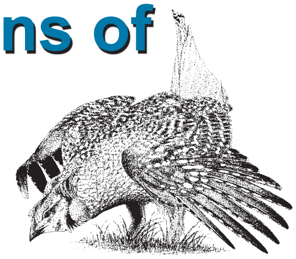
STATE OF WASHINGTON Progress Report December 2013

Re-establishment of Viable Populations of Columbian Sharp-tailed Grouse in Washington: Progress Report



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FISH AND WILDLIFE
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ABSTRACT

Declining populations and distribution of Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*) in Washington have resulted in serious concerns for their long-term conservation status. The overall population was estimated to be 886 in 2013, associated with 39 leks. Translocations of sharp-tailed grouse from 'healthy' populations outside the state are being conducted to improve the genetic and demographic health of populations within Washington. The Washington Department of Fish and Wildlife, in cooperation with the Colville Confederated Tribes, translocated 368 Columbian sharp-tailed grouse from central British Columbia, southeastern Idaho, and north-central Utah to Washington State in spring 2005–2013. The release sites in Washington included Dyer Hill (south of Brewster in Douglas County), Swanson Lakes (south of Creston in Lincoln County), Greenaway Springs (southeast of Okanogan), and Nespelem (east of Nespelem in Okanogan County). Two of the release sites included state-owned public land and the other sites are Colville Tribal land; all are being managed for the benefit of wildlife, and in particular sharp-tailed grouse. In all release sites, sharp-tailed grouse declined through the year 2005, despite the acquisition and protection of habitat and ongoing habitat restoration efforts. Efforts to monitor movement, survival, and productivity of the translocated birds are ongoing. Although it is too early in the process to determine whether the augmentations should be considered a success, the results to date have been promising.

ACKNOWLEDGEMENTS

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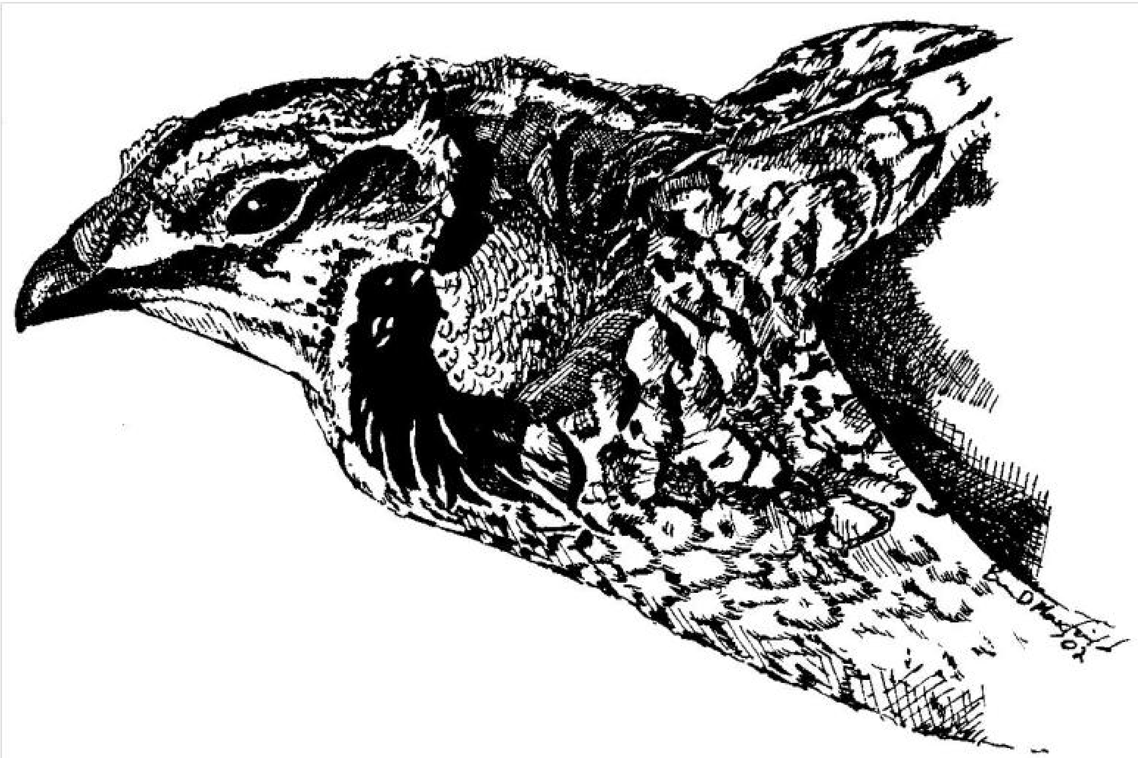
On the cover: Cover photo of Douglas County and top inset photo by Michael Schroeder; bottom inset photo by Chris Sato; cover and back cover illustration by Darrell Pruett; title page illustration by Brian Maxfield.

RE-ESTABLISHMENT OF VIABLE POPULATIONS OF COLUMBIAN SHARP-TAILED GROUSE IN WASHINGTON: PROGRESS REPORT



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BACKGROUND

Columbian sharp-tailed grouse were historically found in many of the shrub-grass habitats of central and southeastern Washington (Yocom 1952, Aldrich 1963). Surveys have indicated that sharp-tailed grouse are virtually extinct everywhere except Okanogan, Douglas, and Lincoln counties (Fig. 1) (Hays et al. 1998, Schroeder et al. 2000). Remaining populations are small and localized within isolated areas of relatively intact shrubsteppe as well as Conservation Reserve Program (CRP) fields (Table 1). The total population in Washington was estimated to be about 886 birds in 2013 (Fig. 2). The population is associated with 39 active lek sites; 87 lek sites documented since 1954 are now inactive.

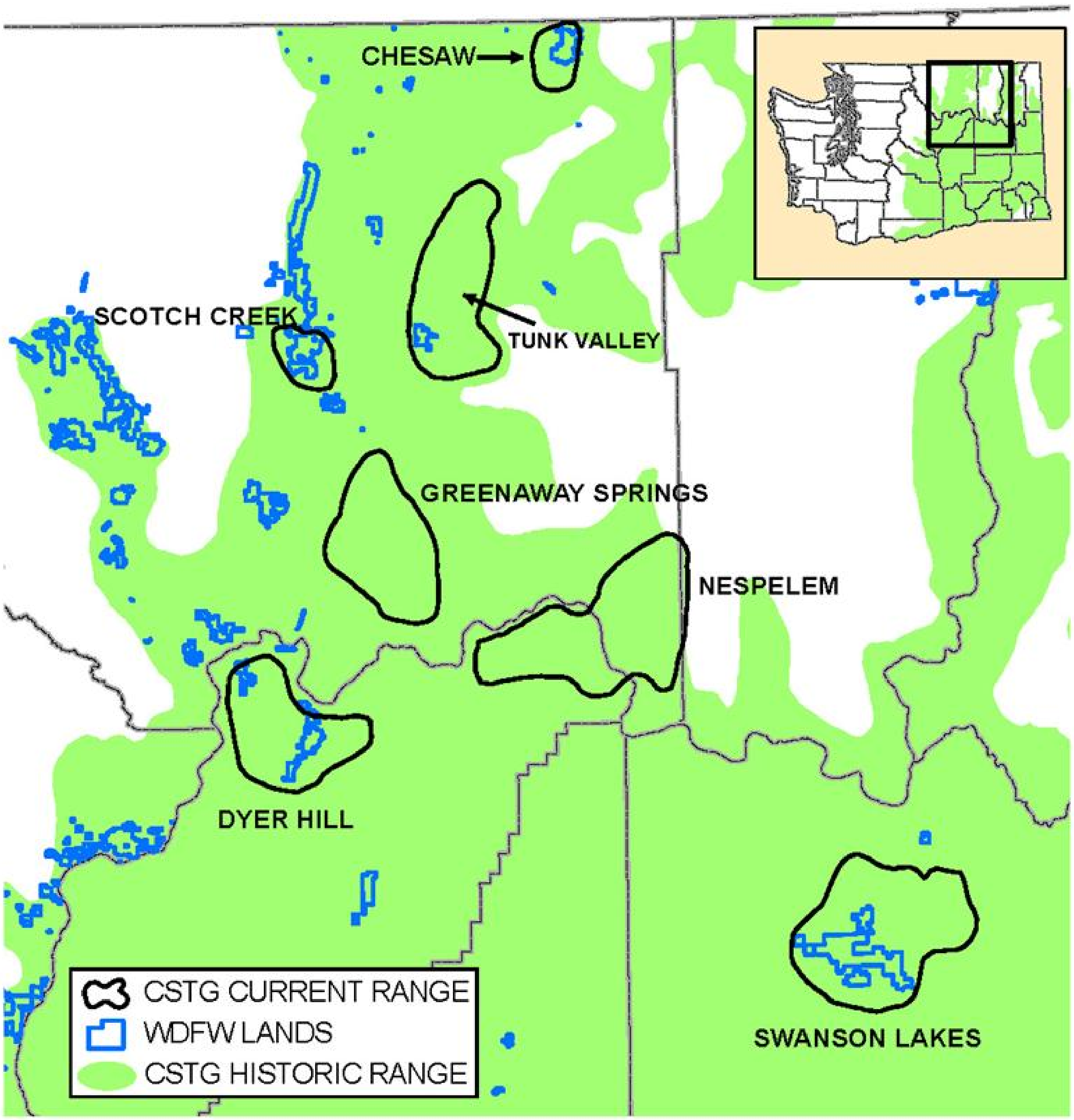

Fig. 1. Estimated historic and current range of sharp-tailed grouse in north-central Washington (modified from Schroeder et al. 2000).

Table 1. Distribution of habitats (1993 Thematic Mapper) in Washington in relation to sharp-tailed grouse populations (adapted from Schroeder et al. 2000).

Range or population	Proportion of area (%)					Total area (km^2)
	Shrubsteppe[a]	Cropland	CRP	Forest-shrub	Other	
Total population	67.2	11.6	5.2	14.5	1.5	2,173
Tunk Valley	69.6	1.5	1.2	27.5	0.2	342
Greenaway Springs	78.7	3.6	2.1	14.5	1.2	340
Chesaw	46.0	0.0	3.9	49.9	0.2	70
Scotch Creek	69.3	4.7	0.9	23.7	1.4	79
Dyer Hill	42.0	44.5	12.0	0.7	0.8	308
Nespelem	65.7	5.1	6.9	19.6	2.7	513
Swanson Lakes	77.0	13.0	5.6	2.4	2.0	521
Unoccupied range	36.5	37.9	4.4	17.7	3.4	77,692
Total historical range	37.3	37.3	4.4	17.6	3.4	79,865

[a]Shrubsteppe includes shrubsteppe, meadow-steppe, and steppe habitats described by Daubenmire (1970).

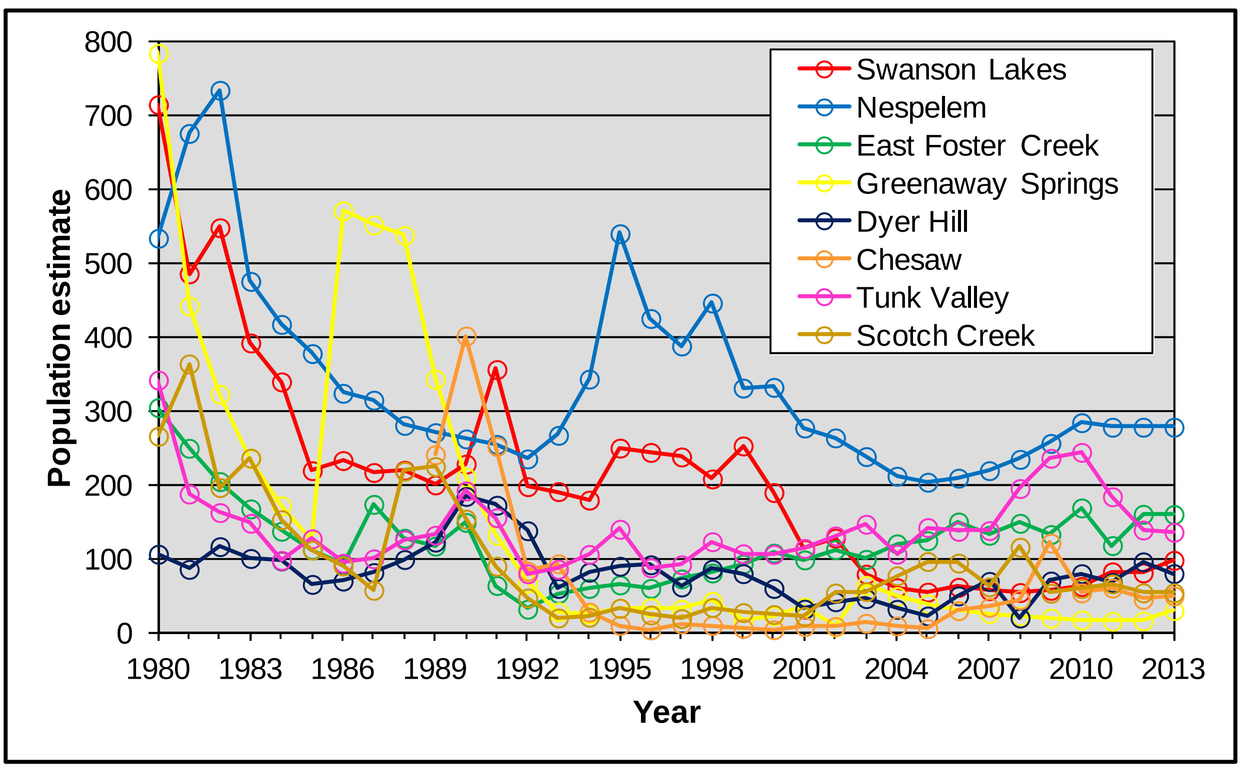

Fig. 2. Estimates of population size for sharp-tailed grouse within Washington, 1980–2013. The Nespelem population (Fig. 1) was divided into the Nespelem area (north of Columbia River) and the East Foster Creek area (south of Columbia River).

The Washington Department of Fish and Wildlife (WDFW) has a goal to recover threatened populations of sharp-tailed grouse in Washington. The state has listed the species as threatened, acquired over 15,000 hectares of sharp-tailed grouse habitat, developed management strategies to improve their habitat (Anderson 2006, Hallet 2006, Olson 2006, Peterson 2006), initiated research on their life history requirements (McDonald 1998), conducted detailed analyses of population genetics throughout the sharp-tailed grouse range (Spaulding et al. 2006), begun experimental translocations to increase and expand populations, and published a recovery plan (Stinson and Schroeder 2012). The Colville Confederated Tribes (CCT) has pursued a similar strategy of acquisition and restoration (Berger et al. 2005, Gerlinger 2005). The BLM lists the sharp-tailed grouse on their Sensitive list with a goal of minimizing or eliminating threats and improving the condition of habitat. The primary management strategy for the WDFW, BLM, and CCT has been to improve habitat on publicly-owned or leased lands that are currently, or were historically, occupied by sharp-tailed grouse. Habitat improvements include the reduction of grazing pressure, transition of cropland (mostly wheat) to grass-dominated habitats (such as in the federally-funded Conservation Reserve Program [CRP]), restoration of native habitat, and planting of key components such as riparian trees and shrubs.

Isolation poses a significant threat to the viability of remaining populations. Westemeier et al. (1998) described the reduction in genetic diversity and in population fitness over a 35-year period in a small, declining greater prairie-chicken (*Tympanuchus cupido*) population in Illinois. They reported that declines in fertility and egg hatchability correlated with a population decline from 2000 individuals in 1962 to less than 50 by 1994. Bouzat et al. (1998) genetically compared the Illinois population with larger populations in Kansas, Nebraska, and Minnesota and found that it had approximately 2/3 the allelic diversity of the other populations. Bellinger et al. (2003) found a similar reduction in genetic variation, though not in reproductive success, in greater prairie-chickens in Wisconsin. Their comparison of greater prairie-chicken samples collected in Wisconsin in 1951 with those collected from 1996 through 1999 revealed a 29% allelic loss.

Population augmentation efforts are one approach to address genetic issues associated with populations (e.g., lack of heterogeneity and small population size). In addition, by translocating birds from ‘healthy’ populations, a basic hypothesis can be tested. Specifically, is habitat limiting the growth and/or expansion of existing populations or is the problem related to the intrinsic ‘health’ of the birds? An increasing population trend following augmentation would support the hypothesis that a population ‘health’ problem existed. If the population size remains the same or continues to decline, and monitoring indicates that the translocated birds remained in the area and survived to attempt reproduction, data will support the conclusion that habitat quality and/or quantity is limiting population growth.

Experimental translocations in 1998, 1999, and 2000 were successful in augmenting one population of sharp-tailed grouse in Washington at the Scotch Creek Wildlife Area, northwest of Omak. Birds for this translocation were obtained from the Rockland area in southeastern Idaho (51 birds) and the Colville Indian Reservation in Washington (12 birds). Prior to the translocation, surveys indicated that the Scotch Creek population had declined to 1 lek with 2 displaying males. This population increased after three years of translocation (Fig. 3).

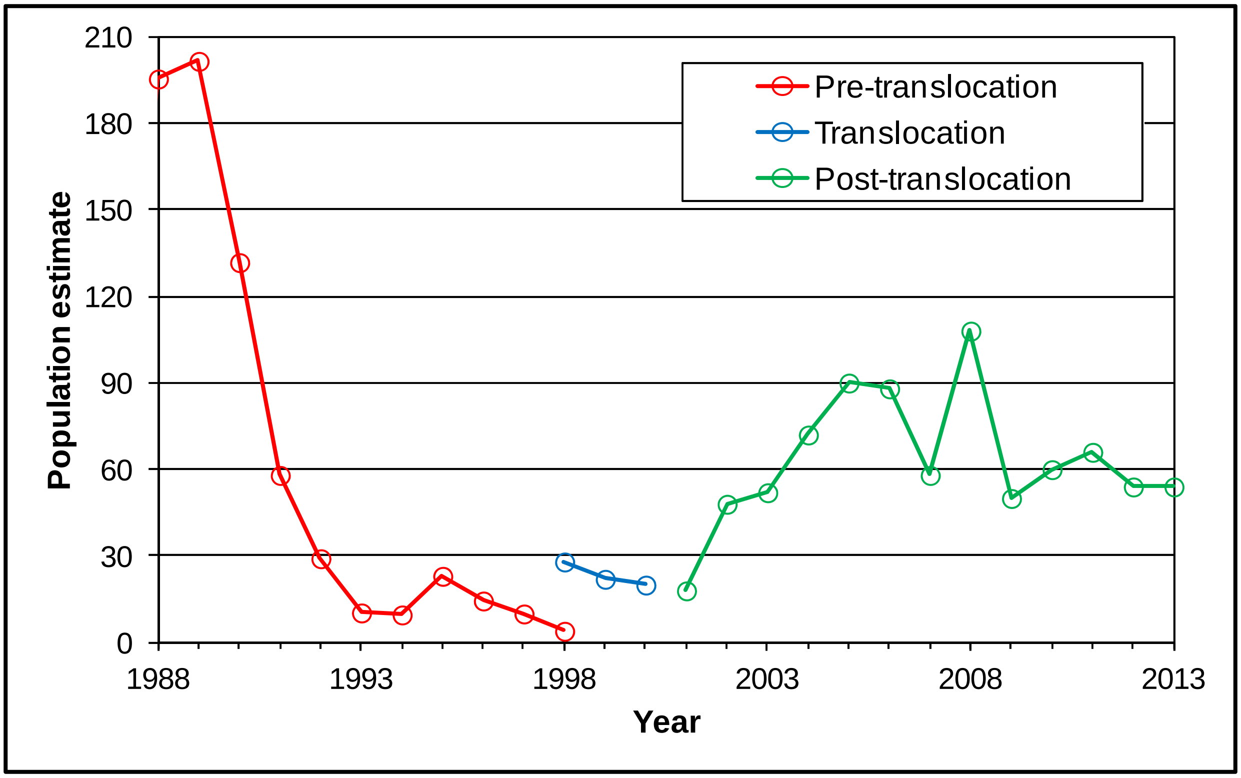

Fig. 3. Estimated population of sharp-tailed grouse on the Scotch Creek Wildlife Area in Washington before and after translocation of 63 sharp-tailed grouse in 1998, 1999, and 2000.

WASHINGTON TRANSLOCATION PROJECT

The translocation effort in Washington was designed to follow recommendations outlined by Reese and Connelly (1997). Translocations of sharp-tailed grouse should include four basic stages to maximize opportunities for successful reestablishment or augmentation efforts (similar to Griffith et al. 1989). These include: ***Stage 1***—Identify potential release sites based on quantity and quality of habitat on, and near, the sites. In addition, the historical presence and current status of sharp-tailed grouse near the release sites needs to be established. ***Stage 2***—Identify source populations for translocation to the proposed release sites. This should include a genetic analysis. ***Stage 3***—Conduct the translocation as efficiently as possible in a way that minimizes the length of captivity and maximizes survival and productivity. ***Stage 4***—Monitor and evaluate the success or failure of the reestablishment or augmentation effort and determine future management efforts. This fourth stage is particularly important so that all translocation efforts, even those that are unsuccessful, will provide valuable information.

STAGE 1: RELEASE SITES

The historical presence of sharp-tailed grouse throughout most of eastern Washington has been well established (Yocom 1952, Aldrich 1963). The current distribution of sharp-tailed grouse has also been documented with the aid of extensive state-wide surveys (Hays et al. 1998, Schroeder et al. 2000). The grouse population has declined substantially over the past 40+ years. Genetic diversity and allelic richness are significantly lower in Washington than in populations in Utah and Idaho (Warheit and Schroeder 2003). Some of this lack of genetic diversity appears to be due to the small size and isolation of populations in Washington relative to other occupied areas.

Because of the declines in sharp-tailed grouse populations throughout Washington and the isolation and small size of the remaining populations, several locations were considered for translocation efforts. Four primary sites were identified based upon assessments of their size, habitat quality, and management potential (Fig. 1): Dyer Hill (south of Brewster in Douglas County); Swanson Lakes (southeast of Wilbur in Lincoln County); Nespelem (east of Nespelem in Okanogan County); and Greenaway (southeast of Okanogan in Okanogan County). Two of the release sites include state and federally-owned public land and the other sites are Colville Tribal land; all are being managed for the benefit of wildlife. The Dyer Hill site also was recommended by McDonald and Reese (1998) as the primary target for improvements in the statewide sharp-tailed grouse population. All of the release sites are recommended in the statewide recovery plan for sharp-tailed grouse (Stinson and Schroeder 2012, Fig. 4).

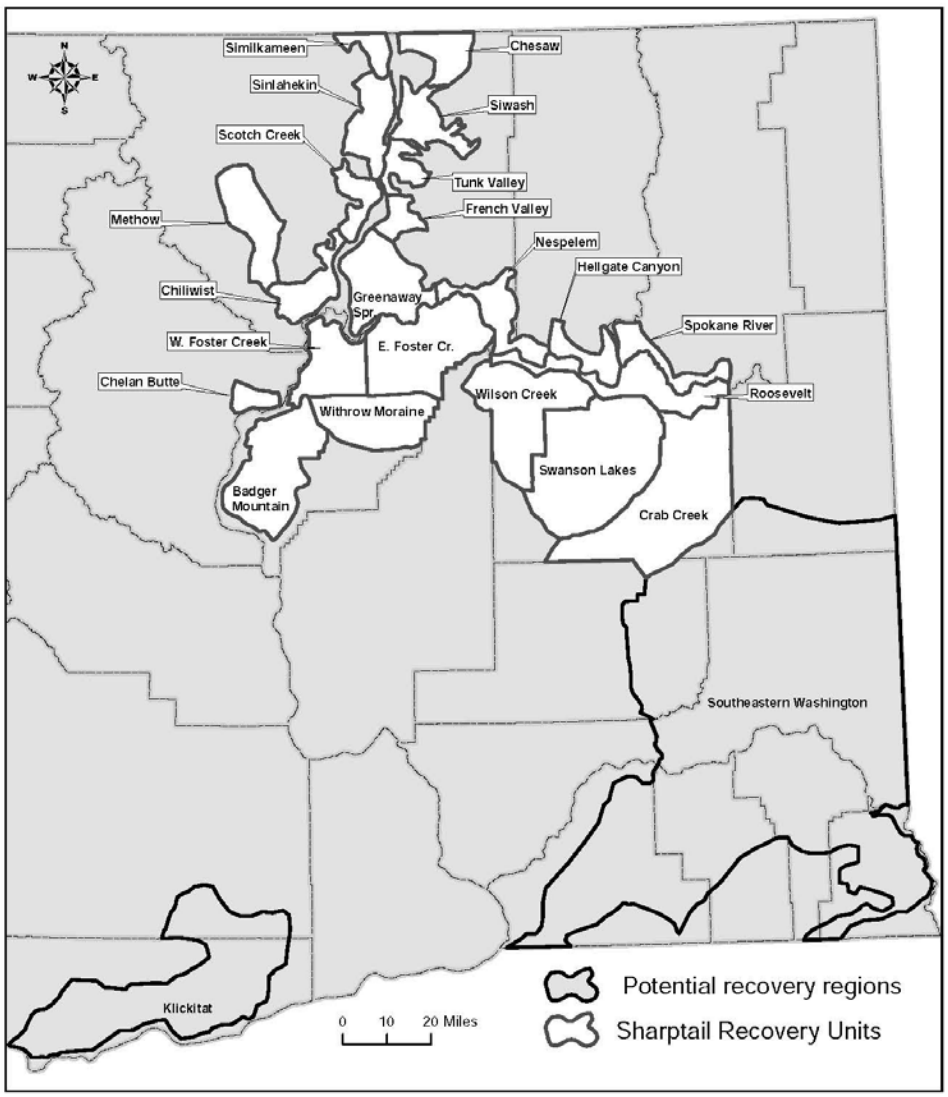

Fig. 4. Twenty-two Columbian sharp-tailed grouse recovery units and two potential recovery regions in Washington (Stinson and Schroeder 2012).

The release sites are clearly within the historical range of sharp-tailed grouse and until relatively recently have had healthy populations of sharp-tailed grouse. Dyer Hill is near the Central Ferry Canyon and West Foster Creek wildlife areas in Douglas County. These state-owned areas include approximately 4,000 hectares of potential sharp-tailed grouse habitat within a matrix of tens of thousands of additional hectares of private land, also with potential to support sharp-tailed grouse. Work is currently underway in the general area to restore 167 ha of old grain fields to shrubsteppe with a $250,000 grant. In addition, 55 km of fence was removed in Douglas County, a portion of which was in the West Foster Creek Wildlife Area.

The Swanson Lakes Wildlife Area includes 8,094 ha, with an additional 518 ha lease of Washington Department of Natural Resources land. In addition, the BLM purchased about 9,000 ha adjacent to the wildlife area, providing an opportunity to secure connectivity of habitats among various agencies. The Lakeview Ranch is a 5,135 ha parcel located approximately 9 km north of the town of Odessa in southwest Lincoln County. Management of the area has focused on supporting wildlife habitat, seasonal livestock grazing, and wildlife-based recreational opportunities. Twin Lakes is a 6,201 ha parcel located approximately 26 km southwest of Davenport in central Lincoln County. Coffeepot Lake is a 377 ha parcel located 19 km west of Harrington in Lincoln County. In 2011, 88 km of WDFW fences and 114 km of fences on adjacent BLM lands in Lincoln County were marked to reduce grouse collision mortalities, funding for this effort was provided by BLM. During 2010 an Aquatic Lands Enhancement Account (ALEA) grant was used to assist the Lincoln County Conservation District with removal of 24 km of unneeded fencing; an additional 8 km was removed in 2011. In 2011, 30 ha of crested wheatgrass was reseeded to native vegetation with funding from the BLM.

The CCT is acquiring and actively managing habitat east of Nespelem on the Colville Indian Reservation in Okanogan County. Although the Nespelem population of sharp-tailed grouse is the largest in the state (perhaps 300 birds), it has been declining for many years (Schroeder et al. 2000). All three of these potential release sites (Dyer Hill, Swanson Lakes, Nespelem) appear to be isolated populations with an inevitable future of extirpation without intervention.

Why have populations of sharp-tailed grouse been reduced or eliminated on the prospective release sites? Has subsequent management on the prospective release sites adequately addressed the explanations for previous declines in numbers of sharp-tailed grouse? There are numerous possible reasons for the sharp-tailed grouse population declines on the potential release sites. These include historical declines in habitat quantity and quality, potential increases in densities of predators such as common ravens (*Corvus corax*), great-horned owls (*Bubo virginianus*), and coyotes (*Canis latrans*) and isolation of remnant populations due to the lack of dispersal corridors between adjacent populations of sharp-tailed grouse. Some of the explanations for the declines have been directly addressed with management activities, in particular, habitat restoration. All the potential release sites have management objectives to conduct habitat restoration activities focused on sharp-tailed grouse habitat needs. These include replacement of poor-quality non-native grass/forb habitats with native shrubsteppe vegetation for spring and summer habitat, and establishment of shrubs and trees necessary for improvement of wintering habitat. CRP also has resulted in the conversion of large areas of cropland to potential sharp-tailed grouse habitat since the mid-1980's, although early CRP plantings have become monocultures of exotic grasses that need to be reseeded with native seed mix. However, because some of the remaining populations have endured severe 'bottlenecks' in abundance, we believe some of these populations have lost some of their intrinsic ability to respond positively to habitat improvements due to their reduced genetic diversity (Westemeier et al. 1998, Bellinger et al. 2003, Johnson et al. 2003). This possibility was consistent with the positive results for the 1998–2000 translocations at the Scotch Creek Wildlife Area (Fig. 3).

STAGE 2: SOURCE POPULATIONS

The sharp-tailed grouse is currently divided into six extant subspecies (Aldrich 1963, Fig. 5); the New Mexican subspecies is extinct. Sharp-tailed grouse in Washington are within the Columbian subspecies range; this subspecies is distinguishable by its grayer color, smaller size, and shrubsteppe and mountain shrub habitat. Taxonomic differentiation of subspecies has been somewhat arbitrary and ambiguous.

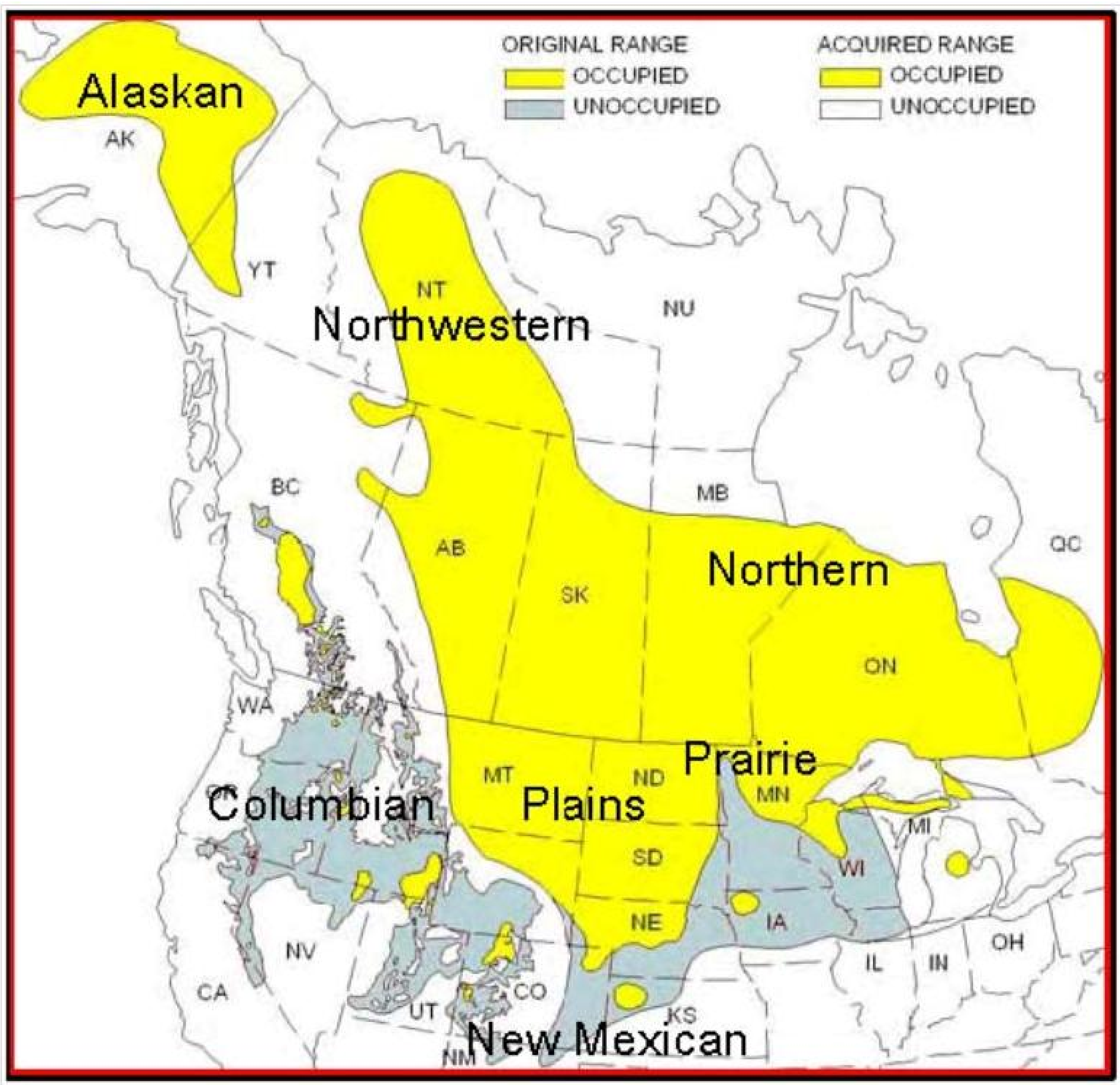

Fig. 5. Distribution of of sharp-tailed grouse subspecies in North America (modified from Aldrich 1963).

Recent genetic analyses indicate that sharp-tailed grouse in Utah, British Columbia, Idaho, and Washington are more similar to each other than to any other region (Warheit and Schroeder 2003, Spaulding et al. 2006). Any population within these areas appears to be a genetically appropriate source population for translocation into Washington. The Columbian sharp-tailed grouse populations in British Columbia, southeastern Idaho and north-central Utah are appropriate populations from which we could translocate birds into Washington – based on population health and habitat similarity (Fig. 6).

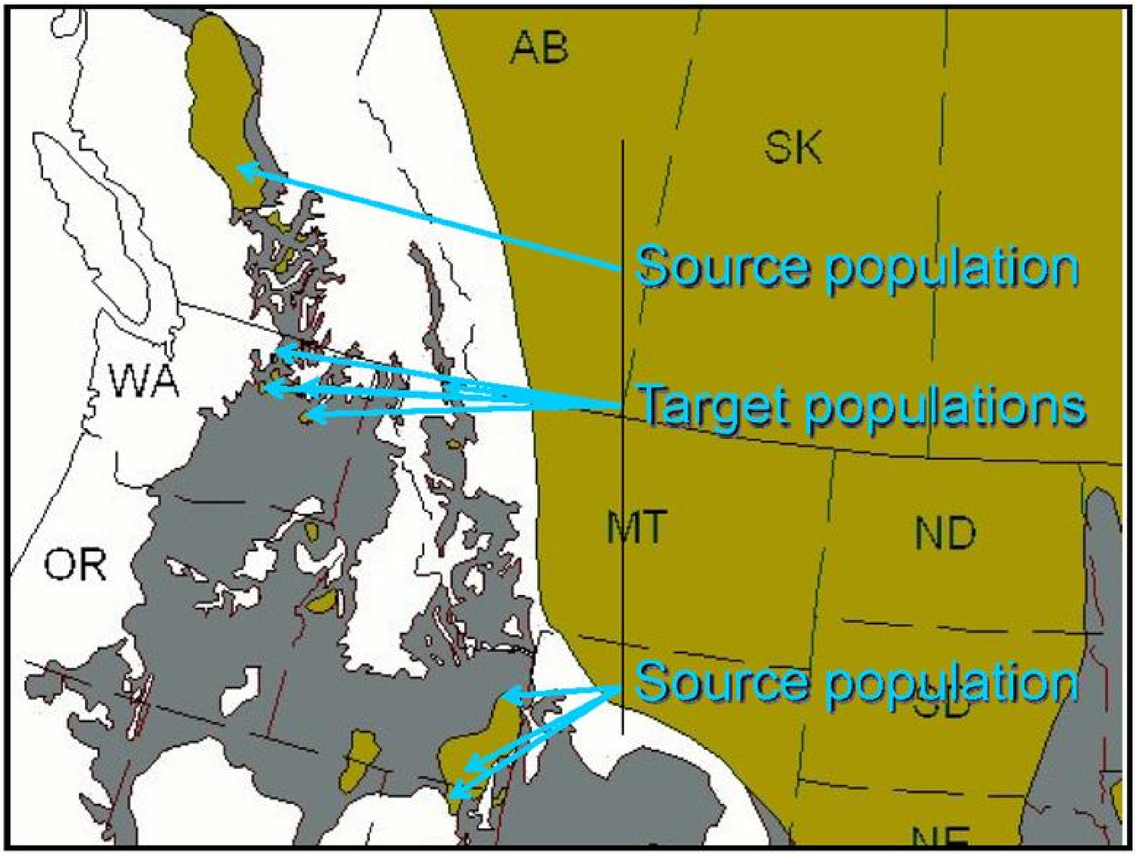

Fig. 6. Location of source populations for translocations within the range of Columbian sharp-tailed grouse in relation to the target populations in Washington.

STAGE 3: CAPTURE AND TRANSLOCATION

Sharp-tailed grouse are generally captured during the spring breeding period (early April) with the aid of walk-in traps on leks. All birds are weighed, measured, banded with unique numbered bands, and fitted with necklace-mounted, battery-powered radio transmitters. In addition, sex and age are determined (Henderson et al. 1967, Caldwell 1980) and blood samples are collected for subsequent genetic testing. Birds are transported by plane or car in an individual box or a portion of a box that is small enough to contain the bird's movement. The bottom of each box is lined with a material to reduce contact between feces and the birds' feet.

Starting in 2008, birds have been held in settling boxes for a minimum of about 15 minutes prior to release, using a box design modified from those described by Musil (1989). This allows small groups of birds to be held together and allowed to leave the box when it was opened with a cord from a hide to minimize stress during release. All birds are released in the target location the same day they were captured, prior to darkness, or the following morning. Prior to 2008, birds were released directly from boxes. All birds destined for translocation receive a health certificate from a veterinarian that is accredited within the donor state. The US Department of Agriculture maintains a disease list for which all translocated birds are screened.

In total 329 sharp-tailed grouse were captured in Utah, Idaho, and British Columbia and translocated to Washington (Table 2). Forty birds were translocated from an area west of Clinton, British Columbia, 20 birds from an area north of St. Anthony, Idaho, 233 birds from an area near Heglar Canyon, Idaho, and 75 birds from north-central Utah. Birds translocated to the Colville Indian Reservation were released in the Haley Creek, Greenaway, and Nespelem areas. One hundred forty one (37%) of the translocated birds were females. All disease testing was negative.

Table 2. Summary of sharp-tailed grouse translocated from British Columbia, Idaho, and Utah to Washington during 2005–2013.

Release location	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Swanson Lakes Wildlife Area	20	10	14	14	30[a]	51	20	7	39	205
Dyer Hill	20	12	15	14	0	0	0	0	0	61
Colville Indian Reservation	20[a]	11	12	14	10	0	9	26	0	102
Total	60	33	41	42	40	51	29	33	39	368

[a]The totals include birds that died in transport; one in 2005 and two in 2009.

STAGE 4: MONITORING AND EVALUATION

The success or failure of the reestablishment effort is evaluated on and near the release site (Toepfer et al. 1990). Although radio-marked sharp-tailed grouse have been monitored at all release sites, most of the effort has been focused on and near the Swanson Lakes Wildlife Area. The specific objectives include evaluation of sharp-tailed grouse movement, habitat use, productivity, survival, and population size. These evaluations help provide essential information to determine whether additional translocations, habitat improvements, release locations, and/or translocation methodologies are necessary. Because these data are currently being collected, the analysis included in this report is preliminary.

Movement

Radio-marked sharp-tailed grouse are located with the aid of portable receivers and 3-element Yagi antennas. Birds are located daily either visually or with triangulation during the first two weeks following release and at least once each week for the duration of the research, particularly on the Swanson Lakes Wildlife Area. For triangulation, three or more azimuths are obtained, usually within 1.5 km of target transmitters and at angles-of-incidence greater than 35^{o} and less than 145°. Error polygons are used to assess the 'quality' of the estimated locations. All locations are recorded with a GPS unit using Universal Transverse Mercator coordinates to the nearest meter and entered into ArcGIS. An attempt is made to avoid disturbance of birds, particularly at nest sites. Fixed-wing aircrafts are used to locate lost birds on a regular basis throughout the year.

Between 2008 and 2012 4,692 locations were obtained for 150 radio-marked birds released at Swanson Lakes Wildlife Area (Fig. 7). Sex, age and year released were considered in an analysis of maximum distance moved from the point of release for the Swanson Lakes' releases. No significant differences in maximum distance moved was found among years of release. Females (12 km, SE = 2 km, n = 64) tended to move farther than males (7 km, SE = 1 km, n = 75) and yearlings (12 km, SE = 1 km, n = 39) farther than adults (9 km, SE = 1 km, n = 100). The maximum observed dispersal distance from the point of release was 89.6 km by a female released in 2006. We calculated minimum convex polygon home ranges for sharp-tailed grouse released at Swanson Lakes Wildlife Area. Home range size did not differ between adults (28 km^2, SE = 10 km^2, n = 95) and yearlings (35 km^2, SE = 11 km^2, n = 37) or between females (40 km^2, SE = 16 km^2, n = 58) and males (22 km^2, SE = 5 km^2, n = 74).

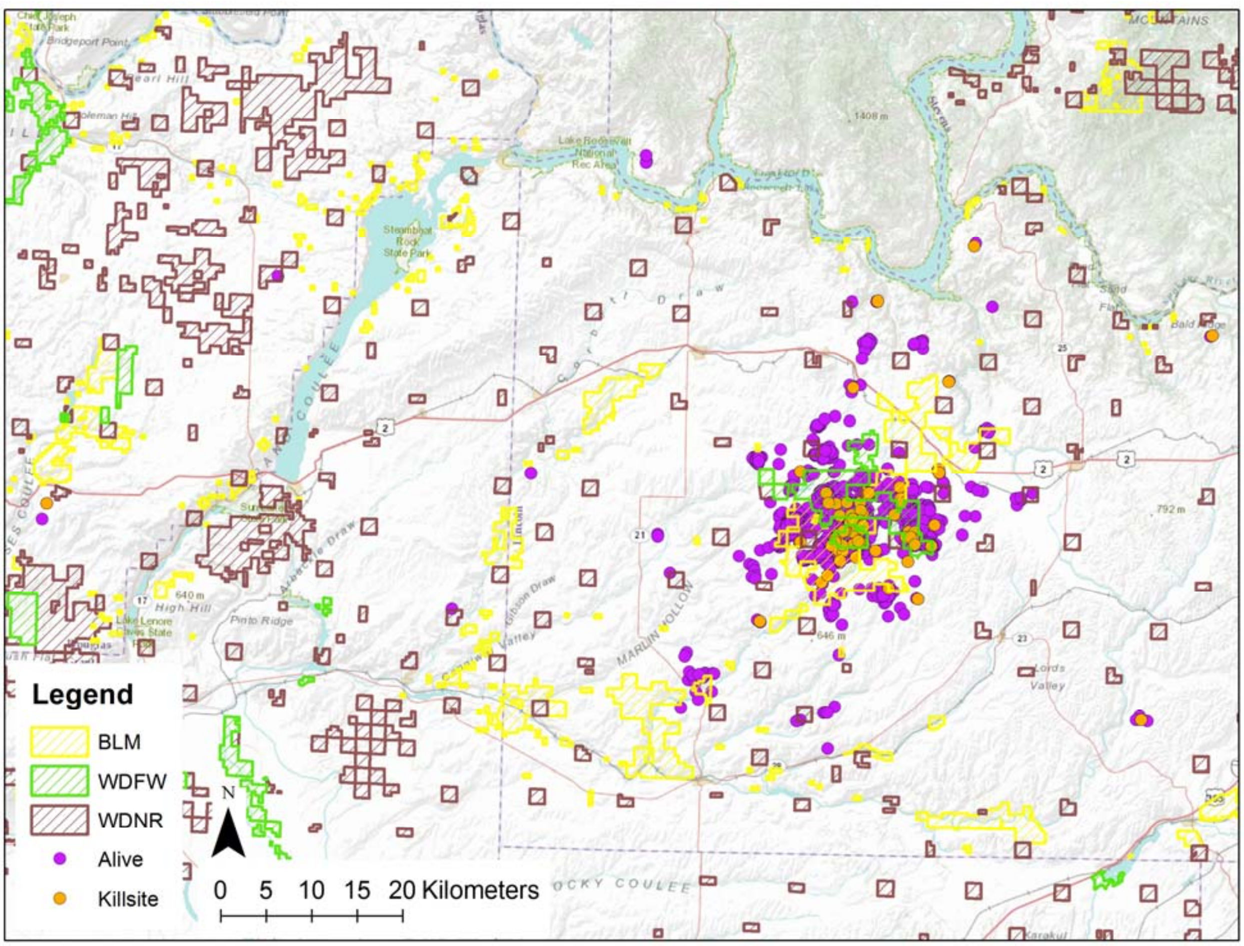

Fig. 7. Locations of radio-marked translocated sharp-tailed grouse released in the Swanson Lakes Wildlife Area (green hatched area) from April 2005 through November 2012 (purple circles = observations of alive birds, orange circles = locations of killsites).

Habitat use

Twenty-six nests for translocated sharp-tailed grouse were documented between 2010 and 2012. The primary protective cover was grass for 87% (mostly bluebunch wheatgrass, *Pseudelephantopus spicatus* and Sherman's big bluegrass, *Poa secunda*), forbs for 7%, and shrubs for 7%. The vast majority of observations (97%) for radio-marked grouse were in shrubsteppe habitat types. Seven percent were in scabland, 4% were in shrubsteppe with dense (>25% cover) shrub, 14% were in shrubsteppe with moderate (5-25% cover) shrub, and 72% were in shrubsteppe with sparse (<5% cover) shrub.

Productivity

Nest success was examined each breeding season (Schroeder 1997). Nests were considered successful if a minimum of 1 egg hatched. Specific evidence of possible predators was examined at unsuccessful nest sites. Brood success was estimated using radio-marked females that successfully produced broods that survived at least 50 days following hatch (chicks can survive on their own after 50 days). Observations of banded and unbanded birds at leks were used to evaluate the recruitment of new birds into the population as well as the presence of birds that may have been on the release site prior to the first translocation. The latter situation may indicate leks which were previously undiscovered.

In 2009, only four hens were observed nesting, one hatched and the brood was assumed lost due to the hen dying prior to 50 days (Table 3). Since 2009, apparent nest success has varied from a high of 71% to a low of 29%. Brood success between 2010 and 2012 was high (≥ 80%), but dropped to 40% in 2013. Overall apparent nest success and brood success are 44% and 76% respectively.

Table 3. Observed nest and brood success for female sharp-tailed grouse translocated to the Swanson Lakes Wildlife Area in Lincoln County, Washington, 2009–2013.

	2009	2010	2011	2012	2013	Totals
Nested	4	13	7	7	7	39
Chicks hatched	1	6	2	5	5	19
Chicks fledged	0	5	2	4	2	13
Broods with unknown success					1[a]	

[a] Hen slipped radio collar three weeks before 50 day flush.

Survival

Examination of radio-marked birds translocated to the Swanson Lakes Wildlife Area showed that at least 94 of 203 birds are known to have died (51%). Many additional birds are missing, have radio transmitters that are no longer functioning, or were not fitted with radio transmitters so the number of dead birds is likely higher (Table 4).

Table 4. Summary by year of release of the status for203 translocated sharp-tailed grouse in the Swanson Lakes Wildlife Area, Washington during 2005–2013. Likely causes of mortality are listed in Table 5.

Fate	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Alive	0	0	0	0	0	0	2	1	13	16
Outlived transmitter	3	0	2	2	10	7	8	0	0	32
Dead	5	6	9	9	14[a]	25	9	6	11	94
Missing	9	2	3	3	3	10	0	0	0	30
Radio fell off	3	2	0	0	1	0	1	0	5	12
No transmitter used	0	0	0	0	0	9	0	0	10	19
Total	20	10	14	14	30	51	20	7	39	203

[a] *Does not include 2 hens that died in transport*

Table 5. Mortality of 94 radio marked sharp-tailed grouse by calendar year in the Swanson Lakes Wildlife Area, Washington, 2005–2013.

Category	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Mammalian				1	3	2	1			7
Great horned owl						1			2	3
Raptor					3	7	8	2	3	23
Unknown	1	7	9	7	8	10	5	3	11	61
Total	1	7	9	8	14	20	14	5	16	94

Females appear to have a higher mortality than males, 57% of radio collared females are known to have died versus 46% of radio collared males. Female mortality occurs most frequently in the spring, whereas male mortality is relatively equally distributed across seasons (Fig. 8). A Known-fate analysis run in Program Mark on 2005–2011 data indicates significant differences in annual survival by sex and age (Fig. 9) with adult females having the lowest survival, but did not indicate any significant seasonal survival differences.

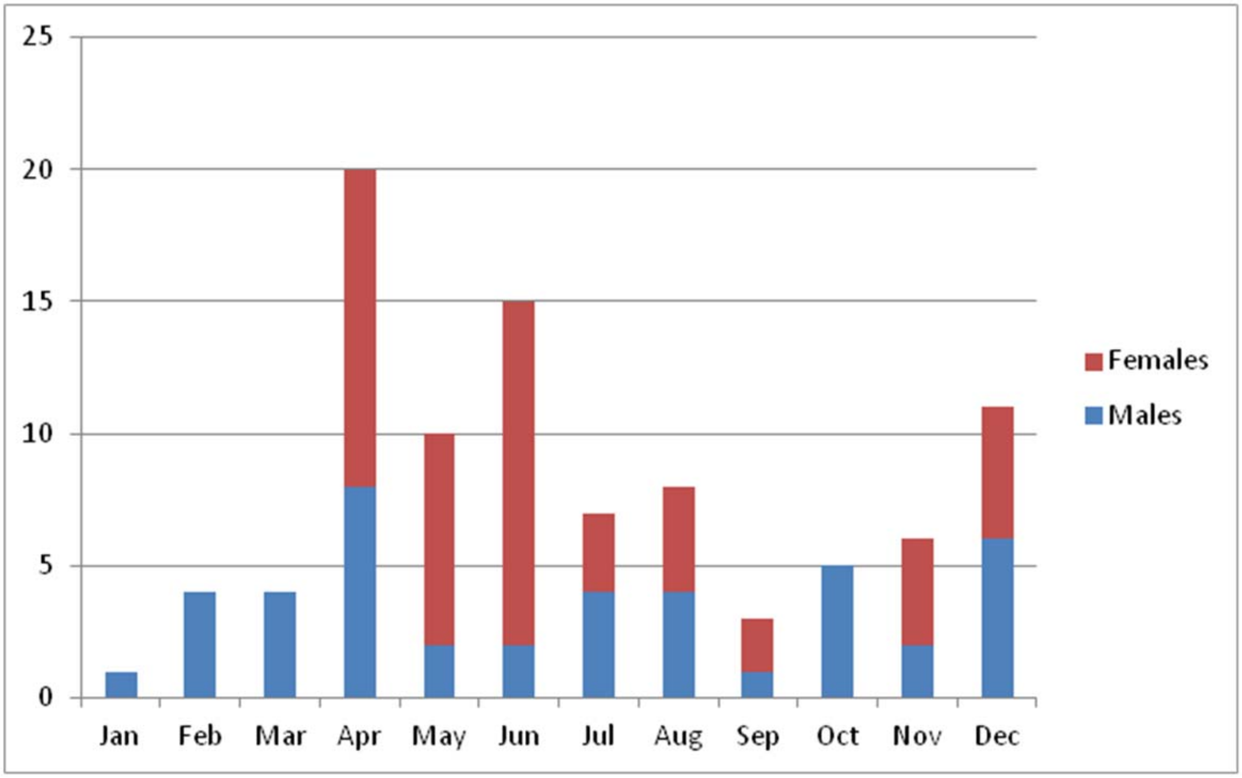

Fig. 8. Distribution of 94 mortalities among 184 radio marked translocated sharp-tailed grouse in the Swanson Lakes Wildlife Area, Washington, 2005–2013. Two females that died during transport are not included.

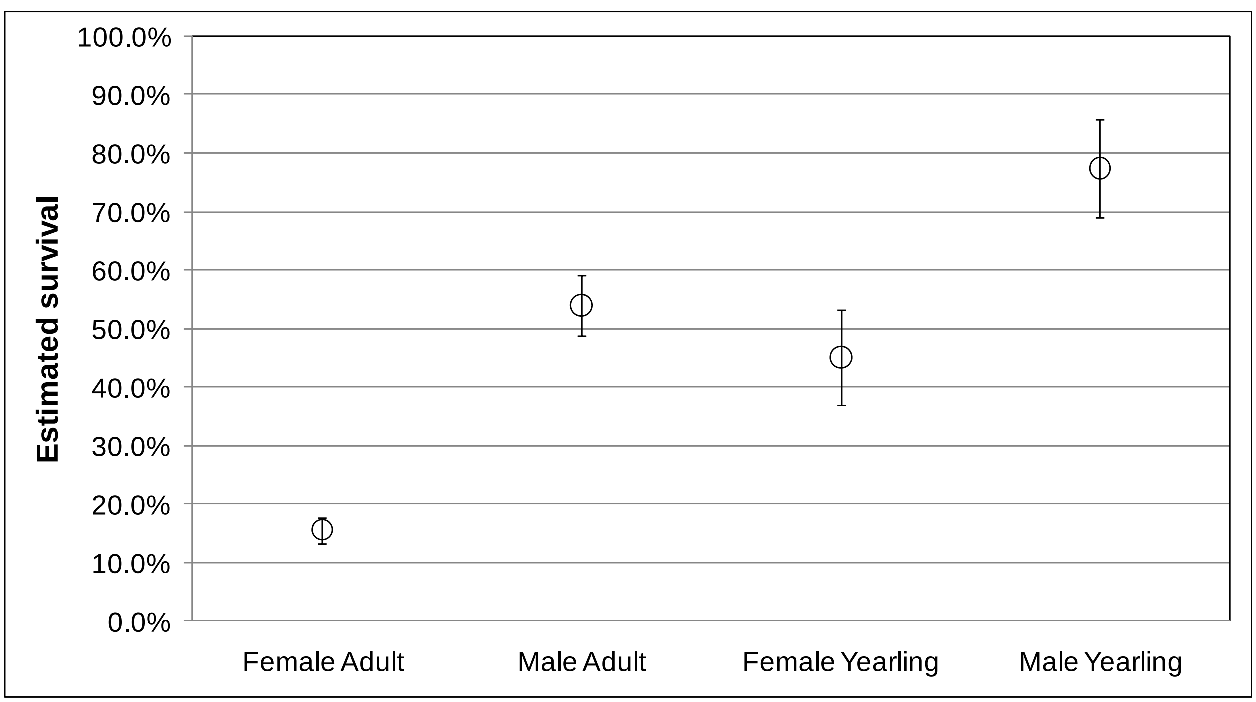

Fig. 9. Known-fate survival analysis using Program Mark on 159 translocated sharp-tailed grouse in the Swanson Lakes Wildlife Area, Washington, 2005–2011.

Population monitoring

Positive population responses and long-term population viability are the ultimate results desired from translocations. Radio-marked males are located during the morning period to determine the locations of temporary and permanent leks. An attempt is made to regularly monitor these leks without disturbing the birds. In addition, all potential sharp-tailed grouse habitat within at least 10 km of the release site is inventoried to estimate lek density and attendance of males (Connelly et al. 2003). Surveys are conducted during March and April of each year

Concerted efforts were made to conduct surveys in the Dyer Hill (Fig. 10) and Swanson Lakes (Fig. 11) areas. As a result, apparent increases in the populations were detected at each site. It is believed that these observed increases are real and not an artifact of increased survey intensity for three reasons: 1) translocated males were among the displaying individuals; 2) the locations where 'new' leks were detected had been surveyed in previous years; and 3) an increase in number of birds was also observed during winter in nearby wintering habitats. Although it is still too early in the process to evaluate the success of the augmentations, there are ongoing efforts to monitor movement, survival, and productivity of the translocated birds. In the first few years of translocations to Scotch Creek, observed success was relatively small. It is hoped that the current translocation efforts will continue to show positive results in 2013.

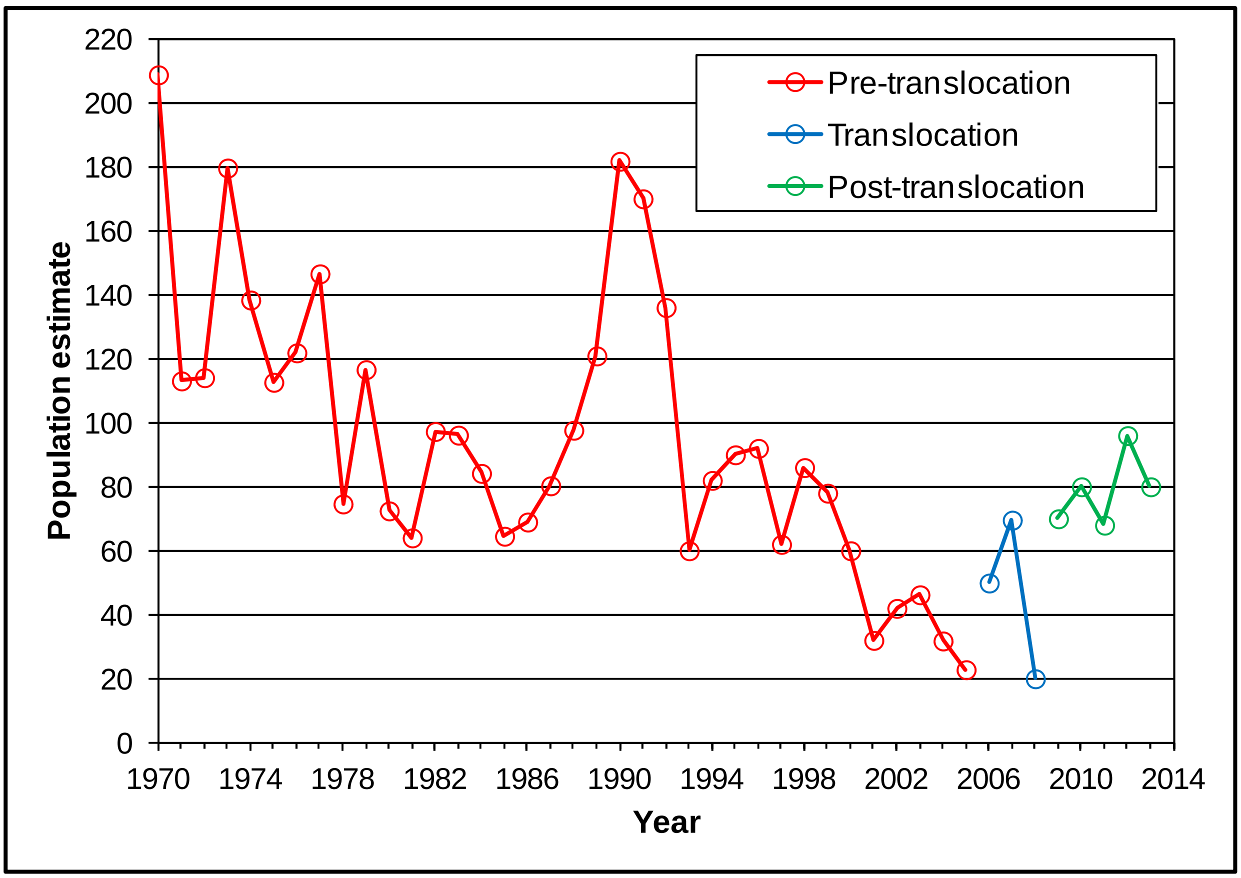

Fig. 10. Estimated population of sharp-tailed grouse on and near the West Foster Creek Wildlife Area (Dyer Hill) in Washington before, during, and after translocation of 61 sharp-tailed grouse in 2005–2008.

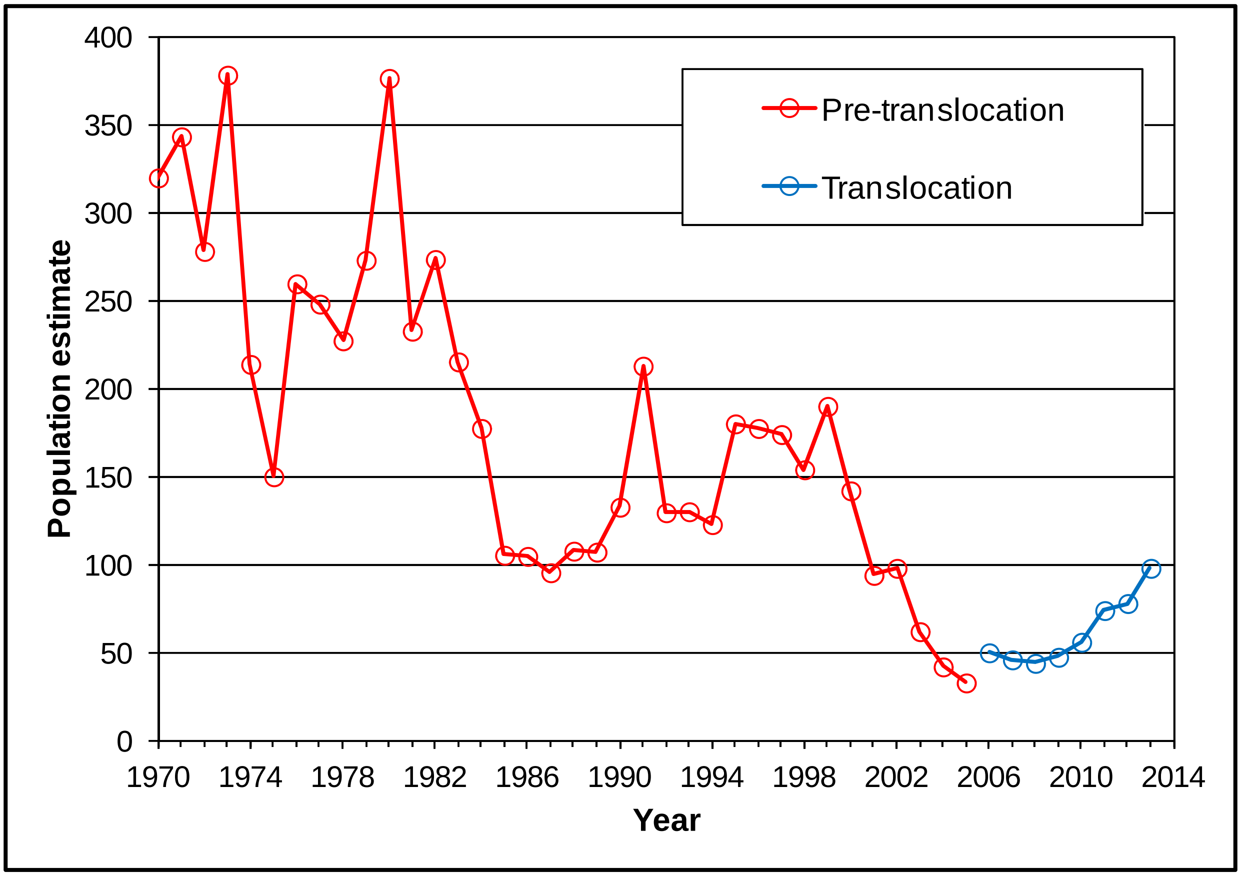

Fig. 11. Estimated population of sharp-tailed grouse on and near the Swanson Lakes Wildlife Area in Washington before and during translocation of sharp-tailed grouse in 2005–2013.

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