ANNUAL REPORT of the
CENTRE FOR WILDLIFE ECOLOGY

2016-2017

Environment and
Climate Change Canada
Environnement et
Changement climatique Canada

Department of Biological Sciences
Simon Fraser University

http://www.sfu.ca/biology/wildberg/NewCWEPage/CWEnewTestHome.htm

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 and Climate Change 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. That agreement has expired, but The Centre for Wildlife Ecology (CWE) as described here continues work with ECCC and with other agencies, on a range of issues pertaining to wildlife and other environmental sciences.

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 and Climate Change 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 and Climate Change Canada (Canadian Wildlife Service, CWS, and Science and Technology, S&T) and the basic research agenda of the University. Information, ideas, expertise, resources and opportunity flow back and forth across this interface, giving government agencies access to a broad base of science capability that helps inform policy and decision making, while the university and its faculty and students benefit from enhanced opportunities for research and application of the ideas their disciplines generate.

III. PERSONNEL

A. Research Team

1. Faculty and Research Associates

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

2. Research Group

Postdoctoral Fellows	***PhD (in progress)***	***MSc (in progress)***	***Staff***
Tom Flower	Marie-Hélène Burle	Seth Bennett	Kathryn Coukell, CWE Admin. Asst.
Tanya Brown	Allison Cornell	Chloe Boyton	Connie Smith, CWE Research Tech
Margaret Eng	Philina English	Rachel Canham	
	David Hope	Alice Domanik	***Visitors***
Undergrads	Richard Johnston	Cybele Heddle (MET)	Pat Baird
	Emily McAuley	Matthew Hepp	Laurens Berends, Univ. Wageningen
	Michal Pavlik	Olga Lansdorp	Gregory van den Top, Univ. Wageningen
	Marinde Out	Spencer Morran (MET)	Enver Ortiz, Peru
	Sarah Thomsen	Mitchell Serota	
	Simon Valdez	Eveling Tavera Fernandez	
	Jeff Yap	Catherine Villeneuve	
		Kristen Walters	
	PhD(defended)	***MSc (defended)***	
		Danielle Dagenais	
		Lauren McFarland	
		Megan Willie	

B. Steering Committee

Name	*Position*	*Affiliation*
Robert Elner	Emeritus Scientist	*EC*
David Green	CWE faculty (non-voting)	*SFU*
Mark Hipfner	Research Scientist	*EC*
Elsie Krebs	Research Manager, Western Canada	*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/NewCWEPage/CWEnewTestHome.htm

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 (address above). Publications and theses are listed at the end of this report. The personnel also can be contacted via the website.

A. Species at Risk

1. Marbled Murrelet (Threatened, COSEWIC)

SFU's research on threatened Marbled Murrelets continues to address issues of direct conservation and management concern for this listed species. This project examining the biology of the threatened and elusive marbled murrelet, was started by CWE chair emeritus Fred Cooke and continued for its 22th year by Dov Lank, addressing evolving questions of management interest for this threatened species.

Lank continued his participation on the Canadian Marbled Murrelet Recovery team, which is addressing an update to the Federal Murrelet Recovery Plan. A technical paper arising from the development of the original plan, co-authored by Lank, was submitted to the BC Journal of Ecosystem Management. Tom Flower, a postdoctoral fellow in the CWE, undertakes research on Steller's jays, a major predator on murrelet nests, focusing on their predation of other bird's eggs and chicks, termed nest predation. Nest predation is of general conservation concern because human-caused habitat fragmentation likely increases nest predation, yet when and why this happens, remains unclear. With help from MSc student Olga Lansdorp, Tom colour-banded 70 jays, and fitted 20 individuals with radio transmitters, providing a window into the predatory behaviour of these birds. Together with two undergraduate students, Katherine Fegan and Griffin Dare (BISC498 course), Tom explored how clear-cut forestry practices affect nest predation patterns. Tom then undertook an experiment illustrating how changes in food abundance due to human land use, can drive increased nest predation behaviour. In addition, Tom worked with Laurens Berends, an MSc student from Wageningen University (Netherlands), to investigate how Steller's jays own exposure to predators affects their nest predation behaviour in fragmented forests. Together this research will improve our understanding of how and why human land use affects breeding bird populations facilitating improved management.

2. Eastern WhipPoorWill (Threatened, COSEWIC)

The Eastern WhipPoorWill was designated as a Threatened species by COSEWIC in 2009. Philina English, who will defend her PhD thesis in April, co-supervised by Dr David Green and Dr Joe Nocera (University of New Brunswick), addressed identified knowledge gaps for this species. She demonstrated 1) that changes in the distribution of whippoorwill from the first and second Ontario Breeding Bird Atlas are not explained by increases in forest cover as forests regrow on abandoned agricultural land, 2) population declines over the last century are associated with changes in the nitrogen isotope signatures in winter grown and breeding ground tissues that reflect changes in their diet, and 3) prey abundance (beetle and moths) predicts the presence and abundance of whippoorwills at two spatial scales (the regional and local). In collaboration with Mike Cadman (CWS), she also used geolocators to determine the migration routes of whippoor-wills breeding at three sites, (QUBS in the Frontenac arch, Torrance Barrens Dark Sky Reserve in the southern Muskoka, and Long Point on Lake Erie. Philina successfully defended her thesis in April 2017; chapters from her thesis have been published in Landscape Ecology (English et al. 2016) and BMC Zoology (English et al. 2017), are under review in Global Change Biology, and will soon be submitted to Oecologia.

3. Lewis's Woodpecker (Threatened, COSEWIC)

Lewis's Woodpecker was designated as a Threatened species by COSEWIC in 2010. Lauren MacFarland, a student in the Green lab co-supervised by Nancy Mahony (EC), defended her thesis examining the habitat specific demography of Lewis's woodpeckers in June 2016. She demonstrated consistent differences in the productivity of Lewis's woodpeckers in riparian cottonwoods, open ponderosa pine and burned habitat within the Okanagan. Her analyses suggest these differences can be attributed to differences in the number of cavities available as nest-sites, rather than differences in the community of secondary cavity nesters (native and non-native), or differences in prey availability. This chapter of her thesis is currently under review by the journal Condor.

4. Yellow-breasted Chat (Endangered, COSEWIC)

Tim Forrester (MSc 2015) investigated how restoration efforts in riparian habitat within the Okanagan influenced the abundance and demography of chats and other riparian dependent songbirds over the last decade. His work, conducted in collaboration with Dr. Christine Bishop (EC) demonstrated that restoration efforts have led to an increase in the abundance of yellow-breasted chats, and that pairs in newly occupied habitat have similar productivity to other pairs. However, restoration efforts for chats did not lead to significant increases in the abundance of other riparian dependent songbirds. The first chapter of his thesis was recently published in Restoration Ecology (Forrester et al. 2017).

5. Scripp's Murrelet (Vulnerable, IUCN)

Santa Barbara Island in the Channel Islands California provides breeding habitat for 20% of the world's population of Scripps murrelets (global population = 2800 pairs). Scripp's murrelets on Santa Barbara may be depredated by barn owls, but barn owls also prey on deer mice that are known to be a major cause of egg failure. Management of barn owls may therefore have unexpected and unintended consequences for murrelets. Sarah Thomsen (PhD student in the

Green lab) used data collected from 2010-2014 to show that barn owls can have both direct (negative) and indirect (positive) effects on Scripp's murrelets. Sarah will defend her thesis in July, 2017; the first chapter of her thesis was recently published in the journal Ecology (Thomsen and Green 2016).

6. Tuamotu Sandpiper (Endangered, IUCN)

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. 1400 individuals. PhD student Marie-Hélène Burle has spent >16 months over 4 field seasons conducting the first study of the species' basic biology. Her information on habitat usage, diet, and social behaviour is being used to support reintroduction planning for the species onto atolls where rats have been or will be removed, in addition to documenting fascinating novel adaptations by an arctic bird to a tropical environment.

7. Cassin's Auklet (Special Concern, COSEWIC) - see Section V.D.1, Coastal Studies of Seabirds.

8. Barn Swallow (Threatened, COSEWIC) - see Section V.B.3.c., Landscape-level determinants of breeding distribution, productivity and foraging in Barn Swallows and Tree Swallows

B. Human Impacts on Birds

1. Contaminants and Toxicology

a. Barrow's Goldeneye Exposure to Contaminants in British Columbia

In collaboration with partners including Environment Canada, Stantec, and USGS, MSc student Megan Willie conducted 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 and mussel samples were collected in those same sites the following summer. Both goldeneye and mussel samples were collected in Burrard Inlet in 2015. Megan defended her thesis in April 2016, and her results indicate that the mussel-goldeneye food chain offers a sensitive, multi-trophic level system for evaluating hydrocarbon contamination. This is useful for monitoring chronic pollution and for determining effects and recovery from larger releases.

b. Developmental neurotoxicity of mercury in birds

Maria Yu (MET student) and Margaret Eng (post-doc) published results of a study on effects of in ovo dosing of mercury (Hg) via egg injection in the zebra finch, a model passerine with small egg size (1 g), and completed a second study on neuroanatomical effects of Hg. Spencer Morran (MET student) completed her study of effects of dosing chicks with Hg during the post-hatching phase only, and defended her thesis in summer 2016. A third MET student (Cybele Heddle)

completed experimental work looking at the combined effect of in ovo and chick dosing, which completed the 5th and final year of this project. She also conducted two collaborative projects with researchers at McGill.

c. Assessment of in vivo effects of Chemical Management Plan (CMP) priority chemicals in passerines

Margaret Eng (PhD 2013) continued to work as a post-doc in the Williams' Lab collaborating with Environment and Climate Change Canada scientists including John Elliott, Robert Letcher, Christine Bishop, Doug Crump and Stephanie Jones, and other toxicologists (e.g. Ken Drouillard, Windsor) on ECCC-funded projects. Although she moved to a post-doctoral position at the University of Saskatchewan in August joint publications continue to emerge (see Publication list). Two studies on priority chemicals (TDCIPP and TBECH) were published in collaboration with students in Dr. Tim Beischlag's lab in the Faculty of Health Science, SFU. We continue to facilitate on-going surveillance and monitoring of CMP priority compounds in the key bio-indicator species, the European starling (*Sturnus vulgaris*) through egg collection and contaminant analysis at several sites in the Lower Mainland.

d. Chronic toxicity of petroleum hydrocarbons and other contaminants in seabird sentinel species

TDW initiated a new project with Drs. John Elliott (ECCC) and collaborators at the National Wildlife Research Centre (NWRC) laboratory in Ottawa. This research will focus on investigating the toxicity of petroleum, specifically oil sands bitumen products, to birds on the Pacific north-west coast. At this stage we envisage the project having a number of potential components including: a) one or more field studies of avian marine sentinel species (initially rhinoceros auklet) which will establish baseline response of a variety of genes; and, laboratory dosing studies of a representative wild species (to be determined), and c) use of an avian lab model, the zebra finch; all involving use, and further development, of gene array techniques: the Avian ToxChip developed by NWRC. A new PhD student (Mason King) will join this project in April 2017, co-supervised by Williams and Elliott.

e. Persistent organic pollutants and their effects on a top predator, the Cooper's hawk

The CWE continues to collaborate with Dr John Elliott (ECCC, SFU Adjunct Professor) on studies examining the exposure and impact of persistent organic pollutants on wildlife. Jason Brogan (MSc 2014) demonstrated that persistent organic pollutants that have not been used in Vancouver for at least 40 years are present in the tissues of urban Coopers hawks and these legacy pollutants have detectable effects on reproduction (Brogan et al. 2016). Kate Fremlin, a new MSc student, is currently describing the bioaccumulation of persistent organic pollutants as they move through terrestrial food web, showing the extent of biomagnifications of legacy and novel pollutants in Cooper's hawks, the apex predator.

2. Reservoirs and the impact of Water Use Decisions on Riparian Birds

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. CWE, working in collaboration with BC Hydro and Cooper-Beauchesne and Associates, has examined how reservoir operations on the Columbia River between 2004-2015 impact the population dynamics of yellow warblers, a species identified by Partners in Flight as a focal

species for riparian habitat. Most recently, Matt Hepp (MSc candidate) has developed an individual based model using 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. He estimated that reservoir operations reduce productivity (fledglings per female per year) by 25%. However, this underestimates the impact of reservoir operations as he also found that post-fledging survival was far lower in territories inundated by water than in territories not impacted by rising reservoir water levels. This work is currently being prepared for publication in Avian Conservation and Ecology and Population Ecology.

3. Agricultural Effects

a. Use of vineyards by bats in the Okanagan Valley

British Columbia's South Okanagan has an expanding wine industry and supports the greatest diversity of bats in Canada. In April 2016 CWE MSc student Danielle Dagenais defended her thesis on the use of vineyards by bats in the South Okanagan Valley to assess the amount of foraging habitat available to bats in this fragmented landscape. Using a radar-acoustic system, designed by CWE Adjunct Professor Rhonda Millikin, she assessed bat movements in the South Okanagan to determine if vineyards provide habitat for bats. She surveyed bat activity in six matched pairs of vineyards and adjacent natural sagebrush habitats. By evaluating the character-istics of radar tracks and combining radar and acoustic data, she compared bat activity over the habitats. Target parameters (height, speed, and relative size measured as Signal-to-Noise ratio) had similar distributions in both habitats. There was no statistical difference between habitats in mean target track length per unit area or in the mean number of acoustic "individual bat passes", nor did these measures differ between surveys in early (bat pregnancy), middle (lactation) and late summer (pup fledging). Her results suggest that the usage by bats of vineyards and natural habitats is similar. Her results will help with the conservation and management of bats in the Okanagan. The data can be incorporated into management strategies with viticulturists to enhance bat habitat in the area while also potentially reducing pest management costs.

b. Breeding phenology and productivity of an invasive, agricultural specialist, the European starling

European starlings are an invasive species of considerable economic importance because of their agricultural and urban impact (as well as being the focal species for Environment Canada’s terrestrial contaminant monitoring under the Chemical Management Plan). However, they are also agricultural specialists associated with less-intensive pasture (short mown or grazed fields), and are dependent on one main prey type (Tipulid larvae or leatherjackets – another introduced pest species) for successful reproduction. As such they could be a useful monitoring species for changes in agricultural land-use and intensification. Our long-term study of the ecological physiology of European starlings marked its 14th year at two sites in the Fraser Valley: Langley (140 nest boxes) and Glen Valley (60 nest boxes); funded largely from sources outside of CWE. In 2016 work was conducted by Allison Cornell (PhD) and Mitchell Serota (MSc) and an army of undergraduate students (several funded by Undergraduate Student Research Awards). We refined use of the NSERC-funded automated radio-tracking system with 4 radio towers to track birds 24/7 during breeding, and validated this approach for measuring detailed activity and behaviour. We completed a study on the effects of a “novel” prey item (soldier flies) which appeared in 2015 associated with a local, commercial insect farming operation.

c. Landscape-level determinants of breeding distribution, productivity and foraging in Barn Swallows and Tree Swallows

Farmland and grassland bird species, including aerial insectivores, have been declining for decades in Europe and North America. Recent studies have cast doubt on the idea that there is a single, global cause for all population declines, e.g. there is only weak cross-correlation in population trajectories in co-occurring aerial insectivore species. This suggests there are highly variable, and complex, spatio-temporal patterns of population change perhaps related to region-specific environmental conditions (e.g. climate, land use). Two MSc students (Olga Lansdorp and Chloe Boynton) completed a fourth field season studying breeding phenology and productivity of two co-occurring aerial insectivores, barn and tree swallows, at 11 sites in the Metro Vancouver region. Specific objectives of Olga's project are to, a) assess effects of livestock presence, and non-agricultural and agricultural land use on breeding density and breeding success; b) to 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. Chloe's work focused on post-fledging behaviour and habitat use in barn swallows involving 4 automated radio towers (MOTUS West) in collaboration with Bird Studies Canada (David Bradley) and Bob Clarke (EC).

C. Declining Avian Populations

1. Migratory Shorebirds

Concern has been raised about apparent population declines of many species of shorebirds over the past two decades. The CWE and its ECCC associates have consistently contributed novel research findings addressing potential causes of these apparent declines. We have cooperated particularly closely with ECCC's Mark Drever (Delta), Keith Hobson (Saskatoon), and with ECCC emeritus Bob Elner, as well as Bird Studies Canada representatives.

a. Shorebird Breeding Biology

In 2016, current and former CWE members contributed to a set of publications arising from our participation in the Arctic Shorebird Demographic Network, an arctic-wide collaborative program that includes over a dozen sites in Alaska and arctic Canada (including contributions from ECCC staff members) utilizing comparable protocols. The publications addressed breeding phenology relative to food supplies, changes in phenology between the mid-1990s and 2010s, migration patterns based on geolocator tracks from >140 Semipalmated sandpipers, the effects of geolocators on individual survivorship and nest success, and a review of incubation strategies of biparental species.

Graduated MSc student Willow English produced an accepted publication on the effects of exclosures on nest success rates of incubating red-neck phalaropes, based on the Nome data from the 1990s and the 2010s.

b. Non-breeding biology

PhD student Richard Johnson, from Colombia, conducted a final field season examining non-breeding flight performance and aspects of the community ecology of wintering shorebirds in large riverine/estuary systems in southern Colombia. Richard prepared his first MS, describing factors influencing the location of roost sites for Whimbrils.

Eveling Tavera Fernandez, from Peru, conducted another successful field season at the end of 2015-spring 2016, capturing and resighting non-breeding shorebirds at Paracas, Peru. She published her first thesis manuscript, describing pre-migratory preparation and moult patterns of Semipalmated sandpipers. At the end of 2016, she returned to Peru for an additional field season. Eve headed a campaign to bring the next meeting of the Western Hemisphere Shorebird Group to her field site at Paracas, Peru, and she is integral to planning the meeting, scheduled for autumn 2017.

c. Population Biology

A paper using Audubon CBC data on Dunlin winter distributions was published by Ydenberg and CWE colleagues. The study shows that over a 35 year period, dunlin populations concentrate at larger sites when winter populations are larger, on both the Pacific and Atlantic/Gulf coasts. On the Pacific coast, dunlin populations also concentrate as falcon numbers have increased.

A highly collaborative paper addresses issues related to perceived Semipalmated sandpiper population changes, which has been of substantial concern, particularly in eastern Canada. This study brought together morphological data suggesting that wing lengths of semipalmated were longest around 1980 and have become smaller since that time. These data suggest alternative explanations for the population significance of changes in morphometrics previously reported at the Bay of Fundy. Authors and collaborators are CWE's Lank, Xu, and Ydenberg plus ECCC staff members Cheri Gratto-Trevor, Paul Smith, Julie Paquet, Christian Friis, retired ECCC biologists Guy Morrison and Peter Hicklin, as well as several students and other academics.

2. Neotropical Migrant Passerines

CWE initiated a long-term study on yellow warblers that migrate between western Canada and Mexico/Central America in 2004. This research conducted in collaboration with Dr. Elsie Krebs (ECCC) takes a whole life cycle approach and includes work on the breeding grounds in Inuvik, NT, and Revelstoke, BC, on migration and on the wintering grounds in Jalisco, Mexico.

Building on work done by Anna Drake (PhD 2013), Simon Valdez (PhD candidate) is further investigating the non-breeding portion of the yellow warbler life cycle. He completed his fieldwork in Mexico in 2015 and is currently writing up his thesis. Preliminary analysis suggests 1) the breeding origins of female yellow warblers influences winter habitat use in Mexico, and 2) winter habitat use influences the condition, departure dates and winter survival of Yellow warblers in Jalisco, Mexico.

Michal Pavlik (PhD candidate) is currently examining 1) how wind conditions on migration interact with conditions on the breeding grounds to determine the timing of breeding and local productivity, 2) how mortality rates vary across the annual cycle, and 3) whether factors that explain vital rates at the local scale predict regional variation in population dynamics.

3. Sea Ducks

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.

4. Aerial Insectivores

The widespread population declines of this guild has led to the suggestion that declines may be due to changes in the abundance and/or availability of their insect prey. Long-term declines in insect abundance have been documented in Europe but similar data is lacking fro North America. Challenge experiments, that were a common tool used to test foraging theory in the 1990's provide a potential alternative approach to evaluating changes in prey availability; if prey availability has decreased parents over the last three decades we would expect to see concomitant changes in the ability of parents to meet the challenge of provisioning experimentally enlarged brood sizes. Catherine Villeneuve, a new student co-supervised by Drs Ron Ydenberg and David Green, has initiated a project to evaluate this approach by repeating a brood manipulation on tree swallows conducted in Creston BC in 1994/5.

See also section V.B.3.c. Landscape-level determinants of breeding distribution, productivity and foraging in Barn Swallows and Tree Swallows.

See also section V.A.2. Eastern WhipPoorWill *(Threatened, COSEWIC).*

D. Coastal Ecology

1. Coastal Studies of Seabirds

Coastal British Columbia supports large populations of many species of seabirds, for which Environment and Climate Change 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 ecology, 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 British Columbia, 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 behaviour, 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 2016 season: We opened the camp on Triangle Island in early April of 2016. The field crew consisted of Glenn Crossin (Dalhousie University), Alice Domalik (MSc Candidate, Simon Fraser University), Mark Hipfner (Environment and Climate Change Canada – Wildlife Research Division) Erika Lok (ECCC – Canadian Wildlife Service), Mark Maftei (ECCC – WRD), Katharine Studholme (PhD Candidate, Dalhousie University), and Ken Wright (ECCC – WRD).

The 2016 season featured very strong El Niño conditions, with ocean temperatures well above normal values. This usually predicts a poor diet and very poor breeding success for Cassin's Auklets; diets were poor, as predicted, featuring record low amounts of the subarctic copepod *Neocalanus cristatus*; but breeding success was only a little lower than normal. We're not sure how they managed that feat. Other species had poor to moderate years, and the Common Murres continued to struggle under the pressure from Bald Eagles and Glaucous-winged Gulls.

The main focus of the research effort in 2016 was the spatial work that has been underway since 2013, which includes Katie Studholme's PhD project involving use of GLS tags, and Alice Domalik's MSc project involving use of GPS tags. The GLS tags have been deployed (and retrieved!) on Cassin's and Rhinoceros auklets on colonies spanning the Northeast Pacific, from California to Alaska. The final deployments on both species occurred on Triangle Island in 2016. A major goal of the GLS project is to test the hypothesis that patterns of population genetic structuring in the auklets are determined by the extent of overlap in wintering areas. The genetics work is being led by Professor Theresa Burg and MSc candidate Marie Prille (Lethbridge University). The objective of Alice Domalik's MSc project is to use GPS tags to locate critical foraging areas for Cassin's and Rhinoceros auklets around several major BC colonies – in 2016, this work occurred on Triangle, Pine, and Lucy islands. Other people working on the GPS project in 2016 included Sarah Hudson (ECCC – WRD), Glen Keddie, Dan Shervill (ECCC - CWS), Strahan Tucker (Department of Fisheries and Oceans Canada) and Ken Wright. This work will continue in 2017.

Several research projects were carried out concurrently with the logger deployments in 2016. Hipfner, Tucker and Marc Trudel (DFO) completed the fifth year of a joint EC-DFO project investigating the consumption of salmon *Oncorhynchus* spp. by seabirds in BC waters. In fact, there was almost no salmon at all in diets in 2016, which was to be expected, given the unusually poor ocean conditions in the last 2 years. And Hipfner and Moira Galbraith (DFO), along with several collaborators, completed the eighth year of a project investigating spatio-temporal variation in the diets of Pacific sand lance and Pacific herring, two forage fish of vital importance to seabirds in British Columbia. This latter project is also providing us with important information on the prevalence of plastic pollution in marine food webs off the BC coast, as is work on Cassin's Auklet diets at Triangle Island.

In addition, Hipfner, Maftei, and Sean Boyd (ECCC, Delta – WRD) visited St. Helena Island, Nunavut, in 2016 to deploy satellite tags on Thayer's Gulls. All 5 of the tagged gulls wintered in the Pacific, as we had hoped, but they were more dispersed than we had expected - from San Francisco north to SE Alaska. After this spring, we hope to have one full annual cycle's worth of information on timing and direction of migration from the Arctic, and back again. After the St. Helena trip, Hipfner, Maftei, and Shanti Davis (ECCC – CWS), visited Nassuravaalik Island, Nunavut, to dodge polar bears and continue ongoing studies of a suite of ground-nesting seabirds including Arctic Tern *Sterna paradisaea*, Sabine's Gull *Xema sabini*, and Ross's Gull *Rhodos-*

tethia rosea.

And finally, Hipfner, Hudson and Maftei conducted a pilot project in winter 2017 investigating the winter ecology of gulls in the Salish Sea in winter. Having had reasonable success, we intend to pursue this project with greater vigor in winter 2018

2. Coastal Usage by Migratory Shorebirds

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 ECCC's environmental assessments as Port of Vancouver operations continue and expand.

David Hope, who obtained an MSc at the CWE, continued his PhD studies in 2016 studying stopover strategies of southward migrating western sandpipers. In collaboration with Bird Studies Canada, he organized volunteers to survey shorebird site and habitat utilization through-out the Salish Sea. This work puts the relative importance of migratory stopover sites into regional perspectives and addresses hypotheses examining the environmental causes responsible for changes in habitat usage.

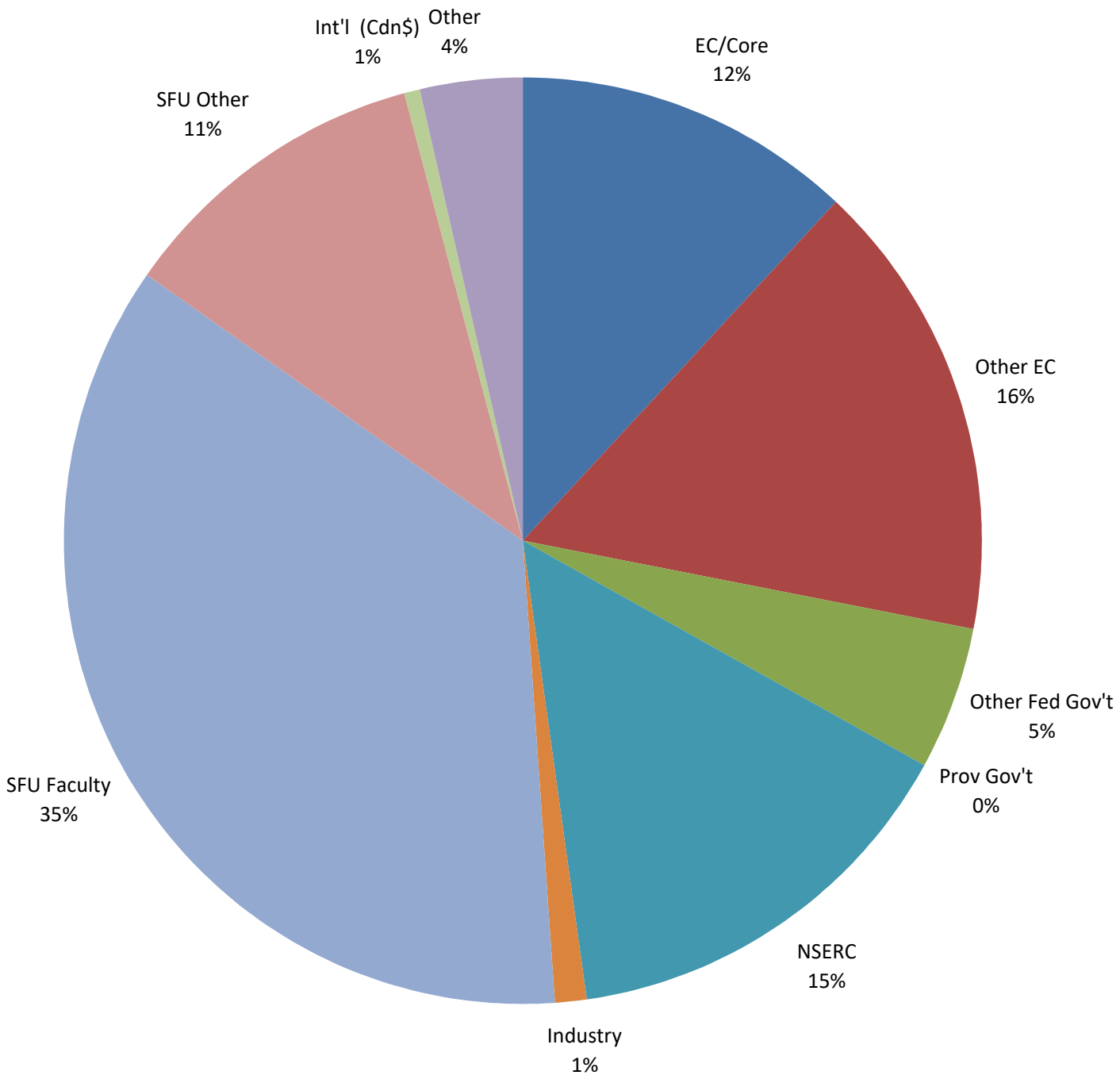
Several CWE-ECCC-contributed papers documenting biofilm usage in the Fraser River delta were published, including one by 2013 PhD graduate Ariam Jiménez, now a professor at the University of Havana.

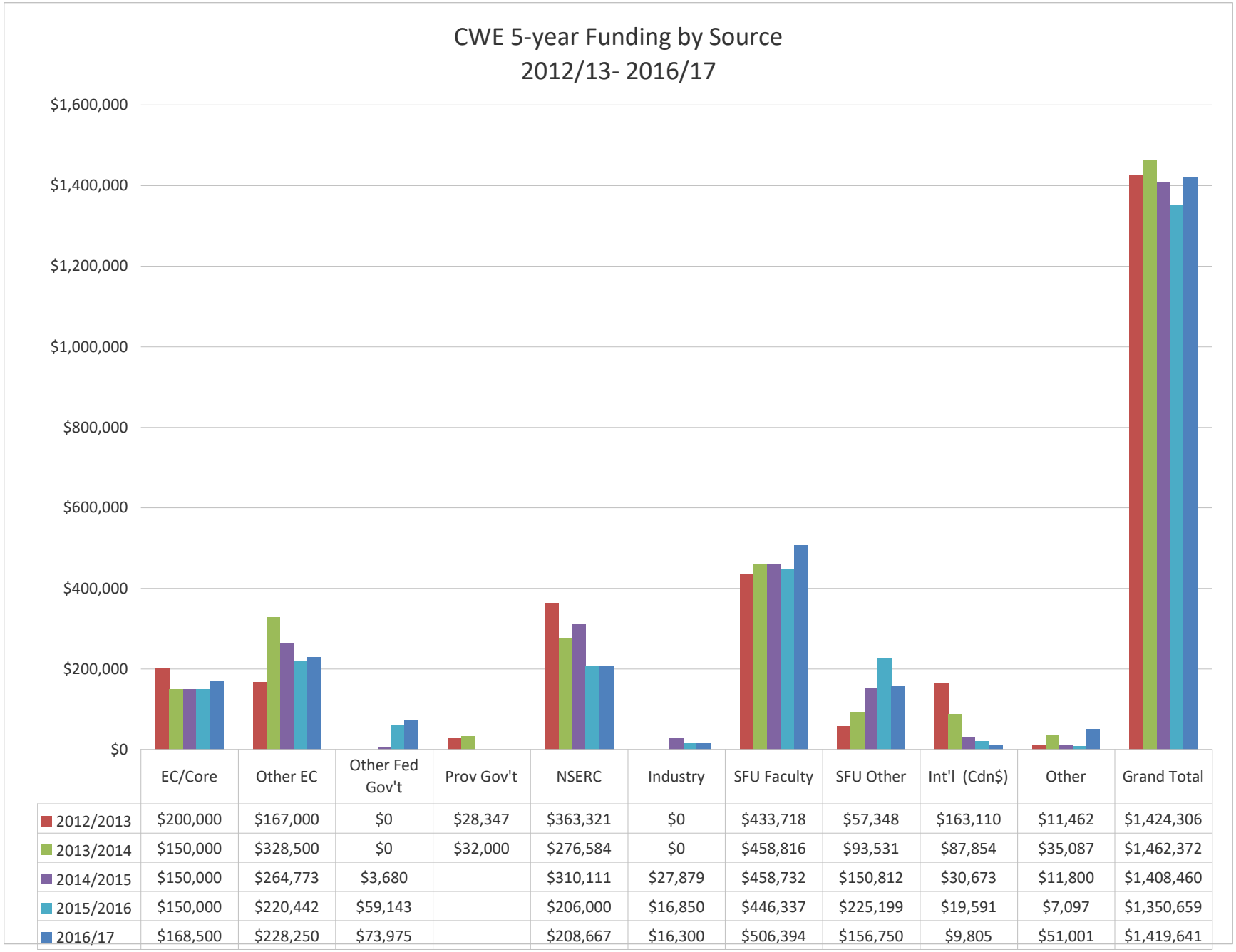
VI FUNDING

2016-2017 was the fourth 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 5 year chart compares revenue projections (formulated for this agreement) to actual revenue from Environment Canada, SFU and other industrial, provincial, federal and international sectors.

CWE Funding by Source 2016/17





	EC/Core	Other EC	Other Fed Gov't	Prov Gov't	NSERC	Industry	SFU Faculty	SFU Other	Int'l (Cdn$)	Other	Grand Total
2012/2013	$200,000	$167,000	$0	$28,347	$363,321	$0	$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
2014/2015	$150,000	$264,773	$3,680		$310,111	$27,879	$458,732	$150,812	$30,673	$11,800	$1,408,460
2015/2016	$150,000	$220,442	$59,143		$206,000	$16,850	$446,337	$225,199	$19,591	$7,097	$1,350,659
2016/17	$168,500	$228,250	$73,975		$208,667	$16,300	$506,394	$156,750	$9,805	$51,001	$1,419,641

1 April 2016 - 31 March 2017

Scholarships, Fellowships, Grants for Students

PhD

NSERC	Michal Pavlik	NSERC IPS - NSERC contribution (Summer, Fall, Spring)	$15,000	
Industry	Michal Pavlik	NSERC IPS - Industry contribution (Summer, Fall, Spring)	$6,000	
SFU Fellowships etc	Alice Domalik	Travel Award (Spring)	$410	
SFU Fellowships etc	Allison Cornell	Sessional (Fall), GF (Spring)	$17,063	
SFU Fellowships etc	David Hope	PRS (Summer), GF (Spring)	$13,000	
SFU Fellowships etc	Eveling Tavera	GF (Fall)	$6,500	
SFU Fellowships etc	Jeff Yap	TA (Fall)	$8,372	
SFU Fellowships etc	Marie Helene Burle	TA (Summer)	$4,101	
SFU Fellowships etc	Marinde Out	TA (Fall)	$6,864	
SFU Fellowships etc	Philina English	TA (Spring), Travel Award (Spring)	$7,364	
SFU Fellowships etc	Richard Johnson	GF (Fall), Travel Award (Summer)	$7,150	
SFU Fellowships etc	Sarah Thomson	TA (Spring)	$4,186	
SFU Fellowships etc	Simon Valdez	GF (Fall), TA (Spring)	$13,364	
Other	Philina English	SICB Conference Support - U. of NB	$1,370	
Other	Marie Helene Burle	AOE Travel Award (for NAOC)	$450	USD $345
Other	Richard Johnson	NAOC Travel Award	$520	USD $400
Other	Sarah Thomson	NAOC Travel Award	$554	USD $410

M Sc

NSERC	Alice Domalik	NSERC (Fall, Spring)	$11,667	Prorated $17,500/yr
SFU Fellowships etc	Chloe Boynton	Travel Award (Summer), GF (Spring)	$7,150	
SFU Fellowships etc	Cybele Heddle	TA (Fall)	$5,819	
SFU Fellowships etc	Kate Fremlin	GF (Fall), Travel Award (Fall, Spring)	$7,500	
SFU Fellowships etc	Michal Pavlik	Entrance Scholarship (Summer, Fall, Spring)	$5,000	
SFU Fellowships etc	Mitchell Serota	TA (Fall), GF (Spring)	$12,319	
SFU Fellowships etc	Seth Bennett	GF (1/2 Summer), TA (Fall)	$9,069	
SFU Fellowships etc	Spencer Morran	TA (Summer)	$5,700	
SFU Fellowships etc	Kristen Walters	TA (Spring)	$5,819	
Other EC	Alice Domalik	Env. Cda. Contract (Spring)	$3,000	
Other EC	Chloe Boynton	Env. Cda. Contract (Summer)	$7,000	
Other EC	Cybele Heddle	Env. Cda. Contract (Spring)	$7,000	
Other EC	Kate Fremlin	Env. Cda. Volunteer Agreement (Fall)	$1,000	
Other EC	Kate Fremlin	Env. Cda. Contract (Spring)	$5,250	
Other EC	Seth Bennet	Env. Cda. Contract (Spring)	$7,000	
Other	Chloe Boynton	AOU (NAOC) Travel Award	$358	USD $265
Other	Kristen Walters	Hancock Foundation (Fall)	$7,000	

General Funding for CWE

EC/Core	EC	EC Annual Chair Funding (4/5 yrs)	$168,500
SFU	SFU	SFU Contribution to Faculty Salaries (Ydenberg Williams Green)	$506,394
SFU	SFU	SFU VPR: Contribution to CWE	$5,000
Other Federal	Ydenberg	Canada Summer Jobs	$2,092
Other Federal	Lank	Canada Summer Jobs	$1,883

Conference Funding

SFU - VPR & Dean of Science	Williams	International Ornithological Congress 2018-B	$5,000
Other	Williams	International Ornithological Congress 2018-B (NSF, Company of Biologists, BES, Loligo, SICB)	$19,500

Generated Research Funding

Species at Risk

Other Federal	Flower	Banting Postdoctoral Award (2/2 yrs)	$70,000
Other	Ydenberg	via Hancock Fdn	$15,000

Human Impact on Birds

Industry	Green DJ	BC Hydro/ Cooper Beauchesne and Associates Ltd.	$2,800
Other EC	Willams TD / Elliott J	Research on developmental neurotoxicity of methyl mercury in birds (5/5 yrs)	$25,000
International	Williams TD	International Program for Scientific Cooperation (PICS)	$9,805
Other	Elliott J	MITACS Elevate: Development and application of molecular tools to assess the acute and chronic impacts of petroleum hydrocarbons on birds (3 months /2 yrs - MITACS contribution)	$6,250
Industry	Elliott J	MITACS Elevate: Development and application of molecular tools to assess the acute and chronic impacts of petroleum hydrocarbons on birds (3 months /2 yrs - Northern Gateway Pipelines contribution)	$7,500

Declining Avian Populations

Other EC	Mahony, N	Swallow Project: Field Season In-Kind Support (with TD Williams)	$31,000
		Coast Ecology	
Other EC	Hipfner MJ	Wildlife Research Division (A-base)	$52,000
Other EC	Hipfner MJ	Canadian Wildlife Service (Protected Areas)	$45,000
Other EC	Hipfner MJ	Canadian Wildlife Service (Marine Tanker Safety Phase 1b)	$20,000
Other EC	Hipfner MJ	Climate Change Action Plan	$25,000
		NSERC	
NSERC	Green DJ	Overwintering ecology, migration strategies and demography of migratory birds (3/5 yrs)	$27,000
NSERC	Lank D	Maintenance of ecological polymorphism by frequency-dependent selection (3/5 yrs)	$27,000
NSERC	Ydenberg RC	NSERC Individual Research Grant - "Predation danger in the ecology of migration" (2/5 yrs)	$32,000
NSERC	Williams TD	Physiological Adaptations for Breeding in Birds (5/6 yrs)	$60,000
NSERC	Elliott J	Investigating sources, transport, accumulation and effects of persistent contaminants in urban environments using a top predator as indicator (1/5 yrs)	$36,000
		Grand Total	$1,419,641
		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 actively. Three 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. PAPERS IN REFEREED JOURNALS OR BOOKS

In press:

Bertram, D.F., D.L. Mackas, D.W. Welch, W.S. Boyd, J.L. Ryder, M. Galbraith, A. Hedd and K. Morgan. In press. Variation in zooplankton prey distribution determines marine breeding distributions of Cassin's auklet. Deep-Sea Res. I.

Brown, S., C. Gratto-Trevor, R. Porter, E.L. Weiser, D. Mizrahi, R. Bentzen, M. Boldenow, R. Clay, S. Freeman, M.-A. Giroux, E. Kwon, D.B. Lank, N. Lecomte, J. Liebezeit, V. Loverti, J. Rausch, B.K. Sandercock, S. Schulte, P. Smith, A. Taylor, B. Winn, S. Yezerinac and R.B. Lanctot. In press. Migratory connectivity of Semipalmated Sandpipers and implications for conservation. Condor.

English, P.A., A.M. Mills, M.D. Cadman, A. Heagy, G. Rand, D.J. Green and J.J. Nocera. In press. Tracking the annual cycle of a nocturnal aerial insectivore in the Americas. BMC Zool.

English, W.B., E. Kwon, B.K. Sandercock and D.B. Lank. In press. Effects of predator exclosures on reproductive success in Red-necked Phalaropes. Wader Study.

Lank, D.B., C. Xu, B.A. Harrington, R.I.G. Morrison, C.L. Gratto-Trevor, P.W. Hicklin, B.K. Sandercock, P.A. Smith, E. Kwon, J. Rausch, L.D. Pirie Dominix, D.J. Hamilton, J. Paquet, S.E. Bliss, S.G. Neima, C. Friis, S.A. Flemming, A.M. Anderson and R.C. Ydenberg. In press. Long-term continental changes in wing length, but not bill length, of a long-distance migratory shorebird. Ecol. Evol.

2017:

Bertram, D.F., A. Harfenist, L.L.E. Cowen, D. Koch, M.C. Drever, J.M. Hipfner and M.J.F. Lemon. 2017. Latitudinal temperature-dependent variation in timing of prey availability can impact Pacific seabird populations in Canada. Can. J. Zool. 95**:** 161-167 dx.doi.org/10.1139/cjz-2016-0197.

Cornell, A., K.F. Gibson and T.D. Williams. 2017. Physiological maturity at a critical life-history transition and flight ability at fledging. Funct. Ecol. 31**:** 662-670. doi:10.1111/1365-2435.12777.

Cornell, A., J.J. Hou and T.D. Williams. 2017. Experimentally prebreeding increased male social behaviour has no effect on female breeding phenology and performance. Anim. Behav. 126**:** 243-251.

English, P.A., J.J. Nocera, B.A. Pond and D.J. Green. 2017. Habitat and food supply across multiple spatial scales influence the distribution and abundance of a nocturnal aerial insectivore. Landscape Ecol. 32**:** 343-359.

Forrester, T.R., D.J. Green, R. McKibbin and C.A. Bishop. 2017. Evaluating the efficacy of seasonal grazing and livestock exclusion as restoration tools for birds in riparian habitat of

the Okanagan Valley, British Columbia, Canada. Restoration Ecol. DOI**:** 10.1111/rec.12495.
Willie, M., D. Esler, R.C. Ydenberg, W.S. Boyd and P. Molloy. 2017. Spatial Variation in Polycyclic Aromatic Hydrocarbon Exposure in Barrow's Goldeneye (*Bucephala islandica*) in Coastal British Columbia. Mar. Pollut. Bull. 118**:** 167-179 http://dx.doi.org/10.1016/j.marpolbul.2017.02.010.
Ydenberg, R.C., J. Barrett, D.B. Lank, C. Xu and M. Faber. 2017. The redistribution of non-breeding dunlins in response to the post-DDT recovery of falcons. Oecologia DOI**:** 10.1007/s00442-017-3835-2.

2016:

Bertram, D.F., C.A. MacDonald, P.D. O'Hara, J.L. Cragg, M.H. Janssen, M. McAdie and W.S. Boyd. 2016. Marbled Murrelet *Brachyramphus marmoratus* movements and marine habitat use near proposed oil tanker routes to Kitimat, BC, Canada. Marine Ornithol. 44**:** 3-9.
Boutin, S.R., S.J. Harrison, L.P. Fitzsimmons, E.M. McAuley and S.M. Bertram. 2016. Same-sex sexual behaviour in crickets: understanding the paradox. Anim. Behav. 114**:** 101-110.
Brogan, J.M., D.J. Green, F. Maisonneuve and J.E. Elliott. 2016. An assessment of exposure and effects of persistent organic pollutants in an urban Cooper's hawk (*Accipiter cooperi*) population. Ecotoxicol. 26**:** 32-45.
Bulla, M., M. Valcu, A.M. Dokter, A.G. Dondua, A. Kosztolányi, A. Rutten, B. Helm, B.K. Sandercock, B. Casler, B.J. Ens, C.S. Spiegel, C.J. Hassell, C. Küpper, C. Minton, D. Burgas, D.B. Lank, D.C. Payer, E.Y. Loktionov, E. Nol, E. Kwon, F. Smith, H.R. Gates, H. Vitnerová, H. Prüter, J.A. Johnson, J.J.H. St. Clair, J.-F. Lamarre, J. Rausch, J. Reneerkens, J.R. Conklin, J. Burger, J. Liebezeit, J. Bêty, J.T. Coleman, J. Figuerola, J.C.E.W. Hooijmeijer, J.A. Alves, J.A.M. Smith, K. Weidinger, K. Koivula, K. Gosbell, K.-M. Exo, L. Niles, L. Koloski, L. McKinnon, L. Praus, M. Klaassen, M.-A. Giroux, M. Sládecek, M.L. Boldenow, M.I. Goldstein, M. Šálek, N. Senner, N. Rönkä, N. Lecomte, O. Gilg, O. Vincze, O.W. Johnson, P.A. Smith, P.F. Woodard, P.S. Tomkovich, P.F. Battley, R. Bentzen, R.B. Lanctot, R. Porter, S.T. Saalfeld, S. Freeman, S.C. Brown, S. Yezerinac, T. Székely, T. Montalvo, T. Piersma, V. Loverti, V.-M. Pakanen, W. Tijsen and B. Kempenaers. 2016. Unexpected diversity in socially synchronized rhythms of shorebirds. Nature Ecol. Evol. DOI**:** 10.1038/nature20563.
Katinic, P.J., D.A. Patterson and R.C. Ydenberg. 2016. Condition-dependence in the marine exit timing of sockeye salmon (*Onchorhynchus nerka*) returning to Copper Creek, Haida Gwaii. Can. J. Fish. Aqua. Sci. DOI**:** 10.1139/cjfas-2015-0533.
Knight, E.C., N.A. Mahony and D.J. Green. 2016. Effects of agricultural fragmentation on the bird community in sagebrush shrubsteppe. Agric., Ecosys. Environ. 223**:** 279-288.
Kouwenberg, A.-L., J.M. Hipfner, D.W. McKay and A.E. Storey. 2016. Corticosterone levels in feathers and blood of a colonial seabird are affected by year-round variation in environmental conditions. Marine Biol. 163**:** 42.
Lukeman, R., A. Christie and R.C. Ydenberg. 2016. Goal-dependent current compensation and drift in surf scoter flocks. Movement Ecol. 4**:** 2 DOI: 10.1186/s40462-016-0068-7.
Ottenburghs, J., H.J. Megens, R.H.S. Kraus, O. Madsen, P. van Hooft, S.E. van Wieren, R.P.M.A. Crooijmans, R.C. Ydenberg, M.A.M. Groenen and H.H.T. Prins. 2016. A tree of geese: A phylogenomic perspective on the evolutionary history of True Geese. Mol. Phylogen. Evol. 101: 303-13**:** 303-313.
Ottenburghs, J., P. van Hooft, S.E. van Wieren, R.C. Ydenberg and H.H.T. Prins. 2016. Birds in a bush: Toward an avian phylogenetic network. Auk 133**:** 577-582.
Ottenburghs, J., P. van Hooft, S.E. van Wieren, R.C. Ydenberg and H.H.T. Prins. 2016. Hybridization in geese: a review. Frontiers in Zoology 13**:** 20.

Pichegru, L., T.B. Edwards, B.J. Dilley, T.P. Flower and P.G. Ryan. 2016. African Penguin tolerance to humans depends on historical exposure at colony level. Bird Conserv. Internat. 26**:** 307-322.

Reurink, F., N. Hentze, J. Rourke and R. Ydenberg. 2016. Site-specific flight speeds of nonbreeding Pacific dunlins as a measure of the quality of a foraging habitat. Behav. Ecol. 27**:** 803-809.

Tavera, E.A., D.B. Lank and P.M. Gonzalez. 2016. Effects of migration distance on life history strategies of Western and Semipalmated sandpipers in Peru. J. Field Ornithol. DOI**:** 10.1111/jofo.12164.

Thomsen, S.K. and D.J. Green. 2016. Cascading effects of predation risk determine how marine predators become terrestrial prey on an oceanic island. Ecology 97**:** 3530-3537.

Weiser, E.L., R.B. Lanctot, S.C. Brown, J.A. Alves, P.F. Battley, R. Bentzen, J. Bêty, M.A. Bishop, M. Boldenow, L. Bollache, B. Casler, M. Christie, J.T. Coleman, J.R. Conklin, W.B. English, H.R. Gates, O. Gilg, M.-A. Giroux, K. Gosbell, C. Hassell, J. Helmericks, A. Johnson, B. Katrínardóttir, K. Koivula, E. Kwon, J.-F. Lamarre, J. Lang, D.B. Lank, N. Lecomte, J. Liebezeit, V. Loverti, L. McKinnon, C. Minton, D. Mizrahi, E. Nol, V.-M. Pakanen, J. Perz, R. Porter, J. Rausch, J. Reneerkens, N. Rönkä, S. Saalfeld, N. Senner, B. Sittler, P.A. Smith, K. Sowl, A. Taylor, D.H. Ward, S. Yezerinac and B.K. Sandercock. 2016. Effects of geolocators on hatching success, return rates, breeding movements, and change in body mass in 16 species of Arctic-breeding shorebirds. Movement Ecol. 4**:** 12 DOI: 10.1186/s40462-016-0077-6.

Ydenberg, R.C. and L. Hemerik. 2016. Division of labour by provisioners. Evol. Ecol. Res. 17**:** 671-683

Submitted:

Hipfner, J.M., K.R. Studholme and M. Galbraith. Submitted. Low incidence of plastics in food loads delivered to the nestlings of a zooplanktivorous seabird over a 21-year period. Mar. Pollut. Bull.

Huang, A.C., C.A. Bishop, R. McKibbin, A.E. Drake and D.J. Green. Submitted. Wind conditions on migration influences the survival of a neotropical migrant, the western yellow-breasted chat (*Icteria sirens auricles*). BMC Ecol.

Jones, T., J.K. Parrish, P. MacCready, P. , W.T., E.P. Bjorkstedt, N.A. Bond, L.T. Ballance, V. Bowes, J.M. Hipfner, K. Lindquist, J. Lindsey, H.M. Nevins, R.R. Robertson, J. Roletto, L. Wilson, T. Joyce and J. Harvey. Submitted. Massive mortality of a planktivorous seabird in response to a marine heatwave. Proc. Nat. Acad. Sci.

Lewis, T.L., D. Esler, B.D. Uher-Koch, R.D. Dickson, E.M. Anderson, J.R. Evenson, J.W. Hupp and P.L. Flint. Submitted. Attaching transmitters to birds using one versus two subcutaneous anchors: retention and survival trade-offs. Wildl. Soc. Bull.

Macfarland, L., N.A. Mahony, M.L. Harrison and D.J. Green. Submitted. Cavity density influences habitat-specific breeding performance of Lewis's woodpeckers (*Melanerpes lewis*) in British Columbia. Condor.

Studholme, K.R., J.M. Hipfner, L.M. Romero, B.M. Gormally, S.J. Iverson and G.T. Crossin. Submitted. Egg size is independent of variation in pre-breeding feather corticosterone in Cassin's Auklets during favorable oceanographic conditions. Gen. Comp. Endocrinol.

Yap, K.N., M.W. Serota and T.D. Williams. Submitted. They physiology of exercise in free-living vertebrates: what can we learn from current model systems? Integrative and Comparative Biology.

B. REPORTS

Bertram, D.F., C.L.K. Robinson, M. Hennekes, M. Galbraith, N. Dangerfield, S. Gauthier and K. Woo. 2017. Plastic ingestion by Pacific Sand Lance (*Ammodytes personatus*) in the Salish Sea. In: *2016 Salish Sea Toxics Monitoring Review: A Selection of Research*, James, C.A., J. Lanksbury, D. Lester, S. O'Neill, T. Roberts, C. Sullivanand J. West, eds. Tacoma, WA: PSEMP Toxics Work Group.

C. THESES

Dagenais, M.M.E.D. 2016. The habitat association of bats in the South Okanagan Valley, BC, Canada: radar-acoustic surveys to assess the use of vineyards by insectivorous bats (*Vespertilionidae*). MSc, Simon Fraser University, Burnaby.

MacFarland, L. 2016. Habitat-specific breeding performance and cavity dynamics of Lewis's Woodpeckers (*Melanerpes lewis*) in British Columbia, Canada. MSc, Simon Fraser University, Burnaby.

Willie, M. 2016. Patterns in winter site fidelity and polyscyclic aromatic hydrocarbon exposure risk in Barrow's Goldeneye (*Bucephala islandica*) in the Pacific Northwest. MSc, Simon Fraser University, Burnaby.