Methods used to determine population baselines and objectives for the Eastern Habitat Joint Venture implementation and evaluation plan 2007-2012

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ABSTRACT

The North American Waterfowl Management Plan is an international conservation initiative that aims to restore and preserve waterfowl populations and their habitats. This plan is implemented via a series of joint ventures that address specific local issues, among which, the Eastern Habitat Joint Venture (EHJV) concentrates on the conservation of wetlands and other waterfowl habitats in eastern Canada. The current 5-year EHJV implementation and evaluation plan includes population baselines and objectives to help in planning, evaluation, and communication of conservation measures and results. This report focuses on the methods used by waterfowl biologists to determine priority species and population baselines and objectives.

Acknowledgements

Introduction

The North American Waterfowl Management Plan (NAWMP) is a long term conservation agreement that was signed in 1986 by Canada and the United States, and in 1994 by Mexico. NAWMP is an innovative conservation initiative that was developed in response to declining continental waterfowl populations during the early 1980's. The main objective of NAWMP is to restore waterfowl populations to the levels that were present in the 1970's by protecting and restoring habitats that could ensure their survival and also benefit other wetland-dependent wildlife. In addition, NAWMP evolved from site-specific habitat protection to a landscape-based waterfowl conservation approach. NAWMP is a partnership between federal, state, and provincial governments and non profit organizations where all partners combine their resources to achieve its objectives by funding conservation projects throughout North America.

The delivery of NAWMP objectives is made possible through a series of joint ventures that address specific waterfowl conservation problems related to geographic locations or to species that deserve special attention due to serious population declines. The Eastern Habitat Joint Venture (EHJV), one of 18 joint ventures initiated across North America, was established in November 1989 to address critical waterfowl habitat conservation issues in eastern Canada. The main objective of the EHJV is to protect and restore wetlands in eastern Canada that produce the majority of waterfowl populations in the Atlantic flyway, and that also contribute to the Mississippi flyway. These habitats provide the breeding, migration, and wintering requirements of a wide range of waterfowl and other wildlife species.

The current 5-year EHJV implementation and evaluation plan (2007-2012) includes a section that outlines population baselines and objectives. Population objectives allow managers to decide which species' populations are currently robust, which others are in need of restoration, and to what level, and which

populations should be managed because of overabundance. Population objectives are set for a 10-year horizon with the intent of assessing progress towards these goals after the first 5 years following the implementation of the EHJV plan.

Population objectives may serve many purposes, such as a starting point for habitat conservation planning, performance indicators for evaluation, and communicating the extent of conservation needs. However, setting and using population or habitat objectives is a challenge, which should be viewed as an ongoing exercise requiring refinement, research into underlying assumptions, and improvement over time. Our current knowledge of population sizes, densities, and distribution of species remain imperfect, as is that of the factors that may influence recruitment and survival, and their variation in space and time and ultimately how populations may react to various management scenarios. Therefore, incomplete information on population dynamics of the species of concern renders the determination of any potential habitat limitation at a given time complex.

In the current EHJV implementation and evaluation plan (2007-2012), population baselines and objectives were presented by species and Bird Conservation Regions (BCR). In this report, we present the methodologies that were used to determine these figures as well as how priority species were selected. Population baselines and objectives are primarily based on aerial surveys conducted yearly within the Eastern Waterfowl Survey Program (EWSP), which provide breeding population estimates for the inland species in all eastern provinces (Ontario, Quebec, New Brunswick, Nova Scotia, and Newfoundland). Other species population baselines and objectives are based on more local and punctual surveys.

These baseline values represent estimates of current numbers of waterfowl using habitats found in the EHJV landscape. From these, population objectives were

determined for the breeding season, and for overwintering and staging waterfowl. The evaluation of population baselines and objectives is an ongoing process that keeps building upon new knowledge of waterfowl ecology and dynamics, and upon new monitoring data. These population baselines and objectives were determined as a starting point in the implementation process, and the evaluation of these figures will be part of the adaptive management framework that was used to develop the new EHJV conservation plan. An evaluation will be done to determine if the implemented conservation measures do in fact have a positive impact on waterfowl populations, and if these measures enable EHJV partners to make strides towards achieving the population objectives as set out in the implementation plan. Future regional conservation plans will provide more refined estimates of current waterfowl populations.

Determination of priority species

The diversity of habitat types in the EHJV and its geographic location makes it an important region for many species of migratory waterfowl in terms of either breeding, migration and staging, or wintering habitat (Table 1). Species priority was established based on factors such as continental conservation concerns, the importance of each region to a species' life cycle and continental distribution, population trend, and the threat level to given species. EHJV-wide priority waterfowl species were determined by EHJV scientists during a science forum held in July 2006. In addition to these EHJV priority species, provincial priority species were also determined through consultation with waterfowl biologists from EHJV partner organizations.

The conservation objectives are therefore aimed at those avian species for which the EHJV partners have a responsibility to take the actions necessary to monitor, conserve, or restore populations to an acceptable level, and to provide, maintain, or manage the habitat that those populations would require. Other waterfowl species are not specifically mentioned because they are not considered as high a

priority for conservation as the species listed in Table 1. The exclusion of these other species should not be interpreted as their somehow being less valuable. Rather, these other species either are considered to have robust or acceptable populations or trends not requiring further conservation action, or we consider the EHJV to be so peripheral to their continental distribution that the species should not distract conservation attention from species that are a higher priority here.

Table 1: EHJV and regional priority waterfowl species.

Species	EHJV	Atlantic	Ontario	Quebec
Ducks				
American black duck	High	High [b s w]	High [b-nb]	High [b]
Mallard	High	Low [b]	High [b]	Low [b]
Green-winged teal	High			Mod. [b]
Blue-winged teal			High [b]	Mod.
Wood duck				Mod. [b]
Redhead			High [nb]	
Canvasback			High [nb]	
Lesser scaup			High [nb]	
Ring-necked duck	High	High [b]	High [b-nb]	Mod. [b]
Common goldeneye			High [b-nb]	Mod. [b]
Barrow's goldeneye	High	Mod. [b w]		High [w]
Common merganser			High [nb]	
Hooded merganser			High [b]	
Harlequin duck	High	High [b w]		High
Long-tailed duck	High	Low [w]		Mod.
Common eider (*dresseri*)	High	High [b s w]		High [b]
Common eider (*borealis*)		High [b s w]		Mod. [w]
Black scoter	High	High [b s]	High [nb]	High
Surf scoter				High
White-winged scoter				Mod.
Geese and swans				
CAGO – Southern James Bay			High [b]	
CAGO – Miss. Valley			High [b]	
CAGO - Atlantic (AP)	High			High [b]
CAGO - Atlantic flyway resident	High	Mod. [b s]	High [b]	Low [b]
CAGO - North Atlantic (NAP)	High	High [b s w]		Low [b]
Greater snow goose	High	Low [s]		High [s]
Tundra swan			High [nb]	

[b] breeding, [nb] non-breeding, [s] staging, [w] wintering

Determination of population baselines

Breeding species surveyed by helicopter

Most inland breeding species that occur in the EHJV landscape are surveyed within the annual EWSP helicopter surveys. These species include the American black duck, mallard, green-winged teal, blue-winged teal, wood duck, American widgeon, gadwall, ring-necked duck, lesser scaup, greater scaup, Barrow's goldeneye, common goldeneye, common merganser, and hooded merganser. Seaducks and geese population estimates are derived from other surveys.

Aerial surveys have been conducted annually since 1990 in Ontario, Quebec, New Brunswick, Nova Scotia, Newfoundland and Labrador to estimate breeding pair populations in the boreal forest. Briefly, plots are surveyed using a helicopter in April or May, depending on yearly climatic conditions and latitude. Until 1996, survey plots measured 10 X 10 km and were systematically distributed every 100 km in Ontario, Quebec, and Newfoundland. Plot location was randomly chosen in Nova Scotia and New Brunswick, whereas surveys are conducted via ground counts in P.E.I. (see Appendix 1 for details concerning P.E.I.). Since 1996, aerial survey plots are reduced to a 5 X 5 km area. Each south-west corner 5 X 5 plot was retained within the former 10 X10 km plots, and others 5 X 5 km plots were added every 50 km. There are four strata within the four provinces that comprise the survey area. Within a stratum, plots were assigned at random to 4 equal sized groups, or panels, and two such panels surveyed each year. The 4 panels (designated a,b,c,d) were covered over 4 years in the following order: ab, bc, cd, and ad. Thus each plot was surveyed twice in a 4-year period. Numerous plots are surveyed in most BCR, although the sampling design has been planned by stratum, without consideration to their distribution through BCRs (Table 2). Therefore, the BCR system represents *a posteriori* stratification.

Density estimates (Indicated Breeding Pairs / 100 km^2) were computed for every year for the period 1990 - 2005 using a linear model with year and plot as

independent variables. This statistical model produces an annual index that compensates for plot rotation in the design. The model was run independently by BCR within each province. Yearly population estimates corresponded to density estimates multiplied by the area of the BCR within each province.

Table 2: Number of plots (and total area [km^2]) included in waterfowl survey programs by province and BCR

Province	BCR07	BCR08	BCR12	BCR13	BCR14
Newfoundland	3 (50,630)	35 (135,511)			
Nova Scotia					30 (54,782)
New Brunswick					40 (72,159)
Quebec		97 (323,407)	51 (173,250)		8 (43,317)
QC Shoreline		84 (2,740)	29 (867)	64 (2,451)	35 (1,222)
QC Lowlands					
-Anticosti		2 (7,557)			
-Appalachians					8 (23,154)
-Abitibi		22 * (4,188)	6 * (1,116)		
-Lac St-Jean		28 (6,843)			
-St. Lawrence				124 (24,303)	
Ontario		13 (83,779)	26 (131,847)	1 (1,401)	
Southern Ontario			95 * (48,471)	245 (78,244)	

Note: One half of survey plots are run each year.
There are an additional 10 plots In Newfoundland and Labrador which are not identified to BCR
*Included in EWSP plot area

Baselines presented in the implementation and evaluation plan 2007-2012 are values judged as best representing repeated high populations estimates during the 1998-2005 period, discounting unusual spikes (appendix 2). If the annual

estimates were considered too low or too erratic to provide reasonable objectives, then no objectives were calculated.

In Quebec, estimates of the EWSP were amalgamated to those of the Shoreline Survey Program and the Lowland Survey Program when the density was noticeably high. The Shoreline Survey area is partially included in the EWSP but also covers some areas over water and a strict interpretation of overlap would be incorrect.

In Ontario, breeding Population baselines were determined by BCR using a combination of survey data from the Eastern Waterfowl Survey (EWS) and the Southern Ontario Breeding Waterfowl Survey (SOBWS); Brian Collins analysed the results and set the baselines using the criteria noted earlier in this report. Population values for the surveyed areas in BCR 8 and 13 were calculated directly using the data from the appropriate plots in the EWS and SOBWS respectively. The value for BCR 12 was compiled by subdividing the area and using the data from whichever survey covers those units most effectively. That area of BCR 12 north and west of the French and Mattawa rivers (North Bay area) was covered using the EWS plots. That part of BCR 12 in central Ontario (south and east of the French and Mattawa rivers) was further subdivided into the two strata used in the SOBWS (high and low density). The high density stratum which is mostly restricted to a band along the boundary with BCR13 was most effectively covered by the SOBWS and its value was generated from those data. The low density stratum was most intensively surveyed by the EWS whose data was thus used. The 5 values were then summed to give the Ontario population baseline. This is not a value for the whole province but is based on coverage of southern, central, and northeastern Ontario which includes all areas where EHJV activities is being undertaken.

Other breeding species and non-breeding periods

Populations of other breeding species in eastern Canada, such as many seaducks as well as geese are not surveyed on an annual basis as is the case for inland waterfowl, or not for as many years. Some progress was made in recent years and short time series are now available in some cases, depending on regions and periods of the year. In these cases, a variety of punctual methods were used to set population baselines, adjusting recent survey results using the general knowledge of regional waterfowl biologists (Appendix 1).

In Ontario, baselines for use of staging areas by migrant waterfowl were determined through the series of coastal surveys of the lower Great lakes undertaken by the CWS from 1999 to 2003. These data were used to calculate waterfowl-use days over the spring and fall migration periods. The objective is at the minimum to maintain stability of these values for all priority species. Given the trend to warmer winters it is expected that use by migrants will likely continue to increase as the waterfowl stage longer or elect to overwinter.

Determination of population objectives

Population objectives are set for a 10-year timeframe during which continuous management, monitoring and scientific studies will take place to ensure optimization of the EHJV implementation plan. Population objectives were set for high priority species within regions. For those already part of existing CWS or NGO conservation programs for which management plans exist, we used the population target that were set out in the available management and conservation plans. Most species' objectives aim at keeping populations relatively stable. In some other cases, small increases are projected whereas for others management will aim at reducing considerably populations, such as for resident Canada geese or greater snow geese. In cases where increases were projected, the level of increase was estimated according to proposed conservation actions of the different EHJV partner organizations.

In Ontario, population objectives have largely been set based on maintaining baseline levels of all priority species. It is anticipated that such an approach will help maintain stable levels of non-priority species as well. Objectives above the baselines have been determined for 4 species (Mallard, American Black Duck, Blue-winged Teal, and Wood Duck). Active management under the Ontario EHJV will provide an increase in the amount and quality of wetland habitat in southern Ontario and should enable a 5% increase over baseline in the population of the Mallard which is the most responsive species to the planned actions. Wood Ducks should also increase an anticipated 1.4% in a similar response to active management (nest box programs, etc.). The Blue-winged Teal has declined drastically in southern Ontario; the goal has been set to halt the decline and grow the population by 5% (300 birds). Lastly the Black Duck population which has dropped in some parts of Ontario should benefit slightly from active management noted above. It is also anticipated that policy discussions stimulated through the EHJV will lead to beneficial changes in land use of the more northerly areas in which the species now concentrates, thus improving habitat conditions leading to increased numbers (3% up).

A population objective below the baseline was determined for one population, the temperate-breeding Canada Geese which have reached problematic levels in southern Ontario. The objective chosen (roughly half the present population size) is the level above which the complaints from the public rose rapidly given the increasing amounts of crop depredation and nuisance. This is an interim objective and may be modified once the official management plan for this population has been completed. This is an objective that the CWS will try to meet primarily through harvest regulations and will not require a significant contribution from the EHJV.

Appendix 1: Data sources for regional baseline populations

Data source for the population baselines in the Atlantic Provinces

Species	Seasonal Relevance	Data Source
Ducks		
American Black Duck	B	NS/NL/NB: Mean of 3 highest Eastern Waterfowl survey reports (1990-2005; B Collins); PE: 2000 aerial survey solely (B. Collins)
American Black Duck	W	PE/NS: data deficient; NB: mean 2001-2006 Bay of Fundy Jan. Boat Survey
Mallard	B	NS/NL/NB: Mean of 3 highest Eastern Waterfowl survey reports (1990-2005; B Collins); PE: 2000 aerial survey solely (B. Collins)
Ring-necked Duck	B	NS/NL/NB: Mean of 3 highest Eastern Waterfowl survey reports (1990-2005; B Collins); PE: 2000 aerial survey solely (B. Collins)
Barrow's Goldeneye	B	Labrador: Inadequate survey coverage; Newfoundland: rare breeder (Gilliland Eastern Waterfowl Survey Program)
Barrow's Goldeneye	W	NS/NB/PE: Mean of 3 highest CWS-AR counts (1959 to present; CWS-AR)
Harlequin Duck	B	Labrador: Inadequate survey coverage; Newfoundland estimate: 130 pair (Gilliland aerial surveys [CWS Occas. Pap. in prep.])
Harlequin Duck	W	2001 COSEWIC Status report (Thomas and Robert); Thomas, pers. Comm.
Long-Tailed Duck	W	PE: Dibblee (late 70's) and aquaculture survey program files (McAloney & Hicks); NB: mean 2001-2006 Bay of Fundy Jan. Boat Survey; NS: 2006 Caostal Block Survey
Common Eider (dresseri)	B	Labrador: 1994 Aerial Survey (adult male count; Gilliland), adjusted for observed lambda North of Fish Cove Point (Chaulk); Newfoundland: 2000 ground count plus extrapolation (Gilliland); NB: 1998-2006 Aerial Surveys (Connor); NS: Aerial surveys (Milton)
Common Eider (dresseri & borealis)	W	NL: 2003 Aerial Survey estimate, partitioned between QC and NL (Gilliland, Bordage and Lepage)
Common Eider (borealis)	B	Labrador: 2006 Aerial Survey (adult male count), north of Fish Cove Point (Chaulk)
Common Eider (dresseri & borealis)	W	NS: maybe should be updated with local survey (2006 eastern North America surveys, NS section): 12,412 white males, 19,806 brown, 32,217 total. Note these are raw counts and not photo corrected. These files still need some work and there is a small area of overlap between surveys - some double counts maybe removed. Finalized counts should be avilable in Jan 07. (Gilliland, Bordage and Lepage)
Common Eider (dresseri & borealis)	W	NB: maybe should be updated with local survey (source: 2006 eastern North America surveys, NB section): 5,622 white males, 7,371 brown, 12,993 total. Note these are raw counts and not photo corrected. These files still need some work and there is a small area of overlap between surveys - some double counds maybe removed. Finalized counts should be avilable in Jan 07. (Gilliland, Bordage and Lepage)

Species	Seasonal Relevance	Data Source
Black Scoter	S	2005 aerial counts (McAloney, Savard & Gilliland), Bay des Chaleurs, NB
Geese & Swans		
CAGO - North Atlantic (NAP)	B	Mean of 3 highest Eastern Waterfowl stratum 2 survey results (1996-2006; B Collins) less target for Quebec (18,000)
CAGO - North Atlantic (NAP)	S	PE: Mean of 3 fall counts (1969-2005; R. Dibblee)
CAGO - North Atlantic (NAP)	W	NS: Mean of 3 highest mid-winter counts (1992-2000; R. Milton)
Greater Snow Goose	S	Mean of 3 highest years survey naturalist reports at Restigouche River Estuary, NB (2000-2006; A. Maddden)
Other species listed as Provincial Priorities:		
American Green-winged Teal (NL, PE, NS, NB)	B	Mean of 3 highest Eastern Waterfowl survey reports (1990-2005; B Collins); PE: 2000 aerial survey solely (B. Collins)
Common Goldeneye (NL, NB)	B	Mean of 3 highest Eastern Waterfowl survey reports (1990-2005; B Collins); PE: 2000 aerial survey solely (B. Collins)
Wood Duck (NB)	B	Mean of 3 highest Eastern Waterfowl survey reports (1990-2005; B Collins); PE: 2000 aerial survey solely (B. Collins)
Surf Scoter (NL)	S (M)	Gilliland & Lewis (aerial surveys, 1998-2000)

Data source for the population baselines in Quebec

Species	Seasonal Relevance	Data Source
Ducks		
American Black Duck	B	Approximate average of aerial survey programs between 1998-2005 (B. Collins)
Mallard	B	Approximate average of aerial survey programs between 1998-2005 (B. Collins)
Ring-necked duck	B	Approximate average of aerial survey programs between 1998-2005 (B. Collins)
Green-winged teal	B	Approximate average of aerial survey programs between 1998-2005 (B. Collins)
Barrow's goldeneye	W	Management Plan
Common goldeneye	B	Approximate average of aerial survey programs between 1998-2005 (B. Collins)
Wood duck	B	Approximate average of aerial survey programs between 1998-2005 (B. Collins)
Common eider (dresseri)	B	Management Plan
Common eider (borealis)	W	Results from survey in 2003
CAGO – Atlantic (AP)	B	Aerial survey of Ungava Peninsula of 2006
CAGO – Atlantic flyway resident	B	Following results of aerial survey programs in 2004
CAGO – North Atlantic (NAP)	B	Average of results of aerial survey programs 2003-2006
Greater snow goose	S	Results from aerial survey of 2007

Data source for the population baselines in Ontario

Species	Seasonal Relevance	Data Source
Ducks		
American black duck	B	Approximate average of survey programs between 1995-2005 (B. Collins)
Mallard	B	Approximate average of survey programs between 1995-2005 (B. Collins)
Green-winged teal	B	Approximate average of survey programs between 1995-2005 (B. Collins)
Blue-winged teal	B	Approximate average of survey programs between 1995-2005 (B. Collins)
Wood duck	B	Approximate average of survey programs between 1995-2005 (B. Collins)
Ring-necked duck	B	Approximate average of survey programs between 1995-2005 (B. Collins)
Ring-necked duck	NB	Based on waterfowl-day totals (in millions) for the spring (March 1 – June1) and fall (August 16 – January 1) migration periods for the southern Great Lakes shore in Ontario as determined during the 1999-2003 survey series.
Redhead	NB	Based on waterfowl-day totals (in millions) for the spring (March 1 – June1) and fall (August 16 – January 1) migration periods for the southern Great Lakes shore in Ontario as determined during the 1999-2003 survey series.
Canvasback	NB	Based on waterfowl-day totals (in millions) for the spring (March 1 – June1) and fall (August 16 – January 1) migration periods for the southern Great Lakes shore in Ontario as determined during the 1999-2003 survey series.
Lesser scaup	NB	Based on waterfowl-day totals (in millions) for the spring (March 1 – June1) and fall (August 16 – January 1) migration periods for the southern Great Lakes shore in Ontario as determined during the 1999-2003 survey series. Waterfowl-day value for total scaup as the 2 species cannot routinely be distinguished during aerial surveys.
Common goldeneye	B	Approximate average of survey programs between 1995-2005 (B. Collins)
Common goldeneye	NB	Based on waterfowl-day totals (in millions) for the spring (March 1 – June1) and fall (August 16 – January 1) migration periods for the southern Great Lakes shore in Ontario as determined during the 1999-2003 survey series.
Common merganser	B	Approximate average of survey programs between 1995-2005 (B. Collins)
Common merganser	NB	Based on waterfowl-day totals (in millions) for the spring (March 1 – June1) and fall (August 16 – January 1) migration periods for the southern Great Lakes shore in Ontario as determined during the 1999-2003 survey series.
Hooded merganser	B	Approximate average of survey programs between 1995-2005 (B. Collins)
CAGO – SJBP	B	From annual breeding ground surveys and management plan
CAGO – resident	B	Approximate average of survey programs between 1995-2005 (B. Collins)
CAGO – MVP	B	From annual breeding ground surveys and management plan
Tundra swan	NB	Based on waterfowl-day totals (in millions) for the spring (March 1 – June1) and fall (August 16 – January 1) migration periods for the southern Great Lakes shore in Ontario as determined during the 1999-2003 survey series.

PEI Estimate of Total Breeding Pairs in 2000.

Data Used in analysis:
1. 2000 Breeding Pair Survey;
2. 2000 PEI Wetland Inventory.

Background

The PEI breeding pair and brood survey sites were originally selected from the 1983 PEI wetland inventory. The inventory was stratified by Golet score into 13 classes from which a random sample of 100 sites was chosen. Those sites have been surveyed for breeding pairs annually since 1985. The wetland inventory for PEI was updated and digitized in GIS in 1990 and again in 2000.

Breeding Pair Data

The Breeding Pair survey sites were grouped by survey site into 13 Golet score classes based on the wetland surveyed. The total number of breeding pairs for each species was calculated for each Golet score class. This number was divided by the total area (ha) of wetland of each Golet score class in the survey. This created a rate of pairs/ha.

Wetland Inventory Data

The 2000 wetland inventory was grouped by 5 point increments into 13 Golet score classes and the total area for each Golet score class was determined. The breeding pair rate for each Golet score class was multiplied by the area of wetland of that score class. The estimates based on this direct extrapolation procedure are summarized in the following table.

Table 1. Estimated number of breeding pairs of waterfowl in PEI for the year 2000.

SPECIES	ESTIMATED PAIRS
ABDU	13,380
RNDU	3,398
AGWT	3,722
BWTE	1,927
MALL	1,561
CAGO	1,961
GADW	1,013
AMWI	1,251
OTHER	1,901
TOTAL	**30,114**

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Appendix 2: Pair density estimates by province and BCR from aerial survey programs used to compute population baselines and objectives for the EHJV

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Quebec BCR 08

Survey areas
Helicopter/Plot Survey                      323401
Shoreline Survey                              2740
Lowlands Survey: Abitibi                      4188
                 Saguenay/Lac St Jean         8643
                 Anticosti                    7557

NOTES
Helicopter/Plot survey overlaps with Saguenay and Abitibi.

The shoreline survey area is partially included in the Heli/Plot survey
area but also covers some area over water and a strict interpretation of
overlap would be incorrect.
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Common Merganser


Density (IP/100 sq km)                                Saguenay
      Heli/Plot  Shoreline   Anticosti  Abitibi  Lac St Jean
1990    7.723                  0.000
1991   11.628                  0.000
1992    8.426                  0.000
1993    2.901
1994    5.780
1995    5.574
1996    4.558
1997    4.404
1998    5.712                            0.000       3.125
1999    5.506                            0.000       6.250
2000    5.802
2001    5.505
2002    7.186
2003    6.650
2004    9.045  48.947                    2.083       0.000
2005    7.496   9.211         0.000      4.545      10.714
2006                          4.000


Population                                           Saguenay
      Heli/Plot  Shoreline   Anticosti  Abitibi  Lac St Jean
1990   24977                     0
1991   37605                     0
1992   27251                     0
1993    9383
1994   18694
1995   18025
1996   14742
1997   14244
1998   18471                               0          214
1999   17805                               0          428
2000   18764
2001   17804
2002   23238
2003   21505
2004   29252    1341                      87            0
2005   24241     252            0        190          733
2006                           302

BASELINE 24000 +  1000  = 25000
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Hooded Merganser (1310)

Density(IP/100 sq km)                           Saguenay
     Heli/Plot  Shoreline  Anticosti  Abitibi  Lac St Jean
1990    1.346              0.000
1991    2.019              0.000
1992    1.847              0.000
1993    1.816
1994    1.390
1995    2.273
1996    1.052
1997    0.964
1998    1.665                         0.000    0.000
1999    3.806                         5.000    2.500
2000    2.700
2001    0.964
2002    1.249
2003    1.644
2004    2.994  0.263
2005    1.395  0.000     0.000       2.083    1.786
2006                     0.000       4.545    0.000


Population                                      Saguenay
     Heli/Plot  Shoreline  Anticosti  Abitibi  Lac St Jean
1990    4352              0
1991    6529              0
1992    5973              0
1993    5874
1994    4495
1995    7352
1996    3402
1997    3118
1998    5385                         0        0
1999   12309                         209      171
2000    8733
2001    3118
2002    4039
2003    5315
2004    9683      7                  87       122
2005    4512      0       0          190      0
2006                      0

BASELINE  5000 + 0 = 5000
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Mallard

Density (IP/100 sq km)                                  Saguenay
      Heli/Plot  Shoreline  Anticosti  Abitibi  Lac St Jean
1990     1.805              0.000
1991     1.354              0.000
1992     1.291              0.000
1993     0.762
1994     0.908
1995     2.342
1996     2.856
1997     1.883
1998     1.410                         70.833    18.750
1999     3.166                         65.000    28.750
2000     4.509
2001     2.478
2002     2.506
2003     4.196
2004     4.035   12.105               52.083     8.929
2005     4.352    6.842     4.000     61.364    21.429
2006                        0.000


Population                                             Saguenay
      Heli/Plot  Shoreline  Anticosti  Abitibi  Lac St Jean
1990     5837                0
1991     4378                0
1992     4174                0
1993     2463
1994     2935
1995     7573
1996     9235
1997     6090
1998     4559                         2967      1283
1999    10238                         2722      1967
2000    14583
2001     8014
2002     8106
2003    13571
2004    13050    332                  2181       611
2005    14074    187       302        2570      1466
2006                        0

BASELINE  13500 +  300              + 2000      2000 = 17800
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Black Duck

Density (IP/100 sq km)                               Saguenay
     Heli/Plot  Shoreline   Anticosti  Abitibi  Lac St Jean
1990   20.382                14.000
1991   15.983                10.000
1992   14.029                32.000
1993   11.898
1994    8.431
1995   11.580
1996   18.104
1997   18.433
1998   21.085                         29.167     12.500
1999   27.220                         57.500     45.000
2000   25.085
2001   21.333
2002   24.057
2003   22.257
2004   21.814    68.947              23.958     18.750
2005   16.203    38.553    24.000    14.773     41.964
2006                       28.000


Population                                          Saguenay
     Heli/Plot  Shoreline   Anticosti  Abitibi  Lac St Jean
1990   65914                 1058
1991   51690                  756
1992   45369                 2418
1993   38478
1994   27265
1995   37449
1996   58549
1997   59612
1998   68190                          1222        855
1999   88030                          2408       3079
2000   81126
2001   68990
2002   77801
2003   71980
2004   70547    1889                  1003       1283
2005   52400    1056      1814         619       2872
2006                      2116

BASELINE 80000  + 1500    + 2000     + 1000    + 1000 = 85500
```

```
Green-winged Teal

Density (IP/100 sq km)                           Saguenay
      Heli/Plot Shoreline   Anticosti  Abitibi  Lac St Jean
1990    5.514               0.000
1991    5.416               0.000
1992    4.748               0.000
1993    1.065
1994    4.558
1995    2.040
1996    4.651
1997    2.384
1998    3.331                           16.667     6.250
1999    4.520                           22.500    18.750
2000    7.504
2001    2.768
2002    6.661
2003    4.781
2004    5.607   15.526                  35.417    12.500
2005    3.544    2.105     0.000        27.273     7.143
2006                       0.000


Population                                       Saguenay
      Heli/Plot Shoreline   Anticosti  Abitibi  Lac St Jean
1990   17832                  0
1991   17514                  0
1992   15356                  0
1993    3444
1994   14741
1995    6597
1996   15042
1997    7709
1998   10772                             698       428
1999   14619                             942      1283
2000   24268
2001    8952
2002   21542
2003   15462
2004   18132     425                    1483       855
2005   11463      58         0          1142       489
2006                         0

BASELINE  19000                      + 1000      1000 = 21000
```

```
Wood Duck

Density (IP/100 sq km)                                   Saguenay
      Heli/Plot  Shoreline   Anticosti  Abitibi  Lac St Jean
1990    0.000                  0.000
1991    0.000                  0.000
1992    0.070                  0.000
1993    0.000
1994    0.000
1995    0.154
1996    0.312
1997    0.496
1998    0.000                           0.000    0.000
1999    0.376                           5.000    2.500
2000    0.613
2001    0.372
2002    0.166
2003    0.376
2004    0.312   0.000                    0.000    1.786
2005    0.259   0.000        0.000       2.273    1.786
2006                         0.000


Population                                              Saguenay
      Heli/Plot  Shoreline   Anticosti  Abitibi  Lac St Jean
1990       0                     0
1991       0                     0
1992     228                     0
1993       0
1994       0
1995     499
1996    1009
1997    1603
1998       0                              0         0
1999    1216                            209       171
2000    1982
2001    1202
2002     536
2003    1216
2004    1009      0                       0       122
2005     837      0           0          95       122
2006                          0

BASELINE  1200
```

Ring-necked Duck

Density (IP/100 sq km)

	Heli/Plot	Shoreline	Anticosti	Abitibi	Saguenay Lac St Jean
1990	12.297		0.000		
1991	10.574		0.000		
1992	9.241		16.000		
1993	6.955				
1994	8.971				
1995	5.552				
1996	5.894				
1997	9.706				
1998	9.279			0.000	12.500
1999	11.039			10.000	7.500
2000	14.257				
2001	10.004				
2002	10.081				
2003	14.692				
2004	12.772	7.368		20.833	8.929
2005	11.463	5.263	4.000	11.364	8.929
2006			4.000		

Population

	Heli/Plot	Shoreline	Anticosti	Abitibi	Saguenay Lac St Jean
1990	39768		0		
1991	34195		0		
1992	29886		1209		
1993	22493				
1994	29013				
1995	17957				
1996	19063				
1997	31391				
1998	30009			0	855
1999	35700			419	513
2000	**46107**				
2001	32352				
2002	32603				
2003	**47515**				
2004	**41303**	202		873	611
2005	37072	144	302	476	611
2006			302		

BASELINE 41000

Common Goldeneye

Density (IP/100 sq km)   Saguenay
     Heli/Plot Shoreline Anticosti Abitibi Lac St jean
1990   10.724   8.000
1991   9.773   8.000
1992   8.195   4.000
1993   13.339
1994   11.140
1995   8.157
1996   7.425
1997   9.516
1998   7.537   0.000   0.000
1999   9.721   0.000   2.500
2000   11.912
2001   9.992
2002   11.735
2003   12.365
2004   12.137   5.000   0.000   5.357
2005   11.167   2.368   28.000   0.000   1.786
2006   12.000

Population   Saguenay
     Heli/Plot Shoreline Anticosti Abitibi Lac St jean
1990   34683   605
1991   31605   605
1992   26503   302
1993   43138
1994   36027
1995   26380
1996   24012
1997   30776
1998   24375   0   0
1999   31437   0   171
2000   **38524**
2001   32316
2002   **37950**
2003   **39989**
2004   **39251**   137   0   367
2005   36114   65   2116   0   122
2006   907

BASELINE 38000

Quebec BCR 12

Survey areas
Helicopter/Plot Survey   172383
Shoreline Survey   867
Lowlands Survey: Abitibi   1116

NOTES
Helicopter/Plot survey overlaps with Abitibi.

The shoreline survey area is partially included in the Helicopter/Plot
survey area but also covers some area over water and a strict
interpretation of overlap would be incorrect.

```
Common Merganser


Density (IP/100 sq km)
     Heli/Plot  Shoreline   Abitibi
1990   11.260
1991   12.466
1992   13.007
1993   12.284
1994    8.671
1995    8.228
1996    7.614
1997   13.650
1998    7.459                 0.000
1999    9.865                 0.000
2000   15.605
2001   12.758
2002   17.367
2003   13.740
2004   15.229   28.095       12.500
2005   11.737   44.286        0.000


Population
     Heli/Plot  Shoreline   Abitibi
1990   19410
1991   21489
1992   22422
1993   21176
1994   14948
1995   14183
1996   13126
1997   23531
1998   12858                   0
1999   17005                   0
2000   26901
2001   21992
2002   29937
2003   23686
2004   26252     244         140
2005   20232     384           0

BASELINE 24000 + 300 = 24300
```

```
Hooded Merganser (1310)

Density (IP/100 sq km)
     Heli/Plot  Shoreline   Abitibi
1990   5.574
1991   3.196
1992   1.618
1993   3.307
1994   4.960
1995   5.464
1996   5.262
1997   5.158
1998   3.812                 0.000
1999   8.519                 0.000
2000   9.041
2001   6.337
2002  12.118
2003   9.484
2004  11.226   4.286        12.500
2005   8.253   1.095        12.500



Population
     Heli/Plot  Shoreline   Abitibi
1990    9609
1991    5509
1992    2790
1993    5701
1994    8551
1995    9419
1996    9071
1997    8892
1998    6572                    0
1999   14686                    0
2000   15585
2001   10924
2002   20890
2003   16349
2004   19352       37         140
2005   14226       17         279

BASELINE  16000
```

```
Mallard

Density (IP/100 sq km)
      Heli/Plot  Shoreline   Abitibi
1990    1.622
1991    1.018
1992    1.298
1993    1.720
1994    0.983
1995    0.558
1996    3.898
1997    2.060
1998    3.373                 75.000
1999    5.284                 87.500
2000    3.397
2001    3.477
2002    3.520
2003    6.416
2004    4.745  30.000         25.000
2005    4.120  44.286         66.667




Population
      Heli/Plot  Shoreline   Abitibi
1990    2797
1991    1754
1992    2237
1993    2965
1994    1694
1995     963
1996    6719
1997    3552
1998    5815                   837
1999    9109                   977
2000    5856
2001    5993
2002    6068
2003   11061
2004    8180    260            279
2005    7103    384            744

BASELINE  7000 + 300      + 700 = 8000
```

```
Black Duck

Density (IP/100 sq km)
     Heli/Plot  Shoreline   Abitibi
1990   31.094
1991   22.417
1992   20.316
1993   23.536
1994   17.136
1995   18.696
1996   22.831
1997   23.313
1998   27.557                 6.250
1999   33.540                 0.000
2000   34.450
2001   33.618
2002   42.395
2003   27.502
2004   30.207   77.143       12.500
2005   30.037  128.571       12.500


Population
     Heli/Plot  Shoreline   Abitibi
1990   53601
1991   38643
1992   35021
1993   40571
1994   29539
1995   32228
1996   39356
1997   40188
1998   47503                   70
1999   57818                    0
2000   59385
2001   57951
2002   73081
2003   47408
2004   52071     669          130
2005   51778    1115          140

BASELINE  58000 + 1000 = 59000
```

```
Green-winged Teal

Density (IP/100 sq km)
      Heli/Plot  Shoreline  Abitibi
1990    1.791
1991    1.832
1992    0.448
1993    1.392
1994    0.464
1995    1.904
1996    1.304
1997    2.580
1998    1.840                  6.250
1999    2.367                  0.000
2000    5.333
2001    4.073
2002    3.962
2003    5.720
2004    7.263   16.190       25.000
2005    4.888   14.762        0.000



Population
      Heli/Plot  Shoreline  Abitibi
1990    3088
1991    3157
1992     772
1993    2399
1994     800
1995    3282
1996    2247
1997    4447
1998    3171                    70
1999    4080                     0
2000    9193
2001    7022
2002    6831
2003    9860
2004   12520     140          279
2005    8426     128            0

BASELINE  9000  + 100  = 9100
```

```
Wood Duck

Density (IP/100 sq km)
      Heli/Plot  Shoreline  Abitibi
1990    1.590
1991    0.332
1992    0.159
1993    0.000
1994    1.302
1995    2.185
1996    0.512
1997    0.966
1998    0.721                31.250
1999    1.154                25.000
2000    1.791
2001    3.862
2002    2.306
2003    1.795
2004    0.682   13.810        0.000
2005    0.772    7.143        0.000


Population
      Heli/Plot  Shoreline  Abitibi
1990    2742
1991     573
1992     274
1993       0
1994    2244
1995    3766
1996     882
1997    1665
1998    1243                 349
1999    1989                 279
2000    3088
2001    6658
2002    3975
2003    3095
2004    1176     120           0
2005    1331      62           0

BASELINE  3000  + 100 +   300 = 3400
```

```
Ring-necked Duck

Density (IP/100 sq km)
      Heli/Plot   Shoreline   Abitibi
1990    16.089
1991     9.162
1992     9.931
1993     8.773
1994     8.773
1995    12.332
1996     9.416
1997    14.883
1998    10.017                   6.250
1999    16.138                   0.000
2000    15.766
2001    13.294
2002    10.776
2003    17.106
2004    13.120   34.762          0.000
2005    17.195   23.333          0.000


Population
      Heli/Plot   Shoreline   Abitibi
1990    27734
1991    15793
1992    17120
1993    15123
1994    15123
1995    21258
1996    16232
1997    25655
1998    17267                     70
1999    27819                      0
2000    27177
2001    22916
2002    18575
2003    29489
2004    22617     301              0
2005    29641     202              0

BASELINE  27500 + 200 = 27700
```

```
Common Goldeneye

Density (IP/100 sq km)
     Heli/Plot  Shoreline   Abitibi
1990    7.077
1991    9.252
1992    8.492
1993    8.098
1994    7.786
1995    6.206
1996    8.437
1997    8.908
1998    5.397                0.000
1999    8.935                0.000
2000    9.821
2001    9.195
2002   15.087
2003   13.568
2004   14.610  38.571       25.000
2005   14.942  16.667        8.333


Population
     Heli/Plot  Shoreline   Abitibi
1990   12199
1991   15948
1992   14639
1993   13959
1994   13422
1995   10699
1996   14544
1997   15356
1998    9303                   0
1999   15403                   0
2000   16929
2001   15851
2002   26007
2003   23390
2004   25185    334          279
2005   25758    145           93

BASELINE  25000 + 200 = 25200
```

Quebec BCR 13

Survey areas
Shoreline Survey   2451
Lowlands Survey   24303

NOTES

The shoreline survey area is partially included in the Lowlands survey area but also covers some area over water and a strict interpretation of overlap would be incorrect.

Common Merganser

```
Density  (IP/100 sq km)
      Shoreline  St Laurent
1998              1.613
1999              6.452
2004   32.692     0.391
2005   40.000     6.818


Population
      Shoreline   St Laurent
1998               391
1999              1568
2004    801         95
2005    980        1657

BASELINE  800  +  1000  = 1800
```

Hooded Merganser

```
Density  (IP/100 sq km)
      Shoreline  St Laurent
1998              0.000
1999              0.000
2004   1.923      0.000
2005   0.714      0.379


Population
      Shoreline  St Laurent
1998               0
1999               0
2004    47          0
2005    18         92

BASELINE  0
```

Mallard

```
Density  (IP/100 sq km)
     Shoreline   St Laurent
1998                19.758
1999                50.000
2004  111.923      54.688
2005   74.643      35.227


Population
     Shoreline   St Laurent
1998                 4802
1999               12152
2004   2743        13291
2005   1829         8561

BASELINE  2000 +  9000 = 11000
```

Black Duck

```
Density  (IP/100 sq km)
     Shoreline   St Laurent
1998                14.516
1999                36.895
2004   99.038      17.969
2005  196.964      20.833


Population
     Shoreline   St Laurent
1998                3528
1999                8967
2004   2427         4367
2005   4828         5063

BASELINE  3000  + 5000 = 8000
```

Green-winged Teal

```
Density  (IP/100 sq km)
      Shoreline   St Laurent
1998                3.226
1999               16.129
2004   18.077      13.281
2005   34.643      10.606


Population
      Shoreline   St Laurent
1998                 784
1999                3920
2004    443         3228
2005    849         2578

BASELINE  500  +  3200 = 3700
```

Wood Duck

```
Density  (IP/100 sq km)
      Shoreline   St Laurent
1998                1.613
1999                2.419
2004   10.385       4.297
2005    5.000       3.409


Population
      Shoreline   St Laurent
1998                 392
1999                 588
2004    255         1044
2005    123          829

BASELINE  200 + 800 =1000
```

Ring-necked Duck

```
Density  (IP/100 sq km)
      Shoreline   St Laurent
1998               1.210
1999               2.016
2004   32.308      3.125
2005   25.357      3.788


Population
      Shoreline   St Laurent
1998                294
1999                490
2004    792         759
2005    622         921

BASELINE   700 +  500 = 1200
```


Common Goldeneye

```
Density  (IP/100 sq km)
      Shoreline   St Laurent
1998               0.403
1999               0.000
2004    6.923      0.000
2005   10.714      0.000


Population
      Shoreline   St Laurent
1998                98
1999                 0
2004    170          0
2005    263          0

BASELINE   200
```

```
Quebec BCR 14

Survey areas
Helicopter/Plot Survey            42317
Shoreline Survey                   1222
Lowlands Survey: Appalaches       23154

NOTES
Helicopter/Plot survey and Lowlands survey do not overlap

The shoreline survey area is partially included in the Helicopter/Plot
survey area but also covers some area over water and a strict
interpretation of overlap would be incorrect.
```

```
Common Merganser


Density (IP/100 sq km)
     Heli/Plot  Shoreline  Appalaches
1990    2.551
1991   10.203
1992    0.000
1993    5.958
1994    5.958
1995    0.000
1996    3.670
1997    0.000
1998    1.695                 1.000
1999    0.992                 9.000
2000    3.670
2001    1.253
2002    2.543
2003    1.984
2004    7.339     87.619      8.000
2005    2.506     22.632      4.000
2006                          2.000


Population
     Heli/Plot  Shoreline  Appalaches
1990    1079
1991    4318
1992       0
1993    2521
1994    2521
1995       0
1996    1553
1997       0
1998     717                  232
1999     420                 2084
2000    1553
2001     530
2002    1076
2003     839                 1852
2004    3106     1071         926
2005    1060      277         463

BASELINE  1500   + 500    + 1500 = 3500
```

```
Hooded Merganser

Density (IP/100 sq km)
      Heli/Plot  Shoreline  Appalaches
1990    5.506
1991    0.918
1992    0.000
1993    0.000
1994   16.461
1995    0.000
1996    4.473
1997    1.273
1998    5.966                  1.000
1999    4.304                  4.000
2000    1.491
2001    3.819
2002    2.983
2003    2.152
2004    5.219      0.000       2.000
2005    2.546      0.000       0.000
2006                           3.000


Population
      Heli/Plot  Shoreline  Appalaches
1990     2330
1991      388
1992        0
1993        0
1994     6966
1995        0
1996     1893
1997      539
1998     2524                   232
1999     1821                   926
2000      631
2001     1616
2002     1262
2003      911
2004     2208       0           463
2005     1077       0             0
2006                            695

BASELINE  2000 +              500 = 2500
```

```
Mallard

Density (IP/100 sq km)
     Heli/Plot  Shoreline  Appalaches
1990   1.912
1991   1.912
1992   0.956
1993   0.000
1994   0.000
1995   0.000
1996   3.824
1997   4.779
1998   0.000                 9.000
1999   4.481                27.000
2000   3.824
2001   4.779
2002   0.000
2003   6.273
2004   6.691    12.364      55.000
2005   0.000     7.895      37.000
2006                        21.000


Population
     Heli/Plot  Shoreline  Appalaches
1990    809
1991    809
1992    405
1993      0
1994      0
1995      0
1996   1618
1997   2022
1998      0                  2084
1999   1896                  6252
2000   1618
2001   2022
2002      0
2003   2655
2004   2832       151       12735
2005      0        96        8567
2006                         4862

BASELINE  2000           +  8000 = 10000
```

```
Black Duck

Density (IP/100 sq km)
     Heli/Plot  Shoreline   Appalaches
1990   14.552
1991   19.554
1992   12.733
1993   15.623
1994   12.694
1995   27.341
1996   18.335
1997   15.596
1998    8.532                20.500
1999   11.896                23.500
2000   37.209
2001   17.117
2002    3.732
2003   10.409
2004   19.413     80.000     27.500
2005    9.129    125.526     15.500
2006                         18.500


Population
     Heli/Plot  Shoreline   Appalaches
1990    6158
1991    8274
1992    5388
1993    6611
1994    5372
1995   11570
1996    7759
1997    6600
1998    3610                  4747
1999    5034                  5441
2000   15746
2001    7243
2002    1579
2003    4405
2004    8215       978        6367
2005    3863      1534        3589
2006                          4283

BASELINE  7000 + 1000    +   4000 = 12000
```

Green-winged Teal


```
Density (IP/100 sq km)
      Heli/Plot  Shoreline   Appalaches
1990    1.777
1991    5.331
1992    1.777
1993    2.274
1994    2.274
1995   11.368
1996   10.162
1997    4.989
1998    2.643                   0.000
1999   11.804                   6.000
2000   12.195
2001    1.663
2002    0.000
2003    1.312
2004    2.032    12.857        11.000
2005    6.652     8.947         8.000
2006                            3.000


Population
      Heli/Plot  Shoreline   Appalaches
1990     752
1991    2256
1992     752
1993     962
1994     962
1995    4810
1996    4300
1997    2111
1998    1119                      0
1999    4995                    1389
2000    5161
2001     704
2002       0
2003     555
2004     860       157         2547
2005    2815       109         1852
2006                            695

BASELINE 4000    + 100    +  1500 = 5600
```

```
Wood Duck

Density (IP/100 sq km)
     Heli/Plot  Shoreline  Appalaches
1990   0.883
1991   0.000
1992   0.883
1993   7.986
1994   3.993
1995   0.000
1996   1.377
1997   0.000
1998   0.000                 0.000
1999   4.674                 1.000
2000   2.066
2001   0.488
2002   0.000
2003   0.000
2004   0.000     0.952       3.000
2005   0.000     0.000       1.000
2006                         0.000


Population
     Heli/Plot  Shoreline  Appalaches
1990    374
1991      0
1992    374
1993   3380
1994   1690
1995      0
1996    583
1997      0
1998      0                   0
1999   1978                 232
2000    874
2001    206
2002      0
2003      0
2004      0       12        695
2005      0        0        232
2006                          0

BASELINE  500       +        300 = 800
```

```
Ring-necked Duck

Density (IP/100 sq km)
     Heli/Plot  Shoreline  Appalaches
1990   8.753
1991  28.010
1992  19.257
1993  20.557
1994  24.295
1995  31.770
1996  11.444
1997  24.581
1998   5.780                22.000
1999  12.480                 2.000
2000   9.684
2001  20.800
2002   4.335
2003  14.351
2004  36.094    5.714        0.000
2005  34.036    5.789        6.000
2006                         9.000


Population
     Heli/Plot  Shoreline  Appalaches
1990   3704
1991  11853
1992   8149
1993   8699
1994  10281
1995  13444
1996   4843
1997  10402
1998   2446                5094
1999   5281                 463
2000   4098
2001   8802
2002   1835
2003   6073
2004  15274      70           0
2005  14403      71        1389
2006                       2084

BASELINE  8000          + 1500 = 9500
```

```
Common Goldeneye

Density (IP/100 sq km)
     Heli/Plot  Shoreline  Appalaches
1990   2.192
1991   3.654
1992   7.309
1993   0.000
1994   0.000
1995   4.615
1996   5.116
1997   4.675
1998  21.814                3.000
1999   0.686                3.000
2000   2.192
2001  14.025
2002   0.000
2003   1.030
2004   2.192     0.953      1.000
2005  14.025     1.579      0.000
2006                        0.000


Population
     Heli/Plot  Shoreline  Appalaches
1990    928
1991   1546
1992   3093
1993      0
1994      0
1995   1953
1996   2165
1997   1978
1998   9231                  695
1999    290                  695
2000    928
2001   5935
2002      0
2003    436
2004    928       12         232
2005   5935       19           0
2006                           0

BASELINE  2000
```

```
Ontario BCR12

There are two long term surveys in Ontario BCR12. A helicopter survey
run on a rotating sampling scheme and a ground based survey run
approximately every 3 years.

The total area can be partitioned into 3 portions based on the survey
designs.

Portion of BCR 12                  Area         Surveys Run
North                              83376        Helicopter
South (Low wetland density)        34095         Helicopter and Ground
South (High wetland density)       14376        Ground
Total                              131847

The following tables give the density of indicated pairs (IP per 100 sq
km) and the estimated total population from the different surveys.




NOTES
Helicopter Plot South : Plots 1-8,10
Helicopter Plot North : All Other plots

The density reported for the Helicopter survey is based on a two-way
model with terms for year and plot. This should enhance year to year
comparability of the results by removing the effect of the plot
rotation.

The area covered by the ground surveys in the low wetland density
portion is small compared with the Helicopter survey and the analysis
for that region will be based on the Helicopter plots only.

There are some substantial declines in densities and population levels
in the Ground survey in the high wetland density strata. Ken Ross
suggested that here may be some timing difficulties with this survey in
the early years and that migrants may have been recorded.
```

Common Merganser

Density (IP/100 sq km)

Year	Helicopter/Plot			Southern Ground	
	North	South(L)		Low	High
1991	10.445	8.230	15.170		
1992	12.442	10.900	15.660	3.906	14.205
1993	9.690	7.102	15.014		
1994	12.289	8.522	20.018		
1995	7.294	6.240	9.946	0.000	17.045
1996	13.528	10.800	19.817		
1997	12.060	16.038	10.409		
1998	5.285	6.013	4.664	0.000	5.682
1999	9.908	8.669	12.732		
2000	10.951	9.200	14.532	0.000	8.681
2001	10.625	8.687	13.879		
2002	17.324	20.544	13.991		
2003	15.192	13.337	19.098	4.112	5.682
2004	15.138	14.401	14.532		
2005	8.328	8.687	9.252		

Population

Year	Helicopter Plot			Ground
	North	South(L)	Total	High
1991	6862	5172	12034	
1992	9088	5339	14427	2042
1993	5921	5119	11040	
1994	7105	6825	13930	
1995	5203	3391	8594	2450
1996	9005	6757	15761	
1997	13372	3549	**16921**	
1998	5013	1590	6603	817
1999	7228	4341	11569	
2000	7671	4955	12626	1248
2001	7243	4732	11975	
2002	17128	4770	**21899**	
2003	11120	6511	**17631**	817
2004	12007	4955	**16962**	
2005	7243	3155	10398	

BASELINE   17000 + 1000 = 18000

Hooded Merganser

Density   (IP/100 sq km)

	------Helicopter/Plot------			---Southern Ground---	
	North	South(L)		Low	High
1991	18.627	12.930	30.639		
1992	17.558	12.068	29.156	23.438	51.136
1993	15.064	7.362	30.128		
1994	24.150	11.453	48.874		
1995	15.596	10.693	26.562	35.156	51.136
1996	21.736	15.732	30.315		
1997	25.372	18.359	38.237		
1998	16.540	10.630	29.396	3.906	25.568
1999	18.516	10.974	36.902		
2000	16.404	12.236	21.399	3.906	20.255
2001	21.897	16.261	32.200		
2002	26.756	19.984	43.069		
2003	30.770	24.508	44.671	0.000	31.250
2004	22.556	16.606	30.315		
2005	28.848	21.506	42.262		

Population

	----Helicopter Plot------			-Ground-
	North	South(L)	Total	High
1991	10781	10446	21227	
1992	10062	9941	20003	7351
1993	6138	10272	16410	
1994	9549	16663	26212	
1995	8915	9056	17972	7351
1996	13117	10336	23453	
1997	15307	13037	**28344**	
1998	8863	10023	18885	3676
1999	9149	12582	21731	
2000	10202	7296	17498	2912
2001	13558	10978	24536	
2002	16662	14684	**31346**	
2003	20434	15231	**35664**	4493
2004	13846	10336	24182	
2005	17931	14409	**32340**	

BASELINE   31000 + 3000 = 34000

Mallard

Density   (IP/100 sq km)

	------Helicopter/Plot------			---Southern Ground---	
	North	South(L)		Low	High
1991	19.702	16.604	25.464		
1992	19.856	14.856	29.871	35.156	235.795
1993	18.829	13.538	27.833		
1994	15.314	9.308	25.244		
1995	16.056	11.262	23.278	50.781	196.023
1996	19.002	11.446	44.569		
1997	23.415	13.076	43.819		
1998	16.242	9.750	24.304	39.063	227.273
1999	18.322	16.746	14.765		
2000	26.940	20.763	42.092	46.875	185.185
2001	21.712	17.100	35.473		
2002	27.356	20.720	38.076		
2003	26.518	20.374	34.144	61.678	156.250
2004	28.383	16.504	69.329		
2005	28.950	22.129	47.993		

Population

	----Helicopter Plot------			-Ground-
	North	South(L)	Total	High
1991	13844	8682	22526	
1992	12387	10184	22571	33898
1993	11288	9490	20777	
1994	7760	8607	16367	
1995	9389	7936	17326	28180
1996	9544	15196	24739	
1997	10903	14940	25843	
1998	8129	8286	16416	32673
1999	13962	5034	18996	
2000	17312	14351	**31663**	26622
2001	14257	12094	26351	
2002	17275	12982	**30257**	
2003	16987	11641	28629	22463
2004	13760	23638	**37398**	
2005	18450	16363	**34814**	

BASELINE   32000 + 28000 = 60000

```
Black Duck

Density  (IP/100 sq km)
        ------Helicopter/Plot------  ---Southern Ground---
                  North    South(L)  Low       High
1991    26.289    26.754   25.366
1992    25.764    25.783   25.858    23.438    28.409
1993    26.148    24.024   29.308
1994    16.243    15.873   16.698
1995    21.622    25.994   17.431    35.156    19.886
1996    28.620    27.508   33.466
1997    18.896    16.262   22.728
1998    17.217    16.645   18.148    11.719    14.205
1999    25.089    25.122   25.850
2000    26.344    27.103   23.426    11.719     8.681
2001    20.910    22.360   18.418
2002    27.630    31.210   22.336
2003    21.028    20.998   21.873     4.112     0.000
2004    27.970    31.755   12.550
2005    20.136    22.106   16.850


Population
        ----Helicopter Plot------  -Ground-
        North     South(L)  Total   High
1991    22306      8648    30955
1992    21497      8816    30313    4084
1993    20030      9992    30022
1994    13234      5693    18927
1995    21673      5943    27616    2859
1996    22935     11410    34345
1997    13558      7749    21307
1998    13878      6187    20066    2042
1999    20946      8814    29759
2000    22598      7987    30585    1248
2001    18643      6279    24922
2002    26022      7615    33637
2003    17507      7458    24965       0
2004    26476      4279    30755
2005    18431      5745    24176

BASELINE                    30000  + 2000  = 32000
```

Green-winged teal

Density (IP/100 sq km)

	------Helicopter/Plot------			---Southern Ground---	
	North	South(L)		Low	High
1991	1.189	1.070	1.175		
1992	2.825	2.354	3.132	7.813	42.614
1993	2.589	2.990	2.707		
1994	2.589	1.708	6.768		
1995	3.684	2.913	6.389	7.813	65.341
1996	5.770	7.858	0.441		
1997	1.046	1.321	0.407		
1998	3.591	4.036	3.959	0.000	17.045
1999	3.390	3.135	6.778		
2000	4.328	4.783	1.764	0.000	17.361
2001	1.395	2.642	0.000		
2002	4.390	4.613	5.939		
2003	2.869	2.822	4.519	4.112	0.000
2004	3.366	3.758	1.323		
2005	1.744	2.642	0.407		

Population

	----Helicopter Plot------			-Ground-
	North	South(L)	Total	High
1991	892	401	1293	
1992	1962	1068	3030	6126
1993	2493	923	3416	
1994	1424	2308	3732	
1995	2429	2178	4607	9393
1996	6551	150	6702	
1997	1102	139	1240	
1998	3365	1350	**4715**	2450
1999	2614	2311	**4925**	
2000	3988	602	**4589**	2496
2001	2203	0	2203	
2002	3846	2025	5871	
2003	2353	1541	3893	0
2004	3133	451	3584	
2005	2203	139	2342	

BASELINE   4500 + 2500 = 7000

Wood Duck

Density (IP/100 sq km)

| | ------Helicopter/Plot------ | | | ---Southern Ground--- | |
	North	South(L)		Low	High
1991	16.110	4.172	41.878		
1992	16.264	6.883	35.895	42.969	107.955
1993	18.572	8.257	41.598		
1994	25.714	9.126	61.339		
1995	14.720	4.690	35.084	42.969	99.432
1996	13.895	7.808	20.654		
1997	26.509	27.684	49.882		
1998	14.981	3.464	38.677	58.594	62.500
1999	28.671	12.881	65.671		
2000	27.500	14.000	46.742	27.344	98.380
2001	17.811	24.224	32.067		
2002	30.961	16.166	72.750		
2003	30.141	12.226	75.862	12.336	48.295
2004	26.342	12.384	48.916		
2005	24.024	20.763	46.319		

Population

| | ----Helicopter Plot------ | | | -Ground- |
	North	South(L)	Total	High
1991	3478	14278	17756	
1992	5739	12238	17977	15520
1993	6885	14183	21067	
1994	7609	20913	28523	
1995	3910	11962	15872	14294
1996	6510	7042	13552	
1997	23082	17007	**40089**	
1998	2888	13187	16075	8985
1999	10740	22391	33130	
2000	11672	15937	27609	14143
2001	20197	10933	31130	
2002	13479	24804	**38283**	
2003	10194	25865	**36059**	6943
2004	10326	16678	27004	
2005	17312	15792	33104	

BASELINE   38000 + 10000 = 48000

```
Ring-necked Duck

Density   (IP/100 sq km)
        ------Helicopter/Plot------   ---Southern Ground---
                 North     South(L)  Low        High
1991    18.814    22.510   10.914
1992    21.975    23.603   18.852    3.906     99.432
1993    15.324    19.960    7.162
1994    15.593    18.186   10.146
1995    13.154     5.988   17.890   11.719     45.455
1996    24.548    27.064   28.643
1997    17.678    20.616   11.458
1998    13.121    18.760    5.400    3.906     90.909
1999    13.652    16.020    8.492
2000    17.878    21.453    5.728   19.531     54.977
2001    15.386    17.445   10.694
2002    26.242    28.463   19.201
2003    18.110    21.236   11.323   16.447     71.023
2004    23.748    28.714    5.728
2005    15.714    21.145    6.111




Population
        ----Helicopter Plot------   -Ground-
        North     South(L) Total     High
1991    18768      3721    22489
1992    19679      6428    26107    14294
1993    16642      2442    19083
1994    15162      3459    18622
1995     4992      6100    11092     6535
1996    22565      9766    32330
1997    17189      3906    21096
1998    15641      1841    17482    13069
1999    13357      2895    16253
2000    17886      1953    19840     7903
2001    14545      3646    18191
2002    23731      6547    30278
2003    17706      3861    21567    10210
2004    23941      1953    25894
2005    17630      2083    19713

BASELINE                 22000  +  8000 = 30000
```

```
Common Goldeneye

Density  (IP/100 sq km)
        ------Helicopter/Plot------   ---Southern Ground---
                 North    South(L)  Low      High
1991      6.219    8.745    1.056
1992      6.959    9.401    2.112    0.000   11.364
1993      5.764    8.588    0.000
1994      5.124    7.634    0.000
1995      8.294   12.324    0.000    0.000    2.841
1996     12.394   17.028    0.000
1997      9.138   14.648    0.000
1998      6.748   11.103    0.000    0.000    0.000
1999      5.676    7.975    0.000
2000      8.094   11.121    0.000    0.000    2.894
2001     12.086   19.373    0.000
2002      9.234   14.609    0.676
2003     10.455   14.690    0.000    0.000    0.000
2004      9.359   12.858    0.000
2005      7.959   12.758    0.000




Population
        ----Helicopter Plot------  -Ground-
          North    South(L) Total   High
1991      7291      360     7652
1992      7838      720     8559    1634
1993      7161        0     7161
1994      6365        0     6365
1995     10276        0    10276     408
1996     14198        0    14198
1997     12213        0    12213
1998      9257        0     9257       0
1999      6649        0     6649
2000      9272        0     9272     416
2001     16153        0    16153
2002     12180      230    12411
2003     12248        0    12248       0
2004     10721        0    10721
2005     10637        0    10637

BASELINE                    12000 +    0 = 12000
```

SINGLE SOURCE PROVINCE BY BCR

For 6 province by BCR combinations there is only one data file as a source for baseline Data. In this analysis the Island of Newfoundland and Labrador are reported separately

Province	BCR	Area	Source
Newfoundland	8	96156	Helicopter/Plot
Labrador	8	39355	Helicopter/Plot
Labrador	7	50630	Helicopter/Plot
PEI	14		Provincial
Nova Scotia	14	54782	Helicopter/Plot
New Brunswick	14	72159	Helicopter/Plot
Ontario	8	83779	Helicopter/Plot
Ontario	13	78244	Ground

NOTES:
The density reported for the Helicopter survey is based on a two-way model with terms for year and plot. This should enhance year to year comparability of the results by removing the effect of the plot rotation.

Estimates for PEI were only provided for one year.

Common Merganser (1290)

	-------Helicopter Plot Survey--------					ON 08	ON 13	PEI 14
	NF 08	LB 08	LB 07	NS 14	NB 14	ON 08	ON 13	PEI 14
1990	1781	411	0	2090	2858	.		
1991	2671	1233	1673	2011	3109	11233		
1992	2671	0	1673	2898	1153	8291	5677	
1993	445	0	1673	2159	3194	6945		
1994	1113	411	1436	2090	591	8681		
1995	1563	1300	**3493**	1350	6351	7093	6572	
1996	1692	0	1043	2019	5232	6789		
1997	**2883**	**1737**	1356	1039	5728	8433		
1998	2217	1077	2329	2907	3492	4596	9462	
1999	2523	1419	867	2954	3937	5309		
2000	**3142**	0	**3128**	1010	**7122**	7167	0	--
2001	1865	**3474**	2027	**3005**	**8838**	**9199**		
2002	**2944**	0	**2905**	4313	5239	8272		
2003	2534	0	1527	2757	3937	**16811**	1141	
2004	1934	3132	646	2120	5668	**9053**		
2005	1865	0	1126	**4674**	**8838**	5366		
Baseline	3000	2000	3000	4000	8000	9000	1000	0

Hooded Merganser (1310)

	-------Helicopter Plot Survey--------					ON 08	ON 13	PEI 14
	NF 08	LB 08	LB 07	NS 14	NB 14	ON 08	ON 13	PEI 14
1990	.	0	0	0	1419	.		
1991	.	1574	0	0	130	4159		
1992	.	0	0	94	131	4649	5574	
1993	.	525	0	178	0	5115		
1994	.	0	0	92	511	7388		
1995	.	0	0	518	2027	2960	2787	
1996	.	0	0	0	961	9333		
1997	.	0	0	373	463	10918		
1998	.	0	1350	963	275	7517	378	
1999	.	0	0	382	1442	4234		
2000	.	0	0	691	3434	6533	1141	--
2001	.	0	0	532	4012	5004		
2002	.	0	0	1031	1237	11275		
2003	.	0	0	572	1682	4763	380	
2004	.	0	0	0	2748	6533		
2005	.	0	810	532	2932	5459		
Baseline	0	0	0	1000	3500	10000	500	0

Mallard   (1320)

<pre>
        -------Helicopter Plot Survey--------
        NF 08   LB 08   LB 07   NS 14   NB 14   ON 08   ON 13   PEI 14
</pre>

Year	NF 08	LB 08	LB 07	NS 14	NB 14	ON 08	ON 13	PEI 14
1990	0	.	0	181	362	.		
1991	0	.	1013	313	315	11577		
1992	0	.	0	174	301	12070	98031	
1993	521	.	0	92	267	13831		
1994	0	.	0	262	0	14895		
1995	0	.	0	0	236	2436	103055	
1996	0	.	675	0	433	8306		
1997	3	.	0	113	875	20770		
1998	0	.	0	600	606	15633	87605	
1999	0	.	0	1978	1764	15078		
2000	0	.	0	273	3138	21083	97107	1561
2001	0	.	0	242	1459	16423		
2002	0	.	0	1608	1211	18039		
2003	32749	.	0	1187	1890	16084	85037	
2004	0	.	0	1776	2705	12778		
2005	0	.	0	2057	1167	11110		
Baseline	--	0	0	2000	2500	20000	85000	1500

Black Duck   (1330)

<pre>
        -------Helicopter Plot Survey--------
        NF 08   LB 08   LB 07   NS 14   NB 14   ON 08   ON 13   PEI 14
</pre>

Year	NF 08	LB 08	LB 07	NS 14	NB 14	ON 08	ON 13	PEI 14
1990	12925	1263	18129	12967	26963	.		
1991	11758	2736	15429	19432	12171	15756		
1992	12536	2526	12729	19138	17720	19314	9462	
1993	7774	4870	3086	17026	18582	12620		
1994	12633	2736	12051	15977	15927	19733		
1995	11741	0	16174	27201	17839	13165	2787	
1996	14859	358	7908	23702	29705	20708		
1997	11990	0	7238	23329	27857	11378		
1998	18007	423	5776	34392	32105	14819	1135	
1999	23025	7810	14492	38087	28070	19413		
2000	27845	537	21863	37529	40787	26403	380	13380
2001	12212	14487	8253	35850	36095	13030		
2002	25083	0	15103	26737	35257	18523		
2003	13431	2541	10880	24251	22445	13630	0	
2004	13860	358	9038	24132	25319	6730		
2005	7882	7244	3765	26942	26562	14315		
Baseline	25000	8000	15000	37000	37000	21000	400	13000

Green-winged Teal (1390)

```
         -------Helicopter Plot Survey--------
         NF 08   LB 08   LB 07   NS 14   NB 14   ON 08   ON 13   PEI 14
1990     2461    1322      .     2140    1865      .
1991     3897     440      .     1979    1622    2862
1992     3897    1489      .     2054    1640    3382    14280
1993     5538    1438      .      819    2176    1744
1994     2872    2203      .     1810    1632    3924
1995     4804    2297      .     1009    4211    2343     7191
1996     5666       0      .     3223    4451    3101
1997     4415       0      .     3029    9030    4705
1998    10864       0      .     1757    4509    3542     7364
1999     5960       0      .     3270    4446    2936
2000     5036    1211      .     2762    6677    3101    11921    3722
2001     4223       0      .     4612   10778    3137
2002     4230       0      .     2872    6148    3099
2003     2304       0      .     2219    3655    2936     4696
2004     5981    1211      .     8287    5564    1241
2005     4223       0      .     3074    3787    2353

Baseline 6000    1000      0     4000    7000    4000     5000    3500
```


Wood Duck   (1440)

```
         -------Helicopter Plot Survey--------
         NF 08   LB 08   LB 07   NS 14   NB 14   ON 08   ON 13   PEI 14
1990       .       .       .       96     407      .
1991       .       .       .      289     330     488
1992       .       .       .      461    1017    1220    26942
1993       .       .       .      337     116       0
1994       .       .       .      577     464       0
1995       .       .       .      725    2429       0    25531
1996       .       .       .      206    1506    2667
1997       .       .       .        0    2044    2071
1998       .       .       .     2640     343     598    32241
1999       .       .       .      403    1588    3119
2000       .       .       .      823     502    8001    14583      --
2001       .       .       .      164    2044       0
2002       .       .       .     1414     685    1495
2003       .       .       .      269    1588    2228    21330
2004       .       .       .      720     502       0
2005       .       .       .      328     681    3107

Baseline   0       0       0      800    2100    3000    20000       0
```

Ring-necked Duck (1500)

```
         -------Helicopter Plot Survey--------
         NF 08   LB 08   LB 07   NS 14   NB 14   ON 08   ON 13   PEI 14
1990     13228     310    7825    2727    7933       .
1991     12808     929    5590    3088    5133   13768
1992      9239       0       0    4347    2838   15356   27906
1993     11969       0    1118    2345    8491   15713
1994     11129       0    5962    4441    5118    9820
1995      9681       0     679    3193    8224   15989    6469
1996      9009       0     462    5473    8350    8614
1997      3278       0       0    6145    8793   17032
1998      7171     312       0    4798    9253   11600     757
1999      5059    1871    3671    3277   18216    7985
2000     11678     530       0    7194   16904   15662    1901     398
2001     17663   21132    1484    8060   13352   15843
2002     17272       0    3895    8056    7786   14800
2003     13719       0    1357    4702    9248   16769    2282
2004     15349    2120    2217    5004   14867   14878
2005     14021   10566     742    6692   12049   13071

Baseline  16000    8000    4000    7500   16000   15000    2000    3000
```

Common Goldeneye (1510)

```
         -------Helicopter Plot Survey--------
         NF 08   LB 08   LB 07   NS 14   NB 14   ON 08   ON 13   PEI 14
1990      6014    5155    2093       0    2190       .
1991      5012    7966    3139       0     453   11056
1992      4410    6314    4186       0     261   12856    1135
1993      2205    6160       0       0    1301    8040
1994      2606    5155       0       0     260   11351
1995      5907       0    4148       0    1106    1532       0
1996      3112    5296    3697       0     406   12829
1997      5469       0    2618     324    1455   12955
1998      6613    6634    2074    1743    1271    9966       0
1999      5299   17547    2156       0    3124   14792
2000      5744    4333    2773     524    2641   17555       0      --
2001      3729   42133    4026     524    1559   15613
2002      5034       0    2294       0    1694   11627
2003      6104    5212    8279    4885    1874   21619     380
2004      5505    7222    4725     787    1422   12829
2005      5717       0    3406     838     935   13952

Baselin    6000    6000    3000    1000    2000   16000       0       0
```