A description of Danish Black Guillemots *Cepphus grylle* with remarks on the validity of *ssp. atlantis.*

STEN ASBIRK

(Med et dansk resumé: Danske Tejsters racetilhørsforhold)

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INTRODUCTION

On the basis of size variables and differences in the amount of white in the wing and in the winter plumage Salomonsen (1944) described 7 subspecies of the Black Guillemot *Cepphus grylle.* Generally the length of the bill decreases towards the north in accordance with Allen's rule, and the amount of white in the plumage increases towards higher latitudes in accordance with Gloger's rule. Other variations are rather irregular, not showing general trends.

The distribution of the nominate subspecies *grylle* is restricted to the Baltic, whereas the more disputable subspecies *atlantis* has populations both in Europe (western Sweden, Norway, England) and Canada (from Maine to southern Labrador). The Faroes and Iceland have their own endemic subspecies, *faeroensis* and *islandicus,* respectively. In the low-arctic part of Greenland and in Labrador the subspecies *arcticus* breeds. In the high-arctic western Greenland and westwards into Canada the subspecies *ultimus* breeds, and in the high-arctic eastern Greenland and further eastward along the coasts of Sibiria the subspecies *mandtii* is distributed.

Later on, especially Storer (1952) has discussed the systematic position of the Black Guillemot populations throughout its range, and he accepts all the subspecies proposed by Salomonsen except *atlantis.* However, Storer points out that the *atlantis* populations differ from the *arcticus* populations, but not sufficiently for maintaining a seperate subspecific name. On the other hand, Storer has not made allowance for differences in the winter plumage, to which Salomonsen draws attention in his review of Storer's paper in the Auk (Salomonsen 1953).

Finally, Vaurie (1965) lumped the two high-arctic subspecies into one, *mandtii,* and all other races into another one, *grylle,* apart from *islandicus* which is still accepted because of its unique colour pattern in the white speculum.

In spite of the large number of skins which have been measured and described from many different localities, the Danish population has never been studied from a systematic point of view. Thus, it is the primary scope of this paper to give a systematic description of the Danish population of the Black Guillemot.

MATERIAL AND METHODS

The material for this study has been collected in two ways. Firstly, 156 birds were caught alive and measured and described in connection with a larger ecological investigation of the species at Nordre Rønner islands in northern Kattegat, 57°22'N-10°56'E (Asbirk 1979). At the time of catching the birds were colour-ringed, so that it has afterwards been possible to determine the sex of part of the birds by observing their copulatory behaviour. Furthermore, 18 birds were caught, measured and described at Hirsholmene islands in northern Kattegat, 57°29'N-10°37'E, but they have not been colour-ringed, so that

I have not had the opportunity of sexing them. All these birds were adult breeding birds, being at least 2 years old.

Further, 57 skins were studied in the collection of the Zoological Museum of Copenhagen. The birds are from many different localities, and they have all been sexed at the preservation. This group includes both juvenile, immature and adult birds in summer plumage as well as winter plumage. The (breeding) provenience of the birds collected outside the breeding season is not known. They are not necessarily Danish breeding birds, since birds breeding in the Baltic and notably in western Sweden also are encountered in Danish waters (Rosendahl & Skovgaard 1968, Andersen-Harild 1969).

Measurements

The following measurements of the birds were taken:

Length of bill measured from the tip of the bill to the feathering (exposed culmen).

Depth of bill measured at the base (adjecent to frontal feather edge).

Tarsus length was measured as the distance from the intertarsal joint to the tarsophalangial joint.

Wing length was measured from the carpal joint to the tip of the longest primary. The wing was pressed flat on a ruler, but without stretching the primaries to maximum length (»Svensson's flattened wing method«). Salomonsen (1944) and Storer (1952) stretched the primaries along the ruler, which gives an increase in wing length of 2.4 ± 0.6 mm (measured on the 57 museum skins) as compared with my measurements. Generally, measurements from different authors have to be used with some caution because of personal ways of measuring, and because many writers have not stated precisely, how the measurements are taken.

The amount of white on the wing was measured as the amount of white on one of the greater coverts in the middle of the speculum, and as the amount of white on the outermost primary in accordance with the description of the method given by Salomonsen (1944). Four measurements have been taken: A, B, C, and D (Fig. 1.). On the birds caught alive it was difficult to measure C and D, thus only A and B was measured. As shown by the illustration in Fig. 1, B is actually not the amount of white on the primary, but the amount of black. Indirectly, however, it is a measurement of the amount of white, because the greater the B, the smaller the amount of white, and the smaller the B, the greater the amount of white. Some individuals even have no white on the outermost primary.

The number of tail feathers were also counted, as a few birds deviate from the usual 12 tail feathers.

Weight. All the birds caught alive were weighed with a 1000 g Pesola balance to the nearest 5 g.

Differences between means have been tested by single classification analysis of variance with unequal sample sizes (Sokal & Rohlf 1969).

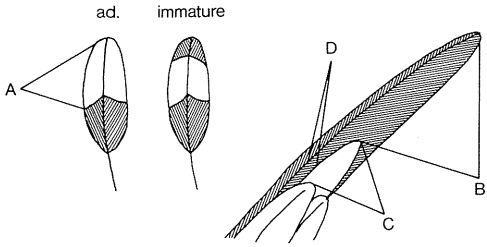

Fig.1. Measurements of the amount of white on wing. Left: Greater upper wing-covers from the middle of the speculum in an adult and an immature bird. Right: The outermost primary seen from below. After Salomonsen (1944).

Målinger af den hvide farves udstrækning på vingen. Til venstre: store øvre vingedækfjer fra midten af spejlet hos en adult fugl og en ikke-udfarvet Tejst (immature). Til højre: undersiden af yderste håndsvingfjer.

RESULTS

All measurements have been summarized in Tables 1 and 2. The only differences between the two sexes are the larger bill depth and bill length of the male, although the differences are only statistically significant in the birds caught alive. On the other hand the males have a smaller amount of white on the outermost primary than the females.

The same sexual differences are found in the immature individuals, although none of them are statistically significant. Generally, these young birds have smaller average dimensions than the adult birds, especially so regarding wing length and bill depth. On the other hand they have more white on the ou-

Table 1. Measurements of Danish Black Guillemots, weight in grams, other measurements in millimeters ± standard deviations.
Mål af danske Tejster, vægt i gram, øvrige mål i mm ± standardafvigelser (SD). Følgende mål er taget: næblængde, næbhøjde, tarselængde, vingelængde, hvidt på vingen A og B (se fig. 1) og vægt. n = antal individer, range = spredning, x = gennemsnit, SD = standardafvigelse.

		bill length	bill depth	tarsus length	wing length	white on wing A	white on wing B	weight
ad. ♂♂	n	33	33	35	34	33	17	40
	range	28.3-36.0	11.0-13.0	29.0-33.4	152-165	21.1-31.8	51.3-64.8	320-430
	x̄	32.42	11.99	31.58	159.4	25.55	57.98	376.1
	SD.	1.74	0.45	1.00	3.1	2.65	3.65	23.8
ad. ♀♀	n	25	25	24	26	26	12	24
	range	29.6-34.4	10.5-12.0	29.5-33.4	151-169	18.6-29.2	49.3-59.2	350-440
	x̄	31.47	11.24	31.48	158.3	25.29	53.33	380.1
	SD.	1.21	0.42	1.22	4.1	2.47	3.01	18.2
	p	<0.025	<0.001	>0.05	>0.05	>0.05	<0.005	>0.05
ad. total	n	173	173	174	174	174	92	158
	range	27.9-37.6	9.9-13.0	28.1-34.4	148-172	17.3-31.8	39.2-64.8	320-440
	x̄	31.63	11.59	31.54	159.4	24.95	55.87	375.1
	SD.	1.58	0.62	1.19	3.6	2.72	4.41	22.9

Table 2. Measurements of skins of Danish Black Guillemots, all measurements in mm ± standard deviations.
Mål af skind af danske Tejster, alle mål i mm. Yderligere forklaring i teksten til tabel 1.

		bill length	bill depth	tarsus length	wing length	white on wing A	white on wing B	white on wing C	white on wing D
ad. ♂♂	n	12	10	13	13	13	9	9	9
	range	29.5-32.7	9.3-11.7	29.0-34.6	152-164	17.9-27.2	44.8-62.7	6.0-16.5	3.7-7.3
	x̄	31.23	10.61	31.24	159.2	23.04	54.96	9.63	5.54
	SD.	1.02	0.66	1.58	4.1	2.24	5.69	3.43	1.23
ad. ♀♀	n	14	13	14	15	15	10	10	10
	range	29.0-32.8	9.8-10.8	28.5-33.7	148-171	17.1-28.8	46.2-57.1	6.3-20.8	1.7-6.3
	x̄	30.74	10.18	31.47	163.5	23.76	51.93	13.83	3.82
	SD.	1.19	0.37	1.30	6.9	3.16	3.66	4.59	1.47
p ♂♂/♀♀		>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	<0.05	<0.025
immature ♂♂	n	12	12	10	12	12	5	5	5
	range	29.3-34.1	9.2-10.0	29.4-33.8	148-164	14.6-26.3	39.0-52.2	6.8-13.1	2.8-6.0
	x̄	30.98	9.77	31.13	152.8	19.64	47.32	13.58	4.70
	SD.	1.37	0.43	1.35	5.1	3.96	5.28	5.60	1.20
immature ♀♀	n	9	10	10	12	12	7	7	7
	range	28.0-31.5	8.8-9.9	28.6-33.1	144-163	13.1-26.4	36.5-50.7	8.5-31.2	2.3-4.1
	x̄	29.79	9.40	31.15	152.3	22.13	42.19	20.06	3.03
	SD.	1.24	0.43	1.47	6.0	4.11	5.82	7.71	0.54
p ♂♂/♀♀		>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	<0.01
p ad.♂♂/imm.♂♂		>0.05	<0.005	>0.05	<0.005	<0.025	<0.05	>0.05	>0.05
p ad.♀♀/imm.♀♀		>0.05	<0.001	>0.05	<0.001	>0.05	<0.001	>0.05	>0.05

termost primary, when the white patch is present. However, more immatures than adults totally missed the white patch on the outermost primary. 46% of the adult birds caught alive totally missed the white patch on the outermost primary. Among the skins, the white patch was absent in 32% of the adults and in 50% of the immatures.

The same differences between immature and adult birds and between the two sexes were found by Salomonsen (1944) and Storer (1952) in other populations of the species, except for bill length.

In other alcids the males usually have larger mean dimensions and body weights than the females, but the differences are small and

cannot be used to recognize the sex of single individuals: Salomonsen (1944: 24-25, 29) for *Alca torda* and *Alle alle,* Storer (1952: 128-133) for *Uria aalge, U. lomvia,* and *Cepphus columba,* Kozlova (1957:78) for *C. carbo,* Sealy (1972:182) for *Brachyramphus marmoratum* and *Synthliboramphus antiquum,* Ridgway (1919: 749, 772) for *Brachyramphus brevirostris* and *Endomychura hypoleuca,* Sealy (1972: 182) for *Ptychoramphus aleutica, Cyclorrhynchus psittacula, Aethia cristatella,* and *A. pusilla,* Feinstein (1955: 61-62) for *A. pygmaea,* Kozlova (1957: 116) for *Cerorhinca monocerata,* Myrberget (1963: 76-81) and Petersen (1976: 188) for *Fratercula arctica,* Sealy (1972: 182) for *F. corniculata,* and Ridgway (1919: 794) for *Lunda cirrhata.*

Generally, the average dimensions of the skins are a little smaller than in the birds caught alive due to shrinkage.

The number of tail feathers in the Black Guillemot is normally 12 (Table 3), whereas it is 14 in the Pigeon Guillemot *Cepphus columba.* All the birds with less than 12 tail feathers (n=8) in one year and caught again in another year had 12 tail feathers in the other year, which indicates that most smaller numbers were due to loosing one or more tail feathers. This must also be the case with one bird, which in 1975 had 13 tail feathers, but in 1976 only 12. Thus the birds with 13 and 14 tail feathers are perhaps more numerous than this material shows, because some birds might have missed one or two tail feathers at the time of catching.

Table 3. The number of tail-feathers in Danish Black Guillemots caught alive (no. birds) and as skins.
Antal halefjer hos danske Tejster (1. kolonne) fanget levende (no. birds) og som skind (no. skins).

no. tail-feathers	no. birds	no. skins
4	1	o
8	2	o
9	o	o
1o	6	4
11	15	7
12	14o	43
13	4	2
14	6	1
total	174	57

MOULT

The moulting stage of all the museum skins have been described according to the method proposed by Salomonsen (1944). The result is shown in Fig. 2. When the juveniles leave their nests in July-August, the upper parts are deep slate grey, sometimes with some white edges on the scapulars. The under-side is dingy white, because the white feathers have grey edges. The wing is plain grey, and the white speculum is mottled with many grey feathers (Fig. 1 and 3) which can be seen easily in the field; thus it serves as a good field character for recognizing juvenile and immature birds in their first winter plumage and first summer plumage. Wing- and tail-feathers are not moulted in the first autumn.

Moulting of the body feathers to the first winter plumage begins in August-September and is completed ultimo October-medio December. Compared with the juvenal plumage the young Black Guillemot now acquires black feathers with white edges on the upper parts and totally white feathers on the underside. Some of the dingy white feathers on the belly may however be retained from the juvenal plumage throughout the winter.

Moulting of the body feathers to the first summer plumage is only documented in two individuals of the subspecies *atlantis,* but their late moulting stage indicates that the moult starts in March-April and is completed in May-June, much later than in the adult breeding birds. The one-year old bird now resembles an adult Black Guillemot except for the mottled speculum and the heavily worn wing- and tailfeathers which often shine silver grey because of the heavy wear (Fig. 3). The legs are red as in the adults, whereas they are blackish grey in the newly fledged individuals, though sometimes mottled with red-brown.

During the next moult all feathers are renewed and the bird now acquires the white wing patch so characteristic of the species. The winter plumage resembles that of the first winter very much. The primaries and secondaries and also the rectrices are shed synchronously, so that the Black Guillemots loose their ability to fly in a period from medio August to medio October. How long time it takes for the wing feathers to grow out in the single individual is not known, but in nine captive Common Guillemots *Uria aalge* Birkhead & Taylor (1977) have reported periods of 42-90 days, on average 63 days.

Moulting to the summer plumage starts in the adult birds already in January and it is completed in March. However, it is not unusual to see adult birds on the breeding locality

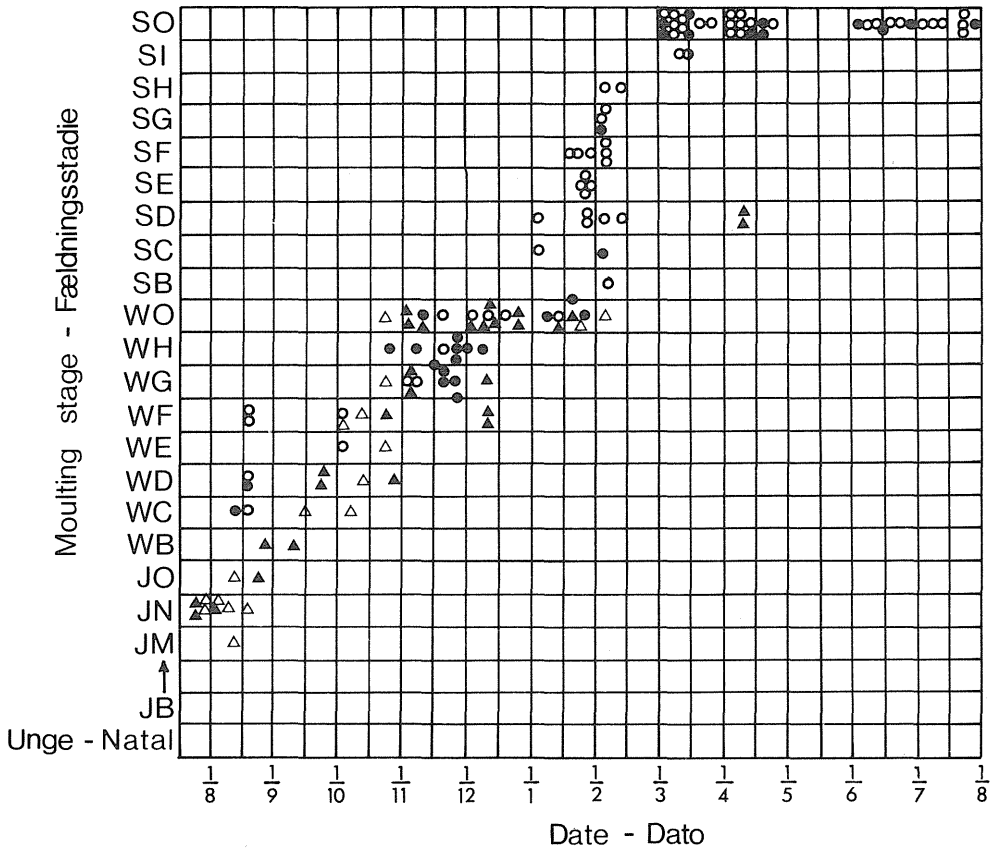

Fig. 2. Diagram showing the moult in juvenile, immature and adult specimens of *Cepphus grylle atlantis*. Open circles: adults from western Sweden and Norway described by Salomonsen (1944). Solid circles: adults from Denmark, this study. Open triangles: juveniles and immatures from western Sweden and Norway described by Salomonsen (1944). Solid triangles: juveniles and immatures from Denmark, this study.

Moulting stages are those described by Salomonsen (1944). Examples: JO = juvenile plumage with no moult. WO = winter plumage with no moult. SO = summer plumage with no moult. WE = synchronous moult of primaries and secondaries in adults, but not in immatures. WF = synchronous moult of tail-feathers in adults, but not in immatures.

Diagram over fældningen hos Tejster af racen atlantis. *Åbne cirkler: adulte fugle fra Vestsverige og Norge beskrevet af Salomonsen (1944). Udfyldte cirkler: adulte fugle fra Danmark. Åbne trekanter: juvenile og ikke-udfarvede fugle fra Vestsverige og Norge beskrevet af Salomonsen (1944). Udfyldte trekanter: juvenile og ikke-udfarvede fugle fra Danmark. Fældningsstadierne refererer til Salomonsens beskrivelser fra 1944. Eksempler: JO = juvenil dragt uden fældning. WO = vinterdragt uden fældning. SO = sommerdragt uden fældning. WE = synkron fældning af hånd- og armsyingfjer hos adulte fugle, men ikke hos de ikke-udfarvede. WF = synkron fældning af halefjerene hos adulte fugle, men ikke hos de ikke-udfarvede.*

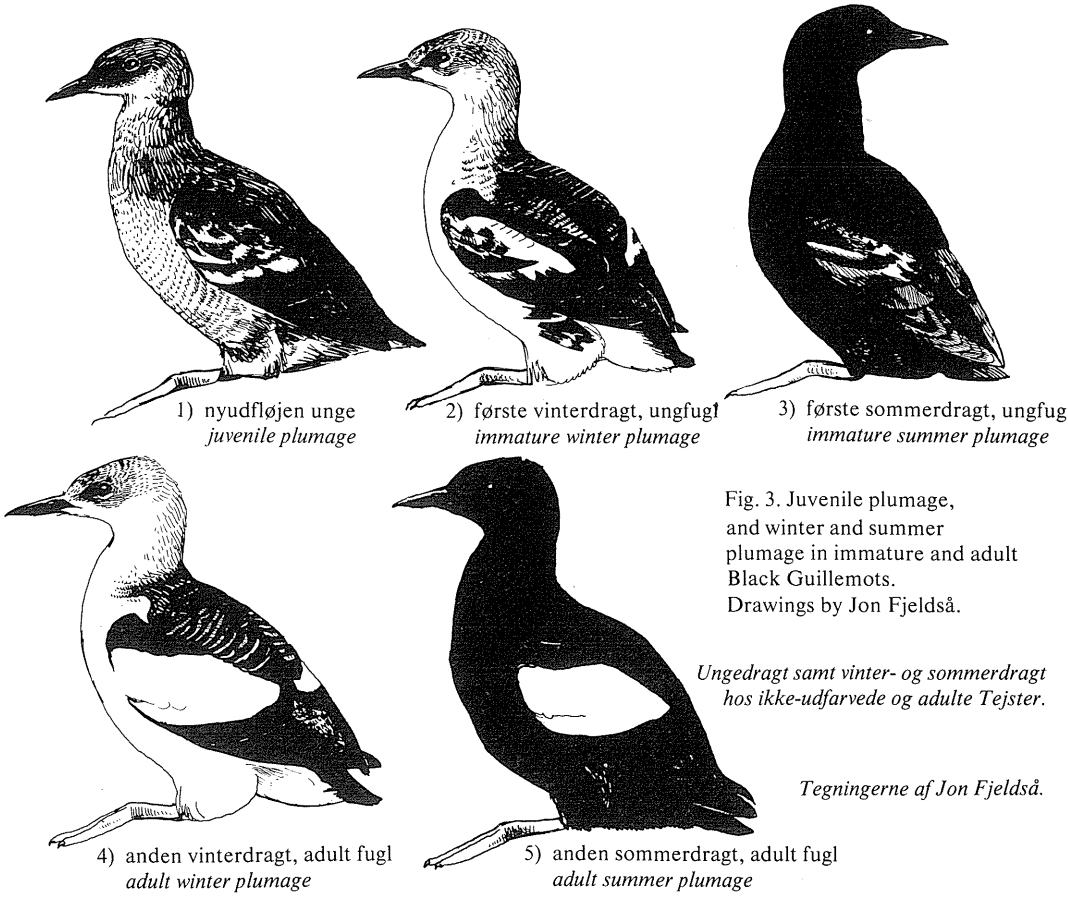

Fig. 3. Juvenile plumage, and winter and summer plumage in immature and adult Black Guillemots. Drawings by Jon Fjeldså.

Ungedragt samt vinter- og sommerdragt hos ikke-udfarvede og adulte Tejster.

Tegningerne af Jon Fjeldså.

(Nordre Rønner) with single white feathers from the winter plumage, especially on the belly. This is also the case with 3 skins from Hirsholmene from 3 March, 15 March, and 18 April, respectively. These birds have completed their body moult (no blood quills left) but the retention of some of the feathers of the winter plumage makes them look like the moulting stages of SD, SF, and SG (Fig. 2.). These birds are described as SO_d, SO_f, and SO_g according to Salomonsen (1944: 71), and they are in Fig. 2 depicted at the level of SO.

Not only young birds, 2 or 3 years of age, retain some white winter feathers in their summer plumage. One at least 8 years old bird observed in May 1977 had about 50 white feathers left on the belly, and these were retained throughout the breeding season.

Field observations at Nordre Rønner also show that moulting to the winter plumage may start already in the first week of August when a few individuals have been seen with white chin feathers.

DISCUSSION

My measurements of Danish Black Guillemots lie very close to those from western Sweden, Norway, and England given by Salomonsen (1944), Storer (1952), Vaurie (1965), and Haftorn (1971). For wing length the difference in measuring tecnique must be taken into consideration (see p. 208).

Compared with birds from the Baltic there is also a great overlap in the measurements of the bill and the white on the wing. However, the Baltic population differs considerably in wing length. In Table 4 length of wing and bill from Danish Black Guillemots are compared with measurements from other Scandinavian countries and England. The population in the Baltic has a considerably longer wing and bill and I do not agree with Vaurie (1965) when he suggests that it is a case of clinal variation. The joint non-overlap between the two populations is 91.5% for wing length and 74% for bill length (analysed from Salomonsen 1944).

Table 4. Measurements of wing and bill length from different localities. Note that Vaurie and the present author used another method for measuring wing length than Salomonsen and Storer (see text), and that Vaurie measured bill length from the skull and not the exposed culmen.
Mål af vinge- og næblængde fra forskellige lokaliteter. Bemærk, at Vaurie og forf. brugte en anden metode til at måle vingelængde end Salomonsen og Storer, og at Vaurie målte næblængden fra kraniet og ikke fra pandefjerene.

Locality		wing length mm	bill length mm	Author
Denmark	n	174	173	This study
	range	148-172	27.9-37.6	(live birds)
	$\bar{x}$	159.4	31.63	
Denmark	n	28	26	This study
	range	148-172	29.0-32.8	(skins)
	$\bar{x}$	161.5	30.99	
W. Sweden and Norway	n	53	56	Salomonsen 1944
	range	155-173	29.0-35.0	
	$\bar{x}$	162.7	31.36	
W. Sweden and Norway	n	16	18	Storer 1952
	range	157-170	29.5-36.5	
	$\bar{x}$	164.3	32.89	
W. Sweden	n	30	30	Vaurie 1965
	range	157-172	37.5-45.0	
	$\bar{x}$	163.9	41.53	
Norway	n	23	-	Haftorn 1971
	range	152-167	-	
	$\bar{x}$	161.3	-	
Murmansk	n	18	18	Vaurie 1965
	range	157-175	38.0-45.0	
	$\bar{x}$	166.5	41.99	
England	n	56	62	Storer 1952
	range	158-172	29.5-37.5	
	$\bar{x}$	164.6	33.27	
England	n	37	37	Vaurie 1965
	range	156-168	37.0-44.0	
	$\bar{x}$	161.8	41.22	
Baltic	n	24	24	Salomonsen 1944
	range	167-182	31.0-35.0	
	$\bar{x}$	174.1	32.92	
Baltic	n	4	6	Storer 1952
	range	169-181	29.5-35.0	
	$\bar{x}$	175.8	33.00	
Baltic	n	14	14	Vaurie 1965
	range	160-181	39.5-49.0	
	$\bar{x}$	172.5	44.14	

The value for wing length must be considered high enough for separating the two populations into two subspecies, especially as they are well isolated from one another by a gape in their breeding distribution from Blekinge to Hallands Väderö (about 200 km), and as they differ in other characters as well. Thus the prenuptial moult in birds from the Baltic starts about two months later than in birds from Kattegat (Salomonsen 1944), and. the tarsal length of the Baltic population (on the basis of four specimens) seems significantly longer than the Kattegat population (Storer 1952). In conclusion, it seems reasonable to recognize two subspecies: *grylle* in the Baltic, and *atlantic* in Kattegat (Denmark and western Sweden), Norway, the Murmansk coast, and England.

The European *atlantis*-population is, according to Storer (1952), well separated from the SW Greenlandic population (race *arcticus*), whereas the population in South Labrador in East Canada cannot be distinguished from neither the European *atlantis* nor the SW

Greenlandic *arcticus*. Salomonsen (1953), however, maintains that there are differences in the winter plumage. The present author had only opportunity to study 4 summer skins from Labrador, so future investigations must show whether the population in South Labrador is an *atlantis* population, as proposed by Salomonsen (1944). So far I would prefer to retain the name *atlantis* for the European population and suppose a clinal variation towards the race *arcticus* in SW Greenland and Canada, where the species breeds continually along the coast.

ACKNOWLEDGEMENTS

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DANSK RESUME

Danske Tejsters racetilhørsforhold

Syv forskellige racer af Tejst er blevet beskrevet af Salomonsen (1944). Danske ynglefugle indgik imidlertid ikke i hans materiale, og målinger og beskrivelser til belysning af bestandens racemæssige tilhørsforhold har aldrig været publiceret.

Tabel 1 og 2 giver en række mål for næb, tarse, vinge og vægt af i alt 174 Tejster indfanget på Nordre Rønner ved Læsø (og på Hirsholmene) samt af i alt 57 skind fra Zoologisk Museums samling. Disse mål ligger meget nær målene for vestsvenske, norske og engelske Tejster, og viser at de danske ynglefugle tilhører racen *atlantis*. Tejster fra Østersøen har ca. 10 mm længere vinger end de danske og vestsvenske Tejster, og de to bestande er desuden tydeligt adskilt af et ca. 200 km bredt bælte i Sydsverige, hvor arten ikke yngler (Hallands Väderö — Blekinge). Da Østersø-Tejsterne endvidere fælder senere om foråret end de dansk-vestsvenske fugle, er der al mulig grund til at bibeholde opdelingen i de to racer: *grylle* i Østersøen og *atlantis* i Danmark, Vestsverige og Norge samt England, og ikke slå dem sammen i én gruppe *(grylle)* som foreslået af Vaurie (1965).

Gennemsnitligt har hannerne af de danske Tejster en større næbhøjde end hunnerne, men mindre hvidt på den yderste håndsvingfjer. Gamle fugle har større næbhøjde og længere vinger end unge fugle, men mindre hvidt på den yderste håndsvingfjer.

Fældningen er beskrevet ud fra de 57 museumsskind (Fig. 2) og nogle af dragterne er afbildet på Fig. 3. Dette afsnit har i det store og hele været publiceret på dansk i Feltornithologen 1977: 92-93 og bliver derfor ikke resumeret yderligere her. Det skal blot bemærkes, at de dragter der i den pågældende artikel er kaldt anden og tredje sommerdragt i stedet skal hedde henholdsvis første og anden sommerdragt.

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Authors address:
Zoological Museum, DK-2100 Copenhagen Ø.
Present address:
Helgesvej 1, DK-4000 Roskilde