

## SEX RATIOS IN DUCKS

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SINCE Lincoln (1932) published his rather startling figures on sex ratios in ducks, a small number of additional studies have been reported whose results, with original observations, have caused the author to wonder whether some of the methods of sex counts used yield data representative of true conditions and whether the entire subject should not be thrown open to more vigorous and widespread research than has lately been evident. It further seems probable that the full extent and complexity of the problem is not generally recognized. The present paper is an attempt, first, to summarize our knowledge of American waterfowl sex ratios, supplying some original field data, and, second, to analyze the effectiveness of our present procedures with special reference to sampling of the nation's duck population.

The author wishes to thank Mr. F. C. Lincoln and Miss May Thacher Cooke of the U. S. Fish and Wildlife Service for critically reading the manuscript and for compiling banding-return records, respectively.

Up to the present time, sex ratios of ducks have been determined from three principal sources—banding records, hunter's bag reports, and sight observations.

## BANDING RECORDS

Lincoln's analysis of 40,904 banded ducks of ten species (*op. cit.*) still provides the most comprehensive data available regarding sex ratios in ducks. From records kept by banding-trap operators in many states, he determined the following:

<i>Species</i>	<i>Males</i>	<i>Females</i>	<i>Ratios</i> ( <i>males : females</i> )
Mallard	12,386	9,572	56 : 44 (= 1.27 : 1)
Black Duck	477	344	58 : 42 (= 1.38 : 1)
Baldpate	413	251	62 : 38 (= 1.64 : 1)
Green-winged Teal	357	95	79 : 21 (= 3.75 : 1)
Blue-winged Teal	765	411	65 : 35 (= 1.86 : 1)
Pintail	6,308	3,759	63 : 37 (= 1.68 : 1)
Wood Duck	391	367	52 : 48 (= 1.07 : 1)
Canvas-back	226	127	64 : 36 (= 1.78 : 1)
Lesser Scaup Duck	2,633	1,444	65 : 35 (= 1.82 : 1)
Ring-necked Duck	455	123	79 : 21 (= 3.69 : 1)

Though the total numbers of ducks studied are small for some species, those for several other kinds run into five figures, nevertheless indicating unbalanced ratios. In view of the preponderance of males

trapped, the question arises as to whether banding traps are selective by sex. Lincoln (personal conversation) has often observed female birds leading flocks into traps, but the composition of these flocks is unknown. Conceivably, they might include a large proportion of males.

Hawkins (1940), in Illinois, found the sex ratio of 8,000 hunter-killed Mallards to be 57 : 43 (1.33 males : 1 female) while, during the same period, 3,700 Mallards were caught in banding traps in the ratio of 74 : 26 (2.84 : 1). In view of the greater proportion of males taken in traps, it would seem more likely that the traps, rather than hunters, were selective by sex, and, as will be shown in the next section, no hunter selection is apparent statistically for Mallards. Hawkins's study is a strong argument in favor of the use of hunters' bag reports, rather than banding records, in sex ratio investigations of ducks.

At the Roaches Run Sanctuary in Washington, D. C., during the winters of 1935-1939, Paul Hodge,<sup>1</sup> then caretaker, banded 69 male and 40 female Pintails, a ratio of 1.72 : 1, which contrasts rather sharply with the ratio of 1.26 : 1 prevalent in more than 12,000 Pintails counted there by the author during the winters of 1941-1943 (see beyond). Furthermore, though it supplies figures too small to be certainly significant, the author also captured eight male and five female Pintails (1.60 : 1) in a banding trap at Roaches Run during March, 1943, when the total population on the refuge occurred at a ratio of 1.26 : 1. Further experiments in this direction were cancelled due to military service.

If one can draw a parallel with the Ring-necked Pheasant, Leopold *et al.* (1943) state that in Wisconsin "census drives consistently show a higher percentage of cocks than the catch of the traps . . . We have no explanation as to why traps yield fewer cocks than the censuses, except that they are harder to trap. . . . We believe that the census tally . . . is more nearly correct than the trap tally." In ducks, females may be similarly just "harder to trap."

While, unfortunately, too few sex-ratio studies of ducks have been recorded in which more than one method of counting was used, to draw definite conclusions, what evidence we have points to the distinct possibility that banding traps may be less attractive to female than male ducks.

<sup>1</sup> Other records kept by Mr. Hodge during this period provide limited banding-trap data for the Washington, D. C., region. The Black Ducks were sexed by bill markings:

Species	Males	Females	Ratio
Mallard	32	19	1.68 : 1
Black Duck	155	69	2.24 : 1
Lesser Scaup Duck	57	24	2.37 : 1
Canvas-back	42	11	3.81 : 1

## HUNTER'S BAG REPORTS

In an attempt to evaluate hunter selectivity, Miss May Thacher Cooke, of the U. S. Fish and Wildlife Service, and the author sorted return cards for 9,311 banded ducks of three species shot by hunters. Inasmuch as the sex ratios of these species were determined by Lincoln (*op. cit.*) for banded birds before being hunted, it was thought that computation of their sex ratios after being shot would indicate whether selectivity was practiced by hunters, knowingly or unknowingly. Time limitations restricted analysis of return records of ducks marked "killed" or "shot" by hunters to the following:

<i>State</i> <sup>1</sup>	<i>Size of Sample</i> <sup>2</sup>	<i>Males</i>	<i>Females</i>	<i>Not Sexed</i>	<i>Totals</i>	<i>Ratio M:F</i>
MALLARD						
Illinois	25%	384	143	4	531	
Louisiana	33%	135	134	78	347	
Montana	20%	271	183	24	478	
Oregon	20%	145	119	12	276	
Kansas	33%	223	128	46	397	
Minnesota	16%	146	101	7	254	
Br. Columbia	20%	258	219	40	517	
North Dakota	25%	165	238	10	413	
Missouri	45%	190	139	146	475	
Michigan	35%	182	166	119	467	
Wisconsin	30%	168	240	33	441	
<i>Totals</i>	16%	2267	1810	519	4596	1.25 : 1
PINTAIL						
Br. Columbia	33%	150	249	19	418	
California	20%	379	118	71	568	
Kansas	50%	214	142	65	422	
Louisiana	20%	270	127	3	400	
North Carolina	100%	59	35	6	100	
<i>Totals</i>	8%	1072	671	164	1908	1.59 : 1
LESSER SCAUP DUCK						
U. S. and Canada	20%	348	191	239	778	1.82 : 1

Referring to Lincoln's data, given previously, it is seen that the sex ratios of shot, banded Mallards, Pintails, and Lesser Scaup Ducks, at least, are about the same as those derived from banding-trap records of these species, indicating negligible sex selection by hunters. As discussed earlier, if this is true, then Hawkins's findings rather defi-

<sup>1</sup> State or province where banded; may have been shot anywhere.

<sup>2</sup> Approximate percentage of total cards on file for the state.

nitely imply that banding traps, at least in Illinois, attract more female than male Mallards.

Hochbaum's (1940) belief, based upon almost even sex ratios or excesses of females (see Table 2), that female ducks of a few species were selected by Manitoba hunters, does not agree with the above data, probably being influenced by differential sex migration or distribution (see beyond).

#### SIGHT OBSERVATIONS

There can be little doubt but that accurate sight counts (or studies of clear photographs) of sexually distinct species of ducks on open waters is a reliable method of determining sex ratios. Unless it can be shown that one sex differentially prefers adjacent coverts, careful tallies of easily visible flocks reveal true sex ratios for the particular time and place concerned. Despite the ease with which such counts may be made, however, few studies of this nature appear to have been recorded in the literature.

In Europe, Frieling (*in* Erickson, 1943) compiled sex-ratio data on 21,764 ducks of ten species. In this country, Erickson (1943) made sex counts of 6,008 ducks of fifteen species migrating through Minnesota, and Furniss (1938) made similar studies on Saskatchewan breeding grounds in spring. For the most part, these investigators found the disparity in the abundance of birds of each sex to be significantly less than that assigned to these species as a result of study of banding-trap records.

The present author, from October, 1941, through February, 1942, and from October, 1942, through March, 1943, studied the sex ratios of several duck species by means of direct censuses at the Roaches Run Waterfowl Sanctuary, Washington, D. C. This area, one of the National Capital Parks, administered by the National Park Service, is situated on the southern bank of the Potomac River but is largely included within the District of Columbia. It is within easy sight of the Washington Monument and Capitol. During the two winters, censuses of the 500 to 1200 birds usually present on the 62 acres of open water included within the refuge were made several times a month, whenever opportunity permitted. Direct counts were easily accomplished during early mornings as the birds drifted away from several feeding places. Very limited cover, found to be largely unoccupied by ducks, was present in winter.

Excluding Black Ducks and small numbers of miscellaneous species, the following data are derived from a total of 13,534 bird observations. The figures for the American Merganser include birds seen

in the near-by Potomac River and Tidal Basin. Because of the relatively small numbers of Mallards and Mergansers, data for both years are lumped together. Since the construction of the adjacent National Airport, with consequent silting of submerged food plants, the diving ducks listed elsewhere in this paper no longer appear at Roaches Run in numbers sufficient to warrant study.

TABLE 1  
SEX RATIOS OF DUCKS COUNTED AT ROACHES RUN, D. C., 1941-1943

<i>Species</i>	<i>Years</i>	<i>October</i>	<i>November</i>	<i>December</i>	
Pintail	1941-2	116 162	1486 1032	1434	932
	<i>Ratios</i>	<i>0.71 : 1</i>	<i>1.44 : 1</i>	<i>1.53 : 1</i>	
	1942-3	111 333	262 303	1041	848
	<i>Ratios</i>	<i>0.33 : 1</i>	<i>0.86 : 1</i>	<i>1.23 : 1</i>	
	1941-3	227 495	1749 1335	2487	1780
	<i>Ratios</i>	<i>0.46 : 1</i>	<i>1.35 : 1</i>	<i>1.39 : 1</i>	
Mallard	1941-3	37 23	183 108	166	96
	<i>Ratios</i>	<i>1.60 : 1</i>	<i>1.69 : 1</i>	<i>1.73 : 1</i>	
American Merganser	1941-3			197	29
	<i>Ratios</i>			<i>6.79 : 1</i>	

  

<i>Species</i>	<i>Years</i>	<i>January</i>	<i>February</i>	<i>March</i>	<i>Total</i>
Pintail	1941-2	818 643	220 200		4074 2969
	<i>Ratios</i>	<i>1.27 : 1</i>	<i>1.10 : 1</i>		<i>1.37 : 1</i>
	1942-3		741 501	643 510	2798 2495
	<i>Ratios</i>		<i>1.48 : 1</i>	<i>1.26 : 1</i>	<i>1.12 : 1</i>
	1941-3	818 643	961 701	643 510	6872 5464
	<i>Ratios</i>	<i>1.27 : 1</i>	<i>1.37 : 1</i>	<i>1.26 : 1</i>	<i>1.26 : 1</i>
Mallard	1941-3	46 32	54 35	53 50	539 344
	<i>Ratios</i>	<i>1.56 : 1</i>	<i>1.54 : 1</i>	<i>1.06 : 1</i>	<i>1.56 : 1</i>
American Merganser	1941-3	2 2	25 15	30 15	254 61
	<i>Ratios</i>	<i>1 : 1</i>	<i>1.66 : 1</i>	<i>2 : 1</i>	<i>4.16 : 1</i>

Comparing these results with data compiled by other investigators (see Table 2), it is seen that the sex ratios of ducks at Roaches Run vary from those determined for these species elsewhere in North America; which brings up the factors of differential sex migration and distribution as affecting the accuracy of sex-ratio data.

#### DIFFERENTIAL SEX MIGRATION AND DISTRIBUTION

Table 2 summarizes the results of a number of American sex-ratio studies published to date:

TABLE 2  
RECORDED RATIOS OF MALES TO EACH FEMALE DUCK

Species	Banding traps				Hunters		Field counts		
	Lincoln (1932) U. S.	McIlhenny (1940) Louisiana—winter	Hawkins (1940) Illinois—fall	Hodge—Roaches Run Wash., D. C.—winter	Hawkins (1940) Illinois—fall	Hochbaum (1939) Manitoba—fall	Furniss (1938) Saskatchewan—spring	Erickson (1943) Minnesota—spring	Petrides, Roaches Run Wash., D. C.—winter
Mallard	1.27	1.00	2.86	1.67	1.33	0.74	1.57	1.01	1.56
Black Duck	1.38			2.24					
Pintail	1.68	1.98		1.72		0.40	1.90	1.16	1.26
Canvas-back	1.78	1.74		3.81		1.11	1.36	1.77	
Lesser Scaup Duck	1.82	2.22		2.37		1.03	1.47	2.56	
American Merganser								0.88	4.16
Redhead							1.08	1.56	
Ring-necked Duck	3.69	3.35					1.26	1.39	
Wood Duck	1.07	1.67							
Blue-winged Teal	1.86	1.80						1.48	
Green-winged Teal	3.75	2.33							
Baldpate	1.64							1.21	

Obviously, considerable disparity of results exists even for a single duck species studied by one method. Sex ratios in banded Mallards, for instance, vary from 1.00 : 1 in Louisiana (winter) to 2.86 males per female in Illinois (autumn). Even more in contrast are the ratios for American Mergansers: 0.88 : 1 counted by Erickson in Minnesota, and 4.16 : 1 enumerated by the author at Washington, D. C.

Despite observations made some years ago that female Mallards (Leopold, 1919, 1920) and American Mergansers (Phillips, 1925) migrate earlier than males of their species, the geographic variation in sex ratios indicated above emphasizes our lack of exact knowledge regarding differential sex distribution, as well as migration, in wintering waterfowl.

That differential sex migration occurs in the Pintail seems evident from Table 1, and if McIlhenny's data (1940) for 3,674 birds trapped in Louisiana are comparable, his ratio of 1.98 : 1 as contrasted with 1.26 : 1 for Washington, D. C., indicates a differential winter distribution.

Commenting upon the Pintail data in Table 2, however, F. C. Lincoln (personal letter) states that "it is a fact that large numbers of [Pintail] drakes . . . migrate much earlier than do the hens" (rather than the reverse as indicated by the Roaches Run data) and cites an

instance where males in eclipse plumage were seen at the Salton Sea, California, in August. He suggests that some males in eclipse plumage may have been counted as females at Roaches Run. Neither Mr. Lincoln nor the author, however, have ever seen eclipse males at Washington, D. C., although Pintails have nested at Roaches Run under unusual circumstances (Auk, 50: 437-438, 1940).

That differential sex distribution may be a disconcerting factor in determining sex ratios on a continental basis is apparent when the locations of waterfowl banding stations are considered. The May, 1933, issue of *Bird Banding Notes* (vol. 2, no. 8, pp. 115-116) lists the stations in operation the previous winter season, giving the number of ducks trapped. When a dot is placed on a map for every 100 ducks banded in a given locality, large concentrations are found to occur in the southern New England, British Columbia, Oregon, San Francisco Bay, and southern Louisiana regions; few dots are located in other areas. Waterfowl throughout most of the vast expanse of the nation have received relatively little attention and conditions in Mexico and other southern areas, where female ducks may be comparatively more abundant, seem to be largely unknown.

Furthermore, the banding return records filed by the U. S. Fish and Wildlife Service for some species represent only a few localities. At the present time, apparently over 90 per cent of the return cards for the Lesser Scaup Duck, for example, have been submitted by E. A. McIlhenny from southern Louisiana. Similarly, very few returns of Pintails banded east of the Mississippi River are available, though many birds evidently winter there. It would seem quite possible, therefore, that early sex-ratio studies of banded birds might have been affected by faulty geographic sampling as well as by selectivity of traps.

#### CONCLUSIONS AND SUGGESTIONS FOR RESEARCH

Though it seems probable from the total number of observations of all kinds that a preponderance of males exists in most ducks, it seems quite possible that the extent to which sex ratios are unbalanced has been exaggerated, due to insufficient sampling of large geographic areas and to reliance on untested methods of gathering data.

In view of the ease with which accurate sex ratios can be obtained, more professional and amateur ornithologists should endeavor to report sight observations made over periods of several years. Banding-trap operators might easily test the reliability of sex ratios derived from banding records by comparing the sex ratios of birds trapped by them with those derived from counts of untrapped birds observed in their regions. Similarly, conservation organizations conducting

game-bag surveys could check the validity of their data by simultaneously conducting direct censuses on suitable sample areas.

#### SUMMARY

Limited evidence indicates that banding traps may be more attractive to male than to female ducks. Records of banded ducks before and after hunting, when compared, reveal similar sex ratios, indicating negligible sex selection by sportsmen. Sight observations are believed best to permit accurate determinations of local sex ratios, and data from Washington, D. C., are provided. Tabulation of all published American sex-ratio data reveals a geographic variation probably due to differential sex migration and distribution—factors which doubtless affected early records of nationally unbalanced sex ratios. More thorough sampling of the continent's wintering grounds is advocated and methods for testing the validity of sex-ratio data derived from banding-trap records and hunter's-bag reports are given.

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