LETTERS

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GYRFALCON COLOR VARIATION

A literature survey dealing with Gyrfalcons (*Falco rusticolus*) reveals that references to the various Gyrfalcon color variants as *morphs* is becoming more common (e.g., Sibley 2000, The Sibley guide to birds, Alfred A. Knopf, Inc., New York, NY U.S.A.). Such references often make the assumption that the three common Gyrfalcon color groups are comparable to the true red and gray morphs of the Eastern Screech-Owl (*Otus asio*) and to the blue and Snow Goose (*Chen caerulescens*) morphs. In my opinion, this is not correct.

Ford (1945, *Biol. Rev.* 20:73–88), emphasized that morphs must first be phenotypically distinguishable with discontinuities in the phenotype. He also stated that polymorphism must not be used to include continuous or quasi-continuous variation.

Huxley (1955, *Acta Int. Ornithol. Congr.* 11:309–328) proposed use of the term *morphism* to denote genetic polymorphism opposed to other kinds of polymorphism (e.g., seasonal, cyclic, geographic). He referred to Ford's definition of genetic polymorphism as the coexistence in one interbreeding population of two or more sharply distinct and genetically-determined forms. Further, Huxley pointed out that the least abundant form should be present in numbers too great to be due solely to recurrent mutation, and proposed that such forms be called *morphs*. Huxley also suggested removal of the adjective "*sharply*" from the definition to accommodate rare cases of continuous polymorphism. He argued that in continuous morphisms, such as in the sea-plantain (*Plantago maritima*), there are no sharp discontinuities, and the excessive genetic variability constituting the continuous polymorphism is maintained by selection. He stressed the fact that every morphism must involve some balance of selective advantage and disadvantage, some underlying genetic basis, and that its discontinuities must be determined either genetically or developmentally.

The Gyrfalcon would be an example of *continuous polymorphism* if that were acceptable terminology. I suggest that the term *continuous polymorphism* is a contradiction that should be avoided.

It has been established for many years that Gyrfalcon color variation extends in a continuum from white to almost black, although most birds are classed as either white, gray, or dark (Th.N. Krabbe 1934, *Medd. Dan. Naturh. Foren* 98:4–107; see Plates III to VI). In a study of 205 specimens collected from European Russia across to eastern Siberia, Ellis et al. (1996, *J. Raptor Res.* 26:81–88) found the same continuum. They classified the birds as *color variants,* and found that climate was a better predictor of color than latitude; the area with the highest percentage of white birds was eastern Siberia.

Clum and Cade (1994, *In* A. Poole and F.B. Gill [EDS.], The birds of North America, No. 114. The Academy of Natural Sciences, Philadelphia, PA and The American Ornithologists' Union, Washington, DC U.S.A.) state the stripe on white birds, when expressed, consists of a few dark streaks next to the shafts of the feathers, giving a kind of speckled appearance. Clum and Cade also asked "what level of plumage variation among *morphs* is justified?" This use of the term *morph* was an error (T. Cade pers. comm.).

In North America, there is a coarse progression in the ratio of light birds to dark birds from northeast to west; birds of northern Greenland and the eastern high arctic are usually white, those of the central arctic are usually 50 50 white:gray, and those in the Yukon and Alaska are mainly gray, a few dark. At Ungava Bay, however, "the whitest and blackest varieties breed together in the same area along with every kind of intermediate" and there are white birds in western Alaska (Cade 1960, *Univ. Calif. Publ. Zool.* 63:151–290). In Eurasia there are no white birds in Fennoscandia and western Russia, but the occurrence of white birds increases eastward until they make up ca. 50% of the population in northeastern Siberia and Kamchatka (Cade et al. 1998, *J. Birds Western Palearctic* 2:1–25).

In the Lower Kolyma, northeastern Siberia, pairs of white Gyrfalcons were limited to the maritime coastline with cliffs, whereas pairs of gray birds were limited to the timberline. The white Gyrfalcons were preying on ducks and waders, while the gray Gyrfalcons were eating grouse (*Lagopus* sp.). The hunting strategy of the two color variants was also different (E. Potapov pers. comm.).

Because Gyrfalcons do not exhibit two or more distinct forms, the various Gyrfalcon color variants are not morphs according to Huxley's definition. Why then do we see more and more references to Gyrfalcons as *morphs* in bird

guides and scientific papers? The error stems from at least two sources. Huxley, apparently, was under the impression that all Gyrfalcons fell into one of three color categories; therefore, he referred to them as *morphs*. Second, some authors have expanded the original definition of *morph*.

> "Morph—term used for recognizably different forms of a species, usually color related. Color morphs are dark, rufous, and light." (Wheeler and Clark 1995, A photographic guide to North American raptors, Academic Press, San Diego, CA U.S.A.).

Frank Beebe (pers. comm.) agrees that the concept of three Gyrfalcon morphs is misleading to some ornithologists and birdwatchers. For example, at some locations white Gyrfalcons have all-white tails, while at other locations they have conspicuously barred tails.

A few field guides refer to the white, gray, and dark *phases* of the Gyrfalcon. For some the term *phase* implies a change with time, and sometimes it refers to synchronization; therefore, its use with reference to Gyrfalcons is not appropriate. It is akin to referring to *blue phase* Rock Doves (*Columba livia*).

What is the appropriate terminology for Gyrfalcons? Cade (pers. comm.) now prefers *color variants*. Thomson (1964, [ED.], A new dictionary of birds, McGraw-Hill, New York, NY U.S.A.) suggested the term *form*, and provided the following definition:

> "Form, in taxonomy, a loose or deliberately neutral term for a species or sub-division thereof, non-committal as regards rank or status to be assigned to it."

This problem in semantics is best resolved by understanding the causes for the unusual color variation. Cade (pers comm.) hypothesized that the three broad color groups are a result of geographic isolation in Pleistocene refugia during the past 100 000 years or so. He believes that the white birds evolved in isolation in the Ellesmere Island–north Greenland refugium. A melanistic form may have evolved in another refugium around Labrador; while the original or ancestral gray gyrs were restricted to habitats south of the continental ice sheets in North America and Eurasia. When the ice retreated, the breeding ranges of the various forms merged and, because no reproductive isolating mechanisms had evolved, the three color variants (originally geographic in origin), have freely interbred to produce the present distribution and range of variants we see in the Gyrfalcon's plumage.

In any case, it is clear that there is a color continuum in Gyrfalcons, and not in screech owls, and that the term *morph* is being used for both patterns of morphological variation. I suggest the term *morph* is most appropriate for discontinuous variants and not the Gyrfalcon.

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TWO WHITE-TAILED SEA EAGLES (*HALIAEETUS ALBICILLA*) COLLIDE WITH WIND GENERATORS IN NORTHERN GERMANY

Recently, the issue has arisen whether wind generator structures may have a significant impact on bird populations The sustainable use of wind energy has led to a substantial increase in the number of wind-power plants in Germany. In the last 5 yr, the number of wind turbines has doubled. In the year 2000, wind power plants generated more than 6113 MW power, or 2.4% of the total energy power consumption in Germany. Especially windy areas in the northern parts of Germany, where large numbers of waders and water birds live, are favored by this development. Studies on these bird groups revealed that wind power plants have a substantial effect on the behavior of these birds through disturbance, harassment, and loss of habitat, rather than the direct mortality due to collisions (Exo 2001, *Natur und Landschaftsplanung* 33:323).

The White-tailed Sea Eagle (*Haliaeetus albicilla*) is still listed as a threatened species in the red data book of Germany (Witt et al. 1998, In: Binot et al. *Rote Liste gefährdeter Tiere Deutschlands, Bundesamt für Naturschutz*, 40–47), although the population has doubled in the last 10 yr, reaching 381 territorial pairs in 2001. The core population that has