

**ANNUAL REPORT of the
CENTRE FOR WILDLIFE ECOLOGY
2011-2012**



**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

<i>Name</i>	<i>Position</i>
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

<i>Postdoctoral Fellow</i>	<i>PhD (in progress)</i>	<i>MSc (in progress)</i>	<i>Staff</i>
Glenn Crossin	Heidi Currier	Jason Brogan	Monica Court, CWE Admin. Asst.
WhoSeung Lee	Anna Drake	Marie-Hélène Burle	Connie Smith, CWE Research Tech
	Margaret Eng	Danielle Dagenais	Jenn Barrett, MAMU/Sea Duck Tech
	Philina English	Mikaela Davis	Danica Hogan, Sea Duck Tech
	Lindsay Farrell	Rian Dickson	
	Samantha Franks	Willow English	
	Raime Fronstin	Tim Forrester	
	Kristen Gorman	Martha Fronstin	
	Ariam Jiménez	Rachel Gardiner	
	Emily McAuley	Nathan Hentze	
	Holly Middleton	Matthew Hepp	
	Marinde Out	Elly Knight	
	Birgit Schwarz	Michaela Martin	
		Eric Palm	
		Calen Ryan	
		Christopher St. Clair	
<i>Visitors</i>	<i>PhD(defended)</i>	Sarah Thomsen	<i>MSc (defended)</i>
Pat Baird		Brian Uher-Koch	Lana Cortese (MRM)
Diane Tracy		Simon Octavio Valdez	Rian Dickson
Pieter van Veelen		Dominique Wagner	Danica Hogan
			Viktoria Khamzina, MET
			Corey VanStratt

B. Steering Committee

<i>Name</i>	<i>Position</i>	<i>Affiliation</i>
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 Environment Canada has an important 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 throughout 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 2011 season: We opened our research station on Triangle Island for year 18 on 26 May 2011. Scientific research was conducted under the direction of Mark Hipfner. We maintained our time series focus on Cassin's Auklets, Rhinoceros Auklets, Glaucous-winged Gulls and Black Oystercatchers.

The 2011 breeding season followed a La Niña event over the preceding winter. This created cold ocean conditions favourable for Black Oystercatchers, which bred at high density, and especially for Cassin's Auklets, whose phenology was well matched to that of their most important prey, the copepod *Neocalanus cristatus*. As a result, those Cassin's Auklets that survived the extreme El

Niño event of 2010 had a successful breeding season in 2011. Of note, Cassin's Auklets are currently being assessed for listing under COSEWIC. However, the spring bloom over Queen Charlotte Sound was very late in 2011, and the Rhinoceros Auklets had a poor breeding season as a result.

In addition, in 2011 we completed the fourth 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 2011. The objectives of the work on Lucy and Pine are to 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; to quantify geographic and intercolony variation in this species' diet and productivity; and 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, contributes information useful for Environment Canada's environmental assessments as Port of Vancouver and ferry operations continue and expand.

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. We are now cooperating with Mark Drever, recently hired by CWS to address shorebird issues. The CWE maintains substantial science capacity for this group of birds. 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 these long-distance Neotropical migrants. We have pursued and aided fieldwork at three breeding sites, several migration locations, and five wintering sites. We have organized twelve 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 reproduc-

tion.

Highlights from the past year:

Organized and ran the 4th Western Hemisphere Shorebird Group Meeting: Lank and Ydenberg organized the 4th biennial meeting of the Western Hemisphere Shorebird Group meeting, 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 was used to provide travel awards to enable 40 Latin American students and researchers 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. PhD student Samantha Franks completed her PhD thesis under this project, and will defend in early in April 2012. The thesis covers stable isotope analyses of western sandpiper feathers collected throughout their annual cycle, and the major paper from this work was published in the Journal of Avian Biology. 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.

Fraser River Delta issues: MSc student David Hope published the major 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 completed her MSc. on Least Sandpipers, the third common local migrant shorebird, in April 2012. She related 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 EC scientists and the CWE.

MSc student Nathan Hentze is writing up the results of 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 quantified temporal, spatial, and environmental factors fostering or curtailing these flights, and 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, of 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 co-organized the second 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. Willow English was taken on as a student under this project to explore consequences of uniparental versus biparental care, focusing on incubation strategies of phalaropes versus Western and Semipalmated sandpipers. The site contributes 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), the Critical Ecosystems Partnership Fund (CEPF), administered by Conservation International, and Island Conservation.

Once widespread across the South Pacific, this species is now found on only 4 atolls, with a world population of ca. 1200 individuals. In 2008-009, PhD 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. In the summer of 2010, Burle returned to Tahanea to conduct a second field season. Supported by Island Conservation, a small removal operation was conducted as a pilot for potentially more extensive work in Tahanea, and as an experiment for Burle's thesis research. Burle also surveyed multiple islets in the atoll, scoring habitat variables, and rodent and sandpiper populations. Towards the end of her season, the population suffered a 50% reduction following salt water swells which killed vegetation and possibly arthropods in the islets. We are planning a third and final season to follow up on the population consequences of the swell event, and during which Burle will be able to visit two additional isolated populations of the species.

C. The Marbled Murrelet Project

SFU's research on threatened Marbled Murrelets continues to address issues of direct conservation concern for this listed species. This ground-breaking and high profile project examining the biology of the threatened and elusive marbled murrelet, started by CWE chair emeritus Fred Cooke, continued for its seventeenth year lead by Dov Lank, addressing ongoing questions of 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 published 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.

In April 2011, Lana Cortese completed her Masters in Resource and Environmental Management thesis relating radar traffic rates to measures of forest size and configuration. Lank and CWE technician Jenn Barrett, who worked closely with Cortese, continued data gathering and presentation to complete analyses 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. This work was largely funded by the BC Forest Science program.

Lank and Barrett prepared a paper describing the distance from the ocean of the nests located during the CWE's earlier murrelet fieldwork at Desolation and Clayquot Sounds.

Lank participated in a meeting between CWS and Alterra Power company to discuss potential modification of a monitoring program to assess the impact of a run of Alterra's run of the river power line on breeding marbled murrelets in the Toba – Montrose area. This may lead to a student project in association with the monitoring program.

Dov Lank continued to serve on the Canadian Marbled Murrelet Recovery Team and participated in calls with the Habitat Implementation Group. The team has become substantially less active as it waited for its recovery strategy to be formally approved in Ottawa; in the mean time, attention has shifted towards implementation though action plans.

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 17 years of the project, and several new papers appeared in 2010 and 2011. We also continue to collect new data on the degree and duration of oil exposure that sea ducks are experiencing, as recently as March 2011, with plans for continued sampling in March 2013. This body of work

has important implications with regard to considerations of oil and gas development and transportation in British Columbia.

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, as part of a flyway-wide collaboration including Environment Canada, U.S. federal agencies, and Washington Department of Fish and Wildlife. 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. MSc student Corey VanStratt successfully defended his thesis this year, addressing foraging conditions and behavior on Pacific coast wintering areas from Alaska to Baja California. MSc candidate Brian Uher-Koch has nearly completed his thesis addressing variation in winter survival of surf scoters at a continental scale. We also are examining relationships between sea duck abundance and distribution and underlying habitat features, led by Jenn Barrett. Collectively, our work has led to significant advances in understanding of scoter wintering and spring migration ecology, and identifies habitat and demographic features that may influence population dynamics.

3. Barrow's Goldeneye Population Delineation – In collaboration with Sean Boyd of Environment Canada, 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). Additional transmitters will be deployed in Southeast Alaska in April 2012, filling in an important data gap. 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 Moulting and Staging in Alberta – As a result, in part, of satellite telemetry work described above, an important molting and staging site was 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 Danica Hogan, who recently received her MSc, 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. One paper has been published, several others have been submitted, and others are in the works; also, results from this work have been presented to agencies in BC and Alberta.

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. Over the last 2 years, we have conducted directed field work, using funding from NRCAN, Environment Canada, and the industrial proponent, addressing 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, defending in April 2012) 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 recent MSc graduate 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. Field work has been completed, and data analysis and write-up are underway.

7. Western Grebe Population Structure and Dynamics – Although not taxonomically a sea duck, the CWE has engaged in studies of western grebes in collaboration with Environment Canada and the University of British Columbia, to address dramatic declines in numbers wintering in coastal British Columbia. A research plan has been formulated to consider the roles of redistribution of birds and declines in demographic attributes of birds that winter in BC, employing a number of different tools to address the issue. Field work will occur next fiscal year.

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 4 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). In 2011 plasma samples were collected by Manning Beauschene employees at multiple different sites and habitats, and samples were assayed by TDW. Dominique Wagner completed two MS using the first 3-years of data and is scheduled to defend his thesis in April 2012.

b) **Altitudinal differences in fattening rates in neotropical migrants using high- and low-**

altitude sites in the Lower Mainland, BC. TDW completed analysis of a 3-years dataset (in collaboration with Kathy Martin, Lesley Evens Ogden) using plasma metabolite analysis to estimate fattening rates of four songbird species during fall migration at two high altitude (1200 m ASL) and two low altitude (<25m ASL) sites in southwestern British Columbia, Canada. Three frugivorous species (Fox Sparrow, Golden-crowned Sparrow and Hermit Thrush) had 37% to 65% higher fattening rates at higher altitude sites. In contrast, the largely insectivorous Orange-crowned Warbler had higher fattening rates at low altitude sites. This study shows that high elevation sites can represent high quality stopover habitats for migrants, and thus should be given consideration for protection for songbird management and conservation.

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 2011 we had three students working on different aspects of this project: a) Margaret Eng (PhD) completed lab work with zebra finches and field studies with starlings using BDE-99; b) Viktoria Khamzina (MET) completed the development and validation of methods for *in ovo* exposure to BDE-99 (and defended her thesis), and c) Heidi Scherr continued her work on molecular action and physiological effects of a new priority chemical (TBECHE; in collaboration with Dr. Tim Beischlag, Faculty of Health Sciences).

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 Langley. Nest boxes are 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 2011 and measured for contaminant concentrations at the NWRC laboratories, Ottawa. Project leader Dr. Laird Shutt (NWRC) and Dr. John Elliott. We also contributed egg samples for an international monitoring study on the use of starling eggs as a biomonitoring tool for organohalogenated contaminants (lead by Drs. van den Steen and Pinxten, University of Antwerp, Belgium).

c) **Relationship between foraging, diet and potential for contaminant exposure in the Glaucous-winged gull.** Mikaela Davis (MSc) completed a final 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 third field season for his PhD study on causes and consequences of reproductive anemia in European starlings. We now have 10 years of data at this study site and TDW completed preliminary analyses of 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). Dr. Glenn Crossin (post-doc) continued to analyse and publish data on penguin, petrels and albatross biology from Bird Island, South Georgia (in collaboration with the British Antarctic Survey), as well as analysing data on Cassin's auklets integrating physiological analysis, and radio-tracking of foraging areas to investigate carry-over effects between breeding and wintering phases (with Dr. Mark Hipfner). Kristen Gorman (PhD) spent another season on the Antarctic Peninsula (in collaboration with Dr. Bill Fraser, Polar Oceans Research Group, MT, USA) on her study of population biology and climate change. Finally, Calen Ryan (new MSc) started a project looking at hormonal control of clutch size.

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 influence 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 Canada. 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 orchards and wineries adjacent to remnant shrub-steppe habitat influence the predator and grassland songbird community in the Okanagan, and a study evaluating hypotheses for the decline of whip-poor-wills in Ontario. We briefly describe these studies below:

Winter habitat use, migration and the demography of Yellow warblers

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). Michaela Martin (MSc candidate) is evaluating how migration distance influences the life history of this broadly distributed species by comparing the reproduc-

tion and survival of our study populations in Revelstoke and Inuvik that migrate approximately 4000 and 6000 kms, respectively, with other study populations spanning a latitudinal gradient from 0 to 68°N. Anna Drake (PhD candidate) has monitored the breeding population in Inuvik and initiated monitoring of winter habitat use of Yellow warblers in Mexico in 2011. She found that riparian habitat in Mexico is occupied primarily by older males, coastal shrub/mangrove is occupied primarily by females and agricultural habitat contains a similar number of birds of all sex/age-classes. However, the winter habitat occupied by an individual did not have a large effect on their arrival dates and subsequent reproductive success upon their return to Revelstoke and Inuvik. Carryover effects of winter habitat only influenced the productivity of yearling females in Revelstoke; carryover effects of winter habitat had no effect on the productivity of any birds (female- yearlings or older, males- yearlings or older) in Inuvik. However, Anna's recent work suggests that annual variation in climatic conditions (wind speed) during migration can have large effects on the arrival dates and productivity of yellow warblers breeding in Revelstoke. Furthermore, wind speed during migration also influences annual variation in apparent survival. This work indicates the importance of conditions during fall migration for the population dynamics of Neotropical migrants using the western flyway. Simon Valdez has initiated work examining how winter habitat (riparian habitat, agricultural habitat and coastal scrub/mangroves) influences the territorial behavior, condition, departure dates and winter survival of Yellow warblers in Jalisco, Mexico. This project that encompasses work on the breeding grounds, wintering grounds and on migration is conducted in collaboration with Elsie Krebs (EC) and Jorge Rivera (UNAM, Mexico).

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). Flooding of nests due to reservoir operations leads to the loss of between 0 and 18% of nests per year. Productivity is further reduced by cowbird parasitism that can influence the productivity of both yearling and older females (Rock, MSc thesis 2011). Matt Hepp (MSc candidate) has initiated a project that will use our estimates of productivity and survival to examine how reservoir operations and large scale climate events that influence productivity and survival influence the population dynamics of Yellow warblers.

Fragmentation, edge effects of orchards and vineyards and the distribution and abundance of songbirds in shrub-steppe habitat in the Okanagan.

Habitat loss alters the configuration of the remaining habitat patches, increasing the ratio of edge:core habitat, and alters the composition of the landscape surrounding remnant patches. The relative importance of habitat change at a local (patch) and landscape level are debated. Elly Knight (MSc candidate) is examining how loss of habitat in the Okanagan due to agricultural and urban development is influencing the composition of the predator community (small mammals, snakes, meso-predators and birds) within shrub-steppe habitat adjacent to orchards and vineyards and evaluating the relative importance of vegetation characteristics at a patch scale, the predator community within patches, land use at a landscape scale in explaining variation in the distribution and abundance of grassland songbirds in edge and core shrub-steppe habitat in the Okanagan. This project is conducted in collaboration with Nancy Mahony (EC-Wildlife

Division).

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), has initiated 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) has also attached 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). Data from geolocators removed from birds returning to these sites in 2012 will be used 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

2011-2012 is the third year of the Simon Fraser University (Centre for Wildlife Ecology) and Environment Canada (Science and Technology Division) four year funding agreement that provides \$200,000 annually as core support for the research activities of the Centre for Wildlife Ecology.

The chart compares revenue projections (formulated for this agreement) to actual revenue from Environment Canada, SFU and other industrial, provincial, federal and international sectors.

Centre for Wildlife Ecology Annual Financial Report

1 April 2011 - 31 March 2012

Scholarships, Fellowships, Grants for Students

PhD

NSERC		Philina English NSERC PGS-D2 - Emily Whattam - NSERC CGS-D - Samantha Franks NSERC - Holly Middleton (IPS)	\$72,917
SFU Fellowships etc		Marinde Out -Special Graduate Entrance Award - Emily Whattam PPD - Birgit Schwarz PRS - Kristine Gorman PRS - Samantha Franks PRS	\$29,800
SFU Fellowships etc		Birgit Schwarz - Dept of Biological travel award - Heidi Currier GSS/BISC travel awards - Kristine Gorman PSG	\$2,000
SFU Fellowships etc		Marie Helene Burle GF/PRS - Raime Fronstin TA/GF - Heidi Currier GF - Birgit Schwarz TA - Kristine Gorman RA/GF/RA - Samantha Franks TA	\$58,031
International		Simon Valdez - CONACYT	\$18,215
Other		Heidi Currier SETAC travel award - Kristine Gorman Anne Vallee Ecological Fund	\$2,000

M Sc

NSERC		Elly Knight, Danielle Dagenais (IPSPI), Willow English (PPD)	\$32,988
SFU Fellowships etc		Rian Dickson, Danica Hogan, Corey Van Stratt, Brian Uher-Koch - Travel Award	\$2,000
SFU Fellowships etc		Danica Hogan, Brian Uher-Koch, Martha Fronstin, Michaela Martin, Willow English, Eric Palm - GF	\$37,500
SFU Fellowships etc		Nathan Hentze, Elly Knight, Michaela Martin, Willow English, Toby St Clair, Mikaela Davis - TA	\$26,320
Leah Bendell		Toby St Clair	\$3,000
Other		Elly Knight - Nature Trust bursary	\$8,500

General Funding for CWE

EC/Core		EC Annual Chair Funding (3rd of 4 yrs)	\$240,000
SFU	SFU	SFU Contribution to Faculty Salaries (Ydenberg Williams Green)	\$426,775

Generated Research Funding

Other EC	Esler D	Science Horizon - Sea duck population ecology: the wing molt stage of the annual cycle	\$12,000
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Other EC	Ydenberg RC/Elliott J	Study of the exposure and effects of soil derived priority chemicals in terrestrial top predators	\$13,200
Waterbirds			
Other EC	Esler D/Ydenberg R	Western Grebes (1st of 2 years)	\$20,000
Other	Esler D/R Ydenberg	Ducks Unlimited	\$9,000
Land Birds			
Provincial	Green DJ	BC Hydro/ Cooper Beauchesne and Associates Ltd.	\$36,336
Provincial	Green DJ	Ontario Ministry of Natural Resources	\$15,000
Provincial	Conboy M/English P Green DJ	Ontario Ministry of Natural Resources - Queen's University	\$43,139
Other EC NSERC		Population trends and threats to migratory birds in the south Okanagan valley, BC, Canada (1st of 2 years)	\$20,000
Other		Teri Johnes - Undergrad Award	\$4,500
Other	Martin M.	Northern Scientific Training Program	\$3,891
Other	James S.	Northern Scientific Training Program	\$2,845
Sea Birds			
Other EC	Hipfner MJ	Environment Canada - Stage	\$17,000
Other EC	Hipfner MJ	Species at Risk and Migratory Birds	\$49,000
Other EC	Hipfner MJ	Scott Islands MWA	\$25,000
Physiological Ecology			
Other EC	Williams TD	Investigating priority chemicals using avian lab and field models 1st of 3 years	\$40,000
Other EC/CMP	Williams TD	Development and validation of an integrated avian laboratory and field model system using Zebra Finch and Starling (4th of 4 years)	\$53,200
International	Williams TD	Polar Oceans Research Groups (NSF-LTER) - Climate-dependent changes in penguin population biology, physiology and nutrition (4th of 4 years)	\$16,250
Western Sandpipers			
Other	S. Franks	Northern Scientific Training Program	\$1,906
Other	W. English	Northern Scientific Training Program	\$3,483
International	Lank D/Ydenberg RC/B Sandercock	Kansas State University/Alaska Fish and Game (year 2 of 3)	\$50,667

Tuamotu Sandpiper Project			
International	Lank D/Burle MH	Island Conservation	\$66,000
Other	Burle MH	Private donation	\$1,958
NSERC			
NSERC	Green DJ	NSERC Individual Research Grant - Dispersal and migration behaviour of birds in natural and modified landscapes (3rd of 5 years)	\$29,000
NSERC	Ydenberg RC	NSERC Individual Research Grant - Predation danger and the annual cycle of migrants (2nd of 5 yrs)	\$50,000
NSERC	Lank D	NSERC Individual Research Grant - RGPIN171290-2008 (4th of 5 years)	\$25,610
NSERC	Williams TD	NSERC Individual Research Grant- RGPIN/155395-200	\$44,850
NSERC	Elliott J	NSERC Individual Research Grant - RGPIN/402344-2011 (1st of 5 years)	\$25,000
Grand Total			\$1,638,881
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 17 publications out in 2012 through March, 16 publications in press and 22 submitted. Over the past year three MSc students, one MET student and one MRM 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:

- Agüero, M.L., P.G. Borboroglu and D. Esler. In press. Distribution and abundance of Chubut steamerducks: an endemic species to central Patagonia, Argentina. *Bird Conserv. Internat.*
- Crossin, G.T., P.N. Trathan, R.A. Phillips, K.B. Gorman, A. Dawson, K.Q. Sakamoto and T.D. Williams. In press. Corticosterone predicts foraging behavior and parental care in macaroni penguins. *Amer. Nat.*
- Dekker, D. In press. The effect of kleptoparasitic Bald Eagles and Gyrfalcons on the kill rate of Peregrine Falcons hunting Dunlins wintering in British Columbia. *Condor.*
- Eng, M.L., J.E. Elliott, S. MacDougall-Shackleton, R.J. Letcher and T.D. Williams. In press.

- Early exposure to 2,2',4,4',5-pe-pentabromodiphenyl ether (BDE-99) affects mating behavior of zebra finches. *Toxicol. Sci.*
- Farrell, L.L., D.A. Dawson, G.J. Horsburgh, T. Burke and D.B. Lank. In press. Isolation, characterization and predicted genome locations of ruff (*Philomachus pugnax*, AVES) microsatellite loci. *Cons. Gen. Res.*
- Federer, R., T.E. Hollmén, D. Esler and M.J. Wooller. In press. Stable carbon and nitrogen isotope discrimination factors for quantifying Spectacled Eider nutrient allocation to egg production. *Condor.*
- Gratto-Trevor, C.L., R.I.G. Morrison, D. Mizrahi, D.B. Lank, P. Hicklin and S. A.L. In press. Migratory connectivity of Semipalmated sandpipers: Winter distribution and migration routes of breeding populations. *Waterbirds.*
- Hipfner, J.M. In press. Influence of sea-surface temperature on egg size and clutch size in the Glaucous-winged Gull. *Waterbirds.*
- Hipfner, J.M., L.K. Blight, R.W. Lowe, S.I. Wilhelm, G.J. Robertson, R.T. Barrett, T. Anker-Nilssen and T.P. Good. In press. Unintended consequences: How the recovery of sea-eagle *Haliaeetus* spp. populations in the northern hemisphere is affecting seabirds. *Marine Ornithol.*
- Hipfner, J.M., K.M. Morrison and A.-L. Kouwenberg. In press. Biology of Black Oystercatchers breeding on Triangle Island, British Columbia, Canada 2003-2011. *Northwest. Natur.*
- Kurvers, R., B. Nolet, H.H.T. Prins, R. Ydenberg and K. van Oers. In press. Boldness affects foraging decisions in barnacle geese: an experimental approach. *Behav. Ecol.*
- Kuwae, T., E. Miyoshi, S. Hosokawa, K. Ichimi, J. Hosoya, T. Amano, T. Moriya, M. Kondoh, R.C. Ydenberg and R. Elner. In press. Variable and complex food web structures revealed by exploring missing trophic links between birds and biofilm. *Ecol. Letters.*
- 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. In press. Spatiotemporal associations between Pacific herring spawn and surf scoter spring migration: evaluating a "silver wave" hypothesis. *Mar. Ecol. Prog. Ser.*
- Major, H.L. and A. Chubaty. In press. Estimating colony and breeding population size for nocturnal burrow-nesting seabirds. *Mar. Ecol. Prog. Ser.*
- Pavlacky Jr, D.C., H.P. Possingham, A.J. Lowe, P.J. Prentis, D.J. Green and A.W. Goldizen. In press. Anthropogenic landscape change promotes asymmetric dispersal and limits regional patch occupancy in a spatially structured bird population. *J. Anim. Ecol.*
- Williams, T.D. In press. Hormones, life-history, and phenotypic variation: opportunities in evolutionary avian endocrinology. *Gen. Comp. Endocrinol.*

2012

- Anderson, E.M., D. Esler, W.S. Boyd, J.R. Evenson, D.R. Nysewander, D.H. Ward, R.D. Dickson, B.D. Uher-Koch, C.S. VanStratt and J.W. Hupp. 2012. Predation rates, timing, and predator composition for scoters in marine habitats. *Can. J. Zool.* 90: 42-50.
- Crossin, G.T., A. Dawson, R.A. Phillips, P.N. Trathan, S. Adlard, K.B. Gorman and T.D. Williams. 2012. Seasonal patterns of prolactin and corticosterone secretion in an Antarctic seabird that molts during reproduction. *Gen. Comp. Endocrinol.* 175: 74-81.
- Crossin, G.T., R.A. Phillips, P.N. Trathan, D.S. Fox, A. Dawson, K.E. Wynne-Edwards and T.D. Williams. 2012. Migratory carryover effects and endocrinological correlates of reproductive decisions and reproductive success in female albatrosses. *Gen. Comp. Endocrinol.* 176: 151-157.
- Crossin, G.T., P.N. Trathan and T.D. Williams. 2012. Potential mode of clutch size determination and follicle development in Eudyptes penguins. *Polar Biology* 35: 313-317.

- Dietrich, M., F. Kempf, E. Gómez-Díaz, A.S. Kitaysky, J.M. Hipfner, T. Boulinier and K.D. McCoy. 2012. Inter-ocean variation in patterns of host-associated divergence in a seabird ectoparasite. *J. Biogeog.* 39: 545-555.
- Draheim, H.M., P. Baird and S.M. Haig. 2012. Temporal analysis of mtDNA variation reveals decreased genetic diversity in Least Terns. *Condor* 114: 145-154.
- Evans Ogden, L.J., M. Martin and K. Martin. 2012. Mating and breeding success decline with elevation for the Pacific Wren (*Troglodytes pacificus*) in coastal mountain forests. *Wilson J. Ornithol.* 124: 270-276.
- Franks, S.E., D.R. Norris, T.K. Kyser, G. Fernández, B. Schwarz, R. Carmona, M.A. Colwell, J.C. Sandoval, A. Dondua, H.R. Gates, B. Haase, D.J. Hodkinson, A. Jiménez, R.B. Lantot, B. Ortego, B.K. Sandercock, F. Sanders, J.Y. Takekawa, N. Warnock, R.C. Ydenberg and D.B. Lank. 2012. Range-wide patterns of migratory connectivity in the western sandpiper *Calidris mauri*. *J. Avian Biol.* doi: 10.1111/j.1600-048X.2012.05573.x.
- Kraus, R.H.S., H.H.D. Kerstens, P. van Hooft, H.-J. Megens, J. Elmberg, A. Tsvey, D. Sartakov, S.A. Soloviev, R.P.M.A. Crooijmans, M.A.M. Groenen, R.C. Ydenberg and H.H.T. Prins. 2012. Widespread horizontal genomic exchange does not erode species barriers among sympatric ducks. *BMC Evolutionary Biology* 12: 45.
- Kurvers, R.H.J.M., S.I. van Santen de Hoog, S.E. van Wieren, R.C. Ydenberg and H.H.T. Prins. 2012. No evidence for negative frequency-dependent feeding performance in relation to personality. *Behav. Ecol.* 23: 51-57.
- Major, H.L., M.J.F. Lemon and J.M. Hipfner. 2012. Habitat as a potential factor limiting the recovery of a population of nocturnal seabirds. *J. Wildl. Manage.* 76(4) doi: 10.1002/jwmg.303.
- Nicolai, C.A., J.S. Sedinger, D.H. Ward and W.S. Boyd. 2012. Mate loss affects survival but not breeding in black brant geese. *Behav. Ecol.* 23: 643-648.
- Quinlan, S.P. and D.J. Green. 2012. Riparian habitat disturbed by reservoir management does not function as an ecological trap for the yellow warbler. *Can. J. Zool.* 90: 320-328.
- Rohwer, S., V.G. Rohwer, A. Townsend Peterson, A.G. Navarro-Siguenza and P. English. 2012. Assessing migratory double breeding through complementary specimen densities and breeding records. *Condor* 114: 1-14.
- Ryan, C.P., W.G. Anderson, L.E. Gardiner and J.F. Hare. 2012. Ground squirrels optimize litter size and sex ratio relative to maternal condition. *Behav. Ecol.* 23: 160-167.
- Vézina, F., T.D. Williams, T. Piersma and R.G.I. Morrison. 2012. Phenotypic compromises in a long-distance migrant during the transition from migration to reproduction in the High Arctic. *Funct. Ecol.* 26: 500-512.
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2011

- Anderson, E.M. and J.R. Lovvorn. 2011. Contrasts in energy status and marine foraging strategies of White-winged Scoters (*Melanitta fusca*) and Surf Scoters (*M. perspicillata*). *Auk* 128: 248-257.
- Bestelmeyer, B.T., A.M. Ellison, W.R. Fraser, K.B. Gorman, S.J. Holbrook, C.M. Laney, M.D. Ohman, D.P.C. Peters, F.C. Pillsbury, A. Rassweiler, R. Schmitt and S. Sharma. 2011. Analysis of abrupt transitions in ecological systems. *Ecosph.* 2: art129.
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- English, P.A. and R. Montgomerie. 2011. Robin's egg blue: does egg color influence male parental care. Beh. Ecol. Sociobiol. 65: 1029-1036.
- Green, D.J., K.B. Loukes, M.W. Pennell, J. Jarvis and W.E. Easton. 2011. Do reservoir water levels influence daily mass gain of wood warblers at a riparian stopover site in British Columbia, Canada? J. Field Ornithol. 82: 11-24.
- Hogan, D., J.E. Thompson, D. Esler and W.S. Boyd. 2011. Discovery of important postbreeding sites for Barrow's Goldeneye in the boreal transition zone of Alberta. Waterbirds 34: 261-268.
- Hope, D.D., D.B. Lank, B.D. Smith and R.C. Ydenberg. 2011. Migration of two calidrid sandpiper species on the predator landscape: how stopover time and hence migration speed vary with proximity to danger. J. Avian Biol. 42: 523-530.
- Jaatinen, K., M. Ost, P. Gienapp and J. Merilä. 2011. Differential responses to related hosts by nesting and non-nesting parasites in a brood-parasitic duck. Molec. Ecol. doi: 10.1111/j.1365-294X.2011.05281.x.
- Jamieson, S.E. 2011. Pacific Dunlin *Calidris alpina pacifica* show a high propensity for second clutch production. J. Ornithol. 152: 1013-1021.
- Jonker, R.M., R.H.J.M. Kurvers, A. van de Bilt, M. Faber, S.E. Van Wieren, H.H.T. Prins and R.C. Ydenberg. 2011. Rapid adaptive adjustment of parental care coincident with altered migratory behaviour. Evol. Ecol. DOI 10.1007/s10682-011-9514-6.
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- Lindstrom, Å., R.E. Gill, S.E. Jamieson, B. McCaffery, L. Wennerberg, M. Wikelski and M. Klaassen. 2011. A puzzling migratory detour: Are fuelling conditions in Alaska driving the movement of juvenile Sharp-tailed Sandpipers? Condor 113: 129-139.
- Love, O.P. and T.D. Williams. 2011. Manipulating developmental stress reveals sex-specific effects of egg size on offspring phenotype. J. Evol. Biol. 24: 1497-1504.
- Major, H.L. and I.L. Jones. 2011. An experimental study of the use of social information by prospecting nocturnal burrow-nesting seabirds. Condor 113: 572-590.
- Morrison, K.W., J.M. Hipfner, G.S. Blackburn and D.J. Green. 2011. Effects of extreme climate events on adult survival of three Pacific auks. Auk 128: 707-715.
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24.

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Whitehorne, I.B.J., M.L. Harrison, N.A. Mahony, P. Robinson, A. Newbury and D.J. Green. 2011. Effects of cattle-grazing on birds in Interior Douglas-fir (*Pseudotsuaga menziesii*) forests of British Columbia. *B.C. J. Ecosys. Manag.* 12: 1-17.

Submitted:

Dickson, R.D., D. Esler, J.W. Hupp, E.M. Anderson, J.R. Evenson and J. Barrett. Submitted. Dynamics of body mass and foraging effort of Surf Scoters (*Melanitta perspicillata*) and White-winged Scoters (*M. fusca*) during remigial moult. *Ibis*.

Dickson, R.D., D. Esler, J.W. Hupp, E.M. Anderson, J.R. Evenson and J. Barrett. Submitted. Phenology and duration of remigial molt in Surf Scoters (*Melanitta perspicillata*) and White-winged Scoters (*M. fusca*) on the Pacific coast of North America. *Can. J. Zool.*

Ekblom, R., L.L. Farrell, D.B. Lank and T. Burke. Submitted. Gene expression divergence and nucleotide differentiation between males of different colour morphs and mating strategies in the ruff. *Proc. Nat. Acad. Sci.*

Fernández, G.J. and D.B. Lank. Submitted. Variation in territorial behavior of Western Sandpipers on their non-breeding grounds: the effect of sex and foraging interference. *J. Field Ornithol.*

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. Do landscape features predict the presence of barn owls in a rapidly changing agricultural landscape? *Landsc. Urban Plan.*

Hipfner, J.M. and R.W. Elner. Submitted. Sea-surface temperature affects breeding density in a rocky intertidal predator, the Black Oystercatcher. *Can. J. Zool.*

Hipfner, J.M., L.A. McFarlane-Tranquilla, B. Addison and K.A. Hobson. Submitted. Two central-place-foraging seabirds combine fixed and flexible behavior in different environments. *Mar. Ecol. Prog. Ser.*

Hogan, D., D. Esler and J.E. Thompson. Submitted. Survival of Barrow's Goldeneyes during remigial molt and fall staging. *J. Wildl. Manage.*

Hogan, D., D. Esler, J.E. Thompson and W.S. Boyd. Submitted. Body mass and foraging dynamics of Barrow's Goldeneyes: strategies for managing risks of simultaneous remigial molt. *Auk.*

Hogan, D., J.E. Thompson and D. Esler. Submitted. Remigial molt phenology and remigial growth rates of Barrow's Goldeneyes. *Condor.*

Jones, I.L., S. Minobe, W.J. Sydeman, A.L. Bond, H.L. Major, F.M. Hunter, J.C. Williams and G.V. Byrd. Submitted. Covariation among annual adult survival of three auklet (*Aethia*) species and ocean climate at three Aleutian Islands during 1990-2008. *Mar. Ecol. Prog. Ser.*

Kouwenberg, A.-L., J.M. Hipfner, D.W. McKay and A.E. Storey. Submitted. Corticosterone and stable isotopes in feathers identify carry-over effects in Atlantic Puffins. *Ibis*.

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