Wing-tip pattern and possible affinities of coastal Finnish Herring Gulls *Larus argentatus*

Mikael Kilpi & Martti Hario

The racial status of Finnish Herring Gulls (*Larus argentatus*) has been a point of persistent interest for many years (Voipio 1954, 1968, Barth 1968, Glutz & Bauer 1982). The occurrence of yellow-legged Herring Gulls (*L. a. omissus* or *L. a. cachinnans*) has been much debated, but the racial features of the majority of the present population breeding on the coast are far from thoroughly studied.

Recently, Coulson et al. (1982) presented a simple method for assessing the population affinities of Herring Gulls, based on the pigmentation pattern of the primaries. Coulson et al. (1982) had found a reasonably clear difference in this pattern between British and Scandinavian (the origin verified also by ring recoveries) Herring Gulls. They suggested that the wing-tip pattern might be an inherited character reflecting the genetic make-up of the birds, and could thus be used to establish genetic relationship between different populations. In this note we will use their method and discuss the possible affinities of Herring Gulls breeding off the southern coast of Finland.

We applied the method of Coulson et al. (1982) to a small sample of Herring Gulls from the breeding population at Söderskär, Gulf of Finland (approx. 60° N, 26° E). The method will not be described here, but examples of wing-tip patterns are given in Fig. 1. The gulls (44 males and 45 females) had been killed during the breeding season (17–18 May 1971). They had been weighed, sexed by dissection, skinned and subsequently stored at the Zoological Museum, University of Helsinki.

All birds had a complete adult plumage. They had probably all owned nesting territories, since they were killed by placing chloralose-treated fish beside active nests.

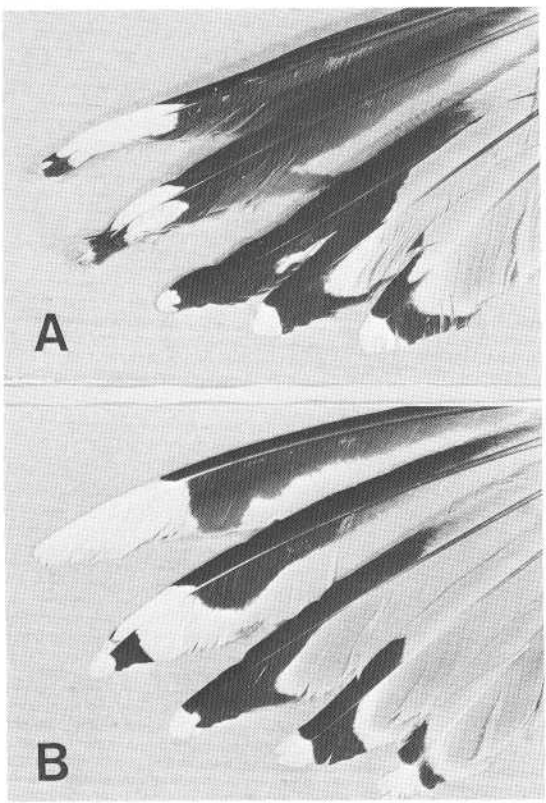

Fig. 1. Examples of wing-tip patterns in the Söderskär sample. A = last (longest) primary with extensive black markings (a female), B = last primary white. Note that this female also shows the "thayeri" pattern (grey web reaches through the black markings) on the second outermost primary (Photo: R. Tyynelä).

The wing-tip pattern

In the Söderskär sample (Table 1.) the females had a slightly higher proportion of individuals with six or more black primaries than the males, but this difference was not significant (χ^2-test). Among the birds with the last primary white, the females had fewer than six black primaries more often than the males ($\chi^2 = 6.1$, df = 1, $P < 0.025$), the proportion being 26 % for the males and 59 % for the females.

When we combine the males and the females, we obtain a sample comparable to the mixed-sex samples of Coulson et al. (1982). In our sample, the proportion of birds with the last primary white and five or fewer black primaries is 34 %, which is in the range of the values for British populations. No bird in our sample had fewer than five black primaries, and only one male had seven black primaries. Four females and one male had the last primary black and only five black primaries altogether.

It seems that the Söderskär sample differs from the birds identified by Coulson et al. (1982) as Scandinavian. The Söderskär gulls had a significantly higher proportion of birds with six or more black primaries (78.6 % of the Söderskär gulls, 34.9 % of the Scandinavian gulls, see Table 2. ($\chi^2 = 42.3$, df = 1, $P < 0.001$). The birds with the last primary white had six or more black primaries significantly more often than the Scandinavian gulls ($\chi^2 = 8.9$, df = 1, $P < 0.01$), but no such difference was found among the birds with the last primary black. The Söderskär gulls did not differ from British gulls (Table 2.).

The "*thayeri*" pattern

Of the 89 gulls we examined, only six (7 %) had the characteristic "*thayeri*" pattern on the 9th primary (when numbered outwards, for a full description of the "thayeri" pattern see Fig. 1. and Barth 1968). All these were females, and thus 13 % of the females had this pattern. Females tended to have a greater total variance in the wing-tip pattern than males, which possibly reflects a stronger tendency to disperse over longer distances (see Chabrzyk & Coulson 1976).

Table 1. The wing-tip pattern of the Söderskär sample.

Sex	N	No. (%) with last primary scored as white	No. (%) with 6 or more black primaries
Males	44	19 (43.0)	39 (88.6)
Females	45	22 (48.8)	31 (68.8)
Total	89	41 (46.1)	70 (78.6)

Affinities of the Finnish coastal population

Our results suggest that Herring Gulls from the Gulf of Finland may be more closely related to Herring Gull populations from the North Sea area and Britain than to the northern Scandinavian populations with very pale wing-tips and few black primaries. This conclusion would of course be more definite if data on other morphological characteristics existed for comparison. The possibility of genetic affinity with southwesterly populations is interesting, since a different conclusion has been reached by many earlier workers (Voipio 1954, 1968, Barth 1968 and references therein). According to these authors, the yellow-legged form (*L.a. omissus*) breeding along the coasts of the White Sea and in northern Fennoscandia is the same as the nominate *L.a. argentatus* (these birds should thus be similar to the Scandinavian birds of Coulson et al. (1982)). After examining extensive material from Norway, Barth (1968) rejected such characters as leg colour and the colour of the eye-ring as diagnostic of subspecies. Yet, in limited material from Finland (33 birds, mainly from inland locations) he found characters (in addition to yellow legs) indicating elements of the southern form *L.a. cachinnans*. Sharing the opinion of Voipio (1954), he finds it possible that the yellow-legged individuals, particularly in Finland and the Baltic, originate from mixing with *L.a. cachinnans* immigrating from the southeast. These opinions have resulted in the common view that at least an appreciable fraction of the Finnish Herring Gulls originates from the Aralo-Caspian area (see Glutz & Bauer 1982). It should be pointed out here, that the material was collected in the 1950s, when the Finnish population was still small (Bergman 1982).

When the Söderskär sample was collected, the original leg colour of the birds was not noted on the labels. The present colour of their legs does not indicate presence of individuals with clearly yellow legs (in the sample examined by Barth (1968) the legs are obviously yellow even today, and these skins have not been treated differently from the Söderskär skins). The population breeding at Söderskär today (some 600 pairs) consists of birds with flesh-coloured legs, and birds with pale yellow legs are encountered only occasionally (our own obs.). Thus both the colour of the legs, and the wing-tip pattern (not known for *cachinnans*-gulls) indicate a westerly affinity. Herring Gulls with yellow legs are, however, found in Finland. Samples taken at the Helsinki City dump in 1979 (23 August, M. Kilpi unpubl.) contained two individuals with pale yellow legs (24 birds caught), which had been ringed as chicks in the Gulf of Finland. Another sample of 59 birds taken later (17 September) at the same location contained 16 birds (27 %) with distinctly yellow legs. By this time, Herring Gulls from the White Sea had probably begun their migration (Bianki 1977) and reached Finland, thus affecting the sample. It is, of course, possible that the yellow-legged birds originated from inland populations in Finland. The wing-tip patterns were not checked.

If we assume that the Söderskär sample is representative of the Herring Gulls breeding on the south coast of Finland, the implications are clear. As most Herring Gulls are coastal, it appears that the majority of the Finnish population has a southwesterly affinity, and does not resemble eastern forms (or northern forms, for that matter). It thus seems that the coastal population is the result of expansion from the southwest.

The yellow-legged Herring Gulls in Finland, breeding mostly on bogs and a few lakes, seem to have a longer history than the coastal population, since large colonies were reported in the last century, when coastal Herring Gulls were still almost unknown. It would be interesting to check whether they resemble *cachinnans*-type birds, or whether they resemble birds from northern Scandinavia or the White Sea. In a few instances it has been noted (Lundberg 1978) that local populations previously dominated by yellow-legged birds have mixed rapidly with immigrating birds with flesh-coloured legs. Due to strong expansion of the coastal birds during the last few decades (Kilpi & Saurola 1983) the inland birds are rapidly being assimilated through mixed pairings. It would be interesting to examine Herring Gulls from large mixed colonies (if such still exist) in order to assess the affinities of the yellow-legged form and to test the assumption that the wing-tip pattern can be used as an indication of origin.

Acknowledgements. Financial aid from the Finnish Academy to MK is gratefully acknowledged.

Selostus: **Suomenlahden harmaalokkien käsisulkien värin yhtäläisyydestä (affiniteetista) läntisten ja pohjoisten kantojen kanssa**

Eri maantieteellisiltä alueilta peräisin olevien harmaalokkien ilmiasun yhtäläisyyksiä selviteltiin vertaamalla Suomenlahdelta kerättyjen 89 yksilön käsisulkien väriä julkaistuihin tietoihin Brittein saarten ja Skandinavian lintujen käsisulkien väristä. Käsisulkien värin käyttäminen tässä perustuu havaintoon valkean osuuden vähenemisestä ja mustan enentymisestä pohjoisesta etelään (tai koillisesta lounaaseen). Milloin uloin käsisulka oli luokiteltavissa "valkoiseksi", oli mustien sulkien määrässä merkitsevä ero Skandinavian lintujen ja Suomenlahden lintujen välillä, mutta ei Brittein saarten ja Suomenlahden lintujen välillä. Mikäli uloin käsisulka oli luokiteltavissa "mustaksi", ei ryhmien välillä ollut eroja (Taul. 2).

Tulos viittaa Suomenlahden lintujen värin läheisempään yhteyteen läntisiin (Brittein saarten ja Pohjanmeren) kantoihin kuin pohjoisiin (Skandinavian). Tämä on ristiriidassa aikaisempien suomalaisten harmaalokkien alkuperää koskevien käsitysten kanssa. Alkuperäinen harmaalokkiasutuksemme lienee ollut sisävesillä esiintyvää keltajalkaista muotoa *omissus*, jota useat tutkijat pitävät nimirodun (Skandinavian *argentatus*) yksilömuunnoksena. Keltajalkaisuutta on rannikon kannoissa nykyään hyvin vähän. Suomenlahden pesimälintujen jalat ovat harmahtavan lihanväriset, mutta keltajalkaisia harmaalokkeja ilmaantuu rannikoille syksyllä. Nämä lienevät joko Suomen sisämaasta tai Vienanmereltä tulevia läpimuuttajia.

Table 2. The wing-tip pattern in the Söderskär sample compared with the pattern in the samples used by Coulson et al. (1982). Numbers and (%).

Last primary Black primaries	white ≤ 5	white ≥ 6	black ≤ 5	black ≥ 6
Söderskär	14 (34.1)	27 (65.9)	5 (10.4)	43 (89.6)
British E coast	126 (39.4)	194 (60.6)	74 (18.6)	323 (81.4)
British W coast	26 (25.5)	76 (74.5)	55 (9.1)	550 (90.9)
Scandinavia	106 (74.1)	37 (25.9)	4 (15.4)	22 (84.4)

Suomen sisämaan kannoista ei ole olemassa vastaavia selvityksiä käsisulkien väristä. Siten ei ole (nykyisin) aineistopohjaisia perusteita pitää Itämeren aluetta myöskään ns. *cachinnans*-muodon esiintymisalueena (yhtä vähän kuin *omissus*-muotoa *L. cachinnans*-lajin alalajina, vrt. Glutz & Bauer 1982). Todennäköisesti Itämeren mereiset kannat ovat nykyään nimirodun ja läntisen *argenteus*-rodun välittävää muotoa, jonka jalat ovat useimmiten harmahtavan lihanväriset, silmäreunus oranssi tai kellanoranssi ja jonka käsisulissa on runsaasti mustaa.

References

Barth, E. K. 1968: The circumpolar systematics of Larus argentatus and Larus fuscus with special reference to the Norwegian populations. — Nytt Mag. for Zool. 15:1–50.

Bergman, G. 1982: Population dynamics, colony formation and competition in Larus argentatus, fuscus and marinus in the archipelago of Finland. — Ann. Zool. Fennici 19:143–164.

Bianki, V. V. 1977: Gulls, Shorebirds and Alcids of Kandalaksha Bay. Jerusalem.

Chabrzyk, G. & Coulson, J. C. 1976: Survival and recruitment in the Herring Gull Larus argentatus. — J. Anim. Ecol. 45:187–203.

Coulson, J. C., Monaghan, J., Butterfield, J., Duncan, N., Thomas, C. S., & Wright, H. 1982: Variation in the wing-tip pattern of the Herring Gull in Britain. — Bird Study 29:111–120.

Glutz von Blotzheim, U. N. & Bauer, K. 1982: Handbuch der Vögel Mitteleuropas. — Band 8/1. Wiesbaden.

Kilpi, M. & Saurola, P. 1983: Geographic distribution of breeding season recoveries of adult and immature Larus marinus, L. argentatus and L. fuscus ringed in Finland. — Ornis Fennica 60:117–125.

Lundberg, C-A. 1977: Sanemossen, en enastående österbottnisk fågelmyr, som bör skyddas. — Österbotten 1976–1977:233–245.

Voipio, P. 1954: Über die Gelbfussigen Silbermöven Nordwesteuropas. — Acta Soc. Fauna Flora Fennica 71:1–56.

Voipio, P. 1968: Zur Verbreitung der argentatus- und cachinnans- Möwen. — Ornis Fennica 45:73–83.

Authors' addresses: Mikael Kilpi, Zoological Museum of the University, University of Helsinki, P.Rautatiekatu 13, SF-00100 Helsinki, Finland, and Martti Hario, Game and Fisheries Research Institute, Turunlinnantie 8, SF-00930 Helsinki, Finland.

Seasonal changes in the mineral content of the liver of the Willow Grouse *(Lagopus lagopus)* in the far north of Finland[1]

Erkki Pulliainen & Paavo S. Tunkkari

Seasonal changes have been recorded in the fresh weight and glycogen content of the liver and in many other characteristics of the Willow Grouse (*Lagopus lagopus* L.) in the far north of Finland (Pulliainen & Tunkkari 1983, 1984, Pulliainen 1985). The diet of the species is also known to vary from season to season (Pulliainen & Iivanainen 1981, Pulliainen, unpubl. data), but until now no information was available on the mineral content of the liver. During one year 53 Willow Grouse were shot in the districts of Inari, Salla and Savukoski in North Finland. They were refrigerated as soon as possible and sent to Oulu, where the livers were removed and dried at 70°C for two days. The manganese, phosphorus, magnesium, calcium, zinc and copper contents were determined with direct-current plasma emission spectrometry (DCP-AES; for methods, see Pulliainen & Lajunen 1984.

Since sex-related differences occurred in the case of only one element, the two sexes are dealt with together here. This exceptional case concerned the concentration of calcium in April-May, i.e. during the breeding season, the average value being significantly lower in the females than in the males ($t=3.13$, $p<0.05$, $df=10$). The daily consumption of calcium by females is great (2 g) during the egg-laying period. The ingestion, absorption and turnover of calcium must be very high in order supply the calcium required for shell formation. Although absorption is known to be higher when calcium is being deposited in the shell than at other times (Hurwitz & Bar 1965), the large requirement for shell formation seems to lower the calcium level in the liver to some extent (see also Fig. 1).

The concentration of phosphorus was about 25-fold that of calcium (Fig. 1). It shows the same rhythm as calcium, the minimum level occurring in the spring (Fig. 1). In general phosphorus is utilized less efficiently and in a more variable manner than calcium (Loosli 1973), which may be reflected in its concentration in the liver.

The level of magnesium was a little higher than that of calcium, and it showed no significant seasonal variation (Fig. 1). Protein supplements are said to decrease magnesium availability (Loosli 1973). The diet of Willow Grouse, however, is rather poor in protein throughout the year (Pulliainen, unpubl. data).

Manganese, copper and zinc are essential trace elements and all showed significant seasonal variation in the liver (Figs. 1–2). Copper is essential for haemoglobin formation, manganese for normal bone formation and prevention of perosis, and zinc, among other things, for prevention of parakeratosis (Fritz 1982). The variations recorded may reflect fluctuations in the availability or in the rate of consumption. The peak recorded for manganese in September-October is interesting, since it is most probably connected with the consumption of large amounts of blueberries. The manganese values of three Willow Grouse which had abundant blueberries in their crops were: 101 (ad. male), 148 (ad. female) and 301 (juv. female) µg/g.

[1] Report No. 158 from the Värriö Subarctic Research Station of the University of Helsinki.