PERSISTENCE OF A RARE COLOR ABERRATION IN THE HEERMANN GULL

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On February 8, 1948, while aboard the Schooner "E. W. Scripps," stormbound in Bahía Tortugas, Baja California, we observed in a flock of Heermann Gulls (*Larus heermanni*) two immature individuals with a patch of white on each wing. The wing pattern of white on dark gray gave these birds in flight a flashing appearance suggestive of Willets. In one bird the white patch extended entirely across each wing and therefore covered several quills, probably secondaries. In the other bird some primary coverts and only two or three quills, on each wing, were white.

A similar individual was twice observed on September 24, 1950, on the beach just north of Punta Cabras, northwestern Baja California. It had an oblong patch of clear white near the bend of each wing, parallel to and well within the front margin. The only other similarly marked Heermann Gull that either of us has seen recently in the field was watched on November 9, 1950, at Playa del Rey, California. Its completely symmetrical white wing patches resembled that shown in figure 1.

These isolated observations assume significance when it is recalled that essentially similar color variants have been observed in this species throughout a wide geographic range sporadically for nearly a century (Swarth, 1924). Most published reports date from 1918 to 1924 and none seems to have appeared during the past quarter century. The persistence of the rare aberration, however, is proved by unpublished observations included in the list on pages 222-224.

The sporadic repetition of this striking variation (Taverner, 1918) suggests that its cause lies in some such genetic mechanism as (1) recurrent mutation; (2) the occasional chance mating of the rare individuals that carry the recessive gene or genes which in homozygous combination produce the anomaly; (3) the infrequent phenotypic expression of a gene or of genes having low penetrance or low expressivity; or, possibly, (4) the rare atavistic retention of an ancestral trait.

Whatever its genetic mechanism may be, the aberrant pattern has remained very rare throughout the century of observation. The two patterned individuals seen on February 8, 1948, were the only abnormal ones among hundreds. The one observed on September 24, 1950, was unique among 194 counted on the same beach. The one watched on November 9, 1950, was the only variant in a flock of about 400. The proportion must be lower than one in several hundred, however, for only these four abnormal individuals have been seen by us among the many thousands checked in 1948, 1949 and 1950 at various localities in California, along the outer coast of Baja California, and at several points in the Gulf of California. Lewis Wayne Walker tells us that he does not recall having seen any such variants among the myriads of Heermann Gulls that he has observed and photographed during several visits, some as long as three weeks, to the breeding colonies on Isla Raza in the Gulf (Walker, 1951). On the same island van Rossem (personal communication) saw about 20 of the variants among the many thousands observed in 1925. On the label of a white-blotched wing that he collected at Isla Raza in 1930 (fig. 1), van Rossem wrote: "this type of wing present in proportion of about 1 to 1000." On the 1925 trip he saw only one such bird in the breeding colony on Isla San Jorge and none in the colony on Isla Ildefonso, both also in the Gulf of California. In 1949 and in other years Ed N. Harrison and others have studied and photographed the breeding Heermann Gulls on Isla San Jorge without noting a single

bird with white wing patches. Bancroft's (1932:341) estimate of one such aberration per thousand birds for the Raza colony in 1925, though agreeing with van Rossem's estimate, was probably excessive. A frequency of only one in ten thousand seems more reasonable.

We have, it is true, located 20 variants of this type among the 616 specimens of the species, downy young excluded, in the nine collections examined (see p. 226 for explanation of abbreviations): LACM, 8 among 108; MVZ, 5 among 98; SDSNH, 3 among 29; DC, UCLA, 2 among 16; MCZ, 1 among 75; CAS, 1 among 168; USNM, 0 among 25;

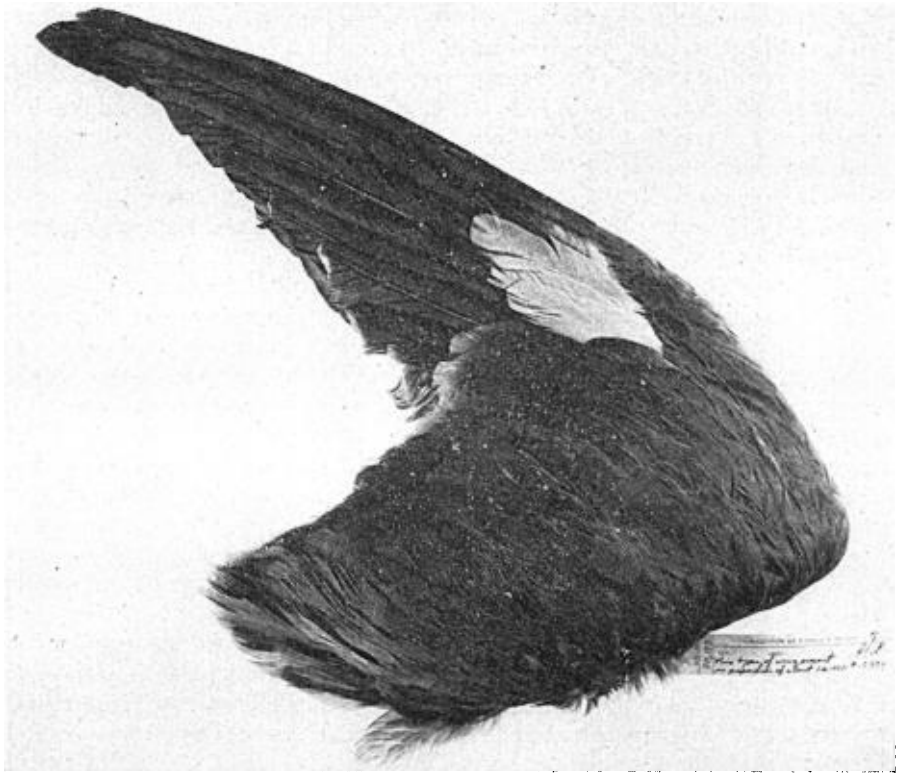

Fig. 1. Wing of Heermann Gull from Isla Raza, Gulf of California (specimen no. 23), showing white blotch on primary coverts.

UMMZ, 0 among 29; AMNH, 0 among 68. It is obvious, however, that the striking variants have been collected and preserved in numbers disproportionate to their actual frequency in nature. The clustering of records around 1910 and 1918, respectively, probably reflects the especially active collecting then of R. H. Beck and of George Willett.

Known records of white wing patches.—The abbreviations for the collections examined are explained in the acknowledgments, page 226. Specimens are listed in order of date of collection or of observation. Because of the complicated seasonal as well as age changes in plumage, the age estimates are subject to error.

1. February 4, 1862: immature female, perhaps in second year; San Diego, California; J. G. Cooper; MVZ 4418, prepared with wings extended. This is almost certainly the bird independently reported, on the basis of information found in the correspondence of the collector, but without adequate data, by Deane (1879) and by Swarth (1924); both authors quoted Cooper as saying that

the large white patch on each wing extended across the "secondary quills," whereas the white is actually on the greater primary coverts (see table 1).

2. January 4, 1897: adult male in winter plumage; Monterey, California; Alvin Seale; MCZ 246919 (not previously recorded). James L. Peters describes the white markings on this bird as follows: On the left wing, "the outer six greater primary coverts are white, although the third one has only a little white freckling on the outer web. The median primary coverts are white—some of them with a small amount of dusky freckling. Almost all the secondaries are white—the inner ones with a small amount of dusky freckling and the outer ones with a good deal of dusky on the outer webs. There doesn't seem to be much sense to the arrangement of the dark areas." On the right wing, "the outer secondaries contain the most white, while the innermost ones are normally colored and the median primary coverts also contain a great deal more of the dark feathers."

3. October 18, 1909: immature female; Monterey Bay, California; R. H. Beck; CAS 15886 (not previously reported. (See table 1.)

4. August 10, 1910: immature female, perhaps in second year; vicinity of Point Pinos, Monterey County, California; Beck; MVZ 18241 (not previously reported). Large white area on left wing, smaller on right (table 1).

5. November 28, 1910: immature male, perhaps in second year; Monterey Bay, California; Beck; MVZ 18265 (not previously reported). (See table 1.)

6. 1911: several observed at Redondo, California (Hubbs, 1919). "Each of these had a large squarish white blotch symmetrically located near the angle of each wing, in some cases more definitely and more extensively developed on the one side than on the other."

7. January 30, 1912: adult female; Hyperion, Los Angeles County, California; George Willett; LACM 1105 (Willett, 1918). Specimen re-examined.

8. March 16, 1912: immature female, perhaps in second year; La Paz, Baja California; W. W. Brown; MVZ 106897 (not reported previously). Two primary coverts partly white on right wing, none on left (table 1).

9. January 26, 1916: adult female; Hyperion Beach, California; L. E. Wyman; LACM 14027 (reported by Willett, 1918, as having "two white feathers in primary covert of one wing, but none in other"). Specimen re-examined (table 1).

10. February 25, 1916: subadult or winter male; Pacific Beach, California; Frank Stephens; SDSNH 6770 (not previously reported). Extremely large white areas in primaries as well as on greater primary coverts (table 1).

11. August 14, 1917: subadult female; Alert Bay, Vancouver Island, British Columbia; Museum of the Geological Survey of Canada (reported by Taverner, 1918, as having four outer primary coverts of one wing and two of the other pure white).

12. January 18 to February 5, 1918: three adult females and one adult male; Hyperion, California; George Willett; LACM 2127, 2128, 2199, 2210 (reported with no. 7 by Willett, 1918, as having a white patch on each wing). Specimens re-examined; no. 2128 has a scattering of white feathers on the abdomen.

13. June 21, 1918: one observed at Pacific Grove, California (Hubbs, 1919; reported with no. 6).

14. October 21, 1918: adult female; Hyperion; L. E. Wyman; LACM 2723 (not previously reported). Wyman noted: "primary coverts white; faint touch of white across abdomen."

15. November 22, 1918: adult female; Hyperion; Willett; LACM 2604 (not previously reported). Five primary coverts largely white, two on the left wing and three on the right.

16. January 30, 1920: adult female; Camp Banning, Santa Catalina Island, California; A. J. van Rossem; DC, UCLA H269 (reported by Dickey and van Rossem, 1923, as having "the aberrant white primary covers"). Specimen re-examined (table 1).

17. February 17, 1921: one seen at Santa Catalina Island "displayed this same covert-pattern" (Dickey and van Rossem, 1923).

18. Spring, 1925: about twenty observed in breeding colony on Isla Raza, Gulf of California (Bancroft, 1932:341, and A. J. van Rossem, personal communication).

19. Spring, 1925: one observed in breeding colony on Isla San Jorge (Georges Island), Gulf of California (van Rossem, personal communication).

20. December 27, 1925: subadult or winter female; North Island Jetty, San Diego, California; Joseph W. Sefton, Jr., SDSNH 10243 (not previously reported). Right wing with two white feathers, left with none (table 1).

21. March 27, 1926: immature male; San Felipe, Baja California (on the Gulf); Raymond Gilmore; MVZ 47843 (not previously reported). (See table 1.)

22. September 12, 1926: subadult or winter male; off Point Loma, San Diego, California; Joseph W. Sefton, Jr.; SDSNH 11237 (not previously reported). Large white patch on each wing (table 1).

23. April 16, 1930: single wing of adult male (fig. 1); Isla Raza, Gulf of California; A. J. van Rossem; DC, UCLA 30170 (not previously reported).

24. February 8, 1948: two observed by authors at Bahía Tortugas, Baja California (p. 221).

25. August 29, 1948: one observed by Robert W. Storer (personal communication); off Golden Gate, California. White patch on each wing.

26. October 15, 1949: two observed by J. R. Pemberton (personal communication); about midway between Ensenada and Islas Todos Santos, Baja California. White patch on each wing.

27. September 24, 1950: one observed by senior author; near Punta Cabras, Baja California (p. 221).

28. November 9, 1950: one observed by junior author; Playa del Rey, California (p. 221).

Table 1

Feathers Involved in White Wing Blotches in Ten Specimens of Heermann Gull

The amount of white in the stated feather of the left and right sides is roughly indicated by 0 = none, 1 = very slight to slight, 2 = moderately small, 3 = medium, 4 = moderately to very large, 5 = complete. The coverts and the primaries are counted from the innermost. Feathers omitted were dark in all specimens examined. The enumeration of the feathers may not be completely precise, because the examination, to avoid damage to the specimns, was rather crude.

	Specimen Numbers (in list on pp. 222–224)										Average per wing
	1	3	4	5	8	10	16	20	21	22	
						Greater primary coverts					
3	0–0	0–0	0–0	0–0	0–0	0?–4	0–0	0–0	0–0	0–0	0.0–0.4
4	5–5	3–0	5–0	4–0	0–0	4–5	4–2	0–0	0–2	0–0	2.5–1.4
5	4–5	5–1	4–5	0–1	0–0	5–4	5–5	0–0	3–3	0–4	2.6–2.8
6	4–4	4–5	5–5	0–4	0–3	4–5	4–2	0–0	4–4	4–5	2.9–3.7
7	3–4	4–4	5–0	0–0	0–0	5–4	4–4	0–3	0–0	4–4	2.5–2.3
8	2–5	5–1	5–0	0–0	0–2	4–5	2–5	0–0	3–0	2–2	2.3–2.0
9	4–4	5–1	5–4	0–0	0–0	5–4	1–2	0–4	0–0	5–4	2.5–2.3
10	0–0	2–0	0–0	0–0	0–0	4–0	0–0	0–0	0–0	5–4	1.1–0.4
Avge.	2.7–3.4	3.5–1.5	3.6–1.7	0.5–0.6	0.0–0.6	3.9–3.9	2.5–2.5	0.0–0.9	1.3–1.1	2.5–2.9	2.1–1.9
						Primaries					
1	0–0	0–0	3–0	0–0	0–0	1–1	0–0	0–0	0–0	0–0	0.4–0.1
2	0–0	0–0	0–0	0–0	0–0	2–0	0–0	0–0	0–0	0–0	0.2–0.0
3	0–0	0–0	0–0	0–0	0–0	0–4	0–0	0–0	0–0	0–0	0.0–0.4
4	0–0	0–0	0–0	0–0	0–0	4–5	0–0	0–0	0–0	0–0	0.4–0.5
5	0–0	0–0	0–0	0–0	0–0	3–4	0–0	0–0	0–0	0–0	0.3–0.4
6	0–0	0–0	0–0	0–0	0–0	2–2	0–0	0–0	0–0	0–0	0.2–0.2
7	0–0	0–0	0–0	0–0	0–0	3–1	0–0	0–0	0–0	0–0	0.3–0.1
Avge.	2.7–3.4	3.5–1.5	3.6–1.7	0.5–0.6	0.0–0.6	2.1–2.4	0.0–0.0	0.0–0.0	0.0–0.0	0.0–0.0	0.3–0.2

Particularly striking and significant are the consistency of pattern and the essential symmetry of the variants. Except for three specimens which have only two white primary coverts in one wing and no white feathers on the other wing, all variants reported or examined have had a white patch near the bend of each wing. Minor asymmetries have been noted in the size and shape of the patches and in the numbers of feathers

variously whitened. Often, white feathers are separated by one or two of normal color. Some greater primary coverts other than the two innermost and the outermost one seem always to be involved, rarely also some secondaries or some primaries, or even some contour feathers on the abdomen (see descriptions and the list above and table 1). The mean number of white coverts per wing is about 4 (table 1).

Occasionally, all defectively pigmented feathers are entirely pure white, or very nearly so, in one or both wings. More commonly, some feathers are piebald, with the dark and light areas either solid, or blotched, or speckled with the opposite shade. In two-toned feathers the dark pigment is usually concentrated along the shaft and near the tip. The degree of whitening of individual feathers grades from a bare trace to completeness (table 1).

The essential consistency and the basic symmetry of the pattern suggest that such aberrations might become segregated, perhaps abruptly, to characterize a new subspecies or species. Speciation along this line would seem to be especially likely in a form such as *Larus heermanni,* which has a relatively limited total population comprising few breeding colonies that occupy only a small proportion of the many available sites. Should the nucleus of a new breeding colony happen to include one of the variants, the aberration might become established rapidly in the expanding population. The "Wright effect" or "drift" might suffice, but the process would be accelerated and be rendered much more probable if the new pattern should have even a slight selectional advantage. Such increases have been observed in the proportion of color variants in certain animals (Huxley, 1943:93-110).

The persistent rarity of the aberration in the Heermann Gull, however, argues against effective selection. As Huxley has indicated in the review just quoted, the proportional numbers of variant types often remain constant over long periods.

The extreme rarily of the variant Heermann Gulls indeed suggests a negative selection. The disadvantage, if any, however, does not seem to involve the social behavior or acceptance of the variants. Their actions and that of their flock companions seem to be approximately normal. At least, unlike some albinos, they are not notably shunned or pecked.

It is possible, however, that the white-marked birds may possess some innate peculiarities of behavior, for plumage mutations appear to be correlated commonly and perhaps characteristically with some distinctive behaviorism, such as tameness (Lee and Keeler, 1951). The mutants seen near Punta Cabras and near Playa del Rey gave evidence of such individuality, for each was among the very last of its flock to be flushed each time it was approached. Such peculiarities in activity might accelerate the organization of plumage mutants into a new race or species.

It may be of significance, from a genetic viewpoint, that among the 21 variants that have been sexed, only 7 were designated as males.

The abnormal white feathering seems to bear almost no relation to the development of the normal white markings of the adult, except in that some birds with unusually large white areas, for example variant number 10 (p. 223) and table 1), appear to have the normal white tip of the secondaries unusually wide and conspicuous. The abnormal white coverts appear in otherwise almost wholly dark juveniles.

Whether all the white-marked variants stem from the breeding grounds on the Gulf islands is not known, for nothing appears to have been determined regarding the presence or absence of the aberration in the population of Isla San Roque, the only breeding station reported on the west side of Baja California (Grinnell, 1928:60). Nor is it known, indeed, whether the breeding populations on the two sides of Baja California

intermingle. Even though very rare, such variants may characterize certain populations or even subspecies. Thus, partly black individuals occasionally appear in various parts of the range of the eastern mosquitofish, *Gambusia affinis holbrooki,* but seem to be lacking in the western subspecies, *G. a. affinis.*

No similar color aberration seems to have been reported for any other species of the Laridae, though some color anomalies have been described in the family, as by Robinson (1926) and by Cruickshank (1940). Even in the very similar and apparently closely related species of the Galápagos Islands, namely *Larus fuliginosus,* of which a large series was examined in the California Academy of Sciences, no specimens have been observed with white wing patches. In their general review of the literature on plumage mutants in birds, Lee and Keeler (1951:82) cite only two instances in the family, apparently disregarding the wing-pattern anomaly treated in this paper. Some similar types of variation, but not of identical pattern, have been observed in other birds, for instance in geese (Hanson, 1949).

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SUMMARY

For nearly a century a striking color aberration of the Heermann Gull (*Larus heermanni*) involving a white patch near the bend of each wing, has been reappearing in great rareness, perhaps one in 10,000. In consistency and in symmetry the marking suggests a character to be expected in a related species. Such an aberration might indeed give rise to a new form. The sporadic repetition suggests a recurrent mutation, a homozygous combination, an infrequent phenotypic expression, or an atavistic trait. There is no evidence of strong positive or negative selection. The plumage variants may also have some behavioristic trait, perhaps tameness. The abnormal white feathering bears little relation to the normal development of white areas. Comparable variations are unknown in other gulls.

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