BARROW'S GOLDENEYE ASSESSMENT

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TABLE OF CONTENTS

INTRODUCTION

Since 1968, the Maine Department of Inland Fisheries and Wildlife (MDIFW) has developed wildlife species assessments to establish management goals, objectives, and strategic plans. Assessments are based upon available information and judgments of wildlife biologists responsible for individual species or groups of species. Previous plans for bald eagles (*Haliaeetus leucocephalus*) were completed in 1976, 1980, and 1986. The last plan was updated in 1991 and again in 1996.

Assessments provide the background for species planning initiatives. A "Natural History" section reviews biological characteristics of the species useful to understanding its status. The "Management" section recaps previous actions, strategic plans, relevant rules, and regulatory authority. Historic, current, and projected future conditions for the species are discussed individually for "Habitat," "Population," and "Use and Demand" analyses. The major points of an assessment appear in a "Summary and Conclusions." State management programs for bald eagles have been ongoing since 1976. MDIFW, the U. S. Fish and Wildlife Service (USFWS), the University of Maine, and the National Park Service collaborated on 6 graduate research studies of Maine's eagles from 1976 to 1997. This assessment is based primarily upon this work as well as continuing inventory and management efforts. Other data are provided as necessary to fill information gaps or strengthen crucial findings. A management system (MDIFW 1989) outlined decision-making processes and state criteria for bald eagle recovery. Programs in Maine and 23 other states evolved under the framework of the Northern States Bald Eagle Recovery Plan (USFWS 1983).

NATURAL HISTORY

Description

Barrow's Goldeneye is a medium-sized diving duck with sizes averaging 45 oz (1, 278 g) for males and 29 oz (818 g) for females (Eadie et al. 2000). Adults are strongly dimorphic in both size and plumage. Breeding males have an iridescent, purplish-black head with a white crescent patch between the eye and bill. They have white sides, breasts, bellies and secondaries, which are contrasted with the black back, wings and tail (Eadie et al. 2000). Females have dark chocolate-brown heads, slate-gray backs, wings and tails, and white flanks, bellies and breasts. Immature and eclipse (non-breeding plumage) males resemble females but are heavier (Eadie et al. 2000). The iridies (colored portion of the eye), which are bright amber in adults, are more brownish in juveniles. May easily be confused with Common Goldeneye (see Eadie et al. 1995 and 2000 for differences).

Distribution

More than 90% of the world's population of Barrow's Goldeneye (*Bucephala islandica*) breeds from central Alaska to northern California (Robert et al. 2000). The species also breeds in Iceland, where the population is estimated at approximately 2000 birds (Robert et al. 2000). There has also been a small population associated with eastern North America, however, historically, breeding records have been sparse and, in many cases, unconfirmed (Bellrose 1980). Robert et al. (2000) documented the first record of Barrow's Goldeneye breeding in eastern North America from surveys conducted from May 1990 to 1998. They observed Barrow's Goldeneye on 137 lakes

and 5 rivers, 95.2% of which were along the north shore of the St. Lawrence estuary and Gulf. Nearly all breeding pairs were observed within 100 km of the St. Lawrence River. Four different broods were recorded. This area may represent a core breeding area for birds wintering along the St. Lawrence River (Robert et al. 2000).

Wintering Barrow's Goldeneye in eastern North America have been reported as far south as Long Island (Bellrose 1980). The wintering distribution in this area is highly local, with wintering concentrations of > 100 individuals only recorded in 3 areas of Quebec (Eadie et al. 2000). Wintering birds have also been reported around Anticosti Island, Gaspe Peninsula and in the Maritimes and eastern coastal U.S. but always in small numbers. Maine and Atlantic Canada likely have fewer than 500 wintering birds (Eadie et al. 2000).

Barrow's Goldeneye also frequent the Pacific coast from Washington northward. They occur inland around the Montana-Wyoming border and in southern Idaho, northern Nevada and Utah (Root 1988). See Eadie et al. (2000) for more detailed distribution information.

Taxonomy

Goldeneyes are two of three species in the genus *Bucephala*, which also includes the Bufflehead (*Bucephala albeola*). Barrow's and Common Goldeneye are sometimes classified in the subgenus *Glaucionetta* apart from Buffleheads (Eadie et al. 2000). Hybrids have been recorded only between Common and Barrow's Goldeneye. Of the 17 records of hybrids, 13 were males of alternate (breeding) plumage (Martin and DiLabio, 1994).

Habitat and Diet

Barrow's Goldeneye are found in alkaline to freshwater lakes in parkland areas as well as subalpine and alpine lakes, beaver ponds and small sloughs (Eadie et al. 2000). Lakes that are devoid of fish and are at least 1 m deep are preferred. The ducks avoid large, deep lakes with steeply sloping shorelines as well as lakes with dense emergent vegetation. They tend to select lakes with high productivity (abundant invertebrates). During the breeding season, both goldeneye adults and juveniles feed almost exclusively on aquatic insects, with vegetative matter making up only about 20% of the diet (Eriksson 1983, Eadie et al. 2000). In Sweden, the number of goldeneye and the density of fish populations were negatively correlated (Eriksson 1983). This was not the case for two dabbling ducks (mallard and teal). In lakes with high densities of fish, the pelagic populations of insects are reduced and insects become restricted to the shallow areas of the lakes with high abundances of emergent vegetation. Because of their feeding habits, dabblers are able to take advantage of the insects in the littoral areas of the lakes. Because goldeneye feed in the pelagic areas of lakes, they must compete with fish for prey items. When fish are present, goldeneye prefer lakes with a high shorelength to surface area ratio (Eriksson 1983). Breeding lakes are also restricted to areas with suitable nest sites. Nests are located in cavities in dead or dying trees (Eadie et al. 2000).

For birds that winter on salt water, mollusks make up most of the diet (78% by volume) (Eadie et al. 2000). Those wintering on fresh water consume insects, salmon eggs and parr, mollusks, crustaceans and vegetation (Eadie et al. 2000).

Breeding Biology

Pairs form during winter-early spring. Savard (1985) found evidence of long-term pair bonds in this species and believes that most pairs reunite on the wintering ground. Fidelity to wintering areas may be as strong as fidelity to breeding areas (Savard 1985). Males perform courtship displays on the wintering grounds (Nov-Jan) and pairs migrate to breeding areas in late March or April (Eadie et al. 2000). Females return to the same breeding area each year and may use the same nest sites (Savard 1985).

Nest parasitism occurs frequently in this species, particularly where nest boxes are provided (Palmer 1976, Eadie 1989, 1991). In British Columbia between 1984 and 1994 the intraspecific nest parasitism rate ranged from 30%-64%. The level of nest parasitism was influenced by nest-site availability. Average nest success was not different from un-parasitized nests, however nest success did decrease when parasitized clutches exceeded 16-20 eggs (Eadie et al. 2000). Average clutch size for un-parasitized nests ranges from 6.1-11.7 (Eadie et al. 2000). Interspecific brood parasitism has also been recorded with mixed clutches from Common Goldeneye, Bufflehead, Hooded Merganser, Wood Duck and Red-breasted Merganser (Eadie et al. 2000).

Brood amalgamation in this species is frequent (22% of 91 broods in British Columbia) with females with 10 day old or younger ducklings more likely to accept foreign offspring (Eadie et al. 2000). Brood survival in British Columbia averaged 37.7% $\pm$ 3.3 SE and the average brood size was 9.2 $\pm$ 0.2 SE ducklings at hatching. Duckling mortality was highest during the first week (Eadie et al. 2000).

Territoriality

Barrow's Goldeneye defend three different territories: 1) breeding, 2) wintering and 3) brood. During the breeding season, females spend twice as much time as males feeding, probably because of greater energy requirements. Therefore, males defend breeding territories to provide an undisturbed feeding area for the female (Savard 1988). Pairs exclude conspecifics from their breeding territories, which average 0.44 ha (1 acre) (British Columbia) (Savard 1982, 1988). This territory defense enhances the foraging efficiency of the female, reduces interference from conspecifics and reduces food depletion (Savard 1988). Males defend the breeding territory even when the female is absent.

Only paired Barrow's Goldeneye defend territories on the wintering grounds. In his study in British Columbia, Savard (1988) found that all wintering territories included some shoreline (i.e.: there were no territories on open water). He surmised that winter territory defense may also be food related, as other species that feed on similar food are also excluded by the pair.

Females defend distinct brood territories, which also appear to be food related. Defense of a brood territory may provide better feeding opportunities for the young (Savard 1988). Brood territories average twice the size of breeding territories (0.91 ha in British Columbia) (Savard 1988). Pair and brood territories rarely coincide, probably because brood territories are established on the lake closest to the nest site. This minimizes overland travel and exposure of the young to predators and loss of energy reserves (Savard 1988).

Survival and Longevity

Annual survival for females banded and recaptured on nest boxes is estimated at 64.1% ± 2.2 SE in British Columbia (Eadie et al. 2000). Little information on survival of males is available, however return rate to Riske Creek, BC was 67% ± 11SE (Savard and Eadie 1989).

Longevity records include two males of 15 years and a female of 12 years (band recovery data; Canadian Wildlife Service). The maximum longevity record was 18 years for a bird of unknown sex. The oldest known breeding female was 10 years.

MANAGEMENT

Regulatory Authority

In order to implement International treaties for the protection of migratory birds, the federal government has the overriding responsibility for establishing migratory bird hunting seasons. State input is through Flyway Councils, which administratively organize the 50 states into an Atlantic, Mississippi, Central and Pacific Flyway. States must select seasons within the federal proposed guidelines.

Past and Current Management

Special mention of Barrow's Goldeneye was made in the 1986 MDIFW Waterfowl Management Plan, noting that their occurrence in Maine's fall and winter waterfowl population was regular but the size and distribution of the population was not well known. It was suggested that further study was needed to define the size and distribution of the Barrow's Goldeneye population in Maine and that if localized concentrations were identified, regulation of harvests in local areas may be desirable.

The eastern North American population of Barrow's Goldeneye is thought to be composed of approximately 4,500 birds, most of which winter in Quebec and along the Gulf of St. Lawrence (Canadian Wildlife Service 2000a). The number of Barrow's Goldeneye wintering in all of Atlantic Canada and Maine rarely exceeds 400 birds (Daury and Bateman 1996, Canadian Wildlife Service 2000a). Important wintering areas in Atlantic Canada and Maine include: Annapolis, Pictou and Pugwash, Nova Scotia; Cocagne, Dalhousie and Shediac, New Brunswick; Oyster Bed Ridge, Roxbury,

and West River, Prince Edward Island; and the lower Penobscot River, Kennebec River, Belfast and Freeport, Maine. Dalhousie, New Brunswick has been identified as the most important site in New Brunswick, followed by Shediac (Daury and Bateman 1996).

Recent studies and surveys by the Canadian Wildlife Service have shown that some of the Barrow's Goldeneyes wintering along the St. Lawrence corridor breed along the north shore of the St. Lawrence Estuary and Gulf (Canadian Wildlife Service 2000a, Robert et al. 2000). Breeding pairs are surveyed annually in Quebec during surveys conducted by the Black Duck Joint Venture (Bordage 2001). Trends in the number of breeding pairs have been variable (Appendix I).

Currently the Barrow's Goldeneye is listed as a species of special concern by MDIFW in Maine. This species was also designated a species of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in November, 2000. Quebec has hunting regulations designed to protect Barrow's Goldeneye during the hunting season. The season has been shortened (closes October 21 in District E) and the daily waterfowl bag limit is 6, but only 3 can be goldeneyes (Canadian Wildlife Service 2000b).

HABITAT ASSESSEMENT

Wintering areas need to be studied in terms of physical structure and food availability and use of wintering sites needs to be documented in relation to tide and ice conditions (Savard and Dupuis 1999).

Fishless lakes have been identified as an important habitat for both breeding Barrow's and Common Goldeneye. Maine has approximately 5,782 lakes totaling 987,299 acres. MDIFW recently surveyed 1,892 lakes in Maine, totaling 926,173 acres (approximately 1/3 of the total number of lakes) and has identified 32 fishless lakes/ponds in the state (Appendix III). Given that Barrow's Goldeneye have recently been found to be breeding in Quebec, it is not inconceivable that they may be breeding in northern Maine, or could someday expand their breeding range into northern Maine. Conservation of fishless ponds potentially could benefit both Barrow's and Common Goldeneye.

Continued coastal development is likely to impact the quality of habitat for both wintering and breeding waterfowl populations. Maine's shoreland zoning ordinances should help reduce impacts of timber harvesting on potential Barrow's Goldeneye breeding habitat in Maine.

POPULATION ASSESSMENT

From 1977 to 1994, 585 wintering Barrow's Goldeneye were recorded in Maine, for an average of 33 birds per year (Daury and Bateman 1996). In 1999 (Moore et al. 2001) and 2000 (Hodgman et al. 2002), MDIFW conducted surveys for wintering Barrow's Goldeneyes at 303 coastal and riverine sites. Forty-eight coastal sites and 26 riverine sites were surveyed in 1999 and 172 coastal and 57 riverine sites were surveyed in 2000. A total of 30 Barrow's Goldeneye were seen at 7 sites in 1999 and 99 Barrow's Goldeneye at 12 sites were seen in 2000 (Appendix IV). Densities at each site appear to change during the season. Sites in Freeport, Belfast, and Orono were identified as concentration areas. Subsequent observations since 2000 yielded flock sizes up to 60 birds on the Penobscot River during fall migration, and a flock of 15-25 birds in outer Jericho Bay (A. Weik pers. commun.).

Nearly all of the eastern population of Barrow's Goldeneye winter in Quebec (approximately 3,500 – 4,000 individuals). There are no consistently collected data to document a trend, but Canadian biologists speculated the population declined during the last century and that it could still be declining (Savard and Dupuis 1999, Canadian Wildlife Service 2000a). Because this population concentrates in a few wintering areas, it may be vulnerable to oil spills or other disasters. In addition, because the population is low, even a small continuous harvest could impact the population (Canadian Wildlife Service 2000a) if the harvest *rate* (i.e., proportion of the population that is killed) is sufficiently high. Potential recovery of local populations could be slow because females do not breed until their second year or later, they are single brooded, and they are

highly philopatric to their natal area (Eadie et al. 2000). In addition, availability of nest sites could be a limiting factor.

USE AND DEMAND ASSESSMENT

Estimates of annual Common Goldeneye harvests in Maine have stayed relatively stable, with a slight drop since 1996 (Appendix V). Mid-winter inventory numbers appear to be stable as well (Appendix VI). Numbers of Barrow's Goldeneye wings from Maine submitted to the USFWS' Waterfowl Parts Surveys (1962-1996) have ranged from 0-7 birds per year, with an average of 1.5 birds per year. In contrast, Common Goldeneye submissions during 1961-2000 ranged from 12-111 birds per year, with an average of 43.8 birds per year. These differences could be attributed to differences in population sizes.

In 2000, MDIFW conducted a survey of migratory bird hunters. 272 people responded to the survey. Of these respondents, 118 (43%) hunted primarily ducks. Of those that hunted primarily ducks, 41 (34%) said they hunted goldeneye. Only 14% (6) of goldeneye hunters indicated that they shot 1-3 Barrow's. Ten (24%) people did not know if they had shot any Barrow's Goldeneye. Unfortunately, this survey did not target primarily waterfowl hunters, so these estimates of demands for goldeneye hunting could be low.

SUMMARY AND CONCLUSIONS

The Barrow's Goldeneye is a medium-sized diving duck that is one of three species classified in the genus *Bucephala*. More than 90% of the world's population of Barrow's Goldeneye breeds from central Alaska to northern California, however there is a small population (≈4,000 birds) that is concentrated along the St. Lawrence estuary. Barrow's Goldeneyes breed on alkaline and freshwater lakes as well as subalpine and alpine lakes, beaver ponds and small sloughs. Fishless lakes are preferred. Pairs form during winter-early spring and may reunite on the wintering grounds. Pairs migrate to breeding areas in late March or April. Males defend breeding territories and females defend brood territories, both of which appear to be food related. Breeding in eastern North America has only recently been confirmed in Quebec. Barrow's Goldeneyes are not known to breed in Maine but a small proportion of the Canadian population winters along the Maine coast. The Barrow's Goldeneye is listed as a species of special concern in both Canada and Maine.

There is much that we don't know about the eastern population of Barrow's Goldeneye. Studies in Canada are beginning to identify important breeding, molting and wintering areas. Further information on wintering populations, particularly philopatry and movements between wintering areas, needs to be gathered in the southern wintering range, including Maine.

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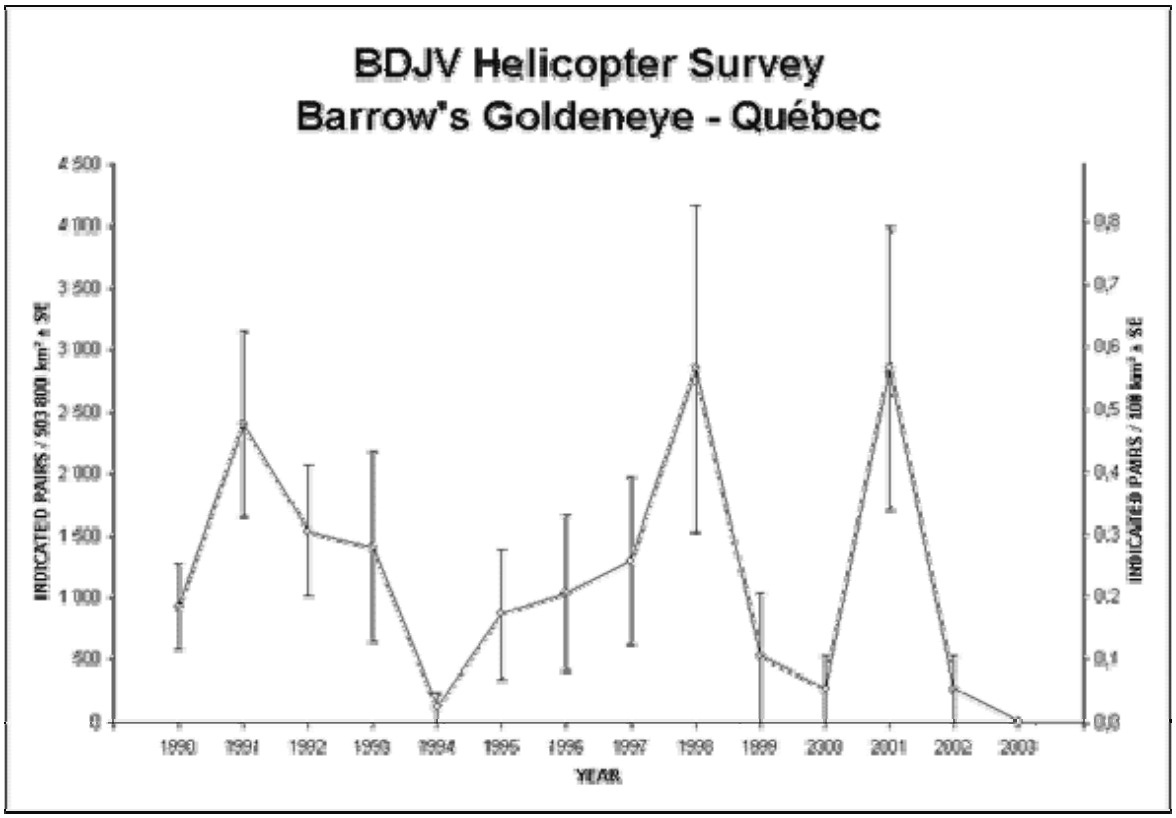
Appendix I



Trends in Common and Barrow's Goldeneye breeding populations in Southern Quebec. Figure from Bordage (2001)

Appendix II

Fishless lakes and ponds in Maine.

Lake Name	**Lake Code**	**Town**
Cole Pond	3782	Paris
Dead Pond	9691	Poland
Hubbard Pond	3162	Porter
Little Pond	5580	Fryeburg
Speck Pond #1	3490	Norway
Speck Pond #2	3492	Norway
Sunken Pond	9679	Sanford
Silver Lake	5676	Phippsburg
Caesar Pond	5258	Bowdoin
Mud Pond	5788	Turner
Pike Brook Pond (East)	9819	T18 MD BPP
Horseshoe Pond	9823	T18 MD BPP
Duck Pond	4474	T22 MD
Unnamed Pond	9633	Aurora
Kerosene Pond	0219	T20 MD BPP
Dead Pond	1180	T25 MD BPP
Rocky Lake	1182	T25 MD BPP
Black Brook Pond (1st)	1188	T19 MD BPP
Black Brook Pond (2nd)	1189	T19 MD BPP

North Pond	3284	Grafton TWP
Fernald Pond	0100	Pierce Pond TWP
Douglas Pond	5044	Kibby TWP
Hill Pond	2460	T04 R05 NBKP
Crater Pond	0468	TB R11 WELS
Lake Cowles	2030	Mt. Katahdin TWP
Davis Pond	2032	Mt. Katahdin TWP
Chimney Pond	2046	Mt. Katahdin TWP
Klondike Pond	2050	Mt. Katahdin TWP
Unnamed Pond	8385	T03 ND
Saddlerock Pond	9662	TB R11 WELS
Mud Lake	1866	Caswell PLT
Johns (Jones) Pond	9468	T12 R13 WELS

Sample	**Mean Size (acres)**	**Std Deviation**
All Lakes	170.10	1364.66
Surveyed Lakes (minus Region G)	474.11	2407.45

Appendix III

Barrow's Goldeneye observed during surveys of coastal and riverine sites in Maine (1999, 2000).

Year	Visit 1	Visit 2	Visit 3	Total
1999	9	12	9	30
2000	44	50	5	99
Totals	53	62	14	129

Sites occupied:

1999

Bradley/Orono – Penobscot River

Fairfield – Kennebec River

Harrington – Pleasant River

Jonesboro – Chandler River

Jonesport – Englishman Bay

Lamoine – Jordan River

Roque Bluffs – Englishman Bay

2000

Brooklin

Stockton Springs

Belfast

Phippsburg

Harpswell

Freeport

Yarmouth

Naples

Falmouth

Biddeford

Kennebunk

Wells

Appendix IV

Maine Waterfowl Harvest Statistics (1961-2000)

Year	Maine Harvest of Common Goldeneyes
1961-65 (mean)	2240
1966-70 (mean)	2380
1971-75 (mean)	2040
1976-80 (mean)	3040
1981-85 (mean)	4040
1986-90 (mean)	2940
1991-95 (mean)	1720
1996	2000
1997	830
1998	775
1999	889
2000	655 (preliminary)

Appendix V

Mid-winter Waterfowl Survey data for Common Goldeneye in Maine (1995-2001)

Year	Total Recorded by Year
1995	6424
1996	3776
1997	5429
1998	4543
1999	7416
2000	3392
2001	2510