GROWTH AND DEVELOPMENT OF YOUNG CALIFORNIA GULLS (*LARUS CALIFORNICUS*)

JEAN E. SMITH

Department of Biology
Carroll College
Helena, Montana 59601

AND

KENNETH L. DIEM

Department of Zoology and Physiology
University of Wyoming
Laramie, Wyoming 82070

A valuable tool in any study of the ecology of a population is the ability of the observer to accurately age and evaluate the physiological condition of the organisms involved. There are no detailed descriptions of the development of juvenile California Gulls in the literature. Dawkins et al. (1965) compared developing embryos of the California Gull and the domestic chick. Dwight (1925) gives a description of the different plumages and soft part colors in the 4-year plumage cycle, including limited information on molts. Behle and Selander (1954) describe the young downy and the juvenal plumage but do not attempt details of the transition. Johnston (1956) describes the first-year through adult plumages and molt cycles. Also considered are changes in colors of soft parts with season and age, but these are not fine enough distinctions to be used to age juveniles accurately. Beck (1942) describes the general development of juvenal plumage but does not give ages of the birds at various stages except in a generalized way. Some aspects of his descriptions are not in complete agreement with observations made in this study. Behle and Goates (1957) studied early growth of the young with little success. From a sample of 128 birds, they took weights and body length measurements of newly hatched chicks and those about 21 days of age. The study was terminated because of the difficulty in capturing the birds and because of the disturbance it caused the colony. Behle (1958) further described all plumages of the California Gull and the color of the soft parts. He also discussed general behavior of the young and their relationships with adults, time of departure of young, and their migration to wintering grounds. Vermeer (1970) studied the growth of young California Gulls as part of a more extensive study. He gives weights from 0 to 40 days of age for 28 broods. His results differ somewhat from those of this study for reasons suggested later in this paper.

As a part of a long-term study of the biology of California Gulls in Wyoming, the young and their development received attention. It was hoped to accomplish three things: (1) establish a growth and developmental standard for the young gulls at the Bamforth Lake breeding colony; (2) develop criteria for aging young California Gulls from a distance as well as in the hand; and (3) develop a method of raising gull chicks in the laboratory and determine to what extent their development deviated from young gulls developing in a natural environment.

MATERIALS AND METHODS

Birds used in this study were obtained from a breeding colony located at Bamforth Lake, 10 miles NW of Laramie, Albany County, Wyoming. In the period from 1967 through 1969, the minimum breeding population ranged from 1364 to 1993 pairs.

Early in the breeding season of 1967, a 12-inch fence was constructed enclosing a square 0.01-acre plot at one end of the colony. Nests within the plot were periodically checked, and eight chicks of known age were marked with size 3 National aluminum poultry wing bands within a day of hatching. This enclosure was used again in 1968 when 12 chicks were tagged for study. In 1969, this fence was replaced with one 18 inches in height, enabling the seven chicks tagged that year to be held for a longer period than was previously possible. Enclosure birds were periodically studied for growth, plumage development, and general behavior, which provided data that represent a sample of developing birds in as natural a situation as could be provided with the least amount of disturbance.

Chicks to be raised in the laboratory were taken from nests outside of the enclosure. Those birds were tagged with wing bands within a day of hatching, and 24 were moved into the laboratory at ages varying from 0 to 7 days. They were housed in wire cages and provided with water ad lib. They were fed water-moistened, dry packaged dog food, supplemented with powdered vitamins and minerals and

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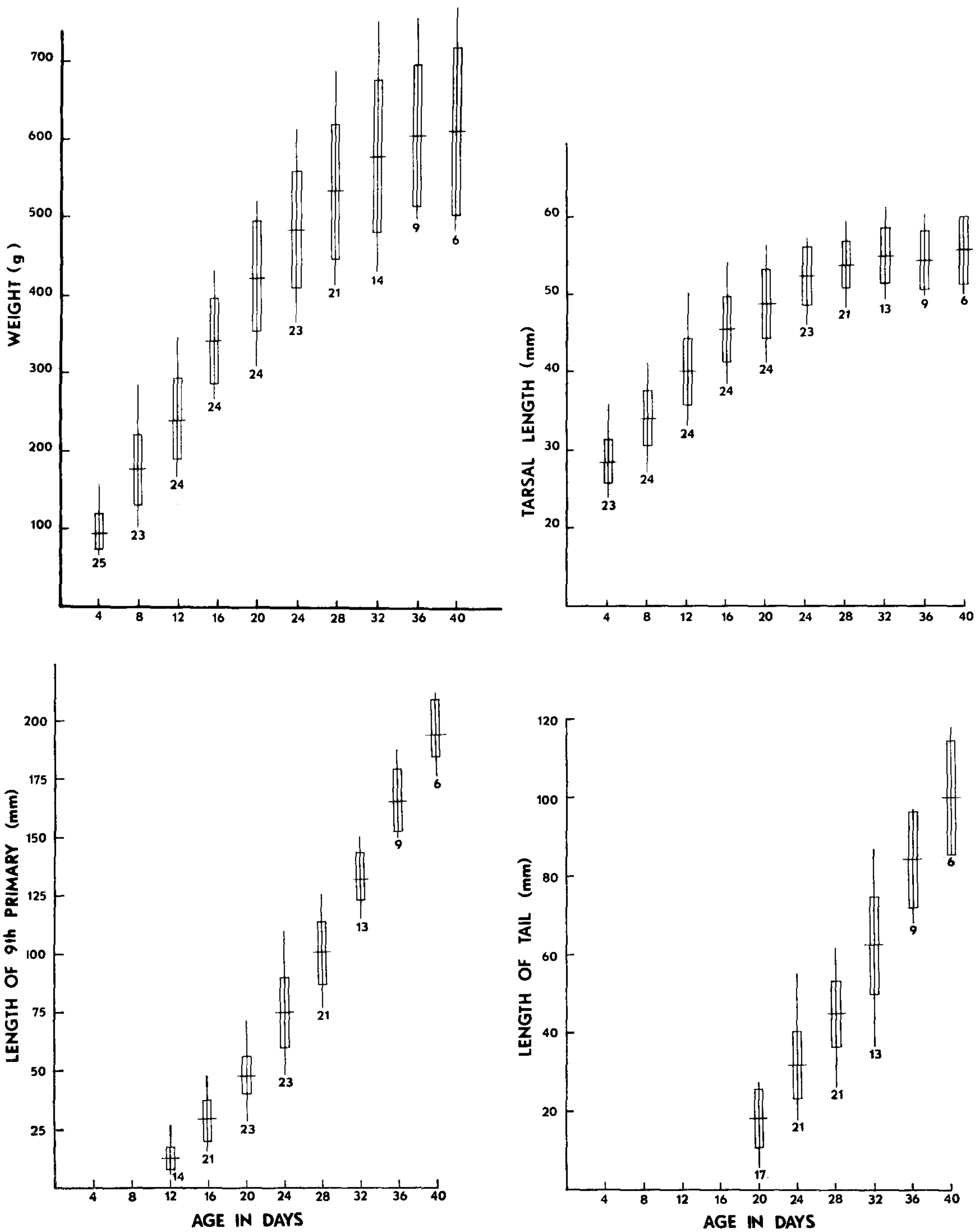

FIGURE 1. Growth of young California Gulls at Bamforth colony 1967, 1968, and 1969 (vertical line indicates range; horizontal line represents the mean; rectangles enclose $\bar{x} \pm 1$ SD, and number below is sample size).

raw meat of various types. These birds were examined and measured at the same time daily until they were about 45 days of age, at which time they were moved to a large outdoor cage for acclimation prior to release. Here they were examined at approximately 3-day intervals. They were releasd on a small lake at ages ranging from 53 to 61 days and observed periodically for 30 days.

RESULTS AND DISCUSSION

GROWTH ASPECTS

A summary of measurements of Bamforth Lake young is presented in figure 1. When weight and tarsal measurements of juveniles are compared with those of Bamforth adults

TABLE 1. Breeding season weights and tarsal lengths of adult and subadult California Gulls on the Laramie Plains, 1969 and 1970.

Age	N	Weight (g)		Tarsus (mm)	
		Range	$\bar{x} \pm$ S.E.	Range	$\bar{x} \pm$ S.E.
Subadults (ages 1–3 yrs.)	15	453–747	608.0 ± 23.19	52–62	55.9 ± 0.80
Adults (ages 4+)	101	486–775	608.8 ± 6.26	50–63	55.7 ± 0.27

and subadults (table 1), it is evident that most juveniles attained maximum physical stature during the 5th week. At this time, however, plumage had not completed its growth.

Vermeer (1970) studied California Gulls at Miquelon Lake, Alberta, and reported weight gains of young somewhat similar to those of this study. In his study, tagged chicks were weighed to the nearest gram on alternate days from hatching to fledging. Those measurements were taken on birds in a plot 300 × 100-ft, fenced with a screen 2-ft high. Because of variations in daily sample size (2–24), it seems evident that his birds weighed each time were not always the same but perhaps were smaller, less aggressive ones that could be caught. From behavior studies on our California Gull juveniles, birds 3 weeks or older often run up to several hundred feet when approached. The older more vigorous birds would be less vulnerable to capture for weighing. This may be the explanation for low average weights of Miquelon Lake juveniles compared to Bamforth juveniles and fluctuations in the growth curve of Miquelon Lake birds (fig. 2).

This explanation appears to be reinforced with two groups of juvenile California Gulls

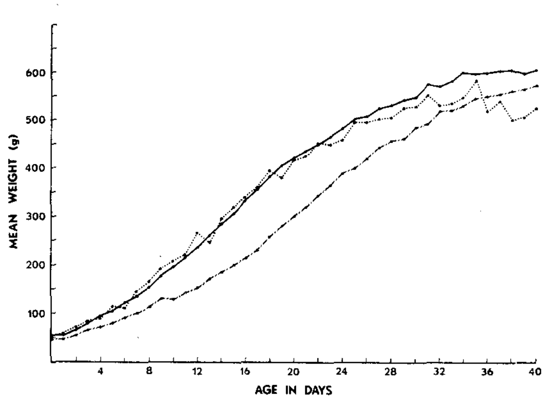

FIGURE 2. Comparative growth of the California Gull at Bamforth Lake, in the laboratory and at Miquelon Lake, Alberta (solid line = Bamforth 1967, 1968, 1969; dotted line = Miquelon Lake, Vermeer, 1967; dot-dash line = caged, 1968).

that Vermeer (1970) raised in greater confinement on an island in Joseph Lake, Alberta. These birds were kept until their 6th week of life in 50 × 30-ft enclosures while testing the relationship of growth and survival to the time of hatching. The number of birds, mean weight, and weight ranges are as follows for the two groups: early hatch $N = 41$, $\bar{x} = 601$/g (270–820); late hatch $N = 36$, $\bar{x} = 633$ g (450–890). Unfortunately, daily weights were not given to permit construction of a growth curve. Vermeer (1970) also gave the average weights at fledging for 18 juveniles as 573 g (435–675) and the average weights of 39 adults collected during the breeding season as 771 g (610–964). Fledging for Bamforth and Miquelon Lake juveniles occurred when the birds reached approximately 40 days of age. Although adults in the Alberta study were considerably larger than Bamforth adults, this difference in size was not clearly indicated in the growth of the chicks (fig. 2). Other variables such as seasonal variation, sample size, clutch size, sex ratio, and methods of study may obscure growth differences between these two populations.

A problem in comparing the weights of adults and subadults from different studies is that capture methods often vary, and this could affect weight. Live-trapped birds will regurgitate food from the upper digestive tract. All adults and subadults in our studies were cannon-trapped and held in crates for 10 min to several hours before being measured, tagged, and released. Also, we were more successful attracting birds to the trap that were leaving the colony rather than returning to the colony. Those coming from the colony were likely going out to forage for food; those returning were already laden with food and ignored the bait. By this method then, lighter birds are more readily caught (table 2). The maximum cargo weight of a California Gull is not known, but gulls here frequently regurgitate intact adult pocket gophers which will weigh about 130 g. In contrast, birds collected with a gun will show a

TABLE 2. Weight (g) of known-age California Gull adults and subadults trapped on the Laramie Plains, 1969 and 1970.

Age	N	$\bar{x}$	Range	S.E.	S.D.
Years					
1–3	8	643.0	527–713	67.0	23.7
4–6	28	614.8	470–734	66.8	12.6
7–10	6	544.7	479–584	39.3	16.1

greater weight variation depending on the contents of the digestive tract. Thus, the collection method used should be chosen to meet the needs of the particular study. If the method is stated in the published report, this variable could be taken into consideration by others using those data.

Ricklefs (1967) describes a graphical method of fitting equations to the growth curves (weight) of birds. In this technique, the growth curve of the species is assigned to one of three growth equations: the logistic, the Gompertz, or the von Bertalanffy (see Ricklefs 1967 and 1968 for details and references for each curve). The technique used to fit these equations to growth data is based on the conversion of growth curves to straight lines by factors derived from each equation. The equation and the asymptote are selected to give the straightest converted line, and the overall growth rate (K) is calculated from the slope of this line. Intraspecific comparisons can easily be made and interspecific comparisons made between birds whose growth curves are fitted to the same equation. An inverse index of growth is expressed by t_{10-90} which is the number of days required to attain from 10–90% of the asymptote.

California Gulls from the Bamforth colony fit the logistic equation (fig. 3). Using an asymptote of 600 g, the growth constant (K) was 0.16, t_{10-90} was 27.5 days and the ratio of adult weight to the asymptote was 0.99. An attempt to apply Ricklefs' (1967) graphical method to Vermeer's (1970) data for California Gulls was only partially successful due to variability in the data, particularly in the older juveniles (fig. 2). Growth of Miquelon Lake juveniles seemed to best fit the logistic equation with a K value of 0.157, not too unlike the Bamforth value. Since the variable nature of the data made it difficult to estimate the asymptote, t_{10-90} and the ratio of adult weight to asymptote were not determined.

Ricklefs (1968) presents growth data for many species with mixed results. He felt that there is a preponderance of Gompertz and von Bertalanffy growth curves among the larger and more slowly growing species. Ricklefs

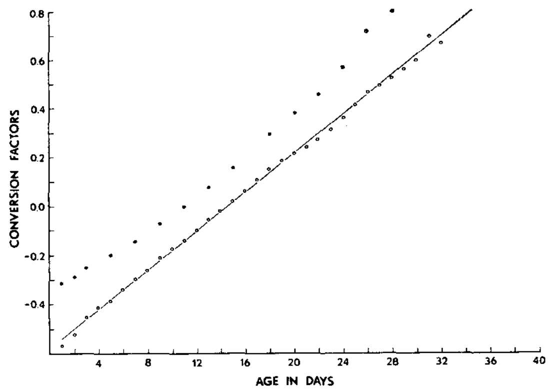

FIGURE 3. Fitted growth curve of young Bamforth California Gulls after Ricklefs, 1967 (solid circles, Gompertz curve; open circles, logistic curve).

further stated that precocial species whose young feed themselves have reduced growth rates. By contrast, in his discussion of diversity of growth patterns, Ricklefs notes that the form of the growth curve does not seem to be related to whether a bird is altricial or precocial.

The only representative of the Laridae in Ricklefs' (1968) compilations is the Glaucous-winged Gull (*Larus glaucescens*). Based on Vermeer's (1963) data, Ricklefs reports that, although this gull grows rapidly, it exhibits the Gompertz growth form. Recently, Ward (pers. comm.) worked up his growth data on the Glaucous-winged Gull of the Mandarte and Cleland colonies in British Columbia. His data suggest neither the Gompertz nor the logistic growth curves fit very well; however, the logistic curve seemed to provide the better straight line fit. Ward's (pers. comm.) t_{10-90} value was 27 to 28 days, very comparable to that value which we calculated for the California Gull. Limited access to detailed growth data and to accurate portrayal of other workers' data makes it difficult to apply large-scale generalization of Ricklefs' (1968) conclusions. A major difficulty concerns the determination of the upper asymptotic weight to be used in Ricklefs' calculations. Also, the data of the older birds tend to have the poorest fit. Here we feel that in a larger bird there are more possibilities for error, particularly where one might weigh a bird that has just been fed or one completely empty. The difference in capacity of an older, large bird as compared to a younger, small bird could conceivably account for the larger disparity in weights of birds about to fly. Added to this is the sexual dimorphism trait which is possibly present even at the preflight ages. Gulls have rapid growth rates and are fed by their parents and should not be considered as truly precocial species. Portmann (1955) and Nice (1962) place gulls as intermediate between typical precocial and altricial forms. Growth data for Bamforth juveniles were somewhat biased in 1967 and 1968 when some of the larger birds escaped. In those years, the study was terminated earlier than was desired because of the escapes. The seven birds studied in 1969 were retained through 40 days of study by the 18-inch fence and this partially offsets the previous years' data. What other effects the enclosure has on growth and development are not known. Birds in their 6th week seemed to be under some stress because they obviously tried to escape. It is also possible that parents are more reluctant to feed fenced young, but we have no evidence that this happened.

Behle and Goates (1957) studied the growth of 128 young California Gulls at Farmington Bay, Great Salt Lake, Utah. The most rapid increase in weight occurred after the gulls weighed 300–350 g, and the average gain was 22.5 g per day. That study was terminated when the young were about 21 days old. During the same period of time, Bamforth young gained an average of 18.4 g per day and Miquelon Lake young, 18.0 g. The Farmington Bay colony was close to a slaughter house (Behle, pers. comm.) which provided an easily available food source for the gulls. Perhaps this was a factor in their rapid growth. However, the significance and extent of these differences cannot now be evaluated because of extermination of the Farmington Bay colony.

Ricklefs (1968) study of growth parameters within an avian species found them to vary as much as 20% with respect to geographic locality and the time of nesting. Other variations are related to nutrition and perhaps inherited variation. He states that little is known about seasonal and geographic changes in the ecology of a species.

COLOR CHANGES OF SOFT PARTS, BILL, AND LEGS

Young caged and colony birds were examined for any change in coloration of soft parts that could be used to age them. The dark-brown iris, black eyelids, and flesh-colored gape did not appear to change during the course of the study.

A white egg tooth was present on the bill at hatching. This structure was lost by 6 days of age, on the average, in both free and caged birds. Extremes in egg-tooth loss ranged from 2 to 13 days. Observations made in this study indicate that this structure flakes off intact rather than being resorbed as suggested in the literature (Behle 1958). Variability in age of egg-tooth loss makes it unsuitable as a character for age determination.

The bills of newly hatched chicks were bicolored, with the proximal three-quarters black and the distal one-quarter a pink-cream color. As the chicks grew, the light tip became less conspicuous until by fledging age it could only be discerned by close inspection. No further observations were made at the colony after fledging, but a drastic bill-color change began in the birds maintained in cages when they were 50 to 66 days of age. The color change consisted of a conversion of the proximal two-thirds of the bill from black to pink, leaving the distal one-third black. A slight lightening of the proximal portion of the mandible occurred prior to this time, but it was not conspicuous. Wild birds in the vicinity appeared to be in a similar stage of color change; however, the exact age of these wild juveniles was not known. Johnston (1956) illustrated subsequent bill-color changes and, after reviewing experimental results on closely related species, concluded that this character in the California Gull was under androgenic control.

Legs and feet were black at hatching, but gradually became lighter in color as they grew. This lightening effect was obvious by 28 to 33 days of age, at which time the legs and feet were a gray-pink with black confined to the larger scales. By 60 days, many captive birds no longer showed any black on legs and feet. Birds that still retained black coloration showed traces of this color on the anterior tarsal scales. Toe nails of birds were black with white tips throughout the study. In general, color changes in soft parts, bill, and legs were too gradual and variable to be used as aging criteria.

FEATHER GROWTH

Caged birds were examined daily to determine the earliest age at which pinfeathers emerged and then began to unsheath. Since the wild birds were not examined daily, only general comparisons between the two groups can be made. The sequence of emergence and unsheathing of pinfeathers was, for the most part, the same. The lag in development of caged versus colony birds was also reflected in the emergence of feathers.

The sequence of emergence showed an interesting pattern (table 3). The first areas of emergence were the humeral tract and sternal area of the ventral tract. These feathers proceeded to unsheath and grew very rapidly,

TABLE 3. Aging of young California Gulls.

Age	Birds seen at a distance	Birds in hand	Behavior
0–6 days	Chicks are covered with natal down; they have a "ball of fluff" appearance with short neck and appendages. No evidence of juvenal plumage can be seen.	Most birds have no pinfeathers emerging. Tarsus 20–39 mm. Egg tooth—may be present.	0–3 days chicks remain in or at edge of nest; at 4 days they begin to move short distances from nest; 0–5 days they crouch in nest when alarm is given.
7–13 days	Covered with natal down but losing ball appearance as legs and neck appear obviously longer. Pin feathers on wing and humeral tract appear at 11 to 13 days of age. Late in week unsheathing scapulars may be visible.	Pin feathers emerging are primaries, upper greater primary coverts, upper median secondary coverts, cervical area of spinal tract, humeral tract, sternal tract. Tarsus 28–51 mm. 9th primary 0–33 mm. Tail 0–9 mm. Egg tooth—may be present.	Chicks move short distances from nest but spend most of their time close to nest; if alarmed and cover is near, they hide under bushes; chicks 9–20 days will run and hide in bushes 10–20 feet from their nests if alarm is sounded and no cover is near.
14–20 days	Scapulars become very prominent as they rapidly unsheath and grow during first half of week. By midweek light bars appear on wings and shoulders. Birds have fuzzy, half-feathered appearance as down clings to tips of juvenal feathers. Lower half of back, rump, and legs are downy. Late in week juvenal feathers may appear on coronal and frontal areas of head. Auriculars are visible as dark gray tufts posterior to eye. Tail not visible in most.	By 14th day all interscapulars are unsheathing. By end of week, tail feathers are starting to emerge. Tarsus 35–36 mm. 9th primary 8–71 mm. Tail 7–28 mm.	
21–27 days	Head is feathered but neck is still downy and bird appears to have a downy ruff around its neck. By midweek, this may be reduced to a spot of down on the back of the neck. Tail is visible. By end of week, back appears entirely feathered in most birds.	Lower half of the back is still downy but feathers are coming in. By end of week, advanced birds will have back feathered. All feather tracts have emerged by end of week. Last to emerge is the interramal. Tarsus 42–58 mm. 9th primary 31–121 mm. Tail 10–55 mm.	Juveniles 20–35 days of age normally do not leave nest territory unless something unusual has happened; if alarmed, they will run long distances; they have good homing ability but take a beating when crossing other territories to return.
28–34 days	Last downy area is a spot on back of neck. Down still clings to tips of tail feathers, breast, and belly. By end of week, birds appear as large as adults. Bird looks to be completely covered with juvenal plumage by end of week.	Legs are partly downy. Back is completely feathered by end of week. 9th primary 76–167 mm. Tail 26–92 mm.	
35–41 days	Small amount of down clings to belly the first half of week. No down left on ends of tail feathers by end of week.	9th primary 141–217 mm. Tail 64–121 mm.	Nest territories are abandoned and juveniles move toward water; some birds can fly short distances by end of week.
42–48 days	No down clings to juvenal plumage.		Young loaf on beach or swim to other parts of lake; parents feed young but are no longer with them at all times. Most birds can fly by end of week.

covering the upper back and anterior ventrolateral areas. These were followed closely by secondaries, upper greater secondary coverts, and interscapulars. A day later primaries, upper greater primary coverts, upper median secondary coverts, the cervical area of the spinal tract, and the femoral tract emerged. Again these feathers protected the back and sides. The earliest juvenal feathers to appear on the head were auriculars which soon covered the external auditory meatus giving the bird the appearance of wearing gray earmuffs; afterward the top of the head became feathered. Late-emerging feathers were generally on the tail, ventral surfaces of the body, undersides of the wings, and underside of the head and neck.

Reports of the emergence of juvenal plumage of precocial or semi-precocial birds in general are scarce. Of the few available, it is evident that the sequence of emergence varies considerably from one group to another. For example, in juvenile Gadwalls ventral feathers develop faster (Oring 1968) than in gulls, but flight feathers are similar in development. Some juvenile quail fly at 1 week of age, indicating tremendous acceleration of growth of flight feathers (Welty 1962). Plumage has been shown to be extremely sensitive to selection, so much so that we take it for granted that every special feature of a bird's plumage is functional and adaptive (Amadon 1966). One would expect juvenal plumage development to be no exception.

The timing and sequence of development of juvenal plumage in the California Gull seems to be mainly adapted to protect the bird against adverse weather conditions. Young rapidly become too large to be brooded. This may occur by 10 or 11 days of age. In addition to not receiving shelter from adults, there is often little or no vegetation in the territory which would provide shelter. The formation of an insulating, waterproof coat of feathers covering the dorsal and lateral surfaces of the body as quickly as possible after brooding ceases would seem highly advantageous.

Severe rain and hail storms with near freezing temperatures occur with moderate frequency at the Bamforth colony during June when almost all gull chicks are attaining the juvenal plumage. Growth of this protective covering takes place on the average from 11 days of age until about 26 days when the back and sides of the birds are covered. This period of vulnerability comprises approximately 28% of the time the young gull spends at the colony after hatching. Although our unpublished mortality data from Bamforth indicate that more than 28% of the dead birds are in this stage of plumage development, it was difficult to ascertain the cause of death from the examination of carcasses. Early in June 1969, there was an exceptionally severe hail storm followed by several days of cold rainy weather. Mortality of the young gulls more than doubled, almost 50% of this mortality was from the 11–26 days age-group. It was obvious that this storm was a major decimating factor in 1969.

CRITERIA FOR AGING YOUNG GULLS

Young California Gulls can be placed in weekly age-groups from hatching to 7 weeks of age when observing their size and plumage development from a distance (table 3). It was felt that more precise aging was not feasible because of the magnitude of variation in physical development. Sources of this variation are difficult to evaluate, but are certainly caused by factors that could influence growth rate such as clutch size, nutrition, inherited variation, sexual dimorphism, and large ranges in the ages of nest mates due to egg stealing and chick adoption. It is suspected that size differences between male and female juveniles are a major source of variability in physical development of the young gulls. In a sample of 13 male and 14 female adults collected in 1970 at Bamforth Lake, mean weight of males was 671 g (574–719) while females weighed 551 g (462–644). Further information on sexual dimorphism in the California Gull will be presented in another publication (Diem and Smith, unpubl.). With the bird in hand, more detailed plumage characteristics may be examined and measurements obtained to more precisely allocate the bird within the correct week. Minor seasonal variations in growth rates did occur in the three groups studied, but it was felt that the combined measurements were representative of the usual development.

Tarsal length is most important in aging younger chicks while plumage characteristics are more important in older age-classes. Tarsi approach their mature length in the 3rd week; whereas, juvenal plumage becomes important late in the 2nd week and continues its growth through the fledging period. Size differences in older birds may be great even though plumage development is similar. Tarsal lengths are important especially when it is desirable to age the bodies of small chicks that have been dead a number of weeks.

With dead chicks, the tarsal length was

found to decrease in length and a correction factor was determined to make the dimensions comparable to measurements on living gulls. This shrinkage correction factor was obtained by measuring tarsi of known-age chicks that died. These bodies were tagged and placed in the colony where they were exposed to weather conditions and trampling to which any dead gull is subjected. They were recovered during the routine collection of dead birds after the colony was abandoned, and tarsi were remeasured to determine the amount of shrinkage. From a sample of 30 individuals, 52 tarsi were checked with an original size range of 20–53 mm. By this means it was found that the tarsi of dead young gulls were reduced an average of 13% from their original length.

COMPARISON OF GROWTH IN LABORATORY AND WILD GULLS

Gull chicks can be raised in the laboratory very easily. Generally, 3–4-day old chicks adjusted best to the laboratory environment. Younger birds had to be taught to eat from a dish and often had to be coaxed to eat; older birds tended to be shy and did not adapt as readily to cage life. Also, older birds were more defensively aggressive and apt to bite when handled. The birds were placed in cages by size rather than age to reduce stress caused by larger dominant birds harassing smaller ones. Sometimes birds were shifted several times to determine the most peaceful combinations. Juveniles about 35 days and older will exercise their wings if allowed enough vertical space, and hence, if possible, it is desirable to house them in large pens at this time.

Food and water were available to the birds at almost all times, with provisioning conducted three times daily. They definitely preferred fresh meat to dry, packaged dog food; however, it was not possible to feed the fresh meat more than once a day. At each provisioning time, they were also coaxed to eat as much as possible. Often this encouragement would cause them to eat uneaten food left in food dishes from the previous provisioning.

Gull chicks maintained in the laboratory were slower in growth and development than birds of comparable age within the colony enclosure (figs. 1, 2 and 4). Caged birds averaged 12–15% lighter in weight and had 5% shorter tarsi than wild chicks. The reasons for the slower growth rate are unknown. Nutritional factors in terms of the types of foods the birds were offered may have been the cause. Perhaps a more frequent feeding stimulus, such as occurs naturally when the young gull is constantly attended by an adult, is necessary for the rapid energy intake required for the rapid growth achieved by the colony birds.

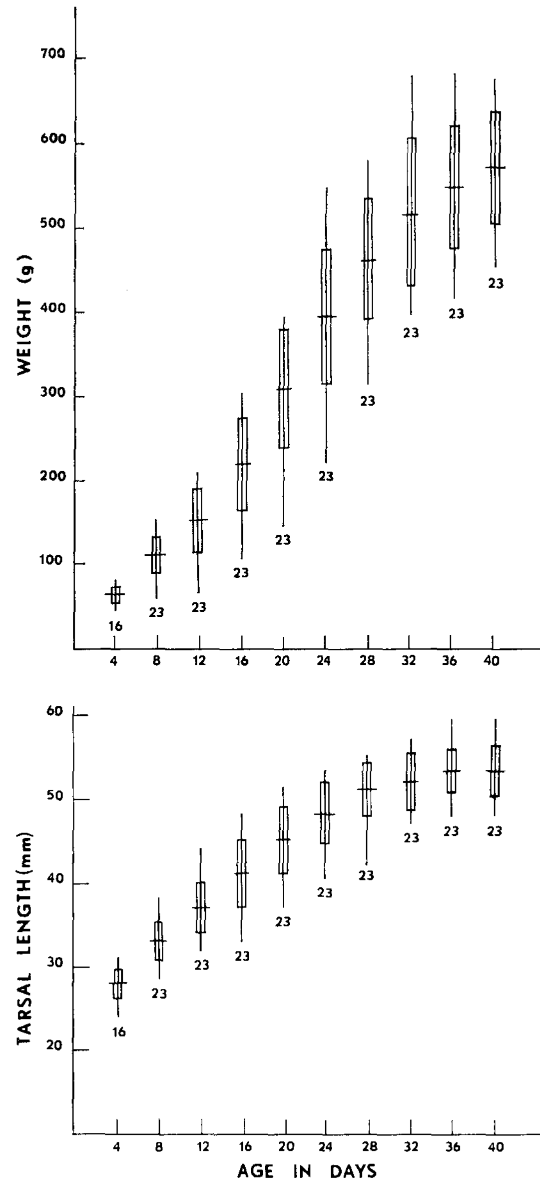

FIGURE 4. Growth of young California Gulls caged in a laboratory, Laramie, Wyoming, 1969 (vertical line indicates range; horizontal line represents the mean; rectangles enclose $\bar{x} \pm 1$ SD, and number below is sample size).

When released on Leazenby Lake at 47 days of age, the laboratory birds had achieved the wild fledgling size. None of the 23 birds could fly when released, but within several days all learned. Two were killed by predators in the area; all others were presumed to have left the lake safely. All of these birds wore US Fish and Wildlife Service leg bands and an orange patagial wing tag with black identifying symbols (Diem and Smith, unpubl.). Four of the birds have been sighted once each on their coastal wintering grounds.

SUMMARY

Data from young California Gulls confined in the Bamforth Lake breeding colony on the Laramie Plains and in the laboratory were used to determine species growth and development characteristics. Maximal physical stature of these juveniles was attained during their 5th week of life. Juvenile California Gulls fledged when they averaged 600 g in weight. This is compared to means of 608 g for subadults and 609 g adults. While weight gains of 18 g per day and growth curves were similar between Bamforth Lake birds and Miquelon Lake, Alberta birds, the Alberta adults averaged 171 g heavier than Bamforth birds.

Applying Ricklefs' (1967) conversion factors, a linear growth curve was fitted to a set of logistic conversion factors. By this method, the growth constant was 0.16 and 80% of the growth was calculated to be achieved in 27.5 days.

Characteristics for aging young California Gulls from hatching to 7 weeks of age are given. Tarsal length was the most important single measurement to age young chicks.

While young gulls raised in the laboratory were slower in growth and development than confined birds in the Bamforth Colony, they had attained normal fledging size when they were released. Patterns and sequence of feather emergence and development are given for the caged chicks, as well as general color changes in the bill, eyes, and eye soft parts.

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