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Effects of repeat sampling in the U.S. Waterfowl Parts Collection Survey

Jesse G. Oetgen
Louisiana State University and Agricultural and Mechanical College

EFFECTS OF REPEAT SAMPLING IN THE U.S. WATERFOWL PARTS COLLECTION SURVEY

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ABSTRACT

Age ratio estimates obtained annually by the Cooperative Waterfowl Parts Collection Survey (PCS) serve as important estimates of annual waterfowl recruitment. To determine if age and sex ratios are biased due to repeat sampling of hunters across years, I examined PCS data collected from 1991-2000. Mean seasonal harvest increased with number of consecutive years hunters responded to the PCS. Proportions of juveniles in the mallard (*Anas platyrhynchos*) harvest and harvest of all species combined decreased with increasing seasonal harvest level. Proportions of males in the harvest increased with increasing harvest level. Proportions of juveniles in the harvest of hunters responding to the PCS 3 and 4 consecutive years were slightly lower than proportions in the harvest of hunters responding only once or twice. Proportion of males in the mallard harvest increased with number of years hunters remained in the PCS. Although large sample sizes produced statistically significant effects ($P < 0.05$) of seasonal harvest and repeat sampling, actual differences in predicted proportions were quite small. My results suggest that age and sex ratio estimates remain relatively unaffected by repeat sampling in the PCS.

INTRODUCTION

Each year the United States Fish and Wildlife Service (USFWS) estimates number of juveniles per adult (age ratio) and number of males per female (sex ratio) in the national waterfowl harvest from the Cooperative Waterfowl Parts Collection Survey (PCS; Martin and Carney 1977). Age ratio estimates are of particular importance because they provide our best estimate of annual recruitment for North American ducks (Baldassarre and Bolen 1994:356). These age ratio data are used in adaptive harvest management (AHM) models to set regulatory frameworks (U.S. Fish and Wildlife Service 2001) and by many researchers who rely upon them as indices of annual production (Heitmeyer and Fredrickson 1981, Kaminski and Gluesing 1987, Raveling and Heitmeyer 1989, Reynolds and Sauer 1991, Johnson et al. 1997, Afton and Anderson 2001). In this study I examine whether the sampling framework of the PCS creates biases in the survey estimates of age and sex ratios.

The initial sampling frame for the PCS consists of hunters who responded to the Hunter Questionnaire Survey (HQS) in the prior year (Martin and Carney 1977). Nonrespondents to the HQS and similar harvest surveys have smaller seasonal harvests and spend fewer days hunting than respondents (Filion 1976, Wright 1978, Barker 1991, Pendleton 1992). Additionally, success and activity of hunters responding to an initial mailing is greater than success and activity of hunters responding to a second mailing (Sen 1970, Sen 1971, Filion 1976, Wright 1978, Pendleton 1992). Sen (1971) reported a decrease in average harvest over 4 successive mailings of a Canadian harvest survey. Developing the PCS sampling frame from respondents to the HQS likely creates an initial bias in the PCS survey sample by overrepresenting hunters who spend much time afield and have high seasonal harvests.

Hunters who previously responded to the HQS are sent a post card requesting their participation in the PCS. Those who respond and are willing to cooperate will be surveyed; nonrespondents and those who decline the invitation to participate are dropped from the survey sample (Paul I. Padding, USFWS, personal communication). If nonrespondents to this request have similar differences in hunting activity and harvest levels shown by nonrespondents to the HQS, then a second source of bias could be imposed on the PCS sampling framework.

Until 1994, any hunter that sent at least one duck wing or goose tail to the PCS would be sent survey materials the following year and similarly resampled for up to 5 consecutive years. From 1994 to 1998, hunters were sampled no more than 4 consecutive years before being removed from the survey. USFWS biologists suspected that sampling hunters for 4 and 5 consecutive years may bias sex and age ratio estimates, so they limited repeat sampling to 3 years after 1998 (Paul I. Padding, USFWS, personal communication). If respondents to consecutive mailings of the PCS harvest more ducks seasonally than those who fail to respond after their initial participation, the current system of repeat sampling of PCS respondents may create a third source of bias in the PCS sampling frame.

Biases in harvest surveys in the U.S. and Canada have been researched extensively, but there have been no investigations of potential biases in the PCS. The sample of hunters included in the PCS may overrepresent dedicated hunters with greater seasonal harvests for 3 reasons: (1) the PCS sample initially comes from a biased source – HQS respondents; (2) hunters with low seasonal harvest levels fail to respond to the PCS participation request, eliminating them from the survey sample; and (3) hunters with low seasonal harvest levels fail to respond to the PCS in subsequent years after their initial response. An important question

is whether the potentially biased sampling frame influences sex or age composition information produced by the PCS.

I hypothesized that the composition of ducks harvested by an individual is related to the individual's hunting behavior, effort, and skill, which is reflected by their seasonal harvest level. More specifically, I predicted that hunters with greater seasonal harvests would be more likely to hunt in quality locations, to lure adult birds into harvest situations, and to identify and selectively harvest males. Regardless of whether my specific predictions are correct, if harvest level relates to composition of the harvest, the PCS may be generating biased data on age ratios or sex ratios because of the strong potential for overrepresentation of dedicated and successful hunters in the PCS sampling framework. I tested my hypothesis that hunters with greater seasonal harvests kill smaller proportions of juveniles and larger proportions of males by relating seasonal harvest level to harvest composition. I also tested whether the number of consecutive years of participation in the PCS is related to seasonal harvest level, proportion of juveniles harvested, or proportion of males harvested.

METHODS

I examined PCS data collected by the USFWS from 1991-2000. From this extensive dataset I identified the number of duck wings sent from each hunter each year (seasonal harvest) and the location where the ducks were harvested. I created 8 categories of the location variable: (1) northern states of the Atlantic flyway – Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, New York, Pennsylvania, West Virginia, New Jersey, Delaware, and Maryland; (2) southern states of the Atlantic Flyway – Virginia, North Carolina, South Carolina, Georgia, and Florida; (3) northern states of the Mississippi flyway – Minnesota, Wisconsin, Michigan, Iowa, Illinois, Indiana, Ohio, and Missouri; (4) southern states of the Mississippi flyway – Kentucky, Arkansas, Tennessee, Louisiana, Mississippi, and Alabama; (5) northern states of the Central flyway – eastern Montana, North Dakota, South Dakota, eastern Wyoming, and Nebraska; (6) southern states of the Central flyway – eastern Colorado, Kansas, eastern New Mexico, Oklahoma, and Texas; (7) northern states of the Pacific flyway – Alaska, Washington, Oregon, Idaho, western Montana, and western Wyoming; and, (8) southern states of the Pacific flyway – California, Nevada, Utah, western Colorado, Arizona, and western New Mexico. Mallards are an abundant and widely distributed species of waterfowl in North America, have been studied extensively in the U.S. and abroad, and are the species of primary interest in adaptive harvest management models (Anderson et al. 1974, U.S. Fish and Wildlife Service 2001). Therefore, I identified the number of mallard wings sent from each hunter each year (seasonal mallard harvest). Proportion of juveniles in the seasonal harvest was computed as number of juvenile wings divided by number of known-age wings. Similarly, proportion of males was computed as the number of male wings divided by the number of wings with known sex. Finally, I

identified the maximum number of consecutive years each hunter responded to the survey (maximum response).

I used individual hunters and their corresponding harvest characteristics as observations in my analyses. Repeat sampling of PCS respondents makes it possible for many hunters to respond to the PCS in multiple years. Therefore, observations in the raw dataset violated the assumption of independent samples. Due to annual variability in the size of the North American duck population, proportion of juveniles in the population, and proportion of males in the population, averaging or pooling data across years would make age and sex ratio comparisons inaccurate. To create independence among samples, I limited my analyses to the use of 1 year for each hunter. I assumed that except for variation associated with year and location of the harvest, a hunter's seasonal harvest level, proportion of juveniles in the harvest, and proportion of males in the harvest were similar during consecutive years of participation in the PCS. I tested this assumption by dividing the data into 3 subsets: (1) data coinciding with a hunter's first year in the survey; (2) data coinciding with a hunter's second year in the survey; and (3) data coinciding with a hunter's third year in the survey. The number of hunters included in the survey a fourth year was insufficient to warrant a fourth subset. As a conservative test for similarity among subsets, I conducted analyses of variance tests comparing logit estimates from logistic regression analyses using each of the 3 subsets. Although samples in each of the subsets were not independent, I expected the covariance of the logit estimates to be positive, resulting in the actual variance of the difference between estimates to be smaller than reported. Because the mean seasonal harvest per hunter for the 3 subsets was approximately 13, logit estimates for all 3 subsets were made at a seasonal harvest value of 13.

Some hunters harvested ducks in more than one of my 8 locations. Thus, limiting my analyses to one year of data for each hunter was not sufficient to create independent samples. Less than 2.5% (525 out of 21,532 in age composition analyses and 528 out of 21,546 in sex composition analyses) of hunters in my dataset harvested ducks in more than one location. Additionally, mean proportion of juveniles [0.58 ± 0.01(SE)] and mean proportion of males [0.64 ± 0.01(SE)] harvested within the primary location were similar to mean proportion of juveniles [0.56 ± 0.02(SE)] and mean proportion of males [0.65 ± 0.01(SE)] harvested outside the primary location. Therefore, I excluded data from ducks harvested outside a hunter's primary location, which is where a hunter harvested the most ducks during a given year. Thus, proportions used in my analyses were estimates, not actual proportions in the seasonal harvest. Exclusion of harvest outside the primary location caused me to underestimate seasonal harvest, but because the distribution among maximum response categories of hunters harvesting ducks in >1 location was similar to the distribution of hunters harvesting ducks in only 1 location, I was able to make comparisons among categories. Harvest in >1 location may be more common among avid and experienced hunters with greater seasonal harvest. If this were the case, my reduced estimates of seasonal harvest would be skewed toward hunters with high seasonal harvest, reducing seasonal harvest effects on proportion of juveniles and proportion of males.

To test the hypothesis that repeat respondents harvest more ducks seasonally than hunters who drop out of the survey due to nonresponse, I compared seasonal harvests among hunters responding to the PCS a maximum of 1, 2, 3, and 4 times. I conducted analyses of variance (PROC GLM, SAS Institute Inc. 1999) to test for seasonal harvest differences among maximum response categories.

I performed logistic regression analyses (PROC GENMOD, SAS Institute Inc. 1999) to determine effects of maximum response on proportion of juveniles and proportion of males in the harvest. I used a model containing only those parameters determined *a priori* to have potential effects on the response variables (Anderson et al. 2001). Martin and Carney (1977) reported considerable annual and geographic variation in age and sex ratios of the harvest. I added seasonal harvest as a covariate in my model to determine if proportions of juveniles and males in the harvest were affected by size of a hunter's seasonal harvest. My final regression model contained the explanatory variables year, location, the interaction between year and location, seasonal harvest, and maximum response. Regression analyses were repeated for the proportion of juveniles in the harvest of all species combined, proportion of males in the harvest of all species combined, proportion of juveniles in the mallard harvest, and proportion of males in the mallard harvest.

RESULTS

I found no evidence that hunters' harvest characteristics differed among years; that is, predicted proportions of juveniles and predicted proportions of males in the harvest of all species combined were similar ($P > 0.15$) among the 3 data subsets (Table 1). Proportions also were similar ($P > 0.27$) among the 3 data subsets in the analyses of the mallard harvest (Table 2). Hereafter, all results are from analyses on the data subset limited to first year responses of hunters who entered the survey in 1991-2000 because that subset contained the largest sample size and was the only one that allowed for comparisons among maximum response categories ranging from 1 to 4 years in the survey sample.

Year, location, and the interaction between year and location had significant effects on proportion of juveniles and proportion of males in the seasonal harvest of mallards and all species combined ($P < 0.001$, Table 3). The individual effects of these variables are not the focus of my research and as such will not be discussed except to highlight their ability to explain variation in proportions of juveniles and males in seasonal harvests.

The maximum number of consecutive years hunters responded to the PCS had significant effects ($F_{3, 21528} = 509.8$, $P < 0.001$) on seasonal harvest level. Mean seasonal harvest of hunters responding only once was 6.85 ± 0.09 (SE); whereas, mean seasonal harvest of hunters responding twice was 9.93 ± 0.19 (SE) during their first year in the PCS. Hunters responding a maximum of 3 years reported a mean seasonal harvest of 14.17 ± 0.18 (SE), and those who stayed in the PCS for 4 years harvested an average of 12.27 ± 0.26 (SE) ducks in their first year of the survey. Seasonal mallard harvest also was affected by maximum response ($F_{3, 21528} = 269.15$, $P < 0.001$). Mean seasonal mallard harvest of hunters responding only once was 2.63 ± 0.04 (SE) compared with a mean seasonal mallard harvest of

Table 1. Z-scores (Z) and p-values (P) for comparisons of predicted proportions ($\hat{\pi}$) of juveniles and predicted proportions of males in the harvest of all species combined from 3 data subsets. Predictions are based on the model containing explanatory variables year, location, interaction year by location, maximum response, and seasonal harvest. Seasonal harvest was set at 13 for all subsets.

	Juveniles					Males				
Maximum Response	Subset	$\hat{\pi}$	Subset Comparison	Z	P	Subset	$\hat{\pi}$	Subset Comparison	Z	P
1	1	0.5637				1	0.6438			
2	1	0.5629	1 vs. 2	1.10	0.27	1	0.6496	1 vs. 2	1.20	0.23
2	2	0.5587				2	0.6452			
3	1	0.5562	1 vs. 2	0.17	0.87	1	0.6430	1 vs. 2	-0.85	0.40
3	2	0.5557	2 vs. 3	0.20	0.84	2	0.6452	2 vs. 3	-0.22	0.83
3	3	0.5552	1 vs. 3	-0.37	0.71	3	0.6458	1 vs. 3	1.05	0.29
4	1	0.5553	1 vs. 2	1.44	0.15	1	0.6498	1 vs. 2	-0.91	0.37
4	2	0.5486	2 vs. 3	-0.49	0.62	2	0.6538	2 vs. 3	0.58	0.56
4	3	0.5508	1 vs. 3	-0.95	0.34	3	0.6514	1 vs. 3	0.36	0.72

Table 2. Z-scores (Z) and p-values (P) for comparisons of predicted proportions ($\hat{\pi}$) of juveniles and predicted proportions of males in the mallard harvest from 3 data subsets. Predictions are based on the model containing explanatory variables year, location, interaction year by location, maximum response, and seasonal harvest. Seasonal harvest was set at 13 for all subsets.

	Juveniles					Males				
Maximum Response	Subset	$\hat{\pi}$	Subset Comparison	Z	P	Subset	$\hat{\pi}$	Subset Comparison	Z	P
1	1	0.5144				1	0.7061			
2	1	0.5123	1 vs. 2	1.08	0.28	1	0.7094	1 vs. 2	0.48	0.63
2	2	0.5053				2	0.7066			
3	1	0.5020	1 vs. 2	1.08	0.28	1	0.7121	1 vs. 2	-0.05	0.96
3	2	0.4970	2 vs. 3	-0.03	0.98	2	0.7123	2 vs. 3	-0.53	0.60
3	3	0.4971	1 vs. 3	-1.02	0.31	3	0.7146	1 vs. 3	0.59	0.55
4	1	0.4923	1 vs. 2	0.74	0.46	1	0.7310	1 vs. 2	0.15	0.88
4	2	0.4866	2 vs. 3	-0.06	0.95	2	0.7300	2 vs. 3	1.04	0.30
4	3	0.4870	1 vs. 3	-0.67	0.50	3	0.7231	1 vs. 3	-1.11	0.27

Table 3. Likelihood ratio chi-squared statistics (χ^2), degrees of freedom, and p-values for each effect in my model for proportion of juveniles and proportion of males in the harvest of all species combined and in the mallard harvest.

		All Species Combined			Mallards		
Response Variable	Explanatory Variable	DF	χ^2	P	DF	χ^2	P
Juveniles/AgeBag [a]	Year	6	919.59	< 0.001	6	290.79	< 0.001
	Location	7	1297.49	< 0.001	7	1491.76	< 0.001
	Location*Year	42	383.89	< 0.001	42	280.47	< 0.001
	Seasonal Harvest	1	77.54	< 0.001	1	0.81	0.37
	Maximum Response	3	10.88	0.012	3	16.04	0.001
Males/SexBag [b]	Year	6	111.10	< 0.001	6	46.27	< 0.001
	Location	7	823.16	< 0.001	7	964.99	< 0.001
	Location*Year	42	216.16	< 0.001	42	151.38	< 0.001
	Seasonal Harvest	1	87.12	< 0.001	1	60.06	< 0.001
	Maximum Response	3	6.92	0.075	3	17.72	< 0.001

[a] AgeBag = Number of ducks in the harvest with known age
[b] SexBag = Number of ducks in the harvest with known sex

3.79 ± 0.1 (SE) for hunters responding a maximum of 2 years. Hunters responding up to 3 consecutive years harvested a mean of 5.32 ± 0.09 (SE) mallards, and hunters responding a maximum 4 years harvested a mean of 4.47 ± 0.13 (SE).

Seasonal harvest had significant ($P < 0.001$) effects on proportion of juveniles in the harvest of all species combined, proportions of males in the mallard harvest, proportion of males in the harvest of all species combined (Table 3). Predicted proportion of juveniles in the harvest of all species combined decreased with increasing seasonal harvest level ($\beta = -0.002$, SE < 0.001), whereas predicted proportion of males in the harvest of all species combined increased with seasonal harvest level ($\beta = 0.002$, SE < 0.001). Similarly, predicted proportions of juveniles in the mallard harvest decreased with increasing seasonal harvest level ($\beta < -0.001$, SE < 0.001). Predicted proportions of males in the mallard harvest increased ($\beta = 0.003$, SE < 0.001) with increasing harvest level.

Although statistically significant ($P = 0.012$, Table 3), differences among maximum response categories in proportion of juveniles in the harvest of all species combined were small (Table 4). Age ratio conversions from the predicted proportions in the harvest of hunters responding a maximum of 1 and 2 years were greater than age ratios in the harvest of those responding a maximum of 3 or 4 years (Table 4). Proportion of juveniles in the mallard harvest also differed ($P < 0.001$, Table 3) among maximum response categories. Predicted mallard age ratios decreased slightly with the number of years hunters remained in the PCS (Table 4).

Maximum response did not have statistically significant effects ($P = 0.08$) on proportion of males in the harvest of all species combined, but maximum response was a significant predictor of proportion of males in the mallard harvest ($P < 0.001$, Table 3). Sex

ratios of the harvest of all species combined were greater for hunters responding a maximum of 2 or 4 times than for hunters responding only once or up to 3 times (Table 5). Although differences in predicted sex ratios among maximum response categories were again quite small (Table 5), proportion of males in the mallard harvest increased with maximum response.

Table 4. Predicted proportions of juveniles in the harvest of all species combined and in the mallard harvest with 95% confidence intervals and age ratio equivalents of predicted proportions for each maximum response level.

Species in the Harvest	Maximum Response	Predicted Proportion	95% C.I.	Predicted Age Ratio
All Species [a]	1	0.565	(0.560, 0.569)	1.297
	2	0.564	(0.558, 0.570)	1.294
	3	0.557	(0.553, 0.561)	1.259
	4	0.556	(0.549, 0.563)	1.254
Mallards [b]	1	0.514	(0.507, 0.522)	1.060
	2	0.512	(0.503, 0.522)	1.051
	3	0.502	(0.496, 0.509)	1.009
	4	0.492	(0.481, 0.504)	0.970

[a] Estimates at Seasonal Harvest = 10.46
[b] Estimates at Seasonal Harvest = 11.95

Table 5. Predicted proportions of males in the harvest of all species combined and in the mallard harvest with 95% confidence intervals and sex ratio equivalents of predicted proportions for each maximum response level.

Species in the Harvest	Maximum Response	Predicted Proportion	95% C.I.	Predicted Sex Ratio
All Species [a]	1	0.643	(0.639, 0.647)	1.799
	2	0.649	(0.643, 0.654)	1.845
	3	0.642	(0.638, 0.645)	1.792
	4	0.649	(0.642, 0.655)	1.847
Mallards [b]	1	0.705	(0.699, 0.712)	2.395
	2	0.709	(0.700, 0.717)	2.433
	3	0.711	(0.706, 0.717)	2.465
	4	0.730	(0.720, 0.740)	2.709

[a] Estimates at seasonal harvest = 10.46
[b] Estimates at seasonal harvest = 11.93

DISCUSSION

Studies of the HQS and similar mail harvest surveys in the U.S. and Canada indicated that respondents to an initial mailing reported greater seasonal harvests than respondents to a second or third mailing (Sen 1970, Sen 1971, Filion 1976, Wright 1978, Pendleton 1992). My data support the hypothesis that repeat respondents to the PCS would similarly have greater seasonal harvests than hunters who failed to respond after 1, 2, or 3 years in the survey. Hunters who remained in the survey for 3 or 4 years harvested more ducks seasonally than hunters who dropped out after 1 or 2 years. Although seasonal harvest increased with the number of years hunters responded to the survey, age and sex ratios remained relatively unaffected by seasonal harvest. The directional influence of seasonal harvest on age and sex ratios supported my predictions that hunters with greater seasonal harvests kill smaller proportions of juveniles and larger proportions of males each year. However, effect sizes are minute, which suggests that age and sex ratios generated by the PCS were largely unaffected by a sampling frame that overrepresents hunters with greater seasonal harvests.

Significance testing of the maximum response variable strongly rejected the statistical null hypothesis that repeat sampling does not affect age and sex ratio estimates of the PCS. However, actual differences of predicted proportions and their age and sex ratio equivalents among maximum response categories were extremely small. Johnson (1999) points out that in studies such as mine where large samples produce significant p-values to null hypothesis testing, statistical significance may not reflect biological or "subject-matter" significance. With a fixed α-level and a large enough sample size, one can always reject a null hypothesis, regardless of the size of the difference. Fundamental interests lie not in the significance of a

p-value from a null hypothesis test but in the size and biological meaning of the differences (Anderson et al. 2000).

It is outside the scope of this study to determine what effects the reported differences in age and sex ratios would have on AHM models or the various research functions of PCS data, but it is my opinion that statistical significance does not equal "subject-matter" significance in my study. The differences in predicted age and sex ratios among maximum response categories do not support my hypothesis that hunters who drop out of the survey after 1 or 2 years harvest a different proportion of juveniles or males than hunters who remain in the survey up to 3 or 4 consecutive years. Evidently, hunters who repeatedly respond to the survey do not differ in their ability to harvest adult ducks or propensity to selectively harvest males to such an extent as to substantially affect proportion of juveniles or adults in the harvest. Repeat sampling in the PCS, therefore, has negligible effects on age and sex ratio estimates (Table 4 and Table 5) and does not likely create biases in annual recruitment.

Because my data were not collected for the specific purpose of this study, it lacked the benefits of proper experimental design. Although my inferences are limited by the quality of my data, I believe that I was able to sufficiently assess the effects of repeat sampling in the PCS. Using existing PCS data was the most efficient way to conduct this preliminary investigation into the sampling scheme of the PCS.

CONCLUSION

My study suggests that using HQS respondents and retaining hunters for up to 4 years does not substantially impact PCS results. Therefore, efforts to limit repeat sampling to fewer years may be unnecessary. However, because age ratios serve such important functions in waterfowl population management, I recommend further research on potential biases in the survey. Age and sex ratio differences among repeat respondents in my study should be investigated further using more detailed and accurate information on harvest characteristics. I also recommend research on the effects of repeat sampling on PCS species composition estimates. A sample of hunters selected from participants in the Hunter Information Program (HIP) could provide a separate dataset from which the repeat sampling scheme could be evaluated. Data collected at hunter check stations across the U.S. could also supply information on hunter and harvest characteristics. I did not have data to test for differences in harvest characteristics between respondents and nonrespondents to the request for participation in the PCS and at each level of sampling in the PCS. I suggest that studies using follow-up techniques similar to those employed by studies of the HQS be used to investigate nonresponse bias in the PCS. Nonresponse bias in the HQS coupled with nonresponse bias and bias created by repeat sampling in the PCS may provide strong evidence for a need for a national list of waterfowl hunters from which to draw a new survey sample each year.

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VITA

Jesse G. Oetgen was born on September 12, 1977, in Champaign, Illinois. He has fond memories of fishing trips with his grandfather and camping and hiking with his family at an early age. At age 7, he moved with his family to Carrollton, Texas, where he attended private school until graduating high school in 1995.

Undecided on his career path, Jesse attended the University of North Texas from 1995-1997 as a general studies major. Desiring a career as a trained professional in a field that would suit his interests in the outdoors, Jesse enrolled in the Department of Wildlife and Fisheries at Texas A&M University in the fall of 1997. During his 3 years at Texas A&M, he was active in the student and state chapters of the Wildlife Society, excelled academically, and developed professionally through summer field positions and volunteer activities. He also became a devoted Aggie and dedicated duck hunter. Through his work as a field assistant for Delta Waterfowl Foundation, Jesse met Dr. Frank Rohwer, who later became his major professor while Jesse pursued his Master of Science degree in the School of Renewable Natural Resources at Louisiana State University.