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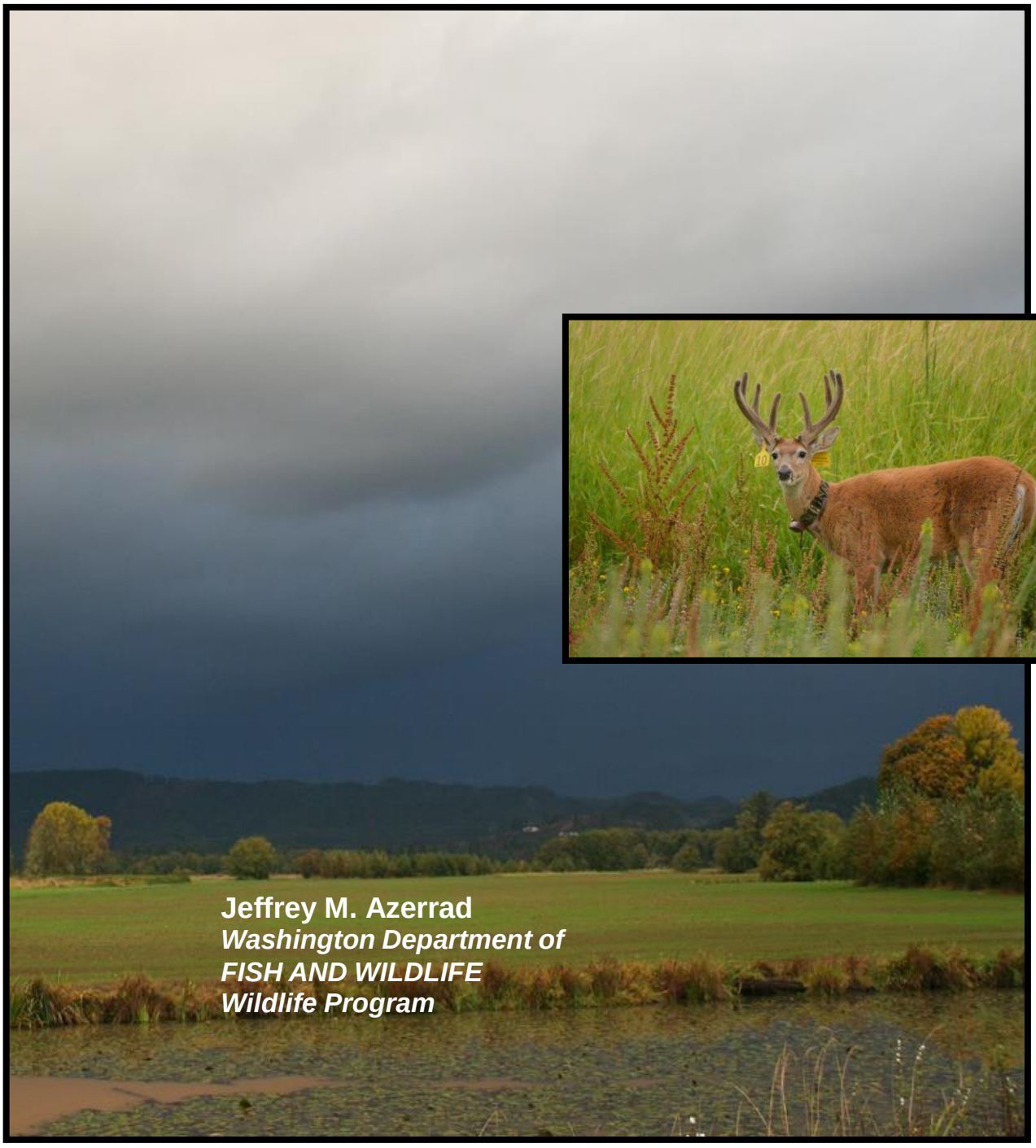
STATE OF WASHINGTON **April 2016**

Periodic Status Review for Columbian White-tailed Deer



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Wildlife Program

The Washington Department of Fish and Wildlife maintains a list of endangered, threatened, and sensitive species (Washington Administrative Codes 232-12-014 and 232-12-011, Appendix A). In 1990, the Washington Wildlife Commission adopted listing procedures developed by a group of citizens, interest groups, and state and federal agencies (Washington Administrative Code 232-12-297. The procedures include how species listings will be initiated, criteria for listing and delisting, a requirement for public review, the development of recovery or management plans, and the periodic review of listed species.

The Washington Department of Fish and Wildlife is directed to conduct reviews of each endangered, threatened, or sensitive wildlife species at least every five years after the date of its listing by the Washington Fish and Wildlife Commission. The periodic status reviews are designed to include an update of the species status report to determine whether the status of the species warrants its current listing status or deserves reclassification. The agency notifies the general public and specific parties who have expressed their interest to the Department of the periodic status review at least one year prior to the five-year period so that they may submit new scientific data to be included in the review. The agency notifies the public of its recommendation at least 30 days prior to presenting the findings to the Fish and Wildlife Commission. In addition, if the agency determines that new information suggests that the classification of a species should be changed from its present state, the agency prepares documents to determine the environmental consequences of adopting the recommendations pursuant to requirements of the State Environmental Policy Act.

This document is the Draft Periodic Status Review for the Columbian White-tailed Deer. It contains a review of information pertaining specifically to the status of the Columbia River Population of Columbian White-tailed Deer. It was reviewed by species experts and will be available for a 90-day public comment period. All comments received will be considered during the preparation of the final periodic status review. The Department intends to present the results of this periodic status review to the Fish and Wildlife Commission at an upcoming meeting.

Submit written comments on this report by e-mail by 9 July 2016 to:
T&Epubliccom@dfw.wa.gov

Or by mail to:

Listing and Recovery Section Manager, Wildlife Program
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600 Capitol Way North, Olympia, Washington 98501-1091

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Cover background photo of Short-grass field on Julia Butler Hansen Refuge for the Columbian White-tailed Deer from USFWS; Columbian White-tailed Deer photo supplied by the U. S. Fish and Wildlife Service.

This work was supported in part by personalized and endangered species license plates

Draft Washington State Periodic Status Review for the Columbian White-tailed Deer

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ACKNOWLEDGMENTS

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EXECUTIVE SUMMARY

Columbian White-tailed Deer (*Odocoileus virginianus leucurus*) is the westernmost subspecies of white-tailed deer. Although widespread and numerous across much of its North American range, this subspecies occurs in relatively low numbers in a highly restricted range. Once Columbian White-tailed Deer (CWTD) ranged widely across much of western Washington and Oregon, however; habitat loss and degradation as well as overhunting led to a significant range contraction as well as a commensurate decline in their numbers. This led the U.S. Fish and Wildlife Service (Service) to include the Columbian White-tailed Deer as an Endangered Species immediately upon adoption of the Endangered Species Act (ESA) in 1973. The Washington Department of Game designated it as a State Endangered Species in 1980.

Columbian White-tailed Deer currently occupy two isolated populations, the larger of which occurs in Douglas County, Oregon. The other occurs along the shores of the lower Columbia River with a range extending from Ridgefield National Wildlife Refuge (NWR) downstream to the Lewis and Clark NWR. This population is considerably smaller than the Douglas County, Oregon population (> 6,000 deer versus < 1,000 deer) and is the only ESA-protected population.

Since it was first listed as a State Endangered Species in Washington, the Columbia River population of CWTD has fluctuated. Since then surveys conducted by the U.S. Fish and Wildlife Service estimated a low point for this population in 2002 when they estimated only 545 deer. Their estimated population since then has generally been lower than estimates for the years immediately after Washington State designated it as an Endangered Species. Population numbers have increased in recent years according to the U.S. Fish and Wildlife Service, with the estimated deer population reaching a high of 966 deer in 2015.

Partners have carried out a number of activities to help bolster this population, including habitat protection and restoration, predator control, and translocating deer to enhance their numbers and expand their geographic range. These activities have had mixed results. On the positive side, the predator control program seems to have measurably benefitted fawn survival and recruitment. Deer translocated to Tenasillahe Island have also responded positively to their new environment. With the exception of the recent translocations to Ridgefield National Wildlife Refuge, where it is premature to draw major conclusions, all other translocations have shown mixed results up until now.

These management challenges have led to recent populations estimates that resemble population estimates from most of the 1980s. One generally accepted theory as to why this population has not responded well to management is that there is an overall lack of suitable habitat within the occupied lower Columbia River range. This likely has inhibited the population's ability to expand beyond a limited carrying capacity.

Although deer numbers seem stifled by habitat constraints, recent proposals likely will shed light on potential ways to enhance the population. One such proposal is for a Population Habitat Viability Assessment that WDFW plans to carry out this year. This will provide a description of the habitat needs and deer numbers required for a viable population and likely will help WDFW and the Service examine the appropriateness of current recovery goals. Another is a proposal by the Washington Department of Transportation to analyze habitat connectivity for this population of CWTD. The results of this will identify habitat linkages that may subsequently be conserved and managed to help expand the population beyond its limited range.

Because of the low population, fragmented and low quality habitat, along with the uncertainty as to what constitutes a viable population, the Washington Department of Fish and Wildlife recommends retaining CWTD as a State Endangered Species in Washington.

DESCRIPTION AND LEGAL STATUS

The Columbian White-tailed Deer (*Odocoileus virginianus leucurus*) is one of 38 recognized subspecies of *O. virginianus* (Smith 1991). This subspecies is considerably smaller compared to other White-tailed Deer in northern latitudes (Smith 1991, ODFW 1995). They are generally distinguishable from Black-tailed Deer (*O. hemionus*) by a longer brown (rather than black) tail, white eye ring, smaller metatarsal gland, and antler tines that arise from the main beam (Fig. 1). Generally, this species displays a red-brown color in summer and a thicker gray-colored coat in the fall, with distinct white rings around their eyes and just behind their nose (ODFW 1995).

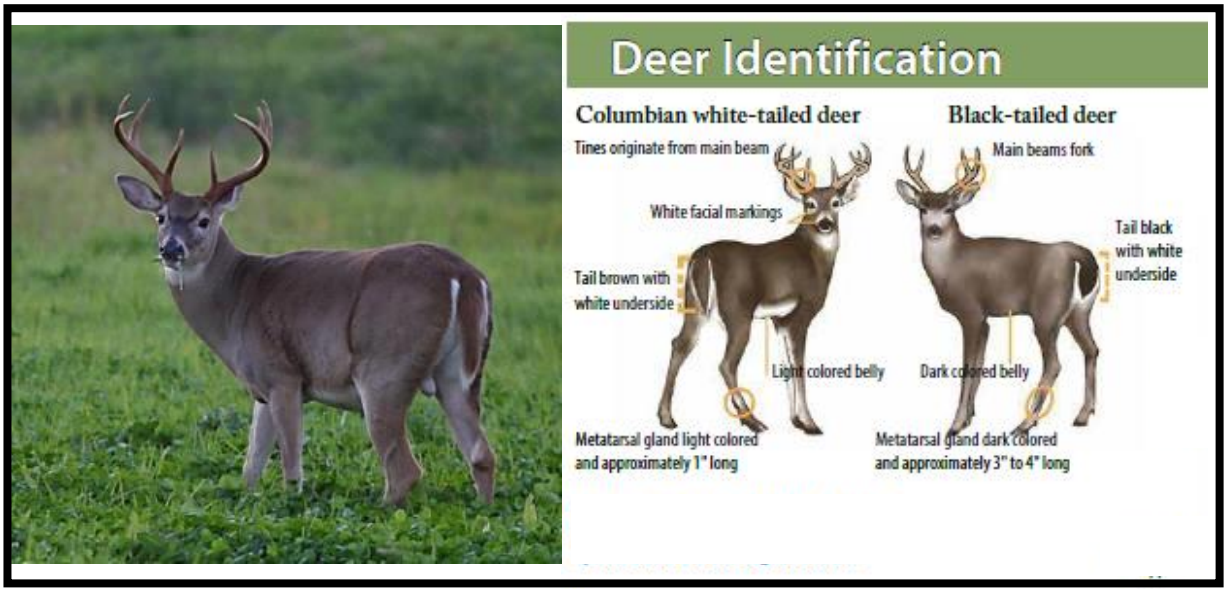

Figure 1. Columbian white-tailed deer: buck (left; *photo by Joseph V. Higbee*), and illustration (Right; Illustrations by Annie Aguirre) from WDFW 2015 Big Game seasons pamphlet.

Columbian White-tailed Deer were first federally listed as Endangered in 1970 under the Endangered Species Conservation Act of 1969 (USFWS 2013a). They were later granted Endangered Species Act (ESA) status when ESA was enacted in 1973 (USFWS 2013a). A recovery team formed in 1974 was responsible for CWTD conservation and for drafting a Recovery Plan that was approved in 1976 (USFWS 1983). In 1980, the Washington Department of Game formally designated it a State Endangered Species. Soon after, the U. S. Fish and Wildlife Service (hereafter referred to as the Service) published the Revised CWTD recovery plan (USFWS 1983), which set federal recovery goals for this subspecies.

In 2003, the Service established two Distinct Population Segments (DPS) for Columbian White-tailed Deer (USFWS 2013a). One DPS, which is partially distributed in southwest Washington (hereafter referred to as the Columbia River Population), has not achieved recovery, and thus is still a federally Endangered Species. The other DPS in Douglas County, Oregon (hereafter referred to as the Roseburg Population) has achieved its recovery goals according to the Service, resulting in its delisting in 2003. Oregon Department of Fish and Wildlife removed both the Roseburg and Columbia River populations off of their State Endangered Species List in 1995 (ODFW 2015). They now have limited controlled hunts of deer in the Roseburg Population (ODFW 2015). In October, 2015 the Service began a formal action to downlist the Columbia River Population from Federally Endangered to Threatened. The public comment period for this action ended on December 7, 2015 (USFWS 2015).

DISTRIBUTION

An endemic to the Pacific Northwest, CWTD is the westernmost subspecies of *O. virginianus* (Smith 1991). The Columbia River population is believed to have originally occurred in both riparian and prairie habitat in the Columbia and Willamette river valleys of Washington and Oregon (Douglas 1829). They historically inhabited a contiguous area of roughly 60,000 square kilometers west of the Cascade Crest (USFWS 2015), where they were primarily confined to the Willamette Valley-Puget Trough-Georgia Basin Ecoregion (Figure 2). This range extended from Grants Pass in southern Oregon north into south Puget Sound. The Dalles, Oregon was the eastern extent of their historic range, while the western edge reached nearly to Astoria, Oregon (USFWS 2015).

The current range of this subspecies has been reduced to two isolated populations (Smith 1985, USFWS 1983). The Roseburg Population encompasses an area entirely within Douglas County, Oregon (Fig. 2). The range of this population is approximately 800 square kilometers (USFWS 2003).

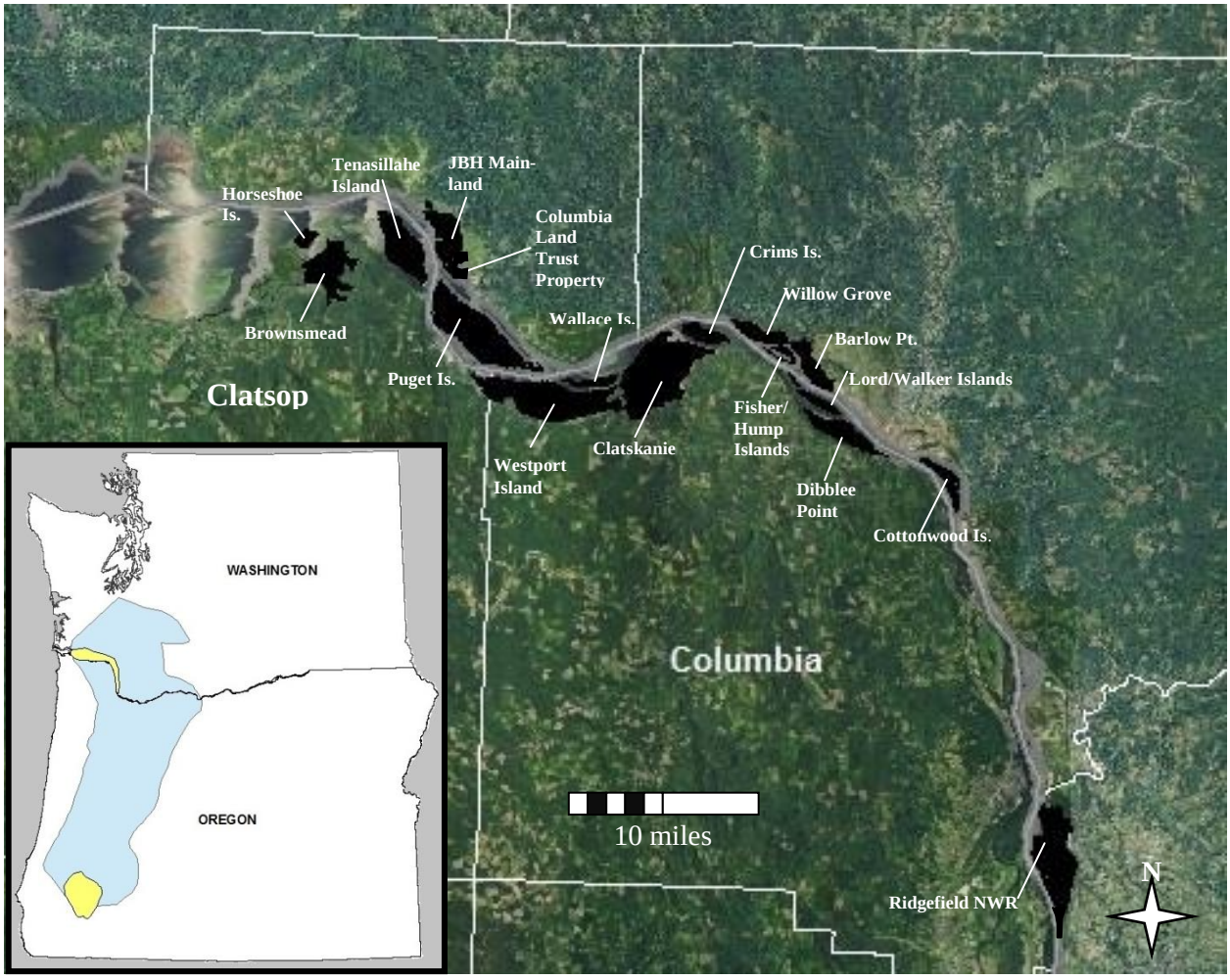

Figure 2. Sites occupied by Columbian White-tailed Deer along the Columbia River (black). Inset map shows the Columbia River Population (top yellow) and the Roseburg Population (bottom yellow) as well as the likely historic range of the Columbian White-tailed Deer (blue).

The range of the Columbia River Population covers about 240 square kilometers of mainland and island habitat along the Columbia River in Clatsop and Columbia counties in Oregon, and Cowlitz, Wahkiakum,

and Clark counties in Washington (Smith 1985, USFWS 2015). Within that range, CWTD occupy an area roughly 6,475 ha (USFWS 2013a). The habitat for the Columbia River Population is fragmented and exists as a meta-population made up of subpopulations separated by artificial (e.g., roads) and natural features (e.g., river channels; USFWS 2014). The largest of these is on Puget Island near Cathlamet, Washington. Other occupied sites occur along the Columbia River in Washington and Oregon from Ridgefield NWR near Ridgefield, Washington downstream to Brownsmead, which lies just south of Lewis and Clark NWR in Oregon (Table 1; Fig. 2). Despite over 40 years of protection, range expansion for this population has only occurred by translocation (Meyers 2012a) because suitable non-occupied habitat is mostly unavailable adjacent to occupied habitat (LCFRB 2004).

Table 1. Major sites occupied by Columbian White-tailed Deer along the Columbia River[1].

Site name	Estimated area in hectares	Estimated percent in public ownership
JBH Mainland Unit	809	100%
Tenasillahe Island	830	100%
Westport/Wallace	2,650	≈10%[2]
Puget Island	2,310	≈5%[2]
Upper Estuary Islands[3]	591	≈70%[2]
Ridgefield NWR	3,648[4]	100%

NATURAL HISTORY

Habitat requirements

Columbian White-tailed Deer are believed to historically prefer upland prairie edge/woodland habitat types below the Douglas-fir (*Pseudotsuga menziesii*) zone (Bailey 1936, Douglas 1829, USFWS 2013a, USFWS 2015). Much of the upland habitat they once preferred has been lost to past (e.g., secession of Native American prairie-oak burning practices) and modern day (e.g., agriculture, urbanization) land use activities (Smith 1981, Vesely and Rosenburg 2010, Hamman et al. 2011). This resulted in a deer population that now is relegated to fragmented and suboptimal pockets of lowland and floodplain habitat, which is much wetter and flood-prone than what they once historically used (Ricca 2000, Whitney 2001, Ricca et al. 2003, USFWS 2013a).

Columbian White-tailed Deer have been able to adapt to lower elevation floodplains with the loss of much of their historical habitat. The types of habitats they now use often are driven by habitat availability (USFWS 1983, 2010), though they do exhibit an affinity for certain habitat characteristics such as an open understory, deciduous forested canopy, and close proximity to streams (Ricca et al. 2003, Brookshier 2004, Smith and Coblentz 2010, Whitney et al. 2011). They also exhibit a preference for open habitats like savanna, park-like forest, and open grasslands (Whitney et al. 2011, USFWS 2013a). Although CWTD use a variety of floodplain forested habitat, they generally will avoid conifer forest (Ricca et al. 2003) as well as forests with dense understory vegetation (Whitney et al. 2011). Of the habitat that still remains, CWTD seem to prefer a mosaic of small deciduous or mixed deciduous forested stands, short grass fields, and tidal marsh (USFWS 2010, 2014).

[1] Sites not included in this table contain only residual populations of Columbian White-tailed Deer.

[2] Estimated from plat maps obtained from interactive mapping tools supplied online by local county assessor's offices.

[3] Lord, Walker, Fisher, Hump, and Crims islands

[4] Ridgefield NWR comprised of 2,111 ha of marshes, grasslands, and woodlands and about 1,537 ha of upland terrestrial habitat (USFWS 2015).

Also important are adequate amounts of fawning habitat. Julia Butler Hansen (JBH) refuge biologists have observed fawns in the Mainland Refuge using areas of tall grass as well as mixed deciduous and Sitka Spruce (*Picea sitchensis*) forest (USFWS 1983, Brookshier 2004). Fawns in the Roseberg Population also favored habitat with dense understory vegetation for concealment and tend to be within 200 m of streams where livestock is absent (Ricca et al. 2003, Smith and Coblentz 2010).

An important element of deer habitat is thermal and security cover (Peek et al. 1982). Although deer prefer forest cover, they will use the new growth of tall forbs as cover in spring and summer (Suring and Vohs 1979). As they use both browse and forage, they thrive where moderate cover, shrubs, and meadows are present (Suring and Vohs 1979, USFWS 2014). This mixture of browse and cover makes riparian areas suitable CWTD habitat (Suring and Vohs 1979, USFWS 2014).

Diet and foraging

White-tailed Deer are a generalist species and opportunistic herbivore that browse, but also graze on forbs, grasses, nuts, fruits, and fungi (USFWS 2010). A two-year nutritional study on the JBH Mainland Unit showed a considerable preference for grazing on grasses, sedges, and forbs over that of browse (USFWS 2010). However, on nearby Tenasillahe Island and off-refuge near Westport, Oregon, browse was more a prevalent food source (USFWS 2010). Differences seen from site-to-site are likely a function of available sources of food and less that of their actual food preference (USFWS 2010).

Columbian White-tailed Deer also show seasonal dietary variation (USFWS 2010, Whitney et al. 2011). The Roseburg Population preferred forbs in fall, winter, and especially spring, while grass consumption was high in the fall and particularly high in the winter and shrub consumption was highest in summer (Whitney et al. 2011). An intensive diet and nutrition study in and around the JBH Refuge found the greatest use of grasses in winter, while forbs characterized the spring and summer diet (USFWS 2010).

Greatly different seasonal CWTD dietary patterns were observed in an earlier study on the Mainland JBH Unit where browse consumption peaked in the fall and winter, while grass consumption was highest in spring and forbs in the summer (Dublin 1980). Gavin (1979) found in another study deer on the JBH Mainland Unit feeding mainly in grazed pastures in late-fall and winter. This likely reflected an avoidance of cattle as few deer fed within 30 meters of cattle (Suring and Vohs 1979) and cattle were removed from the refuge by late October. In general, the high variation in diet and nutrition, both geographically and seasonally, indicate that this species is selecting food items on the basis of availability and less as a result of their actual food preferences.

Home Range and Movements

Columbian White-tailed Deer are not migratory and restrict their dispersal and movements to relatively small home ranges (Gavin et al. 1984, LCFRB 2004). Gavin et al. (1984) and Ricca (2000) characterized them as remarkably sedentary animals with no apparent tendency to disperse. Estimated distances traveled by CWTD between successive locations in the Roseburg population averaged 1.3 km and never exceeded 3.8 km (Ricca 2000). For the Columbia River population, Gavin et al. (1984) reported yearlings moving further than other age classes and males moving further than females, which is consistent with male-biased dispersal in mammals (Greenwood 1980).

Home range sizes for CWTD are generally at the low end of the spectrum for temperate white-tailed deer in the northern hemisphere (Sparrowe and Springer 1970, Lesage 2000, Grovenburg et al. 2009). As with most other white-tailed deer subspecies (Smith 1991), bucks generally occupy home ranges that are larger than does (Suring 1974, Gavin et al. 1984, Ricca 2000). Mean lifetime home range on the Mainland JBH Unit was estimated at 192 ha for male deer (N=20) and 159 ha for females (N=32; Gavin et al. 1984). In southwestern Oregon, Smith (1981) reported an average home range of 47 ha for bucks and 45 ha for

does. A later study in the same region reported an average home range of 117 ha and 41 ha for bucks and does, respectively (Ricca 2000). On the Mainland JBH Unit, Suring (1974) estimated an average home range of 92 ha for bucks (N=3) and 39 ha for does (N=7).

Fawns are generally the most sedentary age class and have the smallest home ranges (Gavin et al. 1984, Ricca 2000, Ricca et al. 2003). When broken down by age class, mean home range on the Mainland JBH Unit was smallest for male fawns (65 ha; N=7), while largest for adult males (209 ha; N=7; Gavin et al. 1984). Suring (1974) found that yearlings on the JBH Mainland Unit were occupying some of the largest home ranges of any age class.

Given its present-day association with riparian habitat, the home ranges of CWTD are greatly influenced by river corridors, and therefore take on a linear shape (Smith 1981, Gavin et al. 1984, Smith and Colentz 2010). The shape of home ranges is also strongly influenced by other permanent features such as roadways (Gavin et al. 1984).

Reproduction

Breeding season takes place from mid-September until late-February (USFWS 2015). The rut for deer on Mainland JBH begins the first week of November and reaches its peak by about the second week of November (USFWS 1983). By the end of November, male reproductive behavior noticeably decreases, although some males are capable of breeding as late as March. Observations of deer on the Mainland refuge indicate peak fawning the second week of June. This correlates well with the observed rutting period, and corroborates a gestation period of about seven months (USFWS 1983). Fawns remain with their mother until just before the next fawning season when does depart to give birth to the next generation (USFWS 2013b).

Adult female CWTD give birth to a mean of two fawns per year (USFWS 2010). Does on Mainland JBH usually participate in the rut as yearlings and give birth for the first time as two-year-olds (Gavin 1979). Gavin (1979) found 70% of two-year-old does and 100% of does older than three pregnant. While not studied in CWTD, male white-tailed deer generally are also reproductively capable as yearlings (Miller et al. 2003, DeYoung and Miller 2011). Thus, the reproductive potential of CWTD seems similar to their counterparts in the remainder of North America.

Although the reproductive potential of this subspecies is high, the actual recruitment of the Columbia River Population is variable (USFWS 2010). This is mostly because fawn survival fluctuates dramatically from year to year and from site to site (Meyers 2012b). Fawn to doe ratios are the primary index for measuring fawn recruitment into the reproductive population as well as overall productivity (Meyers 2012b). The Service's goal has been to maintain ratios at or above 37 fawns per 100 does when deer are below population objectives, and 20 fawns per 100 does when deer numbers exceed population objectives by 25% (USFWS 2010).

While one survey on the JBH Mainland and Tenasillahe Island showed an annual adult survival generally comparable to that of white-tailed deer in other regions (Phillips 2009), fawn to doe ratios have widely varied and observed ratios were considerably lower than what has been observed for white-tailed deer in eastern Washington (USFWS 2010, WDFW 2014). Between 1996 and 2011 the number of fawns per 100 does have ranged from just under 3 to 60 on JBH Mainland and from 0 to 50 on Tenasillahe Island (Table 2; Meyers 2012b). The average number of fawns per 100 does on the Mainland and Tenasillahe Island units during 1986-2006 was 25 and 34, respectively (USFWS 2010). While in more recent years average fawn to doe ratios for all four sites (Mainland JBH, Tenasillahe Island, Puget Island, and Westport) have generally been above 37:100 (USFWS 2013a), the most volatile measurements have been observed in the Refuge's Mainland and Tenasillahe Island units (Table 2; USFWS 2013a).

Table 2. Number of fawns/100 does on key sites occupied by CWTD (Meyers 2012b) as determined through annual ground-based deer counts carried out along set routes (P. Meyers, pers. comm.).

	Mainland JBH Unit	Tenasillahe Island	Puget Island	Westport
1996	15.7	35.0	27.3	45.0
1997	60.6	38.5	38.7	15.8
1998	42.7	12.4	45.4	29.8
1999	15.3	10.0	45.1	10.6
2000	33.6	7.9	70.0	23.1
2001	48.8	18.0	48.8	39.5
2002	25.0	0.0	39.8	29.0
2003	21.4	0.0	26.7	23.5
2004	11.5	30.0	35.9	33.3
2005	3.7	23.5	22.1	13.9
2006	23.3	39.1	22.1	17.5
2007	2.9	50.0	36.3	36.6
2008	29.6	39.3	45.0	38.9
2009	25.9	46.2	45.0	51.2
2010	60.5	37.5	42.5	82.8
2011	35.0	40.0	25.5	35.1

Survival

White-tailed deer can live up to 20 years, though they usually do not live much longer than five years (Cypher and Cypher 1988). Deer older than ten are fairly rare in harvested populations (Cypher and Cypher 1988, Craven and Hygnstrom 1994). One Service study showed a median age at death for CWTD of roughly three years for bucks and five years for does (Gavin 1984). More recent data from CWTD translocated in 2013 and 2014 revealed a median age at death of five years for bucks and nine years for does (USFWS 2015).

While the annual rate of survival of adult CWTD is relatively stable, fawn survival is generally poor and has fluctuated considerably from year to year and site to site (Table 2; Meyers 2012b). This variability is closely tied to predation as well as to environmental conditions. Since JBH Refuge was first established, survival rates for neonatal deer and fawns have been low (USFWS 2010).

Although a number of factors influence fawn survival, coyote (*Canis latrans*) predation is by far the greatest impact depressing fawn recruitment (Smith 1991, Clark et al. 2010, USFWS 2010). The largest fawn survival study carried out so far concluded that only about 20% of 131 radio-collared fawns on the JBH Refuge survived throughout the fawning period (USFWS 2010). Predation by coyotes was the primary cause of mortality (69% of deaths) followed by disease and starvation (16%). Many fawns that died of unknown causes in this study also are believed to have been predated on by Coyotes (USFWS 2010).

The ratio of fawns to does was used to measure the influence of Coyote removal on fawn survival on the JBH Refuge (USFWS 2010, 2013a). Nine Coyotes were removed in 1997 from the Mainland Refuge (USFWS 2010). While fawn to doe ratios the year prior to removing Coyotes was only 15:100, the ratio increased to 61:100 the next year. On nearby Tenasillahe Island, fawn to doe ratio prior to Coyote control averaged only 6:100 from 2001 to 2003. After 31 coyotes were removed the ratio increased to a mean of 37:100 (USFWS 2013a). Survival rates at the end of fawning season for all mortality factors were 0.11, 0.23, and 0.53 for recent years without Coyote control, past years without Coyote control, and recent years with Coyote control, respectively (USFWS 2010). Although these results show a possible positive

response in fawn survival where Coyote removal took place, a statistical correlation has never been reached because of a lack of resources to carry out more intensive Coyote surveys (P. Meyers, pers. comm.).

The primary diseases inflicting the Columbia River population are Necrobacillosis and hair loss syndrome (Gavin 1979, Creekmore and Glaser 1999). Based on necropsied deer on the JBH Refuge, a handful of deaths were attributed to Necrobacillosis (Gavin et al 1984), while no documented mortality has been attributed to hair loss syndrome (USFWS 2010). Neither Necrobacillosis nor hair loss syndrome seems to limit population growth (USFWS 2010). Columbian White-tailed Deer are susceptible to all of the deadly and contagious hemorrhagic diseases (AHD, EHD, bluetongue), though these diseases have not yet been detected in the Columbia River CWTD population. However, Oregon Department of Fish and Wildlife veterinarians identified AHD and EHD in the Roseburg deer population in 2014 (J. Burco, pers. comm.). This outbreak led to significant mortalities in that population during the summer of that year (J. Burco, pers. comm.).

Annual mortality rates are generally low for adults in the Columbia River population. Periodic episodes of catastrophic flooding have caused large losses of Columbia River adults and fawns (USFWS 2013a). Although populations returned to prior levels within a few years after recent large floods (USFWS 2013a), the severity of these large die-offs is likely a limiting factor and is of concern to the recovery of the Columbia River population. Other direct causes of adult mortality include malnutrition and disease, vehicle collisions, and poaching (Smith 1981, Gavin et al. 1984, Ricca et al. 2002), while to a lesser extent, deaths from predation and fence entanglement (Smith 1981).

POPULATION AND HABITAT STATUS

Historical and zooarchaeological records suggest CWTD once were abundant in their historic range (Bailey 1936, Lyman 2006, USFWS 2010). Abundant populations persisted until the mid-19th Century when habitat modification and overhunting caused populations to decline (Lyman 2006). By the early 1900s, CWTD were nearly extirpated range wide (Bailey 1936, Jewett 1914), primarily because of habitat loss and degradation (Gavin et al. 1984, Brookshier 2004). By the time the Service listed CWTD as Endangered, the population along lower Columbia River was estimated at only 300 to 400 deer (USFWS 1983). After designating Columbia River CWTD as Endangered, the Service issued a recovery plan and set recovery goals (USFWS 1983). The Service set a population goal of at least 400 deer maintained in at least three viable[1] subpopulations, two of which must be on secure[2] habitat as a requirement for downlisting to Threatened. The Service considers a subpopulation viable when at least 50 deer are maintained. A population of 400 deer must be maintained in at least three viable and secure subpopulations to delist Columbia River CWTD (USFWS 1983).

[1] A population whose probability of extinction is relatively low as determined from annual estimates of population size, and whose population is large enough to minimize effects of inbreeding.

[2] Habitat is secure only if it is free of adverse human activities in the foreseeable future and is relatively safe from natural phenomena that would destroy its value to Columbian White-tailed Deer. The Service originally interpreted secure habitat as having a designated protected status (USFWS 1983). They later broadened their interpretation "to include locations that, regardless of ownership status, have supported viable subpopulations for 20 or more years and have no anticipated change to land management in the near future that would make the habitat less suitable" (USFWS 2013a).

The Columbia River Population is unique in that it is typified by discreet subpopulations that vary annually from each other in population trends and fawn survival (P. Meyers, pers. comm.). Since first listed as Federally Endangered, the overall population has varied considerably. According to the Service's population estimates, deer numbers increased after they became ESA-listed up until the late 1980s. Then the Service's estimates showed a gradual decline up until 2006 when numbers began again to increase (Figure 3). Low fawn recruitment is implicated in overall low population numbers (USFWS 2014). Marginal habitat quality along the lower Columbia River may also explain why population trends have generally not shown a noticeable increase from estimates taken the first few years after the revised recovery plan was issued. The total estimated population has ranged from a high of over 900 deer in 2015 to a low of 350 in 1983 (USFWS 2010). While distribution has expanded, the core area where deer persisted in the 1970s (JBH Mainland, Tenasillahe Island, Puget Island, and Westport) still supports the bulk of the population (Table 3; USFWS 2015).

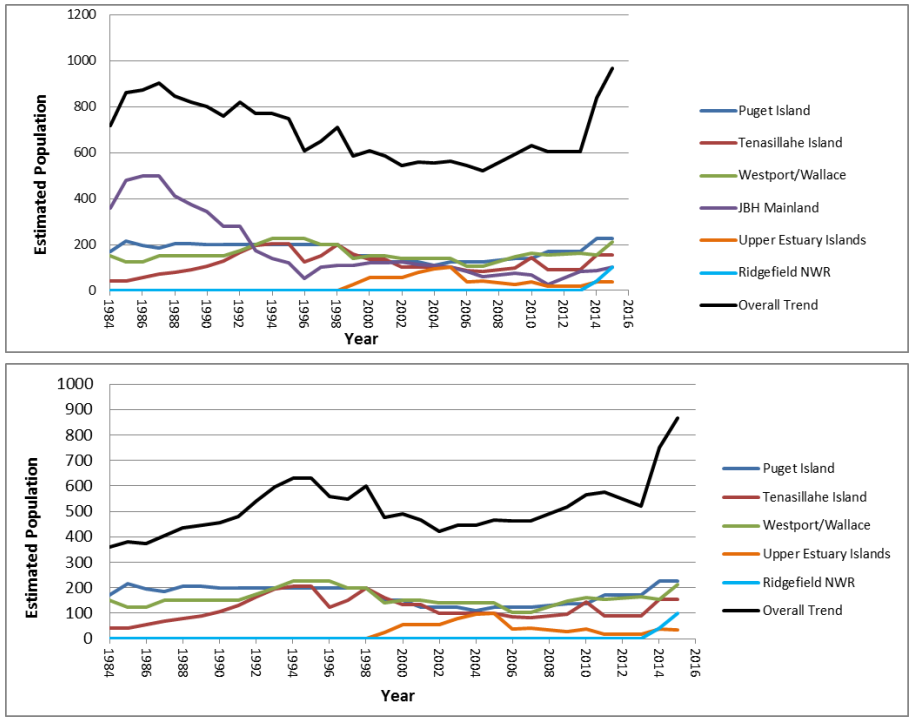

Figure 3. Top graph shows CWTD population estimates for key occupied sites and overall Columbia River population trends at these key sites. The bottom graph is the same as the top graph excluding the JBH Mainland unit.

Table 3.Yearly CWTD population estimates for key sites estimated from a combination of FLIR and ground-based counts, along with annual Lower Columbia River total population estimates, (USFWS 2015) and the yearly number of deer translocated to (+) or from (-) each site. Unless otherwise indicated estimates in this table come from USFWS (2015). Cells are blank for occupied sites when a population estimate was not calculated for that year.

Year	Puget Island	Translocated	Tenasillahe Island	Translocated	Westport Wallace	Translocated	JBH Mainland	Translocated	Upper Estuary Islands [1]	Translocated	Ridgefield NWR	Translocated	Total pop.
1984	170		40		150		360		0		0		720
1985	215				125		480		0		0		860
1986	195	-21 [4]	55	+21 [4]			500		0		0		875
1987	185	-20 [4]	70	+20 [4]	150		500		0		0		905
1988	205	-22 [4]	80	+22 [4]			410		0		0		845
1989			90				375		0		0		820
1990	200		105				345		0		0		800
1991			130				280		0		0		760
1992			165		175		280		0		0		820
1993			195		200		175		0		0		770
1994			205		225		140		0		0		770
1995							120		0		0		750
1996			125				51		0		0		610
1997			150		200		100		0		0		650
1998			200				110		0		0		710
1999	150	-18 [2]	160		140	-12 [2]			25	+30 [4]	0		585
2000			135		150	-31 [4, 5]	120		55	+31 [4]	0		610
2001	125										0		585
2002			100		140		125				0		545
2003		-12 [4]				-16 [4]	115		80	+28 [4]	0		560
2004	110	-11 [3]				-8 [3]	110		95	+19 [4]	0		555
2005	125						100		100		0		565
2006		-10 [4, 5]	86		104	-14 [4, 5]	81	+5 [4]	37 [7]	+24 [4]	0		543
2007			82				59		41		0		522
2009	138		97	-20 [6]	146		74	+20 [6]	28		0		593
2010			143		163 [7]	-15 [9]	68	+8 [4, 8]	39		0		632 [7]
2011	171		90		154 [7]		83		28 [7]		0		603
2013		-12 [9]						-37 [10]				+37 [10]	
2014	227	-11 [11]	154		154	-10 [11]	88		39		40 [7]	+21 [10]	840 [7]
2015 [12]	228		155		212		100		36		100		966

[1] Lord, Walker, Fisher, Hump, and Crims islands

[2] Figure acquired from Page 3 in USFWS 2000

[3] Figure acquired from Page 3 in USFWS 2005

[4] Figure acquired from page 21, Table 5 in USFWS 2013a

[5] Assumes translocations to Estuary Islands in Oregon originated from Westport, while translocations to Estuary Islands in Washington are from Puget Island based on statement saying that "only deer from Oregon (Westport) were moved to Lord and Walker Islands, per agreement with Ron Anglin, Wildlife Division Administrator" (see Page 2 in USFWS 2005).

[6] Figure acquired from Page 4-39 (see footnote in Table 4-7) in USFWS 2010

[7] P. Meyers, pers. comm.

[8] Deer sourced from Roseburg, Oregon (see Page 21 in USFWS 2013a)

[9] Deer translocated from Westport to Cottonwood Island in 2009 (See Page 1 in Cowlitz Tribe of Indians 2010). Additional deer translocated from Puget Island to Cottonwood Island in 2013 (See Page 22 in USFWS 2013a).

[10] Figure acquired from Page 60856-60857 in USFWS 2015

[11] See statements on Page 60857 of USFWS 2015 saying "Eleven deer were removed from the area (Puget Island) for the 2014 translocation to Ridgefield" and that "10 deer were removed from the area (Wallace-Westport) for the 2014 translocation to Ridgefield"

[12] 2015 population estimates acquired from Paul Meyers at the JBH Refuge.

The overall population trend has primarily been influenced by shifts in the number of deer on the JBH Mainland site (Figure 3; USFWS 2013a). The JBH Mainland population experienced a dramatic increase in size after the Refuge was established, peaking at roughly 500 deer in 1986 and 1987 (Table 3; USFWS 1992). According to the Service, JBH at that time was believed to be well in excess of an estimated carrying capacity of 125 deer (USFWS 1992, 2013a). Its numbers then fell to a low of 59 in 2007 (USFWS 2013a). Consistent Coyote predation and significant flooding events in 1996, 2006, and 2009 have partly been implicated in that decline. Translocation efforts between 2006 and 2010 began to augment the declining number of deer on the JBH Mainland site, and in 2011 the unit supported an estimated 83 deer. After 37 deer were moved to Ridgefield NWR in 2014 in an emergency translocation, the estimated number of CWTD on JBH Mainland went down to 48 (Table 3). This emergency relocation came about after the Service found a dike in imminent risk of failure on JBH, which they deemed a threat to deer on the JBH Mainland Unit (USFWS 2013a). The Service estimates a population of about 100 deer currently occupying the JBH Mainland Unit.

Along with the Mainland JBH Unit, the Columbia River Population is composed of a number of other sites occupied by CWTD, a few of which originated as a result of ongoing translocation efforts (WDFW 2013). Although a sizable proportion of the Columbia River deer population occur on the JBH Refuge, the combined total number of deer from other sites makes up the bulk of the Columbia River population, with the largest number of CWTD currently occupying Puget Island (Table 3).

According to the Service's original interpretation of federal recovery plan criteria, the JBH Mainland Unit and Tenasillahe Island were the only sites that qualified as both secure and viable (USFWS 1983). Although more than 50 deer occupy secure lands on Ridgefield NWR, the translocation of these deer occurred just recently so it is still too soon to tell if this population can persist over a longer duration at this level. Two other sites meet the threshold of 50 CWTD that the Service set in the Federal Recovery Plan (USFWS and WDFW 2011) at Westport, Oregon, and Puget Island, Washington, but these occur predominately on privately owned lands.

Columbian White-tailed Deer Translocations

A large part of the recovery effort has concentrated on an ongoing program of translocating deer to augment existing populations and to establish new ones. Almost 80% of translocated deer have originated from either the Puget Island or Westport/Wallace sites (Table 3), as both have comparatively large deer populations (USFWS 2013a). Deer numbers on both these have quickly rebounded after removing deer for translocations (USFWS 2013a). Translocated deer have also come from Tenasillahe Island, JBH Mainland Unit, and the Roseburg Population.

Tenasillahe Island has been the most successful of all sites on the receiving end of deer to date (Table 3). Just prior to the first set of translocations to Tenasillahe Island, the population stood at an estimated 40 deer. After deer were translocated to the island for three consecutive years in the mid-1980s, this island's population has reliably maintained an estimated population of over 100 deer, reaching a peak population just over 200 deer in the mid-1990s (Table 3).

The other sites receiving translocated deer have achieved mixed results when compared the success that have come out of the Tenasillahe Island translocations. Although other translocations have significantly expanded the range of occupied habitat along the Lower Columbia River, many sites receiving translocated CWTD seem not to have seen the same success as Tenasillahe Island in terms of increasing their overall populations. This included a group of islands near Longview that the Service identified to establish a secure subpopulation through translocations. These islands are comprised of Fisher (225 ac), Hump (100 ac), Lord (500 ac), and Walker (109 ac) islands (hereafter referred to as the Upper Estuary Islands). Sixty-six deer have been translocated there from 2003 and 2006. Since then, the Upper Estuary Islands have

only supported 10 to 14 deer, with the most current population estimated at eleven deer as of 2015 (P. Meyers, pers. comm.). Sixty-six deer were translocated to nearby Crims Island from 1999 to 2006 (USFWS 2013a). This site has supported between eight and 33 deer since 2000, with an estimated population of 25 deer in 2015 (P. Meyers, pers. comm.). The Upper Estuary Islands along with nearby Crims Island have so far failed to maintain the Service's target population of 50 deer.

Although estimated populations on the Upper Estuary Islands and Crims Island have decreased since these translocations took place, the Service believes some of the originally translocated deer ended up moving onto nearby private lands. According the Service, deer that moved off these original release sites are now located primarily in Willow Grove, Dibblee Flats, and Clatskanie and that roughly 100 deer are estimated to occupy these three sites (P. Meyers, pers. comm.).

Just upstream of the Upper Estuary Islands the Cowlitz Tribe and the Service moved deer to Cottonwood Island, which is listed in the Recovery Plan as a potential relocation site (USFWS 1983, Cowlitz Tribe of Indians 2010). During this effort the Tribe translocated 15 deer in 2010 while the Service subsequently translocated 12 deer in 2013. The Service currently estimates a population of 10 to 20 deer in the areas in and surrounding Cottonwood Island (P. Meyers, pers. comm.).

Another area where major translocation efforts have occurred is on the JBH Mainland Unit. Here these translocations began in 2006 to augment a declining population of CWTD. Deer were relocated there from Puget Island in 2006 and then again from Tenasillahe Island in 2009 (Figure 3). A handful of deer were also brought up from the Roseburg Population in 2010 in an effort by the Service to enhance genetic diversity (P. Meyers, pers. comm.). However, the emergency translocation of deer off of the Mainland Unit has had the effect of temporarily reducing deer numbers at the JBH Mainland Unit (USFWS 2014).

Deer removed from the JBH Mainland Unit in 2014 were subsequently moved to Ridgefield NWR, the year after another translocation to Ridgefield NWR took place (Table 3). Some of these translocated deer subsequently dispersed to Sauvie Island in Oregon and to WDFW's Shillapoo Wildlife Area (P. Meyers, pers. comm.). There are now 49 radio-collared deer in the Ridgefield area, with an estimated total on Ridgefield NWR, Sauvie Island and Shillapoo Wildlife Area of 90 to 100 CWTD (P. Meyer, pers. comm.).

Columbian White-tailed Deer Habitat Status

Several CWTD populations occur on state or federal protected lands (Table 1), affording them opportunities for management and protection. Although mostly in private ownership and not specifically managed to conserve or protect CWTD, Wallace/Westport and Puget Island have long maintained relatively large and stable numbers of deer (Table 1), (USFWS 2013a). The stability of deer populations on these sites shows that a mosaic of ownerships and land protection levels may not necessarily be incompatible with persistent CWTD numbers. In fact, both Wallace/Westport and Puget Island have shown greater stability when comparing their population trends to that of the protected, though much more flood-prone, JBH Mainland Unit (USFWS 2015).

Puget Island has undergone land use changes such as the conversion of large farms to small hobby farms (USFWS 2015) as well as conversions of pastures to hybrid poplar plantations (S. Bergh, pers. comm.). The Westport site has had little habitat conversion as that site is owned by a single private landowner. In 2011 the Westport site was reverted to a trust, thus future ownership and management of this site is currently unknown (P. Meyers, pers. comm.). Wallace Island was acquired by the Service specifically for long-term CWTD conservation, though the Service considers the island too small (227 ha) to fully support a viable CWTD population (USFWS 2010).

The remaining occupied areas of habitat are on sites used by smaller populations of deer, some of which are residual and are seeing changes in land use. This includes Crims Island, which was thought to support 50 to 100 deer, though the Service currently estimates its population at only 25 deer (USFWS 2015). About 85% of Crims Island or roughly 280 ha is in public ownership.[1] At Willow Grove and Dibblee Point, persistent deer populations have established sites comprised of semi-rural, privately owned lands that are in close proximity to Longview, Washington and Rainier, Oregon. Both these sites seem likely to see a continued change from an agricultural to a suburban landscape, which could negatively impact these deer depending on the density of future development (USFWS 2013a). The Upper Estuary Island complex (Lord, Walker, Fisher, and Hump islands) is owned by a combination of public and private entities. Other residual CWTD populations occur on Clatskanie Flats, Brownsmead, Barlow Point, and Rainier, which are all primarily owned by the shipping ports or are in private ownership (USFWS 2015).

Just upstream of Willow Grove and Dibblee Point is Cottonwood Island, a site of roughly 384 ha that received deer from Puget Island. Owned by multiple private entities, this site, comprised largely of dredge material, also lies in close proximity to Longview, though no people live on the island and there is no current interest in commercial development (USFWS 2013c).

FACTORS AFFECTING COLUMBIAN WHITE-TAILED DEER IN WASHINGTON

Adequacy of Regulatory Mechanisms

Federal measures. The Columbian White-tailed Deer was part of the first group of species designated under ESA. From the onset of ESA, CWTD was granted Endangered Species status. In 1971, the Service established the Julia Butler Hansen National Wildlife Refuge for the Columbian White-tailed Deer, in Cathlamet, Washington to preserve and manage this species. The JBH Refuge has regularly worked to enhance and improve habitat and has also carried out a predator control program. To date the Service has protected 3,604 ha of habitat for CWTD along the lower Columbia River (USFWS 2015).

The Service released a recovery plan for CWTD in 1976, which they revised in 1983 (USFWS 2015). The revised plan addresses the Columbia River and Roseburg populations separately. The Service published a rule in 2003 recognizing a DPS in Douglas County, Oregon and another along the Columbia River. The Service published their 5-year status review in 2013, and has recently proposed that the Columbia River Population be downlisted to Threatened due to progresses in species status (USFWS 2015).

This recent proposal to downlist CWTD to threatened includes a proposal under Section 4(d) of ESA. The Service uses this section of ESA to establish special regulations for Threatened species or distinct population segments. If enacted, the rule will permit up to 5% of the Columbia River CWTD population to be lethally taken annually for the following activities combined: (1) Damage management of problem CWTD, (2) misidentification during black-tailed deer damage management, and (3) misidentification during black-tailed deer hunting. The proposed rule would provide incentive to States, Tribes, and private landowners to support the movement of CWTD across the landscape by alleviating concerns about unauthorized take of CWTD.

The Service has carried out a number of habitat improvement, translocation, and predator control activities to enhance deer numbers on occupied sites and to expand the range of the Columbia River population as a whole. However, no critical habitat was designated as part of the federal protection for the Columbia River Population (USFWS 2013b).

[1] Estimated from plat maps obtained from online GIS mapping tool supplied Columbia County, Oregon.

*State, county, and city measures***.** The Washington Fish and Wildlife Commission has authority to list species (RCW 77.12.020) and they listed CWTD as State Endangered in 1980 protecting them from direct take (WDFW 2013). All state listed species are also designated as priority species in WDFW's List of Priority Habitats and Species (PHS List; WDFW 2008). The PHS List is used by the agency as well as voluntarily by others to conserve PHS-listed species and habitats. As part of the PHS Program, WDFW published recommendations to provide science-driven guidance for activities that could negatively impact this species and its habitat (Brookshier 2004). The WDFW also enforces hunting regulations. Due to its State Endangered status, it is illegal to hunt, possess, or control CWTD in Washington[12].

There is no State Forest Practices Rule (FPR) in Washington for CWTD. The Washington Department of Natural Resources and WDFW do take a voluntary approach with forest land owners to manage and protect state-listed species. The Forest Practice Act (FPA) may afford some limited protection to CWTD habitat given this species close relationship with riparian habitat. The FPR regulates riparian harvest along Type S and F Waters. In western Washington, harvest is only permitted in the inner riparian management zone (≤75 feet of the ordinary high water mark) under some circumstances. These circumstances allow for harvest so long as a minimum amount of timber is retained. The intent is to protect riparian functions necessary to sustain instream processes (e.g., water temperature), though these protections may also provide some indirect benefit to CWTD.

Though the FPR do not specifically address CWTD, they do address endangered and threatened species under their ''Class IV-Special'' rules. If a landowner's forestry-related action would ''reasonably...be expected, directly or indirectly, to reduce appreciably the likelihood of the survival or recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species,'' the landowner is required to comply with the State Environmental Policy Act guidelines before performing the action.

Under the Growth Management Act, Washington jurisdictions must adopt critical areas ordinances (CAO; RCW 36.70A.060). "Critical areas" include fish and wildlife habitat conservation areas and frequently flooded areas, both of which have relevance to habitat used by CWTD. Development proposals impacting the habitat of a listed species are regulated by local CAOs. Thus such proposals can consequently be conditioned to avoid, minimize, or mitigate impacts. Counties and cities are required to include the best available science in developing their CAOs.

Both Cowlitz and Wahkaikum are required to designate and protect CWTD and riparian habitat in their CAOs. The riparian buffer zones intended to protect lands from development along the Columbia River cover an area 150 and 100 feet perpendicular of the river's ordinary high water mark in Cowlitz and Wahkaikum, respectively (Wahkaikum County 2000, Cowlitz County 2009). Although these buffers afford CWTD some protection, they fall far short of buffers recommended by WDFW to adequately conserve species that use riparian ecosystems (Knutson and Naef 1997). A number of activities are also exempt from Cowlitz and Wahkiakum county CAO protections, which may also limit how effective their regulations are at protecting CWTD. Cowlitz and Wahkiakum counties are scheduled to revise their critical areas ordinances by 2017 and 2018, respectively (Washington State Department of Commerce 2012).

[1] WDFW may authorize the removal or killing of wildlife that is destroying or injuring property, or when it is necessary for wildlife management or research (RCW 77.12.240).
[2] The 4(d) rule proposed by the Service may relax some of these restrictions.

Factors Limiting Columbian White-tailed Deer Recovery

Habitat Loss and Fragmentation. The loss of and limited access to high quality habitat is the greatest present day threat to CWTD recovery (USFWS 2013a). The effect that future habitat conversion could have on this species is compounded by historic habitat losses that have left this population with a paucity of suitable habitat.

The loss and degradation of riparian habitat is of particular concern, as this is the primary habitat that they currently occupy (USFWS 1983, Brookshier 2004). Limiting any further losses and degradation of floodplain riparian habitat within the restricted range of the Columbia River Population is vitally important to recovering this species, given that clearing or heavy grazing of riparian areas likely renders these areas less suitable (Suring and Vohs 1979, Smith and Coblentz 2010).

Urbanization has fragmented much of the former habitat that made up CWTD historical range (Figure 4). This further complicates recovery by inhibiting natural range expansion beyond areas currently occupied by the Columbia River Population.

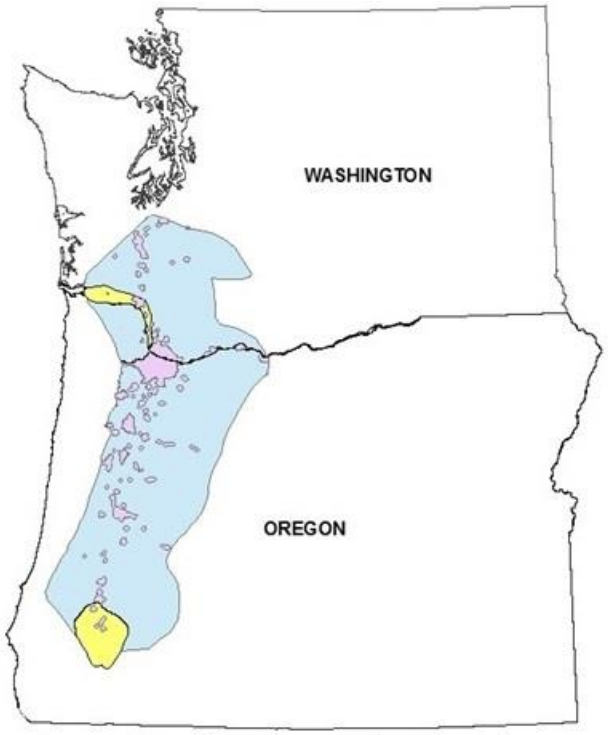

Figure 4. Cities and their Urban Growth Area boundaries shown in pink overlaid above the current (in yellow) and historic (in blue) range of the Columbian White-tailed Deer.

Small and Insular Populations. The estimated size of the Columbia River Population has risen since it was first listed as a federally and state endangered species, though there are still relatively few deer. In contrast, the Roseburg Population was estimated at more than 6,000 deer by the time the Service delisted it in 2003. This population's larger size as well as its recent recovery is likely a result of there being significantly more favorable habitat in Douglas County, Oregon (USFWS 2013a). This has made it possible for the Roseburg population to reach numbers that are more than six times greater than the Columbia River Population (USFWS 2003).

Because a relatively small number of deer make up the isolated Columbia River population, they are vulnerable to stochastic events such as flooding, disease, and inbreeding (Hopken et al. 2015). The Columbia River Population may be particularly vulnerable to inbreeding given it is made up of a chain of small subpopulations that are somewhat isolated from each other.

The insular nature of this population also makes it vulnerable to extirpation as well as to the other negative influences often attributed to isolated island populations (Simberloff and Wilson 1969). Though not all Lower Columbia River CWTD occur on actual islands, the deer population as a whole is isolated by the fact that much of the habitat surrounding it (at a watershed scale) is suboptimal. The habitat also is surrounded by a road network including high-use roads such as State Highway 4, U.S. Highway 30, and Interstate 5 that limits movement and contributes to mortality (Figure 5).

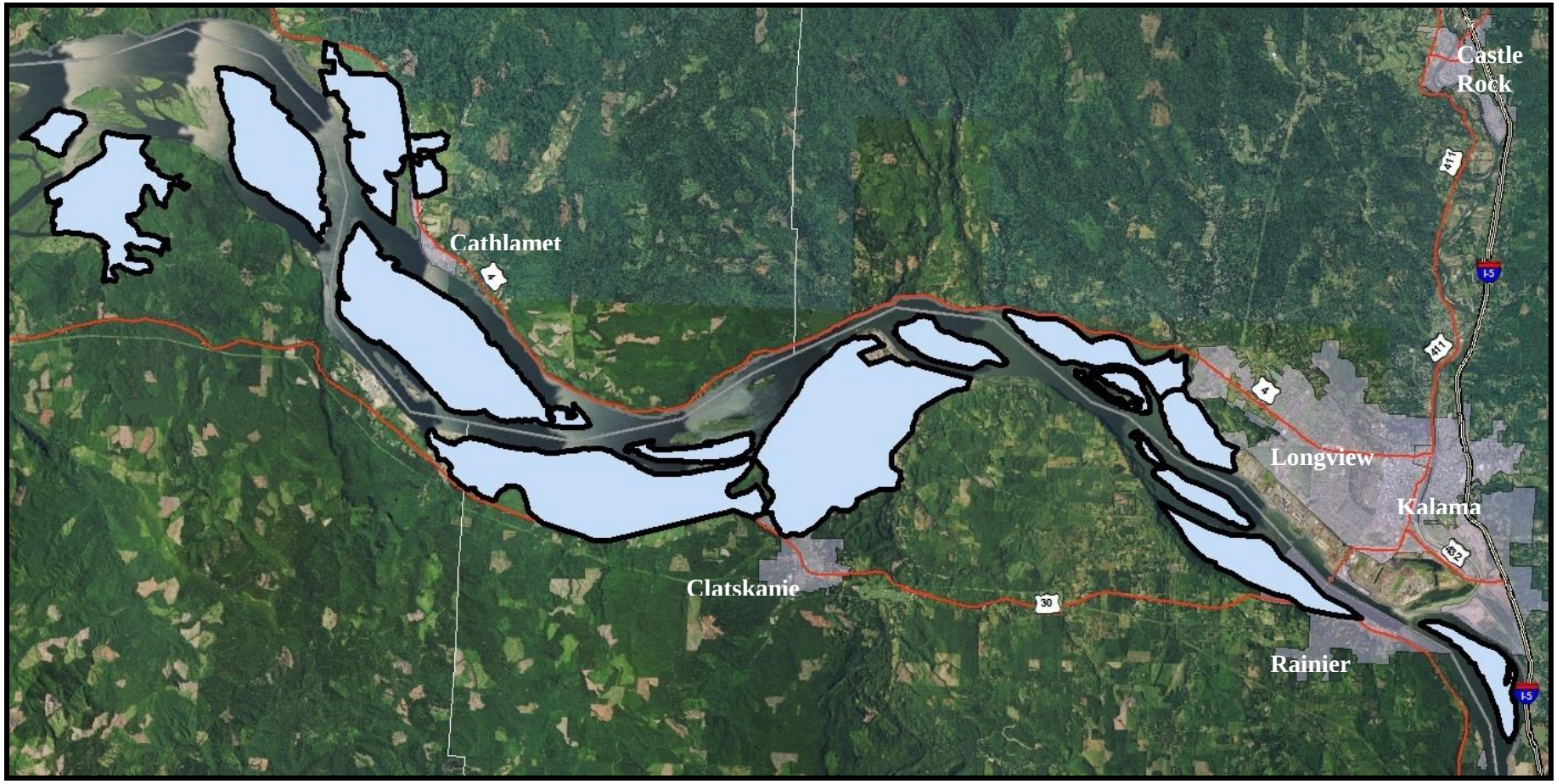

Figure 5. Sites occupied by Columbian White-tailed Deer (excluding Ridgefield NWR) outlined in black. The map shows the surrounding road network as well as urban growth area boundaries for cities in close proximity to the Columbia River population.

Although artificial barriers make interchange of CWTD across sites and dispersal extremely difficult, the presence of natural barriers are also an issue. With the loss of a majority of historical prairie-oak communities in favor of conifer forest (Vesely and Rosenburg 2010, Hamman et al. 2011), habitat surrounding occupied sites are now almost entirely made up of suboptimal habitat. Because pure conifer has replaced much of the former prairie-oak communities, the surrounding habitat is now unsuitable and serves in some ways as a barrier to this species (USFWS 2014). Wide river channels separating occupied sites also pose challenges to movement and gene flow among CWTD (USFWS 2014).

These factors have inhibited this population's ability to disperse and expand its range without active assistance by way of translocations (NPCC 2004), habitat enhancements, and land acquisitions. In the short-term, translocating deer can increase the number of occupied sites, which can in turn help the population become more resilient to stochastic events (e.g., die-offs from disease or flooding). But protection and restoration of habitat and increased habitat connectivity is needed in the long-run to create adequate linkages among occupied sites. This way the improved habitat conditions will help to better support more stable deer populations without as much need for costly and labor intensive human intervention. However, creating a self-sufficient population will be a great challenge given the amount of permanent infrastructure and the limited amount of available habitat.

Interspecies Relationships. Predation has long been implicated as a major factor limiting CWTD population growth and expansion (USFWS 1998, 2013a, 2014). Young fawns in particular are an extremely vulnerable to intense predation pressure, primarily by coyotes (USFWS 1998, Smith 1991). Thus, coyote predation is thought to be the most significant impact on fawn recruitment (USFWS 2013a). Coyote predation was implicated in the decline of the deer population on the JBH Mainland Unit (USFWS 2013a). Consistent predator control efforts have been taken on the JBH Refuge for years by the Service to increase fawn survival so they can reach maturity and enter the breeding population and will need to be continued while populations are low and isolated (USFWS 2010).

Competition for resources with other ungulates is a potential problem. A study in Douglas County, Oregon showed CWTD and Black-tailed Deer maintaining spatial segregation within interior valleys of the Umpqua River with at least one of the two species demonstrating interspecific avoidance (Smith 1987). The relative paucity of high quality habitat along the lower Columbia River may mean that the chances for direct interspecies competition along the lower Columbia River is higher than what was observed in Douglas County.

Hybridization of CWTD with Black-tailed Deer has also recently been identified as a potential threat to the population along the Lower Columbia River. Gavin and May (1988) found evidence of hybridization in six of 33 samples of CWTD on the JBH Mainland Unit and in surrounding areas. A subsequent study revealed evidence of hybridization on Tenasillahe Island (Piaggio and Hopken 2009). There thirty-two percent of deer tested and identified as CWTD (N=25) had genes of Black-tailed Deer.

Flooding and Altered Flood Regimes. Major flood events in the past couple decades have noticeably hindered the recovery of Columbia River Population. Significant flooding in 1996, 2006, and 2009 have been partially implicated in the decline of deer on the JBH Mainland Unit. The greatest loss of deer was recorded during a major flood in 1996, when roughly 50% of the deer on the JBH Mainland Unit was lost to mortality and emigration (USFWS 2013a). Though major floods have caused significant short-term population declines on affected sites, these populations have generally been able to recover to pre-flood levels a few years after the event (USFWS 2013a).

Much of the usable habitat in the Columbia River is below the high tide level and thus is protected by flood control structures. This poses a risk to CWTD and its habitat in the event of structural failure and catastrophic flooding. A portion of the levee protecting the JBH Mainland eroded away in 2011, leading to the loss or degradation of about 28 ha of occupied deer habitat (USFWS 2015). Other levees protecting Tenasillahe Island, Puget Island, Westport, and Ridgefield NWR were built during the same era and represent aging dikes that are subject to the same type of degradation (P. Meyers, pers. comm.). Given the expected increase in sea levels over time, the condition of these levees represents a potential threat to the Columbia River CWTD population.

Projections on the impact of climate change in the lower Columbia River show that the effects of changes to the flood regime could be significant. Climate change forecasts completed by the National Wildlife Federation show that sea levels could rise almost a foot by 2050 (Glick et al. 2007). This would almost certainly lead to severe recurring floods in tidally influenced parts of the Columbia River, which in time could undermine the integrity of dikes (USFWS 2010). There is significant risk to CWTD and an increased probability of habitat loss in low-lying riparian areas along the Columbia River in the face of sea level rise (USFWS 2015).

There has been interest in recent years in restoring natural tidal regimes in the lower Columbia River, mainly for fish habitat enhancement (USFWS 2015). This could also reduce deer habitat in areas where CWTD rely on lands reclaimed from tidal inundation by dikes and levees (USFWS 2010) and could significantly impact deer numbers.

MANAGEMENT ACTIVITIES

Habitat Protection. To date the Service has worked to conserve 3,604 ha of habitat specifically to protect CWTD (USFWS 2015). Although the Julia Butler Hansen NWR makes up the bulk of the lands set aside for CWTD, federal, state, and private partners have also protected other locations for CWTD. Other relatively large acquisitions include a 101 ha parcel adjacent to the JBH Mainland Unit as well as a 126 ha parcel near Longview that is managed by the Columbia Land Trust for deer habitat conservation and restoration (USFWS 2015). The Washington Department of Fish and Wildlife also owns and manages just over 50 ha of White Island and roughly 100 ha of Fisher Island for CWTD (WDFW 2006). Most of Cottonwood Island has been secured for the protection of CWTD through an agreement with the owners (a coalition of several ports and the U.S. Army Corps of Engineers; USFWS 2013a).

Monitoring. Monitoring is needed to assess progress toward state and federal recovery goals. It also helps measure the influences that conservation actions are having on CWTD. Ongoing monitoring has been used for years to assess how the effects of predator removal programs on fawn survival (USFWS 2010). Monitoring has also taken place to examine how well deer respond to habitat restoration (USFWS 2013a). The Service, WDFW, and the Cowlitz Tribe have also conducted ongoing population monitoring to evaluate progress of deer translocations (USFWS 2013a). Along with monitoring the rates of fawn survival, the Service has conducted an ongoing program of monitoring fawn to doe ratios through annual ground-based counts along fixed survey routes (USFWS 2010).

The Service in 1996 began using Forward-Looking Infrared (FLIR) thermography camera systems affixed to aircraft to conduct aerial deer surveys in the lower Columbia River in addition to annual fall ground counts (USFWS 2013a). Fall ground counts have been conducted since 1985 and have been used to provide more clarity in establishing long-term population trends by determining gross population changes. In years when FLIR surveys are not completed, ground counts have been used to see if there have been any unusual drops or increases in deer numbers (USFWS 2013a).

The Service in 2010 conducted a controlled validation trial of FLIR using ground-based surveyors in pre-arranged locations over the three habitat types normally found during surveys. The results showed the Service has been underestimating the deer population (P. Meyers, pers. comm.). When estimating the population, the Service has typically increased FLIR counts by 10% to adjust for undetected deer (USFWS 2013a). From this more recent trial the Service decided that this adjustment should actually be 25% in areas with higher overstory cover like forested and reed canary grass habitats (USFWS 2013a).

Predator Management. Studies on the JBH Refuge mainland have found that most fawn mortality is caused by coyote predation (USFWS 1998). Because of this the refuge for some time has implemented a program to control coyotes. The Service has said they will continue this practice on both JBH and Ridgefield NWRs to support deer populations (USFWS 2015). While predator control has shown some promise in terms of potential benefits to fawn survival, it is a short-terms fix that does not address the root causes that has led this species to become endangered, namely habitat loss and degradation.

The Service's attention to predator control has shown that, in the short term, predation can likely be managed through control measures (USFWS 2015). Predator control on both JBH Mainland Unit and Tenasillahe Island has in many cases been followed by increased fawn survival (USFWS 2013a). Due to the promise that predation control has shown at JBH, Ridgefield NWR began controlling coyotes in May 2013 to support this newly translocated CWTD population (USFWS 2013a).

Coyotes are a ubiquitous predator, though coyote monitoring and control does not occur in all occupied CWTD habitat (USFWS 2013a). On private lands off the refuge predator control sometimes occurs (USFWS 2015), but typically not for the benefit CWTD. Rather it is used mainly to reduce poultry and livestock depredation (USFWS 2015). Because the extent of coyote control is not as closely monitored on private versus refuge lands, less is known about the effects of predation on fawn survival on private property. While this may be less an issue on private or mixed private-public lands with stable population trends (e.g., Puget Island), resource managers should further examine the effects of predators on areas occupied by less stable populations.

Translocations. Habitat used by CWTD in the lower Columbia River region is highly fragmented. This has meant that deer occupying different sites are generally disconnected from one another. This fragmentation has made it nearly impossible for deer to naturally expand their range. Recovery has thus required moving deer from one location to another. This has been done to enhance the populations of sites already occupied by CWTD and to expand deer into unoccupied range. Though the translocation program has led to an expansion of the current occupied range of the CWTD along the Lower Columbia River, it has seen mixed result in achieving established and stable populations at translocation sites.

A total of 314 deer have been translocated as part of the recovery effort to date (USFWS 2015). The success of this translocation program is mixed. Deer moved to Cottonwood Island, Upper Estuary Islands, and Crims Island has had mixed results in terms of establishing populations on these islands (Table 3). Population estimates subsequent to these sites receiving deer show either a further decrease from the year prior to translocation or small increases followed by precipitous drops several years after deer were translocated (Table 3). Although low population estimates on these sites may in part be a result of FLIR undercounting, it is reasonable to assume that deer have not successfully established these specific sites. Although deer numbers on these receiving islands are low, the Service believes many of these translocated deer likely moved to adjacent mainland sites.

The one site that has shown consistent success using translocated deer so far is Tenasillahe Island. Here the Service has exceeded its recovery goal for the site through combining translocations, predator control, and habitat restoration (USFWS 2015). Prior to moving deer to the island its estimated population was 40

deer. The most current FLIR survey (in 2015) estimates a population of 155 deer (Table 3). Tenasillahe Island has consistently retained about 100 to 200 deer each year since translocations to the island ended in 1988 (USFWS 2015).

We cannot say exactly why translocated deer have done so well on Tenasillahe Island when compared to other sites where this practice has seen mixed results. One likely reason is that Tenasillahe Island is relatively large and protected (E. Holman, pers. comm.). It therefore can support more deer when compared to smaller sites that have received deer (e.g., Lower Estuary Islands, Cottonwood Island). Tenasillahe Island is also completely diked, and thus stays fairly dry except in the most extreme flood events (e.g., February 1996 Flood). This feature of the island has also likely helped secure Tenasillahe Island's deer numbers. A high proportion of Tenasillahe Island is also made up of relatively high quality habitat (e.g., pasture, deciduous riparian forest). The ratio of higher to lower quality habitat on other sites that have received deer is quite a bit lower. Other possible factors include that Tenasillahe Island is free of human disturbance and has a lack of elk to compete with CWTD (E. Holman, pers. comm.). These factors, which may have played a role in the success of the Tenasillahe Island program, along with factors that could lead to direct mortality (e.g., post-translocation vehicle strikes or handling mortality) are important considerations when planning any future translocations.

The most recent site to receive translocated deer is Ridgefield NWR. This site received 37 deer by translocation in 2013 and then another 21 CWTD in 2014 (Table 3). The Service's most current estimate shows a population of about 100 CWTD as of 2015. This recent estimate is promising, though it is too soon to tell if these numbers will persist over the long-run.

Habitat creation and restoration. Some CWTD habitat in Refuge ownership or secured through landowner agreements has been restored (USFWS 2013a). The Service's focus for restoring refuge habitat is to provide high quality browse, forage, and cover (USFWS 2013a). Over 140 ha of wetlands, pastures, and riparian forested habitat has been created on the JBH Mainland and Tenasillahe Island units to support CWTD since 1999 (USFWS 2010).

Most of this habitat restoration has occurred on the JBH Mainland Unit (USFWS 2013a). This has included roughly 120 ha restored to woodland cover as well as another 120 ha of pasture enhancements. These pasture enhancements have come about through active cattle grazing on a five to seven year rotation to reduce invasive reed canary grass and to keep pasture grasses young and high in protein, which has improved CWTD habitat quality (USFWS 2010, 2013a). In addition, about 8–16 ha per year are tilled and planted in pasture forbs and grasses with the aim of maintaining 80 ha of high-quality forage (P. Meyers, pers. comm.).

Beyond work to restore habitat on the Mainland Unit, the Service has also restored habitat on the Refuge's Tenasillahe Island Unit, and more recently at Ridgefield NWR. Similar to the work on the Mainland Unit (though on a smaller scale), Tenasillahe Island is actively managed to enhance and restore a mosaic of short-grass pasture, early successional riparian forest, and managed wetlands (USFWS 2010). A recent enhancement program at Ridgefield NWR is focused on plantings to increase browse and forage available to the recently translocated deer (USFWS 2015).

Though restoration on unprotected lands is limited (USFWS 2010), fields dominated by nonnative reed canary grass on Crims Island have undergone restoration. This has helped restore important tidal marsh and riparian forest (USFWS 2010). Although considerable effort has been expended to secure suitable deer habitat off Refuge, many of these areas still offer poor quality forage, which influences the condition and survival of local deer populations (USFWS 2013a).

Research. Research has focused on several areas relevant to the status and recovery of the Columbia River deer population. One major area of study has examined fawn survival and has used genetics research to determine how deer are influenced by hybridization with other deer species (Gavin and May 1988). Other genetic research has looked into distinguishing CWTD from other western White-tailed Deer subspecies (Hopken et al. 2015).

The results of relatively recent studies examining the genetics and morphology of CWTD have led to questions concerning their uniqueness when compared to the more common Northwest White-tailed Deer (*0. v. ochrourus*). One such study evaluated cranial variation of CWTD in the Roseburg and Columbia River populations with that of Northwest White-tailed Deer populations east of Cascades (Smith et al. 2003). They found that the cranium of the two CWTD populations differed from one another as much as they differed from the Northwest population. In a genetics study of these same three populations of white-tailed deer, Gavin and May (1988) found taxonomic ambiguities among the populations. Though Hopkins et al. (2015) reported some taxonomic ambiguities among the same three white-tailed deer populations, their study also revealed distinguishing genetic variation among each of the populations.

Other research that is planned includes a Population Habitat Viability Assessment (PHVA) that WDFW has obtained funding to carry out. The PHVA will provide an updated assessment of what a viable CWTD population looks like. The Service has acknowledged that this kind of assessment is a high priority short-term need to support recovery (USFWS 2013a). Using this powerful tool specifically designed to understand imperiled populations (Reed et al. 2002) the PHVA will help WDFW and the Service examine the appropriateness of current recovery goals.

Another research effort is being led by the Washington Department of Transportation (WSDOT). Along with a number of their partners, WSDOT is currently modelling the effects of roadways on habitat connectivity for the Columbia River deer population. The results of this study will help us understand where high use corridors exist. This ultimately could inform decisions for reducing collision-related mortality. It also could help identify effective ways to facilitate safe passage across the existing highways to enhance dispersal and to expand the range of this population.

The Service also recently began evaluating CWTD body condition on JBH lands (P. Meyers, pers. comm.). The results of this effort could help to guide management decisions concerning habitat and forage characteristics.

CONCLUSIONS AND RECOMMENDATIONS

Recent population estimates of the Columbia River Population of CWTD still closely resemble populations estimates seen throughout much of the 1980s (Table 3). Columbian White-tailed Deer numbers along the Lower Columbia River have generally fluctuated (low of 545 deer in 2002 to a high of 966 deer in 2015) but remain relatively low since the species was first listed as State Endangered. Collaborative efforts from the Service, WDFW, ODFW, Cowlitz Tribe, along with NGOs have done much to enhance habitat and halt the decline of the species.

Some actions have shown promise and have helped enhance this population. This includes the Service's ongoing predator removal program and habitat restoration efforts. The former program was taken on because coyotes proved a very efficient predator of fawns. Controlling coyotes has been shown to improve fawn survivorship and seems to have increased the chances that fawns become yearlings. This has positively impacted the population since yearlings that become recruited into the breeding population are then at much less risk of being killed by coyotes. Though predator control seems to have benefitted the population, it is a short-terms fix that does not address the root causes that have led this species to become endangered, namely habitat loss and degradation.

Translocations have also aimed to expand the population and expand the CWTD range. Translocations to Tenasillahe Island led to an increase in the population of that site. Though recent translocations onto Ridgefield NWR have shown promise, it is currently too early to determine if translocations there will be a long-term success. Translocations on the Upper Estuary Islands, Cottonwood Island, and the JBH Mainland Unit have not led to corresponding population increases, though some of these translocation efforts have increased the range occupied by CWTD along the Lower Columbia River.

One generally accepted theory as to why translocating deer has succeeded on Tenasillahe Island while other areas have seen only mixed results is that there is a lack of suitable habitat in the current occupied range of CWTD along the lower Columbia River. Places where successful populations exist generally are large in area, made up of higher quality habitat (e.g., deciduous forest), and are less flood-prone. That describes all of the sites with established and translocated deer that seem self-sustaining (i.e., Puget and Tenasillahe islands and Wallace/Westport). One or more of these features is essentially lacking on all translocation sites where CWTD populations have not taken as firm a hold.

The issues of fragmented habitat and small isolated populations are also still major factors inhibiting recovery. The population as a whole is hemmed within a limited range by both natural (e.g., lack of suitable habitat that is readily available) and artificial (e.g., highways) barriers. This makes it difficult for this population to expand beyond areas currently occupied CWTD. It has also inhibited interchange of deer among occupied sites. With these small isolated populations also comes the danger of local extinctions by threats such as flooding, disease, and land conversion. In general, these are issues that existed when CWTD was first listed as a State Endangered Species and are still issues to this day.

There is upcoming work that should help us better understand what needs to be done to achieve recovery and that will help to guide future management of this species. Two such activities are the PHVA initiated by WDFW as well as WSDOT's habitat connectivity work. While the former project will help us understand the characteristics of a viable population and likely will help WDFW and the Service examine the appropriateness of current recovery goals, the latter will help stakeholders identify ways to expand deer outside of their current occupied range through identifying areas of important habitat connectivity. In addition to these new initiatives, our knowledge of this species is greater than what it was when WDFW first designated CWTD a State Endangered Species. For example, we now know from experience with

deer on Puget Island that this species can coexist with some level of human disturbance. This is good for the species and is useful for us to understand given that little habitat remains in the lower Columbia that has not been disturbed by intensive human activities.

The Washington Department of Fish and Wildlife views the lack in a consistently positive population trend as indicating that the status of this population has shown little improvement. Problems associated with the quality and connectivity of currently occupied habitat is also of concern in terms of the influence these factors could have on this species future. These factors, in part, likely explain why management directed at CWTD has seen mixed results. Lastly, the population as a whole is still quite small and is thus still highly vulnerable to stochastic events that could potentially be catastrophic to such a small population. For these reasons the Washington Department of Fish and Wildlife recommends that CWTD remain a State Endangered species.

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WASHINGTON STATE STATUS REPORTS, PERIODIC STATUS REVIEWS, RECOVERY PLANS, AND CONSERVATION PLANS

Status Reports

2015 Tufted Puffin
2007 Bald Eagle
2005 Mazama Pocket Gopher, Streaked Horned Lark, and Taylor's Checkerspot
2005 Aleutian Canada Goose
2004 Killer Whale
2002 Peregrine Falcon
2000 Common Loon
1999 Northern Leopard Frog
1999 Olympic Mudminnow
1999 Mardon Skipper
1999 Lynx Update
1998 Fisher
1998 Margined Sculpin
1998 Pygmy Whitefish
1998 Sharp-tailed Grouse
1998 Sage-grouse
1997 Aleutian Canada Goose
1997 Gray Whale
1997 Olive Ridley Sea Turtle
1997 Oregon Spotted Frog
1993 Larch Mountain Salamander
1993 Lynx
1993 Marbled Murrelet
1993 Oregon Silverspot Butterfly
1993 Pygmy Rabbit
1993 Steller Sea Lion
1993 Western Gray Squirrel
1993 Western Pond Turtle

Periodic Status Reviews

2015 Steller Sea Lion
2015 Brown Pelican

Recovery Plans

2012 Columbian Sharp-tailed Grouse
2011 Gray Wolf
2011 Pygmy Rabbit: Addendum
2007 Western Gray Squirrel
2006 Fisher
2004 Sea Otter
2004 Greater Sage-Grouse
2003 Pygmy Rabbit: Addendum
2002 Sandhill Crane
2001 Pygmy Rabbit: Addendum
2001 Lynx
1999 Western Pond Turtle
1996 Ferruginous Hawk
1995 Pygmy Rabbit
1995 Upland Sandpiper
1995 Snowy Plover

Conservation Plans

2013 Bats

Status reports and plans are available on the WDFW website at:
http://wdfw.wa.gov/publications/search.php