

**COLORADO DIVISION OF WILDLIFE - AVIAN RESEARCH PROGRAM**  
**Progress Report**  
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**TITLE: Evaluating relationships between hunting regulations, habitat conditions, and duck hunting quality on State Wildlife Areas in northeastern Colorado**

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**ABSTRACT**

The lower South Platte River corridor has historically supported the highest numbers of wintering ducks and highest hunter numbers and duck harvest of any region in Colorado. There is concern that harvest pressure has led to reduced numbers of wintering ducks and low harvest success, particularly on State Wildlife Areas (SWAs), which could in turn lead to lower hunter satisfaction and declining hunter recruitment and retention. The goal of this study is to determine the extent to which a set of more restrictive hunting regulations influence duck hunter success, hunter activity, hunter satisfaction, and duck distribution, compared to a set of less restrictive hunting regulations, on selected state wildlife areas (SWAs) along the South Platte River (SPR) corridor. We will also examine how the influence of regulations on these responses varies among SWAs with differing habitat conditions. The 2008-2009 regular duck season was the first field season of the project. We selected 3 pairs of SWAs representing different habitat conditions along the SPR corridor, and assigned 1 SWA in each pair a set of restrictive hunting regulations (hunting access permitted only on weekends, Wednesdays, and legal holidays; reservations required for a limited number of parties; and the property is closed to the public after 2 p.m.), with no restrictive regulations on the other SWA in each pair. We established check stations at each of the SWAs and required all waterfowl and small game hunters to check out during the regular duck season. We interviewed all hunters and recorded information on their hunting experience and methods, harvest success, and satisfaction. We also conducted monthly aerial counts of waterfowl along the SPR corridor, and weekly ground counts on the study SWAs. During the 2008-2009 duck season, we obtained information from 1450 hunting parties on study SWAs, of which 1184 were duck hunting parties. Activity varied from a high of 624 duck hunting parties and 1146 duck hunter-days at Jean K. Tool/Brush SWAs (unrestricted) to a low of 18 duck hunting parties and 42 duck hunter-days at Overland Trail SWA (restricted). Season-long harvest success, measured as ducks bagged per hunter per party per day, was lowest on 3 on-channel study areas (Atwood [unrestricted], Overland Trail, and Jean K. Tool/Brush) at 0.3, was 0.6 on Bravo SWA (restricted), and was highest at Red Lion SWA (unrestricted, 1.2) and Jackson Lake SWA (restricted, 1.4). Hunting parties' satisfaction with hunter crowding levels, habitat conditions, property-specific regulations, and their overall hunt experience averaged slightly satisfied or satisfied on all study SWAs; hunters tended to be dissatisfied with duck numbers on on-channel properties and satisfied with duck numbers on off-channel properties. Numbers of migrating/wintering ducks in the SPR were relatively low in 2008-2009, and weekly counts at study SWAs were variable but generally low. This study is expected to continue for 3-5 years, with a cross-over of regulation assignments to study SWAs occurring in 2010 or 2011.

**EVALUATING RELATIONSHIPS BETWEEN HUNTING REGULATIONS, HABITAT  
CONDITIONS, AND DUCK HUNTING QUALITY ON STATE WILDLIFE AREAS IN  
NORTHEASTERN COLORADO**

**Annual Progress Report, July 1, 2008 – January 31, 2009**

**Jon Runge and Jim Gammonley**

**PROJECT OBJECTIVES**

The goal of this study is to determine the extent to which a set of more restrictive hunting regulations influence duck hunter success, hunter activity, hunter satisfaction, and duck distribution, compared to a set of less restrictive hunting regulations, on selected state wildlife areas (SWAs) along the South Platte River (SPR) corridor. We will also examine how the influence of regulations on these responses varies among SWAs with differing habitat conditions. Specific objectives include:

1. Compare duck hunter success (ducks bagged per hunter) on selected SWAs with different hunting regulations and habitat conditions.

Hypothesis 1: Average hunter success will be higher on properties with more restrictive hunting regulations than on properties with similar habitat conditions where hunting regulations are less restrictive.

Hypothesis 2: Average hunter success will be lower on properties with more restrictive hunting regulations than on properties with similar habitat conditions where hunting regulations are less restrictive.

Hypothesis 3: Differences between the two types of areas will be statistically indistinguishable.

2. Compare hunter activity (hunter use-days, party size, hunting methods, number of hours per day when hunters are present on the property) on selected SWAs with different hunting regulations and habitat conditions.

Hypothesis 1: Properties with more restrictive hunting regulations will have less intensive use than properties with similar habitat conditions where hunting regulations are less restrictive.

Hypothesis 2: Differences between the two types of areas will be statistically indistinguishable.

3. Compare self-reported indices of waterfowl hunter satisfaction on selected SWAs with different hunting regulations and habitat conditions.

Hypothesis 1: Average indices of hunter satisfaction will be significantly higher on properties with more restrictive hunting regulations than on properties with similar habitat conditions where hunting regulations are less restrictive.

Hypothesis 2: Average indices of hunter satisfaction will be lower on properties with more restrictive hunting regulations than on properties with similar habitat conditions where hunting regulations are less restrictive.

Hypothesis 3: Differences between the two types of areas will be statistically indistinguishable.

4. Compare duck numbers/density on and adjacent to SWAs with different hunting regulations and habitat conditions.

Hypothesis 1: Numbers/density of ducks will be significantly higher on and adjacent to properties with more restrictive hunting regulations than on and adjacent to properties with less restrictive hunting regulations.

Hypothesis 2: Differences between the two types of areas will be statistically indistinguishable.

5. Correlate overall duck numbers, climate data (temperature, precipitation), and indices of habitat conditions (river flows, percent of area flooded, percent of area frozen) with results from objectives 1-4.

Prediction: These measures will explain a high proportion of the variation observed over space and time in the response variables for Objectives 1-4.

6. Based on results from objectives 1-5, develop recommendations for future duck hunting management of SWAs along the South Platte River corridor.

Because the purpose of restrictive regulations is to reduce disturbance to waterfowl on SWAs, it will also be necessary to restrict activities of other small game hunters. Although not the focus of this study, we will also measure the harvest, activity, and satisfaction of small game hunters on SWAs along the SPR.

### **SEGMENT OBJECTIVES**

1. Collect information on hunting activities, harvest, and satisfaction levels from all waterfowl and small game hunting parties on 7 SWAs along the SPR corridor during the 2008-2009 regular duck hunting season.
2. Conduct periodic aerial surveys of waterfowl numbers and distribution along the SPR corridor throughout the 2008-2009 regular duck hunting season, and conduct ground counts of waterfowl numbers on 7 SWAs along the SPR corridor.

### **INTRODUCTION**

About 50% of Colorado's annual statewide duck harvest occurs in 5 counties (Logan, Morgan, Sedgwick, Washington, and Weld) along the lower South Platte River (SPR) corridor in northeastern Colorado (U.S. Fish and Wildlife Service, unpublished harvest survey results). Over 60% of Colorado duck hunters hunt in this area, and a majority of these hunters hunt exclusively or regularly on public lands (Colorado Division of Wildlife 2006). There are 26 State Wildlife Areas (SWAs) located in the SPR corridor from Greeley to the state line, and duck hunting is a major activity and management emphasis on many of these areas. The Colorado Division of Wildlife (CDOW) historically has managed to provide a range of duck hunting opportunities on SWAs along the SPR corridor. Some properties have no restrictions on hunting beyond the statewide regulations, and the management emphasis is on maximizing hunting opportunity. On other properties, the CDOW has attempted to address issues of hunting quality in part through property-specific restrictions in hunting regulations. Property-specific restrictions include requiring reservations for access, day closures (portions of the week when no hunting is allowed), and assigned areas. Use of hunting restrictions has been largely on an ad hoc, property-specific basis. No rigorous evaluation has been conducted on the effectiveness of restrictive hunting regulations on duck distribution or on hunter success, activity, or satisfaction.

Since the 1980s the annual midwinter index of ducks counted in the SPR corridor has averaged less than half the number counted during the 1970s. Although the possibility exists that detection probability decreased over those years, it is unlikely that it decreased by 50%; thus winter abundance of ducks in the SPR has likely declined. Although overall duck harvest during 1999-2006 has been comparable to historic levels, in recent years there have been increasing concerns about the quality of duck hunting along the SPR corridor, particularly on SWAs. There is a desire to increase wintering populations of ducks, increase harvest success (i.e., average number of ducks bagged per hunter trip), and recruit and retain more duck hunters. It has been suggested that disturbance from excessive hunting

activity along the SPR corridor has led to decreased use of this area by ducks, poor harvest success, overcrowding and interference among hunters on public areas, and unsatisfactory experiences for duck hunters. This concern is supported by the results of a 2005 national duck hunter survey (National Flyway Council and Wildlife Management Institute 2006), in which 66% of Colorado duck hunters surveyed ( $n = 488$ ) reported they believed hunting pressure had become worse compared to 5 years prior to the survey, 65% of hunters believed crowding was worse at hunting areas, 53% reported more interference from other hunters, and 50% believed ducks were more concentrated on fewer areas. Dissatisfaction with duck hunting could in turn result in declining duck hunter recruitment and retention. Concerns over the quality of duck hunting along the SPR have led to proposals to increase hunting restrictions in this area.

Recent monitoring of duck hunter activity and harvest on South Platte SWAs indicates that patterns of public use and duck harvests are variable among SWAs and on individual SWAs among years. Voluntary reporting data suggest that average duck harvest/hunter trip was similar between public areas with restrictive hunting regulations and areas without restrictive regulations in 2004-2005 and 2005-2006, but higher in unrestricted areas in 2006-2007. Patterns of hunter use and harvest success may vary among properties in relation to the property size and the habitat types present on the property (e.g., shallow marsh impoundments, river channel, warm-water sloughs). Harvest success, particularly on properties adjacent to the river channel, was weather-dependent: harvest success increased during colder, wetter duck seasons, and within a duck season harvest success was higher when temperatures were colder. Ducks use large reservoirs that act as refuge areas within the SPR corridor, and ducks often move to feeding areas after dark. Duck use of the river is limited until low temperatures cause reservoirs to freeze and the river provides the only available open water.

It is generally acknowledged that disturbance from hunting activity can influence the distribution of ducks at a variety of spatial scales (Baldassarre and Bolen 1994). Ducks quickly find refuge areas when hunting seasons begin, and alter their spatial and temporal activity patterns to avoid hunted areas (Cox and Afton 1998a, Fleskes 2002), although refuge size and habitat conditions may influence their use and value to waterfowl (Rave and Cordes 1993, Cox and Afton 1998b, Rave 1999, Cox and Afton 1999). Numerous studies have documented anthropogenic disturbance to waterfowl (Dahlgren and Korschgen 1992, Madsen 1995, Madsen and Fox 1995, Fox and Madsen 1997, Madsen 1998a, 1998b; Evans and Day 2001, 2002; Pease and Butler 2005). Most studies that examine hunting impacts compare bird use, usually measured by counts, on sanctuary or refuge areas (i.e., no hunting or other disturbance) to hunted areas, rather than comparing different levels or types of hunting disturbance. On a Danish wetland where hunting was permitted only once every 1-3 weeks, Bregnballe and Madsen (2004) determined the proportion of waterfowl occupying the wetland just prior to hunts that returned within 1-2 days after hunts, and found that response to hunting disturbance was variable among species and within species in relation to habitat conditions. Using a similar approach, Bregnballe et al. (2004) concluded that restricting hunting to the afternoon did not adequately reduce disturbance to maintain bird numbers and diversity. In addition, most studies focus exclusively on bird responses, but do not document changes in hunter activity, success, or satisfaction in relation to creation of refuges. Madsen (1998b) noted that following creation of refuge areas on 2 Danish wetlands, hunter numbers declined on hunted portions of one area, and numbers did not decline but were redistributed on the other wetland; hunter success was not reported. Hockin et al. (1992) and Hill et al. (1997) reviewed literature on studies investigating disturbance to birds from human activity and reported that most results were anecdotal, with only a small minority of studies having some sort of experimental design that compared control and treatment areas. They recommended increased use of manipulative studies to more rigorously assess impacts of disturbance or the effectiveness of controls on disturbance.

Relationships between federal frameworks for hunting (e.g., Flyway-specific season lengths and bag limits) and resulting duck harvests have been investigated at national and regional scales (Martin and Carney 1977), but few studies have been conducted to examine the influence of local-scale hunting regulations on hunter success or satisfaction. Hunting parties were assigned 1 of 3 alternative bag limit regulations (a 2-bird limit, Flyway-specific regulations, or point system) and their performance and satisfaction were measured on a state game area during one season in Michigan (Mikula et al. 1972).

However, this study did not examine impacts of regulations other than bag limit restrictions, and variation across years or among areas was not investigated. During 1963-1970, the CDOW, in cooperation with the U.S. Fish and Wildlife Service, conducted intensive studies examining how local duck populations and duck hunters responded to various experimental duck hunting regulations in the San Luis Valley (Hopper et al. 1975). However, this study did not directly compare results to more restrictive regulatory approaches, and did not examine harvest success or hunter satisfaction in relation to hunting regulations at a more local scale.

Given the interest in reducing duck hunting pressure in the SPR corridor, there is a need to evaluate how more restrictive hunting regulations impact duck numbers and distribution, and hunter success and satisfaction, at local and regional scales. Here we detail results from the first year of a management experiment in SWAs along the SPR corridor that examines this issue.

### STUDY AREA AND METHODS

This study is being conducted in the SPR corridor between Greeley and the state line (Fig. 1). An intensive evaluation of hunting restrictions is being conducted on 7 SWAs.

On 7 non-randomly selected SWAs (see table below), we are using a quasi-experimental cross-over design to examine the influence of hunting restrictions on selected response variables. Properties were selected to represent the range of wetland habitat types on SWAs along the SPR, including areas off the river channel with shallow, seasonally-flooded wetland impoundments near large reservoirs; small properties on the river channel that have little other wetland habitat; and larger properties on the river channel that have more diverse wetland habitats. For each pair of properties with these habitat conditions, each member of the pair was assigned a different set of hunting regulations. On “Unrestricted” properties, no additional hunting restrictions are applied for waterfowl and small game hunting beyond the regulations that apply throughout eastern Colorado. A set of additional regulations are applied to “Restricted” properties, intended to limit hunting disturbance while still providing some hunting opportunity. These regulations include: (1) reservations are required for hunting access (a limited number of parties on the property, with no more than 4 hunters per party); (2) all parties must leave the property by 2 p.m.; (3) hunting is allowed only on Saturdays, Sundays, Wednesdays, and legal holidays; and (4) hunting parties are assigned to specific areas on the property. These restrictions apply to waterfowl and small game hunting during the regular duck hunting season, but not to deer and spring turkey hunting.

Restricted (R) and Unrestricted (U) regulations will be applied to the selected properties for up to 6 years as described in the table below. A cross-over design will be used to account for site-specific influences on response variables of each pair of properties. After the first 2 years, if there are large differences in hunter success between the R and U properties in each habitat type, the cross-over would be implemented for another 2 years, and the evaluation may be completed in 4 years.

		Hunting Season Regulations (R = Restricted, U = Unrestricted)					
Type	State Wildlife Area	2008	2009	2010	2011	2012	2013
Off river channel	Jackson Lake	R	R	R	U	U	U
	Red Lion	U	U	U	R	R	R
On-channel small property	Overland Trail	R	R	R	U	U	U
	Atwood	U	U	U	R	R	R
On-channel large property	Bravo	R	R	R	U	U	U
	Jean K. Tool & Brush	U	U	U	R	R	R

Check stations were established at these 7 SWAs, and access to these areas was from designated parking areas only. During the regular duck hunting season, all waterfowl and small game hunters were

required to check out at the check station before leaving the property. A check station attendant recorded information on the hunters, their harvest, hunting methods, and measures of satisfaction (Appendix A). Voluntary hunter check-out cards requesting the same information were also provided in case a check station attendant was not present when hunters checked out.

During the third week of November, ice buildup was noted on the ponds at Jackson and Red Lion SWAs, and ground counts in these areas suggested that bird use greatly declined. For comparative purposes, data from before November 20 and on or after November 20 are summarized separately for these 2 SWAs. After December 5, check station attendants were no longer assigned to these properties, and we relied on hunters filling out voluntary check-out cards.

While conducting quality control on the data, we noted that some hunters were deliberately giving inaccurate numbers regarding the number of years they had hunted in the SPR corridor, e.g., on one day they would say they had hunted the corridor for 1 year, then the next day claim they had hunted the SPR corridor for 5 years. Information from these hunters that was not verifiable by the technicians was excluded from the analysis.

Aerial surveys of the SPR corridor from Greeley to the state line were conducted monthly during the regular duck hunting season (October 3, November 19, December 10, and January 5) to provide an index to overall waterfowl numbers and distribution in the region. Observers recorded numbers and locations of ducks and geese on the river and associated sloughs, as well as ponds and reservoirs in the SPR corridor. Weekly ground counts were conducted on the 7 study SWAs to provide an index to waterfowl use of these properties during the regular duck hunting season. An observer was stationed at a point on each SWA where a large portion of the river channel or wetland impoundments on the property could be viewed and recorded all waterfowl that were present, leaving, and arriving 40 minutes before and 20 minutes after sunset. Counts were conducted this time to determine whether ducks were coming to study SWAs to roost or feed in the evening.

## **RESULTS AND DISCUSSION**

During the 2008-2009 waterfowl hunting season, we obtained harvest and satisfaction measures from 1450 hunting parties. Of these, 1184 (82%) were duck hunting parties. We interviewed 1055 duck hunting parties, and 129 additional duck hunting parties left checkout cards at unmanned check stations. Jean K. Tool and Brush SWAs had the highest use, with 624 duck hunting parties and 1146 duck hunter-days, and Overland Trail SWA had the lowest use, with 18 duck hunting parties and 42 duck hunter-days (Table 1). Note that these numbers are uncorrected for hunting parties that did not report.

Overall, 32% of duck hunters at the 7 study SWAs were in their first year of hunting the lower SPR corridor, 11% had hunted the area for 2 years, 10% for 3 years, 6% for 4 years, and 41% for 5 years or more. Most (97%) duck hunters surveyed were male, and 3% were female. Most (90%) of duck hunters surveyed hunted mainly public lands, 3% hunted mainly private lands, and 7% said they hunted both equally. The average duck hunting party was about 2 people on all areas (Table 1). A total of 1571 individual hunters comprised the 1184 duck hunting parties. Across all 7 SWAs, 69% of hunting parties used standard decoys (using an average of 14 decoys), and 35% of hunting parties used spinning wing decoys; use of decoys was higher on off-channel SWAs with impounded wetlands (Red Lion and Jackson Lake) than on SWAs along the river channel (Table 1). Dogs were used by 36% of duck hunting parties, and 77% of hunting parties reported using duck calls.

A total of 1112 ducks was harvested on the 7 study SWAs. Season-long harvest success was measured as ducks bagged per hunter per party per day over the 2008-2009 regular duck season. Three of the on-channel study areas (Atwood, Overland Trail, and Jean K. Tool/Brush) had a low average harvest success of 0.3. Harvest success on Bravo SWA was twice as high at 0.6. Prior to complete freezing of small impoundments (November 20), hunters at Red Lion and Jackson Lake SWAs had the highest harvest success, with Jackson Lake SWA slightly higher than Red Lion SWA (1.4 v. 1.2) (Table 1). After November 20, harvest success on Red Lion and Jackson Lake SWAs declined to an average of 0.1 ducks per hunter per day at both areas (Table 1). When broken down into frequency distributions of ducks shot

per hunter per day (measured at the party level), the on-channel properties had the largest proportion of 0 ducks bagged and very small proportions of >3 ducks bagged (Figures 2 and 3). Distributions of ducks shot per hunter per day were more evenly distributed on the off-channel properties, with 30-40% of parties shooting 0 ducks, and proportionally more experiencing success than on the on-channel properties (Figure 4). Taken as an average across all areas, daily bag per hunter exhibited peaks associated with weekends in the first hunting season, the first weekend of the second hunting season, and weather events in late November and December (Figure 5). Other game harvested and recorded as part of the study included 74 Canada geese, 3 light geese, 19 mergansers, 31 coots, 18 pheasants, 57 quail, 7 doves, 33 squirrels, and 20 rabbits. Two parties specifically targeted coyotes, but none were harvested.

Hunter satisfaction with the level of crowding from other hunters was consistently higher at restricted areas, although mean satisfaction with crowding measures were high at all areas, ranging from an average of 4.0 (out of 5) at Red Lion SWA to an average of 5.0 at Overland Trail SWA (Table 2). When matched pairs of restricted vs. unrestricted SWAs with similar habitat conditions were considered (i.e., Bravo vs. Jean K. Tool/Brush, Overland Trail vs. Atwood, Jackson Lake vs. Red Lion) satisfaction with bird numbers was generally higher at restricted areas with the exception of Overland Trail and Atwood SWAs, which were equal. Satisfaction with bird numbers was highest at the off-channel SWAs of Red Lion and Jackson Lake (4.0 and 4.6, respectively) and lowest at the small on-channel SWAs Atwood and Overland Trail (both 2.3) (Table 2). Satisfaction with habitat conditions was consistently higher at SWAs without hunting restrictions. Satisfaction with property-specific hunting regulations followed a similar pattern with the exception of Jackson Lake SWA, which had an equal average satisfaction level to Red Lion (3.9) (Table 2). Overall satisfaction levels were generally higher at SWAs without restrictions, again with the exception of Jackson Lake SWA, which had the highest average overall satisfaction level (3.9).

We estimated correlation coefficients between satisfaction measures of crowding, hunting regulations, overall satisfaction, and average ducks shot per hunter per day. Correlation coefficients provide a rough estimate of the effect these factors have upon one another. A correlation coefficient of 1.0 suggests a perfect positive correlation between two factors, and -1.0 suggests a perfect negative correlation between two factors. A correlation coefficient of 0.0 suggest no correlation whatsoever between two factors. Generally, the highest correlation coefficients were between average ducks shot per hunter per day and overall satisfaction (range of 0.21-0.45, Table 3). Satisfaction with hunting regulations and overall satisfaction were also moderately correlated (range: 0.14 – 0.47, Table 3). Crowding issues did not appear to exhibit high degrees of correlation with overall satisfaction (range: 0.06 – 0.23, Table 3).

Ground counts of ducks were highly variable, ranging from 0 ducks counted at many SWAs to 551 counted at Red Lion just prior to the beginning of hunting season (Figures 6a and 6b). Generally, the off-channel properties of Red Lion and Jackson Lake SWA had higher abundances early in the year, tapering off to counts of 0 ducks by late November. Counts at these areas were discontinued in late November when ice covered 100% of all ponds. Bravo SWA had the highest counts of the on-channel properties with counts of 82 and 84. Like the other properties though, counts were extremely variable. On-channel properties did experience lower counts on average in October, with high counts coming in November – January.

Counts of ducks during aerial surveys of the South Platte corridor increased from 7801 in October to 22802 in November, peaked at 25469 in December, and declined to 20642 in January (Figure 7). During the October and November counts, >90% of ducks observed were on large reservoirs and other wetlands along the SPR corridor, but >50% of ducks observed were on the SPR and associated sloughs during the December and January counts. The January (mid-winter) count was substantially below counts in recent years, suggesting that relatively few ducks wintered along the SPR corridor during the 2008-2009 duck hunting season.

This study is expected to continue for 3-5 more years; the cross-over of assignments of regulations to study SWAs will occur in 2010 or 2011. Data collection will resume in October 2009. Before then we will estimate the degree of hunter compliance with the requirement to report to check

stations on the 7 study SWAs. Hunters at the northeast Brush SWA parking lot and at some of the Red Lion SWA parking lots seemed to have a much lower degree of compliance than other areas. Once the degree of non-compliance in these areas is calculated, we may need to discuss methods for improvement. Aside from these compliance issues, most hunters seemed willing to participate in the survey. Both dissension and support for the study were noted, and a future progress report will contain an appendix with comments from the hunters.

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Table 1. Statistics associated with duck hunting parties on selected State Wildlife Areas (SWAs) along the South Platte River corridor. Percent statistics are the percent of parties that used decoys, spinning wing decoys, dogs, or duck calls.

SWA	Total parties	Total hunter days	Avg. number in party	Avg. total duck harvest	Avg. ducks /hunter /day	Avg. number decoys (%)	% spinning wing decoys	% dogs	% duck calls
<b><u>Interviews</u></b>									
Atwood (U)	90	162	1.8	0.4	0.3	19 (72)	27	40	79
Overland Trail (R)	17	39	2.3	0.6	0.3	14 (76)	41	53	82
Jean K Tool /Brush (U)	573	1045	1.8	0.5	0.3	11 (65)	35	37	79
Bravo (R)	89	163	1.8	0.9	0.6	11 (68)	26	23	68
Red Lion (U)	120	256	2.1	2.8	1.2	22 (85)	58	34	73
Jackson Lake (R)	97	216	2.2	3.1	1.4	23 (92)	52	42	94
<b><u>Cards</u></b>									
Atwood (U)	2	2	1.0	0.0	0.0	0 (0)	0	0	50
Overland Trail (R)	1	3	3.0	1.0	0.3	12 (73)	100	100	100
Jean K Tool /Brush (U)	51	101	2.0	0.4	0.2	10 (44)	16	40	64
Bravo (R)	12	23	1.9	1.3	0.9	14 (73)	45	18	64
Red Lion (U)	5	8	1.6	0.8	0.6	5 (20)	20	60	60
Jackson Lake (R)	0	0	-	-	-	-	-	-	-
<b><u>Total: Interviews &amp; Cards</u></b>									
Atwood (U)	92	164	1.8	0.4	0.3	18 (71)	26	39	78
Overland Trail (R)	18	42	2.3	0.7	0.3	14 (78)	44	56	83
Jean K Tool /Brush (U)	624	1146	1.8	0.5	0.3	11 (64)	33	37	78
Bravo (R)	101	186	1.8	1.0	0.7	11 (69)	28	22	68
Red Lion (U)	125	264	2.1	2.7	1.2	21 (82)	57	35	73
Jackson Lake (R)	97	216	2.2	3.1	1.4	23 (92)	52	42	94
<b><u>After ice-up</u></b>									
Red Lion (U)	76	149	2.0	0.2	0.1	15 (40)	15	46	46
Jackson Lake (R)	50	120	2.4	0.2	0.1	24 (86)	41	16	92

Table 2. Average satisfaction measures of duck hunting parties on selected State Wildlife Areas (SWAs) along the South Platte River corridor. Scale is 1 through 5, with 1 being the least favorable and 5 being the most favorable. SWAs are designated as Restricted (R) or Unrestricted (U) based on property-specific

SWA	Total parties	Crowding	Bird numbers	Habitat conditions	Hunting regulations	Overall
<b><u>Interviews</u></b>						
Atwood (U)	90	4.8	2.3	4.0	4.0	3.6
Overland Trail (R)	17	5.0	2.3	3.4	3.5	3.5
Jean K Tool /Brush (U)	573	4.5	2.3	4.1	4.1	3.5
Bravo (R)	89	4.7	2.5	3.4	3.3	3.2
Red Lion (U)	120	3.9	3.1	4.3	3.9	3.5
Jackson Lake (R)	97	4.6	3.6	4.1	3.9	3.9
<b><u>Cards</u></b>						
Atwood (U)	2	5.0	4.0	5.0	5.0	4.5
Overland Trail (R)	1	5.0	1.0	4.0	4.0	2.0
Jean K Tool /Brush (U)	51	4.1	2.0	4.0	3.9	3.1
Bravo (R)	12	4.3	2.5	3.2	3.5	3.0
Red Lion (U)	5	4.8	2.8	5.0	4.4	3.2
Jackson Lake (R)	0					
<b><u>Total: Interviews &amp; Cards</u></b>						
Atwood (U)	92	4.8	2.3	4.0	4.0	3.6
Overland Trail (R)	18	5.0	2.2	3.4	3.6	3.4
Jean K Tool /Brush (U)	624	4.5	2.3	4.1	4.1	3.5
Bravo (R)	101	4.7	2.5	3.4	3.3	3.2
Red Lion (U)	125	4.0	3.1	4.3	3.9	3.5
Jackson Lake (R)	97	4.6	3.6	4.1	3.9	3.9
<b><u>After ice-up</u></b>						
Red Lion (U)	76	4.1	2.4	4.0	3.6	3.2
Jackson Lake (R)	50	4.6	2.5	4.2	4.4	3.3

Table 3. Correlation coefficients between some of the factors measured from duck hunting parties at selected State Wildlife Areas (SWAs) along the South Platte River corridor during the 2008-2009 regular duck season.

SWA	Factor	Crowding	Hunting regulations	Avg. ducks /hunter /day
Atwood (U)	Hunting regulations	0.05		
	Avg. ducks /hunter /day	-0.08	-0.17	
	Overall	0.13	0.14	0.24
Overland Trail (R)	Hunting regulations	*		
	Avg. ducks /hunter /day	*	-0.18	
	Overall	*	0.14	0.15
Jean K Tool /Brush (U)	Hunting regulations	0.16		
	Avg. ducks /hunter /day	0.05	0.04	
	Overall	0.23	0.37	0.21
Bravo (R)	Hunting regulations	-0.06		
	Avg. ducks /hunter /day	0.10	-0.09	
	Overall	0.06	0.14	0.34
Red Lion (U)	Hunting regulations	0.03		
	Avg. ducks /hunter /day	-0.12	0.02	
	Overall	0.12	0.25	0.41
Jackson Lake (R)	Hunting regulations	0.14		
	Avg. ducks /hunter /day	-0.08	0.27	
	Overall	0.09	0.47	0.45

\*all parties interviewed at Overland Trail SWA rated crowding a 5 (i.e., no crowding issues), therefore obtaining correlation measures for this factor is not possible.

Figure 1. South Platte River corridor from Greeley to the state line, showing State Wildlife Areas included in the study.

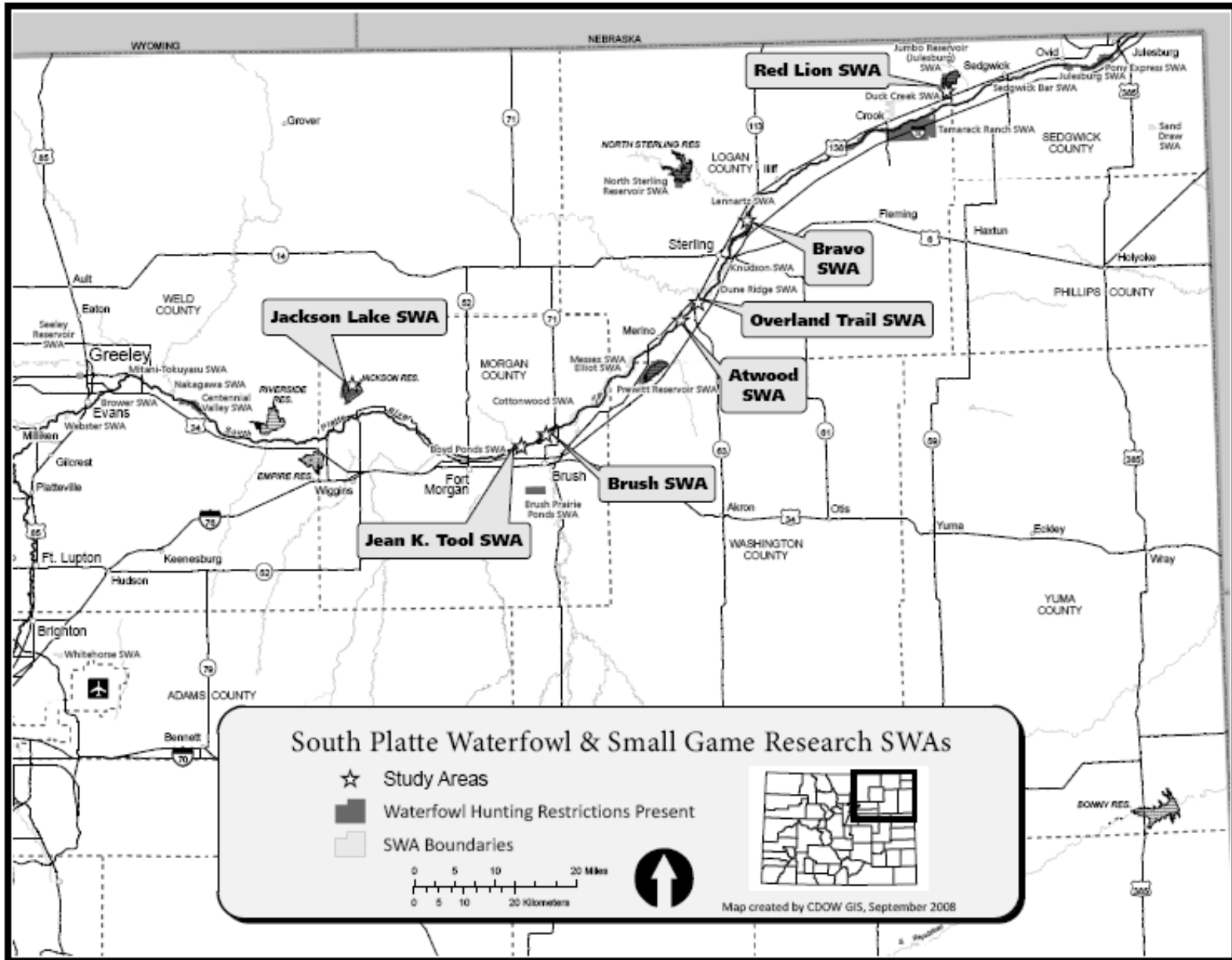


Figure 2. Distribution of ducks shot per hunter per day for parties hunting Atwood (Unrestricted) and Overland Trail (Restricted) SWAs during the 2008-2009 regular duck season.

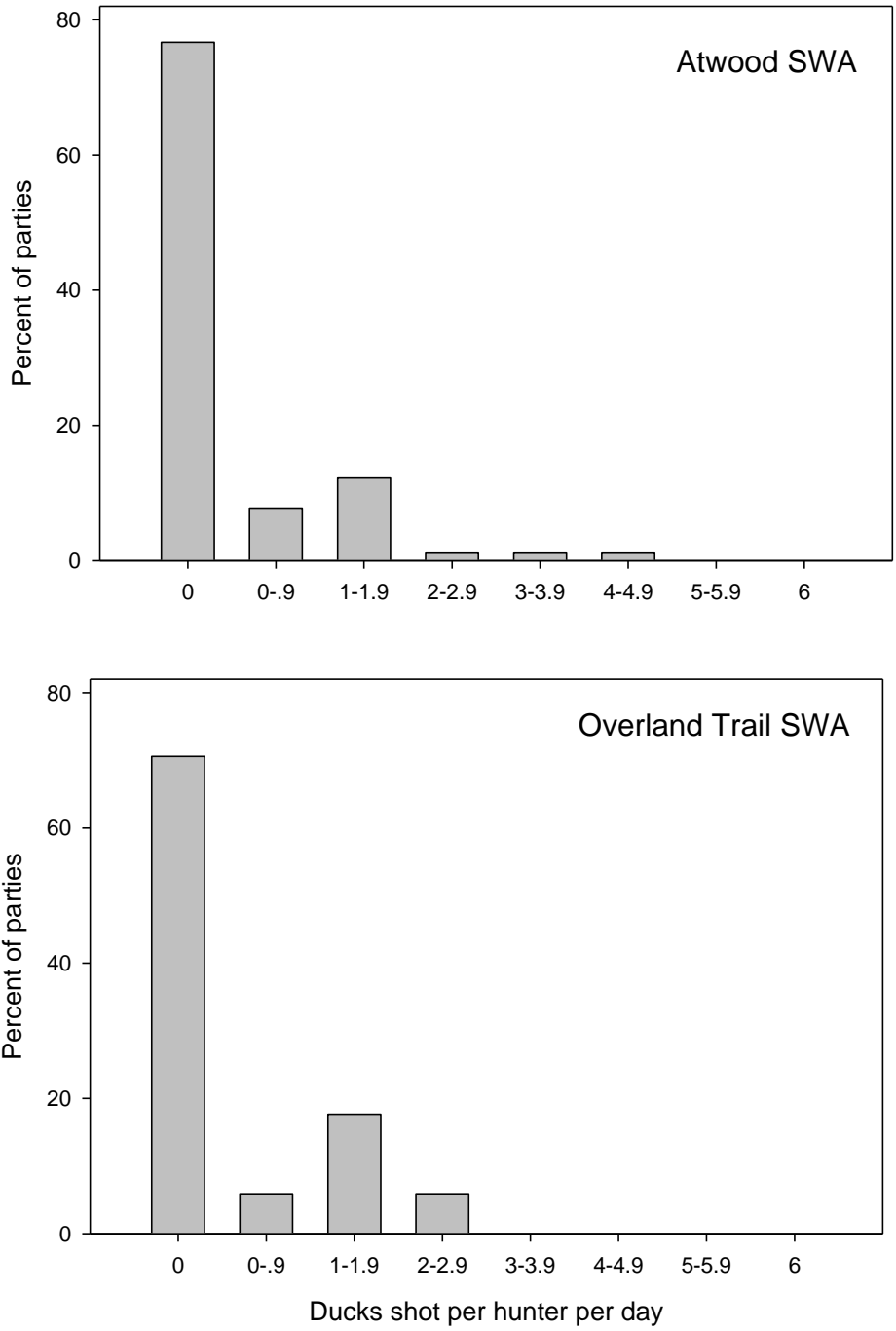


Figure 3. Distribution of ducks shot per hunter per day for parties hunting Jean K. Tool/Brush (Unrestricted) and Bravo (Restricted) SWAs during the 2008-2009 regular duck season.

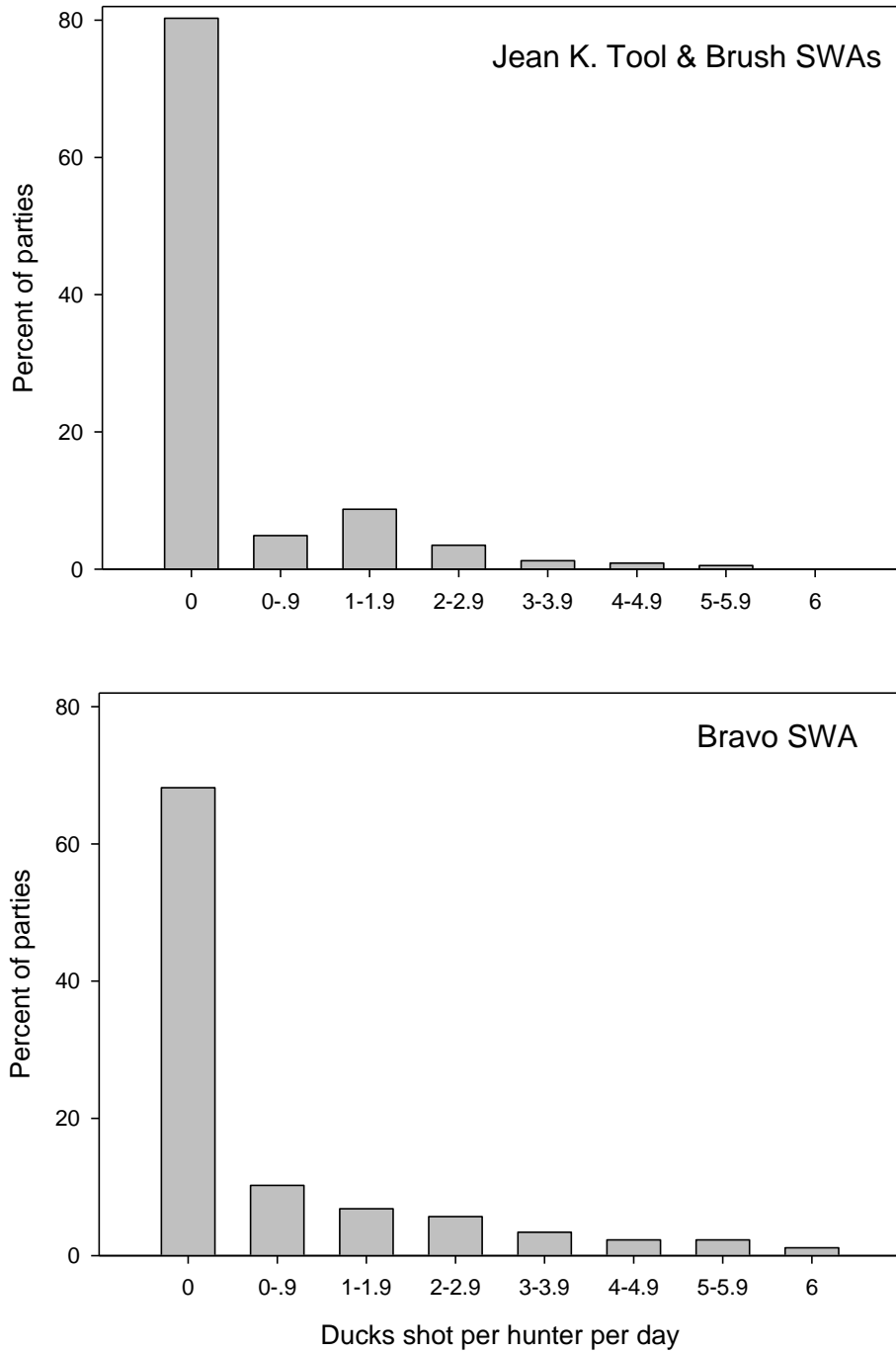


Figure 4. Distribution of ducks shot per hunter per day for parties hunting Red Lion (Unrestricted) and Jackson Lake (Restricted) SWAs during the 2008-2009 regular duck season.

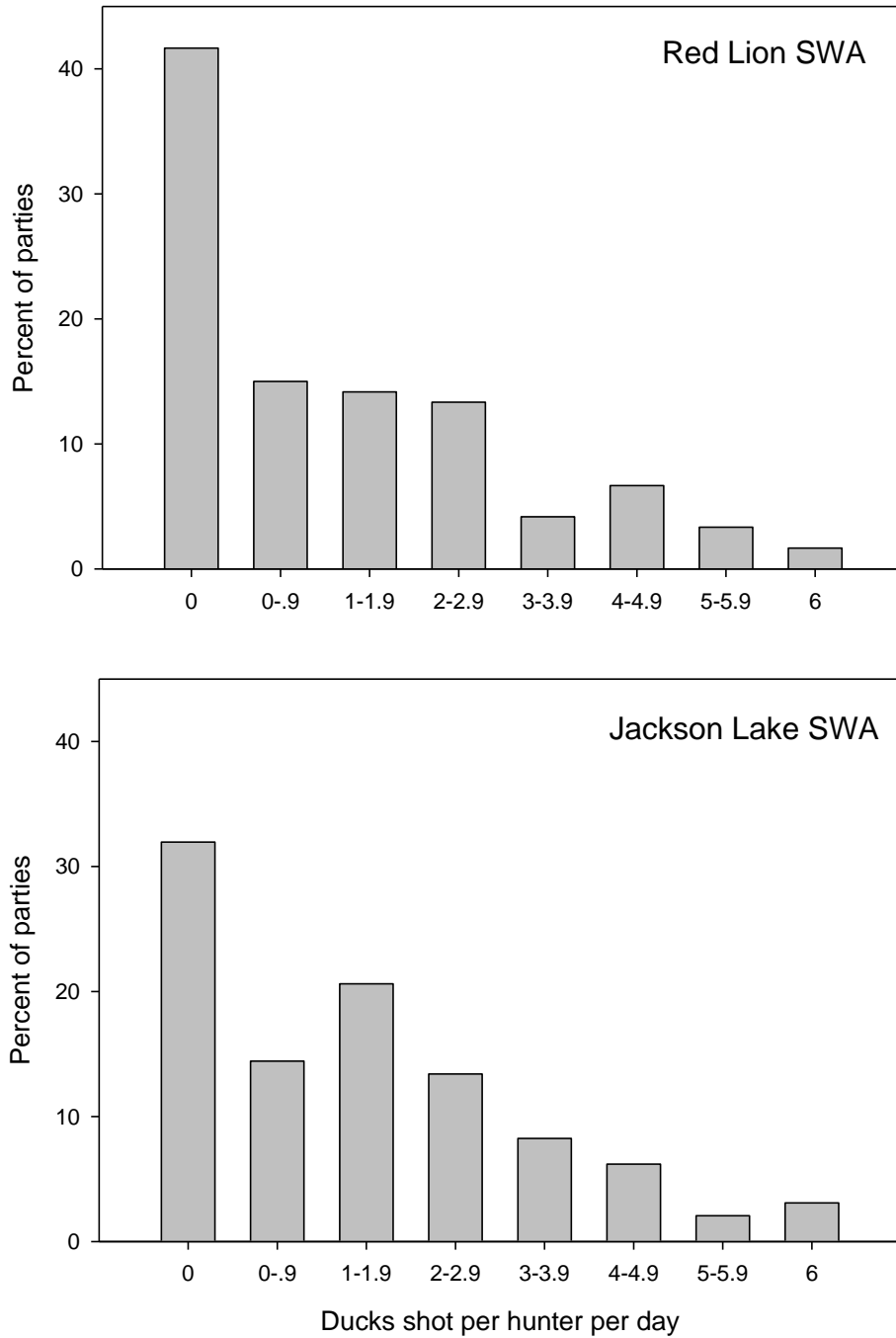


Figure 5. Chronology of duck hunting success on 7 SWAs along the South Platte River corridor during the 2008-2009 regular duck season.

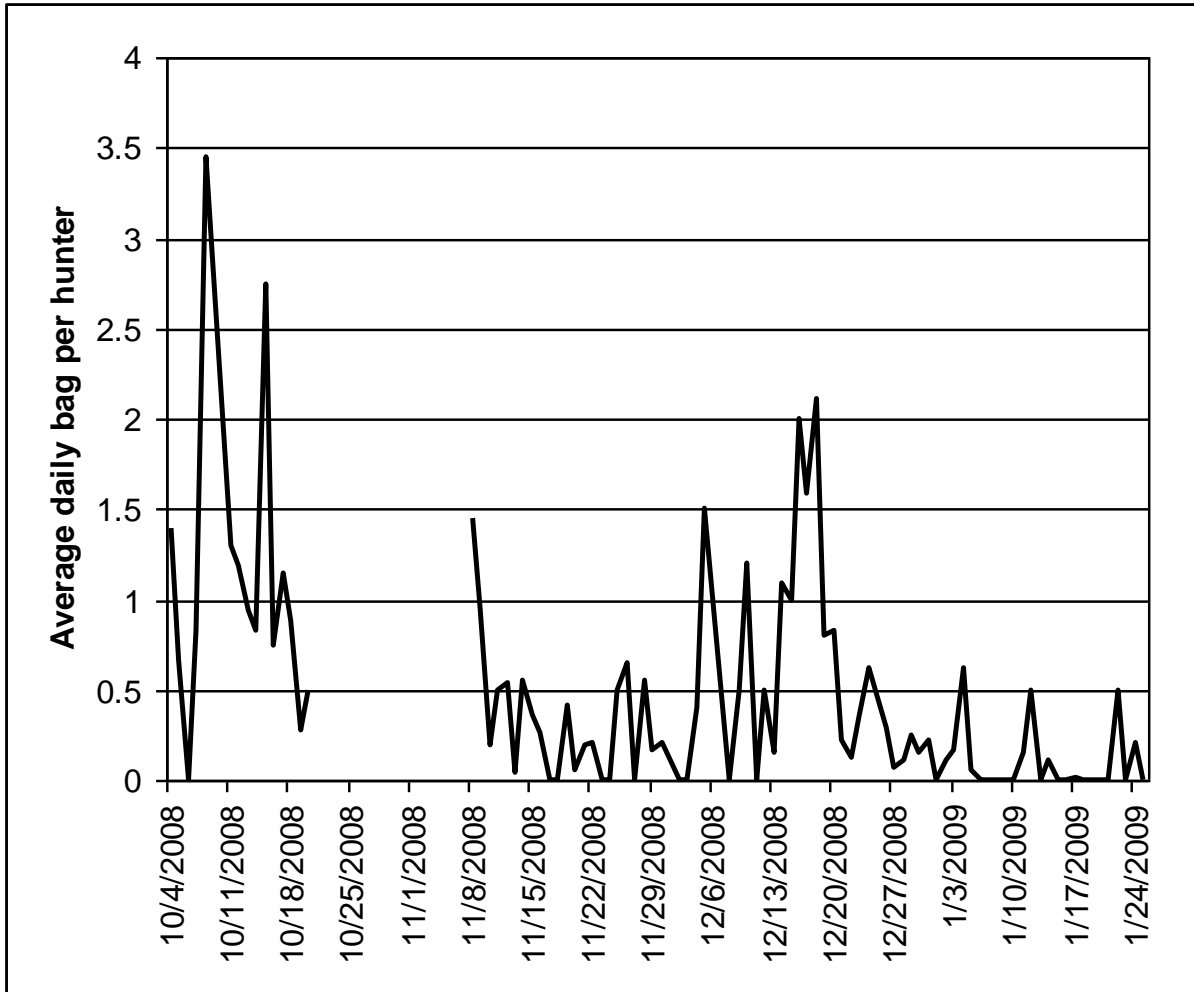
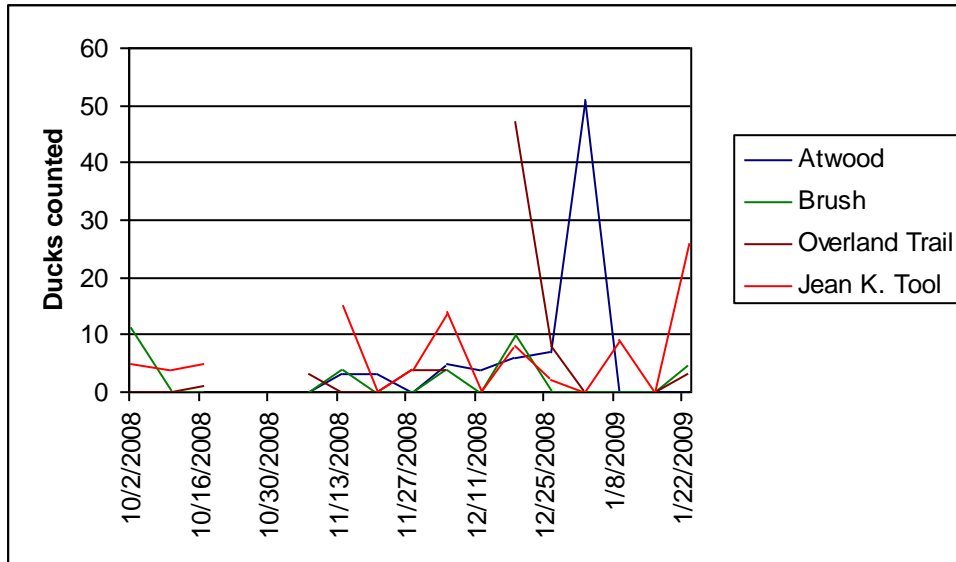


Figure 6. Ground counts of ducks on (a.) Atwood, Brush, Jean K. Tool, and Overland Trail SWAs and (b.) Bravo, Jackson Lake, and Red Lion SWAs during the 2008-2009 regular duck season.

a.



b.

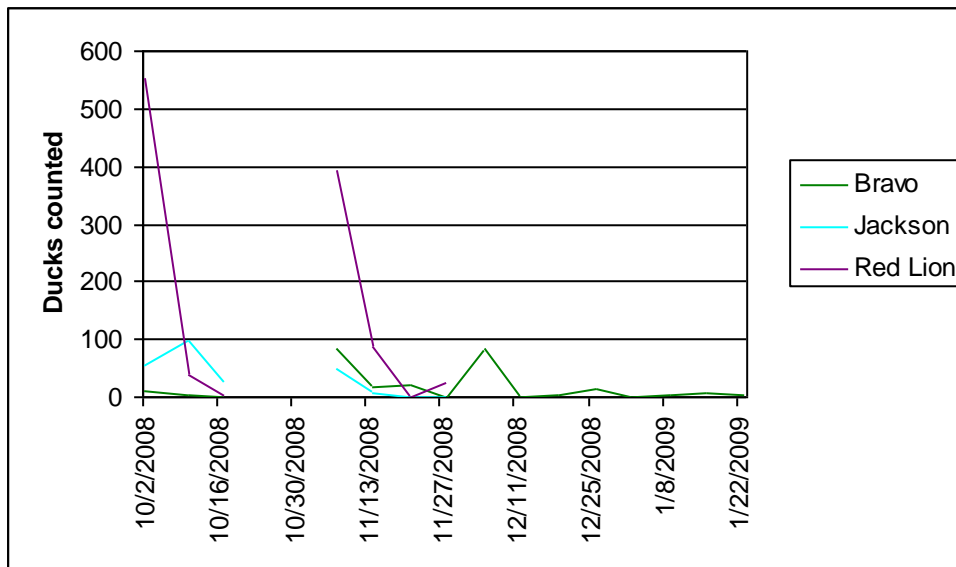
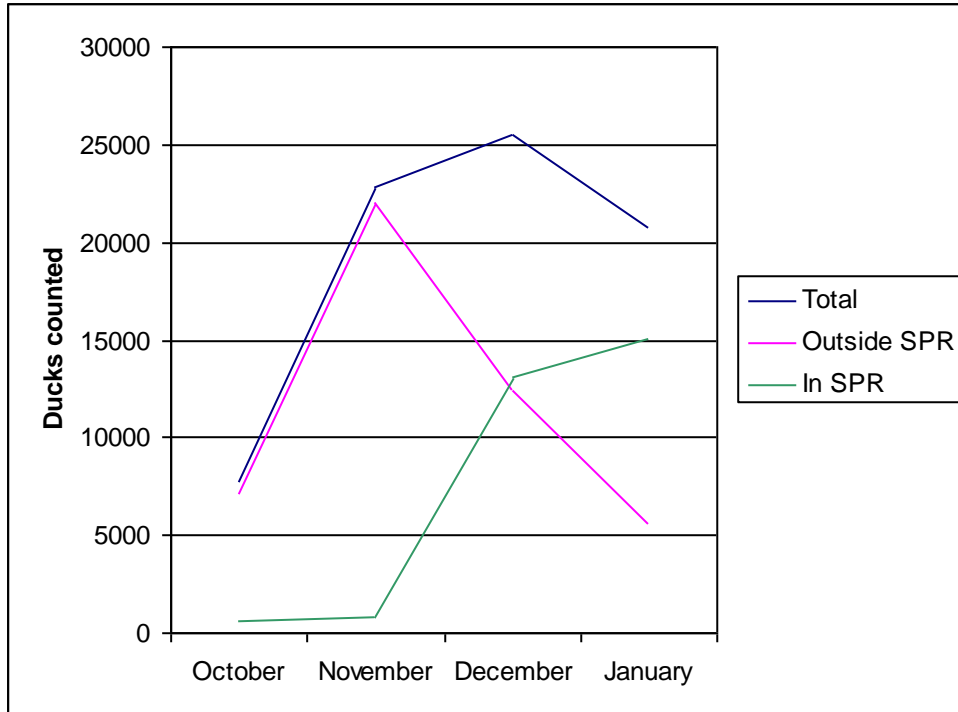


Figure 7. Aerial counts of ducks in the South Platte River corridor (SPR) from October 2008 through January 2009.



Appendix A. Information collected from waterfowl and small game hunters on selected State Wildlife Areas along the South Platte River during the 2008-2009 regular duck hunting season.

**South Platte River Corridor State Wildlife Area Hunting Study**

State Wildlife Area \_\_\_\_\_ Date \_\_\_\_\_ Initials \_\_\_\_\_

Number in hunting party \_\_\_\_ Party arrival time \_\_\_\_\_ Party departure time \_\_\_\_\_

License plates \_\_\_\_\_

CID number	Sex	Years out of last 5 hunted on SPR?	Mostly public	Mostly private	Equal

Harvest:

	Male	Female	Unknown	Notes
Mallard				
Blue-winged/Cinnamon teal				
American wigeon				
Gadwall				
Northern shoveler				
Northern pintail				
Wood duck				
Pheasant				
Bobwhite quail				

Decoys (# dozen)? \_\_\_\_\_ Spinning-wing decoys (#)? \_\_\_\_\_ Dogs (#)? \_\_\_\_\_ Calls (Y/N)? \_\_\_\_\_

Rank the following from 1 to 5 for today's hunt:

Crowding problems (1 = extreme crowding problems, 5 = no crowding problems) \_\_\_\_\_

Bird numbers seen (1 = no birds seen, 5 = abundant numbers of birds seen) \_\_\_\_\_

Habitat conditions on the area (1 = very poor, 3 = average, 5 = excellent conditions) \_\_\_\_\_

Hunting regulations on the SWA (1 = very dissatisfied, 3 = neutral, 5 = very satisfied) \_\_\_\_\_

Overall satisfaction with the hunt (1 = very dissatisfied, 3 = neutral, 5 = very satisfied) \_\_\_\_\_

Notes: