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PLUMAGE AND SOFT-PART VARIATIONS IN THE HERRING GULL

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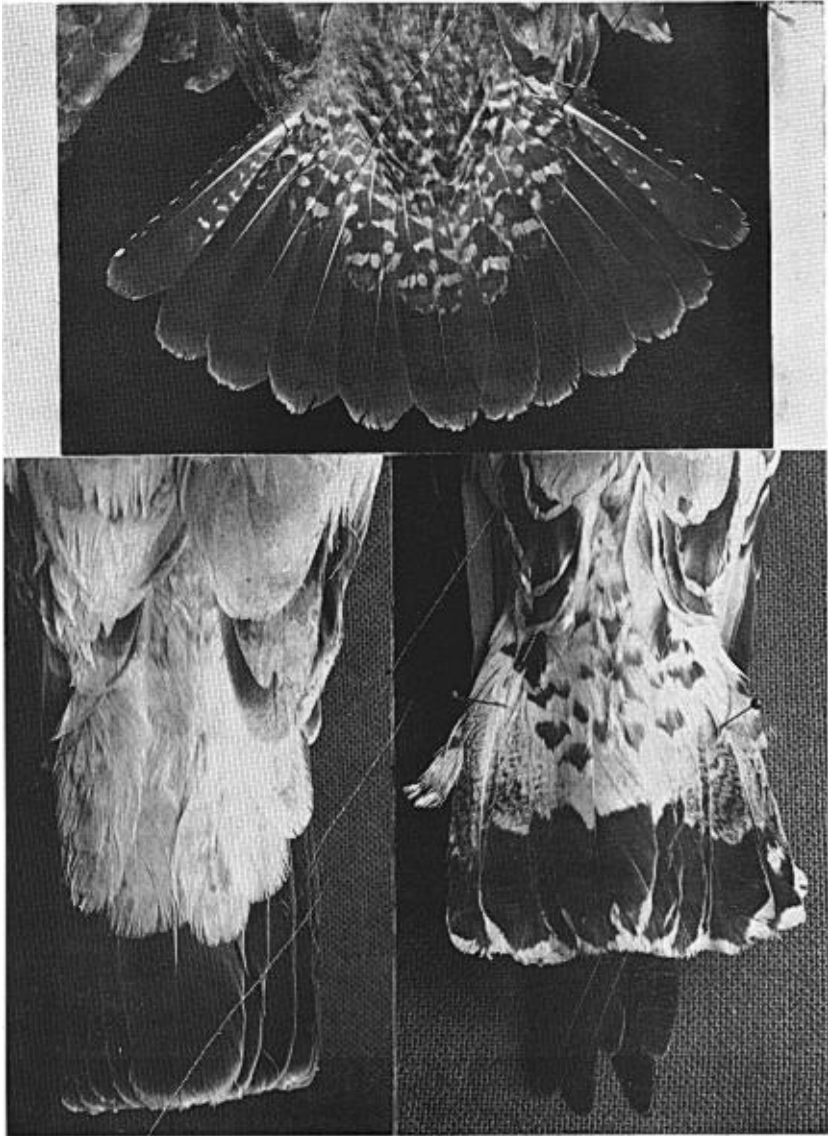
Plate 5

INTRODUCTION

IN 1937, 1938, and 1939, a total of 21,561 young Herring Gulls (*Larus argentatus smithsonianus*) were marked with colored bands at eleven colonies along the Atlantic Coast as the initial step in a coöperative study by banders and field observers sponsored by the Linnaean Society of New York. The color combinations were different at each colony and in each year (*cf.* Bird-Banding, 10: 126, 1939), so that observations of the bands on a living bird would identify the year of hatching and natal colony of that individual. In previous papers (Poor, 1943, 1944) the writer has summarized the banding program and discussed some of the distributional information obtained.

The aim of the present paper is to set forth those results of the project, based on field observations of living birds, which relate to changes of plumage and soft parts with age. Variations with age, as determined by examination of museum specimens, have been discussed by numerous authors, notably Dwight (1901, 1920, 1925).¹ Dwight's conclusions have been concisely summarized by Allen and Hickey (1940). In such investigations the use of specimens has certain obvious advantages over field observations. Details may be critically studied, comparisons among various specimens may be made, and specimens may be examined repeatedly to check conclusions. However, field observations possess some unique advantages over museum skins. Soft parts are seen in their natural colors, and the large number of observations permits some statistical conclusions as to the propor-

¹ Following undated references to Dwight are to his 1925 monograph.



(Upper figure), TAIL AND UPPER TAIL-COVERTS OF FIRST-WINTER HERRING GULL.
(Lower left figure), TAIL AND UPPER TAIL-COVERTS OF SECOND OR THIRD-YEAR HERRING GULL (AMNH No. 358183).
(Lower right figure), TAIL AND UPPER TAIL-COVERTS OF IMMATURE RING-BILLED GULL (AMNH No. 113577).

tion of gulls of a given age possessing certain characters. Of paramount importance is the fact that the ages of color-banded birds are *definitely known*. With museum skins one must infer the ages of the birds from those very plumage characters which one desires to correlate with the age thus determined. This was the only method available before the days of mass banding, but the logic of the expedient is questionable and the results are not always satisfactory. For example, Brooks (1943) disagrees with Dwight on the interpretation of the plumages of the California Gull (*Larus californicus*). Collected banded birds would resolve the conflict of these two authorities.

The possibilities of systematic collecting of banded specimens to solve various ornithological problems have been largely ignored in the past. In the case of the Herring Gull, measures to control the population are at present necessary, so that extensive collecting would not be detrimental to the species. In peace time, banded gulls are numerous, and in many places easy to collect. The taking of banded birds on the breeding grounds would disclose the proportion of interbreeding among different colonies, the age of first breeding, etc. Data on morphological variations with age *and sex*, not obtainable in any other way, could be secured. (Dwight states that females advance less rapidly to maturity than males, but sex cannot be determined without dissection.)

The work of Dr. A. O. Gross and associates at Kent Island, New Brunswick, has demonstrated that Herring Gulls return to their respective natal colonies to breed (Gross, 1940). This tendency toward reproductive isolation of breeding colonies from one another suggests potentialities of development of genetic differences among local populations, and suggests that critical studies of series of specimens from various Atlantic-coastal and Great Lakes colonies might reveal hitherto unsuspected variations. Dr. Ernst Mayr has pointed out to the writer that Stegmann (1934) and others believe they have found significant differences among birds from various parts of the European breeding range of the Herring Gull, although serious doubt is cast upon the validity of the presumed racial differences by failure to take into consideration the pronounced sexual dimorphism known to exist and studied in detail by Goethe (1937), particularly since the dimorphism is pronounced in those characters used to discriminate the races. Dr. Mayr recommends that investigators studying the differences among American colonies first collect a large series of accurately sexed males and females from a single colony and determine with this material the degrees of sexual dimorphism as well as of individual variability.

ACKNOWLEDGMENTS

In a program utilizing the efforts of numerous banders and field observers, detailed acknowledgments are impossible. However, special mention should be made of J. J. Hickey, who originated the project; C. L. Whittle and R. P. Allen, who actively sponsored it; and S. C. Harriot, who maintained the records. In the preparation of this paper the writer obtained helpful suggestions from Dr. Ernst Mayr, J. J. Hickey, and E. Eisenmann, and photographic assistance from N. W. Young.

SOURCES OF DATA

The basic data for this paper are the reports of observers on color-banded Herring Gulls studied in the field. The writer has checked certain points with museum skins, but unless specifically noted, statements and conclusions regarding plumage and soft parts are based on these reports.

Data from field observations by numerous different persons under widely varying conditions have limitations which must be recognized. Personal interpretations will vary among observers in regard to some of the characters that show gradual rather than abrupt changes, comparisons with color standards and with other specimens are impossible, and sight records cannot be later checked for accuracy. The advantages of known age, however, give the records a special value. Some of the reports submitted were complete and precise; others were practically worthless. The question of rejection or retention of any particular observation was usually easily decided. Where age is expressed in months it has been assumed that the bird was hatched in July, an arbitrary but convenient assumption which has also been used by others (Eaton, 1933; Gross, 1940; Brooks, 1943).

There are three sources of data: (1) observations listed on printed plumage-record cards distributed by the Linnaean Society's Gull Survey Committee; (2) the writer's records on cards of his own devising which seemed to him better suited for plumage analysis; and (3) data submitted in no standard form. In some places in this article it has seemed expedient to treat these three groups separately.

The writer examined 19 of Dwight's 22 "reference specimens" of juvenal and subsequent plumages of this species, and found none inconsistent with the results of the present study. J. J. ter Pelkwijk pointed out to J. J. Hickey that Dwight's first-winter reference specimen, JD 53,177 (AMNH 358,153) collected in England is not a Herring Gull, but a Lesser Black-backed Gull (*Larus fuscus*). Dr. Robert Cushman Murphy has kindly examined this specimen and informed

the writer that he considers it to be a second-winter male of *Larus fuscus graellsii*.

MOLTS

For an understanding of plumage changes it is necessary to be familiar with the various molts. These are elaborately discussed by Dwight, whose monograph forms the basis for the following brief summary. Gulls are hatched with natal down which is soon succeeded by juvenal plumage. A postjuvenal molt of the body plumage, but not the wings and tail, leads to the first-winter plumage, which in turn passes to the first-nuptial plumage through an incomplete prenuptial spring molt that does not include the wings or tail. Each year thereafter there is a complete postnuptial fall molt and an incomplete prenuptial spring molt excluding wings and tail. (The foregoing is valid for all species of gulls except *Larus pipixcan*, which has a complete prenuptial molt, and *L. maculipennis*, which renews the tail feathers at the prenuptial as well as the postnuptial molt. In Dwight's terminology, "nuptial" refers to the breeding season regardless of the reproductive capacity of the individual.)

In the Herring Gull the postjuvenal molt occurs from September to December, the prenuptial molt in March, April, and May, and the postnuptial chiefly in August, September, and October. Completely adult plumage is normally acquired in the fourth winter. There is considerable individual variation; throughout the plumage changes some birds are backward, and others probably precocious. Dwight states that males advance to maturity more rapidly than females. The important effect of hormones in determining the rate of advance toward maturity has been experimentally studied by Boss (1943—abstract in *Bird-Banding*, 15: 80, 1944).

PRIMARIES

The color and pattern of the exposed areas (top) of the outer primaries constitute a plumage character that is both definite and easily observed. The primaries are renewed annually at the postnuptial molt, and with but few exceptions are either (1) unpatterned dark brown with an edging of light buff at the tip, or (2) black with apical white spots and with a white subapical 'mirror' on the outermost primary and often on the adjacent one. The apical spots frequently, and the mirrors occasionally, are worn away as the feathers age, since these unpigmented areas are less abrasion-resistant than the dark areas.

According to Dwight, the primaries are brown for the first two years;

in the second winter "rarely there are slight traces of a white mirror on the outer (tenth) primary." Third-winter birds have black primaries with white apices and a white mirror on the outermost, although the white markings are deficient or absent in backward individuals. Fourth-year and older birds have white-tipped black primaries with a mirror on the outermost primary, and in about half the specimens, also on the next. Forbush (1925)¹ gives brownish-black primaries for first-winter birds, "largely dark or blackish, tipped white" for second-winter specimens, and black with white apices and mirrors for adults.

Since the Gull Survey cards did not provide specifically for recording this character, most of the following observations are the writer's:

Twenty-five sight records of gulls up to and including the second-nuptial plumage show the normal brown, unpatterned primaries. Two unusual individuals were recorded. One, seen in December, 1938, at the age of 17 months by R. T. Peterson and J. J. Hickey, was reported as having black primaries with no mirrors. A 1939 bird at the age of 24 months, seen on Long Island by the writer on July 27, 1941, had black primaries with white mirrors. These observations, if correct, indicate that occasional individuals are precocious.

In the third-winter and third-nuptial plumages, half the birds have acquired black primaries; 17 with brown and 18 with black primaries have been recorded. One 29-month bird particularly noted by the writer had a white mirror on the outermost of its *brown* primaries, and primaries in the writer's possession from an unbanded bird found dead show this same character, which is shared by a few specimens in the American Museum of Natural History. The large proportion of brown-primaried third-year birds is at variance with Dwight's conclusions.

Fourteen birds in fourth-winter and fourth-nuptial plumages without exception had black primaries, as did all birds of greater age.

UPPER TAIL-COVERTS

Dwight makes no mention of the upper tail-coverts, and Forbush merely mentions that they are white in the adult. The writer, however, believes that, if the relatively few data available can be considered representative, this is one of the more reliable age criteria. In first-year gulls the upper tail-coverts are dark brown barred with buff (see Plate 5, upper figure), and in adults they are pure white. In the transition stages, both types of feathers occur together as the white coverts replace the barred ones.

¹ Subsequent references to this work are undated.

When Herring Gulls are observed at close range it is possible to note readily the feather pattern of the upper tail-coverts, although at a considerable distance the distinction between tail and tail-coverts is often obscure. Since no provision was made on the Gull Survey cards for recording this item specifically, and since it is apparent that most observers failed to distinguish between tail and tail-coverts, only the writer's records of tail-covert characters are here used.

Four records of first-winter and six records of second-winter birds up to and including January (18 months old) show tail-coverts entirely barred brown.

It appears to be during the second prenuptial molt from March to May that the change from barred brown to white coverts is usually accomplished, although sometimes incompletely. Three February records of birds 19 months old show one bird with coverts barred brown, one with a few white feathers among the brown, and one with white coverts. Of three March and April birds (20 and 21 months old), one had white coverts and two had barred brown coverts; these last were the oldest birds observed without at least one-third of the covert area white.

One second-nuptial and fourteen out of the seventeen third-winter birds had entirely white coverts; the remaining three third-winter birds had white coverts with dark feathers covering 10% to 60% of the area.

One third-nuptial (35 months old) bird had a few dark covert feathers among the white, while five other third-nuptial and fifteen older birds had entirely white coverts.

MANTLE

The term 'mantle' is used to indicate those areas of the plumage which in the fully adult Herring Gull are pearl-gray—namely, the back and the upper surfaces of the wings, exclusive of the outer primaries. The feathers of the mantle are renewed twice each year. All possible intermediate stages are found between the juvenal mantle of dark brown feathers edged with buff and the completely gray mantle of the adult. The gradual changes and irregular patterns do not lend themselves well to accurate description nor simple analysis.

According to Dwight, first-year mantles are mottled brown, with suggestions of gray in the first-nuptial plumage. Increasing quantities of gray appear until the brown has essentially disappeared in the third-nuptial plumage. Forbush considered the first-winter mantle to be mottled grayish brown, second-winter "more or less pearly gull-gray," and adults "pale bluish-gray."

It seems simplest to present the field data on this character in tabular form (see Table 1). In the first-winter and first-nuptial plumages there are no gray feathers in the mantle. A considerable proportion of individuals acquire gray feathers, up to about half the area of the mantle, during the first post-nuptial molt. (In many individuals the gray feathers appear first on the upper back between the shoulders, and frequently this area is almost entirely gray while the remainder of the mantle is chiefly brown.) Completely gray mantles do not appear until, and completely brown mantles are not present after, the third-winter plumage. In the fourth-winter plumage, only an occasional bird is found with more than a trace of brown in the mantle.

TAIL

According to Dwight, the rectrices of first-year and second-year Herring Gulls are deep brown, with irregular white barring at their bases, particularly on the outer feathers. Third-year birds are described as having tails largely white, with varying amounts of dark smudging, "probably all white in a few birds," and fourth-winter rectrices are given as "snowy white." Forbush lists the tails of first-winter birds as mostly brownish black, of second-winter birds as "sometimes dark, sometimes light (when light with imperfect bar of dusky near end)," and of adults as white. Actually, the rectrices of young Herring Gulls appear wholly dark brown except for a narrow terminal edging of buff, since the basal four inches of the feathers, including the light markings mentioned by Dwight, are covered by the upper tail-coverts (see Plate 5, lower two figures), with only two and one-half inches of the rectrices remaining exposed.

Many individuals develop white upper tail-coverts while retaining the brown tail, and in flight give the appearance of having a white tail with a terminal dark band. Peterson (1939: 72) states for field marks of the immature Ring-billed Gull (*Larus delawarensis*): "One of the best distinguishing features, aside from the size and the color of the legs, is the pattern of the tail. In the Herring Gull the tail terminates in a broad dark band that blends into the whitish color of the rump. The band near the tip of the tail of the Ring-bill is narrower and sharply defined." It is true that the actual rectrices of the Herring Gull never have a sharply defined band, but the sharpness of definition is not a reliable field mark since the "blending" area is covered by the upper tail-coverts, which often present just as sharply defined a contrast as in the Ring-billed Gull (compare the two lower figures of Plate 5). (It may also be pointed out that the legs of the first-year Ring-bills are pinkish as in the Herring Gull, not yellowish or greenish

TABLE 1
MANTLE FEATHERS

<i>Plumage</i>	<i>Months Old</i>	<i>Writer's records</i>	<i>Gull Survey records</i>	<i>Other records</i>
First-year July to July	0-12	4-100% brown 0-gray	39-100% brown 0-gray	—
Second-winter Aug. to Feb.	13-19	5-100% brown 8-part gray (7 up to 30%; 1 is 50%)	39-100% brown 26-part gray (up to 2/3)	9-100% brown 30-part gray ¹
Second-nuptial Mar. to July	20-24	1-100% brown 2-part gray (up to 80%)	—	0-100% brown 5-gray in mantle
Third-winter Aug. to Feb.	25-31	15-15% to 90% gray 4-100% gray	6-100% brown 12-part gray 12-100% gray	1-100% brown 24-up to 100% gray in mantle
Third-nuptial Mar. to July	32-36	3-80% gray 3-100% gray	—	—
Fourth-winter Aug. to Feb.	37-43	3-gray with traces of brown 11-100% gray	—	—
Fourth-nuptial and older	43+	2-100% gray	7-100% gray	—

¹ Numbers disproportionately high due to the obvious tendency of these observers to report the (supposedly) unusual.

TABLE 2

BILL COLORING

<i>Plumage</i>	<i>Months old</i>	<i>Writer's records</i>	<i>Gull Survey records</i>	<i>Other records</i>
Juvenal and first-winter July to Feb.	0-7	1—completely dark	23—all dark 5—base $\frac{1}{8}$ light 4—tip $\frac{1}{8}$ black	36—"black" or "all dark" 22—varying amounts (up to $\frac{1}{2}$) light, usually noted as basal 1—"black" 6—"dark" or "all dark" 65—part light, part dark (numerous variations)
First-nuptial March to July	8-12	2—completely dark	2—all dark	4—part dark, part light
Second winter Aug. to Feb.	13-19	12—basal 50% to 70% light, terminal 0% to 20% light, re- mainder of bill dark	1—base $\frac{1}{8}$ light 4—all dark 21—base $\frac{1}{8}$ light 29—tip $\frac{1}{8}$ dark 1—straw, dark spot	13—part dark, part light 7—yellow, black spot 3—yellow, red spot
Second-nuptial March to July	20-24	3—basal 65% light, tip 5% light, re- mainder dark	1—base $\frac{1}{8}$ light 12—tip $\frac{1}{8}$ black 9—"straw," "buff," "whitish," etc., with "dark spot"	
Third-winter Aug. to Feb.	25-31	17—basal 50% to 70% light, tip 0% to 30% light, remainder dark. Two yellowish at tip	4—yellow with red spot	
Third-nuptial March to July	32-36	5—yellowish, dark bar on both mandibles		
Fourth-winter Aug. to Feb.	37-43	2—yellow with red spot 3—basally light, terminally yellowish without red or dark spot 10—same except dark spot on one or both mandibles 1—same except red spot 1—yellow with red spot		
Fourth-nuptial June	47			

TABLE 3
SUMMARY OF PLUMAGE AND SOFT PARTS (based on color-band records)

	(<i>Juv. and</i>) <i>First-winter</i>	<i>First-nuptial</i>	<i>Second-winter</i>	<i>Second-nuptial</i>	<i>Third-winter</i>	<i>Third-nuptial</i>	<i>Fourth-winter</i>	<i>Fourth-nuptial</i>
<i>How acquired</i>	Partial molt	Partial molt	Complete molt	Partial molt	Complete molt	Partial molt	Complete molt	Partial molt
<i>Time of molt</i>	Sept. to Dec.	March to May	August to Oct.	March to May	August and Sept.	March to May	August and Sept.	March to May
<i>Primaries</i>	Brown	Brown	Brown	Brown	Brown or Black	Brown or Black	Black	Black
<i>Tail</i>	Brown	Brown	Brown	Brown	Brown to White	Brown to White	White, often with dark areas	White, often with dark areas
<i>Tail-coverts</i>	Barred brown	Barred brown	Barred brown	One-third to all white	One-third to all white	White	White	White
<i>Mantle</i>	Brown	Brown	Brown, often mixed with gray	Brown, usually mixed with gray	Brown to gray	Gray, often with some brown	Gray, some times traces of brown	Gray
<i>Head and neck</i>	Brown, streaked	Brown, streaked	Brown to whitish, streaked	Brown to whitish, streaked	Whitish, streaked; a few brown	White	White, streaked	White
<i>Breast and belly</i>	Brown usually mottled	Brown to whitish	Brown to whitish	Brown to whitish	White, often mottled; a few brown	White, often mottled	White, streaked on breast only	White
<i>Iris</i>	Dark	Dark	Dark to light	Dark to light	Light, rarely dark	Light, rarely dark	Light	Light
<i>Bill</i>	Blackish, often light basally	Blackish, often light basally	Dark with light tip and base	Dark with light tip and base	Light with dark bar, to adult	Light with dark bar, to adult	Light, usually yellowish	Probably adult

as in the adult Ring-bill, so that leg color is *not* a distinguishing point for young Ring-bills.)

For field data on the characters of the tail, the writer had to rely largely on his own observations since the Gull Survey cards did not stress the distinction between the upper coverts and the "base of the tail," and most observers apparently confused the two.

In the first and second winter and nuptial plumages, the tail (reference is made only to the exposed upper surface of the rectrices) is dark brown edged with buff. Reports of tails becoming whitish basally, or being largely white with a terminal band, arise from confusion of the tail and upper coverts.

In the third-winter and third-nuptial plumages, all possible variations are observed. The writer noted seven individuals in these plumages with completely dark tails, eight others with up to 50% white areas in the exposed rectrices, four with dark areas covering less than 50% of the exposed rectrices, and two with pure white tails. A total of 60 observations in this age group from all sources showed only eight birds (13%) with all-white tails. Dwight did not consider that third-year birds could have completely dark tails, but a considerable proportion do, and many others have the dark areas predominating. A third of the writer's observations fall into each of these two categories.

In the fourth-winter and fourth-nuptial plumages the tail is mostly white; the writer's data (no other reports available) show six birds having tails chiefly white with dark areas covering one-third or less of the exposed rectrices, compared to nine individuals with pure white tails. Dwight considered fourth-winter and older birds to be adult and to have snowy white rectrices, but a considerable proportion of the birds retain dark markings in the tail at this age.

Eight records of birds banded as adults show pure white tails.

HEAD, NECK, AND UNDER PARTS

The plumage characters of these areas are difficult to describe accurately. It may be obvious to an observer that one of two brownish immatures is considerably lighter than another, but there appears to be no satisfactory way of recording that information in such fashion that a third bird seen by a different observer will be known to be lighter or darker than either of the first two. Furthermore, the protracted semiannual molts, differences in pigmentation, and the effects of fading and wear produce all possible gradations from the darkness of juveniles to the white of adults, with much individual variation. The data, however, do confirm the tendency of the birds to become

lighter as they become older. In the following paragraphs the writer's data and the Gull Survey records are combined; the few other observations are unusable.

HEAD AND NECK.—According to Dwight, the head and neck are brownish streaked with whitish in the first winter, gradually becoming lighter until in the third winter these areas are white, thickly streaked, and in the third-nuptial plumage white, sometimes lightly streaked. Fourth-winter birds are listed as having white heads and necks, streaked with brown, and fourth-nuptial pure white. Forbush gives brown streaked with whitish for the first winter, lighter, more or less streaked, for the second winter, and white for the adult, streaked with gray in the winter.

In the first-winter and nuptial plumages there are records of thirty brown-headed individuals. Six others were recorded as having whitish heads and necks (four of which were specifically noted as streaked), which the writer believes are incorrectly classified and belong in the first group. In second-winter and nuptial plumages there are 35 records of brown, and 32 records of whitish, heads and necks, mostly noted as streaked in either case. Third-winter records show only four brown heads and 35 white or whitish, streaked. Third-nuptial records show seven individuals with white heads, only one of which was streaked. In the fourth-winter plumage, streaking reappears; all eighteen fourth-winter records show white heads and necks with streaks.

BREAST AND BELLY.—These feathers are rather evenly colored, so that streaking of these parts does not occur. However, the brown feathers are basally white and some are light-edged, so that some densely plumaged birds show a uniform brown coloration while others, on account of whitish feather edgings, molts, wear, feather disarrangement, or other cause, show a mottled effect. The winter-recurring streaks of the adult's white head and neck extend down onto the breast, but in the adult the belly remains white at all seasons. According to Dwight, the breast and belly are initially brown, more or less mottled, becoming lighter until in the second-nuptial plumage they are largely white, with brownish clouding, particularly in the mid-abdomen. In the third winter they are white, sometimes clouded with brown, and in subsequent plumages white. Forbush gives ashy-brown for the first winter, lighter, more or less streaked, for the second winter, and white for the adult.

Thirty-seven first-winter color-banded gulls were reported with brown under parts, 26 of which were noted as mottled. In the first-nuptial plumage, three brown and three whitish, mostly mottled, were

recorded. Second-winter birds showed 43 brown (mostly mottled), 18 whitish mottled, and four whitish or white (no mottling recorded). Second-nuptial birds showed two brown and three whitish, mostly mottled. Observations of third-winter birds yielded six brown (three mottled), 20 white, mottled, and 15 white (no mottling recorded). Seven third-nuptial birds had white under parts, some mottled. Fifteen fourth-winter birds showed white under parts, unmarked on the belly but streaked on the breast.

COLOR OF THE LEGS

Dwight and Forbush classify the colors of the tarsus in different ages of Herring Gulls into various quite similar terms, such as pinkish or flesh-color. Due to partial color-blindness, the writer disqualified himself from making any personal records of this character. Eighty-six acceptable records were reported on Gull Survey cards, distributed as follows among the four color classifications provided on the cards: "fawn or flesh," 36; "pinkish buff," 23; "bright pink," 14; and "pinkish white," 13.

No consistent age or seasonal variation in the color of the tarsus was revealed by these data. This indicates either that the leg color of Herring Gulls is indiscriminately variable within the range of the color classifications listed, or that these classifications are so closely similar that different observers, noting leg color under various conditions of observation, and lacking a standard color chart for comparison, cannot, as a group, classify their observations accurately and consistently into these categories.

COLOR OF THE EYE

At all ages the pupil of the eye is so dark that it appears black. The iris is dark brown in downy young birds, indistinguishable from the pupil even with the birds in the hand, and grows lighter as the bird matures, becoming pale yellow in the adult. According to Dwight, the iris is dark brown during the first year, either dark or light during the second year, and light (yellowish) thereafter. Forbush gives the iris as brown in the first winter, and "silvery-white to pale yellow" in the adult. It is interesting to note that the iris of adults in the other North American race, *thayeri*, has been reported as pale brown (see Brooks, 1937; Shortt, 1939; Shortt and Peters, 1942). Witherby (1941) gives the iris of adult *argentatus* as "very pale lemon."

The Gull Survey cards provided the alternatives of iris "brown" or "yellow." Records submitted by letter reported the irides as "brown," "dark," "yellow," or "light." The writer's records were classified

into four groups: "dark as pupil," "slightly lighter than pupil," "much lighter than pupil," and "very light." In the following summary, "brown" and the writer's first two categories are classed as dark; "yellow" and the writer's second two categories, as light.

All of the 74 records of birds from four to twelve months old showed dark irides.

Among 157 birds thirteen to twenty-four months old, 108 (69%) had dark irides, and 48 (31%), light. Records within this age group are scattered and show no trend with season or age. One anomalous individual seventeen months old (December of second winter) was noted by O. K. Stephenson, Jr., to have one iris brown and one iris yellow!

Of the 66 gulls from twenty-five to thirty-six months old, 59 (89%) were reported as having light irides. Two of the seven reported with dark irides were particularly noted by the observers as "very dark birds." They did not show any abnormal backwardness in plumage characters, but were probably excessively pigmented individuals. Four of the five others were reported by a single observer, and may represent unusual interpretation of observations.

Twenty-three gulls from thirty-seven months old to fully adult were, without exception, reported as having light irides.

COLOR OF THE BILL

The pattern and coloration of the bill follow a continuous sequence of complicated changes, subject to individual variation, from the bill of the downy young, entirely blackish excepting the light extreme tip, to the breeding adult's bright yellow bill with a red spot in the lower mandible near the gonys. According to Dwight, during the first two years the bill is blackish with the base and extreme tip pale, and with the basal light area increasing in extent in the second year, becoming somewhat yellowish by the second nuptial season. In the third year, the bill is dull yellowish with a dark band of variable extent at the gonys, the dark band disappearing and the red spot of the adult starting to appear in some individuals. Fourth-year birds have yellowish bills with red gonydeal spot, brighter in the breeding season than in winter. Forbush lists the bill as "flesh-colored, blackish toward tip" in the first winter, and "yellow with transverse spot of red above angle of lower mandible" for breeding adults, duller in winter adults. Regarding *thayeri*, Brooks (1937) states: "Up to the time Thayer's Gulls leave the British Columbia coasts, which is some time about the end of April, they can be told from American Herring Gulls in life by their paler yellow or greenish bills, not the deep yellow bills of the last named form."

Data from the color-banding program are condensed in Table 2. During the first year a majority of the birds have bills essentially 100% blackish, while a sizable minority have light areas at the base and tip of the bill. The light areas are described by most observers as "pinkish" or "flesh-color."

During the second year, most (? = all) gulls acquire extensive light basal areas and light tips to the bill. The dark area sometimes extends from the gonydeal region in a thin line along the commissure to the gape.

In the third year, the light basal and terminal areas are extended, and many birds appear to have a light bill with a dark bar on both mandibles at the gonys; the general pattern differs but little from that of the adult Ring-billed Gull, although Dwight states that the edges of the band are sharply defined in the latter species and not so in the Herring Gull. Also, the light areas in the Herring Gull bill at this stage are pinkish, not yellow as in the adult Ring-bill. In some birds the bills become yellowish, apparently first near the tip, and the dark bar recedes from the upper mandible, then from the lower, where a red spot remains. A few birds apparently develop adult bill characters in the third year.

Fourth-year birds have bills yellowish, at least terminally, which vary from apparent third year to adult.

SUMMARY AND CONCLUSIONS

Several hundred field descriptions of the plumage and soft parts of the Herring Gull, ranging from fragmentary to fairly complete, have been reviewed. In each case the age of the bird under observation was known from the colored leg-bands which it carried.

(1). Correlation of variations in plumage and soft parts with age is discussed in detail. The results are summarized in Table 3.

(2). No differences could be noted among birds from the various breeding colonies at which color-banding was conducted.

(3). The writer believes that in most cases it is impossible to determine accurately the age of a Herring Gull, either in the field or as a museum specimen, by the pattern and color of plumage and soft parts, since practically every normal combination of these characters can be assumed in two different years.

(4). Dwight's reference specimen JD 53,177 (England) is actually *Larus fuscus*.

(5). The results of this study of living gulls differ in the following points from Dwight's analysis based on museum specimens:

- (a) About half the third-year birds have brown primaries, whereas Dwight lists only black for this age;
- (b) Data on upper tail-coverts, omitted by Dwight, are here presented;
- (c) Many third-year birds have the exposed rectrices wholly brown;
- (d) Many fourth-year birds have dark areas in the tail;
- (e) Dark feathering of the under parts in the third year is more frequent and more extensive than Dwight indicates.
- (6). Forbush's descriptions of plumage require correction in the following points:
- (a) Second-winter birds have plain brown primaries as in the first year, without white markings;
- (b) There is less gray in the second-winter mantle than Forbush implies;
- (c) The tail is not light in the second year;
- (d) In first-year birds the bill is usually chiefly blackish.
- (7). Bent's analysis of plumage (1921) assigns to second-year and third-year birds plumages that are actually those of the third and fourth years respectively.
- (8). Neither the sharpness of definition of the tail-band nor the color of the legs is a satisfactory field character for distinguishing young Ring-billed from Herring Gulls.
- (9). The colors of eye and bill of *thayeri*, not determinable from skins, have been found by other writers to differ noticeably from those of *argentatus*.

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