ANNUAL REPORT of the
CENTRE FOR WILDLIFE ECOLOGY

2007-2008

Department of Biological Sciences
Simon Fraser University

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

Dr. Ron 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 the Canadian Wildlife Service (CWS) 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, Assistant Professor
Dov Lank	University Research Associate / Adjunct Professor
Dan Esler	University Research Associate / Adjunct Professor
Mark Hipfner	University Research Associate / CWS Biologist
Doug Bertram	CWS Biologist / Adjunct Professor
Sean Boyd	CWS Research Scientist
Rob Butler	CWS Research Scientist / Adjunct Professor
Bob Elner	CWS Research Scientist
John Elliott	CWS Research Scientist / Adjunct Professor
Barry Smith	CWS Research Scientist / Adjunct Professor
Fred Cooke (retired)	Emeritus Chairholder

2. Research Group

Postdoctoral Fellow	***PhD (in progress)***	***MSc (in progress)***	***Staff***
Sophie Bourgeon	Kathy Brodhead	Jenn Barrett	Monica Court, CWE Admin. Asst.
Caz Taylor	Marie-Hélène Burle	Samantha Franks	Connie Smith, CWE Research Tech
	Margaret Eng	Dan Guertin	Vanessa Richard, Sea Duck Tech
	Lindsay Farrell	Dong Han	Karen Rickards, NSERC USRA
	Sarah Jamieson	Megan Harrison	Josh Malt, MAMU Tech
	Ariam Jiménez	Sofi Hindmarch	
	Heather Major	David Hope	
		Iain Jones	
		Peter Katinic	
		Lauren Kordonowy	
		Kyle Morrison	
		Sam Quinlan	
		Dora Repard	
		Pat Robinson	
		Christine Rock	
		Michael Silvergieter	
Visitors		Marc Travers	
Kimi Jaatinen		Kirsten Webster	
Nelli Rönka		Ivy Whitehorne	
Michael Clinchy	***PhD(defended)***	***MSc (defended)***	
Liana Zannette	Joel Heath	Josh Malt	
Mieke van Opheusden	Oliver Love	Erika Lok	
Whoseung Lee		Emily Wagner	

B. Steering Committee

Name	*Position*	*Affiliation*
Elizabeth Elle	Assistant Professor	*SFU*
Arne Mooers	Assistant Professor	*SFU*
Robert Elner	Head, Migratory Birds Conservation	*CWS*
David Green	CWE faculty (non-voting)	*SFU*
Kristina Rothley (SFU alternate)	Assistant Professor	*SFU*
Paul Kluckner	Regional Director, ECB PYR	*CWS*
Barry Smith	Research Scientist	*CWS*
Tony Williams	CWE faculty (non-voting)	*SFU*
Ron Ydenberg	CWE Director (non-voting)	*SFU*

IV. INTRODUCTION

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

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

or contact Ron Ydenberg at ydenberg@sfu.ca.

V. THE CWE IN ACTION

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

A. The Triangle Island Seabird Research Station

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

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

The 2007 season: We opened our very cold and wet research station on Triangle Island for year 14 on 27 March 2007, with continued logistical support from the Canadian Coast Guard. Scientific research was conducted under the direction of Mark Hipfner, while Kyle Morrison and Mark led the field crew at various times in the summer. We maintained our time series focus on Cassin's Auklet, Rhinoceros Auklet, Tufted Puffin, Common Murre, Pelagic Cormorants, Glaucous-winged Gulls and Black Oystercatchers, coupled with graduate student research (see below).

The 2007 season was notable mostly for the dismal breeding season experienced by Rhinoceros Auklets and Tufted Puffins – near-complete (Rhinos) or complete (Tufteds) failure. It appears that this was related to very late ocean primary production in spring 2007. Fortunately, this late phenology did not have such dramatic consequences for other species, although no species experienced a boom year by any stretch.

Graduate students:

Kyle Morrison, who began his MSc at SFU in September 2006 co-supervised by David Green and Mark, spent much of summer 2007 conducting field work on Triangle Island. Kyle's thesis will investigate survival and colony attendance patterns in Tufted Puffins in relation to age and gender. In addition, Marjorie Sorenson, an MSc candidate with Ryan Norris at University of Guelph, conducted thesis-related field work on Triangle Island in 2007. Marjorie's thesis will investigate carry-over effects related to pre-breeding diet quality and their influence on breeding success of Cassin's and Rhinoceros auklets using stable-isotope analysis.

B. Integrated Shorebird Research

Shorebirds are among the most highly migratory of all birds. Populations of many species travel half the globe in the course of their annual migrations. The Canadian Wildlife Service has an historical, mandated responsibility for the conservation of migratory birds. Great concern has been raised about apparent population declines of many species over the past two decades. The CWE is studying two small calidrid sandpipers - western sandpipers and dunlin - to better understand these apparent declines.

The majority of the world's 3.5 – 4.0 million Western Sandpipers stop briefly to refuel in Boundary Bay or on Robert's Bank during their annual northward migration, providing a thrilling sight for local residents. A good fraction 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. Local information on shorebird usage, including western sandpipers and dunlin, contributed towards Environment Canada's submission in response to proposals to enlarge the Coal Port facility on Robert's Bank, and will be of substantial value with respect to environmental assessment as planning for the next phase of port expansion continues.

Since its inception in 1993, the CWE has nurtured the development of the Western Sandpiper Research Network as a platform for research on a hemispheric scale that can address this issue, which includes CWE staff Ron Ydenberg, Dov Lank, and Tony Williams. Our multifaceted research is documenting and modeling the factors controlling the population size, migratory routes and timing, ecological relationships with predators and prey, habitat use, and physiological ecology of this long-distance, Neotropical migrant. We have pursued and aided fieldwork at three breeding sites, several migration locations, and four wintering sites. We have organized ten 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? Of direct conservation concern is the consequence of the removal or deterioration of one or more locations on survival and reproduction. As a result of our work, the Western Sandpiper is now the best-studied sandpiper in the Western Hemisphere.

Highlights from the past year:

The highest profile event of the year came as it closed, with publication in *Ecology* of a paper documenting the quantitative level of diet derived from biofilm feeding by shorebirds (Kuwae et al. 2008). The article and its associated videos attracted considerable media attention across Canada. In addition, postdoctoral fellow Yuri Zharikov, who was based at the PWRC in Delta, completed a model of winter use, particularly dunlin, on Robert's Bank. Both pieces of work are of management significance with respect to potential alterations of Roberts Bank, heavily used by sandpipers, with proposed expansion of Vancouver Port facilities.

In related work, Dov Lank and Yuri Zharikov continued a second year of collaboration with a radio-tracking study of habitat use by dunlin in the Skagit Delta in Washington State, initiated by Gary Slater, from the Ecostudies Institute and Ruth Milner, Washington Fish and Wildlife. The study borrows approaches used in the Fraser River delta by earlier CWE students, and involves CWS' Keith Hobson, Saskatoon.

MSc student Samantha Franks conducted her second field season on southward migration stopover behaviour of continental-migrating western sandpipers and other calidrid species in Kansas, with assistance from 1996 graduate from the CWE, Brett Sandercock, now at Kansas State University. Samantha spent the fall running isotope samples at Queen's University. Sarah Jamieson spent a term in the Netherlands doing collaborative lab work on Dunlin egg production. Postdoctoral researcher Caz Taylor completed one version of an individual-based model of Western Sandpiper migration, which may be expanded to more of the annual cycle. Ron Ydenberg and co-authors published a commentary highlighting potential effects of predation danger on migration strategies to the Journal of Avian Biology.

We continued to collaborate with radio-tracking studies organized by Dr. Pat Baird, who received her fourth year of funding from the U.S. government for a project investigating the southern portion of the migration route, in Panama and Mexico. She has discovered new migratory paths for the westerns from the southern overwintering area in Panama that were previously unknown.

Additional collaborators included graduated PhD student Guillermo Férnandez, now at the Universidad Nacional Autónoma de México in Mazatlan; Dick Dekker, who is examining local raptor-dunlin interactions; and Dr. Ryan Norris, at the University of Guelph, with whom we published a paper demonstrating the potential for trace element profiles to identify highly local places where feathers are grown. Building in part on this start, the year closed with substantial funding obtained from both NSERC's Strategic grants program and the USF&WS' Neotropical Migratory Bird Conservation fund to document the migratory connectivity of Western Sandpipers, using multiple approaches. This will provide support for field and laboratory work by several students for the coming three years, including a Mexican graduate student.

Finally, the CWE notes the formal retirement of Rob Butler last year and imminent retirement of Bob Elner from the Canadian Wildlife Service. Both contributed immeasurable leadership to the CWE/CWS shorebird work, and we hope that they will remain active participants in our projects.

C. The Marbled Murrelet Project

This ground-breaking and high profile project examining the biology of the threatened and elusive marbled murrelet continues for its fourteenth year. Dov Lank, Josh Malt, Mike Silvergeiter and MREM graduate student Jenn Barrett continued their work. The SFU team worked closely with Louise Waterhouse from the BC Ministry of Forests and other murrelet researchers in government, industry, and academia, including Peter Arcese (UBC) and Alan Burger (UVic).

Dov Lank continued to serve on the Canadian Marbled Murrelet Recovery Team, which is headed by former CWE staff member Doug Bertram. This participation enables the results of the CWE's research to be rapidly assimilated into evolving policy guidelines for management of this threatened species, under the protection of the federal Species at Risk Act and Provincial Identified Wildlife Management Strategy. Through the Recovery Team, Lank participated in the never-ending rewriting the federal recovery strategy and action plans. Joint publications and reports were produced with Louise Waterhouse, BC Ministry of Forests, to evaluate current methodology for classifying murrelet nesting habitat.

MSc student Josh Malt defended his thesis at the beginning of April 2007. His project was primarily an experimental examination of landscape effects of forest fragmentation and local edge effects on probable Marbled Murrelet nest survivorship. Josh continued as a research associate to complete the major analyses from all three field seasons of this project. This topic remains controversial in BC, and has substantial management implications. This manuscript has been submitted, and a major paper from Malt's thesis was published in *Biological Conservation*.

Mike Silvergeiter's MSc thesis is focusing on stand-level habitat characteristics of nest sites, utilizing data collected in previous years, including some he gathered while working as an undergraduate two years ago. He is also collaborating with Alan Burger on models predicting nest site availability.

MREM student Jenn Barrett, from the Resource Management Department at SFU, has nearly completed her GIS-based analysis of data collected by CWE researchers in previous years to jointly model marine and terrestrial effects on habitat usage and nesting success, following up on work begun by Elsie Krebs.

Yuri Zharikov's second major paper, looking at landscape-level effects on forest habitat usage and nesting success, was published in the Journal of Applied Ecology. Blood samples collected previously were forwarded to other researchers for population genetic analyses, and for stable isotope work to infer historical changes in diets.

As a new initiative, Dov Lank brought together private and government researchers as a consortium to use the extensive radar traffic rate data sets which have been gathered in BC to address (1) the utility of several methods of habitat suitability classification, and (2) the magnitude of fragmentation effects on local breeding population size. This work was subsequently funded by the BC Forest Science program and will continue for the coming three years.

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. Much of the work is conducted along the Pacific coast from Alaska to Mexico, including a concentration in British Columbia. 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 universities throughout North America. Details of each project are presented in an updated web site (http://www.sfu.ca/biology/wildberg/CWESeaducksfolder/CWESeaducks/index.html) and are described in brief below.

1. Chronic Effects of the Exxon Valdez Oil Spill on Sea Ducks – This long-term program continues to evaluate the progress of population recovery of sea ducks (harlequin ducks and Barrow's goldeneye) from the 1989 Exxon Valdez oil spill in Prince William Sound, Alaska. At this stage, most efforts are directed towards analysis and publication of data collected over the 13 years of the project. However, we continue to collect new data on the degree and duration of oil exposure that sea ducks are experiencing. In addition, we are constructing a population model that will allow evaluation of the relative effects of acute mortalities immediately after the spill and mortalities related to chronic exposure to oil over the subsequent 18 years. Collaborators on the project include U.S. Geological Survey, U.S. Fish and Wildlife Service, and Oregon State University.

2. Scoter Interactions with Shellfish Aquaculture in Coastal British Columbia – This work, part of the Sustainable Shellfish Aquaculture Initiative, was conducted in close collaboration with the Canadian Wildlife Service. The research was designed to evaluate mechanisms by which shellfish aquaculture might affect, positively or negatively, wintering surf and white-winged scoters. Funding was provided by an NSERC Strategic Grant to Leah Bendell-Young et al., the Canadian Wildlife Service, Ducks Unlimited, and the Sea Duck Joint Venture. Many CWE personnel were involved in this multi-faceted project, including Dan Esler, Sean Boyd, Ron Ydenberg, Ramūnas Žydelis, Sam Iverson, Deb Lacroix, and graduate students Tyler Lewis and Molly Kirk.

Data collection for this project was completed in 2005 and we are in the analysis and write-up phases, with 13 papers already published and many others in review or preparation. Both Tyler and Molly have graduated and have done a great job getting their work into the primary literature.

The findings of this project have been encouraging from the perspective of scoter conservation. Using a suite of metrics (habitat use, changes in abundance, survival, foraging behaviour, and habitat quality), we determined that shellfish aquaculture had either neutral or beneficial effects on scoters, depending on the location, type of aquaculture, and prey type. These findings have been used by the industry and regulators to help chart a sustainable course for BC's coastal environments.

3. Behavioural, Distributional, and Physiological Responses of Scoters to Herring Spawn – Many birds are known to aggregate at sites where Pacific herring spawn in the spring. However, the importance of this phenomenon, in terms of the numbers of species and individuals that use this ephemeral food resource and in terms of the benefits conferred by foraging on spawn, has not previously been addressed. In direct collaboration with the Canadian Wildlife Service and the University of Wyoming, we have been collecting data to address these issues. We have found that the largest and most predictable herring spawn sites in the Strait of Georgia are used by hundreds of thousands of individuals of many species. Surf scoters show a particularly strong

response; CWE MSc students Molly Kirk and Erika Lok have used radio and satellite telemetry to show that nearly all surf scoters that winter or migrate through coastal BC utilize herring spawn. Collaborator and PhD candidate (UWyo) Eric Anderson has been tracking changes in mass and condition of scoters in association with herring spawn, using stable isotopes and fatty acids to determine sources of lipid reserves. CWE MSc student Tyler Lewis demonstrated that surf and white-winged scoters dramatically decreased their foraging effort during herring spawn, suggesting that they were easily able to meet maintenance and lipid acquisition costs when foraging on the abundant spawn.

4. Staging Habitats of Spring-migrating Surf Scoters – As part of a collaborative project investigating Surf Scoter spring migration ecology, Erika Lok (CWE MSc student) used a combination of satellite telemetry, radio-telemetry, aerial surveys, and existing GIS habitat data to investigate habitat use of Surf Scoters along the northern BC coast and southeast Alaska during spring. Funded by the Sea Duck Joint Venture (U.S. Fish and Wildlife Service) and working with research partners from Canadian Wildlife Service, U.S. Geological Survey, and the Washington Department of Fish and Wildlife, Erika identified important spring habitats based on the location of marked scoters from throughout the Pacific wintering range, including Baja California Mexico, San Francisco Bay, Puget Sound, and British Columbia. Satellite telemetry, VHF telemetry and survey data collected during springs of 2005 and 2006 indicated that Surf Scoters use specific staging sites within Southeast Alaska during migration, and that herring spawn events are an important habitat attribute of these sites. Erika has recently graduated and has one paper in press, and two others ready for submission.

5. Habitat Use by Sea Ducks in SE Alaska – This project (funded by the Sea Duck Joint Venture, the U.S. Geological Survey, and U.S. Fish and Wildlife Service) uses aerial survey data collected throughout southeast Alaska to analyze distribution and habitat use by wintering sea ducks. Combining the spatially explicit survey data with habitat attributes in GIS is allowing us to evaluate species-habitat relationships at a broad scale. This work is being done by SFU (REM) MSc candidate Dora Repard in collaboration with Kris Rothley (SFU-REM), U.S. Geological Survey researchers (Jerry Hupp), and U.S. Fish and Wildlife biologists (Jack Hodges, Debbie Groves, and Bruce Conant).

6. Harlequin Duck Conservation Research - The CWE and Canadian Wildlife Service have had long-standing conservation concerns and research interests regarding harlequin ducks in the Strait of Georgia. Past studies have resulted in an unprecedented understanding of ecology and demography of a seaduck.

During the summers of 2003 and 2004, we conducted studies of harlequin ducks breeding on streams in the southern Coast Mountains of British Columbia, and we are now finishing write-up of reports and papers. This project was funded in part by BC Hydro's Bridge-Coastal Fish and Wildlife Restoration Program and was led by Dan Esler and Ron Ydenberg. CWE MSc students Jeanine Bond, who completed her degree in December 2005, and Sunny LeBourdais, who graduated in summer 2006, were the workhorses on the project. This research was designed to determine factors affecting distribution and productivity, including abiotic habitat features, presence of fish and invertebrates, and strategies of nutrient acquisition and allocation by females for egg production. Our results indicate that some abiotic features (e.g., slope) are important predictors of harlequin duck occurrence and density, and that fish may have a negative influence, perhaps as a result of their influence on behaviour (and subsequently availability to ducks) of aquatic insects. Female harlequin ducks acquire egg resources entirely from breeding streams,

although nutrients acquired on coastal wintering sites may be important for other reproductive stages. Final results of this work have been summarized in a final report for BC Hydro and also are available in the theses of Jeanine Bond and Sunny LeBourdais. This project has generated 4 journal publications, with more in the works.

7. Black Scoter Reproductive Energetics – In collaboration with the U.S. Geological Survey (Paul Flint), we are addressing nutrient acquisition and allocation strategies of female black scoters for meeting costs of reproduction. Despite clear declines in numbers of Black Scoters breeding in tundra habitats of Alaska, the mechanisms underlying population change are uncertain. Waterfowl ecologists and managers increasingly recognize the influence of spring energy management strategies on productivity, and ultimately population dynamics, of waterfowl. Therefore, we are quantifying the timing and locations at which female black scoters acquire nutrients and energy for subsequent investment into reproduction, with the intention of identifying habitats and annual cycle stages that are particularly important for management consideration. Field collections for this work have been completed, as have body composition and stable isotope analyses. Data analysis and writing will be conducted soon.

8. Latitudinal Variation in Wintering Ecology of Surf Scoters – Tens of thousands of surf scoters winter along the west coast of Baja California, which represents the southern extent of their wintering range, yet we know very little about their wintering ecology (e.g., movements, foods, habitats used) in the region. In contrast to more northern wintering sites, our preliminary observations indicate that Surf Scoters in Mexico appear to have a different diet, exert greater foraging effort, and have a disproportionately higher number of females and juveniles in the population. We are using telemetry to study the ecology of Surf Scoters wintering in Baja California and gain a more complete delineation of the winter population structure, specific migration routes and patterns, and breeding distribution of scoters in the Pacific Flyway. In February 2006, November 2006, and November/December 2007, we captured Surf Scoters in Bahia San Quintin and Bahia Ojo de Libre, Baja California, Mexico and deployed both satellite and radio transmitters to obtain spatial and temporal movement patterns of this wintering population, foraging effort information, habitat use, survival, and population delineation. This effort is led by CWE PhD candidate Kathy Brodhead, in collaboration with U.S. Geological Survey (David Ward) and local universities.

9. Barrow's Goldeneye Population Delineation – In collaboration with Sean Boyd of the Canadian Wildlife Service, we are using satellite telemetry to evaluate population structure, movements, site fidelity, and habitat use of Barrow's goldeneyes in British Columbia. Twenty males were marked at Riske Creek in May 2006, 10 in May 2007, and ten males and ten females were marked in Indian Arm on the coast during December 2006. We intend to deploy more radios over the next 2 years, to mark all age and sex cohorts at different annual cycle stages. 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. To date, we have learned that males from Riske Creek undergo extensive northward molt migrations, some as far north as the Beaufort Sea. Also, wintering areas of these males range from southeast Alaska to the Strait of Georgia, suggesting that local breeding populations are constituted from birds from numerous wintering sites.

10. Offshore Wind Farms and Effects on Sea Ducks – The CWE has been identified as a

collaborator and national lead on research efforts by the Canadian Wildlife Service to evaluate effects of offshore wind turbine arrays on wintering and migrating sea ducks. To date, the only offshore wind farm proposed for Canada is in Hecate Strait near Haida Gwaii (Queen Charlotte Islands). We have laid the groundwork for participating in research in the region by hosting workshops, conducting extensive literature reviews, interacting with European researchers with experience in this area, visiting the site to meet with local interests, interacting with the proponent, and collaborating with the U.S. Fish and Wildlife Service to conduct aerial surveys. The full extent of CWE research on this topic remains to be seen.

11. Molting and Wintering Ecology of Scoters in Southeast Alaska – Thanks to funding and collaboration from the Sea Duck Joint Venture, U.S. Geological Survey, and the U.S. Fish and Wildlife Service, we are initiating new projects addressing nonbreeding ecology of surf and white-winged scoters in southeast Alaska. This region is known to host substantial proportions of the continental populations of these species during nonbreeding periods (especially wing molt) but studies of their ecology have never been tackled. The molting work, led by MSc student Rian Dickson, will be addressing a variety of basic and applied questions, including energetics, movements and habitat use, and demography (survival). MSc student Corey VanStratt will lead the winter studies, which will provide a continental perspective on wintering biology of surf scoters, in conjunction with our previous and ongoing studies in BC and Mexico.

12. Foraging Strategies of Arctic Wintering Common Eiders - Sea ice conditions in Hudson Bay are important to the winter ecology of Common Eiders. CWE PhD student Joel Heath has conducted field work in the Belcher Islands, Nunavut, to determine how wintering common eiders adjust their foraging behaviour in response to different environmental and physiological constraints, in order to balance their energy budgets in mid-winter. These results indicate the importance of considering factors operating across multiple time scales, and provide insight into potential impacts of environmental change in sea ice habitats. This project was conducted in collaboration with Grant Gilchrist of the Canadian Wildlife Service and the Sanikiluaq Hunters and Trappers Association and provides important information to facilitate informed co-management strategies. Joel has graduated and continues to produce manuscripts from the project.

E. Ecological physiology

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

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

We have continued to extend the application of plasma metabolite analysis for the assessment of fattening rate, general condition, and the relative quality of habitats or sites used by

migratory birds, in a wide variety of on-going collaborative studies: a) habitat use in pre-migratory staging areas for shorebirds in Alaska in relation to oil and gas development (with Audrey Taylor and Drs. Abby Powell and Rick Lanctot, University of Alaska Fairbanks); b) altitudinal habitat use in migratory passerines in the Lower Mainland (with Drs. Lesley Evans-Ogden, NSERC PDF at UBC and Kathy Martin); c) plasma metabolites in relation to incubation intensity and habitat use in different populations of king eiders (with Rebecca McGuire and Dr. bby Powell, University of Alaska, Fairbanks); d) yolk precursor analysis in relation to migration, timing of arrival and onset of reproduction in snow geese in the high-Arctic (with Dr. Joel Bêty, Universite de Rimouski; e) yolk precursor analysis in relation to stable isotope signatures in marbled murrelets (with Drs. Ryan Norris, University of Guelph and Peter Arcese, UBC); f) yolk precursors and migration in surf scoters in California and Alaska (with Matt Wilson and Dr. John Takekawa, USGS); g) yolk precursors and breeding propensity in lesser scaup (with Kate Martin and Dr. Mark Lindberg, University of Alaska, Fairbanks); and h) yolk precursors as markers of breeding status in the endangered Kittlitz's Murrelet (with Michelle Kissling, US Fish & Wildlife, Alaska).

2. **Ecotoxicology projects**

a) Determining the relationship between brodifacoum exposure and prothrombin time in California quail and estimation of barn owl exposure to anticoagulants. The anticoagulant rodenticide brodifacoum has incredible efficiency in eradicating invasive rats causing harm to many bird species, however it has also been linked to the deaths of several raptors, including owls. This project will be conducted by Kirsten Webster (MET student) in collaboration with John Elliott and Kim Cheng (UBC) and will validate the relationship between anticoagulant exposure, prothrombin time (PT) and liver residues of brodifacoum in laboratory California quail. This relationship will then be used to estimate the oral anticoagulant exposure and liver residue concentrations in barn owl plasma samples obtained from a previous study. This laboratory correlation will also be useful for continued monitoring of birds brought to wildlife centres due to abnormal behavior or bleeding.

b) Anthropogenic maternal effects: long-term effects of early (in ovo or natal) exposure to xenobiotics in birds. Margaret Eng (new PhD student) will be conducting a project in collaboration with John Elliott with the following objectives: 1) to investigate the long term effects on avian development of early exposure to environmentally relevant, sublethal levels of the flame retardant PBDE-99, 2) to investigate what factors affect maternal transfer of PBDE-99 concentrations between mothers and eggs, 3) to determine if the pattern of transfer from mother to egg differs between natural endogenous hormones essential for normal development and contaminants, including possible synergy between hormones and contaminants, 4) to investigate the long term effects of early exposure to contaminants in a widespread, free-living species, the European starling common in agricultural land, and 5) to measure levels of POPs and hormones in the blood and eggs of other avian wildlife such as tree swallows and glaucous gulls.

3. **Reproductive ecology and physiology**

a) Dr. Oliver Love (PhD) successfully defended his thesis on the interaction between corticosterone, reproduction and environmental stress in European starlings (*Sturnus vulgaris*). He obtained an NSERC post-doctoral fellowship and we are now involved in a collaborative project with Drs. Joel Bety (UQAR) and Grant Gilchrist (Environment Canada) looking at physiological mechanisms linking body condition, climate change and timing of reproduction in Arctic-nesting common eiders (an ArcticNet project);

b) Lauren Kordonowy (MSc student) is completing her studies investigating plasma leptin

as a measure of body condition in relation to maternal and chick quality in European starlings;

c) Dr. Sophie Bourgeon (post-doctoral fellow) has been investigating causal links between immunosuppression and oxidative stress in breeding birds using experimental manipulation of antioxidants in European starlings (*Sturnus vulgaris*); she has also developed assays for oxidative stress and total antioxidant capacity;

e) Marc Travers (MSc student) is completing his study on how variation in clutch number (due to predation events) affects clutch size, and the physiological basis of cost of reproduction in free-living song sparrows on Vancouver Island, BC; this project is a collaboration with Drs. Liana Zanette and Mike Clinchy (University of Western Ontario);

f) Dong Han (MSc student) is completing his studies on the molecular basis of individual variation in reproductive physiology, specifically focusing of receptors and yolk precursors regulating egg production.

4. **E-Bird: an NSERC-funded Network on avian reproduction and environmental change: integrating ecology and physiology** http://www.sfu.ca/biology/faculty/williams/ebird/

NSERC funding (to TDW) for the Canadian component of this international research network continued through April 2008. This funding raised the international profile of Canadian researchers in this field and allowed Canada to be a full partner in the larger international E-Bird network co-funded by NSF and ESF. We supported three workshops - including one co-organised on 'Individual Variation' in Vancouver with Ben Sheldon, U. Oxford - a final full meeting in Glasgow, and an International Postgraduate workshop on interdisciplinarity, and we provided funding to more than 30 Canadian graduate students and post-docs for international lab exchanges or workshops. Most recently we published a Special Theme issue of *Philosophical Transactions of the Royal Society* B including 13 synthesis/future directions chapters based on the E-Bird workshops (TDW was co-editor and a contributing author for this issue). Finally, through E-BIRD TDW was invited to join the $9.3M CFI-funded Advanced Facility for Avian Research (AFAR) which is currently under construction at the University of Western Ontario, which will provide a national and international center for future collaborative work in this area (http://publish.uwo.ca/~smacdou2/afar.htm).

F. Population ecology of landbirds

CWE's research on landbirds is coordinated by David Green and addresses two key questions in avian ecology and conservation. Firstly, we are interested in how migratory strategies of individual birds influence their fitness and the demography of populations. This question is addressed using two model systems; American dippers within the Chilliwack River watershed, and yellow warblers that breed in Revelstoke but overwinter in the neotropics. Secondly, we are interested in how anthropogenic changes to the landscape influence habitat selection, breeding performance and survival of threatened landbirds in British Columbia. 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 habitat selection and reproductive success in the provincially threatened Brewer's sparrow, a study examining how changes in agricultural practices in the Fraser Valley influence the foraging ecology productivity and survival of barn owls, and a study examining how grazing induced changes to grasslands influence productivity of Vespers sparrow. We briefly describe these studies below:

Migratory behaviour and population demography of American dippers

We have studied dippers in the Chilliwack River Valley, BC since 1999. The majority of dippers, in this and other populations, make seasonal movements between low elevation wintering grounds on large rivers and breeding grounds on higher elevation tributaries. However some individuals do not undergo this seasonal migration and remain on permanent territories year round. We have used morphometric data, mark-recapture analysis and radiotelemetry to investigate whether migratory/sedentary behaviour is associated with distinct morphological and physiological traits, and to examine how variation in migratory behaviour influences natal philopatry, recruitment, survival and reproductive success of American dippers. Migratory and sedentary dippers do not differ morphologically (Green et al. in press). However, sedentary individuals consistently have higher reproductive success and lower survival than migrants (Gillis et al. 2008). Ivy Whitehorne (MSc) has demonstrated that differences in reproductive success do not arise because of differences in the age structure of the sedentary and migratory population. She has also found that the higher survival of migrants does not result because they expend less effort and are in better condition at the end of the breeding season. Her work instead suggests that not having to defend a breeding territory in the winter improves their ability to deal with fluctuations in prey availability. Ivy will defend her thesis in 2008.

Migratory behaviour and reproduction in Yellow warblers

We have studied the breeding biology of Yellow warblers, a declining songbird dependant on riparian habit, in Revelstoke since 2004. Sam Quinlan, an NSERC Industrial student supported by BC Hydro, has used information that can be obtained from hydrogen isotope ratios in feathers to determine where yellow warblers molt and over-winter. He is due to defend his thesis in 2008. His research will provide a platform for a new PhD student, Anna Drake, who will examines how molt and migratory strategies influence the survival and subsequent reproductive success of birds that return to their breeding grounds in Revelstoke. This work will provide considerable insight into migratory connectivity of Yellow warblers and the importance of carry-over effects during the winter period on subsequent productivity.

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. Prevention of further declines will require an understanding of how to minimize human impacts on these bird populations along with informed restoration efforts. Yellow warblers have been identified by Partners in Flight as a focal species that could be used to evaluate the health of riparian habitat within BC. We established a marked population of Yellow warblers in three riparian habitat types within the drawdown zone of Upper Arrows Lake Reservoir, near Revelstoke, in 2004. We have shown that Yellow warblers prefer territories containing a high proportion of willow habitat, and that this cue predicts subsequent productivity (Quinlan and Green 2006, Green and Quinlan 2007). We have also shown that current water use decisions have limited impact on productivity and survival of yellow warblers, but that advancing when water levels rise by as little as two weeks would triple nest mortality (6 vs 18%; Green and Quinlan 2007, 2008)

Habitat selection mechanisms in Brewer's sparrow

The Brewer's sparrow is a provincially red-listed species that is restricted to the sagebrush steppe, an ecosystem type that is under intense pressure from agricultural and residential development. Research on Brewer's sparrows was initiated by the Canadian Wildlife Service (Pam Krannitz, Nancy Mahony, and Kathy Martin) in 1997 and extended to include multiple sites

within the Okanagan in 2003. Megan Harrison (MSc) initiated a project to examine how habitat characteristics and conspecifics influence settlement decisions in 2007. Data collected so far suggest that habitat characteristics have only a small effect on habitat occupancy and the order in which territories are settled. She is currently using a large scale playback experiment to explore the role conspecifics play in determining whether sagebrush habitat is occupied.

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

Land used for agriculture provides habitat for a diversity of wildlife. However, the intensification of agricultural practises, increased use of pesticides and encroachment of urban centres have been linked to the widespread decline of many species associated with agricultural land in Europe. Less is known about the extent to which recent changes to agricultural land use and practices in the Fraser Valley have impacted wildlife. In 2007, Sofi Hindmarch (MSc) initiated a project to 1) investigate how land use patterns influence the distribution and breeding performance of barn owls and 2) evaluate the extent to which barn owls are exposed to rodenticides. This project is a collaboration with Elsie Krebs and John Elliott of the Canadian Wildlife Service, and Markus Merkens of Delta Farmland and Wildlife Trust. This research will be used to promote agricultural practices that have positive effects on wildlife in an agricultural landscape.

Impacts of grazing induced changes to rangeland on grassland birds.

Native grasslands are one of the most threatened ecosystems in the province and cattle have been shown to have a profound impact on the vegetation community. This may have significant impacts on the bird community; 60% of bird species native to North American rangelands have declining population trends. We have therefore initiated a research project, in collaboration with Nancy Mahony of the Canadian Wildlife Service, to assess how grazing induced changes to rangeland influence the productivity and survival of a common grassland bird, the Vespers sparrow. This project, to be conducted by Pat Robinson (MSc) will help inform rangeland management decisions in the Cariboo region of BC.

VI. CONFERENCES

Dov Lank gave an invited paper, "Polyandry at Leks: implications for the adaptive significance of multiple paternity", at the symposium “Genetics of Lekking” at AOU meeting summer 2007.

VII FUNDING

Budget

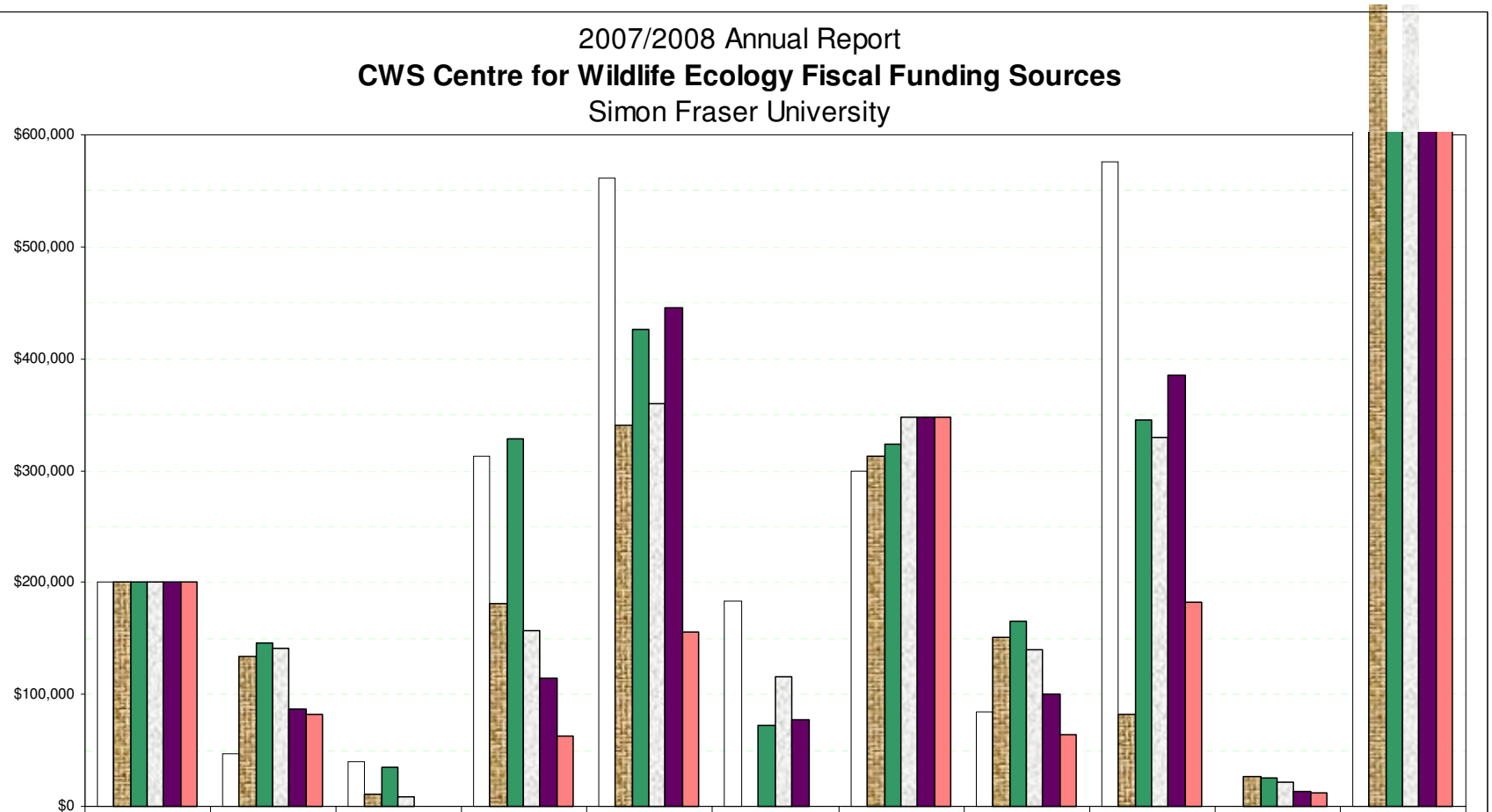
1 April 2007 to 31 March 2008 was the final year of the current five-year agreement between Simon Fraser University (the Centre for Wildlife Ecology) and Environment Canada (the Canadian Wildlife Service PYRC). This Contribution Agreement provides $200,000 annually as core support for the research activities of the Centre for Wildlife Ecology.

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

2007/2008 Annual Report

CWS Centre for Wildlife Ecology Fiscal Funding Sources

Simon Fraser University



	EC/Core	Other EC	Other Fed Gov't	Prov Gov't	NSERC	Industry	SFU Faculty	SFU Other	Int'l (Cdn$)	Other	Grand Total
Projections	200,000	47,000	40,000	313,115	561,181	183,898	300,000	85,000	576,141	0	2,306,335
2003/2004	200,000	134,500	11,195	180,843	340,846	0	313,242	150,630	81,611	27,143	1,440,010
2004/2005	200,000	145,526	35,373	327,958	426,332	72,750	323,250	165,242	345,550	25,600	2,067,581
2005/2006	200,000	140,818	8,035	156,825	359,600	116,000	347,257	140,110	329,218	21,600	1,819,463
2006/2007	200,000	86,540	0	114,660	445,417	77,500	347,257	100,500	$384,697	12,993	1,769,564
2007/2008	200,000	82,000	0	63,250	155,573	0	347,257	63,583	181,753	11,900	1,105,316

Category for Chart		**Centre for Wildlife Ecology Annual Financial Report** 2007/2008 Fiscal Year **1 April 2007 - 31 March 2008**	
		Scholarships, Fellowships, Grants for Students	
		PhD	
SFU Fellowships etc		Sarah Jamieson GF	$6,250
E-bird travel Grant		Sarah Jamieson	$1,800
Travel Award Grad Studies - International Travel		Sarah Jamieson	$500
Departmental travel grant		Sarah Jamieson	$500
		M Sc	
SFU Fellowships etc		Kyle Morrison - CD Nelson Entrance Scholarship	$7,500
NSERC CGS-M		Kyle Morrison	$10,208
NSERC CGS-M		Samantha Franks	$7,291
NSERC CGS-M		Megan Harrison	$17,350
NSERC - PGS-M		Samantha Franks	$10,091
NSERC - PGS-M		Ivy Whitehorne	$11,533
SFU Fellowships etc		Ivy Whitehorne	$6,250
SFU Fellowships etc		Mike Silvergieter GF	$6,333
FSP - GSPPG		Megan Harrison	$10,000
SFU Spring bursary		Lauren Kordonowy	$6,250
Travel Award		Lauren Kordonowy	$500
PCGF	Provincial	Marie-Helene Burle	$10,000
		General Funding for CWE	
EC/Core		EC/CWS Annual Chair Funding 1 April 06 to 31 March 07	$200,000

SFU	Ydenberg RC	SFU Dean of Science: Contribution to Centre for Wildlife Ecology (2nd of 5 yrs)	$30,000
SFU	SFU	SFU Contribution to Faculty Salaries (Ydenberg Williams Green)	$347,257
Other EC	Esler D	Science Horizon - Population Delineation of Barrow's Goldeneyes	$9,000
Other EC	Esler D	Wind Farms (2nd of 3 years)	$23,000
Other EC	Esler D, Boyd S	EC: Marine Bird Conservation (2nd of 5 years)	$35,000
		Generated Research Funding	
Other	R. Yden-berg/H. Major	WWF - Recovery of Ancient Murrelets after the eradication of introduced predators in Haida Gwaii	$8,900
Other EC	R. Yden-berg/H. Major	EC - Using Audio Clues and Artificial Burrows to enhance Ancient Murrelet Recovery at Langara Island	$6,000
		Ducks	
International	Esler D	US Fish & Wildlife: Sea Duck Joint Venture (3rd of 3 years)	$6,600
International	Esler D	US Fish & Wildlife: Sea Duck Joint Venture 2nd of 3 years)	$34,606
International	Esler D	USGS - Female Black Scoters (2nd of 2 years)	$8,244
International	Esler D	SDJV - Sea Duck Habitat	$17,864
International	Esler D	USGS - Exxon - Harlequin Duck	$86,942
International	Esler D	USGS - Southeast Alaska	$7,260
International	Esler D	USGS - David Ward	$19,737
		Marbled Murrelet	
Provincial	Lank D	BC Forest Sciences - Nest site reuse and management of nest attributes of Marbled Murrelets in coastal forests	$6,000
		Land Birds	

Provincial	Green DJ	BC Hydro Columbia Basin Fish & Wildlife contribution Program: Evaluating the health of riparian habitats: The role of habitat structure in nest site selection and breeding success of yellow warblers in the Revelstoke Reach, BC	$8,900
Provincial	Green DJ	Forest Science Program - Determining thresholds of habitat quality for breeding birds in rangeland ecosystems in the Cariboo Region	$28,350
		Triangle Island	
Other EC	Hipfner MJ	Environment Canada - Science Horizons: "Demography and Post-Breeding Dispersal of Common Murres Breeding at Triangle Island"	$9,000
		NSERC	
NSERC	Green DJ	NSERC Individual Research Grant - Dispersal and migration behaviour of birds in natural and modified landscapes (4th of 5 years)	$22,000
NSERC	Ydenberg RC	NSERC Individual Research Grant - "Predation danger and the annual cycle of migrants (3rd of 5 yrs)	$51,300
NSERC	Lank D	NSERC Individual Research Grant – "Maintaining variation in ecologically significant traits in birds" (5th of 5 yrs)	$24,000
		Grand Total	$1,102,316
		SFU In-Kind	$116,678

VIII. PUBLICATIONS

This list reflects those publications produced since our last report (publications that were "in press" or "submitted" for the last report are included and have been updated). We continue to publish very actively with 17 publications out in 2008, 24 publications in press and 16 submitted. Over the past year, two Doctoral and three Masters students 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

In press:

Bond, J.C. and D. Esler. In press. Complications using subcutaneously-anchored radio transmitters on harlequin ducks. Wilson Journal of Ornithology.

Bond, J.C., D. Esler and T.D. Williams. In press. Breeding propensity of female harlequin ducks. J. Wildl. Manage. 72.

Caro, S.P., A. Charmantier, M.M. Lambrechts, J. Blondel, J. Balthazart and T.D. Williams. In press. Local adaptation of timing of reproduction: females are in the driver's seat. Funct. Ecol.

Cesh, L.S., T.D. Williams, D.K. Garcelon and J.E. Elliott. In press. Spatial and temporal trends of chlorinated hydrocarbons in nestling Bald Eagle (*Haliaeetus leucocephalus*) plasma in British Columbia and southern California. Arch. Environ. Contam. Toxicol.

Fernández, G.J. and D.B. Lank. In press. Foraging behaviour of non-breeding western sandpipers (*Calidris mauri*) as a function of sex, habitat and flocking. Ibis.

Gorman, K.B., D. Esler, P.L. Flint and T.D. Williams. In press. Nutrient reserve dynamics during egg production by female Greater Scaup (*Aythya marila*): relationships with timing of reproduction. Auk 125.

Gorman, K.B., D. Esler and T.D. Williams. In press. Plasma yolk precursor dynamics during egg production by female Greater Scaup (*Aythya marila*): characterization and indices of reproductive state. Physiological and Biochemical Zoology.

Green D.J., I.B. Whitehorne, A. Taylor and E. Drake. In press. Morphological variation in migratory and sedentary American Dippers. Wilson J. Ornithol.

Hagmeier, K.R., B.D. Smith and W.S. Boyd. In press. Estimating the number of Black Brant using two spring-staging sites. J. Wildl. Manage.

Heard, D.J., D.M. Mulcahy, S.A. Iverson, D.J. Rizzolo, E.C. Greiner, J. Hall, H. Ip and D. Esler. In press. A blood survey of elements, viral antibodies, and hemoparasites in wintering harlequin ducks (Histrionicus histrionicus) and Barrow's Goldeneyes (Bucephala islandica). J. Wildl. Diseases.

Hipfner, J.M. and J.L. Greenwood. In press. Breeding biology of the Common Murre at Triangle Island, British Columbia, 2002-2007. Northwestern Naturalist 89.

Hipfner, J.M., L.A. McFarlane Tranquilla and B. Addison. In press. Do marine birds use environmental cues to optimize egg production? An experimental test based on relaying propensity. J. Avian Biol.

Lewis, T.L., M. Mews, D.E. Jelinski and M. Zimmer. In press. Detrital subsidy to the supratidal zone provides feeding habitat for intertidal crabs. Estuaries and Coasts 30.

Lok, E.K., M. Kirk, D. Esler and W.S. Boyd. In press. Movements of pre-migratory surf and white-winged scoters in response to Pacific herring spawn in the Strait of Georgia, British Columbia. Waterbirds.

Love, O.P., K.G. Salvante, J. Dale and T.D. Williams. In press. Sex-specific variability in the

immune system across life-history stages. Amer. Nat.
Love, O.P. and T.D. Williams. In press. The adaptive value of stress-induced phenotypes: effects of maternally-derived corticosterone on sex-biased investment, cost of reproduction and maternal fitness. Amer. Nat.
Love, O.P. and T.D. Williams. In press. Plasticity in the adrenocortical response of a free-living vertebrate: the role of pre- and post-natal developmental stress. Hormones and Behavior.
Middleton, H.A. and D.J. Green. In press. Correlates of post-fledging survival, the timing of dispersal and local recruitment in American dippers. Can. J. Zool.
Peterson, J.H., B.D. Roitberg and R.C. Ydenberg. In press. When nesting involves two sequential, mutually exclusive activities: what's a mother to do? Evol. Ecol. Res.
Pomeroy, A.C., D.A. Acevedo Seaman, R.W. Butler, R.W. Elner, T.D. Williams and R.C. Ydenberg. In press. Feeding-danger tradeoffs underlie stopover site selection by migrants. Avian Cons. Ecol.
Salvante, K.G. In press. Techniques for the study of integrated immune function in birds. Auk.
Taylor, C.M., D.B. Lank, A.C. Pomeroy and R.C. Ydenberg. In press. Relationship between stopover site choice of migrating sandpipers, their population status, and environmental stressors. Israel Journal of Ecology and Evolution.
Thayer, J.A., D.F. Bertram, S.A. Hatch, J.M. Hipfner, L. Slater, Y. Watanuki and W.J. Sydeman. In press. Forage fish in the North Pacific as revealed by the diet of a piscivorous seabird: synchrony and relationships with ocean climate. Can. J. Fish. Aquat. Sci. 65.
Wagner, E.C., C.A. Stables and T.D. Williams. In press. Hematological changes associated with egg production: direct evidence for changes in erythropoiesis but a lack of resource-dependence. J. Exp. Biol.
Žydelis, R., D. Esler, M. Kirk and W.S. Boyd. In press. Effects of off-bottom shellfish aquaculture on winter habitat use by molluscivorous sea ducks. Aquatic Conservation.

Submitted:

Addison, B. Submitted. Different shell traits of the marine mussel *Mytilus trossulus* (Gould 1850) mediate predation risk by crabs and seastars. J. Shellfish Res.
Addison, B., Z.M. Benowitz-Fredricks, J.M. Hipfner and A.S. Kitaysky. Submitted. Do female birds adjust yolk androgens to environmental conditions? A test in two seabirds that lay single-egg clutches. Gen. Comp. Endocrinol.
Addison, B., A.S. Kitaysky and J.M. Hipfner. Submitted. Sex allocation in a monomorphic seabird with a single-egg clutch: test of environment, mate quality and female condition hypotheses. Beh. Ecol. Sociobiol.
Arcese, P., A.E. Burger, C.L. Staudhammer, J.P. Gibbs, E. Selak, G.D. Sutherland, J.D. Steventon, S.A. Fall, D.F. Bertram, I.A. Manley, S.E. Runyan, W.L. Harper, A. Harfenist, B.K. Schroeder, D.B. Lank, S.A. Cullen, J.A. Deal, D. Lindsay and G. Jones. Submitted. Monitoring designs to detect population declines and identify their cause for the Marbled Murrelet. Can. J. For. Res.
Bahn, V. and D.B. Lank. Submitted. Habitat suitability model testing for the Marbled Murrelet (*Brachyramphus marmoratus*). Avian Cons. Ecol.
Blackburn, G.S., J.M. Hipfner and R.C. Ydenberg. Submitted. Evidence that tufted puffins use colony overflights to reduce kleptoparasitism risk. J. Avian Biol.
Bond, J.C., S.A. Iverson, N.B. MacCallum, C.M. Smith, H.J. Bruner and D. Esler. Submitted. Variation in breeding season survival of adult female harlequin ducks. J. Wildl. Manage.
Davies, W.E. Submitted. Taking stable isotopes into the field: methods for calculating field-based discrimination factors. Oecologia.

Davies, W.E., J.M. Hipfner, K.A. Hobson and R.C. Ydenberg. Submitted. Seabird seasonal trophodynamics: isotopic patterns in a community of Pacific alcids. Mar. Ecol. Prog. Ser.

Hipfner, J.M. Submitted. Matches and mismatches? Ocean climate, prey phenology and breeding success in a zooplanktivorous seabird. Mar. Ecol. Prog. Ser.

Hipfner, J.M., J. Dale and K.J. McGraw. Submitted. Variation in yolk carotenoid profiles in a marine bird community: links to foraging strategies and breeding success. J. Anim. Ecol.

Hipfner, J.M., L.A. McFarlane Tranquilla and B. Addison. Submitted. How important are timing and parental effects in driving seasonal declines in breeding success? Experimental tests in a zooplanktivorous seabird. Oecologia.

Ronconi, R.A. and J.M. Hipfner. Submitted. Egg neglect under risk of predation in the seabird Cassin's auklet. Can. J. Zool.

Schamber, J.L., D. Esler and P.L. Flint. Submitted. Evaluating the validity of using unverified indices of body condition. Can. J. Zool.

Sorensen, M.C., J.M. Hipfner, T.K. Kyser and D.R. Norris. Submitted. Carry-over effects in a mainly zooplanktivorous seabird: stable isotopic evidence that non-breeding diet quality influences breeding success. J. Anim. Ecol.

Stein, R.W., G.J. Fernández, H. de la Cueva and R.W. Elner. Submitted. Disproportionate bill length dimorphism and niche differentiation in wintering western sandpipers (*Calidris mauri*). Can. J. Zool.

Ydenberg, R.C., D. Dekker, G. Kaiser, P. Shepherd, L. Evans Ogden, K. Rickards and D.B. Lank. Submitted. Danger management by wintering Pacific dunlins: changes in winter mass and high tide behavior as responses to raptor population recovery. Funct. Ecol.

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Albert, C., T.D. Williams, V.M.-W. Lai, W.R. Cullen, C. Morrissey and J. Elliott. 2008. Tissue uptake, mortality and sub-lethal effects of monomethylarsonic acid (MMA (V)) in nestling Zebra Finches (*Taeniopygia guttata*). J. Toxicol. Env. Health 71A**:** 353-360.

Albert, C.A., T.D. Williams, V. Lai, W.R. Cullen, C.A. Morrissey and J.E. Elliott. 2008. Dose dependant uptake, elimination and toxicity of monosodium methanearsonate (MSMA) in adult Zebra Finches (*Taeniopygia guttata*). Env.Tox. Chem. 27**:** 605-611.

Boyd, W.S., L. McFarlane Tranquilla, J.L. Ryder, S.G. Shisko and D.B. Bertram. 2008. Variation in marine distributions of Cassin's Auklets (*Ptychoramphus aleuticus*) breeding at Triangle Island, British Columbia. Auk 125**:** 158-166.

Boyd, W.S., L. McFarlane Tranquilla, J.L. Ryder, S.G. Shisko and D.F. Bertram. 2008. Variation in marine distributions of Cassin's Auklets (*Ptychoramphus aleuticus)* breeding at Triangle Island, British Columbia. Auk 125**:** 158-166.

Cockburn, A., H.L. Osmond, R.A. Mulder, M.C. Double and D.J. Green. 2008. Demography of male reproductive queues in cooperatively breeding superb fairy-wrens *Malurus cyaneus*. J. Anim. Ecol. 777**:** 297-304.

Cockburn, A., R.A. Sims, H.L. Osmond, D.J. Green, M.C. Double and R.A. Mulder. 2008. Can we measure the benefits of help in cooperatively breeding birds: the case of superb fairy-wrens *Malurus cyaneus*. J. Anim. Ecol. 77:430-438

Evans Ogden, L.J., S. Bittmann, D.B. Lank and F.C. Stevenson. 2008. Factors influencing farmland habitat use by shorebirds wintering in the Fraser River Delta, Canada. Agric., Ecosys. Environ. 124**:** 252-258.

Fernández, G. and D.B. Lank. 2008. Effects of habitat loss on shorebirds during the non-breeding season: current knowledge and suggestions for action. Ornit. Neotrop. 19 (Suppl.)**:** 633-640.

Gillis, E.A., D.J. Green, H.A. Middleton and C.A. Morrissey. 2008. Life history correlates of

alternative migratory strategies in American dippers. Ecology 89**:** 1687-1695.
Kirk, M., D. Esler, S.A. Iverson and W.S. Boyd. 2008. Movements of wintering surf scoters: predator responses to different prey landscapes. Oecologia 155**:** 859-867.
Kuwae, T., P.G. Beninger, P. Decottignies, K.J. Mathot, D.R. Lund and R.W. Elner. 2008. Biofilm grazing in a higher vertebrate: the western sandpiper, *Calidris mauri*. Ecology 89**:** 599-606.
Lewis, T.L., D. Esler and W.S. Boyd. 2008. Foraging behaviors of Surf and White-winged Scoters in relation to clam density: inferring food availability and habitat quality. Auk 125**:** 149-157.
Love, O.P., K.E. Wynne-Edwards, L. Bond and T.D. Williams. 2008. Determinants of within- and among-clutch variation in levels of yolk corticosterone in the European starling. Hormones and Behavior 53**:** 104-111.
Nilsson, P.B., T.E. Hollmen, S. Atkinson, K.L. Mashburn, P.A. Tuomi, D. Esler, D.M. Mulcahy and D.J. Rizzolo. 2008. Effects of ACTH, capture, and short term confinement on gluco-cortecoid concentrations in harlequin ducks (*Histrionicus histrionicus*). Comparative Biochemistry and Physiology Part A 149**:** 275-283.
Wada, H., K.G. Salvante, C. Stables, E. Wagner, T.D. Williams and C.W. Breuner. 2008. Adrenocortical responses in zebra finches (*Taeniopygia guttata*): individual variation, repeatability and relationship to phenotypic quality. Hormones and Behavior 53**:** 472-480.
Wagner, E.C., J.S. Prevolsek, K.E. Wynne-Edwards and T.D. Williams. 2008. Hematological changes associated with egg production: estrogen-dependence and repeatability. J. Exp. Biol. 211**:** 400-408.
Waterhouse, F.L., A. Donaldson, D.B. Lank, P.K. Ott and E.A. Krebs. 2008. Using air photos to interpret quality of Marbled Murrelet nesting habitat in south coastal British Columbia. B.C. J. Ecosys. Manag. 9.
Williams, T.D. 2008. Individual variation in endocrine systems: moving beyond the "tyranny of the Golden Mean". Phil. Trans. Roy. Soc. B. 363**:** 1687-1698.
Worcester, R. and R. Ydenberg. 2008. Cross-continental patterns in the timing of southward Peregrine Falcon migration in North America. Journal of Raptor Research.

2007

Ball, J.R., D. Esler and J.A. Schmutz. 2007. Proximate composition, energetic value, and relative abundance of prey fish from the inshore eastern Bering Sea: implications for piscivorous predators. Polar Biology 30**:** 699-708.
Bond, J.C., D. Esler and K.A. Hobson. 2007. Isotopic evidence for sources of nutrients allocated to clutch formation by harlequin ducks. Condor 109**:** 698-704.
Evans Ogden, L.J., D.B. Lank and S. Bittmann. 2007. A review of agricultural land use by shorebirds with special reference to habitat conservation in the Fraser River Delta, British Columbia. Can. J. Plant. Sci. 87**:** 1-13.
Fernández, G. and D.B. Lank. 2007. Variation in the wing morphology of Western Sandpipers (*Calidris mauri*) in relation to sex, age class, and annual cycle. Auk 124**:** 1037-1046.
Heath, J.P., H.G. Gilchrist and R.C. Ydenberg. 2007. Can diving models predict patterns of foraging behaviour? Diving by common eiders in an arctic polynya. Anim. Behav. 73**:** 877-884.
Hipfner, J.M., M.R. Charete and G.S. Blackburn. 2007. Subcolony variation in breeding success in the Tufted Puffin: association with foraging ecology and implications. Auk 124**:** 1149-1157.
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