ANNUAL REPORT of the
CENTRE FOR WILDLIFE ECOLOGY

2010-2011

Department of Biological Sciences
Simon Fraser University

http://www.sfu.ca/biology/wildberg/index.html

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I. HISTORY

Under the Migratory Birds Convention and Canada Wildlife Acts, the mandate of the Canadian Wildlife Service is to protect and conserve migratory bird populations. In the 21st century, this historical mandate is broadening to encompass other environmental concerns such as species at risk, biodiversity, sustainability and endangered habitats. To meet these broad and varied responsibilities, Environment Canada depends on sound science, and participates in cooperative ventures. In 1993, the Natural Sciences and Engineering Research Council of Canada, Simon Fraser University, and Environment Canada signed a ten year agreement to create the NSERC/CWS Chair in Wildlife Ecology at SFU. The Centre for Wildlife Ecology (CWE) described here is a revised administrative structure based on the Chair, formed after the retirement in 2002 of the original chairholder, Professor Fred Cooke.

II. MISSION STATEMENT

The mission of the Centre for Wildlife Ecology (CWE) is to foster high quality graduate training and research, conduct basic and applied research in wildlife ecology, and to provide knowledge and personnel that will help Environment Canada and other agencies meet the challenges of conservation in the 21st century. The central concept is to foster synergy between the mission-oriented research and management policies of Environment Canada (Canadian Wildlife Service, CWS, and Science and Technology, S&T) and the basic research agenda of the University. Information, ideas, expertise, resources and opportunity flow back and forth across this interface, giving government agencies access to a broad base of science capability that helps inform policy and decision making, while the university and its faculty and students benefit from enhanced opportunities for research and application of the ideas their disciplines generate.

III. PERSONNEL

A. Research Team

1. *Faculty and Research Associates*

Name	*Position*
Ron Ydenberg	Director, Professor
Tony Williams	Professor
David Green	Associate Director, Associate Professor
Dov Lank	University Research Associate / Adjunct Professor
Dan Esler	University Research Associate / Adjunct Professor
Mark Hipfner	EC Research Scientist / Adjunct Professor
Doug Bertram	EC Research Scientist
Christine Bishop	EC Research Scientist / Adjunct Professor
Sean Boyd	EC Research Scientist / Adjunct Professor
Rob Butler	EC Research Scientist Emeritus / Adjunct Professor
Bob Elner	EC Research Scientist Emeritus/Adjunct Professor
John Elliott	EC Research Scientist / Adjunct Professor
Barry Smith	EC Wildlife Research Head / Adjunct Professor
Fred Cooke (retired)	Emeritus Chairholder

2. *Research Group*

Postdoctoral Fellow	***PhD (in progress)***	***MSc (in progress)***	***Staff***
Eric Anderson	Anna Drake	Marie-Hélène Burle	Monica Court, CWE Admin. Asst.
Glenn Crossin	Margaret Eng	Lana Cortese (REM)	Connie Smith, CWE Research Tech
WhoSeung Lee	Philina English	Mikaela Davis	Jenn Barrett, MAMU/Sea Duck Tech
	Lindsay Farrell	Rian Dickson	
	Samantha Franks	Willow English	
	Raime Fronstin	Martha Fronstin	
	Kristen Gorman	Rachel Gardiner	
	Ariam Jiménez	Nathan Hentze	
	Holly Middleton	Danica Hogan	
	Heidi Scherr	Viktoria Khamzina, MET	
	Birgit Schwarz	Elly Knight	
	Emily Whattam	Michaela Martin	
		Eric Palm	
		Calen Ryan	
		Sarah Thomsen	
		Brian Uher-Koch	
Visitors		Corey VanStratt	
Pat Baird		Dominique Wagner	
Diane Tracy			
Lysanne Snijders	***PhD(defended)***	***MSc (defended)***	
Pieter van Veelen	Heather Major	Christine Rock	

B. Steering Committee

Name	*Position*	*Affiliation*
Elizabeth Elle	Assistant Professor	*SFU*
Arne Mooers	Assistant Professor	*SFU*
Robert Elner	Emeritus Scientist	*EC*
David Green	CWE faculty (non-voting)	*SFU*
Paul Kluckner	Regional Director, ECB PYR	*EC*
Barry Smith	Wildlife Research, Head	*EC*
Tony Williams	CWE faculty (non-voting)	*SFU*
Ron Ydenberg	CWE Director (non-voting)	*SFU*

IV. INTRODUCTION

The aim of this Annual Report is to give an overview of our activities, outline the progress on new and continuing projects, describe the personnel involved, and to give some indication of our scientific and community involvement. Previous Annual Reports are available from the CWE. Contact us via our website

http://www.sfu.ca/biology/wildberg/index.html

or contact Ron Ydenberg at ydenberg@sfu.ca.

V. THE CWE IN ACTION

The accounts that follow give brief overviews of the major projects run by the CWE. More detail is available on our website (http://www.sfu.ca/biology/wildberg). Publications and theses are listed at the end of this report. The personnel also can be contacted via the website.

A. The Triangle Island Seabird Research Station

Coastal British Columbia supports large populations of many species of seabirds, for which the Pacific and Yukon Region of the Canadian Wildlife Service has stewardship responsibility. The Triangle Island Seabird Research and Monitoring Station was established in 1994 as a centre for research devoted to understanding seabird biology, aimed particularly at identifying and understanding environmental and demographic causes of population change so as to recommend appropriate conservation actions. The Anne Vallée Ecological Reserve on Triangle Island supports the largest and most diverse seabird colony in BC, including the world's largest population of Cassin's Auklets, BC's largest populations of Tufted Puffins and Common Murres, and a large population of Rhinoceros Auklets, among others. As part of the Scott Island Group, Triangle Island is recognized as an Important Bird Area (IBA). Moreover, waters around the Scott Islands are being developed as a Marine Wildlife Area (MWA) under the Canada Wildlife Act, to protect critical habitat for the millions of seabirds that depend on these waters through the year.

Our ongoing investigations examine breeding propensity and chronology, reproductive performance, nestling diet and development, parental foraging and provisioning patterns, attendance patterns, and adult survival, among other topics. Of particular interest is the issue of how climate-induced fluctuations in the timing and availability of marine prey populations affect seabird reproduction and survival.

The 2010 season: We opened our research station on Triangle Island for year 17 on 05 May 2010, with continued logistical support from the Canadian Coast Guard. Scientific research was conducted under the direction of Mark Hipfner, while Kristin Charleton, Glenn Crossin and Mark led the field crew at various times in the summer. We maintained our time series focus on Cassin's Auklet, Rhinoceros Auklet, Tufted Puffin, Common Murre, Pelagic Cormorants, Glaucous-winged Gulls and Black Oystercatchers.

The 2010 breeding season followed another severe El Nino event over winter 2009-2010 and this

had dramatic consequences for seabirds' phenology (very late) and breeding success (extremely poor- the worst in the time series for Cassin's Auklets). And Common Murres had another difficult season, facing harassment and predation by Bald Eagles and Glaucous-winged Gulls.

In addition, in 2010 we completed the third year of a project to band Rhinoceros Auklets at the large colonies at Pine Island (central coast) and Lucy Island (north coast). We also banded on SGang Gwayy, in Haida Gwaii in 2010. We plan to continue this project for several more years, in order to (1) obtain estimates of adult survival rates at these important colonies to enable us to assess the potential effects of mortality in gill-net fisheries on local Rhinoceros Auklet populations, (2) to quantify the extent of population genetic structuring in Rhinoceros Auklet colonies in BC and elsewhere, so as to identify management units for conservation; (3) to quantify geographic and intercolony variation in this species' diet and productivity, and (4) to quantify geographic and interannual variation in diets of Pacific sandlance, a key prey species for Rhinoceros Auklets at all BC colonies.

B. Integrated Shorebird Research

Populations of many species of shorebirds travel half the globe in the course of their annual migrations. Great concern has been raised about apparent population declines of many species over the past two decades. The CWE is studying small calidrid sandpipers - Western and Least sandpipers, and Dunlin - to better understand the causes of these apparent declines.

The majority of the world's 3.5 – 4.0 million Western Sandpipers stop briefly to refuel in Boundary Bay or on Robert's Bank during their annual northward migration, providing a thrilling sight for local residents. Much of the species' population also stops over on southward migration, following a flight over the Gulf of Alaska. Because of this, the species is ranked in the highest priority class in the draft BC-Yukon region CWS Shorebird Management Plan. Each winter, the Fraser River Delta (FRD) hosts the most northerly wintering population of Pacific Dunlin – some 30,000-50,000. Local information on shorebird habitat usage, including western sandpipers and dunlin, contributed towards Environment Canada's submission in response to proposals to enlarge the Coal Port facility on Robert's Bank, and will be of substantial value with respect to environmental assessment as port operations continue and planning for the next phase of port expansion continues.

Since its inception in 1993, the CWE has nurtured the development of the Western Sandpiper Research Network, including current CWE staff Ron Ydenberg, Dov Lank, and Tony Williams, EC's Barry Smith, and recent retirees Bob Elner and Rob Butler, as a platform for research on a hemispheric scale that can address migratory bird issues. The CWE maintains substantial science capacity for this group of birds in the Pacific region. Our multifaceted research is documenting and modeling the factors controlling the population size, migratory routes and timing, ecological relationships with predators and prey, habitat use, and physiological ecology of this long-distance Neotropical migrant. We have pursued and aided fieldwork at three breeding sites, several migration locations, and five wintering sites. We have organized eleven workshops to help keep researchers in touch, and we run a list-server for this purpose.

Our integrated approach allows us to examine how factors at one location affect events at another. How do events in the wintering grounds, migration sites, and breeding grounds

interconnect? Where are population bottlenecks? How do changes in environmental danger and food availability affect migration and stopover strategies? Of direct conservation concern is the consequence of the removal or deterioration of one or more locations on survival and reproduction. As a result of our work, the Western Sandpiper now ranks with the best-studied shorebirds in the Western Hemisphere.

Highlights from the past year:

Initial organization for the 4th Western Hemisphere Shorebird Group Meeting: Lank and Ydenberg agreed to organize the 4th biennial meeting of the Western Hemisphere Shorebird Group meeting, to be held at SFU in August 2011. They raised ca. $66,900 in sponsorship funding, including Environment Canada, the US Fish and Wildlife Service, the US Forest Service, the US Geological Survey, the Pacific Wildlife Foundation, and SFU. Much of this is intended to provide travel awards to enable Latin American students to attend the meeting.

Migratory Connectivity Project: The Western Sandpiper migratory connectivity project is designed to develop the use of intrinsic markers – information present in the body of the bird – as tools for establishing the connections among the suite of sites utilized by migrants. This international project involves Environment Canada as a partner, plus faculty from UBC (Darrin Irwin), Queen's (Kurt Kyser) and Guelph (D Ryan Norris), three universities in Mexico, Kansas State University, and the Point Reyes Bird Observatory, with additional cooperators in Alaska, Russia, Texas, Florida, South Carolina, Puerto Rico, Panama and Ecuador. Samples were analyzed for stable isotope signatures and genetic composition. We have data on birds' morphology from all sites, and are creating statistical methods that combine information from multiple sources produce probabilistic population assignments. PhD student Samantha Franks took responsibility for a portion of the migratory connectivity project, including sample collection and stable isotope analyses of western sandpiper feathers collected throughout their annual cycle. Birgit Schwarz, a second PhD student supported by German graduate fellowships, took responsibility for blood sample collection and genetic analyses, working with Dr. Darren Irwin, at UBC. These students also again organized fieldwork in the FRD during both northward and southward migration, collecting data for the migratory connectivity project.

Direct evidence of migratory connectivity comes from radio-tracking studies. Research Collaborator Pat Baird completed her final report to the US Department of Defense on her multinational study of western sandpipers as a model for neotropical migration. We continue to collaborate with other researchers at SFU, Panama Audubon, and the Universidad Nacional Autonoma de Mexico.

Fraser River Delta issues: MSc student David Hope submitted one chapter from his MSc thesis addressing migration strategies of Western Sandpipers through the Fraser River Delta with respect to changing schedules of predation risk. PhD student Ariam Jiménez continued detailed work with sandpiper usage of biofilm on Robert's Bank, guided by EC-CWS's Bob Elner and CWE's Ydenberg, and contrasted finding here with those on the wintering grounds in Cuba. His work includes on-the-ground and remote sensing, and direct observation and "poop counts" as indirect indices of habitat usage. MSc student Rachel Gardiner wrote up her work on Least Sandpipers, the third common local migrant shorebird, and is relating aspects of their intertidal habitat usage at different sites to measures of fattening rates and predation danger. Her analyses utilize both currently acquired data and historical data available from previous work by the CWS

and CWE.

MSc student Nathan Hentze continued his project exploring the costs and benefits of high-tide over-ocean flocking by Dunlin over Boundary Bay. This occurs throughout the winter, largely during diurnal high tides, and we interpret it as an anti-predator "roosting" tactic. Hentze took high-speed films of flights, which will be used to parameterize energetic models comparing the flight costs of over ocean flocking with those of normal flight.

Dov Lank and Yuri Zharikov continued a collaboration with a radio-tracking study of habitat use by Pacific Dunlin in the Skagit Delta in Washington State, initiated by Gary Slater, from the Ecostudies Institute and Ruth Milner, Washington Fish and Wildlife. The study borrows approaches used in the Fraser River delta by earlier CWE students, and involves EC-S&T's Keith Hobson, Saskatoon for stable isotope analyses of diets.

Shorebird Breeding Biology:

Lank organized the first field season of a 4-5 year project to support demographic research on nesting shorebirds with respect to environmental factors, near Nome Alaska, together with collaborator Brett Sandercock, a CWE alumnus who is now a professor at Kansas State University, funded by NSF and the Alaska Department of Fish and Game. Several CWE current graduate students participated in the first year of this study. The site will contribute towards an arctic-wide collaborative program dubbed the Arctic Shorebird Demographic Network, which includes a dozen sites in Alaska and arctic Canada utilizing comparable protocols.

Tuamotu Sandpiper Conservation: In partnership with the USF&WS (Rick Lanctot, Alaska region, Brad Bortner, Chief, Division of Migratory Birds and Habitat Programs, Pacific Region) and Island Conservation, the CWE is lending its expertise in shorebird biology to support a conservation project on the highly endangered Tuamotu Sandpiper. The work is supported by the French Polynesian Regional Division for the Environment (DIREN) and the USF&WS, with logistical help from a local ornithological NGO (the Society of Polynesian Ornithologists, SOP-MANU), and the Critical Ecosystems Partnership Fund, administered by Conservation International.

Once widespread across the South Pacific, this species is now found on only 4 atolls, with a world population of ca. 1200 individuals. The previous year, Master's student Marie-Hélène Burle spent 5 months conducting the first study of the species' biology on the atoll of Tahanea, including the transition from the non-breeding to the breeding season. The information on habitat usage, diet, and social behaviour is being used to support reintroduction planning for the species onto atolls where rats have or will be removed, and a small removal has been planned for the summer of 2011. Burle presented her findings at the 2010 SCO-AOU-COS meeting in San Diego, where she won a best student paper award from the SCO.

C. The Marbled Murrelet Project

SFU's research on threatened Marbled Murrelets continues to address issues of direct conservation concern for this listed species. Under Lank's leadership, this ground-breaking and high profile project examining the biology of the threatened and elusive marbled murrelet continued for its seventeenth year, addressing new questions of significant management interest for this

threatened species. Five papers on aspects of habitat usage, classification and the effectiveness of management approaches were published or submitted with provincial Ministry of Forests and Range collaborator Louise Waterhouse, and with Alan Burger (UVic) and others.

Graduated MSc student Mike Silvergeiter published two of the three chapters of his MSc thesis, focusing on stand-level habitat characteristics of nest sites, utilizing data collected in previous years, including some he gathered while working as an undergraduate. Undergraduate student Jason van Rooyen submitted a manuscript examining microclimate changes in the canopy along different kinds of forest edges, looking for effects on epiphyte growth that would affect murrelet nest platform availability, based on data gathered during graduate student Josh Malt's MSc thesis.

Early in April 2011, Lana Cortese is scheduled to complete her Masters in Resource and Environmental Management thesis relating radar traffic rates to measures of forest size and configuration. This work was largely funded by the BC Forest Science program. The focus of ongoing CWE activity on this species was the analysis of the extensive radar traffic rate data sets which have been gathered in BC to address (1) the utility of several methods of habitat suitability classification, and (2) the magnitude of fragmentation effects on local breeding population size. CWE graduate and research technician Jenn Barrett worked closely with Cortese on these analyses.

Dov Lank continued to serve on the Canadian Marbled Murrelet Recovery Team. The team became less active as it waited for its recovery strategy to be formally approved; in the mean time, attention shifted towards implementation though action plans. Lank participated in several action planning group meetings, which enables the results of the CWE's research to be rapidly assimilated into evolving policy guidelines for management of this threatened species, under the protection of the federal Species at Risk Act and Provincial Identified Wildlife Management Strategy.

D. Sea Duck Ecology

The sea duck research group, led by Dan Esler, conducts a broad range of studies addressing factors affecting population dynamics of sea ducks along the Pacific coast. All studies are collaborative ventures with federal agencies, including the Canadian Wildlife Service, U.S. Geological Survey, and the U.S. Fish and Wildlife Service. We also collaborate with numerous universities and other partners throughout North America.

1. Chronic Effects of the Exxon Valdez Oil Spill on Sea Ducks – This long-term program continues to evaluate the progress of population recovery of sea ducks (harlequin ducks and Barrow's goldeneye) from the 1989 Exxon Valdez oil spill in Prince William Sound, Alaska. At this stage, most efforts are directed towards analysis and publication of data collected over the 15 years of the project, and several new papers appeared this year. However, we continue to collect new data on the degree and duration of oil exposure that sea ducks are experiencing, as recently as March 2011.

2. Winter and Spring-migration Ecology of Surf and White-winged Scoters – Our research group has been studying various aspects of scoter winter and migration ecology since 2001. This has

included specific evaluations of local anthropogenic effects such as shellfish aquaculture, as well as flyway-wide considerations of factors related to winter site selection and spring migration strategies. Following completion of field efforts in April 2010, efforts are now focused entirely on analysis and write-up of findings. CWE MSc candidates Corey VanStratt and Brian Uher-Koch are leading ongoing work on wintering ecology of surf scoters across their Pacific wintering distributions (Mexico to Alaska). Corey is focused on variation in foraging behaviour, while Brian is addressing survival. We also are examining relationships between sea duck abundance and distribution and underlying habitat features, led by Jenn Barrett.

3. Barrow's Goldeneye Population Delineation – In collaboration with Sean Boyd of the Canadian Wildlife Service, we are using satellite telemetry to evaluate population structure, movements, site fidelity, and habitat use of Barrow's goldeneyes in western North America. Goldeneyes have been marked at a breeding site (Riske Creek, BC), 2 wintering sites (Indian Arm, BC and Prince William Sound, Alaska), and a molt site (Cardinal Lake, Alberta). This work will have important implications for understanding population level effects of factors at different annual cycle stages (e.g., oil pollution on coastal wintering areas, changes to interior breeding areas) and will provide the first insights into migratory connectivity for the species.

4. Barrow's Goldeneye Wing Moult and Staging in Alberta – As a result, in part, of satellite telemetry work described above, an important molting and staging site was recently discovered in northwestern Alberta. In collaboration with Jonathan Thompson of Ducks Unlimited Canada and Sean Boyd of EC, we are documenting moulting strategies of Barrow's goldeneyes. Led by MSc candidate Danica Hogan, this work quantifies body mass variation, feather growth rates, foraging effort, and survival of goldeneyes through the moult and staging periods, which for males can constitute up to one-third of their annual cycle. Field work is completed and data analysis and write-up are underway.

5. Offshore Wind Farms and Effects on Sea Ducks – The CWE has been identified as a collaborator and national lead on research efforts by Environment Canada to evaluate effects of offshore wind turbine arrays on wintering and migrating sea ducks. To date, the only offshore wind farm proposed for Canada is in Hecate Strait near Haida Gwaii (Queen Charlotte Islands). Since 2005, we have laid the groundwork for research in the region by hosting workshops, conducting extensive literature reviews, interacting with European researchers with experience in this area, visiting the site to meet with local interests, interacting with the proponent, and collaborating with the U.S. Fish and Wildlife Service to conduct aerial surveys. This year we initiated field work, using funding from NRCAN, Environment Canada, and the industrial proponent, addressing field studies of trophic interactions and energetics of long-tailed ducks white-winged scoters. This work is intended to provide perspective on the habitat function of the proposed wind farm site, including comparisons to other areas within the province. This effort includes CWE personnel Eric Palm (MSc candidate) and Eric Anderson (Post-doc).

6. Molting Ecology of Pacific Scoters – Thanks to funding and collaboration from the Sea Duck Joint Venture, U.S. Geological Survey, Washington Department of Fish and Wildlife, and the U.S. Fish and Wildlife Service, we are conducting a project addressing ecology of surf and white-winged scoters during the wing moult phase of the annual cycle. This work is being conducted in southeast Alaska and in the Strait of Georgia/Puget Sound, providing a flyway-wide assessment of wing molt. This work, led by MSc student Rian Dickson, is addressing a variety of basic and applied questions, including energetics, movements and habitat use, and demography (survival). CWE Post-doc Eric Anderson is also a PI on the work, and collaborators include Joe Evenson

(WDFW) and Jerry Hupp (USGS). Field work has been completed, and data analysis and write-up are underway.

E. Ecological physiology

The main aims of CWE's research in ecological physiology are three-fold: 1) to obtain a better understanding of the fundamental mechanisms underlying individual and population-level variation in physiological traits in order to provide a solid basis for predicting how animals might respond to environmental change, 2) to determine more meaningful intra-specific measures of body condition, quality and individual health for birds, and 3) to develop and apply new physiological approaches and techniques to conservation biology and ecotoxicology. We approach these aims through a combination of studies on basic physiology, often using tractable model systems (e.g. zebra finches) as well as free-living birds (starlings, western sandpiper), coupled with more applied, and more specific, goal-orientated projects (e.g. addressing current ecotoxicological problems). The following projects are on-going in the Williams' lab at present:

1. **Plasma metabolites as indicators of physiological state, condition and habitat quality**

a) **Arrow Lakes Reservoir Neotropical Migrant use of the Drawdown Zone: use of physiological indicators for assessment of habitat quality.** We completed year 3 of this collaborative BC Hydro-funded project (with John Cooper, Manning Beauschene and Associates Ltd., and David Green, and Dominique Wagner MSc student) using physiological assessment of fattening rates and condition (plasma metabolites, corticosterone) to determine effects of reservoir water management strategies, on four species of neo-tropical migrants (Common Yellowthroat, Yellow Warbler, Orange-Crowned Warbler, Wilson's Warbler). Physiological data will be combined with banding station data and information of feather stable isotopes to determine effects on 'local' versus migratory birds.

2. **Ecotoxicology projects**

a) **Anthropogenic maternal effects: long-term effects of early (in ovo or natal) exposure to xenobiotics in birds.** Early life stages in birds are sensitive to environmental conditions, and factors such as hormones and pollutants can have permanent effects on the resulting phenotypes at concentrations much lower than those required to affect adults. The level of in ovo and post-hatch exposure to hormones and xenobiotic contaminants can be influenced by the mother, potentially resulting in maternal effects (non-genetic modifications of offspring phenotype caused by the conditions provided by the mother during development). Polybrominated diphenyl ethers (PBDEs) are a class of brominated flame retardants that have become ubiquitous in the environment, yet their long-term effects on avian wildlife are poorly understood. We are using a combination of captive (Zebra finch) and wild (European starling) studies to 1) investigate the long term effects on avian development of early exposure to environmentally relevant, sublethal levels of PBDEs, 2) determine what factors affect the relationship between PBDE concentrations in the eggs and mothers, 3) determine if the pattern of transfer from mother to egg differs between hormones and contaminants, and if hormone transfer is affected by contaminants, 4) measure levels of contaminants and hormones in avian wildlife, and 5) investigate the long term effects of early exposure to contaminants in a free-living species. This project is funded by EC's Chemical Management Plan, in collaboration with Drs. John Elliott (S & T), Drs. Rob Letcher

and Tony Scheuhammer (NWRC) and Dr. Scott MacDougall-Shackleton (UWO). In 2010 we had three students working on different aspects of this project: Margaret Eng (PhD) conducted lab work with zebra finches and initiated field studies with starlings using BDE-99; Viktoria Khamzina (MET) developed and validated methods for in ovo exposure to BDE-99, and Heidi Scherr (new PhD) initiated work on molecular action and physiological effects of a new priority chemical (TBECH).

b) **Surveillance and monitoring of CMP priority compounds in key bio-indicator species.** In 2008 EC selected the European starling (*Sturnus vulgaris*) as the "terrestrial" indicator species to monitor new contaminants in biota to provide early warning support to ongoing risk assessment (under the Chemical Management Plan). Nest box 'trails' (25 boxes/site) have been established in four urban centers (Halifax, Montreal, Toronto, Vancouver). Lower Mainland sites include the Delta landfill, Burnaby/Surrey, Abbotsford and our new study site at Langley. Nest boxes will be checked daily throughout the breeding season (April – June) to monitor timing of breeding and obtain data on egg and clutch size. Eggs were collected from all locations in 2010 and measured for contaminant concentrations at the NWRC laboratories, Ottawa. Project leader Dr. Laird Shutt (NWRC) and Dr. John Elliott.

c) **Relationship between foraging, diet and potential for contaminant exposure in the Glaucous-winged gull.** Mikaela Davis (MSc) completed a second field season investigating Glaucous-winged gull diets across three historically-used breeding colonies off the coast of Vancouver Island, and compare findings with those of similar studies conducted 27-37 years ago. We hope to determine if there is an emphasis on marine or terrestrial food items and further demonstrate whether the diet and trophic level are reflective of a high level trophic predator in the local marine environment. Results from the project are necessary to interpret contaminant monitoring data and assess whether the Glaucous-winged gull is a feasible monitoring species for marine contaminants on the Canadian West coast.

3. **Reproductive ecology and physiology**

Raime Fronstin (PhD) completed a second field season for his PhD study on causes and consequences of reproductive anemia in European starlings. We now have 9 years of data at this study site and TDW collated these long-term data to look at breeding phenology and reproductive performance in the context of climate change, prey availability, and agricultural usage (in collaboration with Dr Marcel Visser, NIOO, The Netherlands). We continued with two studies integrating physiology, foraging, oceanographic conditions and climate change in seabirds (penguins, albatross, and petrels), one on the Antarctic Peninsula (Kristen Gorman, PhD, in collaboration with Dr. Bill Fraser, Polar Oceans Research Group, MT, USA) and one at Bird Island, South Georgia (Glenn Crossin, post-doctoral fellow, in collaboration with the British Antarctic Survey). Crossin and Mark Hipfner conducted a study in Cassin's auklets integrating physiological analysis to investigate carry-over effects between breeding and wintering phases.

F. Population ecology of landbirds

CWE's research on landbirds is coordinated by David Green and addresses two key questions in avian ecology and conservation. Firstly, we are interested in how migratory strategies of individual birds influences their fitness and the demography of populations. This question is

currently being assessed by examining how winter habitat use and migration distance influence the life history and demography of yellow warblers that over-winter in Mexico and breed in Revelstoke, B.C. and Inuvik, N.W.T. Secondly, we are interested in how anthropogenic changes to the landscape influence habitat selection, breeding performance and survival of threatened or declining landbirds in British Columbia. Current projects with this focus include a study examining how water use decisions by BC Hydro influence the breeding performance and survival of Yellow warblers in riparian habitat, a study examining how changes in agricultural practices in the Fraser Valley influence the foraging ecology productivity and survival of barn owls, a study examining how grazing induced changes to grasslands influences productivity of Vespers sparrow, and a study evaluating hypotheses for the decline of whip-poor-wills in Ontario. We briefly describe these studies below:

Migratory behaviour and reproduction in Yellow warblers

We have monitored the arrival date, breeding phenology and reproductive success of Yellow warblers breeding in Revelstoke, B.C., since 2004 and in Inuvik, N.W.T. since 2009. Previous work using stable isotope signatures in feathers indicates that individuals breeding in BC and between Alaska and the NWT overwinter along the Pacific and Gulf coasts of Mexico (Boulet et al. 2006). Michalea Martin (MSc candidate) is evaluating how migration distance influences the life history of the broadly distributed species by comparing the reproduction and survival of our study populations that migrate approximately 4000 and 6000 kms respectively. Anna Drake (PhD candidate) monitors the breeding population in Inuvik and has also initiated monitoring of winter habitat use of Yellow warblers in Mexico. She is examining how winter habitat use influences the arrival dates and subsequent reproductive success of birds that return to their breeding grounds in Revelstoke and Inuvik, NWT. Logistic support for this work is provided by CWS (Pacific and Yukon Region and Prairie and Northern Region) and the work is conducted in collaboration with Dr. Elsie Krebs (EC Wildlife Division). Preliminary data indicates that there is a sex bias in the distribution of birds among winter habitats with older males being more common in riparian habitat and females and younger birds being more common in coastal scrub/seasonally flooded mangrove habitat. Carbon signatures of winter grown feathers that reflect winter habitat use are correlated with the onset of breeding (first egg dates) of yearling, but not older females, in Revelstoke but not correlated with the onset of breeding of yearling or older females in Inuvik. This suggests that carryover effects of winter habitat use on individual breeding performance do not have a consistent effect on the population dynamics of Yellow warblers on the western flyway. Future analysis will focus on the potential for carryover effects that operate at the level of populations rather than individuals.

Water use decisions and the demography of a riparian dependant songbird

Human activities have caused a dramatic loss in the amount of riparian habitat in North America and this habitat loss is linked to population declines of many riparian dependant songbirds. We have shown that riparian habitat impacted by reservoir operations on the Columbia River do not function as an ecological trap for yellow warblers, a species identified by Partners in Flight as a focal species for riparian habitat. Yellow warblers prefer territories with more riparian shrub/tree habitat and build nests at sites with more willow stems; these habitat selection decisions increase annual productivity (Quinlan and Green 2012). Christine Rock, who defended her MSc in Spring 2011, examined how cowbird parasitism influences productivity and survival of yearling and older females. Future work will use our estimates of productivity and survival to examine how reservoir operations that flood 0-18% of nests in any given year influence the population dynamics of Yellow warblers.

Impacts of changing agricultural land use on the distribution and breeding performance of barn owls

Land used for agriculture provides habitat for a diversity of wildlife. However, the intensification of agricultural practises, increased use of pesticides and encroachment of urban centres have been linked to the widespread decline of many species associated with agricultural land in Europe. Sofi Hindmarch, who defended her MSc in Fall 2009) investigated how land use patterns influence the distribution and productivity of barn owls. She found that the most important factor influencing change in barn occupancy since the 1990's and current barn occupancy is traffic volume and the length of major highway in the $3km^2$ surrounding a barn. However, the major factor influencing the productivity of barn owls was the amount of urban development surrounding breeding sites. She, along with Elsie Krebs (EC Wildlife Division and John Elliott Toxicology Division), is preparing this work for publication in Landscape and Urban Planning and Condor.

Impacts of grazing induced changes to rangeland on grassland birds.

Native grasslands are one of the most threatened ecosystems in the province and cattle have been shown to have a profound impact on the vegetation community. This may have significant impacts on the bird community; 60% of bird species native to North American rangelands have declining population trends. We conducted a research project, in collaboration with Nancy Mahony (EC Wildlife Division), to assess how grazing induced changes to rangeland influences habitat use and productivity of grassland birds. We found that grazing results in changes in the structure and composition of grasslands in the in the Chilcotin –Cariboo but that grazing-induced changes to the vegetation had both positive (less bare ground) and negative effects (shorter vegetation) on the abundance of Vespers sparrow and western meadowlark such that the overall abundance of these species did not differ in grazed and ungrazed sites (Harrison et al. 2010). Similarly, grazing induced changes to the vegetation had both positive (increased cover of species promoted by grazing) and negative effects (shorter vegetation) on nest survival of Vespers sparrows (Harrison et al. 2011) such that productivity did not differ in grazed and ungrazed sites. We also examined how grazing influenced vegetation and the avifauna in Douglas fir forest of the Cariboo Chilcotin. We found that grazing reduced ground vegetation height and reduced grass cover but led to increased numbers of shrub cover and saplings, but these changes had few impacts on the bird community (Whitehorne et al. 2011). Overall, this project suggests that rangeland can sustain grazing of the intensity currently observed in the Cariboo-Chilcotin since this level of grazing has limited impact on birds of the intermountain region of BC.

The role of diet, land use change on breeding grounds and wintering location in population declines of eastern whip-poor-wills

Populations of aerial insectivores in eastern North America are argued to be declining at a faster rate than populations of other avian guilds. Philina English, a PhD candidate co-supervised by Dr Joe Nocera (Ontario Ministry of Natural Resources), is initiating a project to investigate hypotheses for population declines in eastern whip-poor-wills in Ontario. She will combine data on whip-poor-will distributions collected for the first and second Ontario Breeding Bird Atlas, land use classification data for the 1980's and 2000's, and habitat specific insect abundance data to evaluate whether changes to land use and prey abundance on breeding grounds can explain changes in the distribution of whip-poor-wills. Philina, in collaboration with Dr Joe Nocera and Dr Mike Cadman (CWS) will also attach light-logging geolocators to whip-poor-will breeding at three sites, (QUBS in the Frontenac arch, Torrance Barrens Dark Sky Reserve in the southern

Muskoka, and Long Point on Lake Erie) to determine the wintering location, migration phenology and migration routes of eastern whip-poor-wills. This information is critical to evaluating the importance of wintering location and migration in explaining population declines.

VI FUNDING

Budget

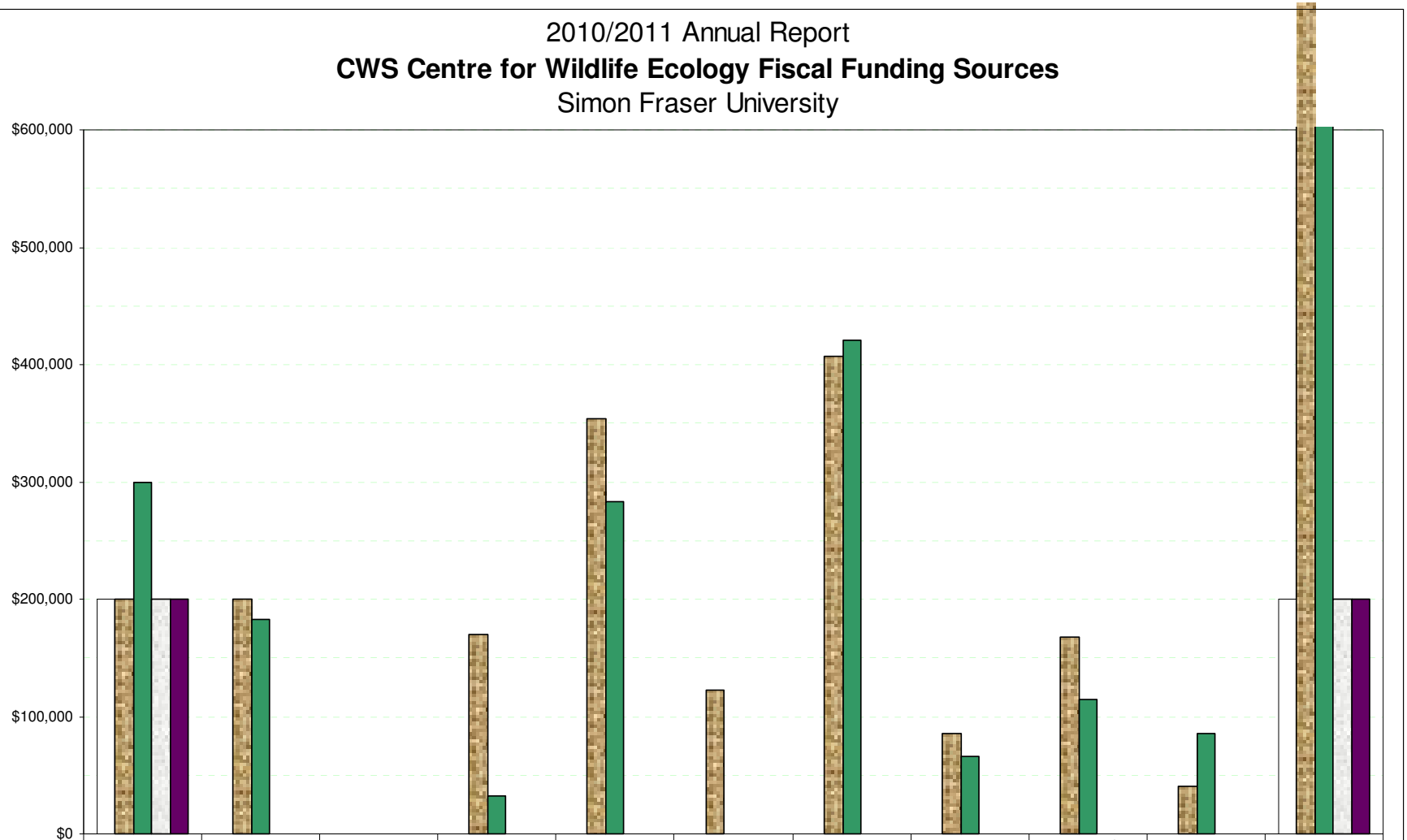
In March 2010 Simon Fraser University (the Centre for Wildlife Ecology) and Environment Canada (Science and Technology Division) finalized a contract for a four year funding agreement; the funding period was from April 2009 to March 2013. This Contribution Agreement provides $200,000 annually as core support for the research activities of the Centre for Wildlife Ecology.

The chart has been revised from the format of previous years to compare revenue projections (formulated for this agreement) to actual revenue from Environment Canada, SFU and other industrial, provincial, federal and international sectors.

2010/2011 Annual Report

CWS Centre for Wildlife Ecology Fiscal Funding Sources

Simon Fraser University



	EC/Core	Other EC	Other Fed Gov't	Prov Gov't	NSERC	Industry	SFU Faculty	SFU Other	Int'l (Cdn$)	Other	Grand Total
Projections	200,000										200,000
2009/2010	200,000	199,460		169,722	353,629	122,940	406,812	85,350	167,865	40,109	1,745,887
2010/2011	300,000	182,340	0	32,186	282,974	0	420,655	66,389	114,189	85,351	1,484,085
2011/2012	200,000										200,000
2012/2013	200,000										200,000

Category for Chart

Centre for Wildlife Ecology Annual Financial Report

1 April 2010 - 31 March 2011

Scholarships, Fellowships, Grants for Students

PhD

NSERC		Samantha Franks, Holly Middleton, Anna Drake	$91,000
SFU Fellowships etc		Lindsay Farrell - Partial Supervisory Stipend DL; Aboriginal Student Leader Award; Russel First Nations Graduate Scholarship	$12,300
SFU Fellowships etc		Birgit Schwarz - Dept of Biological Sciences - TA	$6,459
SFU Fellowships etc		Kristin Gorman - GF and PRS	$12,250
International		Birgit Schwarz - Daimler Benz Foundation	$7,020
Provincial		Birgit Schwarz - Pacific Century Graduate Scholarship; Lindsay Farrell - NAAF De Beers Canada Northern Ontario Bursary Award	$3,850
Canadian Bureau for International Education		Who-Seung Lee	$36,500

M Sc

SFU Fellowships etc		Danica Hogan - Graduate Entrance Scholarship	$6,000
SFU Fellowships etc		Rian Dickson - GF	$6,250
SFU Fellowships etc		Calen Ryan - PPD	$4,500
SFU Fellowships etc		Toby St Clair, Elly Knight, Mikaela Davis - TA	$18,630
NSERC		Rian Dickson, Calen Ryan, Willow English	$42,514
Leah Bendell		Toby St Clair	$6,500

General Funding for CWE

EC/Core		EC Annual Chair Funding (2nd of 4 yrs)	$300,000
SFU	SFU	SFU Contribution to Faculty Salaries (Ydenberg Williams Green)	$420,655

Generated Research Funding

Ducks

Other EC	Esler D	Science Horizon - postbreeding Biology of Barrow's Goldeneyes	$12,000
International	Esler D	US Fish & Wildlife: Sea Duck Joint Venture - Population Delineation and wintering ecology of Surf Scoters in SE Alaska(1st of 3 years)	$12,120

International	Esler D	US Fish & Wildlife: Sea Duck Joint Venture - Molting ecology of Surf and White-winged Scoters in SE Alaska	$12,120
International	Esler D	US Fish & Wildlife: Sea Duck Joint Venture - Refining marine contaminants studies of Pacific scoters: integrating analyses of distributions, diet and condition	$25,133
Other	Esler D / Dickson R	Ducks Unlimited	$17,000
Other EC	Esler D	Wind Farms	$82,000
		Land Birds	
Provincial	Green DJ	BC Hydro/ Cooper Beauchesne and Associates Ltd.	$28,336
Other	Drake A	Northern Scientific Training Project	$4,044
Other	M. Pennel	Northern Scientific Training Project	$2,738
		Triangle Island	
Other EC	Hipfner MJ	Environment Canada - Stage	$25,000
Other	Hipfner MJ	Migratory Birds	$10,000
Other EC	Hipfner MJ	EC Protected Areas	$15,000
		Physiological Ecology	
Other EC	Williams TD	Development and validation of an integrated avian laboratory and field model system using Zebra Finch and Starling (2nd of 4 years)	$18,340
Other EC	Williams TD	Investigate the effects of mixtures of environmentally relevant substances in the Fraser River Valley ecosystem on early developmental processes in wild birds	$30,000
Other	Williams TD	Canada Summer Jobs	$2,240
International	Williams TD	Polar Oceans Research Groups (NSF-LTER) - Climate-dependent changes in penguin population biology, physiology and nutrition (4th of 4 years)	$10,200

International	Williams TD / Crossin G	Antarctic Science	$7,452
		Western Sandpipers	
Other	S. Franks	Northern Scientific Training Program	$2,655
Other	N. Hentze	Northern Scientific Training Program	$3,309
Other	W. English	Northern Scientific Training Programt	$365
		Tuamotu Sandpiper Conservation	
International	Lank D / Ydenberg RC	Critical Ecosystem Partnership Fund	$19,745
International	Lank D / Ydenberg RC	US Fish & Wildlife Service	$20,400
		NSERC	
NSERC	Green DJ	NSERC Individual Research Grant - Dispersal and migration behaviour of birds in natural and modified landscapes (2nd of 5 years)	$29,000
NSERC	Ydenberg RC	NSERC Individual Research Grant - "Predation danger and the annual cycle of migrants (1st of 5 yrs)	$50,000
NSERC	Lank D	NSERC Individual Research Grant - RGPIN171290-2008 (3rd of 5 years)	$25,610
NSERC	Williams TD	NSERC Individual Research Grant- RGPIN/155395-200	$44,850
		Grand Total	$1,484,085
		SFU In-Kind	$116,678

VII. PUBLICATIONS

This list reflects those publications produced since our last report (publications that were "in press" or "submitted" for the last report are included and have been updated). We continue to publish very actively with 10 publications out in 2011 through March, 11 publications in press and 11 submitted. Over the past year one MSc student and one PhD student supervised by CWE faculty successfully defended their theses. Most of our publications relate to the research carried out in the main CWE programs and most refer to work carried out in the Pacific Northwest. We are however interacting with scientists throughout Canada and beyond and some of our publications reflect this.

A. Papers in Refereed Journals or Books

In press:

Anderson, E.M. and J.R. Lovvorn. In press. Contrasts in energy status and marine foraging strategies of White-winged Scoters (*Melanitta fusca*) and Surf Scoters (*M. perspicillata*). Auk.

Burger, A.E., I.A. Manley, M. Silvergieter, D.B. Lank, K.M. Jordan, T.D. Bloxton and M.G. Raphael. In press. Re-use of nest sites by Marbled Murrelet (*Brachyramphus marmoratus*) in British Columbia. Northw. Natur.

Draheim, H.M., P. Baird and S.M. Haig. In press. Temporal analysis of mtDNA variation reveals decreased genetic diversity in Least Terns. Condor.

Green, D.J., K.B. Loukes, M.W. Pennell, J. Jarvis and W.E. Easton. In press. Do reservoir water levels influence daily mass gain of wood warblers at a riparian stopover site in British Columbia, Canada? J. Field Ornithol.

Lank, D.B. In press. Book Review: *Shorebird Ecology, Conservation, and Management*, by M.A. Colwell. Berkeley: University of California Press, 344 pp. Condor.

Love, O.P. and T.D. Williams. In press. Manipulation of developmental stress reveals sex-specific effects of egg size on offspring phenotype. J. Evol. Biol.

Mulcahy, D.M. and D. Esler. In press. Survival of captive and free-ranging harlequin ducks (*Histrionicus histrionicus*) following surgical liver biopsy. J. Wildl. Diseases.

Silvergieter, M.P. and D.B. Lank. In press. Marbled Murrelets select distinctive nest trees within old growth forest patches. Avian Cons.Ecol.

Silvergieter, M.P. and D.B. Lank. In press. Patch scale nest-site selection by Marbled Murrelets (*Brachyramphus marmoratus*). Avian Cons.Ecol.

Takekawa, J.Y., S.W. De La Cruz, M.T. Wilson, E.C. Palm, J. Yee, D.R. Nyeswander, J.R. Evenson, J.M. Eadie, D. Esler, W.S. Boyd and D.H. Ward. In press. Breeding synchrony, sympatry, and nesting areas of Pacific coast surf scoters (*Melanitta perspicillata*) in the northern boreal forest. Studies in Avian Biology.

Wilson, J.W., R.M. Wanless, M.-H. Burle, A. Angel, P. Kritzinger and B. Stead. In press. Breeding biology of Brown Noddies *Anous stolidus* at their southern-most breeding site, Gough Island, in comparison to other sites. Ardea.

2011

Bond, A.L., I.L. Jones, H.L. Major, S. Minobe, J.C. Williams and G.V. Byrd. 2011. The influence of ocean climate on reproductive performance of auklets (*Aethia* spp.) at three Aleutian Island breeding sites. Mar. Ecol. Prog. Ser. 424**:** 205-218.

Borstad, G., W. Crawford, J.M. Hipfner, R. Thompson and K.D. Hyatt. 2011. Enviromental control of the breeding success of rhinoceros auklets at Triangle Island, British Columbia. Mar. Ecol. Prog. Ser. 424**:** 285-302.

Esler, D., B.E. Ballachey, K.A. Trust, S.A. Iverson, J.A. Reed, A.K. Miles, J.D. Henderson, B.W. Wilson, B.R. Woodin, J.R. Stegeman, M. McAdie and D.M. Mulcahy. 2011. Cytochrome P4501A biomarker indication of the timeline of chronic exposure of Barrow's goldeneye to residual Exxon Valdez oil. Mar. Pollut. Bull. 62**:** 609-614.

Harrison, M.L., N.A. Mahony, P. Robinson, A. Newbury and D.J. Green. 2011. Nest-site selection and productivity of Vesper Sparrows breeding in grazed habitats. J. Field Ornithol. 82**:** 140-149.

Hipfner, J.M., K.A. Hobson and J.E. Elliott. 2011. Ecological factors differentially affect mercury levels in two species of sympatric marine birds of the North Pacific. Sci. Total Environ. 409**:** 1328-1335.

Hipfner, J.M., K.W. Morrison and R. Darvill. 2011. Peregrine Falcons enable two species of colonial seabirds to breed successfully by excluding other raptors. Waterbirds 34**:** 82-88.

Jaatinen, K., J. Lehtonen and H. Kokko. 2011. Strategy selection under conspecific brood parasitism: an integrative modeling approach. Behav. Ecol. 22:144–155**:** 144-155.

Jonker, R., M. Kuiper, L. Snijders, S. van Wieren, H.H.T. Prins and R. Ydenberg. 2011. Divergence in timing of parental care and migration in Barnacle geese. Behav. Ecol. 22**:** 326-331.

Lok, E.K., D. Esler, J.Y. Takekawa, S.W. De La Cruz, W.S. Boyd, D.R. Nyeswander, J.R. Evenson and D.H. Ward. 2011. Stopover habitats of spring migrating surf scoters in southeast Alaska. J. Wildl. Manage. 75**:** 92-100.

Quinlan, S.P. and D.J. Green. 2011. Variation in deuterium (□D) signatures of Yellow Warbler *Dendroica petechia* feathers grown on breeding and wintering grounds. J. Ornithol. 152**:** 93-101.

2010

Agüero, M.L., P.G. Borboroglu and D. Esler. 2010. Breeding habitat attributes and nest site selection of Chubut steamerducks in Patagonia, Argentina. Emu 110**:** 302-306.

Blight, L.K., D.F. Bertram, T.D. Williams and L. Cowen. 2010. Interannual variation in egg neglect and incubation routine of the rhinoceros auklet (*Cerorhinca monocerata*) during the 1998/1999 El Nino/La Nina event. Marine Ornithol. 38**:** 11-15.

Burger, A.E., R.A. Ronconi, M.P. Silvergieter, C. Conroy, V. Bahn, I.A. Manley, A. Cober and D.B. Lank. 2010. Factors affecting the availability of thick epiphyte mats and other potential nest platforms for Marbled Murrelets in British Columbia. Can. J. For. Res. 40**:** 727-746.

Cesh, L.S., K.H. Elliott, S. Quade, M.A. McKinney, F. Maisoneuve, D.K. Garcelon, C.D. Sandau, R.J. Letcher, T.D. Williams and J.E. Elliott. 2010. PCBs, p,p'-DDT, PBDEs, and metabolites in relation to circulating thyroid hormone and retinol in nestling Bald Eagles (*Haliaeetus leucocephalus*). Env.Tox. Chem. 29**:** 1301-1310.

Crossin, G.T., P.N. Trathan, R.A. Phillips, A. Dawson, F. Le Bouard and T.D. Williams. 2010. A carry-over effect of migration underlies individual variation in reproductive readiness and extreme egg-size dimorphism in macaroni penguins. Amer. Nat. 176**:** 357-366.

Draheim, H.M., M.P. Miller, P. Baird and S.M. Haig. 2010. Subspecific status and population genetic structure of Least Terns (*Sternula antillarum*) inferred by mitochondrial DNA control-region sequences and microsatellite DNA. Auk 127**:** 807-819.

Esler, D. and S.A. Iverson. 2010. Female harlequin duck winter survival 11 to 14 years after the Exxon Valdez oil spill. J. Wildl. Manage. 74**:** 471-478.

Esler, D., K.A. Trust, B.E. Ballachey, S.A. Iverson, T.L. Lewis, D.J. Rizzolo, D.M. Mulcahy,

A.K. Miles, B.R. Woodin, J.J. Stegeman, J.D. Henderson and W. B.W. 2010. Cytochrome P4501A biomarker indication of oil exposure in harlequin ducks up to 20 years after the Exxon Valdez oil spill. Env.Tox. Chem. 29**:** 1138-1145.

Federer, R., T. Hollmén, D. Esler, M.J. Wooller and S.W. Wang. 2010. Stable carbon and nitrogen isotope discrimination factors from diet to blood plasma, cellular blood, feathers, and adipose fatty acids in Spectacled Eiders (*Somateria fischeri*). Can. J. Zool. 88**:** 866-874.

Gorman, K.B., E.S. Erdmann, B.C. Pickering, P.J. Horne, J.R. Blum, H.M. Lucas, D.L. Patterson-Fraser and W.R. Fraser. 2010. A new high latitude record for the macaroni penguin (*Eudyptes chrysolophus*) at Avian Island, Antarctica. Polar Biology 33**:** 1155-1158.

Harrison, M.L., N.A. Mahony, P. Robinson, A. Newbury and D.J. Green. 2010. Vesper sparrows and western meadowlarks show a mixed response to cattle grazing in the intermountain region of British Columbia. Avian Cons. Ecol. 5**:** 1. [online] URL: http://www.ace-eco.org/vol5/iss1/art1/.

Heath, J.P., G. Gilchrist and R.C. Ydenberg. 2010. Interactions between rate processes with different time scales explain counterintuitive foraging patterns of arctic wintering eiders. Proc. Roy. Soc. B 277**:** 3179-3186.

Hipfner, J.M., J. Dale and K.J. McGraw. 2010. Yolk carotenoid and stable isotopes reveal links among environment, foraging behavior and seabird breeding success. Oecologia 163**:** 351-360.

Hipfner, J.M., K.B. Gorman, R.A. Vos and J.B. Joy. 2010. Evolution of the embryonic developmental period in the marine bird families Alcidae and Spheniscidae: roles for nutrition and predation? BMC Evolutionary Biology 10**:** 179.

Hipfner, J.M., M.J.F. Lemon and M.S. Rodway. 2010. Introduced mammals, vegetation changes, and seabird conservation on the Scott Islands, British Columbia. Bird Conserv. Internat. 20**:** 295-305.

Iverson, S.A. and D. Esler. 2010. Harlequin duck population injury and recovery dynamics following the 1989 Exxon Valdez oil spill. Ecol. Appl. 20**:** 1993-2006.

Jaatinen, K., A. Lehikoinen and D.B. Lank. 2010. Female-biased sex ratios and the proportion of cryptic male morphs of migrant juvenile ruffs (*Philomachus pugnax*) in Finland. Orn. Fenn. 87**:** 125-134.

Kurvers, R.H.J.M., K. van Oers, B.A. Nolet, R.M. Jonker, S.E. van Wieren, H.H.T. Prins and R.C. Ydenberg. 2010. Personality predicts the use of social information. Ecol. Letters**:** DOI: 10.1111/j.1461-0248.2010.01473.x.

Mather, M., T. Chatwin, J. Cragg, L. Sinclair and D.F. Bertram. 2010. Marbled Murrelet Nesting Habitat Suitability Model for the British Columbia Coast. BC Journal of Ecosystems and Management 11**:** 91–102.

Mathot, K.J., D.R. Lund and R.W. Elner. 2010. Sediment in stomach contents of Western Sandpipers and Dunlin provide evidence of biofilm feeding. Waterbirds 33**:** 300-306.

Ricca, M.A., A.K. Miles, B.E. Ballachey, J.L. Bodkin, D. Esler and K.A. Trust. 2010. PCB exposure in sea otters and harlequin ducks in relation to history of contamination by the *Exxon Valdez* oil spill. Mar. Pollut. Bull. 60**:** 861-872.

Salvante, K.G., F. Vézina and T.D. Williams. 2010. Evidence for within-individual energy reallocation in cold-challenged, egg-producing birds. J. Exp. Biol. 213**:** 1991-2000.

Scherr, H., J. Bowman and K.F. Abraham. 2010. Migration and winter movements of Double-crested Cormorants breeding in Georgian Bay, Ontario. Waterbirds 33**:** 451-460.

Sheehy, J., C.M. Taylor, K.S. McCann and D.R. Norris. 2010. Optimal conservation of migratory animals: integrating demographic information across seasons. Conservation Letters 3**:** 192-202.

Stoskopf, M., D.M. Mulcahy and D. Esler. 2010. Evaluation of a portable automated serum chemistry analyzer for field assessment of harlequin ducks, *Histrionicus histrionicus*. Vet. Med. Internal. 2010**:** Article ID 418596, 5 pages.

Taylor, C.M. and D.R. Norris. 2010. Population dynamics of migratory networks. Theoretical Ecology 3**:** 65-73.

Travers, M., M.L. Clinchy, R. Boonstra, L. Zanette and T.D. Williams. 2010. Indirect predator effects on clutch size and the cost of egg production. Ecol. Letters 13**:** 980-988.

Whitehorne, I. 2010. Physiology and Site Fidelity in a Partial Migrant, the American Dipper (*Cinclus mexicanus*). Waterbirds 33**:** 461-470.

Wilson, J.W., M.-H. Burle, R. Cuthbert, R.L. Stirnemann and P.G. Ryan. 2010. Breeding success in Northern Rockhopper Penguins (*Eudyptes moseleyi*) at Gough Island, South Atlantic Ocean. Emu 110**:** 137-141.

Ydenberg, R. and W.E. Davies. 2010. Resource geometry and provisioning routines. Behav. Ecol. 21**:** 1170-1178.

Submitted:

Agüero, M.L., P.G. Borboroglu and D. Esler. Submitted. Distribution and abundance of Chubut steamerducks: an endemic species to central Patagonia, Argentina. Bird Conserv. Internat.

Anderson, E.M., D. Esler, W.S. Boyd, J.R. Evenson, D.R. Nysewander, D.H. Ward, R.D. Dickson, B. Uher-Koch, C.S. VanStratt and J.W. Hupp. Submitted. A preliminary assessment of the predator seascape for scoters: predation rates, timing, and predator composition. Can. J. Zool.

Dietrich, M., F. Kempf, E. Gómez-Díaz, A.S. Kitaysky, J.M. Hipfner, T. Boulinier and K.D. McCoy. Submitted. Inter-ocean variation in patterns of host-associated divergence in a seabird ectoparasite. Heredity.

Fairhurst, E.N., E.A. Krebs, E.A. Gillis and D.J. Green. Submitted. Begging to be heard: Signaling in an acoustically noisy environment. Beh. Ecol. Sociobiol.

Green DJ, W.I., Middleton HA, and Morrissey CA. Submitted. Do American dippers obtain a survival benefit from altitudinal migration? Oikos.

Guillaumet, A., B. Dorr, G. Wang, J. Taylor, R. Chipman, H. Scherr, J. Bowman, K. Abraham, T. Doyle and E. Cranker. Submitted. Individual and population-level strategies in local and migratory movements of Great Lakes double-crested cormorants (*Phalacrocorax auritus*). Behav. Ecol.

Hindmarch, S., E.A. Krebs and D.J. Green. Submitted. Land use predicts the persistence and distribution of barn owls in a rapidly changing agricultural landscape. Landscape Ecol.

Hogan, D., J.E. Thompson, D. Esler and W.S. Boyd. Submitted. Discovery of important postbreeding sites for Barrow's Goldeneye in the boreal transition zone of Alberta. Waterbirds.

Major, H.L., R.T. Buxton and I.L. Jones. Submitted. Variability in colony attendance decisions by a colonial seabird. J. Zool., Lond.

Major, H.L. and I.L. Jones. Submitted. An experimental study of the use of social information by nocturnal burrow-nesting seabird prospectors. Condor.

van Rooyen, J., J.M. Malt and D.B. Lank. Submitted. Relating microclimate to bryophyte abundance: edge effects on nesting habitat availability for the marbled murrelet. Northwest Science.

B. Other Publications

Baird, P. 2011. Multinational Study of Neotropical Migrants: the western sandpiper as a Model

2004-2008. Report to: Department of Defence. Project # 03-199 to 07-199. pp.
Baird, P. 2010. Foraging study of California Least Terns in San Diego Bay and Near ocean Waters, San Diego, California, 2009. Report to: U.S. NAVFACENGCOM. 91 pp.

C. Theses

Major, H.L. 2011. Prospecting decisions and habitat selection by a nocturnal burrow-nesting seabird. PhD, Simon Fraser University, Burnaby. pp.
Rock, C. 2011. Brood parasitism, reproductive success, and survival in Yellow Warblers. MSc, Simon Fraser University, Burnaby. pp.