

**ANNUAL REPORT of the
CENTRE FOR WILDLIFE ECOLOGY
2013-2014**



Environment
Canada

Environnement
Canada

**Department of Biological Sciences
Simon Fraser University**

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

Dr. Ronald C. Ydenberg, Director

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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 Fellows</i>	<i>PhD (in progress)</i>	<i>MSc (in progress)</i>	<i>Staff</i>
Margaret Eng	Marie-Hélène Burle	Seth Bennett	Monica Court, CWE Admin. Asst.
Melinda Fowler	Heidi Currier	Jason Brogan	Connie Smith, CWE Research Tech
Cailin Xu	Philina English	Allison Cornell	Teri Jones, Lab Asst.
	Kristen Gorman	Danielle Dagenais	
	David Hope	Annie Ellison	
	Emily McAuley	Tim Forrester	
	Marinde Out	Martha Fronstin	
	Birgit Schwarz	Matthew Hepp	
	Simon Valdez	Richard Johnston	
		Olga Lansdorp	
		Lauren MacFarland	
		Sarah Thomsen	
		Megan Willie	
		Maria Yu (MET)	
<i>Visitors</i>	<i>PhD(defended)</i>	<i>MSc (defended)</i>	
Pat Baird	Anna Drake	Willow English	
Aroha Miller	Holly Middleton	Elly Knight	
Jesus Rodriguez		Michaela Martin	
		Calen Ryan	
		Brian Uher-Koch	

B. Steering Committee

<i>Name</i>	<i>Position</i>	<i>Affiliation</i>
Robert Elner	Emeritus Scientist	<i>EC</i>
David Green	CWE faculty (non-voting)	<i>SFU</i>
Mark Hipfner	Research Scientist	<i>EC</i>
Elsie Krebs	Research Manager, Western Canada	<i>EC</i>
Tony Williams	CWE faculty (non-voting)	<i>SFU</i>
Ron Ydenberg	CWE Director (non-voting)	<i>SFU</i>

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 2013 season: We opened our research station on Triangle Island for year 19 on 28 May 2013. Scientific research was conducted under the direction of Mark Hipfner, and the field crew was a diverse bunch that included the CWE's own David Green, as well as Katie Haman (UBC), Kevin Fort and Mark Drever (EC), Catherine Jardine (Bird Studies Canada) and Katharine Studholme (Dalhousie University). We maintained our time series focus on Cassin's Auklets, Rhinoceros Auklets, Glaucous-winged Gulls and Black Oystercatchers.

The 2013 season continued the recent string of years (since 2007-2008, but excluding 2010) characterized by cold ocean conditions. Thus conditions were extremely favourable for Black

Oystercatchers, which bred at high density, and for Cassin's Auklets, which bred early and on time to match biomass peaks of their most important prey, the copepod *Neocalanus cristatus*. Rhinoceros Auklets in particular laid very early and enjoyed a highly productive year.

In 2013 we also completed the sixth year of a project to band Rhinoceros Auklets at the large colonies at Pine Island (Central Coast) and Lucy Island (North Coast); we also visited Moore Island in 2013. The objectives of the work are to obtain estimates of adult survival rates at these colonies to enable us to assess the potential effects of mortality in gill-net fisheries on local populations; to quantify geographic and yearly variation in this species' diet and productivity; and to quantify spatial and temporal variation in diets of Pacific sandlance, a key prey species for Rhinoceros Auklets at all BC colonies. And in 2013, we also continued a collaborative project to quantify the consumption of salmon, especially Fraser River sockeye, by seabirds; and began a project to deploy GLS tags on Rhinoceros Auklets in order to track migratory routes and delineate habitats of importance during their annual cycle.

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 – principally Western and Least sandpipers, and Dunlin - to better understand the causes of these apparent declines.

The majority of the world's three and a half to four 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 Elnor 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 reproduction.

Highlights from 2013:

Fraser River Delta issues: David Hope, who obtained an MSc at the CWE, returned as a PhD student in 2013 to study stopover strategies of southward migrating western sandpipers. In collaboration with Bird Studies Canada, he is organizing volunteers to survey shorebird site and habitat utilization throughout the Salish Sea. This work puts the relative importance of the FRD into a regional perspective. Hope submitted the second chapter from his MSc thesis for publication (now published), looking at changes in stopover behaviour throughout the summer as predation danger changed.

Migratory Connectivity Project: The Western Sandpiper migratory connectivity project is nearing completion. This international project focusing on intrinsic markers involved 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 published a stable isotope based dietary study from her 2012 PhD thesis. Birgit Schwarz, a second PhD student is addressing population structure using genetic analyses and song, co-supervised by Darren Irwin at UBC. As part of the breeding study at Nome, several geolocators were recovered from Western and Semipalmated sandpipers, demonstrating a non-stop flight from Alaska to, and wintering at, the Fraser River delta.

Shorebird Breeding Biology: Lank co-supervised the fourth 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 study, which focuses on the demography of Western and Semipalmated sandpipers, and how this may have changed since Sandercock's PhD work at the site in the 1990s. 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.

CWE MSc student Willow English conducted a short third field season focusing on consequences of uniparental care, working with red-necked phalaropes. She submitted a MS on phalarope sex ratios, and completed her MSc in spring 2014.

Sarah Jamieson (PhD CWE 2009) submitted her final thesis paper with Ydenberg and Lank, relating the duration of parental care to migration strategies of sympatric dunlin and Western sandpipers.

The 5th Western Hemisphere Shorebird Group Meeting: Eight members of the CWE Shorebird Group participated in the 5th WHSG meeting held in Colombia in September 2013. Richard Johnson as a new CWE graduate student from Colombia played a central role in organizing the meeting.

At the meeting, we recruited Eveling Tavera Fernandez, from Peru, as a new MSc student who

will start in May 2014. Eveling organized a shorebird banding project in Peru, and has discovered that both eastern and western populations of Semipalmated Sandpipers winter in Peru, arriving on different schedules.

Western Sandpiper account in the Birds of North America: With partial support from EC via funding from Mark Drever, recently graduated student Samantha Franks (2012) and Lank revised the Birds of North America account for Western Sandpipers, which was 20 years out of date. This widely used reference now includes much of the information the CWE had generated on this species over the past two decades. See: <http://bna.birds.cornell.edu/bna/species/090>, [doi:10.2173/bna.90](https://doi.org/10.2173/bna.90)

Tuamotu Sandpiper Conservation: The CWE is lending its expertise in shorebird biology to support a conservation project on the highly endangered Tuamotu Sandpiper, in partnership with the USF&WS (Rick Lanctot, Alaska region), Island Conservation, the French Polynesian Regional Division for the Environment (DIREN), a local ornithological NGO (the Society of Polynesian Ornithologists, SOP-MANU), and the Critical Ecosystems Partnership Fund (CEPF), 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. PhD student Marie-Hélène Burle has now >15 months conducting the first study of the species' biology. 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.

C. The Marbled Murrelet Project

SFU's research on threatened Marbled Murrelets continues to address issues of direct conservation and management 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 nineteenth year lead by Dov Lank, addressing evolving questions of management interest for this threatened species.

A major activity in 2013 involved supporting the year-long CWS-led revision of a Marbled Murrelet recovery strategy by the Canadian Marbled Murrelet Recovery Team, stimulated by an NGO-initiated court case against the federal government for failing to post a strategy under SARA in a timely manner. The 'SFU' nesting data gathered by Cooke's crews were invoked as the 'best available information' in multiple contexts. Lank participated in a series of team meetings and contributed analyses towards dealing with questions of critical habitat definitions.

The second major activity was continued analysis of the extensive radar traffic rate data sets that have been gathered in BC to address:

- (1) The utility of several methods of habitat suitability classification as predictors of local traffic rates during the breeding season, and
- (2) The magnitude of fragmentation effects on traffic rates, as an index of local breeding population size. Science Horizon intern Teri Jones contributed to this project along with Lank and a statistical consultant.

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 evaluates population recovery of sea ducks (harlequin ducks and Barrow's goldeneye) from the 1989 Exxon Valdez oil spill in Prince William Sound, Alaska. We continue to collect new data on the degree and duration of oil exposure that sea ducks are experiencing, with most recent data collection in March 2013 and plans for continued analysis and sample collection. This body of work has important implications with regard to considerations of oil and gas development and transportation in British Columbia.

2. 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), 5 wintering sites (Indian Arm, BC; Douglas Channel, BC; Prince William Sound, Alaska; Juneau, Alaska; and Kachemak Bay, 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.

3. Barrow's Goldeneye Exposure to Contaminants in British Columbia – In collaboration with partners including Environment Canada and Stantec, new MSc student Megan Willie has initiated a project to evaluate variation in cytochrome P4501A induction, as a measure of exposure to hydrocarbons, in wintering Barrow's goldeneyes. Goldeneye samples were collected in the Douglas Channel area of north coastal BC in April 2014; additional bird samples, as well as samples of sediments and mussels will be collected throughout the province, representing different levels of likely contamination.

E. Ecological physiology

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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. Reproductive ecology and physiology of species in agricultural habitats

a) **European starling:** We completed a 12th field season (2002-2013) investigating the ecological physiology of European starlings at two sites in the Fraser Valley: Langley (140 nest boxes) and Glen Valley (60 nest boxes); funded largely from sources outside of CWE. We are currently focusing on the broader ecological and agricultural context of reproduction, initiating studies of prey (Tipulid sp.) density in fields, prey composition of diet, foraging (using radio tracking) during chick provisioning, and physiological determinants of chick quality at fledging, in relation to breeding success and physiological condition. This work will continue over the next few years with Allison Cornell (PhD), Melinda Fowler (post-doc) and several undergraduate students. We have also initiated a number of analyses of our long-term data asset including a) effects of climate change and temperature on timing of breeding (in collaboration with researchers at the Netherlands institute of Ecology; where TDW was a Visiting Scientist in Summer 2013), b) individual plasticity in laying date and breeding productivity (Laramie Ferguson, Honours student), and c) determinants and consequences of double-brooding (Allison Cornell). As well as studying a species which is dependent on traditional agriculture in an area undergoing rapid urbanisation, this work provides essential ecological context for the use of the European starling for toxicology monitoring under the CMP (see below).

b) **Aerial insectivores:** landscape-level determinants of Barn Swallow and Tree Swallow breeding success and foraging behaviour in the Metro Vancouver area. We initiated this project in 2013 as a collaboration with Nancy Mahony (Environment Canada) with Olga Lansdorp as a new MSc student. The goal of this research is to determine where swallow breeding productivity is the highest, and determine the factors that contribute to high quality breeding habitat. Specifically we will, 1) compare non-agricultural and agricultural land use and determine the effect of livestock presence on breeding productivity/success of Barn Swallows and Tree swallows; 2) measure the abundance, diversity, and phenology of aerial arthropods in the different swallow breeding habitats, and 3) study the potential of Grassland Set-Asides to provide high quality feeding habitat for Barn Swallows within an agricultural landscape.

2. 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. The earlier work on this project by Dominique Wagner (MSc student) from 2008-2010 was accepted for publication in *Conservation Physiology* and *Physiological and Biochemical Zoology*. We analysed plasma samples collected in 2013 (the 5th year of this project) for four species (COYE, SWTH, YRWA, YWAR) at multiple different sites (cf. earlier work which was conducted at a single site). We found no YEAR or SITE variation in estimated fattening rate and no effect of water level on fattening rate. There was some evidence for an effect of water level on glycerol (body condition?). In general results were consistent with those from the 2008-2010 study. This work was conducted in collaboration with David Green (SFU) and John Cooper, Manning Beauschene and Associates Ltd., and a final report was submitted to BC Hydro who is funding this work.

3. Ecotoxicology projects

We continue a long-term and highly productive collaboration with Dr. John Elliott, S & T, on

long-term effects of early (in ovo or natal) exposure to xenobiotics in birds, largely funded via non-CWE grants or agreements. Early life stages in birds are sensitive to environmental conditions, and factors such as hormones and pollutants can have long-term (permanent) effects on the resulting phenotypes at concentrations much lower than those required to affect adults. We have developed an integrated model system using lab-based studies of breeding zebra finches and field-based studies of European starlings. This combines various methods of exposure of embryos or chicks during early development (egg injection, exposure via maternal transfer, etc), assessment of long-term effects of contaminants when these chicks reach adulthood (mating and courtship behaviour, breeding success), and potential intergenerational effects on the offspring of birds exposed as chicks. More recently we have incorporated in vitro (cell-based and molecular) assays of potential endocrine disrupting effects before we start in vivo testing using physiological, neurobiological, behavioural and reproductive endpoints (with Dr. Tim Beischlag, Faculty of Health Sciences). We have now used this system to test a series of “priority” chemicals identified by colleagues at NWRC, Ottawa (Drs. Crump, Fernie, Letcher), under EC’s Chemical Management Plan (CMP). Current projects include:

a) **effect of exposure to brominated flame retardants on growth, development, and reproduction in free-living European starlings and captive-breeding zebra finches.** Captive-breeding zebra finches were used to investigate the effects of two brominated flame retardants, 1,2-dibromo-4-(1,2-dibromoethyl) cyclohexane (TBECH) and polybrominated diphenyl ethers (PBDEs) on growth, development, and reproduction (Heidi Scherr, PhD). Effects of exposure to environmental contaminants, primarily PBDEs, were studied in free-living starlings breeding at the landfill site in Delta, BC, in comparison to ‘reference’ populations in rural Langley, BC. This included i/ analysis of PBDE levels in eggs, chicks, adults, invertebrate prey and other diet items, b) analysis of breeding phenology, breeding effort and reproductive success, c) effects on female provisioning rate and physiological health, and finally d) analysis of PBDE levels in landfill soils, and the starling food chain, which indicated that contaminants are bio-accumulated in soil invertebrates and biomagnified in starlings. This study shows the benefits of integrating both lab and free-living animal models to investigate the detrimental effects of exposure to environmental contaminants for risk assessment studies.

b) **effect of exposure to the brominated flame retardant BDE-99:** Margaret Eng (PhD) defended her thesis in January 2013 and published two papers in 2013 on developmental exposure to a brominated flame retardant: an assessment of effects on physiology, growth, and reproduction in a songbird, the zebra finch (*Environmental Pollution*), and on individual variation in body burden, lipid status and reproductive investment affects maternal transfer of a brominated diphenyl ether (BDE-99) to eggs in the zebra finch (*Environ. Toxicol. Chem.*). Two other papers were accepted for publication on methods for assessing developmental toxicity in a free living passerine: growth, physiology, neuro-anatomy, and photo-induced reproductive development (*Ecotoxicology*); and an assessment of concentrations and effects of organohalogen contaminants in a terrestrial passerine, the European starling (**Science of the Total Environment**).

c) **assessing embryonic metabolism and effects on survival, growth and reproduction of CMP2/CMP3 priority organic flame retardants** (e.g. TBOEP) in zebra finches (Margaret Eng, post-doctoral fellow).

d) **experimental field dosing study assessing the embryotoxicity of dioxin-like compounds (DLCs)** in European starlings (Margaret Eng, post-doctoral fellow).

e) **developmental neurotoxicity of mercury in birds;** Margaret Eng (post-doc) and Maria Yu (MET student) are developing methodologies for in ovo dosing via egg injection in the zebra finch, a model passerine with small egg size (1 g).

f) **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). We continued to provide eggs, other samples, and breeding data, for this monitoring from our two main starling study sites. A paper on bioaccumulative flame retardants at sites across Canada, including the Delta landfill, was published in *Environmental Science & Technology* using these data (Chen et al. 2013).

F. Population ecology of landbirds

Research coordinated by David Green and focuses on 1) examining how factors operating at different stages of the annual cycle influence the survival and productivity of a neotropical migrant (the yellow warbler) and 2) assessing 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

Anna Drake (PhD, defended April 2013) studied the breeding population in Revelstoke and Inuvik and examined winter habitat use of Yellow warblers in Mexico from 2009-2012. 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. She demonstrated that the winter habitat occupied by an individual did not have a large effect on their subsequent reproductive success. 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 (Drake et al. 2013 *J Avian Biol* 44:321-330; Drake et al. 2014 *Polar Biol* 37: 181-191). Subsequently, Teri Jones (BSc Hons) found evidence that the breeding phenology of yellow warblers in Revelstoke and Inuvik is more likely to result from differences in the intrinsic quality of individuals than a carry-over effect of winter habitat use (Jones et al *BMC Ecology* 14:13). Anna also investigated the relative importance of breeding conditions, winter conditions, and migration on the demography of Yellow warblers using the western flyway. In contrast to previous work in eastern North America, her work emphasized the importance of conditions (wind speed) during fall migration on the arrival dates, productivity and annual survival neotropical migrants. Subsequently, Amber Richmond (BSc Hons) used an extra years data to show that annual survival was best described by average westerly wind speed on the western flyway during a two month migration window rather than a longer or shorter period, but that this result was not explained by the frequency of wind and rain storms in April and May.

Simon Valdez (PhD candidate) continued his work examining 1) whether the natal origins of yellow warblers influences winter habitat use in Mexico, and 2) evaluating 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. Radiotelemetry work demonstrated that while some individuals hold small distinct winter territories others “float” and have far larger winter ranges. Floating was more common in agricultural habitat and the use of this habitat was associated with lower rates of daily mass gain and elevated stress levels. He conducted a third winter field season and will complete his fieldwork in 2015. This project 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 et al. 2013 Can J Zool 91:505-511). Matt Hepp (MSc candidate) has developed an individual based model using our detailed data on arrival dates, clutch and brood sizes, daily nest survival, and re-nesting probabilities to examine how different reservoir water use decisions influence productivity on the breeding grounds. This model incorporates an unexpected result indicating nest survival rates are actually higher when a bird’s nest site is inundated with water, because nest predation rates are reduced (van Oort et al. in prep). Matt is also using radiotelemetry to examine whether reservoir operations impact post-fledging survival. This project is conducted in collaboration with Cooper-Beauchesne Associates with funding and support from BC Hydro.

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, defended April 2013) examined how loss of habitat in the Okanagan due to agricultural and urban development influences the composition of the avian community within shrub-steppe habitat adjacent to orchards and vineyards and evaluated 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, abundance and nest success of grassland songbirds in edge and core shrub-steppe habitat in the Okanagan. She found that bird communities differed in edge and core habitat primarily due the presence of generalist species that used adjacent agricultural habitat (Knight et al. submitted to Landscape Ecology). Shrubsteppe songbird nest densities were also lower in edge than interior habitat. Nest success, however, was only lower in edge habitat adjacent to orchards. Differences in nest success in orchard edge habitat and vineyard edge habitat and interior habitat was not due to differences in the abundance of the major predators - identified as snakes using nest cameras or differences in the vegetation (Knight et al in press Avian Cons Ecol). This project was 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), completed fieldwork on a project that has investigated hypotheses for population declines in eastern whip-poor-wills in Ontario in 2013. She has found evidence that nitrogen isotope signatures in winter grown and breeding ground tissues have become more depleted over the last century, and plans to use isotope analysis of prey samples collected over the same time period to evaluate whether this change is a result of changes in diet (that could link to the population declines) or changes in atmospheric nitrogen due to the increased use of artificial fertilizers. Philina is also combining 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 and retrieved 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 and 2013 provided the first information on the wintering location of eastern whip-poor-wills. Philina is currently analyzing her data and preparing manuscripts and will defend her thesis in Spring 2015.

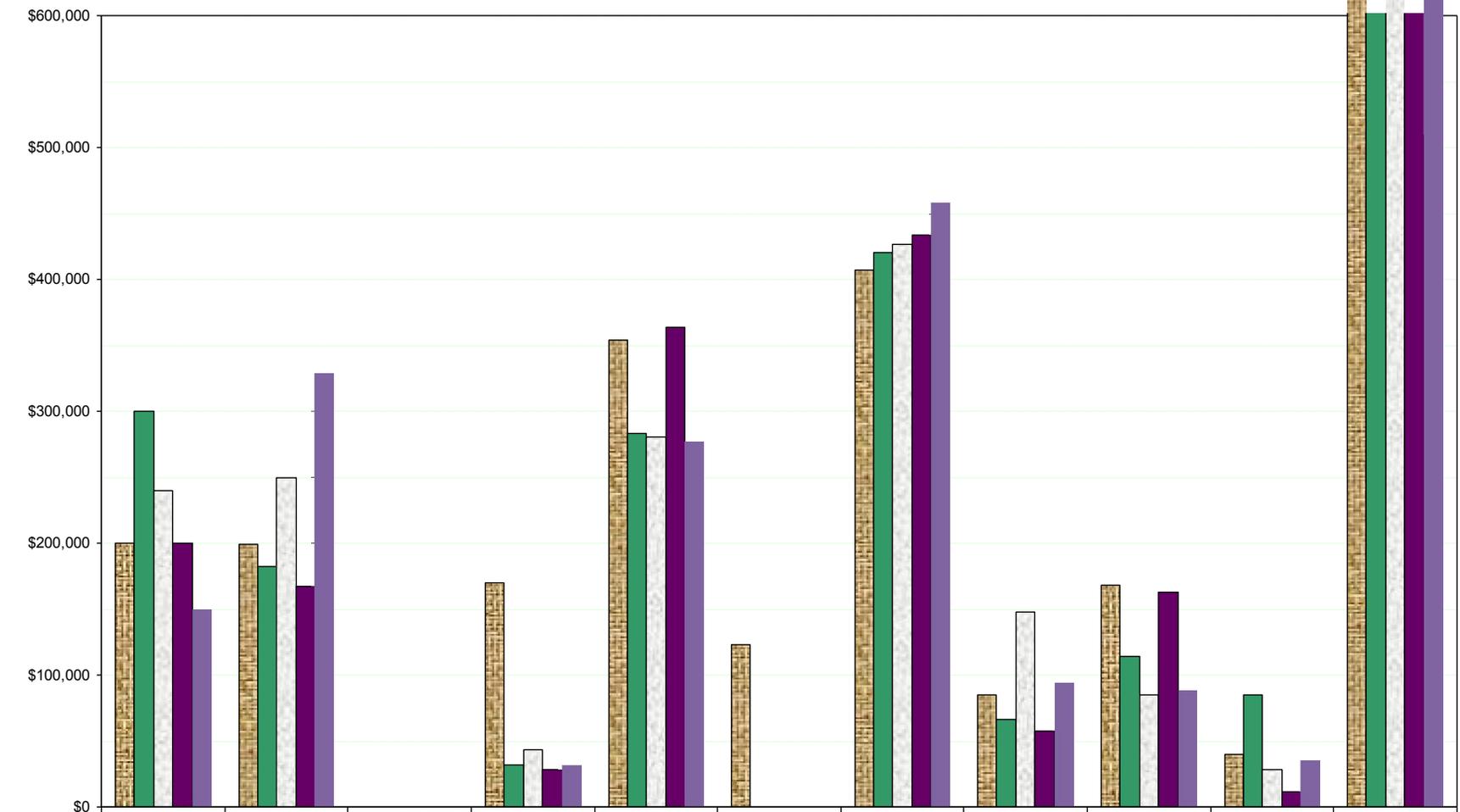
VI FUNDING

2013-2014 was the first year of a five year funding agreement between the Simon Fraser University (Centre for Wildlife Ecology) and Environment Canada (Science and Technology Division) that supplies \$150,000 per year for CWE research in priority coastal, riparian and grassland ecosystems in British Columbia.

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

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
■ 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	1,484,084
□ 2011/2012	240,000	249,400	0	43,336	280,365	0	426,775	147,901	85,132	27,889	1,500,798
■ 2012/2013	200,000	167,000		28,347	363,321		433,718	57,348	\$163,110	11,462	1,424,306
■ 2013/2014	150,000	328,500	0	32,000	276,584	0	458,816	93,531	87,854	35,087	1,462,372

Centre for Wildlife Ecology Annual Financial Report

1 April 2013 - 31 March 2014

Category for Chart

Scholarships, Fellowships, Grants for Students

PhD

NSERC	David Hope	IPS	\$15,000
NSERC	Marie-Helene Burle	GF	\$6,250
NSERC	Emily Missyabit McAuley	CGS-D & Parental Supple- ment	\$23,334
SFU Fellowships etc	Marie-Helene Burle	GF + 2 Travel Awards	\$7,250
SFU Fellowships etc	Birgit Schwarz	Travel Award (x2)	\$1,295
SFU Fellowships etc	David Hope	Travel Award	\$500
SFU Fellowships etc	Sarah Thomsen	Travel Award	\$500
SFU Fellowships etc	Emily Missyabit McAuley	Provost Prize of Distinction + GF + Aboriginal Community Engagement Award	\$9,917
SFU Fellowships etc	Holly Middleton	TA	\$4,123
International	Simon Valdez	CONACYT & Provost International + Travel Award	\$25,215
International	Marie-Helene Burle	CEPF	\$1,563
Other	David Hope	Bird Studies Canada + Western Hemisphere Shorebird Group	\$10,095
Other	Birgit Schwarz	Western Hemisphere Shorebird Group	\$719
Other	Sarah Thomsen	PSG Travel + National Science Fdn. Travel	\$890
Other	Emily Missyabit McAuley	Indspire	\$4,700

M Sc

NSERC	Danielle Dagenais	IPS	\$21,000
NSERC	Meghan Willie	IPS	\$7,000
SFU Fellowships etc	Anne Ellison	TA + Graduate Open Bursary (x2) + Travel Award	\$9,429
SFU Fellowships etc	Willow English	TA	\$4,100
SFU Fellowships etc	Seth Bennett	TA	\$6,667
SFU Fellowships etc	Richard Johnson	Entrance schol. + GF + Travel Award	\$13,000
SFU Fellowships etc	Olga Lansdorp	GF	\$6,250
SFU Fellowships etc	Lauren MacFarland	Travel Award	\$500
Other EC	Lauren MacFarland	Environment Canada	\$7,000
International	Willow English	US National Science Fdn	\$3,000

General Funding for CWE

EC/Core		EC Annual Chair Funding (1st of 5 yrs)	\$150,000
SFU	SFU	SFU Contribution to Faculty Salaries (Ydenberg Williams Green)	\$458,816
SFU	Ydenberg RC	SFU - VPR: Contribution to Centre for Wildlife Ecology	\$5,000
SFU	Lank	SFU - VPR: NSERC Bridge funding	\$25,000
Other	Lank	Canada Summer Jobs	\$2,300

Generated Research Funding

Other EC	Lank	Science Horizon - Habitat Quality Indices, Forest Configuration and Marbled Murrelet Local Population Size	\$12,000
Other	Ydenberg / Lank	Coast Forest Products	\$13,800

Ducks**Land Birds**

Provincial	Green DJ	BC Hydro/ Cooper Beauchesne and Associates Ltd.	\$25,000
Provincial	Williams TD	BC Hydro/ Cooper Beauchesne and Associates Ltd.	\$7,000
International	Green DJ; Thomsen S	Montrose/NFWF	\$51,090

Triangle Island

Other EC	Hipfner MJ	Wildlife Research Division	\$91,500
Other EC	Hipfner MJ	Canadian Wildlife Service	\$103,000

Physiological Ecology

Other EC	Williams TD	Investigating priority chemicals using avian lab and field models (3rd of 3 years)	\$40,000
Other EC	Williams TC / Elliott J	Research on developmental neurotoxicity of methyl mercury in birds (2nd of 5 years)	\$25,000

International	Williams TD	Polar Oceans Research Groups (NSF-LTER) - Climate-dependent changes in penguin population biology, physiology and nutrition (4th of 4 years)	\$6,120
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Shorebirds

Other	W. English	NSTP - field expenses and assistant	\$2,583
Other EC	RC Ydenberg	Postdoctoral Contribution (year 2 of 3)	\$50,000
International	Lank D / Ydenberg RC / Sandercock B	Kansas State University (year 3 of 3)	\$349

Tuamotu

International	Lank D / Ydenberg RC	Critical Ecosystem Partnership Fund	\$517
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NSERC

NSERC	Green DJ	NSERC Individual Research Grant - Dispersal and migration behaviour of birds in natural and modified landscapes (5th of 5 years)	\$29,000
NSERC	Ydenberg RC	NSERC Individual Research Grant - "Predation danger and the annual cycle of migrants (4th of 5 yrs)	\$50,000
NSERC	Williams TD	NSERC Individual Research Grant- RGPIN/155395-200 (2nd of 5 yrs)	\$60,000
NSERC	Williams TD	NSERC T-RGPAS 429387 (2nd of 3 yrs)	\$40,000
NSERC	Elliott J	NSERC Individual Research Grant - RGPIN/402344-2011 (3rd of 5 years)	\$25,000

Grand Total \$1,462,372

SFU In-Kind \$120,000

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 11 publications out in 2014 through April, 13 publications in press and 15 submitted. Two PhD and five MSc students 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. Books or Book chapters

Franks, S.E., D.B. Lank and W.H. Wilson. 2014. Western Sandpiper (*Calidris mauri*). In: *The Birds of North America, Online*, Poole, A., eds. Ithaca: Cornell Lab of Ornithology.

B. Papers in Refereed Journals or Books

In press:

- Drake, A.E.G., C.A. Rock, S.P. Quinlan, M. Martin and D.J. Green. In press. Wind speed during migration influences the survival, timing of breeding, and productivity of a Neotropical migrant, *Setophaga petechia*. PLoS One.
- Ellison, A.M., J. Watson and E. Demers. In press. Testing problem-solving in turkey vultures (*Cathartes aura*) using the string-pulling test. Anim. Cognit.
- Eng, M.L., T.D. Williams, R.J. Letcher and J.E. Elliott. In press. Assessment of concentrations and effects of organohalogen contaminants in a terrestrial passerine, the European starling. Sci. Total Environ.
- Hipfner, J.M. and M. Galbraith. In press. Diet of the Pacific sand lance (*Ammodytes hexapterus*) in the Salish Sea in the 1960s. Can. Field Nat.
- Katinic, P.J., D.A. Patterson and R.C. Ydenberg. In press. Thermal regime, predation danger and the early marine exit of sockeye salmon (*Oncorhynchus nerka*) in Copper Creek, Haida Gwaii. J. Fish Biol.
- Knight, E.C., N. Mahony and D.J. Green. In press. Crop type influences edge effects on the reproduction of songbirds in sagebrush habitat near agriculture. Avian Cons. Ecol.
- Miller, K.M., A. Teffer, S. Tucker, S. Li, A.D. Schulze, M. Trudel, F. Juanes, A. Tabata, K.H. Kaukinen, N.G. Ginther, T.J. Ming, S. Cooke, J.M. Hipfner, D.A. Patterson and S.G. Hinch. In press. Infectious disease, shifting climates and opportunistic predators: cumulative factors potentially impacting declining wild salmon populations. Evol. Appl.
- Ryan, C.P., A. Dawson, P.J. Sharp, S.L. Meddle and T.D. Williams. In press. Circulating breeding and pre-breeding prolactin and LH are not associated with clutch size in the Zebra Finch (*Taeniopygia guttata*). Gen. Comp. Endocrinol.
- Thomsen, S.K., C.E. Kroeger, P.H. Bloom and A.L. Harvey. In press. Space use and home range size of Barn Owls on Santa Barbara Island. W. North Amer. Natural.
- Tissier, M.L., T.D. Williams, S. Zahn, S. Massemin and F. Criscuolo. In press. Maternal effects underlie ageing costs of growth in the zebra finch (*Taeniopygia guttata*). PLoS One 4.21.
- Wagner, D.N., D.J. Green, J.M. Cooper, O.P. Love and T.D. Williams. In press. Variation in plasma corticosterone in migratory songbirds: a test of the migration-modulation hypothesis. Physiol. Biochem. Zool.

- Wagner, D.N., D.J. Green, M. Pavlik, J. Cooper and T.D. Williams. In press. Physiological assessment of the effects of changing water levels associated with reservoir management on fattening rates of neo-tropical migrants at a stopover site. *Conservation Physiology*.
- Warren, J.M., K.A. Cutting, J.Y. Takekawa, S.E. De La Cruz, T.D. Williams and D. Koons. In press. Previous success and current body condition determine breeding propensity in lesser scaup: evidence for the individual heterogeneity hypothesis. *Auk: Ornithol. Advances*.

2014

- Abbott, C.L., R.L. Millikin, M.J. Hipfner, S. Hatch, M. Ito, Y. Watanuki and T. Burg. 2014. Genetic structure of rhinoceros auklets *Cerorhinca monocerata* breeding in British Columbia, Alaska and Japan. *Marine Biol.* 161: 275-283.
- Agüero, M.L., P.G. Borboroglu and D. Esler. 2014. Trophic ecology of breeding White-headed Steamerduck (*Tachyeres leucocephalus*). *Waterbirds* 37: 88-93.
- Drake, A.E.G., M. Martin and D.J. Green. 2014. Winter habitat use does not influence spring arrival dates or the reproductive success of Yellow Warblers breeding in the arctic. *Polar Biology* 37: 181-191.
- Gorman, K.B., T.D. Williams and W.R. Fraser. 2014. Ecological sexual dimorphism and environmental variability within a community of Antarctic penguins (genus *Pygoscelis*). *PLoS One* 9: e90081.
- Hipfner, J.M., L.A. McFarlane-Tranquilla, B. Addison and K.A. Hobson. 2014. Seasonal variation in the foraging ecology of a zooplanktivorous seabird assessed with stable isotope analysis. *Marine Biol. Res.* 10: 383-390.
- Hope, D.D., D.B. Lank and R.C. Ydenberg. 2014. Mortality-minimizing sandpipers vary stopover behavior dependent on age and geographic proximity to migrating predators. *Beh. Ecol. Sociobiol.* 68: 827-838 DOI: 10.1007/s00265-014-1695-x.
- Jones, T.B., A. Drake and D.J. Green. 2014. Individual quality explains association between plumage colouration, arrival dates and mate acquisition in yellow warblers (*Setophaga petechia*). *BMC Ecol.* 14: 13.
- Love, O.P., S. Bourgeon, C.L. Madliger, C.A.D. Semeniuk and T.D. Williams. 2014. Evidence for baseline glucocorticoids as mediators of reproductive investment in a wild bird. *Gen. Comp. Endocrinol.* 199: 65-69.
- McCormick, J., C.T. St. Clair and L.I. Bendell. 2014. Concentration and partitioning of metals in intertidal biofilms: implications for metal bioavailability to shorebirds. *Ecotoxicol.* 23: 229-235.
- Thomson, R.L., V.-M. Pakanen, D.M. Tracy, L. Kvist, D.B. Lank, A. Rönkä and K. Koivula. 2014. Providing parental care entails variable mating opportunity costs for male Temminck's stints. *Beh. Ecol. Sociobiol.* DOI: 10.1007/s00265-014-1737-4.

2013

- Beaubier, J.E. and J.M. Hipfner. 2013. Proximate composition and energy density of forage fish delivered to Rhinoceros Auklet *Cerorhinca monocerata* nestlings at Triangle Island, British Columbia. *Marine Ornithol.* 41: 35-39.
- Bishop, C.A. and J.M. Brogan. 2013. Estimates of avian mortality attributed to vehicle collisions in Canada. *Avian Cons. Ecol.* 8: 2. <http://dx.doi.org/10.5751/ACE-00604-080202>.
- Bustnes, J.O., G.H. Systad and R.C. Ydenberg. 2013. Changing distribution of flocking sea ducks as non-regenerating food resources are depleted. *Mar. Ecol. Prog. Ser.* 484: 249-257.
- Buxton, R.T., H.L. Major, I.L. Jones and J.C. Williams. 2013. Examining patterns in nocturnal seabird

- activity and recovery across the Western Aleutian Islands, Alaska, using automated acoustic recording. *Auk* 130: 331-341.
- Calvert, A.M., C.A. Bishop, R.D. Elliot, E.A. Krebs, T.M. Kydd, C.S. Machtans and G.J. Robertson. 2013. A synthesis of human-related avian mortality in Canada. *Avian Cons. Ecol.* 8: 11. <http://dx.doi.org/10.5751/ACE-00581-080211>.
- Crossin, G.T., R.A. Phillips, C.R. Lattin, M. Romero and T.D. Williams. 2013. Corticosterone mediated costs of reproduction link current to future breeding. *Gen. Comp. Endocrinol.* 193: 112-120.
- Crossin, G.T., R.A. Phillips, K.E. Wynne-Edwards and T.D. Williams. 2013. Post-migratory body condition predicts ovarian steroid production and breeding decision in female gray-headed albatrosses. *Physiol. Biochem. Zool.* 86: 761-768.
- Drake, A.E.G., C. Rock, S.P. Quinlan and D. Green. 2013. Yellow Warblers (*Setophaga petechia*) show age-sex-specific carry-over effects in western North America. *J. Avian Biol.* 44: 321-330.
- Eens, M., V.L. Jaspers, E.v.d. Steen, M. Bateson, C. Carere, P. Clergeau, D. Costantini, Z. Dolenc, J.E. Elliott, J. Flux, H. Gwinner, R. Halbrook, P. Heeb, T. Mazgajsk, A. Moksnes, V. Polo, J.J. Soler, R. Sinclair, J.P. Veiga, T.D. Williams, A. Covaci and R. Pinxten. 2013. Can starling eggs be useful as a biomonitoring tool to study organohalogenated contaminants on a worldwide scale? *Environ. Internat.* 51: 141-149.
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- Eng, M.L., T.D. Williams and J.E. Elliott. 2013. Developmental exposure to a brominated flame retardant: an assessment of effects on physiology, growth, and reproduction in a songbird, the zebra finch. *Env. Poll.* 178: 343-349.
- Farrell, L.L., T. Burke, J. Slate and D.B. Lank. 2013. A first-generation microsatellite linkage map of the ruff. *Ecol. Evol.* 3: 46314640 DOI: 10.1002/ece3.830.
- Farrell, L.L., T. Burke, J. Slate, S.B. McRae and D.B. Lank. 2013. Genetic mapping of the female mimic morph locus in the ruff. *BMC Genetics* 14: 109. doi:10.1186/1471-2156-14-109 324.
- Franks, S.E., G. Fernández, D.J. Hodkinson, T.K. Kyser and D.B. Lank. 2013. The long and the short of it: no dietary specialisation between male and female western sandpipers despite strong bill size dimorphism. *PLoS One* doi: 10.1371/journal.pone.0079835.
- Goedbloed, D.J., H.J. Megens, P. van Hooft, J.M. Herrero-Medrano, W. Lutz, P. Alexandri, R.P.M.A. Crooijmans, M. Groenen, S.E. van Wieren, R.C. Ydenberg and H.H.T. Prins. 2013. Genome-wide single nucleotide polymorphism analysis reveals recent genetic introgression from domestic pigs into Northwest European wild boar populations. *Molecular Ecology* 22: 856-866.
- Hipfner, J.M. and M. Galbraith. 2013. Spatial and temporal variation in the diet of the Pacific sand lance *Ammodytes hexapterus* in waters off the coast of British Columbia, Canada. *J. Fish Biol.* 83: 1094-1111.
- Hobson, K.A., G.L. Slater, D.B. Lank, R.L. Milner and R. Gardiner. 2013. Agricultural lands subsidize winter diet of the Dunlin at two major estuaries. *Condor* 115: 515-524.
- Hogan, D., D. Esler and J.E. Thompson. 2013. Duration and phenology of remigial molt of Barrow's Goldeneyes. *Condor* 115: 762-768.
- Hogan, D., D. Esler and J.E. Thompson. 2013. Variation in body mass and foraging effort of Barrow's Goldeneyes (*Bucephala islandica*) during remigial molt. *Auk* 130: 313-322.
- Jones, I.M., R.W. Butler and R.C. Ydenberg. 2013. Recent switch by great blue herons in the Pacific northwest to associative nesting with bald eagles to gain predator protection. *Can. J. Zool.* doi: 10.1139/cjz-2012-0323.
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- Lank, D.B., L.L. Farrell, T. Burke, T. Piersma and S.B. McRae. 2013. A dominant allele controls development into female mimic male and diminutive female ruffs. Biol. Lett. 9: 20130653 DOI: 10.1098/rsbl.2013.0653.
- Palm, E.C., D. Esler, E.M. Anderson, T.D. Williams, O.P. Love and M.T. Wilson. 2013. Baseline corticosterone in wintering marine birds: methodological considerations and ecological patterns. Physiol. Biochem. Zool. 86: 346-353.
- Palm, E.C., D. Esler, E.M. Anderson, T.D. Williams and M.T. Wilson. 2013. Variation in physiology and energy management of wintering white-winged scoters in relation to local habitat conditions. Condor 115: 750-761.
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- Schofield, O., H. Ducklow, K. Bernard, S. Doney, D. Patterson-Fraser, K. Gorman, D. Martinson, M. Meredith, G. Saba, S. Stammerjohn, D. Steinberg and W. Fraser. 2013. Penguin biogeography along the West Antarctic Peninsula: Testing the canyon hypothesis with Palmer LTER observations. Oceanogr. 26: 78-80.
- Singh, A.D., S. Wong, C.P. Ryan and S. Whyard. 2013. Oral delivery of double-stranded RNA in larvae of the yellow fever mosquito, *Aedes aegypti*: implications for pest mosquito control. J. Insect Sci. 13: 69.
- Stein, R.W. and T.D. Williams. 2013. Extreme intraclutch egg-size dimorphism in Eudyptes penguins, an evolutionary response to clutch-size maladaptation. Amer. Nat. 182: 260-270.
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- Zanette, L.Y., K.A. Hobson, M. Clinchy, M. Travers and T.D. Williams. 2013. Food use by songbirds is affected by the experience of nest predation: implications for indirect predator effects on clutch size. Oecologia 172: 1031-1039.

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.
- Drake, A.E.G., S.O. Valdez Juarez and D.J. Green. Submitted. Habitat use differs by sex in wintering Yellow Warblers. Condor.
- English, W.B., D. Schamel, D.M. Tracy, D.F. Westneat and D.B. Lank. Submitted. Sex ratio varies with egg investment in the red-necked phalarope (*Phalaropus lobatus*). Beh. Ecol. Sociobiol.
- Evers, D.C., J.A. Schmutz, N. Basu, C.R. DeSorbo, J.S. Fair, C.E. Gray, J. Paruk, M. Perkins, K. Regan, B.D. Uher-Koch and K.G. Wright. Submitted. Mercury exposure and risk in yellow-billed loons breeding in Alaska and Canada. Waterbirds.
- Hemerik, L., M. van Opheusden and R. Ydenberg. Submitted. Ashmoe's Halo as the outcome of a predator prey game. Marine Ornithol.
- Hindmarch, S., E.A. Krebs, J. Elliott and D.J. Green. Submitted. Urban development influences the breeding performance of barn owls in the Fraser Valley, British Columbia Canada. Condor.
- Jiménez, A., R.W. Elner, C. Favaro, K. Rickards and R.C. Ydenberg. Submitted. Intertidal biofilm

- distribution underpins differential tide-following behavior of two sandpiper species (*Calidris mauri* and *Calidris alpina*) during northward migration. *Estuar. Coast. Shelf Sci.*
- 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.*
- Knight, E.C., N.A. Mahony and D.J. Green. Submitted. Local and landscape effects on the bird community in sagebrush shrubsteppe habitat fragmented by agriculture. *Landscape Ecol.*
- Major, H.L., R.T. Buxton and I.L. Jones. Submitted. Variability in colony attendance decisions by a colonial seabird. *J. Avian Biol.*
- McAuley, E.M. and S.M. Bertram. Submitted. Field crickets compensate for unattractive static long-distance call components by increasing dynamic signalling effort. *Anim. Behav.*
- Schmutz, J.A., K.G. Wright, C.R. DeSorbo, J.S. Fair, D.C. Evers, B. Uher-Koch and D.M. Mulcahy. Submitted. Size and retention of breeding territories of yellow-billed loons. *Waterbirds.*
- St. Clair, C.T., P. Baird, R.C. Ydenberg, R. Elner and L.I. Bendell. Submitted. Trace elements in Pacific Dunlin (*Calidris alpina pacifica*): patterns of accumulation and concentrations in kidneys and feathers. *Ecotoxicol.*
- Uher-Koch, B.D., D. Esler, S.A. Iverson, D.H. Ward, W.S. Boyd, M. Kirk, T.L. Lewis, C.S. VanStratt, K. Brodhead, J.W. Hupp and J.A. Schmutz. Submitted. Variation in winter survival of surf scoters: interacting effects of latitude, mass, sex and age. *Can. J. Zool.*
- Xu, C., J. Barrett, D.B. Lank and R.C. Ydenberg. Submitted. Strong decadal-scale population fluctuations of migratory Pacific (*Calidris alpina pacifica*) and Atlantic (*C. a. hudsonica*) dunlins are explained by density-dependence and meteorological factors. *Ecology.*

C. Theses

- English, W. 2014. The evolutionary ecology of reproductive traits in the red-necked phalarope (*Phalaropus lobatus*). MSc, Simon Fraser University, Burnaby.
- Middleton, H.A. 2014. The influence of intensive land use types in the foraging distribution of ducks wintering in the Fraser River delta, British Columbia. PhD, Simon Fraser University, Burnaby.
- Drake, A.E.G. 2013. Seasonal interactions in the Yellow Warbler (*Setophaga petechia*): winter habit use, migration and demography. PhD, Simon Fraser University, Burnaby.
- Knight, E. 2013. Impacts of habitat fragmentation by agriculture on breeding songbirds in the Okanagan sagebrush shrubsteppe. MSc, Simon Fraser University, Burnaby.
- Martin, M. 2013. Latitudinal variation in life history traits and incubation patterns of Yellow Warblers (*Setophaga petechia*). MSc, Simon Fraser University, Burnaby.
- Ryan, C.P. 2013. Prolactin and avian clutch size: Testing the only physiological model for a key life history trait. MSc, Simon Fraser University, Burnaby.
- Uher-Koch, B. 2013. Latitudinal and seasonal variation in non-breeding survival of surf and white-winged scoters. MSc, Simon Fraser University, Burnaby.