DEPARTMENT OF NATIONAL DEFENCE

ESAC

ENVIRONMENTAL SCIENCE ADVISORY COMMITTEE

CANADIAN FORCES BASE ESQUIMALT

2010 / 2011 Annual Report

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EXECUTIVE SUMMARY

The Department of National Defence (DND) Environmental Science Advisory Committee (ESAC) for CFB Esquimalt was established in 1994 as a multi-agency technical advisory committee that reviews and recommends proposals from researchers and other parties interested in carrying out natural resources research on CFB Esquimalt properties.

Every year from 1994 to 2010, ESAC has collected, reported on, and archived the findings of the research activities in a printed and web-based annual report. ESAC has also acted as an advisory body to CFB Esquimalt on various environmental issues occurring on CFB Esquimalt properties, and served as a gateway to a network of scientists accessible to Maritime Forces Pacific (MARPAC) staff.

In 2010, the Committee reviewed 14 proposals to conduct research and collection activities on CFB Esquimalt properties. Each proposal was reviewed by ESAC for scientific content and forwarded to DND to ensure that the proposed activities would not result in any adverse environmental effects or interfere with military operations. Eleven ESAC research and collection permits were issued to individuals and organizations, authorizing environmental research on CFB Esquimalt lands. A compilation of the scientific reports obtained from each of these authorized research projects, as well as a summary of the Committee's activities conducted throughout the year, are presented in this annual report.

To facilitate the sharing of research findings collected on CFB Esquimalt land in 2010, the Committee hosted its ESAC Annual Workshop on 3 February 2011 at the Pacific Forestry Centre, Victoria, B.C. Six presentations, focusing on wildlife and sensitive ecosystem inventories, monitoring, restoration and archaeology were given to personnel from government and non-government organizations. The 2010 ESAC Annual Workshop was well attended with over 70 individuals in attendance.

After 17 successful years, ESAC ceased to exist as of April 2011. With the increasing capacity of DND Formation Environment and participation on numerous multi-agency species and ecosystem recovery teams, CFB Esquimalt no longer had the same requirements for the Committee as it once had. As such, CFB Esquimalt did not renew the Letter of Understanding which expired on 31 March 2011 and the Committee dissolved. Environmental research on CFB Esquimalt properties will continue to be permitted. A new system of facilitating access permits for scientific research has been implemented by the Formation Environment Office at CFB Esquimalt.

P137-10 Tracking tagged River Otters using radio telemetry techniques.

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INTRODUCTION

Maritime Forces Pacific (MARPAC) constitutes Canada's Navy on the West Coast. Her Majesty's Canadian Dockyard at Canadian Forces Base (CFB) Esquimalt is home to the Navy's Canadian Pacific Fleet. The role of CFB Esquimalt is to support the ships of the Canadian Pacific Fleet and other key military units.

With approximately 4,200 hectares of land and multiple properties under its administration (Table 1, Figure 1), MARPAC has long acknowledged its responsibility to consider environmental impacts in the management of its training areas and in the planning and conduct of its activities. Efforts to minimize the adverse effects of training and operations, in conjunction with innovative management practices, will ensure continued protection and enhancement of the many significant natural areas and unique features located on CFB Esquimalt lands in British Columbia (B.C.).

MARPAC properties, while utilized for a variety of military purposes, including industrial activities, training exercises, and communications infrastructure, are often relatively undisturbed by human impact.

A number of CFB Esquimalt properties support remnants of sensitive ecosystems such as coastal Douglas-fir forests and Garry oak meadows which provide unique opportunities for scientists to conduct an array of environmental studies.

Table 1. CFB Esquimalt Properties: Area in hectares (ha).

Albert Head	93
Aldergrove (Maintenance Detachment)	514
Colwood	90
CFMETR	288
Dockyard / Signal Hill / Yarrows	63
Heals Rifle Range	212
Mary Hill	178
Masset	824
Matsqui TX	95
Naden	45
Nanaimo Rifle Range	351
Nanoose TX	105
Rocky Point	1078
Royal Roads	229
Work Point	66
Total Area	**4231**

BACKGROUND

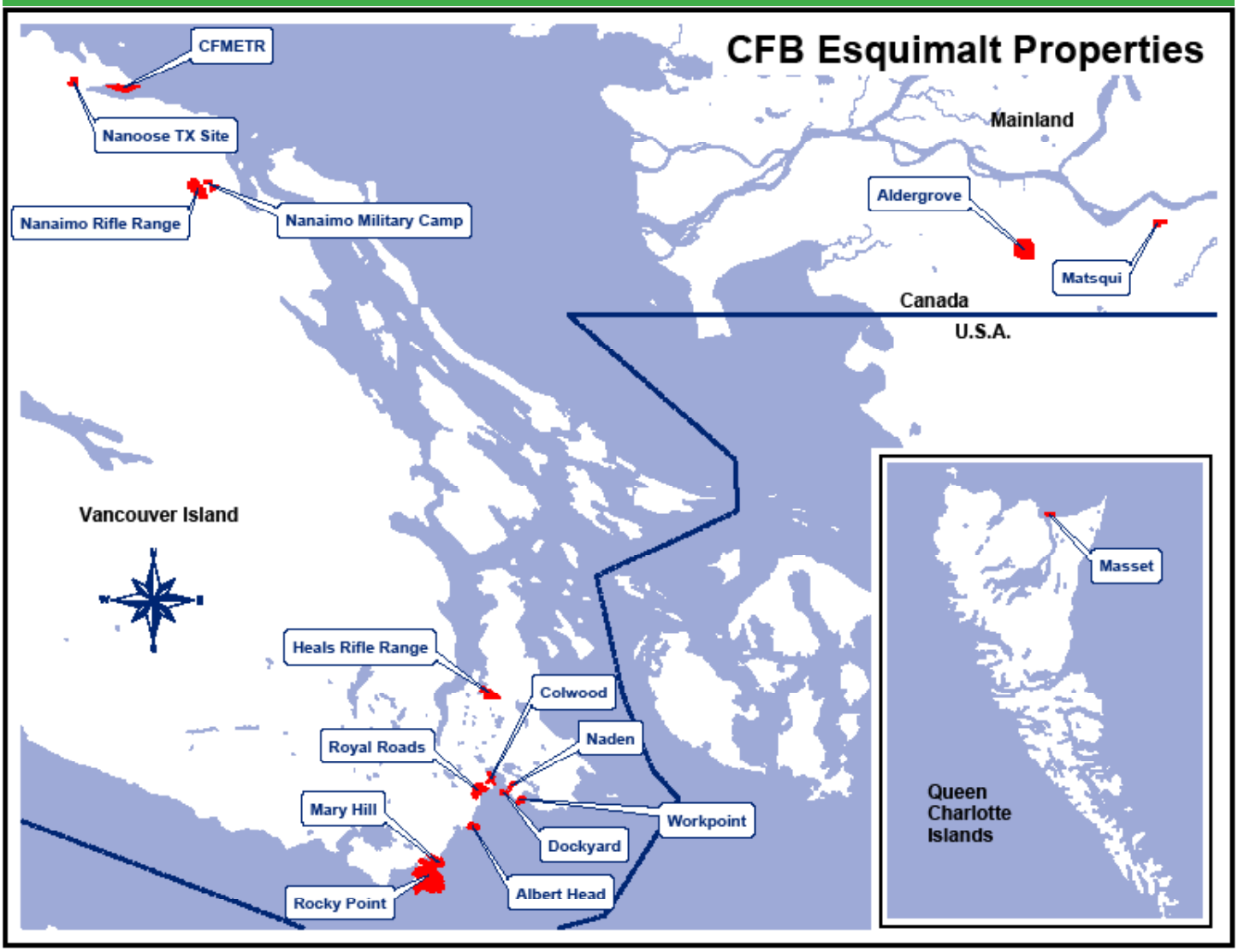
ESAC 1994 - 2011

Prior to 1994, there was minimal coordination between research projects undertaken on CFB Esquimalt properties, and the findings were not readily available to MARPAC personnel for use in environmental management and decision-making. The recognized need for a process to track the research activities and associated findings resulted in the formation of the DND Environmental Science Advisory Committee (ESAC) for CFB Esquimalt in 1994.

A series of Letters of Understanding (LOU) between CFB Esquimalt and the ESAC member agencies set the framework for the Committee; and the most recent LOU was for the five-year period 2006-2011.

From the Committee's inception through 2010, ESAC has facilitated and coordinated environmental studies on CFB Esquimalt properties, in conjunction with other environmental projects funded by DND. The Committee's primary functions have been to

Figure 1. Map of CFB Esquimalt Properties.



review, evaluate, and provide scientific expertise and advice to CFB Esquimalt on proposals received to conduct biological and environmental studies on its properties.

Research activities requiring an ESAC permit have included the following: observations; photography; surveys and inventories; tagging and banding; collection of wildlife specimens; and installation of scientific monitoring structures.

The ESAC has provided scientific advice within the context of MARPAC's overall Natural Resources Program. This program encompasses the management of natural resources on CFB Esquimalt lands including Species At Risk, sensitive ecosystems, forests, wetlands, and riparian zones while ensuring sustainable military training and operations. ESAC has acted as an advisory body to MARPAC by providing direction and insight on various environmental issues occurring on CFB Esquimalt properties. ESAC members have also provided MARPAC personnel with the ability to connect with the broader scientific community regarding various environmental topics.

Members of ESAC

ESAC is a multi-agency technical advisory committee composed of the following members:

- CFB Esquimalt (Formation Safety and Environment Branch)
- CFB Esquimalt (Base Construction Engineering Office)
- Natural Resources Canada (Canadian Forest Service)
- Environment Canada (Canadian Wildlife Service)
- B.C. Ministry of Forests and Range
- University of Victoria
- Royal Roads University

A complete list of ESAC members in 2010 and contact information is located at the end of this report.

Table 2. Number of research proposals received and permits issued since 1995.

Year	Proposal	Permits
2010	14	11
2009	22	21
2008	18	18
2007	18	15
2006	22	21
2005	25	21
2004	16	16
2003	26	24
2002	21	20
2001	14	14
1999	25	25
1998	26	26
1997	24	24
1996	25	24
1995	22	20

ESAC ACTIVITIES IN 2010

Research And Collection Activities

A total of 14 proposals were received and reviewed by ESAC in 2010. Of the 14 proposals received, 11 permits were issued; all of which were renewals of previous year's permits. Table 2 shows the number of proposals received and permits issued annually since 1995.

The diversity of projects conducted in 2010 enhanced the knowledge and understanding of the wildlife, sensitive ecosystems and cultural features occurring on CFB Esquimalt properties. In addition, research findings collected under ESAC permits contributed to sound decision-making and environmental management by CFB Esquimalt personnel. Table 3 lists all research and collection activities conducted in 2010 under the auspices of ESAC.

Advisory And Reporting Activities

The year of 2010-11 was the 16th and final full year of activity for ESAC. During that period, the Committee met three times to review project proposals and status, plan reporting activities, and advise CFB Esquimalt on other environmental issues occurring on CFB Esquimalt properties. The committee also discussed and advised on Natural Resource program activity plans for 2010-11.

The locations of ESAC project sites as well as all wildlife and sensitive ecosystem inventory data collected by projects in 2010 were integrated into the CFB Esquimalt Natural Resources Geographic Information Systems (GIS) database. Such information helps minimize overlap and potential conflicts between military training and

other activities, and increases the available information for natural resources management of the properties.

As part of the reporting process, ESAC permit holders are required to submit a report on their activities and results, for the permit year. ESAC compiles these documents and makes them available to all member agencies and other interested organizations by way of the annual report. All of the ESAC annual reports from 1994 – 2010/2011 are available online via the ESAC website: http://cfs.nrcan.gc.ca/projects/99

To further promote the sharing of information obtained through ESAC research projects, the Committee hosted its last annual workshop. The 2010 ESAC Workshop, held on 3 February 2011 at the Pacific Forestry Centre, included opening remarks from Base Commander Craig Baines. The workshop was well attended with over 70 individuals in attendance; participants included representatives from several federal, provincial and municipal agencies, universities, non-governmental organizations and the general pubic. Six presentations, focusing on wildlife and sensitive ecosystem inventories, monitoring, restoration and archaeology were given for the projects noted in Table 3.

P044-10 Bruce Cousens presenting an update on Purple Martin research at the ESAC Annual Workshop.

Table 3. Summary of research projects conducted under ESAC in 2010.

ESAC Permit Title	Project Leader	Permit #	Properties (Abbreviations Below)
Rocky Point Bird Observatory Avian Monitoring**	A. Nightingale	P003-10*	AH, HR, RP, RR
Purple Martin Origins and Relationships**	B. Cousens	P044-10*	CO, DY, RR
Wildlife Tree Stewardship Program (WiTS)	I. Moul	P074-10*	AH, CO, RP
Garry Oak Acorn Survey	R. Negrave	P079-10*	CFMETR, RP
The Strait of Georgia Mortuary Landscape Project	D. Mathews	P104-10*	AH, CO, RP
Western Bluebird Nestbox Program**	K. Vaino & K. Martell	P108-10*	CFMETR, RP
Monitoring of the Oregon Spotted frog (*Rana pretiosa*)	C. Bishop	P109-10*	ALD
Year-round Microclimates Experienced by Butterfly Larvae in Garry Oak Ecosystems	B. Sinclair	P124-10*	RP
Efficacy Testing of Pheromones and Kairomones for Woodboring Coleoptera**	L. Humble	P126-10*	RP
Organic and Inorganic Nitrogen Indices Along a Productivity Gradient in Coastal Temperate Douglas-fir Forests**	M. Kranabetter	P134-10*	HR, RP, RR
Contaminant Exposure in River Otters (*Lontra canadensis*): An Assessment of Spatial and Geographic Trends in Home Range and Population Demographics	C. Nelson	P137-10*	AH, CO, DY, NA, RP, RR, WP

* Renewed from previous years.

** A presentation on this project was made at the ESAC Annual Workshop, 3 February 2011.

Properties: AH: Albert Head; ALD: Aldergrove; CFMETR: Canadian Forces Maritime Experimental and Test Ranges; CO: Colwood; DY: Dockyard; HR: Heals Rifle Range; NA: Naden; RP: Rocky Point; RR: Royal Roads.

Rocky Point Canopy Station

Decommissioning of the Rocky Point Canopy Station began in 2009 with the removal of microclimate monitoring equipment on the canopy trees and adjacent metal tower. In 2010 the metal tower was removed. Removal of the remaining canopy infrastructure is planned for 2011.

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SCIENTIFIC REPORTS

Research and Collection Activities Conducted in 2010

Rocky Point Bird Observatory Avian Monitoring – Passerine Migration Monitoring

Project Leader(s): Ann Nightingale
Organization(s): Rocky Point Bird Observatory
Address(es): 1721 Cultra Ave, Saanichton, BC, V8M 1T1
Telephone No.(s): (250) 514-6450
Email(s): rpbo@rpbo.org

PERMIT #: P003-10
LOCATION(S): ROCKY POINT, ROYAL ROADS

START DATE: 21 JULY 2010
COMPLETION DATE: 18 OCTOBER 2010
PROJECT STATUS: 1994-ONGOING

Introduction:

2010 marked the 16th season of passerine migration monitoring at Rocky Point. Monitoring takes place within the 90-day period from 21 July until 18 October to maximize coverage during the peak season for the majority of neotropical passerine species migrating through the southern part of Vancouver Island, British Columbia (B.C.).

The migration monitoring projects at Rocky Point collect data on population trends, and over time provide data for determining population changes at the landscape level. Data collected at Rocky Point cover migrants from coastal B.C. and Alaska, and when the data are combined with results collected from the other banding stations across Canada, the status of migrating songbirds can be assessed at a national scale.

Study Area and Methods:

Rocky Point Bird Observatory (RPBO) is located at the southernmost tip of Vancouver Island, B.C. on the Canadian Forces Ammunition Depot (CFAD) at Rocky Point. The location of the study area is the riparian zone immediately north of the Building 100 site.

The fall migration monitoring effort at Rocky Point employed 13 mist nets in established positions around the site. Nets were opened 30 minutes before sunrise and operated for six hours each day between 21 July and 18 October. RPBO's protocol calls for daily monitoring during this period except for days with inclement weather or when access to Rocky Point cannot be obtained due to military use on the site. A total of nine days coverage was lost in 2010 out of the standard 90-day migration-monitoring season. Four of these days were due to heavy rain, and five were due to military activity. The resultant 5,775.27 net hours (one net hour equals the opening of one standard 12m mist net for one hour) represents the highest since 2005.

Birds captured in the mist nets were identified, banded, measured for a number of morphometric features, sexed and aged using the criteria in Pyle (1997), and released. Each day, a standardized census route was walked and general observations on all birds present in the area were recorded (RPBO 2008).

In addition to the banding effort and daily census, RPBO personnel also recorded personal observations of birds, including those species that were not banded at Rocky Point, at the site.

Additional background information regarding the ecological context at Rocky Point and the methods used to monitor birds is covered in both the final report for 2008 (David 2008) and the RPBO protocol (RPBO 2008).

Results:

A total of 3,193 individuals of 63 species and forms (including two subspecies of Yellow-Rumped Warbler (*Dendroica coronata audubonii* and *D. c. coronata*), unidentified Dark-eyed Junco (*Junco hyemalis* sp.), and Traill's Flycatcher – an historical amalgam of Willow and Alder Flycatcher (*Empidonax traillii* and *E. alnorum*) were banded in 2010 (Table 1). An additional species, Red-shafted Flicker (*Colaptes auratus*) was recorded solely from a recaptured individual from a previous season. This addition gives a total of 64 species and forms encountered during 2010, the highest diversity of species banded during RPBO fall migration monitoring. The total individuals banded during 2010 represented the fifth highest banding total since 2000.

A juvenile Red-tailed Hawk (*Buteo jamaicensis*) was banded on 22 September, representing the first banding record for this species at RPBO since monitoring began. Red-tailed Hawks are resident at Rocky Point throughout the year, and are frequently observed in small to moderate numbers throughout the monitoring period. It is likely that the only reason one has not been banded previously is that the mesh size of the mist nets used for migration monitoring banding is too small to effectively capture birds of such large size.

P003-10 Varied Thrush with leg band.

Four species were banded in record high numbers in 2010; these were Townsend's Warbler (*Dendroica townsendi*) (13 – previous high 12), MacGillivray's Warbler (*Oporonis tolmiei*) (71 – previous high 68), Song Sparrow (*Melospiza melodia*) (170 – previous high 168), and Rufous Hummingbird (*Selasphorus rufus*) (27 – previous high 24). It is likely that for all of these species, the uninterrupted banding access during the end of July through mid-August played a major role in their higher than normal numbers. Rufous Hummingbird, and Townsend's and MacGillivray's Warblers are relatively early migrants and their presence reached peak numbers during this time.

A number of species that are uncommon to Rocky Point were banded during the season. These included Alder Flycatcher (3rd RPBO record), Olive-sided Flycatcher (*Contopus cooperi*) (8th RPBO record), Nashville Warbler (*Vermivora ruficapilla*) and Swamp Sparrow (*Melospiza georgiana*).

The number of hatch year (HY) birds captured during the monitoring period was, as is typical during the fall migration period, much higher than the number of after hatch year (AHY) birds. An HY bird is one fledged during the 2010 calendar year while an AHY is one fledged earlier. In 2010, 87.6% of birds captured were HY. Details of captures by species and age classification are presented in Table 1.

Table 1. Summary of constant effort mist net captures at RPBO field site by species, band status and age. After Hatch-year - AHY (birds in at least their 2nd calendar year) and Hatch-year - HY (birds in their 1st calendar year) are based on initial annual captures only.

Species	Total number of birds captured	Number of new birds banded	Number of individuals recaptured	AHY	HY	Unknown age	% of HY birds
Alder Flycatcher	1	1		0	1		100
American Goldfinch	98	94	4	22	76		77.6
American Robin	27	26	1	6	21		77.8
Audubon's Warbler	5	5		0	5		100
Barred Owl	2	2		1	1		50
Belted Kingfisher	2	2		1	1		50
Bewick's Wren	51	30	21	5	31		86.1
Black-headed Grosbeak	2	2		1	1		50
Black-throated Grey Warbler	7	7		0	7		100
Brown Creeper	15	10	5	0	10		100
Brown-headed Cowbird	6	4	2	0	4		100
Cassin's Vireo	2	2		0	2		100
Cedar Waxwing	8	8		5	3		37.5
Chestnut-backed Chickadee	123	56	67	22	61		73.5
Chipping Sparrow	7	7		0	7		100
Common Bushtit	11	11		2	9		81.8
Common Yellowthroat	118	87	31	3	83	1	95.4
Cooper's Hawk	2	2		0	2		100
Downy Woodpecker	6	4	2	1	3		75
Fox Sparrow	187	149	38	18	136	1	87.7
Golden-crowned Kinglet	132	111	21	9	104		92
Golden-crowned Sparrow	56	54	2	10	45		81.8
Hairy Woodpecker	2	2		1	1		50
Hammond's Flycatcher	20	19	1	3	16		84.2
Hermit Thrush	75	74	1	3	71		95.9
House Finch	2	2		1	1		50
House Wren	24	20	4	4	17		81
Hutton's Vireo	9	6	3	1	5		83.3
Lincoln's Sparrow	119	113	6	11	102		90.3
MacGillivray's Warbler	82	71	11	2	69		97.2
Marsh Wren	12	7	5	0	7		100
Myrtle Warbler	16	16		6	10		62.5
Nashville Warbler	1	1		0	1		100
Northern Pygmy-owl	1	1		1	0		0
Olive-sided Flycatcher	2	1	1	0	1		100
Orange-crowned Warbler	212	195	17	27	174		86.6
Oregon Junco	41	40	1	9	31		77.5
Pacific Wren	193	175	18	10	163	2	93.1

Table 1 Continued: Summary of constant effort mist net captures at RPBO field site by species, band status and age.

Species	Total number of birds captured	Number of new birds banded	Number of individuals recaptured	AHY	HY	Unknown age	% of HY birds
Pacific-slope Flycatcher	310	307	3	20	288		93.5
Puget Sound White-crowned Sparrow	170	128	42	11	121		91.7
Purple Finch	10	10		6	4		40
Red-breasted Nuthatch	3	3		2	1		33.3
Red-shafted Flicker	1		1	1	0		0
Red-tailed Hawk	1	1		0	1		100
Red-winged Blackbird	9	9		0	9		100
Ruby-crowned Kinglet	258	240	18	22	219	2	90.1
Rufous Hummingbird	27	27		2	25		92.6
Savannah Sparrow	49	48	1	7	41		85.4
Sharp-shinned Hawk	2	2		0	2		100
Spotted Towhee	158	146	12	30	121		80.1
Steller's Jay	14	13	1	1	12		92.3
Swainson's Thrush	86	70	16	18	55		75.3
Swamp Sparrow	2	2		0	2		100
Townsend's Warbler	13	13		3	10		76.9
Traill's Flycatcher	10	9	1	0	9		100
Unid. Dark-eyed Junco	3	3		0	3		100
Varied Thrush	2	2		0	2		100
Violet-green Swallow	1	1		0	1		100
Warbling Vireo	18	18		5	13		72.2
Western Tanager	1	1		1	0		0
White-throated Sparrow	6	5	1	1	4		80
Willow Flycatcher	48	41	7	4	38		90.5
Wilson's Warbler	369	334	35	25	316		92.7
Yellow Warbler	180	173	7	38	135		78
Total	**3710**	**3193**	**517**	**400**	**2878**	**7**	**87.6**

A total of 69 birds of 17 species from previous seasons were recaptured in 2010. The oldest was a Chestnut-backed Chickadee (*Poecile rufescens*) originally banded on 27 July 2003. An American Robin (*Turdus migratorius*) originally banded on 12 September 2004 and a Chestnut-backed Chickadee from 7 August 2004 were also recaptured in 2010.

In 2010, two days of the 90-day monitoring period yielded banding totals of 100 or more birds; these were 21 September with 172 individuals banded (19 species), and 29 September, with 109 individuals banded (20 species). This closely mirrored what Leckie (2008) observed; i.e., that typically the highest banding totals of the fall season at Rocky Point occur towards the end of September. David (2008) noted that 20 and 21 September were generally the most productive days. For 2010, rain curtailed banding on 19 September and led to a disappointing yield of only 14 birds banded (13 species) on 20 September. The following three

days (21 September through 23 September) were the most productive of the season, with a total of 349 birds being banded and a capture rate of 161.2 birds per 100 net hours.

A total of 167 species were encountered at Rocky Point in 2010 during the standardized census and through casual observation and banding results. The results, and a rough guide to monthly presence/absence, are presented in Table 2.

With a total of 8,103 individual sightings, Turkey Vulture (*Cathartes aura*) was the most numerous species recorded. Nearly half of these sightings (4,015) occurred between 29 September and 2 October. This 4-day period turned out to be the peak in numbers of several migrating raptor species, including Red-tailed Hawk, Cooper's Hawk (*Accipiter cooperii*), and Sharp-shinned Hawk (*A. striatus*).

Five bird species were recorded on each of the 81 days when monitoring took place; these species, all of which are year-round residents, were Belted Kingfisher (*Megaceryle alcyon*), Common Raven (*Corvus corax*), Chestnut-backed Chickadee, Red-breasted Nuthatch (*Sitta canadensis*), and Song Sparrow. Twenty-one species, representing 12.6% of the species total, were encountered on only a single day. The majority of these species were local or regional rarities.

Discussion:

A long-term data set quantifying bird migration is a very valuable tool for analyzing species trends, both on a geographic flyway level, and on a site-specific level. Declining and at-risk species and ecosystems can be identified, leading to conservation and/or restoration activities if appropriate. As data collection continues over time, the effect of vagaries in local weather and other anomalies is reduced, making trend analysis more accurate, sensitive, and consequently even more useful.

Rocky Point Bird Observatory has been monitoring fall bird migration through Rocky Point since 1994. Using a mixture of dedicated, skilled volunteers and experienced staff, RPBO has made great contributions in the field of neotropical migrant research, including the quantification of population levels, migration chronology, regional avian breeding success, and migrant use of Garry oak meadow habitat. Given that Bird Studies Canada has identified the northern Pacific coastal rainforest (Bird Conservation Region 5) as a region of high research interest due to the large number of range-limited species and sub-species that occur there; and that RPBO operates the only Pacific coastal migration monitoring station in Canada (Crewe *et al*. 2008); the national and international value of RPBO research cannot be underestimated.

RPBO hopes to continue fall migration monitoring at Rocky Point. In addition, monitoring activities could expand to include the overwintering period and possibly some of the spring migration, to give a more complete picture of the avian use of the site. The former could be accomplished by a combination of banding when weather conditions permit and by a regular census. This would reveal the use of species and individuals of Rocky Point as an overwintering site, and over time with recovery data, individual longevity. This, combined with the Monitoring Avian Productivity and Survivorship (MAPS) data, would provide a more complete measure of ecosystem health for the Garry oak meadow habitat at Rocky Point. Spring migration monitoring, which could be accomplished with a regular census, would give chronology data for spring migration, and identify the species present on the site during the spring.

(Continued on page 16)

Table 2. Species Observed During Fall 2010 Migration Monitoring at Rocky Point Including Monthly Presence/Absence (presence indicated by X.)

Species	Total Obs.	Max. Obs.	Date(s) of Max. Obs.	No. of Dates Recorded	Ave. per Date	July	Aug	Sept	Oct
Gr. White-fronted Goose	321	245	28 Sep	8	40.1			X	X
Black Brant	2	2	21 Jul	1	2.0	X			
Cackling Goose	6	6	14Oct	1	6.0				X
Canada Goose	1194	43	08 Aug	69	17.3	X	X	X	X
Mute Swan	2	1	07, 08 Oct	2	1.0				X
Wood Duck	2	1	01, 03,Oct	2	1.0				X
American Wigeon	45	5	25 Sep; 9, 18 Oct	18	2.5			X	X
Mallard	1081	42	23 Aug	75	14.4	X	X	X	X
Northern Shoveler	1	1	15 Sep	1	1.0			X	
Northern Pintail	84	12	17 Sep	30	2.8		X	X	X
Green-winged Teal	180	44	17 Sep	29	6.2		X	X	X
Harlequin Duck	141	20	10 Oct	28	5.0		X	X	X
Surf Scoter	601	90	20 Sep	24	25.0		X	X	X
White-winged Scoter	27	4	many	12	2.3			X	X
Unidentified Scoter	15	15	16 Sep	1	15.0			X	
Bufflehead	7	5	18 Oct	2	3.5				X
Hooded Merganser	5	2	17, 18 Oct	3	1.7				X
Common Merganser	7	7	25 Sep	1	7.0			X	
Red-breasted Merganser	31	25	02 Oct	2	15.5				X
California Quail	1328	55	01 Aug	75	17.7	X	X	X	X
Red-throated Loon	1	1	19 Aug	1	1.0		X		
Pacific Loon	3	3	03 Oct	1	3.0				X
Common Loon	19	3	20 Sep	16	1.2	X	X	X	X
Unid. Loon	7	5	20 Sep	2	3.5		X	X	
Horned Grebe	4	2	7,8 Oct	2	2.0				X
Red-necked Grebe	11	3	16 Oct	9	1.2		X	X	X
Western Grebe	7	2	9, 11 Oct	5	1.4				X
Sooty Shearwater	1	1	20 Sep	1	1.0			X	
Fork-tailed Storm Petrel	1	1	08 Sep	1	1.0			X	
Brandt's Cormorant	359	67	01 Oct	28	12.8		X	X	X
Double-crested Cormorant	1307	182	14 Oct	43	30.4		X	X	X
Pelagic Cormorant	26	3	30 Sep; 01 Oct	19	1.4	X	X	X	X
Great Blue Heron	197	7	01 Aug	79	2.5	X	X	X	X
Turkey Vulture	8103	1334	02 Oct	77	105.2	X	X	X	X
Osprey	4	2	22 Sep	3	1.3			X	
Bald Eagle	151	6	01 Aug	61	2.5	X	X	X	X
Northern Harrier	18	1	many	18	1.0		X	X	X
Sharp-shinned Hawk	285	40	01 Oct	50	5.7	X	X	X	X

Table 2 Continued: Species Observed During Fall 2010 Migration Monitoring at Rocky Point Including Monthly Presence/Absence (presence indicated by X.)

Species	Total Obs.	Max. Obs.	Date(s) of Max. Obs.	No. of Dates Recorded	Ave. per Date	July	Aug	Sept	Oct
Cooper's Hawk	113	22	01 Oct	40	2.8	X	X	X	X
Unid. Accipiter	2	2	03 Sep	1	2.0			X	
Broad-winged Hawk	12	4	01, 02 Oct	4	3.0			X	X
Swainson's Hawk	2	1	23 Sep; 07 Oct	2	1.0			X	X
Red-tailed Hawk	310	41	01 Oct	61	5.1	X	X	X	X
Golden Eagle	4	1	many	4	1.0			X	X
American Kestrel	7	3	23 Sep	4	1.8			X	
Merlin	45	2	many	39	1.2	X	X	X	X
Peregrine Falcon	22	2	many	17	1.3		X	X	X
Virginia Rail	19	1	many	19	1.0	X	X	X	X
Sora	10	2	23 Jul	9	1.1	X	X		
Sandhill Crane	65	14	20 Sep	10	6.5			X	X
Black-Bellied Plover	11	8	25 Aug	4	2.8		X	X	
Pacific Golden Plover	1	1	15 Sep	1	1.0			X	
Semipalmated Plover	24	4	19 Aug	14	1.7	X	X	X	
Killdeer	289	18	22 Aug	67	4.3	X	X	X	X
Black Oystercatcher	438	23	10 Oct	74	5.9	X	X	X	X
Spotted Sandpiper	11	2	19 Aug	10	1.1	X	X	X	
Solitary Sandpiper	1	1	16 Aug	1	1.0		X		
Greater Yellowlegs	57	4	04 Aug; 27 Sep	41	1.4	X	X	X	X
Lesser Yellowlegs	21	18	30 Aug	4	5.3	X	X		
Ruddy Turnstone	1	1	09 Aug	1	1.0		X		
Black Turnstone	153	30	18 Aug	26	5.9	X	X	X	X
Surfbird	7	5	18 Aug	2	3.5		X		
Semipalmated Sandpiper	13	12	06 Aug	2	6.5		X		
Western Sandpiper	208	50	22 Aug	20	10.4		X	X	
Least Sandpiper	216	23	27 Aug	23	9.4	X	X	X	
Pectoral Sandpiper	1	1	07 Sep	1	1.0			X	
peeps sp.	160	30	12 Aug	22	7.3	X	X	X	
Short-billed Dowitcher	9	3	11 Aug	7	1.3	X	X	X	X
Long-billed Dowitcher	12	4	18 Sep	7	1.7	X	X	X	X
Wilson's Snipe	11	7	10 Oct	4	2.8			X	X
Red-necked Phalarope	17	10	22 Sep	3	5.7		X	X	
Unid. Phalarope	25	15	19 Aug	4	6.3		X	X	
Bonaparte's Gull	322	46	29 Jul	32	10.1	X	X	X	X
Heermann's Gull	1352	97	19 Aug	75	18.0	X	X	X	X
Mew Gull	626	75	26 Aug	50	12.5	X	X	X	X
Ring-billed Gull	100	97	20 Sep	2	50.0			X	

Table 2 Continued: Species Observed During Fall 2010 Migration Monitoring at Rocky Point Including Monthly Presence/Absence (presence indicated by X.)

Species	Total Obs.	Max. Obs.	Date(s) of Max. Obs.	No. of Dates Recorded	Ave. per Date	July	Aug	Sept	Oct
Western Gull	2	1	01 Aug; 10 Oct	2	1.0		X		X
California Gull	6242	575	13 Oct	75	83.2	X	X	X	X
Glaucous-winged Gull	4146	450	27 Sep	80	51.8	X	X	X	X
Gull sp.	7723	750	08 Oct	57	135.5	X	X	X	X
Caspian Tern	1	1	14 Aug	1	1.0		X		
Pomarine Jaeger	2	1	08, 17 Sep	2	1.0			X	
Unidentified Jaeger	1	1	26 Sep	1	1.0			X	
Common Murre	1878	505	19 Aug	48	39.1	X	X	X	X
Pigeon Guillemot	146	16	29 Jul	30	4.9	X	X	X	X
Marbled Murrelet	19	5	05 Aug	8	2.4		X	X	X
Rhinoceros Auklet	3750	1395	19 Aug	56	67.0	X	X	X	X
Tufted Puffin	1	1	04 Aug	1	1.0		X		
Band-tailed Pigeon	2874	500	17 Sep	65	44.2	X	X	X	X
Eurasian Collared-dove	2	2	30 Jul	1	2.0	X			
Great Horned Owl	24	2	many	19	1.3	X	X	X	X
Northern Pygmy-owl	5	1	many	5	1.0	X	X		
Barred Owl	37	3	many	27	1.4		X	X	X
Northern Saw-whet Owl	4	1	many	4	1.0			X	X
Common Nighthawk	11	4	23 Sep	8	1.4	X	X	X	
Black Swift	14	11	07 Sep	2	7.0			X	
Vaux's Swift	467	118	05 Sep	17	27.5		X	X	
Anna's Hummingbird	10	2	01 Aug	9	1.1	X	X	X	X
Rufous Hummingbird	131	11	04 Aug	32	4.1	X	X	X	X
Unidentified Hummingbird	1	1	06 Oct	1	1.0				X
Belted Kingfisher	162	4	08 Aug; 08, 10 Oct	81	2.0	X	X	X	X
Red-breasted Sapsucker	2	1	21 Sep; 03 Oct	2	1.0			X	X
Downy Woodpecker	236	7	10, 16 Oct	77	3.1	X	X	X	X
Hairy Woodpecker	127	5	25 Aug; 05 Sep	71	1.8	X	X	X	X
Red-shafted Flicker	519	17	10 Oct	80	6.5	X	X	X	X
Pileated Woodpecker	60	3	30 Aug	46	1.3	X	X	X	X
Olive-sided Flycatcher	124	8	04 Aug	32	3.9	X	X	X	
Western Wood Pewee	10	2	10 Aug	9	1.1	X	X		
Alder Flycatcher	1	1	03 Sep	1	1.0			X	
Willow Flycatcher	118	13	09, 12 Aug	39	3.0	X	X	X	
Traill's Flycatcher	15	3	19 Aug	9	1.7		X	X	
Hammond's Flycatcher	44	7	23 Aug	25	1.8		X	X	
Dusky Flycatcher	1	1	02 Oct	1	1.0				X
Pacific-slope Flycatcher	630	35	23 Aug	61	10.3	X	X	X	

Table 2 Continued: Species Observed During Fall 2010 Migration Monitoring at Rocky Point Including Monthly Presence/Absence (presence indicated by X.)

Species	Total Obs.	Max. Obs.	Date(s) of Max. Obs.	No. of Dates Recorded	Ave. per Date	July	Aug	Sept	Oct
Unidentified Empid.	1	1	02 Oct	1	1.0				X
Northern Shrike	1	1	08 Oct	1	1.0				X
Cassin's Vireo	16	2	01, 03, 12 Aug	13	1.2	X	X	X	
Hutton's Vireo	48	4	28 Aug	36	1.3	X	X	X	X
Warbling Vireo	165	33	23 Aug	35	4.7	X	X	X	
Steller's Jay	923	52	03 Oct	57	16.2		X	X	X
Northwestern Crow	450	74	12 Aug	47	9.6	X	X	X	X
Common Raven	369	19	02 Aug	81	4.6	X	X	X	X
Purple Martin	16	6	01 Sep	6	2.7		X	X	
Violet-green Swallow	256	26	19 Aug	33	7.8	X	X	X	
N. Rough-winged Swallow	156	12	08 Aug	31	5.0	X	X	X	
Cliff Swallow	3	2	22 Jul	2	1.5	X	X		
Barn Swallow	422	60	22 Jul	32	13.2	X	X	X	
Chestnut-backed Chickadee	2848	77	23 Aug	81	35.2	X	X	X	X
Bushtit	334	30	02 Aug	34	9.8	X	X	X	X
Red-breasted Nuthatch	748	22	07 Sep	81	9.2	X	X	X	X
Brown Creeper	398	18	05 Aug	72	5.5	X	X	X	X
Bewick's Wren	460	22	30 Aug	79	5.8	X	X	X	X
House Wren	341	16	12 Aug	60	5.7	X	X	X	X
Pacific Wren	769	69	21 Sep	79	9.7	X	X	X	X
Marsh Wren	169	5	13 Aug	75	2.3	X	X	X	X
Golden-crowned Kinglet	1150	132	16 Oct	62	18.5	X	X	X	X
Ruby-crowned Kinglet	547	36	01 Oct	41	13.3		X	X	X
Swainson's Thrush	242	25	05 Sep	64	3.8	X	X	X	X
Hermit Thrush	89	17	21 Sep	24	3.7			X	X
American Robin	1670	240	26 Sep	80	20.9	X	X	X	X
Varied Thrush	122	13	03 Oct	25	4.9	X		X	X
European Starling	718	77	04 Aug	49	14.7	X	X	X	X
American Pipit	297	151	17 Sep	19	15.6		X	X	X
Cedar Waxwing	1380	80	17 Sep	62	22.3	X	X	X	X
Orange-crowned Warbler	534	54	09 Aug	65	8.2	X	X	X	X
Nashville Warbler	1	1	01 Oct	1	1				X
Yellow Warbler	457	52	09 Aug	55	8.3	X	X	X	X
Audubon's Warbler	46	10	29 Jul	17	2.7	X	X	X	
Myrtle Warbler	18	5	23 Sep	10	1.8			X	X
Unid. Yellow-rumped Warbler	478	93	01 Oct	47	10.2	X	X	X	X
Black-throated Gray Warbler	59	18	09 Aug	23	2.6	X	X	X	
Townsend's Warbler	175	78	09 Aug	34	5.1	X	X	X	X

Table 2 Continued: Species Observed During Fall 2010 Migration Monitoring at Rocky Point Including Monthly Presence/Absence (presence indicated by X.)

Species	Total Obs.	Max. Obs.	Date(s) of Max. Obs.	No. of Dates Recorded	Ave. per Date	July	Aug	Sept	Oct
MacGillivray's Warbler	153	21	09 Aug	45	3.4	X	X	X	
Common Yellowthroat	433	21	05 Sep	72	6.0	X	X	X	X
Wilson's Warbler	782	106	09 Aug	61	12.8	X	X	X	
Spotted Towhee	588	45	01 Oct	76	7.7	X	X	X	X
Chipping Sparrow	48	7	09 Aug	18	2.7	X	X		
Savannah Sparrow	259	18	20 Sep	60	4.3	X	X	X	X
Fox Sparrow	390	39	21 Sep	42	9.3		X	X	X
Song Sparrow	1020	39	01 Oct	81	12.6	X	X	X	X
Lincoln's Sparrow	299	43	30 Aug	41	7.3		X	X	X
Swamp Sparrow	3	2	11 Oct	2	1.5				X
White-throated Sparrow	5	2	23 Sep	4	1.3			X	X
Puget Sound WC Sparrow	1744	82	23 Aug	73	23.9	X	X	X	X
Golden-crowned Sparrow	181	19	21 Sep	30	6.0			X	X
Oregon Junco	527	49	01 Oct	72	7.3	X	X	X	X
Unidentified Dark eyed Junco	2	1	25, 30 Aug	2	1.0		X		
Western Tanager	57	7	23 Aug	31	1.8	X	X	X	
Black-headed Grosbeak	31	4	23 Jul, 03 Aug	13	2.4	X	X		
Red-winged Blackbird	1241	77	28 Sep	68	18.3	X	X	X	X
Western Meadowlark	2	2	17 Oct	1	2.0				X
Brewer's Blackbird	1	1	30 Sep	1	1.0			X	
Brown-headed Cowbird	56	5	04 Aug	27	2.1	X	X	X	
Purple Finch	370	57	20 Sep	65	5.7	X	X	X	X
House Finch	147	20	22 Jul	38	3.9	X	X	X	X
Red Crossbill	212	18	19 Aug	35	6.1	X	X	X	X
Pine Siskin	242	37	02 Oct	33	7.3	X	X	X	X
American Goldfinch	1189	66	14 Aug	72	16.5	X	X	X	X
Evening Grosbeak	86	20	04 Sep	28	3.1	X	X	X	X

Conclusions and Recommendations:

RPBO maintains historic datasets and currently collects information on 38 of 54 priority landbird species identified by Bird Studies Canada within a vegetation community (Garry oak) of critical conservation concern (PIF BC/Yukon 2006). These data are invaluable in assessing the historic and current population status of coastal migrant landbird species as RPBO operates the only Pacific coastal migration monitoring effort in Canada (Crewe *et al*. 2008).

With the significant regional conservation responsibility in mind, RPBO recommends the funding, design and implementation of a study investigating the origin and destination of landbirds using southern Vancouver Island as a stopover site during migration. Not only would a study of this nature fill gaps in a growing body of information on migratory connectivity for western landbird species (Carlisle, *et al*. 2009), but also it would add necessary context to the interpretation of abundance and productivity trends derived

from mist netting and census efforts conducted to date. In order to assess management actions and climatic effects within Bird Conservation Regions, an understanding of the breeding locations of migrant birds moving through southern Vancouver Island is needed (Dunn *et al*. 2006).

Acknowledgements:
Migration monitoring at Rocky Point relies heavily on support from individuals and agencies beyond those actively participating in this project. Access to the site is provided by the Department of National Defence, including the very helpful staff at Formation Environment and Range Control, the Environmental Science Advisory Committee, and the Commissionaires at the gate. RPBO gratefully acknowledges the assistance of all involved to ensure continued operation of this long-term project.

Guidance and financial support is provided by the Canadian Wildlife Services, with special note of thanks to Wendy Easton for her interest and assistance over the years.

Financial and in-kind support from public and private sources, including the B.C. Public Conservation Assistance Fund, Environment Canada's Science Horizon Youth Internship program, Pedder Bay Marina, Kowa Optics and private donors in 2010 made this season the success that it was.

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Rocky Point Bird Observatory Avian Monitoring – Northern Saw-whet Owl Project

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PERMIT #: P003-10
LOCATION(S): ROCKY POINT

START DATE: 15 SEPTEMBER 2010
COMPLETION DATE: 31 OCTOBER 2010
PROJECT STATUS: 2002-ONGOING

Introduction:
The Northern Saw-whet Owl (*Aegolius acadicus*) is a small, migratory raptor which has been monitored extensively in eastern North America with well over 150,000 individuals banded since 1955.

Since the fall of 2002, Northern Saw-whet Owls have been actively monitored at Rocky Point during their southward migration. A total of 2,803 Northern Saw-whet Owls have been banded at Rocky Point since this project's inception. Owls banded at Rocky Point have been recaptured at the banding site in subsequent years, as well as found or recaptured in British Columbia (B.C.), Washington, California, and Saskatchewan.

Study Area and Methods:
Northern Saw-whet Owl migration was monitored following protocols established by Project Owlnet (www.projectowlnet.org), a continent-wide consortium of banding stations. Owl monitoring at Rocky Point was conducted nightly from one half hour after sunset for six consecutive hours during the period from 15 September to 31 October, except when constrained by military activities or inclement weather. Banding occurred on a total of 43 nights during this period, although on several dates the schedule was shortened due to rain.

The mist-netting site established in 2008, southeast of the banding station was used again in 2010. A triangle of three proximate 12 meter long x 2.6 meter high mist nets was erected among the willow and alder, and an audio lure (playing a Northern Saw-whet Owl territorial call) was placed in the centre of the triangle. Five passive nets were also employed: one to the southwest, one directly west, one to the northwest, and two to the east of the owl-triangle.

Once captured, the owls were removed from the nets and numbered aluminum leg bands were affixed. In addition, various morphometric measurements were taken and the age of each bird was determined. When possible, using the criteria from Project Owlnet, the sex of the owl was also determined, then the bird was released.

Results:
In 2010, 525 Northern Saw-whet Owls and 7 Barred Owls (*Strix varia*) were banded during 1,794.78 net hours of operation. The capture rate of Northern Saw-whet Owls (0.29 birds/net hour) was slightly higher than 2009's rate (0.27 birds/net hour), but well below the highest rate (0.42 birds per net hour) achieved in 2003. Of the Northern Saw-whet Owls banded in 2010, 77.0% were hatch-year birds, 10.5% were second-year, 11.8% were after second-year and 0.8% were unspecified after hatch-year birds.

The captures were well distributed throughout the banding period, with the peak occurring between 28 September and 4 October. One hundred and seventy-nine Northern Saw-whet Owls, 34.1 % of the season's total, were captured and banded during that interval. The night with the highest number of birds was 29 September; 38 Northern Saw-whet Owls were banded that night.

As in previous years, the majority (51.2%) of the Northern Saw-whet Owls captured were classified as females using the combination wing chord/ mass criteria established by Project Owlnet. Only 16.6% were identified as male. The remaining birds fell within the overlap range of the two sexes and thus their gender could not be determined through measurements.

Six Northern Saw-whet Owls banded at Rocky Point in 2010 were subsequently recaptured on-site. Only one bird was recaptured the same night as it was banded, which was similar to the pattern observed in previous years. The other five captures ranged from 1 to 16 days after original capture, indicating significant stopover use of southern Vancouver Island this year. There were no between-year or foreign recaptures in 2010.

Barred Owls are not specifically targeted for capture; however, they do occur at the banding site and are sometimes caught in the nets. Five of the seven Barred Owls captured in 2010 were hatch-year birds and two were after hatch-year individuals. Based on the criteria in Pyle (1997), one bird was classified as a male and two were as females. The measurements of the remaining birds fell within the range of overlap between males and

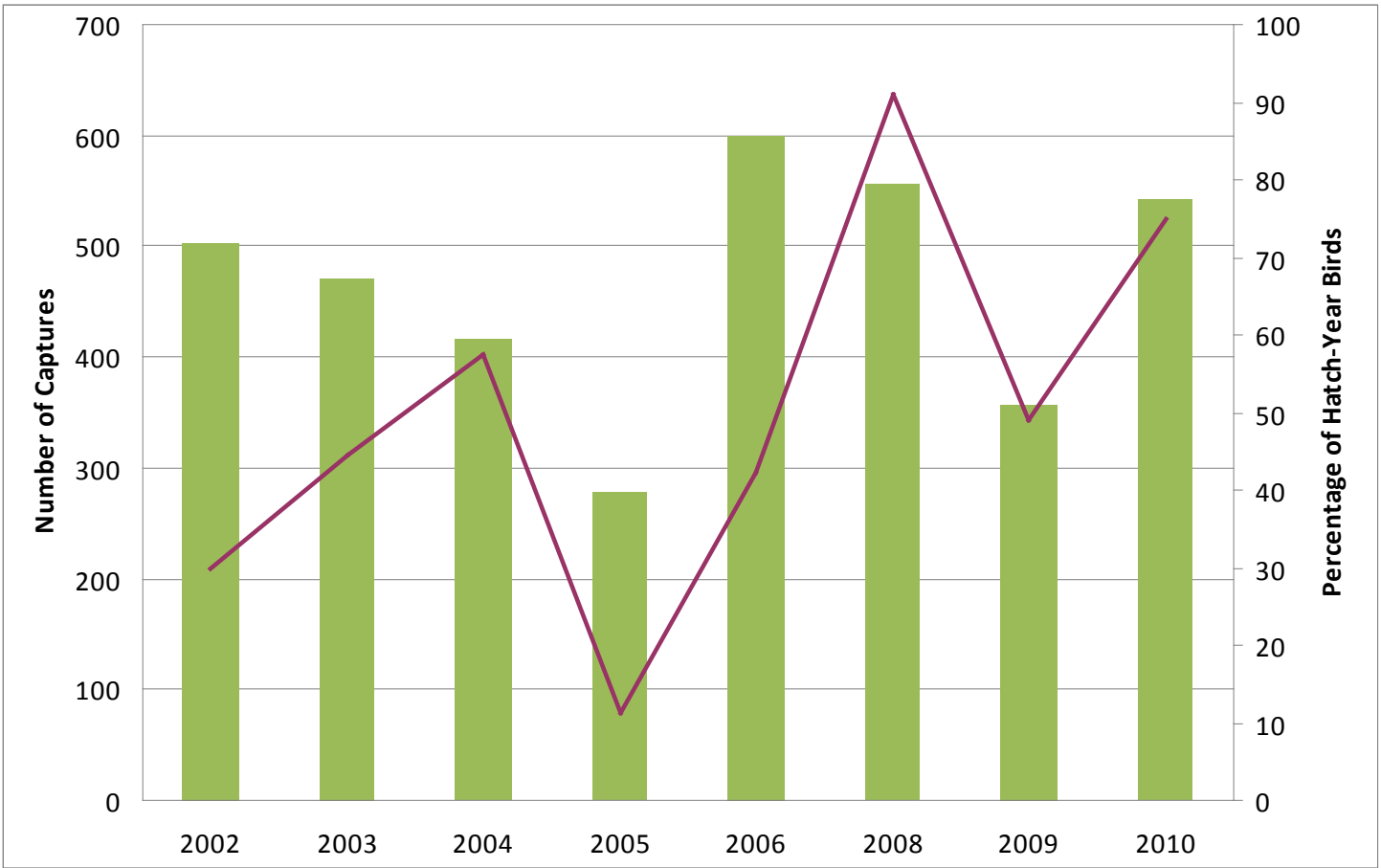

Figure 1. Northern Saw-whet Owl Captures (line) and Percentage of Hatch-Year Birds (bars), 2002-2010 (Note: banding was not conducted in 2007).

females, so the gender could not be determined. A Barred Owl captured on the first night of banding (15 September) was recaptured in the same net 11 nights later.

Discussion:

Northern Saw-whet Owls are believed to have a four-year population cycle synchronized with that of their most common prey species, deer mice (Swengel and Swengel 1995). Based on that cycle, captures in 2010 were predicted to be higher than in 2009, which in fact was the case. One interesting pattern that is developing concerns the proportion of hatch-year birds over the cycle as shown in Figure 1. As the population increases during each four-year cycle, the proportion of hatch-year birds decreases. This is counter-intuitive and is worthy of investigation.

Priestley (2008) suggests that Northern Saw-whet Owls may demonstrate a significant northward post-breeding dispersal before their southward migration. This birds banded at Rocky Point may originate both south and north of the banding site. If confirmed, this could have international conservation implications for birds encountered at Rocky Point.

Conclusions and Recommendations:

Rocky Point is an important location on the southward route of the Northern Saw-whet Owl. As one of a small number of Project Owlnet sites west of the Rocky Mountains actively monitoring this species, continued banding operations at Rocky Point contributes greatly to the knowledge base for western populations. RPBO will be able to provide a coastal perspective to the development of sexing measurement criteria, which appear to have geographic variances. Efforts should be made to identify the geographic origin of the birds occurring at Rocky Point. Stable isotope research could be used to determine if the birds encountered here are breeding north or south of this area.

While it is clear that Rocky Point is on a significant migration corridor, movement of Northern Saw-whet Owls in western North America is still poorly understood. RPBO should attempt to capture and band owls at other locations on southern Vancouver Island during the peak to establish if this migration corridor is narrow, focused over the southern tip of the island, or more broadly distributed.

All data from this project have been submitted to the Canadian Wildlife Service for inclusion in their database and submission to the Bird Banding Laboratory of the U.S. Geological Survey.

Acknowledgements:

The Northern Saw-whet Owl project was initiated by Paul Levesque in 2002. In 2010, project manager/ licensed bander Ann Nightingale was assisted by RPBO's bander-in-charge, Brian Pomfret, intern Jessie Fanucchi and many dedicated volunteers. In 2010, a total of 886 hours of fieldwork were contributed to this project.

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Rocky Point Bird Observatory Avian Monitoring – Monitoring Avian Productivity and Survivorship (MAPS)

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PERMIT #: P003-10
LOCATION(S): ROCKY POINT

START DATE: 30 MAY 2010
COMPLETION DATE: 4 AUGUST 2010
PROJECT STATUS: 2003-ONGOING

Introduction:
The Monitoring Avian Productivity and Survivorship (MAPS) project was created by the Institute for Bird Populations in 1989 to assess and monitor the vital rates and population dynamics of over 120 species of North American breeding landbirds at more than 500 sites across North America. The site at Rocky Point has been used for MAPS since 2003, except for a hiatus in 2007. The MAPS site at Royal Roads University was not used in 2009 or 2010 due to a lack of human resources.

The purpose of the MAPS project at Rocky Point is to create an inventory of the breeding songbird populations using a standardized methodology, and to record sightings of other species to allow comparisons of populations and avian diversity over time and across MAPS sites. The data are submitted to both the Canada Wildlife Service (banding data) and to the Institute of Bird Populations (banding, observation, breeding status, and habitat structure data).

Study Area and Methods:
MAPS monitoring was conducted at Rocky Point, following the MAPS protocol (DeSante *et al*., 2009). Songbirds were captured in mist nets and banded during standardized sampling sessions. The mist nets were located in a variety of habitat types, at prescribed distances from each other. The area covered by the MAPS station was approximately 3.25 hectares. The sessions were conducted for a six-hour period starting at sunrise once per 10-day period between 31 May and 2 August. Nets were not operated in rainy or windy conditions. A total of 400.5 net hours of banding was conducted in 2010.

Results:
A total of 228 birds (excluding birds that were recaptured), representing 36 species, were banded at Rocky Point during the MAPS project in 2010. This total was below the average number of birds captured, but was comparable to 2009 when 231 birds were banded. The 2010 capture rate was 0.57 birds per net hour.

Sixteen birds captured in 2010 had been banded at Rocky Point in previous years, indicating that they have established breeding territories on the site. These were: Chestnut-backed Chickadee (*Poecile rufescens*, two individuals from 2009), Swainson's Thrush (*Catharus ustulatus*, 2009), Bewick's Wren (*Thryomanes bewickii*, 2009), House Wren (*Troglodytes aedon*, 2009), Orange-crowned Warbler (*Vermivora celata*, 2008), American Robin (*Turdus migratorius*, 2004, 2009), American Goldfinch (*Spinus tristis*, 2009), Song Sparrow *(Melospiza melodia*, 2009), Pacific-slope Flycatcher (*Empidonax difficilis*, 2008; two individuals from 2009), Purple Finch (*Carpodacus purpureus*, two individuals from 2008) and Puget

Table 1: MAPS captures at Rocky Point in 2010

Species	New Band	Recapture	Captured but Unbanded	Total
American Goldfinch	4	1		**5**
American Robin	28	5	1	**34**
Bewick's Wren	4	3		**7**
Black-headed Grosbeak	1			**1**
Brown Creeper	3			**3**
Brown-headed Cowbird	1			**1**
California Quail			1	**1**
Cassin's Vireo	1			**1**
Cedar Waxwing	2			**2**
Chestnut-backed Chickadee	12	2		**14**
Chipping Sparrow	15			**15**
Cliff Swallow	1			**1**
Common Yellowthroat	2			**2**
House Finch	2			**2**
House Wren	4	3	1	**8**
MacGillivray's Warbler	5	2		**7**
Northern Flicker	1			**1**
Olive-sided Flycatcher	1			**1**
Orange-crowned Warbler	15	2		**17**
Oregon Junco	1			**1**
Pacific Wren	1			**1**
Pacific-Slope Flycatcher	13	5		**18**
Purple Finch	11	2	1	**14**
Red-winged Blackbird	11			**11**
Rufous Hummingbird	14		2	**16**
Savannah Sparrow	1			**1**
Song Sparrow	10	7		**17**
Spotted Towhee	1			**1**
Swainson's Thrush	5	4		**9**
Varied Thrush	1			**1**
Warbling Vireo	1			**1**
White-crowned Sparrow	39	7	6	**52**
Willow Flycatcher	2	1		**3**
Wilson's Warbler	13	3		**16**
Yellow Warbler	1			**1**
Yellow-rumped Warbler	1			**1**
Totals	**228**	**47**	**12**	**287**

Sound White-crowned Sparrow (*Zonotrichia leucophrys pugetensis*, 2009). An additional 31 within-season recaptures were also recorded.

An Olive-sided Flycatcher (*Contopus cooperi*), a species listed as threatened under the federal Species at Risk Act (SARA), was captured and banded in 2010. As this was an incidental capture (i.e., was not a targeted study species), banding was allowed without a SARA permit. The Olive-sided Flycatcher is a breeding species at the Rocky Point MAPS site, and this was the second banded during the MAPS project at this location.

Table 1 lists by species the number of birds captured and recaptured at Rocky Point in 2010.

Discussion:

Rocky Point continues to be productive in terms of the number of individuals observed and in species richness. However, as was the situation in 2009, weather played a major factor in the reduced capture rate in 2010. On several banding days, the most productive nets on the site had to be closed due to high winds; that undoubtedly affected the number of individuals and the diversity of species captured.

The recapture rate of birds banded in previous years is an important component of the MAPS program. Although it is not expected that the same individual adult birds will be captured every year, consistent methods (i.e., the placement of nets in the same locations and the same monitoring dates each year could result in high recapture rates of breeding adults over time. The recapturing of birds is a key component of the survivorship aspect of the MAPS research, and many birds initially banded at Rocky Point, have been caught again in subsequent years.

Conclusions:

The MAPS program is providing data on the productivity and survivorship of a wide variety of species in varied habitats across North America. The MAPS database serves as an important resource for population monitoring and conservation efforts, and may provide valuable information on range changes. The monitoring at Rocky Point should continue.

As with any longitudinal survey, sites should be chosen which have the least probability of major habitat changes during the study period.

References:

DeSante, D.F., K.M. Burton, P. Velez, D. Froehlich, and D. Kaschube. 2009. MAPS Manual: 2009 Protocol. The Institute for Bird Populations, Point Reyes Station, CA. 75 pp. http://www.birdpop.org/DownloadDocuments/manual/MAPSManual09.pdf

P003-10 Common Yellowthroat (*Geothlypis trichas*).

Rocky Point Bird Observatory Avian Monitoring – Bander Training Workshop

Project Leader(s): Ann Nightingale
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PERMIT #: P003-10
LOCATION(S): ROYAL ROADS

START DATE: 19 MARCH 2010
COMPLETION DATE: 21 MARCH 2010
PROJECT STATUS: 2003-ONGOING

Introduction:
The processes of capturing wildlife, and marking and collecting of data and samples from individual birds, require specialized training to ensure animal safety and successful research results. Since 2003, the Rocky Point Bird Observatory (RPBO) has been offering short training programs to teach the correct techniques in bird capture, banding, ageing, and in morphometric measurements.

Study Area and Methods:
The Avian Monitoring and Bird Banding workshop was held on March 19 to 21, 2010, and consisted of lectures, lab sessions, and field work at Royal Roads University. For the field component, six mist nets were used to capture songbirds that were used for live teaching demonstrations. The workshop instructor was Jukka Jantunen, master bander and former bander-in-charge for RPBO. Several banders and volunteers assisted with the training, providing about a three-to-one student-to-trainer ratio.

The 2010 workshop focused on providing bird-banding training to novices. Lectures covered bird identification, safe handling of birds and the basics of ageing and sexing passerines.

The lab component of the workshop focused on bird identification techniques, and for those with considerable identification experience, on ageing and sexing the birds according to the criteria in Pyle (1997). Local specimens held by RPBO, under the appropriate federal and provincial permits, were used in the lab component. A collection of study skins borrowed from the Bird Banding Office of the Canadian Wildlife Service (CWS) was used to provide access to specimens from eastern North America.

Field sessions included site selection, net set up, and capture and extraction of birds. As the majority of participants were novices, and to reduce stress on the birds, less emphasis was placed on the actual banding of birds during the field component than in previous workshops. Compared with previous years, more time was spent at the nets, in order to train the participants in safe handling and extraction of birds from the nets. Each participant had several opportunities to handle live birds and to band at least one individual.

Hummingbird banders, Jonathan and Alison Moran, provided field and lab sessions outlining the specific practices related to banding, including band preparation and importance of leg health of banded hummingbirds.

A nighttime demonstration of owl banding procedures was held to show the techniques used to capture Northern Saw-whet Owls. No owls were captured during the demonstration, although a

Barred Owl did come in to investigate the audio lure.

An optional lab session on specimen preparation was given for those who were interested in acquiring this skill.

Results:
Sixteen participants attended the workshop. Fifty-six birds (nine species) were fully processed and banded, and five birds were subsequently recaptured. Birds were banded by holders of valid CWS banding permits or by the students under the supervision of permitted banders. The data collected were sent to the CWS; and detailed banding data are available by request from RPBO, or from the CWS Bird Banding Office in Ottawa.

Discussion:
The bird banding workshop has been very successful in providing specialized training to people working on bird research projects throughout western North America. The Royal Roads site is a near ideal location for the workshops due to classroom, accommodation and field study amenities. The use of several banders, along with volunteers to assist the instructor, has proven to be very effective in ensuring that all participants are exposed to a variety of bird handling techniques, bird identification techniques, and ways to minimize stress to the birds. Several past participants have gone on to volunteer or work in ornithology and at least one has now achieved a Master's Permit for banding.

Unfortunately, several mist-nets were stolen from the banding area during the banding workshop in 2010. The ropes of the support poles were cut and the nets removed during the night or early morning. In addition to the cost of replacing the nets, the workshop organizers are concerned about the possible misuse of the stolen equipment. The theft was reported to the Royal Roads Security and the Colwood RCMP.

Conclusions:
The Avian Monitoring and Bird Banding workshops continue to be well received. By providing an introduction to safe handling of birds, as well as techniques for ageing, sexing and monitoring populations, the workshop prepares participants for field study or volunteer positions.

As a generality, there are greater risks when conducting field research on publicly accessible lands than on secured sites. However, because of the theft of the nets in 2010, it is likely that future workshops and banding at Royal Roads University will require procedural changes to not only ensure that valuable equipment is secure, but as well, to reduce the risk of misuse. Despite this, the RPBO plans to offer another workshop in March 2011.

References:
Pyle, P. 1997. Identification Guide to North American Birds, Part I. Bolinas, CA, Slate Creek Press.

P003-10 Northern Saw-whet Owl

Rocky Point Bird Observatory Avian Monitoring – Christmas Bird Count

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PERMIT #: P003-10
LOCATION(S): ROCKY POINT, HEALS RANGE, ALBERT HEAD
START DATE: 18 DECEMBER 2010
COMPLETION DATE: 27 DECEMBER 2010
PROJECT STATUS: 2003-ONGOING

Introduction:
Since 1900, the Christmas Bird Count (CBC) has been an annual event attracting thousands of birders across North America to census winter bird populations within a local 24 km circle. Long-term trends are analyzed and compiled now for more than 1800 counts across North America. The data are widely used by researchers and organizations to understand changes in bird populations.

Since 2003, DND has provided access for volunteers to enter three key properties for the Victoria and Sooke CBCs: Rocky Point, Heals Rifle Range and Albert Head.

Study Area and Methods:
Much of North America has been divided into CBC Count Circles, which define each count area. The 24 km diameter circles are further divided into discrete zones; each zone is assigned to a team of volunteers to avoid duplicate counting. Survey teams cover as much of their assigned zones as possible, recording species and numbers of individuals they encounter.

During the Victoria CBC, which took place on 18 December 2010, participants completed surveys at two DND sites. Coverage by counting parties consisted of three hours at Albert Head and one hour at Heals Range. The Rocky Point zone includes the Race Rocks Ecological Reserve and is part of the Sooke CBC, which occurred on 27 December 2010. Rocky Point received the greatest coverage of the three DND sites, with five and one half hours of daytime effort, and two and one half hours of owl search effort. Participants recorded all individual birds seen and/or identified by voice.

Results:
The CBC participants observed 48 species and 281 individuals at Albert Head. At Heals Range, observers tallied 14 species and 138 individuals. The team at Rocky Point/Race Rocks reported 78 species and 11646 individuals. For detailed results, see Table 1.

Discussion:
In the past, the Albert Head site has proven to have a high number of species with as many as 90 bird species using the area in winter (for shelter and/or for feeding). Both terrestrial and marine-associated species are generally well represented in Albert Head counts, with numbers of marine-associated birds sometimes exceeding 10,000. In 2010, as in 2009, the numbers of gulls, cormorants, sea ducks and alcids were well below average due to high winds and rough seas. The windy conditions also reduced detection of common landbirds, resulting in the lowest count of individual birds in this survey's eight-year history.

The Heals Range sub-area has never produced a large number of species or individuals on the CBC, most likely due to the low habitat diversity. In 2010, only 14 species were detected (compared to the average of 18), and the number of individual birds (138) was approximately half of the average number observed (267).

By contrast, the weather conditions were good on December 27 and the Rocky Point zone produced the highest number of species and individual birds in the history of the count. In previous years, counters visited the Race Rocks Ecological Reserve for a short survey. This year, a birder was staying at the reserve and was able to count there for an extended period. Several uncommon birds were found on Race Rocks during the count, including a Snow Bunting (*Plectrophenax nivalis*), eight Ruddy Turnstones (*Arenaria interpres*), and two Heermann's Gulls (*Larus heermanni*). The Ruddy Turnstones were the first recorded in the history of the Sooke Christmas Bird Count. Two Brant (*Branta bernicla*) were seen from Rocky Point. A number of common species, including Cooper's Hawk (*Accipiter cooperii*), Sharp-shinned Hawk (*Accipiter striatus*), and European Starling (*Sturnus vulgaris*) were not encountered at any of the three DND count locations in 2010.

Conclusions:

The 2010 Victoria and Sooke CBC results from DND sites produced 12,065 individuals of 83 species in total, slightly under the five-year average of 12,660 birds but above the average of 77 species.

Weather conditions, food supply and volunteer effort can affect the results of a single-day survey such as the Christmas Bird Count. The primary value of continued survey effort over many years is in the contribution of these data to the larger international database managed by the Audubon Society.

The DND sites are subject to less human disruption than most of the other areas covered during the CBCs and they add to the variety of habitats monitored. Both the species diversity and numbers of individuals contribute significantly to the counts for the local count circles. It is worth continuing coverage to produce long-term trends for wintering birds on DND lands on southern Vancouver Island and to contribute to the knowledge base on bird populations of North America.

P003-10 Recording physical dimensions as part of bird monitoring, Rocky Point Bird Observatory.

Table 1: Christmas Bird Count Results

Species	Albert Head	Heals Range	Rocky Point	Total
Brant			2	**2**
Canada Goose			17	**17**
Gadwall			9	**9**
American Wigeon			5	**5**
Mallard		76	16	**92**
Northern Pintail		2	1	**3**
Ring-necked Duck	6	1	1	**8**
Harlequin Duck	6		9	**15**
Surf Scoter			19	**19**
White-winged Scoter			20	**20**
Bufflehead	42		93	**135**
Hooded Merganser			10	**10**
Common Merganser	3		6	**9**
Red-breasted Merganser			5	**5**
California Quail	5			**5**
Red-throated Loon			1	**1**
Common Loon			4	**4**
Red-necked Grebe	1		2	**3**
Western Grebe			1	**1**
Brandt's Cormorant			290	**290**
Double-crested Cormorant	20		278	**298**
Pelagic Cormorant	2		98	**100**
Great blue Heron			7	**7**
Turkey Vulture	1			**1**
Bald Eagle (adult)	2	1	5	**8**
(immature)	1		2	**3**
Red-tailed Hawk		2	3	**5**
Merlin			1	**1**
Peregrine Falcon			1	**1**
Virginia Rail			1	**1**
American Coot		2		**2**
Killdeer			5	**5**
Black Oystercatcher			32	**32**
Spotted Sandpiper	1			**1**
Ruddy Turnstone			8	**8**

Table 1 Continued: Christmas Bird Count Results

Species	Albert Head	Heals Range	Rocky Point	Total
Black Turnstone			18	**18**
Surfbird			6	**6**
Dunlin			1	**1**
Heermann's Gull			2	**2**
Wilson's Snipe		1	4	**5**
Mew Gull	40		14	**54**
California Gull			50	**50**
Thayer's Gull	8		1506	**1514**
Glaucous-winged Gull	50	37	835	**922**
Common Murre			7410	**7410**
Pigeon Guillemot.			7	**7**
Marbled Murrelet			3	**3**
Ancient Murrelet			162	**162**
Rhinoceros Auklet	2		4	**6**
Great Horned Owl			4	**4**
Anna's Hummingbird			2	**2**
Belted Kingfisher			1	**1**
Downy Woodpecker	1		5	**6**
Hairy Woodpecker			2	**2**
Northern Flicker	5		12	**17**
Pileated Woodpecker			2	**2**
Steller's Jay		2	5	**7**
Northwestern Crow		1	5	**6**
Common Raven		4	4	**8**
Chestnut-backed Chickadee	7		180	**187**
Bushtit			10	**10**
Red-breasted Nuthatch			10	**10**
Brown Creeper	1	2	15	**18**
Bewick's Wren	3		2	**5**
Pacific Wren	6		34	**40**
Marsh Wren	1		2	**3**
Golden-crowned Kinglet	25		105	**130**
Ruby-crowned Kinglet			5	**5**
Hermit Thrush	4		1	**5**
American Robin	12		14	**26**

Table 1 Continued: Christmas Bird Count Results

Species	Albert Head	Heals Range	Rocky Point	Total
Varied Thrush			61	**61**
Spotted Towhee	10		11	**21**
Lincoln's Sparrow	1			**1**
Savannah Sparrow			4	**4**
Fox Sparrow	3		10	**13**
Song Sparrow	3	1	18	**22**
Golden-crowned Sparrow			10	**10**
Dark-eyed Junco	9	6	20	**35**
Snow Bunting			1	**1**
Red-winged Blackbird			30	**30**
Purple Finch			1	**1**
House Finch			1	**1**
Pine Siskin			85	**85**
Survey Date	18-Dec-10	18-Dec-10	27-Dec-10	
# individuals	**281**	**138**	**11646**	**12065**
# species	**30**	**14**	**78**	**83**

Effort	# of observers: 2	# of observers: 2	# of observers: 8
	# hours on foot: 3	# hours on foot: 1	# hours on foot: 5.5
	Distance on foot: 2.5 km	Distance on foot: 1 km	Distance on foot: 5 km
	# hours by car: .33	# hours by car: 0.5	# hours owling: 2.5
	Distance by car: 2 km	Distance by car: 12.4 km	Distance owling: 8.2 km

Note: Common Names are approved by the American Ornithological Union and are presented in taxonomic order.

References:

American Ornithological Union, 2010, Check-List of North American Birds, http://www.aou.org/checklist/north/full.php, accessed 12 December 2010

Purple Martin (*Progne subis*) Origins and Relationships

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PERMIT #: P044-10
LOCATION(S): COLWOOD, ROYAL ROADS
START DATE: 1 APRIL 2010
COMPLETION DATE: 30 SEPTEMBER 2010
PROJECT STATUS: 1998-ONGOING

Introduction:

Western Purple Martins (*Progne subis arboricola*), the largest member of the swallow family in North America, reach the northwestern limit of their breeding range in southwest British Columbia (B.C.). This subspecies is classified as at risk throughout the breeding range west of the Rocky Mountains, from B.C. to California (CA) and the Rocky Mountain foothills of Utah and Colorado. They have Blue-listed conservation status ("Special Concern", formerly "Vulnerable") in B.C., and are recovering from near extirpation due to widespread habitat loss and competition for cavity nest sites from non-native species throughout their historic breeding range. In 1984 martin numbers in B.C. had declined to five known pairs. In response to provision of man-made nest boxes for a decade, the number of known Purple Martin pairs nesting in B.C. had increased to 55 by 1995 (Fraser *et al*. 1997, B.C. Ministry of Water, Land and Air Protection 1997).

Since 1997, Purple Martin colonies in B.C. were monitored systematically to document annual abundance and juvenile production. As well, from 75% to 98% of all nestlings produced at known breeding locations in B.C. were banded each year with standard Canadian Wildlife Service (CWS) identification bands and uniquely coded coloured plastic or aluminum auxiliary marker bands. The latter are visible with binoculars and readable with a spotting scope. The goals of banding are to monitor inter-colony movements (natal dispersal and recruitment) and interactions, annual migration, population age structure, fledgling production and seasonal mortality.

The nest box program resulted in the B.C. martin population recovering to ~200 pairs at 16 colonies in 2000 (Darling *et al*. 2004), and to a peak of ~650 pairs at 46 colonies in 2007, before declining to ~500 pairs (-23%) at 45 colonies in 2009. The rapid growth prior to 2007 was caused by three nesting seasons with favourable weather that resulted in high nesting success, production and subsequent recruitment (Cousens *et al*. 2005, Lee *et al*. 2007). The recent decline was the result of low recruitment after reduced nesting success and production in 2007 and 2008 and adult losses in spring 2008, caused by unfavourable spring and summer weather (Finlay *et al*. 2009).

Study Area and Methods:

The DND Colwood and Royal Roads colony sites, located on southern Vancouver Island near Victoria, are two of 51 currently active nest box sites throughout the Strait of Georgia in B.C. In 2010, 48 Purple Martin colonies, including DND sites, were visited periodically to identify individuals banded in B.C. and Washington (WA) in previous years, inspect nests, document number of pairs and nesting success and band nestlings. Bands

were read with 15-45x or 20-60x spotting scopes and the band codes were recorded. The number of eggs and/or nestlings were recorded in all accessible nest boxes inspected. Adults captured incidentally on the nest were examined and band numbers were recorded before the bird was replaced on the nest or released.

Productivity (nestlings fledged per pair) was determined for each colony and used in combination with overall abundance and average overwinter survival from previous years to predict the returning population the following year from the B.C. population forecast model. As well, a sample of 325 birds identified and aged from incidental captures and band reading at 20 colonies was used to document subadult dispersal and recruitment from natal colonies and adult relocation from previous breeding sites, provide longevity data, and estimate age composition of the population.

Eight visits to the Colwood colony and 11 visits to the Royal Roads colony occurred between 15 April and 28 August for observations, nest box checks and banding nestlings. The Royal Roads colony was visited and monitored on the same dates as the Colwood site, with additional visits for band reading and banding nestlings. Banding data and band re-sight records of identified individuals were compiled and submitted to the CWS Banding Office.

P044-10 Examining a Purple Martin nestling prior to banding.

Results:

After three years of nest failure and abandonment at the Colwood colony in 2006-08, and no martins nesting there in 2009 (Cousens and Lee 2010), one pair of adult and one pair of subadult martins re-occupied this site in 2010, and both nested successfully. The colony was visited on 8 occasions between April 18 and August 12 and eight nestlings were banded, for a fledging success rate (productivity) of 4 young per pair.

Adult martins were first reported at the established colony at Royal Roads University on April 9, slightly earlier than at many other colonies with the cool wet weather that predominated in spring of 2010 and delayed migration for many songbird species. Adult and subadult birds continued to arrive throughout May and June, respectively, with all available standard wooden martin nest boxes (but none of the five PVC nest tubes) occupied by martins or swallows by the end of June, as in 2009. Twelve of the 14 nest boxes were occupied by martin pairs, all of which fledged young successfully. The other two nest boxes were occupied by swallows, which also nested successfully. We banded a total of 52 nestlings in 12 nest boxes (4.3 young/pair) between July 25 and August 2.

No martins were reported nesting on vessels berthed temporarily at Dockyard this year, as occurred in some previous years, so we had no occasion to visit this site.

Three of the four birds nesting at the Colwood colony in 2010 were colour banded as nestlings in previous years. These included two birds banded at a colony on The Gorge in 2009 and a small

colony at Ladysmith in 2008. At the Royal Roads colony seven bands were read, also on birds banded as nestlings at colonies on southeast Vancouver Island: The Gorge (Victoria) and Ladysmith in 2009, Sooke, Patricia Bay (Saanich Inlet) and Ford Cove Marina on Hornby Island in 2008, and West Bay in Victoria Harbour in 2006 and 2007. Three of these birds also nested and were identified here in previous years.

Among 325 leg band numbers read at 20 colonies around the Strait of Georgia in 2010 to determine where and when these birds were originally banded and fledged, we found four birds banded at Colwood in 2004 and 2005, nesting at Deep Bay, Cowichan Bay, Ladysmith and Nanoose Bay. We also found two birds from the Royal Roads colony banded in 2006 and 2007, nesting at Cowichan Bay and Royston (near Courtenay), respectively.

Discussion:

Purple Martins re-occupied the Colwood colony at the DND Diving Dock in 2010 with one adult and one subadult pair, both of which fledged 4 young. This may mark the beginning of the return of Purple Martins to nesting at this location after absence in 2009 and 3 years of breeding failure and abandonment in 2006-08, possibly due to suspected nocturnal nest predation attempts by owls, the most common cause of otherwise unexplained colony martin abandonment (Finlay *et al*. 2009). No indications of predation were noted in 2010, perhaps because wire mesh predator guards were installed in 2007. We will continue to monitor for evidence of such attacks in the future.

Re-occupation of the Colwood colony site with strong subadult recruitment in 2010 was anticipated after a successful nesting season in B.C. in 2009 (3.3 young fledged per pair, vs. ~2.6 young per pair required to maintain a stable population size; Cousens unpublished data), and similar recruitment was evident at most other colonies this year. The colony should continue to grow with new subadult recruits in 2011 and time will tell whether colony abandonment again becomes a cause for concern at this site.

The colony at Royal Roads University dramatically increased from three to 12 nesting pairs of Purple Martins in 2009, likely as a result of relocation of adult birds from West Bay, where nest boxes were temporarily unavailable in early spring (Cousens and Lee 2010). This colony was fully occupied again in 2010 as many of these birds returned to their new home colony and subadult recruits occupied any vacant nest boxes. All 12 pairs were successful, fledging 52 nestlings (4.3 young/pair), the highest fledging success we have seen at this site so far.

Martins exhibit *variably asynchronous* nesting timing: when possible, early-arriving adult birds nest up to 2-3 weeks earlier than later-arriving subadults (Cousens, unpub. data). Early season adult nesting timing is determined by weather conditions and resulting food availability, which likely influences egg production in females. With only a single brood, asynchrony potentially reduces the extent of nestling starvation during periods of adverse weather. In 2010, as in 2008, prolonged cool wet spring weather delayed adult nesting timing by 2-3 weeks, until early-mid June, in sharp contrast to the favourable weather and early nesting (from late May) that occurred in 2009. This resulted in most adult and subadult birds nesting almost concurrently, late in the nesting season, potentially leaving most nestlings equally vulnerable to brief periods of adverse weather during the critical early nestling rearing period (as occurred with heavy losses in 2008). However, with generally favourable weather throughout July and August in 2010, Purple Martins in B.C. and throughout the Pacific Northwest had an extremely successful nesting season with overall fledgling production of 4.0 young/pair, the highest we have

seen in the 14-year history of the monitoring program in B.C.

The bands read at the Colwood and Royal Roads University colonies reflect new adult and subadult recruitment to both sites from recent year classes, mostly from colonies within 25-50 km but occasionally from colonies 75-150 km away. As well, at least three birds nesting at Royal Roads nested there previously in 2007-09, demonstrating strong site fidelity. Similarly, birds fledged from both colonies were found nesting at other colonies within 50-150 km. These band sightings indicate typical site fidelity, dispersal and genetic mixing within the regional population, as observed for other B.C. colonies and reported elsewhere. The number of birds fledged from Colwood seen at other colonies continues to decline (12 in 2008, nine in 2009, five in 2010) due to annual adult mortalities with aging (senescence) and the lack of fledgling production in 2006-09 since the initial abandonment of the colony in 2006.

Conclusions:

After a prolonged decline to near extirpation prior to 1985, the Purple Martin population in B.C. has increased over the past 25 years, despite periodic adverse weather-related temporary declines. This recovery is due to the provision and maintenance of clustered single nest boxes since 1985. This volunteer-driven nest box-based recovery program has been highly successful in conserving and recovering this population. The recent declines in abundance were caused by adverse weather conditions, which are natural regulators of martin populations. Much of the recent 23% decline was reversed with a 13% population increase from 519 nesting pairs in 2009 to 585 pairs in 2010.

Considering that 2.6 young/pair is the current best estimate from the population forecast model of the productivity just offsetting average annual mortality, to sustain a stable population without increase or decline (Cousens unpub. data), production of 4.0 young per pair in 2010 should cause a substantial population increase in 2011, assuming a typical overall annual survival rate of 48-50%. The model prediction for 2011 is 800 pairs, a 35% increase. The actual return is expected to be closer to 700-750 pairs, due to the high proportion of older (5+) birds in the population as a result of the 2003-06 population boom and the relatively low production and lack of population growth since. Martins 5+ years old have an increased annual mortality rate due to senescence (Stutchbury *et al*. 2009), which is not taken into account by the current age-independent population model based on mean overall annual survival with all age classes combined.

This age class composition skewed towards older birds is the most likely reason the B.C. martin population in 2010 (585 pairs) was somewhat lower than the forecast of 600-650 pairs (Cousens and Lee 2010). This age structure is beginning to reverse after fairly high production and recruitment in 2009-10 and age class composition should return to a more evenly balanced structure with a predominance of younger birds by the 2011 season. The current revised interim population objective for Purple Martins in B.C. is 800 pairs by 2012, which appears achievable if the current trend continues.

The ongoing monitoring and banding studies of Purple Martins in B.C. have provided a well-documented record of the progress of recovery and continue to provide valuable biological data on productivity, dispersal, recruitment, longevity and population dynamics, helping to explain observed changes in abundance.

Over 2,000 of ~10,300 Purple Martins banded as nestlings at B.C. colonies in 1997-2009 have been re-sighted at colonies in B.C., as well as in WA and Oregon, and in CA during migration.

In addition, 35 of ~1,500 birds banded in WA in 2001-2008 have been sighted throughout the breeding range in B.C. These data confirm that regional populations mix and overlap, as shown by mitochondrial DNA analysis (Baker *et al* 2008). The DNA study indicates that the B.C. colonies are part of a broader regionally stratified population in B.C.-WA and throughout the west coast breeding range.

The band re-sight data also provide information on the average and maximum life span of Purple Martins, as well as inter-annual variations in population age structure. The proportion of subadult recruits in the B.C. population has declined annually since the period of high production and rapid growth in 2003-2006, from 50-60% in 2004 to a low of only 13% in 2009, then increased to 31% of the population in 2010. The increase in proportion of younger birds should continue in 2011 as the last large year class from 2005 shows increased aging mortality. In addition, the strong recruitment from the 2010 year class will most likely rejuvenate and rebalance the population age structure, greatly reducing risks of a population collapse due to prolonged low recruitment.

The recovery and monitoring program will continue in 2011, including all recent activities at the Colwood site to monitor recovery and prevent further abandonment. We also intend to continue the monitoring, nestling banding and band reading sessions at the Colwood and Royal Roads University colonies. After two years being occupied at full capacity, the Royal Roads colony would benefit from modest expansion, increasing the number of martin nest boxes from 14 to 20 with the addition of three new support posts and two nest boxes on each post, and several swallow boxes may be added as well. There is room on the upper dock to add three more support posts without obstruction of use. This expansion is proposed for spring of 2011.

We hope to obtain access to colonies by 1 April 2010, as martins begin to return in early April, so that we can check for and read bands on any banded birds.

Acknowledgements:
We wish to thank the Rocky Point Bird Observatory Society for continued partnership and assistance with this program at DND sites near Victoria, as well as Tom Gillespie (volunteer South Island Regional Coordinator/Bander for the Purple Martin recovery program), Cam Finlay and Linda Knox for their ongoing assistance and support.

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P044-10 Purple Martin nest boxes on the Esquimalt Lagoon at Royal Roads.

Wildlife Tree Stewardship Program

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PERMIT #: P074-10
LOCATION(S): ROCKY POINT, ALBERT HEAD, AND COLWOOD
START DATE: 1 APRIL 2010
COMPLETION DATE: 31 DECEMBER 2010
PROJECT STATUS: 2002-ONGOING

Introduction:
Bald Eagles (*Haliaeetus leucocephalus*) nest along much of the Vancouver Island coastline. Typically, Bald Eagles build their nests in veteran trees in sites with clear views of the marine waters. Bald Eagles defend nesting territories representing an average of one kilometre of coastline. Within each territory Bald Eagles often have two or more nests which they move between over the years. Territories are often centred near points of land or creek mouths, locations where coastal currents are naturally disrupted resulting in concentrations of fish and waterfowl, the food needed to raise young eagles.

This report is an update of an ongoing research project. The Wildlife Tree Stewardship (WiTS) Program began on Vancouver Island, British Columbia (B.C.) in 2000. The program has two main objectives: 1) to document the use of wildlife trees and the nesting success of raptors, using open nests, and other bird species (owls and woodpeckers) using cavities for nesting; and 2) to provide nest site inventory and monitoring data to regional government staff to help in securing protection of wildlife. The aspect of the WiTS program carried out on Department of National Defence (DND) lands at Rocky Point, Albert Head and Colwood, to this date, includes the locating and monitoring of Bald Eagle and Osprey (*Pandion haliaetus*) nests. As the Rocky Point and Colwood sites are protected from much of the human related disturbance found at sites in more populated areas, these nesting territories are valuable for comparison with other sites.

Study Area and Methods:
The study area includes Bald Eagle and Osprey nests sites in the coastal forests of Rocky Point (Figure 1), and Albert Head, Royal Roads and Colwood (Figure 2). Across North America, measuring the productivity of Bald Eagle nests is based on a common method that involves determining the number of chicks raised to fledging in each occupied territory (Postupalsky 1974).

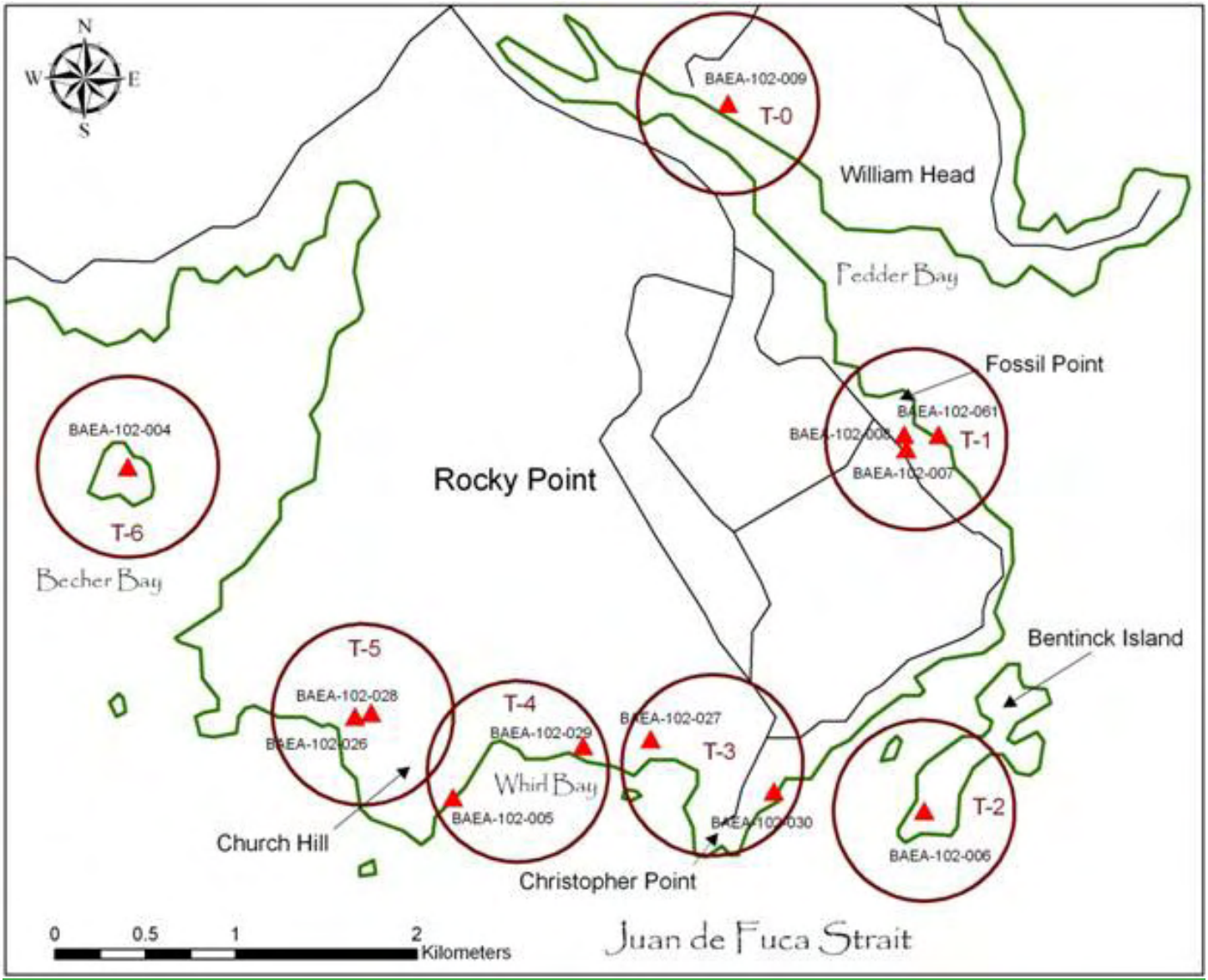
Each year, known eagle nest sites are visited at least twice. An initial site visit between late March and the end of April is used to determine activity at the nest sites. During this visit, we are cautious to not disturb the birds; observations involve either locating by calls or by distant viewing by means of binoculars or telescopes. During the initial visit we check for evidence of new nest sites (by sight and/or sound), and attempt to determine if the birds have shifted between alternate nests within a territory.

A final site visit, to measure nesting productivity takes place in mid June to mid July; this is timed to observe eagle chicks when they are close to fledging. By this stage in the breeding cycle, the

presence of humans has minimal effect on the eagles, and nests can be viewed at close proximity, including from under the nest tree. While under the tree, we look for further evidence of recent nest use, including: excrement, prey remains, and the carcasses of fallen chicks. During this visit, conditions of the nest tree and the surrounding habitat are noted. With Ospreys, similar methods are used but the site visits are shifted to later in the season.

Results:

Rocky Point: Five eagle nest sites representing four nest territories were monitored (Map 1, Table 1). Nesting attempts at two of the three occupied territories were successful with one chick believed to have fledged at each of these sites. Bald Eagle nest site BAEA-102-030, in the Christopher Point Territory (T-3 on Figure 1) is located in a restricted area and has only ever been viewed from a distance. There was not enough eagle activity in the area of Christopher Point to score the territory as being used in 2010. An Osprey nest on a constructed platform near the base offices was



Map 1. Bald Eagle nest site locations and nesting territories at Rocky Point.

observed three times. Between April and June there appeared to be no nesting activity. During an observation on 8 July, an Osprey was observed and the nest appeared active. We did not make a follow-up site visit to determine if chicks were present and if they were successfully fledged.

Albert Head: There was no evidence of Bald Eagle or Osprey nesting at Albert Head in 2010.

Royal Roads: A new Bald Eagle nest site was located along College Drive on the Royal Roads Campus (Map 2). One eagle chick fledged from this nest in 2010 (Table 2).

Colwood: Bald Eagles did not appear to nest at the Colwood site in 2010 (Table 2). Osprey were not observed during a site visit on 3 May 2010; the Osprey nest that had been constructed on the artificial platform north-west of the fuelling jetty appeared unused and deteriorating. No follow-up visit was made to determine if the Osprey attempted to nest later in the season.

Map 2. Bald Eagle nest site locations and nesting territories at and near Colwood.

Table 1. Bald Eagle nesting history at DND Rocky Point, 2000 through 2010.

Territory	Year										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
T-1	-	1C	OT	OT	0C	0C	1C	0C	0C	0C	1C
T-3	A	OT	OT	1C	NA	NA	OT	1C	0C	OT	NA
T-4	A	OT	OT	OT	1C	1C	0C	0C	1C	1C	1C
T-5	-	-	2C	0C	2C	1C	NA	1C	1C	1C	0C

A = Active nesting attempt though no evidence of chicks; NA = Not Active; OT = Occupied Territory;
0C = No chicks, nesting attempt failed; 1C = One chick fledged; 2C = Two chicks fledged

Table 2. Bald Eagle nesting history in the DND Colwood area, 2001 through 2010.

Territory	Year									
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Royal Roads - West	1C	-	-	-	-	-	-	-	-	-
Royal Roads - East	-	-	-	-	-	-	-	-	-	1C
DND Colwood	-	-	-	OT	OT	A	A	OT	1C	NA
Saxe Point	-	A	2C	2C	0C	OT	-	1C	0C	2C

A = active nest though no evidence of chicks; 1C = one chick fledged; 2C = two chicks fledged;
OT = occupied territory

Discussion:

With monitoring only four Bald Eagle nesting territories at Rocky Point, the sample size is too small to make statistical comparison between the nests or to predict trends. However, if the data are pooled over the eleven seasons, we have 26 observations of occupied territories with a 48% fledging success rate. As more than one chick was fledged in some of the nests, there was an overall average production of 0.55 young per occupied territory. This is below the 0.70 chicks per occupied territory thought necessary to sustain a local population (Sprunt *et al*. 1973), but not out of line with nesting success rates measured in other remote locations on the BC Coast (0.27 chicks per occupied territory in Clayoquot Sound, as reported by Elliott *et al*. 1998). At Colwood and Royal Roads, with sporadic records of nesting productivity data, it is not possible to make any inferences on the population.

The one-kilometre diameter nesting territory circles on Figures 1 and 2 are centred on either the nest location or an average centre point of nests thought to make up a nesting territory. In reality however, Bald Eagle nesting territories are never precise circles and they vary in size depending on habitat conditions. In the Colwood and Esquimalt area, the aerial photograph in Figure 2 shows how the nesting territories and nest trees are located in the few remaining patches of forest. With the exception of Saxe Point, all the sites are further inland than we might expect if suitable trees were available near exposed shorelines. In contrast, Bald Eagle nesting territories at Rocky Point are situated at prominent locations near the shore.

As top predators, the success and vitality of Bald Eagles is a good measure of the health of the natural systems in any local area. Along the east coast of Vancouver Island and throughout the Capital Regional District development pressure for residential properties has led to the loss of much natural habitat and most veteran trees. DND lands, such as at Rocky Point and Colwood, that are kept in a relatively natural state, are valuable as refuge habitat, as well as being useful for comparing Bald Eagle nesting success with sites in more altered environments.

Conclusions:

Monitoring the Bald Eagle nests at Rocky Point and other DND properties is a valuable data source to compare with other areas around Vancouver Island. While the WiTS program would like to continue its work, financial constraints have forced us to reduce the scope of the WiTS program and we will discontinue monitoring the DND study sites.

Acknowledgements:

We wish to thank Barb Begg, Fern Walker, Jenny Hyndman, and Sue Myerscough for assisting in data collection for this project.

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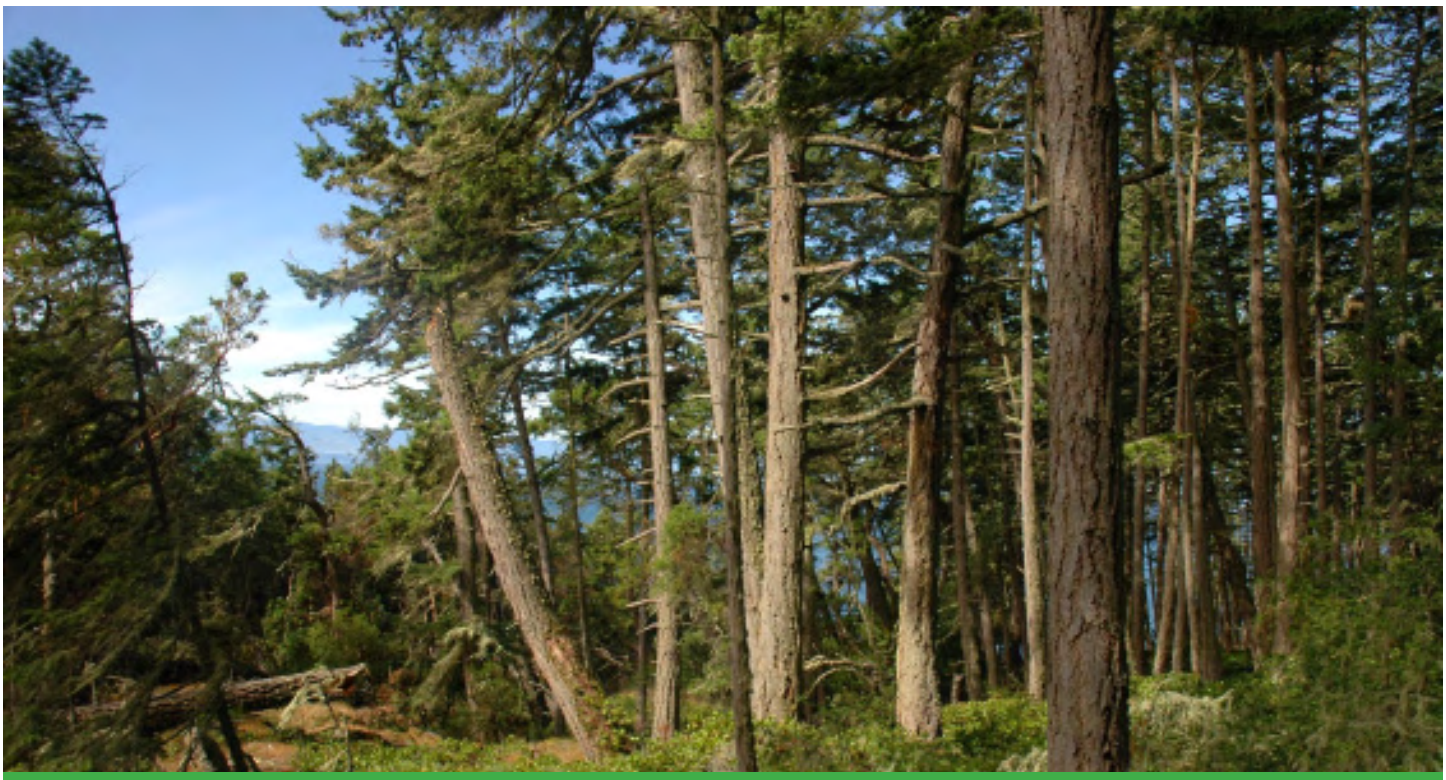

P074-10 Douglas-fir forest at Church Hill, Rocky Point.

Garry Oak Acorn Survey

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PERMIT #: P079-10
LOCATION(S): CFMETR AND ROCKY POINT

START DATE: 24 SEPTEMBER 2010
COMPLETION DATE: 4 OCTOBER 2010
PROJECT STATUS: 2001-ONGOING

Introduction:
Garry oak (*Quercus garryana*) ecosystems from southern California to Vancouver Island are disappearing or changing due to introduction of exotic species, fire suppression and land conversion for agricultural and urban uses (Agee 1993, Bell and Papanikolas 1997, Chappell and Crawford 1997, Reed and Sugihara 1987, Tveten and Fonda 1999). Garry oak-associated communities are among the most threatened ecosystems in Canada and provide habitat for more than 100 red- or blue-listed species (Gedalof *et al*. 2006). Garry oak primarily reproduces from acorns, although root-crown sprouting may also occur if stems are heavily damaged (Stein 1990).

High annual and tree-to-tree variation in acorn production is characteristic of oak species in general (Koenig 1980), and Garry oak in particular (Peter and Harrington 2009), but more information on acorn crop variation or regularity in Garry oak is needed (Stein 1990). The purpose of the Garry Oak Acorn Production Study is to determine the spatial and temporal variation in acorn production and the factors that influence it. Annual acorn production is monitored from Vancouver Island to southern Oregon with the help of volunteers and cooperating agencies. To assist our volunteers and inform the general public, we created a website with background information, methods and forms used in the survey, and results of the survey (www.fs.fed.us/pnw/olympia/silv/oak-studies/acorn_survey).

The Vancouver Island sites are important as they are near the northernmost distribution of Garry oak and may thus reveal important information about climatic limitations on Garry oak distribution. In this report, we describe acorn production among sites on Vancouver Island, including DND properties. Acorn production for the adjacent Pacific Northwest Region of the United States (Washington State and Oregon) is presented for comparison.

Study Area and Methods:
The number of trees monitored annually on or near Vancouver Island has increased from 54 trees in 2001 to 230 trees in 2005. In 2010, only 199 trees were monitored due to mortality (9 trees), lack of access to one DND site (Mary Hill: 16 trees), one isolated location with boat access only (Pylades Island: 3 trees) and three isolated trees that had been cut down on the Saanich Peninsula. The sample trees extend from Courtenay in the north to Rocky Point southwest of Victoria in the south. Mary Hill is no longer included in the analysis, as access to this site is no longer possible.

We surveyed acorns in September and October and ranked acorn production from 1 to 4 , with

1 indicating no acorns and 4 indicating a heavy crop (Graves 1980). Acorn class increments are not equal; for example, in total acorn counts from a small sample of trees, class 3 trees averaged about eight times as many acorns as class 2 trees. Results from trees greater than 10 cm dbh are reported here. Trees were assigned to groups based on location and site characteristics. These included: cultivated locations such as lawns, pastures and parks; riparian locations near water bodies; woodlands; and CFMETR, which is distinct in that it is very open and savannah-like. The woodland group was further separated into northern and southern groups at the latitude of Duncan. Rocky Point was included in the southern woodland group. A separate category for juvenile trees was also used.

For comparison, 2010 acorn production data for Washington State and Oregon are presented as "US Regional Average".

Results:

Acorn production in 2010 appears to be the lowest on record (i.e., since 2001). As has been the situation since 2003, CFMETR again had the lowest acorn production in 2010 (Figure 1). Production appeared to be greatest on cultivated areas, which has been a consistent trend with the exception of 2009 when riparian production was

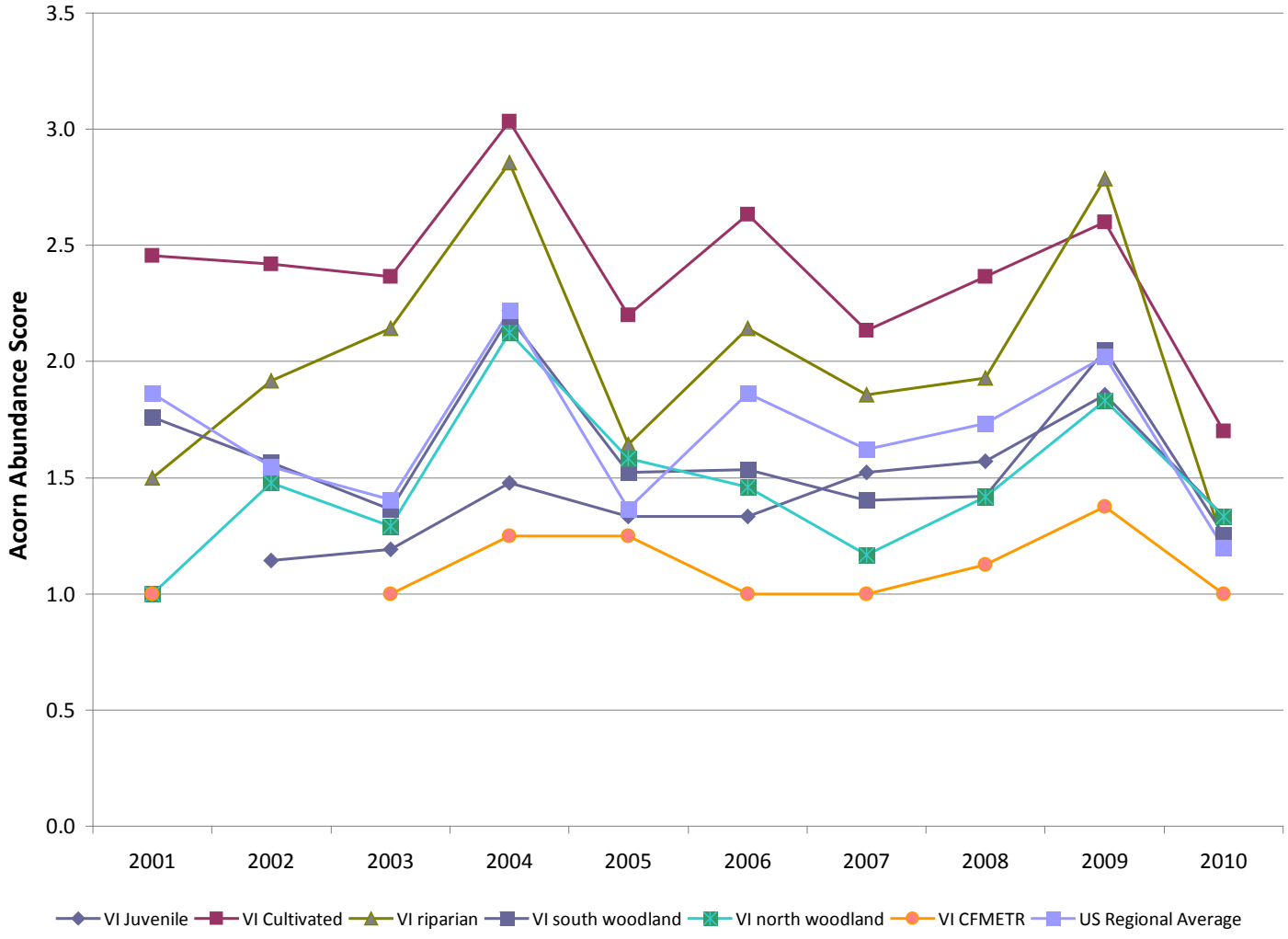

Figure 1. Average, annual, Garry oak acorn production by group for Vancouver Island.

greatest (Figures 1 and 2). Juvenile and North Woodland stands were tied in terms of acorn productivity; and South Woodland and Riparian sites followed, in declining order of productivity (Figure 1).

Canadian acorn production in 2010 equaled or exceeded the US regional average on all sites, except CFMETR (Figure 2). With the exception of Vancouver Island Riparian and Cultivated sites, the US regional average typically equals or exceeds production on the Canadian sites (Figure 1).

Discussion:

The results from this study were in agreement with those from other studies in that long, warm, moist growing seasons and dry spring conditions benefit acorn production (Peter and Courtin 2006, Peter and Harrington 2009). The generally moister conditions of cultivated and riparian areas are likely responsible for the typically higher acorn production than at other locations. The poor acorn production in 2010 may be attributable to cool spring conditions but further analysis is needed to confirm this. Interestingly, riparian acorn production seems to have decreased relatively more than the other groups did in 2010; however, the reason for this is currently unknown. Since measurements

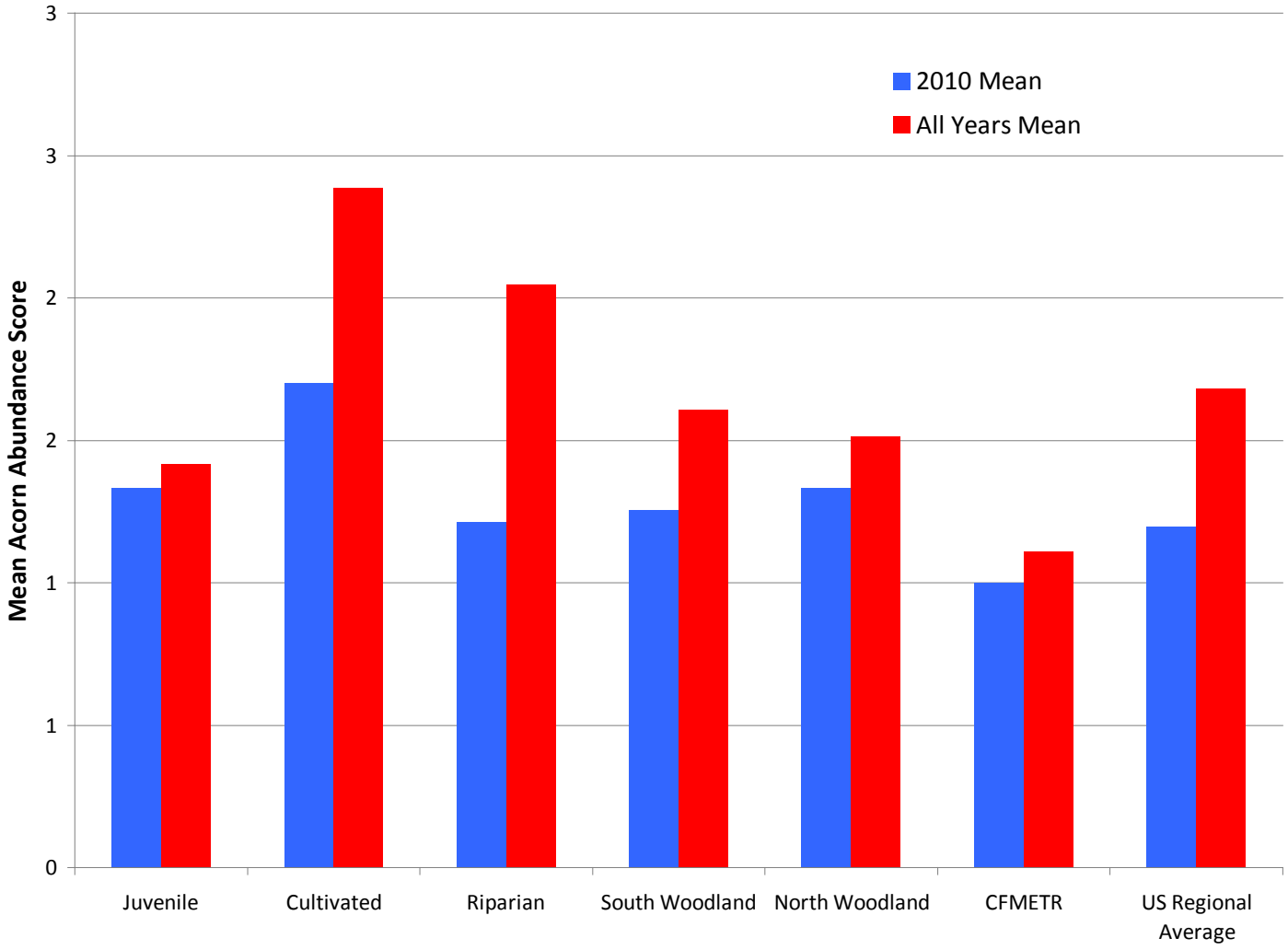

Figure 2. Average acorn production by group for Vancouver Island compared to US regional average for 2010 and study duration (2001 – 2010).

began in 2001, there have been three good production years (2004, 2006 and 2009). Although preliminary, these results might indicate that mast years occur about every 3 years.

Conclusions:

We plan to continue acorn surveys for at least 2 more years (as each year of data adds clarity to geographic and climatic relationships with acorn production) and hopefully continue the study until 2020. We anticipate that several papers, describing geographic and temporal masting patterns, and the effects of weather, habitat and competition on acorn production in Garry oak will be published as a result of this study. Data for this study is maintained at the USDA Pacific Northwest Forestry Sciences Laboratory in Olympia, WA.

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P079-10 Garry Oak (*Quercus garryana*) acorns.

P079-10 Conducting the Garry Oak acorn survey at Rocky Point.

The Strait of Georgia Mortuary Landscape Project

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PERMIT #: P104-10
LOCATION(S): ROCKY POINT

START DATE: 1 JANUARY 2010
COMPLETION DATE: 31 DECEMBER 2010
PROJECT STATUS: 2004-2011

Introduction:

At the Department of National Defence (DND) Rocky Point Training Area, there is a record of pre-European contact First Nations history preserved in the numerous burial features on the property (Figure 1). Southern Vancouver Island has been home to the Straits Coast Salish people for millennia and their cemeteries are well preserved at Rocky Point (Mathews 2006). Between about 1500-400 years ago, these peoples built a distinctive form of interment for their dead called burial cairns and mounds (Lepofsky *et al*. 2000; Mathews 2006; Oakes *et al*. 2008; Smith and Fowke 1901; Thom 1995). These funerary features consist of arrangements of rocks and soil carefully placed over the deceased. Cairns are constructed primarily from stone, with only a minor or moderate amount of soil packed between the stones. Burial mounds are essentially burial cairns covered with a thick layer of soil. There is variation in the shape and size of these monuments, ranging from a small concentration of less than a dozen stones, to massive features with many tonnes of rocks, and measure more than ten meters in diameter. Some features are circular, square or rectangular, while others are irregular. But within this variability are also some discernable patterns in how these features were built. Burial cairn and mound sites may have as few as one, or as many as 300 or more features. The DND properties, particularly Rocky Point, Mary Hill, and Albert Head, have the best remaining record of these ancient cemeteries on southern Vancouver Island (Mathews 2004a, b).

The Rocky Point property offers an unprecedented opportunity to study burial cairns and mounds on a large scale, as it has the best remaining cemeteries of this type in British Columbia. Between 2004-2006, the largest burial cairn site in the province, DbRv-3 (the Rocky Point site) was recorded under ESAC Permits P104-04 to 06 (Mathews 2006). Working in consultation with the Scia'new First Nation, 333 cairns and mounds were identified, mapped and recorded at the Rocky Point site in great detail. Under ESAC permits P104-07 to 10, work has continued at the Rocky Point site, but research has also expanded to include other cairn and mound cemeteries elsewhere on the Rocky Point property, as well as on private land adjacent to the property.

Burial cairns and mounds are the material remains of funerals. The manner in which cairns and mounds were built, and where on the landscape they were placed, are the results of hundreds of funerals over many generations, and when considered as a whole, offer unprecedented insight into the social world of Straits Salish precontact communities. Burial cairns at the Rocky Point cemetery can be reasonably viewed as memorials, built to express the identity of the deceased and the manner in

which mortuary space is used – the style, material chosen, size, and placement of cairns – has great interpretive potential to identify socially meaningful patterns in how precontact Straits Salish peoples articulated and negotiated their social, economic, and spiritual relationships.

There are two objectives to this project; the first is to collect data on the physical form and spatial location of individual burial cairns; and the second is to collect intrasite landscape spatial data. Information on how and where individual burial cairns and mounds were built, when combined with the geographic layout of cairn sites in relation to each other and to the natural and cultural elements of the local landscape offer a multi-scalar picture of inter-village and regional social relations.

Study Area and Methods:

The research project utilized data from seven localities, six of which were on the Rocky Point property. The 2010 field season focused on three of these sites: small cemeteries at Manor Point, Cape Calver and Bentinck Island (Figure 1).

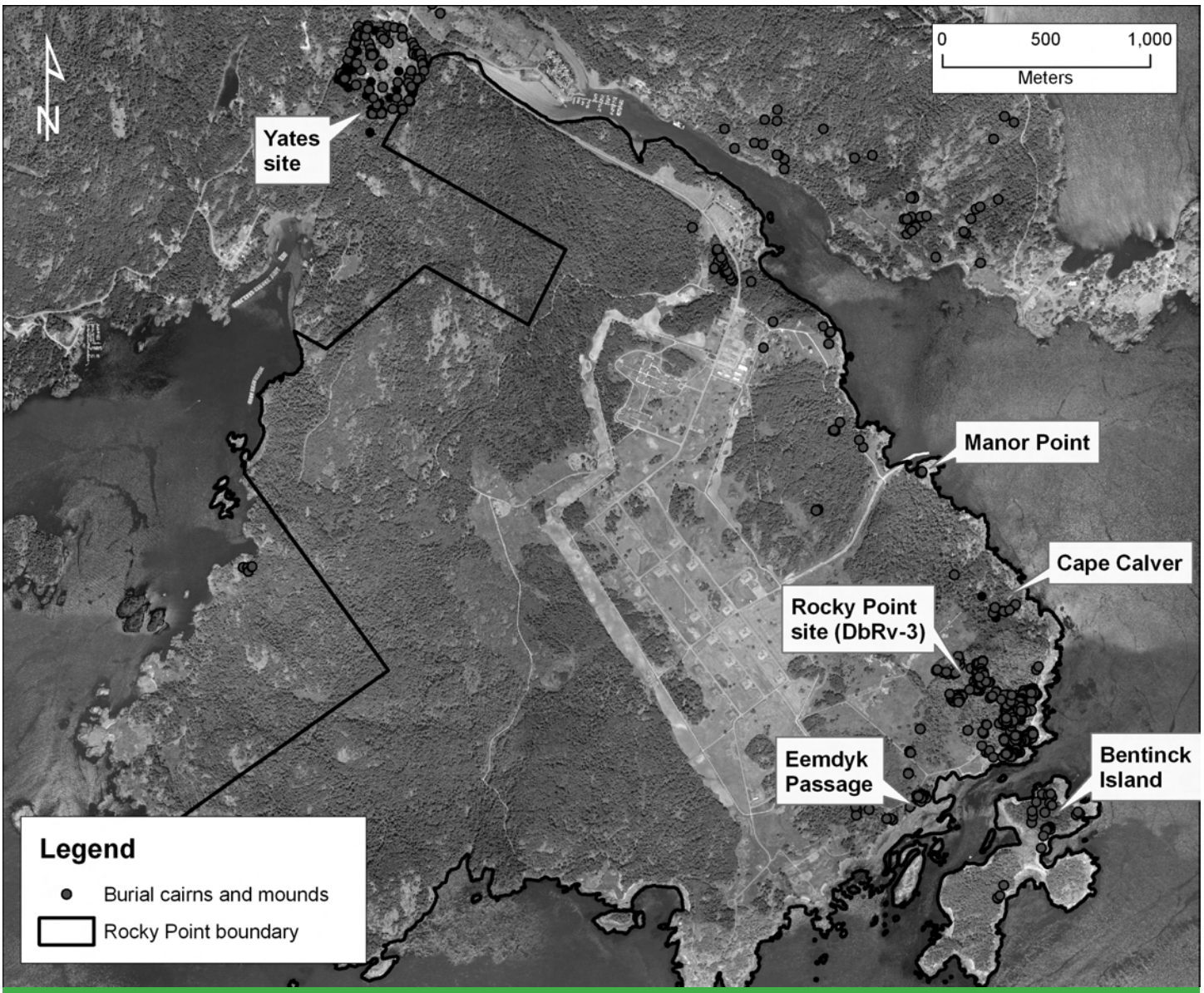

Figure 1. The Rocky Point Training Area with Burial Cairn Sites

Additional follow-up work was done at the two largest localities; the Rocky Point site (DbRv-3) at Eyde Point, and the Yates Site, which overlaps with the northernmost edge of Area C at Rocky Point and an adjacent private property (Figure 1).

In order for the intrasite spatial analysis of burial cairn sites to be successful, it was necessary to first inventory the Rocky Point landscape according to the following methodology: a crew of three to five experienced archaeologists walked systematic transects with a 2-metre interval between surveyors, recording the location of each archaeological feature with a Trimble 2005 GeoXT GPS. With differential correction, this data was accurate to 1-2 m. The spatial data was imported into a geographic information system (GIS). Relevant landscape features, such as bedrock outcrops and hydrological features were also recorded. High-detailed mapping was also done at Manor Point using a Trimble S3 robotic total station and TSC2 controller (Figure 2).

For the analysis of individual cairns, a total of 18 analytical variables were collected, in addition to the production of photographs, and detailed diagrams of significant cairns (Figure 3). The metric attributes of each feature, information on the specific type, amount, shape, and size of the constituent rock, and the structure of each cairn were recorded on a standardized form.

GIS was instrumental as a means of data quantification and management, ensuring a high level of accuracy in mapping and analysis, and a method by which to group data. By using GIS as a management tool, mortuary features were quantified and reorganized and reassigned into analytical units based on quantifiable spatial and morphological attributes.

Results:

Prior to this research, there had not been a comprehensive and encompassing examination of the spatial distribution of burial cairns in the Strait of Georgia, despite the fact that the cairns were one of the earliest types of archaeological sites studied in the region (Mathews 2006a; Smith and Fowke 1901.) Additionally, there had not been a comprehensive inventory of burial cairns in the Victoria region. From a culture history perspective, this research generated a systematic and detailed survey of significant parts of Metchosin; the largest single systematic archaeological survey conducted in the Victoria area. In addition, over 600 cairns were inventoried, mapped, and entered into a GIS spatial database. This type of non-invasive detailed analysis of the individual burial cairns at Rocky Point is the first of its kind in the province, and possibly in North America.

At DbRv-3, analysis to date has identified six distinct types of mortuary features. Concurrently, a spatial analysis defined seven distinct areas within the site. Analysis of the distribution of the six types of cairns throughout the seven different areas revealed distinct patterning, possibly representing the exclusive burial localities of separate households. The Rocky Point site is contrasted with the newly recorded Yates site. Both cemeteries were situated close to the villages in which the living resided. While the Rocky Point site had over 300 relatively small features in a 3-hectare area, the Yates site had over 100 features in a similarly sized area, but the mean feature size was significantly larger. There were also several previously unknown types of burial features at the Yates site that had not been observed at the Rocky Point site, or elsewhere. This may represent two contemporaneous, adjacent communities, each with many similarities in funerary ritual, but also exerting differences in the types of constructed features, and perhaps

Figure 2: Robotic total station mapping of burial cairns and landscape, Manor Point.

Figure 3: Detailed recording of burial cairns, Bentinck Island.

different classes or categories of people being buried in each cemetery.

Analysis of the morphological and spatial data collected in 2010 from the sample of smaller cemeteries at Manor Point, Cape Calver and Bentinck Island is currently underway. These smaller cemeteries, positioned between the two much larger cemeteries of DbRv-3 and the Yates site, offer clues to the use of shared space between villages.

Discussion:

The 2010 field season was the second largest to date for the Strait of Georgia Mortuary Landscape Project. The aim of the research will continue to focus on gathering detailed information on cairn morphology and use this information to spatially and statistically test associations within and between individual cairns, cemeteries and the landscape. Research is anticipated to continue at Rocky Point, as well as at other non-DND properties throughout the Strait of Georgia and Puget Sound. Other DND properties, such as Mary Hill and Albert Head, could also benefit from similar survey and detailed burial cairn recording in the future.

Conclusions:

The use of mortuary space at multiple scales of interaction, from the household to the region, is the material expression of ancient Straits Salish social relationships. The funerals in which burial cairns and mounds were built represent an institution of ceremonial exchanges, a network that linked people from separate villages within the wider regional community. Together with marriage and the cultivation of other strategic social, economic, and political ties, cairns may have simultaneously provided a forum in which identity and inequality at the local kin or village-based level could be created, contested, and renegotiated. Being the best-preserved burial cairn landscape in British Columbia, the ongoing research at Rocky Point will form the theoretical and methodological stepping off point from which a regional analysis can be approached.

Preliminary results of the ESAC field data collected between 2004 and 2010 will be presented at the upcoming Society for American Archaeology conference in Sacramento, California, in April 2011. The results of the doctoral dissertation stemming from this research, which will likely be defended in 2011, will be the basis for a book and multiple articles on the burial cairns and mounds of the Strait of Georgia. The resulting data will be curated with the Environmental Sciences Advisory Committee, the University of Victoria Archives, and the Royal British Columbia Museum for access to future researchers and resource managers. Data provided under this ESAC permit provides concrete information for the long-term management of cultural values on DND properties.

P104-10 Archaeological marker at Rocky Point.

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P108-10 House Wren nest and spider web in a Western Bluebird nestbox at CFMETR.

Western Bluebird Nestbox Program

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PERMIT #: P108-10
LOCATION(S): CFMETR AND ROCKY POINT
START DATE: 1 JANUARY 2010
COMPLETION DATE: 31 DECEMBER 2010
PROJECT STATUS: 2005 - ONGOING

Introduction:

The Georgia Basin (or Georgia Depression) population (Garry Oak Ecosystems Recovery Team, 2002; Slater, 2009) of Western Bluebirds (*Sialia mexicana*) has suffered serious population declines since the 1950's. The Georgia Basin Western Bluebirds bred regularly around Puget Sound and the San Juan Islands, Washington until the 1960's, and on southern Vancouver Island, British Columbia (B.C.), and the southern Canadian Gulf Islands until the 1980's. This population has been considered extirpated from B.C. since 1995 (Slater, 2009). The Western Bluebird is not federally listed as a species at risk in Canada; however, it is red-listed in B.C. and is included in the *Recovery Strategy for Garry Oak and Associated Ecosystems and their Associated Species at Risk in Canada, 2001-2006* (Garry Oak Ecosystems Recovery Team, 2002). The decline of the Georgia Basin population of Western Bluebirds is thought to have been caused by a number of interacting factors including habitat degradation caused by the intensification of agriculture and the removal of large, dead trees suitable for secondary cavity nesting. Additionally, it is possible that changing climate (in particular more frequent wet springs) over the last century limited the abundance of insects, the primary food source of Western Bluebirds in the Georgia Basin. Competition for nesting cavities, from introduced species such as the European Starling (*Sturnus vulgaris*), may also have contributed to the Western Bluebird's decline in the Georgia Basin (Slater, 2009).

The Western Bluebird Nestbox Project is part of the larger "Bring Back the Bluebirds" program of the Garry Oak Ecosystems Recovery Team (GOERT), coordinated in part by the GOERT Vertebrates at Risk Recovery Implementation Group and the Salt Spring Island Conservancy. The goal of the program is to re-establish a viable Canadian population of Western Bluebirds. Nesting cavity availability is thought to be a critical habitat element for the species (Slater, 2009). The nestbox project was initiated in 2005 to supplement suitable nesting sites for Western Bluebirds. Suitable sites are generally open habitat, such as Garry Oak meadows and grasslands, with some perches nearby to be used for hunting and fledgling. The nestbox project has coordinated building and erecting over 100 nestboxes since 2005, and monitoring the newly erected nestboxes as well as those that were mounted on southern Vancouver Island through the 1980's and 1990's. Since 2005, nestboxes have been monitored sporadically and more have been added.

Bluebirds are known to respond well to nestbox programs. In Washington State, where similar population declines in Western Bluebird populations occurred over the last half century,

nestbox programs are proving successful at Fort Lewis and the San Juan Islands (part of the historic Georgia Basin population). The population at Fort Lewis has recovered from only a couple of breeding pairs in the 1980's, to over 200 pairs, through an intensive nestbox program (Slater, 2009). Since 2007, the Fort Lewis population has served as a source for the San Juan Islands Western Bluebird Reintroduction Project on San Juan Island. 2010 was the fourth year of the five year program to reintroduce 90 breeding adults. In 2010, 23 Western Bluebirds returned to the San Juan Islands from their winter migration and 84 juveniles fledged (Foley, 2009). Long-term monitoring will determine the viability of this population.

As part of the "Bring Back the Bluebird" program, there are plans to reintroduce Western Bluebirds from the Fort Lewis population to Salt Spring Island beginning in 2012 (Slater, 2009). Maintaining a network of suitable nestboxes will provide potential nesting for bluebird pairs and is critical in supporting reintroduction efforts. Monitoring of the nestboxes is equally important. With a single exception, there has been no evidence of Western Bluebirds nesting on Vancouver Island or the southern Gulf Islands since 1995. The exception took place in 2008, when a pair nested in Victoria B.C.; however, the nest failed.

Additionally, a number of individuals have been sighted around southern Vancouver Island in recent years.

This report summarizes 2010 nestbox monitoring results.

Study Area and Methods:

The study area for the Western Bluebird Nestbox Program includes suitable habitat throughout southeastern Vancouver Island and the southernGulf Islands. Study areas on DND lands are at CFMETR Nanoose Bay and Rocky Point.

Nestboxes at Rocky Point were monitored once in 2010. Monitoring took place in June and consisted of checking each box for signs of nesting. Any nests found were identified to determine which species were using the boxes. Photos were taken of the inside of each nestbox.

The seven nestboxes at CFMETR were monitored in July. Any nests found were identified to determine which species were using the boxes. Photos were taken of the inside of each nestbox prior to cleaning them in October.

P108-10 Nestbox monitoring at CFMETR.

Results:

In 2010, signs of nesting were observed in several of the nestboxes at Rocky Point. Nests were identified primarily to be House Wren (*Troglodytes aedon*) or Chestnut-backed Chickadee (*Poecile rufescens*) nests. There was no evidence of nesting by Western Bluebirds at Rocky Point in 2010.

As at Rocky Point, we found no evidence of nesting by Western Bluebirds at CFMETR in 2010. Four of the nestboxes at CFMETR showed no signs of nesting by any species; the other three nestboxes showed signs of House Wren activity.

Discussion:

In 2010, no Western Bluebirds were found nesting at Rocky Point or CFMETR, or at other sites in this project. There is no evidence that bluebirds have successfully nested on southern Vancouver Island or the southern Gulf Islands since 1995. The closest population is the re-establishing San Juan Island population, approximately 40 km from Rocky Point, which has been growing annually. Birds from this population have not yet shown evidence of dispersing beyond that island. If they disperse naturally to southern Vancouver Island, nestboxes will provide critical habitat and improve the chances of re-establishing a Western Bluebird population here.

In addition, nestboxes erected for this project are providing valuable habitat for other cavity-nesting bird species.

Conclusions:

The 'Bring Back the Bluebirds' program is a long-term project and it may be many years before Western Bluebirds are re-established within the Georgia Basin. It is therefore critical to maintain a network of nestboxes. The ongoing maintenance and cleaning of nestboxes will ensure that the structures are in adequate working condition. The value of regular monitoring is that it may provide insight into the threats that Western Bluebirds face, including valuable information about the species and numbers of nest competitors; it might detect visiting Western Bluebirds; and it will hopefully provide evidence that bluebirds have nested in the boxes. Maintenance and monitoring at Rocky Point and Nanoose Bay will continue in 2011. A reintroduction within Canada (not on DND land) is planned for 2012. The long-term results of the larger project will hopefully be published in a peer-reviewed journal. Data collected during this project are housed with the Garry Oak Ecosystems Recovery Team and are available upon request.

Acknowledgements:

GOERT would like to thank Ann Nightingale, Karen Barry, and Eric Demmers for volunteering their time to monitor nestboxes.

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Monitoring of the Oregon Spotted Frog (*Rana pretiosa*)

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PERMIT #: P109-10
LOCATION(S): MD ALDERGROVE

START DATE: 1 MARCH 2010
COMPLETION DATE: 20 NOVEMBER 2010
PROJECT STATUS: 1999 - ONGOING

Introduction:

Rana pretiosa (the Oregon Spotted Frog) is a Pacific north-west species (Corkran and Thoms 1996). In B.C. today, it is the rarest amphibian and are absent from 90% of its historic range (Matsuda *et al*. 2006). It occurs at four known sites in the extreme south-west corner of the province: namely Maintenance Detachment (MD) Aldergrove, Mountain Slough and Morris Valley in Agassiz, and Maria Slough adjacent to Seabird Island (Haycock 2000a, and C. Bishop, pers. ob.).

R. pretiosa was designated as “endangered” in an emergency listing in November 1999 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Haycock 2000b). The reason for the designation is the fact that the distribution of the species has been reduced to only a few isolated sites, with each site containing very low numbers of individuals, and because the species has been adversely affected by habitat loss due to urban expansion, agriculture, exotic competitors, and exotic vegetation (COSEWIC 2000).

The MD Aldergrove population, particularly, has shown a steady annual decline from 90 egg masses in 1997 to 33 egg masses in 2001 (Haycock 2001). No egg masses were observed since 2007 (C. Bishop, pers ob.). The goals of the study are to determine the number of egg masses oviposited at MD Aldergrove and their embryonic survivorship; to increase the breeding population by captive rearing programs; to determine the survivorship of adults previously reared at the breeding facilities and released at MD Aldergrove; and to better understand habitat use at this location and estimate overwintering survival of captive raised *R. pretiosa* through radio telemetry.

Study Area and Methods:

Study site

The research was conducted at the Department of National Defence’s MD Aldergrove facility (latitude 49° 04’ and longitude 122° 29’). The MD Aldergrove study site consisted of two sub-sites: the Pipeline Sub-site and the Frog Restoration Sub-site (FRS). The sub-sites are connected and are open wetlands with a mix of open water and vegetation. The Frog Restoration Sub-site was altered in 2002 and now consists of a large body of open water with little vegetation in the littoral zone.

Egg mass surveys, embryonic survivorship and captive rearing

Egg mass surveys were done by walking through the wetland in historic and potential *R. pretiosa* oviposition sites. No embryonic survivorship study was done and no egg masses were collected and therefore no captive rearing was done during 2010.

Oregon Spotted Frog trapping

Sixty collapsible minnow traps were put out during the weeks of 1 and 8 March at the Frog Restoration Sub-site and the Pipeline Sub-site at known *R. pretiosa* oviposition sites. Thirty traps were put out at each sub-site. Traps were put out on Tuesday mornings and checked on Wednesday, Thursday, and Friday mornings. Traps were removed from the wetland after being checked on Friday mornings. Traps were moved to a new location within the sub-site every week. A GPS reading was taken at each trap and traps were put out in numerical order to ensure all traps were checked at each visit. If an amphibian was caught, the species and sex (if possible) were recorded and mass, snout-vent-length (SVL), and total lengths (for salamanders only) were recorded. To avoid salamanders from drying out, they were placed in a Ziploc bag with water while measurements were taken. Disposable gloves were worn at all times. Water temperature readings were taken every time egg mass surveys were done or traps checked.

Radio-telemetry

In October 2010, eight captive reared *R. pretiosa* were released at one of the historic oviposition sites in MD Aldergrove and tracked in an attempt to better understand habitat use at this location and estimate overwintering survival of captive raised *R. pretiosa*. Frogs were fitted with transmitters no greater than 5% of their body weight using a belly belt system designed to minimize discomfort and altered behavior by the individuals. Battery life of the transmitters ranged from three to four weeks and was limited by the size of the transmitters. All frogs were located two to three times a week and for each location habitat was assessed within a 0.25 m^2 plot centered on the frog's location. Habitat variables recorded within the plot included the percent of each plant species, water depth, air and water temperature, maximum vegetation height and depth and the distance of the frog to the nearest aquatic/terrestrial boundary.

Results:

Egg mass surveys, embryonic survivorship and captive rearing

Surveys for egg masses were conducted at the two sub sites during March and April 2010. No egg masses were found and therefore no embryonic survivorship was done and no eggs were collected for captive rearing.

Oregon Spotted Frog trapping

Four amphibian species were caught during trapping, including *Hyla regilla* (Pacific Tree Frog), *Ambystoma gracile* (North-western Salamander), *Taricha granulosa* (Rough-skinned Newt), and *Lithobates catesbeianus* (Bullfrog). The North-western Salamander was the most common species caught (Table 1).

Water temperature ranged from 4.3 ºC to 13 ºC at the Frog Restoration Sub-site, and between 3.1ºC and 12ºC at the Pipeline Sub-site.

Radio-telemetry

Frogs were relocated a total of 36 times, averaging 4.5 relocations per individual from 12 October 2010 to 4 November 2010 and habitat plots were

P109-10 Oregon Spotted Frog with the elastomer dye on toe (back right foot).

Table 1. Amphibians trapped at MD Aldergrove during 2010.

Date	# per species				Total / trap night	# of amphibians / trap
	Pseudacris regilla	*Ambystoma gracile*	*Taricha granulosa*	*Lithobates catesbeianus*		
3 March	0	13	1	0	14	0.23
4 March	1	33	8	2	44	0.73
5 March	1	54	3	0	58	0.97
10 March	2	13	4	0	19	0.32
11 March	0	14	0	0	14	0.23
12 March	1	14	9	3	27	0.45
Total	**5**	**141**	**25**	**5**	**176**	

measured at each location. Attempts to re-catch individuals as transmitter batteries expired were made, but were largely unsuccessful due to the complex habitat of the site compounded with low temperatures during that time period. The goal of the project was to estimate overwintering survival but because frogs could not be caught to replace expiring transmitters, the study was terminated prematurely this year and those results were not obtained.

Discussion:

R. pretiosa usually breeds in February and March, soon after snow melt (Licht 1971). The lethal thermal limits for young *R. pretiosa* embryos are about 6 – 28 °C (Licht 1971). During 2010, temperatures at known oviposition sites were in the low range of temperature tolerance limits for the species. On a few occasions, minimum temperatures dropped below 6 °C but *R. pretiosa* embryos can withstand temperatures of 1 °C for up to eight hours (Licht 1971). Temperatures were therefore within acceptable limits for *R. pretiosa* breeding.

One of the main issues with telemetry at MD Aldergrove during the fall is that temperatures are low and water levels are high. Frogs rise to the surface less often under these conditions, making it difficult for field technicians to get visual observations or catch the frogs. Radio-telemetry can be a useful tool for quantifying habitat use of *R. pretiosa*, but methods need to be refined if this technique will be used again, as planned, in 2011.

Conclusions:

No *R. pretiosa* egg masses were located during 2010 and no *R. pretiosa* was observed during visits to the study area. However, *R. pretiosa* takes two to three years to breed and can live 8 years (Jones *et al.* 2005) and individuals that were released from the captive rearing facilities during 2005 and 2006 can still breed in future years. Surveys should therefore continue to determine whether *R. pretiosa* is still present at MD Aldergrove.

Radio-telemetry will be conducted in 2011 and changes will be made to the methods in an effort to increase the success of the project. Specifically, frogs will be released earlier in the year so that field technicians can develop a “site image” for the frogs and hone the skills needed for capturing frogs in complex habitat under adverse conditions. In addition, larger *R. pretiosa* will be used that are able to carry a heavier transmitter with a longer battery life.

Acknowledgements:
Thanks to DND for granting us access to MD Aldergrove.

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P109-10 Captive-reared Oregon Spotted Frogs with two styles of waist-mounted radio transmitters.

Year-Round Microclimates Experienced by Butterfly Larvae in Garry Oak Ecosystems

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PERMIT #: P124-10
LOCATION(S): ROCKY POINT

START DATE: 1 JANUARY 2010
COMPLETION DATE: 31 DECEMBER 2010
PROJECT STATUS: 2007 - ONGOING

Introduction:
This project addresses the impacts of overwintering conditions and climate change on the biology of species at the edge of their geographic range. It is complementary to work conducted by Dr Jessica Hellmann at University of Notre Dame. The overall goals of the project are to determine the effects of microclimatic conditions on the energy utilization, survival, and subsequent reproductive potential of overwintering individuals of the butterflies *Erynnis propertius* and *Papilio zelicaon*. Physiological work is being conducted in the laboratory in London, ON, using larvae collected on Vancouver Island, and these physiological data will be interpreted using the long-term microclimate temperature recordings. The primary questions to be addressed using microclimate temperature data collected from Rocky Point and other locations on Vancouver Island are as follows:

1. To what extent is reproductive output determined by energy consumption during the overwintering period;

2. What is the relative importance of temperature conditions in fall and winter in determining energy reserves remaining for spring reproduction in these species; and

3. Is there a risk of mortality for these species due to low temperature exposures of short or long duration?

Thus to address the central question of this study: "Do overwintering conditions, whether through mortality or energy expenditure, determine the northern geographic limit for these species?", the microclimate data from Rocky Point site will be need to combined with data from other microclimate stations (to be established in Oregon and elsewhere on Vancouver Island) along with the results of the physiological measurements.

Overall, this study will: provide important information for ongoing studies on the flora and fauna of the Garry oak ecosystem; provide information for future conservation and management of the butterfly species; and, address a number of knowledge gaps concerning the effects of changing winter conditions on insect population biology.

Study Area and Methods:
Microclimate temperature recording stations were established in October 2007 in Garry Oak (*Quercus garryana*) meadows at Rocky Point in close proximity to transects used for on-the-wing butterfly surveys carried out by Dr. Hellmann.

Each microclimate station consists of two iButton DS1922 data-loggers, which make time-stamped temperature recordings at one- hour intervals. The data-loggers at each of four stations were deployed in pairs – one was affixed to a branch in the

canopy at 1.8 to 2 m height (representative of 'leaf temperature', experienced by growing caterpillars and by caterpillars overwintering in leaf rolls that do not drop to the ground), and another was anchored to a tent peg and placed in the leaf litter directly below the canopy data-loggers to provide temperature measurements representative of overwintering habitat in the leaf litter. Each pair of iButtons was encased in silicone to prevent moisture damage, and wrapped in aluminum foil to minimize radiant heat gain. Ground-level iButtons were shaded with a white-painted pie plate to further reduce radiant heat gain. This configuration was also used at two other sites in Garry oak meadows on Vancouver Island and at two sites in Oregon. The level of replication within and between locations was necessary to allow a determination of the variability of temperature conditions both among and within sites.

Data download and maintenance of the data-loggers was done on -site using a laptop computer.

Results:

Data-loggers were checked and data downloaded on 28 May 2010 and set to run unmonitored for 18 months to avoid difficulties in having to return prematurely to reset the loggers (anticipated for spring 2011). Hourly temperature data from each of the four stations from October 2007 to May 2010 were collated and mean monthly minima, maxima and means calculated. One set of ground buttons had disappeared, although the pie plate was still intact. These buttons were replaced. No buttons failed due to moisture damage, however due to concerns about the insulating properties of the plastic vials we have switched to a new method of waterproofing, which involves encasing the buttons in clear silicone and wrapping in aluminum foil. This method does not alter the thermal properties of the buttons, and still provides excellent waterproofing.

Discussion:

This project is still ongoing. Although we had previously planned to use the data this year, the plastic containers we used for waterproofing the buttons unfortunately led to elevated temperatures inside the vials which made that year of data unusable. Therefore we must wait at least one more year until we have a longer-term data set for the microclimate modeling. We anticipate being able to use the data in conjunction with physiological data after the 2010/2011 winter.

Conclusions:

We have successfully established and maintained microclimate temperature monitoring sites at Rocky Point, as well as at two other Vancouver Island locations and two locations in Oregon. Related work on the physiology of the butterfly species (collected under Dr Hellmann's permit) is currently in progress. This work has thus far resulted in two publications in high-ranking journals (Pelini *et al*. 2009; Williams *et al*. in press).

Our plan for 2011 is to use the microclimate data (in conjunction with data from sites in Oregon and elsewhere on Vancouver Island) to build a model of the field-responses of overwintering larvae and pupae of *E. propertius* and *P. zelicaon*. We will use metabolic rate-temperature relationships and rates and nature of metabolic fuel use under different temperature regimes to predict overwinter energy consumption in the field, and to compare overwinter energy consumption between the core and edge of the range of these species.

We also plan to continue the maintenance of the data-loggers. Long-term, ecologically-relevant temperature data sets are very rare, and a 10 year data set will allow us to revisit the physiological data to examine longer-term trends.

Acknowledgements:
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P124-10 Downloading data to a laptop on-site.

P124-10 iButton DS1922 data-logger.

Efficacy Testing of Pheromones and Kairomones of Wood-Boring Coleoptera

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PERMIT #: P126-10
LOCATION(S): ROCKY POINT
START DATE: 4 MAY 2010
COMPLETION DATE: 24 AUGUST 2010
PROJECT STATUS: 2009 – 2010

Introduction:

Pheromone-based detection tools can be used to monitor native and non-indigenous woodboring beetles (Coleoptera). Pheromones are chemicals released by an organism that cause specific behavioral or physiological reactions in one or more conspecific individuals (Karlson and Luscher 1959; Norlund and Lewis 1976). Pheromones are important tools for inter- and intraspecific communication in the insect world. Over the past 50 years, research on insect pheromones has resulted in the elucidation of pheromone chemical components for many taxa. The systems are often multi-component blends of isomers (Seybold 1993) that function synergistically. Lacey *et al*. (2004) reported the first occurrence of male-produced aggregation pheromones in the longhorned beetle family (Cerambycidae), and found structural similarities to pheromones produced by males of six species of Cerambycinae. Structurally these compounds are straight chains of six, eight or ten carbon atoms with hydroxyl or carbonyl groups at C2 and C3.

Wood-boring beetle larvae feed on the tissues of woody plants, damaging and killing trees, and are consequently considered significant insect pests. The Cerambycidae or longhorned beetles are one of the largest families of insects in the animal kingdom, comprising over 35,000 species (Lawrence and Newton 1982). In their native habitats, they often attack weakened or dying trees and are ecologically valued for their ability to break down dead plant material. However, in a novel habitat, where they may be considered an exotic species, they can flourish and wreak havoc on forest ecosystems, attacking both moribund and healthy trees. The European brown spruce longhorn beetle (*Tetropium fuscum* F.) is considered a secondary pest, attacking dead or dying spruce trees in its native range (Smith & Humble 2000). In 1999, however, *Tetropium fuscum* found its way to Nova Scotia (Smith and Hurley 2000) and successfully attacked and killed healthy native spruce trees (Sweeney *et al*. 2004, 2006). Pheromone-based lures have been developed for *T. fuscum* by Silk *et al*. (2007), which have increased our ability to detect this and the related indigenous species, *T. cinnamopterum* (Kirby).

Surveillance systems for non-indigenous bark and wood-borers currently deployed in Canada and the United States generally employ at least two traps baited with host volatiles (ethanol alone and ethanol in combination with alpha-pinene) for the detection of wood-borers. The addition of traps baited with specific cerambycid attractants (pheromones) may be the most effective way to intercept new introductions. The aim of this study was to determine if the specific cerambycid lures (C-6 and C-8 ketol and diols) would be as effective if

run in combination with two host volatiles i.e. could the cerambycid lures simply be added to other lures currently being employed or would additional traps be required if they were incorporated into the surveillance programs.

Study Area and Methods:

Study Area

12-unit funnel traps (ConTech International Incorporated, Delta, British Columbia) were installed at the Department of National Defense, Rocky Point, Metchosin, British Columbia (Areas B and C). Traps were set out in two sites differentiated by the dominant host species Garry oak (*Quercus garryana*) or Douglas-fir (*Pseudotsuga menziesii*) on 11 May 2010. Each trap was hung from a metal stake (see Figure 1) with a minimum distance of 30 meters between adjacent traps. The collection cup on each trap was filled with 125 ml of propylene glycol to retain captured specimens. The traps were serviced on a bi-weekly basis from 21 May to 24 August 2010. During servicing, trap contents were transferred to Whirl-Pac bags for transport to the lab. Lure trials were set up in a randomized complete block design with 10 replicates of 6 treatments in each forest type. Different lures, synthesized by Dr. Peter Silk (Natural Resources Canada, Canadian Forest Service, Atlantic Forestry Centre, Fredericton, New Brunswick) were used in each forest type (see Table 1.)

Specimen Processing

In the laboratory, the contents of cup collections were washed with water and then preserved in 95% ethanol. All Coleoptera were then separated from the plant debris and sorted into their groups of interest, and then either pinned or preserved in 20 ml vials in 95% ethanol. Cerambycidae and Scolytidae were identified to species, counted, mounted and labeled. Voucher specimens were selected for accession into the reference collection at the Pacific Forestry Centre.

Results:

A total of 954 adult Cerambycidae were recovered from the Douglas-fir-dominated forest in 2010, which is a 27% drop from the total number of cerambycids collected in 2009. The difference in total capture is likely due to the addition of alpha-pinene, which has reduced the overall response to the pheromone lures. 410 Cerambycidae were recovered from the Garry-Oak-dominated forest a 94% increase in capture over that in 2009. In 2010, we tested both C6 and C8-ketols, whereas in 2009 only C8-ketols were deployed, Figures 2 and 3 show the difference in the number of cerambycids caught with C6-ketol versus C8-ketol lures. The total number of individuals for each family and subfamily by collection date in each experimental area is given in Tables 2 and 3. A list of all beetles identified to species is given in Table 4.

Figure 1. Servicing a funnel trap at Rocky Point.

Table 1. Kairomone and pheromone lures used in Garry Oak and Douglas-fir stands.

Experiment	Lures	Lure abbreviation	Replicates
Garry-oak-dominated forest	un-baited trap (blank)	blank	10
	host volatile	HV	10
	S-C6-ketol + host volatile	S-C6-K + HV	10
	R-C6-ketol + host volatile	R-C6-K + HV	10
	S-C8-ketol + host volatile	S-C8-K + HV	10
	R-C8-ketol + host volatile	R-C8-K + HV	10
Douglas-fir-dominated forest	un-baited trap (blank)	blank	10
	host volatile	HV	10
	C6-ketols + host volatile	C6-K + HV	10
	C8-ketols + host volatile	C8-K + HV	10
	C6-diols + host volatile	C6-D + HV	10
	C6-ketols+C8-ketols+C6-diols+ host volatile	C6-K + C8-K + C6-D + HV	10

Preliminary data analysis shows that in both forest types studied, C6 ketols and diols combined with IAS standard host volatile lures are good cerambycid attractants (Figures 2 and 3). In the Garry oak forest, we recovered more *Neoclytus conjunctus* LeConte and *Phymatodes aeneus* LeConte with the R-C6-ketol than with the S-C6-ketol.

Discussion:

Cerambycid trapping experiments at DND-Rocky Point in 2010 revealed that a variety of Cerambycinae and Lepturinae inhabit the Douglas-fir and Garry oak forests. In particular, we found that cerambycids were attracted to the C6-ketols and diols. The most notable result was the capture of *Phymatodes aeneus*, which comprised 68% of the total captured cerambycids across 120 traps installed at Rocky Point from May to August 2010. 99% of *P. aeneus* caught at Rocky Point in both 2009 and 2010 were caught with C6-ketols.

In the Garry-oak-dominated forest we found that more cerambycids were attracted to the R-C6-ketol-enantiomer (S-3-(+)-hydroxy-2-hexanone) than to the S-C6-ketol-nantiomer (S-3-(-)-hydroxy-2-hexanone). In particular, there was a large number of *Neoclytus conjunctus* captured with C6-ketols. Similarly, Lacey *et al*. (2009) found that the congener, *Neoclytus acuminatus acuminatus* Fabricius was attracted to the C6 compound, (2S,3S)-2,3-hexanediol (the male pheromone of that species). We found that 83% of the N. conjunctus were attracted to the R rather than the S-C6-ketol-enantiomer. Similar results were found by Hanks *et al*. (2007) where *Neoclytus modestus modestus* Fall was found to be attracted to (R)-3-hydroxyhexan-2-one.

In addition to the cerambycids caught, a number of Scolytinae (bark and ambrosia beetles) were captured at both sites. In previous years, we have caught large numbers of the ambrosia beetle, *Monarthrum scutellare* LeConte, in the Garry-oak-dominated forest with C8-ketols and ethanol lures. This year we found that by adding alpha-pinene to the lure combination, the response of *M. scutellare* was strongly inhibited. In total 62 *M. scutellare*

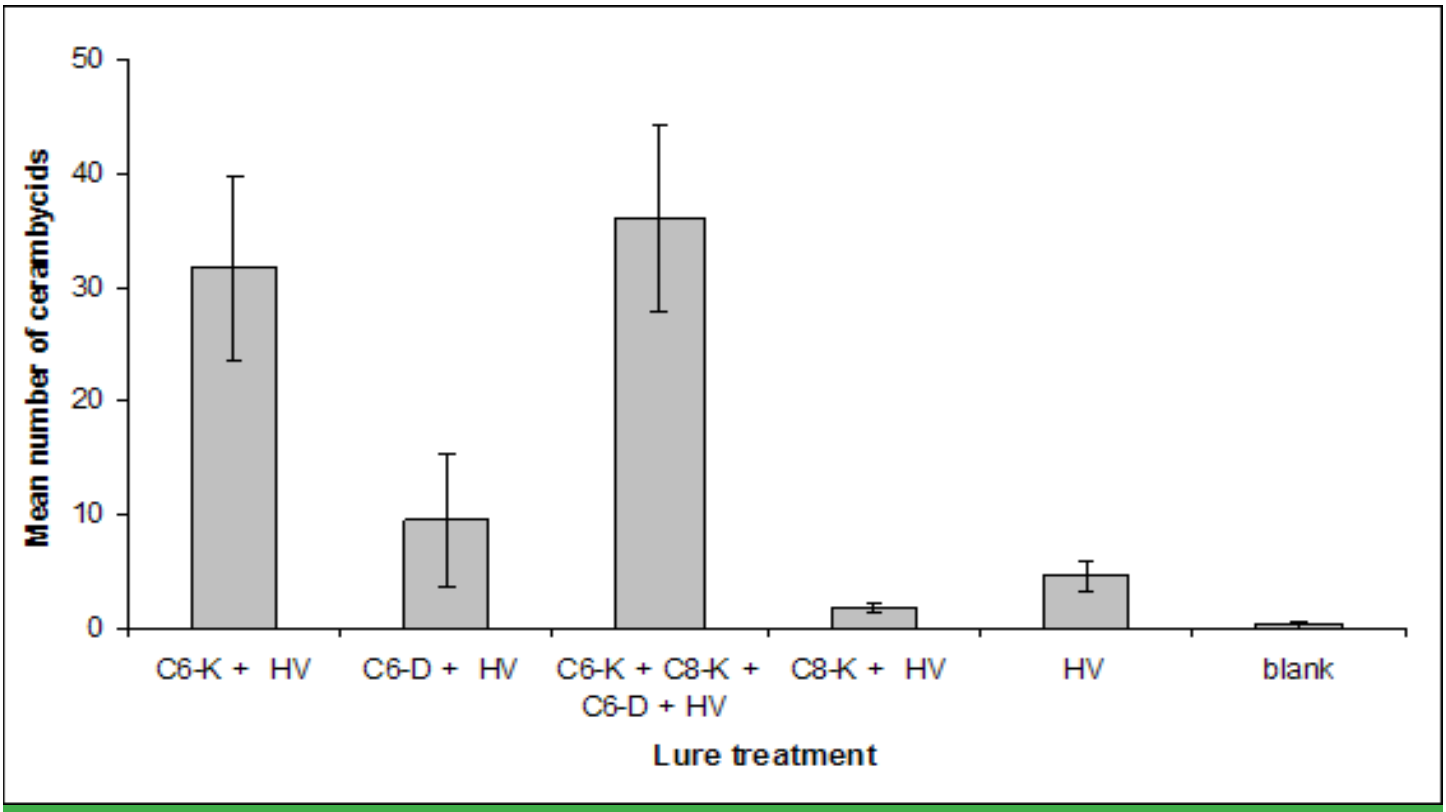

Figure 2. Cerambycids in Douglas-fir-dominated forest.

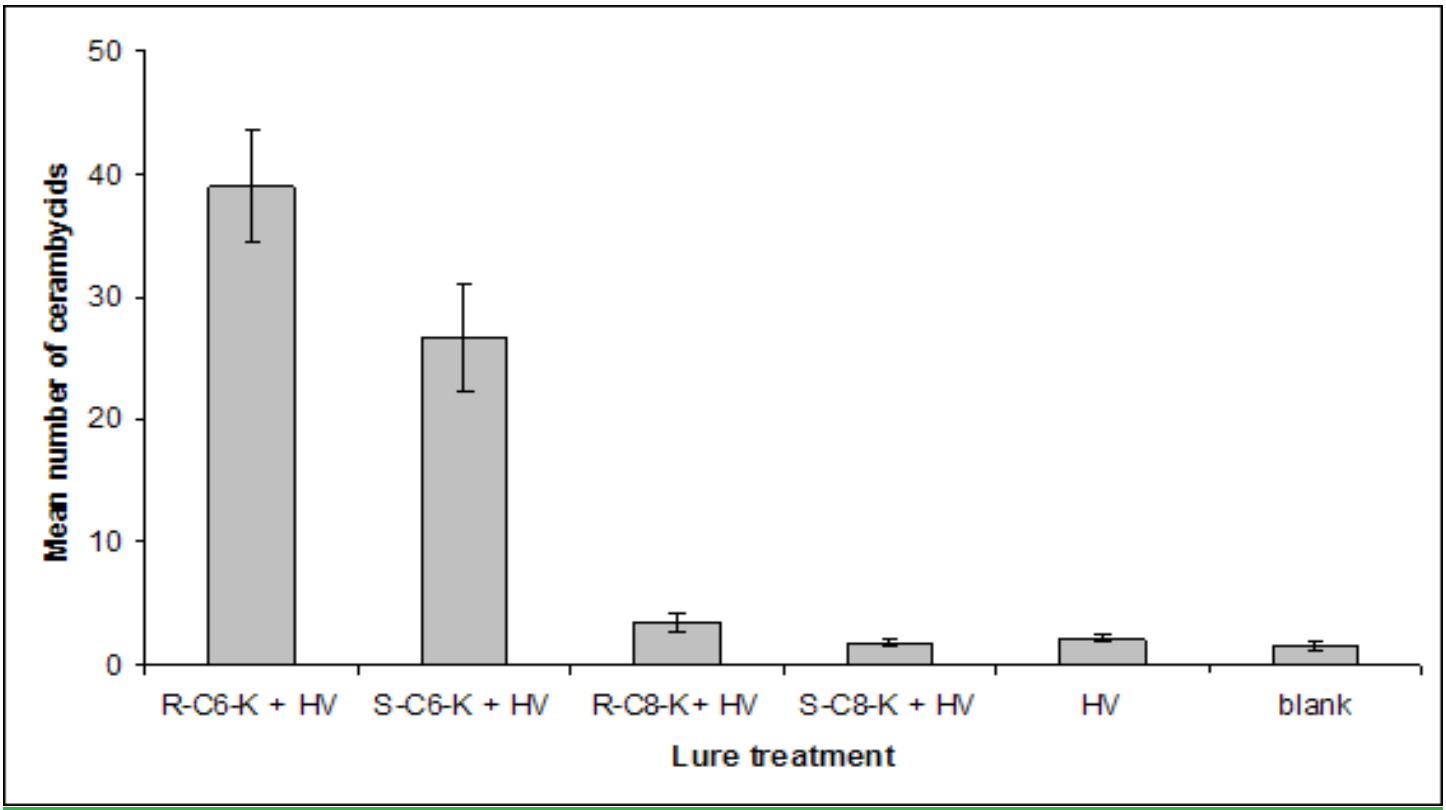

Figure 3. Cerambycids in Gary-oak-dominated forest.

Table 2. Garry Oak forest- total numbers of Curculionidae and Cerambycidae recovered from multiple funnel traps at DND-Rocky Point between 25 May and 24 August 2010.

Taxon	Collection Date							
	25 May	8 June	21 June	6 July	21 July	3 Aug	24 Aug	**Total**
Curculionidae								
Scolytinae	5	1	4	14	109	9	21	**163**
Curculionidae various	52	36	47	14	9	8	1	**167**
Total Curculionidae	**57**	**37**	**51**	**28**	**118**	**17**	**22**	**330**
Cerambycidae								
Aseminae	0	0	0	0	1	0	0	**1**
Cerambycinae	87	12	40	50	110	52	21	**372**
Lepturinae	0	0	1	3	8	17	8	**37**
Total Cerambycidae	**87**	**12**	**41**	**53**	**119**	**69**	**29**	**410**

Table 3. Douglas-fir forest- total numbers of Curculionidae and Cerambycidae recovered from multiple funnel traps at DND-Rocky Point between 21 May and 24 August 2010.

Taxon	Collection Date							
	21 May	4 June	18 June	2 July	16 July	30 July	24 Aug	**Total**
Curculionidae								
Scolytinae	2391	564	1520	491	293	236	157	**5652**
Curculionidae various	55	0	15	18	483	21	109	**701**
Total Curculionidae	**2446**	**564**	**1535**	**509**	**776**	**257**	**266**	**6353**
Cerambycidae								
Aseminae	0	0	0	0	12	24	45	**81**
Cerambycinae	8	0	15	91	453	152	117	**836**
Lepturinae	0	0	0	0	4	14	19	**37**
Total Cerambycidae	**8**	**0**	**15**	**91**	**469**	**190**	**181**	**954**

beetles (1% of all the Scolytinae trapped) were recovered during the entire trapping period in both forest types. In 2009, 51% of all scolytids caught at Rocky Point were attracted using C8-ketol and ethanol lures without alpha-pinene.

Conclusions:

Ongoing studies across Canada aim to determine what combination of pheromones and host volatiles work best for detecting a variety of wood-boring species as a part of a national study for surveillance monitoring. The development of powerful, proven trapping attractants will result in more effective early detection programs and help protect native forests from exotic insect invasions.

Acknowledgements:

Thanks to The Department of National Defence for allowing access to Rocky Point for these experiments and to Esme John (University of Victoria) for trap set-up, monitoring and preliminary identifications, mounting, labeling and sexing target species.

Table 4. Genera and species of Cerambycidae and Curculionidae recovered from traps at DND-Rocky Point.

Family	Subfamily	Genus or Species
Curculionidae	Scolytinae	*Alniphagus aspericollis*
		Cryphalus pubescens
		Dendroctonus ponderosae
		Dendroctonus pseudotsugae
		Dendroctonus valens
		Gnathotrichus retusus
		Gnathotrichus sulcatus
		Hylastes gracilis
		Hylastes longicollis
		Hylastes nigrinus
		Hylurgops porosus
		Hylurgops reticulatus
		Hylurgops rugipennis
		Monarthrum scutellare
		Pityophthorus
		Pseudips mexicanus
		Pseudohylesinus grandis
		Pseudohylesinus sericeus
		Pseudohylesinus tsugae
		Scolytus tsugae
		Trypodendron lineatum
		Xyleborus dispar
Cerambycidae	Aseminae	*Megasemum asperum*
	Cerambycinae	*Clytus planifrons*
		Necydalis laevicollis
		Neoclytus conjunctus
		Opsimus quadrilineatus
		Phymatodes aeneus
		Phymatodes decussatus
		Phymatodes nitidus
		Xylotrechus longitarsis

Table 4 Continued: Genera and species of Cerambycidae and Curculionidae recovered from traps at DND-Rocky Point.

Family	Subfamily	Genus or Species
Cerambycidae	Lepturinae	*Centrodera spurca*
		Grammoptera subargentata
		Leptura obliterata obliterata
		Lepturopsis dolorosa
		Necydalis laevicollis
		Ortholeptura valida
		Xestoleptura behrensi
		Xestoleptura crassipes

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P126-10 University of Victoria co-op student checking a funnel trap.

Organic and Inorganic Nitrogen Indices Along a Productivity Gradient in Coastal Temperate Douglas-Fir Forests

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PERMIT #: P134-10
LOCATION(S): HEALS RIFLE RANGE, ROCKY POINT AND ROYAL ROADS
START DATE: FEBRUARY 2010
COMPLETION DATE: 31 DECEMBER 2010
PROJECT STATUS: 2010 – 2011

Introduction:

The nitrogen (N) status of soils is a key attribute of forest ecosystems, both in the total amount of N available for plant uptake and the proportions of N in either organic (primarily amino acids) or inorganic forms (ammonia and nitrate, or NH_4^+ and NO_3^-, respectively). The nature of the soil N cycle in the warm, temperate forests of the Coastal Douglas-fir zone (CDF) is potentially unique because soil temperatures are probably less limiting to microbial activity and N mineralization as compared to other biogeoclimatic zones of British Columbia. To improve our understanding of forest ecology in the CDF zone we characterize soil N indices and the corresponding $\delta^{15}N$ signature of trees along natural productivity gradients of upland sites. Secondly, we contrast the contemporary landscape with the previous century using the $\delta^{15}N$ signature of wood increment cores of Douglas-fir (*Pseudotsuga menziesii*). The results provide a more thorough baseline of conditions in CDF forests and provide insights into how sensitive soil N availability and associated plant communities have been to climate variation over the past 100 years.

Study Area and Methods:

Fifteen plots were selected to provide three replicates of each of five site series of the CDF: 02 FdPl – Arbutus; 03 Fd – Oniongrass; 01 Fd – Salal; 04 FdBg – Oregon grape; and 06 CwBg – Foamflower. The plots include a subset of sites described in 2009 as part of the biogeoclimatic classlification of DND properties, as well as additional sites within Thetis Lake Park. In mid-spring of 2010 (29-31 March), an *in situ* incubation of soils was established at five random locations within each plot. Soil cores were extracted with a soil auger at 0-15 cm and 15-30 cm depths, then gently poured into polyethylene bags, sealed with a twist tie, and returned to the bore hole for eight weeks. Forest floors were not sampled separately because the majority of microsites had mineral soil directly beneath the litter; if surface organic matter was found (usually 1-2 cm), it was included with the upper mineral soil incubation. After 8 weeks the soil samples were retrieved and immediately run through a 5 mm sieve for analysis of amino acids, NH_4^+ and NO_3^- concentrations using the methodology outlined in Kranabetter *et al*. (2007). Loss on ignition (650° for 24 hours) was then undertaken on these samples to derive a bulk density estimate based on organic matter content for each buried bag (Périé and Ouimet 2008).

Soil samples for total N and carbon (C) concentrations were collected at the same depths in July of 2010 at nine random locations and bulked into three samples per depth. These soils were air-dried, ground and sieved (2 mm) for total C and N analysis using a combustion elemental analyzer. The coarse fragment content was determined

gravimetrically and converted to a percent volume estimate using a specific gravity of 2.65 g cm^3 and sampling volume corresponding to the auger (15 cm depths and 4 cm diameter). Concentrations of extractable N (soil amino acids and inorganic N) from the buried bag incubations and total N were converted to mass estimates for the soil profile (0-30 cm) using the bulk density values derived from organic matter content and the average coarse fragment content determined from soil chemistry sampling.

Increment cores of three co-dominant Douglas-fir were taken in February of 2010. Samples of wood from 3-year increments were separated with a chisel, going from 2009 back to 1900 (36 samples per core), and bulked together by sample period among the three sample trees. In October of 2010, the current year wood increment was sampled with an increment corer from nine codominant trees and bulked into three samples. All of wood samples were oven-dried at 60°C for 24 hours, ground to 2 mm and sent to the University of California for $\delta^{15}N$ isotope analysis.

Results:

The average concentrations of amino acids, ammonia and nitrate after the eight week incubation demonstrated strong patterns across the productivity gradient (as defined by Douglas-fir site index) (Figure 1). Amino acids comprised the highest proportion of extractable N on the low productivity sites, followed by ammonia on the medium productivity sites and nitrate on the most productive sites. When converted to mass, the total extractable N was positively correlated to Douglas-fir site index (Figure 2), comparable to the total N content of the bulk soils (Figure 3.). The quality of the soil organic matter, as defined by the C:N ratio, demonstrated a negative curvilinear correlation with site productivity (Figure 4).

Discussion:

The prevailing model of N form distribution (Schimel and Bennett 2004) was fairly well matched by the distribution of amino acids (highest concentrations on poor sites), ammonia (peaking on medium sites) and nitrate (dominating the richest sites) along the productivity gradient, although some 'hotspots' of inorganic N were unexpectedly found on two of the six poorer plots. This was matched to some degree by a curvilinear correlation in soil C:N ratio, which influences mineralization rates, so it is possible some of these poorer microsites are relatively dry but still producing ecologically significant amounts of inorganic N. These results are in contrast to a similar study in the boreal forest, where virtually zero mineralization rates and high C:N ratios were consistent among very poor forest ecosystems (Kranabetter *et al*. 2007). The correlation between extractable N (inorganic and organic combined) or total N content with site index were significant but quite variable (r^2 of approx. 0.5), suggesting either some difficulties in accurately measuring N status of these ecosystems, or a secondary growth limiting factor, such as soil moisture, also affecting tree productivity. It will be interesting to examine the patterns in wood $\delta^{15}N$ (analysis ongoing) with these indices as an alternative determination of how N-limited these ecosystems are (Kranabetter and MacKenzie 2010), and whether the current alignment of the edatopic grid (from dry, poor to moist, rich) is conceptually consistent with the patterns in ecosystem N described here.

Conclusions:

A manuscript summarizing the N status of the CDF ecosystems and the utility of the wood $\delta^{15}N$ isotope signature will be forthcoming in 2011 after all laboratory analysis is complete. In the secondary objective, the wood $\delta^{15}N$ isotope signature from the present day to 1900 will be compared to the instrument record of Victoria climate (mean annual temperature, mean annual precipitation

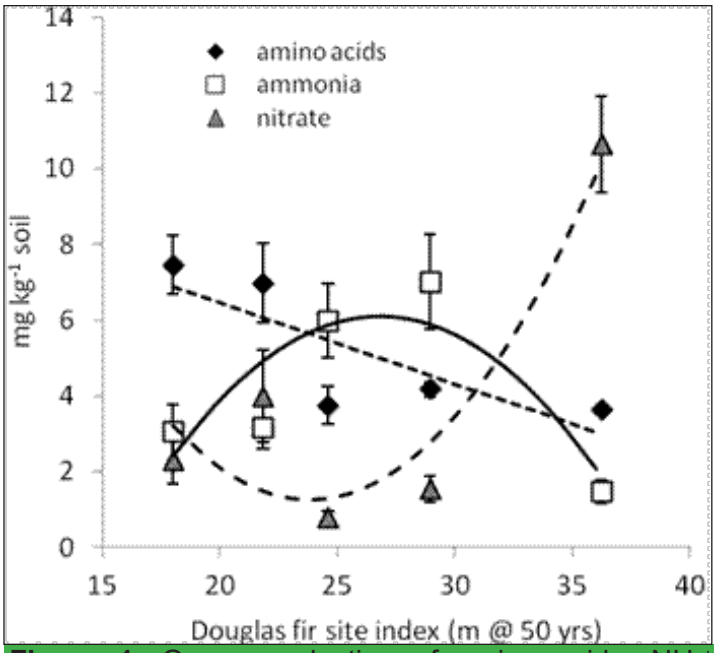

Figure 1. Gross production of amino acids, NH_4^+ and NO_3^- after an 8 week in situ incubation across a gradient of site index for Douglas-fir. Each data point is an average of 3 replicates (± SE) corresponding to (from left to right) the very poor, poor, medium, rich and very rich forest ecosystems.

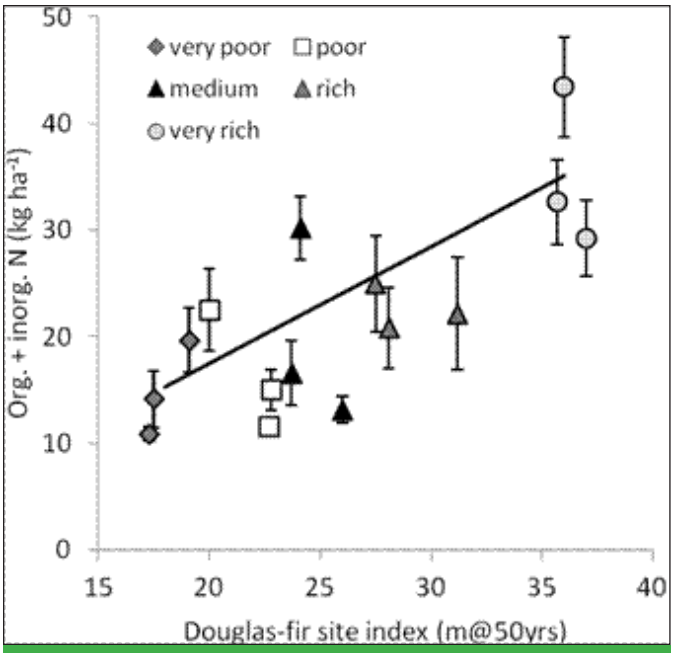

Figure 2. Linear correlation between extractable N (amino acid + inorganic N) content (kg ha^{-1}) of the soil profile (0-30 cm) (± SE) and Douglas-fir site index. (Extractable N = -5.0 + 1.03[SI]; p = 0.001, r^2 = 0.56).

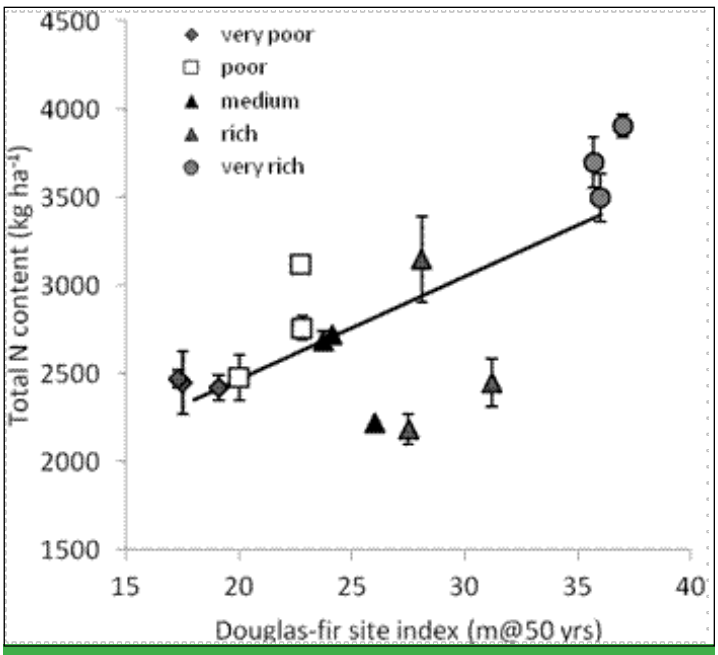

Figure 3. Linear correlation between total N content (kg ha^{-1}) of the soil profile (0-30 cm) (± SE) and Douglas-fir site index (Total N = 1297 + 58.5[SI]; p = 0.003, r^2 = 0.51).

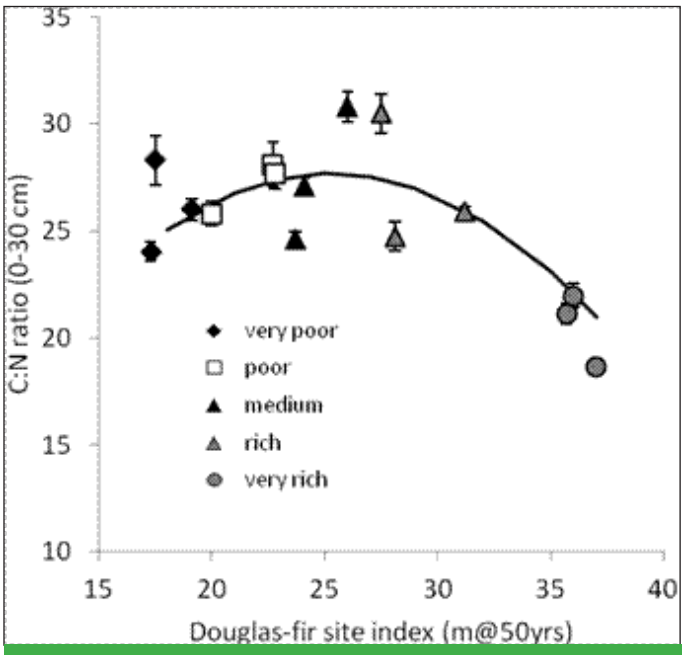

Figure 4. Curvilinear correlation between soil C:N ratio (0-30 cm) (± SE) and Douglas-fir site index (C:N = -3.4+ 2.55[SI] – 0.05$[SI]^2$; p = 0.001, r^2 = 0.68).

and summer moisture deficit) to determine if any deviation in wood $\delta^{15}N$ would be significant enough to indicate a change in the ecosystem N status associated with the site index and plant communities of each site type.

In a related study, the relationships among climate, microclimate, soil nutrient availability, and vegetation of the CDF moist maritime subzone (CDFmm) and the Coastal Western Hemlock very dry maritime subzone (CWHxm) are being studied to identify the potential impacts of climate change across the transition of these neighboring dry ecosystems. Decreased summer moisture availability and lengthening of the summer drought will alter growing conditions, and we hypothesize these changes, and their relationships to regional climate, may differ across the current nutrient-moisture gradient. Preliminary field measures of soil microclimate and correlations of soil moisture to site features reflect current, quantified differences in vegetation communities and prominence values of indicator species. However, site-microclimate correlations appear to differ across the latitudinal range of these forests, influencing expectations regarding the nature of landscape-level change with climate shifts. Field data are being used to validate model projections of species presence-absence under various climate change scenarios and to design experimental studies for further evaluation of resilience and productivity of these forest ecosystems.

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P134-10 Sampling soil from the forest floor.

Contaminant Exposure in River Otters (*Lontra canadensis*): An Assessment of Spatial and Geographic Trends in Home Range

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PERMIT #: P137-10
LOCATION(S): ROYAL ROADS, ALBERT HEAD
START DATE: 5 OCTOBER 2009
COMPLETION DATE: 31 DECEMBER 2010
PROJECT STATUS: 2009 – ONGOING

Introduction:
As part of an ongoing initiative by Environment Canada to investigate the impacts of persistent organic pollutants (POPs) on wildlife, a River Otter (*Lontra canadensis*) population is being studied to investigate the finer scale effects of new and residual toxins in the environment. Victoria and Esquimalt Harbours on southern Vancouver Island, British Columbia (B.C.) are known hot spots for POPs, particularly polychlorinated biphenyls (PCBs) that have accumulated in the marine ecosystem through industrial effluent. The bioaccumulative nature of these toxins has poses a threat to top predator wildlife species inhabiting these ecosystems.

River Otters are well suited for monitoring local sources of contamination as they are exposed to POPs through diet, have relatively small and seasonally constant home ranges and do not hibernate or migrate over long distances. If their home range is positioned close to a source of contamination, exposure could be chronic and body burden would represent accumulated contaminants within the system.

The purpose of this project is to increase the knowledge base of coastal River Otter ecology and ecosystem health on southern Vancouver Island. This study will contribute to effective management and conservation through the following objectives:
(1) to define habitat use by investigating home range and movement patterns;
(2) to relate individual trends to contaminant exposure and stress; and
(3) to evaluate the effectiveness of non-invasive sampling techniques in River Otters.

This research combines spatial, genetic, toxicological and physiological analyses. As there have been few multi-disciplinary studies of this kind within BC, this project will facilitate a unique and collaborative approach to management and conservation efforts. The information gathered will inform the public, stakeholders and management agencies of the current environmental issues and implications to wildlife and their habitats.

Research has demonstrated that otters are being exposed to high levels of toxins on southern Vancouver Island. Basic movement data derived from fecal sampling revealed that habitat use could play an important role contaminant exposure and population structuring. There is limited knowledge of the movement patterns of marine foraging River Otters in this region; therefore, defining individual home range and spatial relationships will be important in evaluating the geographical extent of the environmental contamination. This study will build on previous investigations of habitat use by supplementing a fecal survey with a radio-

telemetry component to evaluate the non-invasive methodology.

Study Area and Methods:

Study area

The study area is located on the coast of southern Vancouver Island, B.C., Canada. Contaminated sites within the urban/industrial areas of Victoria and Esquimalt Harbors will be the focus of the study. These harbors have a long history of industrial activities including forestry, ship building and metal processing. The study area will include approximately 40 km of heterogeneous coastline both east and west of the centrally located harbors.

Methods

The coastline within the study area was surveyed to establish active latrine sites, characterized by fresh (< 24hrs) scat deposits. Active sites were identified at Esquimalt Lagoon and Albert Head, and mapped using a hand held GPS unit to record UTM coordinates. Access was by boat, car or foot. Following the initial latrine survey, sites were visited during designated sampling periods to collect fecal samples. Using non-invasive techniques, scat deposits (specifically anal jellies) were collected, divided and processed for genetic, toxicological and hormone analysis.

Approximately 900 scat samples were collected from the greater study area. These samples are currently being analyzed at the UBC Genetic Data Centre to assign individual genotypes and investigate parameters of population genetics.

Using approved animal care methods, 12 River Otters were live captured from the broader study area, including sites at Albert Head. Trapping methods were coordinated in collaboration with a professional government licensed trapper. Upon capture, the animals were transported to the Ministry of Environment lab. Chemical immobilization and surgical procedures were approved and led by the Provincial Wildlife Health Veterinarian, Dr. Helen Schwantje. Animals were anesthetized and surgically implanted with VHF radio transmitters and biological samples (blood, hair, feces and fat) were collected and processed according to desired analysis.

Using radio telemetry techniques, tagged animals are being tracked to investigate home range, habitat use and foraging behavior relative to the contaminated sites. At present, all 12 otters are being tracked.

Results:

No results to report at this time.

Discussion:

Toxicological and hormone analysis of scat samples will be done during the spring/summer 2011. Data derived from these and the genetic scat analyses will be validated with supplementary data obtained through radio-tracking and animal sampling.

Conclusions:

Research findings will be formally submitted as a Master's thesis and manuscripts in December 2011.

Acknowledgements:

I would like to acknowledge Environment Canada, the BC Ministry of Environment and the UBC Genetic Data Centre for field and lab support. I would like to thank the ESAC and DND properties for permitted our research on DND land. Finally, I would like to sincerely thank Dr. Helen Schwantje, Caeley Thacker, Dan Guertin, Carol Ritland and my supervisors Dr. Kim Cheng and Dr. John Elliott for their support, expertise and guidance.

OUTLOOK FOR 2011 AND BEYOND

After 17 successful years, ESAC will come to a close. With the expiration of the Letter of Understanding on 31 March 2011, the CFB Esquimalt Environmental Science Advisory Committee was dissolved.

The ESAC process and the information that has been collected, has changed the way that the MARPAC views their properties, and has increased the understanding of these areas. The Formation Environment office at CFB Esquimalt has expanded in capacity and personnel over the years that ESAC has operated. As well, since the implementation of Federal Species at Risk (SARA) legislation a number of multi-agency species and ecosystem recovery teams formed and have provided additional sources of knowledge and expertise for Formation Environment staff. The knowledge from experts and internal staff capacity will allow CFB Esquimalt environment staff to confidently manage the natural resources on the properties under their jurisdiction.

Spatial data derived from past ESAC projects are incorporated in the DND Natural Resources Geographic Information System (GIS) which will continued to be maintained, used for management of the properties, and added to as additional information becomes available.

The valuable information gathered and published in past reports resulting from ESAC activities over the last 17 years will continue to be archived and made available online at the ESAC archives website: http://cfs.nrcan.gc.ca/projects/99.

Environmental research on CFB Esquimalt properties will continue to be permitted. A new system for granting of access permits for scientific research projects has been implemented by the Formation Environment Office at CFB Esquimalt. Individuals interested in the new permitting process can obtain more information by contacting the Formation Environment Office at: ESQFSEFormationEnvir@forces.gc.ca

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- All of the individuals who presented at and/or attended the ESAC annual workshop in February 2011. Your attendance and participation are valued.

Maritime Forces Pacific, CFB Esquimalt would like to thank:

- All of the member agencies of ESAC, and their staff who have devoted countless hours to the Committee. During the 17 years of operation the Committee has reviewed over 300 research proposals, attended countless meetings and hosted the annual workshop.
- All of the researchers who have conducted ESAC projects over the years. Your studies have greatly contributed to the sustainable environmental management of the CFB Esquimalt properties.

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For more information on MARPAC/CFB Esquimalt's environmental programs and initiatives, please visit our website at: http://www.navy.forces.gc.ca/marpac or contact:

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