

CRITERIA FOR AGING CASSIN'S AUKLETS

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The increased interest and research on marine bird populations in North America has focused attention on several important aspects of biology for which we have little information. One such area is aging birds so that ornithologists can study population dynamics and social behavior. For alcids, extensive banding is usually necessary to document ages of birds accurately. This paper presents criteria for aging Cassin's Auklet (*Ptychoramphus aleuticus*). The age criteria discussed in this paper are based on iris color, molt cycle, and length of the sublingual gular pouch.

METHODS

The information contained in this report was collected on Southeast Farallon Island, California where the Point Reyes Bird Observatory (Bolinas, Calif.) has manned a research station since 1968. The Observatory personnel banded 1,884 Cassin's Auklets in 1968. In 1969, I began an intensive banding program that continued through August 1971, during which time 4,669 Cassin's Auklets were banded. We captured auklets by taking them from burrows, from the ground surface at night, and by mass capture during the early morning departure flight, using a large fishing net stretched between two poles (Ralph and Sibley, 1970). Data from recaptures of adults and subadults form the basis of this paper.

After handling several hundred birds I classified iris color into several types, varying from the totally dark brown of the fledgling to the white of adults. After recapturing known-age subadults, I could then assign age classes to iris types.

Molt cycle was determined by noting the location of feather replacement and amount of feather wear. The gular pouch was measured by methods described by Speich and Manuwal (1974).

RESULTS AND DISCUSSION

Known-age Auklets

To find usable external characteristics for aging subadult auklets, I banded 1,000 auklet nestlings during 1969 and 1970. Subsequently 14 (1.4%) of these birds were recaptured in 1970 and 1971. From these known-age birds criteria have been determined for three age classes: hatching-year, subadult (one- and two-year-olds), and adult (at least three years old).

Iris Color

Thoresen (1964) assumed that juvenile Cassin's Auklets could be identified by their iris color. My data from banded known-age auklets substantiates his report. Adult Cassin's Auklets have white irides (Type I,

Fig. 1). Nestlings have dark brown irides (Type IV). After a nestling fledges, the iris color changes from dark brown to the white of the adult. The iris color first becomes lighter around the pupil and begins to extend outward as the fledgling matures. The irides change from Type IV to Type II or I in about two years. However, about 10% of the adults at least three years old retain a Type II or III iris color. Table 1, which compares iris color of young and adult auklets, indicates variability in the rate of change in the iris color of young auklets. Consequently, iris color by itself cannot be used for exact age determination.

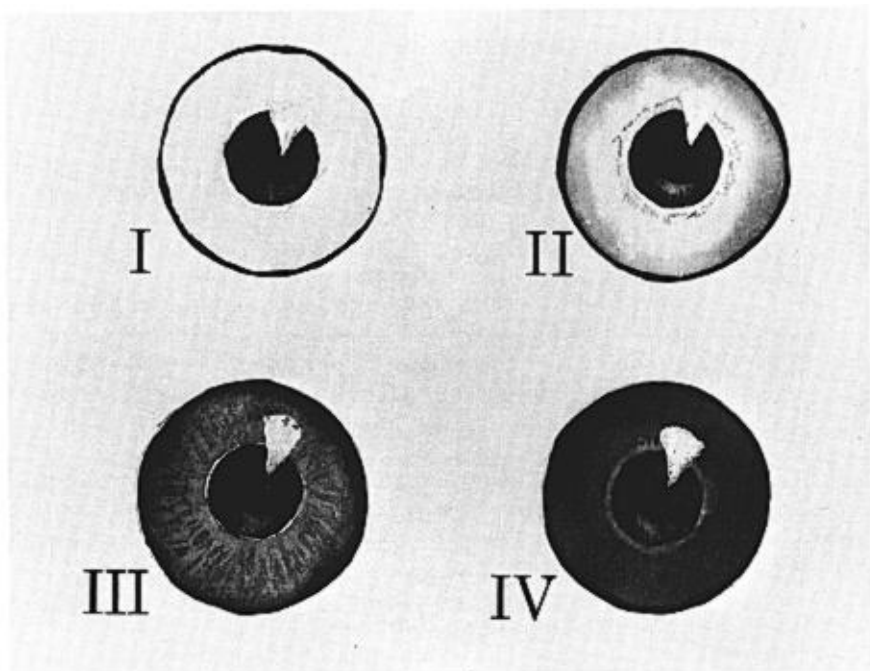


FIGURE 1. Iris color types of Cassin's Auklets. Type I, white iris; Type II iris whitish around pupil, brown periphery; Type III iris light brown or mottled with brown flecks; Type IV iris uniform dark brown.

TABLE I
Iris color of subadults banded as nestlings and adult Cassin's Auklets.

Age	Iris color type			Sample size
	I	II	III	
One and two years	21	36	43	14
Three years and older	86 ²	12 ¹	2 ²	84

¹ Differences between the two age groups significant at $P = .05$.

² Differences between the two age groups significant at $P = .01$.

Molt Cycle

The molt cycle of one- and two-year-old (subadult) auklets that do not breed appears to differ from that of adult breeding auklets. This was also found to be the case with subadult *Aethia* spp. and *Cyclorhynchus* in Alaska by Bedard and Sealy (Ms). All 14 subadults had nearly identical plumages as follows:

Contour feathers freshly molted, light under-tail coverts, fresh rectrices, greater and marginal wing coverts recently molted and replaced; remaining coverts old and worn; all remiges old and worn, no brood patch, bill very dark blue-black; the general appearance suggests a fledgling except for the heavily worn remiges.

Adult auklets during the breeding season have heavily worn contour feathers, remiges, and rectrices. Auklets in the Pacific Northwest, where burrows are often located in humus, may show less wear than Farallon auklets (pers. observ.). All the previous descriptions are of birds captured during late May 1970, when the breeding population was feeding young nestlings. Molt and feather wear should be used for aging only when the population is in the late stages of incubation and early- to mid-nesting period.

Sublingual Gular Pouch

The third criterion useful in aging Cassin's Auklets is the length of the gular pouch. This structure is a bag-like extension of the buccal cavity extending posteriorly alongside the esophagus and trachea (Speich and Manuwal, 1974). This specialized structure is an adaptation for transporting food long distances to the nest site and is present in all plankton-feeding auklets (Bedard, 1969).

Fledgling Cassin's Auklets have no gular pouch. The pouch begins to develop when the birds breed for the first time, usually at three years. The pouch then reaches a maximum distended length of about 125 mm when they are feeding nestlings. After each breeding cycle, the pouch regresses to about 65 mm in length. This developmental pattern permits an immediate distinction between auklets that have previously bred (adults) from those that have not (subadults). Our banding records indicate that approximately 80% of the Cassin's Auklets on the Farallon Islands do not breed until they are at least three years old.

Application of Age Criteria

A complicating factor in the analysis of age criteria is the occurrence of a substantial nonbreeding Cassin's Auklet population on Southeast Farallon Island; these auklets are most often captured on the ground surface (Manuwal, 1974). Table 2 summarizes iris color characteristics of auklets captured by various methods. It shows that there is no difference in iris color of birds captured randomly in a net during the dawn departure and those found breeding in burrows. Between 85% and 89% of these auklets had iris color Types I and II that are typical of adult auklets. On the other hand, significantly fewer auklets captured on the ground surface had adult iris color.

TABLE 2

Comparisons of the age classes of Cassin's Auklets captured by hand and taken from burrows with those caught randomly in a net.

Method of capture	Percent adults ¹ (Iris types I and II)	Sample size
Taken from burrows	89.2 ²	326
Mass-captured in net	85.4	2,603
Hand-captured above ground	78.8 ³	261
Mass-captured in net	85.4	2,603

¹ Test concerning the difference between two sample proportions, Zuwaylif, 1970.

² Difference not significant at $P = .05$ level.

³ Difference significant at $P = .01$ level.

Based on the criteria outlined in this paper, approximately 69% of a sample of 2,600 mass-captured Cassin's Auklets occupying Southeast Farallon Island were auklets at least three years old and considered to be adults. The remaining 31% were subadults. Table 3 summarizes the age-class characteristics of the Cassin's Auklet population on the Farallon Islands.

TABLE 3

Summary of age-class characteristics of the Cassin's Auklet population of Southeast Farallon Island, California.

Age class	Iris type	Color (%)	Plumage	Sublingual pouch
Hatching-year	IV	100	Fresh	None
One to two years	II-III	79	Contour feathers fresh, ¹ wing coverts show some wear, remiges heavily worn.	None
	I	21		
Three or more years	III	2	Entire plumage worn	At least 65 mm ²
	II	12		
	I	86		

¹ Assuming that the birds are nonbreeders.

² Assuming that the birds are breeding.

SUMMARY

The age criteria presented in this paper were developed by examining banded known-age Cassin's Auklets. Using the characteristics outlined in this paper it is possible to determine whether individual Cassin's Auklets are subadults or adults. Subadults (less than three years old) have

dark irides, have a fresh plumage in the latter part of the summer, and usually have no sublingual gular pouch. Breeding adults have white irides, worn plumage in the latter part of the summer, and a sublingual gular pouch of at least 65 mm.

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LITERATURE CITED

- BEDARD, J. 1969. Feeding of the Least, Crested and Parakeet auklets on St. Lawrence Island, Alaska. *Can. J. Zool.*, **47**: 1025-1050.
- MANUWAL, D. A. 1974. Effects of territoriality on breeding in a population of Cassin's Auklet. *Ecology*, **55**: 1399-1406.
- RALPH, C. J., AND F. C. SIBLEY. 1970. A new method of capturing nocturnal alcids. *Bird-Banding*, **41**: 124-127.
- SPEICH, S., AND D. A. MANUWAL. 1974. Gular pouch development and population structure of Cassin's Auklet. *Auk*, **91**: 291-306.
- THORESEN, A. 1964. Breeding behavior of the Cassin's Auklet. *Condor*, **66**: 456-476.
- ZUWAYLIF, F. H. 1970. General Applied Statistics. Menlo Park, Addison-Wesley Publ. Co.
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