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## PLUMAGES OF THE LEAST TERN

BY BARBARA W. MASSEY AND JONATHAN L. ATWOOD

### INTRODUCTION

Over the past five years, U.S. breeding colonies of the endangered California Least Tern (*Sterna albifrons browni*<sup>1</sup>) have been closely monitored throughout the nesting season (Atwood et al., 1977). One result of this close scrutiny has been the observation each year of a small number of birds in prebreeding or subadult plumages (in this discussion, the term subadult is used to represent any alternate plumage that differs from "nuptial," i.e. definitive alternate, plumage). Such birds have often appeared later in the season, after nesting has begun. Although they have sometimes engaged in courtship behavior, these individuals have not been observed actually breeding.

Terns in subadult plumage have been seen for many years in breeding colonies of the larger *Sterna* species. Two rather distinct plumage types, observed in Arctic Tern (*S. paradisaea*) colonies over 100 years ago, were originally described as separate species—*S. pikei* (Lawrence, 1853) and *S. portlandica* (Ridgway, 1874). Both "species" were subsequently determined to be subadult plumages of the Arctic Tern. The names have been retained to refer to stages in the plumage development of terns, *portlandica* referring to the plumage of 1-year-old birds, and *pikei* generally used for subadult plumages beyond the first year (Cullen, 1957; Grant, et al., 1971).

Common Terns (*S. hirundo*) in subadult plumage have been seen regularly in eastern U.S. breeding colonies (Palmer, 1941). The plumage sequence of this species was first described by Dwight (1901); his assumption that full "nuptial," i.e. definitive alternate, plumage was attained by 1-year-old birds has been corrected by subsequent data. Palmer determined that the Common Tern has a *portlandica* phase, and that, even though some 1-year-old birds in this plumage migrated to the nesting grounds, they did not breed. Birds in *pikei* plumage were also regularly present, and were observed to breed occasionally. He noted one "white-faced" Common Tern for every 150 breeding pairs in a colony in Maine (Palmer, 1941). Nisbet (pers. comm.) reports less than one *portlandica*-plumaged Common Tern for every 1,000 breeding birds in Massachusetts during recent years.

The literature lacks mention of Least Terns in subadult plumage at breeding colonies, although Haverschmidt (1972) briefly described the *portlandica* plumage from Least Terns collected on the coast of Surinam (where flocks of immature terns summer, but are not known to breed).

<sup>1</sup> For convenience, the more familiar name, *Sterna albifrons*, for the Least Tern (AOU Check-list, 1957) is retained here, although it has been suggested elsewhere that the Little Terns (*S. albifrons*) of the Old World and the Least Terns (*S. antillarum*) of North America should be given full species rank (Massey, 1976).

Over the past few years with increased surveillance, both *portlandica*- and *pikai*-plumaged Least Terns have been noted at breeding colonies on both U.S. coasts. In 1977, we were able to confirm that Least Terns in *portlandica* plumage were indeed 1-year-old birds; we assume that at least some *pikai*-plumaged individuals are two years of age, although other age classes may also take on *pikai* characteristics. Examination of museum specimens, coupled with field observations, has enabled us to analyze and present here the sequence of plumages from juvenal to definitive for North American populations of the Least Tern.

#### METHODS

As part of a long-range, ongoing study of the California Least Tern, an intensive effort was begun in 1976 to band hatchlings; over 500 chicks were banded in 1976 and 1977 (Rypka, 1978). Color banding has been done on a selective basis at several colonies, but since the color bands have not usually survived for more than one year, this technique has proved useful only for determining the postbreeding movements of fledglings. Breeding grounds, roosting sites, and postbreeding flocking areas have been watched closely for the return of banded birds. Banding operations were conducted under authorization of state and federal banding permits and Endangered Species Banding Permit PRT-8-207-B-C issued to Charles T. Collins.

When banded adults were found breeding, they were trapped on the nest. Because Least Terns do not tolerate handling well when they are breeding, trapping must be done just before hatching when the eggs are "starred" or "pipped." At that time the bond between parent and egg is strong enough to prevent the adult from deserting the nest (Massey, unpubl. data). Minimum handling is also a necessary precaution; adults were trapped, the band read, and the birds released immediately with no time taken to record additional data. None of the adults captured on nests in this manner deserted.

We know of no easy way of trapping non-nesting Least Terns, and even some incubating individuals have proved impossible to capture. Furthermore, the restraints placed upon studying an endangered species preclude techniques that would cause more than minimal trauma to the colony. Our method for determining band numbers on such birds has been to read the digits through a 20–60× spotting scope. To accomplish this, conditions for viewing must be optimum, and the observer must be within 20 ft of the bird. We obtained band numbers from four subadult and five "nuptial" plumaged Least Terns by this method. In addition we observed two birds that had retained their color bands, and could determine their ages by color code.

Data on all North American Least Tern recoveries through 1974, obtained from the Bird Banding Laboratory, were examined for information on the age of first breeding and longevity.

Museum specimens of Least Terns in all available plumages were examined. Three juveniles (CSULB #5223, 5224 and LACM #5177),

one bird in 1st basic (1st winter) plumage (MVZ #109499), three *portlandicas* (MVZ #145333 and AMNH #79355, 812089) and six "nuptial" plumaged adults (CSULB #955, 1058, 1059, 1060, 1063, 4331) served to corroborate our field observations and provided detailed descriptions of the plumage characteristics.

#### RESULTS

A few Least Terns in prebreeding or subadult plumage have been seen in southern California in every breeding season since 1974, but in 1977 the number observed was far greater than in previous years. A total of 30 *portlandica*- and *pikei*-plumaged individuals were seen in the southern California breeding range where approximately 722 pairs were nesting. At least five of the *portlandicas* were banded; the band numbers of four of these individuals were read in the field, and all proved to be 1-year-olds banded as chicks at local breeding colonies in 1976. The fifth bird was color banded, and although the band number could not be read, the color band identified it as a 1st year bird from a local colony.

Unfortunately, none of the *pikei*-plumaged birds were banded, and their ages have not yet been verified. Their appearance and behavior strongly suggested that they were prebreeders. Figure 3 shows a Least Tern in *pikei* plumage.

We saw no evidence that any bird in *portlandica* or *pikei* plumage was actively engaged in breeding. In almost all instances, *portlandicas* stood alone at the edge of a nesting colony, or with a group of adults at a loafing or bathing area. Twice, both late in the breeding season, *portlandicas* were seen participating in fish-flight displays (Massey, 1974) with adults. In both instances the adult was carrying the fish, and the 1-year-old bird was presumably a female. Another *portlandica* landed too close to an active nest, and was chased away by the pair of resident adults.

Birds in *pikei* plumage also were usually segregated from the actively nesting birds. Once a *pikei* was courted on the ground by a male offering a fish, but was unresponsive to this courtship behavior.

Birds in *portlandica* and *pikei* plumage were generally nonvocal. Least Terns of both sexes are extremely vocal when breeding (Massey, 1976) and the virtual absence of vocalizations by birds in these plumages is consistent with their nonbreeding status.

We have obtained nine recoveries of known breeding adults, ranging in age from two to six years (Table 1). Clearly some Least Terns develop

TABLE 1.  
Age distribution of known breeding Least Terns.

Age (years)	2	3	4	5	6
No. of individuals	4	1	1	1	2

full "nuptial" plumage and breed at two years of age, but the data are as yet insufficient to describe the age ratio of the total breeding population.

#### PLUMAGE SEQUENCE AND CHARACTERISTICS

Due to a lack of specimen material of North American Least Tern populations away from the breeding colonies, we can only speculate as to the timing and duration of molt. Table 2 summarizes the suggested

TABLE 2.

Probable molt sequence in the Least Tern. Slanted lines represent approximate periods of molt.

Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb
			//	Juvenal		//	First basic				//
			First alternate ( <i>portlandica</i> )			//	Definitive basic				//
			Definitive alternate ("nuptial")				Definitive basic				//
			or			//					
			Intermediate ( <i>pikai</i> )								
			Definitive alternate ("nuptial")			//	Definitive basic				//

sequence of plumages. Fall molt appears to be partial, limited to the head, wing coverts and body regions. During the late winter or early spring there appears to be a complete molt which is finished by early April.

The following descriptions are oriented toward distinguishing those plumages (for the purpose of this discussion we also include bill and leg characters) likely to be encountered in the vicinity of U.S. Least Tern breeding colonies. Observations of the species south of the U.S. breeding range during the nonbreeding season will likely involve plumages intermediate between those described below.

#### *Juvenal*

*Field Identification:* Recently fledged birds are characterized by the presence of considerable brown and buff coloration in the plumage of the back, wings and head; pale buff or whitish feather edgings give the back and wings a markedly scaly appearance. Individuals with this plumage begin to appear in the vicinity of the U.S. breeding colonies near the end of June (Table 2), and are readily identifiable.

*Description* (Figs. 1, 2, 3): Crown buff with varying amounts of dull black speckling which diminishes with age; lores buff or buffy-white; broad, poorly defined, dull black eyestripe beginning in front of eye and extending variably toward nape; back, scapulars, and tertials dull grayish-buff edged with pale buff and with darker subterminal brownish-gray crescents; rump pale gray finely edged with buff; tail shorter and less deeply forked than that of "nuptial" (definitive alternate) plumaged adult; rectrices bluntly pointed, mostly pale gray narrowly edged with white and darkening toward tips to form dull grayish-brown spots; inner primaries and alula dark grayish narrowly edged with buffy-white;

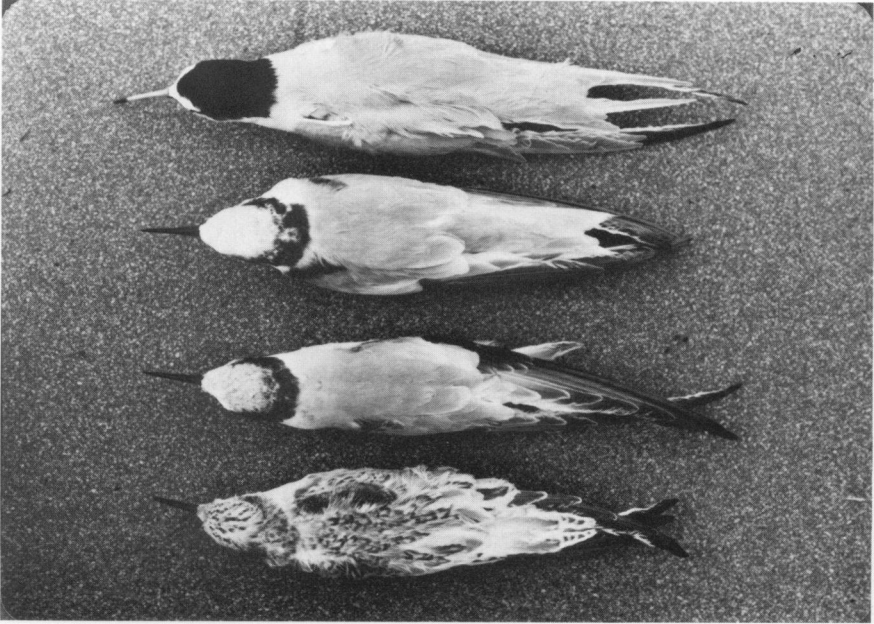


FIGURE 1. Comparison of the plumage characteristics of the Least Tern; dorsal view. Specimens, from top to bottom: Definitive alternate ("nuptial") (CSULB #955); 1ST Alternate (*portlandica*) (MVZ #145333); 1ST Basic (MVZ #109499); Juvenal (LACM #5177).

outer three primaries slightly darker grayish, broadly margined with white on inner web except near tips; marginal coverts of leading edge of wing dark grayish, forming a cubital bar on wing extending along the outer edge to the primary coverts; greater, median, and lesser wing coverts gray edged with buff or dull white; chin, throat, sides of head below the blackish occipital line, and upper breast suffused with varying amounts of buff; lower breast, belly, undertail coverts, sides, and wing linings white; bill relatively short, blackish-orange; legs and feet dull orange, darkening with age to blackish-orange.

#### *First Basic*

*Field Identification:* This plumage, which is acquired during the fall, is rarely (if ever) encountered within the U.S. breeding range of the species. However, some older fledglings begin to show the early stages of this plumage in late July and August (Table 2). In general, the buffy and brownish tones of the back and wings are gradually replaced by gray, the buffy regions of the head become increasingly white, and the scaly appearance of the wings and back becomes less pronounced. If the tail can be seen well from above (or, possibly, from below with strong backlighting), dusky spots near the tips of the rectrices are diagnostic of this plumage as compared to the 1st alternate (*portlandica*) plumage of the second and subsequent basic plumages. Since the full transition from juvenal to 1st basic plumage is seldom, if ever, com-

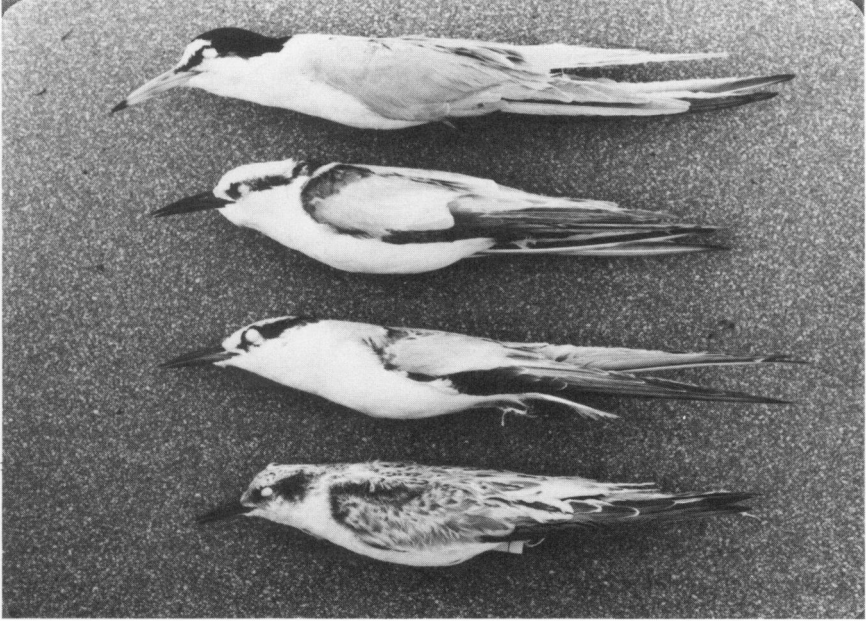


FIGURE 2. Comparison of the plumage characteristics of the Least Tern; side view. Specimens arranged as in Fig. 1.

pleted in the vicinity of the U.S. breeding colonies, observers near these areas will have little difficulty in distinguishing recently hatched birds from 1st alternate (*portlandica*) plumaged individuals.

*Description* (Figs. 1, 2): Acquired by a partial postjuvinal molt limited to the wing coverts (possible excluding the marginal wing coverts), body and head regions; juvenal rectrices, secondaries, primaries, alula, and (possibly) marginal wing coverts are retained. Forehead white, crown whitish-gray with very limited black flecking; lores mainly white with black eyeline extending only partially toward base of bill; broad black stripe through eye extending across nape to form distinct nuchal collar; back, scapulars, tertials, and rump pale gray; greater, median, and lesser wing coverts pale gray and lacking in buff or whitish edgings; juvenal-appearing marginal wing coverts present, forming a dark grayish cubital bar on the wing (we are uncertain whether these juvenal-appearing feathers are retained during the postjuvinal molt or if they are replaced by feathers identical to the juvenal plumage during this molt); chin, throat, breast, belly, undertail coverts, sides, and wing linings white; bill blackish with limited amount of blackish-orange at base; legs and feet blackish-orange or dull black.

#### *First Alternate* (*portlandica*)

*Field Identification:* Under most field conditions the *portlandica* plumage may be indistinguishable from the 1st basic plumage; however, the latter is never fully acquired during the breeding season, whereas



FIGURE 3. Least Terns in *pikei* plumage (foreground) and juvenal plumage. Photograph by C. T. Collins, taken at Harbor Lake, Los Angeles Co., CA, August 1977.

*portlandica* plumaged birds may be seen throughout the spring and summer (Table 2). Any Least Tern observed near the U.S. breeding grounds and characterized by a well-defined black eye stripe, dark cubital bar on the wing, dark gray inner primaries, black bill, and absence of scaliness or buffy coloration in the back or wings may be safely assumed to be in *portlandica* plumage. In the fall and away from the breeding grounds, full 1st basic plumage may only be distinguished from the *portlandica* plumage by the absence of dusky, subterminal spots on the rectrices of the latter.

*Description* (Figs. 1, 2): Acquired by a complete first molt in the early spring. The *portlandica* (1st alternate) plumage is identical to the 1st basic plumage with the exception of the rectrices, which in the *portlandica* are pale gray or white, and lack the subterminal, dull grayish-brown, U-shaped bar or spot characteristic of the 1st basic plumage.

#### *Definitive Basic*

This plumage, probably never fully acquired within the species' breeding range (Table 2), likely resembles the 1st alternate (*portlandica*) plumage; however, we have been unable to locate any winter specimens of the North American populations. It is unknown whether the dark cubital wing bar is found in the basic plumage of all age classes. Dark gray inner primaries are characteristic of 1st, and possibly in some cases, 2nd basic plumages; most 2nd and probably all



subsequent basic plumages have the primary characteristics of "nuptial" (definitive alternate) plumaged adults.

#### *Intermediate (pikoi)*

We have observed a number of Least Terns in the intermediate *pikoi* plumage (Fig. 3), and we suspect that they are 2-year-old birds that have not fully acquired definitive alternate ("nuptial") plumage. Unfortunately, none of these individuals have been banded. At this time we cannot exclude the possibility that some *pikois* are either hormonally "advanced" 1-year-olds or hormonally "retarded" older individuals. The *pikoi* plumage of the Least Tern is characterized by a variably extensive blackish crown pattern usually approaching in size and shape that of full "nuptial" plumage, but which is strongly interspersed with white feathers; the bill coloration, while varying considerably, is usually dull yellow-orange with dusky or blackish at base, along the culmen, and toward the tip. The presence of mostly white lores in the *pikoi* plumage should reduce possible confusion during late summer with breeding plumaged birds that are beginning to molt (Table 2). White flecking in the anterior portion of the black cap appears to be one of the first stages in acquisition of winter (basic) plumage in breeding adults. The wing characteristics of *pikoi*-plumaged birds appear to be somewhat variable; most have the dark grayish cubital bar and dark gray inner primaries characteristic of *portlandica* plumage. However, one of us (JLA) has observed at least one individual that displayed *pikoi* head characters and a dark cubital bar, but had acquired the black outer primaries and pale gray inner primaries found in the "nuptial" plumage. Cullen (1957) found similar variability in the *pikoi* plumage of the Arctic Tern.

#### *Definitive Alternate*

*Field Identification:* The familiar Least Tern "nuptial" plumage, characterized by a glossy black cap with a sharply defined white forehead area, pale gray upper parts, pale gray wings with black outer primaries, yellow bill with variable black tip, and reddish-orange legs and feet. This plumage is frequently acquired the second year. Four banded 2-year-olds recovered on nests were characterized by full "nuptial" plumage, as were three 2-year-old individuals of unknown breeding status.

*Description:* Forehead white, extending backward on sides of crown to above eye; crown and nape glossy black, extending forward through eye and lores to base of upper mandible; back, scapulars, tertials, and rump pale gray; outer rectrices elongate and pointed, inner rectrices shorter and bluntly pointed; outer rectrix mainly white with some graying toward tip on inner web; remainder of rectrices uniform pale gray; inner primaries, secondaries, alula, and wing coverts pale gray; outer two or three primaries mainly black with white edge to inner web; chin, throat, sides of head below eye, breast, belly, undertail coverts, sides, wing linings, and undersurface of rectrices white; bill yellow with variable

amount of black at tip (some individuals have completely yellow bills); legs and feet reddish-orange.

#### DISCUSSION

The age of first breeding has been documented with reasonable certainty for two of the larger *Sterna* species. Cullen (1957) determined through banding that Arctic Terns generally bred in the third year. He observed the behavior of known 2-year-olds and found that they remained unmated throughout the breeding season. Although Cullen did not preclude the possibility that nesting could occur at age two, the youngest banded breeding birds in his series were three years old. Common Terns, in general, also begin breeding at age three (Palmer, 1941; Austin, 1945). In Austin's large series of banding recoveries, 82% of the breeding birds were three years or older. Nisbet (1978), working also with banded birds, found that although Common Terns bred at two and three years of age, most were unsuccessful at raising young. Not until the fourth year were the terns generally capable of successful breeding.

No conclusive reports are known for Common or Arctic terns breeding either at one year or in *portlandica* plumage. Austin (1932) reported a 1-year-old Common Tern incubating eggs, with no mention of exceptional plumage characteristics. However, in 25 years of subsequent trapping of banded adults, he did not find another nesting 1-year-old, and has long suspected that the reported instance may have been attributable to a misread band (Austin, pers. comm.). The single instance of a *Sterna* tern allegedly breeding in *portlandica* plumage was reported by Robinson (1940). He observed a Sandwich Tern (*S. sandvicensis*) in "full eclipse" plumage incubating an egg. The phenomenon was exceptional enough to be worthy of a note, with the author commenting that it was the only breeding bird seen in that plumage in 35 years of observation.

*Pikei* plumage is more variable than *portlandica* and the ages of *pikai* birds less certain, although most of them are probably 2-year-olds. Arctic Terns in this plumage have been documented as breeders, although the phenomenon is rare (Cullen, 1957); however, these individuals were not banded so their ages were unknown. Most of the *pikai*-plumaged birds in Cullen's study were nonbreeders. He observed five banded 2-year-old Arctic Terns in the *pikai* plumage, none of which succeeded in acquiring a mate throughout the breeding season. He documented only one instance of a breeding male with a white-streaked forehead in three years of observation. Common Terns in *pikai* plumage were occasionally observed nesting by Palmer (1941). More recently, Nisbet (pers. comm.) has found Common Terns in *pikai* plumage regularly breeding in Cape Cod colonies. These individuals tend to lay eggs later than the main body of the colony, and are rarely successful in raising young. He has documented, through banding recoveries, that the breeding *pikai* birds are usually 3-year-olds, although others are seen with more white in the forehead, and at least two of these proved to be 2 years old when

trapped on eggs (Nisbet, 1978). Two- and 3-year-olds comprised only a small percentage of the breeding population; most of the population sampled was in the 4- to 8-year age bracket.

Sandwich Terns in subadult plumage (heads streaked with white) comprised up to 25% of the breeding birds in English colonies (Robinson, 1940). Since no banding data were available to correlate appearance and age, one must assume that either Sandwich Terns regularly breed earlier (at age two) than other large *Sterna* terns, or that the species tends to have predefinitive or subadult plumage for a longer period of time (through the third summer).

North American banding records for the Least Tern were examined in the hope of securing more data on the age of first breeding and longevity. The information contained in the banding records unfortunately does not include whether or not the bird was breeding, nor the characteristics of its plumage. It is likely, however, that most birds aged two years or older recovered in breeding colonies were actively engaged in breeding. From 1928 through 1974, there were 45 recoveries of Least Terns of known age on breeding grounds. Data for the west coast population were previously analyzed (Massey, 1973) but have been included again here. Additionally, 17 recoveries in California since 1974 have been included, bringing the total number of recoveries within the species' U.S. breeding range to 62. Table 3 presents these data according to age at time of recovery.

TABLE 3.  
Summary of Least Tern banding data from 1928 to 1977.<sup>1</sup>

Age (years)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
No. of birds	12	7	8	3	7	7	5	2	0	1	2	0	2	0	3	0	1	0	0	0	2

<sup>1</sup> Based on recoveries obtained within the North American breeding range of the species.

The 12 1-year-old individuals (Table 3) that were recovered included the five *portlandica*-plumaged birds discussed earlier (see Results). Information on the plumage and breeding status of the other seven 1-year-olds is not available; all but one of these birds were banded before 1942 and the banders are no longer active. Most (63%) of the birds recovered were from two to eight years of age. If the 1-year-olds are excluded from the series (and we are confident these are nonbreeders), then 78% of the banding recoveries were birds two to eight years old.

We must await further data on banded adults before we can describe the population dynamics of the Least Tern. Our present data suggest the following timetable. One-year-old birds, characterized by *portlandica* plumage, migrate in small numbers to the breeding grounds but do not engage in active breeding. The same appears to be true for birds in *pikai* plumage, presumed to be 2-year-olds, but whose age class has not yet been documented by banding. Only birds in full "nuptial" plumage (in-

cluding the 2-year-olds we have trapped on nests) have been observed actually breeding. The majority of the breeding population probably falls within the 2- to 8-year-old age bracket.

#### SUMMARY

Least Terns in subadult plumage have been appearing in small numbers on U.S. breeding grounds. The return to breeding colonies of Arctic and Common terns in homologous plumages has long been known, but the phenomenon has not been previously described for the Least Tern. Two prebreeding or subadult plumages have been identified in the field—the *portlandica* plumage, now documented as characteristic of 1-year-old terns, and *pikai* plumage worn by birds that are possibly hormonally “retarded” 2-year-old individuals. Birds breeding at two years of age have already obtained definitive alternate (i.e. “nuptial”) plumage. No birds have been observed breeding in subadult plumage. The probable sequence of plumages from juvenal to adult has been outlined with the aid of museum specimens and field observation.

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