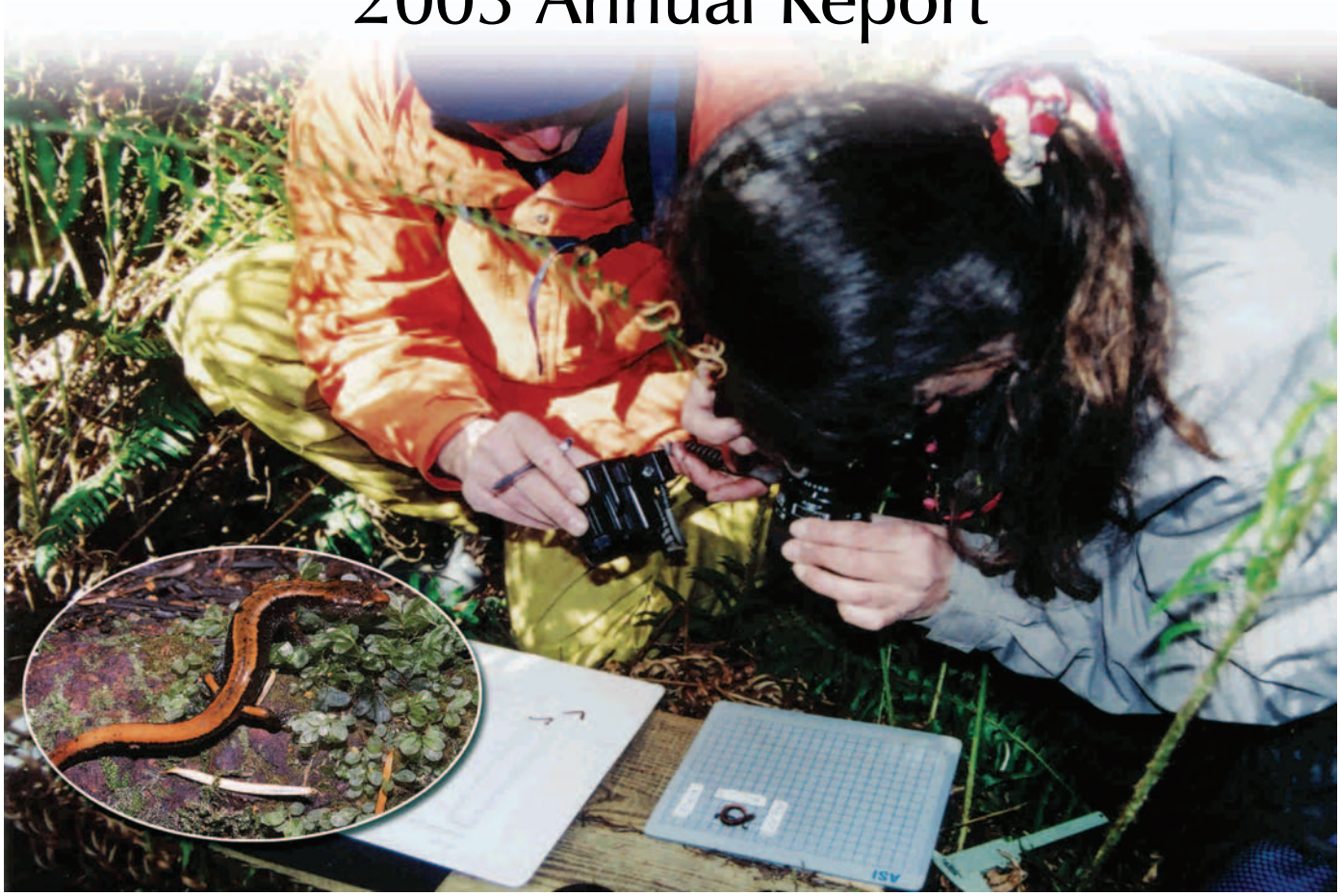
DEPARTMENT OF NATIONAL DEFENCE

ESAC

ENVIRONMENTAL SCIENCE ADVISORY COMMITTEE

CANADIAN FORCES BASE ESQUIMALT

2003 Annual Report



National Defence / Défense nationale

Canada

March 2004

Prepared on behalf of the Committee by:

Stephanie Blouin
Department of National Defence
MARPAC, CFB Esquimalt
Formation Risk Management Branch
Bldg 199 Dockyard
P.O. Box 17000 Station Forces
Victoria, BC V9A 7N2

Nicole Ayotte
Natural Resources Canada
Canadian Forest Service
Pacific Forestry Centre
506 West Burnside Road
Victoria, BC V8Z 1M5

Arthur Robinson
Natural Resources Canada
Canadian Forest Service
Pacific Forestry Centre
506 West Burnside Road
Victoria, BC V8Z 1M5

Dr. J.A (Tony) Trofymow
Natural Resources Canada
Canadian Forest Service
Pacific Forestry Centre
506 West Burnside Road
Victoria, BC V8Z 1M5

Cover Photo Credits:

Top Left:
N. Ayotte - Garry oak (*Quercus garryana*) acorn

Top Right:
G. Searing - Osprey (*Pandion haliaetus*) at Rocky Point

Bottom:
N. Ayotte - Salamander survey at Rocky Point

Inset:
K. Ovaska - Western Red-backed Salamander (*Plethodon vehiculum*)

Printed on recycled paper in Canada

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 proposals and issues permits that enable environmental studies on CFB Esquimalt properties. Each year, ESAC collects, reports, and archives the findings of the research activities in a printed and web-based annual report. ESAC also acts as an advisory body to CFB Esquimalt on various environmental issues occurring on CFB Esquimalt properties, and serves as a gateway to a network of scientists accessible to MARPAC staff.

In 2003, the Committee reviewed 26 proposals to conduct research and collection activities on CFB Esquimalt properties including the following studies:

- Bald Eagle nest tree inventory
- Bird migration monitoring
- Garry oak acorn survey
- Pilot monitoring program for terrestrial salamanders
- Fire history and ecology of Garry oak ecosystems
- Sharp-tailed Snake habitat assessment
- Microclimate station upgrading and monitoring at the Rocky Point Forest Canopy Research Station

Each proposal was reviewed by ESAC for scientific content, then forwarded to Base Operations (Range Control) personnel to ensure that the proposed research did not interfere with military operations and activities. Lastly, each proposal was sent to the Base Commander at CFB Esquimalt for final approval. The Base Commander issued 24 ESAC research and collection permits to individuals and organizations to conduct environmental studies on CFB Esquimalt lands. This annual report is a compilation of the scientific reports obtained from each of these projects in addition to a summary of the Committee's activities conducted throughout the year.

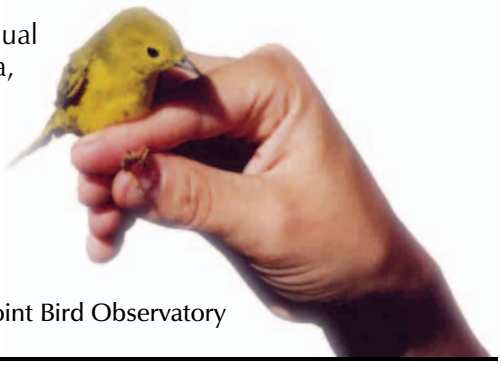
The Rocky Point Forest Canopy Research Station Operating Committee facilitated a safety inspection of the canopy trees, which recommended that the canopy platforms and access system undergo a major structural enhancement. In addition to the safety inspection, and as part of the canopy and microclimate upgrading at Rocky Point, a solar panel supported by a 60 ft. tower was installed on a rocky knoll adjacent to the microclimate monitoring station. In 2003, the Committee reviewed the management options in a study of a Double-crested Cormorant winter roost site along the Pedder Bay shoreline at Rocky Point and forwarded its recommendations to CFB Esquimalt and Lester B. Pearson College for further action. Follow-up is scheduled for 2004.

As part of a broader communication plan, a bilingual information brochure on ESAC was prepared and published for distribution to other Canadian Forces Bases, as well as other federal and provincial departments, and academic institutions.

Research findings obtained from all permitted environmental studies in 2003 were integrated into CFB Esquimalt's Natural Resources Geographic Information System (GIS) database. The GIS is used to produce practical maps annotating significant natural resources information which is readily available to Maritime Forces Pacific (MARPAC) personnel.

To facilitate the sharing of this information, the Committee hosted its annual ESAC workshop, January 28th, 2004 at the Pacific Forestry Centre, Victoria, B.C. The workshop was considered a success with approximately 55 individuals in attendance, representing a wide variety of agencies. Nine presentations were given and the workshop was covered in a local newspaper.

www.pfc.cfs.nrcan.gc.ca/programs/esac



Yellow Warbler (*Dendroica petechia*) Rocky Point Bird Observatory

TABLE OF CONTENTS

INTRODUCTION

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

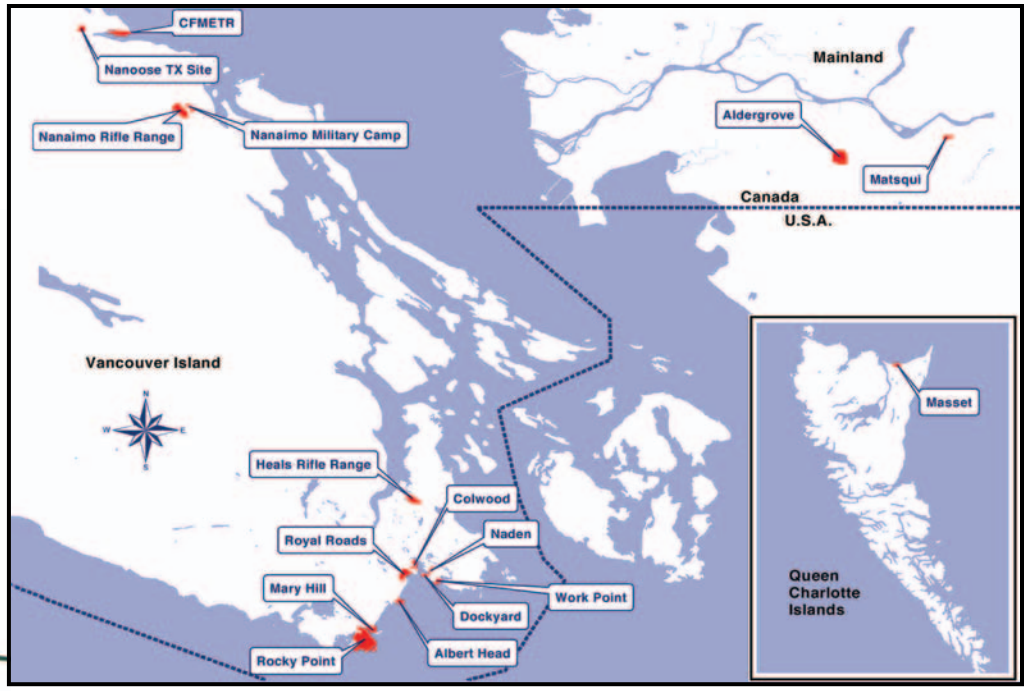
MARPAC is one of the largest government organizations in the Pacific Region, with 4,000 regular and reserve Canadian Forces members and 2,800 civilian employees. With approximately 4,200 hectares of land within 14 different municipalities and regional districts (Table 1), MARPAC has long acknowledged 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 remarkable natural areas and unique features located on CFB Esquimalt properties.

Over 3,200 hectares of MARPAC lands are forested. As human disturbance is minimal within these areas, they have become a refuge for many wildlife species. A number of CFB Esquimalt properties support remnants of sensitive ecosystems, such as Coastal Douglas-fir forests and Garry oak meadows, as well as a variety of rare plants and animals, providing unique opportunities to conduct various environmental studies.

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

Albert Head	92.7
Aldergrove	514.0
Colwood	90.0
CFMETR / Nanoose Bay	288.4
Dockyard / Signal Hill / Yarrows	62.7
Heals Rifle Range	212.4
Mary Hill	178.1
Masset (Queen Charlotte Islands)	824.0
Matsqui	95.1
Naden	45.4
Nanaimo Rifle Range	351.0
Nanoose TX Site	105.0
Rocky Point	1078.0
Royal Roads	229.0
Work Point	66.0
TOTAL AREA	**4,232.8**

CFB ESQUIMALT PROPERTIES



Fairyslipper *(Calypso bulbosa)*

BACKGROUND

Prior to 1994, various individuals and organizations carried out research on CFB Esquimalt properties. Research was *ad hoc* and the findings were not readily available to DND for use in sound environmental management and decision-making. The recognized need for a process to track the research activities and associated findings resulted in the creation of the Environmental Science Advisory Committee (ESAC), in 1994. Since then, ESAC has facilitated and coordinated environmental studies on CFB Esquimalt properties in conjunction with other environmental projects directly funded by DND.

The ESAC provides advice within the context of MARPAC's overall Natural Resources Program. This program encompasses the management of natural resources on CFB Esquimalt properties while ensuring enhanced and sustainable military training and operations. The program includes the management of: rare and endangered species; sensitive ecosystems and habitats; forests; wildlife and their habitat; wetlands and riparian zones; and archaeological features.

MEMBERS

ESAC is a multi-agency committee composed of two representatives from CFB Esquimalt (Formation Risk Management Branch and Base Construction Engineering Office) and one representative from each of the member agencies:

Canadian Forest Service
Canadian Wildlife Service
B.C. Ministry of Forests
University of Victoria
Royal Roads University

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

Photo: J.Hellmann

Photo: J.Hellmann

Top Photo: A cage for *Erynnis propertius* females
Bottom Photo: Larval enclosure at CFMETR
Permit P090-03: Abundance and adaptation of butterflies in Garry oak meadows

Photo: J.Hellmann

Erynnis propertius on oak leaves.

ROLES AND RESPONSIBILITIES

Proposal Review and Tracking

The Committee's primary functions are to review, evaluate, and provide scientific expertise and advice to CFB Esquimalt on proposals received to conduct biological and environmental studies on its properties. The Committee maintains a formal permitting system to facilitate the tracking of proposals and permits to conduct research on CFB Esquimalt properties. Research activities requiring a permit include, but may not be limited to the following: observations; photography; surveys and inventories; tagging and banding; collection of wildlife specimens; and installation of scientific monitoring structures. Individuals interested in conducting environmental studies on CFB Esquimalt properties can obtain more information by contacting ESAC.

Each proposal is sent to and reviewed by ESAC. Subsequently, proposals are sent to the Formation Environment Office who forward the application to Base Operations (Range Control) personnel to ensure that the proposed activity does not interfere with military operations and activities. Lastly, each permit is sent to the Base Commander for final review, approval, and permit issue.

Reporting of Activities

As part of the reporting process, permit holders are required to submit a report describing their research findings obtained throughout the year. ESAC compiles and archives these scientific reports, making them available to member agencies and other interested organizations, through the production of an annual report.

To facilitate the sharing of information and research conducted on CFB Esquimalt properties to other researchers and agencies, the Committee hosts an annual workshop. Further information on ESAC, the workshop, and an archive of past annual reports are available on the ESAC website. The website is updated annually following release of the annual report.
www.pfc.cfs.nrcan.gc.ca/programs/esac

Other Committee Activities

ESAC acts as an advisory body to MARPAC, CFB Esquimalt by providing direction and insight into various environmental issues occurring on CFB Esquimalt properties. ESAC members also provide MARPAC staff with the ability to connect with the broader scientific community for various environmental issues. In addition, the Committee oversees the activities of the Operating Committee for the Forest Canopy Research Station at Rocky Point.

Photo: K. Ovaska

Yellow-bordered Taildropper *(Prophysaon foliolatum)* feeding on a mushroom
Permit P096-03: Surveys for terrestrial gastropods (slugs and snails) on CFB Esquimalt properties

Photo: C. Engelstoft

A juvenile Sharp-tailed Snake *(Contia tenuis)*.
Permit P100-03: Sharp-tailed Snake habitat assessment on CFB Esquimalt, Coast Guard and Parks Canada Lands

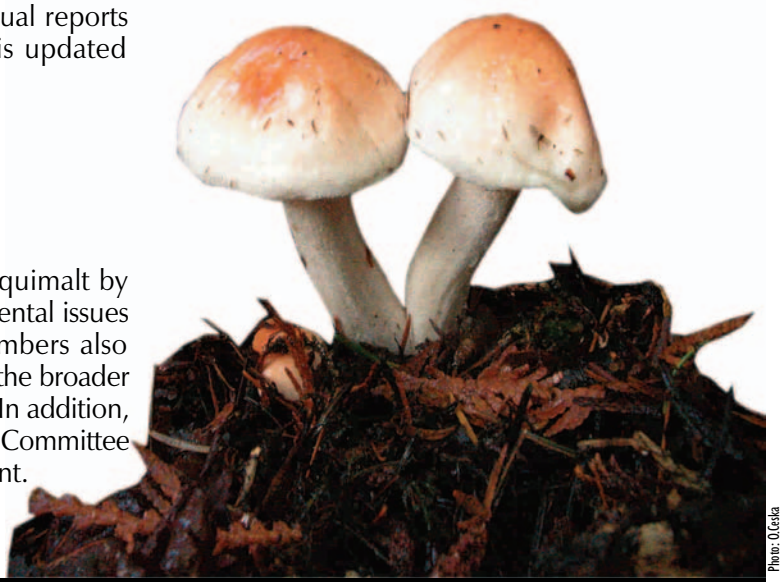


Photo: O. Ceska

Hygrophorus pudorinus observed at Heals Rifle Range

ESAC ACTIVITIES IN 2003

ADVISORY AND REPORTING ACTIVITIES

This year was the ninth full year of activity for ESAC. The Committee met three times during 2003 to review project proposals and status, plan reporting activities and advise CFB Esquimalt on other environmental issues. In 2003, an email-based review process was fully implemented to expedite the review of proposals. Dr. Richard Ring and Mr. Andy MacKinnon retired from the Committee in 2003 and were replaced by Dr. Don Eastman and Mr. John Parminter, respectively.

The 2002 Annual Report was prepared and approximately 400 copies of the report were distributed in 2003. A bilingual information brochure on ESAC was prepared and published for distribution to other Canadian Forces Bases, provincial agencies, other federal departments and academic institutions.

During the 2003 annual ESAC workshop, held January 28th, 2004 at the Pacific Forestry Centre, nine presentations were given and more than 50 individuals attended. Participation was from a wide variety of agencies including the Department of National Defence, the Canadian Wildlife Service, the B.C. Ministry of Water, Land and Air Protection, Royal Roads University, the Canadian Forest Service, the University of British Columbia, the City of Colwood, the Victoria Natural History Society (VNHS), the Rocky Point Bird Observatory and the Sierra Club of Canada.

In 2003, the Committee reviewed the management options from a study of a Double-crested Cormorant winter roost site along the Pedder Bay shoreline at Rocky Point and forwarded its recommendations to CFB Esquimalt and Lester B. Pearson College for further action. As a result, MARPAC's Formation Risk Management Branch prepared and distributed an information sheet to all Married Quarters at Rocky Point describing the presence and significance of the roost site.

Photo: N. Ayotte

Garry oak *(Quercus garryana)* meadow - Rocky Point

RESEARCH AND COLLECTION ACTIVITIES

A total of 26 proposals were received and reviewed by ESAC. Of the 26 proposals received, 24 permits were issued (11 were renewals of previous years). Table 2 shows the number of proposals received and permits issued since 1995. Table 3 lists all research and collection activities conducted in 2003 under an ESAC permit.

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

Year	# of proposals	# of permits
2003	26	24
2002	21	20
2001	14	14
2000	19	16
1999	25	25
1998	26	26
1997	24	24
1996	25	24
1995	22	20

Photo: P. Levesque

Nocturnal Owl Monitoring Project - Rocky Point Bird Observatory
Permit P003-03: Bird migration monitoring

The wide variety of projects conducted in 2003 greatly enhanced the knowledge and understanding of the species and ecosystems found on CFB Esquimalt properties, and contributed to sound decision-making and environmental management by CFB Esquimalt personnel and Canadian Forces members. The knowledge gained could also be applied, in varying degrees, to neighbouring and similar ecosystems under different jurisdictions, thus adding to the value of the research carried out on CFB Esquimalt properties.

Table 3: Summary of ESAC permits issued in 2003

ESAC Permit Title	Project Leader	Permit #	Prop.#	Property
Bald Eagle Nest Tree Monitoring at CFMETR	Gray	P089-03	03-01	CFMETR
Wildlife Tree Stewardship Initiative: Monitoring Bald Eagle Nests at Rocky Point and Albert Head	Greenwood	P074-03*	03-02	RP
Abundance and Adaptation of Butterflies in Garry Oak Meadows	Hellmann	P090-03	03-03	RP, CFMETR
Monitoring of Winter Moth and the Parasites Introduced for its Control at Colville Officer's Mess on Hotham St.	Otvos	P031-03*	03-04	NA (Hotham St.)
Canopy and Microclimate Station Upgrading at Rocky Point - Royal Roads University	Dushenko	P087-03*	03-05	RP
Introduction to Bird Banding	Levesque	P092-03	03-07	RR
Bird Migration Monitoring	Allinson	P003-03*	03-08	RP
Restoration at Esquimalt Lagoon - ER 390 Project RNS Program	Carnahan	P093-03	03-09	RR
Purple Martin Origins and Relationships	Finlay	P044-03*	03-10	CO
Environmental Technology Program Field Trip to Rocky Point	Humphrey	P075-03*	03-11	RP(FCRS)
Inventory of Rare Garry Oak Butterflies and Rare Forest Gastropods at Aldergrove, Matsqui and Colwood	Heron	P094-03	03-12	AL, MT, CO
Thermal Characteristics of Townsend's Big-eared Bat Roosts	Craig	P086-03*	03-13	MH
Oregon White Oak Acorn Production Study	Courtin	P079-03*	03-14	CFMETR, MH, NT, RP
Victoria and Sooke Christmas Bird Counts	Allinson	P095-03	03-15	AH, HR, MH, RP
A Pilot Monitoring Program for Plethodontid Salamanders on Vancouver Island, B.C.	Paige	P088-03*	03-16	RR, RP
Surveys for Terrestrial Gastropods (slugs and and snails) on CFB Esquimalt Properties	Biolinx	P096-03	03-17	AH, AL, CO, HR, MH, MS, MT, RP, RR, WP
Characterization of the Late Summer Flying and Ground Beetle Communities in a Garry Oak Ecosystem	McLean	P097-03	03-18	MH, RP
Monitoring of Rare Vascular Plants at Selected CFB Esquimalt Properties	Ceska, A.	P050-03*	03-19	AH, CFMETR, CO, RR, DY/NA, MH, RP, WP
Monitoring of Macrofungi at Selected CFB Esquimalt Properties	Ceska, O.	P098-03	03-20	MH, RP, RR
Fire History and Ecology of Garry Oak Ecosystem	Pellatt	P099-03	03-22	CFMETR, MH, RP
Sharp-tailed Snake Habitat Assessment on CFB Esquimalt, Coast Guard and Parks Canada Lands	Engelstoft	P100-03	03-22	AH, CO, DY/NA, HR, MH, RP, RR, WP
Phenology of Wildflowers on Nanoose Hill, CFMETR, Compared with Other Locations on Central Vancouver Island	Thirkill	P101-03	03-23	CFMETR
Advanced Field Methods of Restoration Course at Royal Roads	Hebda	P102-03*	03-25	RR
Victoria Area Overwintering Mosquitoes	McCann	P103-03	03-26	MH, RP

Properties: AH: Albert Head; **AL:** Aldergrove; **CFMETR:** Canadian Forces Maritime Experimental and Test Ranges; **CO:** Colwood; **DY:** Dockyard; **HR:** Heals Rifle Range; **MH:** Mary Hill; **MS:** Masset; **MT:** Matsqui; **NA:** Naden; **NT:** Nanoose TX Site; **RP:** Rocky Point (**FCRS** – Forest Canopy Research Station); **RR:** Royal Roads; **WP:** Work Point.

* Renewed from previous years.

Photo: N. Ayotte

Forest Canopy Research Station - Rocky Point

ROCKY POINT FOREST CANOPY RESEARCH STATION

The Forest Canopy Research Station at Rocky Point was constructed in 1994 and consists of five old-growth trees fitted with platforms in the canopy along with ladders leading to higher levels. An Operating Committee is responsible for the station's maintenance, use and oversees its operations.

In 2002, ownership and responsibility for the Rocky Point Forest Canopy Station was transferred from the University of Victoria to Royal Roads University, as part of Royal Roads University's efforts to monitor climate change and atmospheric transport of contaminants. As of the end of 2002, all sensors associated with the microclimate station were removed, tested and recalibrated, and a new environmental sensing strategy for the site was developed. An aerial ladder was installed between two trees to support temperature/relative humidity profiling within the canopy.

In 2003, a solar panel supported by a 60 ft. tower was installed on a rocky knoll adjacent to the microclimate station. The solar panel will provide a more permanent power supply to the data logger and sensors. A small utility shed was also set up to house the data logger and associated supplies.

A safety inspection of the canopy trees was completed in 2003, which recommended that a major upgrade and structural enhancement of the canopy platforms and access system was required. The Operating Committee began looking at costs and funding to complete this work.

Photo: N. Ayotte

A solar panel supported by a 60 ft. tower located on the rocky knoll adjacent to the microclimate station at Rocky Point.

GEOGRAPHIC INFORMATION SYSTEM

The research findings obtained from all ESAC research projects are incorporated into CFB Esquimalt's Natural Resources Geographic Information System (GIS) database in an effort to produce practical natural resource maps accessible to CFB Esquimalt personnel. The maps depict all significant natural resources information located on each CFB Esquimalt property. Information available on the maps includes the location of rare species, sensitive ecosystems, wetlands and riparian zones, significant and heritage trees, as well as additional basemap layers updated on a semi-annual schedule (Table 4).

The use of these maps has proven to be a powerful tool for CFB Esquimalt personnel in performing a wide variety of activities including preparation of environmental assessments; environmental awareness and training; planning and design of construction engineering projects; and conducting military exercises. Selected GIS layers for specific properties are also made available to member agencies.

Photo: N. Ayotte

Douglas-fir forest with veteran *Arbutus menziesii* trees

Table 4: Status of CFB Esquimalt Natural Resources Program GIS Database

		Location (CFB Esquimalt)															
		AH	AL	CFMETR	CO	DK	HR	MH	MS	MT	NA	NM	NR	NT	RP	RR	WP
File Type	DXF Files										1993		1993				
	ArcView Shapefiles	1998	1998	1998	1998	1998	1998	1998	1998	1998	1998		1998		1998	1998	1998
GIS Layers - Date of Last Update	Contours	1993	1993	1993	1993	1998	1993	1993	1993	1993	1998	1993	1993	1993	1993	1993	1998
	Roads	2003	2000	2000	2003	1999	2000	2000	2003	1993	1999	1993	2000	1993	2003	2003	1999
	Water	2003	2000	2000	2003	1999	2000	2000	1993	2001	1999	1993	2000	1993	2003	2003	1999
	Man-made Structures	2003	2001	2000	2003	1999	2000	2000	2003	2001	1999	1993	2000	1993	2003	1998	1999
	Forest Cover	2003	2001	2001	2003	2001	2001	2001	2001	2001	1993	1993	2000	2001	2003	2001	
	Cons.Mgmt Zones	1998		1998		n/a	2003	1998			n/a				1998	1998	n/a
	Rare Species	2003	2003	2001	2003	1999	2003	2003	2002	2003			1998		2003	1998	2003
	Birds (nest)	1998		2003	2003		1998	1998					1998		2003	1998	
	Archaeological Sites	2002		2001	2001	1998	2001	2001	2001	2001	1998		2001		2003	2003	1998
	Research Plots			1999				2003							2003		
	Contaminated Sites	1999		1999		1999					1999		1999		1999		
	TEM	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002		2002		2002		2002
	Ecosystems							2001								2002	
	Positive and Negative Features							2001								2002	
	Significant & Heritage Trees							2001								2002	

Properties: AH: Albert Head; **AL:** Aldergrove; **CFMETR:** Canadian Forces Maritime Experimental and Test Ranges; **CO:** Colwood; **DK:** Dockyard; **HR:** Heals Rifle Range; **MH:** Mary Hill; **MS:** Masset; **MT:** Matsqui; **NA:** Naden; **NM:** Nanaimo Military Camp; **NR:** Nanaimo Rifle Range; **NT:** Nanoose TX Site; **RP:** Rocky Point; **RR:** Royal Roads; **WP:** Work Point.

DEPARTMENT OF NATIONAL DEFENCE

ESAC

ENVIRONMENTAL SCIENCE ADVISORY COMMITTEE

CANADIAN FORCES BASE ESQUIMALT

SCIENTIFIC REPORTS

Research and Collection Activities Conducted in 2003

Bald Eagle Nest Tree Monitoring at CFMETR

Sandra Gray

WiTS Coordinator for Arrowsmith Naturalists, P.O. Box 285, Errington, BC V0R 1V0
Tel: (250) 248-5565 • Email: saninerr@shaw.ca

Permit #: *P089-03* ***Start Date:*** *January 2003*
Location: *CFMETR* ***Completion Date:*** *On-going*

Overview

As part of a larger project on the East Coast of Vancouver Island, the Wildlife Tree Stewardship Initiative (WiTS) naturalist groups have been searching out, identifying, and monitoring Bald Eagle (BAEA) nest sites. Our group, based out of the Parksville/Qualicum Beach area, are volunteers from the Arrowsmith Naturalists. Some have been monitoring BAEA nest sites since 1996. This past 2003 season, our 25 volunteers monitored over 60 BAEA nest territories between Nanoose Bay and Deep Bay. The WiTS initiative aims to document wildlife usage and location of wildlife trees as well as conserve wildlife trees within the remnant habitats of Vancouver Island. Currently, the two active BAEA territories we have identified within CFMETR are sites which we were previously unsure of and had very few details on.

Objectives

1. To access and monitor BAEA territories;
2. To locate BAEA nest trees;
3. To assess tree conditions and health; and
4. To report on productivity and to document findings.

Methodology

- Monthly visits to observe BAEA activity on their territory.
- Visit the base of all nest trees.
- Determine the location of perch trees and possible alternate nest trees.
- Observe other bird species and wildlife in the area.

Results to Date

In the past, we used binoculars and spotting scopes from positions off CFMETR to watch the movement of the BAEAs. We observed existing active territories however details were lacking. After the 2003 season of observations, we located two confirmed active BAEA nest trees along with numerous perch sites.

Our first site visit to CFMETR was on January 10, 2003. We drove the main roads searching for veteran trees, scoped high points as well as any perching and/or flying BAEAs. The following 'E numbers' refer to known past and present Bald Eagle nest trees and frequent perch sites on file at the B.C. Ministry of Water, Land and Air Protection.

E105-125 Wallis Pt. – A nest tree prior to 1994 and still used as a perch site. The nest tree is a Class 2-3 Douglas-fir with few live branches remaining, and marked with a Wildlife Tree Sign. Close by, are two veteran Douglas-fir trees that had some branches trimmed by B.C. Hydro contractors in 2001 to make an easier entry and exit for the eagles. These could be future nest trees for BAEAs and are currently used as perches.

E105-092 Wallis Pt. Ridge - No nests found to date. We anticipate future exploration of this area in 2004. Several existing Douglas-fir veteran trees are used as perches by BAEAs and Turkey Vultures. These trees could all be alternate nest or perch sites for E105-125 Wallis Pt., E105-045 Richard Pt., E105-300 Mid Nanoose Harbour (Ranch Pt.) or possibly E105-126 Wallis Pt. (Brickyard Cove pair that lost their tree 1999).

E105-124 Mid Nanoose Harbour (DND Tower E) – Used from 1996 to present as a perch. A nest was not found, however several perch sites exist at suspected locations. This is an old nest site, circa 1993, with nest history dating back

Bald Eagle Nest Tree Monitoring at CFMETR

to at least 1997. We believe a pair moved to E105-300 (Ranch Pt.). Future exploration of the area is planned.

E105-300 Mid Nanoose Harbour (Ranch Pt) – An active nest exists. There were no chicks fledged in 2003. This nest tree is at the edge of a meadow within a stand of veteran Douglas-fir trees situated about halfway between the two wharves on the shoreline side of the road. Deer usage is high and there is very little evidence of human foot traffic. The nest tree is a healthy, Class 1 Douglas-fir.

March 14 – The nest tree was found. A Wildlife Tree Sign was placed and measurements were taken.

April 11 – Incubation. One immature and two adult BAEAs on the territory.

May 9 – A visit with a biologist. Both BAEA adults were at the nest and on nearby perches. No chicks were observed, however, one immature BAEA was observed in the area. The adult BAEAs were nervous at our presence, so we kept our distance.

June 13 - No chicks were observed. The BAEA adults flew off when we approached the area, so we kept our distance.

July 11 - No activity at the nest. Whitewash and numerous prey items were observed at the base of the tree. One immature and one adult BAEA were flying close to the nest tree. Turkey Vultures were also flying overhead. A photo was taken of the remains of a raptor approximately 30 m from the base of the nest tree. The raptor was most likely a BAEA due to length of the wings, the depth of the breast-bone, the feather colour and the overall large size.

November 14 – A BAEA pair perched 25 m from the nest. Prey items observed include: two deer carcasses, gulls, several ducks, several fish species, moonsnails, rabbits, and miscellaneous feathers. Remains of a dead eagle were still present. Whitewash was very heavy at several locations within the meadow.

Recommendation

Maintain minimal human activity at this site during the active season (January to July).

E105-045 Richard Point Nanoose Harbour (DND Camp)- This nest tree has been known to us for several years, however, we were unable to observe it in detail until 2003. The nest tree is a healthy, Class 1 Douglas-fir. The eagle pair is somewhat used to human activities due to the regular presence of campers, although we saw very few during our site visits.

February 14 - Visit to the base of the nest tree. A Wildlife Tree Sign was placed and measurements were taken. One adult BAEA was observed in the area.

March 14 - Adult BAEA in the nest incubating.

April 11 – Incubation. Both adults on the territory. Two immature BAEAs in the area.

May 9 – A visit with a biologist. Both adults were observed at the nest. No chicks were seen but the adults were perching at the edge of the nest. Probable chicks have hatched. One immature BAEA was observed flying in the area.

June 13 - Both adults were at the nest. The nestling was stretching its wings and food was brought to the nest. We walked out to end of Wallis Point and observed one adult BAEA. The pair uses Wallis Point regularly. Two chicks fledged out of the Southey Island BAEA nest tree in 2003.

July 11 – Two adults and one fledged chick were moving around the nest tree and various perches close by. The adults were hunting and food was brought to the nest.

November 14 – A pair of BAEAs were perched on a tree approximately 50 m South of the nest tree. Extensive whitewash was observed at the base of the perch and the nest tree. Fish skeletons, feathers (gull, duck) and owl pellets were also observed at the base of the perch tree. The pair was flying around the territory.

Bald Eagle Nest Tree Monitoring at CFMETR

Recommendation

The Department of National Defence (DND) or the Camping Club should place a barrier at the beach access just off the group site parking area near the base of the nest tree to reduce compaction of soil. Large logs are suggested to prevent cars from driving or parking close to the nest tree base.

Discussion

Few suitable BAEA nest trees exist on CFMETR. Past logging activity has resulted in scattered Douglas-fir veteran trees with mostly second growth conifers and deciduous species that are not usually used by BAEAs. Mature Arbutus, Garry oak, Alder, Willow and Big-leaf maple exist, however, very few might be suitable as a BAEA nest tree. Three areas with stands of veteran old-growth Douglas-fir trees (favoured nest trees) are all that remain. The areas include: the campground; the area between the two wharves on both sides of the road; and the base and lower portions of Notch Hill between the main gate and the Ranch Pt. wharf.

Due to minimal human activity at the nest and perch tree locations on CFMETR, the BAEAs have little tolerance for humans near their nest, especially during incubation and when the chicks are very young (January through to July). In the campground, some cutting of downed wood and clearing of woody debris close to the nest tree was observed. This is understandable and expected in a camping area. A buffer area (35-100 m) should be established with no or minimal cutting and clearing except for safety reasons. Hopefully no new campsites are planned for the immediate area near the nest tree. Placement of a log across the beach access, as described above, would improve the protection of the nest tree base.

Continued monitoring in 2004 is planned with approval from DND. Further exploration of the Wallis Point Ridge area, the Cable TV Tower area, the base and lower portions of Notch Hill and the DND Tower area above the Administration Building is planned to search for new, alternate and old nest sites.

Photo: D.F. Gray

A Bald Eagle sitting at the top of a perch tree.

Wildlife Tree Stewardship Initiative: Monitoring Bald Eagle Nests at Rocky Point and Albert Head

Gwen Greenwood*[1] *(with Kerri-Lynne Wilson and Terri Martin)

[1] *8590 Alec Road, Saanichton, BC V8M 1S4*
Tel: (250) 652-2876 • Email: tggreenwood@shaw.ca

Members of the Federation of BC Naturalists

Permit #: *P074-03*
Location: *Rocky Point and Albert Head*
Start Date: *January 2003*
Completion Date: *December 31, 2003*

Overview

The Bald Eagle Nest Tree (BENT) monitoring program began on Vancouver Island in 2000 to build an inventory of Bald Eagle nest trees and to document eagle productivity and tree condition.

In 2002, the Wildlife Tree Stewardship Initiative (WiTS) was formed with the goal to create, coordinate, and assist a network of community stewards committed to conserving coastal wildlife tree habitats through volunteer monitoring, landowner agreements, and community education along the Strait of Georgia.

Monitoring began at Rocky Point with two Bald Eagle nest trees in 2001 and continued in 2003, as part of WiTS, with a total of six nest trees. The monitoring will be carried out each year to provide a long-term observation of these sites. In 2003, we also monitored Albert Head in search of any raptor nest trees and are following the progress of a pair of nesting Osprey at Rocky Point.

The project is supervised by Kerri-Lynne Wilson (WiTS Stewardship Coordinator), Karen Morrison (MWLAP) and Terri Martin (WiTS Technical Specialist).

Objectives

To monitor Bald Eagle nest trees at Rocky Point and to locate and monitor any other raptor nest sites at Rocky Point and Albert Head.

Methodology

Five visits were made throughout the year to monitor known nest sites and to search with binoculars, a telescope, and sound for any additional raptor activity or nest sites.

Results to Date

Six Bald Eagle nest trees have been located and identified at Rocky Point (Figure 1).

Nest 'A' - Fossil Point, located just off the East Perimeter Road in Polygon 119. This nest tree was uprooted in a storm (December 1999).

Nest 'B' - Fossil Point, just off the East Perimeter Road in Polygon 119. This nest fledged one young in 2001, not active in 2002 or 2003. Douglas-fir, decay class 1.

Nest 'C' - Church Hill, South East in Polygon 6, on West side of Whirl Bay. This nest is of unknown age, apparently active in 2000 as reported by fishing boats, and not active in 2001, 2002, or 2003. Nest deteriorating somewhat. Douglas-fir, decay class 3.

Nest 'D' - Church Hill, North West side in Polygon 4. Nest first discovered in May 2002 and fledged two young that year. No activity seen at this nest in 2003.

Nest 'E' - Whirl Bay, in Polygon 14, approximately 70 metres inside gate #10. Nest discovered from the top of Church Hill in April 2003. One young seen beside the nest on July 19, however the eaglet did not fly during the observation. Douglas-fir, decay class 1.

Wildlife Tree Stewardship Initiative: Monitoring Bald Eagle Nests at Rocky Point and Albert Head

Nest 'F' - Church Hill, North West side in Polygon 4. Nest discovered in May 2003 with one adult sitting on the nest and one in a perch tree. No activity was seen on subsequent visits. The nest is apparently abandoned. The base of the tree was accessed in June by Art Robinson. Douglas-fir, decay class 4.

One osprey nest was monitored at Rocky Point (Figure 1). While the nest was not in a tree, monitoring this nest activity may be of interest for any future mitigation. On September 24th, 2003 an osprey nest built on top of a power pole in the Ammunition Depot, approximately 150 metres in from the main gate was visited due to concern that the nest touching live wires would be a fire hazard. A decision was later made to postpone any interference with the nest until the young had fledged. In October 2003, an alternate pole and platform were erected 30 metres from the nest. The nest was then moved to the new platform and secured. The food remains in the nest were determined to consist mostly of Rainbow Trout from a nearby trout farm. CFB Esquimalt staff had observed that there were three young Osprey. One had died and fallen to the ground, one had an injured leg but was flying, and a third appeared to be healthy. The Osprey were observed visiting the nest on the new platform before migrating.

Monitors Gaye and Tom Goldie went to Albert Head during the week of June 22nd, 2003, to see if they could locate any Bald Eagle nest trees. Upon spending approximately three hours walking the shoreline, no nests were located. There was an eagle on the shoreline but that was the only one observed. The monitors did however come across a Red-tailed Hawk.

Figure 1:
Bald Eagle and Osprey nest locations at Rocky Point.

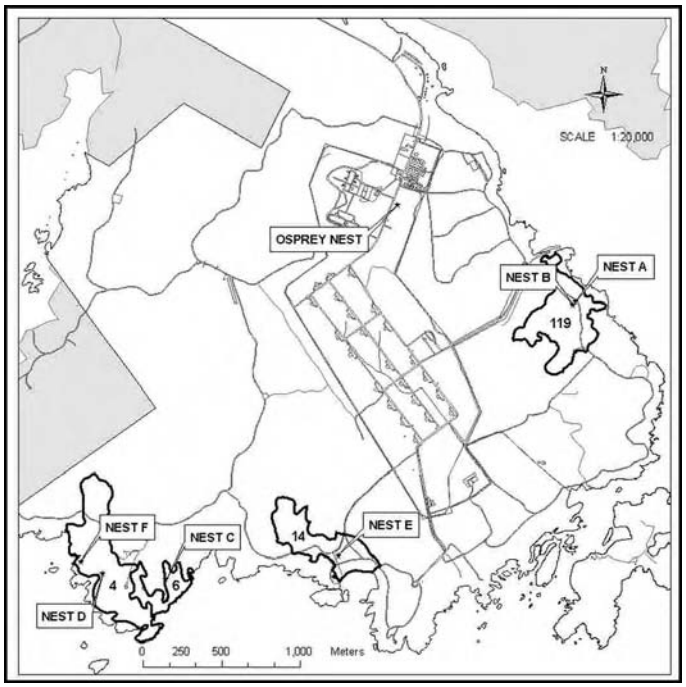


Photo: S. Blouin

Osprey nest relocation project - Nest mounted on the new platform.

Photo: S. Blouin

Osprey nest on the new pole standing about 30m from the old nest site.

Abundance and Adaptation of Butterflies in Garry Oak Meadows

Jessica Hellmann

Assistant Professor, Department of Biological Sciences, University of Notre Dame, 107 Galvin Life Science Center, Notre Dame, IN 46556 USA (formerly of the Centre for Biodiversity Research, University of British Columbia)
Tel: (574) 631-7521 • Email: hellmann.3@nd.edu

Permit #: *P090-03* ***Start Date:*** *March 1, 2003*
Location: *Rocky Point and CFMETR* ***Completion Date:*** *On-going*

Overview

A series of studies involving butterflies and plants in Garry oak meadows were undertaken at Rocky Point and CFMETR in the spring of 2003 (April - August). These sites, together with five others on Vancouver Island, B.C., constitute a multi-year project concerning the abundance and dynamics of butterflies at the edge of their geographic range. All butterfly species are observed and counted, but two are of particular interest. These are the large-bodied generalist, *Papilio zelicaon*, and the small-bodied specialist, *Erynnis propertius*. (E. *propertius* also is designated as endangered in B.C.). *P. zelicaon* feeds on *Lomatium* within Garry oak meadows and non-native relatives outside the meadows. *E. propertius* feeds on Garry oak itself. Both require abundant flowering plants as nectar sources.

One large, continuous patch of Garry oak meadow was identified on each property for detailed study. At Rocky Point, this patch was south of the access road near the shoreline; at CFMETR, this patch was located on Notch Hill (Table 1). The perimeter of each patch was delineated with a GPS (Fig. 1), and the following studies were executed. First, each patch was surveyed for host plants, nectar sources, and oak trees (Fig. 2) and was visited regularly to count butterflies along pre-set transect lines (Fig. 3; Table 1). Second, temperature (Rocky Point and CFMETR and rainfall (Rocky Point) data were collected in each site at five-minute intervals (Fig. 4). Third, *E. propertius* larvae were reared in each site from capture-and-released females as the basis for future, more expanded studies of larval adaptation to local climatic conditions (Fig. 5; Table 2). And fourth, genetic samples of *E. propertius* were collected in each site for subsequent analysis of gene flow and genetic relatedness among all seven sites. Analysis of the data from 2003 is ongoing but preliminary results are promising. Significant differences are emerging among the study sites, as are predicted differences between the focal study species. Additional seasons of data collection are necessary to measure population fluctuations among years and to determine if the patterns emerging from 2003 are representative of processes operating at the distributional limit of this meadow ecosystem.

Objectives

The principle objective of studies in 2003 was to establish protocols for the study of butterflies and plants as the basis of multi-year research. Objectives largely were executed as stated in the project work plan of my 2003 ESAC application:

"To examine local and regional factors that limit butterfly distributions. Field assistants and I will pursue four studies in a number of sites on Vancouver Island, B.C., including two CFB Esquimalt properties. Study sites lie along a north-south gradient to uncover spatial patterns of populations near the northern limit of oak-grassland ecosystems. 1) Measure the density and abundance of all butterflies and their plant resources in each study site. 2) Record environmental variables in each site. 3) Study the local adaptation of two species, *Erynnis propertius* and *Papilio zelicaon*, with larval growth experiments. 4) Collect DNA samples from these two species for analysis of the genetic similarity among sites." All objectives outlined for 2003 will be repeated in 2004.

In 2003, one objective was not executed as planned. I intended to execute a fully-replicated translocation experiment of larvae among sites to see how larval performance varied in native versus translocated sites across the seven study areas. Such an experiment tests the degree to which larvae are locally adapted. For the first year of

Abundance and Adaptation of Butterflies in Garry Oak Meadows

study in this system, however, this goal was overly ambitious. Instead, I reared only *E. propertius* larvae and only within the site where their mothers were collected (i.e., no translocation). These initial studies do, however, demonstrate the viability of our rearing methods and provide valuable baseline information for comparison to future translocation experiments. I plan to implement translocation experiments for both *E. propertius* and *P. zelicaon* in 2004.

One other objective in 2003 was not met fully. Individuals of *P. zelicaon* were not as dense within the study sites as I had anticipated, and they were difficult to catch with the amount of field assistance available. For this reason, fewer genetic samples of *P. zelicaon* were collected than desired at all sites. I will concentrate on increasing the number of genetic samples collected for *P. zelicaon* in 2004.

Methodology

Following the numbered objectives above, the following procedures were used in 2003. These procedures largely follow those outlined in the work plan of my research application, and all took place between April and August. These procedures will be repeated in 2004 with a more fully executed version of objectives 3 and 4 (see "objectives" above).

1. To measure the plant community (quality of each patch for butterflies), 1x1 m quadrats were placed evenly across each study patch. The number of quadrats was set by the size of the patch (Rocky Point: n=120; CFMETR: n=550; Table 1). Within each quadrat, we measured shrub and ground cover, number of *Lomatium spp., Camas quamash,* and Garry oak stems, number of flowers, and grazing intensity (Fig. 2). To quantify butterfly diversity and abundance, we regularly surveyed transects composed of 30 m segments (Rocky Point: n=44 segments; CFMETR: n=124 segments) evenly spread across each study patch (Table 1; Fig. 3). At Rocky Point, all butterflies observed within 5 m of the transect line were recorded. At CFMETR, all butterflies observed within 10 m of the transect line were recorded. Transects were walked at a steady pace on sunny days approximately once per week. In this way, sampling effort was standardized for patch size and was constant over the growing season.

In addition, the phenology of each site was measured over time. Oak leaf size was measured repeatedly on four reference trees, and we noted which plant species were in flower in each site on each visit. Over the season, we also noted the species on which *E. propertius* nectars (a total of 14 species).

2. To measure the climate of each site, HOBO devices (Onset Computing Inc.) that record air temperature and relative humidity were placed in each patch (Fig. 4). At Rocky Point and select other sites, automated rain gauges also were used. These devices recorded data every five minutes over the entire study season.

3. To measure butterfly performance in the study sites, larvae were reared at both Rocky Point and CFMETR (Fig. 5). Adult females (17 females/site) were captured and held in cages for 2-4 days with cut oak branches and sugar water. The resulting eggs then were moved to mesh enclosures hung in an oak tree (Rocky Point: 3 enclosures; CFMETR: 2 enclosures). Enclosures were regularly surveyed for hatched larvae, and the length and width of larvae were measured repeatedly over time (Fig. 5; Table 2). Enclosures were tied off to prevent larval escape and closed with Velcro. To our knowledge, no individuals escaped from the enclosures, suggesting that the design is suitable for subsequent translocation experiments (see "objectives" above).

4. To assess gene flow and genetic similarity among sites, genetic samples of *E. propertius* were collected at both Rocky Point and CFMETR. (We intended to collected *P. zelicaon* as well, but see "objectives" above.) A rear leg of 20 individuals were collected from each site and stored in ethanol vials. Leg removal did not affect flight capacity (or likely survivorship) as on several occasions, five-legged individuals were recaptured. In addition, two vouchers, one female and one male, were collected as representatives of the morphology of each site. Genetic samples are stored at the University of Notre Dame awaiting analysis. Vouchers are in temporary storage in the laboratory of Elizabeth Elle at Simon Fraser University (ultimately to be shared with the BC Royal Museum).

Abundance and Adaptation of Butterflies in Garry Oak Meadows

Results to Date

Below are a series of tables and figures emerging from recent data analysis. Several figures show data for Rocky Point and CFMETR in the context of all seven study sites. These preliminary data also have been shared with the World Wildlife Fund as required under the Endangered Species Recovery Fund and with the Garry Oak Ecosystem Recovery Team. Appendix I lists all of the butterfly species observed at Rocky Point and CFMETR and their date of observation.

Table 1: Information for Rocky Point and CFMETR

	Rocky Point	CFMETR
Latitude and longitude of study patch	N4819.5169′ W12332.6033′	N4916.2799′ W12409.5288′
Patch area[1]	6.21	29.11
Butterfly species richness[2]	13	16
Abundance of *E. propertius*[3]	51 (8.2)	328 (11.3)
Abundance of *P. zelicaon*[4]	1	5
Number of butterfly surveys[5]	8	7

[1] in hectares

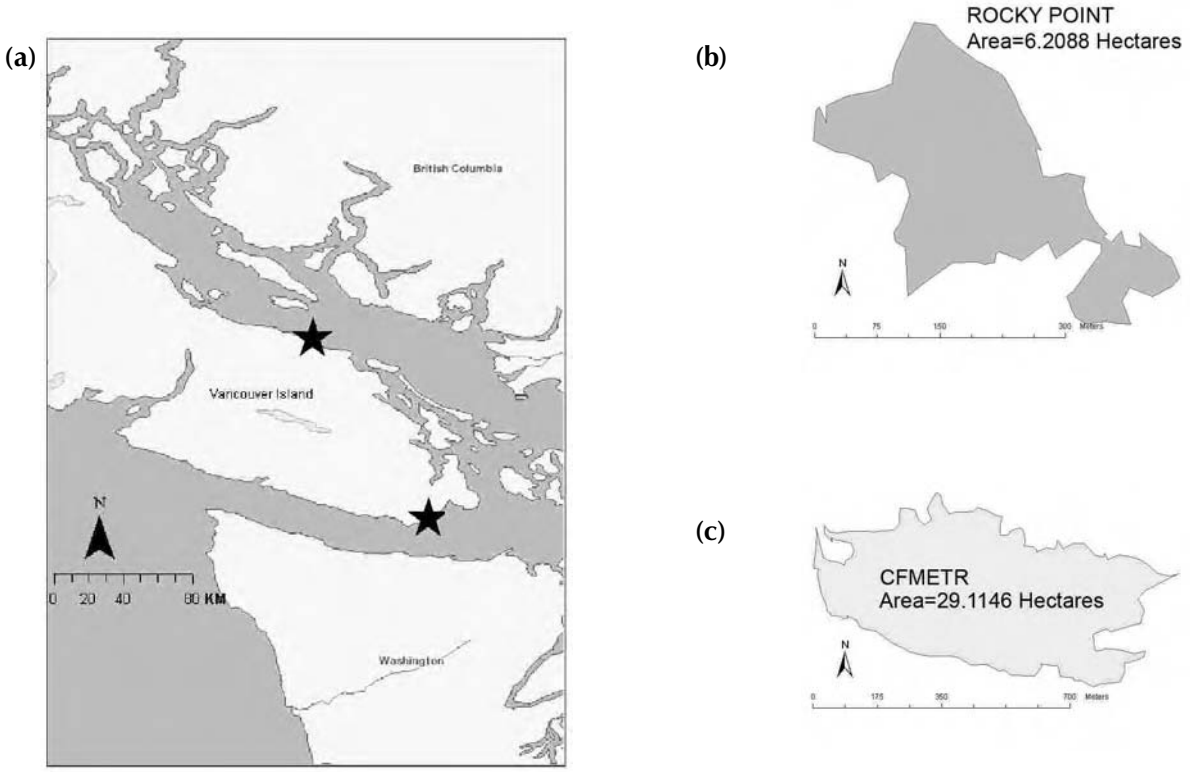
[2] as recorded on regular butterfly surveys or seen during any site visit (see Appendix I)

[3] total number of *E. propertius* adults recorded on regular butterfly surveys in the patches of Fig. 1; value in parentheses is scaled by patch area (i.e., density)

[4] total number of *P. zelicaon* adults recorded on regular butterfly surveys in the patches of Fig. 1

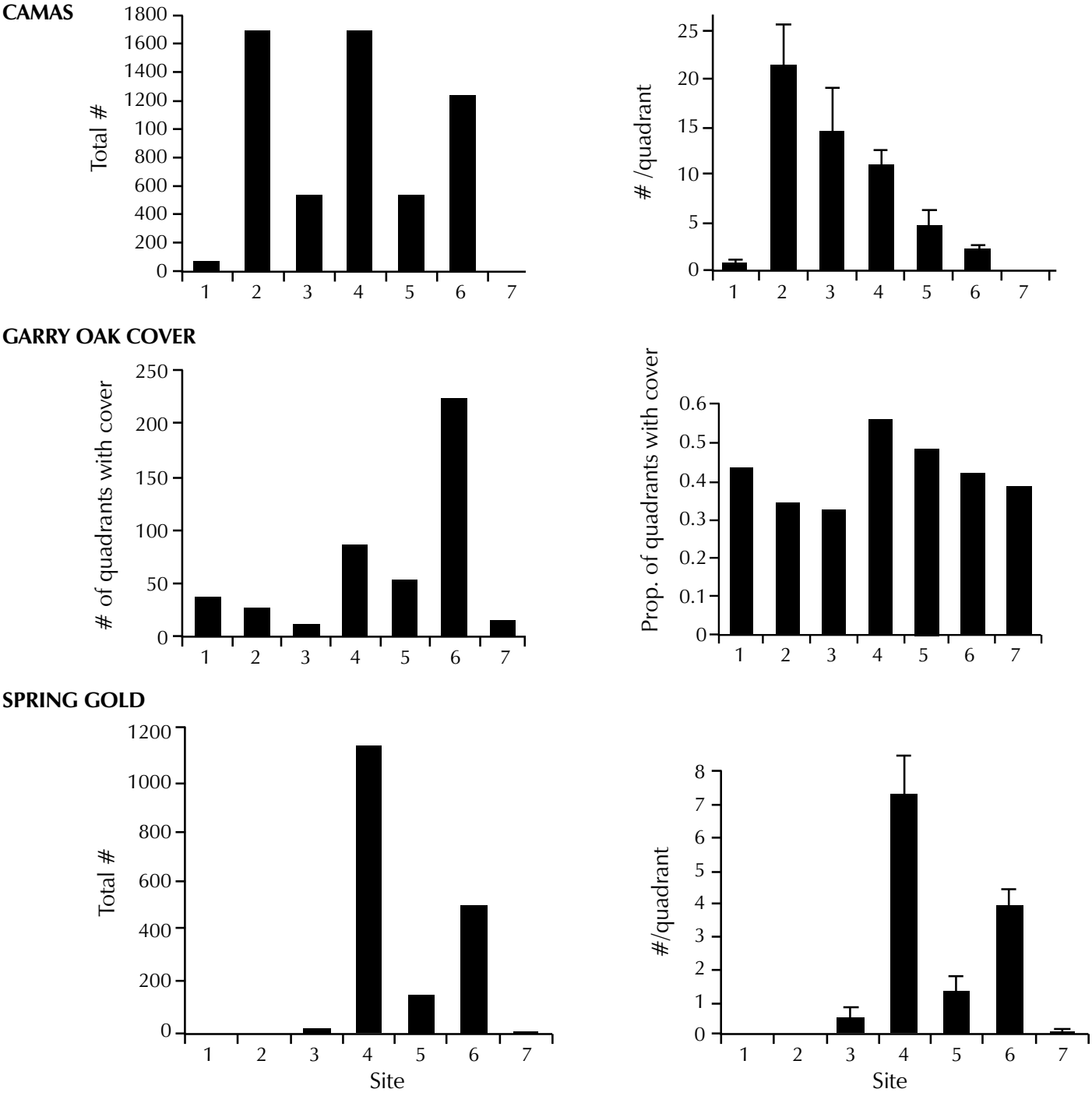
[5] surveys began on May 2 and ended on June 22 at Rocky Point; surveys began on May 8 and ended on June 23 at CFMETR

Figure 1: Locations (★) of the DND study areas on southern Vancouver Island (a) and shape and size of the study patches at Rocky Point (b) and CFMETR (c).



Abundance and Adaptation of Butterflies in Garry Oak Meadows

Figure 2: Data on vegetation from all study sites, listed from south to north. Totals for each site (not controlled for size) are on the left; density (controlled for site size) is shown on the right. Totals are number of stems (or cover) over entire study area where the number of quadrats per site was scaled to site size. Density is average number of stems (or cover) per site. Error bars are standard error. Rocky Point is site 1; CFMETR is site 6.



Abundance and Adaptation of Butterflies in Garry Oak Meadows

Figure 3: Number of *Erynnis propertius* per hectare as estimated from regularly-spaced butterfly surveys between April, 1 and June 30, 2003. Rocky Point is site 1; CFMETR is site 6. Sites are listed from south to north.

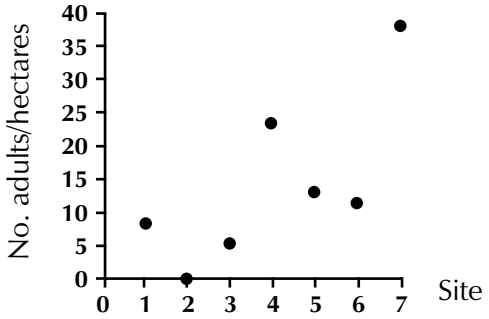


Figure 4: Average weekly temperature at 15:00 for Rocky Point (dashed line) and CFMETR (solid line).

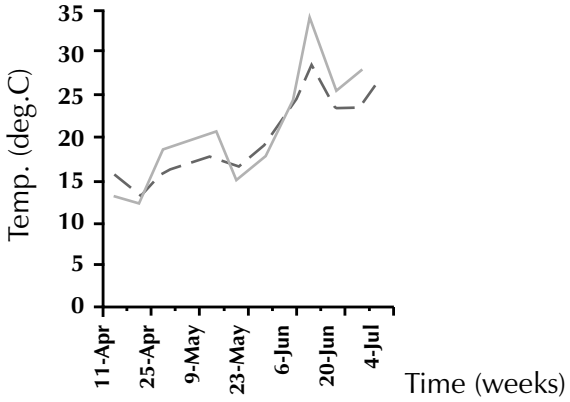


Figure 5: Estimates of mean biomass over time as recorded for Erynnis propertius larvae in enclosures at Rocky Point (○). Larvae were reared in field enclosures collected from captured females native to each site, and all larvae within an enclosure were laid on the same date ("birthdate" in Table 2). Larvae were released from the enclosures at the end of the study period. Data also are provided for the Cowichan Garry Oak Preserve (near Duncan, BC) for comparison (•).

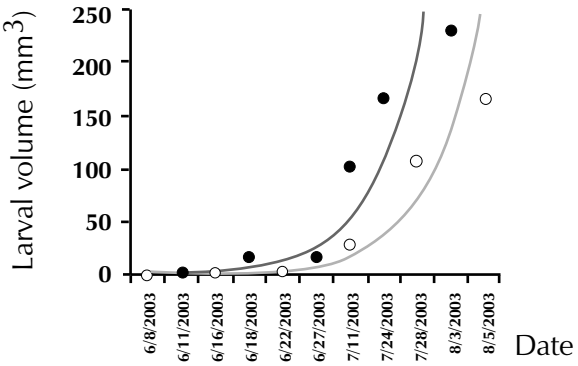


Table 2: Estimated rates of growth for *E. propertius* reared in enclosures. Rates were estimated as a linear fit to log-transformed data. Enclosures established at different times are distinguished by the date on which stock eggs were laid (i.e., "birthdate").

Site	Birthdate	Growth Rate	R^2
Rky Pt	May 19	1.2	0.94
Rky Pt	May 31	1.09	0.98
CFMETR	May 18	0.75	0.93
CFMETR	May 30	1.04	0.92

Discussion

The studies outlined above will be continued over the coming years (with continued permission of the land owners). These studies represent one of the main research projects of Dr. Jessica Hellmann at the University of Notre Dame and should expand to include related projects of graduate students over the coming years. Through this research, numerous students, both Canadian and American, receive training in field biology and experience the beauty of these rare, and increasingly threatened, ecosystems. This and subsequent years of data also will provide useful information for managing Garry oak meadows, including those on CFB Esquimalt properties. As a result of this research, land managers of southern Vancouver Island already have learned vastly more about the invertebrate community of Garry oak than was known previously. Such collaboration allows findings from this research to inform land management.

For more information or for more recent analysis of the data collected in 2003, please contact Jessica Hellmann at hellmann.3@nd.edu. **Please do not publish or present these findings without the consent of J. Hellmann as these studies are part of a research program in progress**. Data from 2003 will be combined with data from up-coming years for publication in scientific journals. Please also note that species richness data for all study sites, including Rocky Point and CFMETR, were shared with the B.C. Conservation Data Centre.

(cont...)

Abundance and Adaptation of Butterflies in Garry Oak Meadows

Appendix I: List of butterfly species observed at Rocky Point and CFMETR.

These data are presence/absence information (1=present), based on observations made while researchers were either generally present at the site or during specific butterfly surveys. By far the most abundant butterfly species seen at both sites was *Erynnis propertius*. Note that in the species list below, the category "Sw" captures swallowtails (*Papilio*) that could not be identified at the species level.

EP	*Erynnis propertius*	Propertius skipper
PZ	*Papilio zelicaon*	Anise swallowtail
SA	*Celastrina echo*	Spring azure
CW	*Pieris rapae*	Cabbage white
GH	*Strymon melinus*	Grey hairstreak
SO	*Anthocharis sara*	Sara's orangetip
AW	*Polygonia spp.*	Anglewing
MC	*Nymphalis antiopa*	Mourning cloak
AS	*Carterocephalus palaemon*	Arctic skipper
PC	*Lycaena helloides*	Purplish copper
LA	*Limenitis lorquini*	Lorquin's admiral
RA	*Vanessa atalanta*	Red admiral
EI	*Incisalia iroides* or *Icisalia mossii*	Elfin (Western or Moss')
MF	*Clossiana epithore*	Western meadow fritillary
Fr	*Speyeria hydaspe* or *Speyeria zerene*	Hydaspe/Zerene fritillary
Sw	*Papilio* spp.	Tiger/Pale/Anise swallowtail
Tsw	*Papilio rutulus*	Tiger swallowtail
Psw	*Papilio eurymedon*	Pale swallowtail

ROCKY POINT

Date	EP	PZ	SA	CW	GH	SO	AW	MC	AS
4/30/2003	1		1		1				
2/5/2003	1		1		1				
13/5/2003	1		1	1					
21/5/2003	1	1	1		1				
29/5/2003	1		1						
3/6/2003	1								
8/6/2003	1		1						
16/06/03	1								
22/06/03	1								

Date	PC	LA	RA	EI	MF	Fr	Sw	TSw	PSw
4/30/2003	1		1		1				
2/5/2003	1		1		1				
13/5/2003	1		1	1					
21/5/2003	1	1	1		1				
29/5/2003	1		1						
3/6/2003	1								
8/6/2003	1		1						
16/06/03	1								
22/06/03	1								

CFMETR

Date	EP	PZ	SA	CW	GH	SO	AW	MC	AS
						1			
5/5/2003	1				1				
7/52003	1					1			
8/5/2003	1		1		1			1	
12/5/2003	1	1	1		1	1			
18/5/03	1	1	1		1	1			
26/5/2003	1	1	1		1				
2/6/2003	1	1	1		1				
9/6/2003	1	1		1					
17/06/03	1								
23/06/03	1		1						

Date	PC	LA	RA	EI	MF	Fr	Sw	TSw	PSw
						1			
5/5/2003									
7/52003									
8/5/2003				1					
12/5/2003									
18/5/03					1				
26/5/2003				1					
2/6/2003							1		
9/6/2003	1						1	1	
17/06/03			1				1	1	1
23/06/03		1					1	1	

Monitoring of Winter Moth and the Parasites Introduced for its Control at Colville Officers' Mess on Hotham Street

Imre S. Otvos

Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre,
506 West Burnside Road, Victoria, BC V8Z 1M5
Tel: (250) 363-0620 • Email: iotvos@pfc.cfs.nrcan.gc.ca

Permit #: *P031-03*
Location: *Colville Officers' Mess on Hotham Street*
Start Date: *May 1, 2003*
Completion Date: *May 31, 2003*

Overview

The winter moth, *Operophtera brumata L.*, is an introduced pest that originated in Europe. It was first introduced into Nova Scotia in 1949 and was first detected in the Victoria area in 1976. By 1977, this insect had defoliated over 120 km^2 on southern Vancouver Island. Its principle host on southern Vancouver Island is the Garry oak, *Quercus garryana* Dougl., a unique tree with restricted distribution.

In 1979, the Canadian Forest Service commenced the introduction of two natural enemies of this insect, both from Europe and from Nova Scotia, where a similar introduction program had been successful. During the successful release program in Nova Scotia, six parasitoid species were introduced, of which two species became established and are credited with controlling the winter moth in Nova Scotia. These same two successfully introduced natural enemies, a parasitic wasp, *Agrypon flaveolatum*, and a parasitic fly, *Cyzenis albicans*, were released over a four-year period at a total of 33 different locations in the Victoria area. One of these locations was adjacent to the Colville Officers' Mess on Hotham Street.

Following the completion of the release program in 1982, a monitoring program was established to track the success of the introductions and the stability and value of the newly established host-parasitoid complex.

Objectives

To monitor the current population density of the winter moth at Hotham Street, one of the sites used for parasite releases between 1979 and 1982, for comparison with data collected during the last 20 years. Winter moth larvae will be collected and reared to determine percent parasitism by the introduced parasites at this and other sites in the Greater Victoria area. These data will be compared with those collected in previous years to determine whether the introduced parasitoids have become established and are effective in controlling winter moth populations.

Methodology

Two sampling methods were employed to monitor winter moth populations and the interaction between the host and parasitoids:

1. Winter moth population densities were determined by making collections of branches from oak trees at six permanent sample locations in the Greater Victoria area, one of these being located on Department of National Defence land at the Colville Officers' Mess on Hotham Street. These branch samples were collected when winter moth larvae had reached late 3^{rd} or early 4^{th} instar, usually during early- to mid-May. Four trees were randomly chosen at each of the permanent sample locations. A pole pruner with a basket attached below the cutting head was used to collect an oak branch that had newly flushed leaf clusters. The branch was cut so that it would fall into the basket and any larvae that were dislodged were retained in the basket. The branch was then cut into smaller pieces and placed into a 20 lb brown kraft paper bag along with the contents of the basket attached to the pole pruner. The bag was then sealed and the process repeated until five branches were collected from each of the four trees (for a total of 20 branches) at each sample location. The samples were then taken to the Pacific Forestry Centre and stored in a cold room at –20°C until they could be examined to count the number of winter moth larvae, leaves and leaf clusters on each branch. Winter moth larval densities were then expressed as the number of larvae per leaf or leaf cluster to monitor changes in the winter moth population over time.

Monitoring of Winter Moth and the Parasites Introduced for its Control at Colville Officers' Mess on Hotham Street

2. Parasitoid populations were monitored when the larvae reached early- to late 4th instar, just before the mature larvae completed feeding and dropped to the ground to pupate in the duff layer. Winter moth larvae were collected and reared in the laboratory because the parasitoid larvae hatch and feed inside the host, and cannot be identified until they complete development later in the year. Two collections were made to ensure that parasitized winter moth larvae were collected. Trees were selected at random at the permanent sample location. A large (2x3 m) white sheet was placed on the ground part of the crown of one tree, and a 2 m pole was used to beat all the branches located over the sheet to dislodge the larvae from the tree. This procedure was repeated until either 200 or more larvae were collected, or the amount of time required to collect the insects exceeded one hour. All the winter moth larvae that had fallen on the sheet were collected and placed in a cardboard bucket containing some oak foliage and a layer of moist peat moss in the bottom for the mature larvae to pupate in. Once the larval collection was completed, the bucket was covered with a fine mesh lid and the insects transported back to the Pacific Forestry Centre for rearing. The winter moth larvae were reared in the buckets until they spun down into the peat moss and pupated. Once the winter moth finished pupating (early June), the peat moss was removed from the buckets and sieves were used to separate the winter moth cocoons from the peat moss, frass and oak leaf debris. The cocoons were then placed in large (100 x 20 mm petri dishes) that contain a layer of moist sand covered with a filter paper. The filter paper and cocoons were and still are being moistened as required to prevent desiccation of the pupae. The pupae were reared at room temperature until mid-September, then transferred to a growth chamber and will be reared at 5-8°C until the spring. Adult moths started emerging around mid-November and are expected to finish emerging in mid-December, while the parasites will not emerge until the spring.

Results to Date

In 2002, winter moth populations averaged 0.14 larvae per leaf in the Greater Victoria area, while in 2003, the population had almost doubled to 0.26 larvae per leaf. This population density caused trace defoliation (damage) to the leaves. In the Colville Officers' Mess area, there was a similar, but less noticeable, winter moth population increase from 0.03 to 0.07 larvae per leaf.

Percent parasitism by both parasitoid species, *Agrypon flaveolatum* and *Cyzenis albicans*, can only be determined in the spring after the overwintered pupae emerge. However, over the previous two years (2001 and 2002), parasitism of winter moth by both species declined. Parasitism by *Agrypon flaveolatum* decreased from 0.7% to 0.2% in the Greater Victoria area, and no *Agrypon flaveolatum* were reared from insects collected at the Colville site in either of these two years. During the same period (2001 and 2002), percent parasitism by *Cyzenis albicans* decreased from 11.8% to 7.4% in the Greater Victoria area, and decreased from 15.0% to 1.2% at the Colville site.

Discussion

Winter moth populations at the Colville location were lower than the regional average, but this is not unusual since winter moth populations have been consistently lower at this location than the overall average population levels for the Greater Victoria area since 1991. Winter moth populations during 2003 were the highest they have been in 10 years. Although population levels of this magnitude occurred in 1993, the population collapsed the following year. However, parasitism by *Cyzenis albicans* was considerably higher then (about 57%). Therefore, one cannot predict if the population levels will continue to increase over the next 2-3 years, or if the population will return to its previous endemic levels. Continued monitoring in the Greater Victoria area will reveal this.

With regards to the parasitoids, the following general statements can be made as predictions. Parasitism by *Agrypon flaveolatum* is likely to remain low (less than 1%) as this parasitoid has never been found in more than 6% of winter moth larvae collected in a single year in B.C. since its introduction 20 years ago, and has never parasitized more than 1% of winter moth during the last 5 years. The experience in Nova Scotia indicates that *Agrypon flaveolatum* attacks winter moth at low population levels, and with a reduction in percent parasitism by *Cyzenis albicans*, the number of insects attacked by *Agrypon flaveolatum* may increase. Interestingly, although it was assumed in 2002 that parasitism by *Cyzenis albicans* would increase, parasitism by this species actually decreased (from 11.8% to 7.4%).

Monitoring of Winter Moth and the Parasites Introduced for its Control at Colville Officers' Mess on Hotham Street

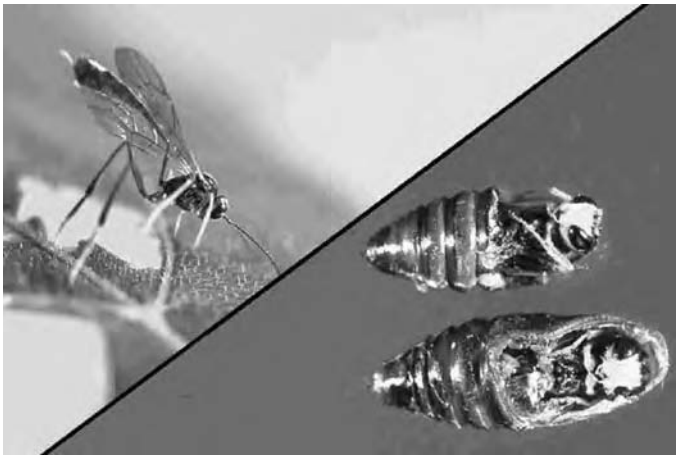
The decline in rate of winter moth parasitism by *Cyzenis albicans* over the last 12 years may result in the following. Winter moth populations may again increase to the point where they cause light to moderate damage to Garry oak in the Greater Victoria area, after which the populations of the introduced parasitoids will also increase, causing a decline of the winter moth population below a level that would cause noticeable damage.

Conclusion

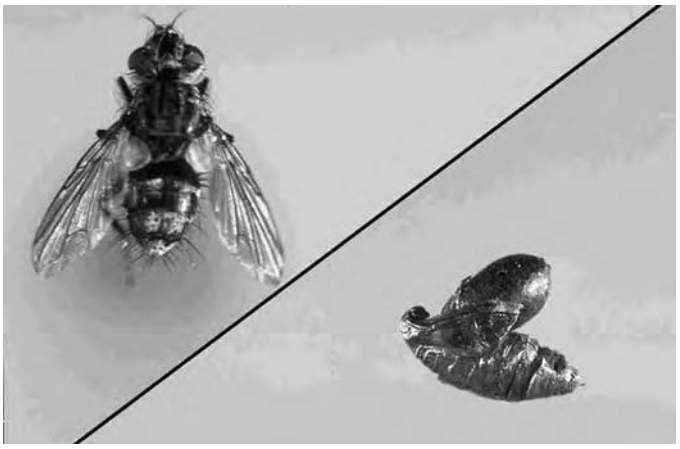
In conclusion, the results of the past 20 years of monitoring winter moth populations in the Greater Victoria area would suggest that the introductions of the two parasitoids, *Agrypon flaveolatum* and *Cyzenis albicans,* particularly the latter, has resulted in control of the introduced winter moth in the Greater Victoria area. The case for the establishment of a stable host-parasitoid complex is complicated by the two gypsy moth treatments that were conducted in 1998 and 1999 in the Greater Victoria area to eradicate the European strain of gypsy moth. These applications of the bioinsecticide, *Bacillus thuringiensis* subsp. *kurstaki*, or *Btk* (a naturally occurring soil bacterium) also reduced winter moth populations on the previous occasion when it appeared that the winter moth populations would increase. Although this application of *Btk* may have disrupted the equilibrium reached between the winter moth and the two introduced parasitoids in the treated areas (including the Colville location), it does not explain the decline observed throughout the Greater Victoria area. Therefore, it is important to continue the monitoring to observe the long-term interaction and stability of the winter moth and parasitoid populations. The monitoring will reveal if the host-parasitoid complex has reached an equilibrium or not, and whether this equilibrium is affected by the periodic use of *Btk* that might be required to prevent the establishment of another invasive species, the gypsy moth (be that either the European or Asian strain), on the West Coast.

Photos: Canadian Forest Service

Winter moth (*Operophtera brumata L.*)



A parasitic wasp (*Agrypon flaveolatum*)



A parasitic fly (*Cyzenis albicans*)

Canopy and Microclimate Station Upgrading at Rocky Point - Royal Roads University

Dr. Bill Dushenko

Royal Roads University, 2005 Sooke Rd, Victoria, BC V9B 5Y2
Tel: (250) 391-2580 • Email: Bill.Dushenko@RoyalRoads.ca

Permit #: *P087-03* ***Start Date:*** *January, 2003*
Location: *Rocky Point* ***Completion Date:*** *On-going*

Overview

This project involves the on-going enhancement of the microclimate monitoring station as part of the existing Ecological Monitoring and Assessment Network (EMAN) site and forest canopy research station at Rocky Point (Figure 1). This includes the installation of a tower and new solar panels to power the existing instrumentation, installation of semi-permanent soil moisture probes in the existing EMAN plots, and the set-up of a small storage shed to house some of the existing and future monitoring equipment from the elements.

Objectives

The general objective of this project is to enhance the current capabilities of the existing microclimate monitoring station at Rocky Point and to begin downloading information from the data logger on a regular basis using remote downloading technology. Specific objectives include the following:

- Installation of a solar panel and tower to provide an adequate power supply for additional station equipment installed there;
- Set up of three soil moisture probes to be installed at selected locations in the EMAN site;
- Installation of a small storage shed for the station equipment and the data logger on the existing platform outside of the EMAN plot;
- And regular inspection and maintenance.

Results to Date

A dynamic aerial rope ladder has been installed between Tree 1 and Tree 2, providing sensing levels at 10, 20 and 30 m elevations for temperature and relative humidity.

A 3-metre tripod stand has been installed within the salal ground cover to provide a sensing level at the surface of the vegetation cover. A quantum radiation sensor, temperature and relative humidity sensor, and a wind speed and direction sensor will be attached to this stand in 2004.

A conduit has been put in place for signal wires from the instrument shed to service power and communication between the data logger and the tripod stand, soil moisture pit and aerial ladder.

Two towers have been set up on the rock outcrop adjoining the microclimate tree. The larger tower is 19 metres and will represent the top of the forest canopy. It is supporting a 750 watt solar panel. This tower will also support a quantum light sensor, wind speed and direction sensor, and a temperature and relative humidity sensor. The smaller tower is 10 metres high and is supporting a tipping bucket rain gauge. It will also support an antenna for cellular communication between Royal Roads and the data logger in 2004.

Preliminary approval in principle has also been received from DND to set up a full ambient monitoring station at Christopher Point along the Strait of Juan de Fuca, located just southeast of the canopy station. Discussions are to commence in early 2004 for establishing a memorandum of understanding, with the intention of setting up the ambient station by spring 2004 in collaboration with Environment Canada.

Canopy and Microclimate Station Upgrading at Rocky Point - Royal Roads University

Discussion/Research Activities/Extension

These improvements will help to support the long-term project of monitoring climate conditions and atmospheric pollutants (both local and long-range), as well as indicators of environmental health in temperate coastal forest ecosystems. This site constitutes the southern Vancouver Island node of the Georgian Basin and is part of a larger global environmental monitoring network. The acquisition of data by the microclimate station situated by the EMAN site below the forest canopy research station at Rocky Point will be an important component of this project. The station has also been attracting the attention of the general public based on recent field tours by the media and will serve as an important vehicle for research, education and extension activities in the future.

Figure 1: Location of the Forest Canopy Research Station and Microclimate Station at Rocky Point.

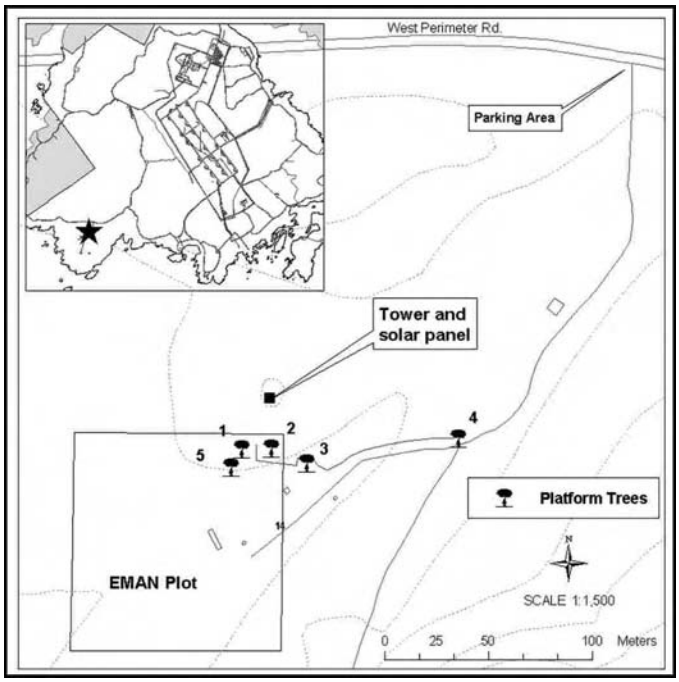


Photo: B. Dushenko

Installation of the 6ft. tower on the rock outcrop adjoining the microclimate tree.

Introduction to Bird Banding

Paul Levesque

Rocky Point Bird Observatory, Suite A 954 Queens Ave, Victoria, BC V8T 1M6
Tel: (250) 995-1404 • Email: tuff_puffin@hotmail.com

Permit #: *P092-03* ***Start Date:*** *March 13, 2003*
Location: *Royal Roads* ***Completion Date:*** *March 16, 2003*

Overview

The purpose of the bird banding workshop is to teach participants bird handling, trapping and banding, and standardized methods of collecting morphometric data. Currently in British Columbia, there is no available training of this sort to the general public, hence the importance of this workshop to increase the quality of data collected and increase bird safety.

Objectives

1. To increase the level of bird safety on future research projects in British Columbia; and
2. To increase the quality of data collected on bird research projects through the standardization of methodology.

Methodology

The Rocky Point Bird Observatory Society held two bird-banding workshops on March 13-14 and 15-16, 2003. The workshop consisted of classroom lectures, lab sessions and a field component that included capturing and banding songbirds at Royal Roads. The lab component included working with a collection of frozen birds. For the field component, two mist nets were used each morning for approximately four hours.

Results

There were 21 workshop participants, most were students from B.C. universities and colleges and a few participants traveled from Alberta and Washington State.

All observed birds, along with banded birds were noted during the field component (Tables 1 and 2).

Table 1: Observed Birds

Species	Number	Species	Number
Canada Goose	63	Chestnut-backed Chickadee	33
Mallard	3	Bushtit	14
Bald Eagle	2	Brown Creeper	1
Sharp-shinned Hawk	1	Red-breasted Nuthatch	7
California Quail	6	Winter Wren	14
Killdeer	2	Bewick's Wren	5
Glaucous-winged Gull	26	Golden-crowned Kinglets	39
Northern Pygmy-owl	1	Ruby-crowned Kinglet	9
Rufus Hummingbird	3	Varied Thrush	11
Belted Kingfisher	2	American Robin	22
Northern Flicker	4	European Starling	41
Red-breasted Sapsucker	4	Cedar Waxwing	2
Downy Woodpecker	2	Townsend's Warbler	1
Pileated Woodpecker	1	Spotted Towhee	8
Steller's Jay	5	Fox Sparrow	2
Northwestern Crow	27	Song sparrow	13
Common Raven	2	White-crowned Sparrow	5
Violet-green Swallow	9	Golden-crowned Sparrow	4
		Dark-eyed Junco	52
		House Finch	7
		Pine Siskin	64

Table 2: Banded Birds

Date	Species	Number
13-Mar	Dark-eyed Junco	7
	American Robin	2
	Song Sparrow	1
14-Mar	Dark-eyed Junco	11
	American Robin	4
15-Mar	Dark-eyed Junco	13
	American Robin	3
	Bushtit	3
	Spotted Towhee	2
16-Mar	Dark-eyed Junco	6
	American Robin	1
	Song Sparrow	1
Total		52

Bird Migration Monitoring

David Allinson[1] and Wendy Easton[2]

[1] Rocky Point Bird Observatory, 572 Atkins Ave., Victoria, BC V9B 3A3
Tel: (250) 391-1786 • Email: passerine@shaw.ca
[2] Landbird Assessment Biologist, Canadian Wildlife Service, 5421 Robertson Rd., RR1, Delta, BC V4K 3N2
Tel: (604) 940-4573 • Email: Wendy.Easton@ec.gc.ca

Permit #: *P003-03* ***Start Date:*** *March 3, 2003*
Location: *Rocky Point* ***Completion Date:*** *December 31, 2003*

Overview

Primarily continue on-going monitoring of neotropical bird migration for southwestern British Columbia as part of a national network of banding stations. In the past, there has been little intensive study done on migratory songbirds in western Canada. For example, studies in other parts of North America have indicated declines for songbird species. Therefore, it is important for future conservation efforts in B.C. to establish baseline data on migration diversity and numbers, even for common species.

Objectives

To establish data for species diversity and numbers for both neotropical migrants and resident species that use southern Vancouver Island as a migration corridor and stop-over.

Methodology

Migration monitoring protocol (as per 'Derbyshire, 2000) with daily census and observation along with consistent daily mist-netting for six hours during migration seasons. For now, primary focus is on fall migration from July to October. A newly established Northern Saw-whet Owl banding project will see nocturnal banding of owls during weekend evenings from September to early November.

Rocky Point Bird Observatory 2003 Season Highlights:

In our 10th season of operation, we ended up banding 3716 birds of 61 species (Table 1). More importantly, the season's bird banded/net hour figure was also above average at 0.57 (compared to 0.48 in 2002, 0.60 in 2001, 0.53 in 2000, and 0.48 in 1999). Out of a possible 7020 total net hours of coverage, our nets were only closed for 483.5 hours all season due to weather, so our net coverage was exceptional at 93% (and a season average of 4.6 for daily Coverage Code using scale 0-5). Remarkably clear, warm weather in July, August, and early September kept the banding operations relatively quiet for the first half of the season. However, migration finally kicked into high gear in mid-September, over 10 days from September 12 to September 21, a phenomenal 934 birds were banded (or approximately a quarter of total banding number for entire season). We also established a new RPBO fall daily banding total record when 187 birds were banded on September 20. Over the whole season, a record total of six days saw 100 or more birds banded.

A remarkable 18 species set new banding highs for us in a single season: Northern Flicker, Willow Flycatcher, Hammond's Flycatcher, Pacific-slope Flycatcher, Red-breasted Nuthatch, Brown Creeper, Winter Wren, Golden-crowned Kinglet, Swainson's Thrush, Hermit Thrush, Cedar Waxwing, Yellow Warbler, Yellow-rumped Warbler, Spotted Towhee, Chipping Sparrow, Fox Sparrow, Lincoln's Sparrow, and White-crowned Sparrow. In addition, the 61 species banded this fall also marks a new record for RPBO (our average was 55 species/year). However, banding numbers for Northern Rough-winged Swallow, Bushtit, Bewick's Wren, Black-throated Gray Warbler, MacGillivray's Warbler, Pine Siskin, and American Goldfinch are low compared to other years perhaps more so, considering our coverage this season.

Visit the Rocky Point Bird Observatory website for more information and photo highlights at: www.islandnet.com/~rpbo

Bird Migration Monitoring

Table 1 Total birds banded and total number of species from 1994-2003.

YEAR	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994
TOTAL BANDED	3716*	3153	2576	2723	2255	2127	1818	1571	1260	1547
TOTAL SPECIES	61	56	54	57	61	59	52	62	62	60

** banding total is 30% above 5-year average and our highest ever.*

Banding Highlights (Table 2):

Among the 353 recapture cards this season, more than 50 were for birds originally banded in previous years. However, our most significant recapture was a male Wilson's Warbler which we first banded as an adult on August 2, 1998 which was re-trapped on August 25 this year. As this bird is at least 6 years, 2 months old, it is only eight months shy of the oldest known Wilson's Warbler on file at the Bird Banding Lab. Interestingly, this bird has also been re-trapped by us a total of six times since its original capture (in 2000, 2001, 2002, and 2003) which is remarkable for a neotropical migrant and a great example of site tenacity. See the following link for more interesting information on longevity records and how maximum age is determined:
www.pwrc.usgs.gov/bbl/homepage/longvrec.htm

Pilot Banding Projects (separate data sets):

1. We began a pilot hummingbird-banding project with assistance from Cam Finlay and as a result 42 Rufous Hummingbirds were banded this year. It appears that 2003 may have been a relatively low year for Rufous Hummingbirds, but we intend to continue this project in future years and hopefully obtain re-trap data.

2. Our bander Jukka Jantunen initiated his own gull-banding project during a few afternoons at Edye Point using simple, yet specialized trap and fish bait. In the end, Jukka managed to only band two adult Glaucous-winged Gulls.

3. Paul Levesque initiated a pilot canopy net project, which has been set up not far from the banding shack (it started operations on August 31). This net was positioned approximately 10 metres above the ground using a pulley/guy wire system. To keep our banding statistics consistent, birds caught in this net were recorded as "non-standard" banding. Unfortunately, the final tally from 'Net 14' remained low with only 14 birds of six species banded, but the project was still of interest.

4. Nocturnal Owl Migration Monitoring. Our second year for this project began on September 5th and continued into November. After 23 nights (up to November 2nd), some 300 Northern Saw-whet Owls had been banded along with two Barred Owl. Our two-year total is now 514 owls. Recently, banders in upperstate Washington began their own nocturnal owl banding projects, so we can hope for some mutual recoveries in the future. A Northern Saw-whet originally banded October 26, 2002 at Rocky Point was recaptured at Bainbridge Island, Washington on October 25, 2003.

Northern Saw-whet Owl

Bird Migration Monitoring

Table 2 Birds banded in 2003 (in taxonomic order for July 21 to October 18)

Species	# Banded	Comments
Northern Harrier	1	only third ever banded at station
Sharp-shinned Hawk	4	
Barred Owl	1	first banding record for daytime operations
Belted Kingfisher	3	new species banded for RPBO
Downy Woodpecker	1	only 8th banded at RPBO
Northern Flicker	4	new station record, but only 12 have been banded at RPBO
Pileated Woodpecker	1	only our 6th banded, and first since 1997
Willow Flycatcher	56	new station record
Hammond's Flycatcher	36	new station record
Pacific-slope Flycatcher	315	new station record
Cassin's Vireo	2	
Hutton's Vireo	4	
Warbling Vireo	14	
Steller's Jay	7	
Violet-green Swallow	5	ties high set in 1994
Northern Rough-winged Swallow	1	low
Barn Swallow	1	
Chestnut-backed Chickadee	59	
Bushtit	27	low - average is 44
Red-breasted Nuthatch	7	new station record
Brown Creeper	19	new station record
Bewick's Wren	31	low
House Wren	14	second highest ever; 2001
Winter Wren	282	new station record
Marsh Wren	15	second highest ever; 2000
Ruby-crowned Kinglet	440	second highest ever; 2002
Golden-crowned Kinglet	156	new station record
Swainson's Thrush	90	new station record
Hermit Thrush	131	new station record
American Robin	38	second highest ever; 1995
Varied Thrush	3	these are our first banding records in four years
Cedar Waxwing	18	new station record
Orange-crowned Warbler	159	
Nashville Warbler	1	eighth record for station; first one banded since 1997
Yellow Warbler	146	new station record
Yellow-rumped Warbler	64	new station record
Black-throated Gray Warbler	1	low
Townsend's Warbler	5	
MacGillivray's Warbler	39	low
Common Yellowthroat	101	second highest ever; 1998
Wilson's Warbler	227	
Western Tanager	1	only 8th banded at RPBO
Spotted Towhee	124	new station record
Chipping Sparrow	25	new station record
Savannah Sparrow	99	
Fox Sparrow	231	new station record; more than double previous high
Song Sparrow	141	second highest ever; 2002
Lincoln's Sparrow	194	new station record
Swamp Sparrow	1	only our sixth banded
White-throated Sparrow	5	
White-crowned Sparrow	105	new station record
Golden-crowned Sparrow	84	second highest ever; 1997
Dark-eyed Junco	76	
Black-headed Grosbeak	1	only 11th banded at station
Red-winged Blackbird	18	
Brown-headed Cowbird	7	
Red Crossbill	2	first banding record for RPBO
Purple Finch	11	
House Finch	1	
Pine Siskin	6	low - average is 19
American Goldfinch	56	low - average is 97

Bird Migration Monitoring

Table 3 List of Uncommon/Rare birds in 2003.

Species	Comments	Species	Comments
Greater White-fronted Goose		Crested Auklet	second record for the province and also Canada (and first in 110 years)
Snow Goose		Barn Owl	unfortunately found predated; our sixth record
Trumpeter Swan		Rock Pigeon	(formerly 'Rock Dove') - uncommon
Gadwall		Mourning Dove	for location
Greater Scaup		Black Swift	
Lesser Scaup		Anna's Hummingbird	only second and third records for checklist
Black Scoter		Red-breasted Sapsucker	
Ring-necked Pheasant		Least Flycatcher	new bird for RPBO checklist
Green Heron	first for Rocky Point in six years	Dusky Flycatcher	remarkably, this is the tenth record for site
Northern Fulmar		Northern Shrike	
Sooty Shearwater		Horned Lark	
Fork-tailed Storm-Petrel		Bank Swallow	our seventh record
Leach's Storm-Petrel	first record in over 10 years	Townsend's Solitaire	
Northern Goshawk		Gray Catbird	second record for our checklist
Broad-winged Hawk	10-14 individuals in total	Yellow-type' Wagtail sp.	new bird for RPBO checklist
Swainson's Hawk	at least two birds: our eighth and ninth records	Red-throated Pipit	new bird for RPBO checklist
Golden Eagle		Nashville Warbler	our eighth record
American Golden-Plover	new for RPBO	Palm Warbler	
Pacific Golden-Plover	only our fourth record	Swamp Sparrow	
Whimbrel		White-throated Sparrow	
Marbled Godwit	only our third record	Lapland Longspur	
Wandering Tattler		Western Meadowlark	
Ruddy Turnstone		Brewer's Blackbird	
Semipalmated Sandpiper			
Baird's Sandpiper			
Pectoral Sandpiper			
Red-necked Phalarope			
Sandhill Crane			
Parasitic Jaeger			
Long-tailed Jaeger	only second sighting in last 10 years		
Franklin's Gull	only fourth record for checklist		
Ring-billed Gull			
Black-legged Kittiwake			
Arctic Tern	only second record for checklist		
Ancient Murrelet			

Restoration at Esquimalt Lagoon - ER 390 Project for the RNS Program

Todd Carnahan

963 Wilmer Street, Victoria, BC
Tel: (250) 595-1180 • Email: toddcarnahan@hotmail.com

Permit #: *P093-03* ***Start Date:*** *February 2003*
Location: *Royal Roads* ***Completion Date:*** *April 2003*

Summary

The Royal Roads property in Colwood, B.C. is part of an area surrounding and including the Esquimalt Lagoon that is under the stewardship of a partnership of agencies including the Department of National Defence (DND), the Department of Fisheries and Oceans (DFO), the Canadian Wildlife Service (CWS), Royal Roads University (RRU), the City of Colwood, First Nations groups, and others known collectively as the Esquimalt Lagoon Stewardship Initiative (ELSI). ELSI's goal is to protect and enhance the site through co-operative community stewardship activities including residential and institutional best practices, landscape naturalization, ecological restoration, and community education (ELSI, 2003). This report identifies two possible restoration sites and general strategies for the creation of three hectares of lowland cedar-skunk cabbage wetlands. As a preliminary scooping exercise, this report is designed to develop support in principle for more detailed design plans and cost estimates. Project costs are estimated at a maximum of $221,500 over several years of phased installation and maintenance. Community and agency participation through volunteering and in-kind support will form a crucial and substantial part of the project delivery. The restoration projects will demonstrate ecologically based development principles recognized in the RRU Campus Plan (RRU, 2001) and will provide years of community stewardship activities and educational opportunities for RRU students.

Introduction

Esquimalt Lagoon is a brackish tidal estuary located in Greater Victoria, on the southeastern tip of Vancouver Island, British Columbia. The property (encompassing 229 hectares) is owned by the Department of National Defence (DND) and leased by Royal Roads University (RRU). It is located on the southeastern extent of a large (17 km^2), raised glaciofluvial delta and outwash plain known as the Colwood Delta (Haegle et al, 2003, Jungen, 1985). The lagoon receives significant surface and ground water flows from the surrounding glacial deposits, and drains through a narrow channel at Coburg spit on the Strait of Juan de Fuca. The shellfish and eel grass beds of the lagoon are fringed by salt marsh and dunes, freshwater wetlands, cedar swamps, and coastal Douglas-fir ecosystems in the surrounding uplands. Designated as a federal migratory bird sanctuary, it is also a historic first nations village site and popular recreational destination. Many indicators suggest that increasing use, urbanization, industrial pollution and other factors are reducing water and habitat quality in and around the lagoon (McElroy et al, 2002).

Restoration of the site will focus on returning natural ground water and surface water flows, improving connectivity between isolated habitats, and restoring natural structure, functions, and processes to degraded landscapes. Building community stewardship through active participation is another goal of the restoration process.

Esquimalt Lagoon Stewardship Initiative (ELSI)

A wide diversity of stakeholders formed ELSI in order to identify and address the many issues relevant to the site in a coordinated way. As part of ELSI's action plan, researchers have identified and mapped ecosystem attributes, characterized invasive species threats, and rated the relative quality of habitats. ELSI approached the University of Victoria for help in developing restoration strategies for priority sites. This report is the first of a series of prescriptions for restoration projects in and around the Lagoon.

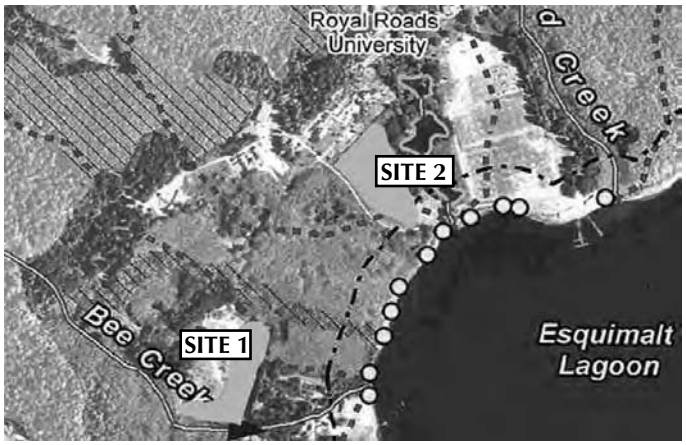
Restoration at Esquimalt Lagoon - ER 390 Project for the RNS Program

Site Definition

Several candidate sites were screened for suitability using the following criteria to eliminate candidate sites:

- WCB-imposed "no work zones" (as recognized by the RRU Union employees);
- Ground contamination (as identified in DND property contamination map);
- Potential campus infrastructure development plans (Campus Plan, 2001); and/or
- Difficult access (road access for large equipment is necessary).

Figure 1:
Location of possible restoration sites at Royal Roads



In addition to being free from the above limitations, two lowland sites adjacent to the lagoon emerged as clear priority areas based on the following attributes:

- Ecological benefits (hydrology, connections, structure, functions, processes);
- Likelihood of success (a straightforward demonstration project is desired);
- Cost versus habitat area created;
- Easy access for public demonstration and learning purposes; and
- Suitability for volunteer participation (access, visibility, safety).

Site One is a degraded pasture adjacent to the Pacific Centre (PC) property on the west side of the Lagoon (Figure 1). Receiving ground water from upland gravels, this Tagner clay-based parcel borders Bee Creek with ditching along the PC property line. The site area is approximately 20,000 m^2. Indicator plants (including *Scirpus microcarpus*) define an area suitable for wetland creation (Figure 2) (Klinka, 1989). Natural succession of the site (and adjacent template communities) demonstrates its suitability for replanting as a red cedar-skunk cabbage association (RIC, 1998).

The prescription calls for the excavation (creation) of several connected and variable depth wetland cells (0.4 m to 1.5 m), invasive species removal, and riparian plantings (Figure 3). The approximate area of the wetland complex is in the 5,000 to 10,000 m^2 range, depending upon funding availability. Site objectives include the acceleration of riparian forest succession to link lagoon habitat with uplands, and the creation of highly-productive freshwater marsh habitat which has been eliminated from other areas around the lagoon. Representative species to be planted on both sites are listed in Appendix 1.

Site One is owned by the Department of National Defence and is leased by Royal Roads University. The northern, upland portion of the site is identified in the University's long-term planning documents as a potential development site; it is not included in this prescription. The endorsement of both organizations is necessary to allow the project to move forward.

Figure 2 and Figure 3 on next page...

Restoration at Esquimalt Lagoon - ER 390 Project for the RNS Program

Figure 2: Existing conditions at Site One. Water flows from top to bottom.

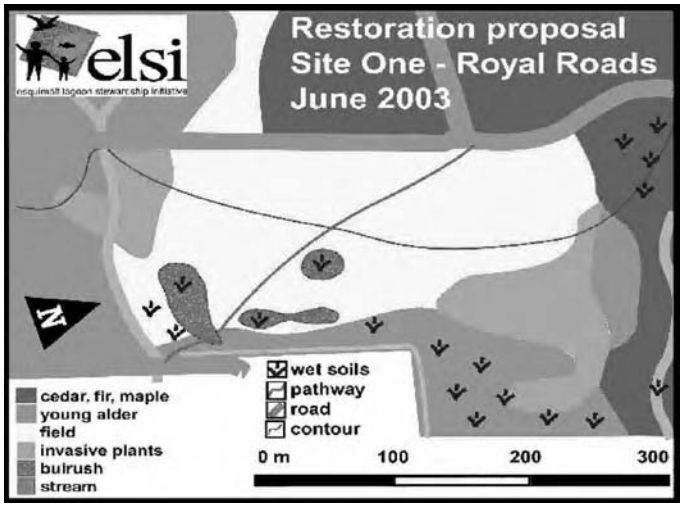
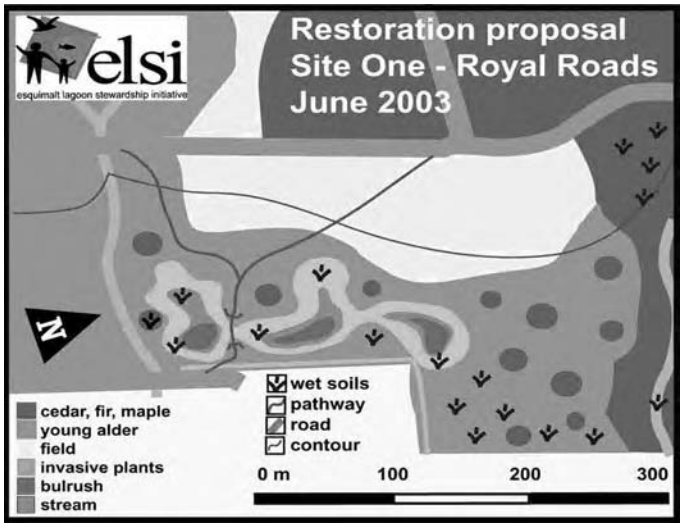


Figure 3: Illustration of proposed wetland and reforestation of Site One.

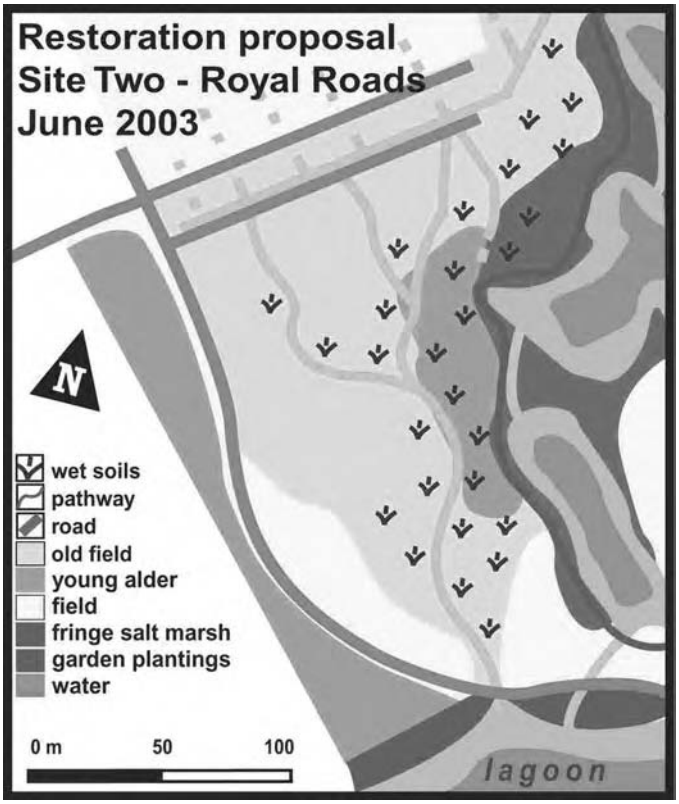


Site Two is adjacent to and south of the artificial pond complex near Hatley Castle (Figure 1). The site is bordered by a road to the south and west, and by the old greenhouse to the north. Extensive tile drainage systems, ditching, and indicator plants reveal a wetland that was converted to hay production around 1910. Left fallow for many years, a succession of alder, cattails, blackberry, and rushes are actively colonizing the parcel from the east side. Grounds staff have maintained a mown border at the southern end and along the road (Figure 4).

The prescription involves reforestation of 15 000 m^2 (1.5 ha) with several tree species fringed by a shrub border adjacent to the road (Figure 5). An interpretive pathway can be incorporated into the existing pond route to connect with the road at the northwest corner of the site. No earth moving is necessary.

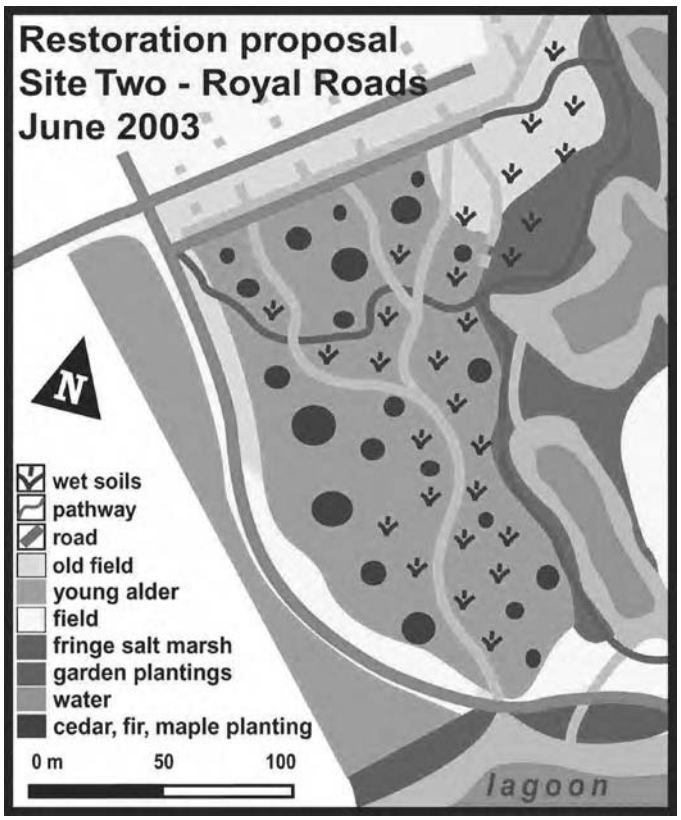
Site Two is also owned by the Department of National Defence and is leased by Royal Roads University. The University has identified this area as a sensitive wetland in planning documents and has no development plans for the site.

Figure 4: Site Two is a wet meadow draining directly into Esquimalt Lagoon.



Restoration at Esquimalt Lagoon - ER 390 Project for the RNS Program

Figure 5: Reforestation plan for Site Two. The upper right area is dominated by herbaceous marsh species and will not be planted. The target state for the remaining area is a cedar-skunk cabbage association with wet shrub meadow borders.



Project Objectives and Goals Ecology

Increasing the diversity and structure of the sites disturbed wetlands will provide enhanced ecological functions including nesting habitat, water quality improvements, and invertebrate food sources for migrating birds. Criteria for assessing the wetland construction project will use the "Proper Functioning Condition" (PFC) technique developed by the USDA Forest Service and the USDI Bureau of Land Management (USDI-BLM, 1993). This technique has been adapted for use as a tool for assessing eco-restoration projects by Aqua-Tex Scientific Consults Ltd (www.islandnet.com/~aqua-tex/).

Inland wetlands provide winter storm shelter and complementary fresh water foraging opportunities for migratory and resident birds (VNHS, 2003). Forested wetlands reduce storm pulses into the lagoon and promote stronger base flows. Water inputs to the lagoon from reforested sites will be cooler (with improved oxygenation), and will contain less nutrients (USEPA, 2003). More oxygen and less nutrients flowing into the lagoon especially during the late summer months is an important factor in reducing the trend of more frequent and severe catastrophic algal blooms, red tides, and paralytic shellfish poisoning events (Wanatabe, 1980). Many studies have been completed on the economic value of wetlands, suggesting that per acres values can exceed $1000 in ecological goods and services per year (Leschine et al, 1997).

Air photo analysis of the Royal Roads property reveals two striking trends: 1) urbanization has completely isolated the remaining forest; and 2) forest cover has dramatically increased since 1928 (Figure 6). What remains is a unique forested lagoon ecosystem with old growth qualities and diverse plant communities within the Capital Regional District. Some researchers consider this sanctuary *Victoria's Stanley Park*.

Figure 6: Air photos from 1926 and 2001 reveal the contrasting effects of forest re-growth and surrounding urbanization.

Recreation and Interpretation

Given the site's long history of human use, natural heritage and high recreational value, efforts to restore the ecological integrity of the area should also include consideration of the following:

- Eliminating recreational use (and impacts) in core areas while allowing for interpretive opportunities in the surrounding garden and recreational zones;
- Creating opportunities for citizen stewardship facilitated by institutional co- operation; and
- Designing for increasing and changing uses (i.e. expanding community, parkland development, and RRU growth).

Restoration at Esquimalt Lagoon - ER 390 Project for the RNS Program

volunteer opportunities over the long-term. When planting is completed then monitoring and sanctuary stewardship roles take on increasing importance. By incorporating interpretive pathways into the restoration design, visitors are actively guided away from sensitive core areas and the restoration site becomes a design element defining and complementing the manicured gardens and recreational zones nearby.

Project Costs

Site One: professional wetland design by a restoration ecologist with wetland experience is required. Precisely engineered elevations are required for proper hydrological functioning and planting design. Costs per square metre for wetland construction can be derived from a Greater Vancouver Regional District storm water management expenditure survey (1998). A backhoe operator with experience in wetland creation is also essential.

Wetland engineering design: 7 days x $500 per day *(site evaluation, survey, design, supervision)*	$3,500
Wetland gross costing: $26 - $55 per cubic metre Site One estimated at 5000 cubic metres	*$130,000
Backhoe (Hitachi 200 series) operator: 25 days x $100 per hr	$25,000
Dump truck and / or caterpillar: 14 days x $100 per hour	$13,000
Planting material: Range: $10 000 to $40 000 *(Density and area dependent, flexible, staged implementation)*	$25,000
Total cost	$196,500

Volunteer hours: 1000+ person hours planting and caring for material.

*Estimate based on low cost ($26/m^3) since storm water runoff is low and storm water retention is not desired. Removed wetland fill can be re-distributed onsite by dump truck or caterpillar, and access is good.

Total cost assumes all work is paid according to union rates (est. $25/hr), although much of the project cost can be offset by in kind donations of personnel and equipment.

Site Two: 15 000 m^2 re-vegetation area

Planting material: range: $10 000 to $40 000……$25,000
(Density and area dependent, flexible staged, implementation)

Volunteer hours: 1000+ person hours planting and caring for material.

Work Plan

- Presentation to ELSI July 7, 2003.
- Upon acceptance in principle, submit detailed budget and time line
- Secure funding source(s)
- Contract professional design services for wetland
- DND, RRU, ELSI approvals
- Wetland excavation in summer dry season
- Planting stock nursery project to run concurrently
- Stabilize open soil with mulch and bioengineered slope treatment prior to rains
- Install path network and first stage interpretive signage
- Planting wetland species and surrounding trees in wet season
- Second phase shade species planting when canopy closure eliminates broom/blackberry
- Conifer release in dense alder thickets (cut alder to increase light)
- Ivy, daphne and holly removal from existing alder forest
- Photopoint monitoring beginning before project implementation, ongoing

References

Esquimalt Lagoon Stewardship Initiative (ELSI) home page. Web document available at: http:///www.veheap.crd.bc.ca/elsi/

Pojar J. and A. MacKinnon (editors) 1994. Plants of Coastal British Columbia. Forest Service of British Columbia, Lone Pine Press.

GVRD 1998. Storm Water Management Practices and Expenditures Survey, Greater Vancouver Regional District.

Haegle, A., Smith, J., Nyman, J., 2003. Hydrological Investigation at Royal Roads Property, Victoria, B.C. Prepared for SEACOR Environmental Incorporated.

Restoration at Esquimalt Lagoon - ER 390 Project for the RNS Program

Jungen J.R. 1985. Soils of Southern Vancouver Island, Report No. 44 British Columbia Soil Survey, Ministry of Environment.

Klinka J. 1989. Indicator Plants of Coastal British Columbia. Province of British Columbia. UBC Press, Vancouver.

Leschine, T., Wellman, K. and Green, T. 1997. The Economic Value of Wetlands. Ecology Publication No. 97-100. Washington State Department of Ecology.Bellvue , Washington. Available at http://www.ecy.wa.gov/pubs/97100.pdf

McElroy, R., Meeres, V., and Pickett, L. 2002. Development of a Water and Sediment sampling and Monitoring Program for the Esquimalt Lagoon. Prepared for ELSI, MWLAP, RRU, and VEHEAP. http:///www.veheap.crd.bc.ca/elsi/publications.htm

Resources Inventory Committee. 1998. Standard for terrestrial ecosystem mapping in British Columbia. Ecosystem Working Group. Victoria, B.C.

Royal Roads University Campus Plan reference

U.S. Environmental Protection Agency. 2003. River Corridor and Wetland Restoration. Web Document available at http://www.epa.gov/owow/wetlands/restore

USDI-BLM. 1993. Riparian area management: process for assessing proper functioning condition. Tech.Ref. 1737-9. Bureau of Land Management, Service Centre, Denver, Colorado.

Shephard, M.G.1999. Victoria and Esquimalt Harbours Bird Census, 1997-1999. Report prepared by Orca Technologies International Inc. Victoria, B.C. For the Victoria and Esquimalt Harbours Environmental Action Plan.

Wanatabe, L.N. ND Robinson, M.G. 1980. The ecology of Esquimalt Lagoon: 1. Nutrient Inputs – the role of sewage. UnpublishedMS report. No.80-2, Esquimalt, B.C.

Appendix 1

Planting list of representative species for Site One wetlands

Emergents – water depth 0.4 m or less
Common rush (*Juncus effusus)*
Sedges (*Carex spp*.)
Small flowered bulrush (*Scirpus microcarpus*)
Tule (*Scirpus lacustris)*
Skunk cabbage (*Lysichiton americanum*)
Buckbean (*Menyanthes trifoliata)*

Aquatics – water depth 1 m or more
Wapato (*Sagittaria latifolia*)
Watershield (*Bresenia schreberi)*
Spatterdock (*Nuphar polysepalum*)
Water smartweed (*Polygonum amphibium)*

Wetland sites typically experience spontaneous colonization of opportunitstic species that should not be planted (e.g. cattails *Typha latifolia)*

Planting list of representative species for both Sites One and Two

Trees
Red alder (*Alnus rubra)*
Red cedar (*Thuja plicata*)
Big leaf maple (*Acer macrophyllum*)
Douglas fir (*Tseudotsuga menziesii*)
Grand fir (*Abies grandis*)
Cascara (*Rhamnus purshiana*)
Bitter cherry (*Prunus emarginata*)
Pacific crabapple (*Malus fusca)*

Shrubs
Hard hack (*Spirea douglasii*)
Ocean spray (*Holodiscus discolor*)
Saskatoonberry (*Amelanchier alnifolia*)
Pacific ninebark (*Physocarpus capitatus*)
Nootka rose (*Rosa nutkana*)
Salmonberry (*Rubus spectabilis*)
Thimbleberry (*Rubus parviflorus*)
Red elderberry (*Sambucus racemosa*)
Snowberry (*Symphoricarpus albus*)

Purple Martin Origins and Relationships

***Cam Finlay*[1] *and Laura Darling*[2]**

[1] *270 Trevlac Place, Victoria, BC V81 3Z1*
Tel: (250) 479-9833 • Email: j&cfinlay@telus.net
[2] *Park and Protected Areas Branch, Ministry of Water, Land and Air Protection*
Tel: (250) 387-4661 • Email: laura.darling@gems7.gov.bc.ca

Permit #: *P044-03* ***Start Date:*** *April 15, 2003*
Location: *Colwood* ***Completion Date:*** *August 30, 2003*

Overview

The Purple Martin (*Progne subis)* is on B.C.'s Red List and it is found nesting at Colwood (Figure 1), one of 14 known colonies of man-made nest boxes in B.C. Nestlings banded at 11 sites in 1997-2003 have been re-sighted at different colonies than their natal colonies including Washington and Oregon. We suspect the B.C. colonies represent a single intermixed population but further confirmation is required. Purple Martin populations are on the increase in B.C. and the American coastal states, and they appear to be recovering in association with availability of man-made nest boxes. It is possible that the current population is derived from the few birds that adapted to man-made nest box colonies. However, preliminary results from the DNA study mentioned below indicate that there does not seem to be a genetic bottleneck and inbreeding, but rather a very diverse genetic makeup of the population with an influx of birds coming north from Washington.

Objectives

1. To continue banding nestlings in nest boxes at the site;
2. To monitor nest success and productivity; and
3. To monitor for band returns, particularly to look for coloured bands on early returns at the beginning of the season, as part of an on-going nest box monitoring and maintenance program.

Methodology

1. Visit colonies throughout southwestern B.C. to identify individuals banded in B.C. in previous years. At least 98% of all nestlings produced at known breeding locations in B.C. in the past five years were banded with individually numbered coloured plastic bands that are visible and readable with a spotting scope, binoculars and a trained eye.

2. Fifteen visits were made to the Colwood site between April and August for observations and nest box checks and banding of nestlings.

Results to Date

115 nestlings were banded in 2003 up from 58 nestlings that were banded at the site in 2002, and up from 123 nestlings banded there in 2001, down from 119 plus two adults in 2000. Of the 52 solid nest boxes at the site, 32 had eggs or young, but only 29 had nestlings that were banded. Two boxes had eggs that failed to produce young and one box was unreachable but used by martins. There was an average of 3.97 eggs per pair. There were 22 adult birds sighted that had been banded in B.C. in previous years. Of these, 12 had been banded at the Colwood site in previous years.

Purple Martin Origins and Relationships

Additional Research

Blood was collected from California this past summer, which was the first collected since 1999. The samples taken prior to this year were analyzed as noted in an earlier report. The California samples are to be analyzed in the very near future with final results hopefully due in 2004. This DNA work is part of an overall study of the origin of the Western martins including B.C., Washington, Oregon and California plus some birds east of the Rockies including Alberta, Manitoba, Ontario and Pennsylvania. The establishment of the relationship between the western and eastern populations is important for the management of this endangered species in the west.

Figure 1:
Purple Martin (*Progne subis*) **nest boxes at Colwood.**

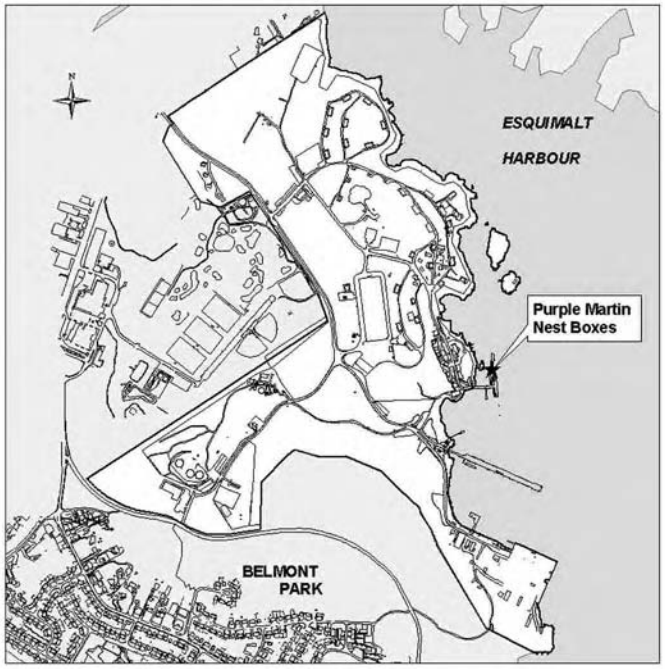


Photo: N. Ayotte

Purple Martin (*Progne subis*) Nest Boxes at Colwood

Photo: N. Ayotte

Purple Martin on a nest box

Environmental Technology Program Field Trip to Rocky Point

Dianne Humphrey

Environmental Technology Program, Camosun College, 3100 Foul Bay Rd, Victoria, BC V8P 5J2
Tel: (250) 370-3432 • Email: Humphrey@camosun.bc.ca

Permit #: *P075-03*
Location: *Rocky Point - Forest Canopy Research Station*
Start Date: *June 20, 2003*
Completion Date: *June 20, 2003*

Overview

The Environmental Technology Program Field Trip at Camosun College provides first-year Environmental Technology students with the opportunity to view an old-growth forest (Forest Canopy Research Station) at Rocky Point. The students gain a first hand impression of an old-growth forest in order to compare it to a second-growth forest and newly harvested areas. Students also see ongoing projects on the eradication of invasive species such as Scotch broom and gorse.

Objectives

1. To introduce students to an old-growth forest; and
2. To view the Forest Canopy Research Station and learn about past and present canopy studies.

Activities

The spring 2003 Environmental Technology Year 1 class toured Rocky Point under the guidance of Mr. Arthur Robinson of the Pacific Forestry Centre on June 20, 2003. This class had an opportunity to view the Forest Canopy Research Station and experience the old-growth forest. They recorded information and the impact of this area in their field notes for later comparison to a second-growth forest and a newly forested area. The experience was extremely worthwhile and hopefully can be repeated in subsequent years.

Students learned about the general history of the Rocky Point property and the on-going invasion of Scotch broom and gorse. The students will be able to draw upon this information in further program endeavors.

Extension

Students in the first year seminar class hear about CFB Esquimalt properties in a lecture on environmental legislation by Mr. Duane Freeman of the Formation Environment Office at CFB Esquimalt. He mentions Race Rocks and the various levels of legislation that pertain to the development of the islands as a Marine Protected Area. He also refers to respectful co-operation among project leaders and the local First Nations Peoples whenever evidence of ancestral activities is discovered. To hear similar information from Mr. Robinson at Rocky Point and to physically see ancestral burial mounds and Race Rocks is valuable to the students.

Mr. Freeman refers to techniques used in Whirl Bay to mitigate the impact of underwater detonations. It is most interesting to see where the action occurs. Several students have obtained co-op work terms with DND and have enjoyed working on projects that involve Rocky Point investigations. Their initial visit to the property and the background provided by Mr. Robinson provide valuable background for the students.

Inventory of Rare Garry Oak Butterflies and Rare Forest Gastropods at Aldergrove, Matsqui and Colwood

Jennifer Heron

Ministry of Water, Land and Air Protection, Biodiversity Branch, Terrestrial Ecosystems Science Section, UBC Campus, 2204 Main Mall, Vancouver, BC V6T 1Z4
Tel: (604) 222-6760 or (604) 812-8198 • Email: jmheron@victorial.gov.bc.ca

Permit #: *P094-03*
Location: *Aldergrove, Matsqui and Colwood*
Start Date: *April 10, 2003*
Completion Date: *On-going*

Overview

There are four butterfly species (Dun Skipper, Island Blue, Island Large Marble, and Taylor's Checkerspot) and two snail species (Oregon forestsnail and Puget Oregonian snail) that are nationally at risk within Canada. These species could potentially occur on federal lands and because these lands have not been adequately or recently inventoried, it is essential that inventories be conducted. Butterflies and gastropods can have patchy distributions and even if properties have been surveyed in the past, it does not conclude the species' presence.

Objectives

1. To inventory rare Garry oak butterflies and forest snail species; and

2. If these species are present, observe their habitats, behaviour and collect information about their habits.

Methodology

• Observation of butterflies by catch and release using a butterfly net.

• Observation of snails by leaving cardboard in the forest for a week and returning to look under the cardboard to see if the snails have taken up residence. Snail inventory would also be completed by a manual search of appropriate habitats for the snails.

Results to Date

Surveys were not carried out on CFB Esquimalt properties this year, however surveying is anticipated in 2004.

Thermal Characteristics of Townsend's Big-eared Bat Roosts

Vanessa Craig, Ph.D., R.P.Bio., EcoLogic Research

406 Hemlock Ave, Gabriola Island, BC V0R 1X1
Tel: (250) 247-7435 • Email: vjcraig@shaw.ca

Permit #: *P086-03* ***Start Date:*** *July 2002*
Location: *Mary Hill* ***Completion Date:*** *July 2005*

Overview

This project examines the temperature characteristics of current known roost sites of the Blue-listed Townsend's Big-eared Bat (*Corynorhinus townsendii, COTO*) at the northern limit of its range. It is a continuation of the project started in 2002, funded by Bat Conservation International. Little is known about the roost requirements of Townsend's Big-eared Bats, especially in British Columbia.

In year 2 of this study, temperature monitors were placed at known maternity roost sites and hibernacula of COTO along coastal B.C., including the Mary Hill property. The data can be used to develop a profile of habitat requirements for this species in B.C. The project is scheduled to continue for three years to collect data suitable for publication in a scientific journal.

Objectives

1. Collect data on the temperature characteristics of known roost sites of the rare Townsend's Big-eared Bat, including the Mary Hill property;

2. Build bat houses suitable for the Townsend's Big-eared Bat on Denman and Hornby Islands. One bat house (on Denman) has been completed to date and temperatures are being recorded at this site. The temperatures of the bat houses will be compared with known roost sites to determine whether the design is suitable or should be modified; and

3. Write a scientific paper for publication in a scientific journal.

Methodology

The methodology for monitoring temperatures of the Townsend's Big-eared Bat roost at the Mary Hill site will be the same as followed in 2002.

A temperature monitor will be placed inside the Command Post building where the Townsend maternity colony is based. The temperature recorders will be programmed to record temperature once per hour. Visits to the colony will be timed and conducted to ensure minimal disturbance to the bats. The original visit to install the temperature monitor is proposed to occur in May, when the colony will not have formed. Removal of the monitor will occur in October after the colony has left. The site will be visited on 1-2 additional occasions to determine the size of the colony. A paired temperature monitor will be placed outside to monitor ambient temperature.

During the October site visit, temperature monitors will be placed in the tunnels where the Townsend's Big-eared Bat colony hibernates. To minimize any disturbance to hibernating bats, monitors will be programmed to record temperature every three hours.

Results to Date

This project is able to build on the data collected from 1995-1999 by Dave Nagorsen (at that time with the Royal British Columbia Museum). In 1996, steel doors on tunnels were modified to be bat-friendly. Continued vandalism of the site prompted the ending of the project early in 1999.

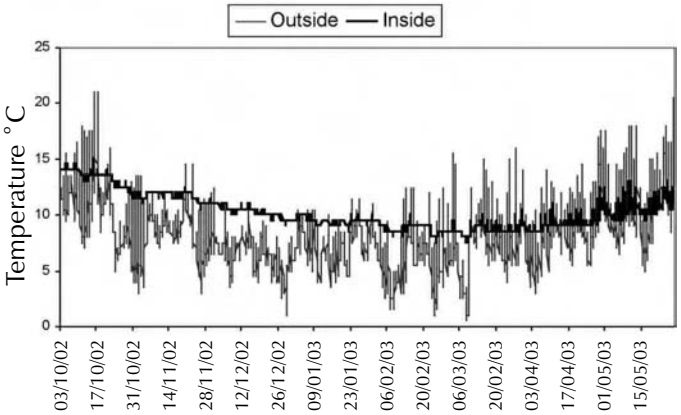
Thermal Characteristics of Townsend's Big-eared Bat Roosts

Disturbance to the Mary Hill site appears to be minimal; all gates and locks were still in place during a site visit on May 27, 2003.

The colony was already in place during the visit in May; approximately 30 females were observed at the site. This suggests that the colony might have increased slightly in size since July 2002, when 30-35 bats (including pups) were observed at the site.

Temperatures inside the hibernaculum were much more stable than outside temperatures (Figure 1), and for most of the period where bats would be expected to be hibernating (November through April), temperatures inside were warmer than outside temperatures. This constancy of temperatures is important for hibernating bats.

Figure 1: Temperatures outside and inside the hibernaculum from October 2002 to May 2003



Temperatures inside the hibernaculum during the hibernation period ranged from 7.5˚C to 13˚C (Figure 1), which is a fairly typical temperature range. Temperatures at the other cave hibernaculum, monitored during this study, were slightly cooler and ranged between 4.5˚C to 11˚C. Temperatures reported from other coastal hibernacula ranged from 0˚C to 4˚C (Island Karst Research 1997) and 8˚C to 10˚C (Nagorsen and Brigham 1993). These temperature ranges are also similar to those reported from the United States (Pierson et al. 1999).

During this period we completed building bat houses on Denman and Hornby Islands that we hope are suitable for C. townsendii. The houses are 8 x 10 sheds with an asphalt shingle roof and metal skirting to prevent predators from entering the roost. The Hornby bat house will also be shingled in winter 2003-04. The door folds down to allow access by researchers to the roost. Future temperature data collection at these sites will be compared with data from other known sites, including the Mary Hill maternity roost, to determine whether these constructed roosts have suitable temperature profiles.

Research Activities

Monitors installed to record temperatures at the hibernaculum in winter 2002-03 were removed in May. Temperature data was not collected at the hibernaculum winter 2003-04. In May 2003, a temperature monitor was installed at the Command Post inside the room with the maternity colony, and another was placed outside on the north side of the building to measure ambient temperature. The monitors will be removed in March. New monitors will be installed in March to monitor conditions inside the maternity roost in summer 2004.

Literature cited

Island Karst Research. 1997. Thetis Island bat caves: fencing estimates and location mapping. Unpublished report prepared for: Ministry of Environment, Lands and Parks. 23 pp.

Nagorsen. D.W., and R.M. Brigham. 1993. Volume 1: The Mammals of British Columbia. Bats of British Columbia. Royal British Columbia Museum Handbook. 164 pp.

Pierson, E.D., M.C. Wackenhut, J.S. Altenbach, P. Bradley, P. Call, D.L. Genter, C.E. Harris, B.L. Keller, B. Lengus, L. Lewis, B. Luce, K.W. Navo, J.M. Perkins, D. Smith, and L. Welch. 1999. Species conservation assessment and strategy for Townsend's big-eared bat (*Corynorhinus townsendii townsendii* and *Corynorhinus townsendii pallescens*). Idaho Conservation Effort, Idaho Department of Fish and Game, Boise, Idaho.

Acknowledgements

Bat Conservation International provided the funding for this project for year 1. I thank David Nagorsen for supplying information about the history of the site, and locations of bats. The Ministry of Water, Land and Air Protection supported this research.

Oregon White Oak Acorn Production Study

David Peter[1] ***and Paul Courtin***[2]

[1] *Ecologist, Constance Harrington, Research Forester U.S. Forest Service, Olympia Forestry Sciences Laboratory, 3625 93rd Avenue SW, Olympia, Washington 98512-9193 • Email: dpeter@fs.fed.us*
[2] *BC Ministry of Forests, 2100 Labieux Rd, Nanaimo, BC V9T 6E9*
Tel: (250) 751-7120 • Email: Paul.Courtin@gems7.gov.bc.ca

Permit #: *P079-02*
Location: *CFMETR, Mary Hill and Rocky Point*
Start Date: *September 1, 2003*
Completion Date: *Long term*

Overview

The Oregon white oak (Garry oak) acorn productivity study was initiated in the summer of 1999 to explore factors influencing acorn production. Reasons for doing this study include: Garry oak ecosystems are rapidly disappearing or changing due to introduction of exotics, fire suppression and land conversion for agricultural and urban uses. Acorns are a rich source of food for many wildlife species and are important for oak regeneration and dispersal. There is little published information on acorn crop sizes in Garry oak. This project is intended to be long term and range wide. A minimum of 10 years data collection is anticipated in order to evaluate acorn production periodicity and climatic influences. The 5th season of data collection has been completed. The sample range now includes sites from British Columbia to southern Oregon or about the northern 2/3 of the range of the tree form of the species. Because the range of the species is so large and the sampling season so short (late August to early October), we depend on a network of volunteers and cooperators to help collect acorn abundance data. In British Columbia, our cooperators since 2001 have been Paul Courtin of B.C. Ministry of Forests and Kevin Brown, a private contractor. The DND has cooperated by granting survey access to oak stands on several of their holdings. To assist our volunteers and inform the general public, we have 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/oaksurvey/oak.htm.

Objectives

The project will determine how common good and bad acorn crops are, the variation in production between places and the environmental and biological factors that influence production. We want to understand the conditions contributing to both individual tree and stand level production. This includes both local and regional environmental factors, biological interactions and community succession. We want to obtain as wide a sample as possible to determine if regional differences in acorn production exist.

Methodology

The acorn survey is conducted using an ocular estimation method developed by Graves (1980) for survey of oaks in California. Acorns are surveyed from the latter part of August to the first week of October, depending on the site and acorn development. Acorn production is scaled with a 1-4 coding system with 1 indicating no acorns produced by a tree and 4 indicating production of a very heavy crop. The method was designed for use with volunteers and tests with volunteers have shown it to be reliable (Graves 1980). Mean acorn codes are used in this report to indicate relative acorn production between sites. It is a simple, intuitive metric, however it should be understood that acorn codes are not evenly spaced estimates of abundance. Counts of acorns in a small sample of trees averaged 0.2 acorns/square metre of external crown surface area. A code 3 averaged about 1.6 acorns/square metre. Thus, a code 3 had about 8 times as many acorns as a code 2 on the average. Code 4 crops probably increase above a code 3 by a similar amount. A range of site and tree data is also collected. Site data such as slope, elevation, aspect, and others

Oregon White Oak Acorn Production Study

characterize the physical setting of the tree which affects tree vigor and acorn production. Also collected are data indicating the anthropogenic setting such as irrigation, fertilization, urban or agricultural settings. Tree data including diameter at breast height (dbh), tree height, crown diameter, tree shape, health, and others allow evaluation of the tree's vigor, size and competitive position.

Results to Date

Fifty-four trees were sampled in 2001, 203 in 2002, and 199 in 2003 on or near Vancouver Island. The decrease in the number of trees in 2003 is attributed to the lack of access to one of the sites and to tree mortality. Figure 1 shows the distribution of sample sites from 2002.

Observations of acorn production have also been made south to southern Oregon with the help of volunteers and cooperators. To date, 1408 trees have been sampled of which 241 have been sampled in all five years and 264 in four years. In 2003, 1337 trees were sampled.

Table 1 shows mean acorn codes from several locations on Vancouver Island. More southerly natural locations have produced slightly better than more northerly locations. Trees near wetlands and in lawns or similar cultivated locations produced the best on Vancouver Island.

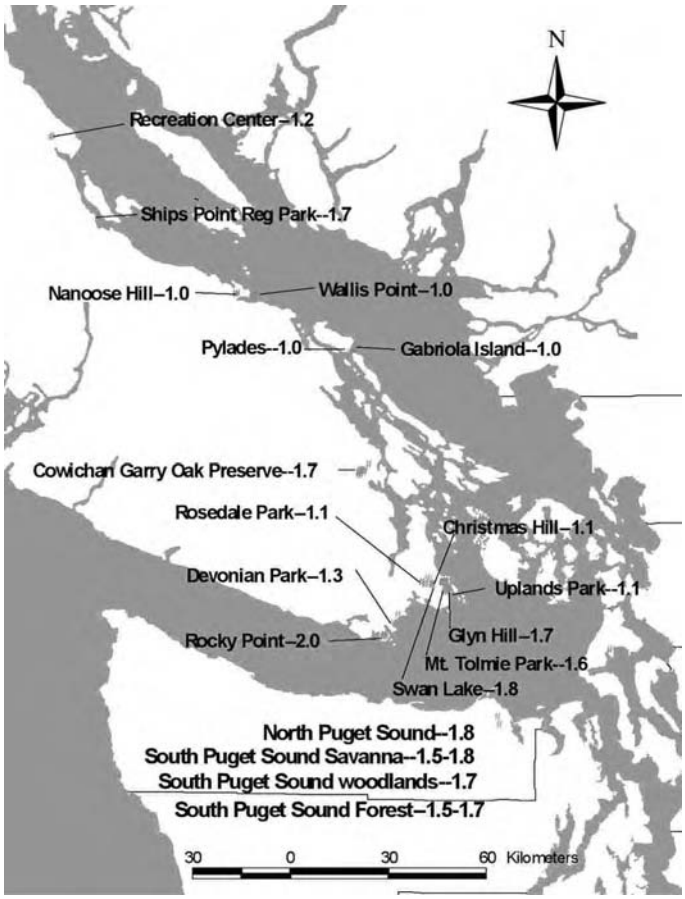
Table 1. Mean acorn codes for Vancouver Island sites.

	2002 mean	2003 mean	mean for all years**
North	1.5	1.2	1.2
South*	1.5	1.3	1.4
Trees < 5 cm dbh	1.1	1.2	1.2
Lawns, etc.	2.4	2.3	2.3
Wetland Edges	1.9	2.2	2.0

* Includes Duncan sites and all sites farther south.
** Includes 2001, 2002 and 2003 data.

Figure 1 shows the sampling sites on Vancouver Island and mean acorn codes for several locations. Rocky Point was the highest producing site with a mean code of 2.0. Several of the northern sites produced the least with mean codes of 1.0. Shown for comparison are several mean codes for sites in the Puget Sound Region (survey years from 1999-2002). North Puget Sound sites, exclusive of wetlands and cultivated sites had, on average, an acorn code of 1.8. South Puget Sound savannas averaged 1.5-1.8, woodlands averaged 1.7, and oak forests 1.5-1.7.

Figure 1. Southern Vancouver Island sites included in the oak acorn survey. Mean acorn codes for 2001-2003 are shown for several locations.



Survey wide (Oregon-Vancouver Island), the most productive sites tend to be warm and well watered. Eastern Washington riparian sites averaged 2.7. A site near Medford, Oregon with a high water table averaged 2.2. Wetland edge sites from Vancouver Island to Oregon averaged 2.2, but trees located within wetlands have only averaged 1.4. Cultivated

Oregon White Oak Acorn Production Study

sites throughout the survey area including lawns, gardens and cultivated pastures averaged 1.9. Young trees are poor producers. Trees, with a diameter of 5 cm or less, averaged only 1.1 across the survey area. The youngest producing trees in the survey (about 10 years old) are trees planted by a freeway interchange in southern Vancouver Island, but elsewhere trees have generally not produced acorns until about 20 years.

Acorn production is influenced by competition (measured by basal area, tree shape and crown contact), moisture (indicated by precipitation, available soil water capacity), age, and fire history. Productivity was highest on well-watered, but well-drained sites on trees at least 60-80 years old growing with little competition from neighbours. Our data suggests that prescribed underburning reduces acorn production in the year immediately following burning, but also contributes to higher production 6-10 years after underburning.

The results of the 1999 survey were analyzed and published in Northwest Science (Peter and Harrington 2002). Data from 1999 and 2000 are available in summarized form on our web site:
www.fs.fed.us/pnw/olympia/silv/oaksurvey/oak.htm.

Other information about the project including background, protocols and contact information are also available on the website.

Discussion

Garry oak produces more acorns on warm, fertile, well-watered sites with adequate soil aeration. High production on well-watered eastern Washington and southern Oregon sites show the importance of warm summers with adequate moisture. Production is high next to streams, but drops rapidly upslope with increasingly droughty soils. Even so, eastern Washington sites generally produce more acorns than western Washington sites, but acorn production is often arrested before maturity in the driest upland sites. The importance of soil moisture is also shown by higher production along wetland edges where roots can reach a dependable source of water without being inundated. Irrigated lawns and parks provide similar conditions and have produced well on average. Acorn production drops when trees grow in wetlands where inundation probably creates anaerobic conditions in the rooting zone for long periods of time. Garry oak can tolerate considerable inundation, but survey trees growing in slough sedge (*Carex obnupta*) wetlands have produced few to no acorns during the survey period. Competition from other trees can reduce acorn production, but only when it becomes severe. Thus, woodland trees in the South Puget Sound have produced as well as savanna trees, but better than oak or oak-conifer forest trees. The response of oak to fire may reflect both a fertilization effect and competition control. Fire, even relatively low intensity burns, can damage acorn production in the year following the fire. However, if the trees are not severely damaged acorn production recovers in 2-3 years. Thereafter, acorn production in underburned trees is greater for up to ten years than in trees that have not been underburned.

References

Graves, W. C. 1980. Annual oak mast yields from visual estimates. Pages 270-274 In T. R. Plumb (technical coordinator), Proceedings of the Symposium on the Ecology, Management, and Utilization of California Oaks, USDA Forest Service General Technical Report PSW-44. Pacific Southwest Forest and Range Experiment Station Berkeley, California.

Peter, D. and C. Harrington. 2002. Site and tree factors in Oregon white oak acorn production in Western Washington and Oregon. Northwest Science, 76(3):189-201.

Victoria and Sooke Christmas Bird Counts

David Allinson

Victoria Natural History Society, 572 Atkins Ave., Victoria, BC V9B 3A3
Tel: (250) 391-1786 • Email: passerine@shaw.ca

Permit #: *P095-03*
Location: *Albert Head, Heals Rifle Range, Rocky Point, and Mary Hill*

Start Date: *May 2003*
Completion Date: *December 31, 2003*

Overview

Since 1900, the Christmas Bird Count (CBC) has become 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 analysed and are currently compiled for more than 1700 counts by the National Audubon Society and Bird Studies Canada. However, significant habitats found on Department of National Defence properties were usually off-limits to Victoria and Sooke CBC's compilers. Albert Head and Heals Rifle Range were covered during the Victoria Christmas Bird Count (CBC) on December 20th, 2003, while Rocky Point and nearby Mary Hill were covered during the Sooke CBC on December 27th, 2003.

Objectives

To obtain a more complete picture of bird distribution in both the Victoria and Sooke count areas for the Christmas bird count.

Methodology

The methodology for carrying out the bird count is as follows:

1. A winter survey was carried out in December. Depending on the site, a two to four hour survey was carried out with all birds seen and heard in the area being identified and recorded. Teams of two and six observers participated in coverage efforts.

2. The data will be summarized and a report prepared.

Results

In the past, the Albert Head site has proven to be rich in bird biodiversity with as many as 70 bird species using the area in winter both for shelter and feeding. In particular, terrestrial and pelagic species are well represented here. In fact, the Witty's Lagoon sub-area, adjacent to Albert Head, has yielded over 90 species on previous counts and is typically among the top three counts for Victoria. This year Albert Head produced 62 species (Table 1), including locally uncommon winter birds such as Spotted Sandpiper, California Gull, Hermit Thrush, as well as the only Red Phalarope tallied for the Victoria CBC. Of interest, Victoria managed to place second overall in Canada with 137 species.

The Heals Rifle Range site is only one section within the Butchart Gardens-Northern Highlands sub-area within the Victoria CBC count circle. While only 15 species were tallied there this past CBC (Table 2), the leader recognized its potential especially for diurnal and nocturnal raptors with ample evidence of rodents. If this site is to be covered again, the leader planned to go there earlier in the day.

The Rocky Point and Mary Hill sites were both sub-areas onto themselves, but comparing their results to entire Sooke CBC, indicate the importance and significance of both sites. Over 1.5 hours of coverage, Mary Hill produced an impressive 25 species and three locally uncommon winter species were tallied there (Townsend's Warbler, Turkey Vulture, and Hermit Thrush) (Table 3). Rocky Point produced 64 species, including Ring-necked Duck, Turkey Vulture, California Gull, Northern Pygmy-Owl, Hermit Thrush, and Savannah Sparrow (Table 4). The two sites combined for 67 species, which is 63% of total species diversity for the Sooke CBC (106 species). The 2003 CBC results from these

Victoria and Sooke Christmas Bird Counts

four sites produced 70 species and 9437 individuals. The individual tally is particularly interesting as their total represents almost 10% of the combined Victoria and Sooke CBC's individual totals. It is quite evident that all these sites are worth repeated coverage to produce long-term trends.

Table 1: Albert Head Christmas Bird Count - 12/20/03

Species	# sightings
Red-necked Grebe	54
Western Grebe	2
Canada Goose	7
American Wigeon	4
Mallard	10
Harlequin Duck	1
Surf Scoter	4
White-winged Scoter	4
Bufflehead	5
Common Goldeneye	1
Hooded Merganser	4
Common Merganser	6
Red-breasted Merganser	5
Red-throated Loon	1
Pacific Loon	15
Common Loon	1
Brandt's Cormorant	324
Double-crested Cormorant	20
Pelagic Cormorant	3
Bald Eagle (adult)	2
Bald Eagle (immature)	1
Black Oystercatcher	1
Spotted Sandpiper	1
Black Turnstone	5
Surfbird	1
Red Phalarope	6
Mew Gull	5000
California Gull	1
Thayer's Gull	60
Western Gull	1
Glaucous-winged Gull	90
Common Murre	230
Pigeon Guillemot	9
Marbled Murrelet	2
Ancient Murrelet	2
Rhinoceros Auklet	25
Rock Pigeon	25
Downy Woodpecker	1
Hairy Woodpecker	1
Northern Flicker	13
Northwestern Crow	2
Common Raven	1
Chestnut-backed Chickadee	54
Bushtit	4
Red-breasted Nuthatch	5
Brown Creeper	3
Bewick's Wren	1
Winter Wren	6
Golden-crowned Kinglet	30
Ruby-crowned Kinglet	8
Hermit Thrush	2
American Robin	32
Varied Thrush	4
European Starling	11
Spotted Towhee	15
Fox Sparrow	6
Song Sparrow	7
Golden-crowned Sparrow	22
Dark-eyed Junco	16
Purple Finch	1
House Finch	30
Red Crossbill	28
Pine Siskin	10
Total Species	62
Individual Totals	6246

# of hours: 2.5
# of hours owling: 0
By car: 3 km
By foot: 6 km
# of observers: 4 (David Allinson, Rod Mitchell, Robert Hadley and Rob Gowan)

Victoria and Sooke Christmas Bird Counts

Table 2: Heals Rifle Range Christmas Bird Count - 12/20/03

Species	# sightings
Bald Eagle (adult)	1
Red-tailed Hawk	2
Downy Woodpecker	1
Northern Flicker	11
Northwestern Crow	200
Common Raven	5
Chestnut-backed Chickadee	6
Bushtit	7
Red-breasted Nuthatch	1
Winter Wren	5
Golden-crowned Kinglet	1
Ruby-crowned Kinglet	1
Fox Sparrow	1
Song Sparrow	1
Pine Siskin	285
Total Species	**15**
Individual Total	**528**

# of observers: 3 (Warren Drinnan, Robin Robertson and Dannie Carsen)

Table 3: Mary Hill Christmas Bird Count - 12/27/03

Species	# sightings
Turkey Vulture	1
Bald Eagle (adult)	1
Glaucous-winged Gull	12
Hairy Woodpecker	1
Northern Flicker	3
Steller's Jay	1
Common Raven	2
Chestnut-backed Chickadee	30
Bushtit	6
Red-breasted Nuthatch	2
Brown Creeper	1
Winter Wren	6
Golden-crowned Kinglet	27
Ruby-crowned Kinglet	4
Hermit Thrush	1
American Robin	16
Varied Thrush	7
Townsend's Warbler	1
Spotted Towhee	3
Fox Sparrow	1
Song Sparrow	2
Golden-crowned Sparrow	4
Dark-eyed Junco	10
Red Crossbill	4
Pine Siskin	6
Total Species	**25**
Individual Totals	**152**

# of hours: 1.5 By foot: 1.5 km
By car: 0.5 km # of observers: 1 (David Allinson)

Table 4: Rocky Point Christmas Bird Count - 12/27/03

Species	# sightings
Canada Goose	31
Mallard	22
Ring-necked Duck	19
Harlequin Duck	2
Surf Scoter	17
Bufflehead	92
Common Goldeneye	2
Hooded Merganser	5
Common Merganser	8
Red-breasted Merganser	19
California Quail	1
Pacific Loon	3
Common Loon	1
Brandt's Cormorant	18
Double-crested Cormorant	46
Pelagic Cormorant	3
Great Blue Heron	4
Turkey Vulture	1
Bald Eagle (adult)	5
Bald Eagle (immature)	2
Cooper's Hawk	1
Red-tailed Hawk	3
Black Oystercatcher	1
Black Turnstone	7
Surfbird	3
Mew Gull	850
California Gull	1
Thayer's Gull	45
Glaucous-winged Gull	475
Common Murre	259
Pigeon Guillemot	1
Rock Pigeon	1
Northern Pygmy-Owl	1
Belted Kingfisher	1
Downy Woodpecker	4
Hairy Woodpecker	3
Northern Flicker	31
Pileated Woodpecker	1
Steller's Jay	2
Northwestern Crow	3
Common Raven	6
Chestnut-backed Chickadee	19
Red-breasted Nuthatch	4
Brown Creeper	3
Bewick's Wren	2
Winter Wren	16
Marsh Wren	3
Golden-crowned Kinglet	63
Ruby-crowned Kinglet	9
Hermit Thrush	4
American Robin	67
Varied Thrush	12
European Starling	8
Spotted Towhee	6
Savannah Sparrow	1
Song Sparrow	5
Golden-crowned Sparrow	4
Dark-eyed Junco	76
Red-winged Blackbird	8
Purple Finch	1
House Finch	13
Red Crossbill	9
House Sparrow	3
Pine Siskin	175
Total Species	**64**
Individual Totals	**2511**

# of hours: 6.5
# of hours owling: 1
By car: 17 km
By foot: 5 km
# of observers: 2
(David Allinson and Andrew Harcombe)

A Pilot Monitoring Program for Plethodontid Salamanders On Vancouver Island, British Columbia

Kristiina Ovaska[1], Lennart Sopuck[2], Christian Engelstoft[3] and Kathy Paige[4]

[1,2] *Biolinx Environmental Research Ltd., 1759 Colburne Place, Sidney, BC V8L 5A2*
Tel: (250) 656-8981 • Email: biolinx@shaw.ca
[3] *Alula Biological Consulting, 1967 Nicholas Road, Saanichton, BC V8M 1X8*
Tel: (250) 652-9770 • Email: alula.bc@telus.net
[4] *Ministry of Water, Land and Air Protection, 2875 Jutland Rd., Victoria, BC - P.O. Box 9374 Stn Prov. Gov*
Tel: (250) 356-7788 • Email: Kathy.paige@gems4.gov.bc.ca

Permit #: *P088-03*
Location: *Rocky Point and Royal Roads*
Start Date: *May 1, 2003*
Completion Date: *Phase 1 – November 30, 2003*

Overview

Forest-dwelling plethodontid salamanders (*Amphibia, Caudata, Plethodontidae*) are very sensitive to environmental perturbations that cause changes to the moisture or temperature regimes on the forest floor, and can be used as indicators of ecosystem health and biodiversity. We set up a pilot salamander monitoring program at two sites on southern Vancouver Island with the Western Red-backed Salamander (*Plethodon vehiculum*) as the focal species and conducted surveys to determine optimal sampling parameters. The set-up of the program followed recommendations for a national monitoring protocol for plethodontid salamanders developed jointly by the Ecological Monitoring and Assessment Network (EMAN) and Parks Canada. One of the study sites is in an old-growth coniferous forest on the Rocky Point peninsula; a second EMAN plot in the same area in Garry oak habitat was deemed unsuitable for monitoring salamander populations based on preliminary surveys. The other site that was selected is within a mature second-growth/old-growth coniferous forest on the Royal Roads property (upland forest ecological monitoring plot).

Objectives

1. To initiate the collection of data of the abundance of plethodontid salamanders at the Rocky Point and Royal Roads study sites as an initial step for establishing an ecological monitoring program; and

2. To determine sampling parameters (such as statistical power for detecting a trend; sample size required) from preliminary data.

Methodology

Cover-boards are an effective method for sampling salamanders and allow for repeated surveys with minimal disturbance to the forest floor. In December 2002, at both sites, we set up layered [91.5 cm (3 feet)-long] cover-boards on three sides around the perimeter of three 20 m x 20 m quadrats that contained vegetation plots managed by researchers from the Royal Roads University (15 boards per quadrat; 45 boards/site in total). This configuration facilitates the linking of habitat attributes to salamander population fluctuations. The number of cover-boards used was a rough estimate based on preliminary surveys of existing cover-boards [183 cm (6 feet)-long, layered boards], which were established at both Rocky Point EMAN plots in 1996 by the former B.C. Ministry of Environment, Lands and Parks. Because of their non-standard configuration and decayed stage, which made inspection difficult, it was necessary to remove all old boards. We re-used the least-decayed of these boards (at a ratio of 1:3 old to new boards) to examine the effect of cover-board age in attracting salamanders.

Results to Date and Discussion

Inspections of the cover-boards in spring 2003, about six months after their installation, resulted in a total of 70 captures of the Western Red-backed Salamander at the two sites during three inspections in May and an additional inspection of the Royal Roads site in June. There were 30 captures of 27 individuals at the Rocky Point site and 40 captures of 33 individuals at the Royal Roads site. The counts per survey were similar at both sites, ranging from 12 to 17 salamanders

A Pilot Monitoring Program for Plethodontid Salamanders on Vancouver Island, British Columbia

per site during wet conditions and from three to eight salamanders after several days of dry, warm weather. There were two captures of the Rough-skinned Newt (*Taricha granulosa)* at the Rocky Point site, but no other salamanders were found. Invertebrate by-catch recorded from the boards consisted of carabid beetles, gastropods, and millipedes, several of which are recognized to have potential as ecological indicators in forest ecosystems (e.g., the Narrow Snail-eating Beetle (*Scaphinotus angusticollis*) and the Yellow-spotted Millipede (*Harpaphe haydeniana*).

As expected, weathered boards were more effective than new boards in attracting salamanders. Microhabitat use of the Western Red-backed Salamander also differed with board age; whereas salamanders used both wood (between layers of boards) and soil (underneath the board on the ground) microhabitats approximately equally within the weathered boards, they were found much more frequently within the soil (83% of captures) than the wood (17% of captures) microhabitat within the new boards. Weathered boards hold moisture better than do new boards and thus provide a more suitable refuge for salamanders, particularly during dry periods.

The web-based power analysis program MONITOR was used to model sampling parameters (Figure 1). We used coefficients of variation of 20%, 30%, and 40% in the model, as they represent realistic values based on this and previous surveys of the Western Red-backed Salamander. Annual sampling for 20 years is required to achieve 90% power to detect a 10% population decline with alpha of 0.1 and CV of 30%, under the model's assumptions. At least four counts per year are required to achieve a power of 80% or greater.

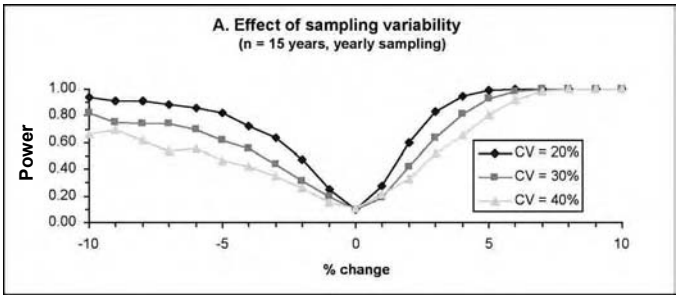
Sampling variability, modeled as the cumulative standard error from the initial data collected in spring 2003, decreased rapidly until the number of cover-boards was about 15 and then decreased more slowly until reaching asymptotic values around 35 boards (Figure 2). Therefore, 45 boards/site provide a safety margin of about 10 boards and are considered adequate for population monitoring purposes at both the Royal Roads and Rocky Point sites. With travel time included, a team of two observers can inspect this number of boards at both sites in one day; in addition to simply counting salamanders, these inspections include individual identification of salamanders and recording of selected macro-invertebrates from the boards.

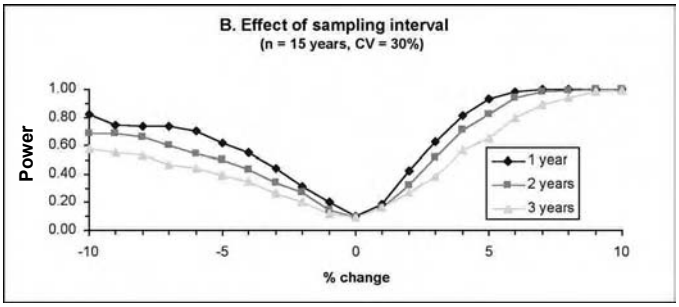
Previous studies suggest that cover-boards continue to improve in effectiveness for the first 1-2 years after installation, as more salamanders find them and as the boards weather. Values ranging from 1.2 to 4.2 times increase in numbers of salamanders have been recorded for the Western Red-backed Salamander from first to second year of sampling, but the magnitude and duration of this start-up effect may vary depending on site-specific conditions. A periodic review of the survey protocol is required to refine sampling parameters as more information becomes available. For the Rocky Point and Royal Roads sites, we recommend annual sampling (with four surveys in spring and autumn) with a review of sampling parameters after the first three years. Although not called for in the EMAN/Parks Canada monitoring protocol, individual recognition of salamanders is desirable. Estimates of reproductive parameters and survivorship, in particular, can help elucidate causes of population fluctuations. In addition, using an estimate of population size in trend analyses, instead of simply numbers caught per survey period, can be expected to result in reduced sampling error and increased power for detecting changes in population size.

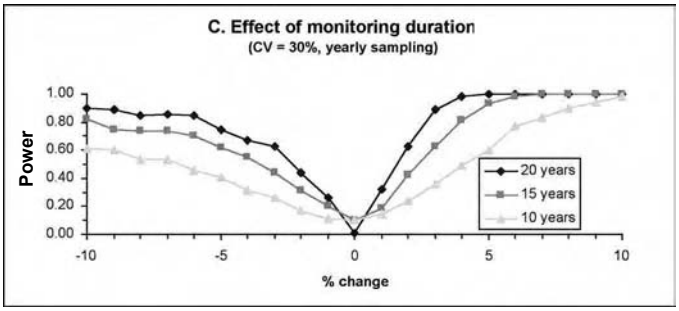
The establishment of other monitoring sites within the range of the Western Red-backed Salamander should be considered to provide information on region-wide patterns in relation to global climate change, pollutants, or other atmospheric or wide-scale environmental changes. The protocol used at Rocky Point and Royal Roads sites should be directly applicable to these sites. However, because densities of the Western Red-backed Salamander and other western plethodontids can vary greatly among sites for reasons that are not fully understood, it will be necessary to conduct preliminary surveys at new sites to refine sampling parameters.

A Pilot Monitoring Program for Plethodontid Salamanders on Vancouver Island, British Columbia

Figure 1 Effect of sampling parameters on the power of detecting changes (increase or decrease) in relative abundance of salamanders. Simulations (500 iterations) were carried out using the program MONITOR.







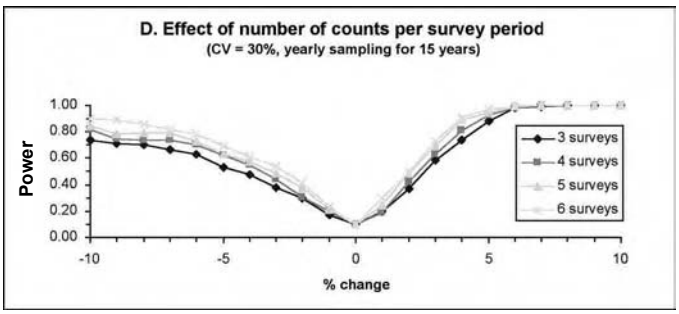


Figure 2 Effect of number of artificial cover-objects on variability in salamander counts. Values were based on data collected in spring 2003. There were 100 iterations for each study site. SE: Standard error; ACO: Artificial cover-object.

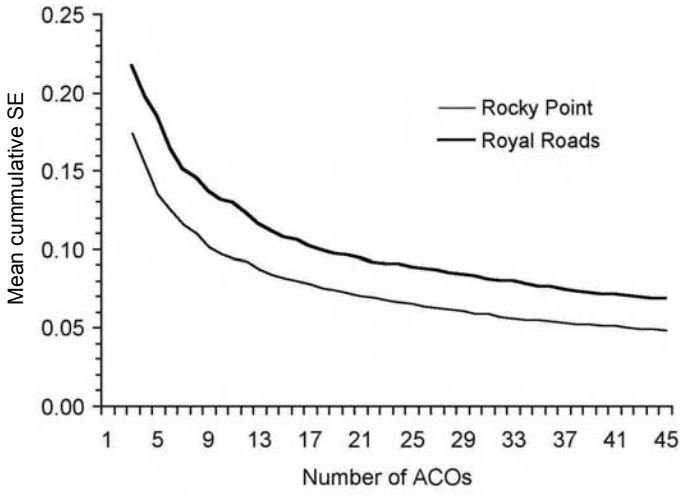


Photo: K.Ovaska

Western Red-backed Salamander *(Plethodon vehiculum)*

Surveys for Terrestrial Gastropods (slugs and land snails) on CFB Esquimalt Properties

Kristiina Ovaska and Lennart Sopuck

Biolinx Environmental Research Ltd., 1759 Colburne Place, Sidney BC V8L 5A2
Tel: (250) 656-8981 • Email: biolinx@shaw.ca

Permit #: *P096-03*
Location: *Albert Head, Aldergrove, Colwood, Heals Rifle Range, Mary Hill, Masset, Matsqui, Royal Roads, Rocky Point and Work Point*

Start Date: *May 2003*
Completion Date: *October 2003*

Overview

This project focuses on obtaining information on the distribution, habitat use, and systematics of terrestrial forest-dwelling gastropods (slugs and snails) with focus on two species that have been discovered in Canada only recently (in 2002): Blue-gray Taildropper Slug on Vancouver Island and an undescribed Jumping-slug on the Queen Charlotte Islands (Haida Gwaii). Since spring 2002, we have conducted surveys for terrestrial gastropods on CFB Esquimalt properties.

The objectives were to characterize gastropod faunas of different habitats and to locate species deemed to be rare or at risk. In 2002, we surveyed the Heals Rifle Range, Mary Hill, and Rocky Point properties on southern Vancouver Island. In 2003, we surveyed the Colwood property on southern Vancouver Island, Aldergrove and Matsqui properties in the Lower Fraser Valley on the mainland, and the Masset Site on Graham Island, Queen Charlotte Islands. Surveys of the Colwood property and both mainland properties began in November 2003 and will be completed in March 2004.

The proposed surveys, funded in part by the Endangered Species Recovery Fund, will provide information that will help assess their national and provincial status and evaluate protection needs. Information on other species of gastropods in the same habitats occupied by these target species will also be documented.

Objectives

1. Delineate the distribution of the Blue-gray Taildropper with focus on Vancouver Island;
2. Delineate the distribution of the Haida Gwaii Jumping-slug with focus on Queen Charlotte Islands;
3. Determine habitat use patterns of both species in different forest types; and
4. Participate in a genetic study to determine relationships of B.C. populations to species in the United States and to obtain information on the uniqueness of the populations/species in B.C.

Methodology

Objective 1: Delineate distribution of the Blue-gray Taildropper with focus on Vancouver Island

We will conduct surveys in forest habitats on Vancouver Island for the Blue-gray Taildropper. A starting point for the surveys will be DND properties in the District of Metchosin on southern Vancouver Island where we located the species in October – November 2002 for the first time in Canada (at two points about 1 km apart). The first step will be to work outwards from these known points to obtain information of the size of these habitat patches and the abundance of the slugs within these patches. The second step will be to expand the search area by selecting suitable forested areas outside the DND properties on southern Vancouver Island that contain similar habitats. We will use available resources, such forest cover maps and topographic maps, to select areas to be surveyed.

We will use two methods to survey for slugs: artificial cover-objects and time-constrained searches of natural cover (such as logs and fallen bark). Artificial cover-objects constructed of 1 x 1′ layered cardboard sheets attract gastropods, which seek refuges underneath and between the layers, and allow for repeated surveys without disturbance to the forest floor. The covers will remain functional for one season, after which they will be removed. We plan to employ these cover-objects

Surveys for Terrestrial Gastropods (slugs and land snails) on CFB Esquimalt Properties

(about 10-20 per site) at the Rocky Point, Heals Rifle Range, and possibly Masset sites.

Time-constrained surveys of natural cover will augment artificial cover-object surveys. Both methods will allow us to quantify the search effort either as number of cover-objects and their surface area per hectare or as person-minutes searched. We will carry out surveys when the ground is wet and when conditions are optimal for surface activity by the animals after or during rainfall. Based on survey results, we will produce a distribution map showing localities searched and where the species was found.

Objective 2. Delineate distribution of the Haida Gwaii Jumping-slug with focus on Queen Charlotte Islands

From maps, we will select areas to be surveyed on Graham and Moresby Islands, including the Gwaii Haanas National Park Reserve. The approach will be to survey widely distributed localities to obtain information on the distribution of the species within the archipelago. However, the sites surveyed, especially on Moresby Island and the Gwaii Haanas Park Reserve, will depend on accessibility. The methods (time-constrained searches and artificial cover-object surveys) and mapping will be as for Objective 1 above.

Objective 3. Determine habitat use patterns of both species in different forest types

To obtain information on habitat use patterns by the two species, we will select different forest habitats for surveys. On Vancouver Island, the habitats will include mixed-wood forests with a component of Big-leaf maple, riparian areas with Red alder, Black cottonwood and Aspen, and coniferous stands of different ages, including old-growth. The study sites will be located within the Coastal Douglas-fir and Coastal Western Hemlock biogeoclimatic zones. In the Queen Charlotte Islands, the habitats will include mature or old-growth coniferous forests at various elevations, and riparian areas.

Objective 4. Participate in a genetic study

Dr. Thomas Wilke (George Washington University, Washington DC) is currently conducting a genetic study of jumping-slugs from western United States, and an excellent opportunity exists to incorporate specimens of both target species from Canada into this study. Previously, Dr. Wilke has completed a similar genetic study of the Blue-gray Taildropper from California and Oregon. Data from Canadian specimens will help to infer phylogeographic history of these groups and to elucidate uniqueness of our populations. Dr. Wilke has offered to sequence two mitochondrial genes in 10 – 20 specimens for the proposed study. From the sequencing data, Dr. Wilke will generate phylogenetic trees using a sophisticated model based on the maximum likelihood method.

Results to Date

The properties surveyed on Vancouver Island harboured a rich and diverse terrestrial gastropod fauna. In total, we found 34 species, including 11 slugs (5 native, 6 exotic) and 23 snails (20 native and 3 exotic). Species diversity was highest in habitats with a deciduous component, particularly in stands with Big-leaf maple, Aspen or Alder, and in low-elevation coniferous forest. Garry oak woodlands contained a mixture of grassland and forest-dwelling gastropods, and exotic species of slugs and snails were strikingly abundant, especially at Mary Hill. Gastropod diversity was relatively low in higher elevation coniferous forests at Rocky Point and in wet meadow habitat at Heals Rifle Range.

The Masset site contained a relatively depauperate fauna of terrestrial gastropods. A total of 15 species (11 native and 4 introduced) were found, including seven species of slugs and eight species of land snails. The most striking difference among the habitats surveyed was the prevalence of introduced species within the Sand-dune/forest ecotone, indicating the disturbed nature of this habitat. These species included the Garlic Snail (*Oxychilus alliarius*), which was exceedingly abundant at one of the sites, and three species of introduced slugs. No introduced species were found in the other habitats. Unusual specimens of small snails of the genus Vertigo, yet to be identified to species, were found in the Sand-dune/forest edge habitat. This property contains potential habitat for the "Haida Gwaii Jumping-slug", a recently discovered, undescribed species of considerable scientific and conservation interest, and further surveys are desirable to ascertain whether this species occurs at this site. Species of gastropods at risk that we located on DND properties include the endangered Oregon Forestsnail (*Allogona townsendiana*), which was found at the Matsqui site in 2003. The Blue-gray Taildropper (*Prophysaon coeruleum*) was found at two sites within the Rocky Point property in 2002 and at the Colwood property in 2003. This rare species was documented from Canada only recently, and its status is yet to be assessed by COSEWIC. The Threaded Vertigo (*Nearctula* sp. A), a small snail that appears to have a localized and restricted distribution in British Columbia, was found at Rocky Point and Heals Rifle Range.

Characterization of the Late Summer Flying and Ground Beetle Communities in a Garry Oak Ecosystem

John McLean

Forest Sciences, University of British Columbia, 3034-2424 Main Mall, Vancouver, BC V6T 1Z4
Tel: (604) 822-3360 • Email: john.mclean@ubc.ca

Permit #: *P097-03* ***Start Date:*** *September 1, 2003*
Location: *Rocky Point and Mary Hill* ***Completion Date:*** *December 31, 2003*

Overview

Analysis of the genetic variability of Garry oak trees shows that there are two major populations; one in southern Vancouver Island and another in the Pacific Northwest United States through Washington and Oregon (Ritland et al. submitted). The Garry oak populations are becoming increasingly fragmented as a consequence of urbanization and pastoralisation. My interest centres around the characteristics of the flying and ground beetle populations found in association with Garry oak. One could hypothesize that flying populations should be able to continue to disperse among sites and maintain similar communities. Ground fauna on the other hand would be considerably restricted and might show greater variability in community structure.

Objectives

The objective of this trapping study was to gain experience with the use of Malaise traps and pitfall traps in assessing the beetle populations associated with Garry oak ecosystems.

The specific objectives were:

1. To carry out four weeks of Malaise and pitfall trapping in two secure sites where Garry oak is the dominant tree species;
2. To evaluate the sorting parameters (time, manpower) to handle samples;
3. To identify Coleoptera to genus and species where possible;
4. To evaluate the similarities/differences between the two collecting sites; and
5. To use this experience to formulate a program of future studies of the impact of fragmentation of the Garry oak ecosystem on the assemblages of beetles inhabiting the sites.

Methodology

Cover maps for Mary Hill and Rocky Point showing areas with more than 60% Garry oak cover were kindly provided by the Canadian Forest Service (CFS). Two Malaise traps were set out in Mary Hill and two at Rocky Point on September 5th. Each Malaise trap was set up 10 – 20 m from the access road. Malaise traps were oriented so that the collecting heads were at the south end of the trap in order to maximize the catch of intercepted insects which generally have a negative geotactic and positive phototactic response that results in their crawling to the top corner of the trap where they drop into 70% alcohol in the collecting jars. Five pitfall traps were set out in an approximate semicircle around each Malaise trap, the road being the diameter of the semicircle (approximate radius 30 m). Depth of soil was a major factor affecting final pitfall trap locations. The trapping liquid in each pitfall trap was approximately 100 mL of polypropylene glycol. Each pitfall trap was covered by a 30 cm square of plywood with 3 cm risers at each corner. Coordinates for the collecting sites have been provided to CFS.

Traps were cleared on September 14, 21, 28 and taken down on October 5. Samples were taken to the laboratory at UBC where they were washed and set out on filter paper to dry. Beetles were separated from other insects, tallied and pinned.

A vegetation survey was conducted at each of the collecting sites with Matt Fairbarns on November 10th.

Results to Date

Malaise Trap Catches:
Relatively few beetles were captured in the Malaise traps (Table 1). The data were too sparse for meaningful analysis but a set diagram showed the common species for each of the sites (Figure 1). The fully wooded site RP2 had the richest assemblage of species. Matt Fairbarns poetically described

Characterization of the Late Summer Flying and Ground Beetle Communities in a Garry Oak Ecosystem

the other three sites as "vernally moist meadows overrun by robust exotic grasses". We will continue to work up the identifications of the coleopteran materials now that they have been pinned and pointed.

Pitfall Traps:
We collected a rich series of ground beetles (Carabidae) with a few Staphylinidae, Lathridiidae and Elateridae. We have identified five of the carabid species so far: *Carabus nemoralis, Pterostichus algidus, Zacotus matthewsi, Scaphinotus angusticollis* and *S. marginatus*. The distribution of total catch numbers by site and week is given in Table 2. Work is progressing on the specific identification of all the insects captured.

We are continuing to identify the coleoptera species captured and will carry out community analysis as soon as the identifications are confirmed. Work schedule parameters (sorting time, pinning time etc.) will be reviewed to guide future program plans and budget requirements.

Table 1: Summary of insects collected in Malaise traps set out at Mary Hill (MH) and Rocky Point (RP), September 5 through October 5, 2003

Malaise trapping fall 2003	*Anobiidae sp # 1*	*Anobiidae sp#2*	*Anthribiidae sp # 1*	*Bruchidae sp # 1*	*Carabidae sp # 2*	*Chrysomelidae sp # 1*	*Coccinellidae sp #1*	*Coccinellidae sp #2*	*Coccinellidae sp #3*	*Coccinella septumpuctata*	*Curculionidae sp # 1*	*Curculionidae sp # 2*	*Dermestidae sp # 1*	*Dermestidae sp # 2*	*Elateridae sp # 1*	*Lathridiidae sp # 1*	*Lathridiidae sp # 2*	*Leoididae (Catops sp.) sp #1*	*Lyctidae sp # 1*	*Pselaphidae sp # 1*	*Scolytidae sp # 1*	*Scolytidae sp # 2*	*Staphylinidae sp # 1*	*Staphylinidae sp # 2*	*Staphylinidae sp # 3*	*Staphylinidae sp # 4*	*Staphylinidae (Eusephalerum sp) # 5*	**Totals**
MH1A				2		3	1	1					1															**8**
MH1B				1			2																					**3**
MH1C						1		2																				**3**
MH1D																												**0**
	0	0	0	3	0	4	3	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**14**
MH2A								1	1																			**2**
MH2B							2	1							1													**4**
MH2C																												**0**
MH2D						1																						**1**
	0	0	0	0	0	1	2	2	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**7**
RP1A											1					1												**2**
RP1B																					1	1						**2**
RP1C	1				1			1		1				1		1											1	**6**
RP1D					1	1		1								1							1					**6**
	1	0	0	0	2	1	0	2	0	1	1	0	0	1	0	3	0	0	0	0	1	1	1	0	0	0	1	**16**
RP2A						1								2				1										**5**
RP2B					1			1				1							1									**4**
RP2C	1	1	1			1								1			1			1				1	1	1		**10**
RP2D																												**0**
	1	1	1	0	1	2	0	1	0	0	0	1	0	3	0	0	1	1	1	1	0	0	0	1	1	1	0	**19**
Totals	**2**	**1**	**1**	**3**	**3**	**8**	**5**	**8**	**1**	**1**	**1**	**1**	**1**	**4**	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**56**

Characterization of the Late Summer Flying and Ground Beetle Communities in a Garry Oak Ecosystem

Figure 1: Species groupings for beetle catches in Malaise traps set out at Mary Hill and Rocky Point, Southern Vancouver Island, September 5th through October 5th, 2003. Two species only were common to all traps, Chr1 = Chrysomelidae species 1, Coc 2 = Coccinellidae species 2. See Table 1 for further details.

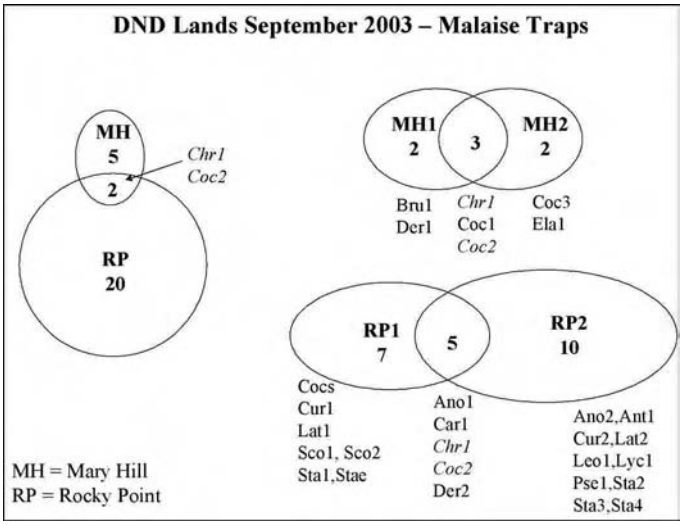


Table 2: Total numbers of beetles captured in pitfall traps at Mary Hill (MH) and Rocky Point (RP) for the period September 5th through October 5th 2003.

	Week				
Location	**1**	**2**	**3**	**4**	**Total**
MH1	86	46	78	47	257
MH2	46	30	74	39	189
RP1	98	91	138	112	439
RP2	110	49	131	96	386
Total	**340**	**216**	**421**	**294**	**1271**

Photo: A. Behennah

Malaise trap at Mary Hill

Photo: J. McLean

Left photo: *Carabus nemoralis* is a eurytropic species clearly favoured by human activities.
Right photo: *Scaphinotus angusticollis* is common in most forests of the northwest. It feeds on sanils, slugs and other protein sources.

Monitoring of Rare Vascular Plants at Selected CFB Esquimalt Properties

Adolf Ceska and Oldriska Ceska

1809 Penshurst Rd., Victoria, BC V8N 2N6
Tel: (250) 477-1211 • Email: aceska@telus.net

Permit #: *P050-03*
Location: *Rocky Point, Mary Hill, Albert Head, CFMETR, Colwood, Naden, and Royal Roads*

Start Date: *May 1, 2003*
Completion Date: *On-going*

Overview

Macoun's meadowfoam (*Limnanthes macounii* Trel.) is a species endemic to southern Vancouver Island and several adjacent islands. It is the only native species of the genus Limnanthes in Canada with False Mermaidweed (*Floerkea proserpinacoides* Willd.), one of two Canadian representatives of the family Limnnathaceae.

Objectives

1. To compile a list of rare vascular plants and their locations on selected CFB Esquimalt properties; and
2. To monitor populations of *Limnanthes macounii* for a COSEWIC Status Report.

Methodology

Known localities of rare vascular plants will be revisited in monthly or bimonthly intervals, other areas will be scanned for possible new occurrences.

Results to Date

The area at Rocky Point between Edye Point and Manor Point contains numerous Macoun's meadowfoam populations. Field surveys during winters of 2001/2002 and 2002/2003 resulted in the discovery of 11 new subpopulations that were previously unknown (Table 1). The size of Macoun's meadowfoam subpopulations varies and a majority of the subpopulations are small (with fewer than 50 plants) or medium (50-200 plants). Merely eight subpopulations have more than 2,000 plants. The main threat to the survival of Macoun's meadowfoam is the competition of introduced plants, particularly perennial tufted grasses. Macoun's meadowfoam requires open areas and cannot survive being shaded out by shrubs (i.e. Scotch broom). Scotch broom along with perennial grasses is responsible for the disappearance of Macoun's meadowfoam from one subpopulation on the western side of Rocky Point and two subpopulations at Mary Hill.

Additional Information on Other Rare Vascular Plants

During our monitoring, we obtained information on the distribution of several other rare plants on CFB Esquimalt properties and other federal lands. In 1977, we found Dwarf Stitchwort (*Minuartia pusilla* [S. Wats.] Mattf.), near Church Point at Rocky Point and so far this is the only place where it has been found in Canada. In the past, we have not been able to confirm its occurrence on this locality until the spring of 2002. We also found several new sites with Seaside Bird's-Foot-Trefoil (*Lotus formosissimus* Greene), Coastal silverpuffs (*Microseris bigelovii* [Gray] Schultz-Bip.) and Foothill sedge (*Carex tumulicola* Mackenzie), among other interesting plant species.

Monitoring of Rare Vascular Plants at Selected CFB Esquimalt Properties

Table 1: Macoun's meadowfoam subpopulations on surveyed CFB Esquimalt properties.

POPULATION	2003 #	SUBPOPULATION	ELEVATION	HABITAT	ORIG. SIZE	2002/2003	TREND	THREATS	FOUND
Rocky Point West	8	Near the gate to Indian Reserve # 2, E side of the road	28m	seepage	x	medium	new	human activity	2002
	9	E side of the road, near road	30m	seepage	x	small	new	human activity	2002
	10	Near the road, in the curve, W side	60m	seepage	x	small	new	human activity	1996
	11	S slope of Middle Peak	60m	seepage	small	none	lost	grass/weeds	1977
	12	W of Church Point	10m	seepage	x	medium	new	grass/weeds	2002
Rocky Point East	13	NW of Edye Point, east side of the road	15m	pools	medium	large	increased	human activity	1974
	14	NW of Edye Point, E side of the road, closer to beach	20m	pool	x	small	new	human activity	2002
	15	NW of Edye Point, W side of the road, margin of a vernal pond	20m	pool	x	large	new	human activity	2002
	16	SW of Cape Calver, east of the road	15m	pools	large	large	stable	grass/weeds	1974
	17	Draining channel of [16]	15m	seepage	x	large	new	human activity	1988
	18	Lower portion of [17] running towards the shore	10m	seepage	x	medium	new	human activity	2002
	19	Branch of [18] towards Montia chamissonis site	10m	seepage	x	small	new	human activity	2002
	20	West of [19], with Trifolium subterraneum	15m	pool	x	large	new	human activity	1988
	21	Between Cape Calver and Fossil Point, east of the road - oak stand	25m	pool	medium	small	declined	grass/weeds	1984
	22	North of [21] -	40m	pool	x	large	new	grass/weeds	2002
	23	Small seep between [22] and [24]	23m	seepage	x	small	new	grass/weeds	2003
	24	SW of Fossil Point, east of the road	27m	seepage	medium	large	increased	grass/weeds	1984
	25	SW of Manor Point, east of the road with Romanzoffia tracyi at the base	10m	seepage	medium	small	declined	grass/weeds	1974
	26	NE of no. [25]	10m	seepage	x	medium	new	grass/weeds	2003
	27	Between [26] & Manor Point	10m	seepage	x	medium	new	grass/weeds	2003
	28	Top of Manor Point	15m	pool	x	medium	new	grass/weeds	2003
Mary Hill West	30	Small bay southwest of Mary Hill, its eastern side	10m	seepage	small	large	increased		1976
	31	Bay south of Mary Hill, disturbed soil off shore	20m	pool	small	none	lost	human activity	1976
	32	W slopes of Mary Hill, rock outcrops	90m	seepage	small	none	lost	human activity	1976
	33	W slope, below the forest edge	65m	pool	x	medium	new	human activity	2002
Mary Hill Southeast	34	NE base of Mary Hill, rock outcrops, broome	65m	seepage	small	small	declined	grass/weeds	1975
	35	NE base of Mary Hill, margin of an arbutus stand	65m	pool	small	small	declined	grass/weeds	1975
	36	NE base of Mary Hill, property line	75m	seepage	small	small	declined	grass/weeds	1975
Albert Head	51	Albert Head, northernmost promontory, lowermost	5m	seepage	x	small	new	grass/weeds	2002
	52	Albert Head, northernmost promontory, lower	35m	seepage	medium	small	declined	grass/weeds	1974
	53	Albert Head, northernmost promontory, uppermost	35m	pool	large	large	stable	human activity	1974
Inskip Island	57	Inskip Island, western point	5m	pool	medium	large	increased	grass/weeds	1976

Monitoring of Macrofungi at Selected CFB Esquimalt Properties

Oldriska Ceska

1809 Penshurst Rd, Victoria, BC V8N 2N6
Tel: (250) 477-1211 • Email: aceska@telus.net

Permit #: *P098-03*
Location: *Mary Hill, Rocky Point and Royal Roads*

Start Date: *May 1, 2003*
Completion Date: *Ongoing*

Overview

Macrofungi play an important role in forest and non-forest ecosystems and their distribution is relatively poorly known.

Objectives

To compile a list of fungi collected at selected CFB Esquimalt properties and to monitor their phenology.

Methodology

Visit selected areas at regular intervals (2-3 site visits in spring and 5-6 site visites in autumn/winter after the rain). Collect specimens for identification and compile a list of species with notes on their distribution.

Results to Date

On November 6th, 2003, a mycological field trip to Rocky Point was carried out with Dr. David Largent, mycologist from the Humboldt University, Arcata, California. In spite of the dry fall this year, several interesting species were collected. Figure 1 shows the location of both, the Douglas-fir forest and Garry oak meadow survey locations at Rocky Point.

Rocky Point:
List of fungi found in a Douglas-fir forest with veteran *Arbutus menziesii* trees at Rocky Point:

Armillaria ostoyae
Clitocybe concave
Cystoderma amianthinum
Cystoderma fallax
Cystoderma granulosum
Fomitopsis pinicola
Gomphidius smithii
Gymnopillus sapineus group
Hebeloma crustuliniforme
Hebeloma sp.
Helvella lacunosa
Inocybe glabrescens
Inocybe lilacina
Lycoperdom foetidum
Lycoperdon perlatum
Mycena filopes
Mycena galericulata
Mycena pura
Mycena purpureofusca
Nidula candida
Nolanea latifolia
Phaeollus schweinitzii
Phellinus ferruginosus
Pluteus lutescens
Rhodocollybia butyracea
Rhodocybe nitellina
Strobilurus trullisatus
Stropharia ambigua
Suillus caerulescens
Trichaptum abietinum
Xeromphalina fulvipes
Psathyrella sp.

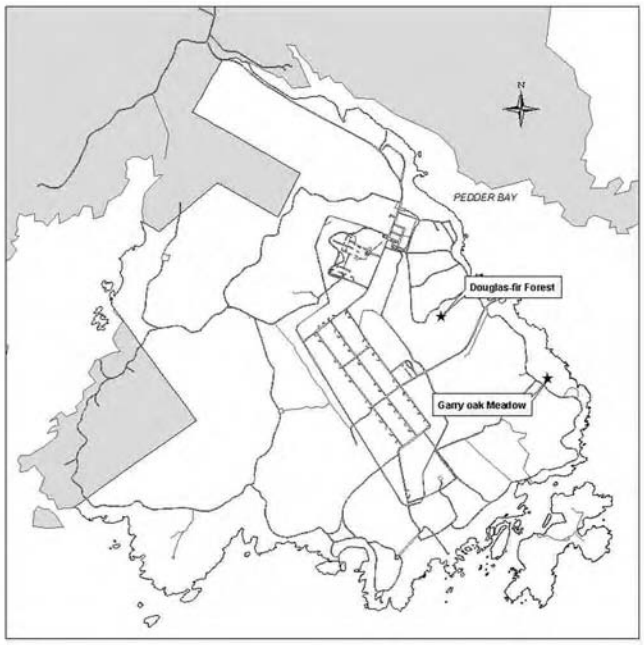
Monitoring of Macrofungi at Selected CFB Esquimalt Properties

List of fungi found within a Garry oak meadow at Rocky Point:

Armillaria ostoyae
Calocera cornea
Cystoderma amianthinum
Gymnopilus luteocarneus
Gymnopus confluens
Marasmius plicatulus
Mycena pura
Nolanea hirtipes
Phaeolus schweinitzii
Psathyrela sp.
Rhodocollybia butyracea
Strobilurus trullisatus
Trametes versicolor
Tubaria sp.

Fungi surveys were not conducted at Royal Roads and Mary Hill in 2003, however, future site visits and collections are anticipated in the spring of 2004.

Figure 1 Map of the Douglas-fir forest and Garry oak meadow survey locations at Rocky Point.



Fire History and Ecology of Garry Oak Ecosystems

Dr. Marlow Pellatt

Parks Canada, 300-300 West Georgia St., Vancouver, BC V6B 6B4
Tel: (604) 666-2556 • Email: marlow_pellatt@pc.gc.ca

Permit #: *P099-03*
Location: *CFMETR, Mary Hill and Rocky Point*
Start Date: *June 2003*
Completion Date: *March 31, 2004*

Overview

Garry oak ecosystems are one of the most endangered ecosystems in Canada. It is believed that less than 5 % of the original Garry oak ecosystems remain intact. These ecosystems are home to 91 species at risk that occur in an area where natural processes have been severely altered. Fire suppression, urban and agricultural development, invasion of introduced species, and global climate change have and will continue to have a great impact on Garry oak and associated ecosystems. Already many natural processes such as fire have been altered and landscape connectivity is a pressing issue.

Parks Canada has established a national park reserve in the Gulf Islands, B.C. Garry oak ecosystems exist within the park and greater ecosystem. Other federal lands to be examined are DND (CFB Esquimalt) lands that have Garry oak ecosystems.

The Garry Oak Ecosystem Recovery Team (GOERT) has identified the establishment of a fire and stand dynamics research and management program as a priority in their Recovery Strategy. It is imperative that protected area managers understand the role of fire, climate change, invasive and exotic species, and habitat connectivity in order to effectively restore and maintain ecological integrity and species at risk in the new national park and greater ecosystem.

Using a fire history and paleoecological research, historical ecology, and remote sensing data, a model will be developed that examines and compares management scenarios pertaining to Garry oak ecosystems. The results will assist protected area managers and recovery team members in actively restoring and maintaining Garry oak ecosystems for species at risk.

Objectives

1. Determine fire history (frequency, intensity, seasonality) in Garry oak ecosystems including the new Gulf Island National Park Reserve (GINPR). Study design will be undertaken in consultation with GOERT;

2. Using tree-ring and fire scar data, we will analyze fire and climate history over the last few centuries; and

3. Develop recommendations for land use and protected area managers regarding fire and species at risk.

Methodology

1. Fire scars and dendrochronology from Garry oak and Douglas-fir on Federal lands (GINPR, DND lands). Fire scars and dendrochronology work will be undertaken on Garry oak, Douglas-fir and other suitable trees by taking increment cores and "cookies" from standing and fallen trees. This data will be analyzed (time series analysis, etc.) and interpreted to infer fire history information.

2. Determine the role of changing climate on the endangered Garry oak and surrounding ecosystems in southwest B.C. and the GINPR.

3. Synthesize results from other objectives and incorporate them into a report for land managers and GOERT.

Results to Date

Post-Doctoral Fellow hired (Dr. Ze'ev Gedalof - University of Victoria, Tree-Ring Laboratory (Dr. Dan Smith)). Initial fieldwork at Rocky Point is complete. Fieldwork at Beaumont Marine Park and Tumbo Island is complete. Tree-ring analysis is being undertaken.

Discussion

We would like to extend the field season to December 31, 2004. The fieldwork has progressed well. There may be some further fieldwork involved to conclude this year's work. The project may be funded for the 2004/2005 fiscal-year as well.

Sharp-tailed Snake Habitat Assessment on CFB Esquimalt, Coast Guard and Parks Canada Lands

Christian Engelstoft

Alula Biological Consulting, 1967 Nicholas Road, Saanichton, BC V8M 1X8
Tel: (250) 652-9770 • Email: alula.bc@telus.net

Permit #: *P100-03*
Location: *Albert Head, Colwood, Dockyard, Naden, Heals Rifle Range, Mary Hill, Rocky Point, Royal Roads and Work Point*

Start Date: *June 2003*
Completion Date: *March 2004*

Overview

The endangered Sharp-tailed Snake (*Contia tenuis*) is known from only a few locations in Canada. Due to the cryptic habits of these snakes, their presence is difficult to confirm and unknown populations are suspected. Consequently, the Sharp-tailed Snake Recovery Team has identified habitat assessment and surveys for new occurrences as a priority so that additional populations can be located and protected.

The overall goal of this project was to find Sharp-tailed Snake populations on federally-managed land (DND-CFB Esquimalt, Coast Guard and Parks Canada properties) within the known range of the species. Similar projects were initiated in the Gulf Islands National Park (Engelstoft et. al 2002) and along the Galloping Goose Regional Trail that year as well (Engelstoft 2002).

Objectives

1. Identify potential habitats on Department of National Defence (CFB Esquimalt) lands and Coast Guard light stations on Discovery Island, East Point, Georgian Point, and Portlock Point;

2. Install artificial cover-objects at localities identified as high- or moderate-quality habitat for the Sharp-tailed Snake within the proposed Gulf Islands National Park; and

3. Inspect new and existing cover-objects and, as needed, install new cover-objects in identified habitats at Lawn Hill, Mary Hill, Rocky Point and Coast Guard light stations.

Methodology

Four steps were taken to achieve the objectives of the project. The first step was to delineate small south facing openings in forested or otherwise protected areas using orthophotos.

The second step was to visit these delineated areas to assess the habitat as high, medium, low or not suitable habitat and to search the areas for reptiles.

The third step was to place artificial cover-objects (ACOs), used for thermoregulation by the snake, in areas with high potential Sharp-tailed Snake habitat. ACOs are sheets (45 x 60 cm) of 50 lbs asphalt roofing material that are placed at strategic locations in the area. The method allows repeated surveys with minimal habitat disturbance. To avoid damage by ACOs to rare and endangered plants, botanists and area managers were consulted about specific locations prior to installing ACOs. ACO stations were placed 5-10 metres apart and at each station, two ACOs were put in. The number of stations per site was generally 10 or less per site, depending on the size of the site.

The fourth step was to check the installed ACOs during optimal activity periods in spring (March to May) and autumn (from late September to early November). Any reptiles or amphibians were noted and Sharp-tailed Snakes were weighed, measured (snout-vent length, tail length) and photographed for identification.

Sharp-tailed Snake Habitat Assessment on CFB Esquimalt, Coast Guard and Parks Canada Lands

Results to Date

The aerial photo interpretation phase and ground assessment of all delineated areas took place during August 2003. A total to 56 sites were visited on the DND properties, five on Coast Guard lands and four on Parks Canada lands (Table 1). Arthur Robinson was consulted about rare plants on the sites, and Adolf and Oldriska Ceska pointed out sensitive areas in the field in the Gary Oak stands on Rocky Point and Albert Head. Consequently, no ACOs were placed where they could damage known populations of rare plants. ACOs were place on a total of 26 new sites during September 2003. A total of 242 new ACO stations were established (Table 1).

Table 1 : Summary table of project activities and findings

	DND	Parks Canada	Coast Guard
No. of assessed polygons	56	4	4
No. of polygons assessed as high	17	0	2
No. of polygons assessed as medium	20	2	2
No. of polygons assessed as low	19	2	0
No. of monitored sites	24	8*	2
No. of artificial cover objects monitored	170	56	16
Species found			
Sharp-tailed snake (*Contia tenuis*)	1	0	0
Northern alligator lizard (*Elgaria coerulea*)	16	4	0
Northwestern garter snake (*Thamnophis ordinoides*)	2	3	0
Wandering salamander (*Aneides vagrans*)	2	0	0

** Sites previously established on Park Canada property were also monitored.*

This report only summarizes ACO checks in October of 2003. All 34 sites with ACOs were checked twice, and 27 were checked three times. These efforts resulted in the discovery of a Sharp-tailed Snake population at Mary Hill (Table 1). A male was found on the 14th of October 2003, at 13h22. The snake had a snout vent length of 193 mm, a tail length of 36 mm and weighed 3 g. The Sharp-tailed Snake was known from a site just outside Mary Hill, but this is the first known population located on federal land.

Other species encountered included wandering salamanders, alligator lizards, and northwestern garter snakes (Table 1). Two wandering salamanders were found on Albert Head under one of the boards located on a decayed log. The most encountered reptile was the northern alligator lizard, which was found on eight sites on DND lands and on three sites on Parks Canada lands.

Discussion

The discovery of the Sharp-tailed Snake at Mary Hill is very welcome because it verifies that the methods used are appropriate, it provides an accessible site for research, and it is the first site on federal land.

After two years of looking for the Sharp-tailed Snake on federal lands without finding any new populations, doubts about the method used were starting to emerge. This discovery shows that the method does work even though our understanding of the Sharp-tailed Snake biology is still limited. Nevertheless, it is important to always be aware of how new information might influence the habitat assessment method and change it accordingly.

Most of the known sites are found on private land on the Gulf Islands and even though landowners generally are very accommodating to research on their land, ferry costs and schedules inhibit access. The easy access to the site provides the opportunity to conduct more Sharp-tailed Snake research.

Finally, the occurrence of the Sharp-tailed Snake on federal land ensures that the Species At Risk Act directly protects at least one Sharp-tailed Snake population.

References

Engelstoft, C., 2002. Sharp-tailed snake inventory and habitat assessment along the Galloping Goose Regional Trail, km 18-38, in the District of Metchosin. Report for Capital Region Parks, Victoria.

Engelstoft, C., L. Sopuck & K. Ovaska.,2002. Assessment of Sharp-tailed Snake habitats in the proposed Gulf Islands National Park – Phase 1. Biolinx Environmental Research Ltd. for Parks Canada, Victoria, B.C.

Phenology of Wildflowers on Nanoose Hill, CFMETR, Compared with Other Locations on Central Vancouver Island

Charles Thirkill

611 Shaughnessy Place, Nanaimo, BC V9R 4V1
Tel: (250) 729-4928 • Email: thirkill@telus.net

Permit #: *P101-03* ***Start Date:*** *July 2003*
Location: *CFMETR* ***Completion Date:*** *September 2004*

Overview

The presence and abundance of wildflowers on Nanoose Hill is well known, however, many species appear a month or so in advance of similar locations in the immediate area. One of the factors affecting wildflower phenology could be the microclimate. This project proposes a study of the appearance of wildflower species from year to year at several locations on central Vancouver Island.

Objective

To compare the appearance of wildflowers on Nanoose Hill with Harewood Plains, near Nanaimo.

Methodology

- Weekly surveys of fixed transects;
- Observe the presence and abundance of wildflower species, temperature readings and weather conditions; and
- Subject to availability, a GPS reading will be taken at each observation location.

Results to Date

By the time access to CFMETR was granted, the flowering season was over and data collection was incomplete. Surveying for wildflowers and collection of phenology data as well as GPS readings will commence in July 2004.

Advanced Field Methods of Restoration Course at Royal Roads

Richard Hebda

Restoration Program, Environmental Studies, University of Victoria, PO Box 1700, Victoria, BC V8W 2Y2
Tel: (250) 387-5493 • Email: rhebda@royalbcmuseum.bc.ca

Permit #: *P102-03* ***Start Date:*** *September 15, 2003*
Location: *Royal Roads* ***Completion Date:*** *September 28, 2003*

Overview

Provide instruction to students in observation of slope stability, terrestrial ecosystem mapping, stream monitoring using Royal Roads' gravel pit, forested ecosystems and Cottonwood Creek respectively.

Objectives

To instruct 18-20 senior Restoration students in advanced restoration techniques.

Methodology

Field inspections and lectures by instructors and guests to teach:

1. Terrestrial Ecosystem Mapping
2. Fish Habitat Assessment
3. Wildlife Tree Assessment
4. Slope Stability Assessment
5. Successional Analysis

The project is a university credit course toward the Restoration of Natural Systems Diploma.

Results to Date

Report not submitted.

Victoria Area Overwintering Mosquitoes

Sean McCann

106-1009 Fairfield Rd, Victoria, BC V8R 5T7
Tel: (250) 385-0039 • Email: smccann@planet-save.com

Permit #: *P103-03*
Location: *Mary Hill and Rocky Point*
Start Date: *October 25, 2003*
Completion Date: *December 31, 2003*

Overview

The Victoria Area Overwintering Mosquito Survey is investigating overwintering habitat of Culex, Culiseta and Anopheles mosquitoes, with the aim of better understanding the natural history of these insects in our area.

Methods

1. To collect representative samples of mosquitoes from their hibernacula, and determine the preferred conditions for overwintering of the species collected; and

2. To establish the species composition of mosquitoes in these habitats, and to estimate the relative abundances of each species.

Methods

Potential subterranean overwintering sites such as bunkers, basements, culverts, mines caves and drains are sampled using a vacuum aspirator. The mosquitoes are collected from the walls and ceilings of the structures, killed, and identified to species. Also, the exact location, approximate volume, size and aspect of entrances, and material of construction and nature of the site are noted. These data will be analyzed with a statistical technique such as Principal Components Analysis to generate predictors for population density, community composition and presence/absence of given species, with the aim of better describing the overwintering behaviour of these species in our area.

Results to Date

Thirteen sites from Metchosin to Central Saanich have been sampled, yielding substantial numbers of mosquitoes in most circumstances. Thus far, five species have been collected, which seem to show varying distributions across the area. The most abundant and widespread species collected has been *Culiseta incidens*, a large conspicuously spotted species. The least abundant and most narrowly distributed mosquito has been *Culex territans*, a relatively rare amphibian biter. Interesting to note is the abundance and distribution of *Culex tarsalis*, reported last year for the first time on Vancouver Island.

Three sites were sampled with substantial numbers of *Culex tarsalis* and *Culex pipiens* recovered from the basement of an abandoned building at Mary Hill. Mosquitoes were absent in a bunker at Mary Hill and a culvert at Rocky Point.

Discussion

A few areas remain to be sampled, notably downtown Victoria and North Saanich. An interesting fact to note is the seeming absence of *Culex tarsalis* and *Culiseta incidens* from Central Saanich. It is unknown why this should be the case, as this agricultural area would seem to offer abundant breeding habitat for these species. Sampling continues and data analysis will be the next task to complete.

OUTLOOK FOR 2004

ESAC will continue to track and review research projects on CFB Esquimalt properties, sponsor the annual workshop, prepare an annual report, and maintain and update the CFB Esquimalt Natural Resources GIS database. In addition, the Committee will follow-up on the Double-crested Cormorant winter roost site management decisions, confer on issues related to the Forest Canopy Research Station, and provide advice to MARPAC on environmental issues occurring on CFB Esquimalt properties.

With the proclamation of the Federal Species At Risk Act (SARA), surveys and inventory work are greatly encouraged on CFB Esquimalt properties in order to have a better understanding of the species and ecosystems found on these lands. ESAC looks forward to the continued support of MARPAC for the research achieved through the Committee, and hopes MARPAC will share the success of this program to a wider audience in an effort to increase the awareness of the type of research presently being conducted on CFB Esquimalt lands.

ACKNOWLEDGEMENTS

MARPAC, CFB Esquimalt and ESAC would like to thank:

Each of the individuals who have conducted studies on CFB Esquimalt properties since 1994. Through your research and collection activities, you have greatly contributed to the knowledge and understanding of ecosystem functioning on CFB Esquimalt properties.

Special thanks to Dr. Richard Ring, University of Victoria and Mr. Andy MacKinnon, B.C. Ministry of Sustainable Resource Management for your contribution to ESAC.

The Canadian Forest Service – Pacific Forestry Centre for hosting the annual workshop.

All of the individuals who attended the ESAC annual workshop in January 2004. Your attendance and participation are much appreciated.

References: List of Environmental Science Reports for 2002/2003

REPORTS IN 2002

DND Environmental Science Advisory Committee – CFB Esquimalt 2002 Annual Report. Canadian Forest Service and CFB Esquimalt, Victoria, B.C. (Includes reports done under Permit Nos. P080-02, P081-02, P064-02, P046-02, P082-02, P0003-02, P074-02, P083-02, P050-02, P084-02, P044-02, P047-02, P031-02, P075-02, P086-02, P087-02, P041-02, P079-02, P088-02, P085-02). 52p.

Durocher, F. and Sargent, J. 2002. Investigations into the Control of Gorse (*Ulex europaeus*) on DND Properties in the Victoria area, British Columbia. Canadian Forest Service, Victoria, B.C. 15p.

Durocher, F. 2002. Scotch Broom (*Cytisus Scoparius*) Control Study Experimental Design. Canadian Forest Service, Victoria, B.C. 12p.

Garry Oak Ecosystems Recovery Team. February 2002. Recovery Strategy for Garry Oak and Associated Ecosystems and their Associated Species at Risk in Canada 2001-2006 (Draft). Victoria, B.C. 191p.

Gebauer, M. 2002. Significant Flora and Fauna of the DND Heals Rifle Range Site. Gebauer and Associates Ltd., Surrey, B.C. 29p.

Gebauer, M. 2002. Significant Flora and Fauna of the DND Nanaimo Rifle Range Site. Gebauer and Associates Ltd., Surrey, B.C. 23p.

Gebauer, M. 2002. Significant Flora and Fauna of the DND Mary Hill Site. Gebauer and Associates Ltd., Surrey, B.C. 36p.

Gebauer, M. 2002. Significant Flora and Fauna of the DND Matsqui TX Site. Gebauer and Associates Ltd., Surrey, B.C. 18p.

Hawryzki, A. R. 2002. Natural History, Population Ecology, and Conservation Biology of Slim-Leaf Onion (*Allium Amplectens*). M.Sc. Thesis. Dept. of Biology, University of Victoria, Victoria, B.C. 102p.

Levesque, P. G. 2002. Nocturnal Owl Monitoring at Rocky Point Bird Observatory, Fall 2002. Victoria, B.C. 23p.

Miller, M. and Roemer, H. 2002. GOERT Rare Plant Survey: Callitriche marginata, Plagiobothrys figuratus and Centaurium muhlenbergii. Victoria, B.C. 7p. + appendices.

Mogensen, N. 2002. Natural History Survey Results on Royal Roads Lands. Victoria Natural History Society's Green Spaces Project, Victoria, B.C. 9p. + appendices.

Nep2ne Consulting. 2002. Development of a Water and Sediment Sampling and Monitoring Program for the Esquimalt Lagoon by Royal Roads University. Victoria, B.C. 50p. + appendices.

Ovaska, K. and Sopuck, L. 2002. Surveys for Terrestrial and Freshwater Molluscs on DND Lands near Victoria, Vancouver Island, British Columbia. Biolinx Environmental Research Ltd., Sidney, B.C. 56p.

Royal Roads University Team 9. 2002. Development of a Recreation Plan for Coburg Peninsula and Esquimalt Lagoon. Victoria, B.C. 66p. + appendices.

Summers, K. 2002. Survey for Significant Flora and Fauna at Albert Head. Ken Summers Biological Services, Aldergrove, B.C. 29p.

Towers, J. 2002. Survey for Significant Flora and Fauna at Masst Ops Site. Biodiverse Consulting, Queen Charlotte City, B.C. 10p. + appendices.

Wind, E. 2002. Husbandry Protocols and Procedures for the Oregon Spotted Frog (Rana pretiosa) in British Columbia. E. Wind Consulting, Nanaimo, B.C. 94p.

REPORTS IN 2003

Carnahan, T. June 2003. Project for the Ecological Restoration of the Wetlands at Royal Roads University. University of Victoria. 12p.

Cocksedge, W. 2003. Social and Ecological Aspects of the Commercial Harvest of the Floral Greenery, Salal (Gaultheria shallon Pursh; Ericaceae). M.Sc. Thesis. University of Victoria. 74p.

References: List of Environmental Science Reports for 2002/2003

Fairbarns, M. March 2003. Summary Report on the Garry Oak Endangered Species Recovery Project: Year 1 – 2002/03. Aruncus Consulting, Victoria, B.C. 159p. + appendices.

Fraker, M.A. March 2003. Deer Habitat Study in Dockyard, CFB Esquimalt. TerraMar Environmental Research Ltd., Sidney, B.C.

Ovaska, K. and Sopuck, L. October 2003. Surveys for Terrestrial Gastropods at the CFS Leitrim – Detachment Masset Site, Queen Charlotte Islands, British Columbia. Biolinx Environmental Research Ltd., Sidney, B.C.

Rietkerk, J., and Francis, A. March 2003. Five-Year Invasive Species Management Plan: Royal Roads Property. Victoria, B.C. 50p. + appendices.

Sargent, J., Webb, C., Robinson, A., Prasad, R., Benner, J., and Singh, S. March 2003. Interim Report 2002/03 - IRF Project # 26. Project to Control Exotic Species in Garry Oak Ecosystems Occurring on Federal Lands. Canadian Forest Service, Victoria, B.C. 16p. + appendices.

SEACOR Environmental Inc. March 2003. Hydrological Investigation at Royal Roads, Victoria, B.C.

Trow Associates Inc. July 2003. Timing and Routes of Transient Species Near Ordnance Demolition Training Areas, Rocky Point, CFB Esquimalt.

Welstead, K.E. and Vennesland, R.G. March 2003. Investigation of Site Usage and Disturbance at Rocky Point Double-crested Cormorant (Phalacrocorax auritus) Winter Roost Site on Southern Vancouver Island. Prepared for the Canadian Forest Service, Natural Resources Canada and CFB Esquimalt, Department of National Defence.

CONTACT INFORMATION

MEMBERS

Don Beamish
Base Property Resources Officer
Base Construction Engineering Office
CFB Esquimalt, Bldg 575 Dockyard
P.O. Box 17000, Station Forces
Victoria, BC V9A 7N2
Tel: (250) 363-4914
Fax: (250) 363-7980
beamish.dg@forces.gc.ca

Dr. Richard Ring (retired from ESAC as of May 2003)
University of Victoria, Biology Department
Room 254, Cunningham Building
P.O. Box 1700
Victoria, BC V8W 3N5
Tel: (250) 721-7102
Fax: (250) 721-7120
raring@uvic.ca

Andy MacKinnon (retired from ESAC as of May 2003)
B.C. Ministry of Sustainable Resource Management
Ecosystem Conservation
780 Blanshard St., Room 124
Victoria, BC V8V 1X4
Tel: (250) 387-8684
Cell: (250) 888-5799
Fax: (250) 953-3481
andy.mackinnon@gems1.gov.bc.ca

Dr. Bill Dushenko
Royal Roads University
2005 Sooke Road
Victoria, BC V9B 5Y2
Tel: (250) 391-2580
Fax: (250) 391-2560
bill.dushenko@royalroads.ca

Ken Morgan
Canadian Wildlife Service
Environment Canada
c/o Dept. of Fisheries and Oceans
Institute of Ocean Sciences
P.O. Box 6000
Sidney, BC V8L 4B2
Tel: (250) 363-6537
Fax: (250) 363-6390
MorganK@pac.dfo-mpo.gc.ca

Stephanie Blouin
Formation Natural Resources Officer
Formation Risk Management Branch
CFB Esquimalt, Bldg 199 Dockyard
P.O. Box 17000, Station Forces
Victoria, BC V9A 7N2
Tel: (250) 363-2313
Fax: (250) 363-2567
blouin.sc@forces.gc.ca

Dr. Don Eastman (ESAC Member as of July 2003)
School for Environmental Studies
University of Victoria
P.O. Box 1700,
Victoria, BC V8W 2Y2
Tel : (250) 472-4568
Fax : (250)721-8985
rns@uvic.ca

John Parminter (ESAC Member as of July 2003)
Research Ecologist, Research Branch
B.C. Ministry of Forests
P.O. Box 9519 Stn Prov Govt
Victoria, BC V8W 9C2
Tel: (250) 356-6810
Fax: (250) 387-0046
John.Parminter@gems7.gov.bc.ca

Dr. J.A. (Tony) Trofymow (chair)
Natural Resources Canada
Canadian Forest Service
Pacific Forestry Centre
506 West Burnside Road
Victoria, BC V8Z 1M5
Tel: (250) 363-0600
Fax: (250) 363-0775
ttrofymow@pfc.cfs.nrcan.gc.ca

ALTERNATES

LCol Paul Arsenault
Base Construction Engineering Officer
CFB Esquimalt, Bldg 575 Dockyard
P.O. Box 17000, Station Forces
Victoria, BC V9A 7N2
Tel: (250) 363-2738
Fax: (250) 363-5784
arsenault.pa@forces.gc.ca

Michael Dunn
Canadian Wildlife Service
Environment Canada
c/o Dept. of Fisheries and Oceans
Institute of Ocean Sciences
P.O. Box 6000
Sidney, BC V8L 4B2
Tel: (250) 363-6501
Fax: (250) 363-6390
michael.dunn@ec.gc.ca

Duane Freeman
Acting / Formation Environment Officer
Formation Risk Management Branch
CFB Esquimalt, Bldg 199 Dockyard
P.O. Box 17000, Station Forces
Victoria, BC V9A 7N2
Tel: (250) 363-2644
Cell: (250) 480-9554
Fax: (250) 363-2567
freeman.de@forces.gc.ca

Dr. Brian Nyberg
Acting Manager, Integrated Resources Section
B.C. Ministry of Forests - Forest Practices Branch
P.O. Box 9513 Stn Prov Govt
Victoria, B.C. V8W 9C2
Tel: (250) 387-3144
Fax: (250) 387-1467
brian.nyberg@gems6.gov.bc.ca

Dr. Vivienne Wilson
Royal Roads University
2005 Sooke Road
Victoria, BC V9B 5Y2
Tel: (250) 391-2600 ext. 4314
vivienne.wilson@royalroads.ca

Dr. Neville Winchester
Department of Biology, University of Victoria
P.O. Box 3020
Victoria, BC V8W 3N5
Tel: (250) 721-7094
Fax: (250) 721-7120
tundrast@uvvm.uvic.ca

OTHERS

Robert Faulkner
Manager – Corporate Realty Assets, DRFMS - 8
Directorate of Realty and Facilities Management Services
Major General Pearkes Building, NDHQ
101 Colonel By Drive, 9th Floor, CBN
Ottawa, ON K1A 0K2
Tel: (613) 996-5351
Fax: (613) 995-1031
faulkner.ra@forces.gc.ca

Arthur Robinson
Natural Resources Canada
Canadian Forest Service
Pacific Forestry Centre
506 West Burnside Road
Victoria, BC V8Z 1M5
Tel: (250) 363-0729
Fax: (250) 363-0775
arobinson@pfc.cfs.nrcan.gc.ca

MWO Gordon Usipiuk
Range Control Officer - Base Operations
CFB Esquimalt
P.O. Box 17000, Station Forces
Victoria, BC V9A 7N2
Tel: (250) 391-4162
Fax: (250) 391-4165
usipiuk.gm@forces.gc.ca

Bob Woods
Head, Natural Resources (D Env P 5)
Directorate Environmental Protection
Director General Environment
Major General Pearkes Building, NDHQ
101 Colonel By Drive, 9th Floor, North Tower
Ottawa, ON K1A 0K2
Tel: (613) 995-4087
Fax: (613) 992-9422
woods.ra@forces.gc.ca

For more information on ESAC, please visit our website at:

www.pfc.cfs.nrcan.gc.ca/programs/esac

For more information on MARPAC/CFB Esquimalt's environmental programs and initiatives, please visit our website at:

www.navy.forces.gc.ca/marpac/

Or contact:

MARPAC – CFB Esquimalt • Formation Environment Office • Tel: (250) 363-5063

Produced by Formation Environment, CFB Esquimalt, Maritime Forces Pacific

Design by: littlefish design company • www.littlefishdesign.net