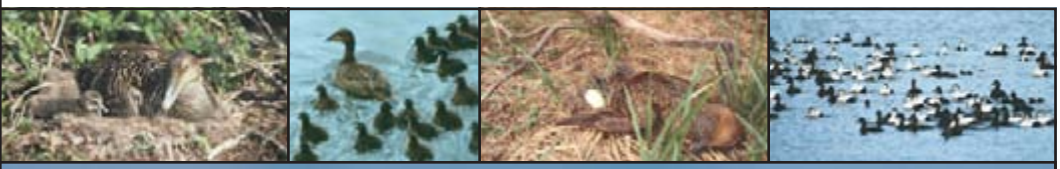
Québec Management Plan for the

Common Eider

Somateria mollissima dresseri



by the Joint Working Group on the Management of the Common Eider

Environment Canada
Canadian Wildlife Service

Environnement Canada
Service canadien de la faune

Canada

Société de la faune et des parcs Québec

Ducks Unlimited Canada
CANADA'S CONSERVATION COMPANY

DUVETNOR Les îles

A special publication of the Joint Working Group on the Management of the Common Eider. Members (in alphabetical order) are:

Héloïse Bastien	Société de la faune et des parcs du Québec
Jean Bédard	Société Duvetnor Ltée
Luc Bélanger	Canadian Wildlife Service – Québec Region
Jean-François Giroux	Société Duvetnor Ltée, Université du Québec à Montréal
Yvon Mercier	Canadian Wildlife Service – Québec Region
André Nadeau	Société Duvetnor Ltée and Canadian Wildlife Service – Québec Region
Raymond Sarrazin	Ducks Unlimited Canada – Québec Region
Jean-Pierre L. Savard	Canadian Wildlife Service – Québec Region

Acknowledgements:

The Joint Working Group on the Management of the Common Eider would like to thank Gilles Chapdelaine, Jean Rodrigue, Pierre Brousseau and Jean-François Rail of the Canadian Wildlife Service, Québec Region for their comments on the document. The Group thanks Marlène Dionne, who graciously provided the photographs by Francis Bélanger, as well as Jean Munro, Patrice Halley, Brad Allen, Jean Bédard, Gilles Martin and Stephen Homer who also provided photographs. We thank Diana Cline for the English translation of the document.

Suggested Citation:

The Joint Working Group on the Management of the Common Eider 2004. Québec Management Plan for the Common Eider *Somateria mollissima dresseri*. A special publication of the Joint Working Group on the Management of the Common Eider, Québec, 44 pages.

To obtain copies of the Plan, contact:

Canadian Wildlife Service
Environment Canada
1141 route de l'Église, PO Box 10,100, 9th Floor
Sainte-Foy (Québec) G1V 4H5

http://www.qc.ec.gc.ca/faune/faune/html/contents.html

Cette publication est également disponible en français.

Photos on the cover: Gilles Martin, Francis Bélanger, Stephen Homer and Jean Bédard/Sauvagîles

Abstract

The Common Eider (*Somateria mollissima*) is a sea duck typical of northern seacoasts. The subspecies *dresseri* nests in colonies on islands in the St. Lawrence estuary and in the Gulf of St. Lawrence. It also nests along the coasts of the Maritime Provinces and Maine. This duck is exploited as a game bird, as subsistence food (aboriginal hunting and egg gathering) and is the only duck that produces commercially harvestable eiderdown, a luxury by-product with a high market value. The characteristics of the Common Eider's life cycle make this species highly adapted to northern environments, but at the same time particularly vulnerable to several forms of human activities.

Conservation measures taken to date have resulted in the protection and management of several nesting sites, primarily in the St. Lawrence estuary. However, the situation of the Common Eider population remains uncertain. Its susceptibility to devastating epidemics, its vulnerability to hunting, the periodic invasion of its habitat by land predators and humans, and the fact that management of the diverse populations is currently under several distinct administrative entities throughout Eastern North America underscore the need for collaboration within an integrated management system. A review of current knowledge on Common Eiders in the St. Lawrence highlights the many gaps in the scientific information needed for sound management of the species.

The Québec Common Eider Management Plan, under the auspices of The Eastern Habitat Joint Venture – Québec was developed by four partners: The Canadian Wildlife Service, Québec Region, the Société de la faune et des parcs du Québec, Ducks Unlimited Canada, Québec Region and the Société Duvetnor Ltée. Its primary objective is to insure habitat protection and population growth of the Common Eider in the St. Lawrence. Population goals have been established at 40,000 nesting pairs in the St. Lawrence estuary and 20,000 on the Lower North Shore. These levels are based on currently available data and will be adjusted on an ongoing basis. Implementation of the Plan is being carried out by a *Coordination Office* comprised of a representative from each of the four partners and by an *Implementation Committee* under the responsibility of two experts on the Common Eider. To attain the primary objective and the targeted numbers, guidelines based on sustainable development are set out. Four key elements for the success of the Plan are also identified: acquisition of necessary scientific information, ongoing collaboration among participants, active participation of the organizations involved, and support of partners on a continental scale. A series of strategic actions required to attain the primary objective and the population goals for the Common Eider are then proposed. These are grouped into three categories: acquisition of knowledge, interventions on the species and its habitat and various administrative and legislative measures.

Jean Bédard/Sauvagiles | Francis Bélanger | Jean Bédard/Sauvagiles

Table of Contents

Francis Bélanger

1 Context

The Common Eider: a Remarkable Duck

The Common Eider (*Somateria mollissima*) is a sea duck typical of northern regions that frequents all the coastal areas of Québec (Goudie *et al.* 2000). It is the only duck to be exploited both as game (sport hunting) and as a source of subsistence food (aboriginal hunting and egg gathering), and is the only duck that produces a luxury by-product with a high market value, the eiderdown. It is also one of the most spectacular species of waterfowl: the persistent courtship displays by males, the unusual system in which their broods group into crèches, its distinctive low flight over the water in long straight lines, its massive gatherings outside breeding periods and its familiarity with man makes it a highly prized species in the recreational tourism industry.

A Species with a Distinctive Life Cycle

Common Eider females nest on coastal islands at densities reaching at times phenomenal levels. In the St. Lawrence estuary, nest numbers can reach up to 1,500/ha. No other species of ducks are as gregarious during the nesting period. The females lay 3 to 5 eggs but usually less than 10% of the ducklings that hatch will survive until fledging, 10 weeks later. The brood-rearing system is very unusual: some of the more maternal and dominant females take charge of several broods or crèches. The cohesion of these groups is very important in ensuring duckling protection from predators such as the Great Black-Backed Gull (*Larus marinus*). Crèches of several dozen ducklings in company of only two or three females are often observed.

Jean Munro

Common Eiders do not breed for the first time until they are two, three, or four years old. The proportion of juveniles that survive the three-year (on average) period between fledging and first-breeding is unknown, and the causes of mortality are numerous. Once begun, however, breeding activity can extend over a fifteen-year period or more. Extremely attached to its nesting island, and even to a specific sector of that island, the female returns year after year.

These characteristics have allowed the Common Eider to successfully colonize almost all northern coastal areas but they also constitute major handicaps that warrant close monitoring of populations in the coming decades.

A Vulnerable Bird

The habit of nesting in high concentrations on a small number of islands makes this bird more vulnerable to the spread of disease, and from time to time recurring epizootics decimate eider populations on certain islands. The high degree of attachment of Common Eiders to its breeding island represents a disadvantage in certain circumstances: when a predator such as a red fox invades the island, the females appear unable to choose alternative sites. This behaviour leads to large fluctuations in annual productivity and possibly in recruitment.


La Razade d'en Haut

Jean Bédard/Sauvagiles

Recreational tourism activities such as sea kayaking, the development of tourism projects, and residential use (cottage developments) constitute real threats because any disturbance in colonies during the nesting period can result in nest desertion and increased predation (especially by gulls that cohabit universally with Common Eiders) (Bolduc and Guillemette 2003). As well, the loss or destruction of even a single nesting island can have major impacts on the numbers of Common Eiders.

As is the case for several sea ducks species, the life cycle characteristics of the Common Eider, its long life span, the long period of time before it begins to breed and its low recruitment make it very vulnerable to sport hunting (Goudie *et al.* 1994). That is why the large harvest taken along the eastern seaboard of the United States is of concern.

Accidental oil spills can also be tragic because of the bird's gregarious nature. The high concentrations of pairs around a few strategic islands before and during breeding, the grouping of broods and crèches in the most favourable rearing areas, the massive congregations of moulting males and the immense gatherings of females and juveniles during migration could be annihilated by a single oil spill (Lehoux and Bordage 1999). Finally, commercial exploitation of coastal resources (brown algae, molluscs) and the use of coastal zones for aquaculture can restrict accessibility or reduce availability of food for eiders, and could compromise the survival of juveniles.

Patrice Halley

The Common Eider in Québec

Jean Munro

Three distinct subspecies of Common Eiders are found in Québec: the first (*S. m. borealis*) occupies the coasts of Labrador, Nunavik, and Nunavut, the second (*S. m. sedentaria*) frequents the entire perimeter of Hudson Bay, while the third (*S. m. dresseri*) is found all along the St. Lawrence coastline (Figure 1).

In the St. Lawrence estuary, the Common Eider nests between the Isle aux Grues archipelago off Montmagny and Pointe des Monts, in particular in the sectors where islands are suitable for breeding. The bird is also abundant in some of the numerous archipelagos which dot the North Shore between Pointe des Monts and Blanc-Sablon, while their low numbers (<500) along the Gaspé Peninsula are attributed to the absence of adequate nesting sites inaccessible to land predators.

In the St. Lawrence estuary, the population of *S. m. dresseri* was estimated at 32,000 pairs in 2001 (Duvetnor, unpublished data) while on the Lower North Shore there were an estimated 10,000 pairs at the same time (Roberge 2002, Rail and Chapdelaine 2002). The *borealis* population distributed along the coasts of Labrador, Nunavik and Nunavut numbers 200,000 pairs. A large contingent of individuals belonging to this subspecies winters in the Gulf of St. Lawrence, primarily in the Mingan Islands, while others winter in Greenland. The *S. m. sedentaria* population is estimated at 75,000 pairs (G. Gilchrist, CWS – Prairie and Northern Region, personal communication) (Figure 1).

Jean Bédard/Sauvagiles

The subspecies *dresseri* is not unique to Québec: it also nests all along the coast from mid-Labrador to Maine, including all of the Maritimes. It winters along the Atlantic coast from Newfoundland to Massachusetts. At the northern limit of its wintering grounds, this subspecies intermingles slightly with certain populations of the more northern subspecies *borealis*, and is subjected to the same environmental conditions (Reed and Erskine 1986, Corr *et al.* 1988, Krohn *et al.* 1992).

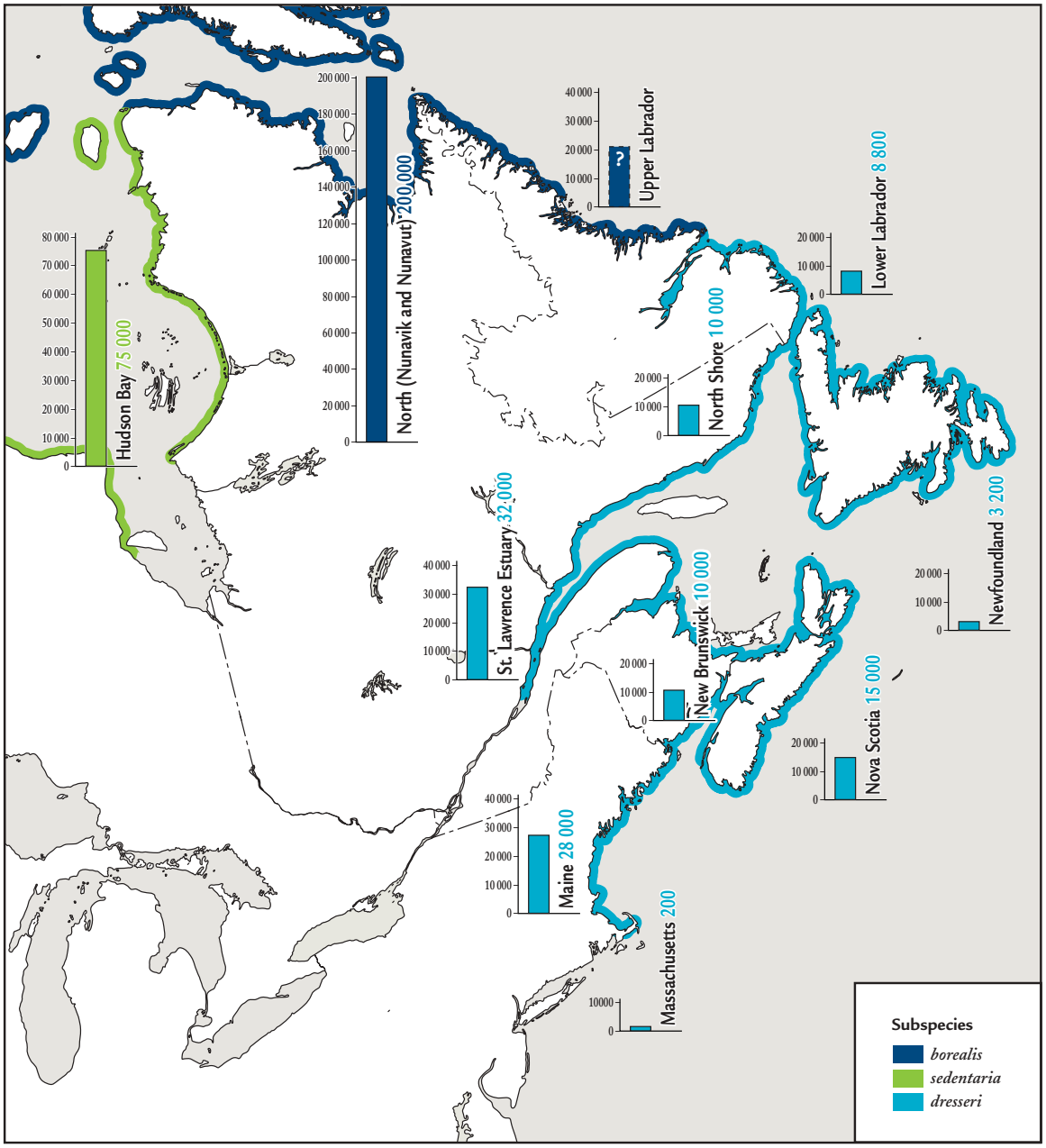


Figure 1 | Number of nesting pairs of Common Eiders in eastern North America (source: SDJV workshop, St. Stephens, New-Brunswick, April 2002 and G. Gilchrist, CWS – Prairie and Northern Region, personal communication).

Conservation Efforts to Date

Following a devastating outbreak of avian cholera in 1985 on Île Blanche near Rivière-du-Loup, initial collaboration among *Ducks Unlimited Canada* (DUC), *Société Duvetnor Ltée* (Duvetnor), *Canadian Wildlife Service* (CWS) and several experts led to major restoration work on the island in the following five years (Bédard *et al.* 1987, Filion and Bédard 1989, Bédard and Guérin 1991). It was estimated that more than half of the some 5,000 females and an undetermined number of males had died in a few days, in what was, at that time, the second largest colony in the St. Lawrence estuary.

A restoration program was then conducted on several other islands in the estuary (Bédard and Guérin 1991). For example, on Îles du Pot à l'Eau-de-Vie, Île aux Fraises and Île aux Pommes, the planting of conifers and various shrub species, layering, and controlled burning as well as the trapping of mammals, such as muskrats, were carried out to stimulate the growth of plants offering good nesting cover for females. Hundreds of nesting boxes were installed on Île Blanche and Îlet aux Alouettes to support the nesting population until the recovery of adequate natural cover.

Jean Bédard/Sauvagiles

Duvetnor also intervened directly by purchasing several nesting islands in the St. Lawrence estuary (Îles Pot à l'Eau-de-Vie, Île aux Lièvres and Les Pèlerins).

In 1925, CWS created several *Migratory Bird Sanctuaries* (MBS), from the Mingan Islands to Blanc-Sablon on the Lower North Shore, to protect seabird and eider colonies from hunting and other human activity. In 1937, the Île du Corossol MBS located in the Sept Îles archipelago was added. Then in 1986, CWS created the Îles de l'Estuaire National Wildlife Area (ÎENWA) specifically to protect the large colonies of Common Eiders on Île Bicquette, Île Blanche and Île aux Fraises.

The creation of the *Mingan Archipelago National Park Reserve of Canada* (MANPRC), by Parks Canada in 1984 had a positive impact on eider populations in this region (Roberge 2002, Rail and Chapdelaine 2002). In 2001, the *Société de la faune et des parcs du Québec* (FAPAQ) granted the status of *Refuge faunique* (Wildlife Refuge) to two colonies of Common Eiders (Îlet aux Alouettes and Île Laval), while private groups such as the *Société Provancher d'histoire naturelle du Canada*, the *Société pour la protection et l'aménagement de l'île aux Pommes* and the *Société protectrice des eiders de l'estuaire* (SPEE) protect other large nesting sites. We must mention the efforts devoted by other local organizations to assure long-term management and protection of important nesting areas, such as the work done by the *Société de développement de Ragueneau* on the islands bearing the same name.

Jean Bédard/Sauvagiles

The idea of establishing a management plan for the Common Eider is not new: the first version of such a plan was introduced in 1988 (Bédard 1988) and updated in 1994 (Bédard and Nadeau 1994). These plans reviewed the validity of efforts carried out to improve the breeding conditions in the St. Lawrence estuary colonies.

The down collecting activities undertaken by Duvetnor since 1982 provided original data on the status of Common Eider populations in the estuary and on the Upper North Shore[1]. In 1999, the joint collaboration of Duvetnor, DUC and FAPAQ made it possible to analyze this data. This exercise culminated in two workshops supported by CWS and organized by Duvetnor in 2003. A first scientific workshop brought together wildlife managers and experts, and the other was informative, for organizations and individuals that could have an impact on eider populations.

The Importance of Establishing a Plan

The Common Eider is very vulnerable because it is exposed to a variety of factors that can lead to higher mortality: devastating avian cholera epidemics, the presence of land predators, human disturbance at the nesting and rearing grounds, oil spills, etc. Another trait specific to this duck is that the populations support different types of exploitation: sport and subsistence hunting, down collecting and egg gathering, each of these activities requiring a specific management approach. A third factor is the numerous possible conflicts with human activities: industrial, residential and urban development of coastal areas, aquaculture, tourism and recreational activities, exploitation of coastal resources, etc. These human activities can reduce the size or quality of essential eider breeding and feeding grounds. A final justification is that populations migrate from one administrative region to another throughout eastern North America, involving a large number of managers at the local, regional, provincial, and international level. No other species of waterfowl is subject to as many uses, conflicts or threats, and all measures aimed to insure its protection, and ideally its population growth, are therefore advisable. For these measures to be effective, they must be coordinated: such is the ultimate goal of an eider management plan, which is proving to be necessary and essential (Bédard 1988, Drolet 1989, Bédard and Nadeau 1994, Caithamer *et al.* 2000).

Jean Bédard/Sauvagiles

1 | "From Tadoussac, in an easterly direction, the region is often subdivided into the Upper North Shore, the Middle North Shore (or Mingan Islands) and the Lower North Shore; these subdivisions refer to the direction of the flow of the St. Lawrence River rather than to any physical features on land." (Commission de toponymie du Québec 1996; free translation). The Upper North Shore is usually designated by the MRCs of La Haute-Côte-Nord and Manicouagan, and the Middle North Shore by the MRCs of Sept-Rivières and Minganie. For simplicity, in this document the "estuary" region will include the Upper North Shore, while the "Lower North Shore" region will include the Middle North Shore.

Jean Bédard/Sauvagiles

The importance of establishing conservation plans and strategies for eiders was recognized internationally by the *Conservation of Arctic Flora and Fauna* (CAFF) working group. Created in 1992, and bringing together professionals, aboriginal representatives and government managers interested in the conservation of the arctic environment, the group produced the *Circumpolar Eider Conservation Strategy and Action Plan* (CAFF 1997).

The *North American Waterfowl Management Plan* (NAWMP), signed by Canada and the United States in 1986, joined by Mexico in 1994, constitutes the basis for implementing and coordinating waterfowl management efforts and wetlands protection throughout the continent. The *Eastern Habitat Joint Venture* (EHJV), one of several joint ventures under the framework of NAWMP, manages conservation initiatives related to habitat in the six provinces of eastern Canada, from Ontario to Newfoundland. NAWMP also oversees the *Sea Duck Joint Venture* (SDJV), which was established with the goal of reversing declines observed in the populations of 10 of the 15 species of sea ducks. The complexity and nature of the questions that touch on their conservation also justified the creation of a joint venture specific to these species.

Jean Bédard/Sauvagiles

La Razade d'en Bas

Île aux Lièvres

Francis Bélanger | Francis Bélanger | Jean Bédard/Sauvagiles

2 The Present Situation

Stephen Homer

In Québec, we have to consider the situation of the subspecies *dresseri* of the St. Lawrence River estuary separately from the Gulf (North Shore). This is because we have a source of unpublished data collected over the years by Duvetnor and SPEE in the course of their down collecting activities in the estuary; nothing equivalent is available for the North Shore population. Conservation efforts and the restoration of nesting areas have also been more intensive there than on the North Shore. The topography of the islands and the coastline also differs between the estuary, where a few large islands provide shelter for large colonies and the Lower North Shore, which is dotted with innumerable small islands and islets along a very jagged coastline. Human demographics, infrastructures and anthropogenic threats are also very different in these two areas.

Demographic Distribution

The Estuary

There are about 35 colonies (Figure 2), three of which account for 55% of the nests counted in the estuary and seven for 82% (Figure 3). Île Bicquette is by far the largest colony with 10,000 nests, followed by colonies of 2,000 to 4,000 nests (Duvetnor and SPEE, unpublished data).

The changes in the number of nests observed between 1984 and 2002 on four islands for which yearly total nest counts are available show broad periodic and synchronous fluctuations. This suggests that external factors act simultaneously on the numbers of birds nesting on the islands in the estuary (Figure 4).

Francis Bélanger

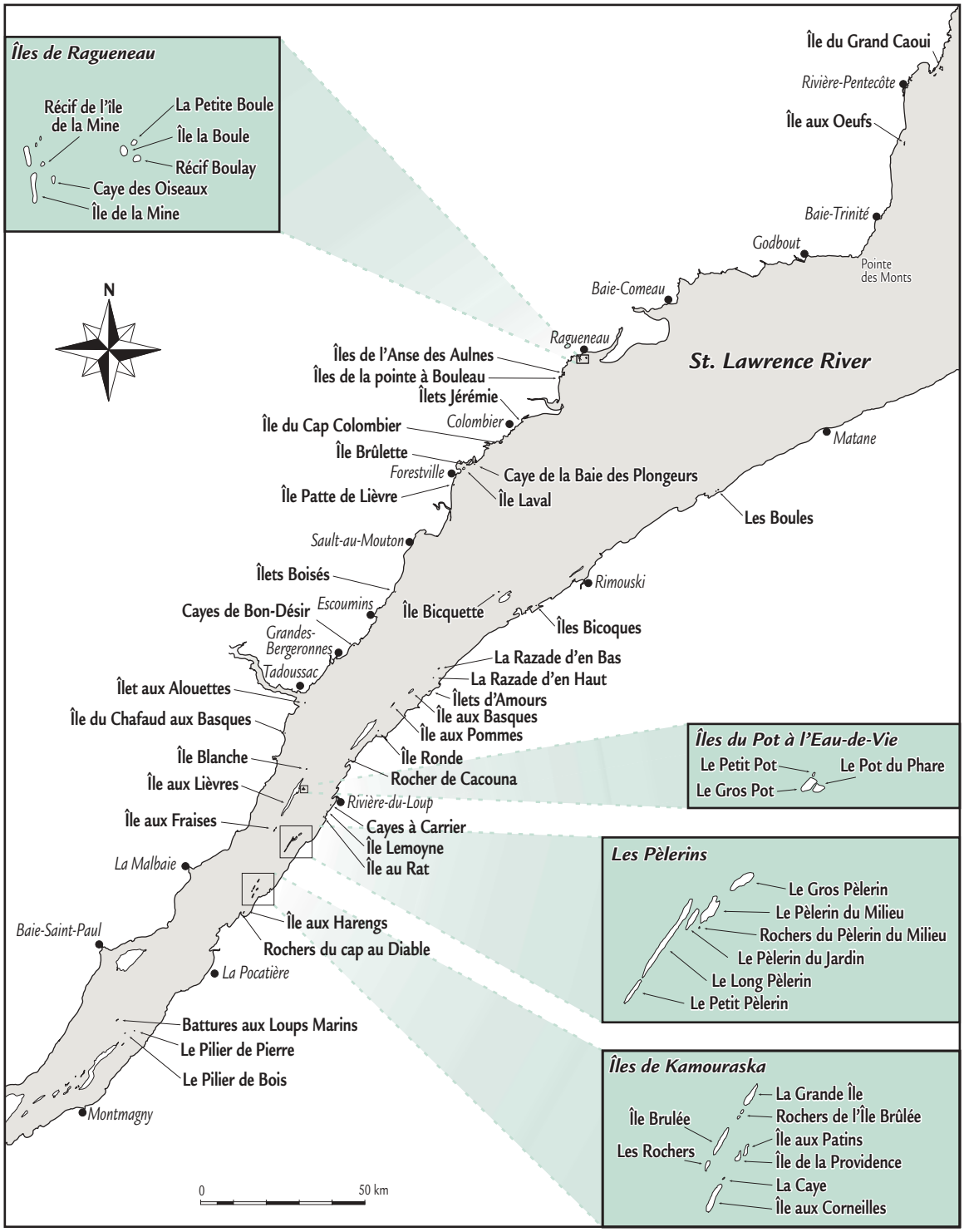


Figure 2 | Location of Common Eider colonies in the St. Lawrence estuary (Duvetnor, unpublished data)

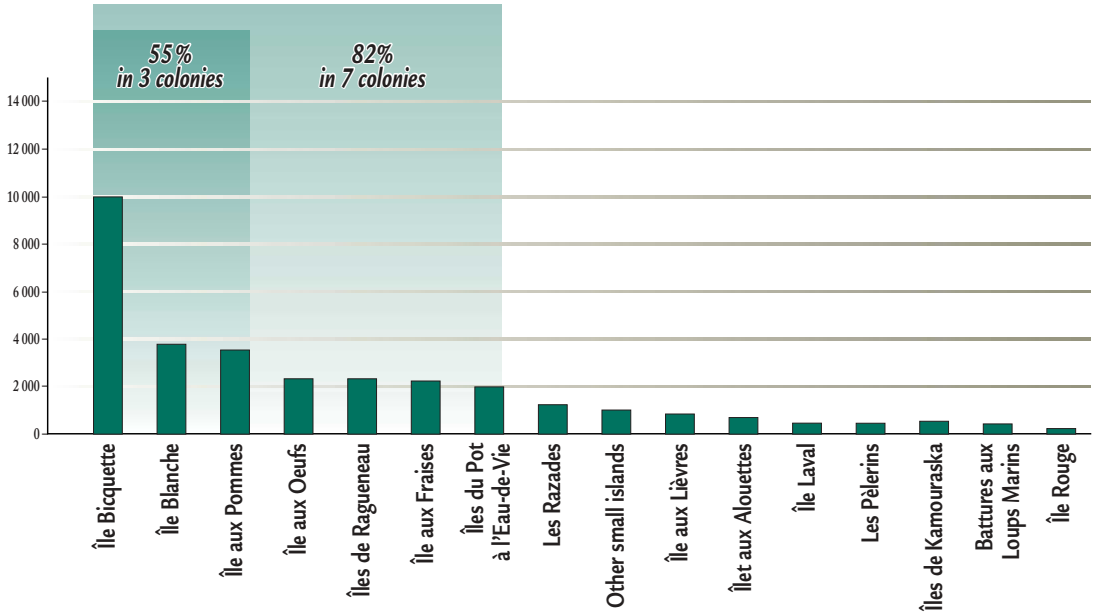


Figure 3 | Number of Common Eider nests in the 16 largest colonies of the St. Lawrence estuary in descending order (Duvetnor and SPEE, unpublished data).

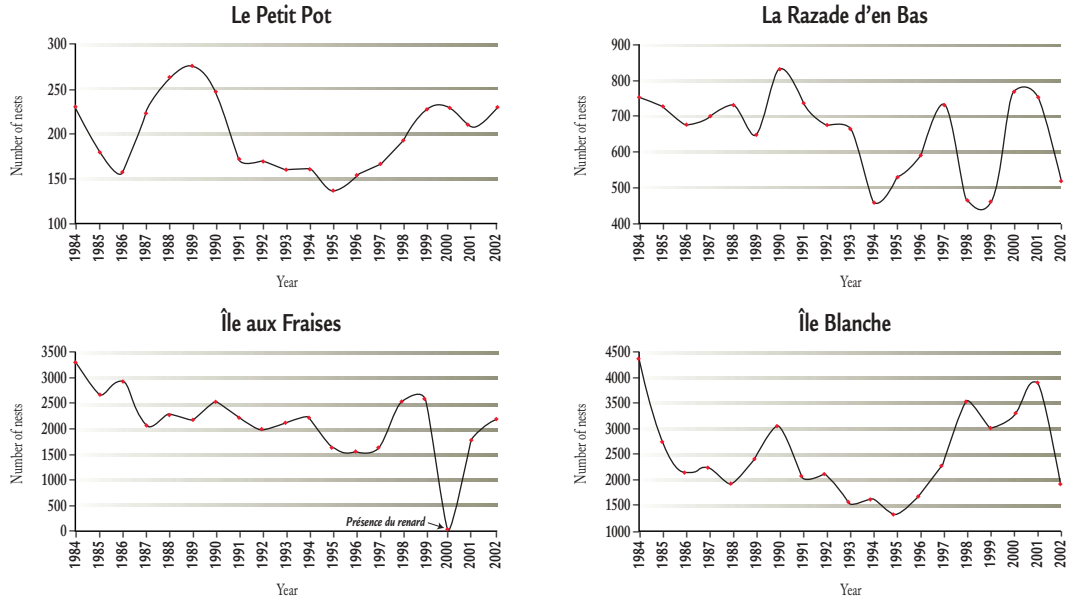


Figure 4 | Number of Common Eider nests in four colonies of the St. Lawrence estuary (Duvetnor, unpublished data).

The Gulf

The data available for the Lower North Shore originate from CWS surveys carried out every five years in the MBSs (Rail and Chapdelaine 2002), from surveys conducted in MANPRC by Parks Canada (Roberge 2002) and from occasional CWS surveys in the Sept Îles archipelago (Brousseau and Chapdelaine 1987) (Figure 5).

The counts taken in the MBSs rarely exceed 1,000 nests except at the MBSs of Watshishou and Betchouane (the latter being included in the western sector of MANPRC) (Figure 6). The large increase in the number of nests observed in the western sector of MANPRC and at the Watshishou MBS since 1984 results from an improved protection of the nesting grounds following the creation of the Reserve.

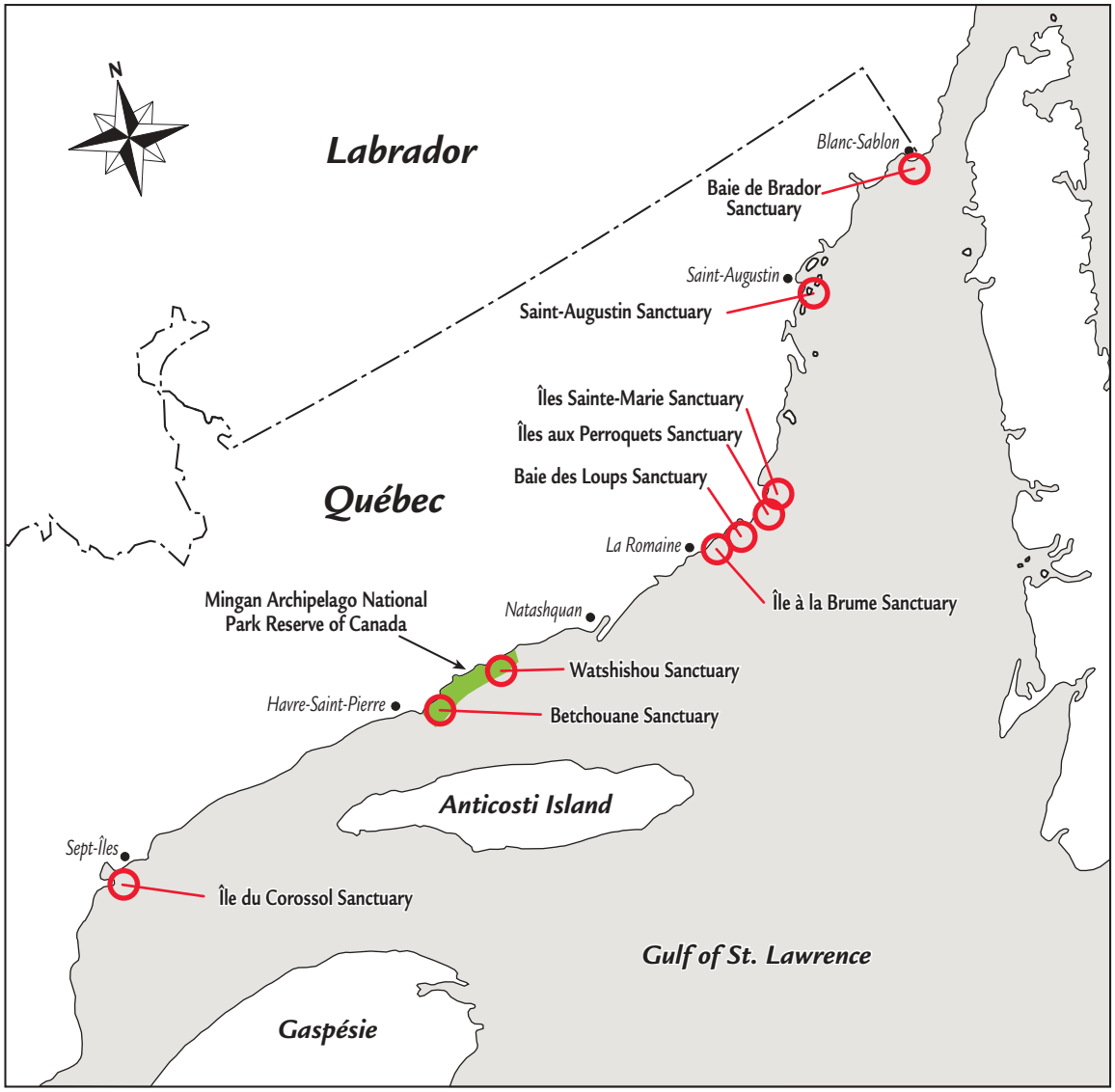


Figure 5 | Location of Common Eider colonies in the Migratory Bird Sanctuaries (MBS) on the North Shore and in Mingan Archipelago National Park Reserve of Canada (MANPRC) (Roberge 2002, Rail and Chapdelaine 2002).

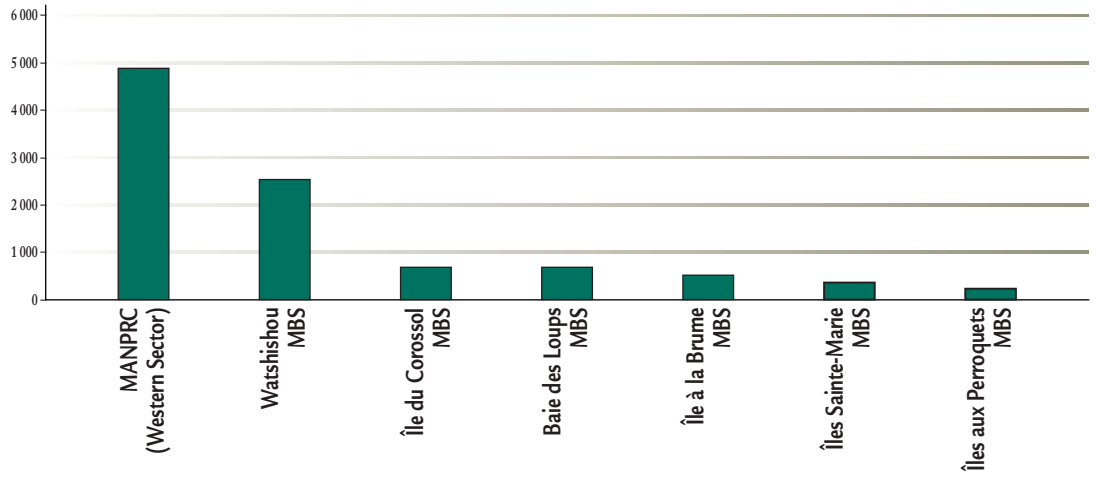


Figure 6 | Number of Common Eider nests in the colonies on the Lower North Shore in descending order (Roberge 2002, Rail and Chapdelaine 2002).

Population Parameters

Nesting Success

The proportion of breeding females in relation to their age is unknown and for that matter is a difficult parameter to assess. Clutch size varies between 3.4 and 4.5 eggs in the estuary and on the North Shore (Lewis 1939; Guignion 1967; van Dijk 1986; Milne and Reed 1974; Duvetnor, unpublished data; Rail and Chapdelaine 2002).

In the estuary, nesting success, that is, the percentage of nests having produced at least one duckling, varies between 15% and 35% (Guignion 1967, Milne and Reed 1974, van Dijk 1986). No assessment has been carried out on the North Shore. It is important to note that due to methods that call for repeated nest visits, it is difficult to obtain measurements of this parameter that are not biaised by such disturbances. The rate of success is probably higher in the absence of human disturbance.

Jean Bédard/Sauvagiles

Francis Bélanger

Juvenile Survival

In the estuary, juvenile duckling predation by Herring Gulls (*Larus argentatus*) and Great Black-Backed Gulls has been observed but its effect on numbers is not known. Munro and Bédard (1977) observed a decline in duckling mortality associated with an increase in crèche size. No data is available for the North Shore. Estimates of duckling survival (percentage of ducklings surviving until the end of the rearing period) in the Maritimes and on the coast of Maine vary from 6 % to 25 % (McAloney 1973, Mawhinney *et al.* 1999). A close correlation has been shown between duckling survival and a series of meteorological parameters (rain, wind, air temperature) measured in June in the Bay of Fundy (S. G. Gilliland, CWS – Newfoundland, personal communication): harsh weather conditions increased juvenile mortality. Finally, Milne and Reed (1974) estimated that an eider pair in the estuary produces 0.3 young annually. There is no recent data on this parameter.

Hunting Mortality

Information on hunting mortality is usually derived from band recoveries. However, banding efforts in Québec have been insufficient to permit any assessment of this parameter.

Estimates on the size of the kill are obtained by the CWS in Canada and the United States Fish and Wildlife Service (USFWS) in the U.S. through a questionnaire sent out to a sample of waterfowl hunters. However, this study is primarily based on dabbling ducks and is generally less applicable to sea ducks. The estimated harvest in Québec of 3,000 to 4,000 eiders must be interpreted cautiously because it is based on a very small sample of wings received from hunters. Furthermore, the absence of data on numbers of hunters and numbers of days devoted to hunting sea ducks, as well as on numbers of crippled birds does not allow a reliable estimate of numbers of eiders killed by hunters in Québec. Finally, it is not known how many eiders from the estuary and Gulf of St. Lawrence are killed elsewhere, especially in Maine and Massachusetts where the eider harvest is considerable (20,000 - 25,000).

In 1998, CWS (Hicklin and Barrow 2004) estimated the amount of embedded lead shot in eiders in seven areas on the east coast of Canada, including the colony on Île Bicquette. Thirty-seven percent of the females captured on their nests had at least one lead shot under their skin or in their muscles; an average of 2.1 lead shots/female was found. The effects of these embedded lead shots are not known but likely affect survival (Madsen and Noer 1996). It would be interesting to determine whether the legal ban on lead shot in Canada in 1997 as well as in the U.S. (1991) has reduced the incidence of this problem. The large percentage of birds found with embedded lead shots clearly demonstrates the intense pressure hunting is placing on this species.

Brad Allen

Jean Bédard/Sauvagiles

Disease Mortality

Avian cholera caused by the *Pasteurella multocida* bacterium leads to high mortality among eiders. The presence of *Pasteurella* was confirmed when devastating epidemics occurred in 1976, 1985 and 2002 on Île Blanche, which could suggest that it is the infectious agent in the majority of deaths observed on the nesting grounds at the time of the annual down collection in the estuary.

On the basis of the index used to determine the existence of epidemic conditions (>5% of nesting females found dead in a given colony), no incidence of avian cholera was ever recorded in the colonies surveyed on the north shore of the estuary (Île aux Oeufs, Île Laval, Îles de Ragueneau and Îlet aux Alouettes). On the south shore (Île aux Fraises, Île Blanche, Île du Pot, Les Razades, Île aux Pommes and Île Bicquette), only the colonies on Île aux Fraises and Île Blanche were hit repeatedly despite habitat restoration work carried out in attempts to correct those conditions believed to favour outbreaks.

In 2002, the worst outbreak was documented in the estuary, with only the colonies on the Îles du Pot and Les Razades being spared. In all, 5,400 dead birds were counted but it is estimated that the total number of casualties reached 7,000, of which 87% were females. This represents 19% of the nesting population in the St. Lawrence estuary (32,000 females).

The epidemiology of avian cholera among eiders remains unknown. There may be a carry over effect; outbreaks occurring late in the summer, such as those observed in 1984 and 2001 on Île Blanche, could have led to the massive die-off early in the following springs. Habitat conditions seem to be less of a factor than what was suggested in the 1980s. For example, intensive habitat restoration on Île Blanche did not completely eliminate the disease even though it may have reduced its frequency and extent. Finally, the disease regularly occurs in some habitats that were assumed not to be very favourable to *Pasteurella* infestation (Île aux Pommes, with its well-drained grassy terrain) and spares most of the time others that were believed to be at particularly high risk (Île aux Oeufs, Île Bicquette, Île Laval and Île aux Fraises).

Jean Bédard/Sauvagiles

Effects of Contaminants

The levels of DDE, PCB and mercury were measured in some eider eggs between 1972 and 1993 in various colonies of the St. Lawrence estuary and of the North Shore and only low levels of these contaminants were found (J. Rodrigue, CWS – Québec, unpublished data). Lévesque (1997) studied the organochlorine contents in eider eggs and ducklings on Île aux Pommes and in MANPRC in 1995 and 1996. The few embryonic malformations noted at Île aux Pommes raise some questions, but can not be directly linked to the very moderate organochlorine levels measured. In conclusion, not much is known about the level of contamination in the eider population of the estuary and the Gulf of St. Lawrence, or about the real impact of these contaminants on the birds themselves.

Survival of Subadults and Adults

The survival of subadults (birds that have not yet reached sexual maturity) and adults can only be assessed through band recoveries. Unfortunately, no subadult birds have ever been banded. Two thousand three hundred adult birds were banded in the estuary, mainly between 1965 and 1975. The large majority (97%) were adult females. By using a model based on composite tables, Reed (1975) calculated a survival rate of 82.6% for this category of bird. Other estimates have been made: 81.0% for the coast of Maine (Wakeley and Mendal 1976) and 87.3% (84-90%) for the coasts of New Brunswick, Nova Scotia and Maine combined (Krementz *et al.* 1996).

The percentage of juveniles among birds killed by hunters indicates the strength of recruitment. Data for the eastern coast of the U.S. (Caithamer *et al.* 2000) as well as for Québec (CWS, unpublished data) suggest a sharp decline in recruitment since the 1970s at least (Figure 7).

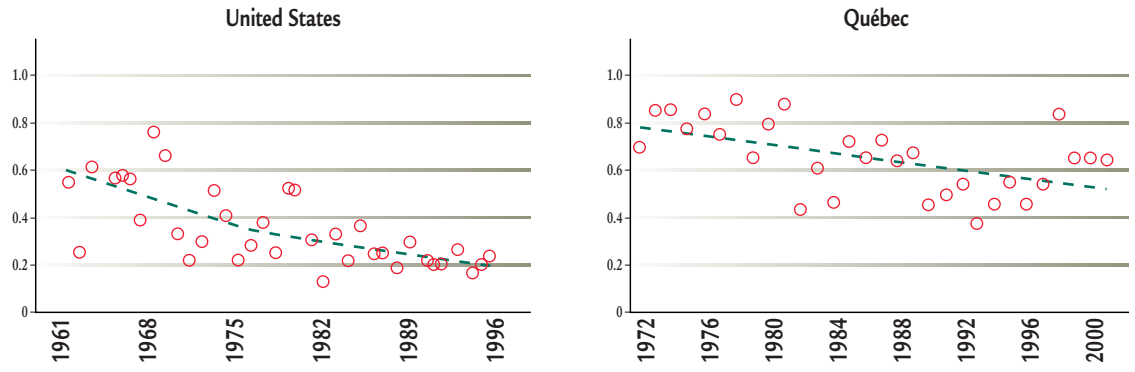


Figure 7 | The proportion of Common Eider juveniles taken in the U.S. and Québec hunts (Caithamer *et al.* 2000, CWS, unpublished data)

Nesting Habitats

Protected Areas

A number of islands harbouring colonies of Common Eiders in the St. Lawrence estuary are protected under various federal and provincial laws or policies, society charters, or by the goodwill of individual owners aware of the need for protection (Figure 8).

Jean Bédard/Sauvagiles

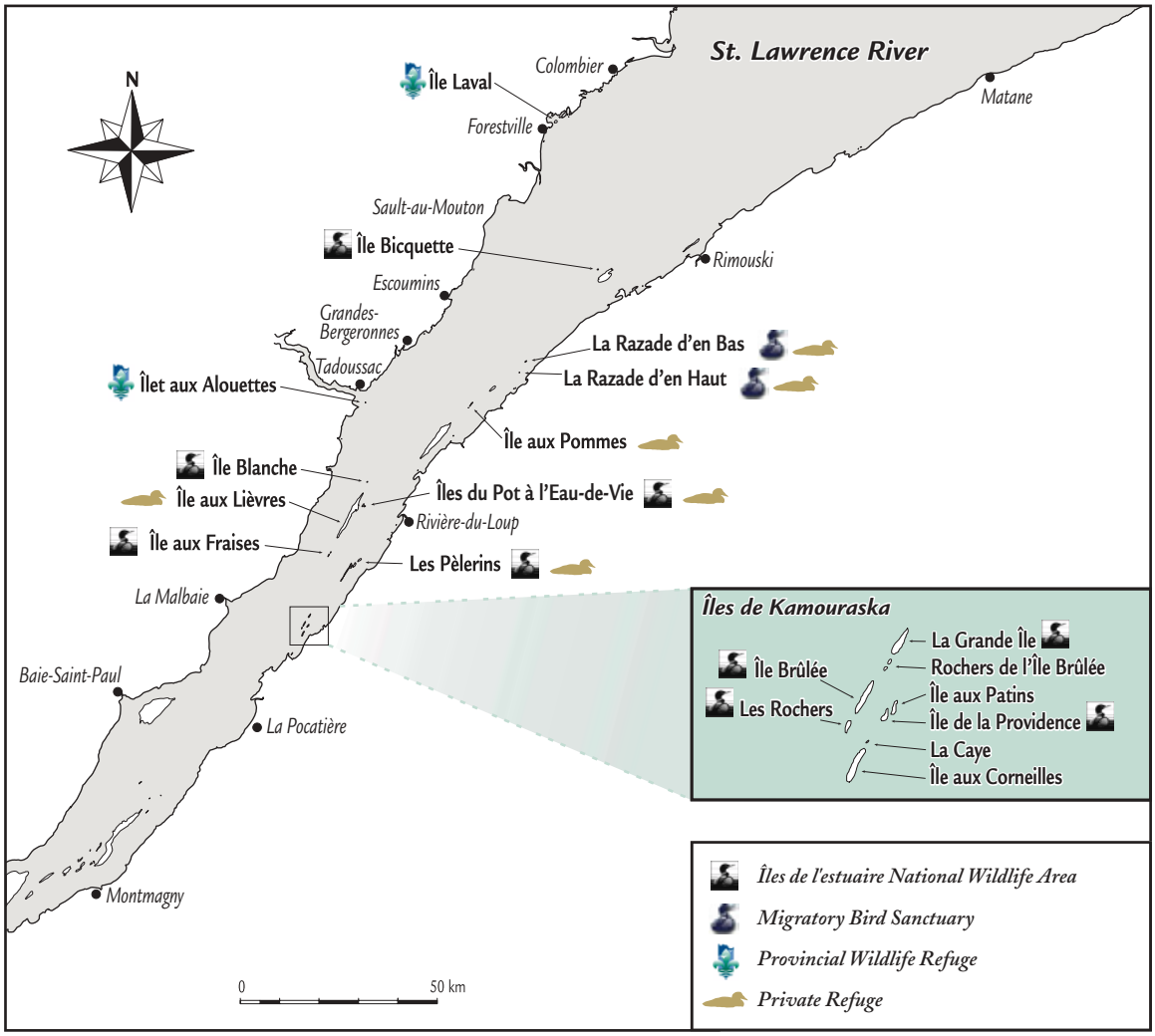
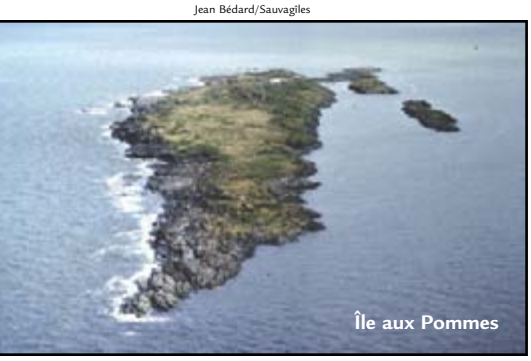


Figure 8 | Location of Common Eider colonies protected under various legal statutes in the St. Lawrence estuary

Jean Bédard/Sauvagiles



Île aux Pommes

Some statutes offer strong safeguards, but in practice, it is the level of surveillance that determines the protection of colonies. In concrete terms, a private island with no legal status can be better protected by an owner who ensures regular surveillance than an island under governmental protection without any surveillance. Giving lawful protection to nesting habitats is a vital step, but without a permanent presence or adequate surveillance this legal status alone offers no guarantee of protection.

In the estuary, the presence of non-profit organizations (NPOs) generally provides adequate protection of eider habitats, but certain large colonies require more protection (legislation and surveillance): Île aux Oeufs, Île Rouge, Îles de Ragueneau, Battures aux Loups Marins and a few others are in this group.

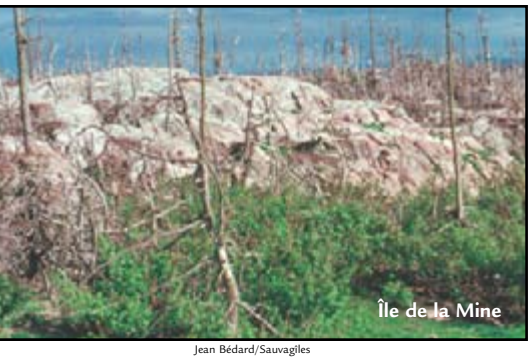
On the Lower North Shore, the presence of MANPRC has helped protect colonies in the Mingan archipelago; elsewhere however, an increase in the number of protected sites and adequate surveillance of these sites would no doubt result in an increase in the eider population.

Habitat Quality

There is a wide range of nesting habitats on the islands of the St. Lawrence estuary and Gulf and Common Eiders are relatively flexible in their choice of nesting cover. These include forested habitats (e.g. Île Bicquette), brushy habitats (e.g. Île aux Fraises), grassy habitats (e.g. Île Blanche and Île aux Pommes) and habitats with minimal or non-existent cover (e.g. La Razade d'en Haut, Récif Boulay, Îlet aux Alouettes).

In absence of disturbances (intrusions, human activities), females can successfully hatch their brood even without the protection provided by plant cover, and in spite of the presence of avian predators (*Corvidae, Laridae*). In the presence of disturbances, plant cover becomes important: the thicker and more difficult it is for avian predators to penetrate, the higher the nesting success.

In the estuary, the majority of eider nesting islands has forested cover but this cover is in a state of constant evolution and is universally deteriorating. On certain islands, such as Île Bicquette, complex and poorly understood mechanisms are behind this deterioration (Bélanger and Bédard 1997). On others, grazing by hares, forest fires, spruce budworm epidemics but above all, the presence of Double-Crested Cormorants are responsible for the deterioration of the forest. However, seventeen years of follow-up on Île Blanche lead to the conclusion that the major interventions on plant cover had no appreciable effect on the nesting birds in either the short or the medium term (Bédard and Nadeau 1994).



Île de la Mine

Jean Bédard/Sauvagiles

Consequently, the quality (density, height, composition) of plant cover in Common Eider colonies cannot be considered a primary factor in maintaining and increasing current population levels. What the female is primarily looking for is basic shelter rather than a healthy or typical plant community.


Île Blanche

Jean Bédard/Sauvagiles

In absence of disturbances, it is therefore futile to devote efforts to improving plant cover because the net gains resulting from this work on recruitment are probably minimal. Only where the plant cover has been severely degraded (to the point of losing topsoil through wind erosion and runoff) and where there are major disturbances (proximity of human activities) can intervention be justified solely for the benefit of the eider. The addition of nesting boxes can be an alternative for maintaining or increasing a population of nesting ducks. They are particularly effective on small islands with little natural cover. Since 1986, a total of 450 boxes have been inspected annually on Île Blanche. The percentage of boxes used by eiders varies from 65% to 94% with an average of 1.6 nests per shelter. Narrow nesting boxes (48x24x8 inches) divided in the centre are more efficient in terms of their use by eiders and of construction costs (Duvetnor, unpublished data).

The Special Case of Île Bicquette

Île Bicquette, with 10,000 nests, harbours the largest colony in Canada and represents about 30% of the population of the estuary. It is the last large colony where the cover is predominantly forest (65% of the surface area) characterized by overmature balsam fir (110-130 years) that is not regenerating (Bélanger and Bédard 1997, Huot 1999). The absence of seedlings is of concern considering the risk of a major windfall or the rapid deterioration of the forest due to fire or spruce budworm. This lack of regeneration could be caused by a failure in seed production, the incapacity of seedlings to develop because of soil conditions, death of seedlings in the absence of germination beds or death of seedlings due to trampling by eiders. More detailed studies are needed to determine the exact cause or causes of this lack of forest regeneration.


Île Bicquette

Jean Bédard/Sauvagiles

Jean Bédard/Sauvagiles

Predators

Long-tailed Weasels, Coyotes and Black Bears are at times present in the colonies but Red and Arctic Foxes are the most efficient land predators and cause the most problems on eider nesting islands. Eiders are extremely vulnerable to predation because females do not react to the presence of foxes by changing the location of their nesting sites.

On small islands, invasion by fox is stochastic, determined mainly by the movements of ice floes, the formation of ice-bridges and the distances from the coast. On large islands (>500 ha) (e.g. Île aux Lièvres), foxes can feed on alternate prey, become permanent residents and repeatedly invade neighbouring islands.

The presence of fox is not only detrimental to eider colonies but also to colonies of several species of seabirds nesting on the same islands: its elimination must be seen in an overall perspective, especially on the islands of ÎENWA, where the preservation of diversified avian communities is important. Because the elimination of predators from islands can be very expensive, the cost/benefit ratio must be considered based on various factors: the frequency of fox intrusions, the size of the eider colonies and other seabirds, the distance from the coast, the cost of trapping, etc.

Francis Bélanger

Two major avian predators abound in all eider colonies of the St. Lawrence: the Great Black-backed Gull and the Herring Gull. Fluctuations in the number of eider nests do not show any relation to the number of these predators. In absence of disturbances, eiders and gulls coexist easily in the nesting areas. However, duckling predation by gulls in the hours that follow nest departure, even in the absence of any disturbance by man, could be considerable and warrants study.

Rearing Grounds

The behaviour of broods/crèches is quite well known. The exclusion of subordinate females by dominant females means that only 12 to 15% of the females participate in rearing. Over the first few days of crèche formation, exclusive female-duckling bonds develop, which fosters the stability and social cohesion necessary for juvenile survival. The dominant female in a crèche appears to be attached to a specific rearing area. The duration of the rearing period (hatching – flight) is not precisely known but is estimated to be 70-80 days. The diet of the young consists of gastropods and gammarids, which abound on rocky substrates and in macrophyte beds (*Fucus*, *Ascophyllum*).

A combination of several factors contribute to mortality during the rearing period: crossing open water between the islands and the coast (sometimes more than 10 km), very high gull predation in the colonies when the ducklings are less than 10 days old, and bad weather conditions during the first days of life. It is not known if the quality of rearing habitat affects young survival.

Batture of Saint-Fabien-sur-Mer

Jean Bédard/Sauvagiles

Breeding and rearing habitats are widely separated in the estuary. With the exception of a few large islands having extensive shorelines (Île aux Lièvres, Île du Bic, Île Saint-Barnabé), the islands in the estuary are not used for rearing (extreme predation by gulls, lack of shelter). Instead, the coastal shorelines provide an abundance of rocky substrates with macrophytes and food (especially downriver); also, predation intensity is probably weak because of the distance from gull colonies. The estuary shoreline offers very little shelter against bad weather compared to the Lower North Shore, where rearing habitats are interspersed among nesting habitats. However, rearing conditions on the Lower North Shore need to be better documented.

Moulting Grounds

Outside the nesting period, male eiders congregate in specific areas, some of which are used during the moulting period (Figure 9). Males begin to moult in late July whereas females moult a little later. Subadults probably go directly to the moulting areas in June; as for the females, it is unknown if they use the same grounds as the males. Eiders can stay on the moulting grounds until mid-October. None of the coastal areas used for moulting are presently protected.

Francis Bélanger

Wintering Grounds

Band returns in the 1970s revealed that eiders from the estuary follow the coasts of New Brunswick and Nova Scotia, and winter primarily off the coasts of Maine and Massachusetts. The existence of another overland flyway was also established (Gauthier *et al.* 1976). The abondance and distribution of the Québec birds along these coasts are currently unknown.

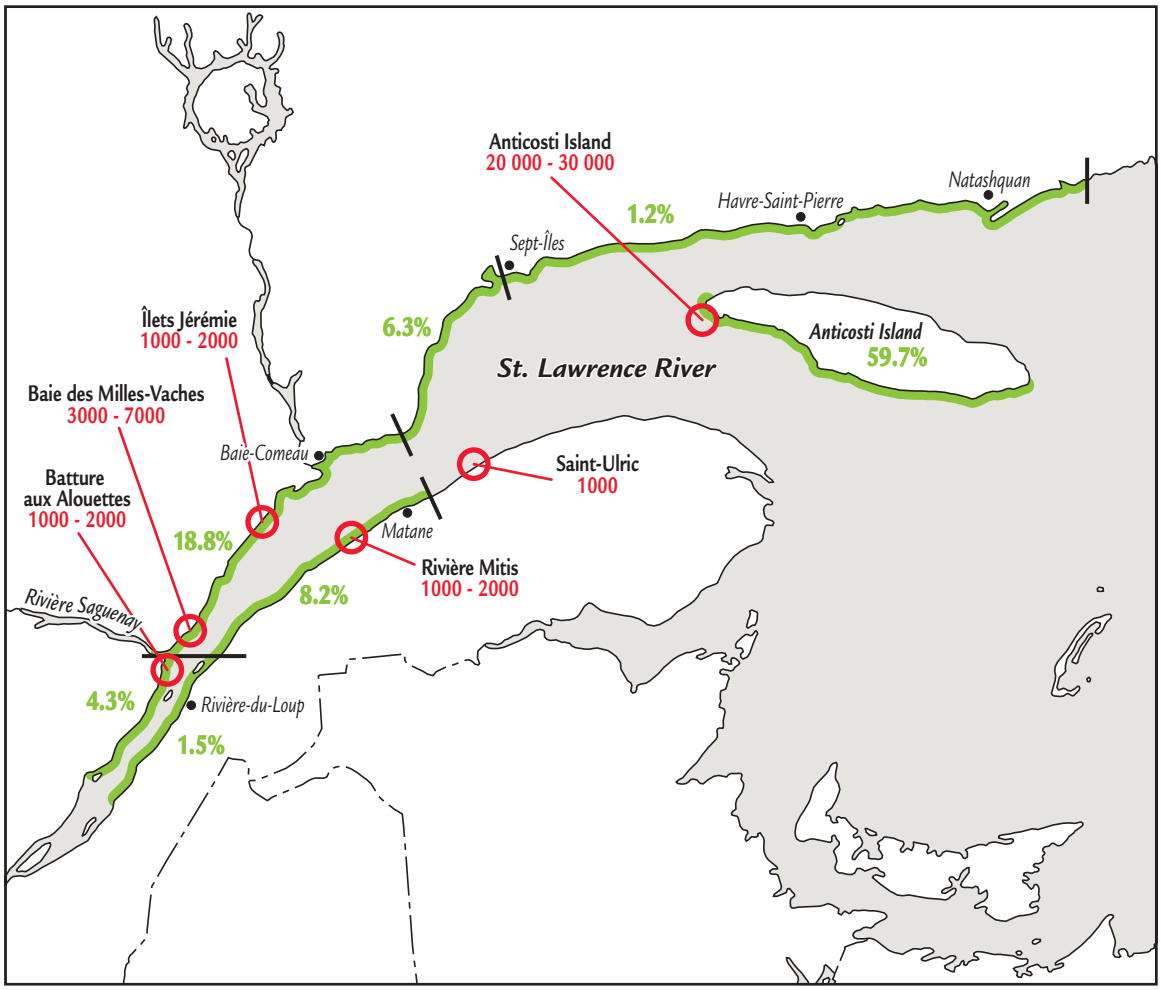


Figure 9 | Distribution of moulting Common Eiders (July and August 1998) by coastal sector and location of the known moulting grounds in the estuary and the Gulf of St. Lawrence (Rail and Savard 2003).

Eiderdown Harvesting

The harvesting of eiderdown is authorized by CWS in accordance with The Migratory Bird Treaty (1916). Eiderdown is the finest of all natural insulators but the market for this luxury product is limited to Europe (Germany, Denmark, Switzerland, Austria, France) and Japan. The annual worldwide production of down is four to five tons, primarily from Iceland. The St. Lawrence only produces 150 to 200 kg/year.

In the estuary, Duvetnor and SPEE hold the two permits to collect down. These two NPOs reinvest the net annual revenues ($50,000 – $100,000) into the protection of nesting grounds. On the Lower North Shore, a few permits are granted

Jean Bédard/Sauvagiles


Jean Bédard/Sauvagiles

to individuals but the level of activity varies from year to year. At this time there is no harvesting within the limits of MANPRC.

Eiderdown harvesting activity in the estuary has made it possible to accumulate a series of unique scientific data that would otherwise have been obtained only at considerable expense. Eiderdown collectors should therefore be considered as partners in the protection and management of the eider rather than as commercial operators.

Anthropogenic Threats

The use of the nesting grounds by man for tourist and recreational activities constitutes a major threat in the St. Lawrence estuary. Human disturbance during the nesting period can seriously impair breeding success: it enhances predation, increases the rate of abandonment and has subtle but harmful physiological effects on nesting females. This is detrimental to the colonies at all times. Females are even more vulnerable during the first half of the 28- to 30-day incubation period (<15 days). Such disturbances also have major effects when hatching occurs (scattering of the ducklings) which greatly increase avian predation (Bolduc and Guillemette 2003, Mawhinney 1999).

The current popularity of sea-kayaking has incited tourism promoters to develop coastal excursions around islands which include landings on some islands used by nesting eiders. Most likely, the eider colonies located along the North Shore will eventually be subjected to the same threat because adventure enthusiasts are increasingly seeking out wild and unspoiled islands in the St. Lawrence. This trend is evidenced by the emergence of tour providers in several small localities.

Poaching is a threat of which the magnitude is unknown as well as the systematic gathering of eggs on the Lower North Shore. The enforcement of regulations remains a problem in outlying regions.

Tankers frequently travel the St. Lawrence Seaway and the risk of accidental spills is still very real. The incident in Havre-Saint-Pierre in the spring of 2000 which resulted in the death of several hundred eiders, illustrates the magnitude of this threat (Lehoux and Bordage 1999).


Jean Bédard/Sauvagiles

The aquaculture industry continues to expand, especially in the Maritimes. Mariculture, among others, creates direct conflicts between man and eiders. There is also a growing interest in the commercial harvest of invertebrates and seaweed in coastal zones, which could have indirect effects upon juvenile survival. These activities are not presently causing any harm in Québec but the situation could change as aquaculture projects and commercial harvests in the coastal zone are being increasingly contemplated.

Stephen Homer

3 Objectives and Challenges of the Management Plan

Primary Objective

To ensure the protection of habitats and to increase Common Eider populations in the St. Lawrence (estuary and Lower North Shore).

Population Objectives

Population goals for St. Lawrence eiders were set at the SDJV workshop in St. Stephens, New Brunswick in April 2002 and during consultations with CWS specialists:

1. Increase the population in the St. Lawrence estuary from the 32,000 pairs (2001) to its potential (estimated at 40,000 pairs) over a fifteen-year period.

2. Increase the population of the Lower North Shore from the current 10,000 pairs (2001) to at least double (20,000 pairs) over a fifteen-year period. Based on current data, it is difficult to assess the potential for the Lower North Shore. However, we believe that the goal of doubling the eider population is realistic, perhaps even conservative, given the rapid growth observed in several colonies that have benefited from protective measures.

Guidelines

To achieve the primary objective and population goals, we need to pursue the following specific objectives:

1. Protect key habitats that ensure the long-term viability of eider populations.

2. Ensure that consumptive use of eiders is sustainable.

3. Encourage non-consumptive use of eiders that respects sustainable development of the resource for the benefit of local economies.

4. Minimize the adverse effects of commercial activities on eiders.

5. Raise awareness in shoreline communities for the conservation of the Common Eider and promote their participation to the implementation of the Plan.

6. Coordinate the management actions in this Common Eider Management Plan with those implemented in the Maritime Provinces and U.S. states and with those for other species of seabirds sharing the same habitats.

7. Pool expertise on the biology of the species to better understand existing data and to encourage cooperation in filling information gaps.

Jean Bédard/Sauvagiles

4 Implementation of the Plan

Key Elements for Success

Research

Enlightened and effective management must be based on sound scientific information. There is, however, insufficient knowledge at present on the fundamental biological parameters that govern the dynamics of the eider population. Furthermore, the relative importance of factors impacting eider mortality is not well understood. To ensure effective population management, specific studies must be conducted to obtain needed data.

Coordination

The success of the Plan depends largely on the collaboration of the private and public owners of the nesting sites, the managers of coastal environments (Saguenay – St. Lawrence Marine Park, MANPRC, Parc national du Bic, etc.), waterfowl hunters, down collectors and the managers of public lands, the MRCs (regional county municipalities). These various groups need to work together toward the adoption of the measures set forth in the Plan.

Success of the Plan also depends on the collaboration of the industry sector (commercial fishery, aquaculture, tourism, etc.) whose activities impact eider populations, and of the agencies regulating such activities (industry regulating agencies, tourism and economic development organizations, etc.).

A consensus with aboriginal communities, especially with those on the Lower North Shore is also fundamental to integrated management of the eider resource.

Participation

Implementation of the Plan requires the active participation of local organizations knowledgeable of specific local problems and capable of creating the necessary synergy between decision-makers, the general public and other local groups to see that the various measures needed for eider conservation and protection are carried out.

Support at the Continental Scale

The success of the Plan at the Québec level is equally dependent on support and collaboration from North American partners. It is essential to work with the wildlife managers responsible for our populations during a part of the year, in particular with the states of Maine and Massachusetts, with New Brunswick, Nova Scotia, Newfoundland and Labrador and the USFWS as well as with all intermediaries, including NAWMP and its joint ventures.

Implementation Framework

The **Joint Working Group** on the Management of the Common Eider in the estuary and Gulf of St. Lawrence in Québec is under the authority of the *Eastern Habitat Joint Venture* - Québec (EHJV) Steering Committee, made up of representatives of DUC, the CWS, the FAPAQ, the Fondation de la faune du Québec and Wildlife Habitat Canada.

The EHJV Steering Committee keeps partners informed of the progress of current projects conducted by one or several of the partners.

The structure of the Joint Working Group on the Management of the Common Eider is as follows: a coordination office, an implementation committee, a secretary/research assistant and various experts.

The **Coordination Office** is made up of a representative from the four following organizations, each having its own mandate:

- Ducks Unlimited Canada – Québec: the protection, restoration and management of wetlands and associated uplands for waterfowl;
- Canadian Wildlife Service – Québec Region: the protection and management of the migratory bird populations, the management of NWAs and MBSs;
- Société de la faune et des parcs du Québec: the protection and development of wildlife habitats;
- Société Duvetnor Ltée: the protection of wildlife and their habitats in the estuary of the St. Lawrence and the education of the public in conservation issues.

The role of the Coordination Office is to:

- coordinate actions and provide funds and resources for implementation of the Common Eider Management Plan according to the available financial resources and the respective mandates of the organizations;
- approve annual research and management priorities as well as anticipated delivrables;
- maintain a link with participating organizations and ensure their involvement in eider management;
- maintain links between the EHJV and the SDJV at the management board level.

Under the joint responsibility of two eider experts, the role of the **Implementation Committee** is to:

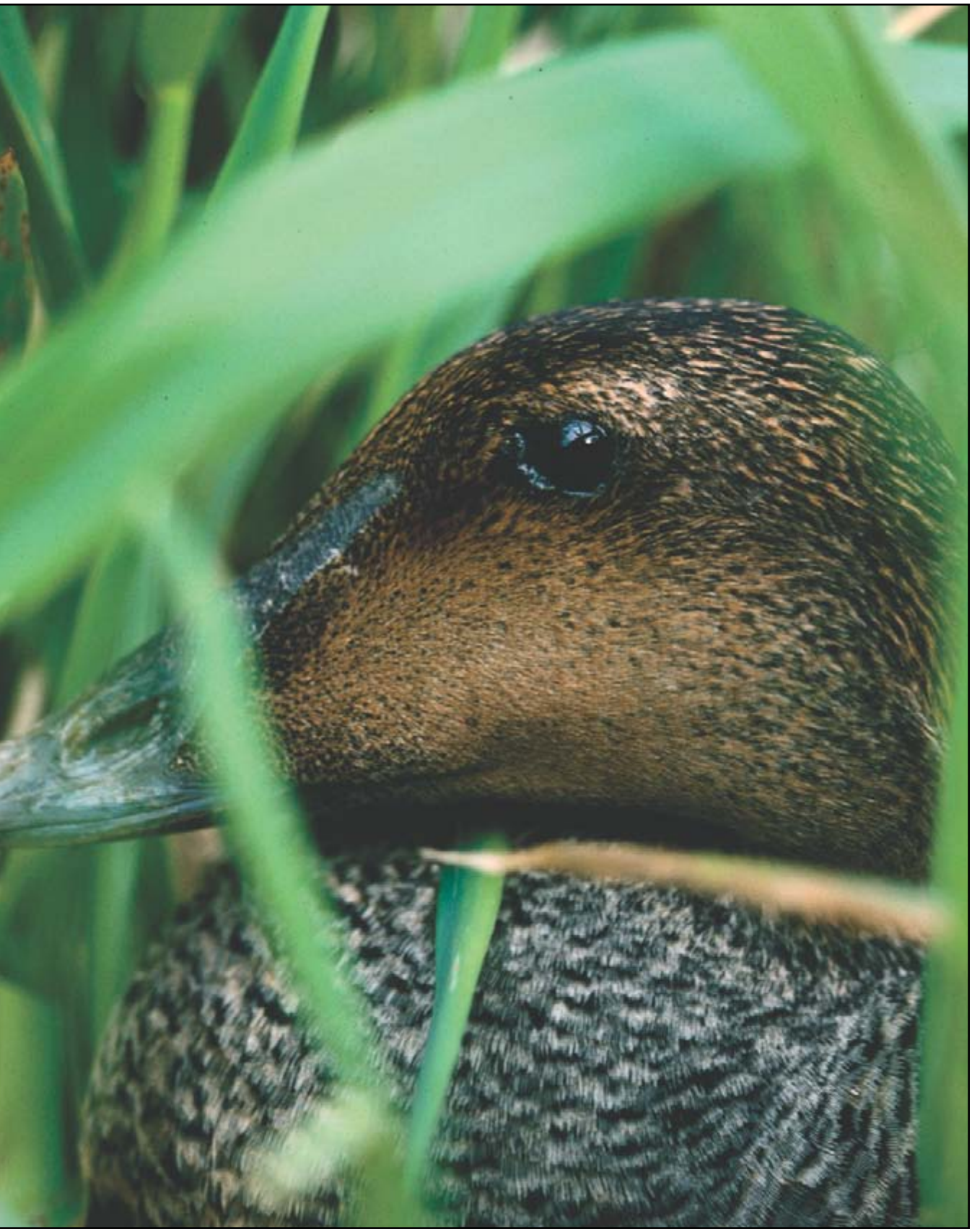
- provide scientific expertise to the Coordination Office;
- identify annual research and management priorities;
- ensure implementation of the conservation and management actions of the Common Eider Management Plan;
- compile and publish knowledge on the St. Lawrence eiders;
- maintain scientific ties with the SDJV and various other eider initiatives in the Maritimes and United States;
- maintain ties within the scientific community concerning eider management;
- evaluate the relevance and scientific value of research projects submitted by various parties;
- submit various research projects to funding organizations;
- supervise scientific studies.

A **secretary/research assistant** is assigned to the Coordination Office and to the Implementation Committee to follow-up on the Joint Working Group activities (notification of meetings, minutes, etc.). Duties also include data analysis, writing reports and communications among participants. This person works in the capacity of a secretary, a liaison person (Implementation Committee) and research assistant as needed, based on the requirements determined by the members of the Coordination Office from time to time.

Various **resource persons** will join the working group as needed.

Funding

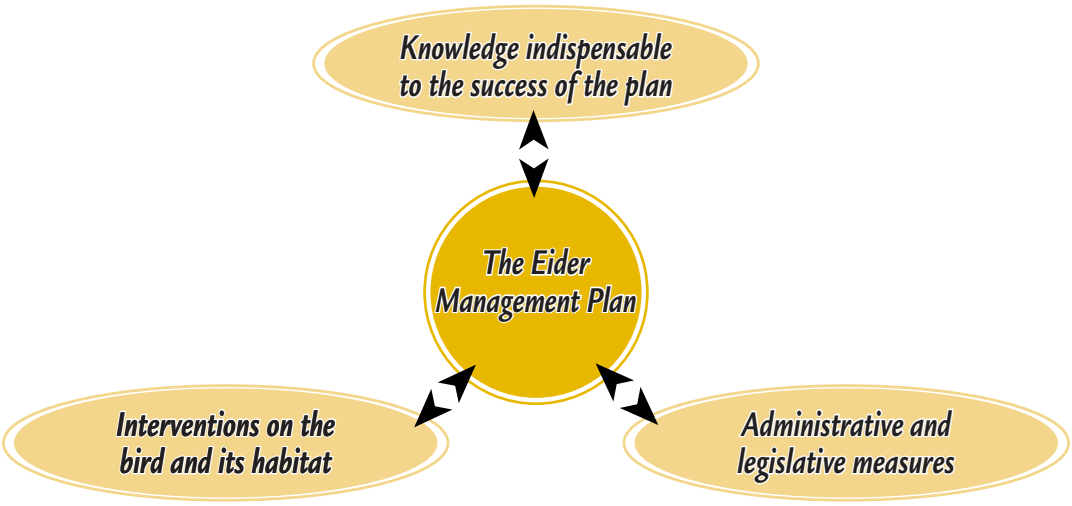
Funding of the operations will be covered by government agencies, non-government organizations, the private sector and community organizations according to their respective mandates and objectives. New financial partners will be solicited. Proposals for eligible projects will also be submitted to existing funding programs.



Gilles Martin

5 Strategic Actions

Strategic actions are divided into three categories: the acquisition of knowledge indispensable to the success of the Plan, interventions on the species and its habitat that could be direct (restoration of plant cover, predation control) or indirect (installation of warning signs to reduce human disturbance) and administrative and legislative measures having a direct or indirect impact on the attainment of the Plan's objectives.

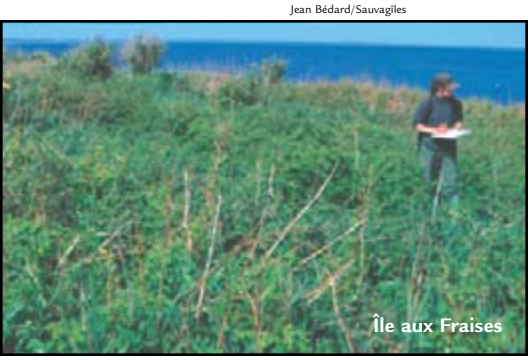


Proposals for knowledge acquisition primarily concern research managers and affiliated research institutes such as universities. Interventions on the species and its habitat can be carried out by various government or private organizations according to their expertise and experience, while administrative and legislative measures will be implemented essentially by the government agencies responsible for law inforcement or for land management.

Acquisition of Knowledge Indispensable to the Success of the Plan

1 Gather accurate data on the number of nesting birds by continuing annual monitoring of colonies in the estuary by down collectors and by increasing the frequency and scope of surveys on the Lower North Shore and by collaborating in the establishment of a structured down collecting program by local participants (aboriginal communities) including a rigorous protocol for monitoring populations.

Jean Bédard/Sauvagiles



2 Develop a model of population dynamics to evaluate the impact of diseases, predation and hunting on eider numbers. A similar exercise carried out on the *borealis* population demonstrated its utility (Gilliland et al., manuscript).

3 Undertake, as soon as possible, a banding program to evaluate the distribution of the hunting harvest, the contribution of the St. Lawrence eider populations to the harvest in the different states and provinces and the survival of various categories of individuals. This program will have to be harmonized with those in the neighboring states and provinces.

4 Understand the epidemiological aspects of avian cholera, a major and recurrent mortality factor in the eider populations of the estuary, and better quantify annual mortality due to this factor.

5 Delineate and characterize rearing habitats (use, quality, etc.).

6 Measure the annual juvenile production and evaluate mortality factors (gull predation, meteorological conditions etc.).

7 Evaluate the need to confirm observations made on the presence of contaminants and embedded lead shot in eiders, examine the levels of other toxic substances (HAP, butylenes) and verify other aspects (links to molluscs, analyses of carcasses found, etc.) of contamination.

8 Examine the dynamics at work in the forest on Île Bicquette and in particular determine the exact cause of the absence of balsam fir seedlings.

9 Develop a model to investigate the impact of periodic Red Fox intrusions on recruitment in colonies of different sizes and document this problem in the Lower North Shore colonies.

10 Delineate moulting areas geographically and temporally, determine their use by sex and age and assess their importance (selection, philopatry) relative to breeding and wintering areas.

Interventions on the Species and its Habitat

1 Increase surveillance to prevent incursions by man in eider colonies by supporting the organizations that provide surveillance in the estuary and especially in the Lower North Shore.

2 Increase awareness of the need to protect nesting grounds among pleasure boaters and fishermen by supporting projects, organizations, and programs carrying out these mandates.

3 Improve warning signs in colonies, devise and produce a more effective type of sign that will have a deterrent effect on human incursions in colonies and install more of these signs.

4 Continue to support groups that monitor numbers in the estuary during the annual down harvest.

Île Blanche

Jean Bédard/Sauvagiles

Jean Bédard/Sauvagiles

5 Develop and implement a strategy to maintain the largest colony of eiders in the St. Lawrence and the integrity of the forest cover on Île Bicquette.

6 Develop and implement a plan for the control of land predators (Red Fox) in colonies when necessary.

7 Improve procedures for detecting avian cholera.

8 Disseminate knowledge on Common Eiders by developing and implementing a communication plan combining various tools (videos, books, an awareness program, posters).

9 Manage the eiderdown harvest to eliminate abusive practices, and introduce a credible program to measure the abundance, condition and quality of habitats used by the species on the North Shore.

10 Consider the addition of nesting boxes in strategic locations, in particular on the North Shore, to encourage the establishment of sustainable colonies.

11 Examine, with Québec authorities, the soundness of establishing comprehensive or local control of the Double-crested Cormorant when its expansion threatens the integrity of Common Eider nesting habitat.

Jean Bédard/Sauvagiles

Administrative and Legislative Measures

1 Protect the remaining nesting islands in the estuary by buying these sites or by having them granted legal status (National Wildlife Area, Provincial Wildlife Refuge, MBS, etc.).

2 On the Lower North Shore, increase the protection and the number of MBSs, create Provincial Wildlife Refuges and expand MANPRC to include other islands of strategic importance to the Common Eider.

3 Protect the main rearing and moulting grounds by the adoption of appropriate regulations with partners, including Fisheries and Oceans Canada and the Ministère de l'Agriculture, des Pêches et de l'Alimentation du Québec.

4 Harmonize the Common Eider Management Plan with other management plans such as futur Double-crested Cormorant Management Plan and an ÎENWA Management Plan.

5 Harmonize the Common Eider Management Plan with those of bordering states or provinces and in particular by the organization of technical meetings and by the distribution of this Plan.

6 Work with concerned authorities to collect more accurate information from sea duck hunting surveys.

7 Establish a liaison between the managers (CWS and MANPRC) and aboriginal communities to protect eiders on nesting grounds located outside parks and sanctuaries in view of building vigorous local eider populations on the Lower North Shore.

8 Assess the potential of protecting the best moulting sectors by having them designated as Marine Protected Areas (Canada Oceans Act).

9 Collaborate with various management agencies and sectors of activity (e.g. tourism development) to orient and coordinate their eider conservation initiatives. This collaboration would take several forms:

- Coordinate conservation measures in the different administrative regions to maximize the objectives reached and minimize costs.
- Work with regional and local coordinating groups (e.g. Committees promoting the *Zones d'intervention prioritaire* Program) involved in conservation and rational use of resources.
- Have eider conservation included as a credible criterion for grants from existing funding programs.
- Continue to seek new partners and develop their know-how in the conservation of the Common Eider.
- Participate in various forums and conferences on eider survival and abundance to raise awareness among agencies, groups and individuals about this species.
- Identify and provide financial and technical support to regional partners in the management of nesting sites to preserve their integrity (monitoring plant cover and controlling foxes) and to reduce threats (human disturbance).
- Set aside a budget appropriation for sporadic and selective use for environmental emergencies (e.g. the elimination of land predators on certain large island colonies).
- Integrate the zones that are significant for the Common Eider into existing land use plans (e.g. regional county municipalities).

Stephen Homer

Literature Cited

Bédard, J. 1988. L'Eider à duvet de l'estuaire du Saint-Laurent: un plan de gestion. Prepared for Ducks Unlimited Canada, Québec Region, by Sauvagîles Ltée, March 1988, 71 p.

Bédard, J. et R. Guérin 1991. Inventaires d'oiseaux nicheurs sur les îles aménagées par Canards Illimités dans l'estuaire du Saint-Laurent de 1985 à 1991. Report prepared for Ducks Unlimited Canada, Québec Region, by Sauvagîles Ltée, Québec, 61 p.

Bédard, J., J. Huot and J-F. Giroux 1987. Île Blanche: Programme de suivi environnemental. Rapport pour l'année 1986. Report prepared for Ducks Unlimited Canada, Québec Region, by Sauvagîles Ltée, February 1987, 20 p.

Bédard, J. and A. Nadeau 1994. L'Eider à duvet dans l'estuaire du Saint-Laurent: un plan de gestion (revisé 1994). Report prepared for Ducks Unlimited Canada, Québec Region, by the Société Duvetnor Ltée, 64 p.

Bélanger, L. and J. Bédard 1997. L'habitat de l'Eider à duvet sur l'île Bicquette: évaluation du couvert forestier et prescriptions sylvicoles. Prepared for Environment Canada, Québec Region, by Société Duvetnor Ltée, February 1997, 32 p.

Bolduc, F. and M. Guillemette 2003. Human disturbance and nesting success of Common Eiders: interaction between visitors and gulls. Biological Conservation 110, 77-83.

Brousseau, P. and G. Chapdelaine 1987. Les oiseaux marins de l'archipel des Sept Îles (Golfe du Saint-Laurent, Québec). Naturaliste Canadien 114(2), 177-186.

Caithamer, D. F., M. Otto, P. I. Padding, J. R. Sauer and G. H. Haas. 2000. Sea Ducks in the Atlantic Flyway. Population Status and a Review of Special Hunting Seasons U.S. Fish and Wildlife Service report, February 2000, 40 p. + tables + figures + appendices.

Commission de toponymie du Québec 1996. Noms et lieux du Québec: dictionnaire illustré. Commission de toponymie du Québec, 2nd edition, Les Publications du Québec, Sainte-Foy, 925 p.

Conservation of Arctic Flora and Fauna (CAFF) 1997. Circumpolar Eider Conservation Strategy and Action Plan. Prepared by the Circumpolar Seabird Working Group, CAFF International Secretariat, Iceland, 16 p.

Corr, P. O., A. E. Hutchinson and W. B. Krohn 1988. Status of the eider duck in the eastern United States with special reference to coastal Maine. Pages 39-50, Eider Management Workshop held in Québec City, January 12-13, 1988 (C.-A. Drolet, ed.), 1989, Canadian Wildlife Service, Québec Region, Technical Report Series Number 64, 68p.

Drolet, C.-A. (ed.) 1989. Eider Management Workshop held in Québec City, January 12-13, 1988. Canadian Wildlife Service, Québec Region, Technical Report Series Number 64, 68 p.

Filion, B. and J. Bédard 1989. Aménagement de l'habitat de l'île Blanche pour contrer l'action sporadique d'épidémie de choléra aviaire. Pages 24-27, Eider Management Workshop held in Québec City, January 12-13,1988 (C.-A. Drolet, ed.), 1989, Canadian Wildlife Service, Québec Region, Technical Report Series Number 64, 68p.

Gauthier, J., J. Bédard and A. Reed 1976. Overland migration by Common Eiders of the St. Lawrence estuary. Wilson Bulletin 88(2), 333-344.

Goudie, R. I., S. Brault , B. Conant, A. V. Kondratyev, M. R. Petersen and K. Vermeer 1994. The status of sea ducks in the north Pacific rim: toward their conservation and management. Transactions of the North American Wildlife and Natural Resources Conference 59, 27-49.

Goudie, R. I., G. J. Robertson and A. Reed 2000. Common Eider. The Birds of North America, No 546 (A. Poole and F. Gills, ed.), The Birds of North America Inc., Philadelphia, PA, 32 p.

Gilliland, S. G., H. G. Gilchrist, R. F. Rockwell , G. J. Robertson, J.-P. L. Savard, F. Merkel and A. Mosbech 2004. Evaluating the Sustainability of Fixed-Number Harvest of Northern Common Eiders in Greenland and Canada. Manuscript report submitted for publication.

Guignion, D. L. 1967. A nesting study of the Common Eider (*Somateria molissima dresseri*) in the St. Lawrence estuary. Master's thesis, Université Laval, Québec, 131 p.

Hicklin, P. W. et W. R. Barrow 2004. The incidence of embedded shot in waterfowl in Atlantic Canada and Hudson Strait. Waterbirds 27(1), 41-45.

Huot, J. 1999. Île Bicquette : problématique de la régénération du couvert forestier. Manuscript report prepared for Ducks Unlimited Canada, Québec Region, 4 p.

Huot, J. and J.-F. Giroux 1985. Aménagement de l'île Blanche. Phase I : Dégagement de l'île, Phase II : Revégétation de l'île et distribution des nichoirs d'eiders. Prepared for Ducks Unlimited Canada, Québec Region, in three separate reports.

Krementz, D. G., J. E. Hines and D. F. Caithamer 1996. Survival and recovery rates of American Eiders in Eastern North America. Journal of Wildlife Management 60(4), 855-862.

Krohn, W. B. , P. O. Corr et A. E. Hutchison 1992. Status of the American Eider with special references to Northern New England. United States Fish and Wildlife Service Technical Report No 12, 12 p.

Lehoux, D. and D. Bordage 1999. Bilan des activités réalisées sur la faune ailée suite au déversement d'hydrocarbures survenu à Havre Saint-Pierre en mars 1999. Manuscript report, Canadian Wildlife Service, Québec Region.

Lévesque, C. 1997. Étude de bioindicateurs de toxicité chez les populations nicheuses d'Eider à duvet (*Somateria mollissima dresseri*) du fleuve Saint-Laurent. Master's thesis in biology, Université du Québec à Montréal, 97 p.

Lewis, H. F. 1939. Size of sets of eggs of the American Eider. Journal of Wildlife Management 3(1), 70-73.

Madsen, J. et H. Noer 1996. Decreased survival of pink-footed geese *Anser brachyrhynchus* carrying shotgun pellets. Wildlife Biology 2, 75-82.

Mawhinney, K. 1999. Factors affecting adult female crèche attendance and duckling survival of Common Eiders in the southern Bay of Fundy and northern Gulf of Maine. Doctoral thesis, University of Nouveau Brunswick, 194 p.

Mawhinney, K., A. W. Diamond, , P. Kehoe and N. Benjamin 1999. Status and productivity of Common Eiders in relation to Great Black-backed Gulls and Herring Gulls in the southern Bay of Fundy and the northern Gulf of Maine. Waterbirds 22(2), 253-262.

McAloney, R. K. 1973. Brood ecology of the Common Eider (*Somateria mollissima dresseri*) in the Liscombe area of Nova Scotia. Master of Science thesis, Acadia University, Wolfville, Nova Scotia, Canada, 92 p.

Milne, H. and A. Reed 1974. Annual production of fledged young from the Eider colonies of the St. Lawrence. Canadian Field-Naturalist 88(2), 163-169.

Munro, J. and J. Bédard 1977. Gull predation and crèching behaviour in the Common Eider. Journal of Animal Ecology 46(3), 799-810.

Rail, J.-F. and G. Chapdelaine 2002. Quinzième inventaire des oiseaux marins dans les refuges de la Côte-Nord : techniques et résultats détaillés. Canadian Wildlife Service, Québec Region, Technical Report Series Number 392, 307 p.

Rail, J.-F. and J.-P. L. Savard 2003. Identification des aires de mue et de repos au printemps des macreuses (*Melanitta* sp.) et de l'Eider à duvet (*Somateria mollissima*) dans l'estuaire et le golfe du Saint-Laurent. Canadian Wildlife Service, Québec Region, Environment Canada, Sainte-Foy, Technical Report Series Number 408, 34 p.

Reed, A. 1975. Migration, homing, and mortality of breeding female eiders *Somateria mollissima dresseri* of the St. Lawrence estuary, Québec. Ornis Scandinavica 6, 41-47.

Reed, A. and A. J. Erskine 1986. La taille et l'état des populations d'Eiders à duvet dans l'Est de l'Amérique du Nord. Pages 163-175 *In* Les eiders au Canada (A. Reed, ed.), Canadian Wildlife Service, Québec Region, Technical Report Series Number 47, 177 p.

Roberge, B. 2002. Situation de la population nicheuse d'Eiders à duvet de la Réserve de parc national du Canada de l'Archipel-de-Mingan 1998. Parks Canada, Conservation of Natural Resources, Mingan Management Unit, 40 p. + appendices.

van Dijk, B. 1986. The breeding biology of eiders at Île aux Pommes, Québec. Pages 119-126 *In* Les eiders au Canada (A. Reed, ed.), Canadian Wildlife Service, Technical Report Series Number 47, 177 p.

Wakeley, J. S. and H. L. Mendall 1976. Migrational homing and survival of adult female eiders in Maine. Journal of Wildlife Management 40, 15-21.

Notes

Notes

Notes

List of Acronyms

CAFF	Conservation of Arctic Flora and Fauna
CWS	Canadian Wildlife Service
DUC	Ducks Unlimited Canada
EHJV	Eastern Habitat Joint Venture
FAPAQ_	Société de la faune et des parcs du Québec
ÎENWA	Îles de l'estuaire National Wildlife Area
MANPRC	Mingan Archipelago National Park Reserve of Canada
MBS	Migratory Bird Sanctuary
MRC	Municipalité régionale de comté
NAWMP	North American Waterfowl Management Plan
NPO	Non-Profit Organization
SDJV	Sea Duck Joint Venture
SPEE	Société protectrice des eiders de l'estuaire
USFWS	United States Fish & Wildlife Service

Published by Authority of the Minister of the Environment

Catalogue No.: En154-24/2004E
ISBN 0-662-36998-X

Legal Deposit - National Library of Canada, 2004