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The Variably Plumaged Gulls of Iceland

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I (Ingolfsson 1970, 1987) described a situation in Iceland where apparent extensive hybridization occurred when Herring Gulls (*Larus argentatus*; comparatively small, with strongly pigmented primaries) immigrated to Iceland starting about 1920 and encountered Glaucous Gulls (*L. hyperboreus*; larger, with light unpatterned primaries). At present the majority of the gulls that breed in western Iceland appear still to be pure *hyperboreus*. In eastern and southern Iceland pure *hyperboreus* are scarce or absent, and most of the gulls appear to be hybrids or pure *argentatus*.

Snell (1991a, b) recently questioned whether hybridization in fact has occurred in Iceland. He considered it more likely that the intermediate plumage pattern of Icelandic gulls "represents the genetic legacy of light-winged *L. argentatus* founders, possibly dispersed from Scandinavia, where light-winged *L. argentatus* are present" (1991b:329). This conclusion was based mainly on two lines of argument. First, "There is no evidence Icelandic populations of either *argentatus* or *hyperboreus* are more variable than allopatric populations of either species morphologically" (1991a:325). Second, there is no correlation between amount of melanin (pigment) in primaries and body measurements.

Snell's reasoning fails on both accounts. This is partly the result of an unfortunate, but understandable, choice of Skrudur as a study colony in eastern Iceland. This colony contains a higher proportion of *argentatus*-like birds than most other colonies in eastern and southern Iceland. My previous account (Ingolfsson 1970) should have made this clear.

Snell (1991b) stated that his samples of *hyperboreus*-like gulls from Bjarnarhafnarfjall (western Iceland), Svalbard (off northern Norway), and Home Bay (Canada) do not differ significantly in melanism scores. This is not so. Significantly larger numbers of gulls have traces of melanistic patterns on their primaries at Bjarnarhafnarfjall (11 of 53) than in Svalbard (1 of 48; Fisher exact test [two-tailed], $P = 0.004$) and Home Bay (0 of 48). My own data, comparing a larger sample of birds from Bjarnarhafnarfjall with *hyperboreus* from Greenland, indicate an even clearer difference. Only 3 of 80 Greenland birds had faint traces of melanin on the primaries (Ingolfsson 1970), while 67 of 167 birds from Bjarnarhafnarfjall showed a melanistic pattern on one or more primaries (Ingolfsson 1987). There can be no doubt that the *hyperboreus*-like gulls of western Iceland are more variable in pigmentation of primaries than neighboring populations of Greenland and Svalbard.

Snell found that the Skrudur gulls of eastern Iceland were no more variable in primary pigmentation than *argentatus* from northern Norway, but were more variable than several other *argentatus* populations sampled. I had noted that some birds from northern Norway and the adjacent Kola Peninsula in Russia were so hybridlike that extensive hybridization in the area was suspected (Ingolfsson 1970). In any case, some of the Icelandic *argentatus*-like populations, especially those I studied at Hromundarey and Horn (Ingolfsson 1987), are considerably more variable in degree of primary melanism than those from Europe, including northern Norway. Snell did not mention this point.

It is not possible to attach much significance to Snell's conclusion that the variability in 16 skeletal measurements of Icelandic gulls he studied was no greater than found in allopatric populations. The two populations he analyzed in Iceland, at Bjarnarhaf-

narfjall and Skrudur, appear from primary pigmentation to be so close to pure *hyperboreus* and pure *argentatus*, respectively, that it seems somewhat unlikely that they would exhibit a marked increase in size variability, detectable in relatively small samples. A study of the more intermediate populations in Iceland would have been of greater interest (but admittedly much more difficult due to the small sizes of these populations).

Snell did not find consistent correlation between primary pigmentation and the 16 skeletal characters he measured in the Skrudur gulls. This agrees with my previous findings on gulls from this colony. However, Snell did not mention that my earlier results from Horn and Hromundarey in eastern Iceland showed clear correlations between degree of pigmentation and size, scarcely understandable without resorting to an explanation involving hybridization between the larger *hyperboreus* and the smaller *argentatus*. My earlier findings indicated that this correlation was becoming weaker with time. This is to be expected if genes for body size and primary melanism are not closely linked.

In addition, I was able to find significant correlation for degree of pigmentation, time of molt and breeding success within colonies (Ingolfsson 1987). Again, this is very difficult to explain except by assuming that a mixing of two gene pools was taking place.

As Snell stated, *argentatus* with reduced melanism on the primaries were found in European populations prior to the immigration of *argentatus* to Iceland. However, he neglected to note that the pattern of reduced melanism is significantly different from that found in Icelandic gulls. In Iceland, assumed hybrids have a black pattern involving the sixth, seventh and eight primaries that is typically diffuse. In gulls with reduced pigment from European populations, this is usually not so; the reduction in pigment is most pronounced on primaries 9 and 10 (Ingolfsson 1970:356). Therefore, the underlying causes are presumably different. Gulls from northern Norway and adjacent Kola Peninsula are exceptions, where many birds are similar to Icelandic hybrids.

It is clear that Icelandic gulls, contrary to Snell's conclusion, show both phenetic intermediacy and increased variability in comparison to *hyperboreus* and *argentatus* from most other areas. This is, as Snell (1991b:340) stated, "strong evidence in support of hybridization." However, Snell also correctly pointed out that failure to find such a pattern is only weak evidence against the hypothesis of hybridization (see also Schueler and Rising 1976). Thus, his final conclusion (Snell 1991b:340) that "It is likely that the variable plumage in the Icelandic populations of *argentatus* simply represents heretofore unrecognized intraspecific variation" is quite puzzling.

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Variably Plumaged Icelandic Herring Gulls: High Intraspecific Variation in a Founded Population

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When phenotypic variability within a species is not adequately understood or is underestimated, "unusual" character states in a population may be erroneously interpreted as evidence of hybridization (Schueler and Rising 1976). First, characters (or character states) thought to be taxon-specific markers may be present in a second taxon at low frequency; such joint occurrence may simply reflect recent common ancestry. Second, character states thought to be intermediate between parental taxa actually may be historically present at low frequency in a portion of a species' geographic range. Third, the spread of seemingly intermediate or unusual character states throughout a species' range or to newly colonized geographic regions may be misinterpreted as hybridization.

Reduced and variable patterning on primary feathers of some Icelandic *Larus argentatus* (Herring Gulls)

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