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Management and Conservation

Spinning-Wing Decoy Use and Reported Duck Harvest in Illinois: Implications for Adaptive Harvest Management

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ABSTRACT Use of battery-powered spinning-wing decoys (SWDs) by duck hunters has generated questions as to the effect these decoys may have on duck harvests. I used data from the annual Illinois Waterfowl Hunter Survey for duck hunting seasons 1999 through 2003 to compare mallard (*Anas platyrhynchos*) and total duck harvest, reported days afield, and duck crippling rates between hunters using and not using SWDs. For the each of the 5 years reported, mean mallard harvest was greater among hunters using SWDs than among hunters not using the decoys and effect size was substantial (1999: $F = 355.01$, $P < 0.001$; 2000: $F = 567.92$, $P < 0.001$; 2001: $F = 333.25$, $P < 0.001$; 2002: $F = 321.58$, $P < 0.001$; 2003: $F = 299.00$, $P < 0.001$). Mean reported total ducks harvested was greater for decoy users than non-users, and I found effect sizes to be substantial for all years (1999: $F = 301.80$, $P < 0.001$; 2000: $F = 607.76$, $P < 0.001$; 2001: $F = 369.49$, $P < 0.001$; 2002: $F = 321.59$, $P < 0.001$; 2003: $F = 335.82$, $P < 0.001$). Decoy users reported hunting more days than non-users (1999: $F = 71.00$, $P < 0.001$; 2000: $F = 716.50$, $P < 0.001$; 2001: $F = 486.75$, $P < 0.001$; 2002: $F = 410.72$, $P < 0.001$; 2003: $F = 466.09$, $P < 0.001$). I observed substantial effect size for days hunted by decoy use for each year except for 1999–2000, for which effect size was typical. Hunters using SWDs reported greater crippled ducks than for hunters not using the decoys, with typical effect sizes observed for each year I examined (1999: $F = 168.42$, $P < 0.001$; 2000: $F = 361.34$, $P < 0.001$; 2001: $F = 163.05$, $P < 0.001$; 2002: $F = 153.29$, $P < 0.001$; 2003: $F = 169.18$, $P < 0.001$). I did not observe significant relationships between years of hunting experience and decoy use (R^2 range = 0.051–0.071). My findings support claims that SWDs lead to increased duck harvests. Recent actions by some state wildlife management agencies have resulted in a mixed approach toward regulating use of SWDs, ranging from prohibiting their use to removing all restrictions. This study seeks to provide managers with greater understanding of potential impacts of SWD use on waterfowl harvests. © 2011 The Wildlife Society.

KEY WORDS *Anas platyrynchos*, duck hunting, harvest, hunter surveys, mail surveys, mallard.

Understanding hunter effort and corresponding harvests are important for determining waterfowl population responses and hunting regulations (Sparrowe and Patterson 1987, Trost et al. 1987, Nichols and Johnson 1989). Adaptive Harvest Management (AHM) of waterfowl populations controls harvest through regulation of season length and bag limits (Johnson et al. 1993, Williams and Johnson 1995). Modeling waterfowl populations, particularly mallards (*Anas platyrynchos*), under AHM allows regulation of species harvests for optimal population responses and identifies harvest pressures on duck populations (Williams et al. 1996, Nichols 2000). One factor in the modeling process is a measure of uncertainty in harvest rates and uses probability of identified outcomes in a stochastic program to predict optimal harvest regulations (Williams and Johnson 1995, Johnson et al. 1997).

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Development of spinning-wing decoys (SWDs) has added uncertainty in determining probabilities of harvest given the use of these decoys (Eadie et al. 2000). The rotating wings of the SWD, which alternate dark and light surfaces visible from a considerable distance, are designed to simulate a landing duck. Waterfowl managers have expressed concern that use of SWDs may lead to increased harvest rates (Mississippi Flyways Council Technical Session, Feb 2000, unpublished minutes). Increased duck harvests, particularly for mallards, may affect waterfowl populations and lead to shorter seasons or smaller bag limits (Nichols et al. 1985; D. Humburg and J. Lawrence, Mississippi Flyways Council Technical Session, unpublished report).

Through a series of 154 experimental hunts in Manitoba, Caswell and Caswell (2004) reported greater likelihood of mallards flying within gun range when SWDs were in operation compared to periods when the decoys were in the off position. They also reported higher harvest (ducks harvested/hunter/hour) but lower crippling rates during operation of the decoys. Szymanski and Afton (2005) reported similar

results when SWDs were in use based on data collected from 219 experimental hunts in Minnesota during that state's 2002 hunting season. They also reported that SWDs attracted larger flocks of mallards and were more effective in attracting hatch-year and after-hatch-year mallards. They did not detect any differences in hen harvest. Although they also found increased crippling rates, they argued this observation was not biologically significant given the proportion of mallards shot using SWDs.

A meta-analysis of 545 experimental hunts in five states in the United States and one Canadian province found that 70.2% of total harvest was obtained while using of SWDs (Ackerman et al. 2006). These results validated that SWDs are effective in attracting birds and increasing actual observed harvest rates; however, reported harvest success among hunters in non-experimental situations has not been addressed. As state harvest estimates are based on reported harvests obtained from surveys of hunters, it is important to understand the potential impact of SWD use on harvests by hunters at large. I examined self-reports of harvests by hunters during five waterfowl seasons in Illinois to determine if reported harvests differed between hunters who used SWDs and those who did not.

METHODS

Data were obtained as part of the annual Illinois Waterfowl Hunter Survey (IWHS) conducted from 1999 through 2004 (Miller et al., 2000, 2001, 2002, 2003, 2004). This survey was conducted annually to determine duck (various species) and Canada goose (*Branta canadensis)* harvest in Illinois. Hunters registered with the Illinois Harvest Information Program (HIP) served as the sample frame for the IWHS. All hunters who hunted migratory birds in Illinois were required to call a toll-free number to register for HIP. Therefore, as the list of hunters registered included hunters of all migratory game birds, hunters who identified themselves as waterfowl hunters were selected from the sample frame. Samples for each year's survey followed the same procedure; approximately 5,000 waterfowl hunters were randomly selected from the subpopulation of waterfowl hunters who registered for HIP. Each year, the selected waterfowl hunters were mailed a self-administered, mail-back questionnaire in February following the close of the Illinois waterfowl season, followed 10 days later by a postcard reminder to non-respondents. After 10 days, non-respondents to the first mailing were mailed a second questionnaire, followed 10 days later by a second postcard reminder. I used reported harvest over a 5-year period to provide greater reliability and decrease potential effects of bias that may be present in data for a single year. Most common sources of bias encountered in self-reported harvests from hunters are recall bias and digit preference (i.e., reporting numbers ending in 0 or 1; Miller and Anderson 2002, Beaman et al. 2005, Vaske and Beaman 2006). As data collection procedures were uniform across the 5 years, and digit preference did not differ between the two hunter groups, I assumed these sources of bias did not influence results. I evaluated if mallard harvest, total duck harvest, and crippling rates reported by hunters using SWDs differed from those not using the decoys. Such differences, if present, would provide managers with information in addition to experimental hunts to make informed decisions regulating use of SWDs.

Hunters were asked to report their season harvest of mallards, wood ducks (*Aix sponsa*), and other species [e.g., gadwall (*Anas strepera*), green-winged and blue-winged teal (*Anas discors* and *Anas crecca*), and northern shoveler (*A. clypeada*)] under the category of "other ducks." The category "total ducks" included wood ducks and other ducks such as gadwall, teal, and northern shoveler (and included mallards). Harvest questionnaire items were open-ended and required hunters to provide county hunted, number of days, and duck species harvested. Ducks harvested for all hunters were totaled for mallards and combined species for each year. Use of SWDs was determined by responses to the question "Did you use a SWD while duck hunting in (year)?" with a binomial "Yes"/"No" response.

Hunters who hunted ducks $\geq$1 days during the season were stratified into SWD users or non-users based on their response. Reported mallard and total duck harvest, ducks crippled, days hunted, and duck harvest/hunter/day were dependent variables for one-way analysis of variance (ANOVA) models that tested differences between hunters using SWDs and those not using the decoys during a 5-year survey period. Potential group size effect was examined using eta (η; Cohen 1992, Vaske 2008), which measures associations between categorical independent (SWD use) and continuous dependent variables (harvest, days hunted). Eta (η) measured the magnitude of the relationship being tested (effect size); effect size 0.1–0.242 were considered minimal, 0.243–0.30 typical, and $\geq$0.31 substantial.

I also addressed a related question regarding SWDs use and harvest success by more experienced hunters. I conducted a Pearson's bivariate correlation analysis to test significance of SWDs use and duck harvests by years of waterfowl hunting experience (used as a surrogate measure of hunting experience) for each of the 5 years of this study.

RESULTS

Percent responses to the mail surveys were 59% (n = 3,160, SE = 1.28) during 1999, 49% (n = 1,857, SE = 1.35) for 2000, 71% (n = 3,017, SE = 1.29) for 2001, 66% (n = 3,150, SE = 1.28) for 2002, and 68% (n = 2,646, SE = 1.37) for the 2003 survey (Table 1). Use of SWDs

Table 1. Mean days hunted by spinning-wing duck decoys (SWD) use among Illinois hunters 1999–2004.

	SWD days hunted	Non-SWD days hunted		
Year	$\bar{x}$	$\bar{x}$	F	η[a]
1999–2000	21.5	15.5	71.00	0.167
2000–2001	15.6	5.2	716.50[b]	0.422
2001–2002	15.9	5.7	486.75[b]	0.373
2002–2003	14.1	5.7	410.72[b]	0.343
2003–2004	15.7	5.4	466.09[b]	0.397

[a] Effect size (magnitude of significance).
[b] One-way analysis of variance (ANOVA) significant at $P < 0.001$.

Table 2. Mean duck harvest and crippling by spinning-wing duck decoys (SWD) use among Illinois hunters 1999–2004.

	SWD			Non-SWD				
		95% CI			95% CI			
Year	$\bar{x}$	Lower	Upper	$\bar{x}$	Lower	Upper	F	η^a
Mallard harvest								
1999–2000	22.1	19.8	24.4	7.1	6.6	7.6	355.01[c]	0.318
2000–2001	15.7	14.7	16.7	3.0	2.6	3.4	567.92[c]	0.383
2001–2002	13.2	12.4	14.0	2.3	1.9	2.7	333.25[c]	0.316
2002–2003	9.3	8.6	9.9	2.7	2.3	3.0	321.58[c]	0.308
2003–2004	13.1	12.2	14.1	3.0	2.5	3.5	299.00[c]	0.327
Total duck harvest[b]								
1999–2000	35.0	32.2	38.7	13.6	13.0	14.7	301.80[c]	0.295
2000–2001	27.8	26.2	29.4	6.1	5.3	6.9	607.76[c]	0.394
2001–2002	22.8	21.5	24.1	4.4	3.8	5.1	369.49[c]	0.331
2002–2003	16.2	15.2	17.2	4.9	4.3	5.6	321.59[c]	0.308
2003–2004	22.1	15.0	16.5	5.4	4.8	5.9	335.82[c]	0.345
Duck crippling[b]								
1999–2000	1.9	2.3	3.0	1.2	1.1	1.4	168.42[c]	0.277
2000–2001	2.0	1.8	2.1	0.4	0.3	0.4	361.34[c]	0.314
2001–2002	1.9	1.7	2.1	0.4	0.3	0.4	163.05[c]	0.227
2002–2003	1.4	1.3	1.5	0.4	0.3	0.5	153.29[c]	0.218
2003–2004	1.7	1.6	1.9	0.5	0.3	0.6	169.18[c]	0.252

[a] Effect size (magnitude of significance).
[b] Harvest/Crippling R^2 by year and use of SWDs (Yes/No): 1999–2000: 0.384/0.564; 2000–2001: 0.600/0.474; 2001–2002: 0.519/0.560; 2002–2003: 0.587/0.439; 2003–2004: 0.560/0.527.
[c] One-way analysis of variance (ANOVA) significant at $P < 0.001$.

among respondents was 15.3% during 1999, 61.2% for 2000, 76.0% for 2001, 68.4% for 2002, and 67.0% for 2003.

Number of years a hunter had previously hunted waterfowl was not related to use of SWDs (R^2 ranged from 0.051 to 0.071) or duck harvest (R^2 ranged from 0.133 to 0.179). Hunters using SWDs hunted more days than those who did not across all years in the study (Table 1). Effect sizes for the ANOVA statistics were substantial for all years except 1999, for which effect size was minimal. Mean days hunted with SWDs was lowest during the 1999–2000 season, increasing threefold during later seasons. Hunters who used SWDs reported greater mean mallard harvest than non-users throughout the study, and effect sizes for these comparisons showed substantial relationships between the two groups (Table 2). Means for total duck harvest between both decoy users and non-users were greatest during the first season studied and declined during following years. Hunters who used SWDs reported greater mean number of crippled ducks than non-users, and effect size comparisons suggest a typical relationship for each year. Number of ducks crippled, by use of decoys, was positively correlated with harvest for each year. Mean duck harvest per hunter per day was greater among SWD users for each year of the study; ANOVA results suggest effect sizes typical for 2000–2001 and 2001–2002 harvest comparisons and substantial for other years (Table 3). Number of ducks reported as being crippled per hunter per day between decoy users and non-users differed across each year of the study. Hunters using SWDs reported greater proportions of ducks crippled per day of hunting than those not using SWDs; however, effect sizes were minimal.

DISCUSSION

Technical advancements manifested as new products marketed to hunters prove a challenge to wildlife management agencies. Often such products are designed to increase hunters' odds of success and given the rapidity with which products are introduced on the market, it is difficult for wildlife agencies to keep abreast of the popularity, effectiveness, and impact of new equipment on wildlife harvests. SWDs are no exception. In the years following their market introduction, many hunters perceived them to be an effective advantage in harvesting ducks (Szymanski and Afton 2008). Illinois hunters are an example of this point, and the popularity of the decoys is evident in the increase in decoy use from 15%

Table 3. Mean duck harvest/hunter/day and duck cripples/hunter/day by spinning-wing duck decoys (SWD) use among Illinois hunters 1999–2004.

	SWD	Non-SWD		
Year	$\bar{x}$	$\bar{x}$	F	η^a
Duck harvest/hunter/day				
1999–2000	1.89	1.07	223.58[b]	0.324
2000–2001	1.78	1.17	175.51[b]	0.266
2001–2002	1.23	0.72	167.67[b]	0.266
2002–2003	1.05	0.78	127.74[b]	0.319
2003–2004	1.41	1.00	113.09[b]	0.228
Duck cripples/hunter/day				
1999–2000	0.13	0.15	7.61[b]	0.121
2000–2001	0.13	0.07	107.00[b]	0.198
2001–2002	0.28	0.06	41.57[b]	0.126
2002–2003	0.22	0.07	21.61[b]	0.040
2003–2004	0.21	0.08	24.07[b]	0.086

[a] Effect size (magnitude of significance).
[b] One-way analysis of variance (ANOVA) significant at $P < 0.001$.

during the 1999 season to 61% the following year. Anecdotal evidence suggests this increase may be due to word-of-mouth claims of the decoy's effectiveness, although data testing this assumption are not available.

Illinois hunters who used SWDs reported an increased mallard harvest compared to those who did not. Total ducks harvested reported by Illinois hunters using SWDs approximated the same harvest trends as that in the experimental hunts conducted by Caswell and Caswell (2004), Szymanski and Afton (2005), and Ackerman et al. (2006), wherein hunters using SWDs reported greater total duck harvests. Although harvests among Illinois hunters are not reported in the experimental fashion as in the experimental hunts, my research confirms the relationship between decoy use and harvest noted in the experimental hunts. Total duck harvest also followed the same trend and harvest among SWD users was greater than non-users.

Given the cost of SWDs (ranging between $50 and $250 in 2011 dollars US), burden of transport, and perhaps perceived ethics related to their use, some hunters determined total costs associated with their use is greater than benefits realized (Miller et al. 2003). Increased use of these decoys, however, suggests otherwise. Increased use may be due to competition: hunters not wanting to be "left out" (being the only hunter in the marsh without one). Further research is needed to determine perceived benefits realized by using SWDs and identify factors that determine whether or not hunters choose to use the decoys. Investigating hunter motivations for decoy use will provide managers better understanding of the potential importance hunters may attribute to these decoys, an understanding that will be important if state agencies move to regulate their use.

One argument advanced to support use of SWDs is lower duck crippling, as birds are lured into range by the decoys. My results do not support this claim. Crippling rates reported by Illinois hunters using SWDs were comparable to those reported by Szymanski and Afton (2005). This greater proportion of crippling may be due to more birds and larger flocks attracted to the decoys, but coupled with hunters inaccurately judging distance and taking longer or more shots at ducks. Data on number of shots taken were not available for this study; crippled ducks may be a factor of shots taken, as there is a strong positive relationship between cripples and harvest for both groups of hunters. My findings suggest a higher rate of crippling among decoy users, as ratios of crippled ducks per hunter per day was two to four times higher among decoy users compared to non-users for the last 3 years of this study. More research is needed to determine if the higher crippling rate with decoy use noted in this study is a factor of decoy use.

Years of waterfowl hunting was not related to use of SWDs. Years of waterfowl hunting was considered as a possible contributing factor because of the accumulated knowledge assumed to play a role in becoming a successful duck hunter; proper calling techniques, decoy placement, and dog training all contribute to successful duck hunting and take time to master. It was assumed that using SWDs would be more popular among hunters with less years of experience as such decoys would provide a short-cut to learning these techniques; however, this relationship was not apparent among Illinois hunters in my samples. Days spent duck hunting did differ significantly between the two hunter groups across each of the 5 years, suggesting a difference between commitment toward, and possibly motivations for, hunting ducks. Further research is needed to investigate possible relationships between commitment to waterfowl hunting and use of SWDs, and to perceptions of ethics (e.g., fair chase) regarding SWD use. Moreover, a need exists to examine decoy use by motivation typology.

I only examined differences in reported annual mallard and total duck harvests between hunters reporting using SWDs and those who reported they did not use them. This study did not examine harvest during actual use of the decoy, nor percent of total harvest resulting from SWD use (assuming hunters did not use SWDs 100% of time hunting). Discussions regarding regulating SWDs have been on-going among waterfowl managers through the United States. Further studies are needed to monitor continued trends in use of SWDs by duck hunters, and real and perceived effectiveness of SWDs in respect to duck harvests.

MANAGEMENT IMPLICATIONS

When first introduced, SWDs were a new hunting technology not covered under many state hunting regulatory frameworks, and therefore their use was not regulated. Most states currently do not regulate use of SWDs, and 1 (Arkansas) rescinded regulations governing their use. Managers are faced with the difficult task of regulatory oversight of such innovations. Waterfowl harvests are closely monitored and reported harvests are factored into population estimates, which are then used to determine season length and bag limits under the AHM framework. If unknown and unregulated activities such as use of SWDs have a significant impact on harvest, managers must be aware of the extent and contributions of this activity and use this information in developing regulations directed at protecting and conserving wildlife populations.

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