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OBSERVATIONS ON SEXING AND AGING DUCKS USING WINGS

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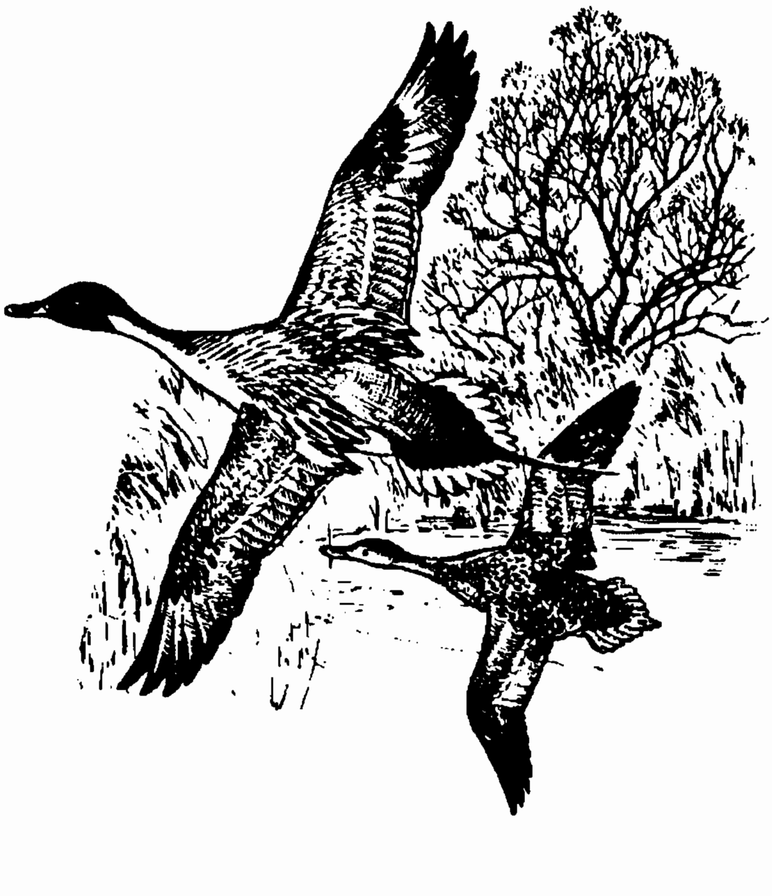

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INTRODUCTION

This report presents information on the development, testing, and limitations of procedures described in the report titled: "Species, age and sex identification of ducks using wing plumage" (Carney 1992). Studies of duck wings begun in 1958 led to the development of most of these procedures (Carney and Geis 1960, Carney 1964) and the details of the development and functioning of the annual Waterfowl Parts Collection Survey have been presented elsewhere (Martin and Carney 1977, Carney 1984, Crissey 1984) and are not included here.

DISCUSSION

During their first fall and winter, immatures of many duck species replace tertials, greater tertial coverts, post humerals, and scapulars with feathers similar to those of adult birds of the same sex. The amount of contrast between feather generations makes replacement conspicuous on wings of species such as the canvasback (scientific names listed in Appendix 1) but inconspicuous on others such as the ring-necked duck. Feather replacement does not occur during this period on wings of those species that require more than one year to mature (Table 1). A good summary of the age at which many species breed may be found in Ferguson (1966).

Table 1. Percentages of immature ducks of selected species that had replaced one or more juvenal tertial coverts.

		Percentage during					Wings examined				
Species	Sex	Sept.	Oct.	Nov.	Dec.	Jan.	Sept.	Oct.	Nov.	Dec.	Jan.
Mallard	M	3	30	30	42	56	78	24	113	111	36
	F	4	19	24	25	33	67	208	95	72	40
Ring-necked duck	M	-	19	18	28	54	-	47	17	51	52
	F	-	11	12	26	36	-	37	17	74	76
American wigeon	M	0	15	11	27	27	97	213	97	49	22
	F	0	12	11	21	25	70	188	92	43	24
Canvasback	M	-	58	75	78		-	79	64	74	
	F	-	36	47	61		-	50	62	49	
Redhead	M	-	6	7	17		-	140	55	24	
	F	-	3	3	3		-	160	72	33	
Lesser scaup	M	-	0	0	7		-	33	2	14	
	F	-	0	0	0		-	26	1	7	
Wood duck	M	100	93	100	83		4	44	7	6	
	F	60	82	91	89		10	29	11	9	
White-winged scoter	M	-	0	0	0	-	-	16	13	13	-
	F	-	0	0	0	-	-	17	9	16	-

Note: Date for December and January are combined for canvasbacks, redheads, lesser scaup, and wood duck. White-winged scoters require two years to mature.

Each year wings are received in the Waterfowl Parts Collection Survey from ducks that have not only replaced tertial coverts, but also some of their middle coverts. Most of these wings are from wood ducks and mottled ducks, both of which are southern nesting species. However, extensive feather replacement is also evident on some wings from other species with southern nesting populations, particularly mallards, northern pintails, and American wigeon shot in the Pacific Flyway States of California, Oregon, and Washington. At Suisun Marsh, California, mallard nest initiations occur considerably earlier than in more northern areas (McLandress *et al.* 1988) (Fig. 1). Some immature ducks associated with this early southern nesting initiate their wing molt in the fall rather than in the spring. Extensive molting of this type can make age identification of a few wings very difficult.

Boyd *et al.* (1977) have suggested that some early replacement on European ducks might be due to accidental loss of the previous feather generation. Balàt (1970), working in Czechoslovakia, observed that male mallards molted about ten days earlier in the lowlands than at higher elevations. Klint (1982) has observed that wing molt is delayed if a female mallard is tending a brood. He suggested that females capable of flight might increase their chances of defending and guiding their broods. Heitmeyer (1987), working with mallards in Missouri, suggested that "...two females molting at the same time in winter (in the same or different locations) could be engaged in different molts (i.e., one in the prebasic, the other in the prealternate)." Thus, it appears clear that the timing of the molt may be influenced by several factors, and these give molts a degree of variability.

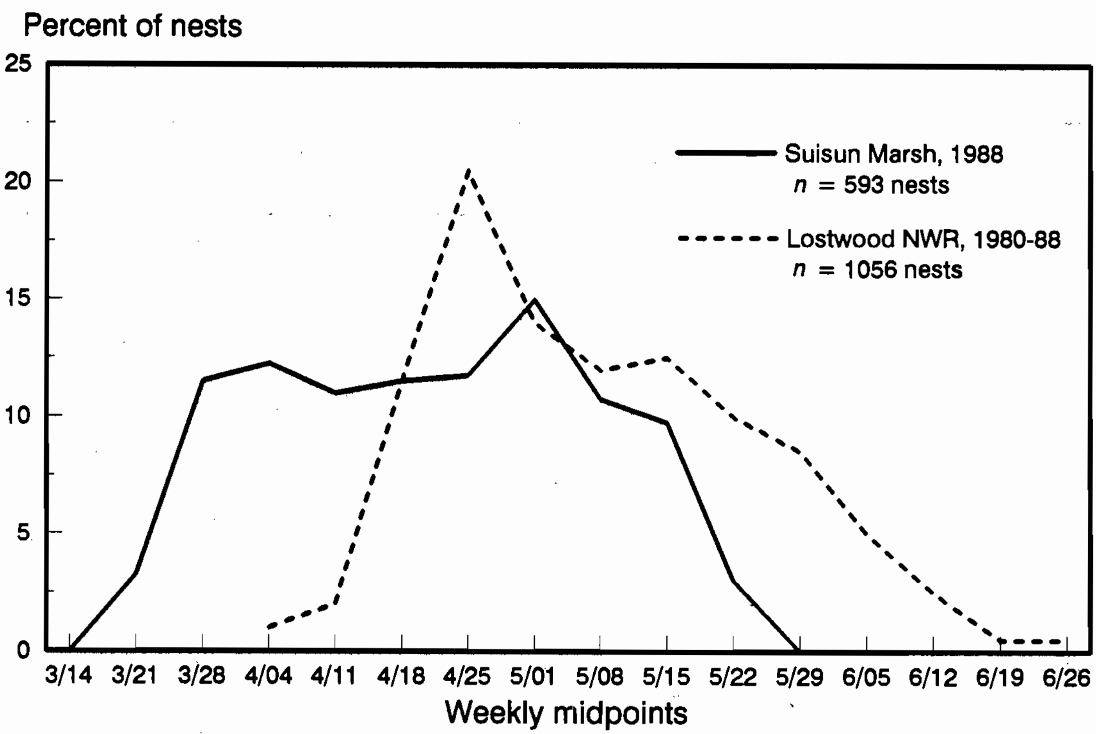


Fig. 1. Chronology of mallard nest initiations in California (Suisun Marsh) and North Dakota (Lostwood National Wildlife Refuge) (McLandress *et al.* 1988).

In most species, wings of male ducks are longer than those of females. However, in only a few species is this difference great enough to separate the sexes. In addition, there is some evidence that game-farm mallards and perhaps other hand-reared species (Wishart 1981) develop shorter wings than do wild-hatched birds. This appears to be the case with a group of wings obtained in 1965 from mallards hand-reared at Remington Farms in Maryland (Table 2). A. D. Geis measured mallard wings received through the 1971 Waterfowl Parts Collection Survey from birds shot in a number of States. Assuming that mallards shot in Arkansas are typical of normal wild mallards, it is interesting to note that the shortest wings came from Pennsylvania (Table 2), a State known at that time to have released large numbers of hand-reared mallards.

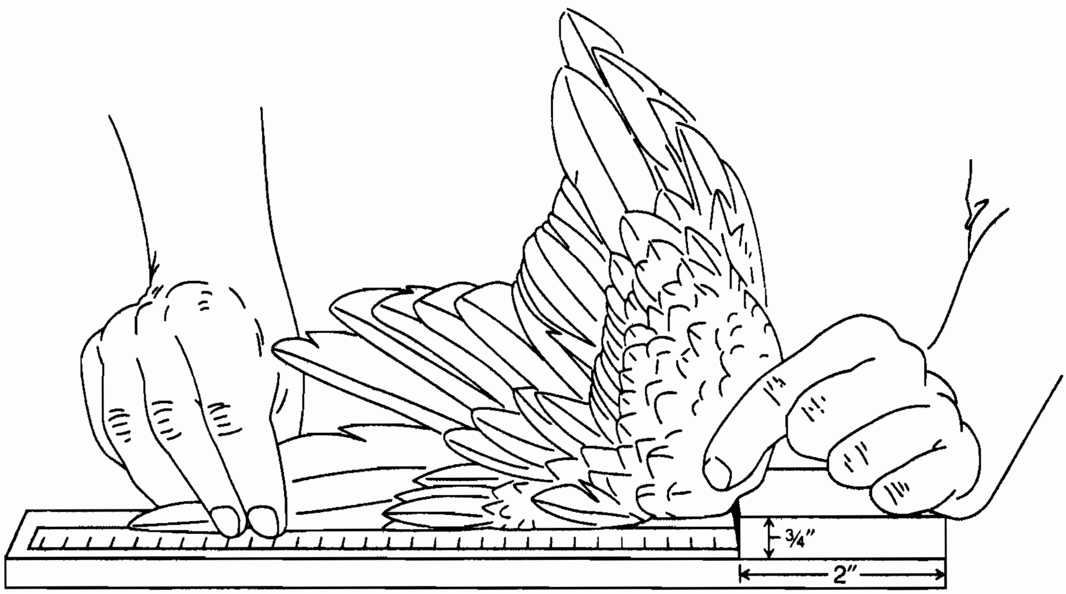
Nutrition may have an effect on wing length in both captive and wild ducks. Pehrsson (1987) noted that captive mallards (especially males) given low protein food developed shorter wing feathers than those on higher protein diets. In addition, there are indications from Waterfowl Parts Collection Survey measurements (examined mostly with reference to brant wing and goose retrix length) of annual variation in size, possibly related to reproductive success and in turn at least partially to nutrition in a particular season.

Wing measurements for individual species are given in Appendix 2. All wing measurements included in Table 2 and Appendix 2 were made with a standardized measuring board (Fig. 2). Because this procedure differs slightly from that described by Baldwin *et al.* (1931), measurements are referred to as wing "notch-length".

Table 2. Measurements (in mm) of mallard wings received through the 1971 Waterfowl Parts Collection Survey and of hand-reared mallards from Remington Farms, Maryland.

	Mean notch-length				Number measured			
	AM	AF	IM	IF	AM	AF	IM	IF
Arkansas	290.0	270.9	279.8	265.3	419	191	164	139
Idaho	288.1	270.0	278.8	263.2	265	128	294	213
Colorado	288.9	271.3	279.1	263.5	222	60	160	70
New England	285.9*	266.6	277.5	262.4	64	36	142	114
New York	285.4*	267.8	278.3	264.3	54	38	134	118
Pennsylvania	284.7**	267.6	276.0*	261.2*	110	48	121	94
New Jersey, Delaware, Maryland, Virginia	286.8*	268.5	278.1	263.4	198	115	177	177
North & South Carolina, Georgia, Florida	288.6	270.8	278.4	263.7	145	70	48	57
Remington Farms	278.9**	259.7**	267.4**	252.4**	32	27	230	104

*differs $P<0.01$ from Arkansas, *t*-test
**differs $P<0.001$ from Arkansas, *t*-test



Place the heel of one hand over the end of measuring board and grasp wing in the area of the radius and ulna. Pull until wooden block seats tightly into the notch at the bend of the wing. Flatten the leading edge of the wing and note the length of the wing at the longest primary.

Note: If primary quills are not completely grown, the measurement is not valid.

Fig. 2. Procedure for measuring wings (drawing by A.J. Godin).

The reliability of mallard age and sex identification procedures using wings has been evaluated by Hopper and Funk (1970). Their conclusion was that these procedures were accurate until March 1; however, they stressed the importance of training and experience as prerequisites for accurate identification. They also noted that there seem to be innate differences among individuals in their ability to achieve high levels of accuracy. They stated, "... some individuals learn the mallard wing technique rather rapidly, while others experience difficulty and will probably never become as highly proficient...". I attempted to learn the approximate reliability of procedures for most species by testing myself using known-age wing specimens on file at the Office of Migratory Bird Management. The results of these tests, conducted under ideal conditions in the laboratory, are presented in Appendix 3. Double checking probably would have reduced the number incorrectly identified by about 33%.

NOTES ON INDIVIDUAL SPECIES

For four species (common merganser, common and Barrow's goldeneyes, and bufflehead), wing lengths differ to a degree that permits sex identification of nearly all immature birds from measurement alone. Henny *et al.* (1981) and Carney (1983) have described the use of wing length to determine the sex of buffleheads and goldeneyes. Despite some differences in measuring procedures, Anderson and Timkin (1981) and Erskine (1971) have presented similar information for common mergansers (Table 3).

In his study of the gadwall, Blohm (1977) found that most of the wing characters useful for age determination in the fall and winter were present the following spring and summer. He noted that it was quite easy to determine the age of males but more difficult to separate females into two age classes during the breeding season. He found wings of captive birds to be unreliable indicators of age.

Wishart (1981) noted that ages of male wigeon could be accurately assigned at all times of the year using the color of the middle coverts. He found it a bit more difficult to determine the ages of females and he used discriminant function analyses to identify them. However, I believe that females can be identified in the hand during the fall and winter if careful attention is paid to detail.

Table 3. Measurements of wing lengths of common mergansers derived from three sources.

Age & sex	Data source	*n*	$\bar{x}$	SD	SE	CV	-2SD	+2SD	$\bar{x}$ as % of adult male $\bar{x}$ [1]
Adult males	Anderson & Timken[2]	124	284.6	7.5	0.7	2.6	269.7	299.5	
	Erskine[3]	57	271.3	5.6	0.7	2.1	260.1	282.5	
	OMBM[4]	162	273.5	5.7	0.4	2.1	262.1	284.9	
Adult females	Anderson & Timken	43	256.8	6.1	0.9	2.4	244.6	269.0	90.2
	Erskine	55	246.7	6.9	0.9	2.8	232.9	260.5	90.9
	OMBM	202	248.7	4.9	0.3	2.0	238.9	258.5	90.9
Immature males	Anderson & Timken	39	274.3	5.2	0.8	1.9	264.0	284.6	96.3
	Erskine	75	262.7	6.9	0.8	2.6	248.9	276.5	96.8
	OMBM	301	264.2	5.8	0.3	2.2	252.6	275.8	96.5
Immature females	Anderson & Timken	35	252.2	4.9	0.8	2.0	241.7	262.7	88.6
	Erskine	99	242.5	5.9	0.6	2.4	230.7	254.3	89.4
	OMBM	322	242.1	5.3	0.3	2.1	232.3	252.7	88.5

[1] This relationship suggests that despite the differences between the means obtained by Anderson and Timken from both those of Erskine and OMBM, the various ages and sexes differ in about the same percentage within each of the three data sets.
[2] Anderson and Timken (1971).
[3] Erskine (1971).
[4] Files Office of Migratory Bird Management.

Dane (1968) examined a number of female blue-winged teal wings. He observed that on most birds that had been through a prebasic molt (i.e., adults), the greater secondary coverts had a symmetrical and acutely angled white inverted "V" marking; females with no sign of a "V" on the coverts were immatures that had not yet undergone their first prebasic molt. He also noted that several types of asymmetrical "V" markings were found on both adult and immature females and thus were unreliable indicators of age.

Duncan (1985) found that separating yearling from adult male northern pintails during the breeding season by the presence or absence of edging on the upperwing coverts was quicker, simpler, and more accurate than the discriminant function analyses. He found, however, that by spring and summer some wild-caught females had so much wear on their secondary coverts that it was impossible to accurately determine the type of markings that had been present. He was able to correctly identify the age of only 86.2% using a discriminant function analysis that excluded these markings. If secondary covert markings were present, accuracy remained at about 95%.

Weller (1957) felt that redheads of both sexes retained immature wing plumage through their first winter. Observations of wings received through the Waterfowl Parts Collection Survey indicate that this is not completely true as small numbers of both males and females replaced tertial coverts during the hunting season (Table 1).

Haramis *et al.* (1982) found that 86% of 580 immature male canvasbacks examined during December and January banding operations had replaced at least some of their tertials or tertial coverts and that the whiteness of the replacements contrasted sharply with the remainder of the wing. Of the 274 immature females they examined during the same period, 68% had replaced some or all of their tertials, tertial coverts, and several proximal greater coverts. While these replacements did not contrast as sharply as those of immature males, they were easily recognized. Haramis *et al.* (1982) concluded that examination of wing plumage was the most efficient method for determining the age of canvasbacks during large scale post-season bandings.

Wilson and Ankney (1988) examined a large number of known-age greater and lesser scaup wings and found no birds intermediate in size and only 9% that could not be identified to species by wing stripe alone. Most of these were either male lesser scaup with unusually white wings or female greater scaup with unusually dark wings. Very few wings with intermediate wing stripes could not be explained by sexual differences. My data indicate that once the sexes have been separated nearly all can be correctly identified to species by wing length.

Anderson and Warner (1969) examined the carcasses of a large number of lesser scaup and ring-necked ducks that had been killed by winter oil spills in Minnesota. Among other information, they included a summary of wing measurements as reported by six other studies. Differences among these illustrated the lack of a standardized measuring procedure. Anderson and Warner's (1969) measurements of ring-necked ducks (Table 4) are similar to but 5-8mm longer than those presented in Appendix 2.

Table 4. Measurements of wing lengths of ring-necked ducks derived from two sources.

Age & sex	Data source	n	$\bar{x}$	SD	SE	CV	-2SD	+2SD	$\bar{x}$ as % of adult male $\bar{x}$ [1]
Adult Males	Anderson & Warner[2]	94	203	4.1	0.4	2.0	194.8	211.2	
	Takekawa & Martin[3]	80	198	3.5	0.4	1.8	190.8	204.8	
Adult Females	Anderson & Warner	72	194	3.6	0.3	1.9	186.8	201.2	95.5
	Takekawa & Martin	113	189	3.4	0.3	1.8	182.2	195.8	95.6
Immature Males	Anderson & Warner	60	202	4.3	0.6	2.1	193.4	210.6	99.5
	Takekawa & Martin	118	194	3.9	0.4	2.0	186.3	201.9	98.1
Immature Females	Anderson & Warner	51	191	3.7	0.5	1.9	183.6	198.4	94.1
	Takekawa & Martin	155	186	3.7	0.2	2.0	178.3	193.1	93.9

[1] This relationship suggests that despite the differences between the means obtained by Anderson and Warner and those obtained by Takekawa and Martin, the various ages and sexes differ by about the same percentages within both data sets.
[2] Anderson and Warner (1969).
[3] Wings collected at Loxahatchee NWR.

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Appendix 1. Scientific names of North American ducks and brant.

Common name	Scientific name
Mallard	*Anas platyrhynchos*
American black duck	*Anas rubripes*
Mottled duck	*Anas fulvigula*
Gadwall	*Anas strepera*
American wigeon	*Anas americana*
Green-winged teal	*Anas crecca*
Blue-winged teal	*Anas discors*
Cinnamon teal	*Anas cyanoptera*
Northern shoveler	*Anas clypeata*
Northern pintail	*Anas acuta*
Wood duck	*Aix sponsa*
Redhead	*Aythya americana*
Canvasback	*Aythya valisineria*
Greater scaup	*Aythya marila*
Lesser scaup	*Aythya affinis*
Ring-necked duck	*Aythya collaris*
Common goldeneye	*Bucephala clangula*
Barrow's goldeneye	*Bucephala islandica*
Bufflehead	*Bucephala albeola*
Oldsquaw	*Clangula hyemalis*
Harlequin duck	*Histrionicus histrionicus*
Steller's eider	*Polysticta stelleri*
Common eider	*Somateria mollissima*
King eider	*Somateria spectabilis*
Black scoter	*Melanitta nigra*
White-winged scoter	*Melanitta fusca*
Surf scoter	*Melanitta perspicillata*
Ruddy duck	*Oxyura jamaicensis*
Common merganser	*Mergus merganser*
Red-breasted merganser	*Mergus serrator*
Hooded merganser	*Lophodytes cucullatus*
Black-bellied whistling duck	*Dendrocygna autumnalis*
Fulvous whistling duck	*Dendrocygna bicolor*
Atlantic brant	*Branta bernicla hrota*
Black brant	*Branta bernicla nigricans*

Appendix 2. Notch-length wing measurements (in mm) of ducks whose age and sex was determined by cloacal and internal examinations, or if at wingbees, by plumage.

Species	Age/Sex	*n*	$\bar{x}$	SD	SE	CV
Mallard	AM	1392	288.5	7.0	0.2	2.4
	AF	590	270.3	7.1	0.3	2.6
Source:	IM	996	279.1	7.9	0.3	2.8
Wingbees	IF	750	264.6	7.2	0.3	2.7
Black duck	AM	195	290.6	6.0	0.4	2.1
	AF	113	270.9	6.2	0.6	2.3
Source:	IM	454	281.5	5.5	0.3	2.0
V.D. Stotts	IF	304	264.2	4.9	0.3	1.9
Mottled duck	AM	26	262.0	7.1	1.4	2.7
	AF	27	248.5	6.5	1.3	2.6
Source:	IM	56	258.1	6.9	0.9	2.7
C. Stutzenbaker	IF	42	244.4	5.7	0.9	2.3
Gadwall	AM	419	271.4	6.5	0.3	2.0
	AF	179	255.2	5.7	0.5	2.7
Source:	IM	479	263.2	6.8	0.3	2.3
R. Blohm	IF	318	247.4	5.6	0.3	2.4
American wigeon	AM	303	265.7	6.3	0.4	2.4
Source:	AF	135	247.9	6.8	0.6	2.7
Wingbees	IM	414	256.8	6.8	0.3	2.6
1965-70	IF	365	244.0	6.9	0.4	2.8
Green-winged teal	AM	86	185.0	4.7	0.5	2.5
Source	AF	51	177.2	4.0	0.6	2.3
Known age	IM	66	182.3	3.8	0.5	2.1
collection	IF	71	174.2	4.1	0.5	2.4
Blue-winged teal	AM	50	187.3	4.7	0.7	2.5
Source	AF	31	180.2	3.7	0.7	2.1
Known age	IM	49	185.0	4.4	0.6	2.4
collection	IF	59	178.3	4.3	0.6	2.4
Cinnamon teal	AM	42	192.1	4.6	0.7	2.4
Source:	AF	40	183.5	4.3	0.7	2.3
Known age	IM	34	189.1	4.3	0.7	2.3
collection	IF	38	180.2	4.1	0.7	2.3
Northern shoveler	AM	114	243.8	6.5	0.6	2.7
Source:	AF	58	227.5	5.3	0.7	2.3
Wingbee 1969	IM	72	235.1	5.3	0.6	2.3
	IF	78	223.0	5.1	0.6	2.3

Appendix 2. Notch-length wing measurements (in mm) of ducks whose age and sex was determined by cloacal and internal examinations or, if at wingbees, by plumage -- continued.

Species	Age/Sex	*n*	$\bar{x}$	SD	SE	CV
Northern pintail	AM	68	274.2	6.9	0.8	2.5
Source:	AF	30	253.4	7.0	1.3	2.8
Wingbees	IM	80	264.7	7.0	0.8	2.6
1962-64	IF	40	247.3	5.3	0.8	2.1
Wood duck	AM	37	225.4	6.2	1.0	2.8
Source:	AF	54	217.8	6.0	0.8	2.8
Known age	IM	50	219.3	5.8	0.8	2.6
collection	IF	60	212.5	5.6	0.7	2.6
Redhead	AM	295	233.5	5.3	0.3	2.3
Source:	AF	219	224.5	5.1	0.3	2.3
Wingbees	IM	680	227.4	5.8	0.2	2.5
1965.70	IF	559	219.6	5.6	0.2	2.6
Canvasback	AM	228	238.3	5.3	0.4	2.2
Source:	AF	176	228.9	5.0	0.4	2.2
Wingbees	IM	396	232.3	5.7	0.3	2.4
1965.70	IF	299	224.3	5.3	0.3	2.4
Greater scaup	AM	336	222.3	4.6	0.3	2.1
Source:	AF	282	214.5	4.0	0.2	1.9
Wingbees	IM	328	217.5	4.9	0.3	2.3
1965-70	IF	316	211.5	4.4	0.2	2.1
Lesser scaup	AM	105	203.7	4.5	0.4	2.2
Source:	AF	72	196.9	5.0	0.6	2.5
Wingbee	IM	296	199.4	5.4	0.3	2.7
1966	1F	218	194.6	5.2	0.4	2.6
Ring-necked duck	AM	80	197.8	3.5	0.4	1.8
Source:	AF	113	189.0	3.4	0.3	1.8
J. Takekawa	IM	118	194.1	3.9	0.4	2.0
T. Martin	IF	155	185.7	3.7	0.2	2.0
Common goldeneye	AM	410	228.5	4.8	0.2	2.1
Source:	AF	265	208.1	5.0	0.3	2.4
Wingbees	IM	376	221.4	6.1	0.3	2.8
1978-87	IF	427	202.2	4.5	0.2	2.2
Barrow's goldeneye	AM	108	236.6	3.9	0.4	1.6
Source:	AF	68	213.7	3.3	0.4	1.5
Wingbees	IM	201	226.5	4.0	0.3	1.8
1978-87	IF	174	206.4	4.7	0.4	2.2

Appendix 2. Notch-length wing measurements (in mm) of ducks whose age and sex was determined by cloacal and internal examinations, or if at wingbees, by plumage -- continued.

Species	Age/Sex	*n*	$\bar{x}$	SD	SE	CV
Bufflehead	AM	53	171.6	3.3	0.5	1.9
Source:	AF	28	156.6	3.5	0.7	2.2
C. Henney *et. al*	IM	59	166.8	3.7	0.5	2.2
	IF	64	152.7	3.2	0.4	2.1
Oldsquaw	AM	24	221.0	6.1	1.3	2.8
Source:	AF	22	210.3	6.1	1.3	2.9
Known age	IM	15	208.0	8.3	2.2	4.0
collection	IF	12	198.7	4.8	1.4	2.4
Common eider	AM	36	288.8	7.6	1.3	2.6
Source:	AF	39	282.4	5.7	0.9	2.0
Known age	IM	27	275.6	7.3	1.4	2.6
collection	IF	30	267.1	7.2	1.3	2.7
Black scoter	AM	69	228.8	4.6	0.6	2.0
Source:	AF	30	220.4	3.8	0.7	1.7
Known age	IM	34	222.3	4.0	0.7	1.8
collection	IF	30	214.5	4.5	0.8	2.1
White-winged scoter	AM	85	282.8	5.9	0.6	2.1
Source:	AF	32	265.7	5.4	1.0	2.0
Known age	IM	41	274.3	6.1	1.0	2.2
collection	IF	39	260.4	6.7	1.1	2.6
Surf scoter	AM	46	240.0	7.2	1.1	3.0
Source:	AF	40	226.8	5.5	0.9	2.4
Known age	IM	40	232.4	7.0	1.1	3.0
collection	IF	55	225.7	6.3	0.9	2.8
Common merganser	AM	162	273.5	5.7	0.4	2.1
Source:	AF	202	248.7	4.9	0.3	2.0
Adults: Wingbees	IM	28	260.9	7.4	1.4	2.8
Imm.: Known age collection	IF	42	240.4	5.6	0.9	2.3
Red-breasted merganser	AM	247	244.6	5.3	0.3	2.2
Source:	AF	195	223.1	4.8	0.3	2.2
Adults: Wingbees	IM	15	230.5	6.6	0.7	2.9
Imm.: Known age collection	IF	7	214.0	3.3	1.3	1.5

Appendix 2. Notch-length wing measurements (in mm) of ducks whose age and sex was determined by cloacal and internal examinations or, if at wingbees, by plumage -- continued.

Species	Age/Sex	*n*	x̄	SD	SE	CV
Hooded merganser	AM	47	196.3	4.0	0.6	2.0
Source:	AF	41	187.2	4.4	0.7	2.3
Adults: Wingbees	IM	20	187.6	3.5	0.8	1.9
Imm.: Known age collection	IF	13	181.8	4.1	1.1	2.3
Ruddy duck	AM	26	146.2	2.3	0.5	1.6
Source:	AF	13	140.4	2.2	0.6	1.6
Known age	IM	24	144.5	3.2	0.7	2.2
collection	IF	28	141.6	3.0	0.6	2.1
Fulvous whist. duck	AU	32	214.6	4.0	0.7	1.9
Source: Wingbees 1978-87, 1989	IU	54	209.4	5.5	0.7	2.6
Atlantic brant	AU	46	330.4	11.0	1.7	3.3
Source:						
Wingbees 1978-87	IU	497	310.0	10.4	0.5	3.3
Black brant	AU	46	335.2	11.2	1.7	3.3
Source:						
Wingbees 1978-87	IU	26	323.1	9.4	1.8	2.9
Aleutian green-	AM	3	188.3			
winged teal	AF	2	184.5			
(All from Adak, AK)	IM	16	190.9	5.4	1.4	2.8
	IF	16	186.6	4.0	1.0	2.1

Appendix 3. Comparison of sex and age data from independent cloacal or internal examinations with data from wing examinations of ducks.

			Mallard[1]		Black duck[2]		Gadwall[3]		American wigeon[4]	
Sex	Age	Exam-ination	Number recorded	Percent of total	Number recorded	Percent of total	Number recorded	Percent of total	Number recorded	Percent of total
Male	Adult	Cloacal	399	33.4	68	16.0	88	29.3	161	29.6
		Wing[5]	404	33.8	74	17.4	89	29.7	170	31.3
	Immature	Cloacal	253	21.2	164	38.5	93	31.0	141	25.9
		Wing	243	20.4	162	38.0	92	30.7	133	24.4
Female	Adult	Cloacal	329	27.6	44	10.3	88	29.3	74	13.6
		Wing	328	27.5	41	9.6	89	29.7	75	13.8
	Immature	Cloacal	213	17.8	150	35.2	31	10.3	168	30.9
		Wing	219	18.3	149	35.0	30	10.0	166	30.5
	Total birds examined		1194		426		300		544	

[1]On 60 birds (5.0%), wing and cloacal determinations differed. Of these, 24 wing determinations probably would have been changed by double-checking. This would result in a final agreement of 97.2%.

[2]On 19 birds (4.5%), wing and cloacal examinations differed. Of these, 2 wing determinations undoubtedly would have been changed had they been double-checked. An additional 4 discrepancies appeared to be due to cloacal examination errors. If these 6 wings are considered as correct, final agreement would be 97 percent.

[3]On 12 birds, (4.0%), wing and cloacal examinations differed. Of these, 2 wing determinations undoubtedly would have been changed had they been double-checked. One other appeared to have represented an incorrect cloacal examination. If these 3 wings are considered as correct, final agreement would be 97.0 percent.

[4]On 29 birds (5.3%), wing and cloacal determinations differed. Of these 14 wing determinations probably would have been changed by double-checking. This would have resulted in a final agreement of 96.3%.

[5]Numbers and percentages derived from wing examinations conceal compensating differences from cloacal examinations.

Appendix 3. Comparison of sex and age data from independent cloacal or internal examinations with data from wing examinations of ducks -- continued.

Sex	Age	Examination	Green-winged teal[1] Number recorded	Green-winged teal[1] Percent of Total	Blue-winged teal[2] Number Recorded	Blue-winged teal[2] Percent of total	Northern shoveler[3] Number recorded	Northern shoveler[3] Percent of total	Northern pintail[4] Number recorded	Northern pintail[4] Percent of total
Male	Adult	Cloacal	130	33.1	76	27.1	50	22.3	157	32.4
		Wing[5]	137	32.9	78	27.9	53	23.7	157	32.4
	Immature	Cloacal	105	25.2	76	27.1	71	31.7	87	18.0
		Wing	92	22.1	76	27.1	64	28.6	86	17.8
Female	Adult	Cloacal	60	14.4	70	25.3	41	13.6	123	25.4
		Wing	62	14.9	71	25.3	40	13.8	124	25.6
	Immature	Cloacal	121	29.1	58	20.7	62	30.9	117	24.2
		Wing	125	30.0	55	19.6	67	30.5	117	24.2
Total birds examined			416		280		224		448	

[1]On 51 birds (12.3%), wing and cloacal determinations differed. Of these, 15 wing determinations probably would have been changed by double-checking. This would result in a final agreement of 91.3%.

[2]On 36 birds (12.8%), wing and cloacal examinations differed. Of these, 1 would have been changed had wings been double-checked. An additional 6 probably were cloacal examination errors. If these 10 wings are considered as correct, final agreement would be 90.7 percent.

[3]On 20 birds, (8.9%), wing and cloacal examinations differed. Of these, 5 wing determinations probably would have been changed by double-checking. This would result in a final agreement of 93.3%.

[4]On 15 birds (3.2%), wing and cloacal determinations differed. Of these, 9 wing determinations probably would have been changed by double-checking. This would have resulted in a final agreement of 98.7%.

[5]Numbers and percentages derived from wing examination conceal compensating differences from cloacal examination.

Appendix 3. Comparison of sex and age data from independent cloacal or internal examinations with data from wing examinations of ducks -- continued.

			Wood duck[1]		Redhead[2]		Canvasback[3]		Greater scaup[4]	
Sex	Age	Examination	Number recorded	Percent of total	Number recorded	Percent of total	Number recorded	Percent of total	Number recorded	Percent of total
Male	Adult	Cloacal	43	9.5	35	38.5	20	18.7	100	25.2
		Wing[5]	46	10.2	34	37.4	20	18.7	100	25.2
	Immature	Cloacal	180	39.8	17	18.7	24	22.4	91	22.9
		Wing	176	38.9	20	22.0	25	23.4	92	23.2
Female	Adult	Cloacal	58	12.8	23	25.3	19	17.8	91	22.9
		Wing	64	14.2	23	25.3	16	15.0	92	23.2
	Immature	Cloacal	171	37.8	16	17.6	44	41.1	115	29.0
		Wing	166	36.7	14	15.4	46	43.0	113	28.5
	Total birds examined		452		91		107		397	

[1]On 36 birds (8.0%), wing and cloacal determinations differed. Of these, 3 wing determinations undoubtedly would have been changed had they been double-checked. If these 3 wing determinations are allowed as correct, the final agreement would be 92.7 percent.

[2]On 6 birds (6.6%), wing and cloacal examinations differed. Of these, 3 wing determinations undoubtedly would have been changed had they been double-checked. This would have resulted in a final agreement of 96.7%.

[3]On 4 birds, (3.7%), wing and cloacal examinations differed. All of these appear to have been due to cloacal examination errors. If so, wing determination can be considered as 100 percent accurate.

[4]On 29 birds (7.3%), wing and cloacal determinations differed. Of these, 15 wing determinations probably would have been changed by double-checking. This would result in a final agreement of 95.2%.

[5]Numbers and percentages derived from wing examinations conceal compensating differences from cloacal examinations.

Appendix 3. Comparison of sex and age data from independent cloacal or internal examinations with data from wing examinations of ducks -- continued.

Sex	Age	Examination	Lesser scaup[1] Number Recorded	Lesser scaup[1] Percent of Total	Ring-necked duck[2] Number recorded	Ring-necked duck[2] Percent of total	Common goldeneye[3] Number recorded	Common goldeneye[3] Percent of total	Barrow's goldeneye[4] Number recorded	Barrow's goldeneye[4] Percent of total
Male	Adult	Cloacal	145	28.0	42	24.9	43(+13)	33.7	9	23.1
		Wing[5]	145	28.0	41	24.3	56	33.7	9	23.1
	Immature	Cloacal	148	28.5	50	29.6	47(-13)	20.4	12	30.8
		Wing	146	28.1	43	25.4	32	19.4	13	33.3
Female	Adult	Cloacal	125	24.1	25	14.8	22(+8)	18.1	5	12.8
		Wing	122	23.5	27	16.0	28	16.8	5	12.8
	Immature	Cloacal	100	19.4	52	30.8	54(-8)	27.7	13	33.3
		Wing	105	20.2	58	34.3	50	30.1	12	30.8
Total birds examined			518		169		166		39	

[1]On 26 birds (5.0%), wing and cloacal determinations differed. Of these, 18 wing determinations probably would have been changed by double-checking. This would result in a final agreement of 98.5%.

[2]On 22 birds (13.0%), wing and cloacal examinations differed. Of these, 4 wing determinations undoubtedly would have been changed had they been double-checked. Three other discrepancies appear to have been due to cloacal examination errors. If these 7 wings are considered as correct, final agreement would be 91.1%.

[3]On 27 birds, (16.3%), wing and cloacal examinations differed. Of these, 21 were probably subadults. If these are regarded as "non-breeding adults", the wing determination can be considered as correct. In addition, two wing determinations probably would have been changed after double-checking. This would result in a final accuracy of 97.6%.

[4]Wing and cloacal determinations agreed on 97.4 percent of the birds examined. Subadult birds would have to be considered as they were in the common goldeneye evaluation.

[5]Numbers and percentages derived from wing examinations conceal compensatory differences from cloacal examinations.

Appendix 3. Comparison of sex and age data from independent cloacal or internal examinations with data from wing examinations of ducks -- continued.

Sex	Age	Examination	Bufflehead[1]		Common merganser[2]		Red-br. merganser[3]		W.-winged scoter[4]	
			Number recorded	Percent of total	Number recorded	Percent of total	Number recorded	Percent of total	Number recorded	Percent of total
Male	Adult	Cloacal	23	19.8	7(+20)	10.0	27(+1)	50.0	83(+30)	42.3
		Wing[5]	23	19.8	9	10.0	28	50.0	113	42.3
	Immature	Cloacal	33	28.4	31(-2)	32.2	14(-1)	23.2	80(-30)	18.7
		Wing	34	29.1	29	32.2	13	25.0	51	19.1
Female	Adult	Cloacal	15	12.9	8(+4)	13.3	5	10.7	29(+24)	19.9
		Wing	12	10.3	11	12.2	5	8.9	50	18.7
	Immature	Cloacal	45	38.8	44(-4)	44.4	9	16.1	75(-24)	19.1
		Wing	47	40.5	41	45.5	9	16.1	53	19.9
	Total birds examined		116		90		56		267	

[1]On 4 birds (3.4%), wing and cloacal determinations differed. Thus, final accuracy was 96.6%.

[2]On 6 birds (6.7%), wing and cloacal examinations differed. Of these, 1 would have been changed had wings been double checked. An additional 5 appeared to be obvious subadults. If these 6 wings are considered as being correct, final agreement would be 100 percent.

[3]On 3 birds (5.4%), wing and cloacal examinations differed. Of these, 1 would have been changed had wings been double checked. An additional 2 were obvious subadults. If these three wings are considered to be correct, final agreement is 100 percent.

[4]On 58 birds (21.7%), wing and cloacal determinations differed. Of these, 54 were probably subadults. If these are regarded as as "non-breeding adults", the wing determinations can be considered as correct. The other 4 birds almost certainly represent differences due to recording errors. If this is so, final accuracy is 100 percent.

[5]Numbers and percentages derived from wing examinations conceal compensatory differences from cloacal examinations.

Appendix 3. Comparison of sex and age data from independent cloacal or internal examinations with data from wing examinations of ducks -- continued.

Sex/Age	Examination	Oldsquaw[1]		Common scoter[2]		Surf scoter[3]		Common eider[4]		Hooded merganser[5]	
		Number recorded	Percent of total	Number recorded	Percent of total	Number recorded	Percent of total	Number recorded	Percent of total	Number recorded	Percent of total
Male/Adult	Cloacal	25	30.1	54(+17)	47.7	31(+25)	25.7	29(+9)	27.9	32	36.8
	Wing[6]	26	31.3	71	47.7	57	26.1	38	27.9	32	36.8
Female/Adult	Cloacal	25	30.1	17(+12)	19.5	20(+26)	21.1	34(+6)	29.4	22	25.3
	Wing	23	27.7	29	19.5	45	20.6	40	29.4	22	25.3
Male & female/Imm	Cloacal	33	39.8	78(-29)	32.9	167(-51)	53.2	73(-15)	42.6	33	37.9
	Wing	34	41.0	49	32.9	116	53.2	58	42.6	33	37.9
Total birds examined		83		149		218		136		87	

[1]On 2 birds (2.4%), wing and cloacal determinations differed. Thus, final accuracy was 97.6 percent.

[2]On 29 birds (19.5%), wing and cloacal determinations differed. All of these were probably subadults. If these are regarded as "non-breeding adults", the wing determinations can be considered as correct. This would result in a final accuracy of 100 percent.

[3]On 52 birds (23.9%), wing and cloacal determinations differed. All but 1 were probably subadults. If these are regarded as "non-breeding adults", the wing determination can be considered as correct. This would result in a final accuracy of 99.5 percent.

[4]On 15 birds (11.0%), wing and cloacal determinations differed. All of these were probably subadults. If these are regarded as "non-breeding adults", the wing determinations can be considered as 100 percent accurate.

[5]Wing and cloacal determinations agreed on 100 percent of the birds examined.

[6]Numbers and percentages derived from wing examinations conceal compensatory differences from cloacal examinations.