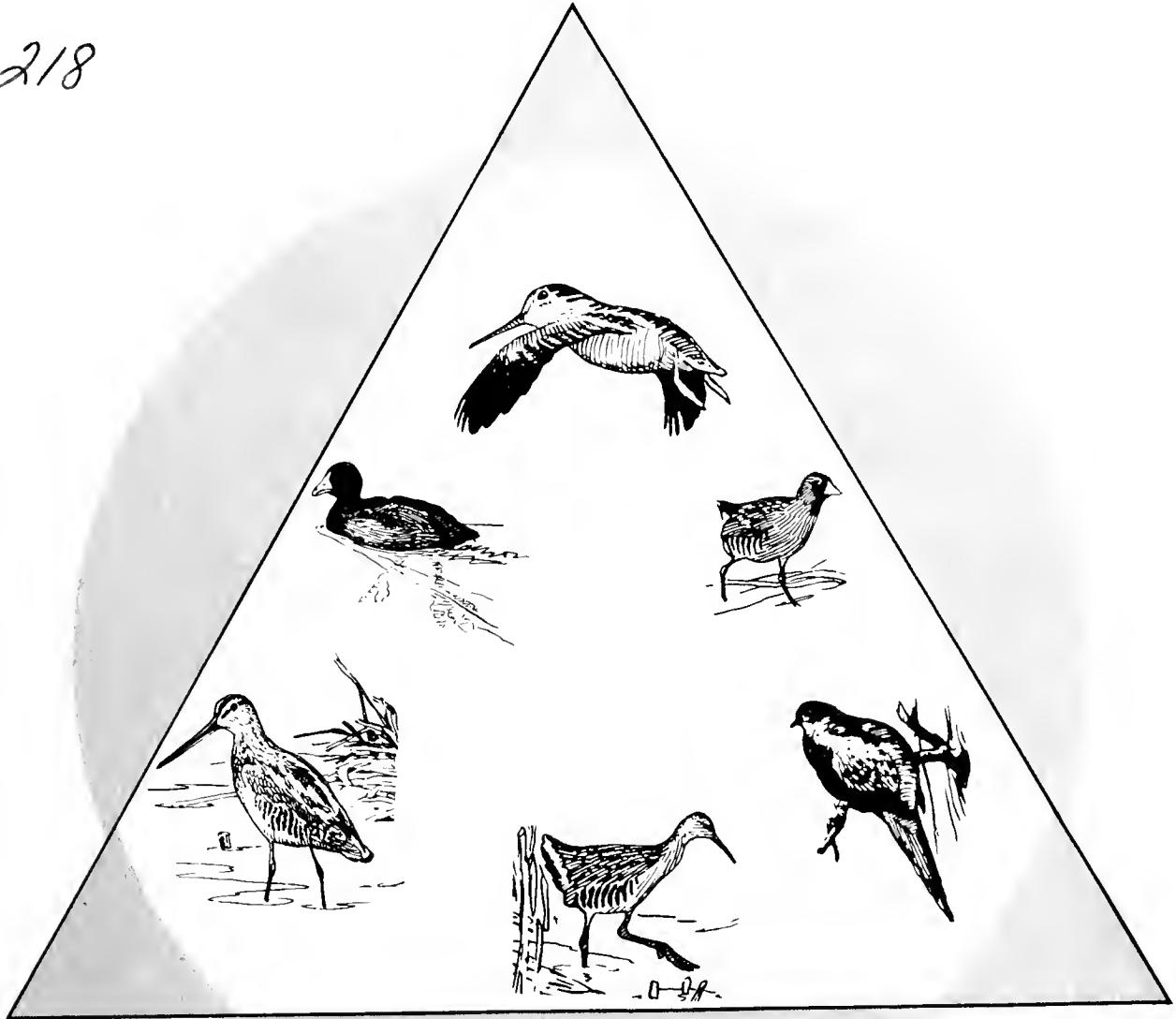




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By Elwood M. Martin



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Hunting and Harvest Trends for Migratory Game Birds Other than Waterfowl: 1964-76

by

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Abstract

Hunting activity and harvest estimates for 10 species or groups of migratory game birds other than waterfowl, based on data collected for 13 seasons (1964-76) in the Service's Annual Questionnaire Survey of U. S. Waterfowl Hunters, are presented. The 1964-75 data, available in time for additional analysis, are discussed in terms of their usefulness as index values for detecting short-term changes and long-term trends and demonstrating regional differences. Species or groups for which estimates were obtained include the white-winged dove (*Zenaida asiatica*), band-tailed pigeon (*Columba fasciata*), mourning dove (*Zenaida macroura*), American woodcock (*Philohela minor*), common snipe (*Capella gallinago*), sandhill crane (*Grus canadensis*), sora (*Porzana carolina*), other rails, gallinules, and American coot (*Fulica americana*). Among an average annual population of 2,013,300 duck stamp purchasers (1964-75), the mourning dove was the most popular of these game birds (averaging 478,000 hunters per year), followed by the coot (172,600 hunters), woodcock (168,700 hunters), snipe (74,600 hunters), band-tailed pigeon (25,400 hunters), white-winged dove (23,700 hunters), rails other than the sora (14,300 hunters), sora (6,300 hunters), gallinules (4,600 hunters), and crane (4,000 hunters). The average annual harvest index (unadjusted for reporting biases), for each species during this period was 12.05 million mourning doves, 1.17 million coots, 588,000 woodcock, 422,000 snipe, 314,000 white-winged doves, 192,000 band-tailed pigeons, 105,000 rails other than the sora, 32,100 soras, 26,400 gallinules, and 7,200 cranes. Several significant year-to-year changes were detected in mourning dove and woodcock average annual bag estimates at the management unit-flyway level. A number of long-term trends were noted as well, including significant increases in the proportions of duck stamp buyers also hunting mourning doves (about 1% annually), woodcock (3%), snipe (2%), cranes (8%), and rails other than the sora (6%). Significant long-term changes in average annual bag included a decrease for band-tailed pigeons in the three Pacific coast States and an increase in the Atlantic Flyway and nationally for rails other than the sora. In addition, a significant long-term increase averaging 2% per year was noted in the ratio of duck stamp sales to hunting license sales. High correlations obtained between certain results in the survey and the results of independent surveys are discussed. Various problems associated with using a waterfowl-hunter sampling frame as the basis for a survey of the hunting of migratory game birds other than waterfowl are evident throughout these analyses. The inescapable conclusion is that, although this survey of waterfowl hunters provides valuable data on the subject, a better sampling frame (or frames) for measuring the activity and success of all hunters of migratory game birds other than waterfowl is needed to meet the high standards now being set for the management of this valuable resource.

Since 1964, the U. S. Fish and Wildlife Service has collected information on the hunting of most migratory game birds other than waterfowl through its Annual Questionnaire Survey of U.S. Waterfowl Hunters. Ten species or groups of such birds are now included on the questionnaire: white-winged dove (*Zenaida asiatica*), band-tailed pigeon (*Columba fasciata*), mourning dove (*Zenaida macroura*), American woodcock (*Philohela minor*), common snipe (*Capella gallinago*), sandhill crane (*Grus canadensis*), sora (*Porzana carolina*), other rails, gallinules, and American coot (*Fulica americana*). In addition, the barnyard pigeon or rock dove (*Columba livia*) has been included since 1967 to reduce the apparent tendency to report them as band-tailed pigeons; rock dove harvest data are not included in this report.

The population of duck stamp buyers is used in the absence of a more suitable sampling frame for hunters of migratory game birds other than waterfowl. It is incomplete in varying degrees depending on the geographic area and species of interest. Therefore, for most of these species, hunting activity and harvest figures obtained are index values, useful primarily as indicators of changes and trends and not as measurements of total hunting activity and success. MacDonald and Martin (1971) summarized survey data for the first 5 years, and a detailed description of the survey will be found there. These early estimates, with some revisions and corrections, are included here together with estimates for an additional 8 seasons. Information on coot hunting activity and success, as obtained in the waterfowl harvest survey since its inception in 1952, was not examined by MacDonald and Martin (1971) but is included here. Annual changes and long-term (1964-75) trends are examined briefly (estimates for the 1976-77 season became available after work on the 1964-75 data had been completed) and, for several species, data from this survey and several independent surveys are compared.

I gratefully acknowledge the help and advice of J. W. Artmann, U. S. Fish and Wildlife Service, in the planning and assembly of material for this report.

Procedures and Limitations

The survey and its analysis have remained essentially as reported by MacDonald and Martin (1971). Certain aspects, however, deserve closer examination or re-emphasis.

The Sampling Frame

The information source is the sample of duck stamp purchasers selected for the annual waterfowl harvest survey. M. F. Sorensen, Office of Migratory Bird Man-

agement, Laurel, Maryland, in an administrative report on sandhill crane hunting dated 7 July 1977, found that 71% of the 1976-77 season crane hunting permit holders also bought duck stamps. In most States, for hunters 16 years old or older, probably at least 90% of the coot hunters, somewhat fewer (75 to 90%?) rail, gallinule, and snipe hunters, and still fewer woodcock, dove, and pigeon hunters purchased duck stamps. Although these figures are speculative, they reflect the inconsistency of the relationship between waterfowl hunting and other migratory game bird hunting, an indication that waterfowl hunters form a poor sampling frame for hunters of other migratory game birds.

The possibility that some of the estimates presented here for waterfowl hunters may contain substantial response/nonresponse biases is a further complication. For example, both 1975 and 1976 surveys of all crane hunting permit holders (the best sampling frame one could hope to have) produced somewhat lower estimates of crane hunting activity and success than did the waterfowl hunter surveys (M. F. Sorensen and H. M. Reeves, Office of Migratory Bird Management, Laurel, Maryland, administrative report on sandhill crane hunting dated 9 July 1976; M. F. Sorensen, administrative report cited above). Such biases do not necessarily negate the value of data provided by waterfowl hunters as indicators of changes and trends, however.

The relative importance of waterfowl hunting to all hunting in each State (Table A-1) is obviously an important consideration in using the data obtained in the survey. The average proportion of all licensed hunters also buying duck stamps in 1964-75 was 13%, ranging from less than 1% (West Virginia) to over 51% (North Dakota). Furthermore, these percentages increased significantly in about one-half the States during this period; there were no significant decreases.

Obviously, waterfowl hunters will not be representative of all hunters in a State, and the problem is compounded when waterfowl hunters from the various States are combined to produce totals for larger units. However, basic information on the relative importance of each species to hunters and to individual States and on trends in harvest, particularly changes in its size and distribution, should be almost as apparent from a sample of waterfowl hunters as from a sample of all hunters. Ruos and Tomlinson (1968) developed a complicated procedure for extrapolating total dove harvest from dove harvest by waterfowl hunters, but some problems remained, and it was not practical to repeat this procedure every year or use it for other species. Clark (1972:13-14) calculated that less than 50% of the total U. S. woodcock harvest can be attributed to waterfowl hunters. In view of such problems, no attempt has been made to project estimates beyond

the waterfowl hunter framework for any of the species included in this report.

The Survey

Except for the addition of several species, the questionnaire design introduced in 1964 remained unchanged through 1968. A slightly revised design was tested concurrently with the original questionnaire in 1967 and 1968 and has been used exclusively since. Some differences in results attributable to questionnaire differences were noted and appropriate adjustments (unpublished report by E. M. Martin, Office of Migratory Bird Management, Laurel, Maryland, dated 17 December 1970) have been made to maintain comparability among years.

Harvest estimates for coots have routinely appeared in Federal reports on waterfowl hunting. Application of the bias-adjustment procedure developed for waterfowl in the 1950's by E. L. Atwood (mimeographed report dated September 1959 on file at Migratory Bird Management Office, Laurel, Maryland) resulted in a sizeable reduction (averaging 35%, see Benning et al. 1975:64) for response bias in coot harvest figures through the years. For the present report, the data on coot hunting activity and success were re-examined for all years of the waterfowl harvest survey and recalculated without bias adjustment; nor have bias adjustments been applied to data for other species. However, because coots have been handled like waterfowl since the survey began, coot data still differ somewhat from those for the other species included here. Active coot hunters were not identifiable, but successful coot hunters were. In addition, estimates of harvest by waterfowl hunters under 16 years of age (conservatively, an additional 9%) and of unretrieved kill are available from this survey for coots but not for the other nonwaterfowl species.

Analysis of Results

To demonstrate potential uses of the survey results, I provide several comparatively simple examples of data analyses. These are intended to show the strengths and weaknesses of the data and point the way for further analysis by those interested in particular aspects.

The approaches used fall into two general categories: (1) seeking evidence of significant differences and changes or trends on the basis of this survey alone, and (2) evaluating the degree to which the results of this survey are supported by (correlated with) the results of independent surveys. The independent surveys examined include other Fish and Wildlife Service surveys and selected State surveys. Many

States collect harvest data on at least some of the species treated here, and more detailed comparisons with these data are encouraged. A better understanding of the harvest, and of each survey, should result.

Survey Results and Discussion

Activity and harvest estimates for the hunting of other migratory game birds by waterfowl hunters in the United States from 1964 through 1976 are summarized by species in Table 1. A more detailed summary (by State, flyway, and management unit) of the 1964-75 data available for inclusion in the additional analyses noted above appear in Appendix A, and similar detail for the 1976-77 season, which became available later, are presented in Appendix B. Statistical examinations of differences and trends are summarized for each species in Tables 2 through 6. The results are discussed briefly in this section by species.

White-winged Dove

During 1966-75, in the five States in which white-winged dove hunting has been permitted, an average of 23,700 waterfowl hunters (7.7% of the duck stamp buyers) harvested about 313,500 white-winged doves (13.2 birds per hunter) annually (Table A-2). Both the percentage hunting white-winged doves and the average bag decreased slightly during the period, but neither change was statistically significant (Table 2). However, on an individual State basis, decreases in the percentage hunting in Texas and the average bag in Arizona were significant, if all statistical assumptions, which tend to be weakest for the less widely hunted species, are met.

Band-tailed Pigeon

These game birds have been hunted in seven States since 1970; only three States participated before 1968. In 1975, an estimated 19,200 (5.2%) of the waterfowl hunters in these seven States also hunted band-tailed pigeons, bagging about 107,900 or 5.6 each (Table A-3). The 1975 figures were the lowest obtained during the 1966-75 period. In the three States for which data for the entire period are available, both the percentage hunting and the average bag showed downward trends (Table 2). These trends were detected in all three States but were significant only in the Washington and combined area average bag figures.

Mourning Dove

In the 12 seasons 1964-75, an average of 478,000

Table 1. Summary of annual activity and success estimates for hunters of migratory game birds other than waterfowl in the United States who also purchased duck stamps: 1964-76.

Species	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77
White-winged dove													
Number hunting			26,800	26,100	21,100	23,200	26,200	25,300	22,100	17,700	23,300	25,500	22,200
Percent hunting			9.7	9.0	7.4	7.3	7.1	7.3	7.2	6.1	7.9	8.4	7.4
Total bag			417,700	462,100	269,100	265,600	342,000	251,100	274,000	239,400	273,700	340,600	300,700
Average bag			15.6	17.7	12.8	11.4	13.1	9.9	12.4	13.5	11.8	13.4	13.6
Band-tailed pigeon													
Number hunting			26,600	23,000	25,200	25,900	25,700	29,700	31,200	24,100	23,500	19,200	19,300
Percent hunting			9.9	8.5	8.5	7.9	6.0	7.2	8.6	6.7	6.5	5.2	5.4
Total bag			227,800	189,400	221,300	192,100	189,500	237,000	253,200	176,100	168,500	107,900	104,000
Average bag			8.6	8.2	8.8	7.4	7.4	8.0	8.1	7.3	7.2	5.6	5.4
Mourning dove													
Number hunting	372,400	339,300	405,000	443,300	417,800	497,900	566,400	558,600	537,800	494,200	532,000	571,200	594,800
Percent hunting	24.14	22.28	22.96	23.33	23.26	24.51	23.82	23.57	25.19	24.30	25.07	26.66	28.96
Total bag (thousands)	9,158.0	8,690.1	11,238.1	11,581.4	10,216.3	12,718.9	14,056.2	13,457.9	14,209.4	12,282.8	12,963.5	13,986.2	15,117.3
Average bag	24.59	25.61	27.75	26.12	24.45	25.54	24.82	24.09	26.42	24.85	24.37	24.49	25.42
American woodcock													
Number hunting	119,900	112,400	116,300	137,500	132,300	174,900	209,400	206,100	192,700	187,800	215,500	220,200	212,100
Percent hunting	9.83	9.50	8.37	9.04	9.41	10.88	10.88	10.64	11.00	11.38	12.41	12.58	12.67
Total bag	452,600	376,600	401,500	497,100	485,200	589,700	666,400	667,200	723,200	658,400	756,100	775,400	822,000
Average bag	3.77	3.35	3.45	3.61	3.67	3.37	3.18	3.24	3.75	3.51	3.51	3.52	3.87
Common snipe													
Number hunting	56,100	47,500	58,600	65,200	59,400	85,300	94,600	79,300	85,300	79,300	85,500	99,200	106,300
Percent hunting	3.63	3.10	3.30	3.41	3.29	4.17	3.96	3.33	3.97	3.87	4.00	4.60	5.13
Total bag	355,300	254,200	329,300	407,500	330,100	493,500	529,100	417,300	466,100	447,500	471,700	564,000	670,500
Average bag	6.34	5.35	5.62	6.25	5.56	5.78	5.59	5.26	5.46	5.65	5.52	5.69	6.31
Sandhill crane													
Number hunting					2,300	3,500	3,600	3,900	3,000	3,800	5,400	6,400	7,300
Percent hunting					0.9	1.2	1.1	1.1	0.9	1.1	1.5	1.7	2.0
Total bag					3,000	5,400	5,600	6,400	3,900	11,700	9,200	12,200	9,500
Average bag					1.3	1.5	1.6	1.7	1.3	3.1	1.7	1.9	1.3
Sora													
Number hunting	5,900	5,000	5,000	5,600	3,800	6,500	8,100	5,500	7,400	6,900	7,300	8,800	9,200
Percent hunting	0.49	0.43	0.36	0.37	0.27	0.40	0.42	0.28	0.42	0.42	0.42	0.50	0.55
Total bag	37,700	26,600	30,400	29,700	13,400	29,500	27,100	31,200	47,200	37,100	30,400	44,900	39,100
Average bag	6.36	5.28	6.14	5.32	3.55	4.54	3.36	5.66	6.35	5.35	4.15	5.08	4.25
Other rails													
Number hunting	8,000	5,800	6,700	10,800	10,400	19,900	21,400	14,900	19,900	18,000	16,400	18,900	19,800
Percent hunting	0.66	0.49	0.48	0.71	0.74	1.24	1.11	0.77	1.14	1.09	0.94	1.08	1.18
Total bag	41,300	24,100	50,600	94,300	67,400	130,000	175,200	118,300	147,100	148,100	108,300	160,300	165,600
Average bag	5.15	4.13	7.58	8.70	6.49	6.52	8.20	7.92	7.40	8.25	6.61	8.49	8.38
Gallinules													
Number hunting	3,700	3,800	3,200	4,100	2,500	4,500	7,000	3,800	4,500	5,300	6,000	6,300	5,800
Percent hunting	0.24	0.25	0.18	0.22	0.14	0.22	0.29	0.16	0.21	0.26	0.28	0.29	0.28
Total bag	20,600	16,800	18,900	23,300	10,100	15,000	38,500	23,900	31,100	42,500	35,000	41,700	63,500
Average bag	5.61	4.41	5.87	5.65	4.02	3.32	5.50	6.31	6.88	7.95	5.80	6.62	11.00
American coot*													
Number successful	110,500	125,400	174,000	172,700	110,300	179,400	209,300	188,400	189,700	139,000	168,100	200,900	157,500
Percent successful	7.16	8.19	9.80	9.04	6.10	8.77	8.75	7.90	8.82	6.78	7.86	9.31	7.60
Total bag (thousands)	765.7	979.9	1,508.6	1,192.2	673.2	1,201.9	1,659.8	1,124.0	1,332.4	921.3	1,251.9	1,488.0	1,273.2
Average bag	6.93	7.81	8.67	6.90	6.10	6.70	7.93	5.97	7.02	6.63	7.45	7.41	8.08

*Numbers of successful coot hunters include only duck stamp purchasers while harvest estimates include birds taken by waterfowl hunters of all ages.

Table 2. Summary of statistical evidence of long-term trends in the hunting of other migratory game birds by waterfowl hunters in those States that had an open season on the designated species every year during the period indicated.

Species and period	Area included	Percentage hunting each species			Average bag		
		Period average ^a	Average annual change	<i>t</i> value ^b	Period average ^a	Average annual change	<i>t</i> value ^b
White-winged dove (1966-75)	5 States	7.75	-0.15	-1.44	13.15	-0.35	-1.59
Band-tailed pigeon (1966-75)	3 States	8.63	-0.13	-1.03	7.85	-0.20	-2.76*
Mourning dove (1964-75)	Eastern Manage. Unit	41.23	0.37	4.30**	28.13	-0.14	-1.43
	Central Manage. Unit	44.79	0.51	3.66**	27.74	-0.13	-0.83
	Western Manage. Unit	33.44	0.03	0.42	19.44	-0.19	-3.34**
	Total	39.80	0.37	4.69**	25.68	-0.09	-1.13
American woodcock (1964-75)	Atlantic Flyway	20.26	0.50	6.77**	3.45	-0.02	-0.83
	Mississippi Flyway	10.73	0.39	3.62**	3.58	0.01	0.33
	Central Flyway	1.54	0.07	2.63*	2.58	-0.01	-0.10
	Total	12.20	0.38	6.03**	3.51	-0.01	-0.37
Common snipe (1964-75)	Atlantic Flyway	3.94	0.03	1.33	6.48	-0.09	-1.12
	Mississippi Flyway	4.26	0.08	1.84	5.22	-0.05	-1.52
	Central Flyway	2.39	0.10	2.52*	5.39	0.02	0.22
	Pacific Flyway	3.87	0.18	5.28**	6.05	0.04	0.68
	Total	3.78	0.09	3.15*	5.68	-0.04	-1.38
Sandhill crane (1968-75)	7 States	1.25	0.10	2.88*	1.79	0.12	1.37
Sora (1964-75)	Atlantic Flyway	0.71	-0.04	-4.83**	6.52	0.13	0.94
	Mississippi Flyway	0.36	0.01	1.66	4.32	-0.12	-1.20
	Central Flyway	0.28	0.02	1.27	3.46	-0.32	-1.62
	Total	0.44	-tr.	-0.17	5.12	-0.09	-1.09
Other rails (1964-75)	Atlantic Flyway	1.59	0.06	3.15*	9.66	0.38	2.88*
	Mississippi Flyway	0.89	0.08	4.11**	3.58	0.01	0.33
	Central Flyway	0.48	0.02	0.75	3.85	0.19	1.83
	Total	1.00	0.06	3.27**	7.20	0.23	2.37*
Gallinules (1964-75)	Atlantic Flyway	0.38	-0.03	-3.76**	5.32	-0.20	-1.54
	Mississippi Flyway	0.30	0.03	3.31**	6.36	0.44	2.79*
	Central Flyway	0.15	0.02	2.63*	4.10	0.31	1.76
	Pacific Flyway	0.14	tr.	1.15	5.53	0.11	0.42
	Total	0.27	0.01	1.77	5.95	0.19	1.84
American coot ^c (1964-75)	Atlantic Flyway	6.60	-0.10	-0.81	6.38	0.02	0.45
	Mississippi Flyway	10.44	-0.03	-0.21	7.92	-0.06	-0.71
	Central Flyway	5.05	0.18	2.78*	4.02	0.04	1.55
	Pacific Flyway	8.34	0.13	2.34*	7.41	0.01	0.08
	Total	8.21	0.01	0.14	7.13	-0.04	-0.56

^aAll years weighted equally in regression calculations.

^b*Indicates an average change significantly different from zero at the 95% confidence level; **denote the 99% confidence level.

^cCoot data based on successful coot hunters; data for other species based on active hunters of respective species.

waterfowl hunters (24.2% of all duck stamp buyers) harvested slightly over 12 million mourning doves (25.2 doves per hunter) annually (Tables A-4, A-5). Almost 40% of the duck stamp buyers in those States in which dove hunting was permitted throughout this period hunted mourning doves. The proportion increased significantly (about 1% annually, a crude indi-

cator of change obtained by expressing average annual change as a percentage of the period average) during this period in the Eastern and Central Management units and in the overall figures. In 13 of 30 States there were significant increases, but in 1 (Louisiana) a significant decrease was indicated (Table 3).

Success rates were lowest (averaging 19.4 doves per

Table 3. *Statistical evidence of long-term trends in the hunting of mourning doves and American woodcock by waterfowl hunters in those States that had an open season on the designated species every year during the period 1964-75.*

Management Unit and State	Mourning doves				American woodcock						
	Percentage hunting doves		Average dove bag		Percentage hunting woodcock		Average woodcock bag				
	Period average ^a	Average annual change	Period average ^a	Average annual change	Period average ^a	Average annual change	Period average ^a	Average annual change			
Eastern											
Alabama	55.61	0.65	2.40*	-0.12	-0.33	41.62	-0.13	-0.38	3.26	-0.14	-4.59**
Delaware	36.08	0.23	0.95	-0.02	-0.09	10.82	0.34	2.36*	tr.	tr.	0.03
Florida	49.39	0.04	0.27	-0.31	-1.55	4.92	0.13	1.46	3.29	0.12	2.24*
Georgia	56.81	0.48	1.24	0.14	0.37	11.79	0.48	2.98*	3.78	0.11	2.23*
Illinois	31.00	0.76	3.72**	0.36	2.04	34.62	1.17	5.71**	6.28	-0.18	-2.39*
Kentucky	49.85	0.63	1.55	-0.08	-0.26	7.68	0.21	2.24*	2.75	0.03	0.67
Louisiana	35.13	-0.91	-3.87**	-0.59	-3.31**	34.42	0.49	2.59*	3.58	0	0
Maryland	31.23	0.49	3.65**	0.06	0.52	36.27	0.41	1.54	4.08	-0.09	-1.35
Mississippi	58.62	0.67	3.05*	-0.33	-1.06	20.70	0.78	4.94**	3.90	0.12	3.38**
North Carolina	58.10	0.81	3.97**	-0.15	-0.17	25.96	0.06	0.57	3.13	tr.	0.20
Pennsylvania	32.05	1.64	7.45**	0.17	1.28	8.66	0.26	3.31**	3.99	-0.01	-0.30
Rhode Island	29.29	3.29	13.91**	0.27	0.94	25.05	0.68	2.97*	2.52	-0.04	-2.17
South Carolina	59.05	0.75	2.93*	0.40	0.97	21.72	0.82	3.51**	3.29	-tr.	-0.04
Tennessee	53.06	1.11	3.73**	0.44	1.60	10.30	0.28	1.70	3.70	-0.03	-0.42
Virginia	48.33	0.04	0.13	-0.13	-1.02	25.87	0.31	1.05	4.36	-0.02	-0.24
West Virginia	29.12	1.33	1.70	0.55	3.07*	7.88	0.42	5.40**	3.22	0.08	1.16
Subtotal	41.23	0.37	4.30**	-0.14	-1.43	18.37	1.30	2.98**	3.91	0.40	5.25**
Central											
Mississippi						20.26	0.50	6.77**	3.45	-0.02	-0.83
Alabama	30.43	0.74	2.21	0.20	0.52	9.20	0.36	2.52*	3.44	0.07	1.06
Arkansas	30.97	0.64	2.83*	0.05	0.49	3.72	0.11	1.30	3.39	-0.03	-0.48
Colorado	52.49	0.35	1.15	0.23	2.04	3.69	0.32	5.12**	2.65	0.04	0.91
Kansas	36.02	0.56	2.23*	0.34	2.11	10.57	0.89	6.49**	2.87	0.02	0.44
Missouri	59.98	0.04	0.08	-0.02	-0.05	4.57	0.44	4.03**	3.02	-0.01	-0.08
New Mexico	49.02	0.83	3.32**	0.05	0.26	11.17	-0.04	-0.27	6.09	0.05	0.49
Oklahoma	53.07	0.51	1.85	-0.40	-1.70	27.08	0.67	1.91	3.29	0.06	1.21
Texas	44.79	0.51	3.66**	-0.13	-0.83	4.66	0.54	6.78**	2.55	0.01	0.19
Subtotal						8.18	0.21	1.69	4.76	0.03	0.33
Western											
Arizona	61.12	0.93	2.02	-0.32	-1.24	2.97	0.07	1.33	2.47	0.06	1.85
California	42.66	-0.07	-0.56	-0.17	-1.73	13.98	-0.09	-0.36	3.05	-0.10	-2.50*
Idaho	28.15	0.68	4.17**	-0.05	-0.45	3.77	0.35	5.10**	2.53	0.10	1.56
Nevada	42.07	0.16	0.56	-0.34	-2.72*	16.00	0.73	2.95*	3.07	0.01	0.40
Oregon	22.78	0.22	0.87	-0.25	-2.93*	10.73	0.39	3.62**	3.58	0.01	0.33
Utah	37.05	0.13	0.49	-0.01	-0.08	1.27	0.09	1.60	1.43	0.02	0.51
Washington	16.01	-0.32	-1.68	-0.34	-3.40**	1.86	0.22	4.92**	2.51	0.12	1.01
Subtotal	33.44	0.03	0.42	-0.19	-3.34**	1.55	0.03	0.79	2.95	0.01	0.12
Total	39.80	0.37	4.69**	-0.09	-1.13	1.54	0.07	2.63*	2.58	-0.01	-0.10
Total						12.20	0.38	6.03**	3.51	-0.01	-0.37

^aAll years weighted equally in regression calculations.

^b**Indicates an average annual change significantly different from zero at the 95% confidence level; *denote the 99% confidence level.

hunter per season) in the Western Management Unit (Table A-5), and decreased significantly (about 1% annually) during the period (Table 3). Elsewhere, Louisiana showed a significant decrease while West Virginia showed a significant increase. The overall downward trend was not statistically significant, but, as noted by Clark (1972:13) with reference to woodcock, such a decrease in average success as participation increases would not be surprising, since most of the additional hunters must be newcomers to the sport and relatively inexperienced. In year-to-year comparisons, significant increases in average bag were indicated for the 1966-67 and 1972-73 seasons whereas a significant decrease was recorded for 1967-68 (Table 4).

American Woodcock

During 1964-75 an average of 168,700 waterfowl hunters (10.6% of the duck stamp buyers in the three eastern flyways; 12.2% in those States having a woodcock season) harvested about 587,500 woodcock (3.5 per hunter) annually (Tables A-6, A-7). Waterfowl hunters in the Atlantic and Mississippi flyways participated in woodcock hunting in about equal numbers, but, although the rate of participation in the Atlantic Flyway has been about twice that in the Mississippi Flyway (20% vs. 10%), success rates have differed little (3.4 vs. 3.6 birds per hunter per season). The average annual harvest by waterfowl hunters exceeded 50,000 in four States, of which Michigan was the leader (89,000).

The proportion of waterfowl hunters also hunting woodcock has increased significantly since 1964 in all three flyways and in 19 of the 33 States in which woodcock have been hunted regularly (Table 3); the increase has averaged about 3% per year. Significant long-term changes in average bag were indicated in seven States but not at flyway or U.S. levels. Indications of significant changes from the previous year in average annual bag (Table 4) were found in the Atlantic Flyway in 1969 (decrease) and the overall 1972 average (increase).

Common Snipe

Annually, an average of 3.7% (74,600) of the duck stamp purchasers in the United States hunted snipe during 1964-75, bagging about 422,000 snipe (5.7 per hunter) each year (Tables A-8, A-9). The average annual snipe harvest by waterfowl hunters was highest in Louisiana (96,000) and also exceeded 50,000 in two other States. The proportion of waterfowl hunters also hunting snipe increased significantly by more than 2% per year during this period, with significant increases recorded for 15 of 46 States; the increases appeared to

become progressively larger from east to west across the country (Table 5). No long-term trend was evident in the average snipe bag. Significant increases were recorded in two States (Georgia, Mississippi), as were significant decreases (Nebraska, North Carolina).

Sandhill Crane

Currently, sandhill cranes are hunted in nine States, and this survey has included all crane hunting States since 1968 when seven States were involved. During 1968-75, duck stamp buyer participation in crane hunting in the seven States continuously involved averaged 1.2% (4,000 hunters), and they bagged an average of 7,200 cranes (1.8 per hunter) each season. Texas was the most important State for crane hunting, accounting for 39% of the hunters and 58% of the harvest during this 8-year period (Table A-10). The proportion of duck stamp buyers participating in the crane hunt in these seven States increased significantly since 1968 (averaging 8% annually); average bag has not changed significantly (Table 2).

Sora

An annual average of 0.4% (6,300) of the duck stamp buyers in the three eastern flyways hunted the sora during 1964-75, bagging about 32,100 birds (5.1 per hunter) each year (Tables A-11, A-12). Harvests averaged over 2,000 birds per year in only five States including Iowa, which did not have a rail season until 1972. Louisiana and New Jersey were the top States, each with harvests of 5,300 birds per year by duck stamp buyers. Both percentage hunting and average bag become progressively smaller from east to west across the country. The only statistically significant long-term change during this period was a decrease of almost 6% per year in percentage hunting in the Atlantic Flyway (Table 2).

Other Rails

Through the years, this category has included the king rail (*Rallus elegans*), clapper rail (*R. longirostris*), Virginia rail (*R. limicola*), yellow rail (*Coturnicops noveboracensis*), and black rail (*Laterallus jamaicensis*). In 1967, the black rail was omitted from the list of hunted species, followed a year later by the yellow rail, and these omissions continue. Very few birds of either species have been taken by hunters. Also, in most noncoastal States, the king rail has not been hunted since 1967. Even before then, the king rail was rarely, if ever, important in the rail harvest (Sanderson 1977:99-101). Thus, although hunters were not asked to report separately any rails but the sora,

Table 4. *Statistical evidence of year-to-year differences in the average annual bags of mourning doves and American woodcock by waterfowl hunters, 1964-75.*

Seasons compared		Mourning dove			American woodcock			
		Eastern Management Unit	Central Management Unit	Western Management Unit	Total	Atlantic Flyway	Mississippi and Central flyways	Total
1964 vs. 1965	\bar{x} (n) ^a	0.04 (16)	1.71 (7)	-1.56 (7)	0.06 (30)	-0.09 (17)	-0.54 (16)	-0.31 (33)
	<i>t</i> -value ^b	0.03	1.39	-2.07	0.07	-0.29	-2.12	-1.55
1965 vs. 1966	\bar{x} (n)	2.31 (16)	1.50 (7)	1.04 (7)	1.83 (30)	-0.05 (17)	0.35 (16)	0.14 (33)
	<i>t</i> -value	3.05**	1.42	2.18	3.78**	-0.34	1.89	1.23
1966 vs. 1967	\bar{x} (n)	-1.91 (16)	-1.10 (7)	0.0 (7)	-1.27 (30)	0.43 (17)	0.23 (16)	0.33 (33)
	<i>t</i> -value	-1.94	-1.06	0.0	-2.15*	2.07	0.80	1.91
1967 vs. 1968	\bar{x} (n)	0.48 (16)	0.62 (8)	-1.19 (7)	0.14 (31)	0.18 (17)	-0.08 (17)	0.05 (34)
	<i>t</i> -value	0.68	0.38	-1.27	0.24	0.64	-0.17	0.20
1968 vs. 1969	\bar{x} (n)	1.84 (16)	0.10 (8)	-0.51 (7)	0.85 (31)	-0.63 (17)	0.29 (17)	-0.17 (34)
	<i>t</i> -value	1.47	0.08	-0.59	1.13	-2.77*	0.56	-0.59
1969 vs. 1970	\bar{x} (n)	-1.31 (16)	-1.11 (8)	0.29 (7)	-0.90 (31)	0.02 (17)	-0.82 (16)	-0.39 (33)
	<i>t</i> -value	-1.66	-0.67	0.47	-1.50	0.07	-1.80	-1.47
1970 vs. 1971	\bar{x} (n)	-0.42 (16)	-0.20 (8)	-1.00 (7)	-0.49 (31)	-0.05 (17)	0.16 (16)	0.05 (33)
	<i>t</i> -value	-0.60	-0.10	-1.13	-0.76	-0.34	1.21	0.50
1971 vs. 1972	\bar{x} (n)	2.32 (16)	2.95 (8)	0.33 (7)	2.04 (31)	0.38 (17)	0.31 (16)	0.34 (33)
	<i>t</i> -value	2.35*	1.89	0.23	2.82**	1.83	1.30	2.23*
1972 vs. 1973	\bar{x} (n)	-2.64 (16)	-1.33 (7)	0.94 (7)	-1.50 (30)	0.05 (17)	0.03 (17)	0.04 (34)
	<i>t</i> -value	-1.84	-1.25	2.35	-1.79	0.30	0.11	0.25
1973 vs. 1974	\bar{x} (n)	-0.15 (16)	-1.89 (8)	-1.39 (7)	-0.88 (31)	0.04 (17)	0.05 (17)	0.04 (34)
	<i>t</i> -value	-0.13	-1.38	-1.98	-1.26	0.19	0.24	0.31
1974 vs. 1975	\bar{x} (n)	-0.01 (16)	2.39 (8)	0.77 (7)	0.79 (31)	-0.06 (17)	-0.05 (17)	-0.06 (34)
	<i>t</i> -value	-0.01	2.03	0.86	1.50	-0.29	-0.32	-0.43

^a \bar{x} = average difference between State-level estimates of annual bag per waterfowl hunter; n = number of States.

^b*Indicates a significant correlation at the 95% confidence level; **denote the 99% level.

some degree of separation is still possible. In most instances, rails reported from States not permitting hunting of large rails will be Virginia rails. However, harvest in these States has amounted to only 6% of the total. Clapper rails are probably dominant in the harvest in most other States although the degree of dominance will vary, and more knowledge of the situation in each State is necessary should a separation be desired.

An annual average of 0.9% (14,300) of the duck stamp buyers in the three eastern flyways hunted rails other than the sora during 1964-75, and bagged about 105,000 such birds (7.4 per hunter) annually (Tables A-13, A-14). Louisiana and South Carolina were the most important harvest States for these birds, each harvesting well over 20,000 annually and together accounting for 50% of the U. S. harvest by waterfowl hunters during this period. Outside Louisiana, the harvest of other rails was strongly concentrated along the Atlantic coast. Both the percentage hunting and the average bag showed significant increases in most areas (Table 2).

Gallinules

Included here are the common gallinule (*Gallinula chloropus*) and the purple gallinule (*Porphyryla martinica*). The latter is much more restricted in range, occurring primarily in parts of eight southeastern States. It has been excluded from Florida's list of hunted species since 1972. On the other hand, in Louisiana it apparently becomes numerous enough at times to be the subject of depredation control measures in rice fields.

Some hunters undoubtedly fail to distinguish gallinules (at least common gallinules) from coots. However, in many areas, few, if any, gallinules are present when coots are being hunted, and vice versa, because of differences in migration dates (and therefore season dates), and main wintering grounds. A possible clue to the extent of this misidentification is found in the Service's Duck Wing Collection Survey which, since 1965, has also asked for coot (but not gallinule) wings. Common gallinule wings are received at the rate of about three per thousand coot wings (no purple gallinule wings have yet been received), whereas waterfowl

Table 5. *Statistical evidence of long-term trends in the hunting of common snipe by waterfowl hunters in those States that had a snipe season every year during the period 1964-75.*

Flyway and State	Percentage hunting snipe			Average snipe bag		
	Period average ^a	Average annual change	<i>t</i> value ^b	Period average ^a	Average annual change	<i>t</i> value ^b
Atlantic						
Connecticut	1.91	0.03	0.54	2.72	-0.07	-0.82
Delaware	2.57	-0.13	-1.48	3.78	0.14	0.74
Florida	20.62	0.67	3.47**	10.99	-0.03	-0.20
Georgia	8.31	0.10	1.12	5.28	0.23	3.69**
Maine	2.65	0.12	1.72	3.74	-0.13	-1.04
Maryland	0.89	-0.01	-0.31	3.56	0.05	0.33
Massachusetts	1.97	0.12	2.33*	2.42	0.04	0.55
New Hampshire	1.67	0.10	1.15	2.07	0.01	0.09
New Jersey	2.82	0.06	0.70	3.72	-0.18	-2.07
New York	1.35	0.06	2.12	2.12	0.08	1.58
North Carolina	5.84	-0.08	-0.76	3.58	-0.16	-2.34*
Pennsylvania	1.33	0.05	1.24	2.20	-0.03	-0.85
Rhode Island	3.12	0.27	3.36**	2.80	-0.03	-0.09
South Carolina	7.80	0.13	1.76	5.54	-0.09	-0.42
Vermont	2.10	0.19	3.61**	3.00	-0.27	-1.54
Virginia	3.82	0.01	0.18	3.29	-0.06	-1.02
West Virginia	3.20	0.36	1.82	2.30	-0.29	-1.09
Subtotal	3.94	0.03	1.33	6.48	-0.09	-1.12
Mississippi						
Alabama	9.27	0.36	2.31*	5.40	0.15	1.23
Arkansas	1.72	0.06	1.16	5.59	-0.22	-1.31
Illinois	1.83	0.03	0.87	3.72	0.04	0.91
Indiana	3.16	0.24	3.11*	2.48	-0.02	-0.24
Iowa	3.78	0.27	6.20**	3.89	-0.03	-0.58
Kentucky	2.27	0.10	1.26	2.52	-0.05	-0.57
Louisiana	11.02	-0.16	-1.32	8.35	-0.02	-0.29
Michigan	4.13	0.07	1.03	3.21	-0.04	-0.54
Minnesota	2.74	0.16	3.11*	3.38	0.07	0.77
Mississippi	6.14	0.12	1.24	5.12	0.23	2.49*
Missouri	1.51	0.02	0.47	4.02	-0.08	-1.00
Ohio	2.64	-0.03	-0.43	3.07	-0.06	-0.67
Tennessee	2.96	0.16	2.15	3.61	0.12	1.01
Wisconsin	4.27	0.18	2.30*	3.21	0.01	0.16
Subtotal	4.26	0.08	1.84	5.22	-0.05	-1.52
Central						
Colorado	1.11	0.12	4.76**	3.88	0.06	0.65
Kansas	2.00	-0.01	-0.15	3.33	-0.18	-1.65
Nebraska	2.33	0.06	1.34	3.50	-0.18	-2.89*
North Dakota	1.92	0.07	2.14	5.81	0.02	0.10
Oklahoma	1.64	0.15	2.20	3.63	0.12	1.00
South Dakota	1.12	tr.	0.02	3.88	-0.12	-0.83
Texas	3.81	0.20	2.40	6.58	0.09	0.74
Subtotal	2.39	0.10	2.52*	5.39	0.02	0.22
Pacific						
Arizona	2.01	0.12	1.25	4.86	-0.32	-1.10
California	4.62	0.25	6.14**	7.12	0.10	1.12
Colorado	1.41	0.11	2.64*	3.19	0.07	0.67
Idaho	1.78	0.16	4.83**	3.88	-tr.	-0.02
Nevada	2.49	0.20	2.59*	4.55	0.05	0.31
Oregon	3.92	0.25	3.99**	4.83	0.06	0.94
Utah	2.57	0.18	2.39*	3.48	0.12	1.34
Washington	4.41	0.07	1.12	5.84	0.01	-0.12
Subtotal	3.87	0.18	5.28**	6.05	0.04	0.68
Total	3.78	0.09	3.15*	5.68	-0.04	-1.38
Alaska (1965-75)	3.26	0.10	1.46	5.65	-0.02	-0.09

^aAll years weighted equally in regression calculations.

^b*Indicates an average annual change significantly different from zero at the 95% confidence level; ** denote the 99% confidence level.

Table 6. Statistical evidence of long-term trends in the hunting of American coot by waterfowl hunters in each State during the period 1964-75.

Flyway and State	Percentage bagging coot			Average coot bag		
	Period average ^a	Average annual change	<i>t</i> value ^b	Period average ^a	Average annual change	<i>t</i> value ^b
Atlantic						
Connecticut	3.38	-0.02	-0.16	2.78	-0.05	-1.31
Delaware	3.54	-0.09	-0.55	5.01	0.25	1.11
Dist. of Columbia	2.68	-0.20	-2.16	3.23	-0.59	-2.01
Florida	21.65	-0.29	-1.15	9.82	0.07	0.68
Georgia	6.71	-0.07	-0.47	5.41	0.08	0.61
Maine	5.32	-0.21	-1.85	5.88	-0.06	-0.34
Maryland	2.04	0.10	0.13	4.10	-0.33	-2.08
Massachusetts	3.97	-0.07	-0.60	3.83	-0.15	-1.17
New Hampshire	2.45	-0.13	-0.97	2.68	-0.12	-0.90
New Jersey	5.25	-0.13	-1.14	3.60	-0.03	-0.53
New York	3.95	-0.13	-1.10	3.48	-0.11	-1.90
North Carolina	11.29	0.43	1.69	7.55	0.15	0.59
Pennsylvania	5.73	-0.09	-0.51	3.45	-0.06	-0.75
Rhode Island	5.19	-0.32	-1.79	3.21	0.08	0.67
South Carolina	10.76	-0.04	-0.22	5.74	-0.13	-1.62
Vermont	2.21	-0.13	-1.76	2.62	0.10	1.01
Virginia	9.42	0.88	3.65**	10.66	0.71	2.36*
West Virginia	7.94	-0.08	-0.21	3.60	-0.33	-1.64
Subtotal	6.60	-0.10	-0.81	6.38	0.02	0.45
Mississippi						
Alabama	13.32	-0.17	-0.62	7.65	0.29	1.37
Arkansas	3.69	0.01	0.11	4.86	0.15	1.16
Illinois	8.13	-0.17	-0.77	5.19	0.06	0.81
Indiana	10.50	-0.06	-0.22	4.95	0.08	0.63
Iowa	6.46	0.05	0.35	4.12	-0.07	-1.14
Kentucky	5.09	0.01	0.04	3.79	0.09	0.67
Louisiana	16.81	0.45	1.34	17.85	-0.51	-1.14
Michigan	11.60	-0.17	-0.78	4.02	-0.01	-0.14
Minnesota	10.28	0.03	0.29	5.33	-0.05	-0.98
Mississippi	6.29	0.02	0.10	6.75	0.11	0.60
Missouri	4.17	0.12	1.59	3.66	0.15	1.73
Ohio	10.97	-0.10	-0.33	4.10	tr.	0.04
Tennessee	8.54	0.25	1.05	4.83	-0.21	-1.31
Wisconsin	13.17	-0.23	-1.17	7.36	-0.05	-0.55
Subtotal	10.44	-0.03	-0.21	7.92	-0.06	-0.71
Central						
Colorado	3.06	0.09	1.52	2.81	-0.02	-0.25
Kansas	5.35	0.05	0.66	3.69	0.04	0.55
Montana	3.90	0.09	1.31	3.01	0.21	3.25**
Nebraska	4.40	0.25	2.31*	3.23	-tr.	-0.01
New Mexico	6.02	0.26	1.50	3.24	0.12	1.31
North Dakota	5.12	0.09	0.62	5.31	-0.07	-0.35
Oklahoma	6.37	0.19	1.23	4.27	0.21	1.37
South Dakota	4.70	0.25	2.91*	4.56	0.09	0.92
Texas	5.51	0.26	4.52**	4.12	0.07	1.09
Wyoming	4.33	0.19	1.41	2.99	0.22	1.58
Subtotal	5.05	0.18	2.78*	4.02	0.04	1.55
Pacific						
Arizona	8.55	0.17	1.71	5.25	0.15	0.65
California	12.29	0.22	2.51*	9.13	0.04	0.23
Colorado	4.38	0.19	1.82	3.55	0.11	0.76
Idaho	5.06	-tr.	-0.01	4.96	-0.01	-0.14
Montana	4.07	-0.02	-0.24	5.23	-0.03	-0.07
Nevada	5.87	0.12	0.97	6.57	0.08	0.55
New Mexico	6.40	-0.28	-1.14	3.29	-0.06	-0.32
Oregon	5.84	0.30	4.16**	5.68	0.15	1.35
Utah	8.07	0.38	2.71*	4.54	0.02	0.41
Washington	5.06	-0.06	-0.90	4.62	-0.10	-1.23
Wyoming	2.84	0.09	0.86	4.43	0.19	0.71
Subtotal	8.34	0.13	2.34*	7.41	0.01	0.08
Total	8.21	0.01	0.14	7.13	-0.04	-0.56
Alaska (1965-75)	1.66	-0.03	-0.84	4.24	-0.30	-1.97

^aAll years weighted equally in regression calculations.

^b*Indicates an average annual change significantly different from zero at the 95% confidence level; **denote the 99% confidence level.

hunters report bagging about 22 gallinules per thousand coots. Thus, waterfowl hunters could be misidentifying as many as 12% of the gallinules they take as coots.

An average of about 4,600 (0.2%) of the duck stamp buyers in the United States during 1964-75 hunted gallinules, taking an average of 26,400 gallinules (5.8 per hunter) annually (Tables A-15, A-16). About 31% of the gallinule hunters and 50% of the harvest by waterfowl hunters were attributed to Louisiana. Statistically significant long-term trends were detected in both percentage hunting (decrease in Atlantic Flyway, increases in Mississippi and Central flyways) and average bag (increase in Mississippi Flyway) at the flyway level, but there was no evidence of nationwide trends (Table 2).

American Coot

Coot hunting activity and harvest are undoubtedly overestimated in the New England-New York coastal areas where scoters (*Melanitta* spp.) are routinely referred to as coots and reported as such to an unknown degree by waterfowl hunters. However, this overestimate involves comparatively few birds (Table A-17) in areas where the American coot is relatively uncommon (Sanderson 1977:133).

On the average, each year during 1964-75, about 8.2% (164,000) of the duck stamp buyers in the United States hunted coots successfully. Probably very few (assume 5%) who hunted coots were unsuccessful, so, for purposes of comparing hunting pressure placed on coots with that placed on other migratory game birds by duck stamp buyers, an estimate of 172,600 hunters (8.7%) seems reasonable. The harvest by all waterfowl hunters, including those under 16 years old and hunting without a duck stamp, averaged 1,175,000 coots (almost 7 per hunter) annually during the same period. Allowing for survey differences, a similar range in coot hunting activity and success was experienced during 1952-63 (Tables A-18, A-19). Over 58% of the harvest occurred in the Mississippi Flyway; Louisiana accounted for over one-fourth of the harvest in the United States (Table A-17). California and Wisconsin together accounted for another 25%. No long-term trends were evident in average bag, but average increases of 3.6% in the Central Flyway and 1.6% in the Pacific Flyway per year in the percentage of waterfowl hunters hunting coots during 1964-75 were statistically significant (Table 6).

Selected Comparisons with Other Surveys

Some of the results of this survey are compared, at

the State level, with those of several other surveys (Table 7). The predominance of high correlations is encouraging and perhaps surprising, particularly since those for total hunters and total bag are as prominent as those for average bag. The latter, being less influenced by variability in duck stamp sales, was expected to be a better measure of the actual situation. The reader is reminded that a high correlation between surveys does not imply that the surveys yield the same results, only that the results tend to differ by a constant amount or factor which can be large or small, positive or negative, depending on the species.

These high correlations look impressive but may be somewhat misleading. Often very wide ranges are involved (e.g., Nevada with 70,100 and California with 1,210,400 mourning doves bagged by duck stamp buyers in 1972), and such data may show substantial departures from a normal distribution. Even comparatively insensitive surveys might agree well enough in such situations to produce high correlations. Thus, the degree of agreement between surveys should be presumed to be exaggerated to some extent, particularly when used for comparisons among States. Comparisons among seasons tend to yield somewhat lower, though still often significant, correlations, and these results are probably more realistic and useful.

The waterfowl hunter survey has the advantage that it is uniformly applied in all States whereas surveys conducted by individual States may lack this uniformity. The low correlations with band-tailed pigeon data from Oregon and Arizona, contrasting with the generally high correlations found elsewhere, may indicate that the surveys of Oregon and Arizona were less efficient than those of the other States. Different survey methods can produce markedly different results. For example, a special mail questionnaire survey of white-winged dove hunters in Texas in 1976, based on an efficient sampling frame of white-winged dove stamp purchasers, produced activity and harvest estimates about 2.5 times larger than those produced by the traditional check station survey (J. H. Dunks, Texas Parks and Wildlife Department, Austin, mimeographed report on white-winged dove harvest in Texas dated 21 March 1977). Measurements of trends and other relationships may be much less affected, however. Simple questionnaire design changes can be important, too. With the elimination of the waterfowl calendar (for reporting daily success) from the Federal questionnaire in 1969 after 2 years of testing, it was necessary to reduce subsequent estimates of other migratory game bird hunting activity by 4%, successful coot hunters by 10%, and coot harvest by 16% to maintain comparability with results obtained in previous years (E. M. Martin, Office of Migratory Bird Management, Laurel, Maryland, unpublished report on changes in the Federal questionnaire survey dated

Table 7. *Correlation of estimates of total hunters, total bag, and average bag of migratory game birds from Federal questionnaire (this report) with estimates from other sources.*^a

Species and State or area	Source of data ^b	Season(s) used	Category tested ^c	Correlation coefficient for:		
				Total hunters	Total bag	Average bag
White-winged dove						
Lower Rio Grande (Texas)	1	1966-75	Seasons (10)	—	0.60	—
Arizona	2	1966-75	Seasons (10)	—	0.66*	0.91*
Band-tailed pigeon						
California	2	1966-75	Seasons (10)	0.76*	0.92**	0.87**
Oregon	2	1966-75	Seasons (10)	-0.28	trace	0.43
Washington	2	1966-75	Seasons (10)	0.74*	0.91**	0.75*
Arizona	2	1968-75	Seasons (8)	-0.37	0.31	0.57
New Mexico	3	1968-75	Seasons (8)	0.82*	0.64	0.44
Colorado	4	1970-75	Seasons (6)	0.92**	0.93**	0.76
Utah	2,5	1970-75	Seasons (6)	0.71	0.58	0.48
Mourning dove						
Arizona	2	1966-75	Seasons (10)	0.75*	0.70*	0.27
California	2	1966-75	Seasons (10)	0.68*	0.43	0.71**
Idaho	2	1966-75	Seasons (10)	0.87**	0.84**	0.27
Nevada	2	1966-75	Seasons (10)	0.69*	0.69*	0.75**
Oregon	2	1966-75	Seasons (10)	0.65*	0.57	0.78
Utah	2	1966-75	Seasons (10)	0.71*	0.73**	0.82**
Washington	2	1966-75	Seasons (10)	0.38	0.76**	0.76**
Management Units						
Eastern	6	1971 or 72	States (10)	0.55	0.69*	0.91**
Central	6	1971 or 72	States (7)	0.97**	0.99**	0.91**
Western	6	1971 or 72	States (7)	0.96**	0.97**	0.98**
Total			States (24)	0.86**	0.87**	0.94**
Sandhill crane						
All states except Alaska	7	1975	States (8)	0.98**	0.99**	0.96**

^aAsterisks indicate significant correlation: * at the 95% confidence level and ** at the 99% level.

^bSource of data for comparisons with waterfowl hunter data from questionnaires:

1. Sanderson (1977:257) and telephone conversation with J. H. Dunks, Texas Parks and Wildlife Department, Austin.
2. Minutes of the Western Migratory Upland Game Bird Technical Committee, Report 15, dated June 1976.
3. Braun et al. (1975:14) and telephone conversation with J. L. Sands, New Mexico Department of Game and Fish, Albuquerque.
4. Braun et al. (1975:14) and telephone conversation with C. E. Braun, Colorado Division of Wildlife, Fort Collins.
5. Braun et al. (1975:14) and minutes of Western Migratory Upland Game Bird Technical Committee, Report 14, dated June 1975.
6. Sanderson (1977:286).
7. M. F. Sorensen and H. M. Reeves, Office of Migratory Bird Management, Laurel, Md., administrative report on sandhill crane hunting dated 9 July 1976.

^cSample sizes in parentheses.

17 December 1970). It is apparently coincidence that this design change and the significant upward trends in the percentages hunting several species occurred at about the same time, in part because, if they were related, then the number of significant decreases has also been underestimated, probably a much less likely occurrence.

The results of some general comparisons of Federal questionnaire and wing collection surveys are shown in Table 8. Duck survey data are shown as a standard with which to compare woodcock survey data. Whereas the agreement between the two surveys

appears increasingly good between 1971 and 1975 for ducks, it has remained generally poor for woodcock, well below the point of real usefulness. Although the waterfowl-hunter sampling frame is acknowledged to be least complete for woodcock, dove, and pigeon hunters, the generally high correlations obtained with dove and pigeon data (Table 7) led to the expectation of similar results for the woodcock. Possibly regional differences are a factor. Somewhat poorer agreement was found in dove data from the Eastern Management Unit where the lowest ratios of duck stamp buyers to hunters occur (Table A-1), and where nearly all wood-

Table 8. State-level comparisons of Federal questionnaire and wing survey estimates of the average seasonal success of duck and woodcock hunters.

Species	Flyway	Number of States	Correlation coefficient ^a for \bar{x} bag				
			1971-72	1972-73	1973-74	1974-75	1975-76
Ducks	Atlantic	18	0.48*	0.71**	0.80**	0.82**	0.87**
	Mississippi	14	0.81**	0.88**	0.88**	0.93**	0.91**
	Central	10	-0.17	0.12	0.30	0.70*	0.78**
	Pacific	11	0.14	0.84**	0.72*	0.85**	0.82**
	U. S.	54	0.57**	0.81**	0.81**	0.87**	0.86**
American woodcock	Atlantic	17	0.71**	0.51*	0.42	0.39	0.33
	Mississippi and Central	14 to 17	0.24	0.52*	0.35	0.41	0.43
	Total	31 to 34	0.54**	0.53**	0.45**	0.44**	0.37*

*Indicates a significant correlation at the 95% confidence level; **denotes the 99% level.

cock hunting activity occurs. Secondly, the incidence of mourning dove hunters in the States in which this bird has been hunted is much higher than the comparable figure for woodcock (40% vs. 12%), resulting in a much larger sample of mourning dove hunters. Thirdly, these wing surveys sample select groups of high success hunters whereas the questionnaire survey attempts to randomly sample all waterfowl hunters. Although adequate for most estimates related to waterfowl hunting, it appears that one or both of these sampling frames yield poor results for woodcock hunting.

Although some statistical tests were applied to data at flyway, management unit, and U. S. levels (obtained by adding various State estimates), it should be recognized that an additional source of error is contained in such figures because of the inability in this survey to either sample the hunters of these various species proportionately or to apply appropriate weighting or expansion factors for making such combined-area estimates. General indications are probably still valid but it may be better, when applying the results in management programs, to place more emphasis on the figures for individual States. Undoubtedly, additional information of better quality on changes and trends can be

extracted from the present survey with a more sophisticated statistical approach, but it is also apparent that, as concluded by MacDonald and Martin (1971:8), a better sampling frame for measuring the harvest of migratory game birds other than waterfowl is still needed.

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Appendix A

The 1964-75 survey results, the subject of various analyses in this report, are summarized here at State, flyway or management unit, and national levels. Other investigators may wish to carry out additional analyses after referring to the preceding sections for background information on the survey and the limitations of its results.

Table A-1. Summary of average duck stamp and hunting license sales and relationships between them at State, management unit, and flyway levels: 1964-75.

Flyway, Management Unit, and State	1964-75 average:		Percentage buying duck stamps		
	Duck stamp sales	Hunting license sales	1964-75 average ^a	Average annual change	t value ^b
Atlantic Flyway					
Eastern Management Unit					
Connecticut	12,262	76,875	15.76	0.43	4.33**
Delaware	11,242	27,112	41.40	1.50	4.49**
Florida	29,748	242,001	12.35	-0.26	-1.56
Georgia	11,965	323,265	3.72	0.07	1.14
Maine	15,518	203,998	7.58	0.24	4.34**
Maryland	31,774	186,209	17.02	0.58	4.63**
Massachusetts	24,193	121,761	20.08	0.80	4.34**
New Hampshire	8,421	87,739	9.74	0.79	13.24**
New Jersey	32,425	184,310	17.49	0.46	4.53**
New York	88,414	728,452	12.19	0.58	2.93*
North Carolina	25,780	418,782	6.18	0.15	2.00
Pennsylvania	61,977	1,109,284	5.53	0.17	2.14
Rhode Island	3,167	16,113	19.55	0.73	5.38**
South Carolina	18,500	200,706	9.26	0.28	2.78*
Vermont	6,886	139,669	4.93	0.31	7.20**
Virginia	19,049	410,088	4.66	-0.01	-0.44
West Virginia	1,834	253,786	0.72	tr.	0.46
Mississippi Flyway					
Eastern Management Unit					
Alabama	14,247	339,408	4.20	-tr.	-0.06
Illinois	71,007	470,355	15.12	0.34	2.01
Indiana	23,820	471,342	5.11	0.21	2.97*
Kentucky	9,619	271,295	3.52	0.10	3.78**
Louisiana	105,379	323,977	32.47	0.12	0.41
Michigan	98,476	896,244	11.06	0.34	2.51*
Mississippi	22,025	288,926	7.59	0.20	2.01
Ohio	35,317	558,113	6.35	0.22	2.84*
Tennessee	26,250	449,714	5.80	0.12	1.94
Wisconsin	125,821	624,214	20.16	0.15	0.71
Central Management Unit					
Arkansas	42,896	300,134	14.11	0.49	2.27*
Iowa	53,870	327,737	16.36	0.35	2.41*
Minnesota	149,520	418,497	36.33	0.51	0.79
Missouri	50,729	447,724	11.28	0.24	3.11*
Central Flyway					
Central Management Unit					
Colorado (East) ^c	36,503	284,859	12.84	0.58	3.31**
Kansas	50,735	220,705	22.72	1.16	6.77**
Montana (East) ^c					
Nebraska	40,959	195,586	20.97	1.06	4.72**
New Mexico (East) ^c	6,332	118,640	5.38	-0.04	-0.63
North Dakota	46,020	89,337	51.39	0.83	2.63*
Oklahoma	29,896	237,170	12.65	0.23	1.29
South Dakota	40,263	156,892	25.82	0.16	0.68
Texas	115,196	745,854	15.42	0.04	0.30
Wyoming (East) ^c	7,231	155,686	4.64	0.20	3.21**
Pacific Flyway					
Central Management Unit					
Colorado (West) ^c					
Montana (West) ^c	26,646	186,846	14.46	-0.23	-1.55
New Mexico (West) ^c					
Wyoming (West) ^c					
Western Management Unit					
Arizona	11,363	156,994	7.21	0.12	1.34
California	156,155	704,288	22.19	0.33	2.84*
Idaho	30,444	210,393	14.49	0.11	1.26
Nevada	12,671	63,061	20.11	0.19	1.13
Oregon	51,585	349,733	14.76	0.25	2.14
Utah	33,698	218,195	15.47	0.21	1.48
Washington	72,402	325,053	22.29	0.14	0.92
Alaska	13,085	56,602	23.42	-0.04	-0.15
Management Unit Totals					
Eastern	935,115	9,423,741	9.90	0.23	2.51*
Central	696,797	3,885,665	17.86	0.30	2.05
Western	368,319	2,027,718	18.15	0.18	1.85
Flyway Totals					
Atlantic	403,154	4,730,150	8.49	0.23	2.87*
Mississippi	828,976	6,187,682	13.38	0.26	1.98
Central	373,135	2,204,728	16.82	0.37	2.97*
Pacific	394,965	2,214,564	17.82	0.13	1.40
U. S. Total (with Alaska)	2,013,315	15,393,725	13.04	0.25	2.38*

^a All years weighted equally in regression calculations.

^b Asterisks indicate annual change significantly different from zero--* at the 95% confidence level and ** at the 99% confidence level.

^c Hunting license figures not separable by flyway; data for these States appear in the flyway where most stamp sales occurred.

Table A-2. White-winged dove hunting activity and success by hunters purchasing duck stamps: 1966-75.

	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	Average
New Mexico											
Number hunting	330	350	310	320	580	440	320	290	440	670	400
Percent hunting	6.0	5.9	4.9	5.6	8.8	6.0	5.0	4.7	5.9	8.1	6.2
Total bag	4,400	5,600	6,400	3,600	4,200	4,400	3,800	3,500	3,900	11,100	5,100
Average bag	13.3	15.7	20.7	11.3	7.2	10.1	11.9	12.1	9.0	16.7	12.6
Texas											
Number hunting	11,400	9,900	8,900	7,200	9,100	9,400	9,700	7,200	8,100	9,400	9,000
Percent hunting	11.5	8.9	9.4	6.3	6.3	6.9	7.6	6.2	6.7	7.2	7.5
Total bag	221,600	182,400	106,500	98,200	139,900	85,400	132,100	103,100	130,900	147,100	134,700
Average bag	19.4	18.4	12.0	13.6	15.4	9.1	13.6	14.4	16.2	15.6	14.9
Arizona											
Number hunting	4,100	4,600	4,000	4,700	4,500	3,900	4,900	4,400	5,000	5,800	4,600
Percent hunting	47.0	44.5	39.9	37.1	31.8	25.6	41.9	39.9	37.5	50.5	38.6
Total bag	86,800	114,700	85,400	57,000	65,900	41,700	64,700	61,500	55,300	81,400	71,400
Average bag	21.4	25.2	21.2	12.2	14.7	10.6	13.1	14.0	11.1	14.0	15.6
California											
Number hunting	10,600	10,700	7,500	10,700	11,500	11,200	6,900	5,600	9,500	9,200	9,300
Percent hunting	7.0	7.1	4.7	6.2	6.2	6.6	4.6	4.0	6.7	6.7	6.0
Total bag	101,000	155,100	68,800	102,500	129,000	114,600	69,100	69,700	80,600	97,500	98,800
Average bag	9.6	14.4	9.2	9.6	11.2	10.2	10.1	12.4	8.5	10.6	10.6
Nevada											
Number hunting	360	530	370	310	500	340	280	220	290	350	360
Percent hunting	3.0	4.2	3.0	2.4	3.5	2.3	2.2	1.6	2.5	2.6	2.7
Total bag	3,900	4,300	2,000	4,200	3,000	5,000	4,200	1,500	3,000	3,500	3,500
Average bag	10.9	8.1	5.5	13.5	6.0	14.6	15.0	7.0	10.4	10.0	9.8
TOTAL											
Number hunting	26,800	26,100	21,100	23,200	26,200	25,300	22,100	17,700	23,300	25,500	23,700
Percent hunting	9.7	9.0	7.4	7.3	7.1	7.3	7.2	6.1	7.9	8.4	7.7
Total bag	417,700	462,100	269,100	265,600	342,000	251,100	274,000	239,400	273,700	340,600	313,500
Average bag	15.6	17.7	12.8	11.4	13.1	9.9	12.4	13.5	11.8	13.4	13.2

Table A-3. Band-tailed pigeon hunting activity and success by hunters purchasing duck stamps: 1966-75.

	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	Average
California											
Number hunting	11,400	10,000	11,100	9,600	9,900	9,700	13,500	8,100	8,800	6,400	9,900
Percent hunting	7.5	6.6	6.9	5.5	5.3	5.7	9.1	5.7	6.3	4.6	6.3
Total bag	109,000	84,600	97,400	70,900	82,700	86,400	142,100	67,000	74,600	39,300	85,400
Average bag	9.6	8.5	8.8	7.4	8.3	9.0	10.5	8.2	8.4	6.1	8.7
Oregon											
Number hunting	6,000	7,000	5,400	7,600	6,100	8,600	8,800	7,200	6,200	5,300	6,800
Percent hunting	12.3	14.6	11.3	13.8	10.0	14.8	17.1	14.2	12.1	9.8	13.0
Total bag	47,800	59,400	44,400	65,600	43,100	75,300	66,900	58,100	45,500	37,900	54,400
Average bag	8.0	8.5	8.2	8.7	7.1	8.8	7.6	8.1	7.4	7.1	8.0
Washington											
Number hunting	9,200	6,100	8,000	8,100	8,600	9,400	7,000	7,500	6,400	5,800	7,600
Percent hunting	13.4	8.6	11.0	10.1	10.3	12.4	10.1	10.5	9.3	8.1	10.4
Total bag	71,000	45,400	77,000	54,600	59,900	65,700	38,900	47,500	42,100	25,100	72,700
Average bag	7.7	7.5	9.7	6.7	7.0	7.0	5.6	6.3	6.5	4.3	6.9
COASTAL STATE SUBTOTAL											
Number hunting	26,600	23,000	24,500	25,300	24,600	27,600	29,400	22,800	21,500	17,600	24,300
Percent hunting	9.9	8.5	8.7	8.2	7.4	9.1	10.9	8.6	8.2	6.7	8.6
Total bag	227,800	189,400	218,800	191,100	185,700	227,400	247,900	172,500	162,200	102,200	192,500
Average bag	8.6	8.2	8.9	7.6	7.5	8.2	8.4	7.6	7.6	5.8	7.9
Arizona											
Number hunting	a/		600	510	450	770	510	330	640	640	440
Percent hunting			5.9	4.0	3.2	5.0	4.3	3.0	4.8	5.5	4.5
Total bag			2,200	790	1,660	2,280	540	1,620	2,140	2,440	1,370
Average bag			3.7	1.6	3.7	2.9	1.1	4.9	3.4	3.8	3.1
New Mexico											
Number hunting			120	60	210	360	320	250	360	350	200
Percent hunting			1.8	1.1	3.2	4.9	4.9	4.1	4.8	4.2	3.7
Total bag			270	270	340	2,050	1,290	790	830	1,970	780
Average bag			2.3	4.2	1.6	5.7	4.1	3.2	2.3	5.7	3.9
Colorado											
Number hunting					380	850	670	590	810	540	380
Percent hunting					0.9	1.8	1.6	1.4	1.9	1.2	1.5
Total bag					1,240	5,090	2,490	1,110	2,770	1,250	1,400
Average bag					3.3	6.0	3.7	1.9	3.4	2.3	3.6
Utah											
Number hunting					110	110	350	60	230	120	100
Percent hunting					0.3	0.3	1.1	0.2	0.6	0.3	0.5
Total bag					540	200	910	90	570	60	240
Average bag					5.0	1.8	2.6	1.3	2.4	0.5	2.4
INLAND STATE SUBTOTAL											
Number hunting			720	570	1,140	2,100	1,850	1,230	2,040	1,640	1,410
Percent hunting			4.3	3.1	1.2	2.0	2.0	1.3	2.0	1.6	1.8
Total bag			2,470	1,060	3,770	9,620	5,230	3,610	6,310	5,720	4,720
Average bag			3.5	1.9	3.3	4.6	2.8	2.9	3.1	3.5	3.3
TOTAL											
Number hunting	26,600	23,000	25,200	25,900	25,700	29,700	31,200	24,100	23,500	19,200	25,400
Percent hunting	9.9	8.5	8.5	7.9	6.0	7.2	8.6	6.7	6.5	5.2	7.4
Total bag	227,800	189,400	221,300	192,100	189,500	237,000	253,200	176,100	168,500	107,900	196,300
Average bag	8.6	9.2	8.8	7.4	7.4	8.0	8.1	7.3	7.2	5.6	7.7

a/ Blank space indicates that the season was not open on band-tailed pigeons.

Table A-5. Annual State-level estimates of the average and total harvests of mourning doves by dove hunters who purchased duct stamps: 1964-75.

Management Unit and State	Average harvest							Total harvest (in thousands)											Average
	1964-65	1966-68	1969-70	1970-71	1971-72	1972-73	1974-75	1964-65	1966-68	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76			
Eastern	46.9	41.3	43.4	37.1	38.3	47.9	47.6	46.5	47.3	39.0	40.2	40.7	33.7	44.8	285.8	319.1			
Alabama	12.2	14.6	11.5	15.0	13.0	13.0	16.6	29.6	17.2	23.1	15.6	14.6	78.4	61.6	76.1	359.1			
Delaware	37.1	29.0	30.9	22.1	25.3	34.3	31.0	16.9	24.1	15.9	25.1	25.1	485.5	348.6	351.0	691.4			
Florida	38.3	35.2	29.8	40.0	36.6	33.7	34.6	29.7	34.6	47.0	33.5	37.9	324.6	351.0	352.5	498.2			
Georgia	38.3	35.2	29.8	40.0	36.6	33.7	34.6	29.7	34.6	47.0	33.5	37.9	324.6	351.0	352.5	498.2			
Illinois	38.3	35.2	29.8	40.0	36.6	33.7	34.6	29.7	34.6	47.0	33.5	37.9	324.6	351.0	352.5	498.2			
Indiana	38.3	35.2	29.8	40.0	36.6	33.7	34.6	29.7	34.6	47.0	33.5	37.9	324.6	351.0	352.5	498.2			
Kentucky	38.3	35.2	29.8	40.0	36.6	33.7	34.6	29.7	34.6	47.0	33.5	37.9	324.6	351.0	352.5	498.2			
Louisiana	38.3	35.2	29.8	40.0	36.6	33.7	34.6	29.7	34.6	47.0	33.5	37.9	324.6	351.0	352.5	498.2			
Mississippi	38.3	35.2	29.8	40.0	36.6	33.7	34.6	29.7	34.6	47.0	33.5	37.9	324.6	351.0	352.5	498.2			
Maryland	38.3	35.2	29.8	40.0	36.6	33.7	34.6	29.7	34.6	47.0	33.5	37.9	324.6	351.0	352.5	498.2			
North Carolina	38.3	35.2	29.8	40.0	36.6	33.7	34.6	29.7	34.6	47.0	33.5	37.9	324.6	351.0	352.5	498.2			
Ohio	38.3	35.2	29.8	40.0	36.6	33.7	34.6	29.7	34.6	47.0	33.5	37.9	324.6	351.0	352.5	498.2			
Tennessee	38.3	35.2	29.8	40.0	36.6	33.7	34.6	29.7	34.6	47.0	33.5	37.9	324.6	351.0	352.5	498.2			
Virginia	38.3	35.2	29.8	40.0	36.6	33.7	34.6	29.7	34.6	47.0	33.5	37.9	324.6	351.0	352.5	498.2			
West Virginia	38.3	35.2	29.8	40.0	36.6	33.7	34.6	29.7	34.6	47.0	33.5	37.9	324.6	351.0	352.5	498.2			
Other States ^a	12.2	14.6	11.5	15.0	13.0	13.0	16.6	29.6	17.2	23.1	15.6	14.6	78.4	61.6	76.1	359.1			
Unit Total	27.7	27.6	30.0	28.4	26.5	28.8	27.6	26.3	29.4	26.2	25.8	25.8	6,263.1	6,433.8	5,948.8	5,950.9			
(Central)	24.4	25.2	24.4	27.4	37.6	30.0	23.5	33.0	27.8	32.3	24.1	27.0	526.9	501.4	550.0	368.7			
Arkansas	16.2	14.0	16.0	15.4	13.3	23.5	20.3	21.4	24.7	15.7	16.4	15.6	198.9	219.1	219.1	177.5			
Colorado	20.1	19.9	23.0	10.4	13.0	20.3	21.4	24.7	21.2	23.0	21.9	22.2	482.3	471.3	457.6	698.9			
Kansas	20.6	19.7	24.0	20.0	19.4	23.0	20.5	22.2	24.2	20.5	24.0	26.2	701.3	645.9	514.8	668.7			
Missouri	29.2	34.7	31.5	32.9	27.8	27.8	36.4	24.6	34.7	31.5	25.9	35.2	99.7	131.2	109.3	339.1			
Nebraska	7.9	34.7	31.5	32.9	27.8	27.8	36.4	24.6	34.7	31.5	25.9	35.2	140.4	109.3	114.5	206.5			
North Dakota	26.5	29.2	29.9	29.4	28.7	31.7	26.2	27.1	33.6	30.5	25.9	29.2	457.4	554.2	473.3	570.5			
Oklahoma	12.4	15.6	18.0	19.4	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	223.2	296.7	2,139.3	2,301.9			
South Dakota	30.0	36.6	40.5	36.1	34.0	31.7	31.6	29.6	33.7	31.6	31.5	32.0	1,914.2	2,521.3	2,137.4	2,016.7			
Texas	17.8	12.9	22.5	19.1	15.5	11.4	19.2	12.3	13.5	15.4	13.9	7.9	60.9	53.5	57.5	48.0			
Other States ^a	24.0	28.5	31.7	27.5	27.2	27.2	25.3	24.8	27.9	27.0	25.8	26.3	4,664.8	5,640.7	4,283.3	5,611.6			
Unit Total	49.7	37.7	40.8	37.7	40.6	37.3	35.5	30.7	39.4	40.4	35.6	36.4	309.5	294.8	307.0	258.6			
(Western)	23.2	23.5	22.5	23.5	19.9	21.0	22.0	22.0	19.9	21.4	20.4	22.6	1,546.4	1,210.4	1,286.0	1,425.7			
Arizona	14.7	12.6	14.2	15.2	14.4	13.7	14.8	16.4	14.7	15.1	13.4	11.8	1,152.2	1,145.6	1,348.0	1,425.7			
California	18.8	19.8	20.2	20.2	17.3	19.8	17.7	15.3	15.2	17.6	18.7	15.4	103.0	92.7	98.0	94.7			
Nevada	14.2	13.1	14.1	14.1	14.1	11.9	12.7	13.4	11.7	11.4	11.0	10.6	70.1	70.1	70.1	97.8			
Oregon	12.5	11.2	12.8	13.7	10.9	10.6	12.9	11.3	11.3	11.3	11.3	11.3	151.5	155.6	155.6	147.5			
Utah	16.9	14.2	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8	14.8	173.1	173.1	173.1	150.0			
Washington	20.9	20.3	20.4	20.9	18.4	18.9	19.5	19.1	18.2	19.3	18.3	19.1	2,267.7	2,134.9	2,429.1	2,338.9			
Unit Total	24.6	25.6	27.7	26.1	24.5	25.5	24.8	24.1	26.4	24.9	24.4	24.5	3,005.5	2,784.6	2,854.2	3,115.5			
Grand Total	42.3	43.2	44.5	43.8	41.3	42.8	42.3	40.7	46.8	45.3	40.3	40.3	11,472.8	11,218.1	11,581.4	12,963.5			

^a An open season on mourning dove in State where duck stamp was purchased, and no data are available for reassignment of hunters to State of harvest. Figures for Ohio, Nebraska, North Dakota, South Dakota, and Wyoming are included in "Other States" total when dove season was not open there.

^b Average for those years during which the season was open.

Table A-10. Sandhill crane hunting activity and success by hunters purchasing duck stamps: 1966-75.

	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	Average
<u>Alaska</u>											
Number hunting	590	310	290	340	470	250	290	540	560	350	400
Percent hunting	5.6	3.1	2.4	2.6	3.6	1.7	2.0	3.2	3.5	2.3	2.9
Total bag	460	440	340	380	720	160	100	1,440	1,050	290	540
Average bag	0.8	1.4	1.2	1.1	1.5	0.6	0.3	2.7	1.9	0.8	1.4
<u>Texas</u>											
Number hunting	- a/	740	1,110	1,630	1,100	1,630	1,390	1,570	1,800	2,110	1,450
Percent hunting	-	0.7	1.2	1.4	0.8	1.2	1.1	1.4	1.5	1.6	1.2
Total bag	-	1,390	1,110	3,860	2,560	4,130	2,270	7,500	4,700	7,010	3,840
Average bag	-	1.9	1.0	2.4	2.3	2.5	1.6	4.8	2.6	3.3	2.6
<u>New Mexico</u>											
Number hunting	-	-	380	210	600	710	130	290	180	410	360
Percent hunting	-	-	6.0	3.8	9.1	9.8	2.0	4.8	2.4	5.6	5.4
Total bag	-	-	1,430	430	1,120	1,260	180	420	220	710	720
Average bag	-	-	3.7	2.0	1.9	1.8	1.4	1.4	1.2	1.7	2.0
<u>Colorado</u>											
Number hunting	b/	-	110	330	410	750	360	310	670	350	410
Percent hunting	-	-	0.3	0.9	1.0	1.6	0.9	0.7	1.6	0.9	1.0
Total bag	-	-	0	230	590	500	370	610	760	80	390
Average bag	-	-	0	0.7	1.4	0.7	1.1	1.9	1.1	0.2	1.0
<u>North Dakota</u>											
Number hunting			270	820	840	330	520	420	1,220	2,600	880
Percent hunting			0.7	1.9	1.7	0.6	1.0	0.8	2.2	4.4	1.8
Total bag			120	370	520	130	890	1,130	1,530	3,030	960
Average bag			0.4	0.4	0.6	0.4	1.7	2.7	1.3	1.2	1.1
<u>Oklahoma</u>											
Number hunting			130	170	160	120	80	450	490	410	250
Percent hunting			0.5	0.6	0.5	0.3	0.2	1.4	1.5	1.2	0.8
Total bag			30	110	80	120	0	420	460	1,080	290
Average bag			0.3	0.7	0.5	1.0	0	0.9	0.9	2.7	1.2
<u>South Dakota</u>											
Number hunting			0	0	20	90	250	30	220	0	80
Percent hunting			0	0	0.1	0.2	0.5	0.1	0.5	0	0.2
Total bag			0	0	50	90	120	90	380	0	90
Average bag			--	--	2.0	1.0	0.5	3.0	1.7	--	1.2
<u>Montana</u>											
Number hunting							30	100	250	80	120
Percent hunting							0.1	0.4	0.9	0.3	0.4
Total bag							0	20	130	0	40
Average bag							0	0.2	0.5	0	0.3
<u>Wyoming</u>											
Number hunting							20	70	10	130	60
Percent hunting							0.2	0.8	0.1	1.8	0.7
Total bag							0	80	30	0	30
Average bag							0	1.2	2.1	0	0.5
<u>TOTAL</u>											
Number hunting			2,300	3,500	3,600	3,900	3,000	3,800	5,400	6,400	4,000
Percent hunting			0.9	1.2	1.1	1.1	0.9	1.1	1.5	1.7	1.2
Total bag			3,000	5,400	5,600	6,400	3,900	11,700	9,200	12,200	7,200
Average bag			1.3	1.5	1.6	1.7	1.3	3.1	1.7	1.9	1.8

a/ Dashes indicate that no data are available as questionnaire used did not include crane question.

b/ Blank space indicates that the season was not open on cranes.

Table A-11. Annual State-level estimates of the percentage and total number of hunters purchasing duck stamps who hunted soras: 1964-75.

Flyway and State	Percentage hunting										Number hunting													
	1964-65		1965-66		1966-67		1967-68		1968-69		1970-71		1971-72		1972-73		1973-74		1974-75		Average			
	65	66	65	66	65	66	65	66	65	66	70	71	70	71	72	73	74	75	74	75	76	Average		
Atlantic																								
Connecticut	.8	1.8	2.1	1.8	1.6	1.7	1.7	1.7	1.7	1.3	2.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
Delaware	0	1.5	.6	.5	.2	0	.8	0	0	0	0	0	0	0	.4	.3	.3	.3	.3	.3	.3	.3	.3	
District of Columbia ^a	0	3.5	1.2	1.9	0	0	1.8	0	0	0	0	0	0	0	1.8	.8	1.1	1.1	1.1	1.1	1.1	1.1	1.1	
Florida	2.2	1.1	1.0	1.0	1.3	1.0	1.8	1.1	1.2	1.2	.8	0	0	0	1.2	.8	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
Georgia	1.0	.5	.4	0	.7	.4	0	.4	0	.3	0	0	0	0	.4	.3	.4	.3	.4	.3	.4	.3	.4	
Maine	.4	.7	.1	.3	.2	.5	.1	.2	.3	.2	.3	.2	.3	.2	.3	.2	.3	.2	.3	.2	.3	.2	.3	
Maryland	.6	1.0	1.1	1.2	.3	.5	.3	.5	.4	.5	.4	.5	.4	.5	.4	.5	.4	.5	.4	.5	.4	.5	.4	
Massachusetts	1.0	.4	.4	.2	.5	.6	.5	.4	.5	.4	.5	.4	.5	.4	.5	.4	.5	.4	.5	.4	.5	.4	.5	
New Hampshire	.3	1.1	.1	0	0	0	.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
New Jersey	4.0	4.1	3.2	3.3	2.4	4.5	3.7	2.4	2.2	3.1	2.2	3.1	2.2	3.1	2.2	3.1	2.2	3.1	2.2	3.1	2.2	3.1	2.2	
New York	1.1	1.4	.6	.5	.2	.1	.3	.2	.1	.2	1.1	1.2	1.1	1.1	1.2	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.1	
North Carolina	1.1	1.4	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	
Pennsylvania	.1	.1	1.6	2.3	.9	.9	.4	.6	0	0	.1	.3	.1	.3	.1	.3	.1	.3	.1	.3	.1	.3	.1	
Rhode Island	0	.4	.4	1.6	1.4	.4	1.4	.4	1.6	1.4	.4	1.4	.4	1.6	1.4	.4	1.4	.4	1.6	1.4	.4	1.4	.4	
South Carolina	.9	.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Vermont	3.0	1.7	1.9	1.8	1.6	1.1	1.1	1.8	2.3	2.2	1.5	1.3	1.3	1.1	1.4	1.3	1.1	1.4	1.3	1.1	1.4	1.3	1.1	
West Virginia	3.1	.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Flyway Total	1.1	1.0	.8	.7	.6	.7	.6	.7	.6	.5	.7	.6	.5	.6	.5	.6	.5	.6	.5	.6	.5	.6	.5	
MISSISSIPPI																								
Alabama	.2	0	.2	.5	0	.6	.2	.3	.4	.3	.4	.3	.4	.3	.4	.3	.4	.3	.4	.3	.4	.3	.4	
Arkansas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Illinois	0	tr.	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	
Indiana	.3	.1	.1	.1	.3	.7	.3	.5	.7	.5	.7	.5	.7	.5	.7	.5	.7	.5	.7	.5	.7	.5	.7	
Iowa	.1	0	tr.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Kentucky	0	.3	0	0	0	.3	.1	0	.2	0	.2	0	.1	0	.1	0	.1	0	.1	0	.1	0	.1	
Louisiana	1.3	.8	.9	1.1	.4	.9	.8	.5	1.6	1.2	1.1	1.3	1.0	1.1	1.3	1.0	1.1	1.3	1.0	1.1	1.3	1.0	1.1	
Michigan	.4	.2	1.1	.4	1.1	.3	.2	1.1	.2	1.1	.2	1.1	.2	1.1	.2	1.1	.2	1.1	.2	1.1	.2	1.1	.2	
Minnesota	.2	.1	.2	.2	.1	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	
Mississippi	.7	.6	.3	.3	.0	.2	.3	0	.3	0	.3	0	.3	0	.3	0	.3	0	.3	0	.3	0	.3	
Missouri	1.0	.8	.4	.9	.7	.3	.6	.3	.3	1.0	1.3	.8	.9	.7	1.0	1.3	.8	.9	.7	1.0	1.3	.8	.9	
Ohio	.1	.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Tennessee	.1	tr.	.1	.1	0	.1	.1	.2	0	.1	.2	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.
Wisconsin	.3	.2	.3	.4	1.1	.4	.3	.2	.4	.5	.4	.5	.4	.5	.4	.5	.4	.5	.4	.5	.4	.5	.4	
Flyway Total	.3	.2	.3	.4	1.1	.4	.3	.2	.4	.5	.4	.5	.4	.5	.4	.5	.4	.5	.4	.5	.4	.5	.4	
Central																								
Colorado	.2	.1	.1	0	.1	.1	.1	.1	.1	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	tr.	
Kansas	1.1	.4	.5	1	.3	.3	2.5	.3	1.1	.3	.5	.7	.6	.3	.5	.7	.6	.3	.5	.7	.6	.3	.5	
Nebraska	.3	1	0	.1	.1	.2	.4	.1	.5	.4	.3	.8	.3	.8	.3	.8	.3	.8	.3	.8	.3	.8	.3	
New Mexico	0	.2	0	.3	0	.2	.4	.1	.5	.4	.3	.8	.3	.8	.3	.8	.3	.8	.3	.8	.3	.8	.3	
Oklahoma	.1	.3	0	.2	.1	.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Texas	.2	.2	.2	.1	.3	1	.2	.2	.3	.3	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	
Wyoming	tr.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Other States ^a	tr.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Flyway Total	.2	.2	.1	.1	.2	.1	.5	.1	.2	.2	.3	.4	.2	.3	.4	.2	.3	.4	.2	.3	.4	.2	.3	
Grand Total																								
Grand Total	.5	.4	.4	.4	.3	.4	.4	.4	.3	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4	.4	

^aNo open season on rails in State where duck stamp was purchased, and no data are available for reassessment of hunters to State of harvest. Figures for New Mexico and Wyoming are included in "Other States" total when rail season was not open there.
^bAverage for those years during which the season was open.

Table A-12. Annual State-level estimates of the average and total harvests of soras by sora hunters who purchased duck stamps, 1964-75.

Flyway and State	Average harvest								Total harvest (in thousands)							
	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	Average			
Atlantic																
Connecticut	3.4	4.5	14.2	3.4	3.5	3.5	6.2	13.9	9.1	2.8	6.2	1.2	6.5			
Delaware	--	2.2	1.3	.5	2.0	--	6.0	--	--	25.5	18.0	1.0	6.4			
District of Columbia ^a	--	2.8	2.5	2.3	--	--	31.0	42.0	--	4.3	2.5	2.0	10.2			
Florida	6.6	7.7	6.5	7.9	2.8	4.4	4.3	6.6	14.6	4.3	8.9	4.6	6.5			
Georgia	5.0	2.0	38.3	--	2.3	1.7	--	--	1.0	4.0	1.0	4.0	6.6			
Maine	27.6	2	0	.5	1.0	--	2.2	2.0	3.0	4.0	3.0	.7	4.1			
Maryland	7.3	12.7	18.2	13.0	8.0	6.9	9.0	16.8	3.5	5.5	4.7	8.6	10.9			
Massachusetts	4.2	2.8	3.6	1.0	2.0	1.7	3.0	8.0	4.2	2.0	3.0	6.7	4.0			
New Hampshire	2.0	4.0	3.0	--	--	--	2.5	--	--	1.0	1.0	--	2.1			
New Jersey	6.9	4.5	3.2	4.5	4.7	4.2	5.4	7.1	2.7	6.6	6.2	12.2	5.6			
New York	0	1.2	5.6	1.3	1.0	1.7	.9	6	5.8	1.0	1.5	2.7	2.4			
North Carolina	5.2	5.1	2.7	4.0	1.0	2.0	1.0	2.0	10.0	5.5	6.2	5.9	5.9			
Pennsylvania	1.3	1.0	0	2.0	3.0	7.2	6.2	1.7	3.0	--	13.0	11.8	5.6			
South Carolina	20.5	0	8.7	13.8	2.5	1.0	1.7	0	--	1.0	1.0	1.3	2.4			
Vermont	7.3	11.4	12.3	4.9	5.3	8.8	5.7	15.5	8.7	20.8	8.1	18.2	10.7			
West Virginia	10.8	24.8	--	--	--	--	1.0	0	--	1.0	--	--	6.3			
Flyway Total	7.2	5.5	8.7	5.6	3.7	4.6	5.1	8.0	6.9	8.3	6.5	8.3	6.5			
Mississippi																
Alabama	0	--	1.0	1.0	--	.5	.5	1.7	.5	1.0	0	1.5	1.8			
Arkansas	--	.9 ^a	1.5	3.2 ^a	2.0	1.5	1.8	--	10.4 ^a	.7	7	12.5	4.8 ^b			
Illinois	0	0	12.0	0	5.0	5.6	3.3	1.3	3.6	2.8	3.5	7.9	3.3			
Indiana	6.1	--	1.0 ^a	1.0 ^a	--	--	--	--	3.6	4.4	4.4	8.6	5.6 ^b			
Iowa	--	0	--	--	--	--	1.0	--	--	--	--	--	.4			
Kentucky	4.6	5.1	4.0	5.8	4.7	3.7	3.8	6.6	8.1	5.4	2.8	4.5	5.1			
Louisiana	5.5	1.7	1.2	2.0	1.3	1.4	1.1	1.2	5.5	1.5	3.9	1.8	2.3			
Michigan	1.1	1.6	1.4	6.8	2.0	12.2	2.6	3.8	7.2	1.9	3.0	2.2	4.5			
Mississippi	9.9	12.2	8.5	5.0	--	3.0	1.3	--	11.4	3.5	3.3	1.3	4.4			
Missouri	4.8	7.9	3.4	4.4	5.7	3.1	2.5	3.5	1.4	3.0	2.7	4.1	3.7			
Ohio	0	1.8	31.1	2.5	5	--	1.0	1.2	1.0	1.0	2.2	--	1.9			
Tennessee	0	--	--	--	--	--	--	--	--	--	--	--	--			
Wisconsin	4.3	6.5	3.1	5.2	4.0	4.6	2.9	3.7	6.2	3.8	3.2	4.5	4.3			
Flyway Total	4.3	6.5	3.1	5.2	4.0	4.6	2.9	3.7	6.2	3.8	3.2	4.5	4.3			
Central																
Colorado	2.0	0	1.0	--	0	2.0	2.0	2.0	1.0	2.2	2.4	1.2	1.8			
Kansas	6.6	1.5	3.0	0	1.2	5.2	.3	1.5	1.0	1.9	4.0	.8	1.8			
Nebraska	2.0	0	--	0	1.0	1.0	3.2	1.5	4.3	5.4	1.7	2.3	2.8 ^b			
New Mexico	0	0	--	--	--	--	--	--	--	--	--	--	--			
Oklahoma	3.0	0	--	1.0	--	1.0	2.0	--	5.0	3.6	1.0	1.3	1.7			
Texas	27.9	9	7.0	7.0	2.8	2.0	6.7	2.9	5.0	3.6	1.0	4.0	5.1			
Other States ^a	0	0	--	--	--	--	--	--	75.0	--	--	--	32.4 ^b			
Flyway Total	10.0	.9	4.7	3.5	2.0	3.3	1.4	2.2	5.6	3.6	2.4	1.9	3.0			
Grand Total	6.4	5.3	6.1	5.3	3.5	4.5	3.4	5.7	6.4	5.3	4.1	5.1	5.1			

^aNo open season on rails in State where duck stamp was purchased, and no data are available for reassignment of hunters to State of harvest. Figures for New Mexico and Wyoming are included in "Other States" total when rail season was not open there.

^bAverage for those years during which the season was open.

Table A-14. Annual State-level estimates of the average and total harvests of rails other than sora by rail hunters who purchased duck stamps: 1964-75.

Flyway and State	Total harvest (in thousands)														
	1964-1966							1967-1975							Average
	65	66	67	68	69	70	71	72	73	74	75	76	Average		
Atlantic															
Connecticut	3.7	2.9	5.1	2.7	1.6	2.7	1.7	2.4	5.4	1.0	3.2	1.0	2.8	1.0	
Delaware	1.0	1.4	7.5	3.3	6.2	4.7	6.7	1.2	8.2	2.3	3.2	3.2	3.2	3.2	
District of Columbia ^a	--	0.0	75.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Florida	3.0	6.4	10.6	7.7	6.1	6.1	7.5	8.5	5.9	10.3	3.5	15.0	15.9	15.9	
Georgia	10.3	3.3	17.1	2.0	17.1	25.3	19.7	13.8	9.1	9.8	25.4	17.2	17.4	17.4	
Maine	5.6	0.0	1.7	5.1	0.0	1.7	0.0	1.0	2.4	1.7	4.4	9.3	2.4	2.4	
Maryland	4.9	2.8	8.7	6.8	1.9	4.0	11.8	4.9	4.6	5.6	2.1	7.2	5.7	5.7	
Massachusetts	3.2	2.6	4.1	0.0	2.4	1.0	2.0	1.5	1.0	4.4	3.4	7.9	2.8	2.8	
New Hampshire	1.0	2.8	7.7	1.0	--	1.0 ^a	--	3.0 ^a	--	4.0 ^a	--	1.8 ^b	1.8 ^b	1.8 ^b	
New Jersey	5.3	3.9	6.1	6.2	1.7	3.1	5.4	3.8	4.0	5.2	4.6	4.1	4.1	4.1	
North Carolina	2.2	1.8	4.1	2.1	2.1	1.9	2.7	1.7	2.4	1.5	1.2	3.3	2.3	2.3	
North Carolina	15.9	6.7	13.1	16.3	10.3	7.9	8.8	5.2	16.0	17.9	15.2	13.5	13.2	13.5	
Pennsylvania	1.8	0.0	3.3	1.0	1.8	5.0	2.5	3.0	2.0	--	3.0	0.0	2.0	2.0	
Rhode Island	6.1	2.4	12.3	1.9	2.5	1.0	8.1	1.0	--	3.3	--	5.5	2.6	2.6	
South Carolina	10.2	15.3	22.4	31.1	18.7	18.6	25.6	24.3	21.0	19.6	15.1	18.5	21.2	21.2	
Vermont	--	--	--	--	0.0	--	5.5	--	5.5	--	2.0	2.0	--	--	
Virginia	14.5	11.9	20.3	14.2	17.7	12.4	15.2	10.2	13.6	10.9	8.4	14.3	13.0	13.0	
West Virginia	2.9	--	--	--	--	--	0.0	4.0	--	4.0	--	30.0	4.0	4.0	
Flyway Total	6.8	5.0	9.2	10.6	8.8	10.0	12.6	11.1	10.4	10.8	9.3	11.4	10.1	10.1	
Mississippi															
Alabama	1.0	1.8	1.0	1.0	3.8	4.5	4.5	8.3	5.0	8.7	3.4	3.0	4.0	4.0	
Arkansas	--	--	0.0	--	0.0	--	2.0	5.0	2.0	5.0	2.2	2.2	2.2	2.2	
Illinois	4.0 ^a	1.3 ^a	1.0 ^a	--	1.5 ^a	1.0 ^a	4.0 ^a	1.0 ^a	1.0 ^a	1.6	3.0	5.7	5.2 ^b	5.2 ^b	
Indiana	7.5	5.5	9.5	--	1.5	2.3	2.0	1.4	2.0	1.2	1.7	2.7	1.8	1.8	
Iowa	2.3 ^a	--	10.0 ^a	--	--	1.0 ^a	1.0 ^a	10.0 ^a	--	5.5	2.1	2.0	3.2	3.2	
Kentucky	--	0.0	--	--	15.0	--	--	--	--	--	2.0	2.0	6.5	6.5	
Louisiana	4.5	4.8	7.3	8.8	4.8	4.6	6.6	5.3	5.9	8.0	5.4	8.0	6.4	6.4	
Michigan	2.2	2.2	1.3	1.0	6.1	6.6	1.1	1.3	7.7	1.8	7.7	1.1	1.1	1.1	
Minnesota	1.5	1.3	2.0	1.6	1.2	1.2	2.5	9.5	5.0	2.3	2.4	4.5	3.5	3.5	
Mississippi	1.7	4.4	3.3	3.3	--	7.0	8.1	9.2	5.8	6.3	5.4	5.8	6.0	6.0	
Missouri	5.2	3.1	3.7	0.0	5.0	3.7	--	6.7	5.5	1.0	1.0	--	3.1	3.1	
Ohio	2.2	1.4	1.2	2.0	--	1.6	8.9	5.5	1.5	8.1	1.3	1.3	1.3	1.3	
Tennessee	--	0.0	--	--	17.0	--	5.0	--	3.0	2.0	--	4.7	4.0	4.0	
Wisconsin	3.7	2.2	10.5	1.6	0.0	1.4	2.4	2.0	4.4	1.7	6.6	9.0	3.0	3.0	
Flyway Total	3.6	3.5	6.3	7.3	4.0	4.3	5.6	5.0	5.4	6.8	4.7	7.0	5.5	5.5	
Central															
Colorado	2.7	6.1	5.0	1.0	1.0	1.0	1.0	5.0	2.1	1.5	5.0	2.7	1.8	1.8	
Kansas	5.5	0.0	3.5	--	1.0	1.7	2.3	3.3	0.0	1.7	1.2	2.4	2.4	2.4	
Nebraska	--	1.7	4.0	1.7	3.5	1.3	1.6	1.2	1.6	2.8	6.0	2.0	2.1	2.1	
New Mexico	--	0.0	1.0	--	1.0	1.5	--	--	--	--	4.5	2.0 ^b	2.0 ^b	2.0 ^b	
Oklahoma	--	9.9	--	--	1.7	1.7	1.0	--	4.0	--	1.5	3.3	1.4	1.4	
Texas	4.7	9.9	5.0	3.8	3.7	4.3	7.0	6.3	7.0	4.2	3.3	6.6	5.3	5.3	
Wyoming	1.0	2.4	--	--	--	--	2.0	0.0	2.0	0.0	--	1.3 ^b	1.3 ^b	1.3 ^b	
Other States ^a	3.4	1.2	4.3	3.3	3.2	3.8	3.4	5.3	6.1	3.7	3.2	5.1	4.0	4.0	
Flyway Total	5.1	4.1	7.6	8.7	6.5	6.5	8.2	7.9	7.4	8.2	6.6	8.5	7.4	7.4	
Grand Total	41.3	24.1	50.6	94.3	67.4	130.0	175.2	118.3	147.1	148.1	108.3	160.3	105.4	105.4	

^aNo open season on rails in State where duck stamp was purchased, and no data are available for reassignment of hunters to State of harvest. Figures for New Mexico and Wyoming are included in "Other States" total when rail season was not open there.

^bAverage for those years during which the season was open.

Table A-18. Flyway-level summary of American coot hunting activity and success by waterfowl hunters:^a 1952-63.^b

	1952-53	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61	1961-62	1962-63 ^c	1963-64
Atlantic Flyway												
Number taking coots	31,400	29,900	23,900	31,600	26,700	18,800	19,400	5,700	8,500	7,200		14,300
Percent taking coots	10.26	8.91	7.08	8.32	7.16	5.37	6.02	2.39	3.29	3.14		5.35
Total bag	313,100	277,900	183,500	235,000	189,700	126,200	98,100	18,000	47,500	45,700	59,300	77,700
Average bag	9.96	9.30	7.67	7.45	7.10	6.70	5.07	3.16	5.62	6.50		5.45
Total hunting mortality	388,800	327,600	217,300	284,600	224,500	153,400	124,400	26,100	60,200	58,000	71,300	93,300
Percent unretrieved	19.47	15.16	15.59	17.42	15.52	17.79	21.13	31.23	21.07	19.51	16.76	16.73
Mississippi Flyway												
Number taking coots	118,200	116,500	91,600	102,100	86,500	73,800	69,800	37,200	52,000	20,900		47,700
Percent taking coots	12.03	12.40	10.01	10.08	8.52	7.39	7.50	5.34	7.03	4.00		8.40
Total bag	883,000	877,100	629,000	734,500	587,900	407,700	458,100	137,600	317,800	113,400	160,800	349,000
Average bag	7.47	7.53	6.86	7.19	6.80	5.52	6.57	3.70	6.11	5.42		7.32
Total hunting mortality	1,039,900	1,051,500	736,000	878,800	693,100	489,100	546,400	193,300	393,900	140,200	186,600	410,000
Percent unretrieved	15.09	16.59	14.55	16.42	15.18	16.64	16.17	28.84	19.31	19.12	13.80	14.87
Central Flyway												
Number taking coots	15,100	17,900	18,100	32,700	24,700	30,800	27,600	8,300	10,500	4,600		7,300
Percent taking coots	3.01	3.52	3.81	6.29	5.03	5.56	5.51	2.28	2.74	1.66		2.78
Total bag	52,900	80,000	66,700	132,200	98,200	133,100	126,700	22,100	31,700	17,300	13,200	27,900
Average bag	3.50	4.46	3.67	4.04	3.98	4.33	4.60	2.66	3.03	3.73		3.85
Total hunting mortality	76,300	99,800	93,100	167,800	126,600	173,300	178,900	34,400	45,600	25,000	19,000	37,600
Percent unretrieved	30.68	19.78	28.41	21.21	22.38	23.16	29.17	35.70	30.56	30.92	30.72	25.84
Pacific Flyway												
Number taking coots	30,800	37,600	43,400	47,000	39,900	38,800	39,100	19,500	17,800	15,100		19,000
Percent taking coots	6.59	8.41	10.46	11.29	9.56	9.32	10.14	6.55	5.65	5.33		5.87
Total bag	196,200	401,000	456,600	474,400	545,000	503,800	464,500	138,000	143,200	114,500	121,200	123,000
Average bag	6.38	10.65	10.52	10.09	13.65	12.98	11.88	7.09	8.06	7.58		6.49
Total hunting mortality	231,900	485,100	542,100	597,100	655,000	605,300	557,500	183,900	179,500	160,400	158,800	176,000
Percent unretrieved	15.38	17.35	15.78	20.55	16.79	16.77	16.68	24.94	20.25	28.62	23.66	30.12
Alaska												
Number taking coots	trace	200	300	500								
Percent taking coots	0.52	1.61	2.37	4.69								
Total bag	trace	600	1,000	1,500								
Average bag	1.00	3.56	3.87	3.39								
Total hunting mortality	300	800	1,200	1,500								
Percent unretrieved	83.98	26.30	20.68	0								
TOTAL												
Number taking coots	195,600	202,100	177,400	213,800	177,800	162,200	155,800	70,700	88,700	47,800		88,200
Percent taking coots	8.63	9.02	8.23	9.15	7.74	6.99	7.29	4.43	5.24	3.64		6.22
Total bag	1,445,300	1,636,600	1,336,700	1,577,700	1,420,800	1,170,800	1,147,400	315,700	540,200	291,900	354,500	577,700
Average bag	7.39	8.10	7.54	7.38	7.99	7.22	7.36	4.46	6.09	6.10		6.55
Total hunting mortality	1,737,200	1,964,800	1,589,900	1,929,900	1,669,100	1,421,000	1,407,200	437,800	679,200	383,600	435,600	717,000
Percent unretrieved	16.80	16.70	15.93	18.25	16.38	17.61	18.46	27.88	20.47	23.92	18.62	19.43

^a Numbers of successful hunters include only duck stamp purchasers while harvest and mortality estimates include birds taken by waterfowl hunters of all ages.

^b A number of changes were made in the questionnaire form during this period, several of which had marked effects on the results, most noticeable in the data for the 1959 season. Because of the variable quality of these data, long-term averages have not been calculated and the reader is especially cautioned that the activity and bag for the 1959, 1960, and 1961 seasons appear to have been greatly underestimated.

^c No tabulation of successful coot hunters has been made for 1962.

Table A-19. Flyway-level summary of American coot hunting activity and success by waterfowl hunters:^a 1964-75.

	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	Average
Atlantic Flyway													
Number taking coots	16,600	22,000	31,800	25,900	17,500	29,300	33,000	33,200	25,300	20,000	22,800	35,200	26,000
Percent taking coots	5.90	7.41	9.62	7.28	4.64	6.77	6.74	6.74	5.89	4.70	5.23	8.27	6.55
Total bag	119,000	141,400	182,400	167,300	99,800	167,400	206,400	231,300	153,200	133,000	151,500	236,600	165,800
Average bag	7.19	6.43	5.74	6.45	5.69	5.72	6.26	6.97	6.05	6.66	6.64	6.72	6.37
Total hunting mortality	139,100	171,400	218,100	199,100	119,100	205,200	245,900	278,000	183,900	159,600	181,200	279,900	198,400
Percent unretrieved	14.45	17.51	16.39	15.99	16.22	18.41	16.06	16.79	16.71	16.67	16.38	15.46	16.44
Mississippi Flyway													
Number taking coots	63,300	66,400	97,700	90,900	52,400	89,700	112,100	94,200	107,300	67,200	85,100	105,500	86,000
Percent taking coots	9.58	10.58	13.02	11.26	7.42	11.16	11.22	9.48	11.92	8.21	9.69	11.74	10.48
Total bag	449,700	605,300	988,500	686,600	386,700	661,400	991,000	583,300	874,700	478,600	664,700	878,300	687,400
Average bag	7.11	9.12	10.12	7.55	7.38	7.38	8.84	6.19	8.15	7.13	7.81	8.32	8.00
Total hunting mortality	534,400	706,900	1,166,200	818,400	468,500	781,600	1,188,700	704,200	1,038,000	571,700	785,600	1,036,500	816,700
Percent unretrieved	15.86	14.38	15.24	16.11	17.45	15.37	16.63	17.17	15.74	16.28	15.39	15.26	15.84
Central Flyway													
Number taking coots	8,300	11,900	14,000	20,100	10,800	22,100	24,700	24,600	24,700	21,100	24,100	24,500	19,200
Percent taking coots	2.96	4.62	4.53	5.61	3.35	5.94	5.67	5.45	5.85	5.17	5.72	5.74	5.17
Total bag	29,400	50,300	53,100	81,600	39,400	87,100	98,800	86,700	115,300	93,000	107,900	95,100	78,100
Average bag	3.56	4.22	3.81	4.06	3.66	3.94	4.00	3.53	4.68	4.40	4.47	3.89	4.06
Total hunting mortality	47,000	69,900	79,800	123,800	55,100	121,300	135,800	127,600	161,600	122,800	143,300	132,800	110,100
Percent unretrieved	37.52	27.98	33.38	34.13	28.47	28.21	27.26	32.04	28.64	24.30	24.74	28.39	29.01
Pacific Flyway													
Number taking coots	22,400	24,900	30,300	35,500	29,500	38,100	39,300	36,100	32,200	30,500	35,900	35,500	32,500
Percent taking coots	6.95	7.33	8.08	9.39	7.54	9.00	8.65	8.35	8.40	7.97	9.32	9.05	8.37
Total bag	167,600	181,700	283,100	256,000	146,600	285,500	362,900	221,300	188,500	215,700	327,400	276,800	242,800
Average bag	7.48	7.28	9.33	7.21	4.97	7.49	9.23	6.13	5.85	7.08	9.12	7.80	7.46
Total hunting mortality	234,000	252,700	371,200	336,600	198,500	390,700	481,800	307,600	234,400	264,100	407,800	352,000	319,300
Percent unretrieved	28.38	28.11	23.73	23.93	26.12	26.91	24.67	28.07	19.58	18.33	19.70	21.38	23.96
Alaska													
Number taking coots	[Not in survey]	200	200	200	100	300	200	300	200	300	200	300	200
Percent taking coots	[Not in survey]	1.88	1.67	2.07	1.06	1.97	1.56	2.24	1.27	1.61	1.21	1.72	1.64
Total bag	[Not in survey]	1,200	1,500	700	600	500	700	1,400	700	1,000	400	1,200	900
Average bag	[Not in survey]	6.57	8.31	3.52	4.43	2.00	3.46	4.23	3.75	3.67	2.17	4.58	4.12
Total hunting mortality	[Not in survey]	1,400	1,700	800	900	600	800	1,700	800	1,100	500	1,400	1,100
Percent unretrieved	[Not in survey]	20.06	13.13	12.74	32.32	16.16	9.29	20.51	10.01	9.76	16.60	12.87	15.94
TOTAL													
Number taking coots	110,500	125,400	174,000	172,700	110,300	179,400	209,300	188,400	189,700	139,000	168,100	200,900	164,000
Percent taking coots	7.16	8.19	9.80	9.04	6.10	8.77	8.75	7.90	8.82	6.78	7.86	9.31	8.24
Total bag	765,700	979,900	1,508,600	1,192,200	673,200	1,201,900	1,659,800	1,124,000	1,332,400	921,300	1,251,900	1,488,000	1,174,900
Average bag	6.93	7.81	8.67	6.90	6.10	6.70	7.93	5.97	7.02	6.63	7.45	7.41	7.17
Total hunting mortality	954,600	1,202,400	1,836,900	1,478,700	842,100	1,499,300	2,052,900	1,419,100	1,618,700	1,119,300	1,518,400	1,802,600	1,445,400
Percent unretrieved	19.79	18.51	17.88	19.38	20.06	19.83	19.15	20.80	17.69	17.69	17.55	17.45	18.72

^a Numbers of successful hunters include only duck stamp purchasers while harvest and mortality include birds taken by waterfowl hunters of all ages.

Appendix B

Survey results for the 1976-77 season, which became available after work on the earlier data had been largely completed, are summarized in Tables B-1 and B-2. It is suspected that the 1976-77 results, and perhaps to a lesser degree the 1975-76 results, were affected by the unavoidable addition of Privacy Act statements on survey forms. A further intrusion into the survey in the form of a prohibition on the proper testing of these changes has thus far frustrated efforts to assess comparability with the results of previous surveys. Response rates for the survey mailing list were depressed by about 30% in 1976 when the Privacy Act statement was implemented for this phase of the survey, and some reduction, though much smaller, in questionnaire response rates likely occurred in both 1975 and 1976. A previous questionnaire change which increased response rates inflated all activity and harvest estimates, particularly those for coots (E. M. Martin, Office of Migratory Bird Management, Laurel, Maryland, unpublished report on changes in the Federal questionnaire survey dated 17 December 1970). This latest change, by depressing response rates, can thus be expected to have decreased activity and harvest estimates, perhaps most noticeably for coots. It is hoped that some evaluation can still be made and adjustments incorporated where necessary. In the meantime, the suspicion remains that activity and success figures for 1975 (to a slight degree) and 1976 (to a potentially very significant degree, at least for certain species) may be underestimated.

Table B-1. Mourning dove, white-winged dove, band-tailed pigeon, and sandhill crane hunting activity and success by duck stamp purchasers during the 1976-77 season.

Species, Management Unit, and State	Stamp buyers participating		Birds harvested		Species and State	Stamp buyers participating		Birds harvested	
	%	Total	Per hunter	Total (thousands)		%	Total	Per hunter	Total
<u>Mourning Dove</u>					<u>White-winged dove</u>				
<u>Eastern</u>					New Mexico	4.0	310	2.9	880
Alabama	61.4	9,400	45.3	424.3	Texas	7.4	10,200	15.5	158,600
Delaware	42.7	5,200	20.3	104.8	Arizona	43.9	5,400	13.4	72,300
Florida	53.7	16,900	39.2	663.1	California	4.6	6,000	11.0	65,900
Georgia	63.2	8,500	46.0	391.8	Nevada	1.8	240	12.3	2,910
Illinois	42.9	27,700	21.5	593.9	Total	7.4	22,200	13.6	300,700
Kentucky	59.1	8,300	38.1	316.8	<u>Band-tailed pigeon</u>				
Louisiana	32.3	39,500	25.8	1,017.6	California	4.9	6,300	5.7	36,100
Maryland	32.3	12,600	17.7	223.9	Oregon	11.9	6,200	5.6	34,900
Mississippi	66.6	19,200	39.2	753.9	Washington	7.9	5,400	5.0	27,100
North Carolina	59.6	16,500	31.5	518.8	Arizona	4.5	560	4.8	2,640
Ohio	33.2	13,400	19.0	253.5	New Mexico	1.2	100	0.9	90
Pennsylvania	43.4	30,400	13.8	418.4	Colorado	1.1	480	5.1	2,430
Rhode Island	31.7	1,100	13.9	15.4	Utah	0.5	210	3.5	740
South Carolina	66.0	14,300	35.3	504.4	Total	5.4	19,300	5.4	104,000
Tennessee	59.4	15,600	36.0	562.1	<u>Sandhill crane</u>				
Virginia	51.0	10,000	28.7	286.9	Alaska	5.5	1,020	1.1	1,080
West Virginia	46.3	900	16.3	14.7	Texas	2.5	3,420	1.9	6,660
Other States ^a	1.9	7,800	14.6	114.8	New Mexico	6.5	500	0.5	250
Unit Total	26.8	257,200	27.9	7,179.3	Colorado	1.1	510	0.3	130
<u>Central</u>					North Dakota	2.4	1,350	0.3	380
Arkansas	37.0	21,600	30.8	663.9	Oklahoma	0.9	300	2.4	730
Colorado	37.7	17,100	19.3	328.5	South Dakota	0	0	--	0
Kansas	59.7	34,400	23.5	806.4	Montana	0.2	70	0.5	30
Missouri	38.5	22,600	24.2	545.2	Wyoming	0.9	100	2.0	190
Nebraska	47.2	20,300	23.3	474.7	Total	2.0	7,300	1.3	9,500
New Mexico	60.8	4,700	30.6	142.8	<u>Western</u>				
Oklahoma	54.9	18,400	30.8	567.5	Arizona	65.3	8,000	37.2	299.8
Texas	55.3	76,600	31.2	2,388.5	California	40.8	52,600	18.5	972.3
Wyoming	25.4	2,600	15.0	38.6	Idaho	29.2	10,200	11.2	114.6
Other States ^a	1.5	4,300	12.3	52.8	Nevada	38.3	4,900	15.5	76.4
Unit Total	29.9	222,500	27.0	6,008.8	Oregon	23.4	12,200	13.0	158.2
<u>Western</u>					Utah	36.3	14,700	10.4	152.6
Arizona	65.3	8,000	37.2	299.8	Washington	18.1	12,300	12.6	155.4
California	40.8	52,600	18.5	972.3	Unit Total	32.9	115,100	16.8	1,929.2
Idaho	29.2	10,200	11.2	114.6	<u>Grand Total</u>				
Nevada	38.3	4,900	15.5	76.4		29.0	594,800	25.4	15,117.3
Oregon	23.4	12,200	13.0	158.2					
Utah	36.3	14,700	10.4	152.6					
Washington	18.1	12,300	12.6	155.4					
Unit Total	32.9	115,100	16.8	1,929.2					
Grand Total	29.0	594,800	25.4	15,117.3					

^aNo open season on mourning dove in State where duck stamp was purchased, and no data are available for reassignment of hunters to State of harvest.

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