THE PLUMAGES OF GULLS IN RELATION TO AGE AS ILLUSTRATED BY THE HERRING GULL (LARUS ARGENTATUS) AND OTHER SPECIES.

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Plates X–XIV

IT is nearly a score of years since I placed on record (Auk, 1901, pp. 49–63) the fact that Gulls and Terns pass through a perfectly definite series of plumages separated by definite moults. This record, modified only a little in details, is as applicable today, as it was then, to the Gulls of the world, and it is only because I have gathered together new characters for determinibg the age of the so-called "immature" specimens that I have again brought up the subject.

While each species has pecularities of plumage at different ages that are specific, it must be remembered that not all species at the same age have equally developed plumages, nor do all birds of the same species at the same age have equally developed plumages. The large species require a longer time to attain adult plumage than do the smaller ones; and there is always a percentage, probbably a small one, in every species of laggards or backward birds that require a longer time in reaching maturity than do the average individuals. These laggards are a source of confusion and have been largely responsible for wrong estimates of age and of the duration of "immature" plumages. They are apparently about one plumage behind their fellows, but in a series of skins taken at random, it is hardly possible to do more than guess the percentage that deviates from the average plumage. At each successive moult, however, birds advance in their plumage towards maturity, but not equally. We do find, however, some very definite characters that are correlated with age, and by combining them, we find that the smaller Gulls attain fully adult plumage at their first postnuptial or annual moult, which is at the beginning of their *second* year, medium sized Gulls, at the beginning of their *third,* and large Gulls at the beginning of their *fourth* year. The percentage of laggards is apparently greatest at the first period of moult and progressively diminishes afterwards.

Another source of confusion in the study of Gulls is due to the fact that different areas of plumage in the same bird advance toward maturity at different paces, although no changes in plumage save fading occur except at periods of moult. The flight-feathers of the wings and the quill-feathers of the tail are moulted but once in the year while the plumzge of the body is moulted twice, so that evidences of immaturity are lost sooner in the body plumage. Nor do discrepancies of development stop here for we may find well developed wings and tail combined with a backward body plumage or vice-versa. But in spite of complications it is possible to group together certain characters so that we have definite plumages representing the average advance made at each period of moult. It may be well to first take up separately each of the several characters by which we may judge the age of a given specimen.

1. *Shape of primaries and rectrices.* Perhaps the most important of the characters is the structural difference in the shape of the primaries and tail-feathers of birds in their first year as compared with those of a second or later year. My attention was directed to this by Mr. H. Ira Hartshorn who in making drawings to scale for me found discrepancies to exist. An examination of specimens of Gulls of the world shows that throughout the first year, and until the first postnuptial or annual moult, the primaries as a rule are more pointed and the rectrices more rounded than in later years. The new second year primaries acquired at this moult, which removes the juvenal wings and tail, have more rounded, broader tips than in the first year, being practically the shape of fully adult feathers. There is some variation, but as a rule in first year birds, the extreme tip appears to be pinched to a point, the outer or distal feather usually showing this pecularity more markedly than the others (see Plate X, fig. 1, and Plate XI, fig. 1).

A similar difference in shape prevails in the tail-feathers of Gulls, first-year or juvenal rectrices being rounded (see Plate X, fig 2, and Plate XI, fig. 2) and replaced at the first postnuptial moult by feathers of the second year which are more or less squared at the tip (see Plate XII, fig. 2). The outer rectrix is perhaps the most diagnostic and as the wings and tail are moulted only once a year the value of these characters is great, for many birds after

the partial prenuptial or spring moult resemble very closely the second-year birds that have not as yet begun this moult.

2. *Pattern of primaries and rectrices.*—Next to shape, the patterns that mark the quill-feathers of the wings and tail are of importance. Every species has a definite adult wing pattern, which, except in the smaller species, is not even foreshadowed in first, and only occasionally indicated in second-year plumages. The same thing is true of the tails. The juvenal or first year primaries in the larger and medium-sized Gulls are as a rule uniformly dingy or black and the second-year primaries that come at the first postnuptial moult scarcely differ although the medium-sized species may have faint indications of "wedges" of a lighter shade on the inner primaries, obscure apical spots or perhaps a dingy "mirror" on the distal quill. The small Gulls during the first year are marked by primaries with more or less dusky areas, but the adult pattern is usually indicated. After the first postnuptial moult then, the new primaries of small Gulls are of adult pattern, those of the larger sized Gulls have a slight suggestion of adult pattern, while those of the largest Gulls at this period hardly differ from the first year primaries. The "wedges" develop sooner than the apical and other spots and the distal primary is the slowest of them all in acquiring adult characters.

Tails develop a little faster than do primaries, but in the largest Gulls three moults are required and often four before all traces of immaturity disappear leaving the tail either pure white or banded as it is in the adults of some foreign species.

3. *Color and pattern of body plumage.*—Under this heading may be included all of the plumage except the remiges and rectrices, and while there is the greatest divergence between the various consecutive plumages, the advance towards maturity in most of the species may be traced through the gradual elimination of the dusky feathers of youth. As the body plumage undergoes two moults each year, the advance is rapid, but at the early moults some brown or dusky feathers are acquired that differ little if any from those that precede them and these immature feathers are often a ready clue to age. The moults of young birds are protracted and the postjuvenal overlaps the prenuptial. Small Gulls at the postjuvenal moult in the autumn acquire a considerable

part of their adult body plumage, and they assume at the first prenuptial moult a plumage that is adult save for wings and tail and finally through the first postnuptial moult they become fully adult. Larger Gulls are quite or very nearly adult in body plumage after the second postnuptial moult but the largest are usually not in full adult dress until after their third postnuptial moult.

4. *Colors of bill and feet.*—The bill is not only rather slow in developing color, but the color often varies between winter and summer. Doubtless there is much more to be learned from fresh birds but museum specimens show indications of immaturity in dark bands and dusky cloudings up to the third and possibly fourth year in the larger species while in the smaller, the time varies from perhaps less than a year to one or two years as the size increases.

The color of the feet and tarsi and eye-ring (the iris too) may be studied successfully only in fresh birds for these parts change color as skins dry so that no clue to their original color remains. In young birds the colors are, as a rule, pale deepening with age to the more brilliant tints or deeper shades of maturity.

It has been my endeavor to show the characters as we find them in *average* birds and it is difficult not to blur the picture with too many details of exceptions. It is no easy matter to pick out typical average birds even with large series to choose from but the accurate sketches by Mr. Hartshorn of wing tips and tails speak for themselves. In explanation of them I will first give a brief diagnosis of the plumages of a small species, Bonaparte's Gull (*Larus philadelphia*) which acquires adult plumage at its first postnuptial moult and then of a large species, the Herring Gull (*Larus argentatus*) which does not acquire adult plumage until its third postnuptial moult, some few specimens retaining slight evidences of immaturity even until the fourth.

Larus philadelphia. BONAPARTE'S GULL.

1. *Natal Down.* Wholly a body plumage and like most Gulls at this stage, the downy chick is whitish or buffy brown clouded with large and small dusky spots.

2. *Juvenal Plumage.* Primaries, pointed, largely white, the tips and outer webs in part, black (Plate X, fig. 1). Tail with rectrices rounded at tips, white, banded subterminally with black (Plate X, fig. 2). Body plumage has much to suggest the adult being chiefly white below but the upper surface is washed and clouded with browns. Bill, pale with dark tip.

3. *First Winter Plumage.* A partial postjuvenal moult in the late fall replaces many of the brown feathers by adult gray ones, but a number of mixed ones may also come in. The juvenal wings and tail remain.

4. *First Nuptial Plumage.* A partial first prenuptial moult in the late winter brings the body plumage a little nearer to that of the adult, the browns being farther diminished.

5. *Second Winter Plumage.* The first postnuptial moult produces the adult plumage except in a very small number of backward birds. The primaries are rounded with the white areas larger (Plate X, fig. 3). The tail has square tipped rectrices and is pure white (Plate X, fig. 4). After this moult, only an occasional bird shows traces of immaturity in slight smudging of the tail or in duskiness of the primaries.

Larus argentatus. HERRING GULL.

1. *Natal Down.* At this stage only body plumage is found which is grayish or buffy, coarsely mottled or clouded with dull clove-brown.

2. *Juvenal Plumage.* Primaries, pointed and dull brownish black. (Plate XI, fig. 1). Rectrices, rounded at tips, dull brownish black, variously but *coarsely* mottled with white, especially on the outer feathers and basally. (Plate XI, fig. 2.) Body plumage, mostly grayish or sooty brown irregularly mottled and barred with buff, the markings coarsest on the upper surface, the lower parts being of a more uniform grayish brown. Bill, black.

3. *First Winter Plumage.* More or less of the body plumage is renewed by a partial postjuvenal moult which may be delayed until well into the winter. The new growth resembles the old, but it usually shows less mottling, the color areas being larger and less broken up. The juvenal wings and tail remain.

4. *First Nuptial Plumage.* A partial prenuptial moult renews some of the now worn and faded body plumage, brown feathers, much like those of the juvenal or first winter stages, growing for the third time. The bill during the winter slowly grows paler at the base, the extent of the black diminishing. The postjuvenal and the prenuptial moults seem to overlap, the former often being delayed and perhaps in some cases suppressed, but as brown feathers mark all renewals during the first year, many specimens of this period appear superficially at least to be in juvenal plumage.

5. *Second Winter Plumage.* The result of a complete first postnuptial moult. Primaries, rounded and dull black, indistinct "wedges" showing

on several of the proximal (Plate XII, fig. 1)). Rectrices, square-tipped and dull black, more *finely* peppered or sprinkled with white than in the first winter. (Plate XII, fig. 2). Body plumage, much like the first winter, but usually whiter below and about the head and with a few gray feathers on the back. Bill, black from tip to nostrils, the base pale and yellowish in dried skins.

6. *Second Nuptial Plumage.* A partial second prenuptial moult renews some of the body plumage, birds becoming much whiter below and grayer on the back. Many of the new feathers, however, are still brown or partially so.

7. *Third Winter Plumage.* A complete second postnuptial moult widens the field for variation because pattern is now pronounced in the primaries (Plate XIII, fig. 1). They are black with more or less white tipping, a "mirror," often with blurred margin, of variable extent is found on the "first" or distal, and gray "wedges" of greater or less extent appear. The tail also shows new pattern (Plate XIII, fig. 2), smudges of black on the white rectrices varying greatly in extent. In some birds the red spot on the bill appears indistinctly but as a rule a dusky band or clouding is found. The body plumage is either adult or there may be a few obscurely dusky areas on the outer surface of the wings.

8. *Third Nuptial Plumage.* A partial third prenuptial moult is hardly noticeable among the body feathers that are already mostly adult.

9. *Fourth Winter Plumage.* After the third postnuptial moult, which is of course complete, it is unusual for evidences of immaturity to remain. The primaries (Plate XIV, fig. 1) are all white tipped and the "mirror" on the first is large and clearly defined, sometimes merging with the white tip, although it is possible that such specimens are still older. A white spot may or may not be found on the next primary, and the "wedges" are more extended but vary with each primary. The tail is now wholly white (Plate XIV, fig. 2). The body plumage is fully adult. The bill is bright yellow with a red spot at angle of mandible.

So it is possible to trace the development of plumages in the Gulls with considerable accuracy and it is a pity to see writers of recent date still clinging to the inadequate term "immature," and to the old-fashioned idea that many years are required to attain adult plumage. With moulting specimens to bridge the gaps between plumages and knowing the characters that develop in sequence much can be learned about age and it is with such material at hand that I have endeavored to show as briefly as the conditions permit, the correlation that exists in the Gulls between plumage and age.

Taking the Gulls of the North American Check List, they may be grouped as follows:

1. Two-year plumage-cycle (like *Larus philadelphia*):—*Xema sabini, Rhodostethia rosea, Larus minutus, Larus franklini, Larus atricilla, Rissa brevirostris* and *Rissa tridactyla.*

2. Three-year plumage-cycle:—*Larus heermanni, Larus canus, Larus brachyrhynchus, Larus delawarensis* and *Pagophila alba.*

3. Four-year plumage-cycle (like *Larus argentatus*):—*Larus californicus, Larus vegae, Larus affinis, Larus occidentalis, Larus schistisagus, Larus marinus, Larus nelsoni, Larus kumlieni, Larus glaucescens, Larus leucopterus* and *Larus hyperboreus.*

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THE SUBSPECIES OF BRANTA CANADENSIS (LINNAEUS)[1]

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In the January, 1920, issue of 'The Auk' (pp. 94–102) Mr. J. D. Figgins has a paper on "The Status of the Subspecific Races of *Branta canadensis.*" This paper is devoted in large part to severe criticism of a publication of my own upon the same subject.[2] I could not possibly take exception to Mr. Figgins for differing from me in matters of opinion, nor for publishing his conclusions. I am, however, perfectly justified in feeling resentful at the ungracious wording of his argument. I object to such statements, for example, as that measurements I have taken are unreliable and that I have suppressed such measurements as did not answer my purpose. I object to having statements ascribed to me that I did not make. I object to having statements of mine "interpreted"—I do not think they need it.

Before discussing in detail some of the statements he has made, it is best, perhaps, to give Mr. Figgins' conclusions, then some of my objections to them. He says finally: "It is, therefore, proposed that '*hutchinsi*' and '*occidentalis*' be eliminated as subspecific forms, that *minima* be raised to specific rank and that the occas-

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[1]Contribution from the Museum of Vertebrate Zoology of the University of California.

[2]A study of a collection of geese of the *Branta canadensis* group from the San Joaquin Valley, California. Univ. Calif. Publ. Zool., vol. 12, 1913, pp. 1–24, pls. 1–2, 8 text figs.