Steller's Eiders *Polysticta stelleri* wintering in Europe: numbers, distribution and origin



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Steller's Eider is among the most northern-living of duck species at all seasons. The recent decline of the species in North America has now increased the awareness of the population wintering in northern Europe. The size of this wintering population is estimated from the available information at 30- 50,000 birds, which suggests that the western population is now of the same magnitude as the eastern one that winters in the Pacific. The most important western wintering area extends from Varangerfjorden in north-eastern Norway to the ice-edge on the Kola coast in north-west Russia. Important winter areas have been found recently on the coasts of Lithuania and Estonia in the eastern Baltic. Recent information about breeding Steller's Eiders on the tundras of Taymyr, Yamal and Gyda peninsulas confirms the existence of a substantial population west of Khatanga, that migrates to the west and winters in North Atlantic and Baltic waters.

Keywords: Steller's Eider, Population Size, Distribution, Wintering, Breeding

Reports of serious declines of the Steller's Eider Polysticta stelleri in the North American breeding and wintering grounds have led to serious concern about the population status of this species. The wintering population of Steller's Eider has suffered an estimated decline from c. 200,000 in the Alaskan peninsula, to less than 65,000, possibly closer to 30,000 in 1991 (Kertell 1991). The East Siberian breeding-population has earlier been estimated to be c. 500,000 birds (Uspenski 1972), to 400,000 or less (Palmer 1976). Recent estimates are much lower, between 30,000 and 100,000 (Kertell 1991), but the two first estimates were based on few data. Steller's Eider has disappeared from much of its breeding-range in Northern America, such as the Yukon-Kuskokwim Delta, Alaska (Kertell 1991). This led to the duck being considered for listing as an endangered species (Harrison 1991). The conclusion of an official US Fish and Wildlife Service appraisal was to award the species Category 1 threatened status, which is the stage before a species is listed as threatened (US Dept. of Interior 1992). 140

It has long been known that a small population of Steller's Eider winters in Varangerfjorden in eastern Finnmark (Collett 1894). Haftorn (1971) mentions flocks of up to 400 individuals in the harbour of Vadsø (70°22' N, 31°06'E) on the Varanger Peninsula, northern Norway, but made no estimate of total numbers. Recent counts (Frantzen 1985, Frantzen & Henriksen 1992, Henriksen & Lund 1994) have revealed that up to 12,500 Steller's Eider stay in the Varangerfjord in winter. Nygård et al. (1988) in an account of the wintering marine ducks in Norwegian waters, found that Varangerfjorden is the only wintering area of importance in Norway. Only scattered small flocks and single individuals have been found elsewhere.

Until recently, Varangerfjorden was the only known important wintering ground of the species in Atlantic waters. Increased efforts in the midwinter counts co-ordinated by the International Waterfowl and Wetlands Research Bureau (IWRB) and the Nordic Collegium for Wildlife Research (NKV) have shown that the Baltic Sea also holds significant numbers of wintering Steller's Eiders. In March 1994, a team of Norwegian and Russian ornithologists found large numbers along the north shore of the Kola peninsula and Murman coast during a helicopter survey. The data from this survey are included in this report; they substantially increase the estimate of the number of wintering Steller's Eider in Europe (Nygård *et al.* 1988), and of the size of the entire western population (Rose & Scott 1994).

This paper attempts to assess the numbers and distribution of birds that winter in north-western Europe. We also present recent evidence which implies that this western population may well constitute a discrete breedingpopulation, disjunct from the one breeding in east Siberia and northern Alaska. If so, its conservation status should be reconsidered.

The wintering population

The main winter distribution of Steller's Eider in Europe is shown in **Figure 1**. **Table 1** shows the numbers counted in different countries each year, and population estimates for each country are given in **Table 2**.

Norway

Varangerfjorden has been censused as part of the international midwinter counts since 1980; the numbers of birds found here have varied between 4.147 and 12,557 in years with complete counts (Table 1). Only scattered flocks have been observed elsewhere. Vardø (70°22'N, 31°06'E), a town at the northwestern side of the Varangerfjord, seems to be the normal limit of the Steller's Eider's winter range, although flocks of up to 450 have been recorded as far west as Tanafjorden (28° 30'E), Berlevåg (29°E) and Kongsfjorden (29°30'E), where, 450 birds were seen on 25 March 1991 (Frantzen & Henriksen 1992). The vast majority of the birds are found on the northern side of Varangerfjorden. On the southern side. 391 birds were counted in March 1992 (Henriksen 1992) and, in March 1994, 469 were counted there; this is a minimum number, as the weather was poor, and not all the bays of the fjord

were counted. For detailed accounts of the Finnmark observations, see Frantzen (1985), Frantzen & Henriksen (1992), Henriksen (1992) and Henriksen & Lund (1994). A flock of variable numbers (max. 64 birds) stayed at Andenes, Andøya (16°E 69°N) from 10 March to April 1991 (Gustad 1993), which is the largest flock yet seen so far south in northern Norway.

Russia

Isakov (1970) estimated the total number of eiders along the Murman coasts and the White Sea in the winter of 1967 and 1968. Ground counts were made on 24 and 22 sites, and four and eight days of aerial surveys were conducted. The counts were classified as "very good". A total of 105,000 eider duck was counted, and he states "The majority of the wintering birds are Somateria mollissima". It was, however, impossible to determine the proportion of King Eiders Somateria spectabilis and Steller's Eiders in the flocks (eider females could not be identified to species from the aeroplane). Only a few identified Steller's Eider were found.

Karpovitch & Kester (1970), in a brief account of the ice-free waters of the White Sea, describe it as a wintering area of the Common Eider and King Eider, but do not mention the Steller's Eider. Alexander Golovkin (pers. comm.) saw a flock of 2-3,000 Steller's Eider in a bay on the Kola peninsula, east of Murmansk, some years ago. In April 1979, after severe ice-conditions, a flock of 2,000 Steller's Eider was observed in an area of open water around Seven Islands (68°N, 37°20'E) between the pack-ice (Y. Krasnov, pers. comm.).

The White Sea and its mouth are largely ice-covered during the months December to May, but there are certain ice-free areas (polynyas) all winter. There are some late winter reports of Steller's Eider from the mouth of the White Sea; 1,050 on 27 March 1968, 1,180 on March 1971 and 480 on 26 February 1977 (Kochanov 1979). In the ice-free straits off Velikovo Island in the Kandalaksha Gulf, five Steller's Eiders were observed in the winter of 1979-80 (Koryakin & Kondratyev 1983).



Figure 1. The main concentrations of wintering Steller's Eider in Europe.

2	Norway (Varanger fjorden)	Sweden ¹ (Aland Islands)	Finland	Estonia (Palanga)	Lithuania	Germany	Total in monitoring areas (rounded figures)	Norway (all other sites)	Finland (spring mig not added t	Russia ration, o Europe total)	Poland	Total counted in Europe
1069	South States	19	16									
1966		15	5		an							
1909		10	3		(11)				1			
1970		22	20		(L3)				21			
1971		15	6		(26)				11			
1073		10	11		(35)				14			
1973		40	22		(100)				80			
1975		56	24		(154)				70			
1976		70	45		(106)				141			
1977		130	69		(180)				308			
1978		95	98		(246)				481			
1979		140	152		(200)				312		19	
1980	1.350*	146	85		(400)		2,000*	0	309			2,000*
1981	6.131	60	95		(345)		6,600	1	287			6,600
1982	4,147	30	70		(400)		4,600	0	292			4,600
1983	4,574	105	110	18	n.d.		4,800*	4	850			4,800*
1984	10,925	100	113		n.d.		11,100*	5	334		0	11,100*
1985	12,553	225	70		(400)	2	13,300	4	362		9	13,300
1986	7,789	280	320		n.d.	3-4	8,400*	10	1,169		5	8,400*
1987	8,373	220	71		400(528)	1	9,100	6			65	9,200
1988	5,351	140		628	200(500)		6,300	2			18	6,300
1989	2,277*	285		524	350		3,400*	10			23	3,400
1990	5,761	135		2,000	670(800)		8,600	2			1	8,600
1991	7,533	95		830	600		9,200	450				10,000
1992	8,210			5,760	570		17,000	6		2,488		17,500
1993	6,398		60	2,630	650		10,300	393			1	10,500
1994	4,886			4,800	1500		11,000	1506		$c.16,000^2$		$28,500^{2}$
Trend	variable	increase	increase	increase	increase	?	variable- increasing	—	increase	?	?	increase

Table	1.	The numbers of Steller's Eider in the Euro	pean wintering area	as. Numbers in bold are	from midwinter monitoring areas
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*coverage incomplete. n.d. = no data. Figures in parentheses denote maximum numbers in one winter. ¹The numbers from Sweden are the combined figures for spring and autumn for each calendar year. ²Kola peninsula included.

Table 2. Estimates of the number of Steller's Eider wintering in the north-west Atlantic and Baltic waters in the early 1990s.

Population	estimate	Range of		
	(19905)	estimate		
Norway	10,000	6,000-15,000		
Russia	25,000	20,000-30,000		
Estonia	4,000	2,000-6,000		
Latvia	10	5-50		
Lithuania	800	500-1,500		
Poland	50	10-100		
Germany	<5	0-10		
Denmark	10	5-20		
Sweden	200	100-300		
Finland	200	100-300		
Other count	tries 10	10-50		
All countrie	s 40,000	30,000-50,000		

Some winter data from the small harbour of Dalnije Zelentsy, a marine biology research station of 69°N, 36°E on the Kola peninsula, are available. In the spring of 1965-66, 30 and 180 individuals were seen. In 1971, 520 birds were seen in March. In 1974, 500 were seen in the Dalnije Zelentsy bay (Kochanov 1979). A flock of c. 120 birds were seen in the mouth of the bay on 6 October 1992 (T. Nygård, pers. obs.). In 1992, a coastal stretch of c. 20 km in the Dalnije Zelentsy area was surveyed in late February and the beginning of March; 2,488 Steller's Eider were counted, of which 1,048 were adult males. They outnumbered both the Common and the King Eider on this small part of the Kola coast (A. Koryakin and T.D. Paneva, pers. comm). This indicated that the number of Steller's Eider wintering on the Kola peninsula might be larger than thought previously (Nygård et al. 1988).

The first comprehensive survey was accomplished finally in 19-23 March 1994, when Yuriy Krasnov, Andrej Kondakov, Per Jordhøy and Torgeir Nygård were able to survey the north Kola coast, from west of Gremikha bay (68°10'N, 39°10'E°), to Rybachi Peninsula (69°50'N, 32°30'E), including the mouth of the Kola bay. More than 16,000 Steller's Eider were counted from a helicopter. The birds were quite evenly distributed along the shore, the majority of the flocks being found in sheltered bays. The median flock-size was c. 25 birds, maximum 600. Including estimates for the areas not covered

(west of Rybachi peninsula, east of Sviatoj Nos, the mouth of the White Sea, and several inlets and bays in the mouth of Kola bay, that were not accessible during the survey due to military restrictions), the estimate for Russia without much doubt rises to 20,000. maybe as high as 30,000 (Nygård et al. 1995). Bjørn Bergflødt (pers. comm.) saw small flocks of Steller's Eider in open water around Vaigach Island $(70^{\circ}N, 60^{\circ}E)$ during a seal survey in February 1993, which indicates that the species may be found much further east in winter than thought previously. This should be investigated in future surveys.

Finland

Steller's Eider was common in Finland during spring migration around the turn of the century, disappeared later, but had returned by the 1960s. The best area seems to be around the remote islands of Lågskär, Åland (59°50', 20°00'E) which is usually free of sea-ice. It was first discovered here in the 1960s, and was seen regularly in flocks of tens of individuals through the 1970s. In the 1980s, the numbers rose to about 100 birds. In 1986, a record number of 320 birds was seen, the majority of them female-coloured. Some hundreds (in 1986 over 1,100) migrate east through the Finnish Bay during spring (middle to end of May, together with the mass migration of Long-tailed Ducks Clangula hyemalis) (Palmgren 1988, M. Hario and M. Pirkkola, pers. comm.).

Estonia

A wintering population of Steller's Eider on the coast of Estonia was first discovered in 1975 at Vilsandi State Nature Reserve of the large island of Saaremaa (58°20'N, 22°30'E) in southwestern Estonia. They arrive in October, and depart in May. Some birds (30-40 have been noted) may also summer. In 1990, 2,000 wintering Steller's Eiders were recorded. In 1992, a record number of 5,760 birds was counted, almost all of them on the west side of Saaremaa. In 1993, c. 3,000 were recorded. Small flocks have been recorded on the island of Hiiumaa, and occasionally on the mainland coast. There has been a steady increase in numbers in later years (Kuresoo 1988 and pers. comm., Kullapere 1990 and pers. comm.).

Latvia

The wintering waterfowl of the whole Latvian part of the Gulf of Riga were counted in January 1991. At Mérsrags, near the lighthouse, in a shallow bay of 1-2 m depth about 60 m from the shore, a small flock of Steller's Eider was observed. On 20 January 1991, one male and three females were counted, and six days later one male and six females were present. These are the first records from the Latvian coast (Stipniece 1992).

Lithuania

The first official record of Steller's Eiders in Lithuanian waters is from 1969. when 11 birds were observed late March (Petraitis 1991). The regular wintering place for the Steller's Eider is at Palanga (55°55'N, 21°05'E), a small town just north of Klaipeda, the major seaport of Lithuania. Here, on a sandy shore of about 30 km², they form large, compact flocks or even one large flock (Švažas & Vaitkus 1992). The numbers observed have increased steadily: in 1970-71 13 birds were seen, in 1973 100 and in 1979 around 400. The numbers were quite stable at around 4-500 during the 1980s, then rose to a temporary high of 800 in 1989-90 (Švažas et al. 1989, Petraitis 1991). A record high of 1,500 birds was observed in February 1994.

Poland

Tomialojc (1990) mentions 11 records of Steller's Eider in Poland from the previous century, and 13 records from 1945 to 1983; seven of these were from the middle part of the coast, and six from the municipal beach near Gdansk. On 4 March, 1979, a flock of 19 birds was seen here. There are no records from the winter of 1984. In 1985-1990, the species was regularly observed in the Gdansk area, mostly as single birds. In 1985, six observations were made with a maximum of nine birds; in 1986, three observations with a maximum of five birds; in 1987, seven observations with a maximum of 32 birds. In addition, a flock of 25 males and 40 females was seen at Władysławowo (54°50'N, 18°30'E), 40 km NNW of Gdansk. This is the largest record so far in Poland. In 1988, ten observations were made with a maximum of 18 birds; in 1989, 12 observations with a maximum of 23 birds; in 1990, one bird, and in 1992, one bird (Komisja faunistyczna 1988, 1989, 1990, 1991, 1992).

Germany

Very scarce, all records of single birds only. Klafs & Stubs (1979, 1987), give a full account of the observations up to 1984. Seven birds were seen in 1985-86, almost all from the Sassnitz-Rügen area. In the mild winters of 1988, 1989 and 1990, no Steller's Eider were observed (H. W. Nehls, pers. comm.).

Denmark

Lehn Schiøler (1926) reviewed the occurrence of the Steller's Eider in Denmark. Only a handful of observations were known to him, all of single birds. According to Malling Olsen (1992), 51 records of the species, involving 74 individuals have been recorded in historical times. A male Steller's Eider tried to pair with a female Mallard Anas platyrhynchos at Saltholm, Denmark in the late 1970s. Twelve or 13 Steller's Eiders were counted from the air at Bornholm on 28 February and 1 March 1985. Other flocks consisted of five birds at Mosede harbour, Sjælland, January-February 1977, and three at Stigsnæs, Sjælland on 18-25 February 1987 (Malling Olsen 1992). It is unlikely that more than ten birds winter in Danish waters annually, taking into account the intensity of observers here.

Sweden

Coverage by the Swedish midwinter counts has been quite extensive. The ice-free areas of the Swedish coast have been well covered yearly from 1967, with up to 1,700 sites being counted (Nilsson 1991) Therefore it seems unlikely that many birds have escaped attention taking into account their preference for

shallow areas. The Steller's Eider has always been very scarce on the midwinter (January) counts. It is given a great deal of attention whenever it occurs (Högström 1977). In the extremely cold winter of 1987, a record of 28 on Oland and 18 on Gotland was recorded (Nilsson 1987). However, adding the number of birds reported throughout the winter give higher numbers. In 1986, 280 birds were reported altogether (Palmgren 1988). However, it is probable that some of the birds were reported more than once.

Great Britain

There have been only 13 observations from the British Isles up to the mid 1980s, mainly in Scotland. The species was first recorded in Scotland on 5 January 1947, when two males were seen off Gairsay, Orkney. One male stayed at South Uist from 25 October 1974 to 1 July at Westray, Orkney. One male was seen at Vorran Island, South Uist from May 1972 through August 1984, and was seen on 13 April 1974 with two females. The species was recorded in 16 years between 1947 and 1983. Most of the records have been from the Orkneys (Thom 1986, Dymond *et al.* 1989).

North Atlantic

One male was seen at Berufir∂i, Iceland, 30 October to 19 November 1989 (Petursson *et al.* 1992), and one juvenile was reported from Nuuk (Godthåb), Greenland, on 24 November 1954 (Salomonsen 1967).

Sex and age of wintering birds

The proportion of juveniles wintering in Norway appears to be low. I. Iversen Båtvik (pers. comm.), who ringed Steller's Eider in the Varangerfjord in the 1980s, reported only 2% juveniles in his material. The sex ratio was checked in the Varanger stock in some of the years, but is difficult to assess with accuracy, as all the second-year birds will be in "female" plumage. However, considering the low percentage of juveniles found, the margins of errors ought to be small. The following percentages of adult males

were obtained: 1982: 47%, 1984: 55%, 1987: 56%, 1988: 53%, 1990: 52%. 1991: 59%, 1992: 48%, 1993: 53% and 1994: 52%. A small overall male bias (53 + /-6%) is clear; but the real bias is probably higher, since some juvenile males are classified as female-coloured. On the Kola peninsula in 1994, 50% of 5,000 birds that were sexed and aged from aerial photographs were adult males. In Lithuania, there was a female bias in the early 1970s; as the total numbers have increased, the numbers of both sexes have become nearly equal (Petraitis 1991). In Finland, the sex-composition of the flocks wintering in the Aland archipelago between 1968 and 1987 was close to equal, except for 1986 when nearly all of the record high number of 320birds were female-coloured (Palmgren 1988).

Breeding

There have been reports of breeding in Finnmark (Jourdain 1926, Bolam 1926, Blair 1936). So far none of these can be considered as proven, since eggs or ducklings have not been collected, these reports have been criticised for their lack of solid evidence (Robinson 1926, Schaanning 1926). Collett (1894)investigated material from a nest claimed to be that of the Steller's Eider, collected in 1878 on Ainov (Henö) islands in Russia , 31°30'E 69°30'N, not far from the Norwegian border. He recognised the abdominal feathers of the species in the material. Nordvi (1862) also records breeding Steller's Eider on Ainov, based on an egg collected from the area.

Uspenskii (1986), in his account of bird life in arctic Russia, does not include the Steller's Eider in his list of birds in the Russian high arctic, which covers Northern Novaya Zemlya, Franz Josef Land, Severnava Zemlva. Novosibirsk Islands, Northern Taymyr, Bennett and Wrangel Islands. In the tundra zone, he includes the Steller's Eider as part of the avifauna of Eastern Siberia, but not west of Khatanga (72°N, 102°E). It is classified as extremely rare in the Anabar tundras (110-120°E), rare in the Indigirka tundras (140-160°E), but absent from the Yamal and Yugorsk



Figure 2. A female Steller's Eider on a nest at the mouth of the Pyasina river, NW Taymyr, summer 1990. G. Nehls, photo.

peninsulas and eastern Bolshezemelskaya tundra (55-75°E), and on southern Novaya Zemlya and Vaigach Island. Dementiev & Gladkov (1952) report summer observations from the Yamal, but not on Belyi Island and Gyda Peninsula. They mention records from north-west Taymyr and Khatanga bay, but no nesting. On the southern island of Novaya Zemlya, in Bezymyannaya Bay, a pair was seen in breeding plumage in June, and a brood of flying young in September at Matochin Shar (Dementiev & Gladkov 1952). These observations from Novaya Zemlya, however, can not be regarded as proof of breeding. Uspenski (1970) does not mention the Steller's Eider in his brief account of breeding wildfowl in the arctic and sub-arctic regions.

Y. Krasnov (pers. comm.) caught a fledgling Steller's Eider around 1987 on the tundra opposite Seven Islands on the Kola peninsula. This is, so far, the most solid evidence for breeding in this area. Bianki (1991) reports that breeding of the Steller's Eider was recorded in Kandalaksha Bay in the White Sea in 1991, but gives no details.

Middendorf (1851) found two nests of Steller's Eider at Lake Taymyr in northwest Taymyr on 8 July 1843 (in Yesou & Lappo 1992). For unknown reasons, this is followed by a paucity of breeding records of more than a century. Proven evidence of breeding of the Steller's Eider west of Khatanga was obtained by joint German/Russian three WWF expeditions to Taymyr in the summers of 1989, 1990 and 1991. In 1990 and 1991, they found Steller's Eiders breeding (Figure 2), or gained evidence of breeding in several places. Two pairs bred at the mouth of the Lydia river, and a nest with seven eggs was found on 30 June 1990. On 1 July, at least 22 pairs were seen on North Beacon Island near Camp Lydia. Five pairs were seen at Sterlegova, and a clutch of five eggs was found in the Taymyr river delta (76°N, 100°E) on 21 July. Nests were also found at the Gusinava river basin and at the east shore of the Taymyr Bay. In 1991, three pairs were recorded north of Dickson (73°50'N, 86°E), and one pair was found on the Lenivaya river (Rogacheva 1992, Hötker 1993).

A nest was found by an international

expedition on a river bank north of Lake Taymyr on 17 July 1990, in the upper part of an estuary ($76^{\circ}02'N$, $99^{\circ}52'E$). Some days after, a second nest was discovered, a dozen kilometres further downstream, still on the riverbank in the north of the estuary ($76^{\circ}09'N$, $99^{\circ}45'E$). A third nest was found in the vicinity of Cape Sterlegova ($75^{\circ}30'N$, $89^{\circ}00'E$). In 1991, a nest was discovered in the river basin of Bolshaya Balakhina ($73^{\circ}36'N$, $104^{\circ}40'E$). Another was seen in the same year in the Kuldima valley ($75^{\circ}16'N$, $112^{\circ}28'E$) (Yesou & Lappo 1992)

On 3 July 1993, B. Frantzen found two female Steller's Eiders on nests at the mouth of the Pyasina river (73°50'N, 86°E). There are also older summer reports of Steller's Eider from central and eastern Taymyr (Rogacheva 1992), indicating that the species may breed over the whole peninsula. S. Švažas saw small flocks of Steller's Eider on the Kotuj river 300 km south of Khatanga (69°N, 104°E), in July 1988.

On the Yamal Peninsula, several observations of breeding have been obtained in recent years, on the island of Sharapovy Koshki (70°40'N, 67°E) off its western coast, in the Yuribey estuary (69°N, 70°E), and in the vicinity of the village of Sëyakha (70°N, 72°30'E) (Yesou & Lappo 1992).

Breeding has been proven on several occasions on Gyda Peninsula, near Antipayuta $(69^{\circ}10'N, 77^{\circ}E)$ and Tadibeyaka $(70^{\circ}10'N, 74^{\circ}E)$, where nests and fledglings have been observed (Yesou and Lappo 1992).

Summering and moult

There are reports of single or small flocks and even pairs of Steller's Eiders from most of its wintering range. Major congregations are, however, few. Here we report the most important ones.

Norway

The regular occurrence of flocks of Steller's Eider summering in the Varangerfjord has been well known to ornithologists for more than a century (Haftorn 1971). Frantzen (1985) and Frantzen & Henriksen (1992) reported that numbers have varied between 400 and 1,100 birds between 1971 and 1990. In 1992, 2.000 Steller's Eider were between Vadsø counted and Hamningberg on 7 July. The largest flock of 400 was in the harbour of Vadsø (Landgren 1992). The age composition of these flocks is not quite clear, and may vary. On 24-27 June 1973, 12 out of 221 birds (5.4%) were adult males; on 9-10 June 1974, 54 out of 588 (9.2%); on 12-14 June 1977, 19 out of 759 (2.5%) and on 11-14 June 1982, 41 out of 134 (30.6%) (Frantzen 1985). Thus it seems likely that the majority of the birds summering in the Varangerfjord are sub-adults.

Russia

Vladimir Semashko and Alexander Cherenkov made several summer expeditions between 1985 and 1992 to the Onega Bay (65°N, 36°E) in the White Sea area, and in 1989, they first discovered flocks of Steller's Eider. Up to 1.000 birds were found in 1992, most around the Solovetski Islands. The majority were believed to be sub-adult. Some birds in pairs were in full breeding-plumage, but no indication of breeding was observed. The birds occurred in flocks of 20-40 individuals, and c, 50 % of the birds were classified as males. The Steller's Eider has increased significantly during recent vears (Cherenkov & Semashko 1990, V Semashko, in litt.). There is also a report of a small flock of Steller's Eider summering in Lake Ladoga (61°N, 32°E) north of Leningrad (M. Hario, pers. comm.).

Kochanov (1979) mentions several observations of small flocks of Steller's Eider summering around the Seven Islands, confirmed recently by Y. Krasnov (pers. comm). S. Švažas saw 150-200 males from a ship in July 1984 south of Dalnije Zelentsy.

Other areas

Sweden: Tyrberg (1987) reports a flock of up to 16 birds in eclipse plumage at Haparanda Sandskär (65°N, 24°10'E) in the Gulf of Bothnia 19 July to 3 Aug 1986.

The Netherlands: In the last week of May 1981, a mixed pair of a male Steller's Eider and a female Common Eider was observed in the eider colony on Schiermonnikoog in the Dutch Wadden Sea. There are a few other summer records from The Netherlands, all of males (Swennen 1981).

Iceland: One adult male was observed at Lake Myvatn, 5-16 June 1981 (Martin 1981). A one-year old male was seen at Langanesi 2 July 1891 (Pétursson & Ólafsson 1989), and one male at Berufirði 6 May 1990 (Pétursson *et al.* 1991, 1992). A male Steller's Eider was paired with a female Common Eider at Örlygshöfn, 8 June 1991 (Pétursson *et al.* 1993).

Greenland: Salomonsen (1967) mentions two observations: an adult male in Disko Fjord on 15 June 1878, and a pair in Sabine Fjord north-east Greenland on 14 June 1944.

Svalbard: Observed for the first time on Svalbard in 1968, there are altogether seven observations, two of which come from Bear Island (Norderhaug 1989).

Discussion

Winter habitat

The Steller's Eider is probably the most arctic of all the ducks and seems to be pushed south and west by expanding sea ice during autumn. The extent of sea ice distribution in winter will, therefore, govern the wintering distribution. All the main wintering areas, both in the Pacific and in the Atlantic/Baltic, are found just off the average maximal ice-limit (**Figure 3**). The duck is rarely seen in areas influenced by warm Atlantic water. Only a few birds are seen as far west as Denmark, where all the records in recent years have been from the eastern side. The species seems to congregate in two main areas in the Baltic; Saaremaa in Estonia and Palanga in Lithuania, which may have something to do with the local food conditions. Steller's Eider feeds mainly on very small molluscs (Collett 1894, Siivonen 1941). Bianki (1993) studied the diet in White Sea, and found that the gastropods made up 70%, the most important being *Littorina* spp. (30%), crustaceans amounted to 15% and 4%. various polychaetes species however, only five stomachs were analysed. The bird is always found in very shallow water, only 0.5 to 5 m in depth. It is very gregarious, and compact flocks will often dive simultaneously. Sometimes it will feed almost like a dabbling duck, up-ending, or feeding only with the head under water (Cramp & Simmons 1977).

Variation in numbers

In Norway, there has been no evident trend in numbers from 1981 up to the present. Peak numbers occurred in 1984-85, but it is difficult to find any consistent pattern that may be explained by environmental factors. Low minimum temperatures in January seem to correlate with high numbers in the Varangerfjord, though the trend is not significant (0.1 < P < 0.2). The Steller's Eiders may be attracted to offal from the capelin Mallotus villosus winter and spring fishery in Finnmark (Henriksen 1992). They are reported to be eager feeders on capelin spawn (I. lversen Båtvik, pers. comm.). The capelin spawns in the area during spring, and the size of the spawning stock has varied from 0.02 to 5 million tons between 1980 and 1991 (data from the Norwegian Marine Research Institute, Bergen). Extensive feeding on fish spawn by diving ducks is also reported from the Baltic (Sellin 1990).

There is no doubt that the numbers of Steller's Eiders wintering in the Baltic Sea have increased during the last couple of decades. In Lithuania, the first known record is from 1969. In Estonia, the first was in the mid 1970s while the first in Latvia was in 1991. The increasing number of Steller's Eider wintering in Estonia and Lithuania is clear (Table 1). However, the numbers from Estonia are for January each year. while the peak numbers at Palanga on the Lithuanian coast are in March and April (Petraitis 1991). It is therefore possible that there is a gradual southern movement during the winter, as the ice-cover in the northern areas in the increases. Much of the Baltic year-to-year variation in numbers at the different sites may be due to variations in ice limits. However, the winters of 1989-93 were very mild in the Baltic, with minimal sea-ice, so the figures from these



Figure 3. The known breeding and wintering grounds of the Steller's Eider and probable migration routes.

Spring data from Ainov Islands (69°50'N, 32°N) show a steady increase in numbers between 1966 and 1987 (I.P. Tatarinkova, pers. comm.)

The decline of the eastern population of Steller's Eider is paralleled by an increase in the western population. It is open to speculation whether some of the birds have shifted from migrating eastwards to migrating westwards. Although a tempting theory, we have no field data to support it.

Moult

The majority of moulting Steller's Eiders in Finnmark are probably pre-breeding yearlings. It is not known where the adults moult. Flightless birds have been seen as early as the end of May and beginning of June. In a flock of 100 birds in Finnmark in June 1983, many were flightless (Frantzen 1985); these were most likely juveniles or sub-adults, which are known to moult one month earlier than the adults (Petersen 1980). If these observations are representative, the moult seems to start earlier in Europe than in Alaska. In Alaska, the main moulting areas are the shallow waters of Nelson Lagoon (Petersen 1980) and Izembek Lagoon (Jones 1965) on the Alaskan peninsula. The exact timing of the moult cycle of the different sex and age classes of the birds is poorly known. Body feathers are shed before the wing feathers. Adult males arrive at Nelson lagoon already in post-breeding plumage. The adult males become flightless in the last days of August and first days of September. Sub-adults start to moult their wing feathers one month earlier (Petersen 1980). The timing of the moult might distinguish birds from different breeding areas, as it may reflect differences in the phenology of the breeding areas. The timing of moult should therefore be investigated closely in the European population.

Breeding

Regular breeding of Steller's Eider on Taymyr in western Siberia is now well documented, and this discovery moves the known breeding limit c. 1,500 km westward. The air distance from

western Taymyr to the Varangerfjord is 2,200 km, while the distance to the Bering Strait is almost 4,000 km. It should therefore be of adaptive value for a breeding population on Taymyr to fly to the west for its winter quarters instead of to the east. Recently, a bird ringed on the wintering grounds near the Alaskan shore was collected near Khatanga (Rogacheva 1992). None of the birds ringed in the Varangerfjord have yet been recovered on the breeding grounds. All available evidence points to the conclusion that the Steller's Eider is a very rare breeding bird west of Yamal. It is highly improbable that it ever bred in Norway, but one cannot dismiss occasional breeding on the Kola peninsula. The Taymyr Peninsula constitute an area of c. 300,000 km². If all the birds that winter in the west bred there, it would mean an approximate average density of a pair per 10-20 km². Yesou & Lappo (1992) estimated the breeding density on Taymyr to be a maximum of about one pair per 13 km². The data from breeding surveys and winter counts thus seem to agree within rough limits. One should, however, keep in mind the breeding records from the Yamal and Gyda peninsulas mentioned & Lappo (1992). in Yesou The lack of breeding records from Yugorskij, Bolshezemelskaya and Maloszemelskaya tundras is striking, but could be attributed to lack of search effort. The habitat (tundra) is apparently suitable, but these areas do not have continuous permafrost, as do the Yamal, Gyda and Taymyr tundras. Obviously, more breeding surveys of the west Siberian high arctic are needed.

Migration routes

Judging from the winter distribution and field observations, some clear patterns emerge (**Figure 3**). The population of Steller's Eider breeding at Taymyr migrates west along the shores of the Kara Sea. When reaching the mouth of the White Sea, some flocks enter the White Sea and proceed south-west over the waterways of Onega and Ladoga, passing through the Gulf of Finland. The majority of Baltic birds settle at Saaremaa in Estonia, while about 1,000 birds move on to Palanga in Lithuania.

Irregular flocks move further west, as far as Denmark. Some flocks head west to the Aland archipelago, where some settle, while others cross the Baltic and settle along the Swedish coasts. The main route, however, is along the north coast of the Kola Peninsula, where most of the birds will remain. Considerable, but varying, numbers reach as far west as the Varangerfjord. Occasional flocks make excursions to other fjords in East Finnmark, and stragglers end up in more southern sites further south-west down the Norwegian coast (Figure 1). There may be three different ways of entering Norwegian waters, from the north, from the Baltic through Skagerrak, or by an overland migration from the Gulf of Bothnia. This is a route used by thousands of Common Eiders from the inner Baltic (Moksnes & Thingstad 1980), and it is not unlikely that some Steller's Eider join these flocks. A detailed treatment of the migration routes used by the East Siberian population is beyond the scope of this paper, but a sketch is outlined in Figure 3. The ringing recovery of a bird shot near Khatanga, ringed on a wintering site in Alaska supports the suggestion that the river Khatanga may be an approximate divide between the eastern and western populations.

Conservation

Two oil spills in recent years have highlighted the vulnerability of this very gregarious species. A small spill was discovered in the harbour of Vadsø on 13 January 1973. Fifteen hundred seabirds were killed, among them many Steller's Eider (Aronsen 1973). Another spill occurred in the Varangerfjord in March 1979, possibly from a fishing-vessel, as the oil was of fuel type. Between 10,000 and 20,000 birds were killed, about 90% of them Brünnich's Guillemot Uria lomvia. Only five dead Steller's Eider were found, but large numbers were at risk (Barrett 1979). It is most important to prevent oil spills in harbours, both from land-based tanks, fishing-boats and other commercial boat traffic. The proposed oil terminal near Palanga in Lithuania must cause some concern. During the helicopter survey, we were quite alarmed at the level of pollution in the Kola bay, especially in the harbours of Murmansk and Severomorsk. Large parts of the bay were covered with a blue shine that seemed to be coming from the quite intense ship traffic.

In the Lumpsucker Cyclopterus lumpus fishery in Finnmark in spring, nets are placed in shallow water, close to the shore. Both the Steller's Eider and the Common Eider are killed by drowning when they are caught accidentally while feeding. We have no estimates regarding the magnitude of this kill, but the losses may be significant, at least in some areas. Local fishermen say that most birds are caught early in the year, when the nights are still dark (Frantzen & Henriksen 1992). It would, therefore, be beneficial to the seaducks if the lumpsucker fishery could be limited to the summer.

The Steller's Eider is no longer a legal game species in Europe. It was in Norway until 1981, but the hunting was never of great significance. However, it was very vulnerable to shooting, as the dense flocks made it possible for hunters to bag many birds with one shot. We also know that it was hunted on the coasts of the Barents Sea in Russia (A. Golovkin, pers. comm.), but we do not know the magnitude of this kill. The species is now protected in Russia.

The office of the county governor in Finnmark started a monitoring programme on the Steller's Eider from 1992, and joint research between Russian and Norwegian ornithologists is on-going. The biometry data in Henriksen and Lund (1994) indicate that the Finnmark birds are larger than birds from Siberia and North America. The available evidence therefore clearly indicates that the Steller's Eiders wintering in Atlantic and Baltic waters constitute a discrete population from the one wintering in the Pacific. If true, this has conservation implications for both populations. The Steller's Eider is now on the list of "responsibility species" in the Norwegian Red Data list (Størkersen 1992).

Area protection is difficult, as many of the Steller's Eider's preferred sites are developed harbours in populated areas. However, some natural bays important to the species should be protected as nature reserves to ensure that its natural wintering habitat is preserved. *Alexander Golovkin gave valuable*

information from northern Russia, and helped with translations of some Russian literature. Vladimir Semashko gave data on the summer distribution in the White Sea. Alexander Koryakin and Tatjana Paneva kindly let us use winter data from the Kola peninsula. Arvo Kullapere and Andres Kuresoo gave data from Estonia. Antre Stipniece gave information from Latvia, W. Meissner supplied valuable information from Poland, and Hans W. Nehls from East Germany. Georg Nehls supplied breeding data and photos from Taymyr. Stefan Pihl helped with information from Danish waters and read through an early draft of the manuscript. Martti Hario and Matti Pirkkola informed on the occurrence of Steller's Eiders in Åland, Finland and Leif Nilsson helped with the Swedish data. Ingar Iversen Båtvik and Gunnar Henriksen gave valuable information from Finnmark. Per Jordhøy, Andrej Kondakov and Yuriy Krasnov took part in the Kola survey in March 1994, a project financed by the Commission for Environmental Cooperation between Russia and Norway, and coordinated by the Directorate for Nature Management in Trondheim, Norway. NINA acted as the executive research intitute, and the host institution in Russia was Murmansk Marine Biological Institute (MMBI). Personnel from the Polar Institute for Fishery and Oceanography (PINRO) in Murmansk gave valuable technical support. Duncan J. Halley gave advice on the English language. Hugh Boyd refereed the manuscript and made many valuable comments and suggestions.

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