Western Screech-owl Inventory and Habitat Stewardship on the Discovery Islands, British Columbia


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List of Acronyms & Terms

ARU	Autonomous Recording Unit
BEC	Biogeoclimatic
CDF	Coastal Douglas-fir
CNN_v3	Convolutional Neural Network Version 3
CPB	Call Playback
CWH	Coastal Western Hemlock
ECCC	Environment and Climate Change Canada
FOCI	Friends of Cortes Island
HSP	Habitat Stewardship Program
PMRA	Pacific Megascops Research Alliance
SM4	Song Meter 4
Station	A specific location along a transect
Study area	Focal area of this study
TEM	Terrestrial Ecosystem Mapping
Transect	A survey route composed of multiple stations
VRI	Vegetation Resources Inventories
WESOke	Western Screech-owl *kennicottii* subspecies
WLRS	Ministry of Water, Lands, and Resource Stewardship
WHR	Wildlife Habitat Ratings

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1 Introduction

Western Screech-owls (*Megascops kennicottii kennicottii*; hereafter 'screech-owl' or 'WESOke') are listed as Threatened under Schedule 1 of the *Species at Risk Act* (SARA) and are provincially blue-listed (Special Concern; B.C. CDC 2023) due to significant population declines (COSEWIC 2012). As per the Recovery Plan (BC MOE 2013), the primary threat to WESOke is habitat loss through urbanization and forest harvesting, road mortality, and competition and predation by Barred owls (*Strix varia*). Screech-owls are sensitive to loss of riparian areas since they often nest in cavities of trees that are adjacent to ponds, wetlands, rivers, and lakes. Common prey species (e.g., insects, amphibians, and small rodents) are also associated with riparian habitats and likewise are negatively impacted by habitat degradation. Therefore, implementing conservation measures for screech-owls is important.

To shed light on population dynamics, habitat use, and raise awareness of screech-owl conservation, the Friends of Cortes Island Society (hereafter 'FOCI') initiated the Western Screech-owl Inventory and Habitat Stewardship Project. FOCI is a charitable organization which has been preserving local ecosystems and providing educational programs for over 25 years. FOCI works to identify environmentally sensitive areas, preserve cultural heritage, monitor and protect wildlife and at-risk ecosystems, and provide community educational programs. Their initiatives are supported by many engaged volunteers. Prior to initiating this project, the following anecdotes were shared with FOCI:

> "*We used to hear many [Western screech-owls]. Say starting around 2000 when we were tuned into noticing. But we feel there were a couple years where we didn't hear any (or at least a lot less). Approx 2020-2022. Then last year we heard them quite a few times again.*" – Sonora Island Resident
>
> "*Yes, we have heard them in the past.*" – Maurelle Island Resident
>
> "*Born and raised on Cortes Island, WESOke were fairly common when I was a child growing up in Whaletown. Soon after the first Barred Owls were*

observed on Cortes Island, late 1970s, the WESOke in my backyard disappeared". – Brigid Weiler (Cortes Island Resident)

In 2021, FOCI received funding from Environment and Climate Change Canada (ECCC) through the Habitat Stewardship Program (HSP) for Species at Risk to engage in Western Screech-owl Inventory and Habitat Stewardship Project on Cortes Island and the surrounding Discovery Islands. The first round of funding supported activities carried out between September 2021 and March 2022, referred to as 'Year 1' in this report, and inventory efforts were focused on Cortes Island only. FOCI was approved for a subsequent round of funding, which supported activities carried out between September 2022 and March 2024, referred to as 'Year 2' in this report, and expanded their study area to include Read, Maurelle, and Sonora Islands. Support throughout this project was provided by local Biologists, dedicated volunteers, and in-kind support from collaborating partners (see above Acknowledgements).

In addition to anecdotal accounts, several historical records of WESOke exist on the Discovery Islands (eFauna 2024; B.C. CDC 2023), however, no formal inventory had been conducted. Therefore, FOCI developed a survey plan in collaboration with the Ministry of Water, Lands, and Resource Stewardship (WLRS) and Pacific Megascops Research Alliance (PMRA) that included a combination of passive acoustic monitoring with Autonomous Recording Units (ARUs) and active call playback (CPB) surveys. ARUs are battery-powered sound recording machines that are programmed to record when owls are most likely to vocalize (e.g., sunset, sunrise). Units can be left at survey stations for multiple nights, thus significantly increasing the likelihood that owls will be detected if present. Recordings are saved on SD cards which are later downloaded for analysis. Using machine learning software, recordings can be efficiently analyzed to determine owl presence. The Convolutional Neural Network software developed by Ruff et al. (2020) not only flags screech-owl detections, but other species too (e.g., Barred owl, Great horned owl [*Bubo virginianus*], Northern pygmy-owl [*Glaucidium gnoma swarthi*], Northern saw-whet owl [*Aegolius acadicus*], Marbled Murrelet [*Brachyramphus marmoratus*], Red squirrel [*Tamiasciurus hudsonicus*], etc.). Non-target species occurrences may be informative for understanding ecosystem dynamics, as well as provide useful data to government databases.

Concurrently, FOCI organized and delivered several education and outreach activities for Discovery Island communities. Presentations by species experts at WLRS and nest box building workshops by FOCI staff were delivered and, subsequently, areas were identified for habitat enhancement via installation of nest boxes. Details of these efforts are documented in this report.

To tie results of inventory surveys to habitat values, FOCI engaged Madrone Environmental Services Ltd. to develop a WESOke Nesting Habitat Model. Terrestrial Ecosystem Mapping (TEM) layers with coverage of the Discovery Island were used to create a Wildlife Habitat Ratings (WHR) model. This model displayed WESOke habitat suitability on the Discovery Islands and could be used to inform locations for additional surveys and/or habitat enhancements, as well as aid in land use planning by the government and stakeholders.

1.1 Objectives

The project objectives support the primary goal to maintain and enhance WESOke populations and their habitats on the Discovery Islands. Specific project objectives were as follows:

1) To determine the distribution and relative abundance of Western Screech-owls on Cortes and neighbouring Islands through surveys, and passive acoustic monitoring.
2) To assess habitat suitability and occupancy of different habitat types for Western Screech-owls to direct efforts for habitat stewardship, protection and improvement.
3) To provide data to the BC Conservation Data Centre and project partners at the BC Ministry of Forests, Lands, Natural Resources Operations and Rural Development, the Pacific Megascops Research Alliance to aid research in identification of important breeding habitats for protection and recovery of the species.
4) To utilize the monitoring program to record other species including species at risk or of conservation concern, during surveys for Western Screech-owls to improve knowledge of species associations and species of conservation interest.
5) To protect and enhance habitat for Western Screech-owls through landowner liaison and stewardship activities.
6) To raise awareness of Western Screech-owls and engage the community in citizen science monitoring and stewardship activities.
7) To build the capacity for the development on Western Screech owl inventory and stewardship activities on neighbouring Discovery Islands, through participation of island representatives in project training, workshops, and data collection.

1.2 Species Account

Western screech-owls *kennicottii* subspecies (*Megascops kennicottii kennicottii*) are riparian-dependent, secondary cavity nesters that rely on wildlife trees adjacent to streams, wetlands, lakes, and rivers for reproduction. They are a small grey-brown owl with yellow eyes and tufted ears. Adults range from 19 to 25.5 cm in total length and 100 to 305 g, with females being slightly larger than males (Cannings and Angell 2001). The primary song consists of a series of short, whistled hoots (notes) more closely spaced at the end of the series that is similar to a 'ball bouncing more and more rapidly over a frozen surface' (Johnsgard 1988, Tripp 2004). This nocturnal raptor is opportunistic with food sources, preying on mammals, fish, insects, invertebrates, and other birds.

Western screech-owls use a variety of habitats for roosting and nesting including mature and old forests (80 – 250 yrs), dense to open young (50 – 60 yrs) open Douglas-fir (*Pseudotsuga menziesii*) forests, black cottonwood (*Populus trichocarpa*), and woodlands bordering marshes, ponds, wet areas or fields (MOE 2013). They prefer habitat with moderate ground cover, low understory, and relatively open canopy cover (25 – 50%) (MOE 2013).

In B.C., nests are usually found in cavities 1.2 – 12.2 m up a tree, which occur below 600 m in elevation (Campbell et.al. 1990). Favored nesting cavities/holes include Pileated Woodpecker (*Dryocopus pileatus*) and Northern Flicker (*Colaptes auratus*) cavities in Douglas-fir, western redcedar (*Thuja plicata*), bigleaf maple (*Acer macrophyllum*), arbutus (*Arbutus menziesii*), grand fir (*Abies grandis*), red alder (*Alnus rubra*), Garry oak (*Quercus garryana*) and western hemlock (*Tsuga heterophylla*) (Campbell et al 1990, Hobbs and Darling, pers. comm. 2001 as cited in COSEWIC 2002).

Western screech-owls are socially monogamous, and they begin their courtship activities in the winter months (February – April, possibly earlier). Nesting typically begins in April – May; the female will lay two to seven eggs and will incubate eggs for 26 – 34 days (COSEWIC 2012). Eggs will hatch late-May to Mid-June, at which point the male will capture food and the female will stay with the young. Juveniles disperse in late summer, approximately 60 days after fledgling (COSEWIC 2012).

1.3 Study Area

The Discovery Islands (Figure 1) are situated northeast of Campbell River between the northern reach of the Strait of Georgia and the southern reach of the Johnstone Strait. The archipelago is within the Coastal Western Hemlock (CWH) biogeoclimatic (BEC) zone. The CWH zone occurs from low to mid elevation, extending to 900 m on windward slopes and

1,050 m on leeward slopes, along the majority of coastal BC (Pojar et.al. 1991). This zone receives higher annual rainfall than any of the other thirteen BEC zones, with precipitation from 1,000 to 4,400 mm/year (mean annual precipitation is 2,228 mm). Mild winters and cool summers, with frequent dry, hot spells, are typical in the CWH zone (Pojar et.al. 1991).

Various subzones of the CWH BEC zone can be found in this study area and vary by gradients of precipitation. Coastal Western Hemlock Very Dry Maritime Eastern variant (CWHxm1) can be found on the majority of Cortes Island and the southern tip of Read Island. This subzone is found at lower elevations and is characterized by dry, warm summers, and moist, mild winters. Coastal Western Hemlock Very Dry Maritime Western variant (CWHxm2) can be found on the majority of Read Island, and all but the highest elevations of Maurelle and Sonora Island. Coastal Western Hemlock Submontane Moist Maritime (CWHmm1) can be found at higher elevations on Maurelle and Sonora Island and is characteristically wetter than the xm1 and xm2 variants. Coastal Western Hemlock Dry Maritime (CWHdm) can be found on the northern tip of Cortes Island.

Study Area
Provincial Parks
Regional Parks
BC Community

Biogeoclamatic Zones

CMAunp
CWHdm
CWHmm1
CWHvm1
CWHvm2
CWHxm1
CWHxm2
MHmm1

0 3 6 9 Km

1:220,000

N

All feature positions as shown are approximate

2 Methods

2.1 Call Playback Survey

Call playback (CPB) surveys were conducted in both years of the study along transects that consisted of four to seven stations spaced a minimum of 800 m apart. Transect design was determined in consultation with PMRA and WLRS. Surveys were conducted at night when WESOke are most active (Hausleitner 2006). Each transect was surveyed three times (Hausleitner 2006).

At each station, a male territorial call was broadcasted from a FoxPro Inferno© game call unit in four cardinal directions. Calls played for one minute every four minutes for a total duration of 17 minutes per station (see PMRA protocols). Responses from other species of interest were noted. Surveys were carried out by two field biologists assisted by volunteers.

2.2 ARU Deployment & Sound Analysis

In Year 1, ARU units were Song Meter 4 (SM4) models by Wildlife Acoustics©. The SM4 has two microphones parallel to the ground (Figure 2) and has an estimated listening radius of 200 – 300 m (unpubl. data R. Chicalo). In Year 2, Song Meter Minis (SM-mini) by Wildlife Acoustics were used. The SM-mini has one microphone parallel to the ground (Figure 3) and has an estimated listening radius of 150 – 200 m (unpubl. data R. Chicalo). Deployment locations were determined by reviewing provincial satellite imagery layers and establishing a stratified (by habitat type) sample design with support from PMRA and MWLRS.

Figure 2. Song Meter SM4 Autonomous Recording Unit (ARU) by Wildlife Acoustics.

Figure 3: Song Meter Mini Autonomous Recording Unit (ARU) by Wildlife Acoustics.

To prepare ARUs for deployment, units were set to time zone UTC-8, and programmed to record for 3 minutes on and 12 minutes off, starting one hour before sunset until one hour after sunrise. This schedule records for approximately 14 hours per night, depending on the date of deployment. To increase the likelihood that a given ARU would detect an owl if it was present, most units were deployed for four weeks (note in Year 2, two transects were deployed for only two weeks).

ARUs were secured to trees smaller than 10 centimeters in diameter approximately 1.5 meters above the ground (Figure 4).

Upon retrieval, sound recordings (.wav files) were downloaded and backed up onto hard drives. In Year 1, wav files were analyzed using PMRA analysis protocols.

Figure 4. Two volunteers installing an ARU on Sonora Island, Diamond Bay.

In Year 2, recordings were analyzed using the Convolutional Neural Network Version 3 (CNN_v3) in R Studio. CNNv3 is a machine-learning recognizers developed by the U.S. Fish and Wildlife to detect critically endangered Spotted Owls (*Strix occidentalis*), as well as other species (WESOke, Marbled Murrelet, Northern Pygmy-owl, etc.) in the Pacific Northwest (Ruff et al. 2020). For Discovery Island sound recordings, the confidence match threshold of the CNN_v3 recognizer was set at a 50% confidence match. Matches for species of interest were then manually reviewed in Kaleidoscope Lite by Wildlife Acoustics to confirm detections. In addition to WESOke, the following species of interest were reviewed for presence/absence:

- Northern Saw-whet Owl
- Marbled Murrelet; SAR
- Great Horned Owl
- Northern Pygmy-owl; SAR
- Pileated Woodpecker (*Dryocopus pileatus*)
- Barred Owl

2.3 Nesting Habitat Model

Three publicly available Terrestrial Ecosystem Mapping (TEM) layers (BAPID 4299, 4301, 6423) were accessed on January 28th, 2024, to create a comprehensive TEM base for the study area (Figure 5A). The total study area encompassed 41,151.90 hectares, with TEM

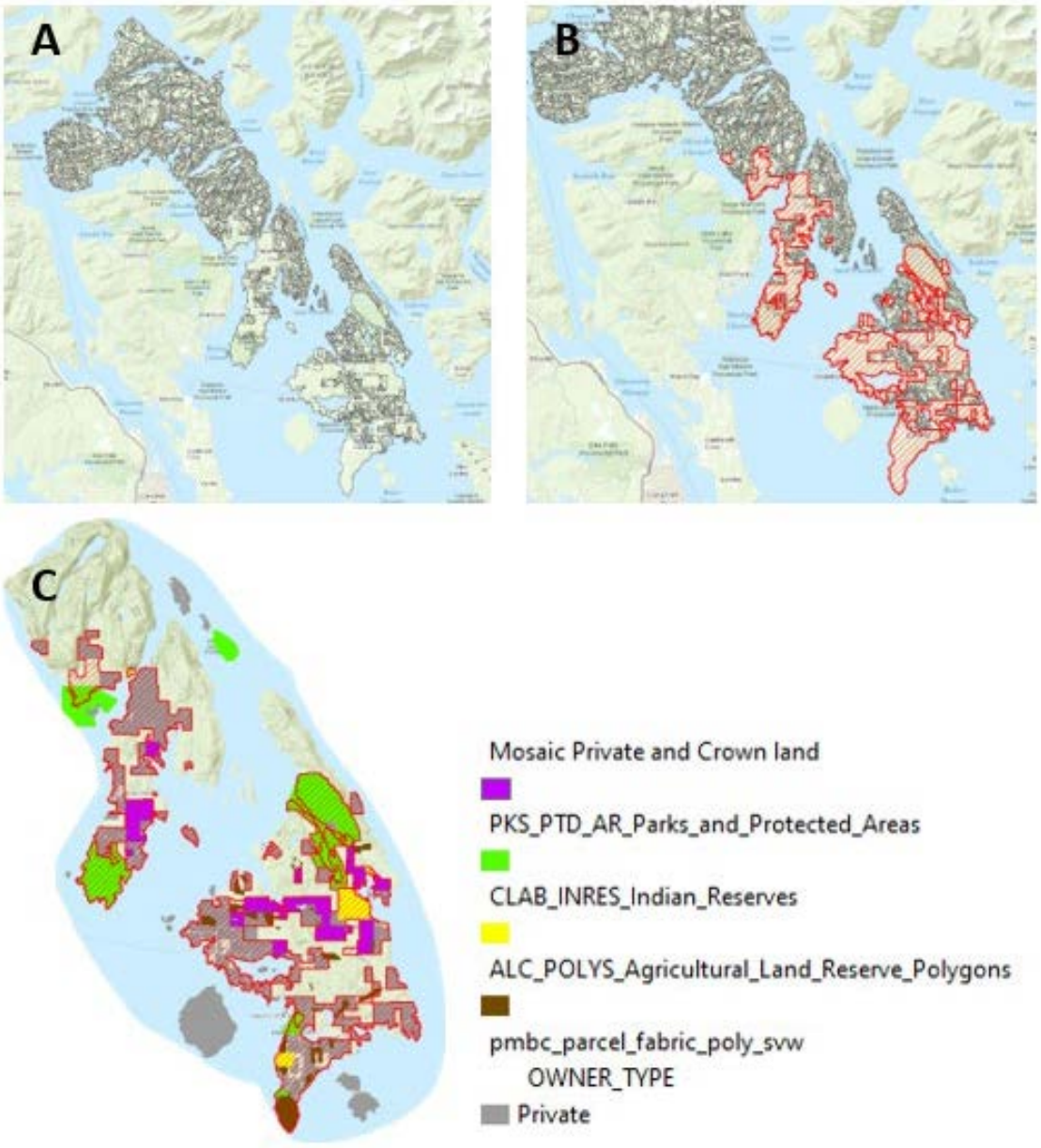


Figure 5: Western screech-owl nesting habitat model development. A) Terrestrial Ecosystem Mapping layer coverage of study area from three BAPIDS (4299, 4301, 6423); B) Gaps in ecosystem information (red cross-hatched); C) Land ownership types as they relate to gaps in ecosystem information.

coverage extending to 41,120.6 hectares (99.9% coverage). However, a specific portion of the area revealed missing ecosystem information (Figure 5B), notably biogeoclimatic and map code data that are required as model inputs. Gaps in ecosystem data were part of BAPID 4301 and comprised 30 polygons overlapping with agricultural land reserve and private lands – including private forestry (Figure 5C), totaling 10,391.1 hectares (mostly on Cortes and Read Island). Therefore, the effective area that could be modeled for WESOke habitat was 74.7% of the study area.

Since TEM layers were initially created in 2008 and reflect forest ages found at that time, structural stage was updated using 2023's Vegetation Resource Inventory (VRI) layer which projects forest age as of December 2022. The linework of TEM and VRI are not always aligned, so a majority overlap tool was used in GIS. Therefore, there may be some instances of mis-alignment when viewing the model against current imagery.

Using the TEM base, a Wildlife Habitat Ratings (WHR) habitat model was created to predict habitat suitability for nesting habitat of WESOke. BC's WHR standards were followed (RIC 1999), and ecosystems were rated such that polygons composed of older, wet and rich forests were rated higher than polygons composed of younger, drier upland forests. Suitability and capability models were created, using a 6-class rating system from 'Nil' (class 6) to 'High' (class 1).

2.4 Nest Box Deployment

Nest boxes were assembled by FOCI and volunteers at nest box building workshops, with box measurements following guidelines provided in Appendix A. FOCI consulted with MWLRS to identify suitable nest box deployment locations and to discuss the specifications of installment (i.e. nest box height and spacing between nest boxes).

Many nest box locations fell on private land, at which point FOCI approached landowners and asked permission to install nest boxes on their property. Given adequate permission, landowners were invited to join FOCI and consult on nest box locations on their property that would see the least amount of human disturbance. FOCI field technicians provided education on WESOke habitat requirements, threats, and behaviours to the landowners. Nest box locations were uploaded to the Birds Canada WESO Nestbox Monitoring Project.

Two inches of wood shavings were placed in the nest box and boxes were mounted 10 ft up in trees with a screwdriver and screws. To adhere to safety protocols, one technician/volunteer installed the box while the other stabilized the ladder.

2.5 Outreach and Education

Friends of Cortes Island Society engaged the community through various initiatives. Educational presentations and nest box building workshops were conducted to involve volunteers and members of the public with WESOke conservation on the Discovery Islands.

3 Survey Results

3.1 Call Playback Surveys

3.1.1 Year 1

CPB surveys were conducted on Cortes Island along five transects (Figure 6) by Sabina Leader Mense and Autumn Barrett-Morgan in February and March of 2022. Each transect was surveyed three times, for a total of 84 CPB broadcasts. No WESOke detections were made in 2022 (see complete data tables in Appendix B). Positive responses from non-target species are summarized in Table 1.

Barred owls were detected nine times, and a Northern saw-whet owl was detected once. Nutshell Lake – Larsen's Meadow had an unclassified detection which was "similar to an owl bark", though a species identification could not be made.

3.1.2 Year 2

CPB surveys were conducted on Cortes Island along five transects (Figure 7) by Sabina Leader Mense and Autumn Barrett-Morgan in February and March 2023. Each transect was surveyed three times, for a total of 93 CPB broadcasts.

Multiple positive WESOke detections were made in Year 2, and all occurred on Cortes' Bullock Bluff transect number 6 (Table 2, Figure 7).

- On February 18th, 2023, a WESOke was detected from CPB station MKDI-06-P02. This detection was approximately 200 meters away at a bearing of 360°.
- On March 18th, 2023, a WESOke was detected from CPB station MKDI-06-P05. This detection was 1,852 meters away at a bearing of 270°. This response came from across the channel on Read Island.
- On March 18th, 2023, a WESOke was detected from CPB station MKDI-06-P06. This detection was approximately 400 meters away at a bearing of 45°.

No additional WESOke detections were made at CPB stations (see complete data tables in Appendix B). Positive responses from non-target species are also summarized in

Table 2. Of note, Barred owls were detected nine times, Northern saw-whet owls were detected 3 times, Northern pygmy owls were detected four times, and a bald eagle was detected once. An observation of a wolf pack was made at station MKDI-04-P05, Carrington Rd-Bluejay Lake, on February 27th, 2023.

Table 1. Summary of 2022 CPB results from stations with positive detections of WESOke or non-target species. 'WESOke'= Western screech-owl, 'BDOW'= Barred owl, 'NSWO' = Northern saw-whet owl, 'NPOW' = Northern Pygmy-owl, 'BAEA'= Bald eagle. Note that the naming scheme of points follow PMRA's guidance: 'MK' = Megascops kennicottii, 'DI' = Discovery Islands, followed by two digits indicating transect number, then 'P' = 'Call playback', and lastly two digits representing station number.

Title	Transect Number	Station Number	Date Surveyed	Transect Name	Observers	WESO (Y/N)	BDOW (Y/N)	NSWO (Y/N)	NPOW (Y/N)	BAEA (Y/N)	Notes
MKDI-03-P02	03	002	24-Feb-22	Carrington Bay - Carrington Lagoon	SLM, DCM	N	**Y**	N	N	N	
MKDI-03-P04	03	004	24-Feb-22	Carrington Bay - Carrington Lagoon	SLM, DCM	N	**Y**	N	N	N	
MKDI-03-P06	03	006	24-Feb-22	Carrington Bay - Carrington Lagoon	SLM, DCM	N	**Y**	N	N	N	
MKDI-03-P06	03	006	09-Mar-22	Carrington Bay - Carrington Lagoon	SLM, DCM	N	**Y**	N	N	N	
MKDI-04-P04	04	004	18-Feb-22	Carrington Bay Road - Blue Jay Lake	SLM, ABM	N	**Y**	N	N	N	
MKDI-04-P05	04	005	18-Feb-22	Carrington Bay Road - Blue Jay Lake	SLM, ABM	N	**Y**	N	N	N	
MKDI-04-P01	04	001	19-Mar-22	Carrington Bay Road - Blue Jay Lake	SLM, ABM, HH	N	N	**Y**	N	N	
MKDI-01-P06	01	006	24-Mar-22	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	**Y**	N	N	N	
MKDI-05-P06	05	006	25-Feb-22	Nutshell Lake -Larson's Meadow	SLM, ABM	N	N	N	N	N	Unidentified call; similar to owl "bark"
MKDI-02-P02	02	002	08-Mar-22	Quartz Bay - Cork Lake	SLM, DCM	N	**Y**	N	N	N	
MKDI-02-P03	02	003	23-Mar-22	Quartz Bay - Cork Lake	SLM, DCM	N	**Y**	N	N	N	

Table 2. Summary of 2023 CPB results from stations with positive detections of WESOke or non-target species. 'WESOke'= Western screech-owl, 'BDOW'= Barred owl, 'NSWO' = Northern saw-whet owl, 'NPOW' = Northern Pygmy-owl, 'BAEA'= Bald eagle. Note that the naming scheme of points follow PMRA's guidance: 'MK' = Megascops kennicottii, 'DI' = Discovery Islands, followed by two digits indicating transect number, then 'P' = 'Call playback', and lastly two digits representing station number.

Title	Transect Number	Station Number	Date Surveyed	Transect Name	Observers	WESOke (Y/N)	BDOW (Y/N)	NSWO (Y/N)	NPOW (Y/N)	BAEA (Y/N)	Notes
MKDI-04-P04	04	P04	14-Feb-23	Carrington Rd-Bluejay Lake	SLM, ABM	N	N	**Y**	N	N	
MKDI-04-P05	04	P05	27-Feb-23	Carrington Rd-Bluejay Lake	SLM, ABM, CAR	N	N	N	N	N	Wolf pack observation
MKDI-04-P05	04	P05	15-Mar-23	Carrington Rd-Bluejay Lake	SLM, JBA	N	**Y**	N	N	N	
MKDI-01-P05	01	P05	17-Feb-23	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	**Y**	N	N	N	
MKDI-01-P01	01	P01	05-Mar-23	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	**Y**	N		N	
MKDI-01-P03	01	P03	05-Mar-23	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	**Y**	N	
MKDI-01-P05	01	P05	05-Mar-23	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	**Y**	N	
MKDI-01-P06	01	P06	05-Mar-23	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	**Y**	**Y**	
MKDI-01-P02	01	P02	19-Mar-23	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	**Y**	N	N	
MKDI-08-P05	08	P05	02-Mar-23	Kwas-Cowan Meadow	SLM, JBA	N	**Y**	N	N	N	
MKDI-08-P06	08	P06	02-Mar-23	Kwas-Cowan Meadow	SLM, JBA	N	N	N	**Y**	N	
MKDI-08-P07	08	P07	02-Mar-23	Kwas-Cowan Meadow	SLM, JBA	N	**Y**	N	N	N	
MKDI-08-P02	08	P02	17-Mar-23	Kwas-Cowan Meadow	SLM, ABM	N	**Y**	N	N	N	
MKDI-06-P02	06	P02	18-Feb-23	Bullock Bluff	SLM, DCM	**Y**	N	N	N	N	WESO 200m @ 360°
MKDI-06-P05	06	P05	18-Mar-23	Bullock Bluff	SLM, DCM	**Y**	N	N	N	N	WESO 1,852m @ 270°
MKDI-06-P06	06	P06	18-Mar-23	Bullock Bluff	SLM, DCM	**Y**	N	N	N	N	WESO 400m @ 45°
MKDI-07-P02	07	P02	16-Feb-23	Stitchville - Ha'thayim	SLM, ABM	N	**Y**	N	N	N	
MKDI-07-P02	07	P02	28-Feb-23	Stitchville - Ha'thayim	SLM, ABM, FJS	N	N	**Y**	N	N	
MKDI-07-P01	07	P01	16-Mar-23	Stitchville - Ha'thayim	SLM, ABM, CAR	N	**Y**	N	N	N	
MKDI-07-P04	07	P04	16-Mar-23	Stitchville - Ha'thayim	SLM, ABM, CAR	N	**Y**	N	N	N	

3.2 ARU Surveys

3.2.1 Year 1

Eight ARUs were deployed on Cortes Island between February and April 2022 and retrieved a month later (Figure 6). Detection results are summarized in Table 3. All ARUs were deployed on Cortes Island during 2022 and no WESOke detections were recorded.

However, Barred owls were detected at all 8 stations; Northern pygmy-owls were detected at 5 stations; Great horned owls were detected at 2 stations; and Northern saw-whet owls, Northern flickers and Band-tailed pigeons were each detected once.

3.2.2 Year 2

Thirty-two SM Mini ARUs were deployed between February and April 2023, and retrieved between two weeks and a month later (Figures 7, 8, 9, and 10). Detection results are summarized in Table 4. ARUs were deployed on Cortes, Read, Maurelle and Sonora Islands during 2023 and no WESOke detections were recorded.

Barred owls were detected at 24 stations; Pileated woodpeckers were detected at 28 stations; Northern pygmy-owls were detected at 18 stations; Northern saw-whet owls were detected at 16 stations; Marbled murrelets were detected at 3 stations; and Great horned owls were not detected at any stations.

3.3 Nesting Habitat Model

As per WHR standards, the *capability* model (Figures 7, 8, 9, and 10) displays habitat conditions for WESOke if ecosystems were able to reach their climax successional stage. Therefore, the capability model *does not* consider current landscape disturbances and instead provides an indication of the 'potential' or 'capability' of a particular area. To contrast, the *suitability* model (Figures 7, 8, 9, and 10) displays habitat ratings given current conditions (i.e., 2022 conditions as per VRI 2023) and therefore accounts for landscape disturbances (e.g., harvesting and fire) and long-term ecosystem conversions (e.g., forests to lawn). For example, in most cases, a general area will have lower suitability vs. capability due to land disturbances that alter structural stage of forests.

Currently, the majority of the study area is composed of moderately suitable habitat for nesting WESOke (rating of 3; Figures 7, 8, 9, and 10). Relatively small pockets of highly rated habitat (rating of 1 or 2) are found in river and creek valleys and adjacent to waterbodies.

Table 3. Summary of 2022 ARU survey results for Cortes Island from stations with positive detections of WESOke or non-target species. Results presented here were obtained from PMRA analysis of recordings. 'NSWO' = Northern saw-whet owl, 'MAMU' = Marbled Murrelet, 'GHOW' = Great horned owl, 'NPOW' = Northern Pygmy-owl, 'PIWO' = Pileated woodpecker, 'BDOW' = Barred owl, 'NOFL' = Northern flicker, 'BTPI' = Band-tailed pigeon.

Transect Number	Station Number	Station Name	Date installed	Date removed	WESOke (Y/N)	NSWO (Y/N)	MAMU (Y/N)	GHOW (Y/N)	NPOW (Y/N)	PIWO (Y/N)	BDOW (Y/N)	NOFL (Y/N)	BTPI (Y/N)
01	01	Wiley Lake South	23-Feb-22	24-Mar-22	N	Y	N	N	Y	N	Y	N	N
01	02	Robertson Lake South	23-Feb-22	24-Mar-22	N	N	N	N	Y	N	Y	N	N
01	03	Robertson Lake Bluff	22-Feb-22	24-Mar-22	N	N	N	N	N	N	Y	N	N
01	04	Robertson Cove	22-Feb-22	24-Mar-22	N	N	N	N	Y	N	Y	N	N
01	05	Swamps edge	28-Mar-22	04-May-22	N	N	N	Y	N	N	Y	N	N
01	06	Channel Rock	31-Mar-22	06-May-22	N	N	N	N	N	N	Y	N	N
01	07	Delight Lake South	09-Apr-22	06-May-22	N	N	N	N	Y	N	Y	N	N
01	08	Delight Lake North	09-Apr-22	06-May-22	N	N	N	Y	Y	N	Y	Y	Y

Table 4: Summary of 2023 ARU survey results for Cortes, Read, Maurelle, and Sonora Islands. Results presented here were obtained from CNNv3 analysis of recordings. 'NSWO' = Northern saw-whet owl, 'MAMU' = Marbled Murrelet, 'GHOW' = Great horned owl, 'NPOW' = Northern Pygmy-owl, 'PIWO' = Pileated woodpecker, 'BDOW' = Barred owl.

Island	Transect Number	Station Number	Date installed	Date removed	Station Name	WESOke (Y/N)	NSWO (Y/N)	MAMU (Y/N)	GHOW (Y/N)	NPOW (Y/N)	PIWO (Y/N)	BDOW (Y/N)
Cortes	04	09	19-Feb-23	18-Mar-23	Northern Peninsula10	N	Y	N	N	Y	Y	N
Cortes	04	10	19-Feb-23	18-Mar-23	Northern Peninsula11	N	Y	N	N	Y	Y	Y
Cortes	04	11	19-Feb-23	19-Mar-23	Northern Peninsula12	N	N	N	N	Y	Y	N
Cortes	04	12	19-Feb-23	19-Mar-23	Northern Peninsula13	N	Y	N	N	Y	Y	N
Cortes	04	13	19-Feb-23	20-Mar-23	Northern Peninsula14	N	N	N	N	Y	Y	Y
Cortes	05	14	23-Mar-23	07-Apr-23	Basil/Sutil OG11	N	Y	N	N	Y	Y	Y
Cortes	05	15	23-Mar-23	07-Apr-23	Basil/Sutil OG12	N	N	N	N	N	Y	Y
Cortes	05	16	24-Mar-23	07-Apr-23	Basil/Sutil OG13	N	N	Y	N	Y	Y	N
Cortes	05	17	25-Mar-23	07-Apr-23	Basil/Sutil OG14	N	Y	N	N	N	Y	Y
Cortes	06	18	14-Apr-23	30-Apr-23	Gorge Peninsulae10	N	N	N	N	N	Y	N
Cortes	06	19	13-Apr-23	30-Apr-23	Gorge Peninsulae11	N	Y	N	N	N	Y	Y

Island	Transect Number	Station Number	Date installed	Date removed	Station Name	WESOke (Y/N)	NSWO (Y/N)	MAMU (Y/N)	GHOW (Y/N)	NPOW (Y/N)	PIWO (Y/N)	BDOW (Y/N)
Cortes	06	20	13-Apr-23	30-Apr-23	Gorge Peninsulae12	N	N	N	N	N	Y	Y
Cortes	06	21	12-Apr-23	30-Apr-23	Gorge Peninsulae13	N	N	N	N	N	Y	Y
Cortes	06	22	12-Apr-23	30-Apr-23	Gorge Peninsulae14	N	N	Y	N	N	Y	Y
Read	07	23	16-Feb-23	16-Mar-23	Read Island/Bird Cove Creek1	N	Y	N	N	Y	Y	Y
Read	07	24	16-Feb-23	16-Mar-23	Read Island/Bird Cove Creek2	N	Y	N	N	N	Y	Y
Read	07	25	16-Feb-23	16-Mar-23	Read Island/Bird Cove Creek3	N	Y	N	N	Y	Y	Y
Read	08	26	16-Mar-23	17-Apr-23	Read Island/Rosen Lake1	N	N	N	N	Y	Y	Y
Read	08	27	16-Mar-23	17-Apr-23	Read Island/Rosen Lake2	N	Y	N	N	N	Y	Y
Read	08	28	16-Mar-23	17-Apr-23	Read Island/Rosen Lake3	N	N	N	N	N	N	N
Maurelle	09	29	17-Feb-23	17-Mar-23	Maurelle Island/Port Maurelle4	N	Y	N	N	Y	Y	Y
Maurelle	09	30	17-Feb-23	17-Mar-23	Maurelle Island/Port Maurelle5	N	Y	N	N	Y	Y	Y
Maurelle	09	31	17-Feb-23	17-Mar-23	Maurelle Island/Port Maurelle6	N	Y	N	N	Y	N	N
Maurelle	10	32	19-Mar-23	18-Apr-23	Maurelle Island/Elephant Lake4	N	Y	N	N	Y	Y	Y
Maurelle	10	33	19-Mar-23	18-Apr-23	Maurelle Island/Elephant Lake5	N	Y	Y	N	Y	Y	Y
Maurelle	10	34	19-Mar-23	18-Apr-23	Maurelle Island/Elephant Lake6	N	N	N	N	Y	N	Y
Sonora	11	35	13-Feb-23	18-Mar-23	Sonora Island/Diamond Bay7	N	Y	Y	N	Y	Y	Y
Sonora	11	36	13-Feb-23	18-Mar-23	Sonora Island/Diamond Bay8	N	N	N	N	Y	Y	Y
Sonora	11	37	13-Feb-23	18-Mar-23	Sonora Island/Diamond Bay9	N	Y	N	N	Y	Y	Y
Sonora	12	38	18-Mar-23	19-Apr-23	Sonora Island/Dorr Lake7	N	N	N	N	N	N	N
Sonora	12	39	18-Mar-23	19-Apr-23	Sonora Island/Dorr Lake8	N	Y	N	N	Y	Y	Y
Sonora	12	40	18-Mar-23	19-Apr-23	Sonora Island/Dorr Lake9	N	N	N	N	Y	Y	Y

3.4 Nest Box Deployment

In Year 2, nest boxes were installed on Cortes, Read, Sonora, and Maurelle Island by FOCI, volunteers, and landowners. Deployments occurred between November 2023 and February 2024. A total of 23 nest boxes were installed for habitat enhancement (Table 5 and Figures 7-10).

On Cortes, six landowners were approached and granted FOCI permission to put nest boxes on their property, including: Cortes Forestry General Partnership, Mosaic Forest Management, Strathcona Regional District, Blue Jay Lake Farm (Private Landowner), Channel Rock (Private Landholding), and Miranda Cross (Private Landowner). Seven volunteers participated in the installment of nest boxes, and often the landowners joined to help. Upon installment of nest boxes, landowners were asked to check the boxes in the spring for signs of activity.

On Read, Maurelle, and Sonora Island, nest boxes were installed by local community members. Nest boxes were primarily installed on Crown Land, though two were put on private landholdings. Community members have agreed to check nest boxes for activity in the springtime.

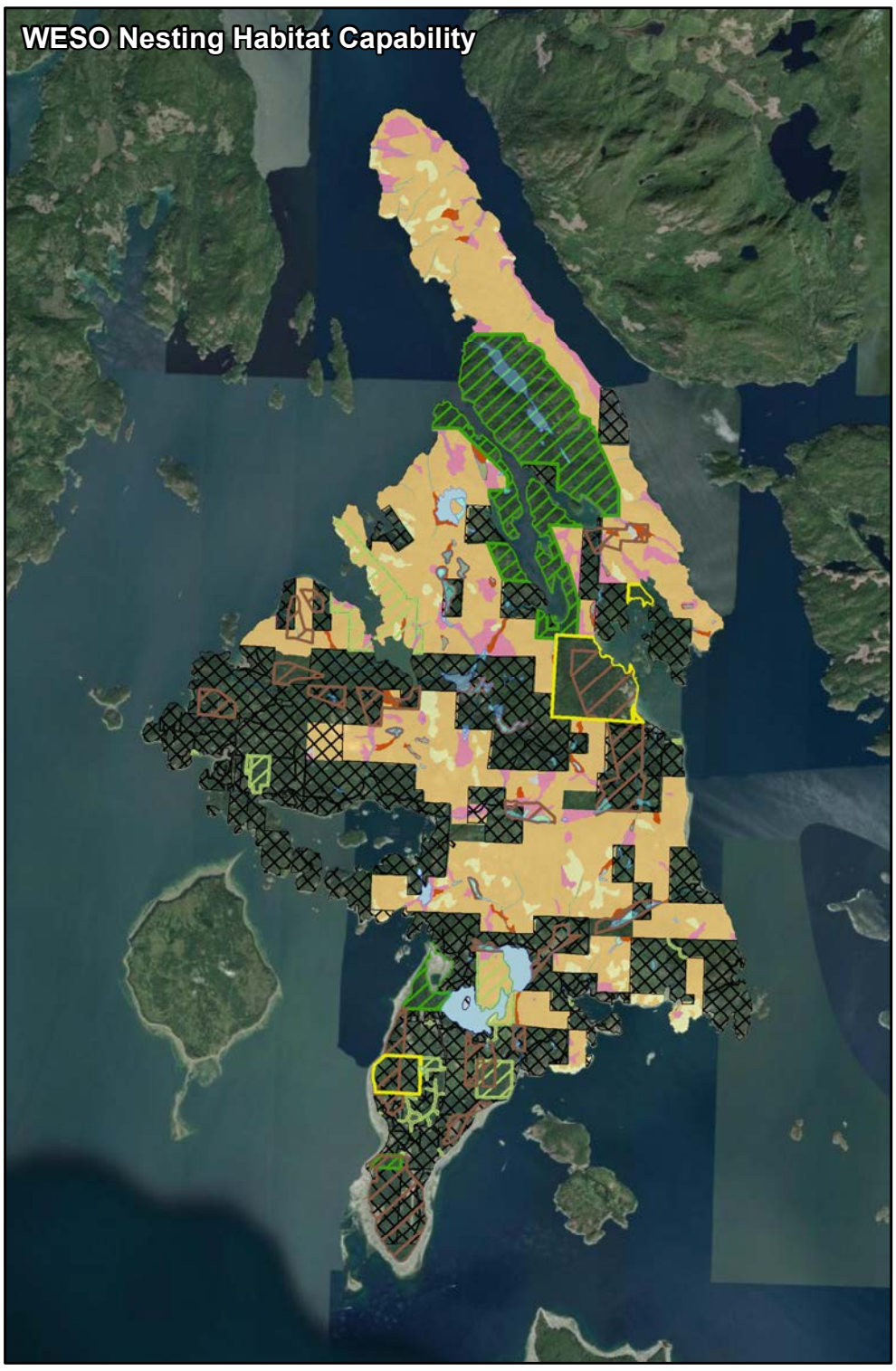
Table 5. 2023 nest box deployment locations and notes.

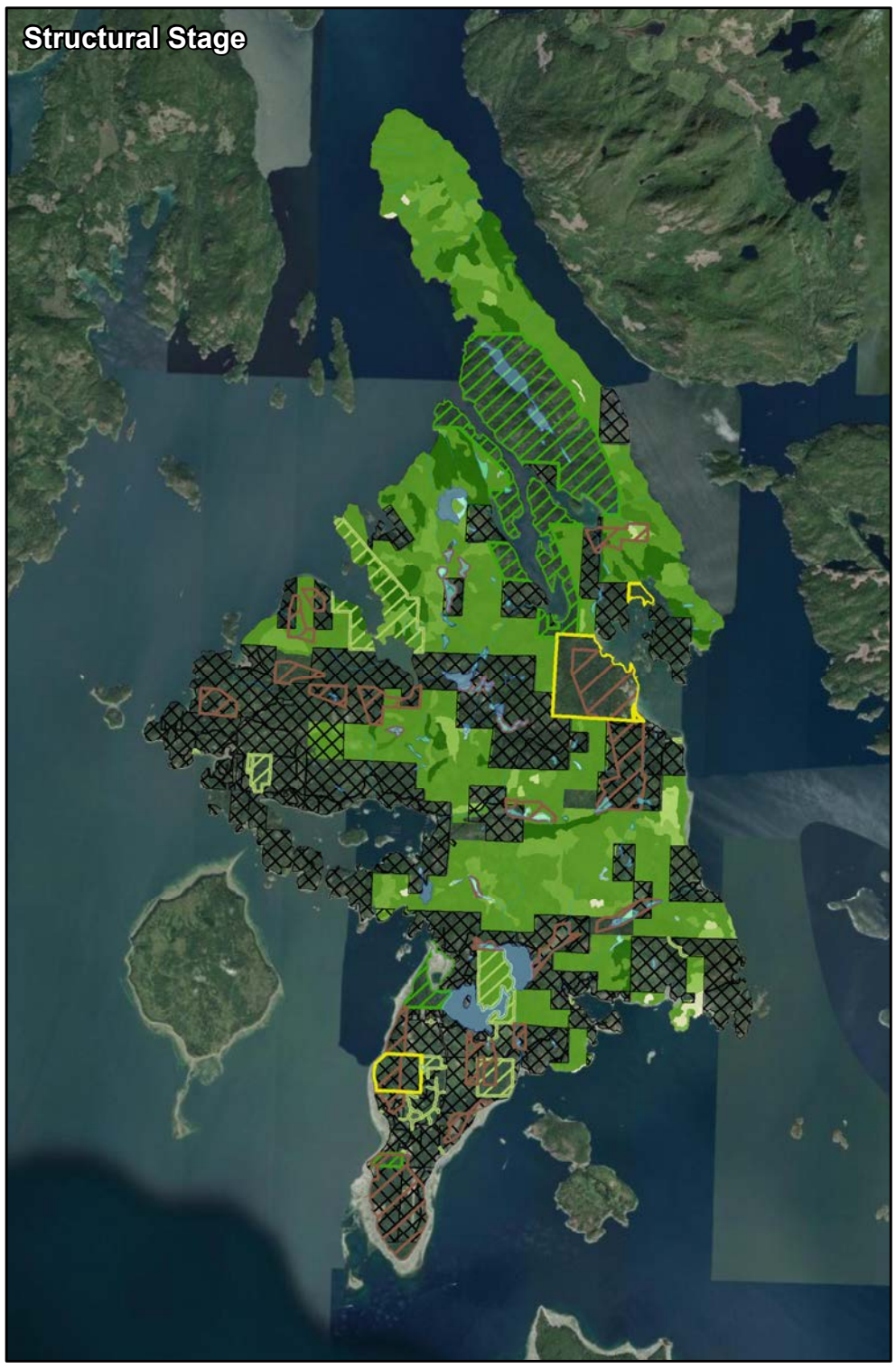
Island	Location Name	Date Installed	Notes
Cortes	Childrens Forest1	27-Nov-23	On fir up the east side of the trail on the hill. Above James creek ravine
Cortes	Childrens Forest2	27-Nov-23	In grandmother grove by James creek and Carrington Lagoon
Cortes	Childrens Forest3	27-Nov-23	Up on the hill of Sam's trail
Cortes	Carrington 4	27-Nov-23	Up from shore on a big cedar tree
Cortes	Sutil 5	27-Nov-23	Large cedar on the Steve Musial trail off to the left above the cliff
Cortes	Kwas 6	06-Jan-24	On large cedar by the channel between the lakes
Cortes	Kwas 7	06-Jan-24	By big fir on a cedar tree
Cortes	ChannelRock 8	05-Jan-24	Up behind the wells of channel rock on a large cedar
Cortes	ChannelRock9	05-Jan-24	Cedar behind channel rock trails
Cortes	Nutshell Lake 10	11-Jan-24	North end of Nutshell Lake near the spillway
Cortes	BluejayLake 11	11-Jan-24	North end of Bluejay lake on cedar
Cortes	Delight Lake12	11-Jan-24	Past Elijah's place, mouth of field-wetland up the valley on a cedar, east side of lake
Cortes	Anvil Lake13	10-Jan-24	To the right off the trail to the lake. On cedar. Some old trees, near stream
Cortes	Beaverdam14	07-Feb-24	On large cedar beside beaver-maintained wetlands
Read	Box 1	23-Feb-23	Second growth forest near to wetland and creek
Read	Box 2	23-Feb-23	Second growth forest near to wetland and creek
Read	Box 3	23-Feb-24	Second growth forest near to wetland

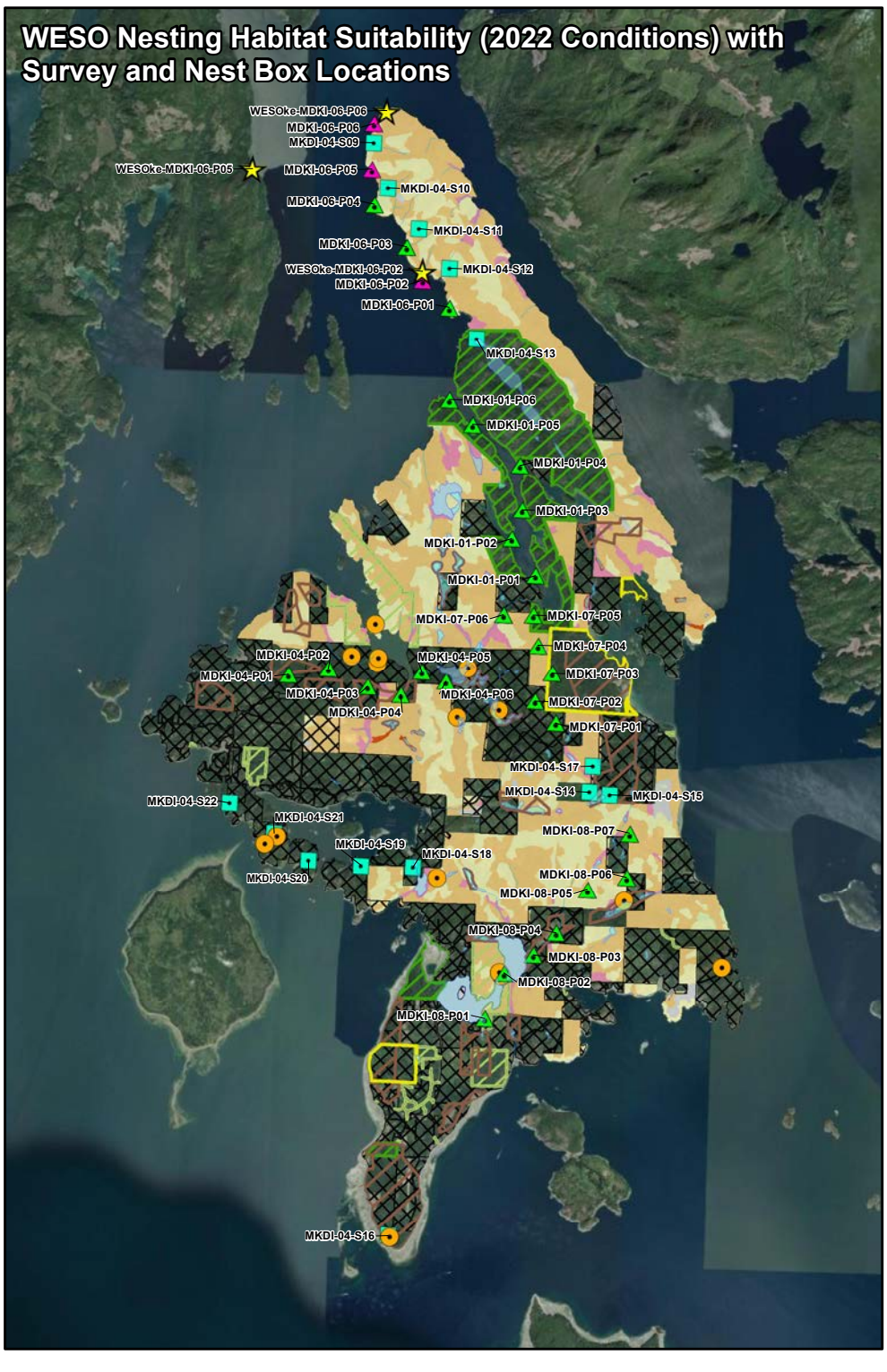
Island	Location Name	Date Installed	Notes
Maurelle	Box 1: Stonecrop Seafarm Coop, Port Maurelle	08-Nov-23	Box located younger second growth. Located on Stonecrop Seafarm Coop holdings, Port Maurelle. Mature second growth forest with some standing old growth trees within 1 km to the east and west of the Stonecrop holdings. WESO detections here in 2022-23
Maurelle	Box 2: N Maurelle Lake Outlet 1	08-Nov-23	Creek valley, second growth
Maurelle	Box 3: Maurelle Lake Outlet 2	09-Nov-23	Maturing second growth, in a small creek valley draining the lake at the north end of Maurelle Lake. There is a large clearcut (harvested in 2016) 100m to north. The creek has a 30m uncut buffer on that side. The forest to the south is mature second growth.
Sonora	Box 1 Campbell Landholding	01-Feb-24	Second growth forest, with few old growth trees. Screech owls have been heard in the area by landowners since 2000.
Sonora	Door Lake	01-Feb-24	Old growth forest
Sonora	Door Lake	01-Feb-24	Old growth forest


2022 CPB and ARU Survey Points
MDKI-S01-004
MDKI-S01-003
MDKI-P01-006
MDKI-S01-002
MDKI-P01-005
MDKI-S01-001
MDKI-P01-004
MDKI-P02-004
MDKI-P02-001
MDKI-P01-003
MDKI-P03-003
MDKI-P02-003
MDKI-P01-002
MDKI-P03-001
MDKI-P03-004
MDKI-P02-002
MDKI-P03-002
MDKI-P01-001
MDKI-P03-005
MDKI-P03-006
MDKI-P04-005
MDKI-P04-002
MDKI-P04-006
MDKI-P04-001
MDKI-S01-008
MDKI-P04-003
MDKI-S01-007
MDKI-P04-004
MDKI-P05-001
MDKI-P05-002
MDKI-P05-003
MDKI-P05-005
MDKI-P05-004
MDKI-P05-006
MDKI-S01-006
MDKI-S01-005
Provincial Parks
Regional Parks
Lakes
Wetlands
Streams
ARU Locations
WESO Not Detected
WESO Detected
Call Playback
WESO Not Detected
WESO Detected
0 1 2 3 Km
1:110,000
N
All feature positions as shown are approximate

Cortes Island







LEGEND

- Provincial Parks
- Regional Parks
- Agricultural Land Reserve
- Private
- Indian Reserve
- Lakes
- Wetlands
- Streams

WESO Nesting Habitat

- Class 1 - High
- Class 2 - Moderately High
- Class 3 - Moderate
- Class 4 - Low
- Class 5 - Very Low
- Class 6 - Nil
- No Data

Structural Stage (STS)

- No Data
- 1
- 2
- 2b
- 3
- 3a
- 3b
- 4
- 5
- 6
- 7
- 7a

- Nest Box

ARU Locations

- WESO Not Detected
- WESO Detected

Call Playback Locations

- WESO Not Detected
- WESO Detected
- Estimated WESO Location (based on CPB surveys)

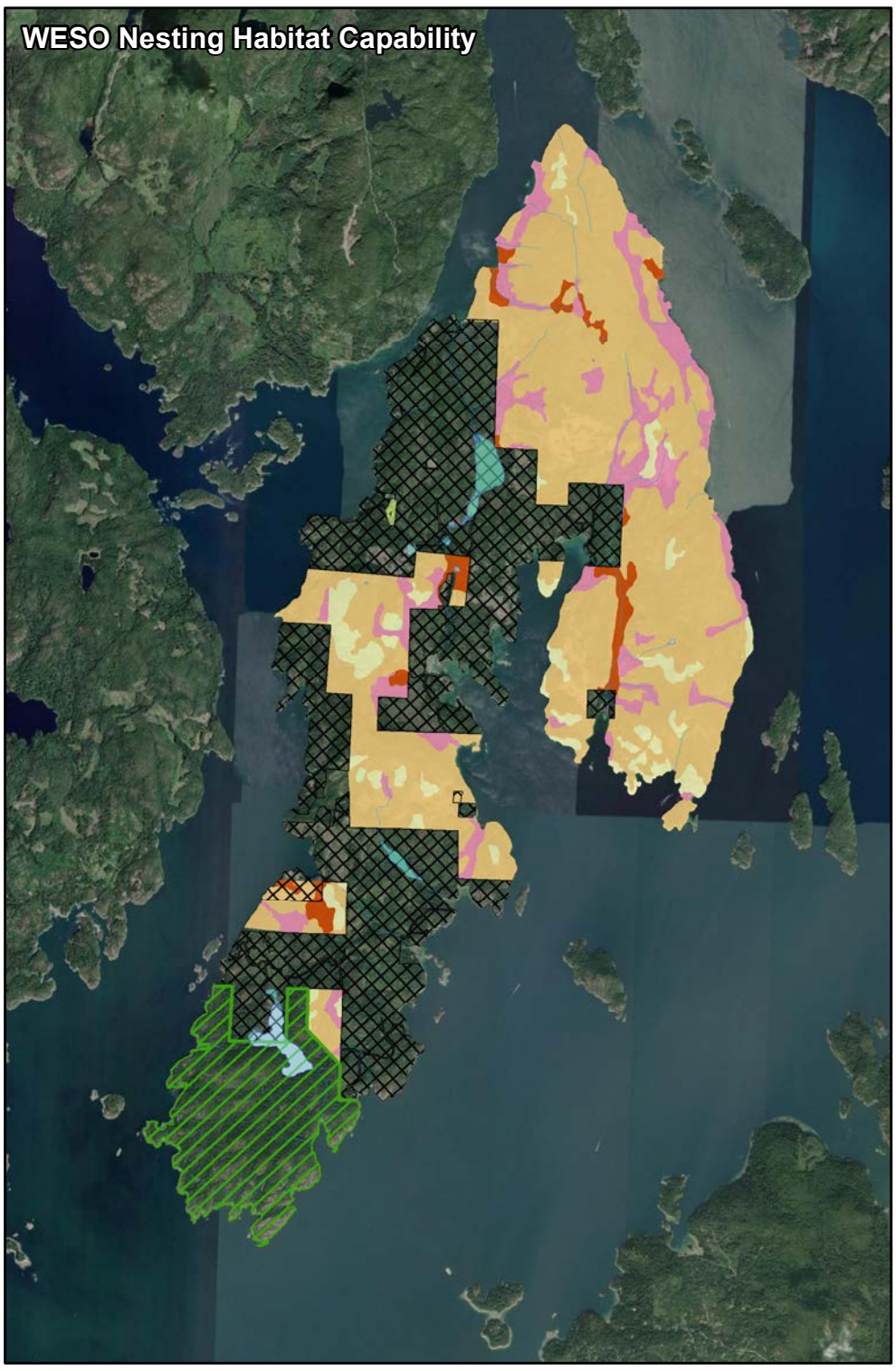
0 1.75 3.5 7 10.5 14 km

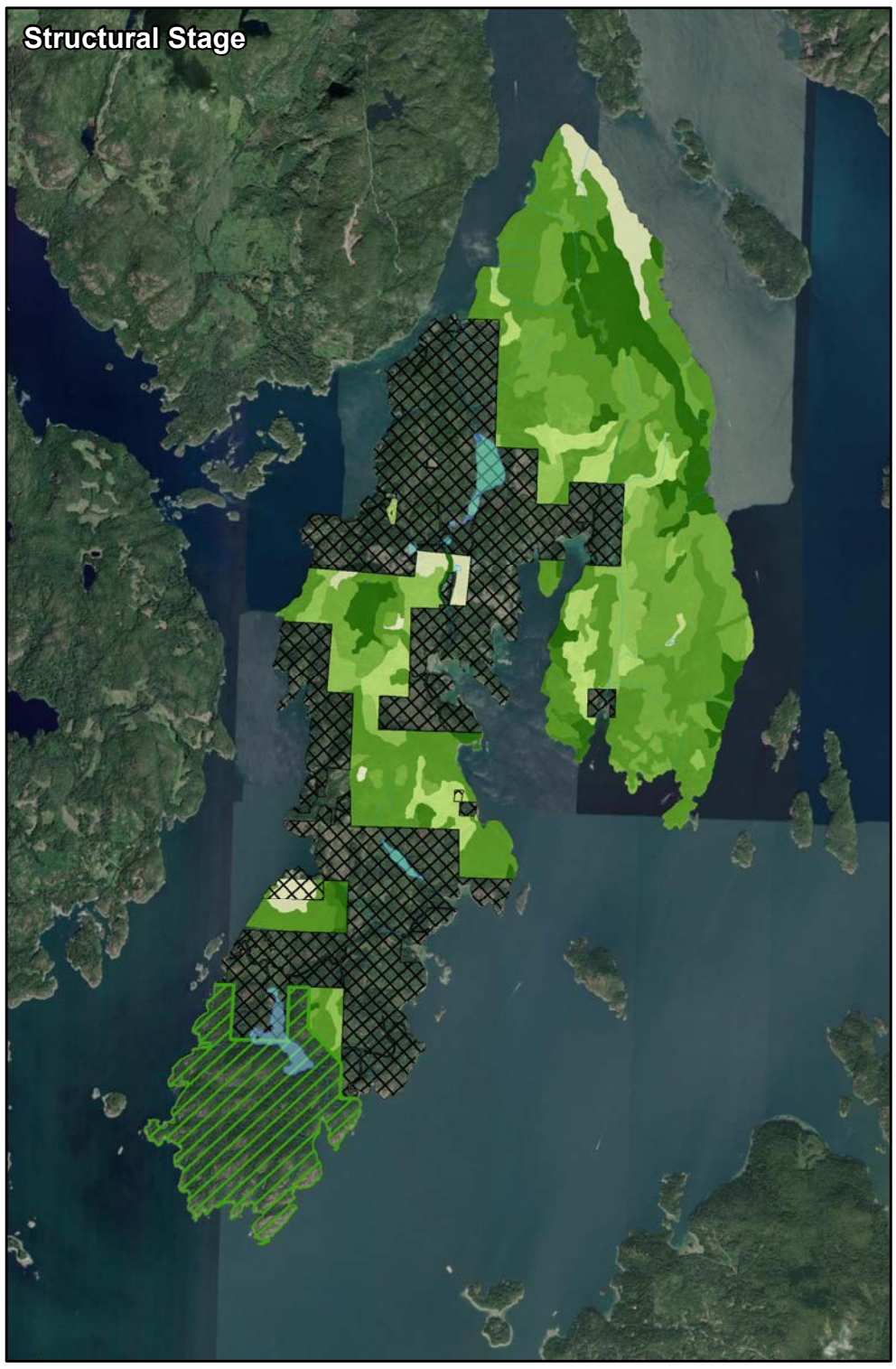
1:150,000

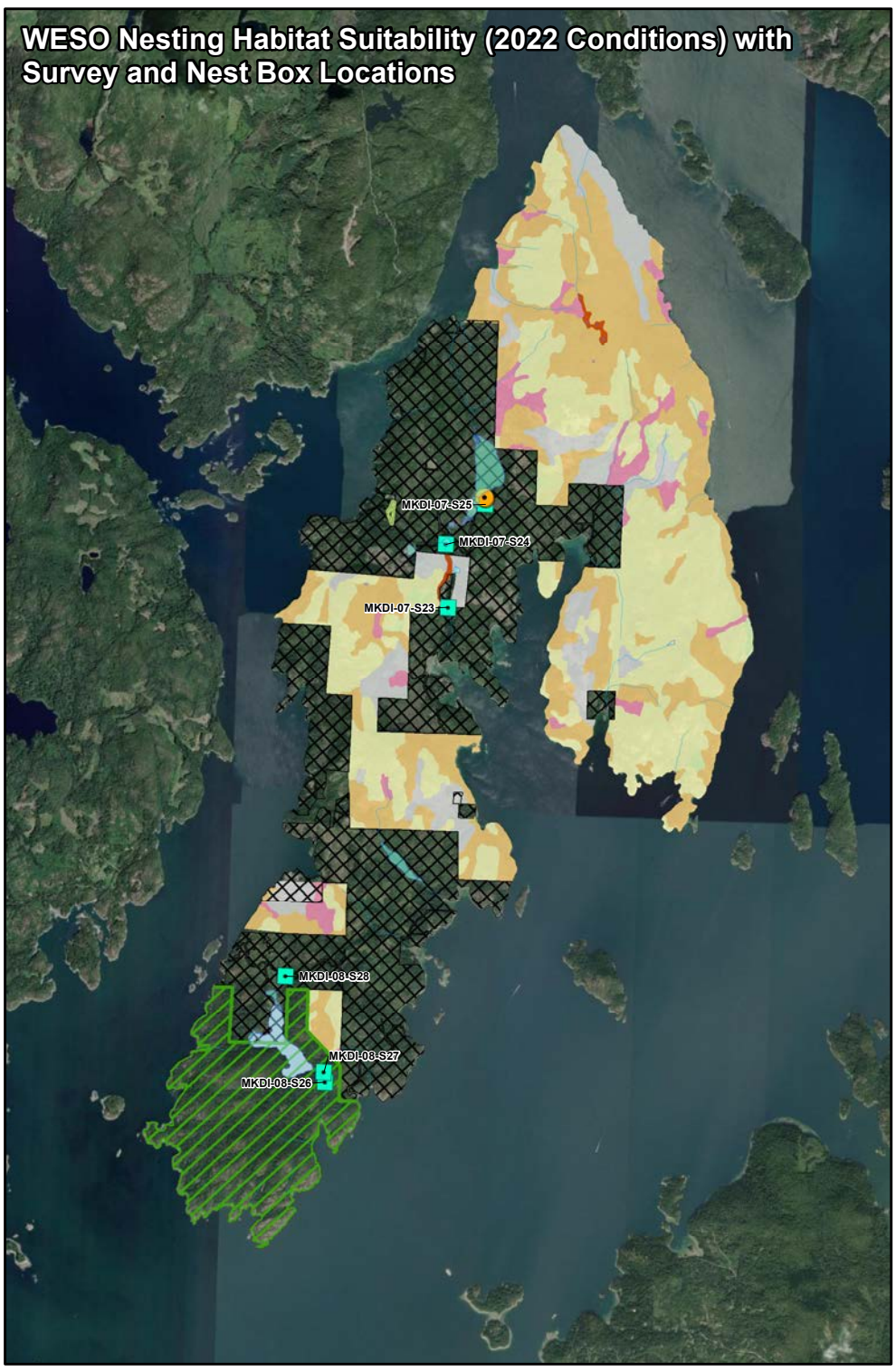
N

2024-04-04

Read Island







LEGEND

- Provincial Parks
- Regional Parks
- Agricultural Land Reserve
- Private
- Indian Reserve
- Lakes
- Wetlands
- Streams

WESO Nesting Habitat

- Class 1 - High
- Class 2 - Moderately High
- Class 3 - Moderate
- Class 4 - Low
- Class 5 - Very Low
- Class 6 - Nil
- No Data

Structural Stage (STS)

No Data	3b
1	4
2	5
2b	6
3	7
3a	7a

- Nest Box

ARU Locations

- WESO Not Detected
- WESO Detected

Call Playback Locations

- WESO Not Detected
- WESO Detected
- Estimated WESO Location (based on CPB surveys)

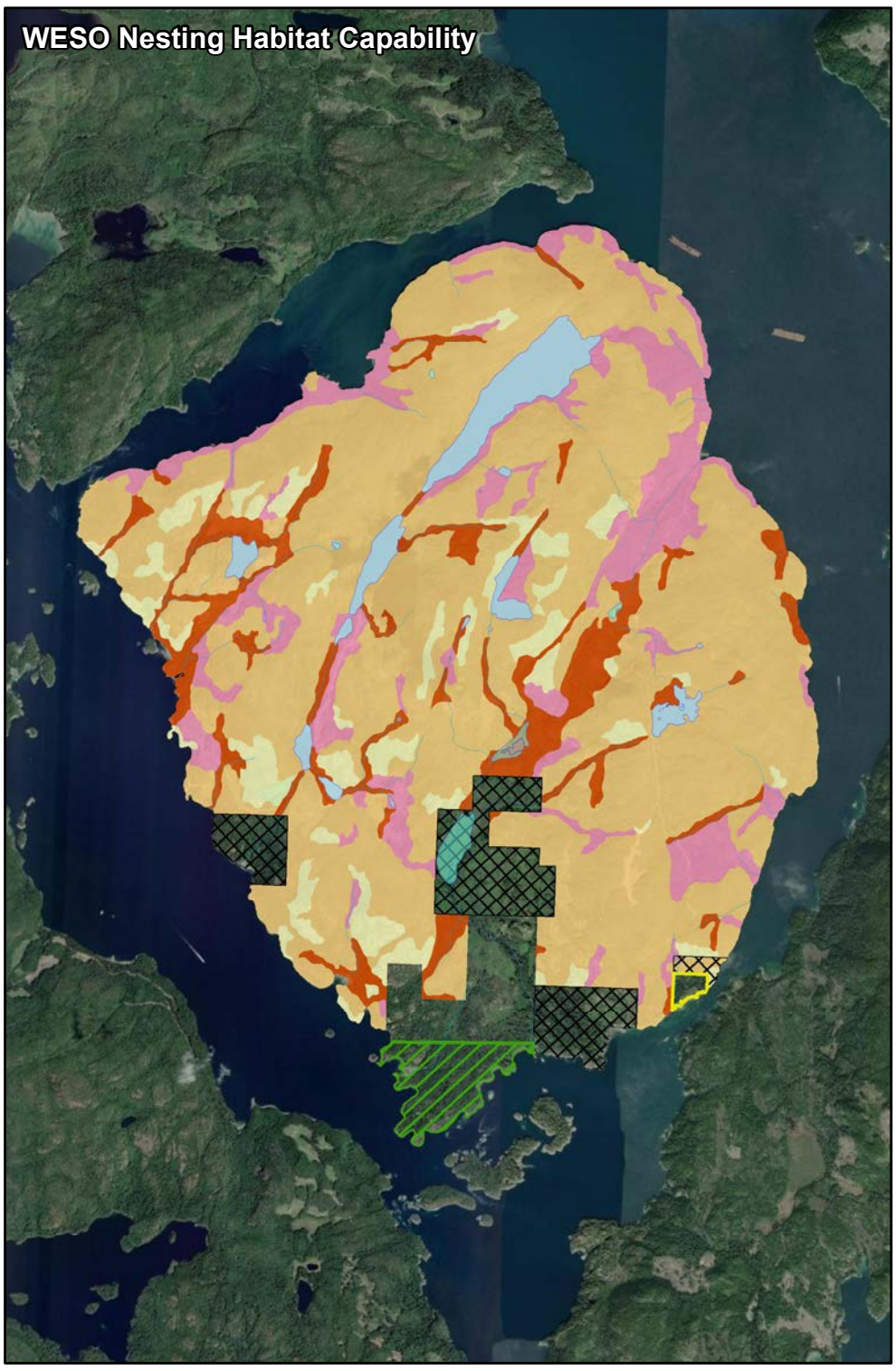
0 1.25 2.5 5 7.5 10 km

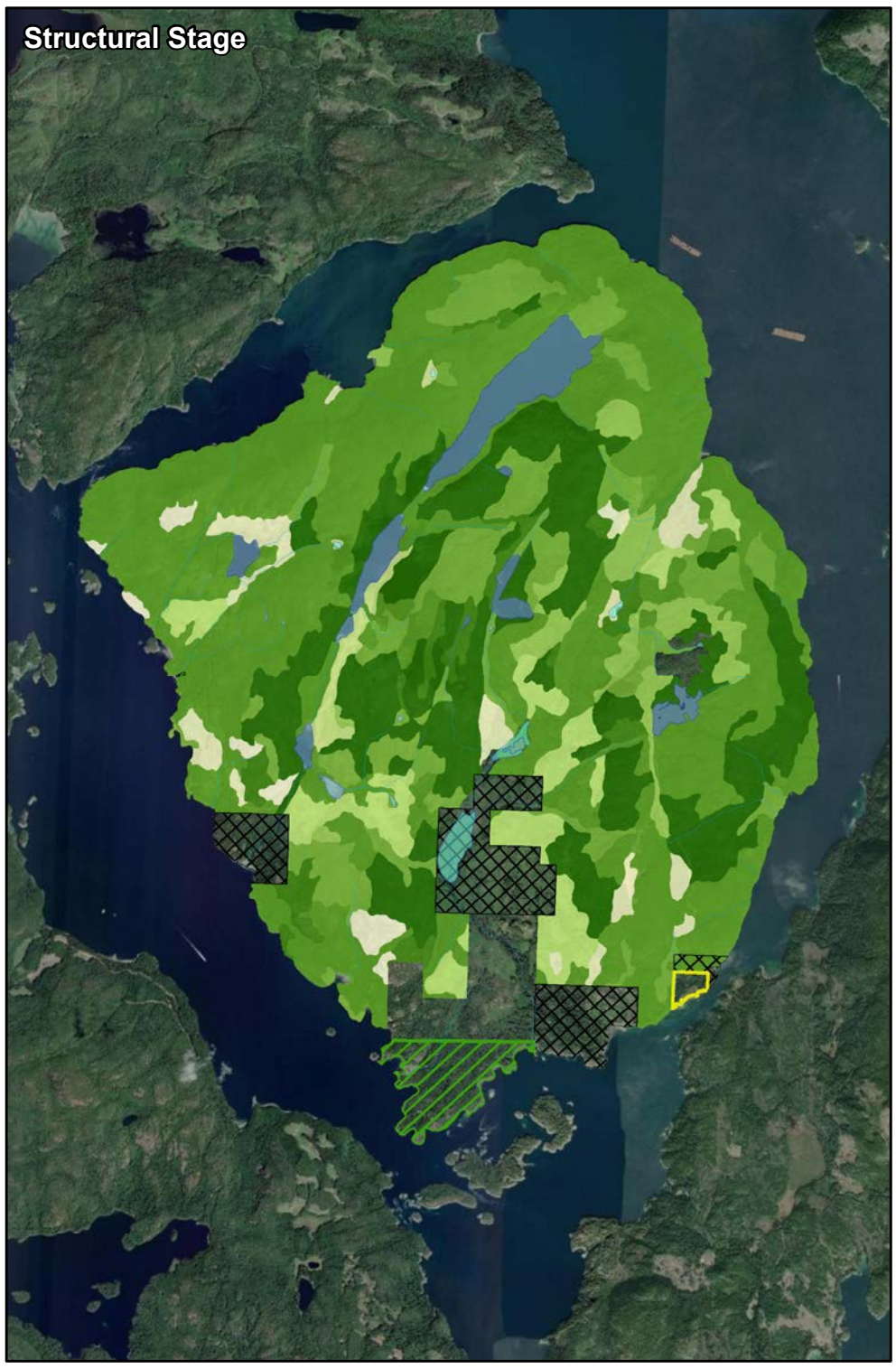
1:100,000

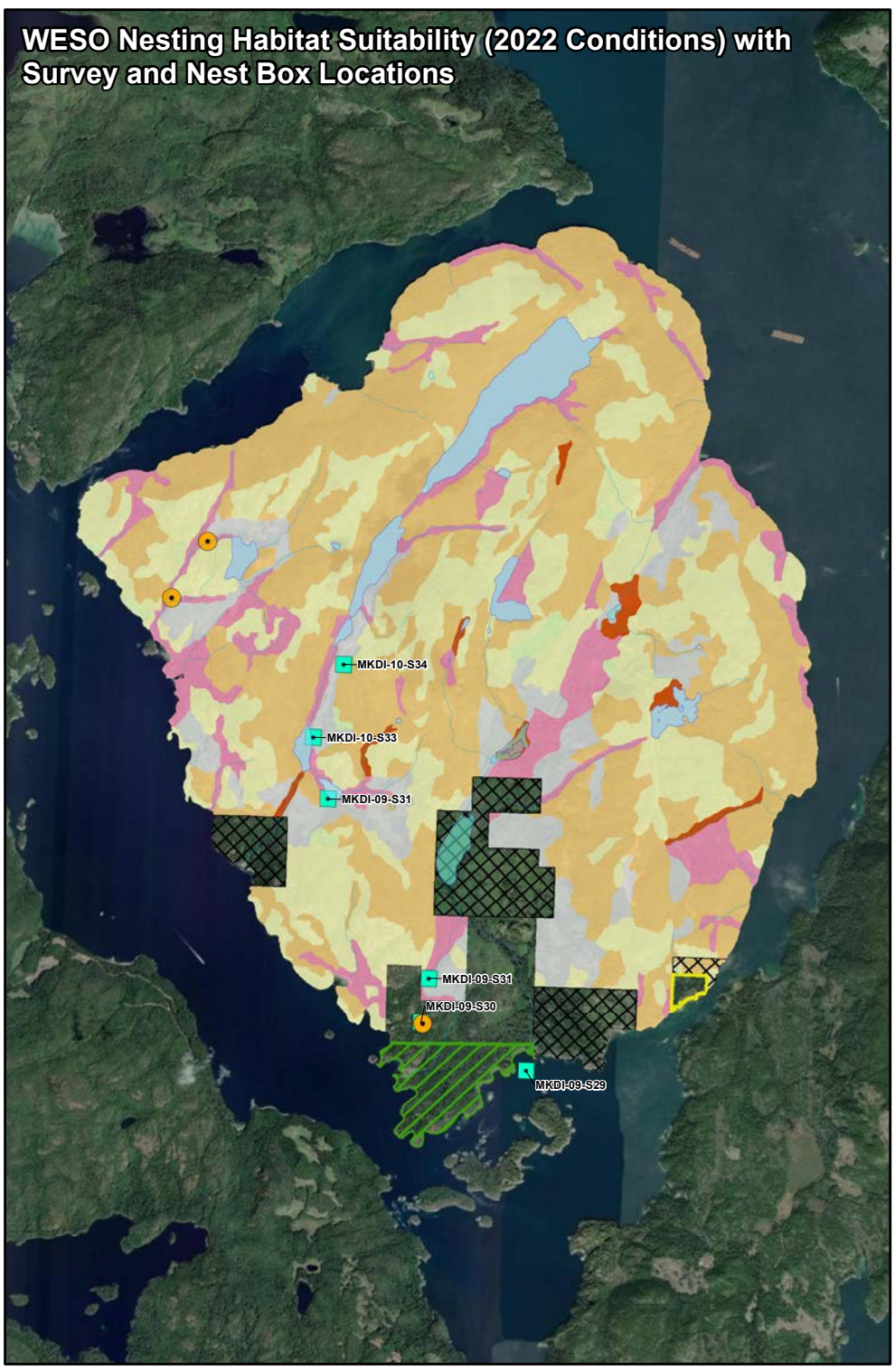
N

2024-04-04

Maurelle Island







LEGEND

- Provincial Parks
- Regional Parks
- Agricultural Land Reserve
- Private
- Indian Reserve
- Lakes
- Wetlands
- Streams

WESO Nesting Habitat

- Class 1 - High
- Class 2 - Moderately High
- Class 3 - Moderate
- Class 4 - Low
- Class 5 - Very Low
- Class 6 - Nil
- No Data

Structural Stage (STS)

- No Data
- 1
- 2
- 2b
- 3
- 3a
- 3b
- 4
- 5
- 6
- 7
- 7a

- Nest Box

ARU Locations

- WESO Not Detected
- WESO Detected

Call Playback Locations

- WESO Not Detected
- WESO Detected
- Estimated WESO Location (based on CPB surveys)

0 1 2 4 6 8 km

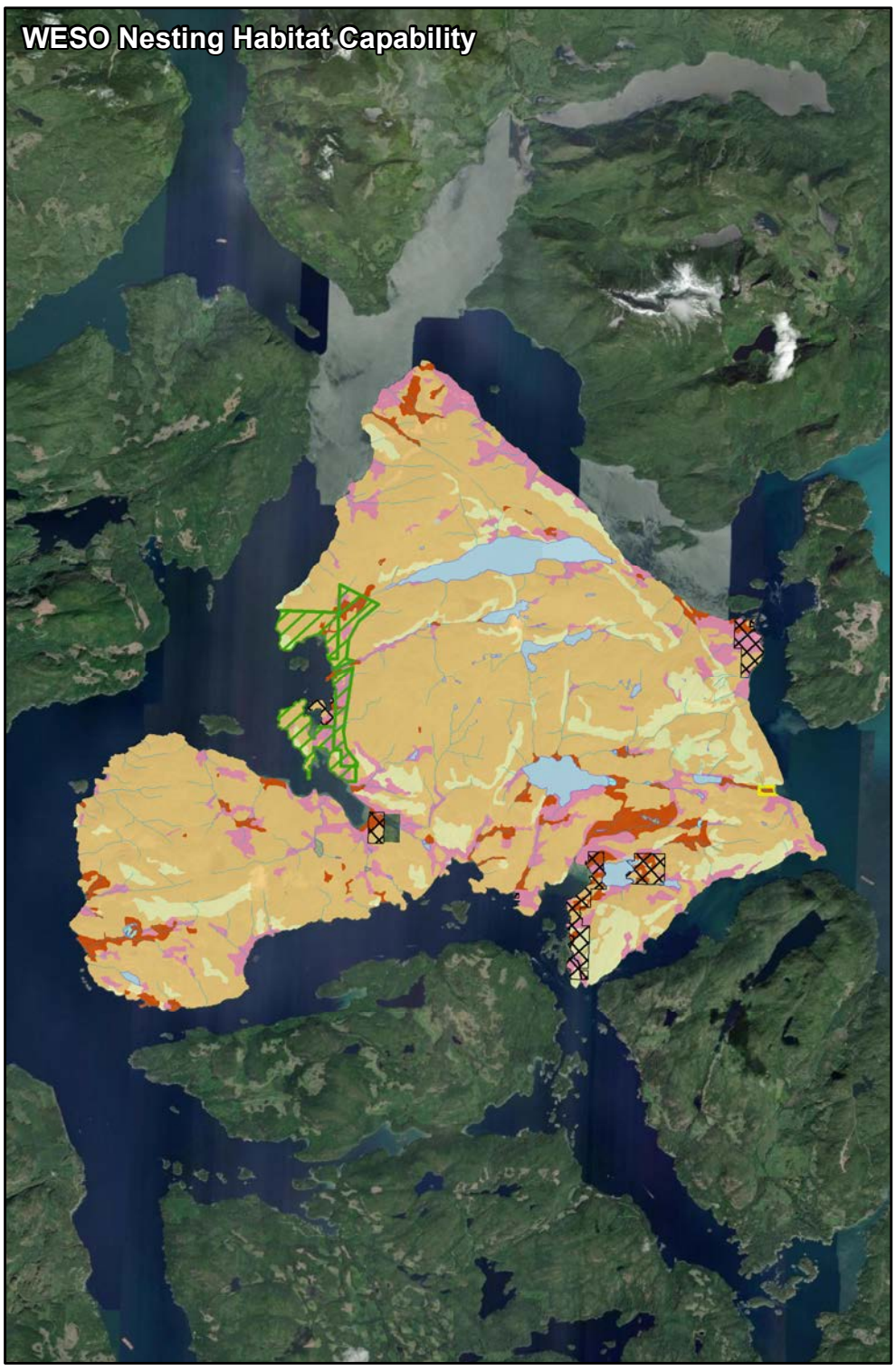
1:80,000

N

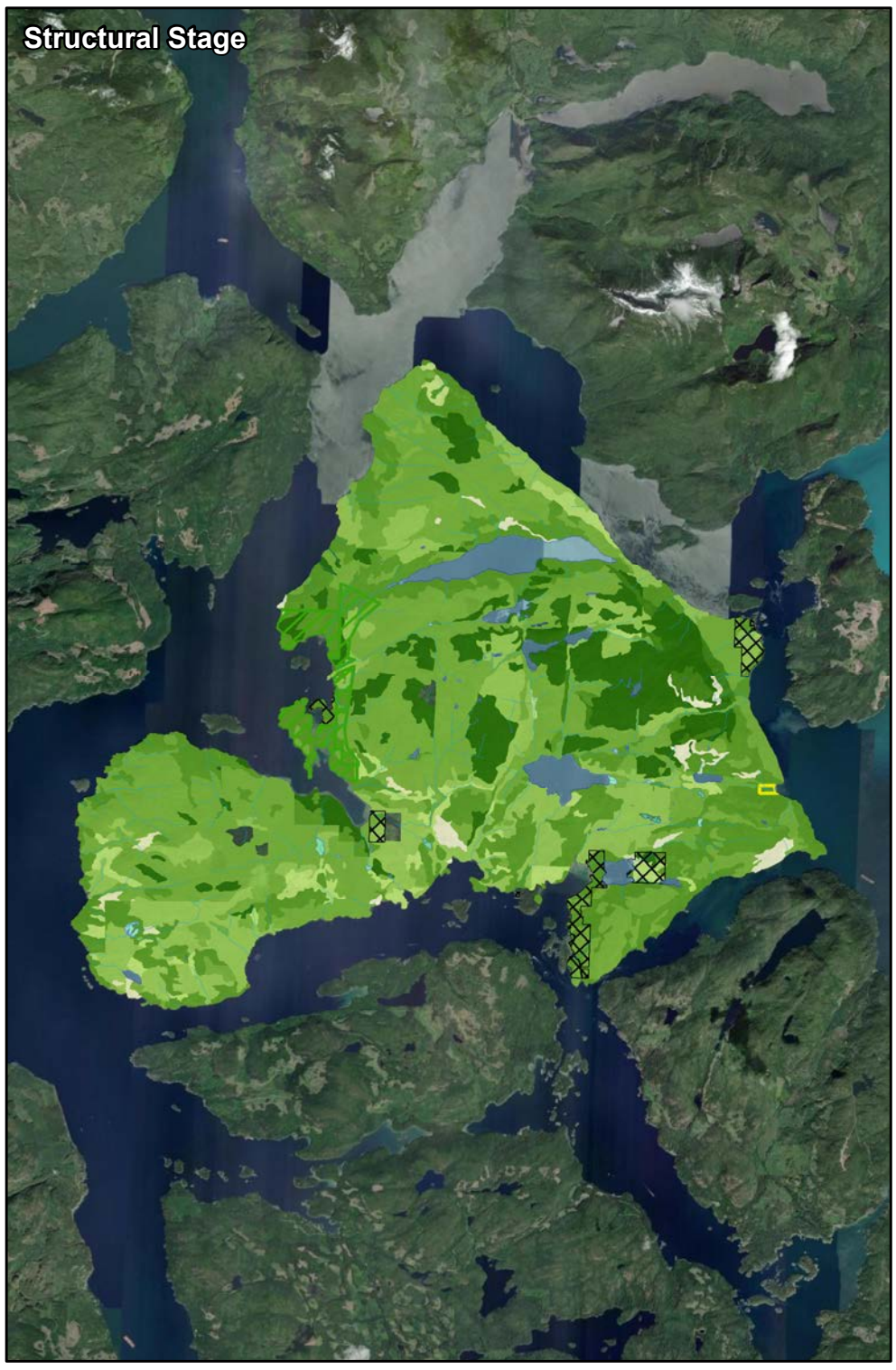
2024-04-04

Sonora Island

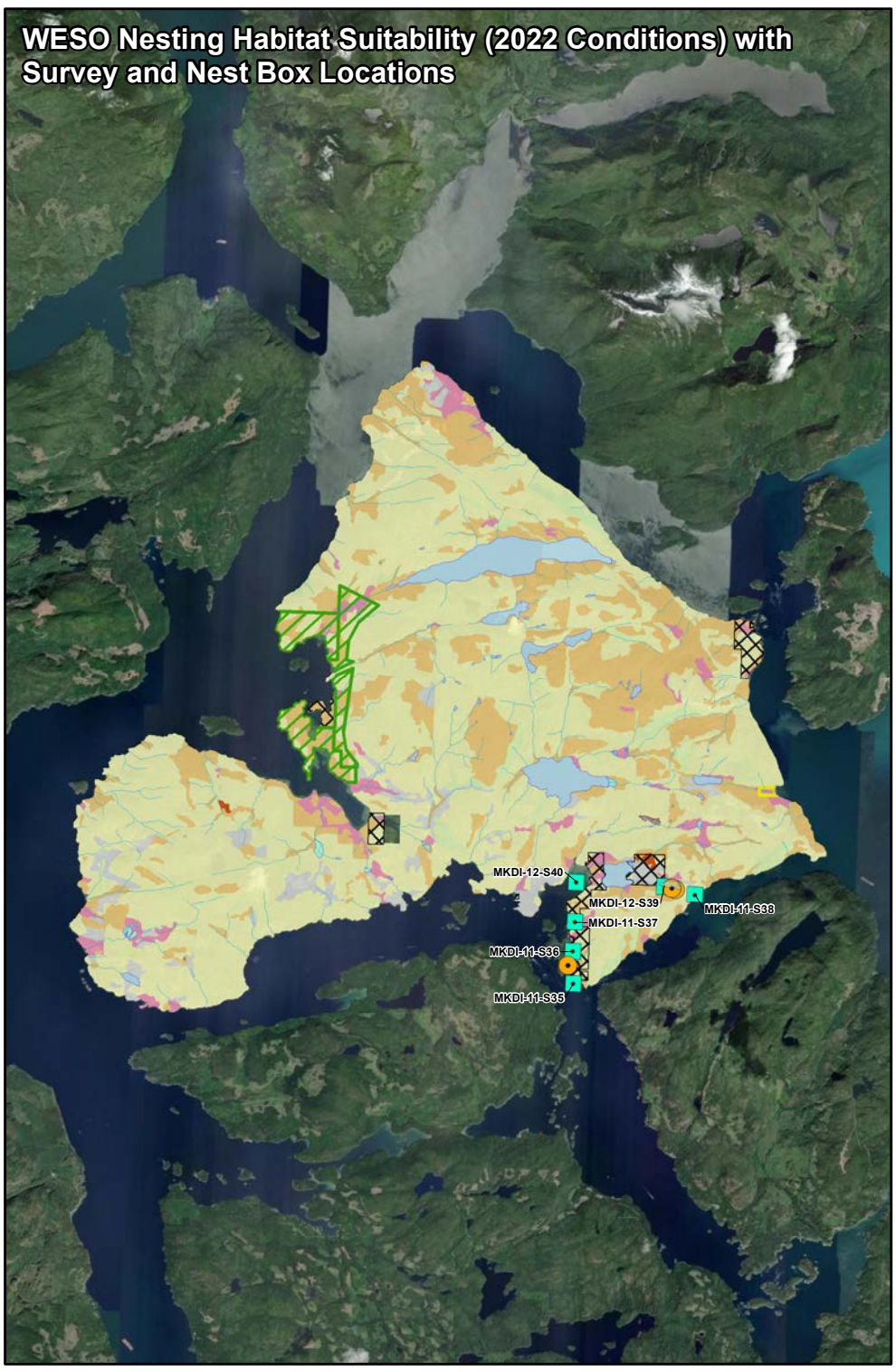
WESO Nesting Habitat Capability



Structural Stage



WESO Nesting Habitat Suitability (2022 Conditions) with Survey and Nest Box Locations



LEGEND

- Provincial Parks
- Regional Parks
- Agricultural Land Reserve
- Private
- Indian Reserve
- Lakes
- Wetlands
- Streams

WESO Nesting Habitat

- Class 1 - High
- Class 2 - Moderately High
- Class 3 - Moderate
- Class 4 - Low
- Class 5 - Very Low
- Class 6 - Nil
- No Data

Structural Stage (STS)

- No Data
- 1
- 2
- 2b
- 3
- 3a
- 3b
- 4
- 5
- 6
- 7
- 7a

- Nest Box

ARU Locations

- WESO Not Detected
- WESO Detected

Call Playback Locations

- WESO Not Detected
- WESO Detected
- Estimated WESO Location (based on CPB surveys)

0 2.25 4.5 9 13.5 18 km

1:180,000

N

2024-04-04

3.5 Outreach and Education

3.5.1 Year 1

The following events were conducted by FOCI in support of WESOke during year 1 of the project:

- Western Screech-Owl educational community Zoom presentation – In collaboration with Emily Upham-Mills (WLRS)
- Jeremiah Kennedy (PMRA) ran a training session for Discovery Island volunteers and biologists in ARU deployment and call play back protocols.
- Educational brochure distributed within the Cortes Island community.
- FOCI website posting found here.
- Cortes Community Radio (CKTZ) radio interview found here.
- Tideline (cortesisland.com) online community posting found here.

3.5.2 Year 2

The following events were conducted by FOCI in support of WESOke during year 2 of the project:

- 'In Search of the Western Screech-Owl' Presentation by Sabina Leader Mense (FOCI) and Emily Upham-Mills (WLRS) – Linnaea Farm Education Centre – March 25, 2023 (Figure 11). Thirty-five people attended. Provincial and local historical WESOke knowledge was provided as well as an update on project activities and findings. An owl call exercise was conducted to familiarize attendees with local owl identification. Four people were recruited to assist in CPB surveys, mount ARUs, and install nest boxes.

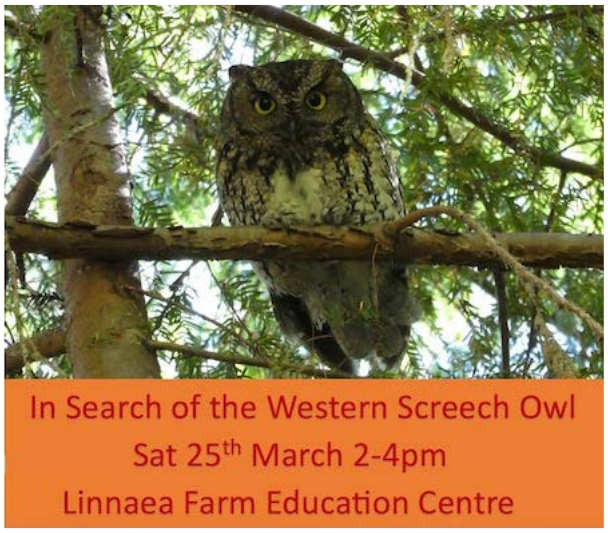


Figure 11. Educational presentation flyer; provided by Sabina Leader-Mense and Emily Upham-Mills, March 2023.

- Read Island Nest Box Workshop – August 14, 2023. Sixteen people attended, including 8 youth; 9 nest boxes were made (Figure 12).

Figure 12. Discovery Islands Nest Box building workshop, August 2023.

- Cortes Island Nest Box Workshop – Seniors Group – August 28, 2023. Two people attended.
- Cortes Island Nest Box Workshop – General community event – September 24, 2023. Twelve people attended, including 6 youth; 16 boxes were made.
- The WESOKe section of the FOCI website was updated.
- The project was promoted through various media outlets:
    - Cortes Island community website
    - Cortes Community Radio (CKTZ)
    - Cortes Currents Radio
    - FOCI's Spring 2023 E-newsletter
    - FOCI's Facebook Page.

4 Discussion

The Friends of Cortes Island Western Screech-owl Stewardship project focused on gaining insight into screech-owl occupancy, implementing habitat enhancement actions, and raising awareness of conservation of this species on the Discovery Islands. These objectives were achieved by passive and active acoustic monitoring, enhancing habitat by installing nest boxes, and organizing public outreach events. Moreover, habitat capability and suitability were assessed to add context to WESOke surveys and strategize future stewardship efforts.

Across both years, there were only a few WESOke detections from surveys on the Discovery Islands. It was along the Bullock Bluff (northern peninsula) transect on Cortes Island where surveyors detected WESOke at three CPB stations (caveat: a response was from across the channel on Read Island) on February 18th and March 18th, 2023 (Table 3; Figure 7), yet ARUs placed nearby did not record WESOke vocalizations. A plausible explanation for this inconsistency is ARUs were placed outside the boundaries of the core breeding territories actively defended by males, and the detection distances of ARUs were too small to detect owls. The distance between CPB stations where surveyors detected WESOke and the nearest ARUs ranged from 430 – 650 meters, which is beyond the detection distance of SM-minis (approx. 150 – 250 meters; unpubl. data, R. Chicalo).

On a site level, the habitat on the Northern Peninsula (where Bullock Bluff is located) of Cortes Island is marked by old-growth pockets (structural stage 7) buffered by mature second growth (structural stage 6, Figure 7). Mature and old forests are characterized by a complex understory with decaying trees, a developing secondary canopy, and ample coarse woody debris (CWD; Figure 13); all of which are good features for nesting WESOke via snag development for nesting cavities, secondary canopy layer providing security for young, and CWD supporting prey populations. The slope is steep and there are numerous seasonal creeks that flow down the slope and likely provide wetter microhabitats; again, good for supporting prey populations and facilitating decaying processes. According to the habitat suitability model, forests along the Bullock Bluff transect are classified as low and moderate, likely due to the relatively drier CWHdm BEC subzone and resulting ecosystems, yet there are likely pockets of ‘moderately high’ and ‘high’ ecosystems found in the area that are not captured by the current mapping scale (e.g., TEM is mapped at 1:20,000 scale). Site conditions where the WESOke responded from across the channel on Read Island are unknown since that area was not visited by survey crews. From suitability mapping, it appears that the majority of that coastline is structural stage 5 (Figure 8), yet maybe a wetter/richer ecosystem type is found at the toe of the slope, thus resulting in a thin stretch of moderately suitable habitat (Figure 8).

Figure 13. Example of habitat along the Bullock Bluff transect on Cortes Island. Note old-growth douglas-fir vet on left, developing secondary canopy composed of western hemlock, and coarse woody debris found on forest floor.

From a landscape perspective, factors that vary between islands such as human density and habitat values may contribute to WESOke apparent abundance and distribution. Cortes Island had the highest level of survey effort relative to adjacent islands, likely adding to why it had more WESOke detections than other islands. Similarly, documented historical records of WESOke only exist for Cortes Island (see Figure 14 & 15) and is likely a result of higher observer densities (i.e. more humans likely to document observations) compared to Read, Maurelle, and Sonora Islands. A high-level visual assessment of habitat values indicate that 'low' and 'moderate' habitat is abundant on the Discovery Islands (Figures 7-10). Given that there is limited 'moderately high' and 'high' habitat, it may be that WESOke breeding on the Discovery Islands require larger home ranges to meet life requisites (e.g., Godet et al. 2018) or are cueing in on microhabitats that are not mapped at the scale presented here. Moreover, in areas that have 'moderately high' to 'high' capability but are now considered 'low' or 'moderate' habitat due to disturbances resulting in younger structural stages, nesting cavities may be a limiting factor since snag development occurs at higher rates in mature and old forest stands. Therefore, nest boxes may be a crucial habitat enhancement measure in those areas.

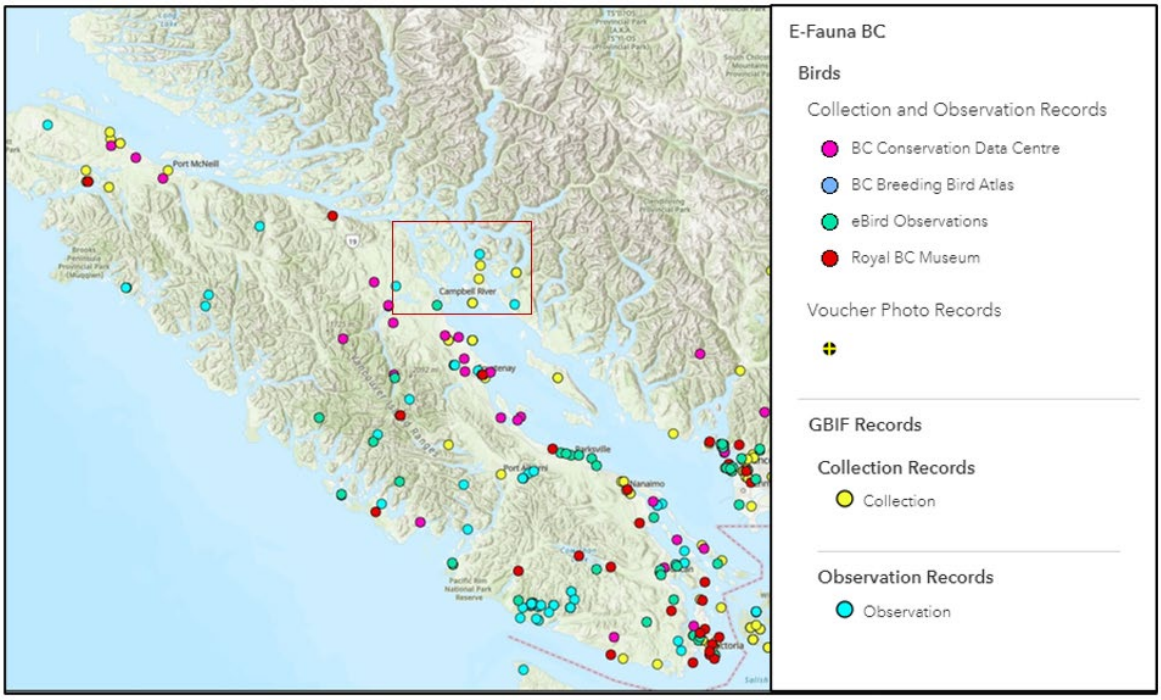


Figure 14. Overview of historical WESOke detections (eFauna; accessed February 2024). Red rectangle represents area displayed in Figure 20.

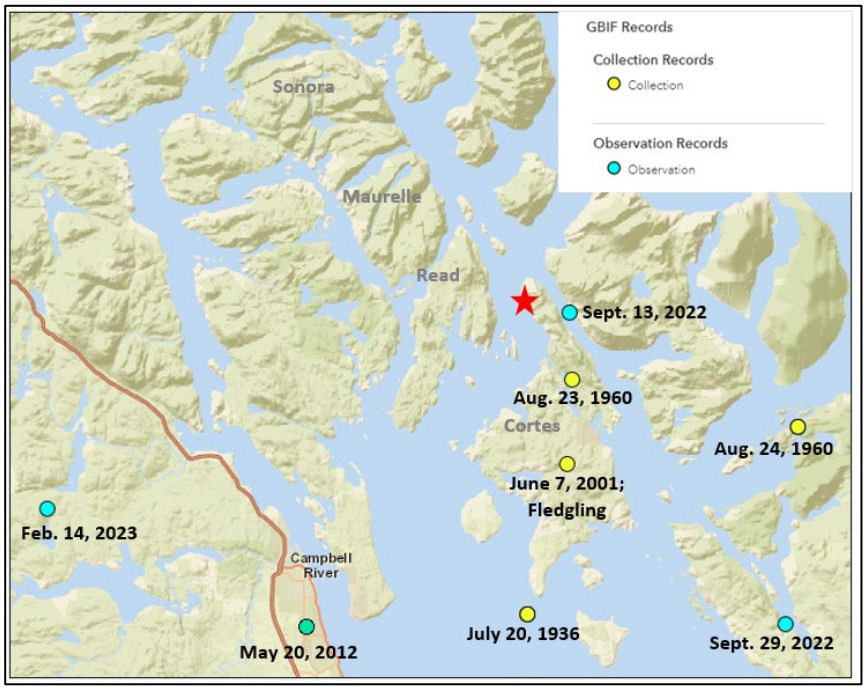


Figure 15. Historical WESOke detections on Cortes Island and surrounding areas (eFauna; accessed February 2024). Red star represents location of WESOke detections via CPB surveys conducted by FOCI.

Maurelle Island appears to have the highest amount of moderate to highly suitable habitat, whereas Sonora Island appears to have the lowest amount of suitable habitat (Figures 9 & 10), however direct comparisons are hard due to gaps in ecosystem data on Cortes and Read Island. Low values on Sonora Island are likely a result of heavy logging pressure as it pertains to Timber Farm License 47. As such, much of the island appears to be in structural stage 4 (pole/sapling) and 5 (young; Figure 10). Higher habitat values on Maurelle may be due to low human densities and lower forestry pressure. On Maurelle, ARUs were placed opportunistically, according to volunteer location and capacity, which overlapped with moderate habitat classes adjacent to small patches of moderately high rated nesting habitat. It would be interesting to increase survey effort on Maurelle to gain a better understanding of how those habitat factors are influencing occupancy.

On a population level, recent surveys have identified WESOke 'hot spots' in areas on Vancouver Island that were not previously considered as characteristic screech-owl habitat. For example, high densities of WESOke were found in nutrient-poor bog habitat on the northern tip of Vancouver Island in the Coastal Western Hemlock Very Wet Hypermaritime variant (CWHvh1) BEC zone (occurrences not yet displayed on eFauna maps; unpubl. data, WLRS). Another 'hotspot' comes from southwestern Vancouver Island where the terrain is steep with incised river and creek beds and narrow riparian margins in the CWH Very Wet Maritime variant (CWHvm1). In both examples, it appears that WESOke are still keying in on water-related habitat features, yet rich soils may not be as important as once thought. Another commonality is that both landscapes contain relatively large patches of remnant old-growth stands that likely represent a well-developed, complex ecosystem, albeit they present in very different ways. Boggy areas are composed of old, stunted trees (10 – 15 m tall) such as shore pine (*Pinus contorta*) and yellow cedar (*Chamaecyparis nootkatensis*), where as forests on southwestern Vancouver Island are composed of 35 – 45 m tall red cedars (*Thuja plicata*), western hemlocks (*Tsuga heterophylla*), and sitka spruce (*Picea sitchensis*). Either way, it appears that both systems are supporting the demands of breeding WESOke and may be offering a refuge from predatory Barred owls that have displaced WESOke in habitat types previously occupied.

To put the above information into a Discovery Islands context, land on Cortes, Maurelle, Read, and Sonora Island fall within the drier variants of the CWH BEC zone (e.g., xm1, xm2, dm), which would mean less rain and snow and fewer creeks, streams, and rivers. In addition, given the relatively gentle terrain of these islands compared to coarser terrain features on southwestern Vancouver Island, perhaps there is a longer history of forestry pressure on these islands due to greater accessibility. In many cases, the remnant old-growth stands we see today were only left because they were deemed 'inoperable' due to accessibility constraints (i.e. very steep) in the early days of logging. Also, since several

residents have claimed that WESOke were more common in the past, lower densities of today may be due to cumulative, lagging effects of Barred owl range expansion that occurred in the 1970's and 1980's (Livezey 2009; Figure 16), expanding human settlements (BC MOE 2013), and a changing climate (BC MOE 2013). Therefore, it may be that the carrying capacity of WESOke on the Discovery Islands is comparatively lower than 'hotspots' of their coastal range (e.g., bog habitat and incised river valleys in wetter ecosystems on Vancouver Island), and likely lower than what it once was prior to Barred owl range expansion.

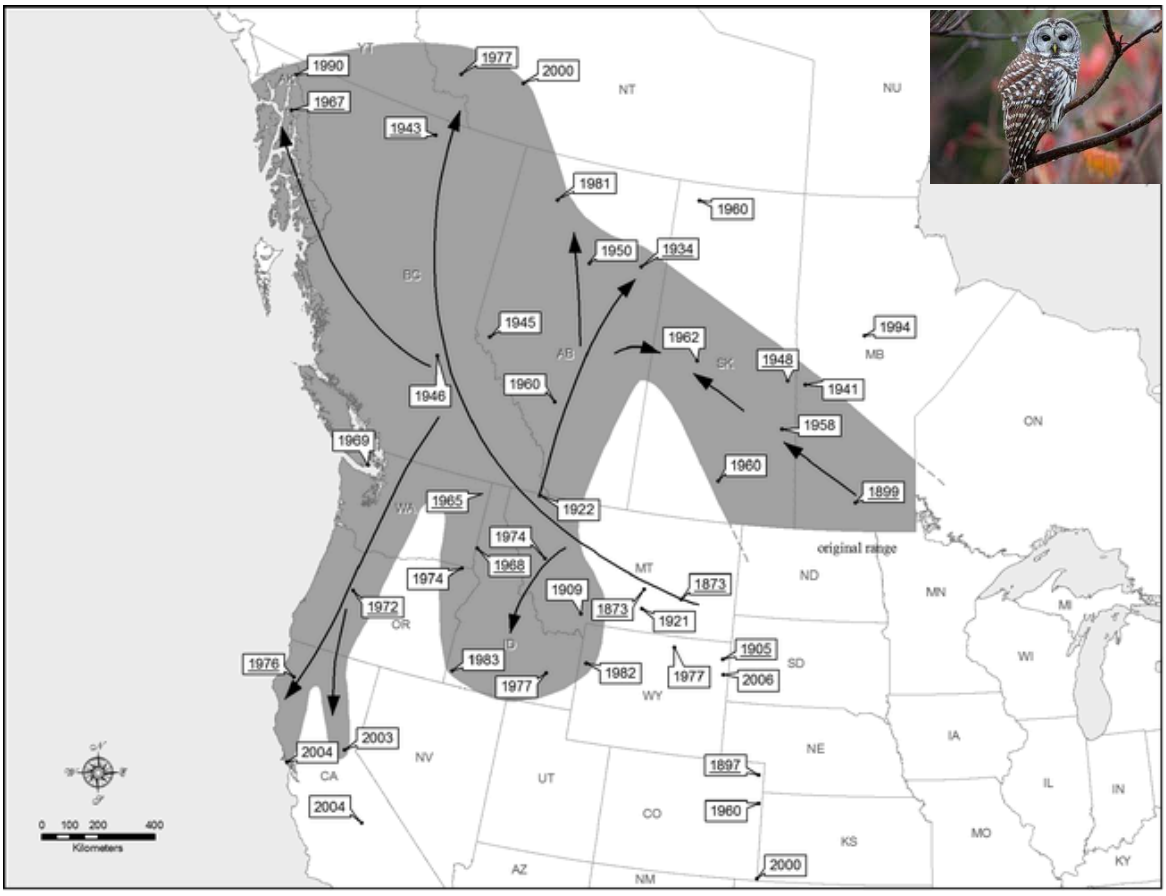


Figure 16. Barred Owl range expansion from Livezey 2009.

Habitat maintenance and enhancement activities, such as nest box deployments carried out in this project, are important for screech-owl by mitigating habitat degradation. Screech-owls are sensitive to habitat loss due to reliance on suitable nesting cavities in trees adjacent to water features (BC MOE 2013). Removing snags, often considered 'danger trees', results in the loss of a key habitat feature required for nesting WESOke, as well as other cavity nesters (e.g., Northern Pygmy-owls, Northern Saw-whet Owls, Woodpeckers, some songbirds, etc.). Unfortunately, snags are often removed because they may pose a

threat to the public or are considered an 'eye sore', and the value they offer to wildlife is often overlooked. Additionally, with past and, in some cases, current forestry practices, large swathes of single-aged forest stands are still fairly common on the landscape, and these stands are often harvested before natural decaying processes (i.e. snag and CWD development) occur. Therefore, nest boxes are a great habitat enhancement measure.

4.1 Recommendations

To continue with FOCI's Western Screech-Owl Inventory and Habitat Stewardship project, it is recommended that surveys, monitoring, education, and habitat enhancement measures continue on the Discovery Islands. Such initiatives contribute to the overarching management and recovery goals of WESOke in British Columbia. Recommendations for future work include the following:

- Expand ARU surveys coverage on Read, Maurelle and Sonora Island.
- Use the Nesting Habitat Model to guide future survey efforts.
    - Consider improving model coverage on Cortes and Read Island by incorporating other ecosystem mapping inputs (e.g., Broad Ecosystem Inventory).
- Monitor known WESOke territories on Cortes and Read Island via deployment of ARU arrays (i.e. grids) to gain understanding in habitat use and home range size.
    - Conduct daytime surveys to locate roosts, which can then be used as the focal point of arrays.
- Continue outreach and habitat enhancement efforts by continuing to deploy nest boxes in the Discovery Islands.
    - Develop a nest box monitoring program that tracks data such as: dates, signs of use, species, condition of nest box, etc.

Moreover, improvements in data management will help to streamline map creation, data summaries, and improve analysis of acoustic data. Some examples are:

- Follow the format of the Microsoft Excel database provided with this report to manage ARU, CPB and nest box locations and associated metadata. This will facilitate queries, sorting, and mapping of data.
    - Provide a unique entry (i.e. row) for each CPB broadcast, despite repetition of locations on different dates.

- Record location data in degrees decimals (i.e. 50.1038, -124.9323) for ease of use in ArcMap or ArcGIS Pro.
- If GPS-enabled tablets are available, the Avenza App can be downloaded and georeferenced maps can be used to collect data using a 'schema'. Data can then be exported as a .csv (excel), .shp (ArcGIS), or .kml (Google earth).

- Acoustic data:
  - The developer of the CNNv3 recognizer has produced subsequent versions (PNW-Cnet Version 4 & 5) that have additional functionalities and include recognition of more species. One such functionality is easy creation of histograms that display species detections by station, a great way to visualize results. For this functionality to work, the naming structure of ARUs (i.e. the prefix set on the units) must follow a precise structure:
    - AreaName_TransectNumber-Station (e.g., CI_T01-S01), which may translate to 'Cortes Island_WileyLakeSouth-Station1'.
    - Consult with PMRA before changing naming structures.
  - If ARUs are moved from transects/stations, ensure that prefixes are changed accordingly.

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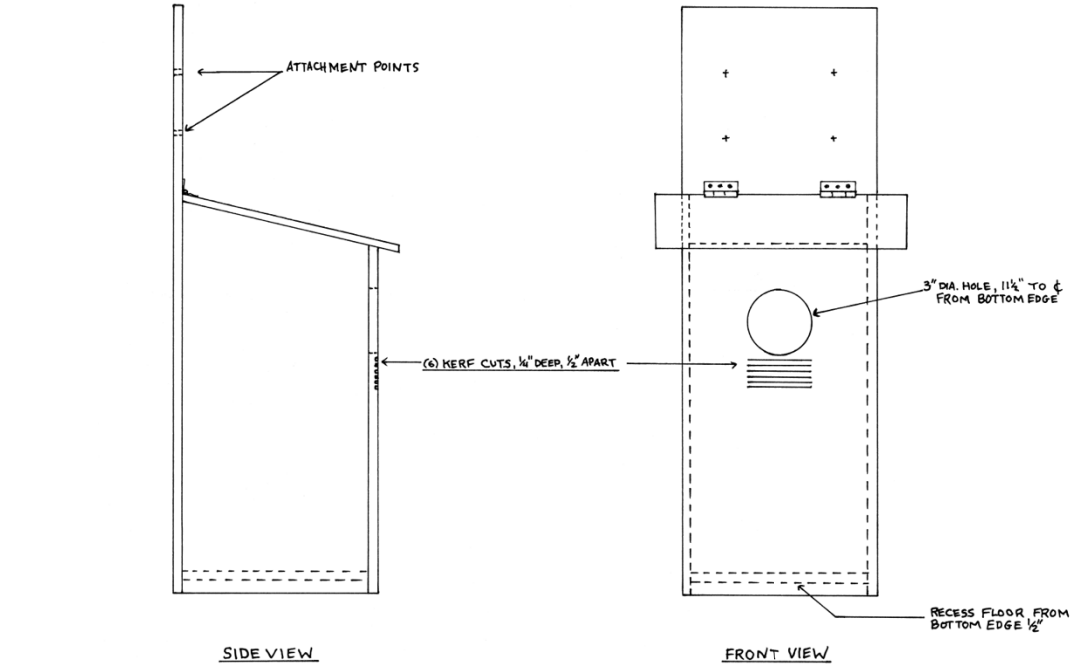
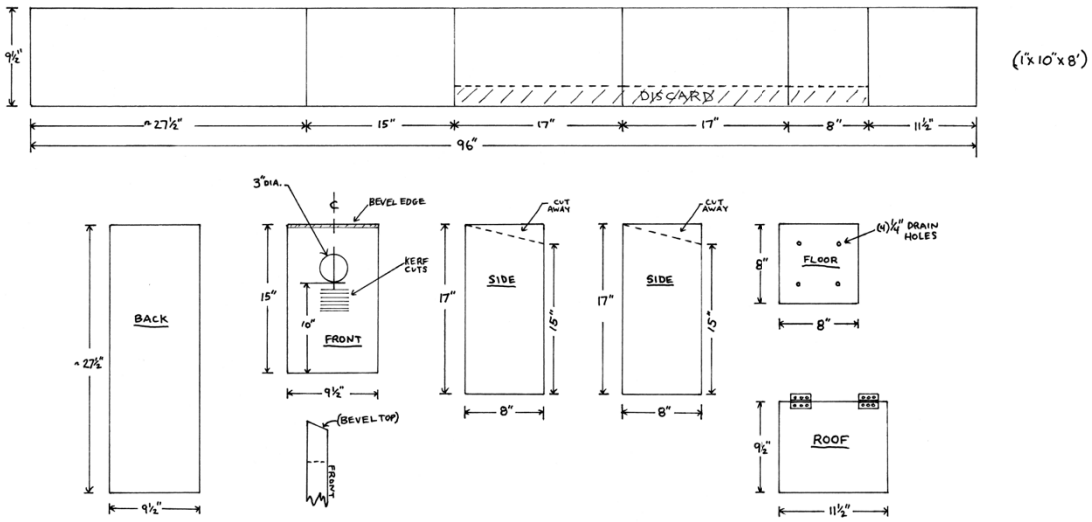
Appendix A - Nest Box Design Instructions


ATTACHMENT POINTS
(6) KERF CUTS, ¼" DEEP, ½" APART
3" DIA. HOLE, 11½" TO ℄ FROM BOTTOM EDGE
RECESS FLOOR FROM BOTTOM EDGE ½"
SIDE VIEW
FRONT VIEW


9½"
(1"x 10"x 8')
DISCARD
~27½"
15"
17"
17"
8"
11½"
96"
BACK
~27½"
9½"
3" DIA.
℄
BEVEL EDGE
KERF CUTS
15"
10"
FRONT
9½"
(BEVEL TOP)
FRONT
17"
SIDE
CUT AWAY
15"
8"
17"
SIDE
CUT AWAY
15"
8"
8"
FLOOR
(4) ¼" DRAIN HOLES
8"
9½"
ROOF
11½"

Appendix B – CPB Data

Table 6. Full list of 2022 CPB survey results from Cortes Island.

Title	Date Surveyed	Latitude	Longitude	Transect Name	Observers	WESO detected (Y/N)	BDOW (Y/N)	NSWO (Y/N)	NPOW (Y/N)	BAEA (Y/N)	Notes
MKDI-T03-001	24-Feb-22	50.14708	-125.02145	Carrington Bay - Carrington Lagoon	SLM, DCM	N	N	N	N	N	
MKDI-T03-001	09-Mar-22	50.14708	-125.02145	Carrington Bay - Carrington Lagoon	SLM, DCM	N	N	N	N	N	
MKDI-T03-001	22-Mar-22	50.14708	-125.02145	Carrington Bay - Carrington Lagoon	SLM, DCM	N	N	N	N	N	
MKDI-T03-002	24-Feb-22	50.14245	-125.0133	Carrington Bay - Carrington Lagoon	SLM, DCM	N	Y	N	N	N	
MKDI-T03-002	09-Mar-22	50.14245	-125.0133	Carrington Bay - Carrington Lagoon	SLM, DCM	N	N	N	N	N	
MKDI-T03-002	22-Mar-22	50.14245	-125.0133	Carrington Bay - Carrington Lagoon	SLM, DCM	N	N	N	N	N	
MKDI-T03-003	24-Feb-22	50.15488	-125.0143	Carrington Bay - Carrington Lagoon	SLM, DCM	N	N	N	N	N	
MKDI-T03-003	09-Mar-22	50.15488	-125.0143	Carrington Bay - Carrington Lagoon	SLM, DCM	N	N	N	N	N	
MKDI-T03-003	22-Mar-22	50.15488	-125.0143	Carrington Bay - Carrington Lagoon	SLM, DCM	N	N	N	N	N	
MKDI-T03-004	24-Feb-22	50.148	-125.00597	Carrington Bay - Carrington Lagoon	SLM, DCM	N	Y	N	N	N	
MKDI-T03-004	09-Mar-22	50.148	-125.00597	Carrington Bay - Carrington Lagoon	SLM, DCM	N	N	N	N	N	
MKDI-T03-004	22-Mar-22	50.148	-125.00597	Carrington Bay - Carrington Lagoon	SLM, DCM	N	N	N	N	N	
MKDI-T03-005	24-Feb-22	50.14015	-125.00298	Carrington Bay - Carrington Lagoon	SLM, DCM	N	N	N	N	N	
MKDI-T03-005	09-Mar-22	50.14015	-125.00298	Carrington Bay - Carrington Lagoon	SLM, DCM	N	N	N	N	N	
MKDI-T03-005	22-Mar-22	50.14015	-125.00298	Carrington Bay - Carrington Lagoon	SLM, DCM	N	N	N	N	N	
MKDI-T03-006	24-Feb-22	50.13327	-124.99847	Carrington Bay - Carrington Lagoon	SLM, DCM	N	Y	N	N	N	
MKDI-T03-006	09-Mar-22	50.13327	-124.99847	Carrington Bay - Carrington Lagoon	SLM, DCM	N	Y	N	N	N	
MKDI-T03-006	22-Mar-22	50.13327	-124.99847	Carrington Bay - Carrington Lagoon	SLM, DCM	N	N	N	N	N	
MKDI-T04-001	18-Feb-22	50.12545	-125.02667	Carrington Bay Road - Blue Jay Lake	SLM, ABM	N	N	N	N	N	
MKDI-T04-001	04-Mar-22	50.12545	-125.02667	Carrington Bay Road - Blue Jay Lake	SLM	N	N	N	N	N	
MKDI-T04-001	19-Mar-22	50.12545	-125.02667	Carrington Bay Road - Blue Jay Lake	SLM, ABM, HH	N	N	Y	N	N	
MKDI-T04-002	18-Feb-22	50.1269	-125.01432	Carrington Bay Road - Blue Jay Lake	SLM, ABM	N	N	N	N	N	
MKDI-T04-002	04-Mar-22	50.1269	-125.01432	Carrington Bay Road - Blue Jay Lake	SLM	N	N	N	N	N	
MKDI-T04-002	19-Mar-22	50.1269	-125.01432	Carrington Bay Road - Blue Jay Lake	SLM, ABM, HH	N	N	N	N	N	
MKDI-T04-003	18-Feb-22	50.12363	-125.00212	Carrington Bay Road - Blue Jay Lake	SLM, ABM	N	N	N	N	N	
MKDI-T04-003	04-Mar-22	50.12363	-125.00212	Carrington Bay Road - Blue Jay Lake	SLM	N	N	N	N	N	
MKDI-T04-003	19-Mar-22	50.12363	-125.00212	Carrington Bay Road - Blue Jay Lake	SLM, ABM, HH	N	N	N	N	N	

MKDI-T04-004	18-Feb-22	50.12223	-124.9917	Carrington Bay Road - Blue Jay Lake	SLM, ABM	N	Y	N	N	N
MKDI-T04-004	04-Mar-22	50.12223	-124.9917	Carrington Bay Road - Blue Jay Lake	SLM	N	N	N	N	N
MKDI-T04-004	19-Mar-22	50.12223	-124.9917	Carrington Bay Road - Blue Jay Lake	SLM, ABM, HH	N	N	N	N	N
MKDI-T04-005	18-Feb-22	50.1269	-124.98543	Carrington Bay Road - Blue Jay Lake	SLM, ABM	N	Y	N	N	N
MKDI-T04-005	04-Mar-22	50.1269	-124.98543	Carrington Bay Road - Blue Jay Lake	SLM	N	N	N	N	N
MKDI-T04-005	19-Mar-22	50.1269	-124.98543	Carrington Bay Road - Blue Jay Lake	SLM, ABM, HH	N	N	N	N	N
MKDI-T04-006	18-Feb-22	50.12512	-124.9779	Carrington Bay Road - Blue Jay Lake	SLM, ABM	N	N	N	N	N
MKDI-T04-006	04-Mar-22	50.12512	-124.9779	Carrington Bay Road - Blue Jay Lake	SLM	N	N	N	N	N
MKDI-T04-006	19-Mar-22	50.12512	-124.9779	Carrington Bay Road - Blue Jay Lake	SLM, ABM, HH	N	N	N	N	N
MKDI-T01-001	23-Feb-22	50.14302	-124.9471	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-001	10-Mar-22	50.14302	-124.9471	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-001	24-Mar-22	50.14302	-124.9471	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-002	23-Feb-22	50.15018	-124.95492	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-002	10-Mar-22	50.15018	-124.95492	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-002	24-Mar-22	50.15018	-124.95492	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-003	23-Feb-22	50.15897	-124.9557	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-003	10-Mar-22	50.15897	-124.9557	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-003	24-Mar-22	50.15897	-124.9557	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-004	23-Feb-22	50.16852	-124.95705	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-004	10-Mar-22	50.16852	-124.95705	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-004	24-Mar-22	50.16852	-124.95705	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-005	23-Feb-22	50.17642	-124.9721	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-005	10-Mar-22	50.17642	-124.9721	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-005	24-Mar-22	50.17642	-124.9721	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-006	23-Feb-22	50.18122	-124.97958	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-006	10-Mar-22	50.18122	-124.97958	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-T01-006	24-Mar-22	50.18122	-124.97958	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	Y	N	N	N
MKDI-T05-001	25-Feb-22	50.11773	-124.97208	Nutshell Lake -Larson's Meadow	SLM, ABM	N	N	N	N	N
MKDI-T05-001	15-Mar-22	50.11773	-124.97208	Nutshell Lake -Larson's Meadow	SLM	N	N	N	N	N
MKDI-T05-001	30-Mar-22	50.11773	-124.97208	Nutshell Lake -Larson's Meadow	SLM, ABM	N	N	N	N	N

MKDI-T05-002	25-Feb-22	50.11207	-124.97527	Nutshell Lake -Larson's Meadow	SLM, ABM	N	N	N	N	N	
MKDI-T05-002	15-Mar-22	50.11207	-124.97527	Nutshell Lake -Larson's Meadow	SLM	N	N	N	N	N	
MKDI-T05-002	30-Mar-22	50.11207	-124.97527	Nutshell Lake -Larson's Meadow	SLM, ABM	N	N	N	N	N	
MKDI-T05-003	25-Feb-22	50.10657	-124.97392	Nutshell Lake -Larson's Meadow	SLM, ABM	N	N	N	N	N	
MKDI-T05-003	15-Mar-22	50.10657	-124.97392	Nutshell Lake -Larson's Meadow	SLM	N	N	N	N	N	
MKDI-T05-003	30-Mar-22	50.10657	-124.97392	Nutshell Lake -Larson's Meadow	SLM, ABM	N	N	N	N	N	
MKDI-T05-004	25-Feb-22	50.10087	-124.97172	Nutshell Lake -Larson's Meadow	SLM, ABM	N	N	N	N	N	
MKDI-T05-004	15-Mar-22	50.10087	-124.97172	Nutshell Lake -Larson's Meadow	SLM	N	N	N	N	N	
MKDI-T05-004	30-Mar-22	50.10087	-124.97172	Nutshell Lake -Larson's Meadow	SLM, ABM	N	N	N	N	N	
MKDI-T05-005	25-Feb-22	50.10003	-124.95682	Nutshell Lake -Larson's Meadow	SLM, ABM	N	N	N	N	N	
MKDI-T05-005	15-Mar-22	50.10003	-124.95682	Nutshell Lake -Larson's Meadow	SLM	N	N	N	N	N	
MKDI-T05-005	30-Mar-22	50.10003	-124.95682	Nutshell Lake -Larson's Meadow	SLM, ABM	N	N	N	N	N	
MKDI-T05-006	25-Feb-22	50.09923	-124.94658	Nutshell Lake -Larson's Meadow	SLM, ABM	N	N	N	N	N	Unidentified call; similar to owl "bark"
MKDI-T05-006	15-Mar-22	50.09923	-124.94658	Nutshell Lake -Larson's Meadow	SLM	N	N	N	N	N	
MKDI-T05-006	30-Mar-22	50.09923	-124.94658	Nutshell Lake -Larson's Meadow	SLM, ABM	N	N	N	N	N	
MKDI-T02-001	21-Feb-22	50.15808	-124.98292	Quartz Bay - Cork Lake	SLM, DCM	N	N	N	N	N	
MKDI-T02-001	08-Mar-22	50.15808	-124.98292	Quartz Bay - Cork Lake	SLM, DCM	N	N	N	N	N	
MKDI-T02-001	23-Mar-22	50.15808	-124.98292	Quartz Bay - Cork Lake	SLM, DCM	N	N	N	N	N	
MKDI-T02-002	21-Feb-22	50.15032	-124.98095	Quartz Bay - Cork Lake	SLM, DCM	N	N	N	N	N	
MKDI-T02-002	08-Mar-22	50.15032	-124.98095	Quartz Bay - Cork Lake	SLM, DCM	N	Y	N	N	N	
MKDI-T02-002	23-Mar-22	50.15032	-124.98095	Quartz Bay - Cork Lake	SLM, DCM	N	N	N	N	N	
MKDI-T02-003	21-Feb-22	50.15462	-124.9894	Quartz Bay - Cork Lake	SLM, DCM	N	N	N	N	N	
MKDI-T02-003	08-Mar-22	50.15462	-124.9894	Quartz Bay - Cork Lake	SLM, DCM	N	N	N	N	N	
MKDI-T02-003	23-Mar-22	50.15462	-124.9894	Quartz Bay - Cork Lake	SLM, DCM	N	Y	N	N	N	
MKDI-T02-004	21-Feb-22	50.15432	-125.00297	Quartz Bay - Cork Lake	SLM, DCM	N	N	N	N	N	
MKDI-T02-004	08-Mar-22	50.15432	-125.00297	Quartz Bay - Cork Lake	SLM, DCM	N	N	N	N	N	
MKDI-T02-004	23-Mar-22	50.15432	-125.00297	Quartz Bay - Cork Lake	SLM, DCM	N	N	N	N	N	

Table 7. Full list of 2023 CPB survey results from Cortes Island.

Title	Transect Number	Station Number	Date Surveyed	Latitude	Longitude	Transect Name	Observers	WESO detected (Y/N)	BDOW	NSWO	NPOW	BAEA	Notes
MKDI-04-P01	04	01	14-Feb-23	50.1255	-125.0267	Carrington Rd-Bluejay Lake	SLM, ABM	N	N	N	N	N	
MKDI-04-P02	04	02	14-Feb-23	50.1269	-125.0143	Carrington Rd-Bluejay Lake	SLM, ABM	N	N	N	N	N	
MKDI-04-P03	04	03	14-Feb-23	50.1236	-125.0021	Carrington Rd-Bluejay Lake	SLM, ABM	N	N	N	N	N	
MKDI-04-P04	04	04	14-Feb-23	50.1222	-124.9917	Carrington Rd-Bluejay Lake	SLM, ABM	N	N	Y	N	N	
MKDI-04-P05	04	05	14-Feb-23	50.1269	-124.9854	Carrington Rd-Bluejay Lake	SLM, ABM	N	N	N	N	N	
MKDI-04-P06	04	06	14-Feb-23	50.1251	-124.9779	Carrington Rd-Bluejay Lake	SLM, ABM	N	N	N	N	N	
MKDI-04-P01	04	01	27-Feb-23	50.1255	-125.0267	Carrington Rd-Bluejay Lake	SLM, ABM, CAR	N	N	N	N	N	
MKDI-04-P02	04	02	27-Feb-23	50.1269	-125.0143	Carrington Rd-Bluejay Lake	SLM, ABM, CAR	N	N	N	N	N	
MKDI-04-P03	04	03	27-Feb-23	50.1236	-125.0021	Carrington Rd-Bluejay Lake	SLM, ABM, CAR	N	N	N	N	N	
MKDI-04-P04	04	04	27-Feb-23	50.1222	-124.9917	Carrington Rd-Bluejay Lake	SLM, ABM, CAR	N	N	N	N	N	
MKDI-04-P05	04	05	27-Feb-23	50.1269	-124.9854	Carrington Rd-Bluejay Lake	SLM, ABM, CAR	N	N	N	N	N	Wolf pack observation
MKDI-04-P06	04	06	27-Feb-23	50.1251	-124.9779	Carrington Rd-Bluejay Lake	SLM, ABM, CAR	N	N	N	N	N	
MKDI-04-P01	04	01	15-Mar-23	50.1255	-125.0267	Carrington Rd-Bluejay Lake	SLM, JBA	N	N	N	N	N	
MKDI-04-P02	04	02	15-Mar-23	50.1269	-125.0143	Carrington Rd-Bluejay Lake	SLM, JBA	N	N	N	N	N	
MKDI-04-P03	04	03	15-Mar-23	50.1236	-125.0021	Carrington Rd-Bluejay Lake	SLM, JBA	N	N	N	N	N	
MKDI-04-P04	04	04	15-Mar-23	50.1222	-124.9917	Carrington Rd-Bluejay Lake	SLM, JBA	N	N	N	N	N	
MKDI-04-P05	04	05	15-Mar-23	50.1269	-124.9854	Carrington Rd-Bluejay Lake	SLM, JBA	N	Y	N	N	N	
MKDI-04-P06	04	06	15-Mar-23	50.1251	-124.9779	Carrington Rd-Bluejay Lake	SLM, JBA	N	N	N	N	N	
MKDI-01-P01	01	01	17-Feb-23	50.1467	-124.9512	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N	
MKDI-01-P02	01	02	17-Feb-23	50.1539	-124.9589	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N	
MKDI-01-P03	01	03	17-Feb-23	50.1597	-124.9560	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N	
MKDI-01-P04	01	04	17-Feb-23	50.1685	-124.9571	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N	
MKDI-01-P05	01	05	17-Feb-23	50.1764	-124.9721	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	Y	N	N	N	
MKDI-01-P06	01	06	17-Feb-23	50.1812	-124.9796	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N	

MKDI-01-P01	01	01	05-Mar-23	50.1467	-124.9512	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	Y	N	N	N
MKDI-01-P02	01	02	05-Mar-23	50.1539	-124.9589	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-01-P03	01	03	05-Mar-23	50.1597	-124.9560	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	Y	N
MKDI-01-P04	01	04	05-Mar-23	50.1685	-124.9571	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-01-P05	01	05	05-Mar-23	50.1764	-124.9721	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	Y	N
MKDI-01-P06	01	06	05-Mar-23	50.1812	-124.9796	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	Y	Y
MKDI-01-P01	01	01	19-Mar-23	50.1467	-124.9512	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-01-P02	01	02	19-Mar-23	50.1539	-124.9589	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	Y	N	N
MKDI-01-P03	01	03	19-Mar-23	50.1597	-124.9560	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-01-P04	01	04	19-Mar-23	50.1685	-124.9571	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-01-P05	01	05	19-Mar-23	50.1764	-124.9721	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-01-P06	01	06	19-Mar-23	50.1812	-124.9796	Ha'thayim (Von Donop) Inlet	SLM, DCM	N	N	N	N	N
MKDI-08-P01	08	01	15-Feb-23	50.0582	-124.9626	Kwas-Cowan Meadow	SLM, ABM	N	N	N	N	N
MKDI-08-P02	08	02	15-Feb-23	50.0674	-124.9571	Kwas-Cowan Meadow	SLM, ABM	N	N	N	N	N
MKDI-08-P03	08	03	15-Feb-23	50.0712	-124.9482	Kwas-Cowan Meadow	SLM, ABM	N	N	N	N	N
MKDI-08-P04	08	04	15-Feb-23	50.0757	-124.9414	Kwas-Cowan Meadow	SLM, ABM	N	N	N	N	N
MKDI-08-P05	08	05	15-Feb-23	50.0845	-124.9321	Kwas-Cowan Meadow	SLM, ABM	N	N	N	N	N
MKDI-08-P06	08	06	15-Feb-23	50.0872	-124.9200	Kwas-Cowan Meadow	SLM, ABM	N	N	N	N	N
MKDI-08-P07	08	07	15-Feb-23	50.0960	-124.9195	Kwas-Cowan Meadow	SLM, ABM	N	N	N	N	N
MKDI-08-P01	08	01	02-Mar-23	50.0582	-124.9626	Kwas-Cowan Meadow	SLM, JBA	N	N	N	N	N
MKDI-08-P02	08	02	02-Mar-23	50.0674	-124.9571	Kwas-Cowan Meadow	SLM, JBA	N	N	N	N	N
MKDI-08-P03	08	03	02-Mar-23	50.0712	-124.9482	Kwas-Cowan Meadow	SLM, JBA	N	N	N	N	N
MKDI-08-P04	08	04	02-Mar-23	50.0757	-124.9414	Kwas-Cowan Meadow	SLM, JBA	N	N	N	N	N
MKDI-08-P05	08	05	02-Mar-23	50.0845	-124.9321	Kwas-Cowan Meadow	SLM, JBA	N	Y	N	N	N
MKDI-08-P06	08	06	02-Mar-23	50.0872	-124.9200	Kwas-Cowan Meadow	SLM, JBA	N	N	N	Y	N
MKDI-08-P07	08	07	02-Mar-23	50.0960	-124.9195	Kwas-Cowan Meadow	SLM, JBA	N	Y	N	N	N

MKDI-08-P01	08	01	17-Mar-23	50.0582	-124.9626	Kwas-Cowan Meadow	SLM, ABM	N	N	N	N	N	
MKDI-08-P02	08	02	17-Mar-23	50.0674	-124.9571	Kwas-Cowan Meadow	SLM, ABM	N	Y	N	N	N	
MKDI-08-P03	08	03	17-Mar-23	50.0712	-124.9482	Kwas-Cowan Meadow	SLM, ABM	N	N	N	N	N	
MKDI-08-P04	08	04	17-Mar-23	50.0757	-124.9414	Kwas-Cowan Meadow	SLM, ABM	N	N	N	N	N	
MKDI-08-P05	08	05	17-Mar-23	50.0845	-124.9321	Kwas-Cowan Meadow	SLM, ABM	N	N	N	N	N	
MKDI-08-P06	08	06	17-Mar-23	50.0872	-124.9200	Kwas-Cowan Meadow	SLM, ABM	N	N	N	N	N	
MKDI-08-P07	08	07	17-Mar-23	50.0960	-124.9195	Kwas-Cowan Meadow	SLM, ABM	N	N	N	N	N	
MKDI-06-P01	06	01	18-Feb-23	50.1995	-124.9805	Bullock Bluff	SLM, DCM	N	N	N	N	N	
MKDI-06-P02	06	02	18-Feb-23	50.2048	-124.9890	Bullock Bluff	SLM, DCM	Y	N	N	N	N	WESO 200m @ 360°
MKDI-06-P03	06	03	18-Feb-23	50.2113	-124.9943	Bullock Bluff	SLM, DCM	N	N	N	N	N	
MKDI-06-P04	06	04	18-Feb-23	50.2196	-125.0047	Bullock Bluff	SLM, DCM	N	N	N	N	N	
MKDI-06-P05	06	05	18-Feb-23	50.2266	-125.0059	Bullock Bluff	SLM, DCM	N	N	N	N	N	
MKDI-06-P06	06	06	18-Feb-23	50.2357	-125.0056	Bullock Bluff	SLM, DCM	N	N	N	N	N	
MKDI-06-P01	06	01	06-Mar-23	50.1995	-124.9805	Bullock Bluff	SLM, DCM	N	N	N	N	N	
MKDI-06-P02	06	02	06-Mar-23	50.2048	-124.9890	Bullock Bluff	SLM, DCM	N	N	N	N	N	
MKDI-06-P03	06	03	06-Mar-23	50.2113	-124.9943	Bullock Bluff	SLM, DCM	N	N	N	N	N	
MKDI-06-P04	06	04	06-Mar-23	50.2196	-125.0047	Bullock Bluff	SLM, DCM	N	N	N	N	N	
MKDI-06-P05	06	05	06-Mar-23	50.2266	-125.0059	Bullock Bluff	SLM, DCM	N	N	N	N	N	
MKDI-06-P06	06	06	06-Mar-23	50.2357	-125.0056	Bullock Bluff	SLM, DCM	N	N	N	N	N	
MKDI-06-P01	06	01	18-Mar-23	50.1995	-124.9805	Bullock Bluff	SLM, DCM	N	N	N	N	N	
MKDI-06-P02	06	02	18-Mar-23	50.2048	-124.9890	Bullock Bluff	SLM, DCM	N	N	N	N	N	
MKDI-06-P03	06	03	18-Mar-23	50.2113	-124.9943	Bullock Bluff	SLM, DCM	N	N	N	N	N	
MKDI-06-P04	06	04	18-Mar-23	50.2196	-125.0047	Bullock Bluff	SLM, DCM	N	N	N	N	N	
MKDI-06-P05	06	05	18-Mar-23	50.2266	-125.0059	Bullock Bluff	SLM, DCM	Y	N	N	N	N	WESO 1852m @ 270°
MKDI-06-P06	06	06	18-Mar-23	50.2357	-125.0056	Bullock Bluff	SLM, DCM	Y	N	N	N	N	WESO 400m @ 45°
MKDI-07-P01	07	01	16-Feb-23	50.1175	-124.9435	Stitchville - Ha'thayim	SLM, ABM	N	N	N	N	N	
MKDI-07-P02	07	02	16-Feb-23	50.1217	-124.9501	Stitchville - Ha'thayim	SLM, ABM	N	Y	N	N	N	

MKDI-07-P03	07	03	16-Feb-23	50.1274	-124.9451	Stitchville - Ha'thayim	SLM, ABM	N	N	N	N	N
MKDI-07-P04	07	04	16-Feb-23	50.1328	-124.9497	Stitchville - Ha'thayim	SLM, ABM	N	N	N	N	N
MKDI-07-P05	07	05	16-Feb-23	50.1388	-124.9515	Stitchville - Ha'thayim	SLM, ABM	N	N	N	N	N
MKDI-07-P06	07	06	16-Feb-23	50.1387	-124.9607	Stitchville - Ha'thayim	SLM, ABM	N	N	N	N	N
MKDI-07-P01	07	01	28-Feb-23	50.1175	-124.9435	Stitchville - Ha'thayim	SLM, ABM, FJS	N	N	N	N	N
MKDI-07-P02	07	02	28-Feb-23	50.1217	-124.9501	Stitchville - Ha'thayim	SLM, ABM, FJS	N	N	Y	N	N
MKDI-07-P03	07	03	28-Feb-23	50.1274	-124.9451	Stitchville - Ha'thayim	SLM, ABM, FJS	N	N	N	N	N
MKDI-07-P04	07	04	28-Feb-23	50.1328	-124.9497	Stitchville - Ha'thayim	SLM, ABM, FJS	N	N	N	N	N
MKDI-07-P05	07	05	28-Feb-23	50.1388	-124.9515	Stitchville - Ha'thayim	SLM, ABM, FJS	N	N	N	N	N
MKDI-07-P06	07	06	28-Feb-23	50.1387	-124.9607	Stitchville - Ha'thayim	SLM, ABM, FJS	N	N	N	N	N
MKDI-07-P01	07	01	16-Mar-23	50.1175	-124.9435	Stitchville - Ha'thayim	SLM, ABM, CAR	N	Y	N	N	N
MKDI-07-P02	07	02	16-Mar-23	50.1217	-124.9501	Stitchville - Ha'thayim	SLM, ABM, CAR	N	N	N	N	N
MKDI-07-P03	07	03	16-Mar-23	50.1274	-124.9451	Stitchville - Ha'thayim	SLM, ABM, CAR	N	N	N	N	N
MKDI-07-P04	07	04	16-Mar-23	50.1328	-124.9497	Stitchville - Ha'thayim	SLM, ABM, CAR	N	Y	N	N	N
MKDI-07-P05	07	05	16-Mar-23	50.1388	-124.9515	Stitchville - Ha'thayim	SLM, ABM, CAR	N	N	N	N	N
MKDI-07-P06	07	06	16-Mar-23	50.1387	-124.9607	Stitchville - Ha'thayim	SLM, ABM, CAR	N	N	N	N	N