SEX AND AGE CRITERIA FOR WISCONSIN RUFFED GROUSE

TECHNICAL WILDLIFE BULLETIN NUMBER 9

Game Management Division
WISCONSIN CONSERVATION DEPARTMENT
Madison 1, Wisconsin
1954

SEX AND AGE CRITERIA FOR WISCONSIN RUFFED GROUSE

by

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Pittman–Robertson Project 13-R

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ACKNOWLEDGMENTS

We have been helped by a great many persons in these studies. Many grouse specimens or measurements were supplied by personnel of the wildlife research section of the Wisconsin Conservation Department, especially F. N. Hamerstrom, Jr. and his assistants; by faculty and students of the University of Wisconsin Department of Wildlife Management; and by Daniel Q. Thompson, who provided most of the records for the 1948 hunting season. We are especially indebted to the hundreds of hunters who patiently allowed us and other checking crews to dismember their grouse kills in the interests of research.

We wish further to thank Donald R. Thompson of Wisconsin Pittman–Robertson project 25–R for statistical analyses of our data, and Cyril Kabat and Robert S. Dorney for advice during preparation of this report.

The authors have had varying degrees of participation in the field work leading up to this report and in preparation of it. Halazon (assisted by Bruce P. Stollberg) gathered the information for the 1948 pre-hunting season period as part of the 1948 "grouse clinic", and a portion of the hunting season data for the same year. Wendt collected most of the data for the pre-hunting and hunting seasons of 1949 through 1951. Hale was project leader in 1948 and 1949, and continued to supervise these studies in 1950 and 1951. He also had the major responsibility in analyzing the collected information and in writing this report. Halazon is now with the Department of Zoology at Washington State College.

TABLE OF CONTENTS

INTRODUCTION

If game management is to be evaluated, it must have yardsticks by which its success can be measured. One of these yardsticks should concern productivity, defined by Leopold (1933) as the rate at which breeding stock produces more breeding stock or a removable crop. An important step in determining the productivity of any game species is learning how to identify the sex and age of individual animals. Without such criteria, productivity analysis is next to impossible.

For example, consider the ruffed grouse (*Bonasa umbellus*), the subject of this study. There are no reliable methods of telling the sex of ruffed grouse in the field, with the obvious exceptions that drumming birds may be safely called cocks and that grouse sitting on eggs are hens. Similar difficulties are met in differentiating between adults and juveniles in the field. Body size and plumage differences separate these two age groups until young birds are about 12 weeks old, after which time the young are practically indistinguishable from adults.

This situation poses a problem, since accurate sexing and aging requires birds in the hand. Grouse in hand are usually available in quantity only through examination of hunters' kills in fall, so sex and age information must be compiled during hunting seasons.

What can be learned about accurate sexing and aging techniques from ruffed grouse shot by hunters? Finding the answer was an important part of our work with Pittman–Robertson project 13–R of the Wisconsin Conservation Department between 1948 and 1951. None of the criteria we have tried to perfect are original with us; however, we felt that further definition of their value for Wisconsin grouse was in order, since the literature on these criteria (to be discussed shortly) does not always offer clear-cut methods.

METHODS

All of the grouse we examined were taken during the period July 15 to November 15 in each year from 1948 through 1951. Most of them were taken after September 15. All the major grouse counties in the northern and central areas of the state are represented. We can discern no conclusive differences in the various measurements between years; for this reason we have combined the 4 years' data in all cases.

Grouse were obtained by two general methods. The first was a pre-hunting-season collection made primarily to sample broods and adults for pathological studies between July 15 and the opening of the hunting season. Sex and age data were an incidental but important part of this collection. The second method concerned examination of grouse shot by hunters during the open season. All data were gathered by ourselves through personal hunting and contacts with other hunters, or by qualified persons both in and out of the Wisconsin Conservation Department whom we asked to assist us. The cooperation received from all parties concerned, and especially from hunters met in the field, was outstanding.

Whenever possible, five measurements were recorded for each grouse handled: Internal sex by dissecting out the gonads, depth of the Bursa of Fabricius in millimeters by probing from the cloaca, length in centimeters of a plucked central tail feather, condition of the subterminal black band on the central tail feather, and contour and molt stage of the primary wing feathers. The numbers of these measurements made each year are recorded in Table 1.

Table 1

Source of Data for Sex and Age Criteria Studies

	Number of Grouse Measured for:		
Collection Period	*Internal Sex and Tail Length*	*Internal Sex and Tail Band*	*Bursa Depth and Wing Contour*
1948 Pre-hunting Season	92	56	74
1948 Hunting Season	15	62	69
1949 Pre-hunting Season	26	49	79
1949 Hunting Season	82	85	81
1950 Pre-hunting Season	14	41	86
1950 Hunting Season	192	248	266
1951 Pre-hunting Season	6	29	46
1951 Hunting Season	149	198	105
Total Birds Measured	576	768	806

It should be emphasized that our findings apply primarily to the late summer and fall seasons. We can make no extensive claims for their validity in the period from mid-November to the following July. However, we see no reason why the diagnostic plumage characters for fully-feathered birds cannot be applied at any time of the year.

SEX IDENTIFICATION

The one completely reliable method of identifying the sex of ruffed grouse at any season is an examination of the internal sex organs. The two male testes are dark (sometimes white), bean-shaped, smooth-surfaced bodies about 1/8 inch long lying one on each side of the backbone against the forward portion of the kidneys. The female normally has but one ovary. It lies on the left side of the backbone in the same position as the left testis. The ovary in summer is a small, yellowish body about 1/4 inch long with a pebbled surface and a shape somewhat resembling a bunch of grapes. Ovaries of adult birds in fall are usually larger and have a more irregular surface than ovaries in hens of the year. The reproductive organs in both sexes become greatly enlarged during the breeding season.

However, internal sex determinations are seldom possible when large samples are needed, so reliance must be placed on external sex characters in the interest of speed and economy. Bump, Darrow, Edminster and Crissey (1947) summarized several characters that often but not always indicate sex. These include the general size and appearance of the birds, shape of the head and neck, size or number of the ruff and rump feathers, leg length, scapular and tail covert colors, and the length and terminal band pattern of tail feathers.

Most of our efforts have been toward defining sex differences in tail feathers, since tails seem to offer the most clear-cut sex differences and usually can be obtained in large numbers from hunters.

We have been unable to find consistent and easily-recognized sex criteria in any external aspects of Wisconsin ruffed grouse except the tail, but the numbers of birds we have examined in this regard have been small.

A. Tail Length

Bump *et al.* (1947) and Ammann (1948) used the length of fully-grown central tail feathers to separate the sexes of New York and Michigan grouse, respectively. They measured length from the tip of the feather to the point where it entered the skin of the tail. Both Bump and Ammann stated that overlap in measurements prevented classification of sex in a portion of their birds. Howe (1951) made additional studies of this method in Maine, as did Grange (1948) in Wisconsin, and Uhlig (1953) tested plucked feather length in West Virginia. The conclusions of Bump, Ammann, Grange, and Howe about what length to use as a point of separation for the sexes are

conflicting (Table 2). Uhlig's data are similarly different than our Wisconsin measurements. Regional differences in ruffed grouse feather development apparently occur, but their causes are not clear.

Table 2

Ruffed Grouse Sex Identification by Length of Central Tail Feather

*State**	*No. Birds Examined*	*Type of Tail Feather*	*Minimum Male Length*	*Maximum Female Length*
New York	?	Unplucked	6¼"	5¾"
Maine	1,702	Unplucked	5⅝"	5½"
Wisconsin A	19	Unplucked	Adult—5⅜"	Adult—Less than 5⅜"
Michigan	2,419	Unplucked	Juvenile—5¾"	Juvenile—5¼"
			Adult—5½"	Adult—5⅜"
West Virginia	?	Plucked	6⅜"	6⅛"
Wisconsin B	576	Plucked	More than 5⅞"	5⅞"

*References: New York—Bump *et al.* (1947); Maine—Howe (1951); Michigan—Ammann (1948); West Virginia—Uhlig (1953); Wisconsin A—Grange (1948); Wisconsin B—This study. West Virginia lengths are converted from centimeters (male—16.1 cm.; female—15.5 cm.).

At the inception of our Wisconsin studies in September, 1948, only the data of Bump *et al.* (1947) were available to us. We found that measuring tail feather length from the point of insertion in the tail was not too satisfactory. A personal error was introduced because the point of insertion was not always accurately found. Tests showed that tail lengths taken some time after a bird was killed were longer than tail measurements of the same birds when freshly killed, due to shrinkage of the tail tissues accompanying dessication. It also appeared that closer length limits could be set for Wisconsin grouse than were established by the New York criteria.

Therefore Halazon in 1948 began to measure the length of plucked, fully-grown central tail feathers. Plucked feathers offer distinct endpoints for length measurements and eliminate variations caused by tissue shrinkage. The tail lengths of male and female grouse in 1948 seemed to be quite sharply separated at 15.0 centimeters, so an arbitrary classification was established. Birds with plucked central tail feathers 15.0 centimeters or longer (more than 5⅞ inches) in length were called male; birds with plucked central tail feathers 14.9 centimeters (5⅞ inches) or less in length were called female (Figure 1).

In the period 1949 through 1951 this length criterion was checked against internal sex in 576 Wisconsin ruffed grouse and found to be entirely satisfactory. Results of these checks are given in Table 3. The frequency distributions of tail lengths for both sexes are shown in Table 4.

Table 3

Sex Identification by Tail Length and Internal Organs of 576 Ruffed Grouse

	Sex by Tail Length		*Sex by Internal Organs*	
	No. Birds	*Per Cent*	*No. Birds*	*Per Cent*
Male	257	44.6	259	45.0
Female	319	55.4	317	55.0
Total	576		576	

Table 4

Tail Length Frequencies of Internally-sexed Ruffed Grouse

Length Range in Centimeters	*Total Female*	*Total Male*	*Female*		*Male*	
			Juvenile	*Adult*	*Juvenile*	*Adult*
12.0-12.4	6	-----	5	1	-----	----
12.5-12.9	21	-----	18	3	-----	----
13.0-13.4	105	-----	90	15	-----	----
13.5-13.9	101	-----	71	30	-----	----
14.0-14.4	64	-----	37	27	-----	----
14.5-14.9	18	4	12	6	4	----
15.0-15.4	2	35	1	1	35	----
15.5-15.9	-----	53	-----	----	51	2
16.0-16.4	-----	61	-----	----	50	11
16.5-16.9	-----	51	-----	----	20	31
17.0-17.4	-----	26	-----	----	11	15
17.5-17.9	-----	21	-----	----	4	17
18.0-18.4	-----	6	-----	----	-----	6
18.5-18.9	-----	2	-----	----	-----	2
Total Birds	317	259	234	83	175	84
Average Tail Length	13.6	16.4	13.5	13.9	16.0	17.1

Only 6 of the 576 birds examined did not have tail lengths agreeing with the 15.0 centimeter separation point for the sexes. These included 4 juvenile males with tail lengths of 14.5, 14.7, 14.8 and 14.8 centimeters and one juvenile female and one adult female, each with tail lengths of 15.0 centimeters.

The difference between sex ratios in our sample indicated by internal sex and by tail length (Table 3) are very slight and have no statistical or apparent biological significance. Based on Table 4, the mathematical probability of identifying all males correctly by tail length is 99.2 per cent; of identifying all females by tail length is 98.8 per cent. The probability of properly identifying both sexes by tail length is 99.7 per cent. These high percentages indicate the accuracy of plucked central tail feather length as a sex criterion for Wisconsin ruffed grouse.

Table 4 includes a frequency distribution of tail lengths for adult and juvenile males and females. Age determinations were based on the depth of the Bursa of Fabricius, a method discussed elsewhere in this report. No significant statistical difference exists between the tail lengths of juvenile and adult females, but there is a highly significant difference between juvenile and adult male tail lengths at the 99 per cent level of confidence.

B. Tail Band Pattern

It is a widely-accepted notion among hunters that the condition of the black (occasionally dark brown) sub-terminal band on the central tail feathers can be used to tell the sex of ruffed grouse. If this band is broad and solid across the two central feathers, the bird is said to be a male. If this dark band is interrupted or lacking on the central feathers, the bird is said to be a female. A third situation is not always recognized by the hunter. If the dark band on the central feathers has a mottled pattern intermediate between the complete and incomplete markings, the bird may be of either sex (Figure 1).

Bump *et al.* (1947) in New York and Ammann (1948) in Michigan investigated this criterion and concluded that it is not reliable. Their findings indicated that too many males have incomplete or female-type bands and that the intermediate tails are too numerous to make this a consistent sex indicator. We have checked tail band patterns of 768 internally-sexed Wisconsin ruffed grouse. The results (Table 5) indicate somewhat different conclusions than those of Bump *et al.* and of Ammann.

Table 5

Sex Identification by Tail Band Pattern and Internal Organs

Sex by Tail Band	*Internal Sex*		*Total Birds*	*Per Cent of Tail Band*
	Male	*Female*		
Complete: Male	268	13	281	42.9
Incomplete: Female	21	353	374	57.1
Intermediate: Both Sexes	76	37	113	
Total Birds	365	403	768	
Per Cent of Internal Sex	47.5	52.5		

If samples of several hundred birds are available, classifying all birds with complete tail bands as males, classifying all birds with incomplete tail bands as female, and ignoring all birds with intermediate tail bands, will give a reasonably accurate sex ratio. The differ-

ence between the sex ratio obtained in this manner and the internal sex ratio of our sample (Table 5) is significant only at the 90 to 95 per cent level when analyzed by the Chi-square test for goodness of fit. However, this difference is not great and in our opinion does not rule out the tail-band sex criterion as a usable technique.

As previously mentioned, the acceptability of this technique is valid only when large samples are to be used. Accuracy is not possible with small samples, since about 15 per cent of all tails are of the doubtful intermediate type. Sample size may be increased by adding the intermediate tails to the complete and incomplete band segments in the ratio of two males to one female, as the internally-sexed intermediates appear in our sample (Table 5). We wish to emphasize, however, that this procedure has not been fully tested.

Based on Table 5, all birds with complete tail band patterns can be called males with a 95.4 per cent mathematical probability of being right. Birds with incomplete tail bands can be called females with a 94.4 per cent probability of being right. The probability of correctly identifying both sexes by complete and incomplete tail band patterns only is 98.8 per cent. Although these percentages are not quite as high as those found for the tail length criterion, they attest the relative accuracy of tail band pattern as a sex indicator for large samples.

C. Other Tail Feather Characters

Three additional aspects of central tail feathers may be helpful at times in determining sex. We have not studied any of them objectively, but they seem to have some merit. By themselves they are probably worthless, but when considered together or with other sex-identifying characters they can help to classify the sex of doubtful specimens.

Size of Feather Shaft. The shaft of a male central tail feather is usually broader and heavier in that portion not bearing the web and for a greater part of its length than is a female shaft. The latter tapers more rapidly and is relatively less broad and heavy. This difference is more apparent when several typical central tail feathers from each sex can be compared side by side.

Shaft Pigmentation. The ventral surface of shafts of male central tail feathers are usually barred with several irregular transverse bands of dark pigment. The ventral surface of a typical female tail feather shaft is also pigmented, but the pigment is in one or two narrow longitudinal stripes running the entire length of the webbed portion of the shaft.

Shape of Web. The webs of male central tail feathers are usually relatively broad, straight, and square-cornered. Typical female webs are narrower, taper slightly toward the end of the feather, and have well-rounded corners.

Bump *et al.* (1947) mentioned another of these secondary aids to identifying sex. If the tail is spread to a full half-circle and the tail feathers do not overlap each other, the bird is probably a female. If the feathers continue to overlap when spread the bird may be either sex. We have not investigated this technique for Wisconsin grouse.

D. Recommendations

We believe that of the major external sex criteria discussed, the length of a plucked, fully-grown, central tail feather is more reliable than the tail band pattern. There are several reasons why tail length is recommended as the best external sexing technique.

There is less chance for personal error when measuring tail lengths than there is when classifying tail band patterns. Plucked tail feathers offer distinct end points that enable the taking of simple but accurate measurements. Determination of tail band pattern is not always so simple, since there is a wide variation in intermediate band types between "nearly complete" and "nearly incomplete" that sometimes makes classification difficult.

When single birds or small samples are to be sexed, they can be safely classified by tail length, as long as central tail feathers are fully grown. The sex of single birds cannot be safely identified by tail band alone if the central feathers have an intermediate pattern. In addition, about 15 per cent of Wisconsin grouse seem to have intermediate tail bands, which may limit the validity of sex ratios in small samples compiled from tail band patterns by reducing the usable sample size and increasing the possible sampling error.

The slightly greater statistical reliability of tail length compared to internal sex is another factor favoring length as a sex criterion.

Whenever possible, grouse to be externally sexed should be subjected to the tail-length criterion. However, when completely-grown central tail feathers are not available, as frequently happens in years of late hatches and early fall hunting seasons, tail-band patterns supplemented by the secondary tail-feather characters may be safely used as sex criteria. Various combinations of the sex characteristics presented here should permit the external determination of sex for ruffed grouse under almost any foreseeable Wisconsin conditions.

AGE IDENTIFICATION

Three approaches may be used to determine the age of Wisconsin ruffed grouse in late summer and fall. The most reliable of these concerns an internal organ, the Bursa of Fabricius. A bird with a bursa present is a young of the year. If the bursa is absent or is very shallow, a bird is more than one year old.

Externally, grouse may be aged in weeks to the time they are 17 weeks old by examination of the post-juvenile wing-molt stage. After 17 weeks, young of the year can be told from adults by the contour of the outer two primary wing feathers.

A. Bursa

The Bursa of Fabricius is a small, pouch-like structure of lymphoid tissue lying on the dorsal side of the cloaca and opening into the cloaca just inside the vent. The function of the bursa is not known.

Gower (1939) was the first to suggest use of the bursa as an objective character to separate birds of the year from adults. The bursa test has since been widely applied to several game bird species. In most species, including ruffed grouse, the bursa is present in all young birds, but is slowly resorbed and usually disappears by the time the bird is one year old. This permits separation of juvenile from adult grouse during the late summer and fall in Wisconsin. Knowledge of the rate of bursal regression is lacking, so no finer age distinctions than juvenile or adult one year of age or older can be applied.

The presence of a bursa may be detected by probing from the cloaca or by dissecting out the lower digestive tract. Probing is the simpler of the two methods and may be used on both living or dead birds. A fine wire probe with a blunt end and calibrated in 2-millimeter intervals is the most commonly-used tool for determining the presence and depth of a bursa.

The age at which the bursas of ruffed grouse disappear is subject to some question. Petrides (1942) said it persists to eight months of age. Bump *et al.* (1947) stated that the bursa is the most reliable means of separating young from old birds up to March 1. In Wisconsin, most young birds are about nine months old on March 1. There is no doubt that bursas persist in young Wisconsin grouse through the fall hunting season.

Ammann (1948) noted that adult ruffed grouse and prairie chickens (*Tympanuchus cupido*) often have a bursa several millimeters deep.

Linduska (1943) found the same situation in pheasants. We have similar findings for Wisconsin ruffed grouse. Of 28 females with broods collected during the summers of 1948 through 1951, one had a bursa of 4 millimeters and 27 had no bursa.

In addition, an inspection of bursal depth frequencies indicates a sharp breaking point at a bursal depth of 5 millimeters between presumed adults and presumed juveniles aged by wing primary contour (Table 6). This indicates that remnant bursas persist in some grouse until one year or more of age. As a result, we have established an arbitrary dividing point for separating age groups by bursa at 5 millimeters. All birds examined during the period July 15 to November 15 were called adult if they had no bursa or a bursa 5 millimeters or less in depth; all birds with a bursa 6 millimeters or more in depth were called juveniles. Although this criterion cannot be documented by bursal regression data from individual birds, we have found no reason to believe it contains serious errors.

Table 6

Separation of Ruffed Grouse Age Classes by Bursal Depth

Bursa Depth in Millimeters	*Number of Birds with*	
	Pointed Primaries (Juvenile)	*Round Primaries (Adult)*
0	1	132
1	0	2
2	1	7
3	0	3
4	3	6
5	5	3
Total, 0–5	10	153
6	5	0
7	3	0
8	16	2
9	10	0
10	38	2
11–26	564	3
Total, 6–26	636	7
Total, 0–26	646	160

Table 6 shows further that the proportion of birds of doubtful age due to shallow bursas is relatively small. We have measured the bursa of 806 grouse; 38 of them (5 per cent) had bursas ranging in depth from 1 to 7 millimeters so that their age might be subject to question. The average bursal depth of 388 grouse with bursas 6 or more millimeters deep and shot during Wisconsin hunting seasons was 17 millimeters. The deepest bursa recorded at any season was 26 millimeters.

B. Wing Molt Progression

When large samples of aged birds are desired, bursal probing is not an economical technique and external age characters become necessary. We have confined our efforts in this direction to refining recognized age characteristics of wing feathers. These characters have been tested and applied to grouse wings collected each year, mainly from Wisconsin hunters.

The primary flight feathers of ruffed grouse wings grow and are molted and replaced at an orderly rate. There are 10 of these primaries. In this discussion, primary feathers will be referred to by number, beginning with number 1 as the innermost and number 10 as the outer wing feather.

Bump *et al.* (1947) worked out the rate of wing molt progression for New York grouse. We have used their data in our studies. Hale and Wendt (1951) have discussed use of the New York findings under Wisconsin conditions.

Primaries begin to grow even before a grouse chick is hatched. After hatching, feather growth proceeds rapidly. The first feathers to appear are part of the first or juvenile plumage. Before the 6th juvenile primary is completely grown, the 1st juvenile primary is dropped and begins to be replaced by a primary of the post-juvenile or adult plumage. The molt then progresses until all ten juvenile primaries are grown and primaries number 1 through 8 are molted and replaced by post-juvenile primaries. The completion of this process takes 17 weeks, at which age wing feather growth is finished for the current year. Each summer thereafter the primary wing feathers are molted and replaced at approximately the same rate as for juvenile birds.

The 9th and 10th juvenile primaries are not replaced during the post-juvenile molt and are retained until the grouse is about a year and a half old (Bent 1932, Bump *et al.* 1947, Dwight 1900, Petrides 1942, Wright and Hiatt 1943). Thus any grouse molting primary number 9 and 10 can safely be called adult. Occasionally, accidents or physiological upset will cause the molt to stop short or progress past primary number 8, but such cases are rare.

Birds whose post-juvenile wing molt is incomplete can be aged successfully in weeks. The molt stage as described by Bump *et al.* for each week of age up to 17 weeks is presented in the key to sex and age identification at the end of this report. After the post-juvenile molt is completed and the quills of the first eight primaries are completely hardened, other wing feather aspects permit the classification of age only as juvenile or adult.

C. Contour of Outer Wing Primaries

We have already mentioned that the outer two primary wing feathers (numbers 9 and 10) are not molted until the year following hatching. Thus in fall, grouse of the year have two juvenile feathers at the outer end of the wing even though they have completed their post-juvenile wing molt. Adult birds have two adult feathers in these positions. The two types of outer primaries have diagnostic differences in the contour of their tips.

In juvenile birds the contour of primaries 9 and 10 are quite sharply pointed, while the two outer adult primaries have a rounded contour (Figure 2). A small portion of Wisconsin ruffed grouse do not have contours that are definitely pointed or round, so that some degree of personal error is introduced by the need for interpreting contour types. However, a supplemental character can be used to aid the classification of doubtful wings from birds taken in late summer and fall.

After the 8th post-juvenile primary is completely grown, scaly remnants of its feather sheath persist for several weeks at the base of the quill. Even though cursory examination of the wing may indicate a completed molt and doubtful contour of outer primaries, presence of sheath scales on number 8 and no such scales on numbers 9 and 10 are conclusive evidence that the bird is a juvenile.

Completely-molted adults seldom have sheath scales on the 8th primary. However, sheath scales should be present on primaries numbers 9 and 10, or both, since in fall these outer feathers are the most recently molted. Wing contours should be checked against presence of sheath scales on the outer three primaries as a safeguard against error in identifying contour type, regardless of whether contours appear typical or not.

During the 4 years of our study, the wing contour criterion was tested with satisfactory results against bursal depth in 806 Wisconsin ruffed grouse. The results are shown in Table 7. The frequency distribution of bursal depths for both contour types are given in Table 8. As previously described, we classed all birds without a bursa or with a bursa not exceeding 5 millimeters in depth as adults; all birds with a bursa 6 or more millimeters deep were called juveniles.

Table 7

Age Identification by Bursal Depth and Wing Primary Contour of 806 Ruffed Grouse

	Age by Primary Contour		*Age by Bursal Depth*	
	No. Birds	*Per Cent*	*No. Birds*	*Per Cent*
Juvenile	646	80.1	643	79.8
Adult	160	19.9	163	20.2
Total	806		806	

Table 8

Bursal Depth Frequencies of Wing Primary Contour Types

Bursa Depth Range in Millimeters	*No. of POINTED Contours*				*No. of ROUND Contours*			
	Male	*Female*	*Sex??*	*Total*	*Male*	*Female*	*Sex??*	*Total*
0.0– 2.0	---	2	-	2	67	64	10	141
2.1– 4.0	1	2	--	3	6	2	1	9
4.1– 6.0	6	4	--	10	2	1	--	3
6.1– 8.0	11	8		19	2	--	-	2
8.1–10.0	22	23	3	48	1	1	--	2
10.1–12.0	19	34	5	58	--	--	--	---
12.1–14.0	21	31	4	56	1		--	1
14.1–16.0	50	51	7	108	--	-	--	---
16.1–18.0	68	74	15	157	1	--	--	1
18.1–20.0	56	49	14	119	--	1	-	1
20.1–22.0	21	24	2	47	--	--	--	---
22.1–24.0	9	7	1	17	--	--		-
24.1–26.0	2	-		2		--		-
Total	286	309	51	646	80	69	11	160

The age ratios derived from the two criteria (Table 7) are not statistically different. Based on Table 6, the mathematical probability of all birds with pointed outer primaries being juveniles is 98.5 per cent; of all birds with round outer primaries being adults is 95.6 per cent. The probability of correctly identifying both age groups by primary contour is 99.6 per cent. It is our opinion that this is an accurate criterion for identifying age of Wisconsin grouse, at least until such time as more information is available on the rate of bursal regression.

During September hunting seasons in years of a late hatch, adult grouse with incomplete wing molts are sometimes found that can be aged to somewhat finer limits than usual (Figure 3). If the 9th primary is in the soft or blood quill stage with a rounded tip and the 10th (outer) primary has a hard quill, a pointed tip, faded color, and ragged edges, the bird is 1½ years old. In this condition, the 10th primary is a juvenile feather retained since the previous year and about to be replaced by an adult feather for the first time. If the same molt stage

exists, but number 10 has a round instead of pointed tip, the bird is an adult 2½ years or older. Since number 10 is an adult feather, it has been molted at least once in the past, so the bird has to be at least 2½ years old. These two situations were the only ones where we could distinguish degree of wear and color differences between juvenile and adult feathers in the manner described by Ammann (1944) for prairie grouse.

D. Recommendations

All the age criteria we have described apply to late summer and fall grouse. In these seasons any bird with an incomplete wing molt can be safely classified for age by that fact alone. It is important to make sure that birds molting only primaries number 1 through 8 are not adult birds whose molt has not yet reached number 9 or 10. At this time of the year it is also our recommendation that for completely molted birds the bursa should be used as the primary age indicator if at all possible, since it seems to offer the most consistent criterion with the least chance for error on the part of the person examining the bird. At other seasons we do not know the extent to which the bursa test can be applied to Wisconsin ruffed grouse.

The wing molt and contour criteria are satisfactory substitutes or supplements to the bursa technique if the user can judge these feather characteristics with confidence. Care should be taken to check the outer three primaries for feather sheath remnants to vertify the contour identification.

A KEY FOR CLASSIFYING THE SEX AND AGE OF WISCONSIN RUFFED GROUSE IN FALL

I. Sex Identification

Item

1. Is examination of internal sex organs possible? If so, go to Item 2. If not, go to Item 3.
2. If testes are present, the bird is MALE. If an ovary is present, the bird is FEMALE.
3. Is a completely grown central tail feather present from post-juvenile or older plumage? If so, go to Item 4. If not, go to Item 5.
4. If a plucked central tail feather measures 15.0 centimeters or longer (more than 5⅞ inches) in length, the bird is MALE. If a plucked central tail feather measure 14.9 centimeters (5⅞ inches) or less in length, the bird is FEMALE. See Figure 1.
5. Are central tail feathers present but not completely grown? If so, go to Item 6. If central tail feathers are absent, reliable sex identification by external characters is not possible.
6. If the terminal band on a central tail feather is complete or nearly complete; if the quill and rachis of a central tail feather are relatively broad and heavy, and usually barred on the under surface with bands of dark pigment; if the web of a central tail feather is relatively broad and square-cornered at the outer end, the bird is *probably MALE.* If the terminal band on a central tail feather is incomplete or nearly incomplete; if the quill and rachis of a central tail feather are relatively narrow and less heavy, and usually striped lengthwise on the under surface with dark pigment; if the web of a central tail feather is relatively narrow and rounded at the outer end, the bird is *probably FEMALE.*

II. Age Identification

Item

1. Can the Bursa of Fabricius be probed? If so, go to Item 2. If not, go to Item 3.
2. If a bursa is present and greater than 5 millimeters deep, the bird is JUVENILE. If a bursa is absent, or not more than 5 millimeters deep if present, the bird is ADULT.
3. Are any primary wing feathers not completely grown (one or more feathers missing, or with blood or soft quill base)? If so, go to Item 4. If not, go to Item 7.
4. Are the outer two primaries (No. 9 and 10) pointed juvenile plumage feathers? If so, the bird is JUVENILE and can be aged in weeks by the schedule listed below. If not, go to Item 5.

Age in Weeks	*Wing Primary Condition*
1	All 10 primaries have blood quills.
2	Primaries #1, 2 and 3 are completely grown, primaries #4 through #10 have blood quills.

3	#1 and #2 dropped.
4	#3 dropped.
5	#4 dropped.
6	#5 dropped.
7½	#6 dropped.
9	#7 dropped.
10	#7 is ¼ to ½ grown.
11	#8 dropped.
12	#7 and #8 have blood quills and are incompletely grown.
13	#7 is completely grown; #8 still has blood quill and is shorter than #10 (Figure 4).
14	#8 has blood quill and reaches a point half way between the ends of #9 and #10 (Figure 4).
15	#8 has blood quill, is shorter than #9, but reaches a point more than half way between the ends of #9 and #10 (Figure 5).
16	#8 has blood quill and is as long or longer than #9 (Figure 5).
17	#8 is completely grown, but the base of the quill is still soft (*not* in blood quill, however) and sheathing remains at the base of #7 and #8 (Figure 6).
17 plus	All primaries complete, hard at the base, and with sheath remnants on #8 and sometimes #7.

5. If the 9th or 10th primary, or both, are in blood quill stage with rounded tips, the bird is ADULT (Figure 6). Check Item 6 for possible further refinement of adult ages.
6. If the 9th primary is in blood quill stage with *rounded* tip and the 10th (outer) primary has a hard quill and *pointed* tip (feather sometimes faded in color and ragged on the edges) the bird is an ADULT 1½ years old. If the 9th primary is in blood quill stage with *rounded* tip and the 10th (outer) primary has a hard quill and *rounded* tip (feather sometimes faded in color and ragged on the edges) the bird is an ADULT 2½ years old or older. See Figure 3.
7. If the outer two primaries (Nos. 9 and 10) are *pointed* at the tip with scaly sheath remnants at the base of Nos. 7 and 8, but not 9 and 10, the bird is JUVENILE. If the outer two primaries are *rounded* at the tip with scaly sheath remnants at the base of Nos. 9 or 10, or both, the bird is ADULT. See Figure 2.

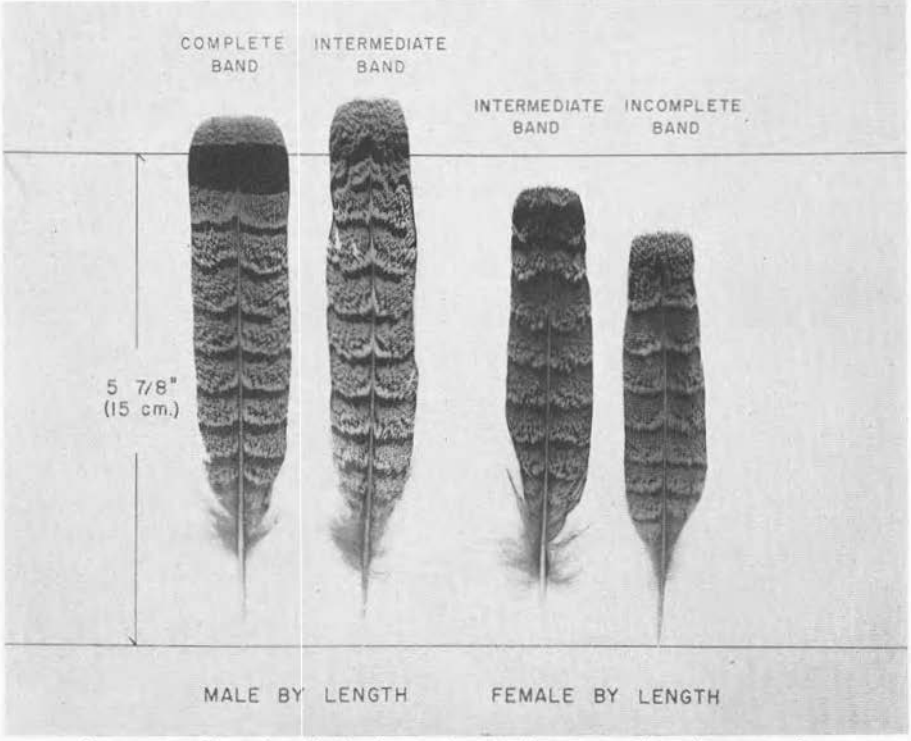

Figure 1—Central tail feathers of rutted grouse, showing sex characters of length and sub-terminal tail band pattern.

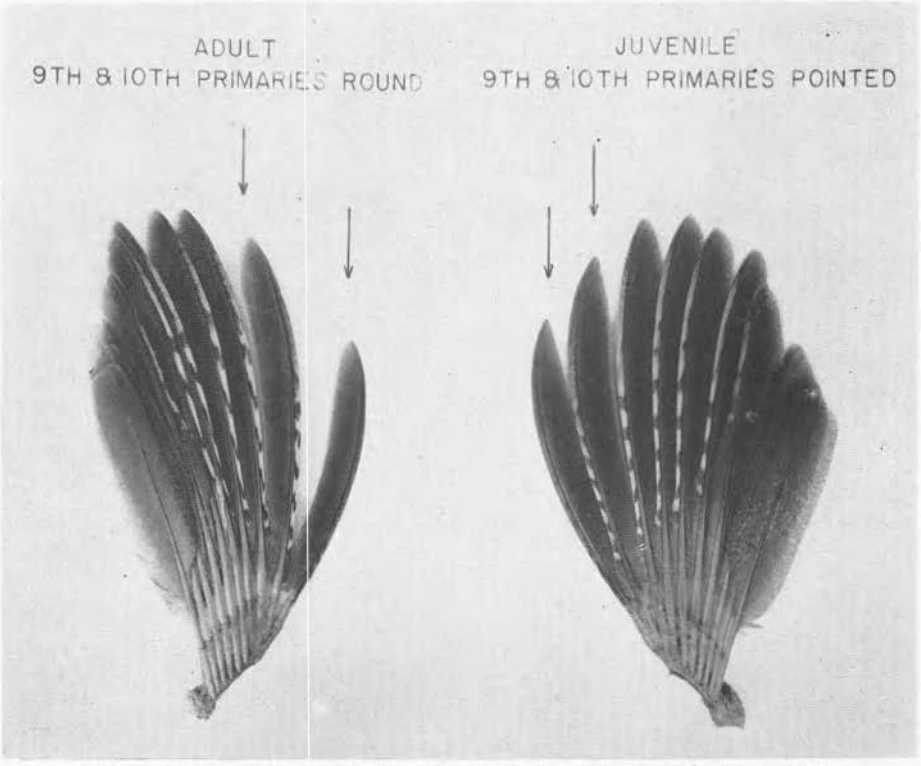

Figure 2—Typical completely molted adult and juvenile grouse wings, showing age difference in contours of outer two primaries.

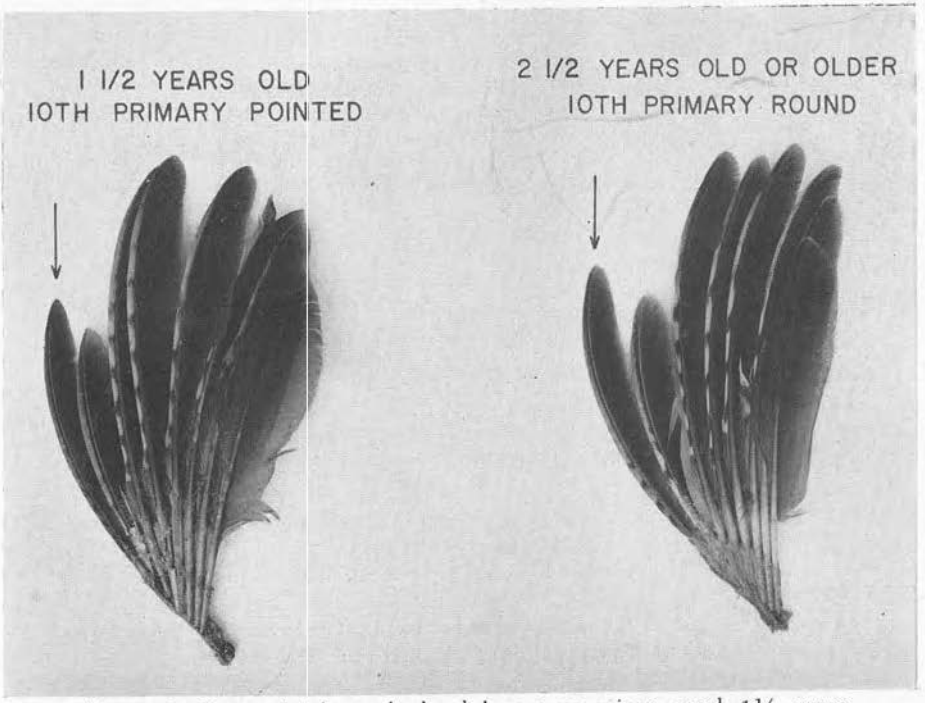

Figure 3—Incompletely molted adult grouse wings aged 1½ years (left) and 2½ or more years (right).

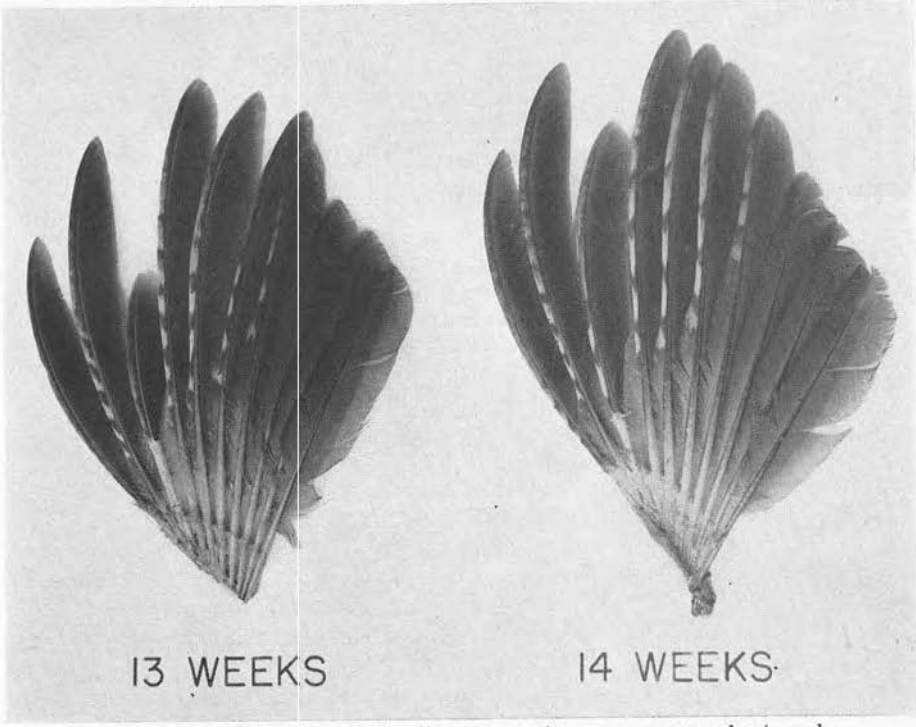

Figure 4—Molt stages of juvenile grouse wings at age 13 and 14 weeks.

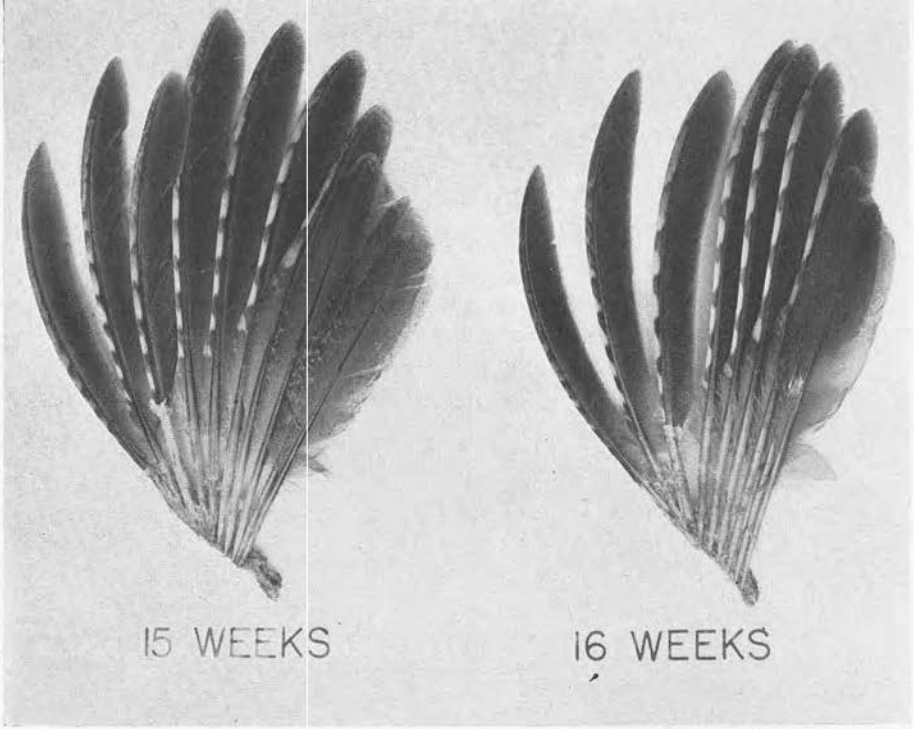

Figure 5—Molt stages of juvenile grouse wings at age 15 and 16 weeks.

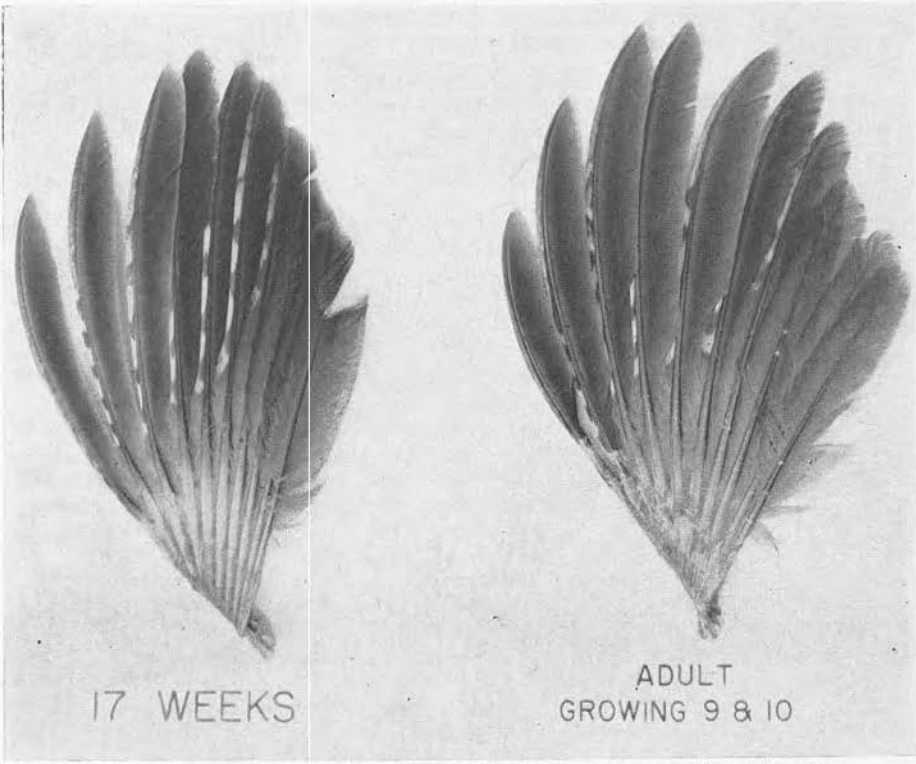

Figure 6—Juvenile grouse wing at age 17 weeks (left) and adult grouse wing with outer two primaries incompletely grown (right).

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