

A review of Bufflehead sex and age criteria with notes on weights

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The Bufflehead *Bucephala albeola* is the smallest diving duck in North America. A recent review by Palmer (1976) noted potential problems regarding sex and age determination which in turn leads to doubts about the relative size among sex and age classes. The present study was designed to check the reliability of several methods used for sex and age determination in this species.

We collected 87 birds during two duck hunting seasons (24 November 1978 to 14 January 1979 and 4 November 1979 to 6 January 1980) at the Salmon River estuary, Lincoln County, Oregon.

Sex and age determination

Sex and/or age may be determined in waterfowl in several ways: (1) general plumage, (2) cloacal and related structures (Hochbaum 1942), (3) internal sex organs, and (4) wing plumage (Carney 1964). Yearling Bufflehead males (as well as adult males) presumably moult into definitive alternate (= breeding) plumage in late August and September, and by the end of September yearling males (then about 15 months old) are indistinguishable from older birds (Erskine 1972). The head of those males is dark with strong purple, violet, bronze, and green gloss except for a large triangle of white starting below the eye and broadening upward over the back of the head. Although males over 15 months of age were not difficult to sex or age by general plumage characteristics, cloacal and wing characteristics were nevertheless recorded. Because immature males resemble immature and adult females during the first fall and winter, we utilized the cloacal and internal characteristics to determine sex and age of the remainder of the sample. These findings were then compared with results based on wing plumage.

Cloacal and internal characteristics

The cloacal criteria for waterfowl were first established by Hochbaum (1942) who

stated that any duck, goose, or swan, regardless of age or plumage, may be sexed by the presence or absence of the penis. However, in the Bufflehead, we found that the penis of immatures (first-year males) was very small and sometimes difficult to ascertain; therefore, an internal check of the gonads was made for verification. In adults, the penis is larger and enclosed within a conspicuous sheath.

In the female, the criterion of age is the left oviduct which empties into the cloacal chamber through the left cloacal wall. In immature females, the oviduct is closed by a membrane; the left cloacal wall is unbroken. In adult females, the occluding membrane is absent; the oviduct may be seen as a conspicuous slit on the left cloacal wall.

In both sexes another criterion of age exists in the cloaca, the bursa of Fabricius. The bursa is a sac-like organ which, in immature birds, forms a pocket within the dorsal wall of the cloaca. The bursa is always absent in adults (Hochbaum 1942). Thus, the presence or absence of the bursa distinguish immature birds from adults.

Hochbaum (1942:300-301) goes on to say: 'Some species of ducks which do not mature until they are more than 1 year old may, like the geese, retain the cloacal characters of immaturity as yearlings. This group might include the American Goldeneye, Bufflehead, Oldsquaw, Harlequin Duck, and the scoters and eiders.' Hochbaum pointed out that few of the above species had been studied; thus, the limits of use of the cloacal age characters were not then known.

Adult and immature males

To provide a check on the bursa technique in Buffleheads, we evaluated 30 adult-plumaged males (including yearlings). Most of these males had no bursa or only the remains of the opening (0-2 mm); however, nine contained a bursa ≥ 3 mm; the two largest were 7 and 15 mm. We believe it is probable that some of the birds with bursas ≥ 3 mm, at least the two with

the largest bursas, were yearlings. Ranked from the lightest coloured breast and belly to the darkest, the grayer or darker birds tended to have a deeper bursa (Table 1).

Table 1. Bursa depth (mm) in 30 adult-plumaged male Buffleheads

Bursa Depth (mm)	Breast and belly colour		
	Light (10)	Medium (10)	Dark (10)
0-2	8	7	6
3-5	2	3	2
6+	0	0	2 ^a

^a Includes a 7 mm and 15 mm bursa.

Immature males (about 5-6 months old) in our study all contained a very small unsheathed penis. Bursa depth ranged from 16 to 23 mm (mean 18.4, SE 0.54, $n = 23$), beyond the range reported for adult-plumaged males.

Adult and immature females

Of the 33 females collected during this study, 32, based upon cloacal characters, could be easily placed into the immature or adult categories (Table 2). The adults had an open oviduct and no bursa, or a very small bursa. The immatures had closed oviducts and a bursa that ranged from 15 to 27 mm (mean 18.4, SE 0.71, $n = 17$). The remaining bird possessed a 13 mm bursa but also an open oviduct, it may have been a yearling (about 17-18 months old).

Table 2. Bursa depth and condition of oviduct in 33 female Buffleheads

Bursa depth (mm)	Immature female (closed oviduct)	Adult female (open oviduct)
0-2	0	14
3-5	0	1
6-9	0	0
10-13	0	0
14-17	6	0
18-21	10	0
22+	1	0

One other female, probably a yearling with an open oviduct, had a bursa 13 mm deep.

Wing plumage characteristics

Information about the sex and age composition of waterfowl populations is needed to manage the various species better. Carney (1964) prepared a preliminary key to waterfowl age and sex determination on the basis of wing plumage. However, he had very little opportunity to check the reliability of his criteria for Buffleheads and some of the other less common species. Thus, as a part of our study, we compared the sex and age data of 85 Oregon birds, based on cloacal and internal characters, with Carney's wing plumage key (see below). Note that when measuring the length of wings Carney did not use the current standard method of taking the distance from the carpal joint to the tip of the longest feather, but instead measured from the small notch which lies just beyond the carpal joint, producing a slightly shorter measurement. In order to distinguish this measurement we have labelled it 'wing notch length'.

Bufflehead Wing Key (Carney 1964)

1. Middle coverts

- (a) Entirely white except over the tertials Adult male
- (b) All black or brownish black 2

2. Wing notch length

- (a) 159 mm or shorter 3
- (b) 160 mm or longer Immature male

3. Greater coverts

- (a) Frayed at tips over secondaries, tertial coverts often appear narrow with brownish fraying at their tips Immature female
- (b) Smooth and rounded over both secondaries and tertials 4

4. Tertials

- (a) Appear short, straight, often with pointed fraying that shows traces of brownish Immature female
- (b) Appear long, drooping, broadly rounded at ends, may show fraying but not brownish Adult female

It should be noted that, based on wing plumage, yearlings are included with the adults. Wing determinations did not agree with internal findings in three adult females which had a wing notch length greater than 160 mm (161[2], 162[1]). These birds would be classified as immature males according to the key. A modification of the key for classifying immature males will eliminate the problem. The revised key shown below will correctly classify all adult males and about two-thirds of the immature males before it is necessary to look at feather shape (a somewhat subjective judgment).

Revised Bufflehead Wing Key

1. Middle coverts

- (a) Entirely white except over the tertials Adult male
- (b) All black or brownish black 2

2. Wing notch length

- (a) 165 mm or longer ... Immature male
- (b) 164 mm or shorter 3

3. Feather shape

- (a) *Greater coverts* smooth and rounded over both tertials and secondaries; *tertials* appear long, drooping, broadly round-

ed at ends, may show fraying but not brownish Adult female

- (b) *Greater coverts* frayed at tips, narrow and somewhat pointed over both secondaries and tertials; *tertials* appear short, often pointed fraying that shows traces of brownish 4

4. Wing notch length

- (a) 159 mm or shorter Immature female
- (b) 160 mm or longer Immature male

A graph of the wing notch length for the sex and age classes is shown in Fig. 1 for birds collected in Oregon (our study) and for records housed at the Office of Migratory Bird Management (Carney, unpublished). Immature females averaged 152.7 mm, SD 3.22, $n = 64$; adult females (including yearlings) 156.6 mm, SD 3.47, $n = 28$; immature males 166.8 mm, SD 3.69, $n = 59$; and adult males (including yearlings) 171.6 mm, SD 3.30, $n = 53$. The figure shows that immature males and immature females collected in Oregon did not overlap the 160 mm measurement of demarcation established by Carney (1964); however, one immature (1 or 123 or 0.8%) from the pooled data would be sexed inaccurately (also in the revised key). We

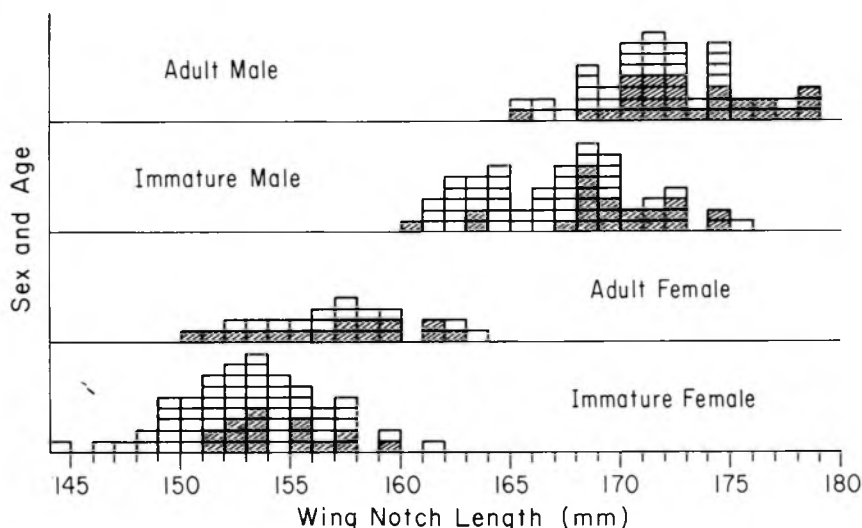


Figure 1. Wing notch length (mm) of Buffleheads collected in Oregon (▨) and records on file at the Office of Migratory Bird Management (□).

believe an error rate of less than 1% is tolerable.

Another point regarding plumage is that 14 of 23 immature males collected in Oregon showed small amounts of iridescence on the head; these tended to be collected later in the hunting season, although the earliest observation was 18 November. Also a few white flecks on the upper part of the head were observed with the iridescence in 7 of the 14 birds. Delacour (1959) noted that first-winter males show some feathers of the adult dress. No iridescence was observed in females.

Body weight

All birds were thawed and weighed to the nearest gramme with a top-loading Mettler Balance. Mean body weights paralleled wing measurements; adult males (473 g) weighed significantly more (*t* test, $P < 0.01$) than immature males (450 g), and adult females (334 g) weighed significantly more ($P < 0.05$) than immature females (315 g) (Table 3). Our adult male weights were in close agreement with those collected at Seneca Lake, New York, by Ryan (1972) from January through April (mean $468 \text{ g} \pm 11$, range 400–550, $n = 21$). However, Palmer (1976) raised questions about the adult female weights (mean $397 \text{ g} \pm 19$, range 310–570, $n = 20$) presented by Ryan. We also question the maxima for females which seem high, and believe immature males were included. In our study, no adult females weighed more than 374 g, in contrast to Ryan's reported weights that ranged up to 570 g. As mentioned earlier, the extremely small size of the penis sometimes makes sexing very difficult, especially under field conditions. This apparent problem of including immature males with females is not restricted to one paper; the range of female weights published by Kortright (1942) shows a range of 227 to 596 g. Averaged throughout the year, Erskine (1972) concluded

that male Buffleheads (all ages) weigh about 450 g and females (all ages) about 330 g. He further noted, 'Both reach their maximum weights during the autumn migration period, with females achieving almost equal weight while laying.' Our weights were similar to those reported by Erskine; the immatures averaged 23 and 19 g less than adults for males and females, respectively.

Other measurements

Attempts were made to find a simple field technique for sexing Buffleheads. The need is especially acute for immature birds and would be of value for banding purposes. The exposed culmen measurements (mm) were; immature females (mean 25.1, SD 1.06, $n = 17$), adult females (mean 25.4, SD 1.21, $n = 16$), immature males (mean 27.8, SD 0.90, $n = 23$), and adult males (mean 27.8, SD 1.09, $n = 31$). However, the considerable overlap between the sexes negated its usefulness as a sexing criterion.

From casual observation the feet of males appeared considerably larger than those of females. We tested the suspected difference in size by measuring the greatest length of the foot web along the middle toe on the dorsal surface (Baldwin et al. 1931). One point of a divider was placed snugly against the base of the web at the proximal end of the middle toe, and with the toe fully extended, the other point of the divider was placed at the site where the web joined the distal end of the toe. The distance between these two points was then measured to the nearest 0.5 mm. The side of the toe with the longer web was always taken. The lengths (mm) were: immature female (mean 46.79, SD 1.20, $n = 17$), adult female (mean 47.98, SD 1.66, $n = 16$), immature male (mean 53.26, SD 1.78, $n = 23$), and adult male (mean 54.08, SD 1.93, $n = 30$). No overlap occurred between males and immature

Table 3. Weights (in grammes) of 85 Buffleheads collected in Oregon

Category	Adult male ^a	Immature male	Adult female ^a	Immature female
Mean	473	450	334	315
Range	424–551	394–493	297–374	273–354
SE	6.1	5.6	5.8	5.5
n	29	23	16	17

^a Includes yearlings.

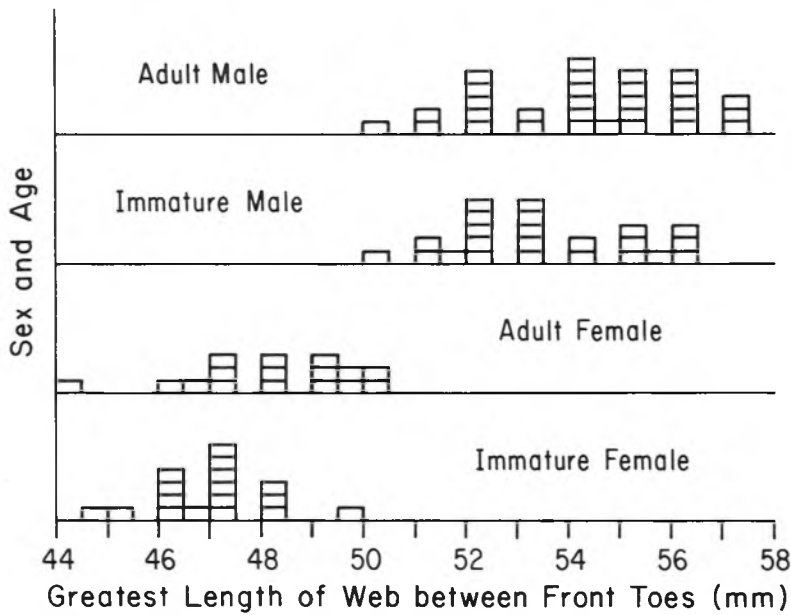


Figure 2. Greatest length of web between front toes (mm) of Buffleheads collected in Oregon.

emales, and very little between males and adult females (Fig. 2). Based on a normal distribution of the web lengths, and by assigning all immatures with webs ≤ 48.5 mm to the female category and all ≥ 50 mm to the male category, the following accuracy is expected: females, 94.9% correct, 0.7% misclassified, and 4.4% unknown; males, 97.5% correct, 0.6% misclassified, and 1.9% unknown.

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Summary

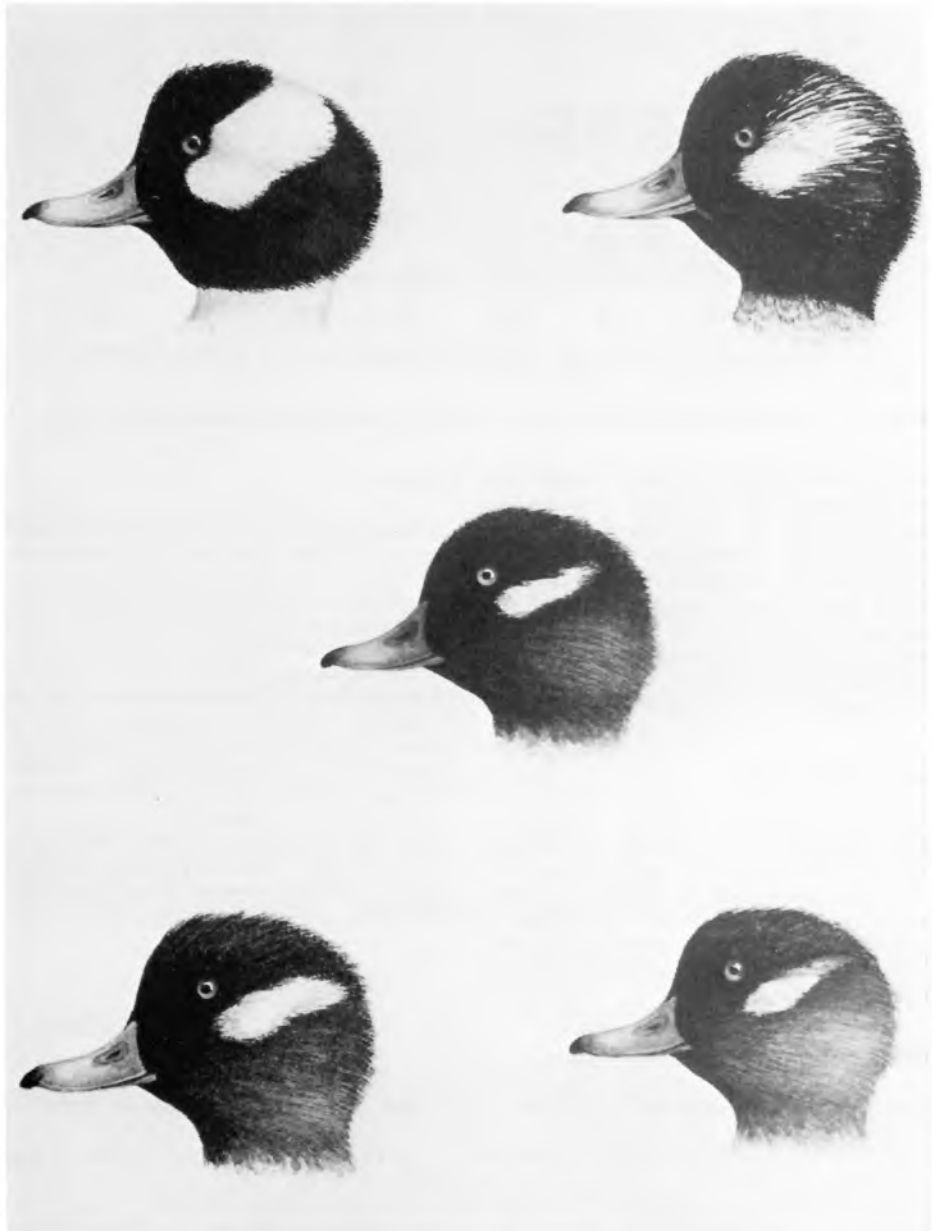
Buffleheads *Bucephala albeola* were collected along the Oregon coast during the hunting season. Birds were first sexed and aged upon cloacal and internal characteristics. Results were then compared with data derived from wing plumage. A small change was made in Carney's (1964) wing plumage key to improve its accuracy. Although only a few studies have been made of Bufflehead weights, it seems that in at least several of these, some immature males have been included in the female category. This mistake has probably resulted from the extremely small penis in the immatures. The foot web length shows potential as a simple sexing criterion during the fall and winter for immatures which are the most difficult to sex under field conditions.

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Bufflehead plumages in fall and winter. Upper left (adult male), upper right (transition male), centr
(adult female), lower left (immature male), lower right (immature female). (John L. Carter).