

FEATHER MORPHOLOGY AS AN AGE INDICATOR IN MANDARIN DUCKS¹

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Abstract. An investigation of known-age Mandarin ducks (*Aix galericulata*) indicated that primary feather length and secondary feather markings could be used to separate the majority of yearling from adult birds. The lengths of the 7th, 9th, and 10th primaries of adults of both sexes were longer than the corresponding feathers in yearlings. The 7th and 9th primaries probably would provide the greatest ageing accuracy, since their lengths were significantly different when the same females were measured as yearlings and adults. Color patterns on the secondaries could not be used to segregate age groups reliably.

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Separation of yearling waterfowl (birds having completed only one pre-alternate molt) from adult waterfowl (birds having completed at least one post-alternate molt) is necessary for determining the influence of age on reproductive capability. Such data are important and useful in management of wild waterfowl populations and in propagation of exotic species such as the Mandarin duck (*Aix galericulata*) (Bruggers 1974).

Many morphological characteristics have been evaluated in ageing waterfowl: cloacal characters, tertial and covert markings, bill spots, primary feather length (summarized by Dane 1968 and Carney 1964), and eye color (Trauger 1974). The purpose of this study was to determine the applicability of some of these methods to known-age Mandarins.

MATERIALS AND METHODS

The study was conducted at the 10 ha estate of Mr. J. J. Schedel, Elmore, Ottawa County, OH. Two interconnected lakes of 0.6 and 1.0 ha were major activity centers for all propagated waterfowl. The data were collected primarily from birds raised during the study, but some individuals belonging to C. Strutz (Jamestown, ND) and C. Webster (Islip, NY) also were examined.

All ducklings hatched at the Schedel estate were raised in indoor pens on Purina Duck

Startena mixed with small amounts of cracked corn for 6 weeks before being put in large outdoor pens enclosing 70m² of land and 55m² of water or liberated directly to the estate grounds. One wing usually was pinioned during the first week after hatching. After liberation the ducklings' diet was the same as adult birds---primarily natural vegetation supplemented by scratch grain diets. Propagation procedures were similar to those used by other breeders.

During late fall 1972 and 1973, after completion of the pre-alternate molt and while the birds were in alternate (or breeding) plumage, primary feather length and secondary feather markings were observed. Ventral, flattened surfaces of the 7th, 9th, and 10th primaries of yearling and adult males and females were measured, using methods of Dane (1968), from the sharply defined edge of digit II and the partially fused digit III to the feather tip. Outer primaries were measured, since they have been found to show greater variation in length than proximal ones (Engles 1938, Baumel 1953, and Dane 1968). White coloration on the margins of the 5th-9th secondary feathers also was examined.

RESULTS AND DISCUSSION

More than half of the yearlings and adults could be separated on the basis of primary feather length. Primaries of adult males and females were significantly longer than those of yearling males and females, respectively (table 1). When the 7th and 9th primaries of the same female were measured when she was a yearling and again as an adult, the adult feather always was longer (fig. 1); the differences in mean lengths were significant ($P < .05$).

The mean primary lengths of all 3

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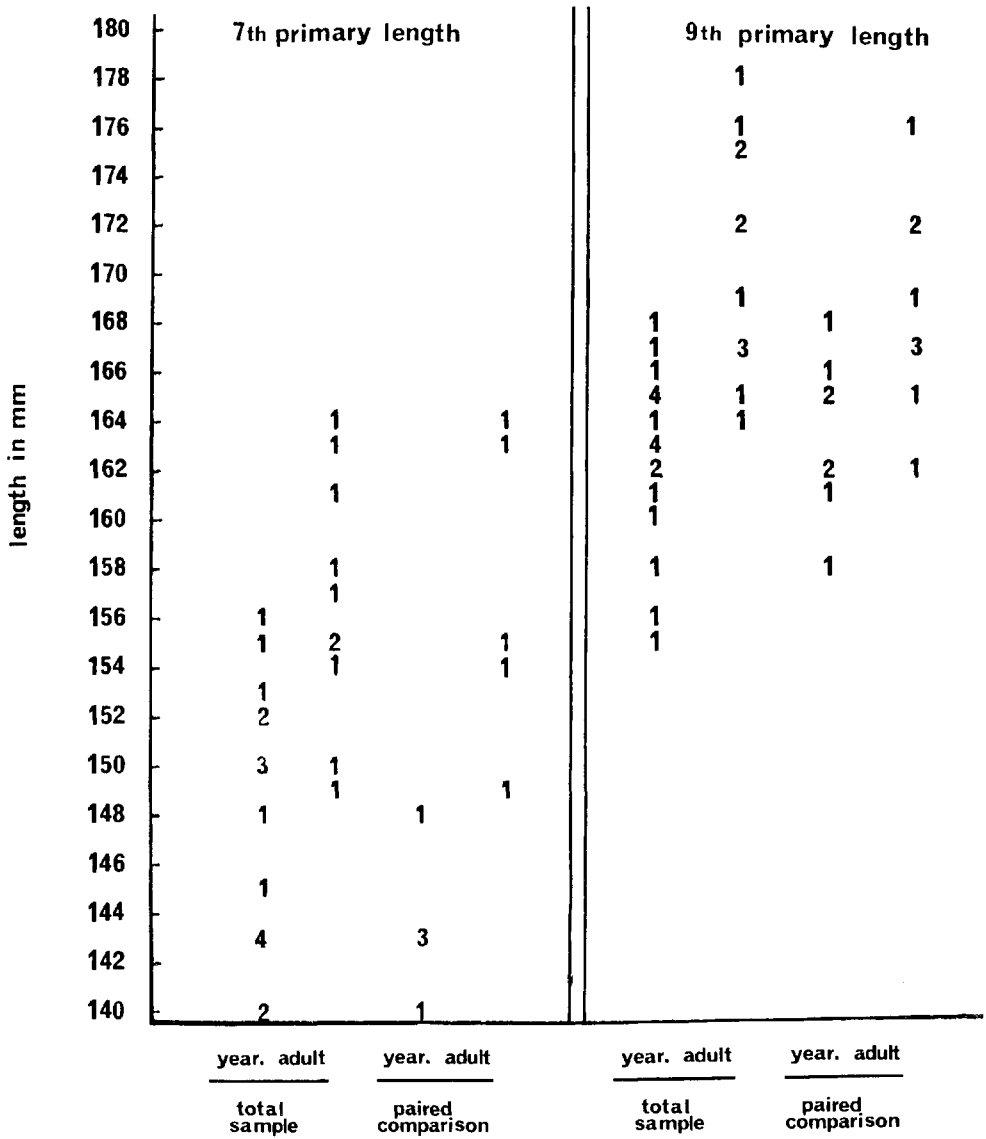


FIGURE 1. Frequency distribution of the 7th and 9th primary feather lengths of yearlings and adult female Mandarin ducks, measured during fall 1972 and 1973. Year.=yearlings not having completed a post-alternate molt. Adults=individuals having completed at least one post-alternate molt. Paired comparisons indicate the same individuals measured as yearlings and adults.

TABLE 1
Primary feather lengths of male and female Mandarin ducks.†

	Males			Females		
	Mean±S.D.	Range	No.	Mean±S.D.	Range	No.
7th primary						
yearlings	154.8±5.2	146-161	16*	149.1±5.7	140-158	22**
adults	162.9±4.9	157-169	9	156.6±5.1	149-164	10
9th primary						
yearlings	167.8±3.4	160-173	20*	162.9±4.1	155-169	26*
adults	174.4±3.0	170-179	10	170.6±4.7	165-178	12
10th primary						
yearlings	168.4±4.6	162-177	18*	165.6±2.8	160-170	21*
adults	175.5±3.9	169-180	10	169.5±2.4	166-173	11

†Measurements in millimeters were made during fall 1972 and 1973 while birds were in alternate plumage. Statistical analysis was by Model I Single Classification ANOVA (Sokal and Rohlf 1969).

*Difference between primary feather length in yearlings and adults, $P < 0.001$.

** $P < 0.01$.

primaries of yearling and adult males were longer than those of the same age females (table 1). Such sex differences also have been found for other avian species by Stewart (1963), Dane (1968), and Johnson (1974).

The tips of the secondaries of yearling females generally were more speckled and less complete (i.e., white not on both sides of the rachis) than those of adult females (table 2). Seventy-eight percent

of 6 females, 3 whose secondaries were speckled or incomplete as yearlings were complete as adults. The other 3, when adults, retained the same markings as when yearlings (fig. 2). These markings were not at all effective in separating yearling and adult males, as the white edges were complete in both age groups. Nutrition probably was not a factor in the feather length or marking differences, since most birds were from the Schedel population, and the supplemental diet provided all birds from the 3 populations was similar.

For breeding programs, segregation of adults and yearlings is often desirable. The proposed use of primary feather length generally is suitable but does not provide complete separation. For example, based on these data, males with the 9th primary less than 170 mm would be characterized as yearlings, those more than 173 mm, as adults. Similarly females with this primary less than 165 mm would be yearlings; those more than 169 mm, as adults. Those in the intermediate ranges could not be characterized. The use of secondary feather marking patterns was not at all satisfactory for making such age distinctions.

Acknowledgments. Appreciation is extended to Mr. and Mrs. J. J. Schedel for allowing me to conduct the study at their estate, to the

TABLE 2

Yearling and adult Mandarin females with complete or incomplete white markings on the distal ends of the secondary feathers.

	No.*	Secondary feather markings		
		Com- plete	Incom- plete	% Com- plete
yearlings	27	6	21	22
adults	12	9	3	75

*yearlings (21 Schedel, 3 Strutz, 3 Webster)
 adults (7 Schedel, 2 Strutz, 3 Webster)

of the yearling females showed speckled or incomplete white markings, whereas markings on 75% of adult females were complete. Observations on a paired-comparison basis, however, were less con-

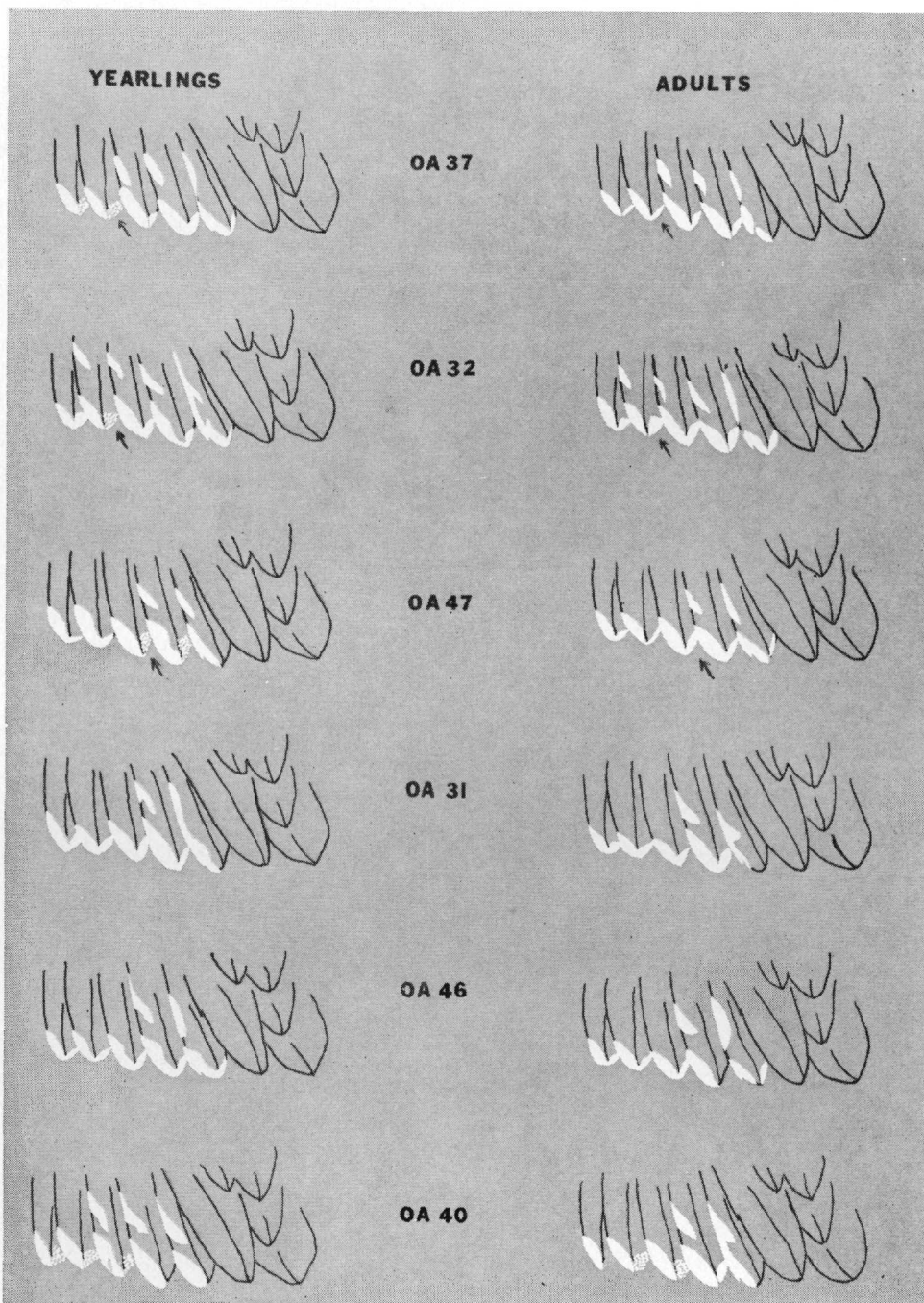


FIGURE 2. Comparison of distal markings of the 5th-11th secondaries of 6 Mandarin duck females as both yearlings and adults, while in alternate plumage. Observations made during fall 1972 and 1973.

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LITERATURE CITED

- Baumel, J. J. 1953 Individual variation in the White-necked Raven. *Condor* 55: 26-32.
- Bruggers, R. L. 1974 Nesting biology, social patterns and displays of the Mandarin duck, *Aix galericulata*. Unpubl. Ph.D. Dissertation, Bowling Green State Univ., Bowling Green, OH. 188 pp.
- Carney, S. M. 1964 Preliminary keys to waterfowl age and sex identification by means of wing plumage. U.S. Forestry and Wildlife Service. Special Scientific Report—Wildl. No. 82.
- Dane, C. 1968 Age determination of Blue-winged Teal. *J. Wildl. Manage.* 32: 267-274.
- Engles, W. L. 1938 Variation in bone length and limb proportions in the Coot (*Fulica americana*). *J. Morphol.* 62: 599-607.
- Johnson, N. K. 1974 Molt and age determination in Western and Yellowish Flycatchers. *Auk* 91: 111-131.
- Sokal, R. R. and F. J. Rohlf 1969 *Biometry*. W. H. Freeman and Co. San Francisco. 776 pp.
- Stewart, I. F. 1963 Variation of wing length with age. *Bird Study* 10: 1-9.
- Trauger, D. L. 1974 Eye color of female Lesser Scaup in relation to age. *Auk* 89: 567-582.

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