Harvest and Hunter Activity During Florida's Special September Duck Season

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Abstract: We estimated total harvest, hunter participation, hunter success, and age-sex composition of the wood duck (*Aix sponsa*) harvest during Florida's special September duck seasons, 1989–1995. We sent mail questionnaires to a sample of Florida's duck hunters to estimate harvest and hunter participation, and collected wings to estimate age-sex composition of the wood duck harvest. An average of 3,555 (SE = 178) hunters participated annually, and hunter-days averaged 8,082 (SE = 473). During years when teal (*Anas discors, A. crecca*) were included in the season, hunter participation and wood duck harvest remained similar to levels in years when the season was restricted to wood ducks; however, on average, teal harvest nearly doubled the total duck harvest. Mean number of wood ducks harvested each year (1989–1995) was 6,391 (SE = 296), and mean teal harvest (1992–1995) was 5,924 (SE = 1,095). Hunter success averaged 1.4 (SE = 0.10) ducks per hunter-day (0.76 [SE = 0.06] wood ducks per hunter-day and 0.67 [SE = 0.11] teal per hunter-day). The mean proportion of adult females harvested was lower, and the mean proportion of young males was higher than that of all other age/sex groups. The mean proportion of young wood ducks in the season's wood duck harvest was 0.60 (SE = 0.03), and ranged between 0.48 and 0.76. The recent estimate of wood duck harvest per hunter-day remained similar to the estimate from Florida's special September seasons during 1981–1983, suggesting that hunter success and possibly wood duck availability have remained stable. Band-recovery data suggest that Florida's September wood duck harvest is primarily composed of birds that spent the previous breeding season in Florida.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 50:496-508

The wood duck is the most abundant of 3 locally breeding species of waterfowl in Florida and ranks third (11.8%) in Florida's harvest of all duck species (U.S. Fish and Wildlife Service [USFWS], Office of Migratory Bird Management [OMBM] file data, 1981–1990). Florida, Kentucky, and Tennessee offer special September duck seasons to provide additional opportunity for hunting locally-breeding wood ducks and migrating teal. These seasons, which began in 1981, are considered experimental

by the USFWS. F. Montalbano and F. A. Johnson prepared an evaluation of the first 3 years of this season in Florida (unpubl. rep., Fla. Game and Fresh Water Fish Comm., Okeechobee, Fla., 1985). In 1997, the USFWS will be evaluating these seasons for all participating states and considering the potential for future use.

The inclusion of wood ducks in the September seasons stemmed from work by Bowers and Martin (1975), which suggested that southern wood ducks had higher survival and lower recovery rates than northern birds; therefore, opportunities existed for increased hunting recreation and harvest of wood ducks in southern states. The authors cautioned, however, that any additional harvest should occur before northern birds arrived on wintering areas.

To evaluate the potential for harvesting northern populations, the Florida Game and Fresh Water Fish Commission (FGFWFC) conducted a study of blood parasites of wood ducks harvested in Florida during the September season (Thul 1990). This study indicated that approximately 95% of Florida's September season wood duck harvest was made up of birds from the southeastern United States. Furthermore, concurrent with liberalized harvest opportunities, harvest of wood ducks increased, but survival rates did not decrease for wood ducks in the southern United States, although power to detect small changes in survival rates was poor (Johnson et al. 1986). In addition, liberalized regulations did not result in an increase in harvest pressure on populations from northern states (Johnson et al. 1986).

Florida's special September duck seasons were for all species during 1981–1987, with daily bag limits of 4 birds. The bag could include up to 4 wood ducks or teal, but only 1 duck of any other species. In 1988, in response to concerns about declining populations of blue-winged teal and other prairie-nesting duck species, the USFWS limited the season to wood ducks only. Further, the USFWS reduced the bag limit from 4 to 3 as part of the effort to reduce the national waterfowl harvest. In 1992, teal and the 4-bird bag limit were restored, but harvest of other species continued to be prohibited through 1995. Shooting was always permitted to begin at 30 minutes before sunrise during the study period.

The USFWS annually estimates waterfowl harvest and hunter activity nationwide. However, these estimates lack sufficient precision to be useful on a local basis or for a short season (Geissler 1990). Therefore, since 1989, the FGFWFC has been monitoring Florida's special September duck season by using indicators of wood duck population status to assess the compatibility of the season with the long-term welfare of wood ducks. One objective of this program was to gain more reliable information on harvest and hunter activity on a statewide basis for the special September duck season. In this paper, we report our methods and results of monitoring harvest and hunter activity during Florida's special September duck seasons, 1989–1995.

We appreciate the many FGFWFC employees and volunteers for their efforts toward the statewide project for monitoring wood duck populations. M. Herrell, K. Stargell, and P. Walker helped with conducting surveys and entering data, and M. Herrell helped prepare the manuscript. S. Linda gave statistical advice. We thank USFWS-OMBM staff, particularly W. Martin, S. Carney, and P. Padding, who identified wings to age and sex class and provided data and advice. F. A. Johnson (USFWS-

OMBM) contributed in many ways to this work and deserves special credit. We appreciate the help with design and data analyses from National Biological Survey (NBS) staff, particularly P. H. Geissler. We thank the hunters who responded to questionnaires, donated wings for harvest surveys, and reported bands on birds they killed. R. R. Bielefeld, R. C. Brust, D. F. Caithamer, G. R. Hepp, T. E. O'Meara, D. A. Wood, and an anonymous reviewer provided helpful reviews.

Methods

We conducted harvest surveys to estimate total harvest, hunter participation, and age-sex composition of the wood duck harvest during the special September duck season in Florida. Hunters between 15 and 65 years of age can become eligible to hunt waterfowl in Florida by buying a state duck stamp (in addition to other stamp and license requirements). Procedures for duck stamp sales produce a "survey card" for every tenth stamp sold, which lists the name and address of the purchaser. We used these cards to sample the state's duck stamp buyers. We set $\alpha = 0.05$ for all statistical tests.

Wing Collection Surveys

We mailed postage-paid, preliminary questionnaires to the sample of previous year's duck stamp buyers in July 1989–1995 to solicit cooperators for the wing-collection survey. The postcard briefly described objectives and benefits of the wing collection survey and explained that postage-paid envelopes for sending wings would be provided. We mailed wing envelopes to willing respondents by the week preceding the season opening. Envelopes were similar to those used in the USFWS Parts Collection Survey (see Voelzer et al. 1982) and included specific instructions to send 1 wing from each wood duck killed during the September season.

Age and sex for wings received were determined using characteristics described by Carney (1992), and using wings from wood ducks of known sex and age for comparison. Wings from 1989 and 1990 were examined and assigned to age/sex class by FGFWFC staff. Beginning in 1991, wings were examined and assigned to age/sex class by USFWS-OMBM biologists involved with the USFWS parts collection survey.

Each year, wing donors included willing respondents to that year's preliminary survey as well as willing respondents from previous years (who also received preliminary surveys). We refer to this group as the questionnaire sample. To increase the sample size of wings, we also collected wings from hunters at check stations and public boat ramps and asked hunters to donate wings through notices, press releases, and casual contacts, beginning with the 1991 season. We refer to the group of wings collected from these efforts as the solicited sample. We used a Chi-square test to compare the age/sex distributions of duck wings between solicited and questionnaire samples each year. In addition, we examined data from the USFWS wing-collection survey from wood ducks killed during Florida's special September season and compared the age/sex distribution between our sample and the USFWS sample each year,

using a chi-square test. When appropriate, we pooled all samples (questionnaire, solicited, and USFWS) of wings to increase the sample size for estimating harvest of each age/sex class. A hunter potentially could contribute 1 wing from a bird to the USFWS and 1 wing from the same bird to our survey. We considered this situation to be infrequent and assumed independence between samples.

Mail-questionnaire Surveys

To estimate harvest and hunter participation and success, we conducted a mail-questionnaire survey using the 1-in-10 sample of duck-stamp purchasers from the preceding hunting season. Because Florida hunters also can purchase certain combination licenses that make them eligible to hunt ducks without specifically buying a duck stamp, we also included these hunters to achieve a representative sample of all potential season participants. The most commonly purchased combination license was the sportsman's license. Therefore, we used a sample of 1,000 sportsman's-license buyers from the preceding hunting season. Beginning in 1992, hunters could purchase 3 additional combination licenses (lifetime sportsman's, lifetime hunting, and 5-year hunting) that made them eligible to hunt ducks without buying a state duck stamp (lifetime-license buyers or lifetime sample). Although lifetime-license buyers were eligible to hunt in the 1992 September season, we did not begin sampling them until 1993. We considered their potential contribution to the 1992 estimates as negligible, because few of these licenses were purchased the first year. To sample lifetime-license buyers, we randomly selected approximately 10% of license holders from the previous hunting season. We mailed postage-paid questionnaires to sampled persons so that they received questionnaires within a few days of the end of the season. Questionnaires asked recipients how many days they hunted during the special September season, how many ducks they harvested (by species), and how many they shot but were unable to retrieve. In the questionnaire mailed to sportsman's and lifetime-license buyers, we asked additional questions unrelated to duck hunting to help reduce nonresponse expected from the large proportion of these hunters who did not hunt ducks. Approximately 1 week after the September season closed, we mailed a postcard reminding all survey recipients to complete and mail the questionnaire. We sent follow-up questionnaires to nonrespondents approximately 3–4 weeks later and again approximately 7–8 weeks after the season ended.

Annual estimates of harvest and hunter participation were calculated separately for the duck stamp, sportsman's license, and lifetime-license samples. Harvest estimates were the medians, and hunter participation estimates were the means of 200 bootstrap sample estimates for each sample (Geissler 1987, 1990). Sample size within each bootstrap sample was the number of respondents. Harvest and hunter participation estimates and variances for the 3 samples were summed for the overall season estimates. Annual rate estimates (e.g., harvest per hunter-day) were reported as weighted means of the 3 sample means.

We used program CONTRAST (Sauer and Hines 1989), which calculates a Chi-square statistic, to compare estimates of harvest per hunter-day. We assumed estimates were independent and covariances were 0.

We were concerned that estimates of harvest and hunter participation based solely on questionnaire responses would be biased. We suspected that hunters returning questionnaires were more likely to have participated in the season and been successful than nonrespondents, which could cause inflated estimates of harvest and hunter participation. Because an average of 45.1% of the individuals receiving questionnaires failed to respond (Table 1), the potential magnitude of bias was too substantial to ignore. We therefore adjusted estimates for nonresponse bias by assigning to all nonrespondents characteristics of respondents to the third questionnaire mailing (Hedayat and Sinha 1991). We multiplied the reported kill per respondent and days hunted per respondent for respondents to the third mailing by the number of nonrespondents to estimate the harvest and participation for this portion of each sample. Rate estimates (i.e., harvest per hunter-day, seasonal harvest per hunter, days hunted per hunter) were calculated from responses from season participants (had hunted ≥1 day) and were not adjusted for nonresponse bias because participation probability did not contribute to potential bias. Harvest estimates for individual bootstrap samples (K_b) were calculated as follows:

$$K_b = (K_r + K_n)/Q \times A \times S,$$

where K_r = total kill reported by respondents, K_n = total kill attributed to nonrespondents, Q = number of deliverable questionnaires, A = adjustment factors for memory and prestige biases and junior hunters (Chamberlain et al. 1972), S = total number of stamps or licenses sold.

Estimates of adult hunters participating in the season were calculated as follows:

$$P_b = (P_r + P_n)/Q \times A \times S,$$

where P_r = total participants reported by respondents, and P_n = total participants attributed among nonrespondents.

Hunter-day estimates for individual bootstrap samples (D_b) were calculated as follows:

$$D_b = (D_r + D_n)/Q \times J \times S,$$

where D_r = total days hunted reported by respondents, D_n = total days hunted attributed to nonrespondents, and J = adjustment factor for junior hunters (Chamberlain et al. 1972). Variances among bootstrap sample estimates were calculated following Geissler (1990:204). We compared the mean number of adult hunters, hunter-days, and corrected wood duck harvest between the 2 groups of years of different regulations, 1989–1991 vs. 1992–1995.

Numbers of wood ducks in each sex and age class in the harvest were estimated by multiplying the proportion of each class in the wing receipts by the corrected harvest estimate from the questionnaire survey. We calculated a variance for the proportion (p) of each age/sex class in the wing receipts and used it and the variance of the corrected harvest estimate in the formula for the variance of a product of 2 estimates (Hanson et al. 1953).

Table 1. Design details, response rates, and participation estimates from a harvest survey of Florida's special September duck season; DS = duck stamp sample, SL = sportsman's license sample, and LT = lifetime-license sample.

	1989		1990		1991		1992[a]		1993			1994			1995		
	DS	SL	DS	SL	DS	SL	DS	SL	DS	SL	LT	DS	SL	LT	DS	SL	LT
Number of stamp or license buyers—previous year	15,771	21,189	15,440	27,901	16,171	19,585	15,939	17,892	14,403	17,239	1,423	13,763	16,650	2,942	13,689	16,349	4,744
Sample size[b]	1,197	1,000	1,139	1,000	1,207	1,000	966	1,000	607	1,000	154	673	1,000	300	681	1,000	475
Undeliverable questionnaires	113	85	96	77	106	88	126	77	55	89	4	64	106	8	80	100	21
Response rate(%)[c]	56.2	54.2	54.6	54.3	55.7	54.3	52.1	54.6	55.7	45.3	70.8	57.5	50.6	72.0	52.6	49.1	69.0
Estimated percentage of stamp or license buyers participating in season	14.6	2.6	15.7	3.5	17.1	4.1	25.5	6.1	24.3	5.3	2.6	24.7	6.2	1.0	28.8	4.2	1.8

[a]Lifetime-license buyers were eligible to participate beginning with the 1992 season. We did not sample them until the 1993 season.

[b]Number of questionnaires mailed.

[c]Number of responses received divided by sample size. Undeliverable questionnaires were considered nonresponses.

Banding and Recovery Data

We examined band-recovery data to assess derivation of wood ducks harvested during the special September season. We used data on file with the Federal Bird Banding Laboratory from only normal, wild wood ducks banded anywhere during the preseason period (June–September [before the September hunting season]) 1987–1993 and recovered in Florida during the September hunting season 1987–1993. Wood ducks were classified as young or adult (≥1 year old) at the time of banding. We used a program developed by the NBS, called the Band Analysis System, to summarize banding and recovery data.

Results

Wing Collection Surveys

We found no differences ($P > 0.05$) in age/sex distribution of wings between solicited and questionnaire samples or between our sample and the USFWS sample in any year (Table 2). Thus, we pooled all wing samples each year. The average proportion of adult females harvested was lower and the average proportion of young males was higher than that of all other age/sex groups, based on examination of 95% CI's of estimates of mean proportions (Table 3). The proportion of young in the September season harvest during 1989–1995 averaged 0.60 (SE = 0.03) and ranged from 0.48 to 0.76 (Table 3).

Mail-questionnaire Surveys

Average response rates for harvest questionnaires during 1989–1995 were 54.9% (SE = 0.74) for the duck stamp sample and 51.8% (SE = 1.35) for the sportsman's license sample. For the lifetime sample during 1993–1995, the average response rate was 70.6% (SE = 0.87). Between 14.6% and 28.8% of respondents from

Table 2. Tests for independence in age/sex distribution of wings between samples from Florida's special September duck season, 1989–1995.

	Solicited vs. Questionnaire sample[a] (df = 3)		FGFWFC[a] vs. USFWS[b] sample (df = 3)	
Year	χ^2	P	χ^2	P
1989	—	—	2.84	0.42
1990	—	—	0.67	0.88
1991	7.38	0.06	4.49	0.21
1992	5.34	0.15	1.73	0.63
1993	6.21	0.10	0.27	0.97
1994	6.22	0.10	1.42	0.70
1995	2.67	0.45	6.23	0.10

[a]Collected by Florida Game and Fresh Water Fish Commission.

[b]Collected by U.S. Fish and Wildlife Service.

Table 3. Wood duck harvest by age-sex class during Florida's special September duck season, 1989–1995. SE's are expressed parenthetically.

Year	N	Adult female		Young female		Adult male		Young male		Proportion of young
		Harvest	Proportion	Harvest	Proportion	Harvest	Proportion	Harvest	Proportion	
1989	97[a]	814 (331)	0.13 (0.03)	1,754 (605)	0.28 (0.04)	1,504 (533)	0.24 (0.04)	2,193 (730)	0.35 (0.05)	0.63 (0.05)
1990	162[a]	598 (195)	0.09 (0.02)	1,860 (448)	0.28 (0.04)	997 (278)	0.15 (0.03)	3,189 (701)	0.48 (0.04)	0.76 (0.03)
1991	306[a]	1,025 (228)	0.17 (0.02)	1,326 (281)	0.22 (0.02)	2.110 (417)	0.35 (0.03)	1,567 (323)	0.26 (0.02)	0.48 (0.03)
1992	321[a]	1,309 (303)	0.18 (0.02)	1,663 (373)	0.23 (0.02)	1,735 (387)	0.24 (0.02)	2,530 (540)	0.35 (0.01)	0.58 (0.01)
1993	421[a]	1,380 (364)	0.19 (0.02)	1,744 (450)	0.24 (0.02)	1,744 (450)	0.24 (0.02)	2,398 (606)	0.33 (0.02)	0.57 (0.02)
1994	273[a]	747 (212)	0.15 (0.02)	1,345 (354)	0.27 (0.03)	1,195 (319)	0.24 (0.02)	1,644 (424)	0.33 (0.03)	0.61 (0.03)
1995	421[a]	823 (253)	0.13 (0.02)	1,646 (479)	0.26 (0.02)	1,722 (514)	0.28 (0.02)	2,025 (583)	0.32 (0.02)	0.59 (0.02)
Mean[b]	7[c]	956 (111)	0.15 (0.01)	1,620 (78)	0.25 (0.01)	1,579 (143)	0.25 (0.02)	2,221 (211)	0.34 (0.02)	0.60 (0.03)

[a]Number of wings examined.

[b]Arithmetic.

[c]Number of years.

the duck stamp sample participated in the season (Table 1). Participation rate for the sportsman's license sample ranged from 2.6% to 6.2% per year. The lifetime-sample's participation rate ranged from 1.0% to 2.6%. An average of 3,555 (SE = 178) adult hunters participated in the seasons annually, and hunter-days averaged 8,082 (SE = 473) (Table 4). Annual wood duck harvest during 1989–1995 averaged 6,391 (SE = 296), and annual teal harvest during 1992–1995 averaged 5,924 (SE = 1,095) (Table 4).

We detected no difference in the mean number of hunters participating in the season between the 2 periods of different regulations, 3,228 (SE = 228.4) in 1989–1991 (wood ducks only, 3-bird bag) and 3,801 (SE = 195.9) during 1992–1995 (wood ducks and teal, 4-bird bag) ($t = -1.90$, df = 5, $P = 0.12$). Mean number of hunter-days also remained similar between the periods, 7,147 (SE = 427.3) during 1989–1991 and 8,784 (SE = 555.2) during 1992–1995 ($t = -2.19$, df = 5, $P = 0.08$). We found no evidence to indicate that mean wood duck harvest differed between the 2 periods ($t = -0.21$, DF = 5, $P = 0.84$). During 1989–1991, wood duck harvest averaged 6,313 (SE = 179.1), and during 1992–1995, harvest averaged 6,451 (SE = 535.8). Restoring teal to the bag resulted in an additional average of 5,924 (SE = 1,095) birds harvested (Table 4). Average wood duck harvest per hunter-day for 1992–1995 (0.72, SE = 0.09) remained similar ($\chi^2 = 0.900$, $P = 0.343$) to the estimate from 1981–1983 (0.63, SE = 0.03) (F. Montalbano and F. A. Johnson, unpubl. rep., Fla. Game and Fresh Water Fish Comm., Okeechobee, Fla., 1985).

Banding and Recovery Data

Eighty-one bands were recovered during the 1987–1993 special September duck seasons, 94% of which were from wood ducks banded in Florida. All direct recoveries were of birds banded in Florida, except for 1 adult male banded in southern Georgia. Of the indirect recoveries, all females and 71% of males were banded in Florida.

Discussion

We dealt with nonresponse bias using an arbitrary, nonempirical adjustment to the data. This adjustment usually resulted in lower estimates of harvest and hunter participation and consistently reduced precision when compared to unadjusted estimates. Any adjustment for nonresponse provides only a subjective assessment of the hunting behavior and success of persons who refuse to report this information. We believed that the approach we used (assuming the nonrespondents behaved similar to persons responding to the third questionnaire mailing) resulted in more accurate estimates than if we assumed that respondents represented the sampled population of stamp or license buyers.

In 1989, 1 respondent to the third mailing reported a retrieved kill of 32 wood ducks (the maximum legal harvest for 1 hunter for the 5-day season would have been 15 and estimated seasonal harvest per participant in 1989 was 1.86 [SE = 0.10]). Because it was a response to the third mailing, this aberrant response had dramatic effect on the 1989 harvest estimate, when adjusted for nonresponse. The wood duck

Table 4. Participation, success, and harvest estimates for Florida's special September duck seasons, 1989–1995.

	1989		1990		1991		1992		1993		1994		1995		Mean[a]	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Adult hunters[b]	2,830[d]	461.5	3,234	442.1	3,621	493.2	4,265	377.9	3,319	405.4	3,730	444.5	3,889	444.1	3,555	178.3
Days/hunter[c]	2.09	0.11	2.02	0.11	2.00	0.10	1.96	0.08	1.94	0.10	2.15	0.10	2.26	0.10	2.06	0.04
Hunter-days[b]	6,306[d]	1,160	7,434	1,204	7,700	1,281	8,970	1,137	7,215	1,137	9,123	1,258	9,827	1,356	8,082	472.8
Wood duck harvest/ hunter-day[c]	0.78	0.11	0.98	0.09	0.69	0.08	0.70	0.08	0.98	0.12	0.60	0.08	0.60	0.08	0.76	0.06
Seasonal wood duck harvest/hunter[c]	1.86	0.19	2.12	0.25	1.75	0.25	1.72	0.22	2.18	0.30	1.42	0.20	1.65	0.27	1.81	0.10
Wood duck harvest (unadjusted)[b]	6,614[d]	1,980	7,013	1,426	6,364	1,152	7,631	1,517	7,670	1,859	5,258	1,275	6,680	1,859	6,747	312.1
Wood duck harvest (adjusted)[b]	6,265[d]	1,876	6,644	1,350	6,029	1,091	7,229	1,437	7,266	1,761	4,981	1,208	6,329	1,761	6,391	295.6
Teal harvest/hunter-day[c]							0.39	0.07	0.59	0.10	0.84	0.11	0.80	0.10	0.67	0.11
Seasonal teal harvest/hunter[c]							0.92	0.14	1.32	0.25	2.05	0.32	2.07	0.31	1.59	0.28
Teal harvest (unadjusted)[b]							4,331	1,047	4,247	1,277	8,762	2,576	7,674	1,795	6,254	1,156
Teal harvest (adjusted)[b]							4,104	991.8	4,024	1,209	8,300	2,440	7,270	1,701	5,924	1,095

[a]Means (arithmetic) were calculated from 1989–1995 estimates ($N = 7$), except means for teal harvest, which were calculated from 1992–1995 estimates ($N = 4$).

[b]Adjusted to account for nonresponse bias.

[c]Based on questionnaire respondents.

[d]One outlier response deleted from 1989 nonresponse-bias correction (see Discussion).

harvest estimate when this response was included was 10,118 (CV = 0.52), 162% higher than the estimate we reported (Table 4). Therefore, we chose not to use this response in calculations to account for nonresponse bias because this response (1) affected the results so substantially, (2) represented illegal harvest, which we did not intend to estimate, and (3) appeared extremely unrepresentative of respondents to the third mailing. We retained this response in calculations that included harvest and participation by respondents only (rate estimates).

Participation rate among state duck stamp buyers during the 1992–1995 seasons (teal and wood ducks) was comparable to the participation rate of 25.2% during the first 3 years of Florida's special September duck season (1981–1983) (F. Montalbano and F. A. Johnson, unpubl. rep., Fla. Game and Fresh Water Fish Comm., Okeechobee, Fla., 1985). Average wood duck harvest per hunter-day also remained similar between 1981–1983 and 1992–1995. This evidence suggests that wood duck availability has not changed between the 2 periods, assuming that vulnerability of wood ducks to harvest also was similar. We were unable to make similar comparisons of total hunter participation and harvest because the 1981–1983 estimates were not adjusted for nonresponse bias.

Because teal are more available than wood ducks for hunters in the southern portion of the state (D. H. Brakhage, J. F. Bergan, and D. R. Eggeman, unpubl. rep., Fla. Game and Fresh Water Fish Comm., Tallahassee, Fla., 1991), we expected participation by hunters from southern areas to increase when teal were restored to the season's bag. Although the differences in participation between the 2 periods of different regulations were not statistically significant, the estimates of adult hunters and hunter-days tended to be higher (P = 0.08–0.12) after adding teal to the bag. Restoring teal to the bag also nearly doubled the average season harvest.

The low proportion of adult female wood ducks in the September harvest would have been expected based on estimates of survival and band-recovery rates (an index to harvest rate). Female wood ducks tend to exhibit lower survival rates than males (Nichols and Johnson 1990). Sex-ratios of wood ducks is 1:1 at hatch (Bellrose et al. 1961); therefore, lower survival rates for females would result in proportionately fewer females than males in the population. LeMaster and Trost (1994) found that the mean summer survival rate for southern adult female wood ducks (0.580, SE = 0.060) was lower than that of northern adult females (0.855, SE = 0.045). The authors suggested that the difference may be a result of higher depredation mortality in southern areas during the summer. Higher over-summer mortality for adult females would further reduce their relative availability to harvest during September. Female wood ducks also tend to be harvested at a lower rate than males, and adults at a lower rate than young (assuming similar band-reporting rates) (Nichols and Johnson 1990). The larger proportion of young males in the harvest also is consistent with generally higher band-recovery rates for this group (Nichols and Johnson 1990).

Kentucky and Tennessee also conducted special September duck seasons designed to increase harvests of locally breeding wood ducks. Estimates of the total annual wood duck harvest in both states increased dramatically when September seasons began in 1981 (Sauer et al. 1990). In Kentucky, annual wood duck harvest

averaged 3,860 during the 1971–1980 hunting seasons and 14,028 during the 1981–1993 seasons (USFWS, OMBM 1973–1995). In Tennessee, annual harvests averaged 11,813 during 1971–1980 and 26,896 during 1981–1993 (USFWS, OMBM 1983–1995). By comparison, Florida's average annual wood duck harvest decreased from 27,077 during 1971–1980 to 22,924 during 1981–1993 (USFWS, OMBM 1973–1995). Because the wood duck harvest during Florida's September duck season comprises a small proportion of the annual wood duck harvest, the decrease likely was driven by influences on harvest during the regular season (e.g., regulations, availability of wood ducks and other species, weather and water conditions, hunter participation).

Band-recovery distributions were consistent with the reproductive behavior of wood ducks; females exhibit strong philopatry to natal and nesting areas (Haramis 1990), whereas males pair with females in wintering areas and follow females to the females' natal areas to breed (Kirby 1990). Despite differences in sex-specific philopatry, most locally banded wood ducks were subsequently recovered in Florida. Thus, our band-recovery data suggest that the wood duck harvest during Florida's September duck season is primarily composed of birds that spent the previous breeding season in Florida.

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