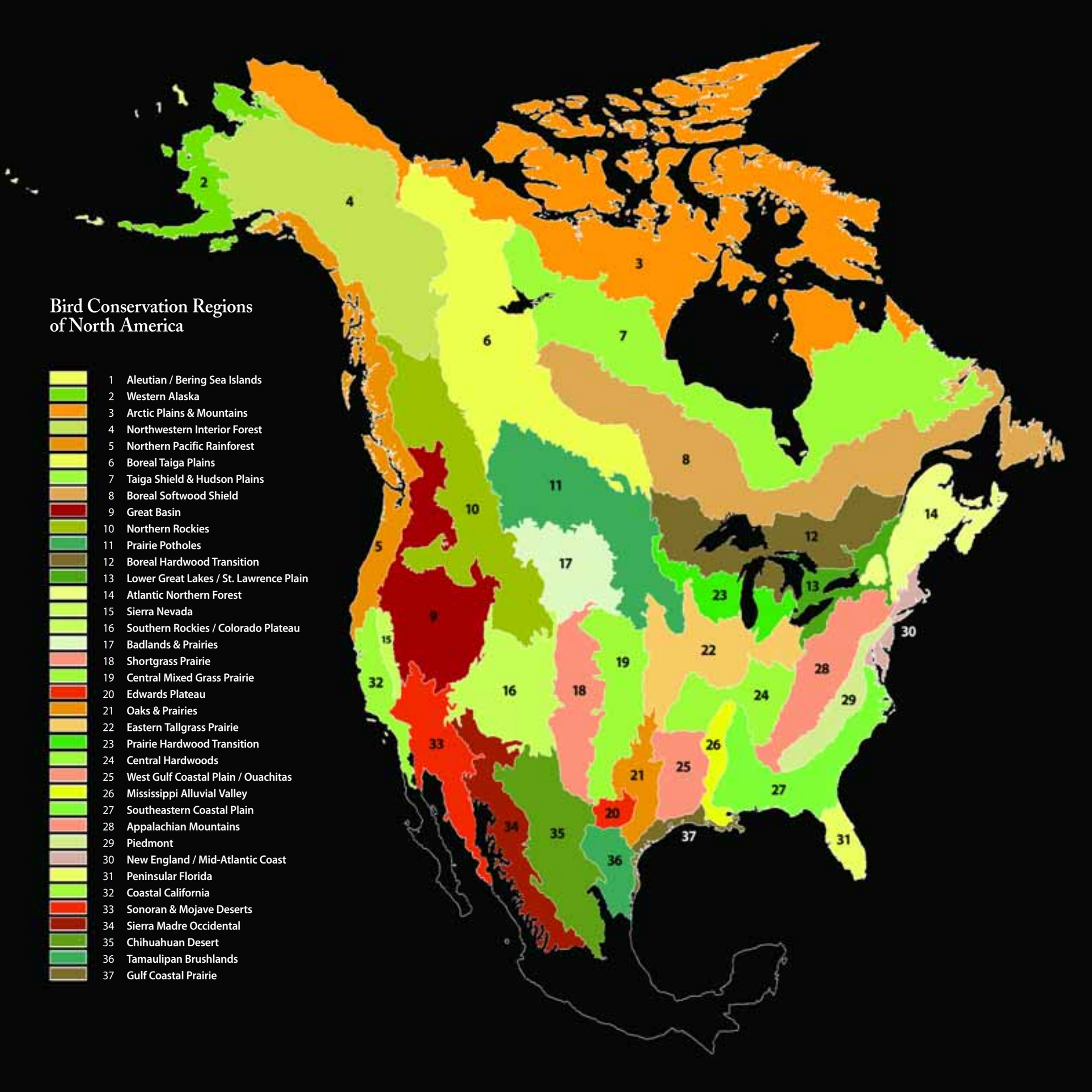
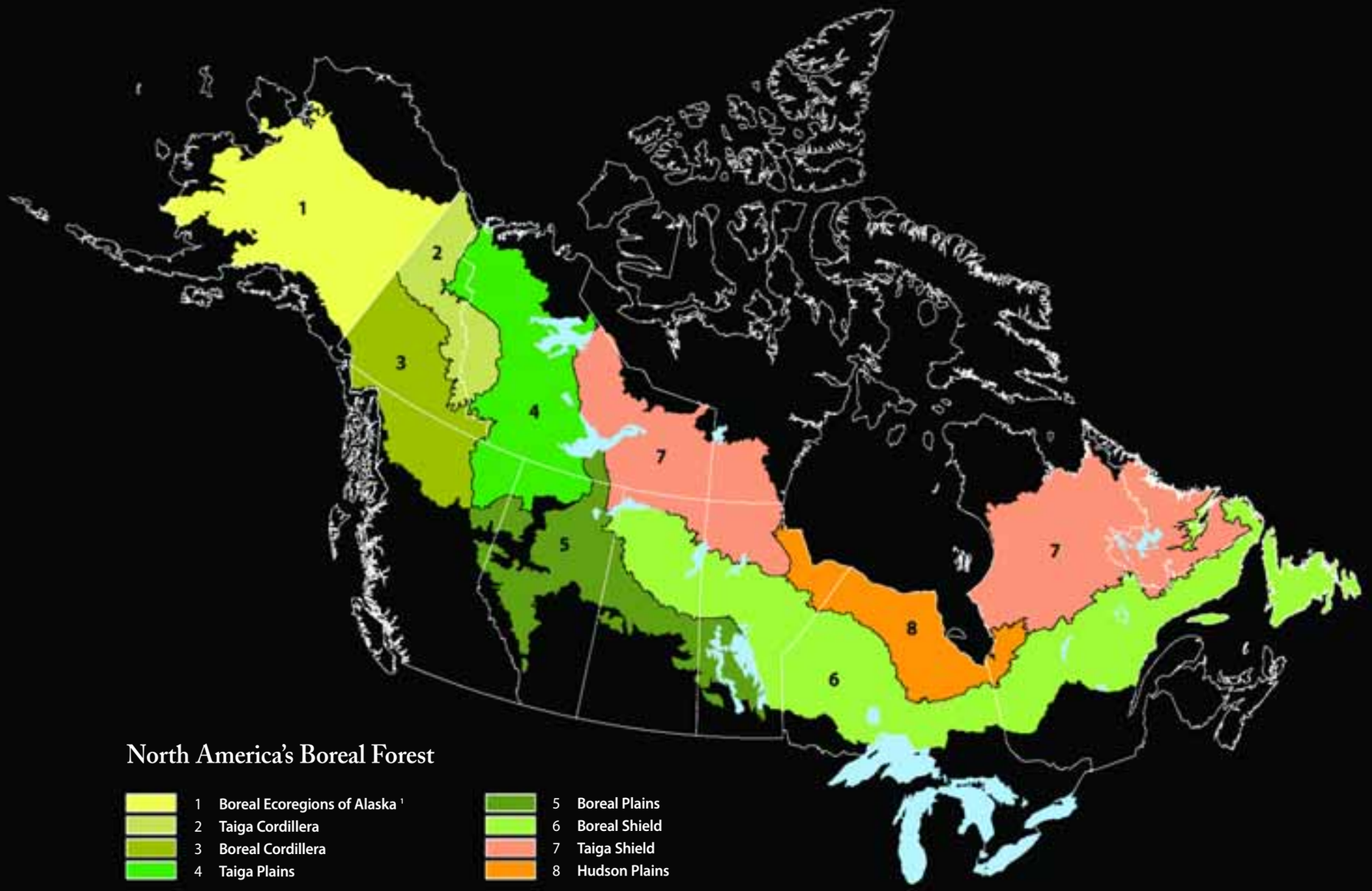
WATERFOWL OF THE BOREAL FOREST


Bird Conservation Regions
of North America
1 Aleutian / Bering Sea Islands
2 Western Alaska
3 Arctic Plains & Mountains
4 Northwestern Interior Forest
5 Northern Pacific Rainforest
6 Boreal Taiga Plains
7 Taiga Shield & Hudson Plains
8 Boreal Softwood Shield
9 Great Basin
10 Northern Rockies
11 Prairie Potholes
12 Boreal Hardwood Transition
13 Lower Great Lakes / St. Lawrence Plain
14 Atlantic Northern Forest
15 Sierra Nevada
16 Southern Rockies / Colorado Plateau
17 Badlands & Prairies
18 Shortgrass Prairie
19 Central Mixed Grass Prairie
20 Edwards Plateau
21 Oaks & Prairies
22 Eastern Tallgrass Prairie
23 Prairie Hardwood Transition
24 Central Hardwoods
25 West Gulf Coastal Plain / Ouachitas
26 Mississippi Alluvial Valley
27 Southeastern Coastal Plain
28 Appalachian Mountains
29 Piedmont
30 New England / Mid-Atlantic Coast
31 Peninsular Florida
32 Coastal California
33 Sonoran & Mojave Deserts
34 Sierra Madre Occidental
35 Chihuahuan Desert
36 Tamaulipan Brushlands
37 Gulf Coastal Prairie



North America's Boreal Forest

1 Boreal Ecoregions of Alaska [1]
2 Taiga Cordillera
3 Boreal Cordillera
4 Taiga Plains
5 Boreal Plains
6 Boreal Shield
7 Taiga Shield
8 Hudson Plains

1) Gallant et al. (1995)

Fact: The boreal forest is one of the last great forests on our planet, and represents approximately 58 per cent of Canada. *(Canadian Boreal Initiative 2005)*

Fact: The boreal is a major source of economic, social and biological wealth for Canada. *(Anielski and Wilson 2005)*

Fact: The boreal forest is wet and wild, and stores more freshwater in wetlands and lakes than anywhere else on the globe. *(Schindler 1998).*

Fact: The boreal forest supports millions of waterfowl, songbirds and other wildlife. *(Anielski and Wilson 2005)*

Based on these facts alone, is it any wonder the boreal forest is truly a global treasure?

WATERFOWL OF THE BOREAL FOREST

DARIN LANGHORST COVER: BRIAN WOLITSKI

FOREWORD

Imagine a natural engine that filters water, controls floods and pests, stores carbon and offers a home to waterfowl and other wildlife. Is it hard to imagine what can do all these things?

Then think of 1.4 billion acres of forests, wetlands and peatlands that sit like a green mantle on the shoulders of Canada's northern lands. This is Canada's Boreal Forest region, our precious part of one of the world's largest and last intact forests. The more we learn about its natural capital, the more we know its true worth.

Some have described Canada's Boreal Forest as North America's bird nursery. Others have recently estimated that the natural services it provides are 2.5 times more valuable than all the lumber, paper, oil, gas, minerals and hydroelectricity produced through industrial development in the region.

In the late 1990s, a Senate subcommittee warned of threats to the survival of Canada's Boreal Forest and set out recommendations to curb them. Recent reports suggest some progress has been made, but there have also been large losses.

There is no doubt however, that public momentum is building to conserve this national treasure. I take heart in Ducks Unlimited's long-standing and continued work toward that goal.

To readers of this book: The first step is knowing what we have got *before* it is gone. Then, we can work together to protect Canada's Boreal Forest for future generations. May this book inspire you to join the effort.

Senator Mira Spivak
Independent Senator for Manitoba,
Deputy Chair of the former Senate Sub-Committee
on the Boreal Forest

Every fall, the sky over North America fills with ducks, geese and swans. Many of these birds were hatched in the boreal forest of Canada and Alaska. Even more of these birds used the boreal habitats to moult, grow or migrate through to the south. It is to the marshes of California, the Gulf Coast, Atlantic Coast and bottomland timber of the Mississippi Delta where many of these birds are headed. Boreal Canada and Alaska are linked together with 49 southern states as a corridor of habitat for waterfowl.

The United States and Canada share strong hunting and fishing traditions and rich waterfowl habitat.

Ducks Unlimited and others have taken the lead in recognizing the importance of the boreal forest and how valuable the resource is. We must all work together in conservation, so that we have a viable boreal forest for generations to come. Understanding boreal waterfowl is a first step to protecting this critical frontier forest.

Mike Thompson
Member of Congress, 1st District California
Co-chair of the Congressional Sportsmen Caucus

BELOW: DARIN LANGHORST PINTAIL: DUCKS UNLIMITED CANADA

ACKNOWLEDGEMENTS

As one might anticipate, a project of this magnitude could not have been completed without a group of dedicated and passionate waterfowl enthusiasts. First and foremost, we owe a great deal of gratitude for the enthusiasm and historical accounts of biologists like Jim King, Carl Ferguson, Art Brazda and Ducks Unlimited Canada's Bill Leitch, who clearly understood and constantly championed the importance of areas of this vast ecosystem for North American waterfowl populations. Furthermore, without Ducks Unlimited's continental commitment to become more involved with waterfowl and wetland conservation in this magnificent forest, the scientific foundation that has now become the backbone of all the work detailed in this book would have never materialized.

Acknowledgements

For each species account, our group of boreal biologists endured countless hours compiling and summarizing historical and up-to-date information. And for this, we sincerely thank Jason Charlwood, Sarah Coulter, Darcy Falk, Brent Friedt, Alicia Korpach, Wally Price, Tasha Sargent and Coleen Stevens. We also owe thanks to Canadian Wildlife Service biologists Gerry Beyersbergen, Robert G. Clark and J. Bruce Pollard for lending their time and effort throughout the species account review process. A special thanks is extended to J. Bruce Pollard, who spent countless hours providing valuable and witty insight into many of these accounts. Additional thanks to Sarah Coulter and Alicia Korpach for providing assistance with finalizing the species accounts. For the accompanying distribution map illustrations, we thank the Boreal Songbird Initiative and Chris Krueger. Data for the banding maps were obtained from the United States Fish and Wildlife Service, and we thank them immensely for making these data available. We also thank Al Richard, Sean Smyth, Darcy Falk and Michael Robin for their work on the banding maps and we thank Jeope Wolfe for his tremendous effort, support and guidance on all maps, and for his creative design of the book. Sincere thanks are also in order for United States Congressman Mike Thompson and Canadian Senator Mira Spivak, who both set the stage internationally in their forewords as to the vast importance of this great forest to North America. Also special thanks are in order for Cathy Wilkinson and Kelly Acton of the Canadian Boreal Initiative for their expertise and help with this book. We are also appreciative that past boreal-based biologists Dave Kay and Art Brazda also took the challenge of helping our readers understand the boreal through the detailing of their own personal experience. Marcel Darveau, Silvie Forest, Eric Butterworth and Chris Smith also were instrumental in helping to ensure that quality content, including the areas provided by each, always had a national profile. We also thank DUC reviewers Henry Murkin, Karla Guyn and Mike Anderson for providing excellent direction and reviews of our book.

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THE PHYSICAL BOREAL

by Eric Butterworth, Sylvie Forest and Chris Smith

The boreal forest drapes across our nation like a huge green shawl. From the west, the great forest enters Canada at the border of Alaska and the Yukon, comprises much of the Northwest Territories, and sweeps across the northern regions of British Columbia and the Prairie provinces before dipping across Ontario. Swinging back north across Québec, it crosses into Labrador and Newfoundland, embracing our country from sea to sea to sea.

Overview

This great forest provides incredibly huge values to Canadians. Canada's boreal is mostly public land and contains almost one-quarter of the world's remaining undeveloped and intact forests (Bryant et al. 1997). It contains the raw material to fuel the economic engine of the nation's economy. The forest further sustains the traditional lifestyle practiced by aboriginal communities. From centuries of aboriginal use to the trappers of the 17th century onward to the industrialists, cottagers, campers and ecotourists of the 21st, this great forest has helped shape Canada's heritage and sense of identity. The boreal forest is at the core of what we are as Canadians.

What is not apparent to Canadians is the inherent natural capital and ecological goods and services that the boreal provides society. The trees, soils and peatlands represent one of the world's largest terrestrial carbon storehouses, integral to regulating global climate. Canada's boreal is also a water-dominated system which provides a strong connection between the health of the forest and the health of the watershed. Boreal wetlands provide a significant service to Canadians by providing water storage and water filtering which is fundamental to sustaining healthy watersheds, water supply and human health, as many of the drinking water resources relied upon by Canada's northern population are directly linked to boreal watersheds. Ecological services provided by the boreal, including water filtration and carbon storage, are estimated to be worth 2.5 times the market value of the natural resources extracted from the boreal each year (Anielski and Wilson 2005).

The Boreal Forest Landscape

It is no surprise the boreal landscape is covered with huge amounts of water and wetlands. The formation of this landscape is the outcome of water moving across the surface over millennia, from the formation of the glaciers of the last ice age that encompassed the northern portions of the globe and their subsequent melting 11,000 years ago, to the changes we experience in climate today. For the most part the soils, forests, lakes, streams and wetlands of the northern hemisphere were largely shaped by the end of the last glaciations when soils were deposited by the action of melting and retreating ice sheets that left a range of diverse landforms and surficial geological expressions. As a result, the boreal is as diverse as it is large. From eastern Canada, where the boreal sits upon the boreal shield and taiga shield, through the prairie provinces, where the boreal plains with its complex geological deposits combine to provide an area with one of the world's most complex hydrology. The Northwest Territories and northern Yukon are shaped by the discontinuous permafrost of the taiga plains, and the southern Yukon by the boreal and taiga cordilleran mountainous regions.

Canada is truly a forest nation, with 11 of the 15 terrestrial ecozones being forested, seven of which are boreal *(see map, inside front cover)*. The boreal shield and boreal plains represent the majority of the commercial forest in the boreal where forest cover is predominantly coniferous. Here, black spruce *(Picea mariana)* is dominant, though jack pine *(Pinus banksiana)*, white spruce *(P. glauca)*, eastern white pine *(P. strobus)*, red pine *(P. resinosa)*, and tamarack *(Larix laricina)* are principle species. Hardwoods, particularly trembling aspen *(Populus tremuloides)*, white birch *(Betula papyrifera)* and balsam poplar *(P. balsamifera)* are well represented and often mixed with conifers, particularly in the southern regions and where better soils prevail (Ecological Stratification Working Group 1995).

The remainder of the boreal, including the boreal and taiga cordillera, taiga plains, taiga shield and Hudson plains, is largely comprised of forest that is not suitable for commercial forestry, mostly due to shorter growing seasons, less productive soils and the presence of permafrost. Black spruce dominates the landscape, though other

The boreal is as diverse as it is large, and takes on a variety of faces as it spans the continent, including *(top to bottom)* rugged Yukon cordillera, northern Alberta muskeg and rich, rolling Québec hills.

LEFT: DARIN LANGHORST TOP RIGHT: BRIAN WOLITSKI RIGHT (2): © GARTH LENZ

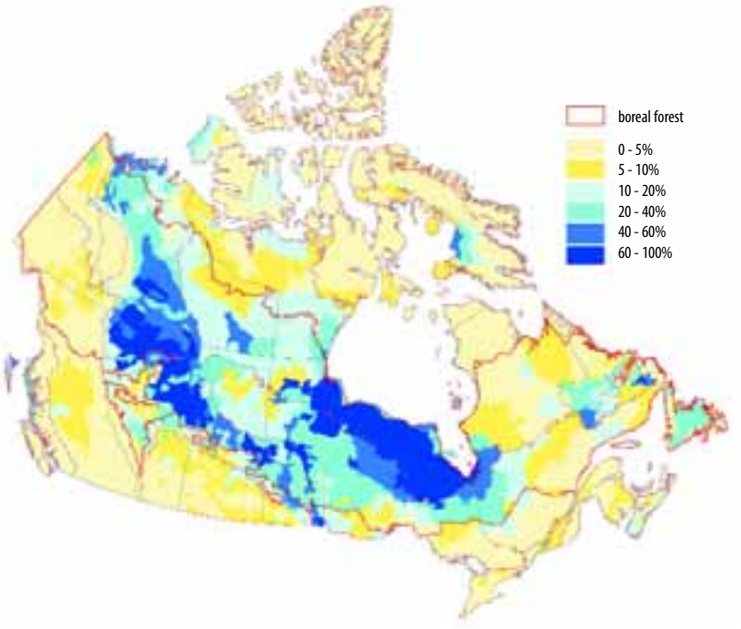


figure 1: National Wetland Dataset – Environment Canada percentage of wetlands by ecodistrict in Canada.

boreal tree species are often present, particularly in the lower elevations in the cordillera and along river valleys where soils and a warmer climate prevail (e.g. the Mackenzie Valley).

The boreal climate is generally characterized by long cold winters and short warm summers, though there is a wide variation depending on the latitude, elevation and location relative to oceans and large bodies of water like the Great Lakes. Precipitation ranges from 200-800 millimetres per year with western and northern regions generally having a drier climate than the central and eastern parts of boreal Canada.

Canada's boreal forest drapes across the shoulders of our nation like a huge green shawl.

Boreal Wetlands

Canada is blessed with over 127 million hectares of wetlands which cover roughly 14 per cent of the land mass (Tarnocai 2001). Some 86 per cent of these wetlands are peatlands (bogs and fens) which occur in the boreal forest *(figure 1)*. Other boreal wetlands include a myriad of shallow ponds and beaver flowages, shoreline marshes and river delta systems such as the Saskatchewan River, Peace-Athabasca and the Mackenzie River Delta. The soils of the boreal vary widely depending on region, with the western boreal generally having deep soil deposits, with shallower soils in the east underlain by the Canadian Shield. In areas with gentle topography and low relief, surface water flow and watersheds are difficult to define. In regions with pronounced topography and slope, surface water flow and watersheds can be identified using elevation differences. Depending on climate, areas with defined topography generally have more defined catchments, and runoff is more likely to occur (e.g. surface water flow after rainfalls or spring melts). Thus, developing an understanding of the interrelationship of climate, landform, soils and geology provides a basis for understanding boreal hydrology, and the fundamental knowledge needed to develop conservation strategies needed to maintain and protect boreal wetland systems.

figure 2: Continental bog with the typical *Sphagnum fuscum* (brown-coloured sphagnum) species that grows in hummocks in bogs and poor fens.

figure 3: Graminoid-rich fen with narrow leaf sedges *(Carex spp)* and buckbean.

It is the diversity of the landscape and climate that provides Canada – and the boreal – with a rich diversity of wetlands important to waterfowl and other wetland-dependent species. The Canadian Wetland Classification System recognizes two main categories of boreal wetlands based on their predominant soil substrate. Organic wetlands also referred to as peatlands, which include bogs and fens, and mineral wetlands that include swamps, marshes and shallow open water. This ecologically-based classification system provides insight into how each wetland class functions in the landscape. Factors that influence the presence of a specific class of wetland include hydrological connectivity, flooding regime, and landscape position. It is this interaction that makes the wetlands of the boreal so diverse. Bogs receive water through precipitation only and minerals and nutrients are introduced by aerial deposition (e.g. dust, ash, pollen)*(figure 2)*. For this reason, bogs are known as nutrient-poor systems.

Fens on the other hand, are influenced by flowing surface water or discharged groundwater and can be considered the green rivers of the boreal (Kevin Devito pers. comm.). Because the water has been in contact with mineral soil or rock, it carries nutrients and minerals. Fens are more nutrient-rich than bogs and have a water table at or near the surface *(figure 3)*. The hydrological connectivity of flowing water is the fundamental difference between fens and bogs.

Mineral wetlands are nutrient-rich systems with some organic accumulation, but less than 40 centimetres in depth. Unlike peatlands, which sequester carbon due to slow decomposition rates, mineral wetlands do not sequester large amounts of carbon because of high nutrient cy-

figure 4: Shrubby swamp dominated with willow species *(Salix spp).*

cling and decomposition rates caused by fluctuating water levels. Swamps are associated with fluctuating water tables and woody vegetation (shrubs and trees) *(figure 4)*. Generally they are adjacent to open water bodies (lakes or rivers) or the transitional zones between fens and uplands or marshes and uplands.

and typical deep "lake-like" aquatic ecosystems (e.g. ponds, lakes, rivers). The class exists because the shallow depths subjects the substrate to nutrient and gaseous exchange, oxidation and decomposition which changes in deeper aquatic systems (Mitsch and Gosselink 1993; National Wetland Working Group 1988). Peatland ponds on the boreal shield are often acidic and not very productive, whereas peatland ponds on the boreal plains can be eutrophic and very productive. It is also not uncommon in the boreal to find more than one type of wetland associated with shallow water wetlands.

figure 5: Marsh with shoreline emergent and dense submerged vegetation.

figure 6: Open water pond. The portion in the foreground is marsh but where the vegetation thins out to less than 25 per cent cover, the wetland class becomes shallow open water.

Marshes occur in shallow water, along the shorelines of lakes and ponds, slow-moving rivers or in oxbows *(figure 5)*. Vegetation is typically dominated by emergent and submerged plants. They can be permanently or seasonally inundated and surface water levels may fluctuate seasonally with drawdown periods, especially in late summer and fall.

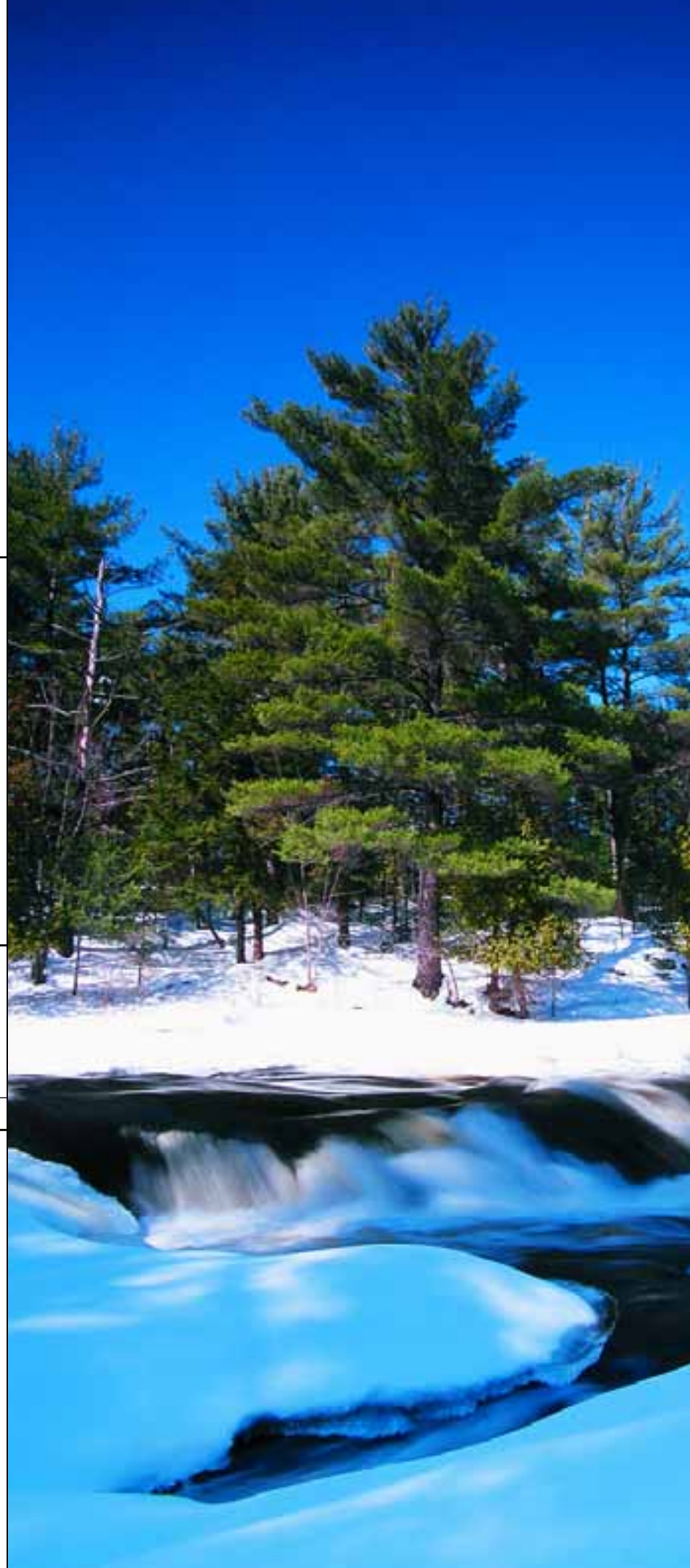
Shallow open water has less than two metres water depth and has less than 25 per cent of the surface covered with emergent or submergent vegetation *(figure 6)*. Shallow open water is a distinct wetland type often located between saturated and seasonally wet sites, marshes

Understanding which wetlands are important to waterfowl – and at what stage of the bird's life cycle – is critical information for conservation.

Conservation Challenges

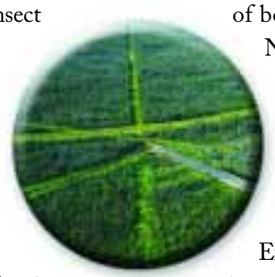
Until recently, conservation in Canada's boreal forest was viewed as unnecessary relative to other conservation priorities facing the nation and the degree of isolation of this vast ecosystem. This perception is rapidly changing.

A wide range of development activities are influencing the boreal and presenting conservation challenges in response to



RIGHT: ANDREW MCLACHLAN INSETS: DUCKS UNLIMITED CANADA

the region's rich natural resource. Often industrial, these activities can occur adjacent to or directly on networks of interconnected boreal wetlands and have the potential to negatively impact their hydrology. In addition, natural disturbance such as forest fires and insect damage is expected to increase due to climate change (Flannigan et al. 2001; Flemming and Volney 1995)resulting in increasing concerns about cumulative effects on terrestrial and aquatic ecosystems.



Seven distinct pressures predominate in Canada's boreal: agricultural expansion, petroleum exploration and development, forestry, hydroelectric development, mining, acid precipitation and climate change.

Agriculture

Agricultural interests continue to expand across portions of the boreal forest, and deforestation has been especially rapid in the southern boreal region. The Clay Belts in Ontario, Québec's Abitibi-Temiscamingue region and the Boreal Transition Zone of the four western provinces have been heavily developed for agriculture. Associated with this deforestation is disruption of hydrology and loss of wetlands.

Loss of forest cover cleared for agriculture alone in the Boreal Transition Zone of the boreal plains is estimated at approximately 0.87 to 1.76 per cent per year (Hobson et al. 2002). Given the current strong demand for aspen for Oriented Stand Board mills, this loss is expected to continue largely from private land and forested government land managed for agricultural purposes. In Ontario, agricultural encroachment in forests and swamps is primarily a concern on the rich soils of the Little Clay Belt where canola, grains and even soybeans and corn are grown. Low soil productivity precludes agricultural development in most of the other areas of boreal Ontario, Québec, Newfoundland and Labrador.

Oil and Gas Development

Exploration and the extraction of petroleum resources is a major influence particularly in the western boreal. One of the largest known oil reserves in Canada is located in Norman Wells, N.W.T., in the heart of the Mackenzie Valley, where numerous wetlands are located. The Mackenzie River Delta and Valley is also the focus of intense interest as substantial gas deposits are poised to be developed and transported to southern markets via a new 1,200 kilometre long pipeline, forever changing the landscape and culture of this pristine area. Oil and gas development is most prominent in Alberta, where over 80,000 oil and gas wells were drilled between 1997 and 2004 alone (Canadian Association of Petroleum Producers 2006). In some areas, more land has been cleared annually for pipelines, seismic lines, roads and production facilities than has been harvested by forestry operations. Petroleum production and oil sands mining have the potential to cause extensive habitat loss and fragmentation, hydrologic interruption, and air and water pollution.

Especially worrisome is the increase in the use of steam injection to access oil sands deposits that cannot be surface mined, operations resulting in both extensive surface disturbance and subsurface disturbance to groundwater systems.

Forest Management

Forest management is a significant land use in the southern boreal where much of the commercial timber has been allocated to private companies for producing lumber, pulp and paper and various engineered wood products. Forest management activities – which include road development, timber harvesting and silvicultural practices – result in a significant anthropogenic footprint over the landscape and influence both terrestrial and aquatic ecosystems and biodiversity.

Hydroelectric Development

Hydroelectric projects are present across the boreal forest, especially in Manitoba, Ontario, Québec and Newfoundland and Labrador. These developments alter the hydrology of river systems, often influencing wetland and associated riparian and upland habitats. Water management has fundamentally altered the Peace-Athabasca Delta near the Alberta-Northwest Territories border and the Saskatchewan River Delta, located on the Manitoba-Saskatchewan boundary. Future development of several Ontario rivers in the Hudson Bay drainage basin may threaten wetlands associated with that coastline. There is also renewed discussion around hydropower developments in the Mackenzie drainage basin.

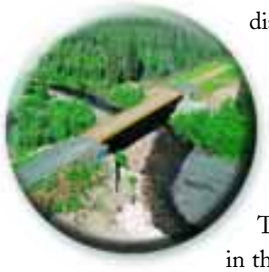
In Québec, the majority of hydroelectric projects are complete, although negotiations and designs continue on the upper Rupert River. The Lower Churchill hydro development project in Newfoundland and Labrador could

Until recently, conservation in Canada's boreal forest was viewed as unnecessary relative to other conservation priorities facing the nation and the degree of isolation of this vast ecosystem. This perception is rapidly changing.

impact a substantial area of the eastern boreal forest.

Mining

Mining is a significant industry in the boreal forests of Manitoba, Ontario, Québec, Newfoundland and Labrador where deposits of nickel, iron, diamonds and other minerals underlie the vast Canadian Shield. Diamond mining has also increased substantially within the Northwest Territories.



To date, mineral exploration in the east has resulted in a relatively limited footprint. Though mining is highly regulated and the overall surface area affected remains low, mineral exploration adds pressure on a much larger land base. This creates a major constraint to establishing culturally and ecologically significant protected areas; places that are also important as benchmark monitoring sites to gauge the successes of sustainable development activities. Furthermore, the reclamation and remediation of toxins such as those at offline gold and uranium mines remains a significant challenge.

Acid Precipitation

Acid precipitation is still prevalent in the eastern boreal forest. The airborne acids overwhelm the neutralizing capacity of Canadian Shield soil and water, and accelerate the leaching of mercury and aluminum. The long-range transport of acids and global pollutants such as mercury arising from combustion and incineration, impact aquatic life, threaten fish-eating wildlife such as loons, and can reduce forest growth. As industrial development continues, the influence of acid precipitation on the boreal forest ecosystem will continue to be a factor.

Climate Change

Changing climate may alter the entire boreal ecosystem. Global climate models generally predict greater warming at higher latitudes. Hence, the impacts of climate change on the boreal forest are likely to be among the most dramatic of any in all the world's life zones. The characteristics of the boreal ecosystem are partly determined by long winters and short summers. Temperatures in central Canada are warming at a higher rate than most of North America, and with a doubling of atmospheric carbon dioxide in this century, average temperatures in the northern regions may increase by as much as 3-5˚C (Natural Resources Canada 2006). This is expected to lead to drier conditions, greater annual climatic variation, melting permafrost, altered surficial hydrology and higher rates of wildfires and the shifting of vegetation zones northward (Natural Resources Canada 2006). Northern peoples have already observed profound changes in ice conditions, snowfall patterns and in spring thaws, with attendant effects on wildlife and the peoples' traditional ways of life (Natural Resources Canada 2006).

RIGHT: ANDREW MCLACHLAN INSETS: DARIN LANGHORST

NORTH AMERICA'S BOREAL FOREST

Contrasts in Waterfowl Habitat Conservation

BY FREDERIC REID AND GARY STEWART

WATERFOWL POPULATIONS

The most comprehensive estimates of waterfowl populations in the boreal forest come from the U.S. Fish and Wildlife Service's Waterfowl Breeding Population and Habitat Survey. This spring survey has been conducted annually since 1955 in parts of the western breeding areas (called the "Traditional Survey Area") and since 1990-1998 in parts of eastern Canada. For this summary, we only examined the traditional survey area, which includes western Ontario, most of the Prairie Provinces and states, a large portion of the Northwest Territories, boreal

valleys in the northern Yukon and Alaska, and the Alaskan tundra.

The traditional survey area does not include the core range of some taxa (e.g. American black ducks, long-tailed ducks and others), so values provided for these taxa, particularly percent in the boreal forest, cannot be interpreted in a continental context. As well, some taxa cannot be readily identified to species during surveys and so appear as a generic taxon (e.g. "generic scaup" includes both greater and lesser scaup).

Based on decadal averages of breeding season population estimates, minimally 12.9-15.1 million waterfowl (both paired and unpaired birds) used the western boreal forest during spring. On average, from 1960 to 2005, five taxa had 79 per cent or more of their traditional survey area populations in the WBF, five had 55-75 per cent, and three had 36-41 per cent.

Key western boreal taxa, for which a large portion of their range occurs within the traditional survey area, include ring-necked ducks, generic scaup, scoter and goldeneye, bufflehead, American wigeon and green-winged teal. From a numbers perspective, five taxa had mean decadal populations (1960-2005) exceed one million birds (*generic scoters - 1,022,013; green-winged teal - 1,070,691; American wigeon - 1,397,262; mallard - 2,115,827; generic scaup - 3,386,160*), and four had mean decadal populations between 500,000 and 700,000 birds (*generic mergansers - 501,683; bufflehead - 518,016; ring-necked duck - 630,234; northern pintail - 646,045*).

Most North Americans waterfowl enthusiasts have studied and experienced the prairies and parklands of the mid-latitudes. And the importance of these regions to continental duck populations is clearly recognized. However, most of these enthusiasts are far less aware of the importance, size or magnitude of North America's boreal forest region and the challenges it faces. That is likely because few have travelled to the vast northern region that pilot biologists, university students and indigenous peoples have known first-hand as containing great wetland landscapes.

Generally, within the community of waterfowl biologists, the belief has been that few birds breed in the boreal region, and are present in numbers only when displaced by prairie droughts. This understanding has become dogma in certain circles – and an accepted principle that waterfowl production is non-existent or very small, mostly from "overflight" birds to these northern areas.

Johnny Lynch (1984) referred to Alaska and the Far North as the "B.F.F." ("Big Fish Factory"), famous for its production of lake trout, grayling, arctic char and jackfish – but of less importance to key waterfowl species. Lynch helped strengthen the perception that the boreal forest was important as an overflight destination for drought-displaced waterfowl by suggesting "in years when both the B.O.P. (Bald-Open Prairie) and the B.C.F. (Big Crow Factory – Parklands) go completely dry and out of production, this B.F.F. could harbor enough refugees from the Prairie nesting grounds to keep these endangered species from winding up on the songbird list."

When Lynch describes the B.F.F., he speaks of habitat and species found in the rocky landscape of the Precambrian Shield. He is correct that these areas are dominated by lakes highly productive for fish, with sparse waterfowl. In contrast, however, the landscapes of the boreal and taiga plains of western Canada, and in Interior Alaska, contain a rich array of highly productive nutrient-rich wetlands and lakes which support 12 to 14 million breeding season ducks, several hundred thousand white-fronted and lesser Canada geese, and – according to the spring breeding season surveys – 25 to 40 per cent of the world's tundra and trumpeter swans.

It is surprising how early the boreal forest was noted for its rich waterfowl resource. Three principal boreal landscapes were recognized near the turn of the 20th century. Cooke (1913) wrote:

"The largest and best of these districts lies in the neighborhood of Athabaska and Great Slave lakes. It includes the whole of the Slave River, the lower hundred miles of the Athabaska River, and the region to the westward for distances varying from 50 to 250 miles. Here are some 30,000 square miles that with even moderately good protection

Millions of waterfowl breed in the boreal forest, and upwards of 80 per cent of the continent's waterfowl use the region for moulting or migration.

LEFT (2): BRIAN WOLITSKI RIGHT: DENIS FAUCHER

	1960-1969					1970-1979				
species	tundra	boreal	prairies	total	% boreal	tundra	boreal	prairies	total	% boreal
common eider	48,708	0	0	48,708	0 %	22,879	322	0	23,201	1%
gadwall	261	45,035	1,166,739	1,212,034	4 %	588	40,286	1,476,937	1,517,811	3%
blue-winged teal	0	451,929	3,360,463	3,812,393	12 %	1,414	415,202	4,236,057	4,652,673	9%
redhead	32	70,524	474,524	545,081	13 %	98	36,099	602,653	638,850	6%
ruddy duck	0	34,654	259,372	294,026	12 %	0	18,608	333,388	351,997	5%
northern shoveler	7,419	271,989	1,452,563	1,731,971	16 %	34,805	227,560	1,727,743	1,990,107	11%
northern pintail	428,697	835,667	3,113,228	4,377,591	19 %	589,624	685,748	4,320,525	5,595,897	12%
mallard	60,211	2,079,660	4,564,548	6,704,419	31 %	81,107	2,298,789	5,819,413	8,199,309	28%
Canada goose	314,431	366,776	80,062	761,269	48 %	148,370	287,543	116,375	552,288	52%
trumpeter/tundra swan	0	17	8	24	68 %	71,747	38,561	1,070	111,378	35%
canvasback	1,737	223,072	305,800	530,609	42 %	3,874	146,388	391,607	541,869	27%
long-tailed duck	113,586	382,501	12	496,099	77 %	150,339	277,525	0	427,864	65%
green-winged teal	38,693	861,648	509,421	1,409,762	61 %	91,220	808,635	957,924	1,857,780	44%
American wigeon	44,089	1,308,455	1,107,453	2,459,997	53 %	122,900	1,394,384	1,456,752	2,974,035	47%
generic scaup	373,339	3,551,788	1,041,298	4,966,425	72 %	382,435	4,407,872	1,511,888	6,302,195	70%
bufflehead	2,630	334,701	139,246	476,578	70 %	2,596	528,835	192,575	724,006	73%
generic goldeneye	24,055	356,122	69,402	449,579	79 %	31,118	374,711	74,810	480,639	78%
generic scoter	225,052	1,158,120	67,399	1,450,571	80 %	224,566	1,212,484	38,936	1,475,986	82%
ring-necked duck	0	363,763	55,446	419,209	87 %	41	410,397	96,102	506,540	81%
generic merganser	1,183	310,619	28,508	340,310	91 %	3,099	373,037	26,560	402,695	93%
American black duck	0	32,477	317	32,794	99 %	0	29,829	201	30,030	99%

A 1939 map shows Ducks Unlimited's efforts in the early stages of the organization's existance.

during the breeding season will produce annually a liberal crop of the most valued kind of ducks. To the northward lies another district, including the delta of the MacKenzie, and the Arctic coast east to Franklin Bay, that supports each year a large waterfowl population, including the mallard, green-winged teal, and several species of geese, but is too far north for gadwall, blue-winged teal, redhead, and canvasback. Eastward a third area fringes Hudson and James bays on the west and extends from the south end of James Bay to 100 miles beyond Cape Churchill."

Of the great refuges, Cooke noted, "the Yukon Delta reservation includes the largest breeding colonies of ducks and geese in Alaska, and with its several hundred thousand acres covers more territory than the entire lake region of North Dakota."

Cooke then went on to speculate on the challenge to Prairie habitat and stated that the future for waterfowl was "by no means hopeless" … "as there is an overlooked area in North America of considerable size, which is well adapted for the breeding grounds of ducks and geese, and is so far north and has so severe a climate that it never will be used to any great extent for farming. Indeed, the places best adapted to the waterfowl – the great marshes – are too wet and cold even in mid-summer ever to be available for agriculture." Unfortunately, Cooke failed to forecast the expansion of extraction industries that would take place later in the century.

The importance of Alaskan boreal habitat to waterfowl was established after the 1959 proposal to build Rampart Canyon Dam on the Yukon River. This would have created a lake 10,500 square miles in size and flooded wetland habitat that produced, conservatively, 1.5 million ducks annually (King 2002). Ducks banded on the Yukon Flats have been recovered by hunters in 45 states, eight provinces and territories in Canada, Russia, as well as in Mexico and Central America (Heuer 2001).

The evaluation of *Alaskan Habitat for Migratory Birds* (King and Lensink 1971) recognized several key waterfowl areas, including the Yukon Flats, Yukon Delta, Koyokuk and Kanuti Flats, Tanana Kuskokwim Valleys and the Innoko River complex. Together, these were deemed to be extremely important for breeding white-fronted geese, lesser Canada geese, lesser scaup, American wigeon, northern pintail, white-winged scoter, green-winged teal, mallard and canvasback. From this evaluation, seven new waterfowl refuges encompassing 22 million acres were established by the Alaska National Interest Lands Conservation Act, signed by President Jimmy Carter in 1980 (King 1980). Together with pre-existing refuges, the boreal habitats of the Alaska national wildlife refuges make up more than 85 per cent of the land mass in the entire U.S. wildlife refuge system.

In 1989, Ducks Unlimited became actively involved in boreal landscape planning by undertaking satellite-based land cover mapping in boreal Alaska. Strong working partnerships were established with the Bureau of Land Management, U.S. Fish and Wildlife Service and the National Park Service. Using systematic and hierarchical vegetation decision tree and extensive helicopter-based land cover surveys and ground truthing, DU and partners have

	1980-1989					1990-1999				
species	tundra	boreal	prairies	total	% boreal	tundra	boreal	prairies	total	% boreal
common eider	18,205	2,862	0	21,067	14%	10,108	0	0	10,108	0%
gadwall	1,175	58,064	1,378,409	1,437,649	4%	3,155	66,101	2,536,406	2,605,662	3%
blue-winged teal	633	582,644	3,243,262	3,826,539	15%	0	354,502	4,635,726	4,990,228	7%
redhead	575	45,195	545,844	591,615	8%	155	40,648	687,248	728,051	6%
ruddy duck	121	60,204	467,065	527,390	11%	0	51,534	457,205	508,738	10%
northern shoveler	111,788	405,909	1,370,604	1,888,301	21%	224,482	476,617	2,087,440	2,788,538	17%
northern pintail	611,497	711,491	1,694,289	3,017,276	24%	609,826	441,949	1,529,635	2,581,410	17%
mallard	135,203	2,101,015	3,892,342	6,128,560	34%	209,829	2,155,502	5,250,457	7,615,787	28%
Canada goose	148,454	380,156	286,467	815,077	47%	222,617	397,720	633,009	1,253,346	32%
trumpeter/tundra swan	115,421	78,866	2,978	197,264	40%	161,800	56,137	2,508	220,445	25%
canvasback	15,193	189,735	305,301	510,229	37%	8,261	218,335	395,343	621,939	35%
long-tailed duck	128,828	298,742	2,595	430,165	69%	74,656	93,555	411	168,622	55%
green-winged teal	136,121	1,162,401	485,306	1,783,827	65%	287,272	1,120,435	687,121	2,094,828	53%
American wigeon	170,180	1,467,629	824,431	2,462,240	60%	285,588	1,379,130	789,214	2,453,931	56%
generic scaup	368,046	3,904,026	1,359,129	5,631,201	69%	459,113	2,783,972	1,102,544	4,345,630	64%
bufflehead	2,801	529,253	180,859	712,913	74%	1,244	570,675	342,020	913,939	62%
generic goldeneye	24,519	425,682	79,853	530,054	80%	8,343	504,063	118,472	630,877	80%
generic scoter	260,043	1,291,680	26,299	1,578,022	82%	211,093	701,373	15,062	927,528	76%
ring-necked duck	5,112	530,646	146,732	682,489	78%	1,953	803,835	145,688	951,476	84%
generic merganser	9,881	469,236	58,760	537,877	87%	13,038	538,925	49,632	601,596	90%
American black duck	0	22,763	309	23,072	99%	0	31,710	774	32,483	98%

mapped over 155 million acres in Alaska and have an additional 30 million acres in progress. A similar process was initiated in the late 1990s in western Canada with industry, aboriginal, foundations and government partners to produce a seamless, highly accurate land cover map for land-use planning and management. To date, over 103 million acres have been mapped with 50 million acres of boreal mapping projects in progress.

Unfortunately in comparison, only 5.6 per cent of Canada's entire boreal region is currently permanently protected from industrial development, mostly in national and provincial parks that often have limited wetland areas. Only one-third of Yukon's world famous Old Crow Flats is permanently protected, while the vast Peace-Athabasca Delta lies unprotected just outside of Wood Buffalo National Park. There is a paucity of boreal National Wildlife Areas, especially in critical, wetland-rich areas like the Mackenzie River Valley, Saskatchewan River Delta, Manitoba's Great Lakes and the Hudson and James Bay Lowlands.

More than 60 years after More Game Birds for America and Ducks Unlimited first investigated wetlands in the western boreal, very little attention was given to this region (Leitch 1978). Much of the boreal remained pristine wilderness, and the focus of wetland conservation was rightly on the prairies and later on other settled areas of the continent where agricultural expansion and urbanization had increasingly threatened wetland and associated upland habitats. There were exceptions, including the vast boreal delta of the Saskatchewan River Delta (SRD). This area was identified as a key area in the late 1930s, when More Game Birds for America and a newly fledged Ducks Unlimited undertook extensive aerial waterfowl surveys across the western boreal. They called this vast area "No Man's Land" and identified boreal wetland hotspots including places like Kazan Lake in Saskatchewan, the Peace-Athabasca Delta and the SRD (Leitch 1978). As a result, DU undertook development of several wetland conservation projects dating back to the 1940s near the communities of The Pas, Manitoba and Cumberland House, Saskatchewan.

Investments became significant in the early 1960s when two hydroelectric dams on the Saskatchewan River took place, which resulted in significant impacts to this two million-acre delta – resulting in altered hydrology and direct flooding.

As was the case in the SRD, over time the wilderness of the boreal has slowly changed as a result of development. And today, much of the forest landscape between the parklands and southern boreal from Manitoba to British Columbia has been altered. Here, bush has been cleared and burned and efforts to drain associated wetlands has followed for the development of pasture, hay and grain production.

North of the transition zone between the prairies and the forest, most of the commercial forest across Canada's southern boreal has been allocated to large forest companies and developments are increasing for oil and gas, mineral extraction and hydroelectric power across the boreal. Environmental groups are constantly campaigning against clear cuts, hydroelectric power and other industrial activities and are calling for the protection of what they call "endangered forests." The cumulative impact of development will soon threaten the integrity of boreal landscapes, unless sustainable development practices are implemented and a network of large protected areas free of industrial development are established. The multiple impacts of development in combination with the influence of climate change can damage waterfowl habitats beyond our current knowledge. There is a growing need for progressive and adaptive wetland and waterfowl conservation planning at international, national and regional levels.

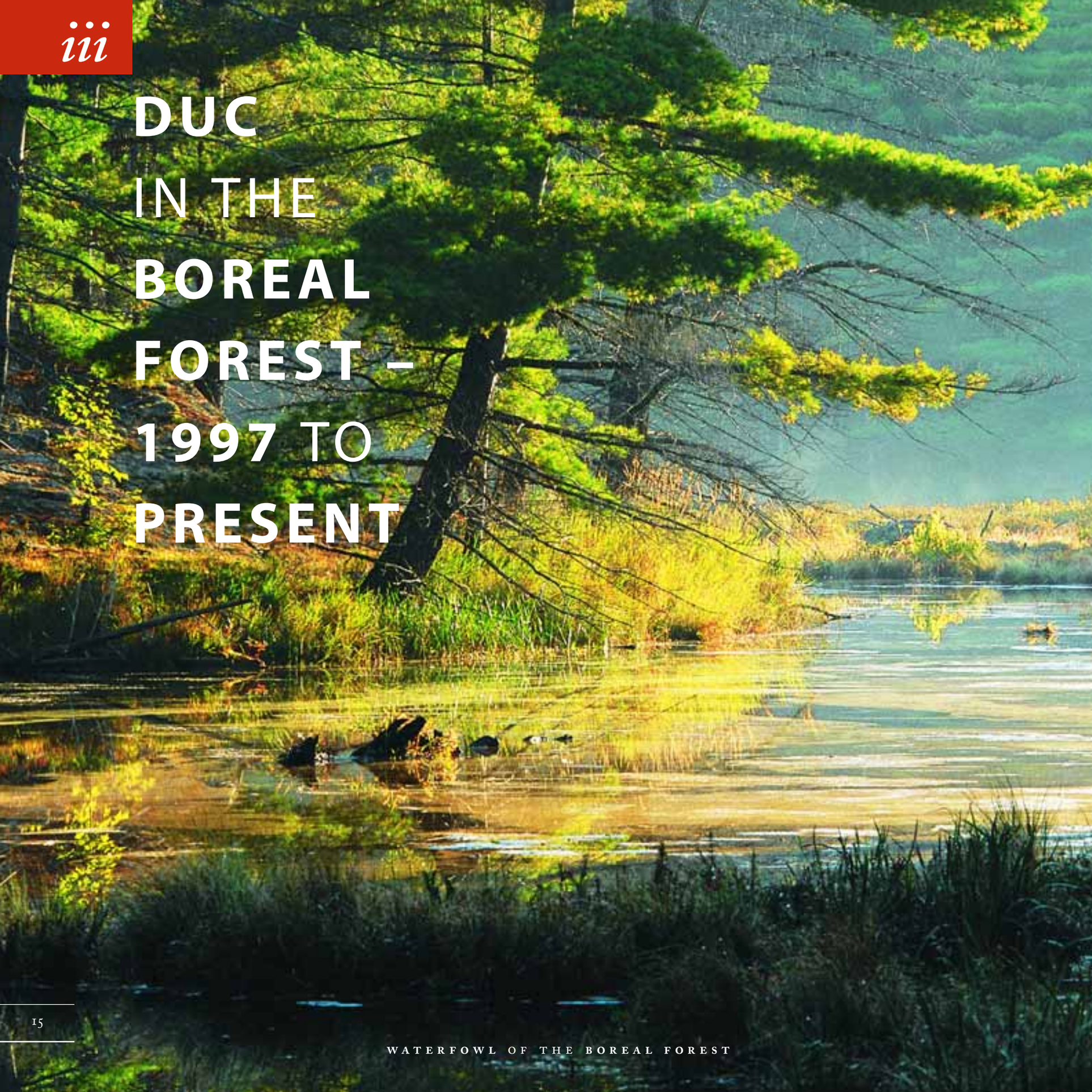
Every year, millions of ducks breed in North America's boreal forest. Perhaps more importantly, upwards of 80 per cent of the continent's waterfowl use the boreal for moulting or migration (Bellrose 1980). The boreal comprises the last great frontier forest on earth. This area, which is a treasure trove of resources, is also critical to the continent's waterfowl and other wildlife. To understand to and know its waterfowl is to begin to understand and tackle the challenges we now face.

RING-NECKED DUCK: DUCKS UNLIMITED CANADA MALLARD: BRIAN WOLITSKI

2000–2005

species	tundra	boreal	prairies	total	% boreal
common eider	14,311	158	0	14,469	1%
gadwall	2,621	48,207	2,514,295	2,565,122	2%
blue-winged teal	370	252,698	5,008,871	5,261,939	5%
redhead	0	38,933	633,992	672,926	6%
ruddy duck	0	42,102	610,931	653,033	6%
northern shoveler	274,946	590,185	2,330,522	3,195,652	18%
northern pintail	699,334	555,370	1,294,734	2,549,438	22%
mallard	327,341	1,944,170	5,563,189	7,834,700	25%
Canada goose	203,013	451,416	1,057,556	1,711,985	26%
trumpeter/tundra swan	114,399	49,463	6,819	170,681	29%
canvasback	16,172	216,871	345,049	578,092	38%
long-tailed duck	76,640	90,181	0	166,821	54%
green-winged teal	431,512	1,400,334	723,474	2,555,321	55%
American wigeon	374,781	1,436,712	574,999	2,386,492	60%
generic scaup	530,387	2,283,141	881,972	3,695,501	62%
bufflehead	1,082	626,613	382,977	1,010,672	62%
generic goldeneye	9,775	541,779	150,141	701,695	77%
generic scoter	205,608	746,409	10,241	962,257	78%
ring-necked duck	3,550	1,042,530	136,740	1,182,820	88%
generic merganser	17,466	816,600	44,073	878,139	93%
American black duck	0	42,643	773	43,416	98%

DUC IN THE BOREAL FOREST – 1997 TO PRESENT



LEFT: ANDREW MCLACHLAN RIGHT: DARIN LANGHORST

DUC in the Western Boreal Forest

BY CHRIS SMITH

By the mid 1990s considerable public attention was being directed at the multitude of developments in North America's western boreal forest and the significant anthropogenic footprint that was transforming the landscape. And although the greatest impact was south of the 60th parallel, primarily in Alberta, the expanded forest industry in Manitoba and Saskatchewan and strong interest in the vast oil reserves of northeastern British Columbia, the northern Yukon and the Northwest Territories' MacKenzie Valley was generating considerable attention.

At that time, Ducks Unlimited Canada (DUC) conservation programs remained firmly anchored in the Prairie ecozone. However, because of the need to gain a better understanding of the significance of industrial development that was underway, and to better determine the value of this vast ecosystem to the continent's water birds, some well-timed resources were directed northward. Previously, with the exception of areas such as selected hydroelectric-affected wetlands within the Saskatchewan River Delta, DUC's involvement in the western boreal forest had been minimal, quite simply because the habitat was considered relatively secure and intact, mostly due to its remoteness.

In 1997, DUC assembled a small team of biologists to compile information on wetlands, waterfowl and other waterbirds, land ownership, industrial developments and other factors (e.g. climate change) that might be influencing wetlands of the western boreal forest. What this team quickly confirmed was that this vast region was critical for continental waterfowl and that it was undergoing a rapid transformation from undisturbed wilderness to a region of economic importance because of its rich natural resources.

Furthermore, it was determined that there was relatively limited knowledge about distribution and abundance of boreal wetlands, how these wetland systems functioned, and which habitats were most important to waterfowl and other water birds. In addition, how the various industrial developments were influencing boreal wetland systems was largely unknown. An initial and somewhat cursory evaluation led to the realization that there were numerous threats to boreal wetland systems and more information was needed to direct meaningful wetland conservation programs.

At the same time, concern was growing over the decline of certain waterfowl species that breed primarily in the western boreal forest (WBF) – in particular, scaup and scoters. Although populations of scoters had been declining for several decades, the rapid and recent decline in breeding scaup was particularly worrisome to waterfowl biologists and researchers. This provided an additional focus on the WBF and the various activities that might be influencing the breeding success of these boreal nesting species.

As a result of this evaluation, DUC launched the Western Boreal Forest Initiative, which developed into a comprehensive program that included inventory, research and strategic partnerships to establish an improved understanding of the wetlands and waterbirds and provide the critical information necessary to influence wetland conservation. Through the analysis of existing U.S. Fish & Wildlife Service strata survey data it became apparent that the boreal and taiga plains are the most important ecozones for breeding waterfowl in the WBF. This analysis, in combination with available wetland information, provided the necessary framework for setting priorities where DUC programs should be delivered.

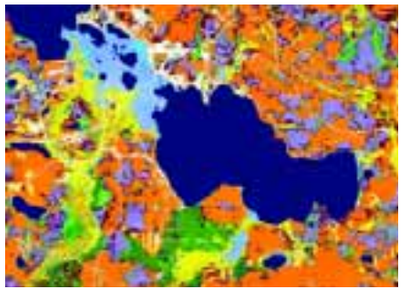
An initial and somewhat cursory evaluation led to the realization that there were numerous threats to boreal wetland systems.

Inventory

Given the remoteness of the western boreal forest and the limited amount of up-to-date habitat information, it was necessary to establish a regional scale baseline inventory on the various upland and wetland cover types. Fortunately, Ducks Unlimited Inc. had established a state-of-the-art satellite-based earthcover inventory and mapping protocol for boreal Alaska that was suitable for inventory projects in Canada. This protocol, which includes extensive helicopter-based field verification and an enhanced accuracy assessment, resulted in a final mapped product with up to 40 vegetation cover types – with accuracy typically over 80 per cent.

Since 1999, DUC's Western Boreal Program has completed 14 inventory projects accurately mapping over 60 million

A decline in the populations of scoters and scaup added focus to DUC's growing efforts in the boreal forest.



Through the Wetland Inventory, DUC has developed the protocols to remotely classify and map up to 18 different types of boreal wetlands. This information provides a remotely sensed, ecologically-based wetland classification system and mapping product for the boreal forest.

Fundamental to influencing wetland conservation in the western boreal forest is the need to develop a solid understanding of how boreal wetlands function.

hectares of the WBF. These mapping products have become the cornerstone of the WBF program by providing the baseline data to undertake other inventory elements, including waterbird surveys, associated research projects and conservation planning. More recently, DUC has actively participated in a multi-partner initiative led by Environment Canada to compile a satellite-based Wetland Inventory for Canada. Through this project, DUC has developed the protocols to remotely classify and then map up to 18 different types of boreal wetlands. This enhanced wetland information, which conforms to the Canadian Wetland Classification System, provides – for the first time – a remotely sensed and ecologically-based wetland classification system and mapping product for the boreal.

An extensive waterbird inventory program has also been implemented as a component of most earthcover inventory projects. This open water inventory program is an effort to determine the use of boreal wetlands by breeding waterfowl and also as moulting, staging and migratory habitat. These surveys are unlike the established and broad-based spring breeding waterfowl surveys conducted by the U.S. Fish & Wildlife Service that are designed to monitor long-term breeding populations and are used to guide the hunting regulations. The objective of the DUC surveys is to identify important wetland systems, and then to use this information in combination with the habitat data generated from the earthcover mapping to determine key habitat elements preferred by waterfowl. To date, these surveys have confirmed the importance of many previously known boreal wetland hotspots (e.g. Saskatchewan and Mackenzie River Deltas), and provided a better understanding of the importance of less understood wetland systems such as beaver-influenced ponds and drainage systems, and large eutrophic water bodies scattered across the western boreal forest. The waterfowl inventory and habitat mapping data are being used to develop modeling tools for important boreal wetland systems.

Research

Fundamental to influencing wetland conservation in the western boreal forest is the need to develop a solid understanding of how boreal wetlands function, how these wetlands are influenced by disturbances (including industrial development) and how wetland-related wildlife responds to these disturbances. Acquiring this kind of knowledge, and undertaking some primary waterfowl ecology studies on scaup and scoter, have become the core research program to date for DUC in the western boreal forest.

Through collaboration with universities and key research scientists, several studies have been started including research on boreal hydrology and wetland dynamics, riparian birds, cavity-nesting species and disturbance impacts. Through these important collaborative research projects, the pieces are being pulled together to help understand how the wetlands in the western boreal forest function, how they interact in the surrounding landscape and how the various disturbances across the boreal landscape can influence these wetlands. Furthermore, we are starting to generate an understanding of how waterfowl and other wildlife species interact with boreal wetland systems and how they respond to disturbance.

When combined with the baseline data generated by DUC inventory projects, this research is providing the foundation for ongoing land-use decisions that will result in the protection of boreal wetlands.

Scaup populations, to which lesser scaup (above) represent close to 90 per cent, have declined roughly 50 per cent since the mid-1950s. These declines appear to be strongest in the boreal forest

LEFT, ABOVE: DARIN LANGHORST

Partnerships

Most of the western boreal forest in Canada is public, or Crown land with an increasing proportion being held by First Nations north of the 60th parallel in the Northwest Territories and Yukon. Though land-use decisions and regulation are ultimately made by governments (including First Nations governments), they are the end result of a process that includes information gathering, planning and consultation with a variety of stakeholders – including industries interested in using the natural resources. And once a land-use decision has been made, ongoing management activities influencing the land base are normally undertaken by industry.

It then became obvious and critical that meaningful partnerships with the various stakeholders including governments, aboriginal communities, industry and non-government agencies were required if wetland conservation in the western boreal forest was to be successful. Since 1997, more than 50 partnerships have been established including agreements with the federal government, the western provincial and territorial governments, the United States Forest Service, North American Wetlands Conservation Act, First Nations, industry (petroleum, forestry and power), foundations, universities and the Canadian Boreal Initiative. Each of these partnerships brings its own unique contribution and vision to the conservation of the western boreal forest and its wetlands.

Conservation Planning

Since the late 1990s, what started as a need to learn more about the water birds, wetlands and associated land-use impacts, has developed into a program that is focused on conservation planning that will result in the protection of wetland resources. The overall objective of this approach is to ensure that wetlands and associated upland communities remain functioning ecosystems in the larger boreal landscape, which in turn will continue to produce a variety of ecological goods and services. A three-pronged approach to promote wetland conservation has been adopted by DUC in the WBF:

1) **Protected Areas** – a network of large, wetland-rich, permanent protected areas (such as National Wildlife Areas) where industrial development is excluded. These areas will include key wetland complexes of known significance and areas of intact boreal forest that will serve as ecological benchmarks against which the success of the managed landscape can be measured.

2) **Special Conservation Areas** – areas in the working landscape where industrial activities occur but under specific operating criteria to ensure the protection of wetland and other sensitive sites.

3) **Sustainable Development Areas** – areas where industrial activities continue on an ongoing basis but are guided by beneficial management practices (BMPs) that ensure the conservation of boreal wetland systems.

This diverse approach to conservation planning uses the information generated from inventory projects and the results from research studies. It works through established partnerships to inform and positively influence land management decisions. Although we are in the early stages of implementing this approach the outlook is promising.

For example, in the Northwest Territories, DUC is working with government employees and the community of Fort Good Hope on a proposal to have the Ramparts River and Wetlands Complex withdrawn from development through the N.W.T. Protected Areas Strategy. Information collected by DUC inventory projects is being integrated into the proposal which is currently before the N.W.T. Legislature for its approval in principle. Once approved, a formal request will be made to the Government of Canada to have this world-class wetland complex withdrawn from development for five years in order to complete steps required to achieve permanent protection as a National Wildlife Area. The Ramparts, located in the Mackenzie River Valley, is 15,000 square-kilometres in size and includes a 4,448 square-kilometre wetland complex.

South of the 60th parallel in the working forest of Alberta, work is ongoing on a Boreal Conservation Project (BCP) with Alberta Pacific Forest Industries, which has forest management responsibilities for 11.5 million hectares in northeastern Alberta. This partnership project uses the earthcover inventory and enhanced wetland classification in conjunction with results from hydrology and disturbance research to develop a new approach to forest management. With knowledge of the hydrologic linkages, wetland connectivity and disturbance impacts, the BCP is working toward a new approach to forest management that will sustain wetland function and associated habitats.

LEFT: ANDREW MCLACHLAN ABOVE RIGHT: DENIS FAUCHER

DUC in the Eastern Boreal Forest

BY MARCEL DARVEAU

There was little conservation effort focused on waterfowl or wetlands in eastern boreal Canada prior to the 1916 Convention for the Protection of Migratory Birds in Canada and the United States. And one has to wonder that had such work been undertaken earlier, if perhaps the Labrador duck would have been protected from over-exploitation and eventual extinction in 1875 (Godfrey 1967).

Fortunately since then, no other waterfowl species of the eastern boreal have become extinct. In fact, several important new conservation initiatives oriented toward waterfowl population or habitat management have been initiated.

The first step to effective conservation is acquiring knowledge. Early efforts in the eastern boreal consisted of explorations by European settlers during the 17th and 18th centuries. During that era, explorers from Britain and later those associated with the Hudson's Bay Company published a considerable amount of information on northern birds (Ouellet 1996).

Later, in his 19th century effort to list the birds of North America, John James Audubon traveled to the lower north shore of the Gulf of St. Lawrence in Québec and Labrador (Audubon 1827-38). Toward the end of the 19th century, books were published by John Rae and Lucien M. Turner on the birds of the Hudson Bay and James Bay areas. As one might expect, exploring inland at this time was not easy and ornithologists traveled by canoes or boats along coastlines and river systems.

In 1901, W.E. Clyde Todd, an ornithologist, began a series of trips to Labrador and to the interior of northern Québec (Ouellet 1996). Over the next decades, as human settlement in the boreal increased, so too did the number of ornithological studies. In the 1920s, work by Harrison F. Lewis, an ornithologist hired by the Canadian government, helped establish the first migratory bird sanctuaries in the eastern boreal. In 1927, he encouraged non-governmental organizations (NGOs) – including the Société Provancher d'Histoire Naturelle du Canada – to acquire the Île aux Basques and the Razades islands where common eiders were known to breed in considerable numbers (Ouellet 1996).

Monitoring programs specific to waterfowl began in the late 1950s, with the work of Kaczinski and Chamberlain in parts of boreal Ontario and Québec, and in the 1970s in Newfoundland and Labrador (Caswell and Dickson 1997). The establishment of the North American Waterfowl Management Plan in 1986 resulted in the demand for more waterfowl information in the eastern boreal forest, a responsibility taken on by various agencies through the Black Duck Joint Venture in 1990.

At the international level, the 1971 Ramsar convention on wetlands led to the conservation in 1987 of three significant coastal sites in Canada's eastern boreal forest: the Grand Codroy Estuary in Newfoundland, Ontario's Polar Bear Provincial Park and Southern James Bay. There have been no other Ramsar sites nominated since that time in the eastern boreal. However, the Canadian Wildlife Service has established nearly 20 Migratory Bird Sanctuaries in the eastern boreal. As well, Parks Canada, using a systematic conservation approach aimed at preserving samples of dominant landscapes in Canada, has created seven parks in the interior of the eastern boreal. Similarly, provincial governments have networks of protected areas based on systematic conservation planning approaches.

Ducks Unlimited Canada has recently initiated several conservation efforts in the eastern boreal forest. This work has benefited from the development of a breeding bird atlas by other NGO organizations like the Federation of Ontario Naturalists, the Association québécoise des groupes d'ornithologues and Bird Studies Canada.

Like in the rest of boreal Canada, conservation efforts in the eastern boreal will require a collaboration approach of government, industry, local communities and NGOs to maximize conservation results.

The eastern boreal forest is home to 50 percent of the total breeding population of American black ducks.

DUC has just recently started to spread its conservation wings into Canada's eastern boreal.

BOREAL WATERFOWL SCIENCE

by Stuart Slattery

Information about the requirements of waterfowl using the boreal forest for a part of their annual cycle is critical to conservation efforts, yet often is lacking. The boreal forest is an expensive and logistically challenging place to work, and these constraints have limited waterfowl research. However, dramatic population decline of key North American waterfowl species and the pressing need to ensure that ecological integrity of this rapidly changing landscape is maintained has motivated the conservation community, and many creative initiatives have begun to fill information gaps. From a waterfowl conservation perspective, these gaps are captured by four key questions:

1. **Where are the birds?**
2. **Why are they there?**
3. **How might population distribution and abundance change in response to human activity?**
4. **What can be done to minimize that change?**

Where are the birds?

Understanding the patterns of spatial distribution and abundance of waterfowl is an essential first step for targeting conservation efforts on the most critical waterfowl habitat at continental, regional and local scales. As well, these patterns may significantly influence conservation philosophy. For example, based on the USFWS (Wilkins et al. 2005) breeding season population data from the western boreal forest, about 80 per cent of boreal scaup occurred at densities of less than five pairs per square mile (less than two pairs per square kilometre) (Slattery unpub. analyses). Therefore, habitat conservation efforts targeting scaup, if they are to benefit a population declining across the continent, must focus on more than just the high-density areas.

Contemporary distribution and abundance of waterfowl in the boreal forest also are a snapshot of dynamic population trends (Wilkins et al. 2005). Examining spatial variation in population trends may well yield insights that will further guide research and conservation activities. For example, regions identified as having populations that have increased, remained stable, and declined would permit comparative studies on processes underlying the respective local population trends that would help iden-tify potential targets for conservation projects (Austin et al. 2006).

Ultimately, maintaining the ability of the boreal landscape to sustain waterfowl in perpetuity requires information to make sound decisions.

LEFT: STUART SLATTERY RIGHT: DARIN LANGHORST

To be truly effective, we also need to understand what makes individual wetlands productive and also why productive wetlands are where they are on the landscape.

Why are they there?

In some cases, we may have enough knowledge of spatial and temporal patterns of waterfowl populations to proceed with conservation action – particularly when habitat threats or strategic conservation opportunities are pressing. However, spatial and temporal patterns in waterfowl populations are likely driven by processes of great relevance to conservation. Indeed, maintenance or restoration of processes underlying stable or increasing waterfowl populations are key to ensuring this landscape can sustain target population levels. If we do not know how the system we are trying to protect and manage functions, how can we know what conservation actions will most effectively maintain or restore ecological integrity?

At a basic level, answering "Why are they there?" means understanding the ecological needs of waterfowl and how different habitats are capable of meeting those needs at both individual and population levels. For example, abundance of waterfowl on a given wetland may be proportional to that wetland's productivity, so waterfowl hot spots may be "hot" because the region has a high density of productive wetlands. However, answering "Why are they there?" goes beyond just answering "Where are the most productive wetlands?" To be truly effective, we also need to understand what makes individual wetlands productive and also why productive wetlands are where they are on the landscape. Answering these related questions requires study of how wetland ecosystems work, and the boreal hydrological processes that affect the flow of water and nutrients through the landscape. As well, most species are reliant on upland habitats for nesting and these uplands may influence wetland productivity. These relationships also merit study.

We also need to recognize that mechanisms driving patterns of waterfowl populations may be highly variable across the diverse boreal landscape – both spatially and temporally – so deciding on the appropriate conservation action at the appropriate scale will be challenging. Currently, there is very little information on boreal wetland ecosystem function and how those ecosystems interact with surrounding uplands, and how these interactions affect waterfowl populations.

How might population distribution and abundance change in response to human activity?

Knowledge of waterfowl habitat requirements and the processes that maintain boreal wetland ecosystems allows us to better predict the degree to which human-influenced habitat change affects ecological integrity – hence waterfowl populations. Anthropogenic habitat change includes both direct effects, such as on-the-ground operations, and indirect effects such as

LEFT: BRIAN WOLITSKI WIGEON: MICHEL BLACHAS TOP: © GARTH LENZ TOP RIGHT: DUCKS UNLIMITED CANADA

climate change. Direct effects like building roads across wetlands, forest management and pipeline development can be dramatic, but we are only beginning to examine how these changes affect both the distribution and abundance of waterfowl and the flow of water and nutrients across various landscapes.

Indirect effects may be more subtle. For example, evidence from Alaska and Siberia (Smith et al. 2005) shows long-term declines in wetland surface area that appear to be linked to climate-induced changes in permafrost. The extent of this drying trend – particularly in the Canadian boreal forest – is unknown, but the implications are clear: areas subject to the greatest increase in temperatures will likely have the greatest wetland loss, and have the most impact on waterfowl populations. However, this basic hypothesis needs to be tested.

What can be done to minimize that change?

Core concepts behind minimizing the impacts of anthropogenic change include retention and restoration of upland and wetland habitats. Both require knowledge of how boreal ecosystems work so that we can design conservation activities with clearly defined goals for ecosystem function, and hence effective habitat legacies.

The process of minimizing impacts has many information needs. First, we must understand which key habitats are most at risk or most sensitive to anthropogenic change, and where those habitats are on the landscape. This knowledge is essential for targeting conservation action on the most critical locations.

Next, we need to determine the best form of conservation for different parts of the boreal. Some areas should simply be protected from industrial activity, while we must help ensure those activities are

environmentally sustainable in others. The latter actions includes helping industry develop beneficial management practices (BMPs) that maintain ecological function of boreal habitats and still fit into operational planning and activity. Developing BMPs likely requires experimental research that evaluates options for wetland ecosystem and waterfowl response across a variety of ecological or hydrological conditions.

BMPs mainly apply to direct anthropogenic effects. Indirect effects pose far greater challenges because the causes of climate change and the solutions to reverse temperature trends are global issues. However, conservation activities might be guided by bet hedging philosophy, which includes identifying waterfowl hot spots that might be most resistant to climate change, and prioritizing protection of these areas above regions more likely to be affected. Such a priority-setting process requires a far better understanding of wetland susceptibility to climate change than we now have.

Species of Special Concern

Of particular concern is that the boreal forest is the primary breeding grounds for scaup, scoters and wigeon, species whose continental or regional populations are declining rapidly (Wilkins et al. 2005, Slattery unpub. analyses). The reasons for these declines are largely unknown, but evidence for scaup and scoter species suggests that important factors may be acting on boreal breeding grounds. Much research is needed on factors affecting demographic rates of these waterfowl before effective conservation action can be undertaken.

Proceeding in the face of uncertainty – the Adaptive Management approach

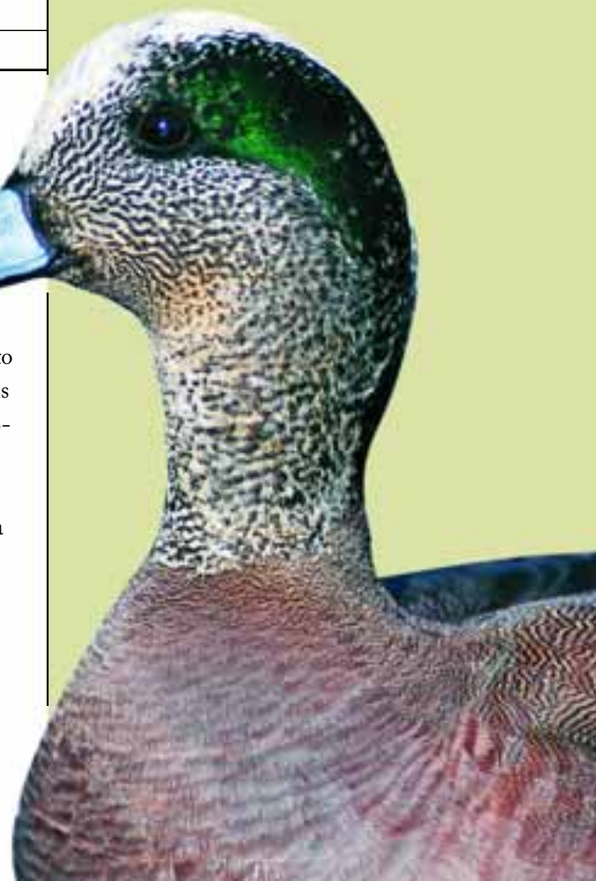
Clearly, the list of information needs for conserving boreal habitat is long, and changes to this landscape are occurring more rapidly than gaps are being filled. Conservation must therefore proceed in the face of uncertainty using an adaptive management (AM) approach. AM is the philosophy of learning while doing, developing management action based on current understanding but treating the deployment of that action as a scientific experiment designed to reduce key uncertainties. This approach includes clearly defined predictions, and measures of success. Although AM has relevance for gauging success of protected areas, the approach is also well suited for evaluating the long-term efficacy of BMPs.

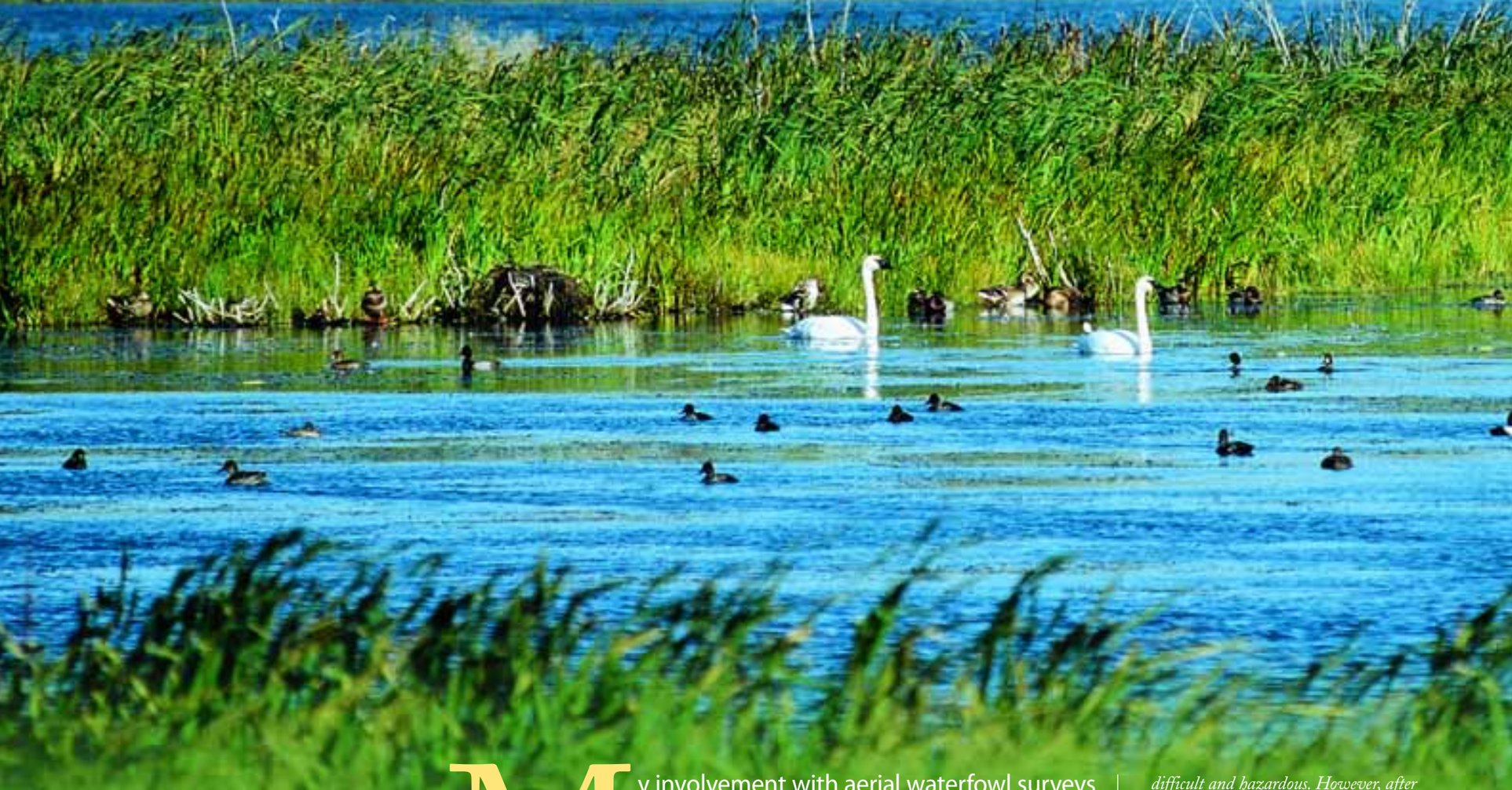
General Conclusions

Ultimately, maintaining the ability of the boreal landscape to sustain waterfowl in perpetuity requires information to make sound decisions. This information need ranges from simply identifying and prioritizing areas for conservation action, to evaluating the efficacy of those actions within a complex ecological and socio-economic landscape.

It's a challenging task, but achievable if we proceed with common goals and a spirit of collaboration.

Of particular concern to researchers is that the boreal forest is the primary breeding grounds for scaup (above), scoters and American wigeon (below), all species whose continental or regional populations are declining rapidly.





THE BUSH: SURVEYING THE BOREAL

BY ARTHUR BRAZDA

My involvement with aerial waterfowl surveys in the boreal forest of Canada began in 1962. Actually, the first year consisted of "on the job" learning experience, covering northern Ontario and comparative regions in Manitoba and Saskatchewan. About 10 years later, the Ontario portion was assigned to another crew and aerial coverage was increased in both Manitoba and Saskatchewan. My survey activities as an aerial survey crew leader in boreal Canada were terminated in 1995 when I retired after working 33 years, plus two previous years in central Alaska.

Years ago I contributed a written piece in the book titled *Flyways*, where I outlined my views on the importance of this northern duck factory. In reviewing this story it seems appropriate to share some of my thoughts of over 20 years ago:

"For many years this boreal region, comprising approximately 400,000 to 500,000 square miles in northern Alberta, Saskatchewan, Manitoba and Ontario was not given proper recognition as waterfowl habitat. Prairie survey crews scoffed at the data and the efforts of personnel operating in the bush, often suggesting that the area was second-rate. Granted, there was neither power nor section lines to guide northern survey crews – and at times the weather made operations somewhat difficult and hazardous. However, after a change in viewpoint and adjustments in investigative procedures, it soon became apparent that herein lies the motherlode."

My assessment of the waterfowl habitat in the boreal forest has always been very high, possibly on the extreme side. This could be because I spent so many years surveying much of the region and was able to get to know and appreciate this huge area better that most waterfowl people. Regardless, "the bush" is a great piece of waterfowl real estate.

During the winter of 1962-63, an analysis of my notes and the aerial data indicated the importance of this vast area to the waterfowl of North America. As time passed, additional data confirmed this importance. To me, the bush was the Number 1 duck factory. To be sure, when

LEFT: BRIAN WOLITSKI RIGHT: © GARTH LENZ GOLDENEYE: DUCKS UNLIMITED CANADA

the prairies are in a wet cycle, waterfowl populations explode, especially those of ducks, but every three to five years when this same prairie region enters a drought period, the bottom drops out of duck numbers.

Indications are that boreal duck populations help revitalize duck numbers on the prairies when habitat conditions improve after a drought; however, some banding data, especially for mallards in the Thompson (Manitoba) area, suggest that certain of these areas support separate entities. This suggestion is supported by aerial survey data that indicate little or no change during a prairie drought cycle. In addition, banding data from the boreal in Manitoba show no migration for some waterfowl until late in the season with almost no banding returns north of the state of Missouri. These data reflect a very late exodus for some waterfowl from the breeding grounds when the hunting seasons on the prairies and the northern tier of states are closed. Much of the habitat in this northern region is associated with extensive river systems and because these river systems stay ice-free later than still-water habitat, a delayed migration probably occurs. In a discussion at the Delta Research Centre in Portage la Prairie, Manitoba, in the mid-1970s, Pete Ward mentioned observing a substantial migration primarily of mallards during several different years. This movement took place after all the local waterfowl had departed.

Just as on the prairies, high water levels in the boreal are not the most desirable habitat conditions for optimum duck production. Most desirable is something in between with high quality and quantity shoreline vegetation or grassy meadows. In contrast to the prairies, low water levels in the boreal do not encourage agricultural activities down to the shoreline and consequently provide good production. On the other hand, very low water levels for an extended period dry the forest out and increase the chance for massive habitat destruction through forest fires. There have been single summer seasons when several million acres of forest have been lost throughout the boreal forest. Three- to four-year periods of drought on the prairie can mean significant duck production loss for the entire area. This situation will probably not occur in the boreal forest, and it can be "business as usual" in a year or two.

During the 33 years that I flew surveys in the north, several proposals were made suggesting how we might enhance our knowledge about waterfowl in the bush. These proposals centred on increased banding and experimental aerial surveys beyond or north of the present survey boundaries. Increased banding was then accomplished to some degree, but the opportunity to do additional aerial surveys did not exist. A lack of funds, qualified personnel and the ever-present short time frame did not allow additional surveys. Seventeen new banding sites were selected throughout northern Alberta, Saskatchewan and Manitoba. Of these, six became operational at one time or another and two are presently annual projects. The long-term success of many of the sites was unknown, but they had potential, and regardless, the information obtained would have added to our waterfowl knowledge of the bush.

In the essay that I wrote over 20 years ago I made mention of the many changes that I had observed. This included the increased number of roads being built into remote regions, mainly to service the developing mining industry. Massive hydroelectric projects had been built and crews exploring for oil and other minerals seem to be everywhere, making me wonder at the time about what the future holds for wildlife. These activities still continue today.

As waterfowl habitat on the prairies continues to diminish, the bush becomes even more important. If left to its own devices, bush habitat is quite stable and probably only man's harassment can alter that. The time to consider the welfare of the bush in a positive light is now, while much of the higher quality habitat still remains. There have been environmental or waterfowl habitat losses in the past, but perhaps future destruction can be mitigated. The concern is not to stop progress but to see that the development is orderly with proper consideration for the future. It is my belief that we must make every possible effort as soon as possible to at least maintain the status quo of the waterfowl habitat or all wildlife habitat. Before any activity takes place that could affect the boreal forest, especially waterfowl habitat, there should be strong representation from responsible agencies such as DUC, CWS, USFWS, Delta Waterfowl, Wildlife Federation, Nature Conservancy and others. Further, the public should become aware of these issues, to keep all proposals "above board."

Aerial waterfowl surveys are often the only way to gauge populations across the vast and remote boreal forest.

As waterfowl habitat on the prairies continues to diminish, the bush becomes even more important. The time to consider the welfare of the bush in a positive light is now, while much of the higher quality habitat still remains.

Art Brazda retired in 1995 from the U.S. Fish and Wildlife Service after a career of more than 30 years as a flyway biologist surveying and banding waterfowl throughout the western boreal forest. Besides the northern forest, Art's illustrious career included working in North Dakota and central Alaska, and surveying wintering waterfowl along the Gulf coast of Mexico. After his retirement, Art remained close to the waterfowl scene by supervising a Central Flyway waterfowl banding project for six years. Art and wife Jean reside in Carencro, Louisiana.

PEOPLE OF THE BOREAL

by Eric Butterworth

Aboriginal and First Nations communities across North America's boreal forest have a long history of interactions with waterfowl. Not only are the forest's rivers, lakes and wetlands relied upon for their transportation, they are important places for cultural activities, sustenance and spiritual renewal.

Historically, waterfowl had many uses for aboriginal communities, providing meat, eggs, waterproof bags and feathers. In many northern communities, the first fresh meat in the spring was provided by the waterfowl returning to their spring breeding grounds in the boreal forest or the Arctic. While activities around waterfowl hunting or egg collection was widespread over traditional lands, areas such as the Mackenzie River Delta, the Peace-Athabasca River Delta, the Saskatchewan River Delta and the Quebec North Shore have long been major sites for aboriginal waterfowl hunting. The Migratory Bird Act was a major concern to aboriginal communities when they found out they could not hunt waterfowl or collect their eggs outside of the hunting season.

However, as of October 1999, the Migratory Bird Act was amended to allow aboriginal communities to collect water-

STAGG RIVER: NORTHERN WATERFOWLERS' UTOPIA

by Dave Kay

Pellets of snow sting angrily against your face as your lonely rock island is consumed by the advancing squall. Your sanity in question, you promise another half hour to the brown dog at your feet, now hopefully scanning the sky out front. As you hunker into the old duck coat for warmth, the sudden jet-wash of wings on wind makes comfort irrelevant. *Ringnecks*, you confirm, as you catch the small swarm rocketing downwind.

The cold now forgotten, you squint into the gloom with renewed interest. The next flock is in and gone before you can react, their determined flight punching through the wall of white. They weren't satisfied, however and begin a long curving sideslip back toward your blocks. As you confront them, the tight mob flings apart, a dozen chunks of feathered shrapnel. Two muffled shots confirm their mistake. As you coax the pudgy heft from the mouth of your dog, you are drawn to its simple beauty: the porcelain

Historically, waterfowl had many uses for aboriginal communities, providing meat, eggs, waterproof bags and feathers.

fowl and eggs at any time of the year.

Today, subsistence hunting is still a major way of life for many communities in the North. Hunts are well organized and of cultural and spiritual significance. In the Hudson Bay Lowlands, hunting Canada geese in the spring is an important annual event. Indeed, it is of such significance to the traditional lifestyle is depicted through the small tamarack goose sold to tourists is a replica of the traditional lifelike tamarack goose decoys used by the Cree during their goose hunt. This hunt is an important part of the local heritage where young hunters are trained and often keep the head of their first kill and decorate it with beads as a memento of the occasion.

Because of its vast size and remoteness, as conservation efforts continue with a northern boreal focus, one of the most rapidly growing needs is the collection and documentation of traditional knowledge from the people who have lived off this land for millennia. For example, the collection of eggs was an important event for the Innu of Labrador, whose elders refer to waterfowl as humans. They knew, for example, where the goldeneye nests, for "they do not nest in the marshes". In the Northwest Territories' Mackenzie Valley, the Gwich'in are concerned over the recent decline in scoters, both *Njaa* (the white-winged scoter) and *Deetree'aa* (the surf scoter). They knew the *Deetree'aa* tasted fishy in the spring and so preferred to hunt the *Njaa* in the spring and the *Deetree'aa* later in the season. They still collect and save down to fill pants and parkas.

Waterfowl are an important food source and the traditional knowledge is of cultural importance to pass on from their ancestors to their children.

Subsistence hunting is still a major way of life for many communities in the North.

LEFT: © GARTH LENZ BELOW LEFT: TYE GREGG RIGHT: ANDREW MCLACHLAN

sheen of its smartly ringed bill and the abrupt peak of its purple black head. The piercing yellow of the feral eyes embody the boreal wild from which it was born.

The remote north arm of Great Slave Lake in the Northwest Territories contains numerous shallow bays and marshes that attract thousands of staging waterfowl. To the residents of Yellowknife this is northern pike country, with few venturing into this part of the world once autumn strokes its red and gold on the drunken forest of twisted spruce. Renowned for its rugged inaccessibility, thousands of rocky islets and shoals make navigation of its waters difficult at best. Weather is unpredictable, often extreme, and there are no services along its 100-kilometre length between Yellowknife and Rae-Edzo. Although several key staging areas are scattered along the shoreline here, most are inaccessible by road.

One such staging area occurs about 80 kilometres west of Yellowknife. Here, an extensive marsh has formed in a large protected bay where the Stagg River enters Great Slave Lake. Thousands of northern dabbling ducks begin staging here in late summer, prior to the annual migration south. This area is one of only three sites in the Northwest Territories chosen as part of the USFWS pre-season banding campaign, testament to its importance to waterfowl. Several thousand ducks are banded here annually, mostly mallard, green-winged teal and northern pintail.

Water levels can fluctuate frequently here, due to wind generated seiches. Starting with an amiable paddle down the kilometre or so of river south of the highway, your plans suddenly change when the channel ends at a wall of marsh, as far as the eye can see. Looking deceptively like no more than a wet meadow to drag your canoe across, most days you are quickly proven otherwise, with a grueling crawl through another kilometre of boot-sucking mud and metre-high horsetail. The Stagg is truly not for the uncommitted. To some however, the rewards are worth the price of admission. Howling wolves and spectacular displays of northern lights are the standard nights entertainment. Endless swarms of northern ducks complete the agenda, making a trip to the Stagg a wildfowling adventure in every sense of the term.

THE SASKATCHEWAN RIVER DELTA: THE TRADITION CONTINUES

BY CHRIS SMITH

The hunting heritage in Manitoba is well documented with accounts and images of places like Delta Marsh, Oak Hammock Marsh and the Minnedosa potholes. Not so well known – but equally historic – are northern destinations that have a hunting heritage every bit as good as their southern counterparts.

One such destination of unparalleled hunting opportunities is the great boreal delta of the Saskatchewan River that surrounds the community of The Pas in Manitoba. These wetlands, which include areas like Saskeram, Reader, Beverly and Kelsey, are home to tens of thousands of breeding waterfowl annually – as well as millions of staging waterfowl during the spring and fall migration.

The hunting value of this area dates back before sport hunting times, when Swampy Cree hunters pursued waterfowl for food in the spring and the fall. Spring hunting took place when the waterfowl returned to breed, and often coincided with the final weeks of spring muskrat trapping. These early migrants provided local aboriginal trappers and their families with fresh fowl to complement the muskrat meat. Concurrent with spring hunting, the annual tradition of collecting duck eggs, as well as the eggs of other water birds such as American coots, provided an additional and nutritious food source.

The hunt was then repeated in the fall, when concentrations of staging waterfowl would provide a plentiful food supply.

But harvesting waterfowl meant more than food for the Swampy Cree. Waterfowl provided an abundance of down and feathers used for bedding and winter clothing so critical during the cold winter in the boreal forest. So it is no surprise that goose-calling is such a popular event at the annual Northern Manitoba Trappers Festival held in The Pas each February.

It's difficult to know exactly when sport hunting became popular, but annual fall hunting excursions to the marshes surrounding The Pas have a long tradition. The non-aboriginal sport hunting fraternity was well aware of the importance of the marshes in the Saskatchewan River Delta at least as far back as the 1930s. Local resident Fred White, now 78, recalls having a field handbook as a youngster published by a prominent sportsmen's

CANADA'S EASTERN BOREAL: A HUNTING HERITAGE

BY MARCEL DARVEAU

When European settlers arrived in eastern Canada, they were surprised that hunting was open to all. Where they came from hunting was reserved for aristocrats. The enthusiasm for sport hunting and respect for subsistence hunting was hatched, and became a part of Canada's heritage.

Records suggest that the first sportsman to hunt waterfowl in Nouvelle-France was Robert Giffard. In 1627, he operated a hunting blind at the mouth of the Ruisseau de l'Ours along the St. Lawrence River east of Québec City. Migratory ducks and geese, likely from the boreal, were apparently abundant along the St. Lawrence at that time.

In 1646, James Lemoyne established the first hunting area around Île-aux-Grues and Île-aux-Oies. It is not clear which of the greater snow goose or the Canada goose was the most abundant species hunted during those early years. Although the legal status of this area has changed since that time, it is still a historic hunting place – helped over the years by the habitat conservation efforts of organizations, including Ducks Unlimited Canada.

Hunting was unregulated in Upper and Lower Canada until 1845. But from that year forward, the government prohibited waterfowl hunting during spring and summer. In 1876, the regulations became a bit more restrictive by extending the no-hunting period from May 1 to September 1 (May 15 to September 1 east and west of Trois-Rivières). Interestingly, hunting for subsistence was permitted year-long in the area located east of the Brandy Pot Island, an area that now corresponds to the estuary and the Gulf of St. Lawrence, and in the Atlantic provinces.

As well as hunting, the harvest of duck eggs from the breeding colonies on the Gulf of St. Lawrence, and along the coasts of the Atlantic provinces, became a traditional activity for the subsistence of local communities in the 17th and 18th centuries. Local people had learned to harvest the eggs without destroying the colonies and apparently duck populations did not suffer because of the harvest. In the 1840s, the activity became unruly and destructive, leaving many colonies plundered by egg-gatherers, and by 1870 there were so many problems that the governments prohibited egg harvesting. Nevertheless, egg harvest by local communities persisted, at least in parts of the Gulf of St. Lawrence. Fortunately, organizations like the Québec-Labrador Foundation now work with local communities to develop sustainable harvest practices.

magazine that highlighted the Saskeram Marsh as an area of importance to waterfowl. He remembers his father taking American hunters to the Pasquia Marshes southwest of The Pas to hunt in the 1940s and recalls that waterfowl, mostly ducks, "were very plentiful" and they would "bag a lot of mallards." These mallards often had crops full of barley from feeding in the small grain fields that dotted the banks of the Carrot River west of town. The Pasquia Marshes no longer exist due to agricultural expansion, but this farming area remains a prime destination for many hunters in pursuit of mallards and Canada geese. As a young man in the 1950s, White remembers hunting the famous Saskeram Marsh and hiding behind old rock blinds built by aboriginal hunters in pursuit of the white-fronted geese that frequent the exposed mud flats during fall migration.

Reader and Root lakes north of The Pas have long been considered a prime hunting destination. These deeper, more permanent wetlands provide optimum fall staging habitat for large numbers of diving ducks. The attraction to this area was to hunt bluebills, canvasbacks and redheads, though hunters regularly reported a good "mixed bag," particularly early in the season. Waterfowl outfitting in this area dates back some 70 years, and although it was known primarily for duck hunting, there were many years when Reader Lake and adjoining marshes had low water and exposed mud flats, attracting respectable numbers of geese.

From the 1940s through to the 1990s, Ducks Unlimited Canada undertook numerous wetland conservation projects in the area. These developments certainly contributed to profiling these significant wetlands as a prime waterfowl habitat. An increasing popularity of the area as a hunting destination evolved over time. Many hunters have developed a strong attachment to the area and have made lifelong friends, returning year after year, and often with their children and grandchildren.

Today, several local outfitters provide their clients with quality waterfowl hunting in Reader Lake, Saskeram and other great destinations throughout the Saskatchewan River Delta, helping to ensure that this truly boreal hunting heritage continues into the future.

Waterfowl outfitting in the Saskatchewan River Delta region dates back some 70 years.

LEFT (2): DARIN LANGHORST RIGHT: DUCKS UNLIMITED CANADA

INTRODUCTION TO THE SPECIES ACCOUNTS

BY GLENN MACK

***The boreal forest is comprised of** vast areas of valuable wetland and upland habitat for great numbers of North America's breeding, nesting, brood-rearing, moulting and staging waterfowl (ducks, geese and swans). These secluded boreal habitats are important to many waterfowl species and absolutely crucial to others.*

As indicated throughout this book, heightened industrial activity in the boreal could pose serious threats to habitat. Therefore, it should be of no surprise that there has been an increased focus on boreal conservation. Most waterfowl professionals agree that maintaining boreal forest habitat is crucial to waterfowl populations; however, many politicians, industrial leaders and the general public – including waterfowl hunters – do not automatically link a healthy boreal forest to healthy waterfowl populations. This book will attempt to establish that link by highlighting the importance of North America's boreal forest to individual waterfowl species.

The species accounts are summarized as individual essays on the life history and conservation status for the 33 North American waterfowl species that depend on the boreal forest during at least one stage of their annual cycle. The list of species was determined from several sources: DUC's western boreal program survey data (unpublished data), the Canadian Wildlife Service (CWS) and United States Fish & Wildlife Service (USFWS) banding data (1924-2002), Bellrose (1980) and Golden (1983).

The accounts are listed by group (ducks, geese, swans) and in alphabetical order. The English, French and scientific names (genus, species) are also provided for each.

Purpose and content of the accounts

Species accounts included in this book are not intended to replace the more detailed accounts in other documents (like the *Birds of North America* series and the provincial breeding bird atlas). Our intention with this publication is to shine a light on the boreal forest to raise awareness about the importance of this region to continental waterfowl populations, including during the often-overlooked moulting and migration periods. Each account provides descriptive information and follows the same template including a synopsis of identification characteristics, habitat, diet/feeding behaviour, breeding and migration patterns. When possible, the current state of knowledge regarding population levels and the conservation challenges that exist in this vast landscape are also included. For the purpose of this book, occasional and rare visitors to the boreal were not included.

Of the 33 waterfowl species covered in this book, 26 are ducks, five are geese and two are swans. While most of the species here use boreal forest habitat extensively, they all use the boreal forest habitats for at least a portion of their annual cycle. The take-home message for our audience is that these species would have a difficult time surviving without the habitat of the boreal forest.

Sources of information

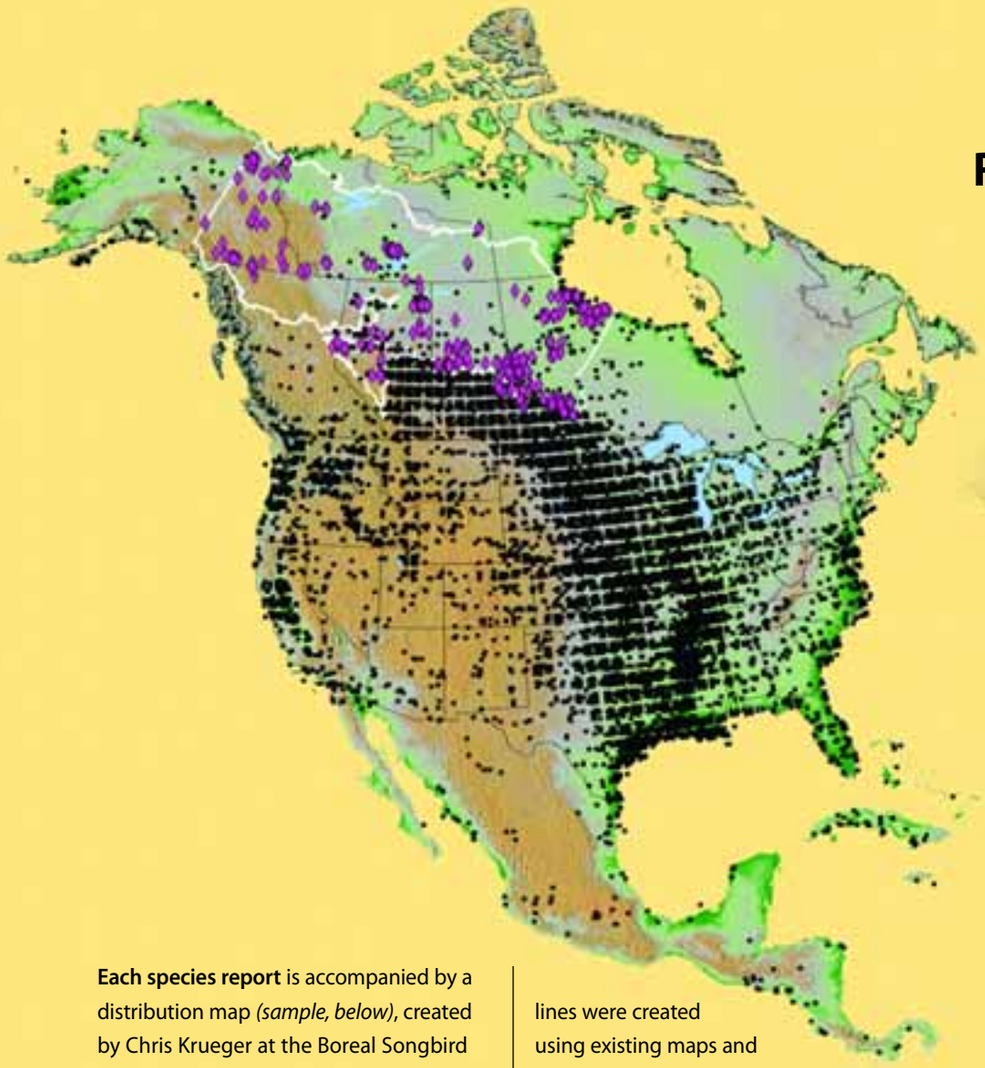
The species reports are summaries of information from two main sources: Bellrose (1980) and the respective *Birds of North America* account. Additional sources were used but because of the paucity of peer-reviewed information (especially boreal-related), authors also relied on existing field guides, websites, unpublished reports and personal communications to provide the most up-to-date information possible.

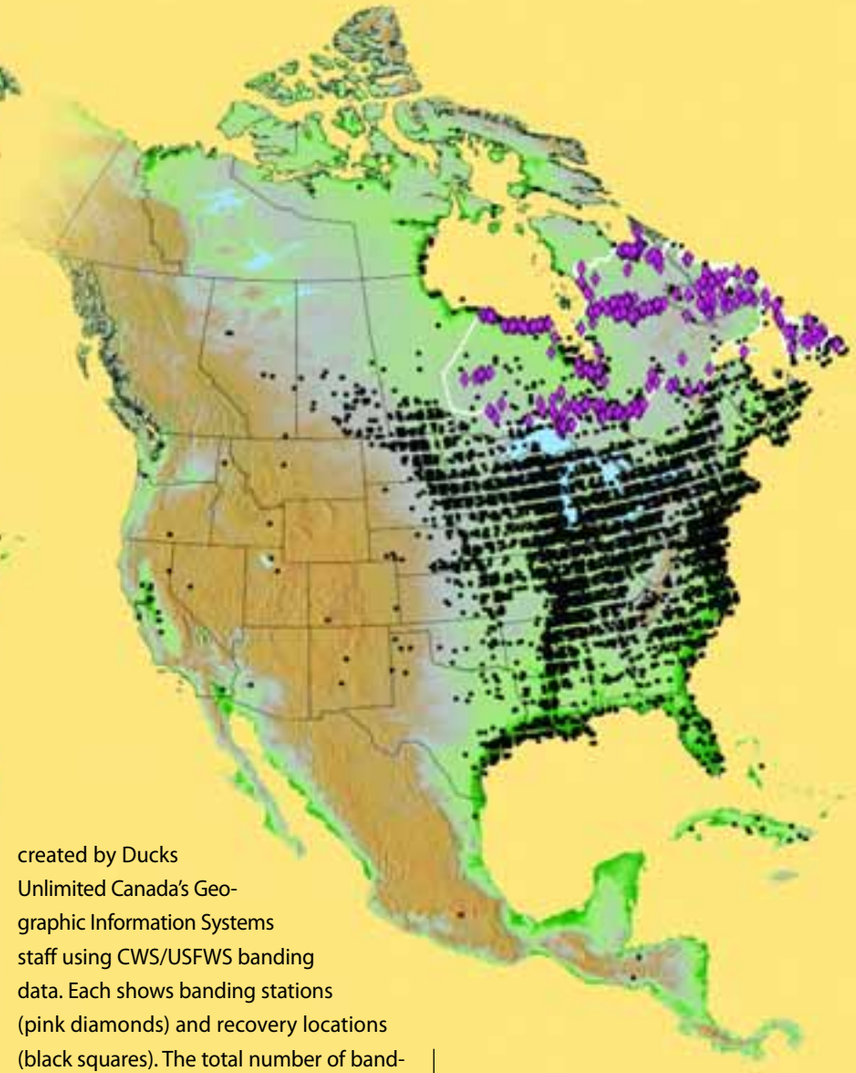
When applicable, we also referenced Ducks Unlimited Canada's unpublished survey data. All references are provided alphabetically by author and catagorized by species in the bibliography.

This book will attempt to establish a link by highlighting the importance of North America's boreal forest to specific waterfowl species.

LEFT: BRIAN WOLITSKI WIGEON: DUCKS UNLIMITED CANADA

RANGE AND BAND RETURN MAPS





Each species report is accompanied by a distribution map *(sample, below)*, created by Chris Krueger at the Boreal Songbird Initiative. Breeding (pink), wintering (green) and year-round ranges (orange) are presented for each species. Red arrows that appear on some maps indicate primary migration routes between breeding and wintering grounds. Because of the boreal forest's size and remoteness, boundary lines were created using existing maps and discussions with experts. Furthermore, due to spatial distribution and temporal changes in habitat conditions, it is important to remember range boundaries can not be considered concrete.

The other maps in this section are band return maps *(sample, below)*, which were created by Ducks Unlimited Canada's Geographic Information Systems staff using CWS/USFWS banding data. Each shows banding stations (pink diamonds) and recovery locations (black squares). The total number of banded and recovered birds is provided beneath each map. These maps are only provided for species with over 100 band returns.

The maps on this page *(above left is the western boreal forest; above right is the eastern boreal)* show all banding stations in their respective region, along with where all waterfowl species banded at these sites were recovered. These maps should be used only to get an idea of what species are banded in the boreal and where they are recovered, and not for the total number of birds that use the boreal forest.

Table 1 *(right)* provides a list of all waterfowl species banded in the boreal forest, the number of individuals banded and recovered, and where (states/provinces) they have been recovered.

species	bands (total boreal forest)	recoveries (total boreal forest)	bands	recoveries	recovery locations (western boreal forest)	bands	recoveries	recovery locations (eastern boreal forest)
American black duck	19,503	2,900	264	46	AL,AR,IL,KY,LA,MI,MB,MO,MS,NJ,OH,ON,PA,SK,TN,WI	19,239	2,854	AL,AR,CT,DE,FL,GA,IA,IL,IN,KY,LA,MA,MB,MD,ME,MI,MN,MO,MS,NB,NC,NH,NJ,NL,NS,NY,OH,ON,PA,PE,QC,RI,SC,SK,TN,TX,VA,VT,WI,WV
American wigeon	4,379	512	3,458	382	AB,AK,AL,AR,AZ,BC,CA,CO,FL,GA,IA,ID,IL,IN,KS,KY,LA,MI,MB,MN,MO,MS,MT,NC,ND,NE,NT,NV,NY,OK,ON,OR,SC,SD,SK,TN,TX,UT,VA,WA,WI,WY,YT	921	130	AB,AK,BC,BC,CA,CO,ID,IL,KY,MI,MB,MN,MT,NC,ND,NE,OH,ON,OR,SK,UT,WA,WI,WY
Barrow's goldeneye	2,598	56	2,585	54	AK	13	2	QC,NB
black scoter	-	-	-	-	-	-	-	-
blue-winged teal	23,669	1,022	20,818	847	AB,AL,AR,CA,CO,FL,IA,IL,IN,KS,KY,LA,MI,MB,MN,MO,MS,MT,NC,ND,NE,NS,NT,NY,OH,OK,ON,PA,QC,SC,SD,SK,TN,TX,WI,WV	2,851	175	AR,CT,DE,FL,GA,IA,IL,IN,LA,MA,MD,MI,MS,NC,NH,NL,NY,OH,ON,PA,SC,VT,WI
bufflehead	977	99	977	99	CA,KS,MD,MB,MN,MT,NE,NT,NY,OH,OK,ON,OR,QC,QC,SC,SK,VA,WA,WI,WV	-	-	-
canvasback	583	89	579	89	BC,CA,IA,ID,IL,IN,KS,LA,MD,MI,MB,MN,MO,MS,ND,NT,NY,ON,OR,SD,SK,TN,TX,VA,WI	4	-	-
common goldeneye	1,742	157	1,470	121	AB,AK,BC,BC,CA,CO,ID,IL,KY,MI,MB,MN,MT,NC,ND,NE,OH,ON,OR,SK,UT,WA,WI,WY	272	36	AR,MB,MD,ND,NY,ON,QC,WI
common merganser	13	-	3	-	-	10	-	-
gadwall	222	33	207	30	AB,AL,AR,FL,IL,KS,LA,MB,ND,OK,PA,SC,SD,SK,TN,TX,WY	15	3	FL,SC
greater scaup	461	31	449	30	LA,MD,MI,MB,MN,MS,NJ,NY,QC,VT	12	1	NS
green-winged teal	33,251	2,350	24,054	1,453	AB,AK,AL,AR,AZ,BC,BC,CA,CO,DE,FL,GA,IA,ID,IL,IN,KS,KY,LA,MB,MN,MO,MS,MT,ND,NE,NM,NT,NV,NY,OH,OK,OR,SC,SD,SK,TN,TX,UT,WA,WI,WY,YT	9,197	897	AL,AR,AZ,CA,CT,DE,FL,GA,IA,IL,IN,KS,LA,MA,MD,ME,MI,MN,MO,MS,NB,NC,ND,NE,NL,NJ,NS,NV,NY,OH,OK,ON,PA,PE,QC,SC,SD,TN,TX,VA,VT,WI
harlequin duck	307	6	-	-	-	307	6	NL
hooded merganser	100	10	2	-	-	98	10	AL,FL,GA,LA,NC,ON,SC
lesser scaup	15,834	1,300	15,781	1,289	AB,AK,AL,AR,AZ,BC,CA,CO,CT,FL,GA,IA,ID,IL,IN,KS,KY,LA,MD,ME,MI,MB,MN,MO,MS,MT,NC,ND,NE,NT,NV,NY,OH,OK,ON,OR,PA,QC,SC,SD,SK,TN,TX,UT,VA,WA,WI,WV	53	11	FL,NY,ON,QC,VA
long-tailed duck	463	12	462	12	MB,NY	1	-	-
mallard	161,668	24,298	137,776	20,575	AB,AK,AL,AR,AZ,BC,CA,CO,DE,FL,GA,IA,ID,IL,IN,KS,KY,LA,MA,MD,MI,MB,MN,MO,MS,MT,NB,NC,ND,NE,NJ,NL,NM,NS,NT,NU,NV,NY,OH,OK,ON,OR,PA,PE,QC,SC,SD,SK,TN,TX,UT,VA,VT,WA,WI,WV,WY,YT	23,892	3,723	AB,AL,AR,CA,CT,DE,FL,GA,IA,ID,IL,IN,KY,LA,MA,MB,MD,ME,MI,MN,MO,MS,NC,ND,NE,NJ,NL,NM,NY,OH,OK,ON,OR,PA,PE,QC,SC,SD,SK,TN,TX,VA,VT,WI,WV
northern pintail	64,492	5,197	61,597	4,873	AB,AK,AL,AR,AZ,BC,CA,CO,FL,IA,ID,IL,IN,KS,KY,LA,MD,MI,MB,MN,MO,MS,MT,NC,ND,NE,NM,NT,NU,NV,NY,OH,OK,ON,OR,PA,QC,SC,SD,SK,TN,TX,UT,WA,WI,WY	2,895	324	AR,CA,CT,DE,FL,IA,IL,LA,MB,MD,MI,MN,MO,NB,NC,ND,NE,NJ,NL,NS,NY,OH,ON,PA,PE,QC,SC,SD,TN,TX,UT,VA,VT,WA,WI
northern shoveler	622	58	561	46	AB,AR,CA,FL,IL,KS,LA,MI,MB,MS,NB,ND,NE,NM,SK,TX,UT	61	12	AR,IL,MI,ON,PA
red-breasted merganser	15	-	7	-	-	8	-	-
redhead	1,448	186	1,443	185	AB,AL,AR,CA,CO,DE,FL,IA,IL,IN,KS,LA,MD,MI,MB,MN,MO,MS,MT,ND,NE,NM,NY,OH,ON,OR,PA,SD,SK,TX,WI	5	1	QC
ring-necked duck	1,828	252	744	95	AB,AR,CA,FL,IA,IL,IN,KS,LA,MB,MN,MO,MS,NC,ND,NT,OK,ON,SC,SD,SK,TN,TX,WI	1,084	157	AL,AR,FL,GA,IL,IN,KS,LA,MI,MN,NC,NL,NS,NY,OH,ON,PA,QC,SC,TN,TX,VA,VT,WI
ruddy duck	70	3	69	2	CA,UT	1	1	ON
surf scoter	65	-	65	-	-	-	-	-
white-winged scoter	253	18	252	18	AK,CA,MB,NT,NY,VT	1	-	-
wood duck	618	91	14	2	LA,NE	604	89	AL,FL,GA,IL,LA,MA,MD,ME,MN,MS,NC,NY,ON,PA,QC,SC
brant	-	-	-	-	-	-	-	-
Canada goose	139,559	25,660	51,011	10,647	AB,AL,AR,BC,CA,CO,GA,IA,ID,IL,IN,KS,KY,LA,MA,MI,MB,MN,MO,MS,MT,NC,ND,NE,NM,NV,NY,OH,OK,ON,OR,PA,QC,SC,SD,SK,TN,TX,UT,VA,WA,WI,WV,WY	88,548	15,103	AB,AL,AR,CA,CO,CT,DE,IA,IL,IN,KS,KY,LA,MA,MB,MD,ME,MI,MN,MO,MS,MT,NB,NC,ND,NE,NH,NJ,NL,NM,NS,NU,NY,OH,OK,ON,OR,PA,PE,QC,RI,SC,SD,SK,TN,TX,UT,VA,VT,WI,WV
greater white-fronted goose	426	61	426	61	AB,AK,AR,KS,LA,MS,ND,NE,PA,SD,SK,TX	-	-	-
Ross' goose	791	70	712	67	AR,CA,CO,IA,IL,KY,LA,MB,MO,ND,NE,OK,OR,SD,SK,TX	79	3	CO,IA,MO
snow goose	171,140	22,441	139,313	18,135	AB,AL,AR,CA,CO,DE,GA,IA,IL,KS,KY,LA,MD,MI,MB,MN,MO,MS,MT,NB,NC,ND,NE,NJ,NM,NT,NU,NY,OH,OK,ON,QC,SD,SK,TN,TX,UT,WI,WY	31,827	4,306	AL,AB,AR,CA,IA,IL,IN,KS,KY,LA,MB,MI,MD,MN,MO,MS,ND,NE,NU,OH,OK,ON,PA,QC,SD,SK,TN,TX,WI
trumpeter swan	214	27	214	27	AB,ID,MT,NE,NT,NV,OR,SD,UT,WY	-	-	-
tundra swan	146	38	134	36	DE,MD,NT,PA,SK,WI	12	2	NC

American Black Duck

canard noir | *Anas rubripes*

The American black duck, or black duck as most people know it, breeds largely in the northeastern United States (Maine west to Michigan) and eastern Canada (Newfoundland west to Ontario and occasionally in northeastern Manitoba). Fifty per cent of the total black duck population breeds in the boreal forest of Québec and many of the black ducks banded here have been recovered throughout the eastern U.S. *(figure 1)*. The boreal forest also provides important moulting and staging habitat. Black ducks winter along the coastal areas of the northeastern states and south to Florida. Open water along the Great Lakes is also used during the winter.

The black duck is closely related to the mallard and the mottled duck. The male and female black ducks are similar in appearance except for the bill, which is greenish yellow on the male and a dull olive green to black on the hen. Compared to the mallard, black ducks have considerably darker brown bodies. The contrast between its light brown head and brown-black body is one visual cue for identification. Other key distinguishing traits are its lack of white bars on the wing above the iridescent blue speculum,

and the absence of white tail feathers, which the mallard exhibits.

Habitat

Black ducks choose a wide variety of wetlands for breeding, ranging from marine and estuarine systems on the east coast to beaver ponds and inland lakes in the boreal forest. For brood-rearing in the boreal forest, black ducks move from small to larger wetlands and to lakes. Black ducks winter on shallow coastal waters along the east coast as well as on marshes near agricultural fields.

Diet/Feeding Behaviour

Black ducks eat a wide variety of food and typically feed by dabbling at or just below the surface. They may also make shallow dives to feed on submerged plants. Black ducks eat mostly seeds, buds and tubers of aquatic plants and grains (mainly waste corn) during late fall and winter. They will also feed on mussels, snails and aquatic insects, particularly during winter when they frequent coastal wetlands, and for females during pre-laying and egg-laying stages.

Breeding

Pair bonds are established as early as September, but usually later in the year. Most black ducks arrive on breeding areas already paired. Males defend their mates from other black ducks to secure quality breeding habitat. They prefer to nest on the ground in wooded, bushy or grassy areas under overhanging vegetation that protects and conceals the nest. Females lay an average of nine greenish buff or creamy white eggs, which are incubated for an average of 26 days. Males will typically abandon the females during mid-incubation and move to larger lakes and wetlands to moult their feathers. Renesting attempts for black ducks are common if a nest is depredated or destroyed but fewer eggs are laid. Once hatched, the female will stay with her ducklings for 58 to 63 days until they are able to fly.

Migration/Winter Range

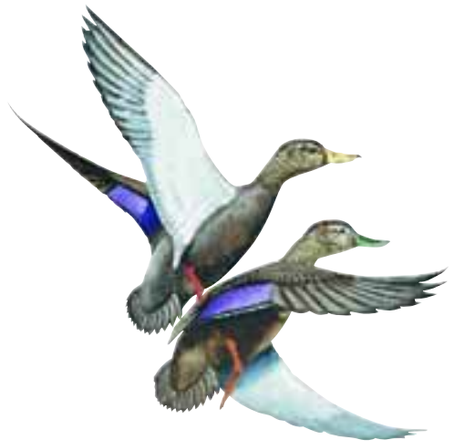
Three-quarters of black ducks migrate using the Atlantic Flyway, particularly a stretch along the coast from Florida to the Maritimes, while the other quarter uses the Mississippi Flyway. Moving short distances between their breeding and wintering grounds, many individuals have overlapping summer and winter ranges. Black ducks usually arrive on the southern breeding grounds in late March to early April, and late May on the northern breeding grounds in the boreal forests of Newfoundland and Labrador, Québec and Ontario. Typically most black ducks begin their fall migration in late September, arriving on the wintering grounds by mid-October. They have a tendency to return to the same wintering area annually.

DENIS FAUCHER (2)

Black ducks choose a wide variety of wetlands for breeding, ranging from marine and estuarine systems on the east coast to beaver ponds and inland lakes in the boreal forest.

Figure 1: Banding and recovery sites – American black duck (19,503 banded; 2,900 recovered)

Fifty per cent of the total black duck population breeds in the boreal forest of Québec.



American Wigeon

canard d'Amérique | *Anas americana*

The American wigeon (or baldpate) is well known for its bright plumage and high-pitched whistle. It is widely distributed, breeding from the coast of the Bering Sea, across the entire Canadian boreal forest to Newfoundland and south to the Prairies. Although many people think of the wigeon as a prairie duck, it is truly a boreal duck. Presently, more wigeon breed in the boreal forest than in the Canadian and U.S. prairies combined. The portion of the breeding population counted in the western boreal forest increased from 45 per cent in the 1950s to 61 per cent by 2005; however, the estimated breeding population in the traditional survey area remains well below the waterfowl population management goals everywhere except in Alaska.

The breeding male wigeon has a distinctive white crown, a vibrant green eye streak, and a bold white shoulder patch, all visible in flight. Females have brownish crowns, creamy white eye streaks, and reddish-brown flanks. Both sexes have rounded heads, a short blue-grey bill with a black tip, white underbellies (conspicuous in flight), and a dark speculum tinted with iridescent green. The male's slow three-note whistle is also diagnostic of the species.

Habitat

During the breeding season, wigeon use sluggish rivers, marshes and shallow ponds with exposed shorelines and submergent vegetation. These wetlands are often located adjacent to dry meadows or brushy areas that are suitable for nesting. Migrating wigeon rely on small and large lakes, quiet rivers, flooded fields and

DENIS FAUCHER

freshwater inlets where food is plentiful. Winter habitat includes freshwater lakes, rivers, marshes, sheltered marine estuaries and bays.

Diet/Feeding Behaviour

Wigeon are among the most herbivorous of dabbling ducks and their short narrow bill, similar in structure to that of geese, is well adapted for grazing. For the most part, they obtain leaves and roots of submerged vegetation by dabbling, tipping up or grazing. However, in deeper water they occasionally will steal food brought up by diving birds. Wigeon wait alertly for divers to resurface with vegetation, and either snap up whatever the diver drops, or snatch vegetation straight from the diver's bill. Wigeon are often observed feeding with canvasbacks, redheads, scaup and coots. They are sometimes even bold enough to steal from geese and muskrats. During the breeding season, the wigeon's diet is supplemented with aquatic invertebrates, like insects and mollusks, which are important for producing eggs and duckling growth. During migration and over winter they also graze on upland grasses, clovers and agricultural crops.

Breeding

Pairs begin to form late in the fall and most females are paired when they arrive on the wintering grounds. Competition for females is fierce, as the sex ratio of the population is heavily skewed towards males. Males use a number of group courtship displays and flights to attract females, intimidate other males and to obtain a mate, such as swimming with head thrust forward and wings pointed upwards. An unseemly courting ritual also used by other dabbler species is "the burp", in which the male emits a high-pitched vocalization while stiffening his upper head feathers and his body in an erect posture. Wigeon have strong pair bonds, but like many dabbler species, males occasionally break existing bonds or participate in forced copulation. The duration of wigeon pair bonds is variable but in many cases these last until the eggs hatch and rarely beyond this. Males will group with other post-breeding or unpaired birds to moult on larger wetlands.

Wigeon conceal their nests in dense leafy or shrubby upland cover, usually within 50 metres of water. The female lays nine to 12 eggs and incubates them for 25 days. Soon after eggs hatch, the female leads the ducklings to a nearby wetland to forage. There she attends to them and, unlike many other species, she does not allow other broods to join hers. If the habitat is appropriate, the female will moult on the rearing pond; otherwise, she will abandon her young, often before they can fly, in search of a suitable moulting area.

Migration/Winter Range

Most wigeon initiate fall migration in all four flyways in late August or early September. However, almost half of the population uses the Pacific Flyway with many of the wigeon banded in the boreal forest being recovered here as well *(figure 2)*. In fact, American wigeon are also the most abundant dabbling duck along coastal British Columbia. Winter habitat consists of marshes, rivers, lakes, coastal estuaries and agricultural areas along the Pacific coast south to Mexico, on the east coast from Connecticut south into the Caribbean and all throughout the south-central U.S. Wigeon migrate in mixed species flocks, often with gadwall and mallards. Most flocks contain about one hundred individuals; however, several flocks of 500 and even a few of over 3,000 birds have been observed on the Peace-Athabasca and the Saskatchewan River deltas.

Figure 2: Banding and recovery sites – American wigeon (4,379 banded; 512 recovered)

Although many people think of the wigeon as a prairie duck, in fact half of its breeding range lies within the boreal forest.

Barrow's Goldeneye

garrot d'Islande | *Bucephala islandica*

The Barrow's goldeneye is a medium-sized sea duck with a very limited breeding distribution. The western population of about 200,000 birds breeds in British Columbia, the Yukon and Alaska, while the eastern population of approximately 4,000 breeds in the St.Lawrence Estuary in Québec. More than 50 per cent of the breeding population is in the boreal forest. Like all sea ducks, Barrow's goldeneyes migrate to coastal habitats for the winter. Birds banded in the Yukon's boreal forest have been recovered in central and coastal Alaska during the winter *(see table, page 38)*, while others winter further south, along the Pacific and Atlantic coasts.

The Barrow's goldeneye is distinguished from the common goldeneye by body size, shape of the bill and head, as well as the shape of the white patch on the head. The male Barrow's goldeneye has a long and rounded crown with a white crescent-shaped patch in front of the eye, whereas the common goldeneye has a sloped crown and a round eye patch. The female is so similar to the common goldeneye (brown head, grey back, wings and tail, a white

The Barrow's goldeneye is a medium-sized sea duck with a very limited breeding distribution.

belly and breast, a yellow eye) that they can only be distinguished during the late winter and spring when the Barrow's bill is entirely yellow and the common goldeneye's is only yellow at the tip.

Habitat

In summer, Barrow's goldeneyes prefer small lakes and alkaline wetlands with open water, very little emergent vegetation, high invertebrate populations and an absence of fish. They also require forested stands with abundant cavities for nesting. In the west, they generally occur in boreal forests, aspen parklands, ponderosa-pine, subalpine stands, and closed coniferous forests. In the east, they breed in black spruce or balsam fir/white birch boreal forests, and seem to prefer small, high-elevation, lakes. During migration they use large inland lakes and rivers and in the winter they inhabit sheltered coastal areas, and ice-free interior lakes and rivers.

Diet/Feeding Behaviour

This species normally feeds by diving along shallow shorelines, but will occasionally dabble as well. Typical dives are one to three metres below the surface. Their diet is dependent on their location in fresh or salt water, and is made up of aquatic invertebrates, crustaceans, mollusks, and smaller amounts of seeds, green plant material, fish and fish eggs.

Breeding

Sexual maturity occurs in their second or third year. Like most waterfowl, courtship displays are initiated in the winter and are fairly complex – performed in groups of five to 20 birds and involving a series of head throws and leg kicks, mainly by the male. Pair bonds will normally remain intact, until the female has completed egg laying. The male will then leave the breeding area to moult.

The female lays an average of nine eggs in existing cavities of dead or dying trees, or in artificial nest boxes between two and 15 metres above the ground. Larger clutch sizes are usually an indication of nest parasitism. Incubation lasts for about 30 days, and like most cavity nesters, nest success is quite high. Renesting is rare, and only occurs when a nest has been destroyed during the very early stages of incubation About two days after hatching, when the young have had a chance to dry off, the female beckons the young to the ground. One by one, they jump out and follow her on the sometimes kilometre-long trek to water. The female is aggressive to other females and broods during brood rearing; however, brood amalgamation is common if a female abandons her brood before they are able to fly, at about 56 days.

Migration/Winter Range

Paired Barrow's goldeneyes are known to travel to their breeding grounds alone, while non-breeders and unpaired birds normally fly in small groups. Some non-breeding birds fly directly from the wintering areas to the moulting areas. Fall migration typically occurs later than other duck species. Most Barrow's goldeneye do not leave their staging areas until the freeze-up. Males normally arrive on their wintering grounds earlier than females and young-of-the-year birds. Western and eastern populations remain isolated from each other year-round.

More than 50 per cent of the Barrow's goldeneye population breeds within the boreal forest.

Female Barrow's goldeneye lay an average of nine eggs in existing cavities of dead or dying trees, or in artificial nest boxes between two and 15 metres above the ground. About two days after hatching, when the young have had a chance to dry off, the female beckons the young to the ground.

LEFT: DENIS FAUCHER RIGHT: BRIAN WOLITSKI

Black Scoter

macreuse noire | *Melanitta nigra*

The black scoter is one of North America's least known sea ducks, due in part to its very limited and remote distribution. It has two distinct populations: the eastern population breeds mostly in the boreal forests of Québec and Labrador, and the western population breeds on the tundra in Alaska. Both populations spend the winter along their respective coasts.

The male black scoter is completely black except for the large orange-yellow bulge at the base of its bill, and a grey fringe on the flight feathers. Female and immature black scoters are dark brown with light grey patches on the throat and cheeks, and a darkly capped head. Both sexes have dusky-coloured feet, unlike the surf and white-winged scoters, which have yellowish or pinkish feet.

Habitat

In the east, breeding black scoters prefer relatively shallow and small lakes with little emergent vegetation, and rocky substrates. They avoid large, deep lakes, and are associated with rivers only during the

LEFT: GILLES DAIGLE RIGHT: STUART SLATTERY

first few weeks of arrival. In Alaska, they use areas like sloughs, riverbanks and tundra wetlands. During migration and in the winter, black scoters occupy shallow marine waters. They forage over cobble or bedrock throughout most of their winter range, though a notable exception occurs in New Hampshire and Massachusetts where they more commonly forage on sandy beaches than rocky headlands.

The western population breeds on the tundra and taiga wetlands of Alaska, Yukon and Northwest Territories. Small lakes surrounded by dense shrubby cover are preferred sites for nesting.

Diet/Feeding Behaviour

The diet of the black scoter is about 90 per cent animal matter and 10 per cent vegetation. On the breeding grounds, they eat freshwater insects, larvae, fish eggs, mollusks, duckweed, pondweed and water milfoil. In winter, black scoters dive for mollusks and small crustaceans, usually in waters less than 10 metres deep. Under water, black scoters use their feet for propulsion and their wings as rudders. Because most prey items are small, they are swallowed whole while under water. The incredibly muscular gizzard crushes the shells.

Breeding

Little is known about the black scoter's breeding behaviour or specific habitat requirements. Researchers suspect that like other sea ducks, black scoters reach sexual maturity at two years of age. Courtship begins in spring on the wintering grounds. Males perform a variety of displays including bowing, tail snapping and forward rushing. These displays are often performed by groups of males, directed toward a solitary female. Shortly after the female selects her mate, the pair migrates to the breeding grounds together. Black scoters stay monogamous throughout the breeding season.

The female selects the nest site, often within 30 metres of the water's edge. Small lakes surrounded by dense shrubby cover are preferred. Nests begin as mere scrapes in the ground but are soon lined with grass and down. Once the female lays her clutch of eight to nine pale oval eggs, she begins incubation, which will last about 29 days. At this point, males leave the breeding grounds for coastal areas. Shortly after the ducklings hatch, they are led to water, where they are attended for seven to 21 days. Most females will abandon their precocial young before the young can fly, about 42 days. At this time, females fly to the coast to join males and non-breeders to moult. The young continue to forage on insects and larvae until the flight feathers emerge and they too can fly to the coast.

Migration/Winter Range

When breeding is completed, black scoters fly to the coast to moult and stage before migrating south. James Bay in the east and Yukon-Kuskokwim Delta in Alaska are two important moulting areas. The St. Lawrence estuary and the Dalhousie area of New Brunswick are both major staging grounds for eastern black scoters. Fall migration begins in September and lasts until November. Most migrants from the eastern boreal forest are bound for Atlantic Ocean wintering areas. They winter as far north as Nova Scotia and as far south as Florida. Some birds also winter along the Gulf coast from Texas to Florida, and others winter on the Great Lakes. The Pacific population winters from Alaska to California. Spring migration begins in April and by late May, most birds have arrived on the breeding grounds just after the spring thaw.

The eastern population of black scoters relies heavily on the boreal forest for its survival.

Blue-winged Teal

Sarcelle à ailes bleues | *Anas discors*

BLUE-WINGED TEALS ARE AMONG THE CONTINENT'S smallest ducks, and are true world travelers, flying to many parts of North America in the spring and returning to Mexico, Central and South America for winter. Bluewings breed from Alaska to Nova Scotia with the highest concentrations occurring in parts of the prairie pothole region; however, the second most important region is the boreal forest. The wetlands of the boreal forest serve as insurance in times of poor habitat conditions further south, and could become even more critical as climate change will likely lead to poorer breeding conditions on the Prairies.

The male blue-winged teal is easily identified by his steel-blue head and white facial crescent. The large blue shoulder patch, iridescent green speculum and brilliant white border also make him easily identifiable. The female blue-winged teal is drab and mottled brown, and her wing patch is subdued with an almost black-green speculum and no white border. The bill of the male bluewing is blue-black, and the female's is dusky with black spots.

Blue-winged teals are among the continent's smallest ducks, and are true world travelers.

Habitat

Breeding bluewings prefer shallow wetlands with an abundance of aquatic invertebrates. They nest in a variety of forested (e.g. beaver ponds) and open (e.g. grassy meadows, marsh edges) habitats. During the brood rearing period, females often move to larger wetlands that have abundant submergent vegetation. Although a few thousand birds winter along the coasts of California, South Carolina and the Gulf States, most leave the breeding grounds in favour of the warmer climates of Central and South America.

Diet/Feeding Behaviour

A bluewing's diet changes dramatically with the season. Although plant matter makes up most of their diet, invertebrates are important for females during the breeding season. Bluewings eat stems and leaves of duckweed, widgeon grass, coontail and pondweeds, and the seeds of bulrushes, sedges, smartweeds and millets. On occasion, they also consume grains from agricultural crops. Throughout the breeding season, aquatic invertebrates like insect larvae, snails and worms become essential in meeting protein requirements of egg production and energy demands of incubation. Blue-winged teals often feed by dabbling or gleaning the surface of shallow wetlands and mud flats, rather than tipping up.

Breeding

Blue-winged teals breed across North America, although they can occur at low densities in many parts of their range. When conditions are good, the highest densities occur in the prairies and parklands; however, bluewings also breed in many parts of the boreal forest. Furthermore, when prairie habitat conditions are poor, many blue-winged teal settle in the boreal forest.

Bluewings establish pair bonds on the wintering grounds and during spring migration. The male is very territorial – and unlike promiscuous northern pintails, extra-pair copulations are uncommon. Blue-wings are one of the last ducks to arrive on the breeding grounds and are considered to be a late nester.

The female often chooses a nest site in a grass meadow or a sedge meadow near water. She scrapes a bowl-shaped depression into the ground, and lines it with grasses within her reach. She lays an average clutch of 10 eggs, and adds down and feathers from her breast to aid in incubation. When the female leaves to forage, she covers her eggs with vegetation and feathers to help keep them warm and concealed. Breaks from attending the nest become shorter and less frequent as the clutch is completed and incubation progresses. Incubation lasts about 24 days. The strong pair bond proves to be temporary, however, and around the third week of incubation, the male departs to undergo his annual wing moult.

Soon after the ducklings hatch, the female leads them to a nearby wetland, which may be several hundred metres away. The ducklings fledge at between 35 and 44 days. The female will abandon the brood at that time.

Migration/Winter Range

Perhaps because of their exceptionally long commute, blue-wings get an early start on fall migration. They depart from Canada in late August or early September and follow various routes to their wintering grounds. The most populous route is across the Great Plains to the Louisiana coast where they await favourable weather conditions before setting out for areas as far south as Argentina in South America.

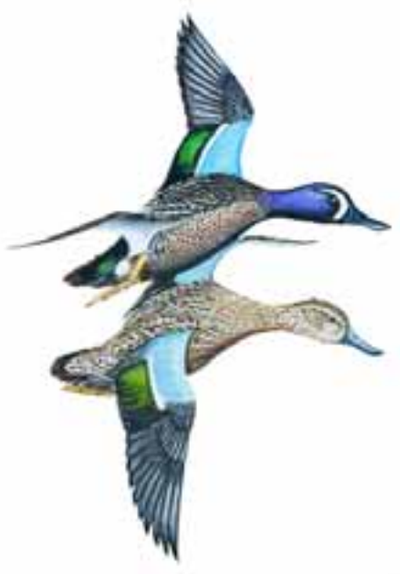
Other important migratory routes include an easterly path from the central Prairies, across the Mississippi Flyway to Florida, or from the eastern Prairies straight east across Canada and then down the Atlantic coast. Blue-wings that were banded in the boreal forest are recovered along their entire migration path *(figure 3)*. Spring migration starts in January or February and can take several months. Arrivals in Canada's boreal forests occur until mid-May.

Figure 3: Banding and recovery sites – blue-winged teal (23,669 banded; 1,022 recovered)

The wetlands of the boreal forest serve as insurance for blue-winged teals in times of poor habitat conditions further south.

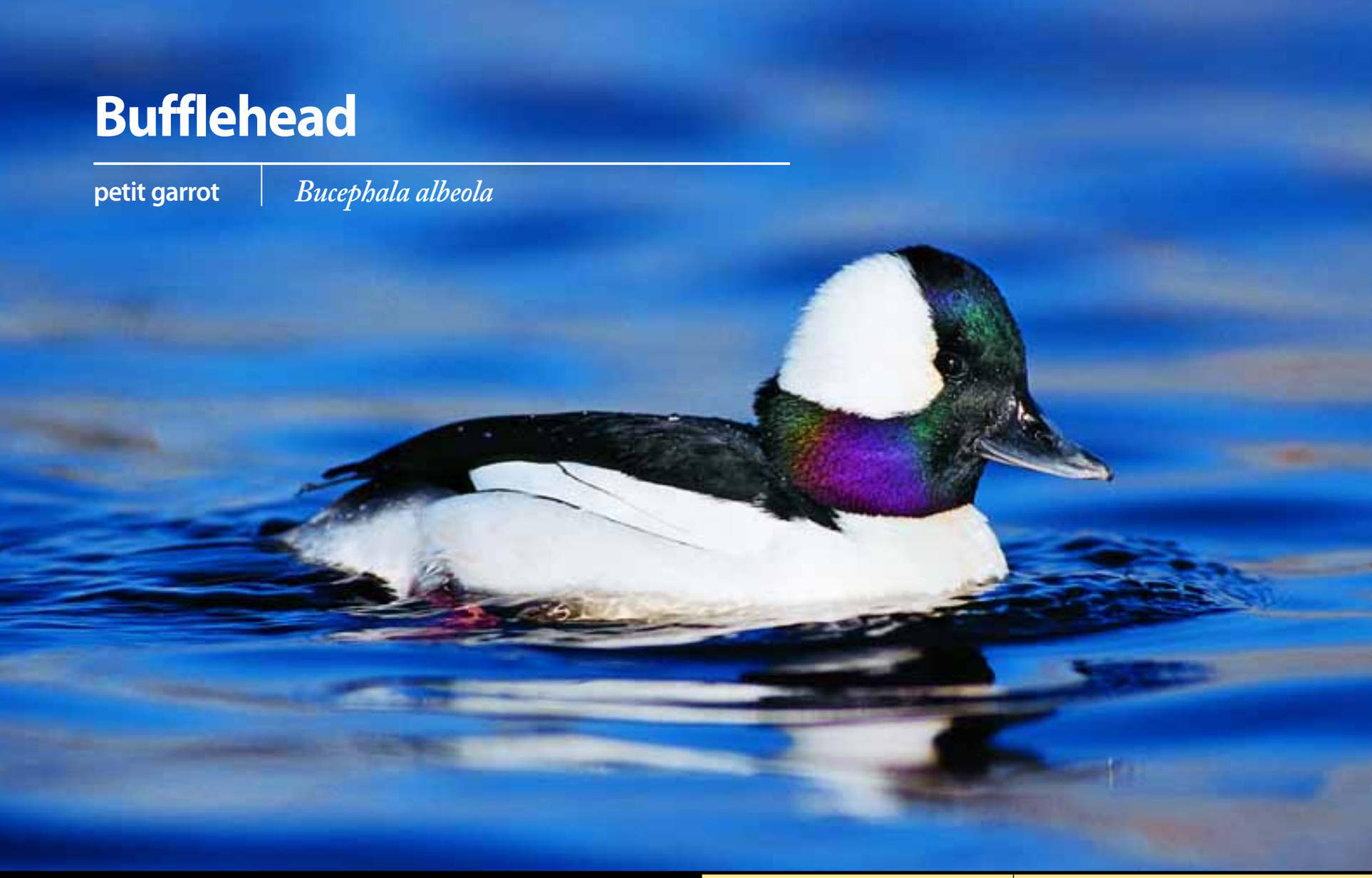
Blue-winged teals establish pair bonds on the wintering grounds and during spring migration. Early migrants, they depart from Canada in late August or early September.

BRIAN WOLITSKI (2)



Bufflehead

petit garrot | *Bucephala albeola*



Considering the small size and active nature of the bufflehead, it seems out of character that this duck's nickname should be butterball, so named by hunters to describe how fat the bufflehead becomes during fall migration. As buffleheads migrate from their breeding grounds in boreal forests and aspen parklands to their wintering grounds, they stop to rest and feed on wetland invertebrates, many of which are also in the boreal forest. Estimates indicate that about 65 per cent of the buffleheads counted on spring surveys in the traditional survey area were counted in the western boreal forest.

The name 'bufflehead' is an abbreviated version of the original 'buffalo head', so named for the disproportionately large head of the male. The forehead, chin and neck of the male are black with a tinge of purple and green, and his cheeks and nape are covered with a large white patch. Females are drab brown with a small white patch behind the eye. Buffleheads are easily distinguished from goldeneyes by their smaller size and the location of the white patch behind the eye rather than in front.

Habitat

Poplar or aspen trees within a few hundred metres of small and permanent freshwater wetlands are ideal nesting habitat. Larger, more open water is avoided until moulting. Once the breeding and moulting are complete, buffleheads will migrate to the wintering grounds on either coastal or inland ice-free waters. On the coast, they use shallow, secluded coves, harbours and estuaries. They avoid open coastlines and deep water, while inland, buffleheads select shallow wetlands, lakes, reservoirs

and even slow-moving rivers that remain ice-free.

Diet/Feeding Behaviour

Buffleheads forage by diving in sheltered, shallow water for aquatic invertebrates. Only the downy young will, at times, dabble at the surface. Buffleheads feed in open water or along the edge of emergent vegetation, preferring not to dive through any kind of dense vegetation. They commonly remain under water for 15 to 25 seconds with pauses of five to 10 seconds between dives.

Buffleheads often dive in groups, leaving just one or two individuals at the surface, seemingly to watch for danger. Invertebrates such as dragonflies, water boatmen, mayfly nymphs and midge larvae dominate the bufflehead's diet. Buffleheads consume seeds of pondweeds and bulrushes in lesser amounts. For buffleheads wintering in marine areas, crustaceans, mollusks, pondweed and some fish constitute the diet.

Breeding

Buffleheads form pair bonds when they reach sexual maturity at about two years of age. During courtship, the male performs an elaborate series of displays including a "dance" whereby he swims with his bill up, neck stretched out, and head puffed up to twice its normal size, showing off his white head patch. He then stands almost erect with his bill held against his swollen breast. Appearing exhausted but still eager, he then quickly dives under the female to complete the act. Throughout, there is much head-bobbing and body movement.

Buffleheads nest exclusively in tree cavities or nest boxes. The most common source of natural cavities is abandoned northern flicker holes. Buffleheads can squeeze through holes as small as 58 millimetres in diameter. Their small size eliminates competition with most other cavity nesters such as the common goldeneye; however, starlings and flickers still compete with the bufflehead for cavities. If a female nests successfully, she will often return to the same tree the following year.

Nests are initiated between early and mid-May. Females lay between six and 11 eggs and incubate them for 28 to 33 days. Once the eggs hatch, the ducklings spend 24 to 36 hours in the nest before leaping to the ground to begin the trek to water.

The bufflehead has a relatively high nest success; however, competition for nesting cavities can be fierce. If the female is driven off the nest by an intruder she may abandon it altogether, resulting in failure. When ducklings are 35 to 42 days old, the female abandons them, often before their first flight, which does not occur until about 50 to 55 days. The ducklings will continue to forage and gain strength until they are able to migrate to the staging grounds themselves.

Migration/Winter Range

Buffleheads congregate in large flocks

during moulting and staging periods. DUC staff have observed several flocks of more than 500 individuals at moulting and staging areas in the boreal forest, including a single flock of 15,000 birds that was once observed on Utikuma Lake in north-central Alberta. Their migration from these staging areas to the wintering grounds begins in late October. Buffleheads migrate in small flocks, but sometimes gather into groups of 500 to 1,000 in wintering areas.

The current guidelines for riparian zone buffers are often too narrow to sustain bufflehead populations.

LEFT: DANIEL MORIAUX RIGHT: DUCKS UNLIMITED CANADA

The name 'bufflehead' is an abbreviated version of the original 'buffalo head', so named for the disproportionately large head of the male. Estimates indicate that about 65 per cent of the buffleheads counted on spring surveys were counted in the western boreal forest.

Canvasback

fuligule à dos blanc | *Aythya valisineria*

THE CANVASBACK, OFTEN CONSIDERED THE "aristocrat of ducks," is one of the larger diving ducks endemic to North America. Canvasbacks breed primarily in the prairies, parklands and boreal forests of western Canada and Alaska, and the northernmost United States. Because of their specific nesting and foraging requirements, they are considered to be an ecological specialist, dependent on deep, stable wetlands. Many boreal wetlands make ideal breeding and moulting habitat. Since the 1980s, an average of about 35 per cent of canvasbacks counted on spring surveys in the traditional survey area were spotted in the boreal forest. Canvasbacks banded in the boreal forest have been recovered in the fall and winter along the Pacific and Atlantic coasts of the United States, as well as down the central and Mississippi flyways as far south as the Gulf coast *(see table, page 38)*.

Canvasbacks are readily identifiable by their striking profile. Their sloping forehead angles directly into their long black bill, creating a sharp and triangular head profile. The male's head and neck are

Because of their specific nesting and foraging requirements, canvasbacks are considered to be an ecological specialist.

chestnut-coloured, his chest is black and his back is white. The female has a similar distinctive profile to the male but has a light brown breast and greyish sides.

Habitat

Canvasbacks breed in small freshwater lakes, deep water marshes, sheltered bays, permanent and semi-permanent wetlands and shallow river impoundments. Preferred wetlands vary in size and are bordered by a variety of dense emergent vegetation, including cattails, rushes and grasses.

During the rearing/moulting period, females and their broods move to nearby lakes. Males, on the other hand, leave the breeding grounds for moulting areas that are located on northerly lakes, many of which are in the boreal forest. During fall and spring migration, canvasbacks make frequent stopovers in coastal marine and freshwater habitats, including estuaries, brackish marshes, saltwater lagoons, slow-moving rivers and flooded fields. The preferred wintering habitat of this species includes deep freshwater lakes, coastal brackish estuaries and shallow bays and harbours.

Diet/Feeding Behaviour

During moulting and migration, canvasbacks forage in loose groups of various sizes; groups of more than 1,000 ducks have been seen feeding together during fall migration. Canvasbacks feed on both plant matter and aquatic insects. Adapted for diving, individuals dive half a metre to nine metres below the water's surface and probe the bottom substrate with their long narrow bill, in an attempt to excavate food items such as pondweed tubers, clams and snails. They also feed on aquatic insects such as damselflies, dragonflies and mayfly nymphs.

LEFT: DUCKS UNLIMITED CANADA RIGHT: BRIAN WOLITSKI

Canvasback nest site selection is a paired effort, while construction is the responsibility of the female. Nests are usually located over the water in cattails, bulrushes or sedges.

Breeding

Mate selection is initiated by females, who perform a courtship display called inciting, where they alternate between two postures: a lowered head while maintaining a threatening demeanour towards the males, and a neck stretch display. Mate selection is completed when the chosen male and female exchange mutual neck stretches while chasing other males away.

Nest site selection is a paired effort, while nest building is the responsibility of the female. Nests are usually located over the water in cattails, bulrushes or sedges and are constructed of the same vegetation. Female canvasbacks lay seven to 10 greyish-olive eggs and incubation lasts about 27 days. Within 24 hours of hatching, the ducklings leave the nest, and at about 63 days, they fledge.

Canvasback nests are subject to egg parasitism, where other species of waterfowl lay eggs in the host's nest. The most common species to parasitize canvasback nests is the redhead, with individuals bullying females off their nests and depositing their own eggs. Canvasback ducklings in broods with parasitic redhead ducklings have a lower survival rate for the first week after hatching than canvasback broods that include redhead young.

Migration/Winter Range

Fall migration for canvasbacks occurs from mid-October to November. Females and juveniles migrate earlier than males, as males undergo a moult migration to boreal wetlands and aspen parklands in central and western Canada. Surveys conducted in August and September by DUC have located numerous flocks of moulting males, sometimes up to 2,000 individuals, on various boreal wetlands. Canvasbacks winter from the Pacific Northwest, south along the Pacific coast to the Baja peninsula and east across the southern half of the U.S. to the Atlantic coast.

Surveys have located numerous flocks of moulting males, sometimes up to 2,000 individuals, on various boreal wetlands.

Common Goldeneye

garrot à œil d'or | *Bucephala clangula*

Common goldeneyes are also referred to as "whistlers" because of the sound their wings make during flight. These medium-sized diving ducks breed throughout the boreal forest. Except for breeding males, both sexes are difficult to discern from the Barrow's goldeneye. Body size, shape of the bill and head, and breeding plumage are the main distinguishing characteristics. The breeding male has a greenish-black head with an oval white patch between its yellow eye and black bill (the Barrow's goldeneye patch is crescent-shaped). He has white sides, breast, belly and secondaries, which contrast sharply against the black wings and tail. Females are smaller, with brown heads, grey backs and tails and white bellies, yellow eyes and bills tipped yellow in the breeding season. Immature males resemble females.

Habitat

The common goldeneye nests in tree cavities or artificial nest boxes, most often near wetlands, lakes and rivers, but sometimes even up to one kilometre away

Common goldeneyes are one of the last waterfowl species to leave the breeding grounds and the first to return.

from the nearest water. Goldeneyes are incapable of making their own nest cavities, so they are dependent on natural events and other species such as woodpeckers to create cavities for them.

Preferred wetlands are small and open, with high invertebrate populations, little emergent vegetation, and an absence of fish. During migration, they stop briefly on large inland lakes and rivers to feed. Common goldeneyes winter in sheltered coastal bays, estuaries and harbours, and occasionally on large inland ice-free lakes and rivers.

Diet/Feeding Behaviour

The common goldeneye normally feeds by diving and occasional dabbling along shallow shorelines. These expert divers use their feet for underwater propulsion and tails for steering. Their diet is dependent on their location in fresh or salt water, and is made up of crustaceans (e.g. crabs, shrimp), aquatic invertebrates (e.g. caddis fly larvae, dragonflies), mollusks (mussels and snails), and smaller amounts of vegetation like pondweed and bulrush, as well as fish and fish eggs.

Breeding

The common goldeneye breeds in forested regions from the Maritimes to Alaska. The majority breed in the boreal forest, though sizable populations also occur around the Great Lakes, in aspen parklands and in montane forests. The southern breeding extent is the northern states along the U.S.-Canada border.

Common goldeneyes form pair bonds on their wintering grounds. Males perform spectacular and complex courtship displays, including 14 distinct behaviours. These courtship rituals are usually performed in groups of four males to every female – and displays include throwing the head back, kicking the water and calling. Once paired, the male tends to the female, driving away other males, until she departs for the breeding grounds with him in tow.

Males perform elaborate territorial displays and defenses during the breeding season including migration. The male guards his mate while she lays seven to 10 eggs, but abandons her soon after the clutch is completed. Common goldeneye females often "dump" their eggs in other females' temporarily unattended nests. Female goldeneyes can also be victims of nest dumping and may end up raising the young of several species. The incubation period is approximately 30 days. Able to feed themselves as soon as they hatch, young may jump from the nest within two days of hatching. Females protect the young for a period of time, but typically abandon them before they can fly, sometimes even as a result of a territorial dispute with other females. Broods will frequently merge after being abandoned by females. Only about a third of common goldeneye ducklings will survive to fledge.

Migration/Winter Range

Common goldeneyes are one of the last waterfowl species to leave the breeding grounds and the first to return. They migrate in small flocks, congregating at suitable stopover points, especially in spring when ice-free locations are limited. All populations are migratory, even where they occur year-round, but individuals may only migrate as far as necessary to find open water. During moulting and fall staging periods, common goldeneyes have been observed in flocks of up to 500 on several boreal wetlands. Many of the birds banded throughout the boreal forest have been recovered in the northwestern U.S., California, the Great Lakes area and the eastern seaboard during the winter *(figure 4)*. Common goldeneyes also winter inland across southern Canada, the U.S. and northern Mexico.

Figure 4: Banding and recovery sites – common goldeneye (1,742 banded; 157 recovered)

During moulting and fall staging periods, common goldeneyes have been observed in flocks of up to 500 on several boreal wetlands.

Common Merganser

grand harle | *Mergus merganser americanus*

COMMON MERGANSERS ARE FISH-EATING SEA DUCKS that breed in the world's boreal forests. In North America, most breed in the boreal zone from Newfoundland to Alaska, yet their range extends south into British Columbia and the Great Plains as well. During the spring breeding population survey conducted by the U.S. Fish and Wildlife Service and Canadian Wildlife Service, estimates for all three species of mergansers (common, hooded and red-breasted) are combined since distinguishing between these species at a distance is difficult. Furthermore, most of their breeding range is not covered by the traditional survey area, and therefore the common mergansers breeding population is not well known. However, total population is estimated between 600,000 and one million birds. Common mergansers nest in tree cavities formed by broken tree-limbs or by pileated woodpeckers, most often in mature stands. Their wintering grounds include coastal areas of Canada and the northern United States, as well as lakes, rivers and reservoirs of the interior U.S. and Mexico.

The common merganser is a large, handsome bird. In his breeding plumage, the adult male has an iridescent greenish-black head, a white neck, side and belly, and contrasting black wings with white secondaries, speculum and upper coverts. His larger size, white breast and sides, and the lack of a crest on his head distinguish him from the closely related red-breasted merganser. The adult female has a brownish-red crested head – distinctly contrasting her white chin patch – and greyish sides, breast and back. She also has a white belly, and wings similar to those of the male but with grey upper coverts. Both sexes have an orange bill and dark brown eyes. When males are in eclipse plumage in the middle of summer, they closely resemble females.

The common merganser's flight is fast, although their takeoff is not swift because they require a running start across water to obtain flight. Their profile in flight is long and pointed, and when in the water they appear to sit low. They are

excellent divers and can stay submerged for up to two minutes, diving to a maximum depth of six metres.

Habitat

Common mergansers prefer to breed and nest on large lakes and rivers in mature mixed wood and coniferous forests of boreal Canada. The dense forest provides an area with few disturbances and ample tree cavities for nesting. Brood-rearing typically takes place on moving water leading to larger lakes, bays and rivers. Depending on the location, coastal waters, estuaries, large lakes, rivers and reservoirs are used as stopovers during migration and also as more permanent wintering grounds throughout the United States.

Diet/Feeding Behaviour

The common merganser's diet consists mainly of small fish captured underwater using its serrated bill. They are generalist feeders, meaning rather than preferring certain species of fish, they feed on whatever suitably sized fish is most readily available. They also feed on crustaceans, aquatic insects, amphibians, small mammals and plants. Broods initially feed on aquatic invertebrates such as caddisflies, dragonflies and backswimmers, but switch to fish about two weeks after hatching. The common merganser is an excellent underwater hunter and will visually pursue prey using their superior underwater vision and diving skills. They use only their feet for propulsion. Large groups of mergansers have been observed cooperatively hunting by forming a loose line and pushing their prey ahead of them.

Breeding

Common mergansers do not attempt to breed until their second year. Pair bonds are formed on the wintering grounds, and the birds arrive at the breeding grounds in pairs within larger flocks. The female generally begins to lay eggs two weeks after her arrival in April or May. The female chooses the nest site, often in an existing tree cavity, but sometimes in a rock crevice, an exposed tree root, a hole in a bank or even in a nest box. Males remain with the females for about two weeks, then leave to moult on larger basins. The clutch of nine to 12 eggs is incubated for approximately 32 days before hatching. Nest success is high because their cavity nests are fairly inaccessible to predators. Ducklings answer the hen's call one or two days after hatch, and jump from the nest to the water or the ground outside the cavity. Young fly at approximately 63 to 77 days.

Migration/Winter Range

Common mergansers are among the earliest spring migrants and are among the last to migrate again in the fall. They use all four flyways and typically fly at night in small groups (three to nine individuals), but may also form large flocks on stopovers. Common mergansers winter on open water as far north as possible. Although they use saltwater basins, they are much more abundant on freshwater. Each year they spend about four months on the wintering grounds, two months in migration and six months on the breeding and moulting grounds.

DUCKS UNLIMITED CANADA (2)

Common mergansers prefer to breed and nest on large lakes and rivers in mature mixed wood and coniferous forests of boreal Canada. The dense forest provides an area with few disturbances and ample tree cavities for nesting.

Degradation of the common merganser's breeding and wintering grounds is a continual conservation concern.

Gadwall

canard chipeau | *Anas strepera*

THE GADWALL IS PERHAPS THE MOST DISCREETLY DRESSED dabbling duck known to breed in Canada's boreal forest. Like the boreal forest itself, the gadwall's charm lies in its subtle beauty and hardy persistence across the landscape, not in bright colouration or bold habits. Although several other waterfowl species have declined in recent decades, the gadwall has increased and expanded its range. The gadwall breeds from New Mexico to the Yukon and Northwest Territories, and from B.C. to Québec – with increased sightings in New Brunswick and Nova Scotia. The gadwall's wintering range includes reservoirs and wetlands throughout the southern United States and Mexico as well as coastal estuaries along both the Pacific and Atlantic coasts.

Unlike its close relatives the mallard and the American wigeon, the gadwall male is distinguished not by brilliant splashes of colour, but by a tweed-like pattern of woven grey back feathers, a mottled brown head and brown, black and white wing patches. Females are identified mainly by their white bellies and similar black and white wing patches. Both sexes have steep foreheads, narrow, greyish-black bills and yellow legs.

Habitat

Most gadwalls in North America (they occur in Eurasia as well) breed across the mixed prairies of the Dakotas, Manitoba, Saskatchewan and Alberta, however relatively high densities also occur in the prairie parklands. In the boreal forest, the Saskatchewan River Delta and Peace Athabasca River Delta provide suitable breeding, moulting and staging habitat.

Gadwalls are famous for finding island getaways on which to nest. They prefer alkaline lakes to fresh water and seek out lakes with abundant submerged vegetation. Once a wetland is selected, the female gadwall chooses the nest site and builds the nest, usually well hidden in grassy or brushy vegetation.

During the spring migration, gadwalls typically use smaller wetlands as stopover habitat, and during fall migration they target larger, more permanent marshes and reservoirs. Once on their wintering grounds, gadwalls use a variety of wetland types (e.g. reservoirs, wetlands, fresh and brackish marshes).

Diet/Feeding Behaviour

Gadwalls feed by dabbling on the surface for submerged plants, and only occasionally dive for food. They eat leaves and stems of aquatic plants like pondweed, widgeon grass, millet and smartweed and also consume seeds, algae, insects and crustaceans when available. The young eat surface invertebrates during their first few days on the pond until they learn to dabble for plants.

Breeding

Courtship displays that lead to pair bonds are initiated during the winter months and most pairs are formed by November. Despite the early pair establishment, gadwalls are one of the last ducks to arrive on the breeding grounds. The majority of pairs arrive by early April, but they do not begin nesting until late May or early June. The pair remains together until the female has completed her clutch in early June when the male abandons her and joins other males and non-breeders to moult on larger lakes in the region.

Females lay an average of 10 creamy white eggs in a shallow nest built of twigs, leaves and branches. Incubation averages 26 days, and the female will sit on the nest for 85 per cent of each day. Gadwalls rear only a single brood each summer; however, if a nest fails early in incubation, they will often make another attempt. Soon after the eggs hatch, the female leads her ducklings to a nearby wetland. The young are precocial, and find their own food. Females defend their broods and territories from other broods, pairs and lone birds, and ducklings begin to fly at between 48 and 52 days of age – and are not abandoned by their mothers until about 70 days post hatching. After abandonment, juveniles fly to larger wetlands to join moulting adults before the migration south. Sexual maturity occurs at age one; however, yearling breeders experience lower nest success rates than older, more experienced ducks.

Migration/Winter Range

By mid-September, gadwalls begin fall migration from the prairies, parklands and boreal forests of Canada to their wintering grounds in the south. Most migrants fly south over the Great Basin states, down the Mississippi Valley and into the saltwater and brackish marshes of the Gulf coast. Gadwalls from western Canada may also fly southwest to the Pacific coast or to inland marshes of the western states. Those breeding further east fly to the coastal marshes of the Atlantic states. Gadwalls banded in the boreal forest have been recovered in 14 states and three provinces *(see table, page 38)*, with the most being recovered in Louisiana. Gadwalls migrate at night in flocks of less than a hundred individuals. By mid- to late October most of them have arrived safely at the wintering grounds.

Although several other waterfowl species have declined in recent decades, the gadwall has increased and expanded its range.

Like the boreal forest itself, the gadwall's charm lies in its subtle beauty and hardy persistence across the landscape.

LEFT: DUCKS UNLIMITED CANADA RIGHT: BRIAN WOLITSKI

Greater Scaup

fuligule milouinan | *Aythya marila*

OF ALL THE BAY DUCKS, A GROUPING WHICH ALSO INCLUDES the ring-necked duck, lesser scaup, canvasback and redhead, the greater scaup is the only one to have an entirely circumpolar distribution. Though primarily a tundra nesting species, breeding populations of greater scaup are also found in Canada's boreal forest, including in the Mackenzie River Delta, Great Slave Lake, Lake Winnipeg and Labrador's Ungava Peninsula. These areas and other large boreal wetland systems also serve as critical stopover habitat during long, cross-continental migrations. Greater scaup banded in the boreal forest have been recovered in eight states and two provinces *(see table, page 38)*. These recoveries suggest greater scaup migrate laterally across the continent. In 2005, the combined breeding population for greater and lesser scaup was estimated at 3.8 million, which is about 35 per cent below the long-term average.

The greater scaup closely resembles the lesser scaup and even a trained eye has difficulty distinguishing between the two species at a distance. For this reason, both scaup species are counted as "generic" scaup during aerial surveys. There are, however, subtle differences. The greater

In 2005, the combined population for greater and lesser scaup was estimated at 3.8 million, about 35 per cent below the long-term average.

scaup is slightly larger and the male's head is rounder and tinted green, not purple like the lesser scaup. Both sexes have a longer, wider bill and white wing patches that extend further into the primary feathers. Lesser and greater scuap females both have a white patch at the base of their bill and are otherwise brown. The only unique feature is the barely discernable light auricular patch that the greater scaup has in the summer.

The greater scaup closely resembles the more common lesser scaup. However, the greater scaup is slightly larger and the male's head is rounder and tinted green, not purple – like the lesser scaup.

Habitat

Greater scaup use an assortment of freshwater and marine wetlands throughout the year. During the breeding season, they use shallow lakes and wetlands with little or no flowing water. Submergent and emergent vegetation in these areas provide excellent protection and concealment, as well as abundant aquatic invertebrates as a food source. Greater scaup move to large shallow lakes to moult. These areas may be located near, or hundreds of kilometres away from, the breeding grounds. During winter they inhabit marine bays or river inlets where silt and sand substrates support high densities of mollusks and crustaceans.

Diet/Feeding Behaviour

The diet of the greater scaup often varies depending on time of year and the availability of food resources. They consume snails, crustaceans, aquatic insects, seeds and parts of aquatic plants, though clams make up the majority of their diet. The introduced zebra mussels have become an important food source for migrants who stop to feed or even overwinter on the Great Lakes. Their main foraging strategy is to dive, usually in water less than two metres deep. During summer, the female and ducklings feed on submerged and emergent vegetation along the shoreline. In marine habitats, foraging takes place in the intertidal zones where silty or sandy bottoms host rich clam beds.

Breeding

The majority of adult greater scaup (two years old or older) establish pair bonds on the wintering grounds in February and March. Most birds are paired before they reach the breeding grounds in mid-May. Yearlings typically do not breed.

Nest initiation begins in late May to early June. The female selects a nest site in tall vegetation in an area safe from flooding. Nests are usually less than one metre from the water's edge but have been found up to 40 metres from water. Females typically lay one olive-grey or buff-coloured egg per day for nine days until the clutch is complete. Males and non-breeders leave for traditional moulting areas like Great Slave Lake and Lake Athabasca when females begin incubation in late June. Females then incubate their clutches for 25 days before the eggs hatch and the young can be led to water. Ducklings feed on insects until they are able to fly (about 57 days).

Migration/Winter Range

Greater scaup in Alaska and northern Canada leave their moulting area anytime between mid-September and late October. They arrive at their wintering areas along the Atlantic and Pacific coastlines or the Great Lakes, anywhere from late October through to mid-January. Surveys flown in January show that about 60 per cent of the population winters on the Atlantic coast, 20 per cent along the Pacific coast and the rest in the interior.

Large boreal wetland systems serve as critical stopover habitat for greater scaup during long, cross-continental migrations.

BRIAN WOLITSKI (2)

Green-winged Teal

sarcelle d'hiver | *Anas crecca*

The green-winged teal (a.k.a. greenwing) is the namesake and symbol for Ducks Unlimited's youth membership program. This little dabbler is one of the smallest and fastest ducks, and with a fondness for hiding in emergent vegetation can be very difficult to spot. Consequently, it is one of the most underestimated ducks on aerial surveys. Approximately the size of a pigeon and with a wingbeat almost as fast as a diving duck's, the greenwing darts around like a shorebird at speeds over 70 km/h, with an entire flock moving cohesively together.

Predominantly a boreal forest and parkland breeder, the green-winged teal breeds in every Canadian province and territory and across several northern U.S. states. Numerous greenwing broods have been seen throughout the boreal forest during aerial surveys conducted by DUC, and greenwings banded in Canada's boreal forest have been recovered throughout their range. Green-winged teals come second only to the mallard in annual harvests, so it is critical to ensure conservation programs are in place to provide necessary habitat for this and other species.

Green-winged teals are a substantial component of the ducks breeding in Canada's boreal forest and the boreal transition zone.

DUCKS UNLIMITED CANADA

Male green-winged teal have a dark grey body with a russet head, and a large dark green eye patch extending to the nape. Females are light mottled brown with a dark eye line characteristic of all dabbler females. When breeding, both sexes have a white belly that is conspicuous in flight and a vibrant dark green speculum with buff borders, often the only obvious colour visible.

Habitat

Green-winged teal are unlike many other dabblers in North America in that they prefer wooded ponds to prairie potholes. They are a substantial component of the ducks breeding in Canada's boreal forest and the boreal transition zone. Greenwings will often occupy beaver ponds and flowages for breeding and brood rearing, but can also be found in deciduous wooded ponds surrounded by grassy upland areas. During spring and fall migration, greenwings tend to choose shallow inland wetlands with abundant floating and emergent vegetation, but also use tidal mud flats more often than any other duck. Wintering greenwings will use freshwater shallow marshes and riparian sloughs, but can also be found in saltwater estuaries and agricultural areas.

Diet/Feeding Behaviour

The green-winged teal's diet is diverse, and varies according to what is most abundant at the time. The fall diet consists mainly of vegetation, the seeds of grasses, sedge and emergent vegetation, as well as the occasional agricultural crop. During the breeding season, greenwings rely more selectively on animal matter like aquatic insects, larvae, mollusks, crustaceans and sometimes fish eggs. A true dabbler, greenwings feed by tipping up with their head under the surface of the water or collecting seeds and insects by skimming the water with their bill. More than any other duck, greenwings feed along mud flats, foraging for seeds, insects and mollusks.

Breeding

Greenwings form pair bonds relatively late in the season compared to the other dabbling ducks, often not until late January or even as late as March. After an elaborate sequence of displays by the male, the female shows her approval by performing her own inciting display. Like most other ducks, once the pair is ready to mate they perform reciprocated head pumping, then copulate on the water. Although they break the pair bond each year, greenwings are largely monogamous during the breeding season.

Nesting females often choose a nest site well concealed with thick brush, sedge or grasses. The female scrapes out a bowl on the ground to construct her nest, using surrounding grasses, twigs and leaves, as well as body feathers to aid in keeping the eggs warm, dry and concealed. The surrounding vegetation forms a type of canopy, concealing the nest from predators. In most cases, a female will lay one egg per day until the clutch is complete at eight to 10 eggs. Shortly after incubation begins, the male abandons his mate and begins to moult. During this process, he sheds his breeding plumage and becomes drab like the females. He remains flightless like this for several weeks, until his flight feathers grow in again in preparation for fall migration. Meanwhile, the female incubates her eggs for approximately 21 days, beginning after the last egg is laid. Once her eggs have hatched, she leads the brood to water within the first day, where the precocial young will be reared.

Migration/Winter Range

Like many dabblers, green-winged teals leave their northern breeding grounds in late August and early September to travel to their wintering grounds, which are equally vast. Greenwings migrate at night in large flocks of up to a few hundred individuals. They do not demonstrate loyalty to a given wintering area; for example, individuals found wintering in Texas one year have been found as far away as California the next year.

Figure 5: Banding and recovery sites – green-winged teal (33,251 banded; 2,350 recovered)

Predominantly a boreal and parkland breeder, the green-winged teal breeds in every province and territory and several northern states.

Harlequin Duck

arlequin plongeur | *Histrionicus histrionicus*

The harlequin duck is a small, relatively scarce sea duck with two distinct populations in North America: the Pacific and the eastern North American – with both using the boreal forest. The Pacific population frequents the boreal forest in the Yukon, and the southwest regions of the Northwest Territories and Alaska. Outside of the boreal forest, they are found in British Columbia, Montana, Alberta, Washington and northern California. This population is estimated at nearly one million birds and is considered to be healthy. By contrast, the eastern North American population has about 1,800 individuals and is listed by the Canadian Wildlife Service as a species of special concern. Birds in this population are found in Labrador, Newfoundland, along the Gulf of St. Lawrence and the northeastern Atlantic Coast.

The male harlequin is one of the most colourful ducks in North America. Breeding males are a slate blue with chestnut flanks and white patches on the head and body. Females are distinguished by brown chests, three white spots on the head and lack of white patch on the wing.

The eastern North American population is listed by the Canadian Wildlife Service as a species of special concern.

Habitat

The harlequin duck uses both coastal and inland locations, particularly undisturbed parts of the boreal forest, montane and tundra habitats. Inland breeding habitats are usually fast-flowing streams, surrounded by forests or patches of willow or alder, while preferred coastal wintering habitats are usually ice-free and exposed ledges. Harlequins also show a liking of large reef systems, which provide relief from predators and human disturbances.

Diet/Feeding Behaviour

The diet of the harlequin duck is mainly a seafood buffet of crustaceans, mollusks, insects and fish. Predominantly a diver, the harlequin duck can submerge three to five feet in swift currents. This duck, however, has also been known to dabble and skim the surface of water for food, or pick insects from overhanging branches.

Breeding

The harlequin duck begins to form pair bonds on the wintering grounds. The male attempts to attract a female by rushing her and performing a courtship display. The courting female will return head-nods to the most suitable suitor. Once pair bonds are formed, the duo leaves for the breeding grounds, arriving in late April or early May. Upon arrival, the female scouts for nest sites by walking along the shoreline inspecting rock crevices and vegetation. When she finds a suitable nest site, the female begins constructing the nest using surrounding vegetation. The female harlequin lays three to eight creamy buff-coloured eggs. After incubating them for 27 to 30 days, the female leads her newly hatched young to the water to be reared. By 40 to 50 days old, the young are able to fly.

Migration/Winter Range

Fall migration consists of lateral movements from the inland breeding grounds to adjacent coastal areas. For males, fall migration begins in late June or early July when they leave the incubating females. Western birds move to moulting areas in coastal British Columbia and the southern coast of Alaska. The majority will then head to the Strait of Georgia along Vancouver Island, while others continue further south to the Washington, Oregon and northern Californian coasts. In the east, two demographically distinct populations have been identified. Birds that breed in southern Québec and Labrador move to moulting areas in northeastern Labrador and Newfoundland before heading south along the coast to the Maritime provinces and the northeastern U.S. coast. Harlequins breeding in northern Québec and Labrador moult in areas on the southwest coast of Greenland. Females moult in the same locations as the males, but usually four to eight weeks later.

Inland breeding habitats of harlequin ducks usually consist of fast-flowing streams, surrounded by forests or patches of willow or alder, while preferred coastal wintering habitats are usually ice-free and exposed ledges.

BRIAN WOLITSKI (2)

The harlequin duck uses both coastal and inland locations, particularly undisturbed parts of the boreal forest, montane and tundra habitats.

Hooded Merganser

harle couronné | *Lophodytes cucullatus*

HOODED MERGANSERS ARE ONE OF THE MOST SECRETIVE DUCKS in North America. Highly wary of humans and human activity, less is known about their breeding and brood-rearing habits than most ducks. There are two populations of hooded mergansers, the western – which breeds in central British Columbia – and the eastern that reaches its highest densities from the boreal forest of central Ontario and Québec to the forest of Minnesota. A large portion of its breeding range is in the boreal forest.

During the spring breeding population survey conducted by the U.S. Fish and Wildlife Service and Canadian Wildlife Service, estimates for all three species of mergansers (common, hooded and red-breasted) are combined since distinguishing between these species at a distance is difficult. Furthermore, most of their breeding range is not covered by the traditional survey area. Therefore, the hooded mergansers breeding population is not well documented; however, a crude estimate of the total population is between 300,000 and 600,000 birds.

The male hooded merganser is distinctive in his breeding plumage, which he does not reach until his second breeding season. When raised, the crest shows a large white patch bordered in black; and when depressed, it shows a broad white stripe with a black edge. The eyes are yellow, and his buffy sides have two black vertical stripes alongside a white chest. Female and immature male hooded mergansers have backward-slanting crests on their russet-brown heads, and are dark grey overall. The smallest of the three mergansers, this species has a thin, ser-

rated bill, long tail and narrow wings, and rides so low in the water that often little is visible other than the head. They fly with very rapid wingbeats, which are so shallow that they often appear to be flying with only their wingtips.

Habitat

During the breeding season, hooded mergansers are most often found in densely wooded streams or small wetlands, where there is little human disturbance or activity. Older forests are preferred for the higher number of tree cavities available for nesting. Brood rearing takes place in a wide variety of habitats, like emergent marshes, small lakes, beaver ponds and forested creeks and rivers, with a preference for streams with cobbled bottoms. Wintering hooded mergansers use shallow freshwater and brackish bays, estuaries, tidal creeks and ponds, as well as emergent marshes, wetlands, rivers and creeks.

Diet/Feeding Behaviour

The hooded merganser's diet consists mainly of small fishes, crustaceans, aquatic insects and amphibians. With superior underwater vision and a bill designed to grasp and handle moving prey, the hooded merganser is an excellent underwater hunter. It uses its feet for propulsion under water, completing multiple dives in search of food. Broods tend to feed in shallow water with low turbidity, preferring crustaceans, amphibians and insect larvae.

Breeding

Hooded mergansers arrive on the breeding grounds in early spring, with females demonstrating strong homing back to their previous nesting areas. Pairing begins on the wintering grounds, where the male performs elaborate courtship displays such as crest-raising (raising and lowering the crest), head throws – where he tosses his head back with his bill in the air – and a rapid head-pumping action. The female will respond by bobbing and uttering a hoarse *gaaaack*. The male will remain with the female until incubation begins, at which time he will normally fly north of the breeding grounds to moult.

Hooded mergansers nest in tree cavities and they will also use man-made nest boxes. Cavities are usually close to water, and often have been prospected by the female the summer before. Nests are lined with the material from inside the cavity, although the female will sometimes add vegetation. Down is not deposited until the last two or three eggs are laid. Hooded merganser eggs are creamy white and almost spherical, with thick shells. Clutch sizes range from seven to 13 eggs, with one egg laid every second day. Some nests are parasitized by other mergansers or wood duck females. Eggs are dumped in the nest, resulting in larger clutches.

When the eggs hatch, ducklings remain in the nest for about 24 hours. The female then flies to the ground and calls for her brood to join her. One by one, ducklings ascend the cavity wall to the opening and leap to the water or ground. If they are not already on a wetland, the female will lead them to nearby water so they can begin to feed.

Migration/Winter Range

Hooded mergansers are not long-distance migrants. Males and non-breeders, which go north to moult, leave for the wintering grounds about the same time as the breeding females and immature birds usually just ahead of the winter ice late in the fall. Most western breeding birds winter in southern B.C. – or further south along the Pacific coast – while eastern breeding mergansers migrate to the southern U.S.

During the breeding season, hooded mergansers are most often found in densely wooded streams or small wetlands. They are tree-nesters, but will also use man-made nest boxes. Nest sites have often been prospected by the female the summer before.

LEFT: DENIS FAUCHER RIGHT: DUCKS UNLIMITED CANADA

Despite the threats, positive trends in population indices suggest that, particularly in the eastern range, this species is making a recovery.

Lesser Scaup

petit fuligule | *Aythya affinis*

Traditionally, lesser scaup (a.k.a. blue bill) have been one of the most abundant ducks in North America; however, over the last 20 years, the population has spiraled downward reaching an all time low of about 3.7 million birds in 2005. Distinguishing between the greater and lesser scaup at a distance is difficult; thus, population estimates for the two species are combined. Lesser scaup, however, make up the vast majority of the combined population. While lesser scaup have declined throughout most of their breeding range, the steepest decline has occurred in the western boreal forest. This wetland-rich region supports about 67 per cent (long-term average) of the scaup counted in the traditional survey area during the breeding population survey as well as some of the highest breeding densities. Consequently, the western boreal forest is recognized as one of the most important breeding and moulting areas. Furthermore, many biologists believe the answer to the decline in lesser scaup populations lies in the boreal forest and as a result more and more research is being conducted there to investigate.

The breeding male lesser scaup sports a black-purple glossed (and slightly peaked) head, a blue bill, a grey and white back, and a short white wing stripe. The drab brown female has a white face patch around her bill and a short white wing stripe.

Many biologists believe the answer to the decline in lesser scaup populations lies in the boreal forest.

Habitat

During breeding, lesser scaup use semi-permanent and permanent wetlands in the boreal forest and in the boreal transition zone, and small seasonal and semi-permanent wetlands in the prairies and prairie-parkland regions. In the fall and winter, they move to larger, more permanent wetlands such as lakes, rivers and estuaries. Typically, lesser scaup use wetlands with large quantities of submergent and emergent vegetation – which are important for feeding, nesting and cover.

Diet/Feeding Behaviour

The lesser scaup diet demonstrates temporal and spatial variability. For much of the early breeding season, they feed on aquatic invertebrates like amphipods, midges, clams, snails and zebra mussels. Seeds from aquatic plants, such as the yellow pond lily, may dominate the diet during the late summer and at other times of the year. The winter diet varies geographically. For example, lesser scaup along the Columbia River eat tremendous amounts of waterweed and pondweed, while scaup wintering in South Carolina eat mostly mollusks. Lesser scaup make short dives for food. Food is taken either from the water column or by shovelling through soft bottom substrates. Most food is swallowed under water, but some larger items are handled at the surface.

Breeding

Lesser scaup begin courtship in December, continue through spring migration, and are paired by the time they reach their breeding grounds. Although yearling females can successfully breed, most do not until they are two or three years old.

Lesser scaup nest in dense cover on islands, uplands, floating mats of vegetation or in emergent vegetation. The average clutch size is nine eggs and incubation lasts between 21 and 27 days. Once hatched, ducklings can walk, swim and dive almost immediately. Broods will sometimes amalgamate, creating large groups with many ducklings and often more than one female. Ducklings are able to fly at 47 days. Males desert their mates roughly midway through incubation and form large post-breeding flocks.

Migration/Winter Range

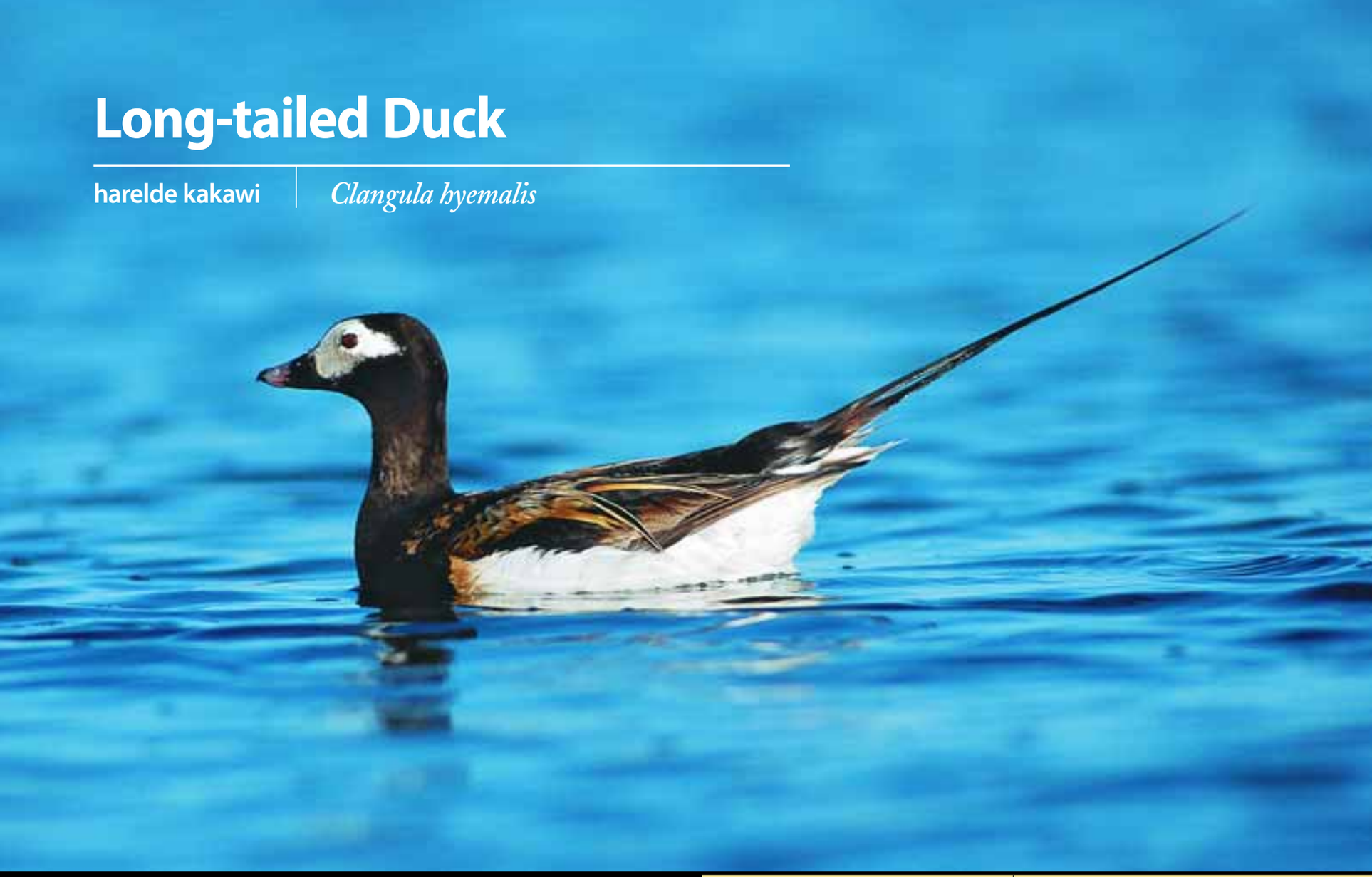
Lesser scaup start moving north from their wintering grounds in February. They arrive on their breeding grounds from late March to early June. During moult migration, males, unsuccessful females and non-breeders will migrate to large lakes or marsh complexes like Utikuma Lake in Alberta, the Peace-Athabasca River Delta or the Saskatchewan River Delta to undergo their primary feather moult. Numerous groups of several hundred – and some of up to 6,000 scaup – have been observed by DUC staff on these and other boreal wetlands during staging surveys. In the fall, lesser scaup are some of the last ducks to venture south. The main migration route from boreal banding stations to their southerly wintering areas is along the Mississippi River, as indicated by the number of banded scaup recovered in this region *(figure 6)*. They typically wait for ice and snow to force them to migrate, moving only as far south as necessary. They begin arriving on their wintering grounds in the southern U.S. and points south in November. Wintering scaup are often seen in large flocks numbering in the thousands.

Figure 6: Banding and recovery sites – lesser scaup (15,834 banded; 1,300 recovered)

While lesser scaup have declined throughout most of their breeding range, the steepest decline has occurred in the western boreal forest.

Long-tailed Duck

harelde kakawi | *Clangula hyemalis*



The long-tailed duck, once known as the oldsquaw, is one of Canada's northernmost breeding diving ducks. Its breeding range includes Canada's Arctic, Subarctic and northern fringes of the boreal forest. Breeding population surveys conducted by the U.S. Fish and Wildlife Service only cover a small portion of the long-tailed ducks breeding range. However, in this traditional survey area, about 55 per cent of the long-tailed ducks counted here since the 1990s have been in the boreal forest with the rest largely being on the Alaska tundra.

Furthermore, the steepest sustained declines have occurred in Canada's western boreal region where populations had decreased by an estimated 3.4 per cent annually from 1961 to 2005. Birds banded in Canada's boreal forest – from as far west as the Yukon – have been recovered by hunters on the Great Lakes and the Atlantic seaboard in the winter *(see table, page 38)*. The boreal forest is critical in providing breeding habitat, and also for providing much needed stopover habitat during migration.

The long-tailed duck, once known as the oldsquaw, is one of Canada's northernmost breeding diving ducks.

LEFT: DUCKS UNLIMITED CANADA RIGHT: JIM FLYNN

Males are easily identified by the very distinct long black tails. During the winter and spring, the male's head, back and belly are white, but the chest, lower back, wings and neck are black. He has a grey eye patch and a black bill. During the other two plumage phases, the colouration is much duller. Though females do not have long tail feathers, they are easily identified by their black and white colouration and a grey eye patch. Long-tailed ducks fly with an erratic pattern of short wingbeats and side-to-side movements. They stretch their wings well down in flight but only slightly above the body on the upstroke, making their flight distinct.

Habitat

Long-tailed ducks nest on islands as well as on the open tundra and in the boreal forest. In Alaska, long-tailed ducks prefer deep wetlands with submerged vegetation early in the season, and shallow sedge or grassy wetlands while breeding. After breeding, they move to deeper wetlands, open lakes and coastal lagoons for moulting. During fall migration, long-tailed ducks stop to rest and feed at marine estuaries and inlets. Inland stopover habitat has not been well documented for cross-continental migrants and requires further investigation. Long-tailed ducks spend the winter on protected marine waters, often over cobble or bedrock shelves, or on large ice-free interior lakes.

Diet/Feeding Behaviour

Depending on the time of year, the diet of the long-tailed duck can consist of larvae, aquatic insects, crustaceans, mussels, herring spawn, clams, and fish eggs and small fish. They dive for food using their feet for propulsion and their wings to steer. Although long-tailed ducks generally feed in water less than nine metres deep, they can reach depths of up to 60 metres – deeper than any other diving duck.

Breeding

The courtship begins on the wintering grounds. Males court females using a variety of displays: bill tossing, lateral head shaking, dipping the head and neck under water, rear end and chest displays and vocalizations. By spring most birds have formed bonds and leave the wintering grounds together.

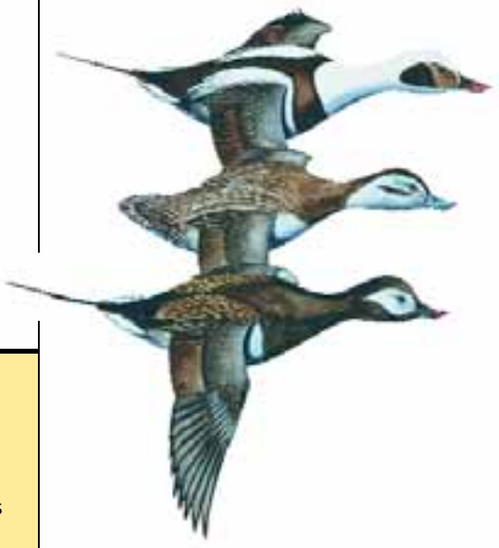
Nesting begins in late June. Females search for suitable nest sites while males remain on the lookout. After the first egg is laid, the female constructs the nest with surrounding vegetation. The eggs are pale grey to olive in colour and the average clutch size is seven. When the clutch is complete and the hen begins incubation, the male leaves for the sea to gather with other males and non-breeders to moult.

Incubation lasts about 26 days. After the ducklings are dry (about 24 hours) the female leads them to a nearby wetland. Once on the water, brood amalgamation is common, and crèches of 32 ducklings with just one attendant adult have been observed. Ducklings fledge at 35 to 40 days and usually fly to the sea to begin preparing for migration.

Migration/Winter Range

On the east coast, long-tailed ducks begin spring migration in late March to early April, but from the west coast or the Great Lakes, they begin in late February. Males and non-breeders will migrate to moulting areas in late June and females and fledglings in August. Winter migration typically begins in October and then peaks in late November to early December. Long-tailed ducks winter along all of Canada's coasts as far south as the northernmost U.S., and as far north as southern coasts of Greenland.

The boreal forest is critical in providing breeding habitat, and also for providing much needed stop-over habitat during migration.



Males are easily identified by their distinct long black tails. During the winter and spring (left), the male's head, back and belly are white, but the chest, lower back, wings and neck are black. Though females do not have long tail feathers, they are easily identified by their black and white colouration.

Mallard

canard colvert | *Anas platyrhynchos*

Ask someone to name a type of duck, and many people will answer readily: the mallard. Arguably the most identified and recognizable duck in North America, the mallard is well known for its colourful appearance and distinctive call. What few people recognize however, is that Canada's boreal forest is a prime breeding area for mallards, second only to the prairie pothole region, which is based on breeding population surveys conducted by the U.S. Fish and Wildlife Service. Since the 1960s, ten-year averages suggest about 30 per cent of the mallards counted in the traditional survey area are in the boreal forest. During drought years on the prairies, many mallards are suspected to continue flying north to the boreal forest. Bands from birds banded in the Canada's boreal forest have been recovered in almost every state, province and territory *(figure 7)*.

With an iridescent green head, green-yellow bill, chestnut breast, curly black tail feathers, violet-blue speculum and orange feet, the male mallard certainly stands out. The female is drab brown with a violet-blue speculum, orange feet and an orange and black bill. Like many dabbler females, she also has a dark eye-line. During the eclipse plumage, males are virtually identical to females except for the yellowish-green bill of the male.

Habitat

The mallard occupies nearly every type of habitat, from human altered landscapes like city parks and golf courses to remote wetlands deep in the forest. In the boreal, mallards occupy vegetated and productive wetlands with open water. During migration, they occupy flooded agricultural fields and shallow marshes and ponds. Even though most mallards winter in the U.S. interior, large numbers do spend winters in cold environments like southern Canada and Greenland. These hardy birds require little more than a patch of open water and a secure supply of food to survive. As a result, they are the most abundant duck observed during Christmas Bird Counts in Canada.

Diet/Feeding Behaviour

As a member of the dabbling duck group, mallards feed by either 'tipping up' or dabbling along the surface. They have an opportunistic and generalized diet, dominated by animal foods – such as insect larvae and aquatic invertebrates – during the breeding season and by seeds, aquatic vegetation and cereal crops during fall migration and winter.

Breeding

Pairing begins as early as August and is 95 per cent complete by the end of December. Males accompany their mates onto land while she selects a nesting site. Sites may be several hundred metres away from the water's edge and are established in a variety of habitat types. They construct the nest with vegetation. Mallards generally lay one egg per day – with an average clutch size of nine. Before the female leaves the nest to forage, she covers her eggs with nest material to conceal and insulate them.

During the egg-laying period, time spent on the nest increases with each egg laid. Incubation begins in earnest when the last egg is laid. Soon after the ducklings have hatched, the female leads them to a nearby wetland. Renesting is fairly common following a predation event, though fewer eggs are laid the second time. Most males abandon their mates once incubation begins. The males will relocate to larger wetlands and gather with others to begin moulting. Females remain with their young until they are able to fly – usually at 52 to 60 days – and often moult nearby on rearing wetlands.

BRIAN WOLITSKI (2)

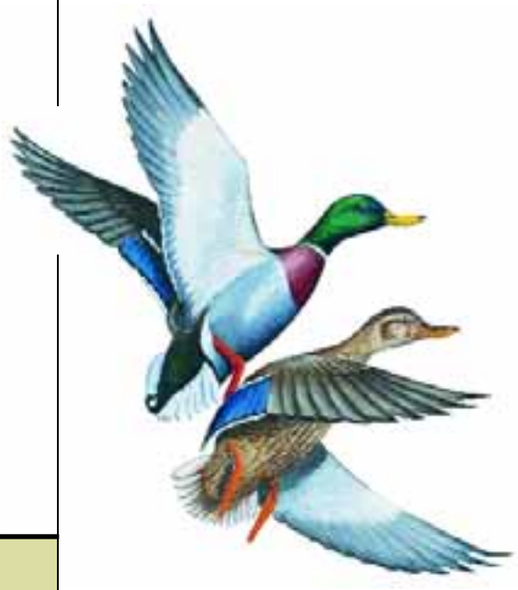
Migration/Winter Range

Mallards are one of last of the dabbling ducks to leave the breeding grounds in the fall. They also have one of the longest fall migration seasons, running from late summer to early winter. The Mississippi Flyway is heavily used by mallards during migration, earning it the nickname of "The Mallard Flyway".

Their winter range extends through parts of southern Canada and the continental U.S., though wintering populations have also been recorded as far north as Nunavut, Yukon and the Northwest Territories. Along with pintails, mallards are among the earliest spring migrants to arrive on the breeding grounds each year.

Canada's boreal forest is a prime breeding area for mallards, second only to the prairie pothole region.

Figure 7: Banding and recovery sites – mallard (161,668 banded; 24,298 recovered)



Mallards occupy nearly every type of habitat, from human altered landscapes like city parks and golf courses to remote wetlands deep in the forest. In the boreal, mallards occupy vegetated and productive wetlands with open water.

Northern Pintail

canard pilet | *Anas acuta*

The northern pintail is one of the most elegant ducks in North America, not only for its beauty, but also its grace in flight. The pintail is also one of the most widely distributed and recognizable ducks in North America, breeding throughout the northern half of the continent. In 2005, the pintail population was estimated at 2.56 million birds, 38 per cent below the long-term average and 46 per cent below the North American Waterfowl Management Plan goal. Since the 1960s, decadal averages suggest that about 20 per cent of the pintails counted in the traditional survey area are in the boreal forest. Each year about 150,000 pintails breed in the Mackenzie River Delta and Yukon's Old Crow Flats. More recent information indicates that pintails marked with satellite transmitters during the winter in California, New Mexico and Texas migrate to the boreal forest and points north. The number of pintails breeding in the boreal forest is even higher when the Prairies are suffering from drought conditions since, like many other ducks that typically nest in the Prairies, they overfly this region to breed in the

The number of pintails breeding in the boreal forest is even higher when the Prairies are suffering from drought conditions.

boreal forest and elsewhere. Returns from pintails banded in the boreal forest indicate they use all four migration corridors to travel to and from their wintering grounds, further highlighting the need to ensure that boreal forest and other habitats are conserved to maintain these populations.

Male and female pintails have a long, slender neck, tapered body, long narrow wings, blue-grey legs and a high posture. Breeding male pintails have a chocolate brown head, grey back, white belly and neck stripe and long black tail feathers. The female is mottled brown, like most other dabbler females, though a slender silhouette makes her distinct. The male's speculum (wing patch) is a brownish-green, with buff below and white above, whereas the female has a dull brown or bronze speculum.

LEFT: DENIS FAUCHER RIGHT: BRIAN WOLITSKI

Pintails use a variety of habitat across their extensive range. In the boreal forest, they use marshes and meadows with low, open sedge and herbaceous growth. During spring and fall migration, pintails stage on large open lakes, reservoirs and saltwater estuaries.

Habitat

Pintails use a variety of habitat across their extensive range. In the boreal forest and on the Arctic tundra, they use marshes and meadows with low, open sedge and herbaceous growth. In the prairie pothole region, they use shallow temporary or semi-permanent wetlands with emergent vegetation and low upland cover, with dry margins. During spring and fall migration, pintails stage on large open lakes, reservoirs and saltwater estuaries. Wintering pintails use a variety of shallow wetlands, both freshwater and intertidal, as well as flooded agricultural lands and estuarine habitats.

Diet/Feeding Behaviour

Pintails feed by tipping up or dabbling along the surface of the water. Their diet consists of a wide variety of foods, which is dependent on the time of year and geographic area. While the seeds of pondweed, sedges and grasses make up a large portion of their spring diet, females will switch to eating more invertebrates during the breeding season to prepare for egg laying. In fall and winter, pintails feed on wheat, barley and rice primarily, but other foods are also consumed.

Breeding

Mate selection is largely completed before spring migration begins. Because of the well documented male promiscuity, however pair bonds are considered to be weak. During the breeding season, mated males attempt to copulate with many females. This behaviour is referred to as extra-pair copulations or forced copulation – and can result in the male fathering multiple broods in one season.

Along with mallards, pintails are one of the first ducks to arrive on the breeding grounds. Pintails primarily nest in sparse cover (e.g. short grass prairie, grain stubble, sedges) but will also nest in winter wheat, buck brush and planted nesting cover. They will often nest as far as two kilometres from the nearest wetland. Females lay seven to 10 pale green to olive buff eggs in a nest constructed of surrounding vegetation and feathers, and incubation lasts about 23 days. After hatching, the female leads ducklings to a nearby wetland to feed. If a nest or entire brood is destroyed, birds will renest once; however, more than two attempts are rare. Young fledge at about 46 to 57 days.

Migration/Winter Range

Pintails begin migrating in February and arrive on their northern breeding grounds in May. They migrate north as fast as the retreating ice and snow allows them to. Pintails begin fall migration in August and arrive on their wintering grounds by late November. Most winter in the Sacramento Valley or in the Gulf coast states, but some winter on the Aleutian Islands and coastal B.C. During spring and fall migration thousands of pintails use boreal wetlands like those around Great Slave Lake and the Mackenzie Delta.

Figure 8: Banding and recovery sites – northern pintail (64,492 banded; 5,197 recovered)

Each year, about 150,000 pintails breed in the Mackenzie River Delta and Yukon's Old Crow Flats.

Northern Shoveler

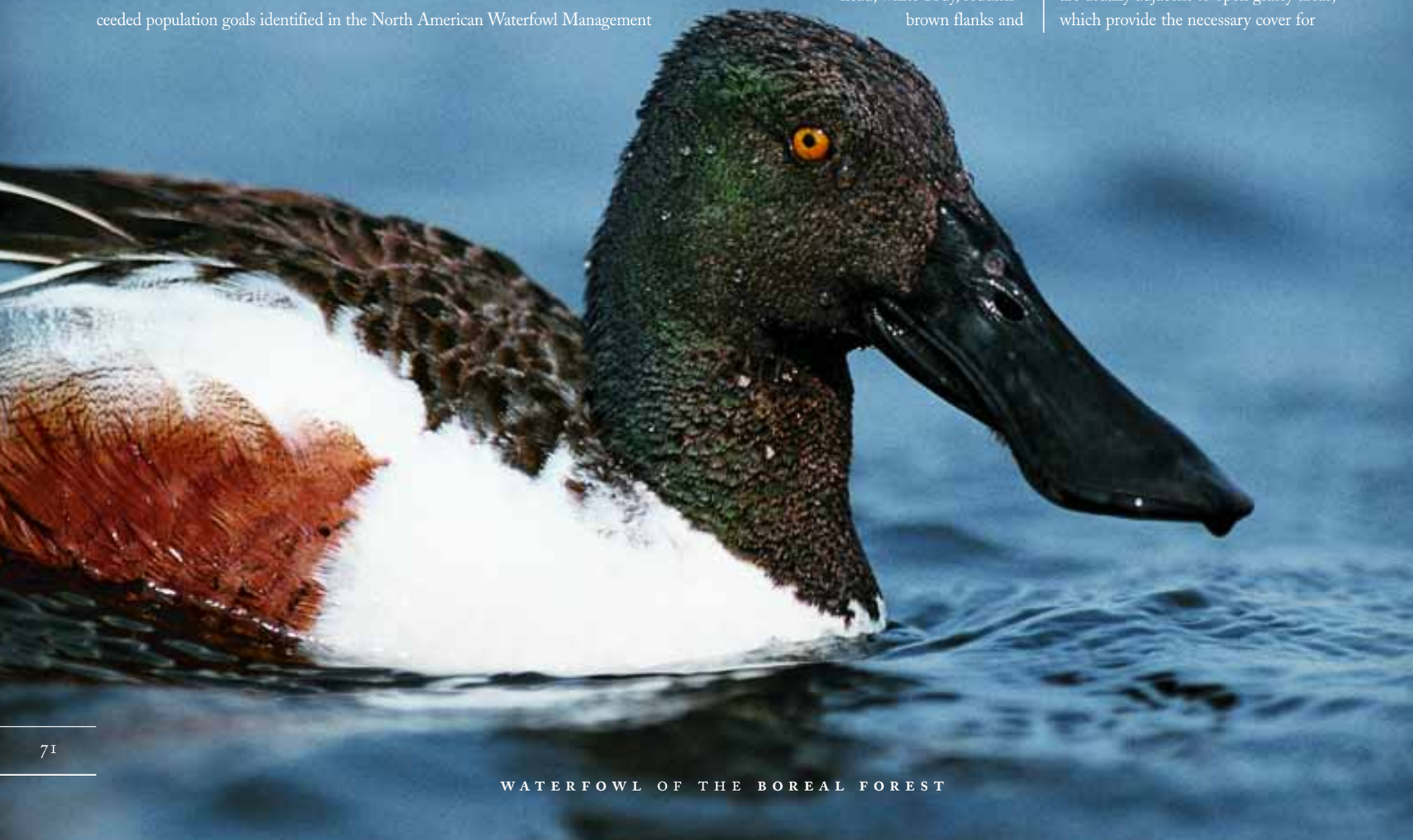
canard souchet | *Anas clypeata*

THE NORTHERN SHOVELER IS A HIGHLY SPECIALIZED DABBLING DUCK. The prairie pothole and parkland regions are the heart of the shoveler's breeding range, however the western boreal forest is also important since about 17 per cent of shovelers counted in the traditional survey area are in the boreal forest. Survey data have shown an increase in population across much of the shoveler's range beginning as early as 1961. This species is one of the few that has exceeded population goals identified in the North American Waterfowl Management Plan, with the largest increase in long-term average occurring in Alaska and the Old Crow Flats in Yukon. The boreal forest also provides valuable habitat for shovelers and other waterfowl during moulting and staging periods. Bands from northern shovelers banded in the boreal forest have been recovered by hunters in 14 states and 5 provinces *(see table, page 38)*. Northern shovelers winter throughout the southern United States and Mexico.

Northern shovelers are often referred to as "spoonbills" or "spoonies" because of their unique spatula-shaped bill. The breeding male is distinguished by a green head, white body, reddish-brown flanks and black bill. The female is grey-brown with subtle black streaking. She has an olive-green bill, a green speculum and blue shoulder patches. At a quick glance, a hen shoveler could be mistaken for a female mallard, though with a closer look most observers would notice the unique colours of the wing and the large silhouette of the bill.

Habitat

Shovelers inhabit open, shallow and muddy wetlands with an abundance of submergent vegetation. These wetlands are usually adjacent to open grassy areas, which provide the necessary cover for



BRIAN WOLITSKI (2)

nests. Similar habitats are used during spring and fall migration. Freshwater and saline marshes, industrial cooling ponds, agricultural wastewater ponds, coastal lagoons, estuaries and mangrove swamps provide wintering habitat.

Diet/Feeding Behaviour

In the summer, the northern shoveler's diet is dominated by small crustaceans, seeds and larvae. Favourite foods include the water boatman, midge and caddis fly larvae, copepods and ostracods. In winter, shovelers consume larger quantities of small mollusks, aquatic insects and zooplankton. The unique bill morphology allows shovelers to excel at filter feeding. The large bill contains comb-like teeth called lamellae that are used to filter food items from the water. Moving its head from side to side, the shoveler extracts food by filtering water through the lamellae. Occasionally they forage in groups, rotating like pinwheels to stir up the suspended food in the water column.

Breeding

Shovelers begin pairing in December. Typically, groups of males court a single female with a variety of visual and auditory displays including lateral dabbling, head dipping, wing flapping and jump flights. Once the female has chosen her mate and pair bonding is complete, pairs depart for their breeding grounds together. Breeding season site fidelity is high, especially if the female bred successfully the previous year. Males defend their mates and territories diligently through the season.

The male shoveler will accompany his mate while she searches for an appropriate nest site, most often in short grass prairie or vegetation less than 0.3 metres tall. The female builds the nest by first scratching a depression into the ground, then building a nest bowl with surrounding vegetation.

Females lay one egg each day until a clutch of eight to 12 pale olive-coloured eggs is deposited. The eggs are incubated for 20 to 25 days. Within 24 hours of the synchronous hatch, the female leads the ducklings to water. The ducklings are able to fly between 47 and 54 days. If a nest is destroyed by a predator, the female will renest. However, the second clutch size is often smaller.

Migration/Winter Range

Shovelers depart from the wintering grounds in late March and are one of the last ducks to arrive on the breeding grounds. Male depart their breeding grounds in late summer, making them one of the earliest fall migrants. Females and young do not depart until September or October. Surveys conducted at various locations throughout the boreal forest show that most staging flocks contain about 100 individuals. Although, at some popular staging areas such as the Peace-Athabasca River Delta, flocks of up to 5,000 birds have been observed by DUC field staff.

Shovelers usually migrate in small isolated flocks of 10 to 25 and travel both day and night. In North America, two migration corridors are favoured. One passage extends through the Central Plains, along the Mississippi and Missouri valleys to the Gulf coast and Mexico. The other corridor extends from western Canada, through intermountain regions of California to the west coast of Mexico.

Approximately 36 per cent of the shoveler population breeds within the boreal forest and even more stop there during spring and fall migration.

Shovelers inhabit open, shallow and muddy wetlands with an abundance of submergent vegetation. These wetlands are usually adjacent to open grassy areas, which provide the necessary cover for nests. Within 24 hours of the hatch, the female will lead the ducklings to water.

Red-breasted Merganser

harle huppé | *Mergus serrator*

This medium-sized sea duck breeds almost exclusively in the boreal and Arctic regions of the northern hemisphere. Decadal averages of the breeding population survey indicate that about 90 per cent of the estimated 600,000 mergansers (all three species combined) counted are in the boreal forest. This population estimate is likely low since it includes only about half of their continental range. Unfortunately, little is known about historic red-breasted merganser population trends as they have not been specifically targeted in surveys. However, between 1961 and 2005, merganser populations increased about one per cent per year in western boreal Canada, and 2.5 per cent overall.

Red-breasted mergansers are medium-sized ducks with dark bodies and long red bills. The male red-breasted merganser is distinguished from the common merganser by its ragged double crest, white collar and reddish chest. Both the male and female have red bills, irises and legs. The red-breasted merganser is one of the fastest ducks in flight, traveling up to 130 km/h. It flies with rapid wingbeats and tip reversal to increase its propulsion. When underwater, it propels itself with its webbed feet as do many diving ducks.

Habitat

Red-breasted mergansers nest along the forested shorelines of rivers and lakes throughout the boreal forest. On the tundra they tend to use larger, deeper lakes than the average Arctic wetland. Though mostly solitary nesters, red-breasted mergansers sometimes form loose colonies on rocky islets or islands. Red-breasted

mergansers use waterways with submergent vegetation for rearing their broods. Habitat selection is also probably affected by the availability and abundance of small fish. In winter, red-breasted mergansers move to sheltered coastal bays and estuaries. They also target areas with submergent vegetation such as seagrass beds. On the eastern seaboard of the United States, red-breasted mergansers show a preference for rocky, silty and sandy substrates over muddy bottoms.

Diet/Feeding Behaviour

The red-breasted merganser diet is comprised mostly of small fish (usually less than 10 centimetres), which it captures underwater with its serrated bill. It hunts in groups or alone by swimming along the surface with its head submerged, looking for prey. The red-breasted merganser is considered an opportunistic feeder, consuming crustaceans, worms, aquatic invertebrates, amphibians, smolts and herring eggs when available.

Breeding

Red-breasted mergansers acquire adult plumage and become sexually mature after their second year. Pair bonds are initiated on the wintering grounds in December, and solidified in March during migration. Male courts females with head shaking, chest and crest lifting, wing flapping and ritualized bathing demonstrations. Pairs arrive on the breeding grounds in late May and often nest at the same location several years in a row. They are tolerant of other nesting birds and often form loose colonies with gulls, terns and other ducks.

Females will choose nest sites on the ground, unlike the common and hooded mergansers, which are both cavity nesters. Red-breasted merganser nests are usually well concealed in dense and overhanging cover such as the low, drooping branches of conifers. In unique documented cases, nests have been found in an abandoned igloo and under an inverted wooden box. Typical vegetation cover includes nettles, thistles, gooseberry and Labrador tea.

The female builds her nest out of vegetation found at the nest site. She lays an average of seven olive-buff coloured eggs in early June and then begins incubation which takes about 30 days. Males leave the breeding grounds for their moulting areas as soon as incubation begins.

Once synchronously hatched, the young spend up to 24 hours at the nest site drying off. They are then led to water where they forage on fish, insects, larvae, worms and crustaceans. Brood amalgamation often occurs and crèches are formed, attended by one or more females. The young remain on the water for up to 60 days before they fledge and ultimately begin their migration southward.

Because red-breasted mergansers are late nesters and breed in the Arctic and boreal zones where the season is short, renesting is unlikely.

Migration/Winter Range

In general, band returns are used to help determine migration routes, but because there are very few red-breasted mergansers banded, their travel corridors are typically determined by other methods. In the fall, most birds fly from the breeding grounds toward either the Atlantic or Pacific coasts. Some fly to inland wintering grounds like the Great Lakes or Great Salt Lake in Utah. Birds usually migrate in flocks of five to 15, though flocks as large as 500 and rafts as large as 15,000 have been reported. Pairs and small flocks begin spring migration in late March to late April, and reach the breeding grounds by mid to late May, just as ice begins to recede from wetlands.

Red-breasted mergansers nest along the forested shorelines of rivers andlakes throughout the boreal forest. Though mostly solitary nesters, they sometimes form loose colonies on rocky islets or islands.

Between 25 and 49 per cent of the red-breasted mergansers breeding range lies within the boreal forest.

DUCKS UNLIMITED CANADA (2)

Redhead

fuligule à tête rouge | *Aythya americana*

Redheads are exclusively North American ducks, found nowhere else on earth. These medium sized diving ducks breed in high concentrations in the prairie pothole region, along the shores of Ontario's Great Lakes and the St. Lawrence River in Québec, and on inland river deltas of the boreal forest, such as the Saskatchewan and the Peace-Athabasca. The boreal forest provides moulting and staging areas for large numbers of prairie breeding redheads as well. DUC staff have observed numerous flocks of several hundred and even a few flocks of close to 5,000 redheads during fall surveys in the boreal. Bands from redheads banded in the boreal forest have been recovered in 27 states and five provinces *(figure 9)*. In the winter, redheads will congregate along the Gulf of Mexico, the Atlantic coast and at inland wetlands of the Midwest.

Although redheads are fittingly named for the male's brightly coloured head, they could just as easily be called 'roundheads' for their distinct sillhouete. Redheads has a greyish-blue bill with a black tip, a black chest and tail, grey back and sides, white belly, grey legs and yellow eyes. Females are more difficult to identify since they are almost entirely brown. They have dark eyes circled by a white eye-ring and a greyish-blue bill. Their grey wings have a light grey band, which extends into the primaries, resembling those of several other diving duck species. The redhead's flight pattern is erratic and fast.

Habitat

Redheads are opportunistic when selecting wetlands. They use a variety of wetland types and sizes including seasonal and

semi-permanent wetlands, natural lakes, and reservoirs. For breeding and brood rearing they prefer deep water wetlands surrounded and interspersed with vegetation such as cattails, sedge and bulrush. For moulting, they prefer clear, shallow lakes (one to two metres in depth) with abundant submerged vegetation. Wintering redheads use shallow coastal waters with abundant sea grasses – as well as inland lakes and reservoirs.

Diet/Feeding Behaviour

Redheads are highly adaptable, and are able to alter their feeding strategy to suit food availability. Depending on water depth, they feed by diving, gleaning from the surface, or dabbling just below the surface. They eat seeds, buds and tubers of submergent aquatic plants, as well as larvae, eggs, snails and other aquatic invertebrates. During egg production and incubation, the female – like most ducks – consumes more protein-rich invertebrates than normal.

Breeding

Pair bonds are initiated in late winter. Courtship increases during spring migration and peaks in late April. Redheads are a late-nesting species and prefer to nest over water in bulrush, cattails or sedges. The redhead has the greatest propensity of all ducks to carry out nest parasitism, in which the female redhead will muscle eggs into the nests of other ducks. Canvasbacks and other redheads are primary targets. Because of the high degree of nest parasitism, the average clutch size for redheads is often difficult to establish. The best estimate is 11 eggs, three to four of which may be the eggs of another female. When on her own nest, the female incubates for 25 days before the eggs hatch. The male abandons the female shortly after incubation is initiated and therefore renesting is rare.

Unsuccessful females congregate with males in large flocks to moult and stage before the fall migration. If the female is successful and the eggs hatch, she stays with her brood for 42 to 56 days. Ducklings are able to fly at about 60 days of age. Although sexual maturity occurs at age one, many individuals do not breed in the first year. It is thought that the timing of hatching and the quality of conditions on the natal wetland will affect the timing of first breeding.

Migration/Winter Range

Redheads arrive on the breeding grounds as soon as the ice breaks in the spring. Fall migration begins in September and most arrive on the wintering grounds by mid- to late October. Redheads migrate overland in tightly packed small groups of five to 35 individuals. They do not fly in large flocks like canvasbacks or scaups, but do congregate by the thousands at stopovers and on the wintering grounds.

The redhead has the greatest propensity of all ducks to carry out nest parasitism, in which the female redhead will muscle eggs into the nests of other ducks. Canvasbacks and other redheads are primary targets.

Figure 9: Banding and recovery sites – redhead (1,448 banded; 186 recovered)

DUC staff have observed numerous flocks of several hundred and even a few flocks of close to 5,000 redheads during fall surveys in the boreal.

DUCKS UNLIMITED CANADA (2)

Ring-necked Duck

fuligule à collier | *Aythya collaris*

THE RING-NECKED DUCK IS ONE OF THE MOST abundant ducks of the western Canadian boreal forest. The core breeding area for ring-necked ducks is the boreal forest of Alberta, Saskatchewan, Manitoba and parts of the Northwest Territories. About 85 per cent of the ring-necks counted in the traditional survey area are counted in the western boreal forest. The prairie pothole region is largely avoided by breeding ring-necked ducks. Ring-necks winter across most of the southern and coastal U.S., as well as Mexico and the Caribbean. Many ring-necks banded in the boreal forest have been recovered in the eastern U.S., especially in the Great Lakes area, Florida and the southern coast *(figure 10)*.

The ring-necked duck is misleadingly named for the chestnut-coloured ring around the black neck of the breeding male, as it is barely visible when identifying birds from a distance. This species is sometimes mistaken for some of its diving duck relatives, like the lesser and greater scaup, but there are some key differences to distinguish them. A breeding male has a black back, a white triangle in front of the folded wing, an angular head, white bars on the bill, and uniformly dark wings. In contrast, scaup species have a grey back, rounded head, plain bill and a white line on the wing. Females resemble scaup and redhead females with the angular head, white band near the bill tip and white eye ring as distinguishing features.

Habitat

Unique to diving ducks, ring-necked ducks prefer shallow wetlands fringed with emergent, submergent or floating vegetation like bulrush, pondweed and

pond lily. They are generally shallow divers when feeding, so they do not tend to exploit the deeper water habitats preferred by their diving duck cousins. And unlike many other divers, the ring-necked duck can take off from a puddle, without having to run along the water's surface, and flies swiftly and erratically in small compact groups, possibly a result of the small woodland wetlands it inhabits during breeding. Wintering ring-necks can be found on wild rice lakes or on other shallow wetlands rich with submergent or emergent plants.

Diet/Feeding Behaviour

Feeding by shallow dives, as well as dabbling at or just under the surface, ring-necked ducks are much more generalized feeders than other diving ducks. They eat mostly plant matter like seeds and tubers of submergent vegetation, but also feed on snails, insects, leeches as well as other aquatic invertebrates. Like many dabbling and other bay ducks, their diet varies for females during high energy cost periods, such as egg production and nesting, when they will consume more protein-rich invertebrates. Young ducklings depend on animal matter exclusively, but as they reach maturity they gradually shift to a diet made up of mostly plants.

Breeding

Pairing usually occurs during spring migration, so unpaired ducks arriving on the breeding grounds are likely non-breeders. Females build nests over water in emergent vegetation on wetland fringes, usually consisting of sedges and woody plants like leatherleaf. Before a female ring-necked duck begins laying eggs, she builds a loose platform of nest material, which develops in size and structure as laying proceeds. When they are completed, nests require constant maintenance to prevent flooding. Females lay an average of nine eggs, and incubate them for 25 to 29 days. The male may accompany the female from feeding areas to the nest during egg laying, but does not stay to defend the nest, and the pair bond abates soon after she starts incubating. There is no evidence of territoriality in this species, and ducklings are the most docile of all diving ducks. The female hides her brood in emergent vegetation along a wetland edge, unlike other diver broods that are commonly seen in open water.

Migration/Winter Range

Ring-necks are midseason migrants, arriving on the breeding grounds from late March to end of May, depending on the destination. Fall migration occurs from late September to early December. Males are first to depart in the fall, with females and young following. The bulk of travel takes place at night in smaller flocks than most duck species.

Careful monitoring and planning is necessary to ensure that the ring-neck's population is not being affected by changes in boreal forest habitat.

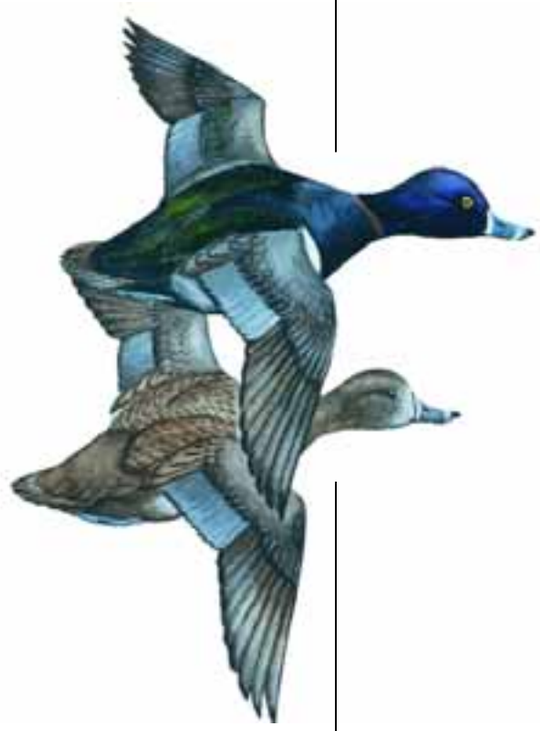


Figure 10: Banding and recovery sites – ring-necked duck (1,828 banded; 252 recovered)

Ruddy Duck

érismature rousse | *Oxyura jamaicensis*

Ruddy ducks are small, stocky, stiff-tailed ducks. Their unique look and coloration, along with their bizarre breeding behaviours, make them popular among birders and naturalists. In North America, ruddy ducks primarily breed throughout the prairie pothole and parkland regions; however, they also breed in the boreal transition zone and southern portions of the boreal forest. The majority of ruddy ducks winter along the U.S. coasts. Ruddy ducks have been banded at several locations in the boreal forest; however, there have not been many of these birds recovered *(see table, page 38)*, mainly because they are not highly preferred by waterfowlers.

The breeding male ruddy duck's upper body, neck and sides are a deep chestnut. He has a dark tail that often stands upright, dark brown wings, a white belly, a sky-blue bill, white cheeks and a black-capped head. The female's cheek patch has a single dark line through it and is less distinct than the male's. She has a slate-grey bill, no black cap, and a grey-brown body. During the non-breeding season, males lose the blue colour on their bill and the reddish-brown of their body, and begin to closely resemble females and immature birds.

Ruddy duck feet are set far back on the body, a common characteristic of good divers. When confronted with danger they prefer to dive rather than fly. Long running takeoffs are required to gain flight, but once in the air they are swift and direct – though not that highly manoeuvrable.

Habitat

Ruddy ducks breed on wetlands of various sizes. They prefer wetlands with extensive

emergent vegetation and ample open water for easy landings and takeoffs. Brood rearing typically takes place on semi-permanent and permanent basins with abundant emergent vegetation. There is little information regarding moult site selection, but it has been suggested that males and non-breeders moult on large wetlands and lakes north of their breeding grounds in the boreal forest. Surveys conducted by DUC have noted groups of up to 300 ruddy ducks on boreal wetlands in September and October. During their migration and on the wintering grounds, ruddy ducks generally use large lakes, reservoirs or other permanent wetlands.

LEFT: DUCKS UNLIMITED CANADA RIGHT: BRIAN WOLITSKI

Diet/Feeding Behaviour

Ruddy ducks feed on aquatic plants in shallow water by diving and occasionally feeding at or just below the surface. Plant material like seeds, tubers and leafy parts of pondweed, bulrush and aquatic grasses are popular. Aquatic invertebrates like midge larvae and mollusks are especially critical to young birds on natal ponds.

Breeding

Males migrate to the breeding grounds before females and pair bonds form shortly thereafter. Depending on latitude and location, peak arrival is anywhere from mid-March to mid-May.

The ruddy duck's "bubbling display" is used both as a courtship display and as a demonstration of aggression. The bubbling display involves a rapid head bob, a beating of the head against the breast, and a fanning of the erect tail. The action of the head beating against the breast creates bubbles in the water.

Despite the ruddy duck's small stature, it is one of the more aggressive ducks in North America. Both members of a pair

The ruddy duck's bubbling display is used both as a courtship display and a demonstration of aggression.

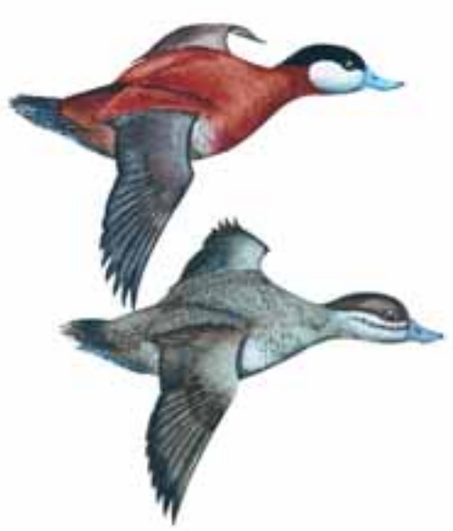
defend their breeding and nesting territory from encroaching waterfowl. Females with broods are very defensive and aggressive, especially towards lone males. In one study a ruddy duck was observed chasing off rabbits along a wetland shore.

Ruddy ducks nest over water in vegetation like bulrushes, sedges and cattails. Nests are normally built up from the marsh bottom, although some nests float. The average clutch size is eight large eggs, and they are incubated for about 25 days before hatching. Nest success is high among ruddy ducks and renesting seldom occurs. Ruddy ducks are also known to be parasitic egg layers. The departure of males from the breeding grounds varies widely, from midway through incubation to after the clutch hatches; some males even moult on their breeding grounds. The female abandons the young before they are able to fly, which doesn't occur until 42 to 49 days of age. This early abandonment may contribute to the high brood mortality rate. They often attempt to breed in their first year, but like many waterfowl species, breeding is more likely to be successful in the second or third year.

Migration/Winter Range

Ruddy ducks typically arrive on their wintering grounds before other diving ducks. Their fall flight begins as early as August with peak migration occurring in October. Ruddy ducks make use of all four continental flyways and typically fly at night in small groups of five to 15 individuals. However, larger flocks may build when multiple groups rest and feed together.

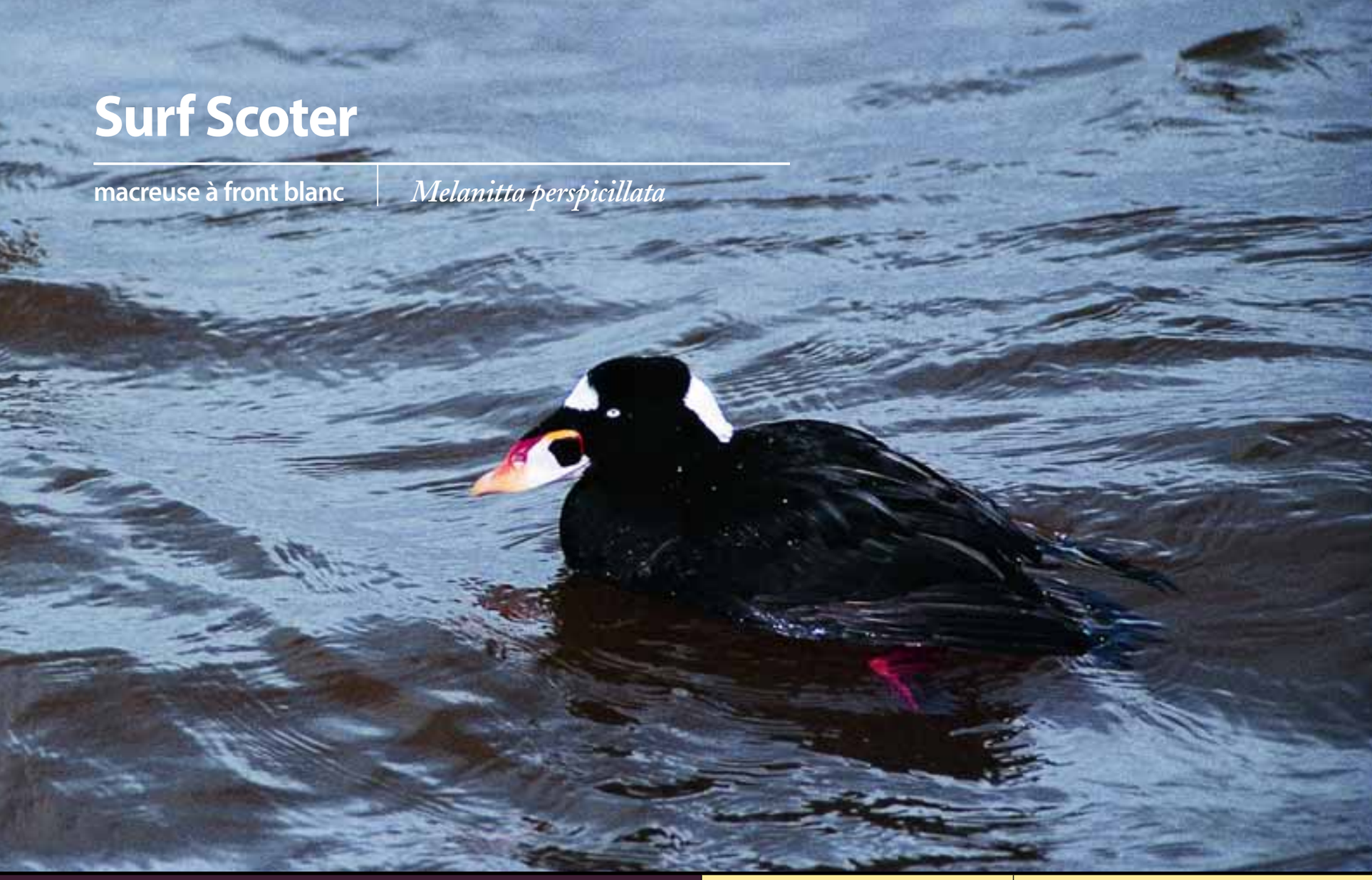
The ruddy duck's winter range includes the Pacific coasts of the U.S. and Mexico, the Atlantic and Gulf coasts of the U.S. and the U.S. interior. The San Francisco Bay area and the large interior valleys in California, as well as the Chesapeake Bay area in Virginia are key wintering areas for the ruddy duck.



Conservation of breeding and moulting sites within the boreal forest could contribute to the maintenance of this species' population.

Surf Scoter

macreuse à front blanc | *Melanitta perspicillata*



The surf scoter (a.k.a. skunk-head) – unlike its sea duck relatives, the white-winged and black scoter – is endemic to North America. Surf scoters breed in the boreal forest of northern Canada and Alaska, and spend the winter diving for clams and mussels along the Pacific and Atlantic coasts. Other than their most basic life history characteristics, very little is known about surf scoter ecology or population dynamics, let alone the role of the boreal forest in maintaining those populations. This may soon change however, as a rapidly declining scoter population (all three species combined) has triggered a cascade of partnerships and research initiatives aimed at better understanding scoter ecology, and hopefully quelling the decline.

The male surf scoter is identified by the prominent white patches on his forehead and neck, by the bright orange and white bill, and the overall black plumage. Females have dark back and light brown bellies, as well as a white patch on their cheek. During courtship, surf scoters make some interesting vocalizations, including a gurgling sound by the male

Other than their most basic life history characteristics, very little is known about surf scoter ecology or population dynamics.

and a crow-like call emitted by the hen. Surf scoter wings also make a whistling sound as they cut through the air in flight, which is characteristic of all three scoter species.

Habitat

Surf scoters breed on shallow lakes, small wetlands and muskeg bogs. They use lakes with rocky edges and little or no emergent vegetation in both western boreal Canada and in Québec. Surf scoters will gather in marine waters to moult. Some known moulting areas include Boundary Bay, British Columbia, the Bering Sea off of Alaska and the St. Lawrence Estuary of Québec. On the wintering grounds, they frequent coastal areas, above both rocky and sandy substrates within one kilometre of land.

Diet/Feeding Behaviour

Surf scoters feed by diving for prey in shallow water, usually less than 10 metres. Dive length is generally less than 30 seconds and synchronous diving is common. During most of the winter, surf scoters forage for mussels and clams; however, when Pacific herring begin spawning, surf scoters – like many other waterfowl – gorge on the nutrient-rich herring roe. Shortly after the spawn, surf scoters will migrate to their breeding areas. Here, they forage on benthic invertebrates like crustaceans and worms.

Breeding

Surf scoters develop pair bonds on the wintering grounds and breed for the first time at two to three years of age. Pairs arrive in the boreal forest from mid-May to early June and begin nesting soon after. The female conceals the nest under the low sweeping branches of conifers, usually a good distance from water. The few nests that have been observed were made from mosses, needles, feathers, twigs and bark.

After laying an average of seven creamy white eggs, the female begins incubation, which lasts for about 30 days. Males leave for their moulting grounds as soon as incubation begins, having spent only three weeks on the breeding grounds. Because the males leave so early, renesting is rare. If a nest is successful, the female leads the newly hatched ducklings to a nearby wetland to feed for about 55 days before they fledge.

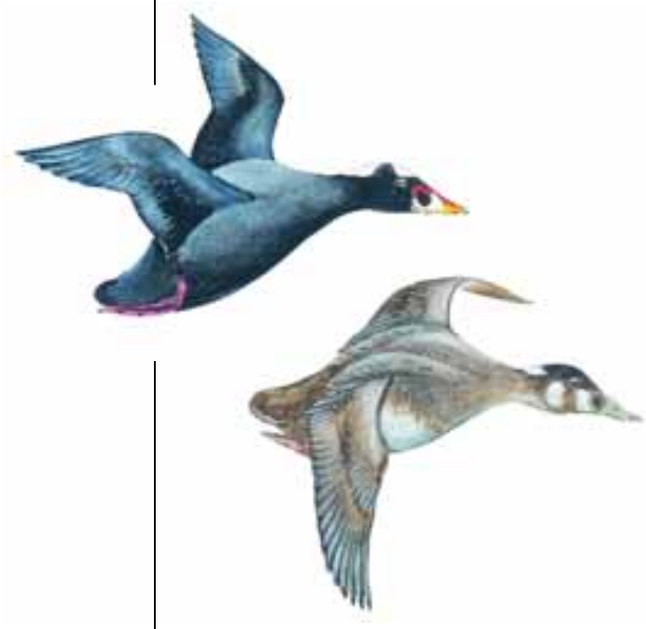
Migration/Winter Range

Spring migration starts in mid-March. Scoters fly along the coasts and overland to reach their breeding grounds. DUC has recorded groups of up to 50 surf scoters on wetlands in the western boreal forest during spring migration. Not all scoters migrate however; immature birds often forgo this first spring migration in favour of remaining on the wintering grounds all year. For those who do breed, moult migration begins in mid-June for males and mid-August for females. Fall migration occurs from August to November. Surf scoters migrate at night in large flocks from hundreds to thousands of birds.

LEFT: GILLES DAIGLE RIGHT: DARIN LANGHORST

Surf scoters breed on shallow lakes, small wetlands and muskeg bogs. They use lakes with rocky edges and little or no emergent vegetation in both western boreal Canada and in Québec.

Scoter populations in western North America have declined by approximately 50 per cent since the 1950s.



White-winged Scoter

macreuse brune | *Melanitta fusca*

White-winged scoters (a.k.a. white-wings) are the largest of three North American scoters. Their flocks resemble long black strings, as these sea ducks spread out in single-file across the horizon. Relatively little is known about their ecology since they breed, moult and winter in isolated areas like the boreal forest. Furthermore, breeding population estimates for white-wings are confounded since it is difficult to distinguish them from surf and black scoters from the air. There is however, evidence that suggests a severe decline in the long term population trend across its breeding range, most of which is in the boreal forest.

For many residents of northern communities, the whited-winged scoter is considered the black duck of the north, because there are virtually no colour markings on either sex – however, the male does have a white teardrop below the eye, an orange bill and a bright white speculum that contrasts markedly on the black wing. There is also a white speculum, albeit duller, on the otherwise drab-coloured female. Both sexes have pinkish feet.

Females often return to the same area to nest, and some even use the same nest bowl year after year.

Habitat

During the breeding season, white-wings use large freshwater and brackish lakes. Densities are particularly high on lakes with islands that have low shrubs and dense vegetation. They place nests under shrubby, even thorny, vegetation like gooseberry, snowberry and rose – and often nest far from water, some times at distances of up to 800 metres. White-winged scoters prefer to nest near lakes with abundant submergent vegetation and sandy bottoms. During migration, they stop over on large lakes, rivers and coastal estuaries – and prefer the shallow inshore waters of bays, estuaries and coastlines in the winter.

Diet/Feeding Behaviour

White-winged scoters dive to depths of one to three metres during the breeding season. Amphipods comprise the majority of their summer diet but clams, mussels, snails and insects are consumed as well. On the marine wintering grounds white-wings dive much deeper, to depths of five to 20 metres for clams, mussels, snails, amphipods and crabs. Small fish and plant material make up a small percentage of their diet.

Breeding

Although several white-winged scoter nests and broods have been recorded in Québec near the Little Whale River, Caniapiscau River and James Bay, historically their primary breeding range extended from the Ontario-Manitoba border west to central British Columbia and north to the treeline in Alaska. Over 60 per cent of the breeding season population now occurs in the boreal forest.

Pairing for this late-nesting species likely begins during migration and is completed on the breeding grounds. Males perform a neck-erect-forward display while swimming rapidly so that the neck appears thick. Pairs perform mutual displays prior to copulation. The male defends the female during egg laying but leaves once incubation begins. Females often return to the same area to nest, and some even use the same nest bowl year after year.

Females lay approximately 10 eggs and incubate them for 25 to 30 days. Soon after hatching, ducklings are led to water. Females protect their young aggressively for one to three weeks before leaving for the moulting grounds. Abandoned young often form aggregate broods of 30 to 55 ducklings, though groups of up to 150 have been observed. Research indicates that duckling survival is extremely low in the southern edge of their breeding range, between 1.4 per cent and 10 per cent surviving the breeding season. If they survive, they fledge about 70 days after hatching.

Migration/Winter Range

White-winged scoters are one of the last species of waterfowl to migrate from their breeding grounds. Leaving in September, they fly in flocks of up to 300 on their way to the Pacific and Atlantic coasts as indicated by some band returns *(see table, page 38)*. On the Pacific coast, white-wings will winter from the Aleutian Islands to California, occasionally as far south as the Baja peninsula of Mexico. Along the Atlantic coast, they can be found from Newfoundland to northern Florida. They are occasionally observed along the Gulf coast and on large reservoirs, lakes and rivers in the southern United States.

There is evidence that suggests a severe decline in the long term population trend throughout its breeding range, most of which is in the boreal.

During the breeding season, white-winged scoters use large freshwater and brackish lakes. Densities are particularly high on lakes with islands that have low shrubs and dense vegetation. They place nests under shrubby, even thorny, vegetation like gooseberry, snowberry and rose.

LEFT: JIM FLYNN RIGHT: STUART SLATTERY

Wood Duck

canard branchu | *Aix sponsa*

The wood duck is a perching duck, and is one of the most colourful ducks in North America, both in terms of its plumage and its habits. It is the waterfowl species most closely associated with mature forested wetlands and therefore this feature is a critical component in its conservation. Wood ducks occur in the southern boreal forest of central and eastern Canada, as well as in the Pacific Northwest and most of the eastern U.S. Because of their unique habitat needs, wood ducks require unique management strategies – which thankfully have led to a recent upturn in population size.

The male wood duck has an iridescent green and blue crested head, with purplish-black cheeks. The white from its chin and neck extend into two white "fingers" on the cheeks and two narrow white lines above and behind the eye. The drake's breast is chestnut with small white flecks. The back, rump and upper tail coverts are a bronze-green. The female is also well-dressed; she has a grey-brown crested head with a greenish gloss, conspicuous white eye markings and a white chin and throat. The rest of her upper body is grey-brown with a bronzy gloss on her tail.

Because of their unique habitat needs, wood ducks require unique management strategies.

Habitat

Wood ducks will use riparian areas, freshwater marshes, beaver ponds and wooded swamps throughout the year. During the breeding season they require wetlands with abundant food resources, sufficient overhead concealment, and adequate cavity nesting sites. They prefer mature stands containing trees at least 30 centimetres in diameter for nesting. Common species include aspen, maple, ash and oak.

Very little information is available on the number of wood ducks breeding in the boreal forest due to the remoteness of the habitat and the low density of birds. However, an increase in wood duck densities was noted in Québec with a 109 per cent increase from the 1990s to 2003.

Diet/Feeding Behaviour

The wood duck diet varies seasonally and geographically. In the breeding season they feed mainly on insects and insect larvae, but will also eat aquatic plants and seeds. Migrating and wintering wood ducks rely on aquatic vegetation, acorns and waste grain.

Wood ducks often feed in small groups, pecking at food along the surface of the water and occasionally tipping up to reach submerged food. They also dive down as deep as one metre to gather acorns, albeit infrequently. Wood ducks can consume a surprising amount of food for a duck of their size. For example, 30 acorns were once found in the esophagus of one wood duck.

Breeding

Wood ducks begin courting in late October. Most are paired by late February. Many nesting females return with their mates to the same nesting area each year, and even use the very same nest tree; others seek new areas. Wood ducks are cavity nesters, building their nests inside preformed tree cavities created by broken branches, lightning scars and broken treetops. But unlike other cavity-nesting ducks, wood ducks rarely use holes made by woodpeckers. They also use artificial nest boxes.

Females select an appropriate cavity close to or over water. Normal clutch size is 12 eggs; however, because of prolific dump nesting, in which multiple females use the same cavity, some clutches may reach 40 eggs. Nest initiation varies by geographic location. In Manitoba, surveys conducted by DUC have estimated wood ducks start nests around May 23, which is seven weeks later than average initiation dates in Georgia.

Males remain with their mates until shortly before the ducklings hatch, at about 30 days. Just 24 hours after the ducklings hatch, the female leaves the nest and calls for her brood to jump to the ground. Ducklings can jump safely from as high as 89 metres. Once they reach a wetland, ducklings begin feeding immediately. The female stays with her brood for 28 to 42 days, and ducklings are able to fly at 46 to 70 days.

Migration/Winter Range

Since the breeding range overlaps with much of the winter range, migration is not necessary for about 33 per cent of the eastern population, and 75 per cent of the Pacific population. The others begin fall migration in September or earlier when breeding in the boreal forest. Timing of spring migration depends on latitude with many wood ducks arriving at northern areas in late April or early May. Most of these boreal ducks winter in the southeastern United States as is evident from band recoveries *(see table, page 38)*.

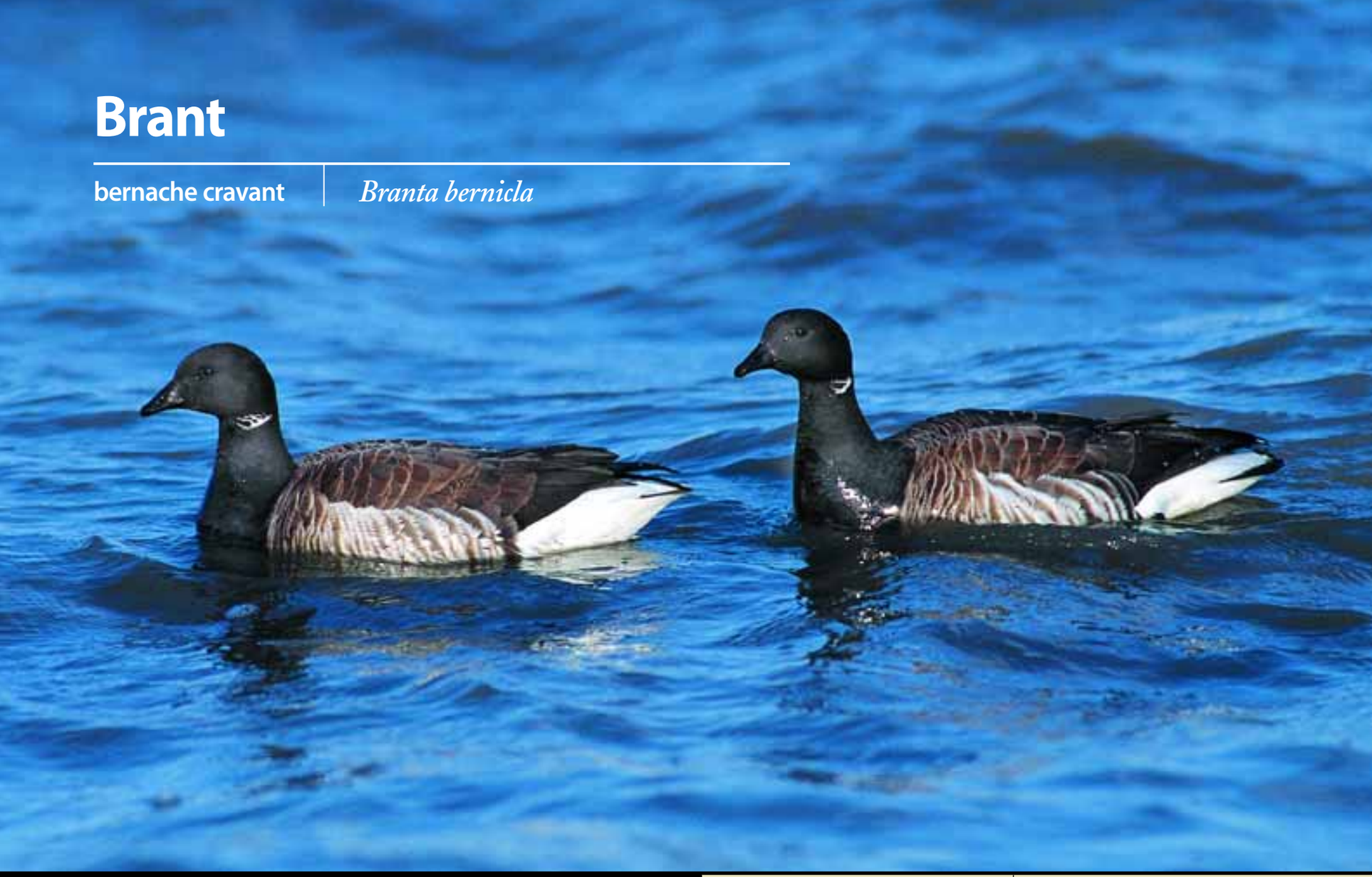
Wood ducks prefer mature stands containing trees at least 30 centimetres in diameter for nesting. Just 24 hours after the ducklings hatch, the female leaves the nest and calls for her brood to jump to the ground. Ducklings can jump safely from as high as 89 metres.

Although the wood duck population is now stable, conservation measures need to continue and expand to ensure their long-term sustainability.

LEFT: CLAUDE PONTHIEUX RIGHT: DUCKS UNLIMITED CANADA

Brant

bernache cravant | *Branta bernicla*



THE BRANT IS A RELATIVELY SMALL GOOSE that has a distinct role in the coastal ecosystem. However, recent telemetry studies indicate that wetlands in the boreal forest may provide vital rest stops for brant migrating between the coast and the Arctic, especially through Ontario and Québec. The species name *bernicla* is the Latin name for barnacle, a highly specialized, intertidal crustacean. Brant feed just below the tide line on partially submerged intertidal seagrasses. Brant spend their winter feeding along the Pacific and Atlantic coasts from Alaska to Mexico, and from Maine to Florida. They breed on Arctic tundra from Russia in the west to Greenland in the east. The North American brant population is estimated at 280,000 individuals. The Atlantic population makes up the largest component, but its size fluctuates greatly from year to year. The Pacific population has steadily declined since the 1960s and is still below historic levels.

Brant have black heads, necks, chests, bills, feet and tails, and a whitish patch on each side of the neck. The relatively large wings are a dark greyish-brown. There are two subspecies in North America, the Pacific and the Atlantic. The Pacific brant (also called the black brant) has a dark belly and neck patches that meet in the front, while the Atlantic subspecies – also known as the light-bellied brant, has a pale grey belly and neck patches that do not meet in the front. Males and females are nearly identical; only the slightly broader neck patch on the male distinguishes them.

Immature brant are identified by the presence of a white trailing edge on their wing coverts.

Habitat

In the lower Arctic, brant nest in salt marshes, on gentle coastal slopes, within river deltas and on islands or gravel spits. In the high Arctic they use inland lakes, braided river valleys, and deltas. While moulting, brant use freshwater, inland lakes with peat shorelines, lagoons and coastal protected bays. On the wintering grounds, brant use shallow, protected waters such as estuaries, lagoons and bays.

Diet/Feeding Behaviour

On the breeding grounds, brant graze on short grasses, forbs and mosses in salt marshes, meadows, along shorelines and in open tundra. During the non-breeding season, they forage almost exclusively on intertidal eelgrass beds. When eelgrass is in short supply, they survive on sea lettuce, green algae and other saltwater plants. Brant feed in flocks by walking through exposed seagrass beds, dipping their heads below the surface or by upending in deeper water. Brant are famous for returning to the same feeding areas year after year, and are also very sensitive to disturbances while at these stopover areas; they will alight quickly at the sight of an eagle flying overhead or a person walking too closely on the beach.

Breeding

Like most geese, brant mate for life. They arrive on the breeding grounds already paired, nesting in colonies and in single pairs. Colonies are often located on islands inaccessible to most predators, however, avian predators like gulls and snowy owls can still cause disturbances. Nests are built in shallow depressions in the permafrost. They are lined with down to help warm and protect the relatively small clutch of three to five eggs.

Incubation lasts 22 to 26 days. Young geese develop quickly and spend most of the long Arctic days feeding. Both parents remain on the breeding grounds until their goslings fledge at 40 to 50 days after hatching. Reproductive output is low as brant do not commonly renest following nest failure, and they do not breed until they are three years of age.

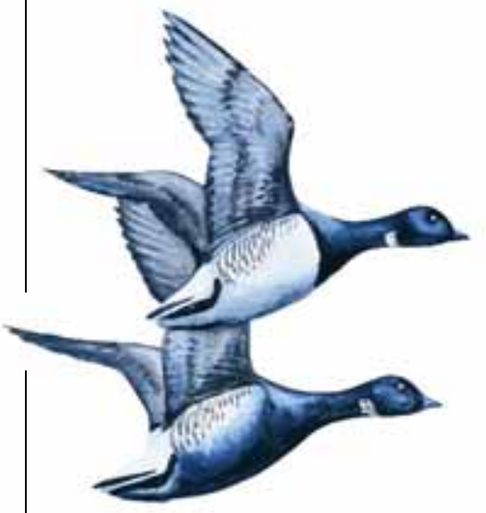
Migration/Winter Range

Brant fly in low, loosely formed flocks. Flock formations are long and ragged (lacking structure) but their flight is fast, and may average up to 99KM/H with the assistance of prevailing winds. They leave the breeding grounds in late August or September and head for their traditional staging areas such as James Bay, Ontario and Izembek Lagoon, Alaska. There they feed, rest and await good weather. Once on migration again, they stop only once or not at all until arriving on their coastal wintering grounds.

The Pacific brant population is actually composed of two subpopulations, one that breeds in the western high Arctic and winters in Puget Sound, and the other that breeds in the western low Arctic and winters along the Pacific coast. Pacific brant migrate along the coast and rarely fly overland. Atlantic brant are also composed of two subpopulations; a small group that breeds in the eastern high Arctic and winters in Ireland, and the rest that breed in the eastern low Arctic and winter along North America's Atlantic coast. These Atlantic brant take a more direct route between breeding and wintering grounds by flying overland. A migratory pathway from coastal New Jersey and Connecticut to James Bay has recently been documented. Boreal wetlands likely serve as important stopover habitat during such migrations.

DENIS FAUCHER (2)

The North American brant population is estimated at 280,000 individuals. The Atlantic population makes up the largest component, but its size fluctuates greatly from year to year. The Pacific population has steadily declined since the 1960s and is still below historic levels.



Recent telemetry studies indicate that boreal wetlands may provide vital rest stops for brant migrating between the coast and the Arctic.

Canada Goose

bernache du Canada | *Branta canadensis*

Cackling Goose

bernache de Hutchins | *Branta hutchinsii*

CANADA GEESE ARE ONE OF THE MOST RECOGNIZABLE waterfowl species in North America. Their black heads with white cheeks and chin, long black necks and greyish bodies are distinguishing features. In 2004 however, the American Ornithologists' Union separated Canada geese into two species (Canada goose and cackling goose), making identification more difficult. Furthermore, there are 11 subspecies (seven of which belong to the Canada goose, and four to the cackling goose species) complicating identification further.

While the extremes can easily be distinguished from one another, there is such overlap between the smaller Canada geese and larger cackling geese that determining which is which can only be accomplished through measuring the size and bill proportions – and even then, it can still be difficult. These two species of geese have been subdivided into 15 management populations, regardless of affiliation to species/subspecies, so identification is confounded further.

Because of the complexity of the population units and species taxonomy, the following account describes the general white-cheeked goose life history.

Habitat

Due to their extensive range across North America, white-cheeked geese have a vast array of wetlands and associated habitats available to them. Whether in tundra, boreal forest, parkland, prairie, coastal regions or urban settings, pairs prefer to nest in open areas near permanent water sources (e.g. lakes, marshes, beaver ponds, rivers, reservoirs). Nesting sites vary and

BRIAN WOLITSKI

include islands, human-made nesting structures, hay bales, beaver and muskrat houses, dikes, ditches, sandbars and even an occasional tree or rooftop. Brood rearing is typically carried out in shallow water with gradual sloping banks to allow easy access to water. Ample grasses and other plant materials are important when they choose brood rearing locations. On the wintering grounds they tend to stay near shallow water, like mudflats, wet grasslands and both saltwater and freshwater marshes. Agricultural fields are popular migration and winter habitats.

Diet/Feeding Behaviour

Canada and cackling geese normally graze in upland areas, although they will dabble on submerged aquatic plants and seeds. Their diet largely consists of grasses, sedges and rushes though they have become accustomed to feeding in croplands (e.g. peas, wheat, corn), especially during migration and winter. As most city dwellers will confirm, they have also adapted to grazing on grass in urban areas.

Breeding

White-cheeked geese are monogamous for life and form pairs before arrival on the breeding grounds. Habitat selection for nest sites is expansive, but nests are generally near water and allow a secure view of the surrounding area. They are among the earliest nesting waterfowl species. Both sexes are extremely territorial, defending their mates, nests and young.

Within the array of subspecies, clutch sizes range up to 12 eggs, with 90 per cent of the clutches containing four to seven eggs. The incubation period also varies within subspecies, but is generally between 24 and 30 days, and renesting is minimal, and it is not uncommon to see broods larger than the average clutch size. This occurrance is usually the result of brood amalgamation, where several broods combine.

The young goslings reach flight stage in 42 to 63 days. It is common for the fledged young to stay with the parents throughout the fall and winter, and even to accompany their parents on spring migration back to the breeding grounds. Young from the previous year may become paired and breed in their first year, but more likely won't mate until their second or third year.

Migration/Winter Range

White-cheeked geese use all four flyways to migrate from wintering to breeding grounds and back, and individuals often return to the same locations year after year. Individual birds banded in Canada's boreal forest during the summer have been recovered in 46 states, 10 provinces and one territory *(figure 11)*. Migration distances between the breeding and wintering grounds vary widely among subspecies and management populations. Some birds are non-migratory (resident southern populations), while others move between Arctic Canada and the southern United States. In general, the smaller, tundra-breeding birds migrate the farthest south.

Migration timing for each population depends on the origin and destination. Fall migration for some geese begins in late August, and most are on their wintering grounds by mid-December. White-cheeked geese can often be early spring migrants, some leaving their wintering grounds in late January. And depending on the latitude and weather conditions, they can arrive on the breeding grounds between mid-March and the end of May.

It has been noted that a second, non-breeding wave of migrants move through some areas about one month after the first, causing potential confusion in breeding population estimates. These geese migrate during the day and night in flocks of 300 to 1,000, but occasionally form larger groups, which are most likely composed of several smaller sub-flocks.

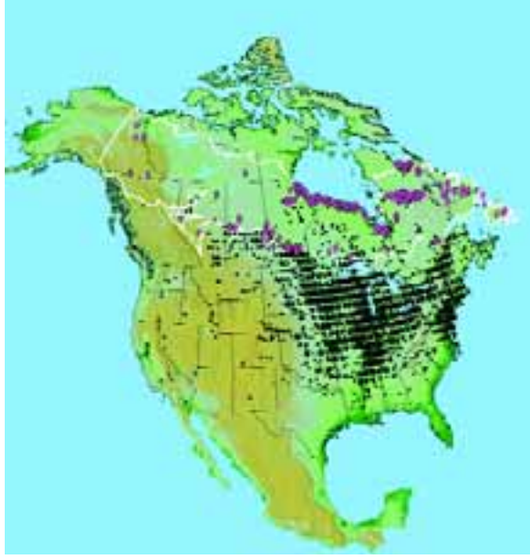
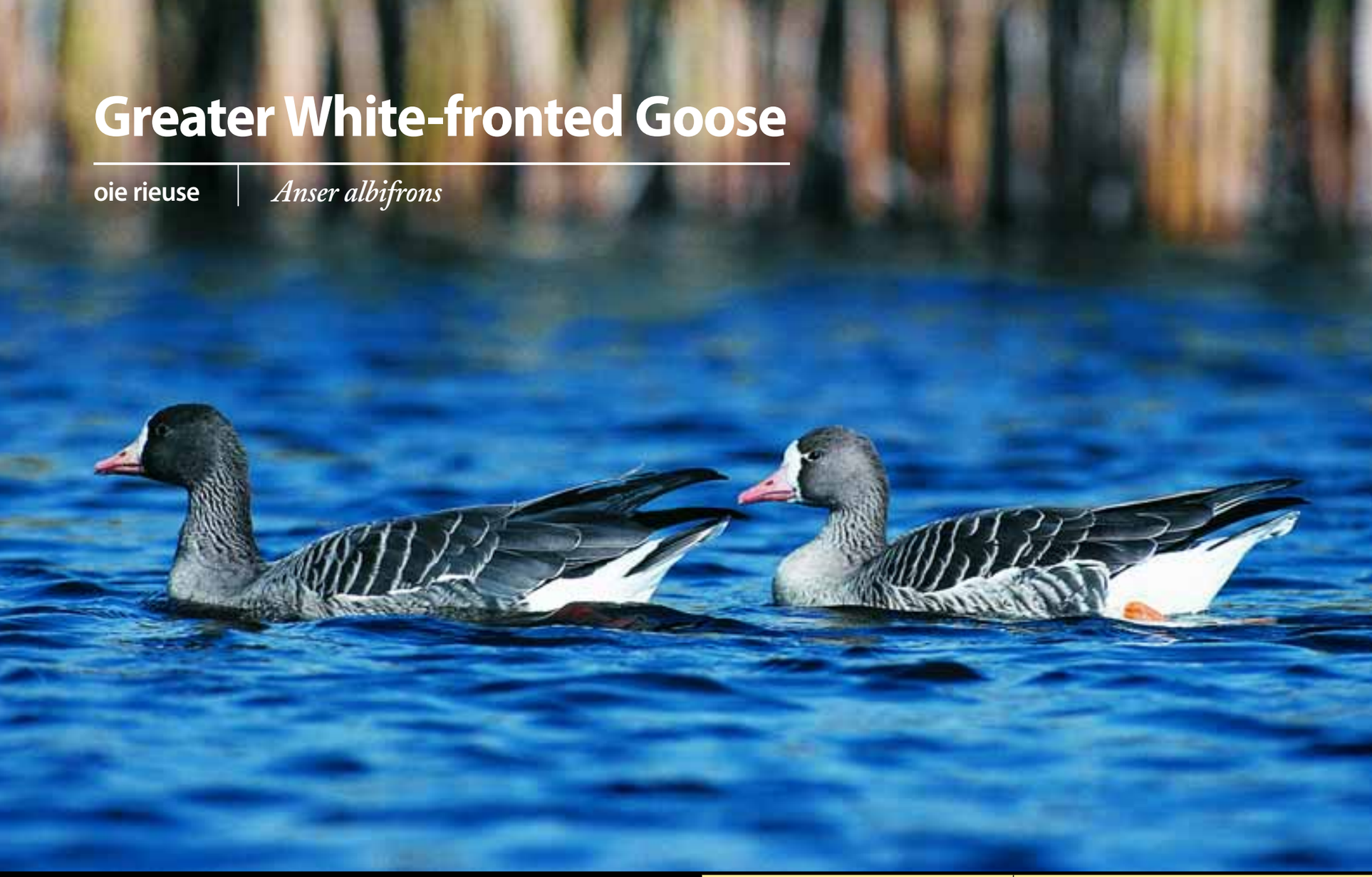


Figure 11: Banding and recovery sites – Canada goose (139,559 banded; 25,660 recovered)

A few populations, particularly in eastern North America and in boreal and subarctic regions, have been experiencing annual declines.

Greater White-fronted Goose

oie rieuse | *Anser albifrons*



This Arctic goose, fondly known as the "specklebelly", is North America's widest ranging Arctic goose. Greater white-fronted geese breed across the Arctic tundra and boreal forests from Alaska to Nunavut. There are two populations of greater white-fronted geese in North America: the Pacific population and the mid-continental population. In 2005, there were about 444,000 white-fronted geese in the Pacific population and about 525,000 in the mid-continental population. While the Pacific population has increased at roughly two per cent per year since 1996, the mid-continental population has declined steadily since the 1990s. Between 25 and 49 per cent of the continental breeding population is in the boreal forest and an even greater percentage likely use the boreal forest for moulting and migration. Because white-fronts have a few key staging areas in the boreal forest, they are particularly vulnerable to changes in habitat availability at those sites. Primary staging areas in the boreal forest include the Mackenzie, Anderson, Peace and Saskatchewan River Deltas. White-fronts winter west of the Mississippi, from Arkansas south to Chiapas, Mexico. Greater white-fronted geese banded in the boreal

Because white-fronts have a few key staging areas in the boreal forest, and are particularly vulnerable to changes in habitat availability at those sites.

LEFT: DUCKS UNLIMITED CANADA RIGHT: BRIAN WOLITSKI

forest have been recovered in 10 states and two provinces *(see table, page 38)*.

The nickname "specklebelly" refers to the dark blotches and irregular bars on their breasts. Both sexes are brown-grey with a striking white mark on their foreheads, and their pinkish-orange bill and red-orange legs further distinguish them from other Arctic geese. In North America, there are two recognized subspecies; the Tule goose (*A. a. gambelli*) is restricted to Cook Inlet, Alaska – and is larger and darker than the greater white-fronted goose (*A. a. frontalis*).

Greater white-fronted geese nest in the muddy emergent vegetation near stream edges, deltas, moss meadows, and other low-lying wetlands. Bogs, raised polygon edges, hummocky ground and immature fens are also used.

Habitat

Greater white-fronted geese nest in the muddy emergent vegetation near stream edges, deltas, moss meadows, and other low-lying wetlands. Bogs, raised polygon edges, hummocky ground and immature fens are also used. On the tundra, nest cover is primarily sedges, grasses, willows, birches and raspberries but in the boreal forest it is more often tall willows, spruces or larches. Nests have also been observed in recently burned areas. Immature fens, inland lake systems and meadows are used during the moult. In winter, they aggregate in salt marshes, along the edges of lakes and rivers and in cultivated fields. Throughout their range, greater white-fronted geese are associated with Canada geese and snow geese.

Diet/Feeding Behaviour

Greater white-fronted geese forage on land and in the water using a variety of techniques, from dabbling and tipping to grazing and gleaning. In the winter their diet consists mainly of seeds and grains, supplemented by both aquatic and upland vegetation. In upland habitats, they glean waste cereal grains and graze on winter wheat, barley, rice and peas. On water, they peck or probe for both emergent vegetation and raised clumps of submergent vegetation. Summer diets consist of grasses, berries, tubers and rhizomes.

Breeding

Long-term pair bonds are formed in the winter and early spring. Pairs form when two individuals perform a mutual courtship display called the "triumph ceremony," which involves lateral head movements and somewhat combative behaviour.

Breeding commences between March and May depending on latitude. Nest building starts in April or May. Females select the site, then scrape out a small depression in the ground and line it with nearby plant material. They add small amounts of down to the nest bowl as the clutch progresses. Females lay between five and seven creamy white eggs and incubate them for 23 to 25 days. Within one or two days of the eggs hatching, the female leads the young to water. Within 42 to 49 days they fledge. Young geese remain with their parents for at least the first year, and may maintain an association for even longer.

Migration/Winter Range

During fall migration, the Pacific population uses the Pacific Flyway, departing in August and flying across the Gulf of Alaska to the mouth of the Columbia River to stage. From there they fly south to California or northern Mexico, arriving in October. The mid-continental population, which is composed of individuals breeding in the boreal forest and western Canadian Arctic, use the Central Flyway. They fly south from the breeding grounds in late August or early October, stage in southeastern Alberta and southwestern Saskatchewan, and then continue south to the wintering grounds along the Gulf coast. Spring migration begins in early February and is usually complete by mid-April.

Between 25 and 49 per cent of the continental population breeds in the boreal forest and an even greater percentage use the boreal during moult and migration.

Ross's Goose

oie de Ross | *Chen rossii*

The Ross' goose is the smallest and the rarest of Canada's white geese. The Queen Maud Gulf Migratory Bird Sanctuary, located in Canada's central Arctic, is home to about 95 per cent of all nesting Ross' geese. The other five per cent are spread out across Canada's eastern Arctic and the west coast of Hudson Bay.

In 1931, the entire population was estimated to be only 5,000 to 6,000 individuals. By the 1960s the population had increased to about 30,000. The population has since increased at a rate of about eight per cent annually. In 1998, there were an estimated 982,000 Ross' geese in North America, and now there are over one million. Some colonies have become so populous that they actually threaten the health of the tundra. Every year, thousands of Ross' geese stop at staging areas in Canada's boreal forests and prairies on their way north from their wintering areas in Mexico, New Mexico, California and Texas. These stopover habitats are important to the successful completion of migration for Ross' geese, especially when any inclement weather stops geese from moving further north.

Other than a minor size difference,

During migration through the boreal forest, they use inland deltas and shallow wetland complexes to rest and to feed.

DENIS FAUCHER

males and females are indistinguishable. Their plumage is uniformly white, other than the black tips of their wings. They have pink feet and legs and a pinkish bill. Ross' geese can be distinguished from the closely related snow geese by their shorter bill, shorter neck, rounder head, smaller size, and lack of "grin patch."

Habitat

Ross' geese nest on islands or near shallow lakes in the low Arctic tundra. Patches of dwarf birch, willows and rock piles are used for cover and protection. During migration through the boreal forest, they use inland deltas and shallow wetland complexes to rest and to feed. On the Prairies they use a variety of wetland types, ranging from ephemeral wetlands in crop fields to permanent lakes. Ross' geese spend the winter feeding primarily in agricultural fields and roosting at night in shallow wetlands and reservoirs.

Diet/Feeding Behaviour

Ross' geese are strictly vegetarian. They forage on grasses, sedges, legumes and grains. Their stumpy bill enables them to closely crop even the shortest vegetation, so they can survive on small patches of tundra. During the breeding season, they eat the seeds and blades of grasses and sedges found close to the nest. In winter, they consume rice, barley and millet, as well as native grasses, sedges and clovers from up-land habitats.

Breeding

Ross' geese nest in colonies with lesser snow geese. These mixed species colonies can include anywhere between 10 and 360,000 individuals. Ross' geese form monogamous pairs and share breeding season duties. Females initiate nest construction within the first week of arriving on the breeding grounds. They lay an average of four non-glossy, light cream-coloured eggs and then begin incubation immediately. Females forage only in short spurts during the 22-day incubation period and can lose up to 44 per cent of their body weight. The male does not help incubate, but instead guards the territory against intruders. To do so, he performs various threatening displays, including stretching his neck and wings out while emitting a low *nnnggg* vocalization.

Once hatched, the young are led to water, where they feed on grasses, sedges and dwarf birch. Goslings grow quickly and can fly within 40 to 45 days. Both sexes defend the young from predators and may group with other families to increase the chances of survival. Young maintain close relationships with parents and siblings for the first year of life, and return to the breeding grounds the following year as a family. Ross' geese will become sexually mature during their second year.

Migration/Winter Range

Although the Ross's goose is one of the first to leave the Arctic breeding grounds in the fall, they never appear to be in much of a hurry. Ross' geese have been spotted on staging areas across Canada's boreal forests and Prairies from early September into late October. As temperatures drop and food becomes scarce, Ross' geese head south for the winter. Ross' geese banded in the boreal forest near Hudson Bay, have been recovered from Northwestern Manitoba to Saskatchewan prairies down to the Gulf coast states *(see table, page 38)*. In spring, they travel northward along the same routes, following the spring thaw. Ross' geese leave the southern wintering grounds in late February and arrive on the breeding grounds by early June.

Every year, thousands of Ross' geese stop at staging areas in Canada's boreal forests and prairies on their way south.

Snow Goose

oie des neiges | *Chen caerulescens*

Snow geese are one of the most abundant waterfowl species in the world, yet oddly, one of the least familiar to many. Snow geese breed in colonies in the high Arctic and winter in huge, gregarious flocks at specific locations in the United States and Mexico. If you happen to live where they do, you have likely witnessed the amazing spectacle of thousands of white geese dropping from the sky into fields and reservoirs. If you live elsewhere, you may have never seen one. The snow goose has two recognized subspecies, the lesser snow goose that breeds in the western and midcontinental Arctic, and the greater snow goose that breeds in the eastern Arctic. This account describes both subspecies.

Snow geese are medium-sized geese. The lesser snow subspecies has two distinct colour phases, white and blue; the greater snow subspecies is only white. White morph snow geese are primarily white with black wing tips and grey primary coverts. They can be distinguished from the Ross's goose by their larger size and black grin patch present on the bill. Blue morph snow geese have dark grey-blue bodies, backs and wings. Their heads and necks remain white. Young birds are various shades of grey. When the geese forage by digging and grubbing in iron-oxide-rich sediments, their faces and necks stain orange.

Habitat

Snow geese breed on coastal Arctic and subarctic tundra. Colonies are most often located on low-lying grass or on sedge meadows near freshwater bodies, though in the high Arctic they also breed inland on more exposed slopes, ravines and hills. Nests are preferably placed on hummocks

and other raised features that clear of snow early in the season, and also escape spring flooding. During migration and in the winter, snow geese seek out protected, shallow wetlands for feeding. In coastal environments they occupy deltas, brackish marshes, estuaries and shallow bays. In the interior, they use freshwater wetlands, marshes, reservoirs and cultivated fields.

Diet/Feeding Behaviour

Snow geese are voracious foragers, feeding intensively for long periods of time in concentrated areas. They forage by shearing off plants at the ground level, picking off fruits and berries, or gleaning waste seeds from the ground. They also pull up plants from the ground to get at the highly nutritious roots or rhizomes, a technique called grubbing.

On the breeding grounds they eat leafy grasses, sedges, rushes and willows as well as rhizomes and tubers of aquatic plants. Goslings feed on fruits and flowers, fresh shoots and insect larvae. In the winter, snow geese eat a variety of native and non-native grasses as well as cultivated grains like rice and corn.

Breeding

Snow geese pairs mate for life, and arrive on the breeding grounds already paired. The female selects the nest site and builds the nest with grasses, leaves and seaweed, often at the same spot year after year. She incubates her clutch of three to five elliptical eggs while her mate stands attentively nearby, defending the nest against predators like foxes and gulls. When predators approach, he responds aggressively by running toward the predator with wings spread out and neck outstretched.

Eggs are incubated for 24 days – and within 24 hours of hatching the goslings leave the nest and begin to feed on their own. At about 43 days, they are able to fly. Family groups then migrate to their traditional staging areas, and remain together until the following summer.

Migration/Winter Range

The western population breeds along the coast from eastern Russia to the Northwest Territories. They winter at several locations in the west including the Fraser River Delta and Central Valley in California. The mid-continental population breeds in the central Arctic and winters in the south-central U.S. from Nebraska to the Gulf coast. The eastern population breeds in Nunavut and Hudson Bay, and winters along the Atlantic coast from Massachusetts to South Carolina.

Snow geese fly at high altitudes (over 600 metres) along relatively narrow migratory corridors. In fall, flocks are large (over 1,000 birds) but in the spring most flocks range from only 35 to 400 birds. During both periods, migrating flocks amass on staging wetlands in the thousands and may stay in these areas for a month or longer. Timing and duration of migration is largely dependent on the weather. Typically, spring migration starts in February and ends when pairs arrive on the breeding grounds in late May or early June. Fall migration starts in late August and continues into November.

Conventional wisdom holds that snow geese skip over boreal wetlands during both migration periods, but observations of large flocks of snow geese in the Peace-Athabasca Delta, the Mackenzie River Delta and near the Saskatchewan River Delta by DUC staff and others would suggest otherwise.

Figure 12: Banding and recovery sites – snow goose (791 banded; 70 recovered)

A dramatic increase in population as a result of increased winter food supply has become the major concern in snow goose management.

Trumpeter Swan

cygne trompette | *Cygnus buccinator*

The trumpeter swan is a symbol of beauty and grace and is North America's largest endemic waterfowl species. Because of its attractive white plumage, the trumpeter swan became a prized species and was hunted relentlessly for its skin and feathers from the 1600s to the 1800s. Eliminated from many parts of its range and nearly wiped out south of Canada, it has since become a focus for conservation efforts and international cooperation. These efforts have resulted in increased numbers and re-colonization of many parts of its original range.

The trumpeter swan's historic breeding range was extensive, covering much of North America from Alaska to South Carolina, however now it is reduced to just a few pockets in Alaska, western Canada and the northern United States. The largest contiguous breeding areas are located in the boreal forest, where swans have been less exposed to disturbance and habitat loss than elsewhere. Trumpeter swans migrate inland and winter along the Pacific coast from Alaska to Oregon. Several birds banded in the boreal forest have been relocated on inland waters of the western U.S., presumably on route to the coast *(see table, page 38)*.

Trumpeter swan surveys were initiated across North America in 1968, and since 1975 have been conducted every five years. The trumpeter swan population grew from about 3,722 birds in 1968 to 23,647 in 2000. The Pacific Coast population increased from 2,847 to 17,551; the Rocky Mountain population increased from 811 to 3,666; and Interior population from 64 to 2,430 over the same time period.

BRIAN WOLITSKI (2)

The trumpeter swan is completely white with a straight black bill that lacks the yellow lores of the tundra swan, or the orange bill of the mute swan. Therefore. trumpeter swans can be distinguished with some effort.

Habitat

The trumpeter swan's preferred nesting habitats are shallow wetlands with numerous elevated nesting sites (e.g. muskrat or beaver lodges), diversity of aquatic foods, little human disturbance, a stable water level, at least 100 metres of open water for takeoff and an early ice-free date. During migration they stage on marshes, rivers, lakes and estuaries, and in winter trumpeter swans often forage in agricultural and aquatic habitats – using sand and gravel bars for roosting and loafing.

Diet/Feeding Behaviour

The diet of breeding adults is essentially 100 per cent vegetation, consisting of submergent and emergent aquatic plants, grains and grasses). Cygnets eat about 95 per cent vegetation and five per cent invertebrates. Adults can consume up to nine kilograms of vegetation daily; food intake is lower when highly nutritious food (e.g. wheat during migration or on the wintering grounds) is available.

Trumpeters will occasionally feed on invertebrates, fish eggs, and in winter, grains, and waste potatoes. Because of their long necks and ability to uproot submerged vegetation with their feet, swans are able to forage in deeper water than geese and dabbling ducks.

Breeding

This long-lived species mates for life, but if a mate is killed, the surviving swan may pair again the following year. Many trumpeters form pair bonds during the second winter, but generally do not start nesting until they are four to six years old. Pairs that spend time together year-round will select nest locations early in the bonding process, up to several years before actually nesting. Both sexes contribute to nest building and the female lays four to eight eggs in April or May. Incubation lasts between 32 and 37 days. Young begin to fly at about 100 days of age, remaining with the parents or joining neighbouring family groups for migration.

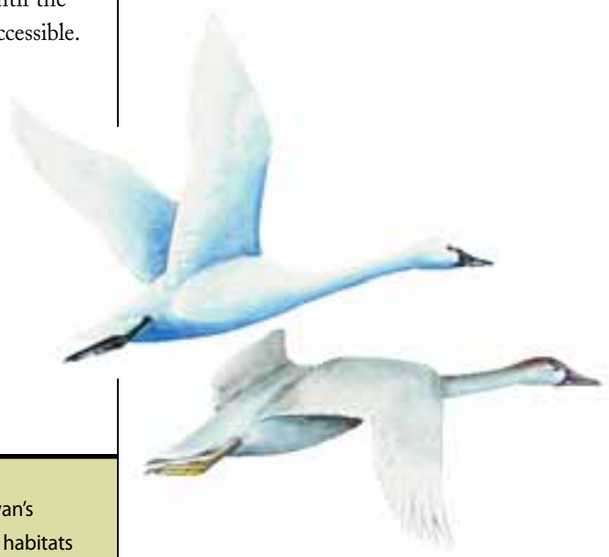
Migration/Winter Range

Migration patterns of trumpeter swans are well known due to their large size and conspicuous nature. Alaskan birds move either along the coast via Prince William Sound or the Copper River Delta to southeast Alaska, coastal British Columbia, Puget Sound and the Columbia River Delta, or more often, inland up the Tanana River and then south on the east side of the Coast Ranges and across to Vancouver Island and Washington. However, a few birds have returned to the Sacramento Valley. Migration and wintering areas for the eastern population

are still developing as the birds become established in new areas.

Spring migration follows fall routes in reverse, arriving on the breeding grounds in April, usually before ice melt. Swans stage on large, ice-free water until the time when breeding habitat is accessible.

The largest contiguous breeding areas are located in the boreal forest, where swans have been less exposed to disturbance and habitat loss.



The trumpeter swan's preferred nesting habitats are shallow wetlands with numerous elevated nesting sites (e.g. muskrat or beaver lodges), diversity of aquatic foods, little human disturbance, a stable water level, at least 100 metres of open water for takeoff and an early ice-free date.

Tundra Swan

cygne siffleur | *Cygnus columbianus*

The tundra swan, also known as the whistling swan, is one of North America's most majestic and endearing waterfowl. Tundra swans breed in the Arctic and boreal forests of the far north, and winter along the Atlantic and Pacific coasts. Tundra swans banded in the boreal forest have been relocated in the upper Midwestern United States *(see table, page 38)*. The highest breeding concentrations occur on river deltas such as the Mackenzie and the Anderson in the Northwest Territories. Tundra swans also rely heavily on productive staging grounds in the boreal forests, Prairies and parklands of Canada where they spend a total of six months a year during migration.

The tundra swan is the smallest of the three North American swans. Adults are white with black bills, legs and feet. Many also have a tiny patch of yellow between the eyes and the bill, a region called the lores. Both the native trumpeter swan and the non-native mute swan closely resemble the tundra; however, the tundra's yellow lores, its smaller size and the whistling sound its wings make in flight make it unique.

Tundra swans prefer shallow, unpolluted wetlands and do not tolerate much human disturbance.

Habitat

Tundra swans breed on coastal deltas, marshes, lakes and ponds located between the Arctic coast and the treeline. The density of breeding pairs increases with wetland density. Tundra swans prefer shallow, unpolluted wetlands and do not tolerate much human disturbance. Stopover habitats include freshwater wetlands, lakes and rivers, as well as brackish estuaries. These stopover habitats are used primarily for refuelling – and therefore should contain a high density of pondweed or other submergent vegetation. On the winter range, swans use lakes, wetlands, reservoirs, shallow estuarine bays and agricultural fields for foraging.

Diet/Feeding Behaviour

Sedges, pondweed and algae have been identified as important food items for breeding swans in Alaska. Nesting pairs prefer to forage at lakes with high concentrations of macrophytes, muskgrass

and pondweed. Their long necks are used to pull up submergent plants and tubers, which they share with their young. The cygnets eat insect larvae and other aquatic invertebrates, and although swans traditionally eat aquatic plants while on their staging and wintering grounds, their diets are increasingly supplemented by waste corn and grains in agricultural fields.

Breeding

Tundra swans are admired not only for their beauty, but also for their dedication to parenting and family life. The parents share almost all breeding season duties, and remain with their cygnets through the winter. Adult swans arrive on the breeding grounds paired. They show a high degree of site fidelity and often occupy the same territory, even the same nest site, year after year. Nests are built on wet tundra, islands and ridges where visibility is high. Clutch size ranges between three to five eggs, and incubation lasts for 31 to 32 days. Both parents incubate, but females spend significantly more time on the nest than males.

Cygnets are brooded for one to two days after hatching and are attended carefully for another 102 to 117 days while they develop. Once the cygnets are able to fly, the family migrates together to their first staging area while on their way south for winter.

Migration/Winter Range

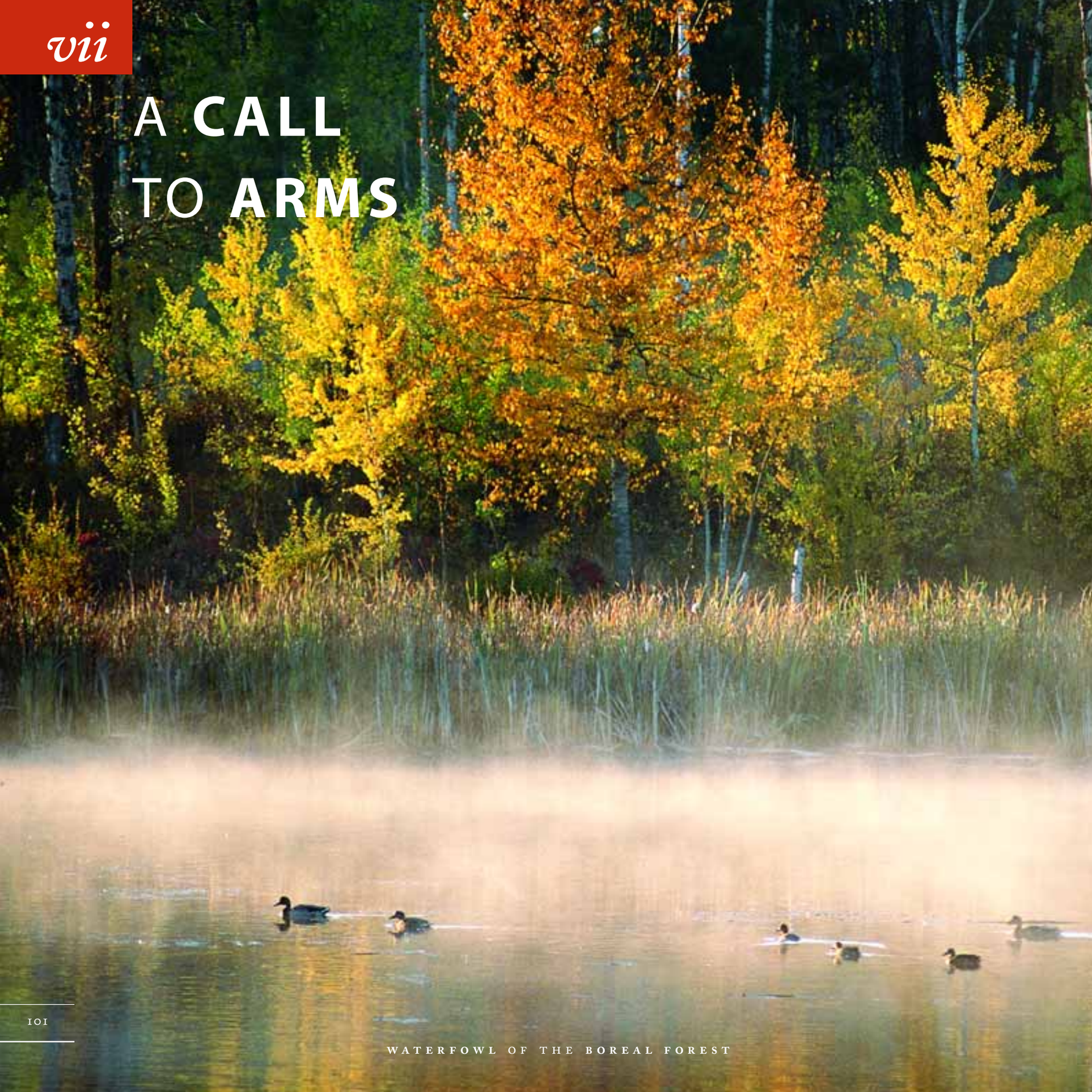
There are two recognized populations of tundra swans in North America: the western population that breeds along the western coastal lowlands of Alaska, and the eastern population that breeds from the Seward Peninsula in Alaska to Baffin Island and Hudson Bay. The western population migrates to coastal British Columbia and the western U.S. for the winter, and the eastern migrates to the mid-Atlantic coast.

During fall migration, tundra swans make long stopovers at boreal wetlands such as the upper Mackenzie Delta, the Peace-Athabasca Delta and Great Slave Lake. In spring, when boreal wetlands may still be covered in ice, they spend more time feeding in agricultural areas, especially around the Great Lakes. The swans migrate in family groups within larger flocks of up to a hundred birds.

Because tundra swans spend half their life migrating between the breeding and wintering grounds, conservation of key staging areas in the boreal forest is critical.

DUCKS UNLIMITED CANADA (2)

A **CALL** TO **ARMS**



SWANS: DUCKS UNLIMITED CANADA LEFT: BRIAN WOLITSKI RIGHT: DARIN LANGHORST

by Gary Stewart

Nationally and internationally, there is a growing recognition that North America's boreal forest contains a wealth of diverse values – ecological, cultural and economic – that are important not only to North Americans, but to life everywhere on the planet. And understanding the region's importance has evolved over time. It once seemed impossible that industrial development and human settlement could make a substantial impact on such a vast and abundant landscape.

Yet over the years, human and industrial developments have advanced throughout the region, and the pace of these changes is increasing exponentially. Land use decisions made over the next few years will have a profound influence on the long-term health of the entire region.

More than 70 per cent of Canada's boreal forest region remains ecologically intact. It is one of the last extensive forest and wetland areas in the world that still supports a suite of native species in large connected ecosystems shaped by powerful natural forces like fire. The vast majority of the region is publicly owned, enabling governments to work with aboriginal peoples, other local communities, industries and conservation organizations to plan proactively for the future.

That said, with less than 10 per cent of the region currently protected from development – and the application of best management practices still in its infancy in many industrial sectors – time is of the essence.

Ducks Unlimited Canada's (DUC) vision is that Canada's boreal forest will remain an ecologically intact and productive habitat that will continue to sustain a high diversity and abundance of wetlands, waterfowl and associated water birds. DUC wants Canada's boreal forest to remain a vast mosaic of forest, rivers, wetlands and lakes that will continue to function with ecological integrity and support historical numbers of breeding, moulting and migrating waterfowl as well as other wetland-dependent wildlife.

To attain our vision, DUC has been working alongside forward-thinking governments, industry, First Nations and aboriginal groups, academic institutions, foundations and conservation organizations to help establish a national boreal conservation network that includes ecosystem based sustainable development, world-leading best management practices and an extensive network of large, wetland-rich protected areas. Achievement of our vision depends upon human use of the region being in better harmony with the land and its vast ecological values. Areas vital to waterfowl and other water birds must be recognized and conserved by the owners and users of those lands. Where human activities occur, it is essential that they be undertaken in a manner consistent with the long-term sustainability of the boreal ecosystem and guided by a set of world-leading environmental standards.

In planning and implementing the strategies to achieve this vision, DUC will help Canada's boreal region become the world's best-conserved ecosystem, sustaining the people who live there and demonstrating world-class sustainable economic resource practices. Others will be made aware of the value to society of maintaining a healthy boreal forest and of this enlightened, balanced approach to land uses.

Our goal is to help conserve all of the wetlands in Canada's boreal forest through a combination of ecosystem-based sustainable development that utilizes state-of-the-art best management practices, and by promoting the establishment of an extensive network of large, interconnected wetland-rich protected areas. DUC will use our foundation of strong science and strategic partnerships to help us move toward this goal.

Commitments to Boreal Conservation

DUC's science will be pivotal in engaging partners in support of our conservation vision and goals. It will underpin all of our conservation planning as we continue to identify critical wetland systems, confirm biodiversity values and develop sustainable-use practices and conservation strategies. We are committed to managing adaptively and will regularly assess the adequacy of our conservation strategies and knowledge as we strive continually to improve our decision support tools. We will continue to expand our aboriginal

Achievement of our vision depends upon human use of the region being in better harmony with the land and its vast ecological values.

Over a third of this great forest is water and wetlands critical to migratory birds, global climate and human health.

partnerships and embed traditional land use information in planning and decision-making processes. DUC will share data and its investments in science to help guide land use planning involving governments, aboriginal partners, industries and others at the local, regional and national levels. Our core commitments are to:

❶ *Watershed-based Conservation*

Human impacts, to date, have affected mainly terrestrial environments. There is growing concern however, about regional impacts on surface and subsurface water resources. The health of the forest and the northern economy depends on water, and protection of water quality and supply is of vital interest to the public. There is a pressing need to develop watershed-based conservation strategies that incorporate water and wetland objectives.

Currently there is a dearth of information on how landscape features, climate and human activities influence the hydrology, water quality, nutrient status and ecology of boreal watersheds. We are committed to acquiring a better understanding of how wetlands function across the wide range of natural variability in landscape position, geology and climate. We will also continue to improve our understanding of how wetlands interact with the adjacent riparian areas, and how various land disturbances, such as timber harvesting, oil and gas developments or road building, affect those relationships.

DUC will continue to develop innovative approaches to conservation planning that lead to easy-to-use management support systems. We will work with land users, managers and regulators to develop and implement conservation plans that maintain the full range of ecological processes, including intact watersheds, wetlands and natural disturbances. Watershed-based conservation plans that maintain and increase forest cover and boreal wetlands will have a significant positive influence on carbon sequestration and other ecosystem services.

❷ *Sustainable Development / Best Management Practices (BMPs)*

Using an adaptive management approach, DUC will assist in the development and testing of BMPs to help ensure that the boreal forest continues to produce sustainable economic and ecological returns. Sustainable resource management practices will require world-leading resource conservation standards and guidelines. A key goal of sustainable resource management will be healthy watersheds that support regional economies and communities. A primary purpose of sustainable development is responsible, sustainable use of the renewable natural resources of the boreal, including its wood, water, fish, plants and wildlife. Future development of non-renewable resources such as oil, gas and minerals within these developed areas will proceed while meeting operating standards that also sustain the social, ecological and economic values of the boreal forest and meet comparable world-leading standards.

❸ *Protected Areas*

Canada's boreal forest encompasses millions of hectares of wetland-rich landscapes critical to the continent's migratory bird populations. These areas also often sustain traditional land uses and lifestyles. It is essential to maintain a portion of the forest as permanent protected areas. The concept is to exclude resource extraction activities from areas of sufficient size that they function as intact natural ecosystems. Protected areas can also help maintain biodiversity, cultural values and ecological goods and services values in perpetuity. For the working forest, these areas serve as benchmark sites against which to compare the results of sustainable management practices.

Establishing sufficient intact natural areas will require the co-operation of the federal, provincial, territorial and aboriginal governments, supported by industry, conservation organizations, private landowners and the Canadian public. DUC will continue to develop strategic partnerships to help enable the identification, the establishment and the management of a network of large, wetland-rich protected areas.

Protected areas should exclude industrial development such as logging, mining, hydroelectric dams, oil and gas and new roads, but should also include traditional human activities such as hunting, fishing, gathering and recreation. Protected areas should respect aboriginal people's long-term relationships with the land, and where possible, be established through land use planning processes with local communities.

❹ *Species of Concern*

Waterfowl are important indicators of habitat quality and quantity, and we are committed to understanding the limiting factors affecting declining boreal waterfowl populations – and also to developing effective conservation programs for their recovery. Special attention will be paid to species of continental concern like scaup and scoters in the western boreal and the harlequin duck and Barrow's goldeneye in the east.

❺ *Education and Awareness*

Canada's boreal forest is truly a global resource. Although few people realize it, the majority of the boreal forest's natural resources are being used by people who

live in North America's urban centres. Infact, the ecological goods and services provided naturally by the boreal forest are valued and in demand around the entire world. There is pressing need to educate the public, industry leaders, policy-makers, government decision-makers and others about the need for boreal forest conservation. And to accomplish this, DUC will accelerate its communication and education programs, in partnership with conservation leaders from all walks of life, to raise awareness of the need for boreal conservation. We will build on the strong foundation of DUC's marketing, communications and education programs already in place from coast to coast to coast.

Making Progress

We are encouraged that the need to manage the accelerating use of natural resources continues to inspire debates and dialogue among concerned parties. In 1999, the Senate Committee on Agriculture and Forestry's Subcommittee on the Boreal Forest published *Competing Realities: The Boreal Forest at Risk*. This report contains 35 recommendations intended to guide Canadians in adopting a "national forest landscape-based approach to managing a boreal forest that is coming increasingly under siege."

However, little progress has been made on these recommendations, and in January 2005 the Canadian Boreal Initiative (CBI) published *The Boreal in the Balance: Securing the Future of Canada's Boreal Region* and noted, "This important region faces an uncertain future because expanding industrial developments are outpacing conservation efforts in certain parts of the vast region." The CBI report reflects the comprehensive approach of the Boreal Forest Conservation Framework – a balanced national vision for the future of Canada's boreal region launched in 2003 by CBI, in concert with leading resource companies, First Nations and conservation groups. In October 2005 the National Round Table on The Environment and the Economy (NRTEE) released its *State of the Debate Boreal Futures: Governance, Conservation and Development in Canada's Boreal* report, stating that "Canada's 'Amazon' is under threat" and urging conservation action across Canada's vast boreal region. In November 2005, the Pembina Institute released its CBI-commissioned report *Counting Canada's Natural Capital: Assessing the Real Value of Canada's Boreal Ecosystems*. Considering everything from the pest-control services provided by birds to the worth of having wetlands filter drinking water and store carbon, the researchers calculated the boreal forest ecosystem's non-market value at more than $93 billion annually.

The Canadian Boreal Initiative has emerged as a committed and balanced leader of boreal conservation efforts across the country. In partnership with the Pew Charitable Trusts and Ducks Unlimited, CBI was established early in 2003, to respond to the unique opportunities and challenges of Canada's boreal forest. In addition to supporting boreal conservation projects across the country, CBI convened the Boreal Leadership Council – an unlikely alliance of resource companies, First Nations and conservation groups – to develop a national vision for conservation of Canada's boreal region. DUC is proud to be an original member of the Council.

The result was the Boreal Forest Conservation Framework, launched in December 2003, to conserve the natural, cultural and sustainable economic values of the boreal forest region by protecting about half of the region in a comprehensive network of protected areas and promoting world-leading industrial practices on the remaining landscape. CBI's Framework represents a balanced conservation solution that offers the opportunity to meet ecological objectives, uphold the rights and interests of aboriginal peoples and accommodate appropriate sustainable development. DUC embraces and supports the principles of this bold conservation framework which embodies much of our vision and goals. CBI's Framework is a national goal and vision for the region as a whole, which sees land use planning as a key mechanism to develop more specific solutions on the ground that reflect regional conditions and priorities. It is vital to find balance between development and protection, while ensuring that ecosystem functions are maintained and the Framework offers a promising path forward for all sectors to work together to secure a meaningful future for Canada's boreal region.

We have learned that we're far better off protecting intact systems while there is still opportunity.

Call to Arms

DUC's urgency to conserve the boreal forest is anchored by our nearly 70 years of delivering conservation programs on Canada's settled landscapes. We have learned that we're far better off protecting intact systems while there is still opportunity. In the case of Canada's wetland- and water-rich boreal forest, we must take advantage of this opportunity now. Canada has a unique opportunity to show the world how to balance development with protection across one of the world's last great wilderness areas. But the key word is *unique*, for it only comes around once. The time for world-leading best management practices and state-of-the-art conservation planning in Canada's boreal forest is now.

But it will not happen without leadership and support.

The need for governments, industries, other key decision-makers and conservationists to become involved and provide leadership and support to the conservation of Canada's boreal has never been greater, particularly given the incredible amount of fresh water that lies within the vast region. Over a third of this great forest is water and wetlands critical to migratory birds, global climate and human health. We hope that this book will help shine a brighter light on North America's boreal forest – our national treasure – and motivate others to become involved in one of the most important conservation opportunities on the planet today.

TOP LEFT: DARIN LANGHORST CENTER LEFT, ABOVE RIGHT: © GARTH LENZ BOTTOM LEFT: BRIAN WOLITSKI

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