Descriptive update on gull taxonomy: 'West Siberian Gull'

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ABSTRACT Information on the appearance, behaviour and ecology of taxa within the evolutionarily young 'large white-headed gull' complex (taxa currently grouped by three species, Lesser Black-backed Gull *Larus fuscus*, Herring Gull *L. argentatus* and Yellow-legged Gull *L. cachinnans*) is of interest to those ornithologists who study their identification, systematics and speciation. A sharp discrepancy has arisen between the demand for information about some of these taxa and the lack of elementary primary data. The delay in gathering data is due to the inaccessibility of the breeding grounds of some forms and to difficulties with systematic methodologies within the group. There is a critical lack of information about three forms in particular: 'West Siberian Gull' *L. heuglini antelius*, 'Taimyr Gull' *L. h. heuglini* (= '*taimyrensis*') and 'Baraba Gull' *L. cachinnans barabensis*.

This paper presents data on the plumage, biometrics, sexual dimorphism and geographical variation of West Siberian Gull. The identification of the Stuttgart type-specimen of *heuglini* is reviewed. It is suggested that this specimen is, in fact, a Taimyr Gull, and that West Siberian Gull should, therefore, be reassigned the subspecific name '*antelius*'.

Footnote: In this paper, the vernacular and scientific names used for the key taxa of interest are those preferred by the author, although this does not necessarily reflect editorial policy.

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The basis for the designation of a species or a subspecies is the original description of its morphological characteristics and biometrics. Subsequent to that original description, and with the accumulation of further data, new characters may be found and it may be recognised that some of the criteria by which a particular taxon was defined are invalid. Leaving aside moments of real discovery, our knowledge is based on the accumulation of observation and experiment. Subjective errors are part of the learning process.

Despite innovations in biological methods, and the large amount of new information which results from them, intuition and morphological classification remain essential in the field of modern systematics. Large numbers of professional zoologists and other interested parties will never be satisfied solely by the contributions made to systematics by molecular biologists and ethologists. Although advanced methods produce generally reliable results, traditional methods which base classification on physical morphology meet the needs of the majority of fieldworkers. The paradigm that all individuals of a taxon conform to the 'type' has long been replaced in science by the idea that, although different taxa may appear to be discrete, individuals within each taxon are potentially variable. Against the background of brilliant innovations in molecular biology, the collection of morphological data is a fundamental part of systematics.

For some taxa, however, the initial descriptive work is weak and, owing to the limited availability of data, progress is either extremely slow or non-existent. This may occur when the taxa of interest are located in an area which is geographically isolated, or where local administrative problems obstruct researchers. These difficulties are exacerbated if the taxa concerned have only recently diverged from each other. Such a situation, whereby sibling or closely related taxa suffer from a paucity of descriptive data, inevitably results in disagreements among scientists. The activities of enthusiastic amateur taxonomists and fieldworkers, keen to publish their own research, lead to the risk of unsupported hypotheses being introduced into the scientific literature.

Just such a difficult situation has developed with respect to the evolutionarily young 'large white-headed gulls' in the genus *Larus* (the complex of taxa currently grouped by three species: Lesser Black-backed Gull *L. fuscus*, Herring Gull *L. argentatus* and Yellow-legged Gull *L. cachinnans*). Systematists face particular difficulties in this case because of the lack of high-quality primary data. The variety of taxonomic decisions affecting this complex of some 25-35 forms has become paradoxical, such that it appears that all possible combinations of phylogenetic arrangements have been proposed. Kist (1961) described the situation as 'Babylonic'. For those who try to understand the problems posed by these gulls from the data in the literature, there are opportunities to accept or reject, defend or refute, any selected taxonomic position. The real data on which opinions are formed are, however, often limited, and the subsequent proliferation of working hypotheses is not constructive, owing to the impossibility of verifying them in the light of the available facts.

A more fruitful approach to the understanding of phylogeny and speciation of large gulls is not to build on existing data (with all its accumulated errors), but to undertake a complete programme of laboratory and field research covering all the gulls in the complex. In the face of conflicting results, enthusiastic ornithologists may oversimplify or misinterpret the data obtained by their own research or from the literature, as discussed by Chylarecki (1993) and Yésou *et al.* (1994). Disagreements will not be resolved until large amounts of data can be collected by ornithologists handling gulls of undisputed identity on the breeding grounds. Discussion of several taxa is hindered by the predominance of data from the wintering grounds, where the accuracy of identification is doubtful and cannot be confirmed.

Within the large white-headed gull complex, 'Heuglin's Gull' [*L. heuglini*] has been so little studied that experts are sometimes compelled to warn against the mythology surrounding it (Hario 1992). It is a large, dark-mantled gull

119. (Left) Tundra of the Russkii Zavorot peninsula, Russia, June 1996. Water and wetlands dominate this tundra, where thousands of karst and lagoon lakes with connecting channels allow 'West Siberian Gulls' *Larus heuglini antelius* to nest on isolated areas of land. *V.A. Buzun*

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120. Colony of 'West Siberian Gulls' *Larus heuglini antelius*, Russkii Zavorot peninsula, Malozemel'skaya Tundra, Russia, June 1996. This colony is in the coastal part of the peninsula, on a 1.8-ha lake islet.

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121. Colony of 'West Siberian Gulls' *Larus heuglini antelius*, Russkii Zavorot peninsula, Malozemel'skaya Tundra, Russia, June 1996. Part of the same colony as that in plate 120. Distance between nests can be as little as 1.2 m, although it averages 10.8 m in colonies (standard error = 1.1; n = 38) and 462.6 m on open tundra (s.e. = 80.0; n = 6). Details of the spacing of nest sites of West Siberian Gull are given in Buzun (in press).

which breeds in the Arctic region between the White Sea and the Yenisei River. The type-specimen is in Stuttgart, Germany, although its identity is controversial (see Appendix on page 231). Heuglin's Gull has been variously designated as a subspecies of Herring Gull *L. argentatus heuglini* (e.g. Vaurie 1965; Grant 1986) or of Lesser Black-backed Gull *L. fuscus heuglini* (Cramp & Simmons 1983). It has also been regarded as a separate species comprising two races, the 'West Siberian Gull' *L. h. heuglini* and the 'Taimyr Gull' *L. h. taimyrensis*, which is the treatment that I adopt in this paper.

The aim of my current research is to determine the limits of variability in morphology, plumage patterns and biometrics of the various forms in the large white-headed gull complex, and to ascertain the areas in which these characters do not overlap. In the present paper I deal with the West Siberian Gull. In an appendix, I argue that the type-specimen is, in fact, an example of Taimyr Gull, and that the West Siberian Gull should be named *L. h. antelius*, following Iredale (1913). In the following text, the West Siberian Gull is referred to as *antelius* and the Taimyr Gull as *heuglini*. I shall also refer to the Armenian Gull *L. armenicus* simply as *armenicus* and to the 'Baraba Gull' *L. cachinnans barabensis* as *barabensis*. Approximate breeding ranges of some of these forms were described by Grant (1986).

Materials and methods

Between 1987 and 1996, I carried out research into the morphology and behaviour of yellow-legged forms of large white-headed gulls. Where possible, I caught and examined live birds. On the northern Taimyr peninsula, in southwest Siberia, and on the Russkii Zavorot peninsula (Malozemel'skaya Tundra), some gulls were killed with alpha-chloralose, in accordance with appropriate local guidelines, and the fresh specimens were processed. In addition, skins from the Zoological Museum of Moscow State University were examined. The nature of the study, looking at very similar and recently diverged forms, means that large numbers of individuals have to be examined in order to obtain statistically significant morphological data. Not all of my samples are sufficiently large.

A precise estimate of mantle colour was achieved, based on Voous (1959, 1961) and using the grey scale from the colour standards of Ridgway (1912, table 53, LIII). For each individual gull, mantle colour was assigned to a defined shade of grey or given an intermediate value between two shades (table 1). A quantitative estimate of the colour pattern of the primaries was also made (table 2). Goethe's (1961) technique, used for classifying the primaries of *argentatus* and *cachinnans*, was found not to be suitable for the Siberian dark-mantled gulls. Details of measurements taken to record the extent of black pigment in the primaries are illustrated in fig. 1, and data for *antelius* are presented in table 3. To control for size differences between taxa and for sexual dimorphism within taxa, four indices were calculated (i1-i4): these represent the extent of black pigment per 1 mm of wing length on the external (i1 = a_{10}/WL) and internal (i2 = b_{10}/WL) webs of the outermost primary (P10) and on the external (i3 = a_9/WL) and internal (i4 = b_9/WL) webs of P9.

Thirty-seven adult West Siberian Gulls were obtained near the nests on the Russkii Zavorot peninsula and Chayachii Island (68°21'N, 53°49'E), and four second-years and one first-year were shot on the Zakhar'in coast. Measurements were taken with a ruler to an accuracy of 1 mm, or with callipers to an accuracy of 0.05 mm, for the following: wing length, flattened and stretched (WL); humerus (HL); ulna from olecranon to the labrum condyli (UL); sternum from the apex to the edge of the cartilage at the caudal end (S); tail (C); tarsus (TL); middle toe without nail (MTL); length of skull from the crista frontalis interior to the tip of the bill [equivalent to head + bill] (KDB); length of bill from border of feathering (BL1); length of bill from front edge of nostril (BL2); vertical depth of bill from tip of gonys to the culmen, without compression (BH1); inclined depth of bill perpendicularly from the proximal side of the gonydeal angle to as far as the culmen (BH2); vertical depth of bill at level of rear of nostrils (BH3); width of bill at level of rear of nostrils (BW).

As a criterion for the estimation of body size, individuals with intestines empty were weighed to the nearest 5 g (M). The mass of a gull varies seasonally, being lowest in summer during the nestling-feeding period (Barth 1967). The majority of specimens for this study were judged to be close to the final stages of incubation.

Results

Plumage and bare-part characteristics of adult and subadult antelius

Mantle colour

A standardised estimate of the shade of grey on the mantle of *antelius*, using Ridgway's (1912) colour standards (see above), showed that *antelius* is darker than most other forms in the large white-headed gull complex (table 1). The mantle and wings of *antelius* exhibit none of the bluish tones which are characteristic of *argentatus*. The form *antelius* can, therefore, be grouped with three other taxa which have a slaty-coloured mantle, namely *heuglini*, *barabensis* and *armenicus*. As a result of an incomplete pre-breeding moult, 31% of breeding individuals from the Russkii Zavorot peninsula retained old, unmoulted feathers which lent a brown cast to the mantle.

Stegmann (1934) characterised the average mantle colour of *antelius* but did not specify the range of variation. Devillers (1983) and Grant (1986) suggested that *antelius* was darker (close to Lesser Black-backed Gull of the race *graellsii* over much of its range) than it really is.

Primary pattern

There is extensive black in the primaries of *antelius*, as with the rest of the group of slaty-mantled gulls. About 5% of individuals show black in only the six outer primaries; the rest show black in seven or eight primaries (the proportions of each type are approximately equal). The results of my classification of the wingtip pattern of *antelius* from two sites within the breeding range are presented in table 2. A sample of the most common type of pattern is given in fig. 1.

Although *antelius* shows more black in the outer primaries than do the other slaty-mantled gulls, it also has extensive white mirrors on the outermost primary (P10). About 50% of individuals possess a shadowy grey patch encompassing between a quarter and one-sixth of the total area of the mirror on the internal web of P10. Typically, mirrors are smaller or absent on P9: approximately 30% of individuals have one mirror on the outer web, and 8% have small mirrors on both webs of P9 (table 3). The white tip of P10 is reduced; 63% of individuals have a white tip on the external web only, and 24% have no white tips at all.

Table 1. Indices of mantle colour of 'West Siberian Gull' *Larus heuglini antelius* from Kanin, the Russkii Zavorot peninsula and the Gulf of Ob, Russia (Kanin sample includes one individual from northern River Dvina). Terms used for colour shades follow Ridgway (1912).

Locality	No.	Mean mantle shade	S.D.	Mode	Limit (standard names)
Kanin	5	12.2 (>Slate Grey)	0.45	—	—
Russkii Zavorot	40	11.4 (Slate Grey)	1.17	11	8-13 (>Deep Gull Grey-Slate Colour)
Ob	15	9.6 (>Dark Gull Grey)	0.98	9	8-11 (>Deep Gull Grey-Slate Grey)

Table 2. Classification of wingtip-pattern types of 'West Siberian Gull' *Larus heuglini antelius* from the Russkii Zavorot peninsula and the Gulf of Ob, Russia.

Locality	Primary	No.	% Type 1	% Type 2	% Type 3	% Type 4	% Type 5
Russkii Zavorot	P10	38	2.6	51.3	23.1	15.4	7.7
	P9	38	0	5.3	21.1	73.7	0
Ob	P10	17	0	84.0	11.0	5.0	0
	P9	17	0	0	26.0	74.0	0

Typological scheme for recording wingtip patterns of 'dark-mantled' gulls:

P10: *Type 1*: Two large, open mirrors; distal mirror connected with white tip of the feather. *Type 2*: Large outer open mirrors; white tips discernible. *Type 3*: Mirror closed (surrounded by black) on outer web; white tips not present, or present on outer web only. *Type 4*: Mirrors closed on both webs. *Type 5*: Only one closed mirror (often on inner web).

P9: *Type 1*: Two large mirrors (but always smaller than those on P10); outer mirror frequently not entirely surrounded by black (open). *Type 2*: Small, closed mirrors. *Type 3*: Closed (or, less often, open-ended) mirror on only one web (often the inner one). *Type 4*: No mirrors present.

Importantly, *antelius* shows one feature which is much more completely developed in 'Caspian Gull' *L. cachinnans cachinnans*: a white or off-white base of the primaries. Although it is not so obvious as the white 'tongues' on the primaries of many *cachinnans* (Garner & Quinn 1997), 70-75% of *antelius* have a white or whitish base of the internal web of P10; in 25-30% of individuals, this base is grey. (It is impossible to give the exact proportion of birds with a grey or a white basal area of P10 because of the difficulty of discerning shades of very pale grey.) The base of the inner web of P9 is normally grey, but on a very small number of individuals it may be grey-white (in comparison with the grey base of P8).

It is usually possible to determine a distinct border between the basal grey and distal black portions of P10, although this is not the case with about 5% of individuals. The shape of this border is largely straight, as in *armenicus*, and is not concave or convex (fig. 1).

The basal grey portion of the primaries of *antelius* is the least extensive of those of all members of the large white-headed gull complex. Moving descendently from P10 in the half-open wing, the grey portion of the outer web first becomes visible (projecting beyond the tips of the primary coverts) between P7 and P5 on 55-60% of individuals, whereas in all other forms (except nominate *fuscus*) it is seen on P8-P9 (fig. 2). The grey base of the primaries is evident from P6-P7 in about 15% of *armenicus*. In *heuglini*, the grey primary bases are usually visible on P8-P9; on only about 5% of birds is the grey first apparent on P7. Consequently, about 50% of *antelius*, with very restricted grey in the primaries, can be confidently distinguished in the hand from *heuglini* on the basis of this feature.

Stegmann (1934) asserted that *antelius* always possesses black subterminal pigment in P4, and frequently also in P3, a statement confirmed by Devillers (1983).

In summary, *antelius* shows the most extensive development of black pigmentation in the primaries within the large white-headed gull complex, with the exception of *fuscus*. This is evident not only in the number of primaries with black subterminal bands, but also in the percentage extent of black across the primaries.

Iris colour

In common with the other Siberian dark-

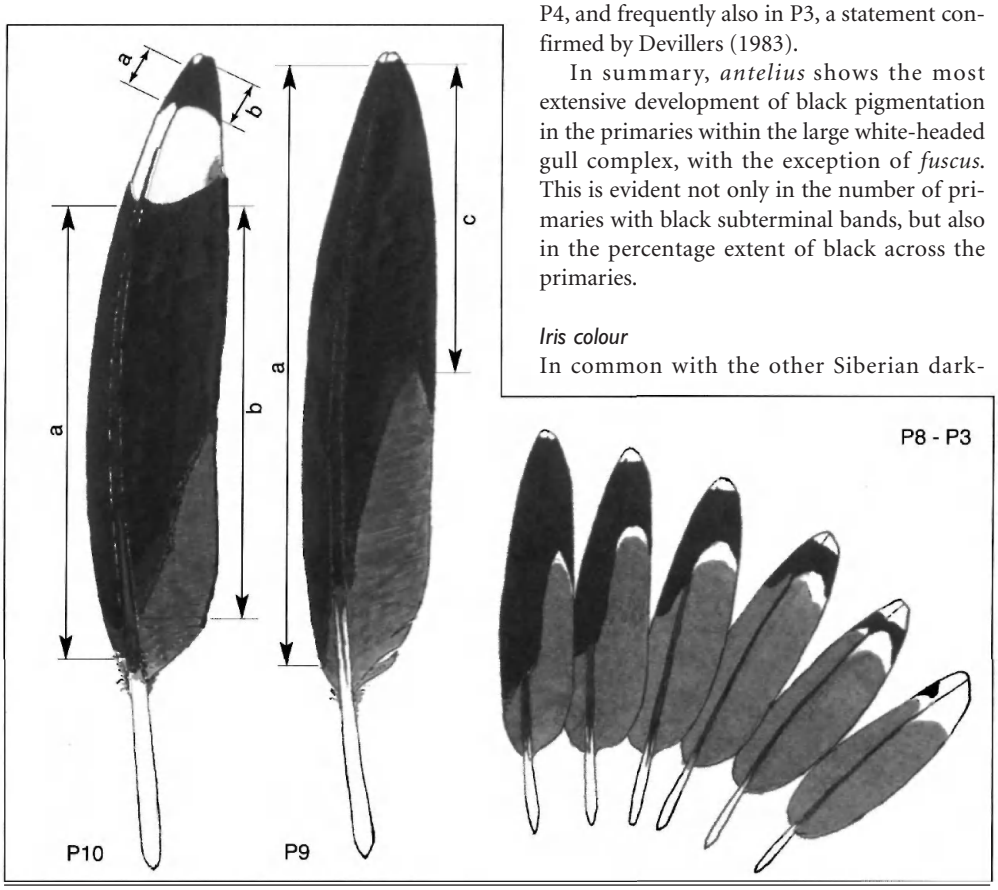

Table 3. Wingtip-pigment parameters of 'West Siberian Gull' *Larus heuglini antelius* from the Russkii Zavorot peninsula. For explanations of sizes a, b and c, see fig. 1; indices i1, i2, i3 and i4 are described in the text. Abbreviations m1, m2, m3 and m4 refer to the length of the mirrors on, respectively, the outer web of P10, inner web of P10, outer web of P9 and inner web of P9.

Characteristics	Size index	No.	Mean (mm)	S.D.	Range (mm)
Length of black phase on P10	a	37	216.4	23.5	102-245
	b	37	202.7	19.1	168-291
	c	37	119.5	23.0	65-175
Length of black phase on P9	a	37	217.9	13.1	190-240
	b	37	190.7	15.2	147-215
	c	37	117.5	30.1	40-165
Length of mirrors	m1	35	27.8	9.5	11-47
	m2	36	27.9	8.2	10-46
	m3	6	6.5	3.7	2-13
	m4	7	9.4	5.2	4-18
Indices of black phase	i1	37	0.49	0.05	0.22-0.54
	i2	37	0.45	0.04	0.39-0.68
	i3	37	0.49	0.03	0.41-0.53
	i4	37	0.43	0.03	0.31-0.47

mantled gulls and *armenicus*, *antelius* normally has some dark pigment in the iris. Only 5% of *antelius* have a completely yellow iris. In some 29% of individuals, the dark speckles in the iris cover only 2-5% of the total area, so that, from a distance, the iris appears completely pale. In the remaining 66%, the iris has a whitish, pale yellow or yellow background over which patches of grey, black or, occasionally, brown pigment are dispersed. The average percentage of the iris marked with dark pigment, estimated visually, is 23.4% (s.e. = 3.9, n = 39).

Orbital-ring colour

The orbital ring of about 80% of *antelius* is dark (coral-) red. The anterior part of the ring may be paler, and in 15% of individuals the orbital ring is a mixture of orange and red. In the remaining 5% it is orange, or even orange-yellow.

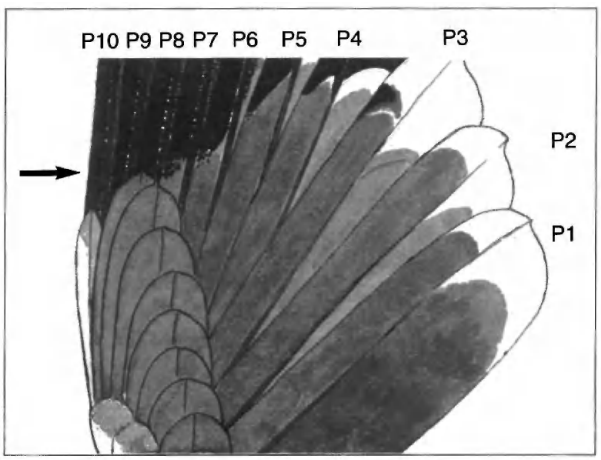

Fig. 2. The most common wingtip pattern of 'West Siberian Gull' *Larus heuglini antelius*. Measurements (a, b, c) used to quantify the extent of the black pigment on P10 and P9 are shown. The size 'b' on P9 is the same as on P10. Maximum lengths are measured for white subterminal 'mirrors'. The basal grey portion of P10 is usually lighter than represented here.

Leg colour

The legs of *antelius* are not uniformly coloured. The tarsus is usually paler and greyer than the rest of the leg, especially along the scales at the front of the leg. In normal field views, about 92% of individuals appear to have yellow legs (pale yellow, lemon-yellow or ochre) and 8% to have grey-yellow to grey legs, although the webs of the feet are always yellow. It appears that those with greyer legs tend to nest in colonies on marine islands.

Bill colour

Adult *antelius* has a yellow bill with a red-orange subterminal spot on the lower mandible. Of 37 adults collected near the nest, eight (22%) had a small black smudge or black band, 3-7 mm wide, on the bill.

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122. The long-call display of 'West Siberian Gulls' *Larus heuglini antelius*, Russkii Zavorot peninsula, Malozemel'skaya Tundra, Russia, June 1996. The angle made by the slope of the head and neck with the plane of the back varies from 30° to 50° in the third phase of the display. This is similar to the same phase of the Herring Gull *L. argentatus* display. In the second phase of the long-call display, however, 40% of West Siberian Gulls from Russkii Zavorot do not bend the head below the breast; instead, they lower the head only to the level of the crop, in contrast to Herring Gulls.

In *armenicus*, the presence of black marks on the bill is a feature of young adults, and is not retained on older birds. I investigated whether this was also the case for *antelius*. Of the adult *antelius* collected, 38% had longitudinal streaks of black or dark grey on some of the greater primary coverts, indicating, as with *argentatus*, that they were 3-4 years old. A statistical analysis showed that there was a significant correlation between the presence of black marks on the bill and black marks on the primary coverts, and therefore between the former and age (χ^2 = 6.03; d.f. = 1; $p < 0.01$). In only 8% of individuals which showed definitive adult plumage were black areas found on the bill, these being very small marks 1-5 mm in extent.

In 5% of four-year-old individuals, there were no black marks on the bill, but red pigment on the upper mandible at the level of the gonys, as is frequently observed on *armenicus* (Buzun 1993). I believe that red pigment on the upper mandible is a feature of young adults, because, on *armenicus*, the red colour is present on areas of the bill that were previously black.

Morphometric characters

As noted earlier, the existing data on size measurements of *antelius* are insufficient for a comprehensive biometric analysis. Outside Russia, only 30 specimens exist in museums (Cramp & Simmons 1983), and not all of them can be assigned to *antelius* with any certainty, since most were collected outside the breeding range. The wintering areas of a number of dark-mantled taxa probably overlap.

The most complete collection of *antelius* skins is stored in the Zoological Institute in St Petersburg, Russia. These specimens have been only partially described biometrically, by Stegmann (1934) and by Yudin & Firsova (1988), neither of which detailed the methods used to obtain measurements. The lengths of the wing, bill and tarsus were analysed only on an elementary level, and for sample sizes which were diverse and variable. Yudin & Firsova (1988) did not clearly specify the borders of the breeding range of *antelius*, and in both cases there was no correction for known shrinkage of stored skins (see Barth 1967). Together, these factors have influenced the results reported in previous studies.

Sexual dimorphism

As significant differences in size between the sexes are known for *argentatus*, *cachinnans* and *armenicus*, the biometric data for *antelius* need also to be analysed separately for males and females. By a combination of skull measure-

Table 4. Measurements of 'West Siberian Gull' *Larus heuglini antelius* from the Kanin peninsula, Russkii Zavorot peninsula and the Gulf of Ob, Russia. Abbreviations of the measurements are explained in the text.

Measurements		Kanin			Russkii Zavorot			Ob		
		Male	Female	Male & female	Male	Female	Male & female	Male	Female	Male & female
WL	No.	8	4	12	17	23	40	8	7	15
	Mean	459.5	434.3	451.1	461.2	434.4	445.8	457.6	437.3	448.1
	S.D.	13.2	13.6	17.8	5.4	12.9	16.9	7.1	15.7	16.8
	Range	442-476	416-448	416-476	452-471	407-468	407-471	429-477	421-456	421-477
HL	No.	—	—	—	17	23	40	—	—	—
	Mean				130.7	122.7	126.1			
	S.D.				3.0	3.1	5.0			
	Range				125.6-136.6	117.4-127.9	117.4-136.6			
UL	No.	—	—	—	17	23	40	7	4	11
	Mean				151.3	141.4	145.6	153.4	143.7	149.8
	S.D.				3.5	4.2	6.3	5.3	3.9	6.8
	Range				143.8-159.1	135.1-151.8	135.1-159.1	143.5-159.1	140.6-149.6	142.6-155.0
KDB	No.	8	4	12	17	23	40	8	7	15
	Mean	126.1	116.3	122.8	126.9	117.3	121.4	129.8	119.6	125.0
	S.D.	3.4	3.7	5.9	2.5	2.6	5.4	1.9	4.9	6.3
	Range	121.6-131.4	112.4-120.0	112.4-131.4	120.8-130.6	111.5-122.5	111.5-130.6	126.7-132.1	109.1-123.4	109.1-132.1
BL1	No.	8	4	12	17	23	40	8	7	15
	Mean	56.6	52.0	55.0	56.8	51.5	53.8	56.6	52.4	54.7
	S.D.	2.38	1.08	2.98	2.38	1.58	3.26	1.44	2.17	2.77
	Range	53.9-60.8	50.7-53.0	50.7-60.8	51.2-61.7	49.0-54.8	49.0-61.7	53.9-57.5	49.2-55.5	49.2-57.5
BL2	No.	—	—	—	17	23	40	8	7	15
	Mean				26.02	23.83	24.76	26.2	24.3	25.3
	S.D.				1.47	0.95	1.61	1.24	0.88	1.42
	Range				23.45-27.80	22.25-25.45	22.25-27.80	24.1-27.3	23.2-25.6	23.2-27.3
BH1	No.	8	4	12	17	23	40	8	7	15
	Mean	18.69	16.63	18.0	19.09	17.15	17.96	19.28	17.15	18.3
	S.D.	0.60	0.42	1.14	0.50	0.64	1.13	1.01	0.57	1.36
	Range	17.6-19.5	16.0-16.9	16.0-19.5	18.35-19.85	15.80-18.50	15.80-19.85	18.15-21.25	16.45-17.95	16.45-21.25

BH2	No.	—	—	—	17	23	40	7	6	13
	Mean				18.65	16.73	17.55	18.96	16.82	18.14
	S.D.				0.64	0.60	1.14	1.24	0.44	1.46
	Range				17.20-19.45	15.35-17.65	13.35-19.45	17.3-21.2	16.3-17.5	16.3-21.2
BH3	No.	—	—	—	17	23	40	8	7	15
	Mean				18.05	16.05	16.89	17.87	16.35	16.15
	S.D.				0.65	0.55	1.16	0.91	0.79	1.14
	Range				16.95-18.90	15.0-16.95	15.0-18.9	17.05-19.75	15.15-16.95	15.15-19.75
BW	No.	—	—	—	17	23	40	—	—	—
	Mean				12.21	11.16	11.61			
	S.D.				0.41	0.58	0.73			
	Range				11.75-13.05	10.0-12.45	10.0-13.05			
TL	No.	—	—	—	17	23	40	8	7	15
	Mean				70.6	65.4	67.6	71.8	66.7	69.4
	S.D.				2.12	2.74	3.58	4.49	2.78	4.49
	Range				66.8-74.5	58.7-70.5	58.7-74.5	65.3-77.3	63.4-71.5	63.4-77.3
MTL	No.	8	4	12	17	23	40	8	7	15
	Mean	56.9	53.1	55.7	53.0	49.5	51.0	54.3	50.8	52.7
	S.D.	2.98	2.65	3.34	1.66	1.32	2.26	1.45	2.13	2.49
	Range	52.0-62.5	45.9-55.9	49.5-62.5	50.2-56.0	47.8-53.2	47.8-56.0	52.6-56.8	47.2-54.2	47.2-56.8
S	No.	—	—	—	17	23	40	—	—	—
	Mean				85.4	80.5	82.6			
	S.D.				2.43	2.04	3.3			
	Range				80.7-90.5	74.4-83.6	74.4-90.5			
C	No.	—	—	—	17	23	40	—	—	—
	Mean				168.2	155.3	160.8			
	S.D.				8.2	5.3	9.2			
	Range				147-185	145-165	145-185			
M	No.	7	3	10	17	23	40	—	—	—
	Mean	997.1	840.0	936.0	1,107.7	906.7	992.1			
	S.D.	49.9	65.6	83.7	84.7	98.5	136.1			
	Range	900-1,040	770-900	770-1,040	960-1,265	745-1,055	745-1,265			

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123 & 124. Nesting 'West Siberian Gulls' *Larus heuglini antelius*, Russkii Zavorot peninsula, Malozemel'skaya Tundra, Russia, June 1996. Note how different postures affect the profile and appearance of the birds.

ments such as condylobasal length (combined head and bill), and bill length and depth, it is possible to sex live gulls reliably. It was, therefore, important to establish similar parameters for sexing *antelius* and *heuglini*. Consequently, I processed and dissected the specimens obtained on the Russkii Zavorot peninsula and in the northern Taimyr peninsula.

It was found that significant numbers of females overlapped in measurements with males. In a sample of 23 females, two were heavy (930 g and 1,045 g), with very long wings (453 mm and 468 mm) and a large skull (122.5 mm and 121.4 mm). Before dissection, both were mistakenly thought to be males. The biometric data for one of these females exceeded the mean for both sexes (table 4). The short sternum, the large, long-billed head and the rather short legs made this female appear massive on the ground, and its long wings made it look large in flight, too. It was not possible to establish a method of sexing birds by weight. Three other females were heavy (1,025–1,055 g), but each had a short, delicate bill which allowed accurate sexing before post-mortem examination.

All 17 males were accurately sexed by their

external appearance, using male *argentatus* as a guide.

Although there is overlap between males and females in each character, individual gulls can be sexed accurately by using a combination of characters. Of those caught on the Russkii Zavorot peninsula, 22% had a humerus length which fell in the overlap zone between males and females; similar overlap between the sexes was found in the condylobasal length (skull) in 10% of individuals and in the bill depth at the rear edge of the nostril in 5%.

The following formulae (DF = discriminant factor) permit 100% accuracy in the determination of males and females (see 'Materials and methods' on page 219 for definitions of measurement abbreviations). For males DF > 0, whereas for females DF < 0.

$$DF = (0.14 \times KDB) + (1.03 \times BH1) - 45.89$$
or
$$DF = (1.31 \times BH1) + (0.32 \times BL1) - 40.64$$
or
$$DF = (0.83 \times BH1) + (0.95 \times BH3) - 31.02$$

It is hoped that these discriminant equations will be widely applicable, because geographical size variation is likely to be weak (see below).

Body-size parameters

The biometric data for *antelius* from three geographically discrete populations are presented in table 4. It seems that *heuglini* is the longest-winged form of the Siberian dark-mantled complex. Taking body size as a whole among the dark-mantled gulls, *antelius* appears to be second largest after *heuglini*. The average wing length of *antelius* from the Russkii Zavorot peninsula is probably exceeded only by that of *L. [cachinnans?] mongolicus* (Piechocki 1968; Firsova & Yudin 1988; but sample sizes extremely small) and *L. cachinnans michahellis* from the Camargue (Isenmann 1973). Stegmann (1934) gave maximum wing length for *antelius* of 490 mm, seemingly measured without stretching the wing or correcting for dehydration of the specimens; the same figure is quoted by Cramp & Simmons (1983). With the exception of bill length and tarsus length, *antelius* is smaller than *heuglini* in most measurements.

Nevertheless, *antelius* has a rather small head, with a short skull. The bill is of medium length and depth; for males, the ratio between the two is 2.98 (s.e. = 0.04; n = 17). The legs are relatively long: for males, the mean ratio (MTL/TL) × 100 = 75.1 (s.e. = 0.72; n = 17); for females, mean = 75.7 (s.e. = 0.65; n = 23).

The wide variation in the weights of males (7.6%), females (10.9%) and both sexes combined (13.7%) is of note. These coefficients are slightly higher than is the case with, for example, *argentatus* from Norway (Barth 1967) or Germany (Kuschert 1979). This variation can probably be explained by the changes in fat deposits within the abdominal cavity of *antelius* during the breeding season. The degree of variation in other biometric characters does not differ from equivalent figures for *argentatus*.

Primary moult

On the Russkii Zavorot peninsula, in 1996, the stage of primary moult differed not only between breeding birds and immatures, but also between those nesting on tundra and those nesting on marine islands.

Of five individuals aged from one to three years, three had begun their primary moult at some time during the first ten days of June. By the end of July, P6 was moulted. For adults, the beginning of primary moult (the loss of P1) occurred between 20th June and 20th July. Consequently, for any given population, there is about one month's variation among individuals. By the middle of July, 25% of adults nesting on marine islands had moulted P3, whereas 30% of adults nesting on tundra had moulted P4 (and some individuals were even more advanced).

Geographical variation in antelius

In addition to the specimens from the Russkii Zavorot peninsula, specimens from both the eastern (Obskaya Bay) and western (Kanin peninsula) parts of the breeding range of *antelius* were examined. Although the western border of the breeding range can be determined with precision (Filchagov *et al.* 1992), the eastern limit and the area of overlap or intergradation with *heuglini* have not been sufficiently studied. The analysis of the geographical variation of mantle colour by Stegmann (1934) demonstrated that the area of overlap between these two forms is extensive and lies between the Gydan peninsula and Yenisei Bay. The samples from the River Ob considered here, therefore, represent the extreme eastern populations of *antelius*, with the Russkii

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125. Nesting 'West Siberian Gull' *Larus heuglini antelius*, Chayachii Island, Pechora Sea, Russia, July 1996. A proportion of West Siberian Gulls nests on marine islands in elevated areas in the supralittoral zone; for details, see Buzun (in press).

Zavorot population representing the centre of the range.

As shown in table 1, the mantle colour of *antelius* darkens from east to west (see also Stegmann 1934). There is, however, considerable variation at any one site, such that, although dark individuals are more frequent in extreme western areas, it is difficult to find any darker than the most dark-mantled birds from the Russkii Zavorot peninsula ('Slate-colour' in Ridgway 1912).

The wingtip pattern of *antelius* also varies from east to west (table 2). The frequency of the dark variant of P10 (one or two small, closed mirrors) increases, while the frequency of birds showing two large open mirrors decreases by 1.5 times, between the Russkii Zavorot peninsula and the River Ob. Variation in size of the white mirrors is, however, independent of the total area of black pigment in the primaries: the standardised indices (corrected for other body measurements as described earlier) of black pigment hardly vary from east to west, although there may be a slight reduction in black on P9. The uncorrected raw data erroneously suggest a gradual reduction in black pigment from east to west.

It follows from table 4 that variation in wing length from east to west is simply an artefact of small sample size. When the sexes are combined for samples from Kanin and Russkii Zavorot, all the differences are not significant (Wilcoxon t-test). There are no significant tendencies for weight and other body-size parameters to increase towards the eastern end of the breeding range. If clinal size variation exists, the trends are extremely weak.

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126 & 127. Nesting adult and nest site of 'West Siberian Gulls' *Larus heuglini antelius*, Russkii Zavorot peninsula, Malozemel'skaya Tundra, Russia, June 1996. Concealment of nests is not typical, but some pairs nesting on mainland tundra use willows *Salix arctica* or *S. glauca* to shelter the nest. For details, see Buzun (in press). The callipers in plate 127 show 10 cm.

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128. 'West Siberian Gulls' *Larus heuglini antelius*, Chayachii Island, Pechora Sea, Russia, June-July 1996. This photo illustrates two extreme variants of mantle colour, from slightly darker than 'Deep Gull Grey' to 'Slate Colour' (see Ridgway 1912), found in a sample of 23 individuals from this island.

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129. 'West Siberian Gulls' *Larus heuglini antelius*, River Ob delta, Russia, June 1998. Two extreme variants of mantle coloration in a sample of eight individuals from this area.

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Appendix

Revision of classification of the Stuttgart heuglini *type-specimen*

The identity of the two gulls described by Bree (1876), collected in winter on the coast of Somalia by Theodor von Heuglin, remains unclear. The type-specimen of 'Heuglin's Gull' is stored in the Stuttgart Museum of Natural Science, Germany, and has repeatedly been re-examined (Neumann 1934; Goethe 1973, 1982; Devillers, in Haffer 1982). Neumann classified it as *taimyrensis*, but he had no specimens of West Siberian Gull for comparison, whereas Goethe changed his mind between 1973 and 1982. From the detailed description of the specimen published by Goethe and information on the fresh specimen examined by Heuglin (1873), it is possible to extract the following characteristics (table 5).

Table 5. Description and identification of the '*heuglini*' type-specimen from the Stuttgart Museum of Natural Science, Germany. Character descriptions are taken from Heuglin (1873) and Goethe (1973).

Character	Candidate taxa			
	antelius	*heuglini* (= *taimyrensis*)	*barabensis*	*armenicus*
1 'Neutral Grey' mantle (Ridgway 1912)	XX	XXX	XXX	XXX
2 Large mirrors on P10; black subterminal band present (tip ragged)	XXX	XXX	XXX	XXX
3 No mirrors on P9	XXX	XXX	XX	XXX
4 Black on six outermost primaries	X	XXX	X	X
5 Whitish base to P10, becoming progressively more restricted on P9-P7	?O	XXX	XXX	O
6 Coral-red orbital ring*	XXX	XXX	XXX	X
7 Brick-red iris with 65-70% coverage of blackish pigment	XXX	XXX	XXX	XXX
8 Black patch on mandible	XX	X	X	XXX
9 Pale yellow legs	XXX	XX	XXX	XXX
10 Length of wing = 460 mm	XXX	XXX	XX	O
11 Length of tarsus = 60 mm	O	XXX	XX	X
12 Sparse, narrow head streaking, coarser on nape and hindneck	XXX	XXX	?O	XXX

XXX = character is absolutely consistent with this taxon.
XX = character is shown by a smaller proportion of individuals of this taxon.
X = character is at limit of range of variation within this taxon.
O = character probably excludes this taxon.

* Note that in Plate XXXVI of Heuglin (1873), the orbital ring and the background of the iris are shown as being paler and more yellowish than stated in the written description.

In addition, the state of moult of the type-specimen is as follows: P1-P4 fresh; P5 growing; P6 in pin; P7-10 old feathers. The individual was collected between 17th and 25th October. Dementiev & Gladkov (1951) state that *antelius* completes primary moult in October, whereas Cramp & Simmons (1983) give January-March.

From character 3, identification as *barabensis* is dubious. Character 4 almost excludes *barabensis*, *armenicus* and *antelius*. On the basis of 5 it is possible to exclude *armenicus* and perhaps *antelius*. Character 10 also excludes *armenicus* and is further evidence against *barabensis*. Character 11 excludes *antelius* and suggests also that the type-specimen is neither *barabensis* nor *armenicus*.

The Stuttgart type-specimen offers an opportunity to test our ability to identify an isolated individual of one of the Siberian dark-mantled taxa away from the breeding location. Until now, this has been a rather difficult problem. On the basis of the evidence gathered by my colleagues and myself, I believe that the 'Stuttgart gull' is very probably a *taimyrensis* or is perhaps an intergrade between *taimyrensis* and *antelius*.

On approximately one-third of *taimyrensis* individuals, the base of P10 is whitish, and on many individuals traces of white may be found at the base of several other primaries, too. This feature is commonly shown by *barabensis* (85% of individuals), but that form can be ruled out because *barabensis* males have, on average, a larger number of primaries with black, as well as shorter wings and longer tarsi. In addition, *barabensis* would probably show a less streaked head and neck in winter plumage.

As suggested in the preceding text (page 220), *antelius* is characterised by a mantle which is darker than that of the Stuttgart specimen, and would also be expected to show a greater number of primaries with black subterminal pigment. Male *antelius* never have such a short tarsus, while the traces of whitish at the bases of P8 and P7 almost certainly rule out *antelius*. The short tarsus of the Stuttgart gull almost unequivocally places the bird with *taimyrensis*. The yellow legs are not an obstacle to its identification as *taimyrensis*, since this feature is shown by 38% of individuals of this form. The black marks on the bill are not typical for breeding *taimyrensis*, but possibly occur more frequently in winter (Hirschfeld 1992).

The second specimen, in immature plumage, is also of interest, but has now unfortunately been lost. Neumann (1934) designated it a syntype. Heuglin (1873) believed it to belong to the same taxon as the adult, with 'perfectly saturated smoke-grey tone on the back'. It was in second-winter plumage, but the sex is not recorded. Judging by the length of the bill (54 mm), it was probably a male. The length of the tarsus was 61 mm, which also places it within shorter-legged *taimyrensis*.

If this revised identification is correct, then the rules of zoological nomenclature dictate that *taimyrensis* be given the subspecific name *heuglini* (*L. heuglini heuglini*). The use of '*heuglini*' for this taxon has rarely been used, and then usually with an explanatory parenthetical explanation, i.e. '*heuglini* (= *taimyrensis*)'. The use of the subspecific name *heuglini* for the 'Taimyr Gull' is unlikely to be popular, since the widespread adoption of the name *taimyrensis* is assisted by the fact that that name conforms with the bird's geographical location. Again according to nomenclatural rules, the 'West Siberian Gull' should reacquire the subspecific name *antelius* (*L. heuglini antelius*), which was the name given to specimens collected near the River Ob and described by Iredale (1913).

It has also been suggested that the use of subspecific vernacular names should cease (see arguments in McKitrick & Zink 1988). Nevertheless, the potential or actual reproductive isolation between some forms of the large white-headed gull complex requires us to refer to them as probable species and to assign them a specific name. Such treatments of the Siberian dark-mantled gulls are, however, based on poor research.

Neither of the common names of 'Heuglin's Gull' given in Russian sources ('West Siberian Gull' and 'Eastern Lesser Black-backed Gull') is fully appropriate, since two-thirds of the breeding range lies outside Siberia, and it is doubtful that the taxon is a Lesser Black-backed Gull. In the light of my revision of the identification of the Stuttgart *heuglini* type-specimen as a Taimyr Gull, the common name of 'Heuglin's Gull' clearly cannot be used as the vernacular subspecific name for *antelius*. If *antelius* and *heuglini* (= *taimyrensis*) are regarded as different subspecies of the same species, *L. heuglini*, then 'Heuglin's Gull' may be used to denote the whole species.

Possible options are to retain the subspecific name 'West Siberian Gull' for *antelius*, or to use the literal translation of *antelius* from the Greek 'αντηλιος' and to call the taxon 'Eastern Gull'. Alternatively, since the specimens used by Iredale (1913) were obtained from the Ob by O. Finsch, the name 'Finsch's Gull' may be appropriate.

Furthermore, the possibility that the Stuttgart type-specimen is a hybrid or intergrade between West Siberian and Taimyr Gulls should be considered, although this is perhaps not verifiable. If such were the case, the name *heuglini* would become invalid; the West Siberian Gull would be termed *antelius* and the Taimyr Gull would return to *L. taimyrensis taimyrensis* Buturlin 1911.