

Distribution and Conservation of the Harlequin Duck, *Histrionicus histrionicus*, in Greenland

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The breeding range of the Harlequin Duck (*Histrionicus histrionicus*) in Greenland includes West Greenland to as far north as 72° 30' N and a few sites in East Greenland. The breeding population is guessed at a few thousand pairs. During winter Harlequin Ducks occur along the West Greenland coast between Maniitsoq and Nanortalik. The size of the winter population is unknown. As Canadian males, which have moulted in Southwest Greenland, also winter there, perhaps accompanied by females and juveniles, the numbers may be considerable. The peak period for clutch initiation seems to be mid- to late June. There is no immediate conservation concern for the small breeding population of Harlequin Ducks in Greenland. However, there is a risk from marine oil spills along coasts where congregations of non-breeding Harlequin Ducks from both Greenland and eastern Canada occur.

Key Words: Harlequin Duck, *Histrionicus histrionicus*, Greenland, breeding status, winter status, conservation, threats, local use.

Within the Atlantic range of the Harlequin Duck (*Histrionicus histrionicus*) there are three disjunct breeding areas: Iceland, Greenland, and eastern Canada (Boertmann 1994; Robertson and Goudie 1999; Petersen 2000). The breeding populations in these three areas are apparently small, but the size has been estimated only for Iceland with 2000-3000 pairs (Petersen 1998). The non-breeding range includes the Atlantic coasts of Iceland, Southwest Greenland and Canada/USA between Newfoundland and Maryland (Vickery 1988; Boertmann 1994; Robertson and Goudie 1999; Petersen 2000). Compared to the apparently hundreds of thousands of non-breeding Harlequin Ducks along the Pacific coasts of North America (see Robertson and Goudie 1999), the known numbers in the North Atlantic are two orders of magnitude lower; for example, only 1800 birds were recently estimated to winter in eastern North America (Mittelhauser 2000*).

The eastern Canadian population is considered endangered (Goudie 1991). It was recently discovered that males from that population migrate to moulting grounds in West Greenland (Brodeur et al. 1999a, 1999b*, 2002). This discovery, in combination with the results of an aerial survey of moulting Harlequin Ducks in July 1999 in West Greenland (Boertmann and Mosbech 2002), suggests that an update of the species' occurrence in Greenland would be desirable. Previous knowledge on this occurrence was published in several more or less comprehensive works (Oldenow 1933; Salomonsen 1950, 1967, 1974, 1981; Boertmann 1994). The updated information on breeding and winter occurrence is summarised here, while information on moulting birds in Greenland was reported by Boertmann and Mosbech (2002).

Material

At the Zoological Museum of Copenhagen (ZMUC) 194 Greenland specimens of Harlequin Ducks were studied in order to determine phenology, breeding and winter distribution, etc. Of these, eight chicks (Table 1) and 155 full-grown individuals (Table 2) are adequately labelled to be included in the present analysis. Additional information was derived from ZMUC's egg-collection (Table 2) and bird-banding files. However, only ten Harlequin Ducks have been banded in Greenland, all in the period 1946-1969 (Salomonsen 1979). Historical and local information was compiled from the literature, inquiries of people in Greenland and the extensive correspondence of the late Finn Salomonsen (in ZMUC). Finally, opportunistic observations of Harlequin Ducks made during surveys and fieldwork by other biologists and myself in Greenland since 1985 are included. Locations and areas mentioned in the text are indicated on the map (Figure 1).

Results

In West Greenland, breeding has been confirmed only 23 times at 18 different sites (Table 1). At 19 other sites birds have been recorded in similar habitats, but without definite proof of breeding (Table 1). In West Greenland breeding and potential breeding records are distributed from Nanortalik District at 60° N to southern Upernavik District at 72° 30' N (Figure 1). Half the breeding and potential breeding records are from Paamiut, Nuuk and southern Maniitsoq Districts. In East Greenland breeding has been proven at two sites (Figure 1): in the extreme south (Knudsen 1935) and near Tasiilaq Town (Helms 1926). In 1992 a pair was observed near Skjoldungen, between those two

TABLE 1. Observations of breeding and potentially breeding Harlequin Ducks in Greenland.

Date	Type	District	N lat.	Elevation	Source
Confirmed breeding records					
Unknown, before 1920	Nest found	Uummannaq	71°	unknown	Bertelsen 1921
Unknown ca. 1980	female with chicks	Sismiut	67°	<50 m asl	O. Vognsen pers. comm.
6 June 1902	6 eggs	Nuuk	64°	unknown	ZMUC
23 June 1900	4 eggs	Nuuk	64°	unknown	ZMUC
27 June 1927	7 eggs	Nuuk	64°	unknown	ZMUC
4 July 1879	1 egg	Uummannaq	71° 30'	unknown	ZMUC
9 July 1974	5 newly hatched chicks	Paamiut	61°	<100 m asl	Boertmann 1979
24 July 1926	6 chicks, age unspecified	Tasiilaq	60°	unknown	Knudsen 1935
Late July 2001	2 clutches, 4 and 7 chicks	Nuuk ^b	64°	at sea	F. Wille pers. comm.
August 1879	2 chicks < 1 week old	Disko Island	69°	unknown	ZMUC
1 August 1947	2 chicks ringed	Nuuk	64° 30'	<50 m asl	ZMUC
3 August 1950	1 chick ringed	Uummannaq ^a	71° 30'	< 50 m	ZMUC
14 August 1905	small chick	Tasiilaq	66° 45'	unknown	Helms 1926
16 August 1955	6 chicks ringed	Uummannaq ^a	71° 30'	<50 m	ZMUC
19 August 1970	5 chicks	Upernavik	72° 30'	<50 m	E. Isakson in litt.
23 August 1919	4 chicks, < 1 week old	Maniitsoq	66° 30'	unknown	ZMUC
Late August 2001	3 large chicks	Nanortalik	61°	<100 m asl	B. Persson in litt.
3 September 2003	2 chicks	Nuuk ^b	64°	sea level	K.E. Kleist in litt.
5 September 1989	3 large chicks	Uummannaq ^a	71° 30'	at sea	Bennike 1990
8 September 1893	1 large chick, nearly fledged	Paamiut	62°	unknown	ZMUC
10 September 1918	1 chick, 1-2 weeks old	Maniitsoq	66° 30'	unknown	ZMUC
12 September 1904	4 large chicks, not yet fledged	Tasiilaq	66° 45'	unknown	Helms 1926
19 September 2003	1 large chick, not yet fledged	Disko Island	70°	at sea	A. Mosbech pers. comm.
Potential breeding records					
6 June 1978	2 pairs at river	Disko Island	69°	sea level	Kampp and Kristensen 1980*
1960-1970	Pairs seen regularly	Sismiut	67°	sea level	P. Grossmann pers. comm.
1985	3 or 4 pairs at river	Maniitsoq	66° 30'	50 m asl	Secher et al. 1987
5 July 1992	Pair at river	Maniitsoq	65°	sea level	own observation
1996	Pair at river	Maniitsoq	65°	100 m asl	P. Aastrup pers. comm.
May 1954	Pair	Nuuk	64°	unknown	ZMUC
1990	2 or 3 pairs at river	Nuuk	64°	250 m asl	P. Aastrup pers. comm.
1990	Pairs seen regularly at river	Nuuk	64°	300 m asl	P. Aastrup pers. comm.
28 June 2003	1 male and 5 females on river	Nuuk	63°	sea level	L. Vilhelmsen pers. comm.
1990-1998	Pairs seen regularly at river	Paamiut	62°	<100 m asl	B. Knudsen pers. comm.
1995	Pair seen at river	Paamiut	62°	<150 m asl	B. Knudsen pers. comm.
1990-1998	Pair seen regularly at river	Paamiut	62°	<150 m asl	B. Knudsen pers. comm.
20 June 1985	5 pairs at river mouth	Paamiut	61° 30'	sea level	own observation
23 June 1985	2 pairs at river	Paamiut	61° 30'	25 m asl	own observation
1988-1999	Several pairs at river mouth	Paamiut	61°	sea level	several sources ^c
1988	Pairs at river mouth	Paamiut	61°	sea level	F. Wille pers. comm.
12 June 1935	Pair shot	Narsaq	61°	unknown	ZMUC
20 May 1908	Male shot	Nanortalik	60°	unknown	ZMUC
31 July 1992	Pair seen	Tasiilaq	63° 30'	sea level	J. Rosing pers. comm.

^a same locality, ^b same locality, ^cK. Kampp personal communication, B. Knudsen personal communication, F. Wille personal communication.

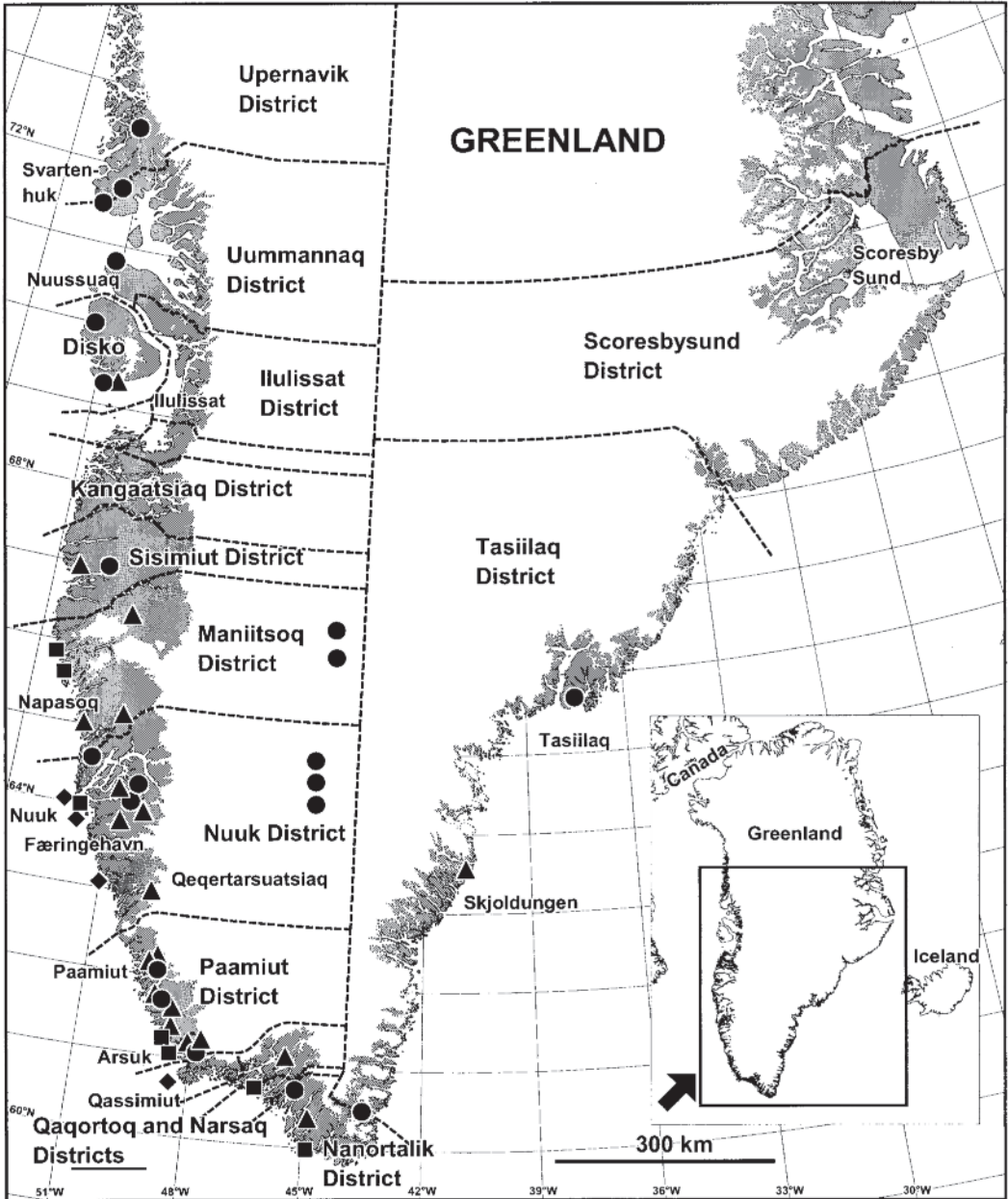


FIGURE 1. Distribution of breeding, probable breeding and winter records of Harlequin Ducks in Greenland: ● = confirmed breeding records (dots placed to the right (on the Inland Ice), represent records which only can be located to a district.), ▲ = records from potential breeding habitats, ■ = winter records from the literature, local knowledge and the skin collection in Zoological Museum, Copenhagen, ◆ = winter records made during surveys for Common Eider, *Somateria mollissima*, in March 1999 (aircraft) and March 2000 (boat) by National Environmental Research Institute, Denmark and the Greenland Institute of Natural Resources. Dotted lines are district borders. Danish names of towns are: Ilulissat = Jakobshavn, Sisimiut = Holsteinsborg, Maniitsoq = Sukkertoppen, Nuuk = Godthåb, Paamiut = Frederikshåb, Qaqortoq = Julianehåb, Tasiilaq = Ammassalik.

sites (J. Rosing, personal communication). Farther north in East Greenland a few birds have been observed or collected in the Scoresbysund District at 70°30' N and 68° N, but only in marine habitats (Pedersen 1930; Andersen 1981*).

The breeding habitats are mainly found at elevations below 150 m above sea level. However, some records from higher elevations inland are reported from the Nuuk District (Table 1). At three sites females with chicks were observed at sea near river outlets (Bennike 1990; A. Mosbech, personal communication; F. Wille, personal communication).

The winter observations and 35 specimens collected between November and March were all from between Maniitsoq and Nanortalik in West Greenland (Table 2; Figure 1). Most observations were from Nuuk and Paamiut Districts, and the southern part of Paamiut District near Arsuk seems to be a preferred area in winter (Helms 1893; H. Korning, personal communication; B. Knudsen, personal communication).

The earliest birds from inland fjord habitats away from the winter sites were collected on 3 May at Arsuk and on 20 May in Nanortalik District. Harlequin Ducks have been recorded in freshwater habitats on 14 May (Knudsen 1935) in extreme South Greenland and on 6 June on Disko Island in central West Greenland (Kampp and Kristensen 1980*). Near Arsuk many paired birds were observed at a river outlet in a fjord on 10 June and 18 June (K. Kampp, personal communication). Spring migration has only been reported twice: A pair flew into the fjord at Nuuk on 24 May 1999 (M. Kviesgaard, personal communication) and eight birds (two males, six females/immatures) flew north at Ilulissat town on 17 June 1999 (E. Mogensen, personal communication).

Discussion

Breeding birds

Most of the breeding and probable breeding records are from Paamiut, Nuuk, and southern Maniitsoq Districts. It is reasonable to assume that this reflects higher breeding density in these districts, although the data could be biased by the fact that the human populations are larger there, particularly in Nuuk (the capital of Greenland). The apparently very low breeding density in the southern districts of Qaqortoq, Narsaq and Nanortalik seems to be real, as this region also has a relatively large human population. From central Maniitsoq and northwards there are very few records, and large areas seem to be devoid of Harlequin Ducks. For example, none were observed in suitable areas in interior parts of Kangaatsiaq District despite extensive ornithological fieldwork there (Fox and Stroud 1981*; Fox et al. 1991*; C. Glahder, personal communication). Large parts of Uummannaq District also seem unsuited to Harlequin Ducks due to the extreme alpine topography. The breeding population in East Greenland is apparently very small and restricted to a few sites. However, human activity is also very limited in this part of Greenland, and breeding pairs could be widely dispersed, as indicated by the observation at Skjoldungen. The few records in Scoresbysund District could be of breeding birds from interior parts of the fjord system or, alternatively, stragglers from Iceland.

The Harlequin Duck's total breeding range in West Greenland covers about 50 000 km² (below 300 m asl), where rivers and streams are numerous. Only small parts of these rivers seem to be utilised by Harlequin Ducks. Many rivers are probably avoided due to the turbid melt-water draining from the inland ice or local glaciers, but others with clear water also fail to attract

TABLE 2. Summary of 155 study skins of full grown Harlequin Ducks collected in Greenland and kept in Zoological Museum of Copenhagen. (ads = adults; imms = immatures; juvs = juveniles; n.a. = not aged).

Month	Males			Females			n.a	Total	Total with location	Districts
	ads	imms	juvs ^a	ads	imms	juvs ^a				
January	6	1	-	0	0	-	0	7	3	Man, Nuuk
February	8	1	-	1	0	-	1	11	1	Nuuk, Pam, Nan
March	6	0	-	1	0	-	0	7	0	Nuuk, Qaq
April	9	0	-	0	0	-	0	9	1	Nuuk, Pam
May ^b	7	0	-	2	1	-	3	13	6	Man, Nuuk, Pam, Qaq
June ^b	19	8	-	2	5	-	0	34	18	Sis, Man, Nuuk, Qaq, Pam, Tas, Sco
July	7	2	-	3	6	-	0	18	12	Dis, Man, Nuuk, Tas
August	14	1	1	0	0	-	3	19	15	Dis, Sis, Man, Nuuk, Tas
September	11	0	0	3	1	3	3	21	15	Ilu, Sis, Man, Nuuk, Pam, Tas
October	2	0	0	0	0	1	3	6	2	Man, Nuuk, Pam, Qaq
November	3	0	2	1	0	1	0	7	1	Man, Nuuk
December	2	0	0	0	0	1	0	3	0	Nuuk, Nan
Total	94	13	3	13	13	6	13	155	74	

^aonly first calendar year birds; after 31 Dec. listed as immatures, ^b includes a pair from a breeding habitat. Districts: Ilu = Ilulissat, Dis = Disko Island, Sis = Sisimiut, Man = Maniitsoq, Nuuk = Nuuk, Pam = Paamiut, Qaq = Qaqortoq (incl. Narsaq), Nan = Nanortalik, Tas = Tasiilaq, Sco = Scoresbysund

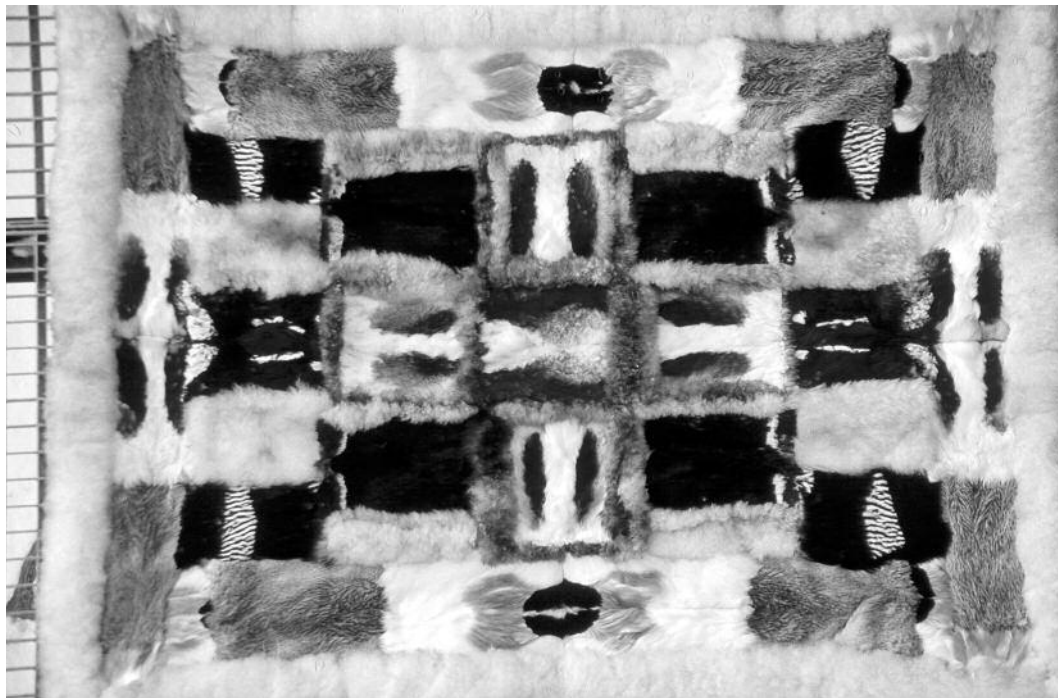


FIGURE 2. Bird skin rug from Qassimiut in Qaqortoq District. The border is made from Common Eider skins, where feathers are removed and down layer is intact. The pattern is made up from head and/or neck skins of Common Eider (both male and female), Common Loon, Mallard (male), Long-tailed Duck (male) and Harlequin Duck (male).

Harlequin Ducks. In Iceland and Canada food abundance seems to limit the breeding populations (Bengtson and Ulfstrand 1971; Bengtson 1972; Rodway 1998), and it is possible that production in many Greenland rivers is insufficient, perhaps related to the low water temperatures. This could also explain why most breeding records are from inland sites where the climate is more continental, with more sunny days and higher temperatures than in areas closer to Davis Strait. Another factor that helps explain the paucity of breeding records is the fact that people in Greenland travel mostly by boat along the coasts, and rarely venture far inland except when hunting Caribou, *Rangifer tarandus*, in August and September. The size of the breeding population of Harlequin Ducks in Greenland is undoubtedly small, and an educated guess may be a few thousand pairs.

Wintering birds

Winter records (Figure 1) are all from the region where open water is reliably available in winter. In this region the probability of sea ice being present in February and March, when ice cover is most extensive, is less than 50%, and when the ice eventually does occur the coverage is usually low (Valeur et al. 1997*). The wintering birds consist of the local breeding population (although no definite proof is available)

and of the eastern Canadian breeding population. The latter were confirmed by a few signals in December to April from three birds equipped with satellite transmitters in 1998 (Brodeur et al. 2002). It is uncertain, however, how many Canadian males actually winter in West Greenland. In 2001 males were tracked by satellite from winter quarters in Maine to moulting sites in Greenland (G. Mittelhauser and M. Robert, personal communication). Thus, at least some males may leave Greenland after moulting. Females and juveniles usually join the males at non-breeding sites (Robertson and Goudie 1999), where courtship behaviour and pair formation take place in the autumn (Gowans et al. 1997; Robertson et al. 1997). These activities have not been confirmed for Canadian males in West Greenland. An observation of four females or juveniles migrating 40 km off the coast of Paamiut on 12 October 1993 (Boertmann and Mosbech 2001*) could have been Canadian birds on their way to Greenland.

The number of wintering Harlequin Ducks in Greenland is unknown, but an estimated 5000-10000 males moult in West Greenland (Boertmann and Mosbech 2002). The low numbers estimated to winter in eastern Canada and the USA imply that only a portion of the moulting Canadian males return there for the winter. If females and juveniles join the remaining males

in Greenland, the winter population there may be substantially augmented. Even without the Canadian females and juveniles, the coasts of southern West Greenland are, at least during the moulting season, extremely important to the survival of the breeding populations of Harlequin Ducks in both eastern Canada and Greenland.

Breeding phenology

The few observations indicate that Greenland Harlequin Ducks arrive at or near the breeding habitats during May and June, and generally later at northern than at southern sites.

Early clutches seem to be initiated around 1 June and the majority apparently later in June, assuming a maximum egg-laying period of 10 days, an incubation period of 28 days and a fledging period of 6 weeks (Bengtson 1972; Cramp and Simmons 1977). Observations of chicks in mid- and late September show that some clutches are initiated as late as mid-July (Table 1). Spring observations of migrating birds and birds staging at Arsuk suggest that mid- or late June is the peak initiation period. However, clutch initiation probably varies with both latitude and elevation of the breeding location and also among years due to climatic fluctuations. Compared to other sites, timing in Greenland seems essentially similar to that reported from Iceland in the 1960s (Bengtson 1972), and somewhat earlier than reported from northern Labrador in 1996 (Rodway 1998).

Local knowledge and use

The Greenlandic name of the Harlequin Duck, "Toornaviarsuk," derives from "Toornaq" which is an assisting spirit in Greenlandic mythology. "Toornaviarsuk" may then be translated as "a funny little spirit". It gives an impression of a mysterious and intangible creature (Salomonsen 1974), encountered only in waters that are difficult to navigate or at remote inland sites.

Many sites in Greenland are named after birds or mammals. Only one site named after the Harlequin Duck has been located during this study. A small island near Qeqertarsuaq is called Toornaviarsuit, the plural form of "Toornaviarsuk". This site is exposed to the open sea and is typical moulting and wintering habitat for Harlequin Ducks. On 21 July 1999 a flock of 20 moulting Harlequin Ducks were observed at this island during an aerial survey (Boertmann and Mosbech 2002).

In a few settlements in West Greenland traditional birdskin rugs still are manufactured. These are mainly made from eiders, but ornamental skin parts from other species such as Common Loon (*Gavia immer*), Mallard (*Anas platyrhynchos*) and Long-tailed Duck (*Clangula hyemalis*) often are included. In rugs from the settlement Qassimiut in Qaqortoq District head and neck skins of male Harlequin Ducks (in alternate plumage) sometimes appear (Figure 2), despite the fact that the species is fully protected in Greenland.

Conservation and Threats

The Harlequin Duck was given full protection in Greenland in 1963, because the breeding population was considered too small to withstand increasing international demand for eggs and birds to stock aviculture holdings and zoological gardens (Salomonsen 1967). Nevertheless, Harlequin Ducks are shot occasionally, either for consumption or to obtain the skin (see above). Harlequin Ducks are particularly vulnerable to increased adult mortality (Goudie et al. 1994), but the number killed in Greenland is very low and probably insignificant in terms of population impacts.

The construction of a hydropower plant south of Nuuk in 1993 dried out a river where several pairs of Harlequin Ducks had bred (Aastrup and Nygaard 1986*). Other hydropower plants are in the planning stages, some of them at rivers inhabited by Harlequin Ducks. These are among the few specific examples in Greenland where human activities have destroyed, or threaten to destroy, bird habitat.

Marine oil spills are a serious threat to Harlequin Ducks (Lancot et al. 1999; Esler et al. 2000), and in West Greenland local breeding populations and the eastern Canadian breeding population are at risk. Half of the 200 000 tons of fuel oil shipped to Greenland annually is unloaded to a tank site at F  ringehavn at 63  45' N (J. Rosenberg, personal communication). This site is adjacent to very important Harlequin Duck moulting and wintering sites, holding up to 1000 males in July (Boertmann and Mosbech 2002). Offshore oil exploration drilling was carried out about 150 km west of Nuuk in 2000, and more such drilling is expected in the future. Oil spill trajectory modelling from the 2000 drill site predicted that oil would hit the Greenland coast somewhere between 62   and 68   N (Mosbech et al. 1996*). The southern part of this coastline (62   – 64   N) held about 70% (2488 birds) of the moulting male Harlequin Ducks recorded in July 1999 (Boertmann and Mosbech 2002).

The risk of by-catch of Harlequin Ducks in gillnets is probably low, as fisheries for Lump sucker, *Cyclopterus lumpus*, and Arctic Char, *Salvelinus alpinus*, take place mainly in fjords and sheltered bays away from the exposed Harlequin Duck habitats. However, the bycatch issue should be examined more closely.

Very few Harlequin Duck habitats are protected in Greenland. Two of the eleven sites in Greenland on the Ramsar List of Wetlands of International Importance (Ramsar Convention on Wetlands) include moulting and wintering sites for Harlequin Ducks, and an area protected mainly due to archaeological and botanical interests also includes a river with breeding Harlequin Ducks.

Future research

The general knowledge on ecology, distribution and abundance of the Harlequin Duck in Greenland is very limited. One of the most urgent research needs is to estimate the size of the breeding population. Once

such an estimate is available, it should be possible to determine the approximate size of the Canadian contingent among the moulting males in West Greenland. In turn, such a determination would contribute to efforts to estimate the eastern Canadian breeding population.

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