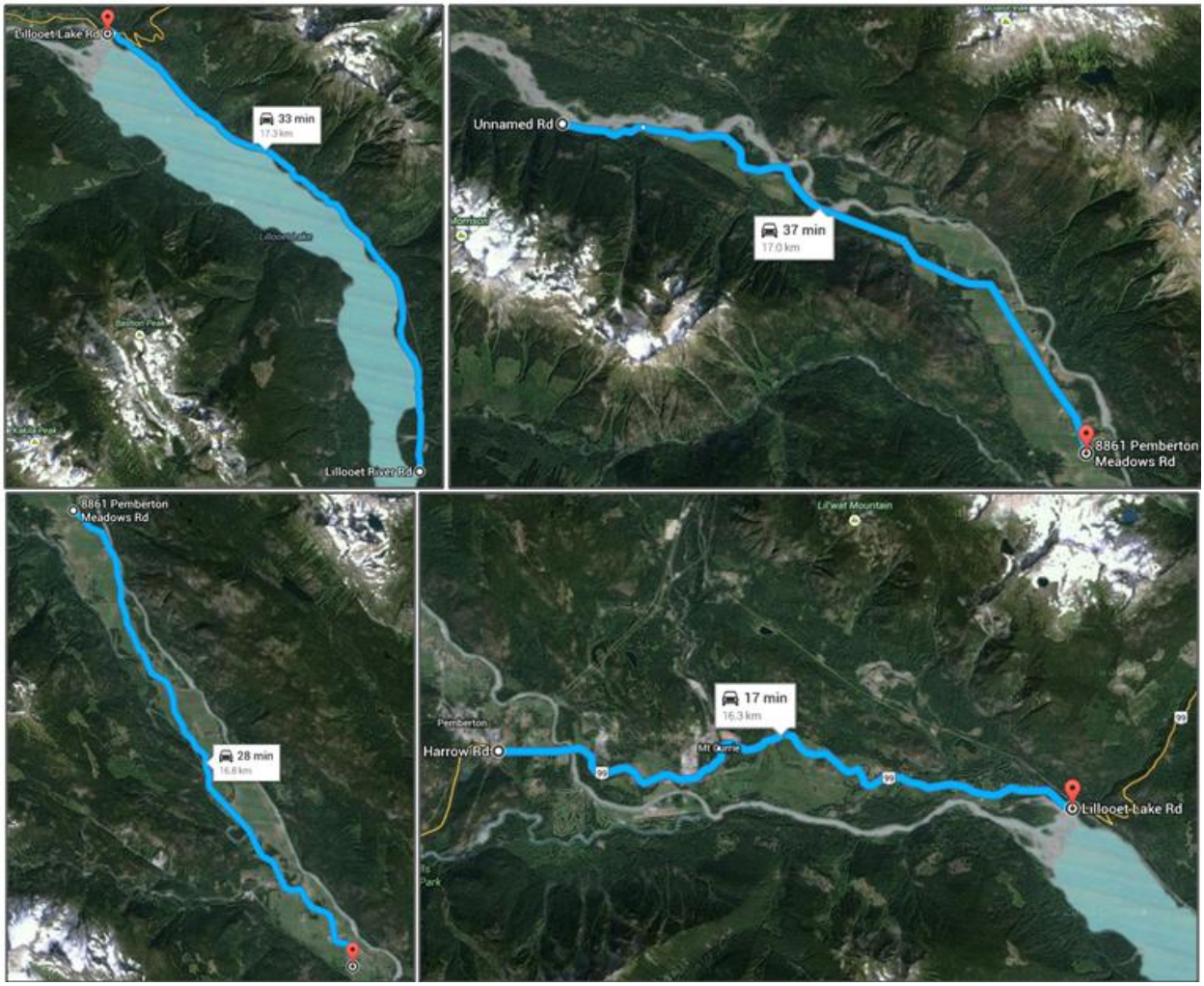


Figure 14. Location of transects surveyed for Common Nighthawk during July 2019 in the Pemberton area[13].

[13] Transect locations clockwise from top left: Lillooet Lake (In-SHUCK-ch Forest Service Road); North Pemberton Meadows Road; Highway 99; and South Pemberton Meadows Road.

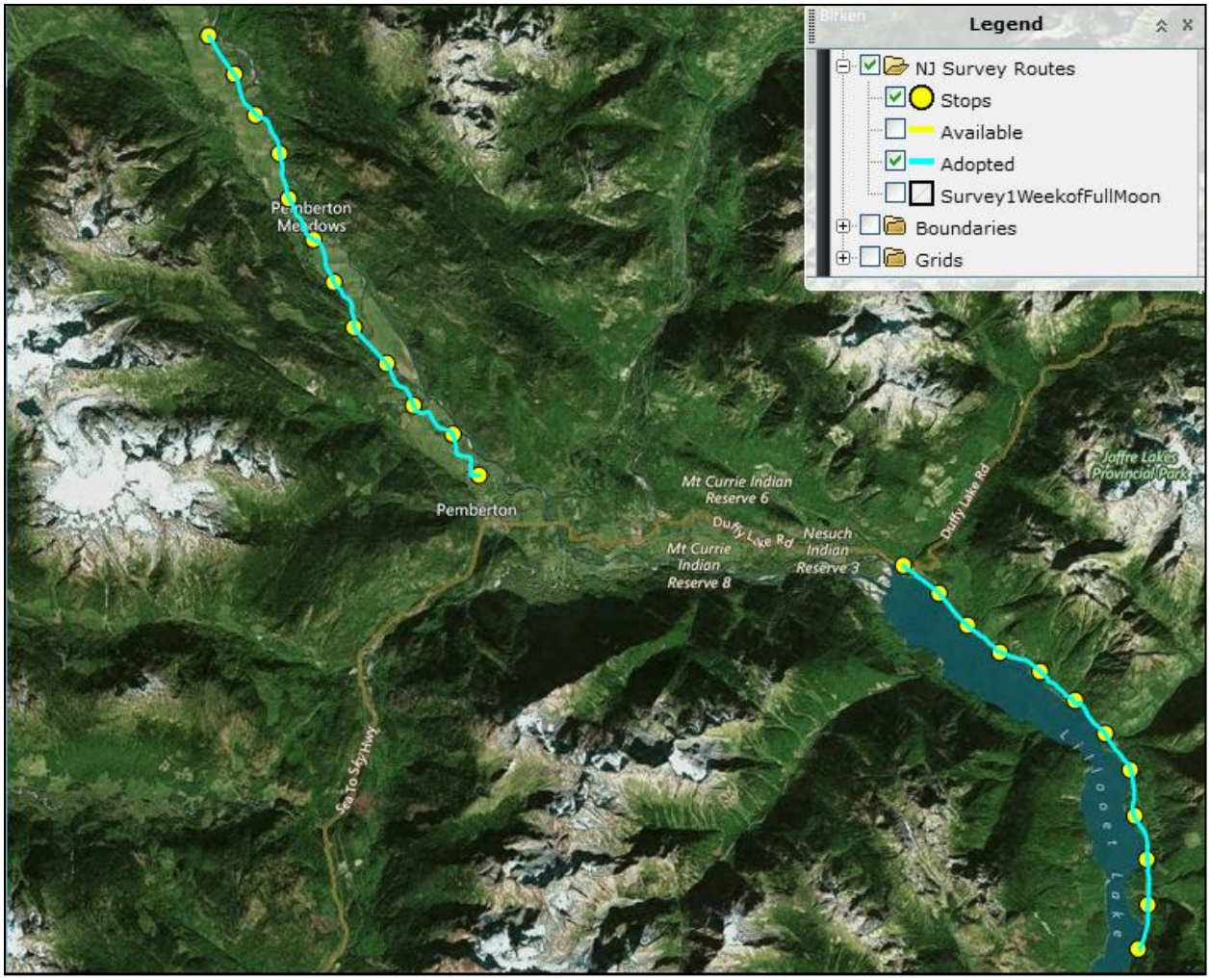


Figure 15. Location of two transects now part of the Canadian Nightjar Survey Program in the Pemberton area.

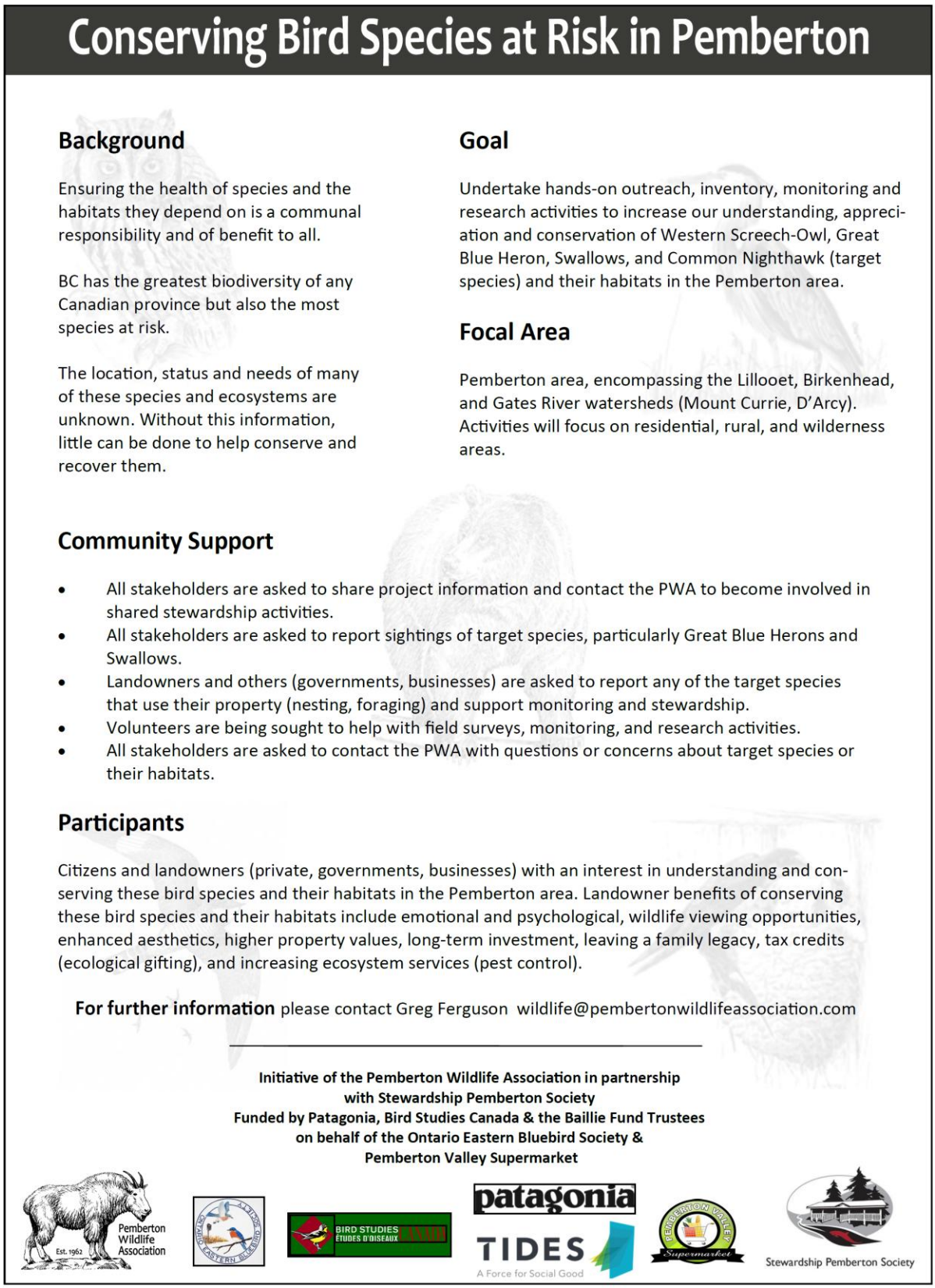
Table 7. Common Nighthawks detected during 2019 transect surveys in the Pemberton area.

Station	Common Nighthawk	Detection Type
Lillooet Lake (In-SHUCK-ch Forest Service Road)	0	
Highway 99	4	3 visual, 1 calling
South Pemberton Meadows Road	3	2 calling, 1 wing-boom
North Pemberton Meadows Road	6	3 calling, 2 wing-boom, 1 visual
Total	13	6 calling, 4 visual, 3 wing-boom

3.5 Outreach

Outreach about this project and its activities started in early spring and continued until late summer/early fall 2019. The majority of outreach was completed using internet based platforms, such as the PWA and SPS websites and email lists and Facebook. Other forms of outreach used included print media, in the form of posters, and word of mouth. Businesses and community organizations in the Village of Pemberton were very supportive of project outreach by allowing the placement of posters on their premises.

A project summary was shared with key stakeholders (e.g., Lil'wat Nation, VoP), the public and organizations via email and social media to inform them about project objectives and activities and encourage their support (e.g., involvement in surveys, reporting sightings, sharing information) (Figure 16). Outreach often included a call to action such as a request for help with surveys or submission of sightings (Figure 17).



Conserving Bird Species at Risk in Pemberton

Background

Ensuring the health of species and the habitats they depend on is a communal responsibility and of benefit to all.

BC has the greatest biodiversity of any Canadian province but also the most species at risk.

The location, status and needs of many of these species and ecosystems are unknown. Without this information, little can be done to help conserve and recover them.

Goal

Undertake hands-on outreach, inventory, monitoring and research activities to increase our understanding, appreciation and conservation of Western Screech-Owl, Great Blue Heron, Swallows, and Common Nighthawk (target species) and their habitats in the Pemberton area.

Focal Area

Pemberton area, encompassing the Lillooet, Birkenhead, and Gates River watersheds (Mount Currie, D'Arcy). Activities will focus on residential, rural, and wilderness areas.

Community Support

- All stakeholders are asked to share project information and contact the PWA to become involved in shared stewardship activities.
- All stakeholders are asked to report sightings of target species, particularly Great Blue Herons and Swallows.
- Landowners and others (governments, businesses) are asked to report any of the target species that use their property (nesting, foraging) and support monitoring and stewardship.
- Volunteers are being sought to help with field surveys, monitoring, and research activities.
- All stakeholders are asked to contact the PWA with questions or concerns about target species or their habitats.

Participants

Citizens and landowners (private, governments, businesses) with an interest in understanding and conserving these bird species and their habitats in the Pemberton area. Landowner benefits of conserving these bird species and their habitats include emotional and psychological, wildlife viewing opportunities, enhanced aesthetics, higher property values, long-term investment, leaving a family legacy, tax credits (ecological gifting), and increasing ecosystem services (pest control).

For further information please contact Greg Ferguson wildlife@pembertonwildlifeassociation.com

Initiative of the Pemberton Wildlife Association in partnership with Stewardship Pemberton Society
Funded by Patagonia, Bird Studies Canada & the Baillie Fund Trustees on behalf of the Ontario Eastern Bluebird Society & Pemberton Valley Supermarket

Pemberton Wildlife Association Est. 1962
BIRD STUDIES CANADA ÉTUDES D'OISEAUX
patagonia
TIDES A Force for Social Good
Pemberton Valley Supermarket
Stewardship Pemberton Society

Figure 16. Bird species at risk project summary shared with local stakeholders.

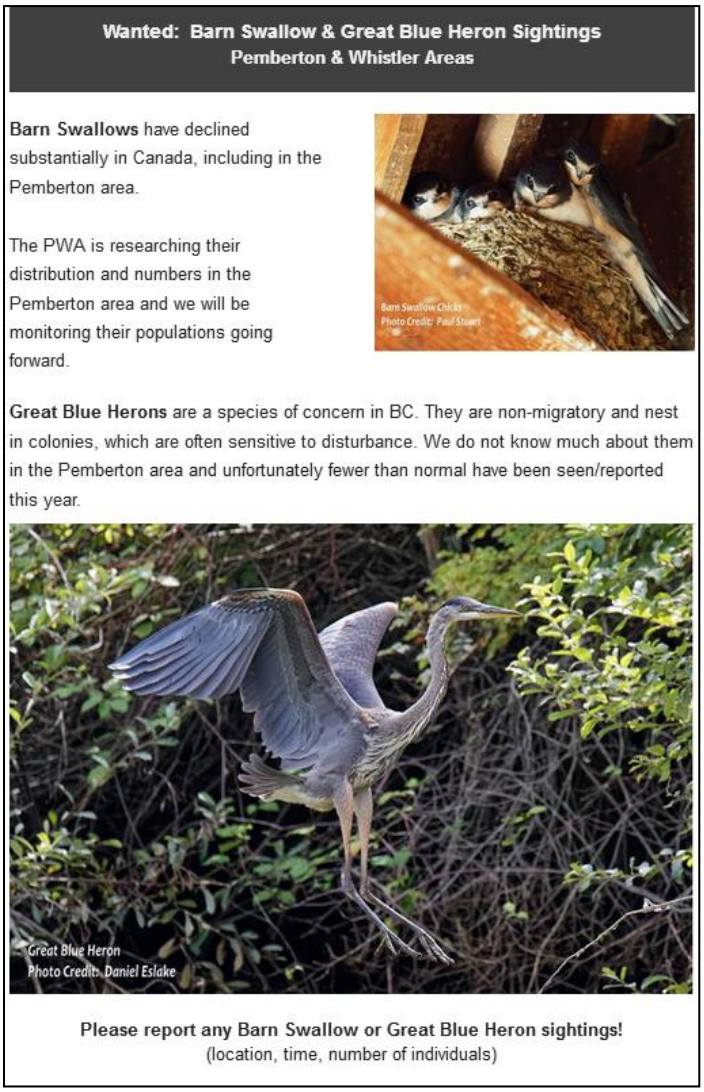
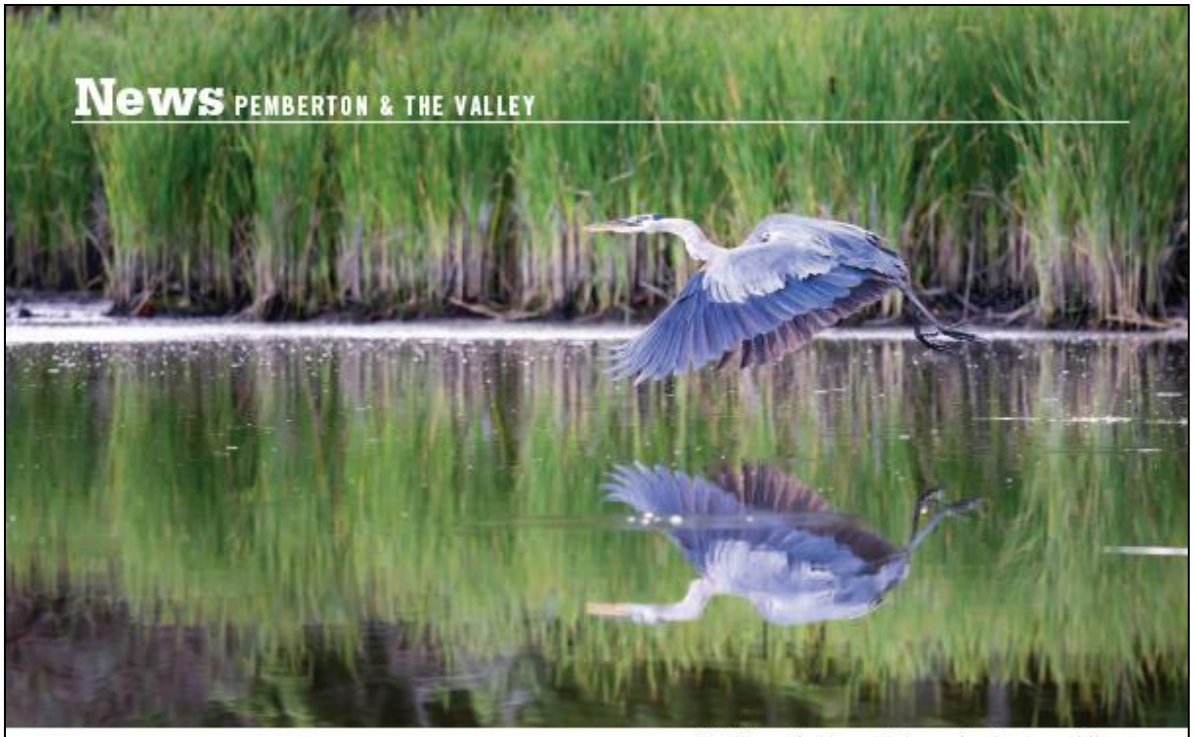


Figure 17. Example of outreach about project activities and request for sightings of target species.

Outreach to organizations included the PWA, SPS, Pemberton Community Forum, Pemberton Farmers Institute, Lil'wat Nation, Pemberton Food and Farm, Birkenhead Lake Estates and Whistler Naturalists. Project information was also shared with local and regional personnel involved with spreading information to the public via print and digital media, such as the Pique Newspaper, VoP, the Wellness Almanac and SLRD.

An article on Great Blue Herons, the surveys being completed and interest in public sightings was published by the Pique newspaper in February 2019 (Figure 18). Provincial and federal government officials involved in the management of target species were kept informed about project activities and important sightings and requests for support were made as needed to undertake project activities.



GRACEFUL Among other things, great blue herons are known for a sinuous neck that forms an "S" curve at rest and in flight.

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Studying Pemberton's great blue herons

BIOLOGIST IS CALLING FOR VOLUNTEERS TO HELP HIM CHART THE HEALTH OF THE SPECIES

By Joel Barde

A registered professional biologist is undertaking a study that aims to shed light on the health of the great blue herons that live in the Pemberton area.

"The key to this project and understanding their status is to find their nests," said Greg Ferguson, who is working in partnership with the Pemberton Wildlife Association (PWA) on the project.

"Nests give us a point where we can focus our monitoring efforts."

Ferguson said the birds have experienced a three-to-five-per-cent decline in the region since 1960 and are covered under the Species at Risk Act.

The great blue heron are a large, mostly grey bird with a long yellow dagger-like bill. The birds that live around Pemberton are a coastal subspecies of the heron that is non-migratory, added Ferguson.

Adults are tall, long-legged birds with a sinuous neck that forms an "S" curve at rest and in flight. They are white on top of their head as are the feather plumes on the back of their head and chest.

They can often be seen standing while foraging in open habitats, such as streams, lakes, wetlands and fields.

Ferguson said that it is vital to protect colonies of the birds, as that is where they breed. "If those get disturbed, that can have a big influence on the population," he explained.

As the birds are covered under the Species at Risk Act, there are implications when nests are found. If they are found on Crown land, a buffer zone is established to prevent activity such as logging that might disturb the birds. If the birds are found on private property, landowners can face restrictions.

"(Land owners) aren't allowed to disturb them under the law," explained Ferguson, adding that sometimes that affects people's willingness to report them.

In such cases workable solutions are possible, he said. "The government and ourselves will try to work with landowners to come up with an agreeable solution that meets everybody's needs."

In coordination with the PWA and the Stewardship Pemberton Society, Ferguson is currently seeking volunteers. He anticipates the monitoring work will get started in March or April, depending on the weather.

Ferguson is open to taking on volunteers of various skill levels, as training is provided.

To take part, volunteers should have an interest in nature and environmental science, as well as a willingness to sit for a couple of hours at a time (to carry out monitoring work).

The study area will include the area up to D'Arcy, Lillooet Lake and the Upper Lillooet River, said Ferguson.

Volunteers will have an involved job, tasked with documenting a number of important facts. These include information on where the sighting was made, what direction the bird was flying and any nesting activity (such as carrying twigs or calling young).

This is the fourth year of the heron count, with previous iterations focusing on the larger Sea to Sky area.

Ferguson noted that despite the smaller focus area, he welcomes any sightings from around the Sea to Sky corridor. The study is part of a broader project looking at species at risk in the corridor.

"The focus this year is on the Pemberton area with surveys for nests and important foraging areas being a key objective and hopefully nest monitoring," he said.

"However, we're still very much open to receiving information from anyone about heron sightings in the Sea to Sky corridor, in addition to Western screech owl and barn swallows."

The great blue heron, he added, is a majestic bird that many feel a connection to. "Lots of people, including myself, find it to be an amazing bird," said Ferguson. "It's a bird we see a lot of—so I think people are familiar with it. It's reflective of a healthy environment."

To take part, you can contact Greg Ferguson by phone at 604-349-4760 or email at suncity28@gmail.com. ■

Figure 18. Pique newspaper article on Great Blue Herons and 2019 project activities.

Education of volunteers and their support with office and field activities were critical to the success of this project. This included the involvement of the following number of volunteers in species surveys and monitoring:

- 9 people supported call-playback surveys and one person supported the assessment of nest boxes for Western Screech-Owl;
- 5 people contributed to stand watch surveys for Great Blue Herons; and
- 1 volunteer supported all surveys for Common Nighthawk.

Volunteers involved were from a range of backgrounds, including experience, age, gender and ethnicity.

Undertaking this project resulted in the formation or fostering of new or existing collaborative partnerships between the following organizations that all have an interest in conserving bird species at risk and their habitats in the Pemberton area:

- PWA,
- SPS,
- Lil'wat Nation,
- VoP,
- FLNRORD,
- FVC,
- Bird Studies Canada,
- Patagonia and Tides Foundation,
- Pemberton Valley Supermarket and
- Quest University.

Eleven private landowners generously supported the project by allowing surveys to be completed on their properties.

A third year undergraduate student from Quest University was hired in late May with support from the Community Foundation of Whistler to assist with a concurrent project on bats. Fortunately funding was flexible to allow her to be involved in this project. The student worked closely with the project coordinator, receiving education, training and hands-on experience in a number of office and field based activities. This included:

- approximately 16 hours developing outreach materials and entering and analyzing data,
- 11 hours conducting stand watch surveys for Great Blue Herons,
- 7 hours assisting with all Common Nighthawk surveys,
- periodic nest monitoring for Western Screech-Owl and
- 8 hours organizing and leading a public walk on owls and bats.

Two evening walks about owls and bats were provided free of charge to 34 community members. These took place at the One Mile Lake Nature Centre and around One Mile Lake. Walks informed participants about project activities, species ecology and stewardship and conservation activities whilst providing hands-on opportunities and experiences to interact with species by conducting call-playback surveys for owls along with interacting with props and survey equipment. Social and print media were used to inform people about this educational opportunity (Figure 19).

A follow up questionnaire was provided to walk participants. One participant provided feedback that was positive. Despite limited feedback to the questionnaire, the majority of participants verbally expressed their gratitude for the walk and an increased understanding and appreciation for owls and bats. Key highlights of both walks, particularly the second, were the close detection and personal interactions people had with a family of owls and a number of bats.

These were the first education walks the PWA has provided to the general public. The walks were conducted with support from SPS, fulfilling their goal to provide science-based participatory learning and engaging participants in hands-on activities that provide them with experiential learning opportunities.

Figure 19. Poster used to inform the public about two free educational walks on owls and bats.

Outreach to local governments included two meetings:

- one with Lil'wat Nation Natural Resource Management staff on February 6 and another with
- VoP Mayor, Council and senior staff on June 11.

Both meetings provided the PWA with the opportunity to inform these key stakeholders about project objectives and activities and discuss opportunities to work collaboratively to understand and conserve bird species at risk in the Pemberton area.

Project data was entered and analyzed and this report was prepared, all of which was submitted to applicable agencies, organizations and individuals involved or responsible for the management of target species.

4 Discussion

4.1 Overall

The overall intention of this project was to contribute to our understanding and conservation of bird species at risk in the Pemberton area and beyond. Collecting data through the inventory, monitoring and research activities undertaken during this project has helped to accomplish this by furthering our knowledge of the distribution, relative abundance, behaviours and critical habitats required by target species to survive and recover. This data also provides a baseline and opportunity for further work to better define the habitat needs, characteristics and status (e.g., survivorship, threats, home range) of targeted bird species and to aid in their conservation locally and regionally.

4.2 Western Screech-Owl

4.2.1 Call-playback Surveys

Nighttime call-playback surveys were considered an effective means of obtaining responses from Western Screech-Owls in areas they have previously been detected or newly detected in 2019. Examples of this include:

1. the detection of one adult in the Owl Ridge area where they have been previously heard calling spontaneously and detected during call-playback surveys in 2016 and 2017, respectively,

2. the detection of one adult near a station (i.e., 437) where it was detected during nighttime call-playback surveys in the fall of 2015 and spring of 2016,

3. the re-detection of a previously reported spontaneously calling adult during the first round of call-playback surveys along the Creekside transect and

4. the detection of one adult along the North Fulton transect during all three call-playback surveys completed in that area in 2019.

This is not to say that all nighttime call-playback surveys in areas where Western Screech-Owl has been detected will result in re-detections. An example of this was from a survey along the Birkenhead River where Western Screech-Owls were detected a total of three times during 2016 and 2017 call-playback surveys but were not detected during the one survey along the same transect in 2019.

During the 128 nighttime call-playback surveys completed during this project there were six incidents in which Barred Owls exhibited what was believed to be an aggressive/territorial response towards Western Screech-Owl, with two of these responses involving Barred Owls swooping at the caller/speaker. Similar behaviour was observed in 2015, 2016 and 2017 where there were three swooping and seven aggressive/territorial responses by Barred Owls to nighttime call-playbacks for Western Screech-Owl. No Great Horned Owls exhibited these behaviours during this project or previous surveys completed by the author.

Given these behaviours, there is concern that call-playback surveys could potentially increase the risk and/or number of calling or potentially non-calling Western Screech-Owls being preyed upon by Barred Owls. Research in Oregon found that the presence of Barred Owl had a negative effect on Spotted Owl detection probabilities and it had either a positive effect on local-extinction probabilities or a negative effect on colonization probabilities (Olson et al. 2005).

To minimize possible risks, it is recommended that surveyors discontinue the call of Western Screech-Owl immediately following the detection of a Barred or Great Horned Owl, particularly the former, and avoid calling at proceeding stations that are within 400, and possibly up to 1000 m, following a detection of these latter species. Additionally, repeating nighttime call-playback surveys in areas that are known to be used by Western Screech-Owls is not advisable. In these areas, effort should be spent on nest and roost surveys when detection of these critical habitats is still needed. The BC Ministry of Environment (2013) advises the essential need (urgent and important, needs to start immediately) to use multi-species radio-telemetry from two or more populations to measure the impact of Barred Owl predation on Western Screech-Owls. Undertaking this research separately and in relation to call-playback surveys would allow for broader understanding and implementation of beneficial management practices during surveys and otherwise (e.g., control options).

The detection rates of owls during nighttime call-playback surveys was highest for Barred Owl, nearly double that of Northern Pygmy and Western Screech-Owl. This result is not unexpected as Barred Owl populations have grown in size and range in BC since the first breeding record (Langley) documented in 1986 (Ryder 1986, Campbell et al. 1990) and Barred Owls were

considered widespread breeders in Greater Vancouver by 1997 (Elliott and Gardner 1997). The Great Horned Owl was the lowest detected species, potentially based on their preference for more open habitats, which were not the target habitat for nighttime call-playback surveys.

Despite only detecting what were believed to be five unique Western Screech-Owls, 19% of all owl detections made during nighttime call-playback surveys were of Western Screech-Owl, with a detection rate of 12% for the 73 stations surveyed. These results are considered good given the habitats surveyed and that a limited number of Western Screech-Owls have been detected during nighttime call-playback surveys in other areas of the South Coast Region, such as Squamish, Metro Vancouver and the Fraser Valley, over a number of years.

To capitalize/build on the detectability of Western Screech-Owl in the Pemberton area, it is recommended that future inventory include the recording and analyses (spectrographic software) of the type of vocalization(s) (e.g., territorial, scared/threatened, attacking, attracting a mate, courtship) given by Western Screech-Owls during surveys to better understand their vocal repertoire, behavior and identity/vocal signatures of sexes and individuals (Tripp 2004). This information could also aid in better population assessment and monitoring efforts, such as understanding territory re-occupancy and annual survivorship.

4.2.2 Nest Surveys and Monitoring

Daytime call-playback surveys for Western Screech-Owl resulted in the detection of the only nesting site found in the South Coast Region during 2019 and a pair of Western Screech-Owls in an area where they have been consistently heard. In both instances, owls were detected quite close to the location where calls were broadcast, 5 and approximately 40 m away. One owl was detected during the morning and the other in the afternoon. Based on these results and those obtained during previous detections, it would seem that calling within close proximity to an owl (e.g., <50 m) may be an important factor in eliciting a response during daytime surveys.

Although a number of daytime call-playback surveys were completed in additional areas of what was believed to be suitable habitat and were in proximity to previously detected Western Screech-Owls, no individuals were detected. It is uncertain the reason(s) behind these lack of detections but it may be due to the timing of surveys (i.e., a number of surveys were completed during mid to late-day, when responses from Western Screech-Owl are likely to be lower (J. Hobbs, pers. comm. 2019)) and/or that the areas surveyed were not areas the owls were using at the time of surveys or more regularly for nesting or roosting. Future daytime call-playback surveys should focus primarily on pre-dawn (1 to 3 hours before sunrise) and secondarily on pre-dusk (1 hour before sunset) times.

Another potential option for indirectly locating Western Screech-Owl nesting sites could be through the use of radio-tracking devices placed on Western Screech-Owl prey species (i.e., owls are enticed to consume prey with transmitters, which are then deposited later in or near by nest cavities) (Shipley 2011).

Despite not detecting owls during daytime call-playback surveys, a number of potential nesting cavities were found and checked using binoculars and a wireless cavity peeper camera. Using the peeper camera and having it mounted on the longest extendable pole found on the market (Mr. Longarm Pro-Lok 23 ft Adjustable 3 Section Extension Pole) allowed surveyors to confirm the presence of owls in the majority of available cavities found. This eliminated the uncertainty of possible owl presence in cavities (e.g., 'hiding', sleeping) when they are not heard or seen in an area following call-playback surveys. Even with the longest pole found on the market, there were a fair number of cavities that were too high to reach/check. Having a lightweight extendable ladder (e.g., 14 ft aluminum telescopic ladder) would be ideal. Preferably two people are present when checking nest cavities, one to maneuver the pole and camera into and around the cavity and the other to guide the camera into the cavity and to watch the camera screen to see what is inside the cavity. One person can accomplish this but it is more challenging.

Based on the furthest estimated location a Western Screech-Owl was detected during nighttime call-playback surveys from the nest site found (i.e., 387 m), the minimum circular breeding territory size for this individual is at least 0.47 km^2 or approximately 50 ha. This is larger or as large as other reported breeding home range sizes from four individuals in Campbell River (i.e., 7.2, 8.2 and approximately 30 and 50 ha using minimum convex polygons) (S. Pendergast, pers. comm. 2012 cited in Ministry of Environment 2013).

It should be noted that based on radio-tracking of nine Western-Screech Owls (*M. k. macfarlanei*) in the Shuswap area of BC, nests were found not to be situated in either the geographic center or core area of the breeding home range and that the area used by Screech-Owls during the remainder of the year was almost four times larger than that used during the breeding season and included considerably different habitats (Davis and Weir 2010).

Overall, with a nest site found and potentially re-used in future years, there is an opportunity to place tracking tags (GPS, radio-telemetry) on owls to better define their breeding and non-breeding home ranges and habitat requirements. Undertaking this research would fill essential knowledge gaps identified by the BC Ministry of Environment (2013) for the recovery of this subspecies.

The nest site was found in an area designated under the BC *Forest and Range Practices Act* as a Wildlife Habitat Area (Number 2-525) to protect habitat for Spotted Owl (*Strix occidentalis*) (Government of British Columbia 2019). Despite this protection, there have been a number of illegal trails constructed in the vicinity of the nest site and general breeding territory. Most of these trails are for mountain biking, with maintenance work observed in the early spring and new trail construction reported this fall. In addition and likely more significant to Western Screech-Owls and the Wildlife Habitat Area overall, are plans to carry out urban rural wildfire smart management activities in the area. These threats were reported to and observed by FLNRORD staff during the project. Given the status of Western Screech-Owl and its fidelity to nest sites and territories, it is hoped appropriate measures will be undertaken to protect the area habitat from further disturbance.

Two Browning Spec Ops Advantage wildlife trail cameras were employed to visually monitor Western Screech-Owl nesting activity. Unfortunately, the cameras were not effective in capturing the majority of owl activity at the nest site. A very limited number of photos were obtained during the night when owls are known to be most active.

In addition, it is believed that cameras were only able to obtain pictures of owls when they were present in the opening of the nest cavity for a long enough time for the camera to sense them. This latter issue of slow camera trigger speed and/or too rapid owl movement has been reported by another biologist who works on Western Screech-Owl on Vancouver Island (T. Tripp, pers. comm. 2019).

An attempt was made to set cameras to take pictures continuously every 5 seconds but unfortunately camera set up was done incorrectly, preventing the ability to assess the effectiveness of capturing images using this setting. With such a setting, one should be cognizant that the camera batteries will drain quicker. Despite these set-backs, cameras were successfully mounted and positioned using a laser pen to capture some images of Screech-Owl in the nest cavity from a distance of approximately 10 m.

It is recommended that further work be done, such as camera testing on other nesting owl or bird species and the attainment of advice from other researchers, to improve the use of wildlife cameras as a monitoring tool of Western Screech-Owl activities and behaviour because of their ability to monitor nest sites continually and in a way that causes limited intrusion/disturbance to owls and their habitat.

Using the wireless cavity peeper camera mounted to a long extendable pole proved to be very valuable in determining the status of the Western Screech-Owl nest. Data collected such as the presence of a bird on the nest and number and age of young enabled surveyors to know the status of the nest, such as timing of use, productivity and approximate fledging date. However, the adult attacked the camera during one monitoring session, which is a behaviour that has also been observed during nest checks on Vancouver Island (T. Tripp, pers. comm. 2019), indicating its use is stressful for the species. It is recommended that the number of nest checks be minimized to avoid potential nest abandonment during or after the breeding season.

When checking nests, damage to surrounding habitat should be minimized (trampling vegetation, compacting and eroding soils, making ‘trails’), no checks should occur if predators or people are in the area and checks should be done as quickly, quietly and by as few people as possible. Using remote cameras, ideally a video camera, and ARUs are believed to be the safest monitoring method. Scratching the base of the nest tree to see if an adult is present, using a juvenile begging call to elicit a response or conducting stand watches from a distant, hidden location during known activity periods (e.g., early evening, fledging) are also considered less disturbing nest monitoring methods.

If after checking cameras for activity and/or two visits with no response using the latter methods, then using a peeper camera is advised. This should only be done later in the breeding

season, such as half way or more through the egg incubation period, and ideally when adults are not in their nest cavity or area to minimize nest abandonment. Davis and Weir (2008) found that females (n = 5) of the interior subspecies of Western Screech-Owl left their nest between 16 and 26 minutes after sunset and were away between 8 and 21 minutes after they started incubating eggs and that their time away increased up to 43 minutes later in the nestling period.

This was the first season ARUs were used by FLNRORD to collect specific data on Western Screech-Owl in the South Coast Region. Despite not obtaining adequate recordings from an ARU established in the Owl Ridge area and not currently having results from the one established near the Creekside nest site, their use provided a valuable learning opportunity. A number of call recordings (classifiers) have now been obtained as a basis for future data analysis. A greater understanding of the limits and potential use of ARUs was acquired, particularly with regards to the location they were established (they should be as close to the desired species but as far as possible from surrounding noise sources) and their duration of use (ARU use should start before and continue after the breeding season and potentially annually to better understand Western Screech-Owl ecology, such as timing of activities, duration of owls in an area and call types).

Like remote cameras, ARUs established in known and potentially unknown areas of owl occupancy allow for ongoing data collection with very limited field time and presence, thus minimizing disturbance caused by site visits and call-playback surveys. Using multiple ARUs to triangulate the location of owls (Hedley, Huang and Yao 2017), particularly in areas they are known to frequent but the location of their nest and/or roost site are unknown, is a future research option. Discussing and working with other researchers that have or are using ARUs to inventory and monitor Western Screech-Owl and/or other owl species should be undertaken, with the development of protocols for ARU use and a central repository established for data entry and analysis.

Although data collected on the status of the nest site detected using remote cameras and ARUs was limited (occupancy and timing, breeding chronology, adult and juvenile behaviour), finding this nest site provides an important opportunity for future, more well planned, timed and resourced data collection during the breeding and/or non-breeding season. Such work can help fill important knowledge gaps, furthering recovery efforts such as critical habitat identification and protection and future research, such as radio-telemetry.

4.2.3 Nest Box Surveys

No nest boxes were used by Western Screech-Owl for the second breeding season that they have been up in the Pemberton area. This was not unusual, as none of the other 166 nest boxes placed up in Squamish, Lower Mainland and Fraser Valley were used this year or in previous years by Western Screech-Owl (S. Hindmarch, pers. comm. 2019).

Nest boxes have been used by Western Screech-Owl on Vancouver Island in recent years, providing valuable data such as the timing of nesting activities and productivity and bird behaviour (T. Tripp, pers. comm. 2019). As with natural nest sites, any future active nest boxes in the Pemberton area should be monitored with care (see section 4.2.2 Nest Surveys and Monitoring for details).

The two landowners with nest boxes on their properties were very supportive of monitoring activities and the presence and purpose of boxes on their land. The peeper camera provided by the FVC and mounted on an extendable pole was invaluable in checking nest boxes. It allowed volunteers to effectively and efficiently check boxes for occupancy and interior conditions, ensuring the highest level of confidence regarding nest box activity and status.

The following is advised with regards to nest box cleaning and maintenance/repair:

- Complete between mid-October and January or before it snows to minimize use by non-target species, such as rodents, but provide suitable boxes for Screech-Owls in the early spring.

- Bring appropriate tools (cordless drill, screw drivers, stainless steel wood screws, hammer and galvanized nails, small broom/brush) and supplies (wood shavings or saw dust, extra wood, roofing shingles, caulking, bucket or bag for waste).

- Wear safety glasses to avoid material falling in eyes.

- Wear gloves and a mask when removing rodent nests or other questionable material.

- Remove any material that fills a box more than half-way, result in an uncomfortable nesting surface (moist or discoloured/moldy wood shavings) and/or would be difficult for owls to remove (twigs, large amounts of grass).

- Fill boxes lacking a nesting base/substrate with 2 inches of wood shavings or saw dust.

- Fill and/or cover gaps/leaks if the boxes appear quite moist or move the box to a tree that provides more cover as a last resort.

4.3 Great Blue Heron

4.3.1 Stand Watch Surveys

A number of locations in the Pemberton area that were readily accessible and provided good views for stand watch surveys were identified early in the project. Communications with residents, travel in the area and heron sightings resulted in the identification of additional

stations for future surveys. The area landscape, particularly the presence of low, steep hillsides with accessible openings to view surrounding valley bottoms from, lends itself well to stand watch surveys for herons.

Stand watch surveys for Great Blue Herons started later in the season and were conducted less times than planned during core survey periods. This was mainly due to time spent on project coordination and daytime call-playback surveys for Western Screech-Owl. Ideally more surveys would have occurred in March and April during the nest building season and June and July during the chick rearing/feeding period when herons are often flying to and from their nests. Despite these circumstances, the time spent surveying from a number stand watch stations (e.g., One Mile Lake, McKenzie Forest Service Road, Industrial Park, North Fulton) was considered ample for detecting herons and locating their nest sites. The lack of heron observations during stand watch surveys in these areas was correlated with a limited number of incidental sightings reported. This data helped define areas of low use and provides good rational for undertaking surveys in other areas where herons are known to or believed to be frequenting. Ideally, more time/effort would be spent at stand watch stations where herons are seen early and frequently.

With regards to the timing of heron breeding activities, it is probable that the fledging date of Great Blue Herons in the Pemberton area was around July 9 in 2019. This is based on the dates (i.e., July 9, 13 and 14) that a number of juvenile herons were first observed at the north end of Lillooet Lake. At the colony in Stanley Park, herons started to fledge on July 10 in 2018, with the first eggs seen on March 28 (Hart 2018). With regards to the arrival of Great Blue Herons at nest sites, they have been documented roosting regularly overnight at the Stanley Park colony between January 14 and March 12 (Worcester 2015). Given this timing, late February/early March is considered a reasonable time when herons should be or start arriving at their breeding sites, followed by nest building or refurbishment, in the Pemberton area.

The annual freshet of the Green, Lillooet and Birkenhead Rivers in the early and late spring raise the water levels in these watercourses and Lillooet Lake. This likely has a large effect on the amount of shallow water foraging habitat available to and preferred by Great Blue Herons, especially along the banks of larger watercourses and at inflow areas into Lillooet Lake such as the large delta area formed at that north end of the lake from late spring/summer and into the fall. The presence of Great Blue Herons in such areas may be limited until early June when water levels were observed to start slowly decreasing. By mid July, water levels seemed to have dropped quite a bit as many more sandbars were present at the north end of Lillooet Lake, which correlated with an increase in heron observations, particularly juvenile herons. Planning stand watch surveys to focus on larger, shallow water areas just prior to and during the time they are developing may prove advantageous in detecting herons as they are expected to be drawn to these areas more as foraging habitat increases.

Given the amount of habitat in the project area available for Great Blue Herons and restrictions on time and travel, it was difficult for surveyors to survey remote stand watch stations.

Therefore, most stand watch surveys occurred near surveyors' homes and in locations that were readily accessible.

In addition, most stations surveyed occurred in areas considered readily frequented by the general public. Repeating surveys at stand watch stations in these areas versus going to new, more distant and/or under surveyed stations resulted in limited heron detections relative to survey effort. Future survey efforts in the Pemberton area should focus on more distant stand watch stations either in person, ideally over extended periods (2 to 4 days) to make the most of travel time and costs, and/or by soliciting greater local/resident help. Based on 2019 stand watch survey results and incidental sightings received from the public, four areas have been identified as priority sites for future surveys (Figure 20).

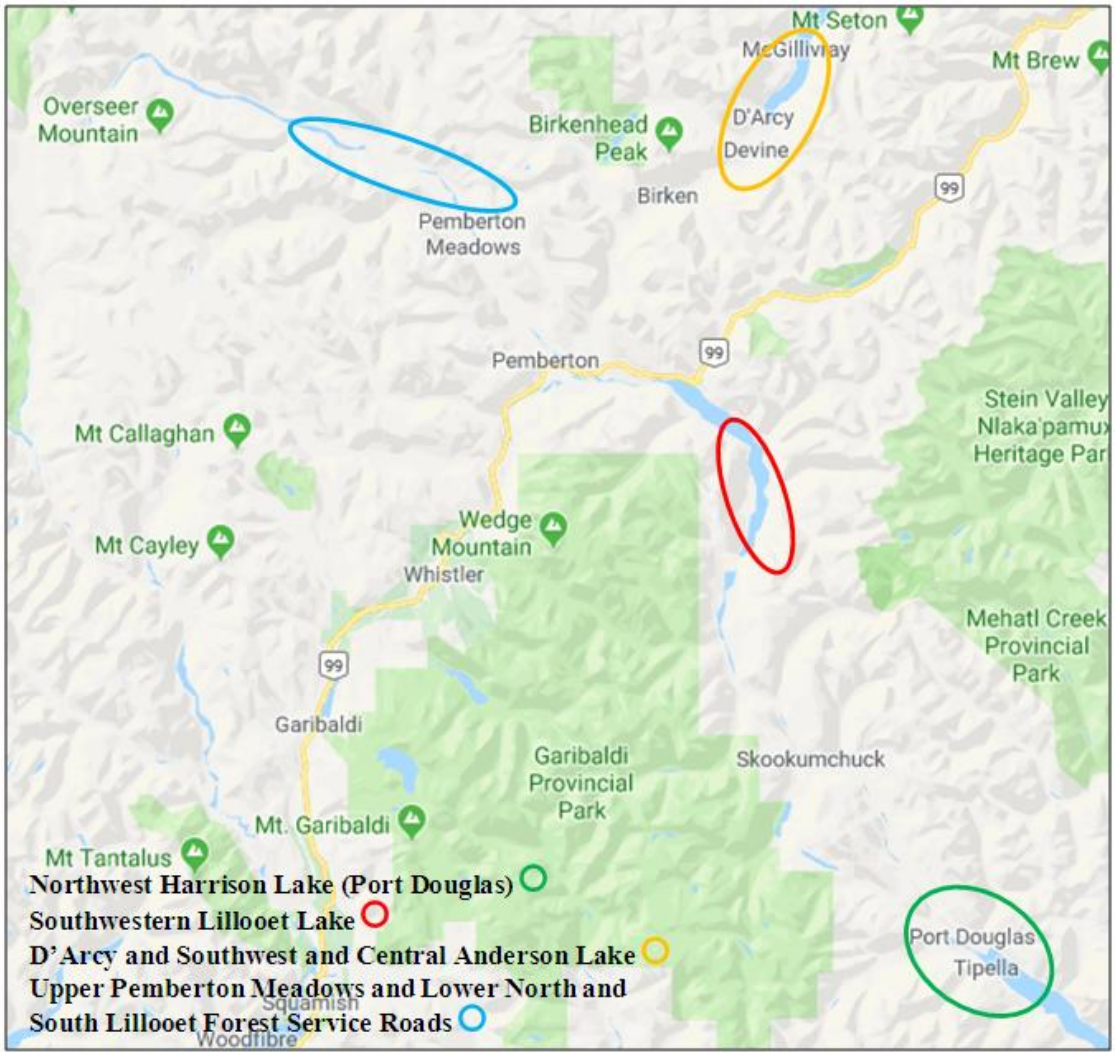

Figure 20. Recommended locations of future stand watch survey sites for Great Blue Herons in the Pemberton area.

1. Northwest end of Harrison Lake, with a focus on Little Harrison Lake, but also surrounding areas including Douglas Creek, Port Douglas Channel and the northwest end of Harrison Lake where the Lillooet River and Tipella Creek enter.

   Reserve Lands of the Xa'xtsa Nation (Douglas First Nation) are present in the area, in addition to a small number of non-indigenous residents. Both the Xa'xtsa Nation and locals should be contacted to inquire about herons using the area and to ask for their assistance and permission to access areas to undertake stand watch surveys. This area was not surveyed in 2019 due to time constraints and its distance from the project focal area.

2. Southwestern portion of Lillooet Lake, south of where Great Blue Herons were last observed flying southwest during 2019 stand watch surveys (see Figure 8). Eleven Great Blue Herons, some of which were juveniles, were detected during four separate stand watch surveys flying towards or in this area after juveniles were believed to have started to fledge.

   These sightings and their correlation with observations of juvenile Great Blue Herons returning to their nests approximately three weeks after fledging (Cornell Lab of Ornithology 2011) provide good justification for further surveys. It is recommended that additional stand watch surveys take place at stations Lillooet Lake 4 to 6 and possibly stations further south given the greater proximity of these stations to the furthest locations Great Blue Herons were observed.

3. D’Arcy, the adjacent southwest and central portions of Anderson Lake and low lying farm and wetland habitat in the community of Gates, southwest of Devine.

   In 2016, a citizen reported that herons nested in the past near the Gates Creek hatchery and roost in trees between Agnes Jack Drive, Lakeshore Drive and Anderson Lake, a wet area. There are also reports of many herons frequenting the D’Arcy area, at times up to seven at the Gates Creek hatchery, but during the non-breeding season.

   Since 2016, the author has not received any incidental reports of herons using the D’Arcy area during the breeding season from May to June and no sightings are reported on eBird during this time. Given this information, it would seem that herons are not nesting in or near D’Arcy and that further surveys should focus on the southwest and central portions of Anderson Lake and low lying and wetland habitat in the community of Gates, southwest of Devine. A benefit of surveying in these areas is that the topography of long linear valleys surrounded by adjacent hillsides provides good vantage points for stand watch stations and likely flight corridors/routes for herons commuting to and from foraging and nesting sites.

   Some future survey effort should also occur in D’Arcy, despite limited breeding season detections, as only two early spring stand watch surveys occurred in the area in 2019

and there is suitable habitat for herons in the area (e.g., Gates Creek, lakeshore). All these areas are within the traditional territory of the N'Quatqua Nation and a number of local residents. Therefore, both should be contacted to inquire about herons in the area and to request their assistance and permission to access areas for surveys.

4. Upper Pemberton Meadows Valley/Road and along the lower North and South Lillooet Forest Service Roads.

   This area is believed to have good habitat for herons, despite a lack of detections during the one stand watch survey in the area and no known reports of herons in the area during the core breeding season of April to June, which may be related to the limited number of residents and visitors that frequent the area. Current and potential stand watch stations identified in 2019 provide a good basis for future surveys in this area and greater effort should be placed on outreach to local landowners.

4.3.2 Incidental Sightings

The 41 incidental sightings of Great Blue Herons received from the public during this project was considered good for the time frame they were sought. In comparison, the author received:

- 34 public sightings in 2016,
- 10 in 2017 and
- 42 in 2018.

Using Facebook, specifically the Pemberton Community Forum, proved this year and in previous years to be the most effective way to obtain sightings from the public.

Despite these results, the number of Great Blue Herons reported during the core breeding season and prior to the expected fledge date of juveniles was low compared to sightings received outside this time frame (i.e., 12 of 43 reports or 28%). The main reason for this is believed to be because herons were not present or were at very low numbers in areas frequented by the public during the core breeding season. Prime examples of this were the lack of or very few heron detections reported from in and around the Village of Pemberton and Industrial Park where both surveyors and citizens spent a lot of time and herons are known to be during the non-breeding season. The north end of Lillooet Lake, the area where most herons were sighted during stand watch surveys, only had four sightings reported before herons were believed to have fledged.

These results seem to indicate that urban and semi-urban/semi-rural areas that are more frequented by people in the Pemberton area are not locations that herons are using during the core breeding season (i.e., unlikely critical foraging habitat or where nests are present or nearby) as one would presume that herons using such areas would be detected and reported more.

4.3.3 Nest Surveys

The one Great Blue Heron nesting site detected during this project was reported by a volunteer who knows a landowner in the Owl Ridge area that had one pair nesting on their property. This report was received after the end of the breeding season, precluding nest monitoring. A request for the specific location and status of this nest site and landowner contact information has been made to the volunteer. If the landowner is willing, then discussions about the status of the species and site visits during next breeding season should be undertaken to assess and monitor the nest. Defining the time herons arrive, begin nest building, have young and leave the colony would be very valuable in informing the best timing for stand watch surveys and expected heron activity.

4.4 Swallows

4.4.1 Transect Surveys

The Pemberton area, particularly the large fertile valley bottoms, is believed to provide ample suitable habitat for Barn and other swallow species. This includes areas for flying and foraging (pasture lands, farms with livestock, golf courses/playing fields), nesting structures (old barns, bridges, sheds, tree cavities, bridges) and materials (mud, feathers), water bodies for drinking and insect food sources. Despite this habitat, there were fewer swallows, particularly Barn Swallow, observed than what the available habitat surveyed was expected to support and what has been historically reported. Similar results have been observed in other areas in southwestern BC where transect surveys for Barn Swallows have been completed by the author. As abundant, suitable swallow habitat still exists in the lower Lillooet and Birkenhead River valleys, these are considered important locations in the South Coast Region for swallow conservation and recovery.

Although transect surveys were undertaken somewhat later in the summer, they were completed within the breeding window/season for all swallow species. Conducting transect surveys later in the summer may have actually resulted in a greater detection of swallows because of the presence of both adults and young of the year. However, completing surveys later in the season may have led to less nest sites being detected given a portion of adult swallows had likely dispersed from their nesting sites and/or did not nest a second time as approximately 60% of Barn Swallow pairs do not have a second brood (Campbell et al. 1997, Turner 2006, Boynton 2017). It is recommended that future surveys be completed twice during the breeding season, once in late May/early June during the nesting period and again in late June/early July when some young will have fledged. If only one survey can be completed, then it should be in late May/early June when nest sites can be more readily detected.

In addition to survey timing, swallow detections, particularly Barn Swallow, should be re-visited if a nesting location was not found during transect surveys in 2019. This unfortunately did not occur in 2019 due to time constraints but is the next step in working to conserve swallows and the habitats they require. Barn Swallows typically occur within 200 m of active nest sites

(Turner 1980, Bryant and Turner 1982), but have also been observed within 400 m (Snapp 1976). Nesting structures (e.g., barns, sheds, boxes, road or foot bridges) can often be located by watching swallows enter them from a distance using binoculars. Specific nesting sites for Barn Swallow are often under the overhang of structures or on horizontal beams, posts or light fixtures inside structures.

The location and number of transects surveyed for swallows in the Pemberton area were considered suitable for inventory and monitoring. One additional survey route could be added along Highway 99 between the Industrial Park and Village of Pemberton, including Pemberton Farm Road, to inventory additional suitable habitat that swallows may be using. Completing transects in the morning on days during the weekend was preferred for safety and reduced noise, especially on Highway 99 along the lower Birkenhead River where the road is narrow and well used at other times.

4.4.2 Incidental Sightings

A number of incidental sightings of Barn and other swallow species were received from the public and obtained while conducting other field work. Like the receipt of Great Blue Heron sightings, the Pemberton Community Forum on Facebook was the most valuable, with seven of the eleven incidental sightings of Barn Swallows received through this forum. Many reports of Barn Swallows were from areas most frequented by people, such as the Village of Pemberton and Industrial Park. It is recommended that greater outreach be done to landowners in more rural areas, particularly to landowners and members of the Lil'wat Nation, who are most likely to have suitable habitat for foraging and nesting birds.

The incidental detection of swallow nest sites, particularly nest boxes, was encouraging, as many observed were being used by target species and it is a good indication of landowner interest in helping swallows. The construction of nest boxes for swallows and other passerines is known to be done by one landowner and the Men's Shed, with the latter providing a large number of boxes annually to Pemberton residents during Canada Day celebrations.

If time permits, it would be beneficial to assess swallow activity at known boxes and encourage further box construction and installation. In addition to boxes, Barn Swallows continue to nest in the underground parking lot of the Pemberton Gateway Village Suites Hotel, with caretaker and resident support. This site should be assessed in the future to document annual activity and breeding success.

To increase our overall understanding of the status (e.g., numbers, distribution) of swallows in the Pemberton area and work to conserve their nesting and foraging habitats, the following sighting locations should be surveyed during the core breeding season from May to July:

1. The three general areas outlined in the results section where Barn Swallows were reported by the public.

2. Swallow sighting locations obtained through the annual North American Breeding Bird Survey for the Pemberton area. Route Pem Meadows (11323) has been surveyed since 2016 and just over half of the survey transect is along the Pemberton Meadows Road from Highway 99 to near the North Lillooet Forest Service Road. Tree, Violet-green, Northern Rough-winged and Barn Swallows have all been sighted along the route, with the number of Barn Swallows sighted decreasing substantially since the first year of surveys (i.e., 12 in 2016, 1 in 2017 and 0 in 2018) (Pardieck et al. 2019).

3. eBird sighting locations for the Pemberton area from May to July for the past 10 years (Sullivan et al. 2009).

In general, additional outreach about swallow species, their status and stewardship actions is a critical need for improving their survival and recovery. Reaching out to landowners with known or potential nesting sites and working with them towards stewardship (e.g., nest and structure conservation or enhancement, habitat protection and/or restoration) is of particular importance. This outreach would also hopefully lead to a better understanding the short and long-term status of swallows. To help with outreach and stewardship, a number of beneficial management practices are available for Barn and other swallow species (Link 2005, Ferguson 2014).

4.5 Common Nighthawk

The main goal of surveys for Common Nighthawks in the Pemberton area was accomplished through surveys completed. Data collected will contribute to our understanding of the species population trend (relative abundance) and distribution (e.g., breeding habitat use, range) at the local to national level over time and help identify landscapes that are important for conservation of nightjar populations.

Undertaking surveys in 2019 revealed that former routes had changed, informing where surveys are necessary in the future. Surveys through the Canadian Nightjar Survey Program are recommended to continue annually in the Pemberton area to continue contributing to long-term data collection and understanding. Conducting future surveys, particularly along the Pemberton Meadows Road route, should be done on low traffic nights, such as Sunday or Monday evenings, to minimize vehicle safety risks and noise.

4.6 Outreach

Outreach was an essential component to the success of this project and it took many forms, some of which are highlighted below.

Early discussions and partnership between PWA and SPS enabled critical funding to be sought and obtained for this project, which would not have been possible by the PWA alone. This included substantial support from Patagonia Environmental Grants Fund of Tides Foundation

and the involvement of an intern in many project activities through monies from the Community Foundation of Whistler. Both organizations continued to work collaboratively and played key roles in ongoing project coordination and delivery, particularly administrative and outreach aspects. Fostering more of this collaborative and mutually beneficial relationship in the future is recommended.

Outreach to the community about this project was very important for three main reasons:

- facilitated the recruitment and involvement of volunteers in project activities,
- allowed for the obtainment of important incidental sightings of target species and
- increased public understanding and stewardship of target species.

A core group of volunteers, including an intern from Quest University, were involved and dedicated to project activities; keen on learning about target species and helping undertake project activities, particularly surveys. In essence, this project empowered these citizens to take direct, meaningful and needed hands-on actions to help understand and conserve target species.

The volunteers contributed a substantial number hours to this project, resulting in the collection of a significant amount of new and important data. Some of this data has already supported the conservation of target species and is expected to support stewardship efforts into the future. Having support from these volunteers facilitated greater outreach to other local residents (e.g., neighbours), which in one case led to the detection of the only Great Blue Heron nest site found in 2019 and that has been documented in the Pemberton area.

Pemberton and surrounding communities are small, close knit and active. This was considered very beneficial and was highlighted by the interest people had in this project, especially the desire of the public to learn more about target species, contribute their sightings and spread information about the project (e.g., word of mouth, sharing social media posts). Regular outreach and ongoing communication played a key role in fostering this relationship. Through outreach to the broader community, substantially more knowledge and support was gained for project activities, particularly sightings of the rare species that were the focus of this project.

Additional community support for the project from local businesses and community organizations for outreach was well received and appreciated. The strong connections of the PWA to the community played an important role in project outreach activities, particularly the facilitation of access to a number of private properties where surveys were completed and the strong support and interest the community showed for the two education walks that were provided by the PWA in partnership with SPS.

Education focused on sharing knowledge about the status and ecology of target species and encouraging shared stewardship. Three main ways this was accomplished was:

- through the training and ongoing mentorship of volunteers,
- sharing knowledge with the community through social and print media and holding two successful public walks and
- meetings with the VoP and Lil'wat Nation.

Many relationships were formed and fostered through this project. One that stands out is the involvement of FLRNORD biologists in this project; initially facilitated through early outreach and fostered through ongoing communication. Outreach to FLNRORD biologists greatly furthered support for this project and the conservation of target species through such things as:

- letters of support for funding,
- professional advice/guidance,
- provision of essential equipment (e.g., wireless peeper camera),
- hands-on involvement in project activities and
- continued interest in future collaborations and the stewardship of target species.

It was recognized that this project and the data collected was important to the ability of the government to further species and habitat conservation efforts locally and regionally (e.g., obtain future internal financial support, engage with local governments and other stakeholders, develop field research techniques, start to fill essential knowledge gaps).

Outreach and the involvement of others in this project was key to its success, resulting in many benefits for those involved and helping to greatly increase our understanding and conservation of four bird species at risk in the Pemberton area. Sharing project information and findings and discussing conservation actions with stakeholders interested and involved in managing these species and their habitats was critical.

In the end, it is people that need to work together and take much needed action to help our most vulnerable species survive and recover.

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