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THE PLUMAGE CYCLE OF THE CALIFORNIA GULL (*LARUS CALIFORNICUS*) WITH NOTES ON COLOR CHANGES OF SOFT PARTS

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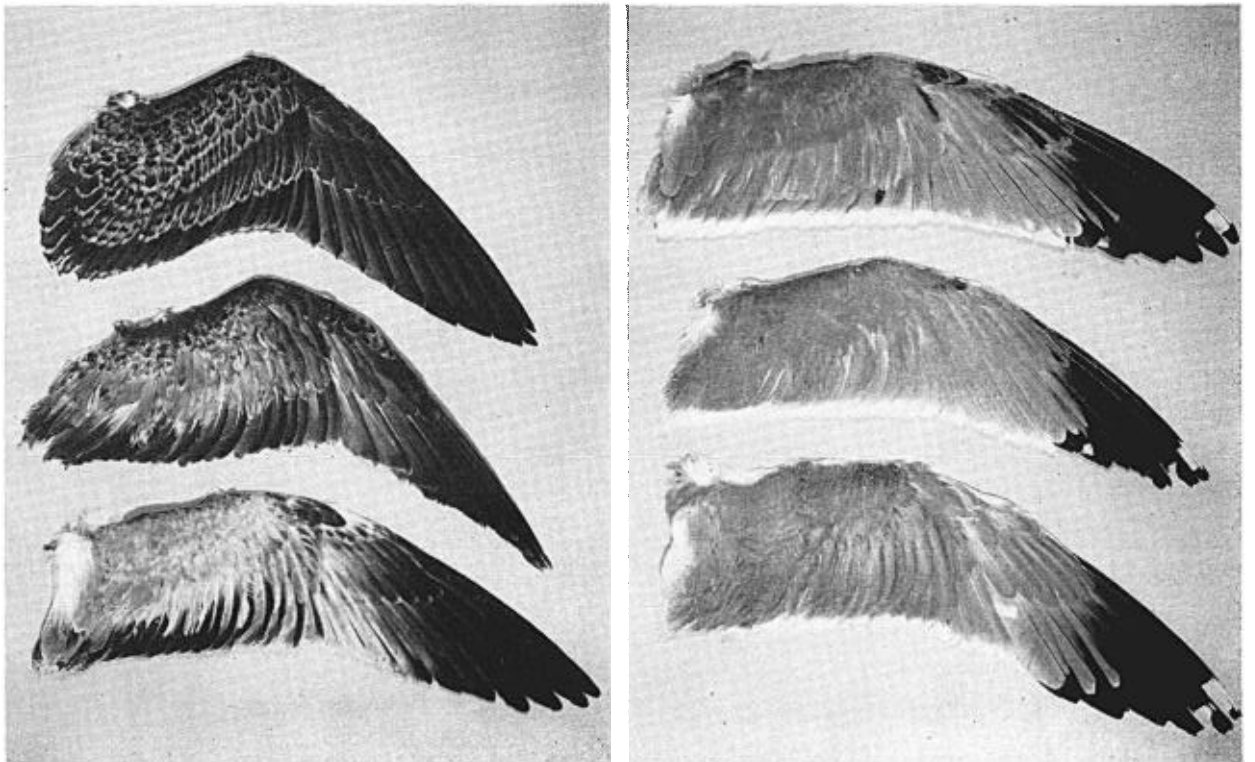
THE standard reference for the sequence of molts and description of plumages of gulls is the work of Dwight in which he attributed (1925: 197) to the California Gull (*Larus californicus*) a four-year plumage cycle whereby the adult non-nuptial or winter plumage is attained in the fall of the third year, and the full adult nuptial plumage is obtained in March and April of the third year, just prior to the time (May) when the bird reaches four years of age (see Dwight, *op. cit.*: 92–96, for terminology of cycles). Brooks (1943) reviewed the cycle of the California Gull in connection with a discussion of the relationship of the species with the Herring Gull (*Larus argentatus*) and the Ring-billed Gull (*Larus delawarensis*) and attempted to show that the California Gull has a two year cycle to maturity (a three-year plumage cycle) with the adult non-nuptial or winter plumage being attained in the fall of the second year, and the adult nuptial plumage being acquired in the following spring shortly before the bird becomes three years old. The principal point of disagreement pertains to the later plumage stages from the third year on, Brooks not recognizing as a regular stage the immature third-year plumage described by Dwight.

The extensive banding of California Gulls in the region of Great Salt Lake (see Woodbury, Behle, and Sugden, 1946; Woodbury and Knight, 1951; and Behle and Woodbury, 1952) developed the possibility of clearing up this discrepancy and extending our knowledge of the cycle of the species with specimens of known age. Poor (1946: 136), in connection with a similar study of the Herring Gull, pointed out the desirability of systematic collecting of banded birds to solve such ornithological problems. Accordingly, during the seasons of 1950, 1951, and 1952, frequent collecting trips were made to the Farmington Bay colonies in Davis County, Utah, where 9300 gulls had been



Wings of California Gulls. (*Left*) Juvenal (*top*); first nuptial (*middle*); second nuptial (*bottom*). (*Right*) Third nuptial (*top*); four-year-old (adult) (*middle*); adult (*bottom*).

banded between 1944 and 1949. We succeeded in collecting banded gulls of several ages as follows: ten two-year-old birds, ten three-year old birds, two four-year-old birds, two six-year-olds, and one each of eight and ten years, respectively. In addition, we obtained 138 unbanded birds of various ages, including three that represent the one-year-old condition. Data concerning body weight, size, coloration of plumage and soft parts, and condition of reproductive organs were recorded in the field. Most of the banded birds were prepared as conventional study skins. The tail and one wing of the unbanded birds were saved as flattened preparations. In addition to material collected for this study, we have examined several specimens of immature birds in California museums. We gratefully acknowledge the help of many students and associates, particularly Howard Behle, John Bushman, Norman Chamberlain, Clark Johnson, and Richard Porter. David W. Johnston examined two early versions of the manuscript and offered several valuable suggestions which were helpful in preparation of the final draft.

This paper presents a summary of the sequence of molts and plumages and a description of the plumages themselves and the associated coloration of the soft parts, based primarily on the banded birds. With the characters for the various ages established by birds of known age, we determined the probable age of the unbanded birds and present the data on these also. To avoid confusion, we have employed the terminology of Dwight who used "nuptial" in referring to plumages assumed during the breeding season regardless of the bird's reproductive capacity. Incidentally, Dwight (1901) outlined the order of renewal of feathers in the process of molt for the Laridae, and Beck (1942: 100) has described the sequence of areas molted by the California Gull from natal to juvenal plumage.

DOWNY YOUNG

Plumage features.—Upon hatching about mid-May, the young gulls have a fluffy covering of whitish natal down feathers. Some specimens show a faint buffy band across the chest and buff under the eye. A few blotches of black appear on the throat and flanks. On the dorsal surface, there are scattered black or dark brown blotches resulting in a mottled or dusky effect, which presumably affords some measure of concealing coloration. The spots on the head are blacker and more sharply defined than those on the back, which are browner and less distinct. Inconspicuous dark spots also appear on the facial region, namely on the lores, chin, and around the eyes. The natal down is worn two or three weeks, being gradually replaced in a com-

plete post-natal molt by the juvenal plumage. This transition occurs for most individuals in late May and early June, so that by mid-June the majority of young are in full juvenal plumage.

Color of soft parts.—The legs and feet are dark brown or blackish during the downy young stage. The eyelids are of similar color with the iris a lighter brown. The bill is black except for the terminal third which is creamy white or flesh colored; the gape pink or flesh colored; the calcified egg tooth near the tip of the maxilla is white. Prominent in the early stages, the egg tooth is gradually resorbed. With the progress of the post-natal molt, there is diminution of the light color at the tip of the bill, which continues until the bill is almost uniformly black in the early juvenal stage.

JUVENAL PLUMAGE

Plumage features.—The young gulls are dusky brown in this plumage, the feathers of the back being brown or cinnamon brown with conspicuous edgings of creamy white or pale buff. The undersurface is also mottled, since the feathers there are white at the base with the terminal third characterized by a series of wavy cross bars consisting in sequence of a wide gray-brown bar, narrow white one, wide gray-brown one, and, finally, a narrow outer margin of white or gray. The remiges are dull black, without spots or mirrors, a bit lighter on the inner webs, and with a very narrow margin of white at the tip (plate 6). The tail is almost uniformly dark brown (plate 7).

The juvenal California Gulls that we have studied show much more white on the dorsum than the specimen presented by Brooks (1943) in his figure 1, plate 2. By September, wear of the white tippings of both the flight and contour feathers has produced a darker bird than a juvenile in late July or August. The juvenal body plumage is replaced by a post-juvenal molt, presumably starting in September and lasting several months. The remiges, rectrices, and tail coverts are retained.

Color of soft parts.—In the early juvenal stage, the bill is uniformly black except for the extreme tip which is creamy white, but with growth of the bird and increase in size of the bill, the basal portion, especially of the lower mandible, becomes lighter. This change is apparent by late July or August. This leaves the terminal half black in contrast to the light base. The feet are dark brown or black in the early juvenal stages, gradually becoming lighter in late July and August. The iris remains brown; the eyelids still blackish; the gape remains flesh color or pink.

TABLE 1

SUMMARY OF PLUMAGE FEATURES OF THE CALIFORNIA GULL

Plumage	*Juvenal*	*First-winter*	*First-nuptial*	*Second-winter*
How acquired	Complete post-natal molt	Partial post-juvenal molt	Partial pre-nuptial molt	Complete post-nuptial molt
Time of molt	Late May-June	September-January	February-May	June-August
Primaries	Black	Blackish brown	Faded to brown	Black with faint basal tongues of gray
Tail	Black edged with white	Blackish brown	Faded to brown	Variable: most with basal half white, terminal half black
Tail coverts	Barred or mottled brown and white	Whiter with less barring	Some white, others barred	White
Mantle	Brown with whitish edgings	Dusky gray splotched with brown	Dull blue-gray with more or less dark blotches	Light and clear blue-gray
Head and neck	Brown with white edgings	Mottled brown and white	White with dusky markings	White with few dusky markings
Throat and breast	Mottled gray and white	Mottled but whiter	White with few dusky markings	White with few dusky markings
Belly	Mottled gray and white	White but still mottled and dusky	Mottled and dusky	Mostly white, some dusky
Alula, primary and secondary coverts	Black	Blackish brown	Faded to brown	Variable: dusky brown or gray
Markings near tips of 9th and 10th, or outermost, primaries	Black with no spots or mirrors	Black with no spots or mirrors	Black with no spots or mirrors	Variable: 9th brown; 10th all brown, or with faint or distinct mirror
Inner 4 primaries	Gray-black	Blackish brown	Faded to brown	Whitish brown; lighter than other primaries

TABLE 1—(*Continued*)

Second-nuptial	*Third-winter*	*Third-nuptial*	*Fourth-winter (adult)*	*Fourth-nuptial (adult)*
Partial pre-nuptial molt	Complete post-nuptial molt	Partial pre-nuptial molt	Complete post-nuptial molt	Partial pre-nuptial molt
February-April	May-August	February-April	June-August	March-April
Black with faint basal tongues of gray at base	Distinct gray tongues	Distinct gray tongues	Distinct gray tongues	Distinct gray tongues
Variable: most with basal half white, terminal half black	Variable: typically mostly white, black near tip	Variable: typically mostly white, black near tip	White	White
White	White	White	White	White
Light and clear blue-gray	Light and clear blue-gray	Light and clear blue-gray	Light and clear blue-gray	Light and clear blue-gray
White with few dusky markings or heavily mottled	White, possibly faint markings	White, occasionally with dusky markings	White streaked with brownish-gray	Pure white
White with few dusky markings	White with few dusky markings	White with few dusky markings	White	White
Mostly white, occasionally some dusky	White	White	White	White
Variable: dusky brown or gray	Variable: blue-gray smudged with brown	Variable: brown, blue-gray, or gray smudged with brown	Gray; often sparsely smudged with dusky	Gray; often sparsely smudged with dusky
Variable: 9th brown; 10th all brown, or with either faint or distinct mirror	Variable: 9th either all brown or with faint mirror; 10th with either faint or distinct mirror	Variable: 9th either all brown or with faint mirror; 10th with either faint or distinct mirror	Variable: 10th with distinct mirror; 9th either all brown or with faint or distinct mirror	Variable: 10th with distinct mirror; 9th either all brown, or with faint or distinct mirror
Whitish brown; lighter than other primaries	Gray as in adults	Gray	Gray	Gray

CHANGES DURING THE FIRST WINTER

Dwight (1925: 198) considered birds in the first winter to represent a distinct plumage, characterized by the "back [being] paler and grayer than the juvenal, and with less mottling, and the barring of a paler brown, more fused and diluted." His reference specimen was taken November 11. Brooks (*op. cit.:* 17) presents in his figure 2, plate 2, a ten-month-old gull (which we have examined), taken April 26, which is in first nuptial plumage and has a decidedly grayish mantle. Beck (1943: 58) stated that "Dwight's description is of a bird at the beginning stages of [the first] winter plumage while Brooks' description is for the terminus of [the first] winter plumage." According to Beck (*op. cit.*), who reared California Gulls from the downy stage, there is a gradual month to month replacement of the body feathers through the first winter as though there were one protracted molt. It seems to us that two molts of the body plumage occur, the post-juvenal and the first pre-nuptial. By January, near the conclusion of the post-juvenal molt, the incoming feathers of the underparts are partly white, resulting in a generally lighter appearance. The juvenal mantle feathers are replaced with dusky-grayish feathers which are variously splotched with brown. Some specimens show replacement of certain of the juvenal marginal coverts of the wing, but many individuals show no replacement of wing coverts during the winter. By early May, the feathers have again been replaced in the first pre-nuptial molt, and the first nuptial plumage is assumed. Throughout both of these molts, the juvenal remiges, rectrices, and apparently many of the tail coverts are retained.

FIRST NUPTIAL PLUMAGE

Plumage features.—The back is now almost continuously blue-gray with only a few dark blotches remaining. The blue-gray is duller than that of subsequent plumages, and there is considerable individual variation in the degree of blue-grayness of the mantle achieved during the winter molts. Two of our one-year-old examples taken May 23 and June 20 do not have their mantles as uniformly blue-gray as does Brooks' specimen illustrated in his figure 2, plate 2, which was taken April 25. The head, nape, and rump areas, although somewhat mottled, are essentially white. The underparts are whitish, although some mottling remains, especially on the belly. The old juvenal rectrices and remiges are now faded to brown and are abraded in greater or lesser degree. The wing coverts (juvenal) are also faded to light brown and frayed (plate 6). Essentially, this is the bird described by Brooks and shown in his figure 2 of plate 2. This is the first nuptial plumage of Dwight.

TABLE 2

SUMMARY OF USUAL OR "TYPICAL" COLORS OF SOFT PARTS FOR DIFFERENT AGE GROUPS OF CALIFORNIA GULLS

Character	*Downy Young*	*Juvenal*	*First Nuptial*	*Second Nuptial*	*Third Nuptial*	*Adult Nuptial*
Gape	Pink or flesh color	Pink or flesh color	Creamy white	Cream, pink, or pale orange	Orange or orange-red	Orange-red
Eyelids	Black	Black	Black	Slightly orange or pale red	Orange-red or red	Orange-red or red
Iris	Brown	Brown	Brown	Brown	Brown	Brown
Pupil	Blue	Blue	Blue	Blue	Blue	Blue
Red spot on lower mandible	Not present	Not present	Not present	Pale to intermediate red	Pale to deep red	Extensive; orange-red
Black band in front of red spot	Not present	Not present	Very wide on both maxilla and mandible	Varies from 11 to 2 mm. in width and forms prominent subterminal band	Reduced, but varies from 10 mm. to 0	Inconspicuous or absent
Bill	Black except for terminal third which is cream or flesh color	Initially black except tip which is creamy white; basal portion becomes lighter	Creamy white except for broad subterminal black band	Varies from cream or gray to greenish yellow or yellow	Greenish yellow or bright yellow	Bright yellow
Legs and feet	Blackish brown or black	Initially blackish brown, becoming gradually lighter	Bluish, gray, or creamy white	Varies from cream to pale green to yellow	Green or yellow	Green, pale yellow, or deep yellow

Color of soft parts.—The bill is now a creamy white except at the tip, where there is a broad subterminal black band on both maxilla and mandible. The iris is brown; the eyelids black; the gape creamy white. The feet are variable in color, being either bluish, gray, or creamy white.

Gonads.—The gonads of our three one-year-old birds in first nuptial plumage are relatively small as compared with birds in second, third, and subsequent nuptial plumages, the left testis measuring 3 x 2 (May 23), 4 x 1 (June 20), and 4.5 x 2 mm. (May 23), respectively. Perhaps the lack of development of the gonads is correlated with poor development of the migratory instinct, since the small sample obtained suggests that most first year birds do not return to the natal region.

SECOND WINTER OR NON-NUPTIAL PLUMAGE

One specimen taken June 20 shows the beginning of the first post-nuptial molt, which involves complete replacement of the plumage. The inner four primaries and their coverts are just coming in; the outer three of the four are of approximately equal length and the innermost is only a little ahead of the others in development. The median upper secondary coverts are new and ensheathed, being about 25 mm. long. Scattered new feathers are coming in on the mantle, neck, breast, and belly, and both the upper and lower tail coverts are being replaced. As noted by Dwight, the new rectrices tend to be squarer at the tips than the more rounded juvenal ones. The new flight feathers are blackish in color on the upper surface but paler gray below. The inner four primaries are lighter than the others. The tail feathers, although essentially black, are more whitish at the base than are those of the juvenile and again are narrowly margined with white. The underparts and head are now essentially white except on the belly, sides of the throat, and eye region, where there is some dusky. The hind neck is still dusky and blotched. The back is essentially blue-gray and comparable in shade to the fully adult condition. The wing coverts are mostly mottled with gray and brown. The alula feathers are blackish brown.

SECOND NUPTIAL PLUMAGE

Plumage features.—The second winter or non-nuptial plumage seemingly is retained with little change except for wear and some further replacement of body feathers during the second pre-nuptial molt. There is much individual variation with respect to the head markings in the second nuptial plumage. The head is white in some birds, although most individuals still have some dusky markings on

the occipital region, so that the appearance varies from white with just a few scattered blotches to dark and heavily mottled. There also is some variability in color of the wing coverts. Most specimens show some gray median upper secondary coverts in the area closest to the body. These are probably attained during the winter in the post-nuptial molt (see plate 6). Some specimens still show dusky feathers on the center of the belly.

TABLE 3

VARIATION IN COLOR OF FEET AND LEGS OF CALIFORNIA GULLS REPRESENTING SEVERAL AGE GROUPS. NUMBERS REFER TO THE NUMBER OF INDIVIDUALS IN THE SAMPLE POSSESSING THE COLOR CHARACTER INDICATED

	1st Nuptial		*2nd Nuptial*		*3rd Nuptial*		*4th Nuptial*	
	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀
Cream or flesh color	1	0	2	3	2	1	0	1
Blue	1	0	5	0	1	0	0	0
Blue-gray	0	0	4	2	0	0	1	0
Gray	1	0	6	2	2	1	1	0
Gray-green	0	0	3	0	4	0	0	0
Green	0	0	8	6	14	1	6	8
Green-yellow	0	0	4	2	2	1	2	0
Yellow	0	0	0	2	8	0	4	8
Total Individuals	3	0	32	17	33	4	14	17

With reference to the white markings on the outermost primary, of 7 banded specimens in this two-year age category, 4 lack white and 3 have a distinct marking similar to that shown in Dwight's figure 111 (page 355). Of 51 unbanded specimens of this age, 8 have a prominent white mark on the outermost primary, 14 have an indistinct mark, and 29 lack white markings. As to the tail pattern, 7 banded specimens have markings essentially as portrayed by Dwight in figure 112 (page 355), except that two have some all-white feathers. Of the 51 unbanded birds, 36 have tails similar to that shown by Dwight in figure 112, while 9 have considerably less black in the tail, especially at the base (see plate 7). The other 6 are variously intermediate. Thus, the darker condition with the basal portion white and the distal half dark brown or black may be regarded as typical. The other conditions appear, therefore, to be instances of individual variation. Furthermore, there is some variability with respect to the coloring of the individual tail feathers. In the tails of 2 banded and 6 unbanded specimens, one or more of the rectrices is pure white (see plate 7).

Color of soft parts.—The feet and legs are exceedingly variable, ranging through eight colors from cream or flesh to yellow, as indicated in table 3. The green type is predominant. The bill likewise shows considerable individual variation, ranging from cream to gray or yellow, there being about as many cream as yellow. The gape is

either cream, pink, or pale orange. The eyelids are pale orange or pale red. The red spot near the tip of the lower mandible varies from slightly to moderately prominent, mostly the latter. The subterminal black band of the bill is, in most specimens, so prominent that it resembles the condition in the Ring-billed Gull. Actually, it is subject to great individual variation, the width ranging from 2 to 11 mm

TABLE 4

MEASUREMENTS OF CALIFORNIA GULLS OF KNOWN AGE FARMINGTON BAY COLONIES, DAVIS COUNTY, UTAH

		Males		*Females*	
Character	*Age Group*	*Number of specimens*	*Mean and extremes*	*Number of specimens*	*Measurements*
Weight (Grams)	2nd nuptial	4	653 (648–794)	1	642
	3rd nuptial	7	660 (600–710)	0	—
	Adult	4	725 (675–820)	1	616
Wing (Chord) (Millimeters)	2nd nuptial	6	379.6(360–395)	1	373
	3rd nuptial	9	394.2(370–415)	0	—
	Adult	4	387.2(370–400)	1	365
Tail	2nd nuptial	6	145.0(138–152)	1	143
	3rd nuptial	9	147.6(140–160)	0	—
	Adult	4	150.7(149–152)	1	144
Tarsus	2nd nuptial	6	58.1(55–62)	1	53
	3rd nuptial	9	58.8(56–62)	0	—
	Adult	4	57.0(53–60)	1	56
Exposed Culmen	2nd nuptial	6	47.1(46–48)	1	50
	3rd nuptial	9	46.8(43–49)	0	—
	Adult	4	47.2(46–48)	1	42
Depth of bill at base	2nd nuptial	6	16.0(15–18)	1	16.0
	3rd nuptial	8	16.2(15–18)	0	—
	Adult	4	17.2(16–18)	1	14.5

Condition of gonads.—Although two-year-old birds are presumably not breeding, their gonads are considerably larger than those of birds in first nuptial plumage and, furthermore, seem to show swelling and shrinking as in the adult cycle. The data that suggest this are presented in tables 6 and 7. The swollen condition was evident by the time our earliest sample was taken on May 8. Based on the length of the left testis of males, indications are that the swelling reached a peak during the third week in May and started to diminish in June. The trend is less pronounced in females, whose largest ova ranged around 3 and 4 millimeters in May. Yet the sample of June 20–21 showed some reduction. The oviduct was not swollen in any of the two-year old females.

TABLE 5

MEASUREMENTS OF UNBANDED CALIFORNIA GULLS OF SEVERAL AGE GROUPS FARMINGTON BAY COLONIES, DAVIS COUNTY, UTAH

		Males			*Females*		
Character	*Age group*	*Number of specimens*	*Range*	*Mean with standard error**	*Number of specimens*	*Range*	*Mean with standard error*
Weight (Grams)	First nuptial	3	575–750	662	0	—	—
	Second nuptial	33	500–775	659±9	17	500–636	567±11
	Third nuptial	33	600–775	671±9	4	525–650	591
	Adult nuptial	15	550–748	653±15	17	425–625	526±11
Wing (Chord) (Millimeters)	First nuptial	3	345–395	375.6	0	—	—
	Second nuptial	33	340–420	389.6±3.0	17	355–390	373.5±2.8
	Third nuptial	33	340–430	392.5±2.4	4	360–385	369.2
	Adult nuptial	15	375–420	398.1±3.1	16	359–400	383.4±2.5
Tail	First nuptial	3	126–145	138.3	0	—	—
	Second nuptial	33	140–158	147.9±0.8	17	132–147	139.9±1.3
	Third nuptial	33	138–160	149.6±0.4	4	138–148	145.0
	Adult nuptial	15	146–159	152.0±1.0	17	135–147	142.2±0.9
Tarsus	First nuptial	3	53–67	60.1	0	—	—
	Second nuptial	33	55–62	58.2±0.3	16	51–58	54.0±0.8
	Third nuptial	33	47–63	58.0±0.5	4	51–53	52.0
	Adult nuptial	15	55–67	59.0±0.8	16	49–62	54.3±0.8
Exposed Culmen	First nuptial	3	41–46	43.3	0	—	—
	Second nuptial	33	43–50	46.6±0.2	17	39–47	42.2±0.5
	Third nuptial	33	43–50	47.0±0.3	4	42–44	43.0
	Adult nuptial	15	45–54	48.6±0.7	17	40–48	44.2±0.6
Depth of bill at base	First nuptial	3	12–15	14.1	0	—	—
	Second nuptial	33	15–18	16.5±0.2	17	13–18	14.8±0.3
	Third nuptial	32	14–20	17.3±0.2	4	14–16	15.0
	Adult nuptial	14	15–19	17.1±0.3	17	14–18	15.7±0.3

* The Standard error of the mean $= \frac{\sigma}{\sqrt{n}}$ where $\sigma = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n-1}}$.

THIRD WINTER OR NON-NUPTIAL PLUMAGE

According to both Dwight and Brooks, when California Gulls are a little over two years old, there occurs in late summer (July and August) the second complete molt. Our specimens show that, in the Great Salt Lake area, molt of the primaries begins by the last week in May. By June 20, the inner 5 or 6 primaries are new and about one-half grown, and the median secondary coverts and scapulars have been replaced. This molt leads to a third winter or non-nuptial plumage which becomes the third nuptial plumage by a partial pre-nuptial molt in March and April. This plumage is similar to that of the adult but is characterized by having the primary coverts and alula smudged with dusky and the tail largely white with a few irregular smudges.

According to Brooks (1943: 17), the first adult plumage is assumed following the second complete molt when the bird is a little over two

years old. He denied the regular occurrence of Dwight's third year plumage, believing that specimens so characterized are "backward individuals," not representative of the normal sequence. Although we have no specimens of birds in the third winter or non-nuptial plumage, we do have several banded specimens of a known age of three years, which demonstrate the existence of a distinctive third year plumage as described by Dwight.

TABLE 6

DEGREE OF DEVELOPMENT OF GONADS OF CALIFORNIA GULLS OF KNOWN AGE
(Measurements in millimeters)

	Length of Left Testis								
	Second Nuptial Plumage			*Third Nuptial Plumage*			*Adult Nuptial Plumage*		
Date	*Number of specimens*	*Range*	*Mean*	*Number of specimens*	*Range*	*Mean*	*Number of specimens*	*Range*	*Mean*
May 8	0	—	—	1	18.0	18.0	0	—	—
May 10–12	4	15.0–7.0	10.7	4	14.0–11.0	12.5	2	12.0–10.0	11.0
May 18	0	—	—	0	—	—	0	—	—
May 23	2	9.5–4.5	7.0	4	19.5–15.0	18.2	0	—	—
June 1	0	—	—	0	—	—	1	12.0	12.0
June 20–21	0	—	—	1	8.0	8–0	1	12.0	12.0
	Largest Ovum								
May 8	0	—	—	0	—	—	0	—	—
May 10–12	1	3.0	3.0	0	—	—	1	4.0	4.0
May 18	0	—	—	0	—	—	0	—	—
May 23	1	5.5	5.5	0	—	—	0	—	—
June 1	0	—	—	0	—	—	0	—	—
June 20–21	0	—	—	0	—	—	0	—	—

THIRD NUPTIAL PLUMAGE

Plumage features.—The mantle and wing coverts are predominantly blue-gray except for some dusky mottling on the alula and primary coverts (plate 6). The amount of dusky marking on the wing coverts is highly variable and is most prevalent or abundant in those specimens having very dark tails. The head, nape, rump, and underparts are pure white with some brownish spotting on the sides of the throat and breast. Dwight showed two tail patterns for gulls in this plumage (1925: figures 114 and 116, page 356). Two of our banded specimens show considerably more black than either of those shown by Dwight and, in this regard, are not distinguishable from birds in the second nuptial or two-year-old condition. Both of these birds had smaller testes than birds having less black on the tail and, hence, were probably retarded individuals. A third specimen lacks a definite tail band, having, instead, half of the rectrices predominantly black and half pure white. The remaining banded specimens have tails

TABLE 7

DEGREE OF DEVELOPMENT OF GONADS OF UNBANDED CALIFORNIA GULLS
(Measurements in millimeters)

	Length of Left Testis											
	First nuptial plumage			*Second nuptial plumage*			*Third nuptial plumage*			*Adult nuptial plumage*		
Date	*Number of specimens*	*Range*	*Mean*	*Number of specimens*	*Range*	*Mean*	*Number of specimens*	*Range*	*Mean*	*Number of specimens*	*Range*	*Mean*
May 8	0	—	—	7	16.5–5.5	11.6	3	19.4–17.3	18.0	3	23.0–19.0	20.4
May 10–12	0	—	—	6	15.0–7.0	10.3	9	22.0–12.0	16.5	3	12.0–10.0	11.0
May 18	0	—	—	2	15.0–11.0	13.0	7	18.0–9.0	14.5	1	15.0	15.0
May 23	2	4.5–3.0	3.7	4	16.0–14.0	15.6	5	20.0–9.0	12.8	2	15.0–14.0	14.5
June 1	0	—	—	6	13.0–9.0	10.5	3	17.0–11.0	14.0	3	9.0–6.0	7.6
June 20–21	1	4.0	4.0	9	12.0–5.0	7.6	3	12.0–6.0	8.3	4	10.0–7.0	8.2
	Largest Ovum											
May 8	0	—	—	3	4.0–3.0	3.3	1	4.0	4.0	0	—	—
May 10–12	0	—	—	5	4.0–2.5	3.3	3	15.0–3.0	7.6	1	10.0	10.0
May 18	0	—	—	0	—	—	0	—	—	0	—	—
May 23	0	—	—	3	4.0–3.0	3.3	0	—	—	9	6.0–3.0	4.6
June 1	0	—	—	0	—	—	0	—	—	0	—	—
June 20–21	0	—	—	6	2.0–1.0	1.8	0	—	—	7	4.0–2.0	2.4

with the irregular black markings confined near the tips of the rectrices (see plate 7). Of our 38 unbanded birds of this age, 6 have tails as dark as or darker than that shown in Dwight's figure 114, and 32 have tails more comparable to his figure 116. Thus, it appears that the typical condition as regards black in the tail is that of having the tail mostly white with irregular subterminal smudges (plate 7).

As pertains to the markings of the outer primaries of three-year old birds in the third nuptial plumage, Dwight figured two situations (figures 113 and 115, pages 355–356). Of the 10 banded birds we have in this age category, one has markings similar to his figure 113, showing no white near the tip of the ninth primary (numbered from the inner to the outer). The others are either like the condition portrayed in his figure 115 or intermediate between the two conditions. Of the 38 unbanded birds which we judge to be of this age, 10 have wing markings similar to his figure 113, while 27 are similar to figure 115. One specimen has no white on the outer two primaries. Thus, the condition shown in figure 115 is the more common.

From this discussion it will be noted that gulls in the third nuptial plumage have many of the features of adult plumage, the most obvious differences being the possession of a black subterminal part of the tail and smudging on the alula and primary coverts. Since it is this third nuptial plumage which Brooks failed to recognize, it may be well to point out in some detail the distinctions between it and both the second nuptial and adult nuptial plumages. As compared with birds in second nuptial plumage, most three-year-old birds have the head and neck generally white instead of blotched with light brown, although some individuals may still have the head lightly specked. The dusky markings on the bend of the wing and wing coverts are greatly reduced, although a few may persist. This feature is highly variable. The primaries of some birds appear to be blacker. The gray tongues on the primaries are as well defined as in the adults. Furthermore, the inner four primaries are gray as in the adults. This is perhaps the best means of discriminating between California Gulls in third nuptial as opposed to second nuptial plumage, for these inner four primaries in the second year birds are light brown (see plate 6). (Even our most retarded three-year-old birds with black tails and much dusky in the body plumage have the inner four primaries gray rather than light brown.) The tail is spotted with black or dusky. The bill is yellower with the red spot more prominent. The black band at the terminal part of the bill is reduced in many specimens, more particularly on the maxilla.

In their third nuptial plumage, California Gulls resemble birds in the adult nuptial plumage in having the head and underparts white and the mantle a clear blue-gray. The bill is bright yellow, but the red spot is not as fully developed as in the adult. The terminal portion of the tail of third year birds is black in greater or lesser degree as opposed to the pure white tail of adults. The primary coverts, alula, and greater secondary coverts of the three-year-old birds are marked with dusky, while those of the adult are, with few exceptions, immaculate. A difference sometimes exists in the secondaries. In most third year individuals these feathers are as in the adult, being gray except for the relatively wide terminal band of white, but some birds in the third nuptial plumage have some or all of the secondaries dusky on the outer half of the vane except for a narrow white terminal margin.

Color of soft parts.—Three-year-old birds in third nuptial plumage show great individual variation in color of soft parts. Seven color types of the legs and feet are represented (see table 3), with the majority of individuals having green legs and feet; but yellow is also common. Most individuals have yellow bills, with a few tending toward green-yellow or orange-yellow. The gape is either orange or red, as are the eyelids. The red spot on the lower mandible tends to be more prominent than in two-year-olds but not as conspicuous as in adults. In a few instances it is only moderately developed, thus resembling the normal condition for birds a year younger. The subterminal black band of the mandibles is reduced in most individuals as compared with the typical two-year-old condition. However, some birds resemble two-year-old birds in this character, while in others the black is virtually absent, thus showing the typical adult condition. The black band ranges from 1 to 10 millimeters in width.

Condition of gonads.—The gonads of individuals of this age group are, on the average, larger than those of birds in second nuptial plumage. The same pattern of recrudescence and subsequent waning as the season progresses is shown (see tables 6 and 7). Maximum size is seen in the small sample of May 8. There are some indications of breeding, as will be discussed in the following section.

BREEDING STATUS OF GULLS IN THIRD NUPTIAL PLUMAGE

If California Gulls breed during their third spring and summer, the third nuptial plumage is the first true nuptial plumage. While the evidence is not conclusive, there are indications that at least some of the gulls in the Great Salt Lake region breed in their third year. Woodbury, Behle, and Sugden (1946: 12) noted two instances of color

banded gulls three years of age supposedly nesting. One, banded at Egg Island, was seen to settle down on a nest with eggs at one of the Farmington Bay colonies. The second, banded at Rock Island, Utah Lake, was seen there along with many other gulls in the nesting colony. To this we add the following evidence. Ten additional banded three-year-old birds and many more judged to be three years old on the basis of plumage characters and colors of soft parts, were taken by us on the islands at Farmington Bay where colonies of gulls nest. They did not differ in behavior from the fully adult individuals with which they were associated. The gonads of these three-year-old birds were swollen, being nearly as large as those of adults. In one female a 15 mm. ovum and a swollen oviduct were found. Richard D. Porter observed a gull with three-year-old plumage features settle down on a nest with eggs at the Ogden Bay Refuge, Weber County, on May 23, 1952.

FOURTH WINTER OR NON-NUPTIAL PLUMAGE (ADULT)

Following the third nuptial plumage there is, according to Dwight (1925: 201), a complete post-nuptial molt in August, September, and October leading to a fourth winter or non-nuptial (adult) plumage. Our material indicates that this molt commences considerably earlier in the Great Salt Lake birds, namely in late June and early July. During this molt, the black of the tail, which is diagnostic of three-year-old birds, apparently is lost, and the tail becomes pure white, presumably thereafter remaining so. The rump and underparts are pure white. The mantle and wing coverts are clear blue-gray. The head now becomes streaked with brownish gray. Thus, the gulls have assumed the adult non-breeding dress three years after the juvenal plumage, when they are slightly more than three years old.

The sequence of molts and plumages is finally rounded out by a partial pre-nuptial molt in March and April (just prior to the beginning of the fourth year) which leads to the fourth or adult nuptial plumage. They presumably breed this spring for the first time, if indeed they did not do so the previous spring.

FOURTH NUPTIAL PLUMAGE (ADULT)

Plumage features.—We have been able to secure only two banded four-year-old birds. These are like the true adults in having pure white tails and immaculate plumage, but the coverts of the outer three primaries and alula are dusky, and one bird has a splotch of dusky on two of the secondaries of either wing (plate 6). According to

(*Left*) Tails of California Gulls (coverts removed). *Top:* Juvenal (which is retained in first nuptial plumage). *Second row:* Variation in second nuptial plumage. *Third row:* Variation in third nuptial plumage. *Bottom:* adult.

(*Right*) Bills of California Gulls. *Top to bottom:* first nuptial, second nuptial, third nuptial, adult nuptial. Note progressive reduction of black in terminal portion.

Dwight (*loc. cit.*), the primary coverts of birds in fourth winter and fourth nuptial plumage are uniformly gray like the mantle. However, limited dusky markings on the primary coverts and alula are present on our eight-year-old specimen, and our ten-year-old specimen has several dusky markings on the primary coverts. It should be noted that both of the banded four-year-old birds have much more dusky on the primary coverts and alula than do the eight- or ten-year-old birds. It would appear, therefore, that at least in some individuals all the dusky markings of the plumage are not lost by the end of four years as Dwight's statements lead one to believe. This is also suggested by some unbanded material.

In our collecting we obtained eight unbanded specimens which we have been unable to place satisfactorily in an age category. All of these specimens have slight smudging on the tail, sometimes as little as a single spot 10 mm. in diameter. Some have immaculate wings (but *with* smudging on the tail), while others have light smudges on the alula or a few of the primary coverts. It would seem that these could be advanced three-year-olds, or four-year-olds, or individual variants of ages greater than four years. However, all five of our banded birds four years or older have pure white tails. Poor (1946: 145) found that not all specimens of the Herring Gull in the fourth winter and fourth nuptial plumages (which Dwight considered to be adult) had pure white tails. In Poor's data, six four-year-old birds had tails chiefly white with dark areas covering one-third or less of the exposed rectrices, compared to nine individuals with pure white tails.

Considerable individual variation exists among adult California Gulls as to the white markings on the outer two primaries. Dwight (1925: 201) reported that "Birds in completely adult dress usually have two mirrors, the outer primary often with a wholly white tip or a large mirror crossed by a narrow black line. There is much variation, some few birds having a mirror only on the outer. The type of the species (A.M.N.H., No. 46070; California), which I have examined, is such a bird and doubtless a fall female. The outer primary is not fully grown and the head and neck are streaked. It is, unfortunately, not a typical specimen, as most adults have either two mirrors, or more often the outer primary has a long white tip. This specimen (Fig. 117) has but one mirror."

As pertains to our specimens, of the six banded birds four years or older, five are like his figure 120, wherein the tip of the outer (tenth) primary is extensively white and the ninth primary is white at the tip with a black band below followed by a prominent subapical white spot. One is more like his figure 119 which was presumably meant to show a

dull or poorly developed mirror on the ninth primary. Of the 32 unbanded adults, 12 are most nearly like his figure 120. Six are more like his figure 119. Four of our examples conform to Dwight's figure 117, in which there is no mirror on the ninth primary. Ten others have the outermost primary as in his figure 117, but the adjacent primary as in figure 119, a combination not illustrated by Dwight. Thus, it appears that Dwight's figure 120 illustrates the commonest condition.

Since the foregoing was written, David W. Johnston has collected a banded female in fourth winter plumage which has the tail feathers splotched with numerous pale dusky markings. This specimen was banded at Farmington Bay, Davis County, Utah, on June 4, 1949, and was collected at the Albany Dump, Alameda County, California, on January 30, 1953.

Color of soft parts.—The color of the legs and feet of adults is either green or yellow (see table 3) except for an occasional one that is flesh color. There is less variability than for the two previous years. The gape is red or orange; the eyelids mostly red, but occasionally orange. The bill is mostly a bright yellow or a brilliant orange-yellow. The red spot is more extensive than in any previous year, being a vivid orange-red and, in some individuals, extending to the upper mandible. The black of the bill continues to be variable. It may be either absent, in the form of a slight blotch within the red, or a noticeable band that varies from 2 to 6.2 mm. in width.

Condition of gonads.—As far as our dates of collection are concerned, maximum size of the testes of males was noted at the time of our first sample on May 8. This was apparently past the peak of the egg-laying period. Beck (1942: 97) reported gulls copulating at Rock Island, Utah Lake, on April 11. He also found the first eggs for the season on April 11 in 1941 and on April 12 in 1942. The peak of egg-laying was around May 1. This corresponds with our observations at Farmington Bay. The earliest date we have for hatching is May 5. The data in table 7 show a gradual diminution in size of the gonads through late May and June. (Incidentally, in many individuals the right testis is smaller than the left.) Fewer data are available for females, but the same trend is indicated.

MOLTS AND PLUMAGES OF ADULTS

It appears that there is in the adult a normal sequence of two molts per year, the annual complete summer-fall molt leading to a dark-headed winter plumage, and a mid-winter or early spring partial molt at which time the head loses the dusky and becomes white for the

breeding season. A seasonal change takes place in the coloration of the soft parts, the colors becoming intensified for the breeding season. This is especially true of the red spot and the yellow of the bill.

SEX RATIOS

Random sampling of California Gulls in the several nuptial plumages revealed some significant differences in sex ratios between pre-adult and adult stages. Only three individuals representing the first nuptial plumage were taken, and all were males. Of 60 birds in second nuptial plumage, 41 were males and 19 females. Of 47 in third nuptial plumage, 43 were males and only 4 were females. In contrast, the adults showed an approximate 50–50 ratio, there being 19 males and 18 females.

The great majority of birds were shot from the air above the nesting sites. In the immature groups representing the second year, the differences can not be attributed to females incubating, and it is doubtful that this explanation would hold for the birds in third nuptial plumage. It would seem that the immature males have a greater attraction to the nesting sites than females of similar age. Whether the immature females are in the region but not at the nesting colonies is not known.

SEXUAL VARIATION

There do not seem to be any differences between the sexes in color characters. This holds true from the downy young to the adult stage. There are, however, several significant size differences between males and females as shown in tables 4 and 5, the males being larger than females. We did not obtain juveniles or females in first nuptial plumage, but the size differences are present from the two-year stage on.

THE RELATIONSHIP OF THE CALIFORNIA GULL AND THE HERRING GULL

Some systematists (see synonymy in Hellmayr and Conover, 1948: 266) have regarded *Larus californicus* as being conspecific with *Larus argentatus*. Brooks (*op. cit.*) protested this treatment on the basis of characters of voice, color of soft parts, and age of maturing. He concluded that *Larus californicus* is a distinct species with affinities as close to the Ring-billed Gull (*Larus delawarensis*) and other species of the green-footed gulls, as to the *Larus argentatus* group. Be that as it may, our findings refute Brooks' argument based on time of maturing. There is close similarity in sequence of molts and plumages

between *Larus californicus* and *Larus argentatus*, and not the differences supposed by Brooks. The two species do not agree in all particulars, however, as a comparison of our table 1 with table 3 of Poor (*op. cit.*: 144) will show. Perhaps the most significant difference is that the Herring Gull, as pointed out by Poor (*op. cit.*: 141), has no gray feathers in the mantle in the first nuptial plumage. In contrast, blue-gray feathers appear in the mantle of the California Gull during the first winter, and a rather uniformly blue-gray mantle is assumed for the first nuptial plumage.

SUMMARY

New data furnished by 26 banded birds of known age and 138 unbanded birds taken on their nesting grounds corroborate the findings of Dwight that the California Gull has a three-year cycle to maturity [a four-year plumage cycle] rather than a two-year cycle as suggested by Brooks.

Despite the occurrence of considerable individual variation in speed of molt and details of plumages, with few exceptions distinctions can be made between gulls in spring and fall for the three years normally required to attain full adult status. Following the speckled whitish natal down stage, there is a distinctive dusky brown juvenal stage in which dress the gulls leave the Great Salt Lake region in late summer and fall.

There is a change from month to month through the first winter as a result of two closely following molts, the post-juvenal and first pre-nuptial, both of which involve the body plumage only. These lead to the first nuptial plumage characterized by a dull blue-gray back and whitish, but mottled, head, neck, and underparts. The wing and tail feathers, which are the old juvenal ones, become faded and frayed.

In summer and fall, a complete molt occurs leading to a second-winter or non-nuptial plumage. A subsequent spring partial pre-nuptial molt establishes the second nuptial plumage, in which the tail is white at the base and broadly banded with black at the tip.

In their third summer and fall the birds undergo a second complete molt and acquire a third winter or non-nuptial plumage. Another spring partial molt results in the third nuptial plumage in which the body is essentially immaculate as in adults, but the wing and tail still show dusky markings in greater or lesser degree.

During the fourth fall there is again a complete molt leading to the adult condition in the fourth winter or non-nuptial plumage. This is followed in the spring by a partial pre-nuptial molt resulting in the adult nuptial plumage. However, there is evidence that the duskiness

is not completely lost on the primary coverts and alula until some time after the fourth year. Banded birds, four, eight, and ten years old, showed slight dusky markings on the wing coverts.

Adults have a complete post-nuptial molt acquiring a dusky-headed fall-winter plumage. The head becomes pure white for the breeding season by a partial pre-nuptial molt.

A series of color changes in legs, feet, bill, and gape accompany the plumage changes of the aging process. Considerable individual variation is manifest in these characters from the first spring on. The colors of the soft parts, particularly the bill, become accentuated during the breeding season. The subterminal black markings gradually diminish.

The California Gull has a molt sequence that is similar in general features to that of the Herring Gull (*Larus argentatus*). One notable difference, however, is the acquisition of a blue-gray mantle by the California Gull during the first year, whereas the Herring Gull has a brown mantle during the first year.

It is not known whether California Gulls regularly breed during the third spring and summer, but the gonads of many individuals have reached full adult size by then, and indications are that some individuals do breed.

There does not seem to be any sexual variation in plumage characters or coloration of the soft parts, but there are size differences, males being larger than females at least from the two-year stage on.

LITERATURE CITED

BECK, D. ELDON

1942. Life history notes on the California gull. Great Basin Nat., 3: 91–108.

1943. California gull, a comparative plumage study. Great Basin Nat., 4: 57–61.

BEHLE, WILLIAM H., AND ANGUS M. WOODBURY

1952. Results of banding California gulls (Larus californicus) at Farmington Bay, Utah. Proc. Utah Acad. Sci., Arts, Letters, 29: 24-29.

BROOKS, ALLAN

1943. The status of the California gull. Auk, 60: 15–20.

DWIGHT, JONATHAN

1901. The sequence of moults and plumages of the Laridae (Gulls and Terns). Auk, 18: 49–63.

1925. The gulls (Laridae) of the world: their plumages, moults, variations, relationships and distribution. Bull. Am. Mus. Nat. Hist., 52, Art. 3: 63–408.

HELLMAYR, CHARLES E., AND BOARDMAN CONOVER

1948. Catalogue of birds of the Americas and the adjacent islands. Pt. 1, No. 3. Field Mus. Nat. Hist., Zool. Ser., 13, Pt. 1 (3): vi + 383 pp.

POOR, HUSTACE H.
1946. Plumage and soft-part variations in the herring gull. Auk, 63: 135–151.
WOODBURY, ANGUS M., WILLIAM H. BEHLE AND JOHN W. SUGDEN
1946. Color-banding California gulls at Great Salt Lake, Utah. Bull. Univ. Utah, 37 (3): 1–15.
WOODBURY, ANGUS M. AND HOWARD KNIGHT
1951. Results of the Pacific gull color-banding project. Condor, 53: 57–77.

Division of Biology, University of Utah, Salt Lake City, August 1, 1952.