

**Columbia Basin Distinct Population Segment of the Pygmy Rabbit
(*Brachylagus idahoensis*)**

**5-Year Review:
Summary and Evaluation**



**U.S. Fish and Wildlife Service
Washington Fish and Wildlife Office
Eastern Washington Field Office
Spokane, Washington**

September 29, 2010

5-YEAR REVIEW

Species reviewed: Columbia Basin Distinct Population Segment of the Pygmy Rabbit
(*Brachylagus idahoensis*)

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5-YEAR REVIEW
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1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office: Pacific Regional Office (Region 1), Portland, Oregon;
Jesse D’Elia, 503-231-2349

Lead Field Office: Eastern Washington Field Office, Spokane, Washington;
Chris Warren, 509-893-8020

Cooperating Field Office(s): N/A

Cooperating Regional Office(s): N/A

1.2 Methodology Used to Complete the Review: New information was gathered and reviewed, and draft documents were developed by staff at the U.S. Fish and Wildlife Service’s (Service) Eastern Washington Field Office. The main emphasis of this review was to reassess the status of the Columbia Basin pygmy rabbit and potential threats to the population in view of new information that has become available since the 2003 listing determination. This review also reassesses the original distinct population segment (DPS) analysis for the Columbia Basin pygmy rabbit (see section 2.1.4). The new information that forms the basis of this review is a combination of peer reviewed published literature; agency reports, monitoring data, and public databases; university theses; and meeting presentations, handout materials, and related notes of the Columbia Basin pygmy rabbit Science Advisory Group (SAG).

1.3 Background

1.3.1 FR Notice citation announcing initiation of this review: April 8, 2010. Endangered and Threatened Wildlife and Plants; 5-Year Status Reviews of 69 Species in Idaho, Washington, Hawaii, Guam, and the Commonwealth of the Northern Mariana Islands. 75 FR 17947.

1.3.2 Listing history

Emergency Listing

FR notice: 66 FR 59374

Date listed: November 30, 2001

Entity listed: Columbia Basin Distinct Population Segment of the Pygmy Rabbit (*Brachylagus idahoensis*)

Classification: Emergency Listing (Endangered)

Final Listing

FR notice: 68 FR 10388

Date listed: March 5, 2003

Entity listed: Columbia Basin Distinct Population Segment of the Pygmy Rabbit (*Brachylagus idahoensis*)

Classification: Endangered

1.3.3 Associated rulemakings: N/A

1.3.4 Review History: N/A

1.3.5 Species' Recovery Priority Number at start of this 5-year review: 3

1.3.6 Current Recovery Plan

Name of plan: August 2007 Draft Recovery Plan for the Columbia Basin Distinct Population Segment of the Pygmy Rabbit (*Brachylagus idahoensis*)

Date issued: September 7, 2007, Notice of Availability (72 FR 51461)

Dates of previous revisions, if applicable: N/A

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) Policy

2.1.1 Is the species under review a vertebrate?

Yes

No

2.1.2 Is the species under review listed as a DPS?

Yes

No

2.1.3 Was the DPS listed prior to 1996?

Yes

No

2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?

Yes

No

Summary of Distinct Population Segment Review

Pursuant to the 1996 DPS policy (61 FR 4722), three elements are considered in a decision

regarding the status of a possible DPS as endangered or threatened under the Endangered Species Act of 1973, as amended (Act), which are: (1) the discreteness of the population segment in relation to the remainder of the taxon to which it belongs; (2) the significance of the population segment to the taxon to which it belongs; and (3) the population segment's conservation status in relation to the Act's standards for listing. The following discussion provides an updated DPS assessment of the first two elements for the Columbia Basin pygmy rabbit in light of new information that has become available since the 2003 listing determination. An update concerning the population's conservation status is addressed in section 2.3, below.

Discreteness

A population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions: (1) it is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors (quantitative measures of genetic or morphologic discontinuity may provide evidence of this separation); or (2) it is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act.

Physical Factors – New fossil evidence supports the conclusions of previous studies that indicate the population of pygmy rabbits within the Columbia Basin became separated from the rest of the species' range at least 10,000 years ago (Lyman 2004, page 1). Currently, the recognized historic (i.e., roughly 200 years ago) distribution of the Columbia Basin population is separated by over 125 miles (200 kilometers) from the next closest historic pygmy rabbit population in central Oregon (Figure 1). Based on the above information, pygmy rabbits within the Columbia Basin are considered physically discrete from the remainder of the taxon.

Ecological Factors – The Columbia Basin represents an unusual ecological setting for the pygmy rabbit due to its different geographic, geologic, climatic, soil, and vegetation community components compared to the rest of the species' historic distribution (see Significance, below, for further discussion regarding ecological settings occupied by the species). However, because the Columbia Basin population is entirely physically discrete from the remainder of the species historic distribution, it is unclear whether ecological factors alone would result in marked separation of populations of this species.

Genetic Factors – Genetic analyses of both mitochondrial and nuclear DNA markers indicate that purebred Columbia Basin pygmy rabbits have markedly different genetic characteristics (e.g., mitochondrial haplotypes, nuclear allele frequencies) compared to other pygmy rabbit populations, and these differences represent an important component in the evolutionary legacy of the species. These genetic differences are similar in nature to subspecific differences recognized in other mammal species, although potential taxonomic reorganization of the pygmy rabbit would require additional study. Based on the above, the Columbia Basin pygmy rabbit is considered genetically discrete from the remainder of the taxon (see Significance, below, for further discussion regarding pygmy rabbit genetic characteristics).

Physiological, Behavioral, and Morphological Factors – Other than differences believed to be

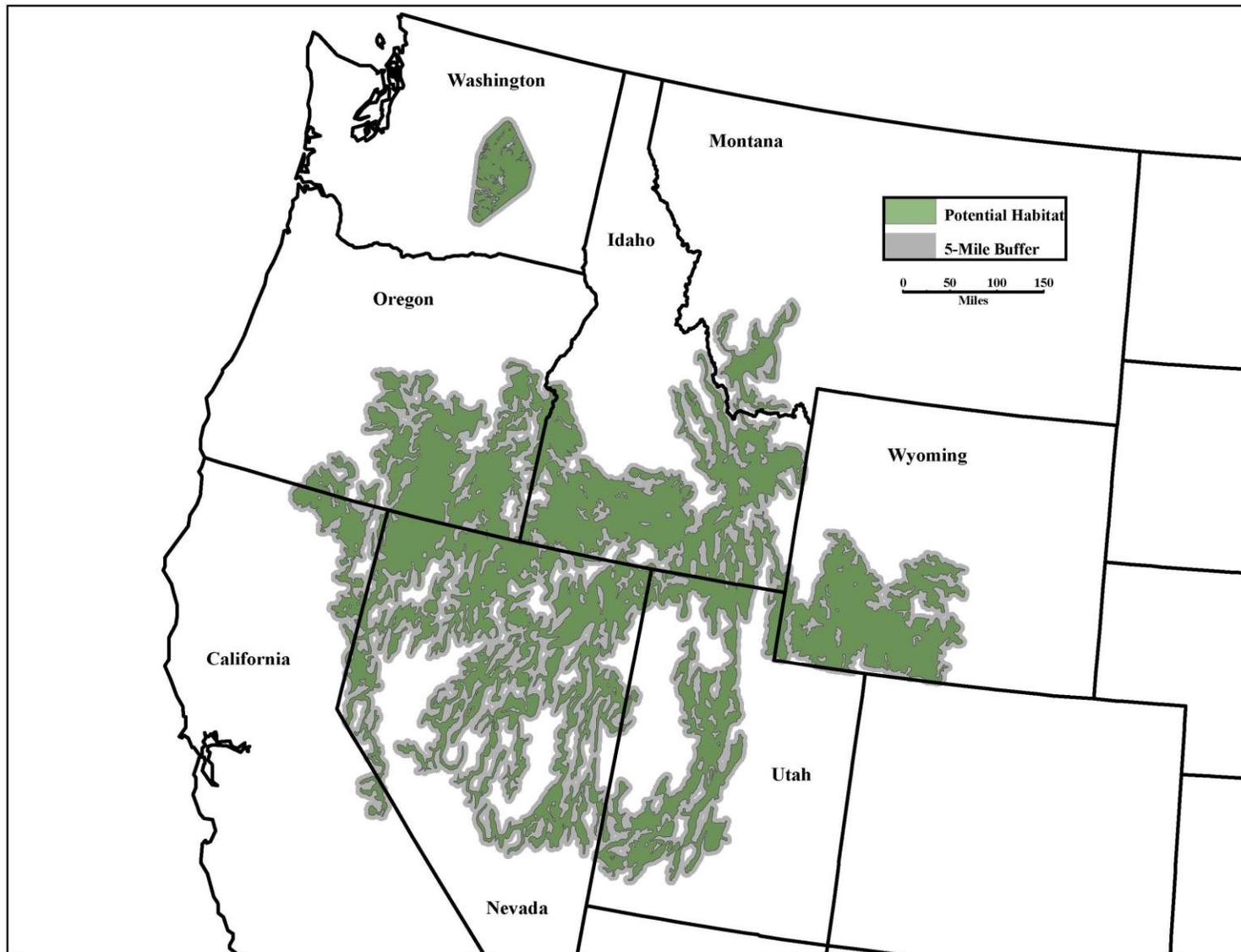


Figure 1. Approximate historic distribution of the pygmy rabbit based on available occurrence data and the distribution of potentially appropriate shrub steppe community types.

associated with inbreeding depression (see USFWS 2007, page 30), currently there are no known physiological, behavioral, or morphological differences between the Columbia Basin pygmy rabbit and other populations of the taxon.

International Boundary – The historic distribution of the pygmy rabbit occurs entirely within the conterminous United States, so the international boundary criterion is not addressed in this 5-year review.

Other New Information – The available new information indicates that the last known wild subpopulation of the Columbia Basin pygmy rabbit was extirpated by early 2004 (WDFW 2005, page 3). However, only about 7.6% (113,244 acres) of the potentially suitable shrub steppe habitat that remains within the Columbia Basin (1,480,489 acres) has been surveyed specifically for pygmy rabbit presence since 2001 (USFWS 2010a, page n/a). Therefore, other wild, but as yet unknown, pygmy rabbit subpopulations may still be present within the Columbia Basin (WDFW 2005, page 3; USFWS 2007, page 46). Consistent with our DPS assessment in 2003, any wild pygmy rabbits that may remain within the Columbia Basin would be considered physically and genetically discrete from the remainder of the taxon. In addition, the captive population of pygmy rabbits was bred specifically to retain, to the extent possible, the markedly different genetic characteristics of the purebred Columbia Basin population, and it continues to be genetically discrete from the remainder of the taxon (see Significance, below).

Significance

The types of information that may demonstrate the significance of a discrete population segment to the remainder of its taxon include, but are not limited to: (1) persistence of the population segment in an ecological setting unusual or unique for the taxon; (2) evidence that loss of the population segment would result in a significant gap in the range of the taxon; (3) evidence that the population segment represents the only surviving natural occurrence of the taxon that may be more abundant elsewhere as an introduced population outside its historic range; and (4) evidence that the population segment differs markedly from other population segments of the taxon in its genetic characteristics. The following significance factors have bearing on the Columbia Basin pygmy rabbit.

Unusual or Unique Ecological Setting – The assessment of ecological settings in the 2003 listing determination compared the Columbia Basin ecosystem to the next closest ecosystems within the species' estimated historic distribution in central and southern Oregon. In 2003, we concluded that the Columbia Basin represents an unusual ecological setting for the taxon due to its different geographic, geologic, climatic, soil, and vegetation community components compared to the species' historic distribution in Oregon. Since the final listing determination, geographic information system (GIS) data layers for vegetation community types throughout the western United States have been more fully developed. This new information now allows potential differences in ecological settings to be addressed in a more quantified manner, and consideration of other ecological settings throughout the species' entire estimated historic distribution. In the following assessment, we have used the composition of vegetation community types as a surrogate for describing ecological settings because the community types reflect the different geographic, geologic, climatic, and soil conditions of a particular region.

Using the available GIS data layers (LANDFIRE 2006, page n/a), we calculated total acreages for all shrub steppe community types potentially used by pygmy rabbits (i.e., those that include sagebrush taxa; n = 13), all other “natural” vegetation community types (e.g., deserts, forests, wetlands), and all vegetation community types that are now represented by significant anthropogenic influences (e.g., crops, industrial developments, urban centers). These totals were then compared between the Columbia Basin and the rest of the species’ historic distribution.

Of the 13 shrub steppe community types potentially used by pygmy rabbits, three of these community types account for over 38% of the potentially used area within the Columbia Basin, while these same three community types account for just over 1% of the potentially used area within the rest of the species’ historic distribution (Table 1). Conversely, 8 of the 13 shrub steppe community types account for less than 1% of the potentially used area within the Columbia Basin, while these same 8 community types account for over 32% of the potentially used area within the rest of the species’ historic distribution.

Table 1. Percent of potentially used area comprised of various shrub steppe community types within pygmy rabbit ecological settings.

Community Type	Columbia Basin	Rest of Distribution
Inter-Mountain Basins Big Sagebrush Shrubland	33	49
Inter-Mountain Basins Big Sagebrush Steppe	29	17
Great Basin Xeric Mixed Sagebrush Shrubland	0	10
Columbia Plateau Low Sagebrush Steppe	0	8
<i>Artemisia tridentata</i> ssp. <i>vaseyana</i> Shrubland Alliance	0	8
Inter-Mountain Basins Montane Sagebrush Steppe	0	4
Inter-Mountain Basins Semi-Desert Grassland	0	2
Columbia Plateau Steppe and Grassland	23	1
Colorado Plateau Mixed Low Sagebrush Shrubland	0	1
Wyoming Basins Dwarf Sagebrush Shrubland and Steppe	0	0
Columbia Basin Palouse Prairie	12	0
Columbia Plateau Scabland Shrubland	3	0
Northwestern Great Plains Mixedgrass Prairie	0	0

The shrub steppe community types represented in the above results indicate that the Columbia

Basin is generally defined by lower elevation big sagebrush (e.g., *A.t. ssp. tridentata*), grassland, and thin-soil habitats, while the rest of the species' historic distribution is generally defined by different sagebrush taxa that typically occur at higher elevations and/or areas of more xeric (e.g., desert) habitat conditions. Although direct evidence is not available, these differences in the composition of shrub steppe community types may influence the species' habitat use patterns, movements, and other life history attributes within the ecological settings. These results are consistent with our 2003 assessment and, based on the above, we affirm that the Columbia Basin represents an unusual ecological setting for the taxon.

Significant Gap in the Range – The Columbia Basin pygmy rabbit represents an isolated portion of the northern-most extent of the species' historic distribution. In 2003, we concluded that this population segment is likely experiencing different selective pressures due to varied habitats at the periphery of the taxon's historic distribution, and is exhibiting genetic consequences of long-term divergence and isolation from other pygmy rabbit population segments. Based on the available information in 2003, the final listing determination concluded that the loss of pygmy rabbits from the Columbia Basin would represent a significant gap in the range of the taxon, due to the loss of a conspicuous peripheral and isolated extension of its current and historic distribution.

Updated GIS data layers (LANDFIRE 2006, page n/a) and new information concerning past and contemporary range wide occurrences of the pygmy rabbit (USFWS 2008, page n/a) have allowed for the refinement of the species' estimated historic distribution based on the distribution of potentially appropriate shrub steppe community types (Figure 1). This new information indicates that the loss of pygmy rabbits from the Columbia Basin would represent a contraction in the species' recognized historic northwestern distribution of over 250 miles (400 kilometers), or over 3.5 degrees of latitude to the south. Other than this improved spatial information, there is no additional new information that pertains to our assessment of a significant gap in the range of the taxon. Therefore, based on the above, we affirm that the loss of the pygmy rabbit from the Columbia Basin would represent a significant gap in the range of the taxon.

Markedly Different Genetic Characteristics – The 2003 listing determination concluded that the Columbia Basin pygmy rabbit had markedly different genetic characteristics compared to other pygmy rabbit population segments. These differences were consistent in both mitochondrial and nuclear DNA indices (e.g., haplotypes, allele frequencies), and between current and museum samples. These genetic results were also consistent with the fossil evidence, and suggested that the Columbia Basin pygmy rabbit began to diverge and became genetically isolated from the remainder of the taxon at least 10,000 years ago. The genetic differences identified between the Columbia Basin pygmy rabbit and other pygmy rabbit population segments were similar in nature to subspecific differences recognized in other mammal species. Based on these results, the main conclusion drawn in 2003 was that the unique genetic characteristics of pygmy rabbits that evolved within the Columbia Basin represent an important component in the evolutionary legacy of the species and, therefore, are a genetic resource worthy of conservation.

In addition to the above genetic differences, which likely result from long-term divergence and isolation, the final listing determination also concluded that the Columbia Basin pygmy rabbit exhibited significantly less genetic diversity historically compared to other pygmy rabbit

populations. Furthermore, based on contemporary versus museum samples, the level of genetic diversity in this population segment has declined significantly and at an accelerated rate since the mid-1900s. These results suggested a recent and rapid decline in the effective population size of the Columbia Basin pygmy rabbit (i.e., the number of individuals contributing to reproduction), and that this population segment may be experiencing a degree of inbreeding. Based on these results, the main conclusion drawn in 2003 was that efforts should be undertaken to address the low level of genetic diversity within this population segment.

Following the 2003 listing determination, it became apparent that the wild Columbia Basin pygmy rabbits that were used to found the captive breeding population were likely suffering from severe inbreeding depression, and that they had a significantly diminished reproductive potential that could not produce enough offspring for anticipated reintroduction efforts (WDFW 2003, page 8; WDFW 2005, page 4). Furthermore, it was subsequently determined that additional purebred animals were not available to augment the captive founders because the last known wild portion of the Columbia Basin population had become extirpated by early 2004 (WDFW 2005, page 11). Considering the above, it was determined that intercrossing the purebred captive animals with pygmy rabbits captured from populations outside of the Columbia Basin was necessary to try and conserve the markedly different genetic characteristics of the founding Columbia Basin animals and to ensure that sufficient genetic variability could be maintained in a recovered population (WDFW 2005, page 4; USFWS 2006a, page 3).

No purebred Columbia Basin pygmy rabbit kits have been produced in the captive breeding program since 2005, and the last purebred Columbia Basin pygmy rabbit in captivity died on August 18, 2008 (USFWS 2010b, page n/a). As of October 12, 2010, the captive population consisted of 111 intercrossed pygmy rabbits that averaged 65% Columbia Basin ancestry by pedigree (ranging from 42% to 88%), with 62 individuals representing at least 75% Columbia Basin ancestry. Modeling exercises using genetic and demographic parameters documented since intercrossing began determined that the existing captive breeding program could still not support anticipated reintroduction efforts (see section 2.3.1.2).

Many of the markedly different genetic characteristics of the founding Columbia Basin pygmy rabbits are still present within the intercrossed captive population (WDFW 2010, pages 10-11). However, considering the available new information and following a thorough review of past breeding efforts (SAG 2008, page n/a), it is currently unclear to what extent it may still be possible or prudent to conserve the remaining genetic characteristics of the founding purebred Columbia Basin animals in a recovered population (see section 2.3.1.3).

Conclusion

The 2003 listing determination concluded that the population of pygmy rabbits within the Columbia Basin had been physically and genetically discrete from the remainder of the taxon for at least 10,000 years. The available new information indicates that the last known wild subpopulation of pygmy rabbits within the Columbia Basin became extirpated by early 2004. However, given the limited area surveyed to date, it is possible that other wild pygmy rabbits still occur in the Columbia Basin. Therefore, we affirm our conclusion from the original DPS assessment that the wild portion of this population segment continues to be physically and

genetically discrete from the remainder of the taxon. Furthermore, the pygmy rabbits currently included in the captive breeding program were bred specifically to retain, to the maximum extent considered possible, the markedly different genetic characteristics of the purebred Columbia Basin population, and the captive population continues to be genetically discrete from the remainder of the taxon. Based on the above, we affirm that the Columbia Basin pygmy rabbit meets one or more of the discreteness criteria of the DPS policy, and that this population should continue to be considered discrete from the remainder of the taxon.

The 2003 listing determination concluded that the Columbia Basin ecosystem represents an unusual ecological setting for the pygmy rabbit taxon. In general, our 2003 conclusion was that the Columbia Basin is lower in elevation, contains soils of varying origin, and has been influenced by different geological processes compared to the ecosystems in central and southern Oregon. Furthermore, these structural differences, combined with regional climatic patterns, significantly influence the broad plant associations found within each ecosystem, which in turn may represent important differences in the food and cover resources that are available for pygmy rabbits occupying these ecosystems. The assessment of ecological settings within this 5-year review, which is based on updated GIS data layers, provides for a more quantitative description of the ecological settings potentially occupied by the pygmy rabbit taxon, and allows for consideration of other ecological settings from throughout the species' entire estimated historic distribution. Our assessment of this new information indicates that it is consistent with the conclusions from the 2003 listing determination that the Columbia Basin is comprised of different geographic, geologic, climatic, soil, and plant community components compared to the remainder of the species' historic distribution. Based on this available new information, in conjunction with the species' reliance on different sagebrush taxa and its close association with shrub steppe ecosystems, we affirm that the Columbia Basin represents an unusual ecological setting for the taxon.

The 2003 listing determination concluded that the Columbia Basin pygmy rabbit represents an isolated portion of the northern-most extent of the species' historic distribution, and that its loss would result in a significant gap in the range of the taxon. In general, the 2003 conclusion was that the past distribution and isolation of the Columbia Basin pygmy rabbit demonstrates that this population segment is likely experiencing different selective pressures due to varied habitats at the periphery of the taxon's range, and exhibits genetic consequences of long-term divergence and isolation from other pygmy rabbit population segments. The available new information simply provides an improved spatial context for this assessment, and our conclusion from the final listing determination remains unchanged. Therefore, we affirm that loss of the pygmy rabbit from the Columbia Basin would represent a significant gap in the range of the taxon.

The 2003 listing determination concluded that the Columbia Basin pygmy rabbit differed markedly from other population segments in its genetic characteristics. At the time, two general conclusions were drawn based on results of the available genetic research on the pygmy rabbit, which were: 1) the unique genetic characteristics of the Columbia Basin pygmy rabbit represent an important component in the evolutionary legacy of the species and, therefore, are a genetic resource worthy of conservation; and 2) efforts should be undertaken to address the low level of genetic diversity within this population segment. Given the available new information assessed in this 5-year review, both the captive intercrossed and, if it remains extant, wild portions of the

Columbia Basin pygmy rabbit population continue to differ markedly from other population segments of the taxon in their genetic characteristics. However, it is also currently unclear to what extent it may still be possible or prudent to conserve the markedly different genetic characteristics of the founding purebred Columbia Basin animals in a recovered population (see section 2.3.1.3).

In light of the available new information summarized above, we affirm that the Columbia Basin pygmy rabbit meets the discreteness and significance criteria encompassed by the DPS policy, and that this population segment is a valid DPS.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?

 Yes

 X *No (go to section 2.3)*

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history:

At the time of the 2003 listing determination, the nesting and rearing behaviors of adult female pygmy rabbits and their kits were largely unknown. Recent information on captive (Elias 2004, pages 17-18) and wild (Rachlow et al. 2005, pages 136-138) pygmy rabbits indicates that females excavate specialized, cryptic "natal" burrows that are disassociated from their resident burrow systems. Recorded lengths of natal burrows from entrance to nest ranged from 7 to 14 inches (17 to 36 centimeters). In the wild, natal burrows typically consist of a single entrance under a large sagebrush plant. Females begin to dig and supply nesting material (e.g., plucked fur, grass clippings) to these burrows several days prior to giving birth, and may give birth and nurse their young in the runway to the burrow's entrance. After nursing, the young return to the burrow and the female fills the burrow entrance with loose soil and otherwise disguises the immediate area to avoid detection.

New information from a study in Idaho indicates that pygmy rabbits have a greater dispersal capability than previously known (Rachlow and Estes-Zumpf 2005, pages 1-3). These more recent records indicate that juvenile pygmy rabbits often undertake a single, rapid dispersal movement between 4 to 12 weeks of age, and that some juvenile animals may disperse over 6 miles (10 kilometers) during this period. In addition, adult pygmy rabbits may disperse over 7.5 miles (12 kilometers) between their more restricted, seasonal use sites. While these movements are considerably longer than those previously documented, it should also be noted that they are maximum estimates and there appear to be large differences in the propensity of individual pygmy rabbits to disperse, with many animals remaining relatively sedentary. Reflecting this, median recorded dispersal distances for the Idaho pygmy rabbits were 0.7 mile (1.1 kilometers) and 1.9 miles (3.0 kilometers) for males and females, respectively.

2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

The last known wild subpopulation of the Columbia Basin pygmy rabbit was extirpated by early 2004 (WDFW 2005, page 3). In addition, none of the 20 captive-bred, intercrossed pygmy rabbits released in March 2007 were known to have survived in the wild through the fall of 2007 (Zeoli et al. 2008, page 509). However, only about 7.6% (113,244 acres) of the potentially suitable shrub steppe habitat remaining in the Columbia Basin (1,480,489 acres) has been surveyed specifically for pygmy rabbit presence since 2001 (USFWS 2010a, page n/a). Therefore, other wild, but as yet unknown, pygmy rabbit subpopulations may still be present within the Columbia Basin (WDFW 2005, page 3; USFWS 2007, page 46).

As of October 12, 2010, the captive pygmy rabbit population consisted of 111 intercrossed animals that averaged 65% Columbia Basin ancestry by pedigree. Over the first eight years of the captive breeding program, the average annual growth rate of the captive population was 32%, ranging from 70% in 2004 to -11% in 2008 (results exclusive of the 20 captive animals released in 2007). The number of kits produced in a single breeding season has increased over time, from a low of 19 during the first year of the program in 2002 to a high of 275 in 2010. However, on a percentage basis, 2010 will also have the poorest annual recruitment of kits to the population, which as of October 12, 2010, was just 13% (n = 36), compared to an average of 30% over the first 8 years of the program and a high of 50% in 2003.

To date, the captive breeding program and intercross strategy for the Columbia Basin pygmy rabbit have been effective in maintaining the captive population, as well as conserving much of the markedly different genetic characteristics of the founding purebred animals (see section 2.3.1.3). However, these actions have not been able to reliably produce enough offspring to accommodate anticipated reintroduction needs of 50 to 100 individuals released to the wild twice annually, or to significantly reduce the risks to the population from demographic and genetic bottlenecks due to long-term management in captivity with fewer than several hundred individuals (Zeoli 2008, pages 509-510; SAG 2008, page n/a). This lack of success is primarily due to the difficulty of husbandry efforts under the existing captive breeding scenario (e.g., the limited availability and inbred nature of the founders, impacts from soil-borne diseases, space requirements), which are compounded by certain life history attributes of pygmy rabbits, such as their obligate use of sagebrush, burrowing behaviors, and short life spans (see section 2.3.2.3).

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

Purebred Columbia Basin pygmy rabbits have markedly different genetic characteristics (e.g., mitochondrial haplotypes, nuclear allele frequencies) compared to other pygmy rabbit population segments (see section 2.1.4). These genetic differences, which are similar in nature to subspecific differences recognized in other mammal species, suggest that the Columbia Basin pygmy rabbit began to diverge and became genetically isolated from the remainder of the taxon

at least 10,000 years ago. It is assumed that markedly different genetic characteristics between population segments confer adaptive advantages to a taxon, or that such differences somehow otherwise represent an important component in the evolutionary legacy of a taxon (e.g., significant past range expansion or isolation events). However, direct evidence that such genetic differences may actually confer an adaptive advantage to a particular population is currently extremely rare. As such, one of the primary aims of the Service is to conserve genetic indicators of potentially adaptive differentiation, which supports the Act's interrelated goals of conserving genetic resources and maintaining natural systems and biodiversity over a representative portion of a taxon's historic distribution (61 FR 4723). Therefore, the markedly different genetic characteristics of pygmy rabbits that evolved within the Columbia Basin are considered an important component in the evolutionary legacy of the species, and represent a genetic resource worthy of conservation.

Purebred Columbia Basin pygmy rabbits exhibited significantly less genetic diversity historically compared to other pygmy rabbit populations (see section 2.1.4). Furthermore, the genetic diversity within this population segment has declined significantly and at an accelerated rate since the mid-1900s. This suggests that a recent and rapid decline in the effective size of this population segment (i.e., the number of individuals contributing to reproduction) has occurred, and that it may be experiencing inbreeding. From a management perspective, efforts should be undertaken to address the low level of genetic diversity within this population segment.

New information indicates that the wild Columbia Basin pygmy rabbits that were used to found the captive breeding population were likely suffering from severe inbreeding depression, and had a significantly diminished reproductive potential (WDFW 2003, page 8; WDFW 2005, page 4). Furthermore, because the last known wild portion of the Columbia Basin population had become extirpated by early 2004 (WDFW 2005, page 11), additional purebred animals were not available to augment the captive founders. Therefore, it was determined that intercrossing the captive purebred animals with pygmy rabbits captured from populations outside of the Columbia Basin was necessary (WDFW 2003, pages 8-9).

The ultimate goal of the intercross strategy for the Columbia Basin pygmy rabbit is to affect the population's genetic restoration to help ensure its long-term viability (USFWS 2007, page 34). The three primary aims of the intercross strategy for the captive population were to: 1) minimize genetic drift by conserving the remaining unique genetic characteristics of the founding Columbia Basin pygmy rabbits; 2) minimize inbreeding by ensuring that the captive population contains an appropriate level of genetic diversity; and 3) minimize the potential for outbreeding depression (i.e., a decline in population fitness due to the loss of locally adapted genetic variation) by ensuring that the unique genetic characteristics of the Columbia Basin pygmy rabbit do not become attenuated through over-representation of genetic material from other pygmy rabbit population segments.

To achieve the above aims, proposed measures to recover the Columbia Basin pygmy rabbit in the wild called for the release of captive-bred progeny with at least 75% Columbia Basin ancestry (USFWS 2006a, pages 3-4), which is likely no longer possible (SAG 2008, page n/a). This desired level of introgression was based on the available information at the time and the stated objectives of minimizing genetic drift (aim #1, above) and the potential for outbreeding depression (aim #3).

However, it was not intended as a strict target for recovery objectives, nor was it meant to limit comprehensive recovery efforts for the Columbia Basin pygmy rabbit. Ultimately, the extent to which intercross breeding for the Columbia Basin pygmy rabbit is appropriate will be a balance between the above aims (USFWS 2007, page 35).

With regard to genetic restoration of the Columbia Basin pygmy rabbit, the captive breeding program has largely succeeded in minimizing genetic drift and inbreeding depression (USFWS 2007, pages 35-36; WDFW 2010, pages 10-12). Minimizing genetic drift is demonstrated through retention of many of the unique genetic characteristics (e.g., mitochondrial haplotypes, nuclear allele frequencies) of the founding purebred Columbia Basin pygmy rabbits in the captive population. Minimizing inbreeding depression is demonstrated by a significant increase in potentially adaptive genetic variation and the improved reproductive success and general immune response in the captive population, which are now at comparable levels with other wild pygmy rabbit populations (USFWS 2007, page 36). It is currently unknown if the improved reproductive success and general immune response documented thus far in the intercrossed captive population will ultimately translate into successive generations (i.e., improved population fitness) once these animals are released to the wild. This is because outbreeding depression would be most likely to manifest itself following the release of captive-bred intercrossed and translocated pygmy rabbits within the Columbia Basin (see #1 under section 4). Therefore, the extent to which intercrossing will help to minimize outbreeding depression is currently unknown, and it remains a threat to the species within this ecological setting (see section 2.3.2.5).

While all three aims of the intercross strategy are interrelated, minimizing genetic drift and the potential for outbreeding depression primarily attempt to address a common risk factor: loss or attenuation of any genetic variation that may confer an adaptive advantage to the taxon within the ecological setting of the Columbia Basin. However, for the following reasons, the available new information indicates that it may not be possible or prudent to further pursue these objectives, and any such efforts would likely come at the expense of losing the gains in the population's overall genetic diversity that have already been realized.

- The purebred Columbia Basin pygmy rabbits that were available to found the captive population were significantly inbred (USFWS 2007, pages 30-31; Zeoli et al. 2008, page 505) and, therefore, the wild population from which they were captured had likely already lost much of the unique genetic variability that could have conferred an adaptive advantage to the intercrossed animals upon their release. The relative value of maintaining the markedly different genetic characteristics of the founding purebred animals diminished as it became apparent that their overall genetic diversity had already declined and that indicators of significant inbreeding depression were already present.
- Some purebred Columbia Basin pygmy rabbits may remain in the wild and, potentially, they could be used to augment the captive breeding program. However, it is not known whether there would be an adequate number of them or that they would be genetically diverse enough to serve as a future source for translocations or captive breeding (USFWS 2007, page 35). The 2003 listing determination concluded that efforts should be undertaken to address the low level of genetic diversity in the wild population, and this was one of the primary reasons for initiating the intercross strategy.

- The effects of apparent inbreeding depression in the captive purebred Columbia Basin pygmy rabbits were severe (WDFW 2003, page 8; USFWS 2007, page 34), and posed a much greater and more immediate threat to the population's overall fitness and security than the potential for outbreeding depression in any pygmy rabbits released within the Columbia Basin (USFWS 2007, pages 30-35).
- The risks of genetic drift and inbreeding depression are significantly reduced in larger versus smaller populations (WDFW 2010, page 8), and the captive pygmy rabbit population has remained at a size that is considered only minimally capable of maintaining itself (Zeoli 2008, pages 509-510; SAG 2008, page n/a).
- New information addressing the role of epigenetics (i.e., the expression of heritable and non-heritable individual characteristics due to influences of the environment that are not differentially encoded within the genomes of closely related organisms) in lineage diversification indicates that the persistence of the pygmy rabbit within the ecological setting of the Columbia Basin may hold significant adaptive and evolutionary implications for the taxon, even if no markedly different genetic characteristics of the purebred Columbia Basin pygmy rabbits ultimately persist in any reestablished subpopulations. Since the 2003 listing determination, the relatively new field of epigenetics has progressed considerably (see Goldberg et al. 2007, Chandler 2007, Rando and Verstrepen 2007, Bernstein et al. 2007, Bossdorf et al. 2008, Jablonka and Raz 2009, Choi and Kim 2009, Hanson 2010). Epigenetic systems suggest an efficient mechanism for populations of species to differentially respond (i.e., adapt) to local environmental conditions. This new information indicates that the extent to which groups of individuals form (or could form) distinct populations in relation to their epigenomes (in addition to other differentiating characteristics) should be a consideration when identifying appropriate units for conservation.

The intercross strategy has been largely successful in conserving the markedly different genetic characteristics of the founding Columbia Basin pygmy rabbits and ensuring that sufficient genetic variability has been maintained in the captive population (USFWS 2007, pages 35-36; WDFW 2010, pages 10-12). However, significant uncertainty remains regarding our ability to maintain a genetically and demographically viable population without substantial changes to our current recovery strategy (see section 2.4).

2.3.1.4 Taxonomic classification or changes in nomenclature:

Since the 2003 listing determination, there is no new information regarding taxonomic classification or changes in nomenclature related to the pygmy rabbit.

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historic range, change in distribution of the species' within its historic range, etc.):

At the time of the 2003 listing determination, information addressing the prehistoric occurrence

and timing of divergence of pygmy rabbit populations within the Columbia Basin was unclear. While these issues are still not fully resolved, a more recent interpretation of the fossil record suggests that the species occurred continuously within the southern portion of the Columbia Basin in present day Washington (i.e., within roughly 12 miles (20 kilometers) of the Oregon border) from at least 100,000 years ago to approximately 13,000 years ago (Lyman 2004, pages 1-3). This area is roughly 31 miles (50 kilometers) further south than the southern extent of the species' currently recognized historic distribution within the Columbia Basin (Figure 1). The fossil record also suggests that the population of pygmy rabbits within the Columbia Basin was likely fully separate from the remainder of the species' range by 10,000 years ago.

Since the 2003 listing determination, new information has become available concerning the distribution of vegetation community types throughout the western United States (LANDFIRE 2006, page n/a). This new information, combined with updated records of past and contemporary range wide occurrences of the pygmy rabbit (USFWS 2008, page n/a), have helped refine the species' estimated historic distribution based on the spatial distribution of shrub steppe community types (Figure 1).

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

New information has allowed differences in vegetation community types within the Columbia Basin to be assessed in a more quantified manner (see section 2.1.4). One conclusion from this updated assessment is that the Columbia Basin appears to have significantly more area affected by anthropogenic influences (e.g., crops, rural developments, urban centers) than the rest of the species' historic distribution (52% versus 12%). This result is consistent with our previous conclusion that native shrub steppe habitats within the Columbia Basin, including those considered essential to the long-term security of the Columbia Basin pygmy rabbit, are among the most threatened areas within the taxon's historic distribution. However, this new assessment is not directly comparable to habitat assessments conducted prior to the 2003 listing determination, so it is not currently possible to determine if there have been substantial changes to the habitat or ecosystem conditions in the Columbia Basin. Other than the above, there is no new information available regarding potential changes to the habitat or ecosystem conditions in the Columbia Basin. However, the following discussion addresses several recovery actions that have been undertaken since the 2003 listing determination directed at inventory, assessment, and protection of various habitats potentially suitable for Columbia Basin pygmy rabbits.

In 2004, the Columbia Basin Pygmy Rabbit Recovery Team undertook efforts to assess and prioritize ten possible reintroduction sites throughout the historic distribution of the Columbia Basin pygmy rabbit (USFWS 2007, page 40). These efforts considered each candidate site's potential to help meet long-term recovery objectives for the Columbia Basin pygmy rabbit, and included assessment of their existing habitat conditions, soil types, land ownership and use, past records of Columbia Basin pygmy rabbit occurrence, site impacts, management flexibility, necessary protection or enhancement measures, surrounding land uses and ownership patterns, and minimum size estimates. Two of the ten sites assessed were identified by the Recovery Team as the top priority sites to consider for near-term recovery objectives, including initial reintroduction efforts, and are referred to as recovery emphasis areas. One of these sites, which

is managed by WDFW, is in the central Moses Coulee area of southern Douglas County and totals approximately 1,515 hectares (3,740 acres); the other site, which is managed by The Nature Conservancy in cooperation with the Lancaster family, is in the Beezley Hills area of northern Grant County and totals approximately 1,374 hectares (3,390 acres). These two sites represent the only recovery emphasis areas that have been identified.

Pursuant to section 10 of the Act, the Service and WDFW entered into a Template Safe Harbor Agreement for the Columbia Basin Pygmy Rabbit (Template SHA) on October 24, 2006 (USFWS 2006b, page n/a). The Template SHA provides a process by which non-federal and non-WDFW landowners and managers can voluntarily contribute to recovery efforts for the Columbia Basin pygmy rabbit without incurring additional regulatory burdens or management requirements related to this species if their voluntary actions result in increased numbers or distribution of Columbia Basin pygmy rabbits on their enrolled property. To date, the Service has issued sixteen Enhancement of Survival Permits under the Template SHA that cover management activities on 109,425 acres within the historic distribution of the Columbia Basin pygmy rabbit. Another 11,107 acres of property managed by the Washington Department of Natural Resources are pending enrollment under the agreement. Measures to pursue and secure additional agreements with non-Federal land owners and managers, as well as other stakeholders interested in recovery efforts for the Columbia Basin pygmy rabbit, are ongoing.

2.3.1.7 Other:

Since the 2003 listing determination, there is no new information available regarding other aspects of the species' biology or habitat.

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

Since the 2003 listing determination, new information has allowed differences in vegetation community types within the Columbia Basin to be assessed in a more quantified manner (see section 2.1.4). One conclusion from this updated assessment is that the Columbia Basin appears to have significantly more area affected by anthropogenic influences (e.g., crops, rural developments, urban centers) than the rest of the species' historic distribution (52% versus 12%). This result is consistent with our previous conclusion that native shrub steppe habitats within the Columbia Basin, including those considered essential to the long-term security of the Columbia Basin pygmy rabbit, are among the most threatened areas within the taxon's historic distribution.

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

Upon Federal listing of the Columbia Basin pygmy rabbit in 2003, and pursuant to section 10 of the Act, the Service issued a recovery permit to WDFW for activities associated with the captive breeding program. In accordance with the permit, WDFW has tracked levels of incidental take

associated with the program (defined as the amount of human-caused disability and mortality of pygmy rabbits as a percentage of the total captive population) and provided annual reports to the Service addressing their activities. Since issuance of the permit, levels of incidental take have ranged from 7% (2004) to 0% (2009) of the captive population on a calendar-year basis. The Service's Biological Opinion addressing issuance of the permit concluded that this level of incidental take is not likely to jeopardize the continued existence of the Columbia Basin pygmy rabbit (USFWS 2003, pages 30-31). To date, no incidental take has occurred in association with the Enhancement of Survival Permits issued in accordance with the Template SHA.

2.3.2.3 Disease or predation:

Disease

Since the captive breeding program began in 2002, a large number of captive pygmy rabbits have died as a result of various substrate-borne diseases, especially coccidiosis and mycobacteriosis (Harrenstien et al. 2006, page 3; WDFW 2010, pages 7-8). Coccidiosis is caused by protozoa that occur in soil and feces, and which invade the intestines and other tissues of animals. A new pathogenic species of coccidian, *Eimeria brachylagus*, was identified in the captive pygmy rabbits. Coccidiosis may be most detrimental in neonate pygmy rabbits, as some animals (both adult and young) can apparently remain free of the disease while harboring high levels of coccidia. Preventive measures that have been taken to help control coccidiosis in the captive population include regular monitoring of coccidia levels, removal of soil from contaminated pens, careful selection and testing of replacement soil, design changes to holding pens so that soil can be replenished more readily, use of larger holding sites that better mimic density conditions in the wild, experimentation with soil-free pens, antibiotic treatment of individuals with elevated coccidia levels, prophylactic antibiotic treatment of breeding females, and dietary changes to improve the overall condition, and presumably disease resistance, of the captive animals (USFWS 2007, pages 21-22).

The bacterium that causes mycobacteriosis, *Mycobacterium avium*, commonly exists in soil and water, and can survive for long periods of time in soil. High numbers of the bacterium can also be shed in feces and urine. The incubation period for mycobacteriosis can be weeks to months, and detection of infected individuals is difficult. In general, purebred Columbia Basin pygmy rabbits had a significantly poorer immune response to mycobacteriosis than pygmy rabbits from Idaho and other lagomorph species. Depressed immune response, which is potentially caused by inbreeding, and higher susceptibility to mycobacteriosis has been demonstrated in a number of other species (Harrenstien et al. 2006, page 5). In addition to the soil treatments discussed above for coccidiosis, other preventative measures for mycobacteriosis include regular monitoring of the captive pygmy rabbits to try and detect those that may be subclinically infected, quarantine of infected animals, and research into development of appropriate treatment regimens.

Off-soil husbandry has been somewhat successful for maintaining pygmy rabbits in captivity, however, concerns remain about implementing such a management approach more broadly or for extended periods of time (e.g., multiple seasons) due to the likelihood of increased habituation to captive conditions (see section 2.3.2.5). Disease concerns are especially relevant to pregnant and nursing females and their litters (see section 2.3.1.1), which to date have not been successfully

housed in off-soil conditions (L. Shipley, Washington State University, and M. Illig, Oregon Zoo, personal communications, April 2010).

All of the above measures to help address the negative effects of disease in the captive population have resulted in an extremely labor and resource intensive husbandry scenario that was not fully anticipated when the captive breeding program began, and the perceived threat of disease to the ultimate recovery of the Columbia Basin pygmy rabbit has increased since the original listing determination in 2003.

Predation

All of the captive-bred pygmy rabbits released to the wild in the spring of 2007 failed to survive beyond the fall season (Zeoli et al. 2008, page 509), and predation is suspected as a major cause of mortality for reintroduced pygmy rabbits (Sayler et al. 2006, page 19; WDFW 2010, page 12). However, these results are not unusual for reintroduction efforts using a relatively small number of naïve animals (Zeoli et al. 2008, page 509), and do not necessarily indicate that predation levels have changed significantly since the 2003 listing determination. At that time, predation was identified as a potential ongoing threat to wild Columbia Basin pygmy rabbits. Other than the above information concerning limited reintroduction efforts to date, there is no new information available that addresses other aspects of disease or predation with regard to wild pygmy rabbits.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Since the 2003 listing determination, there is no new information regarding the inadequacy of existing regulatory mechanisms with regard to the Columbia Basin pygmy rabbit.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Habituation to Captive Conditions

Since its inception, one objective of the captive breeding program has been to mimic, to the extent practical, the natural habitat conditions encountered by wild pygmy rabbits to help lessen the extent of habituation to captive conditions and to better prepare naïve individuals for reintroduction (Elias 2004, pages 40-48; Zeoli et al., page 510; SAG 2008, page n/a). To accomplish this, initially all captive pygmy rabbits were housed individually or in small groups (e.g., breeding females with one or more males, females with litters) in relatively large pens with sufficient soil to allow burrowing behavior (i.e., ranging from roughly 1.3 to 130 cubic yards (1 to 100 cubic meters)). The captive animals have also been provided natural vegetation as a diet supplement and, to a limited extent, to provide cover.

Even with implementation of management measures to help control habituation to captive conditions, it can negatively effect various life history traits (e.g., behavior, physiology, genetics) for eventual reintroduction efforts and can occur within just a few generations (Frankham 2008, page 325; Zeoli 2008 et al., page 504). The captive breeding program for the Columbia Basin

pygmy rabbit was not intended to be long-term (USFWS 2007, pages 89-103). However, anticipated reintroduction and augmentation efforts have not been possible under the existing captive breeding scenario (see section 2.3.1.2) and, necessarily, have resulted in the program extending for multiple generations with no additional input of wild animals (the only wild-bred pygmy rabbit currently in captivity is a male Idaho founder). In addition, various measures to help address the negative effects of disease in the captive population have resulted in an extremely labor and resource intensive husbandry scenario that further lessens the ability of the existing program to mimic natural conditions and sufficiently prepare the captive animals for eventual release (see section 2.3.2.3).

The above circumstances have increased concerns about excessive habituation to captive conditions and, ultimately, lowering the potential for successfully reestablishing wild subpopulations of pygmy rabbits within the Columbia Basin (SAG 2008, page n/a).

Outbreeding Depression

It is assumed that the markedly different genetic characteristics of the purebred Columbia Basin pygmy rabbit population historically conferred an adaptive advantage to the taxon within this ecological setting (see section 2.3.1.3). However, all currently available options for attempting to reestablish a viable population of pygmy rabbits within the Columbia Basin will necessarily limit this genetic representation and increase the risk of outbreeding depression, which could hold important implications for recovery of the species in the region (see section 2.4).

2.4 Synthesis

The available new information assessed in this 5-year review indicates that two of the five threat factors identified in section 4 of the Act have increased in immediacy and magnitude since our 2003 listing determination (see sections 2.3.2.3 and 2.3.2.5). These threat factors, summarized below, act in concert and include disease and habituation in the captive population and potential outbreeding depression in wild pygmy rabbits following proposed reintroduction efforts.

Substrate-borne diseases have become a significant concern for the captive breeding program due to the interplay between the species' life history attributes, unanticipated effects associated with soil management, and the limitations of the existing captive breeding facilities to produce enough animals to accommodate anticipated release planning (see section 2.3.2.3). Measures to help address the negative effects of disease in the captive population have resulted in an extremely labor and resource intensive husbandry scenario that was not fully anticipated when the captive breeding program began. Furthermore, trying to address these and other shortcomings in the existing captive breeding program (e.g., habituation to captivity, lack of appropriate pre-release conditioning) would require a significant commitment of additional resources to expand the program, yet these actions would hold little assurance of improved success for reintroduction efforts due to their inability to further address the increased risk from outbreeding depression (see following).

The ultimate goal of the intercross strategy for the Columbia Basin pygmy rabbit is to help ensure the population's long-term viability by affecting its genetic restoration, while the ultimate

goal of the captive breeding program is to help reestablish viable subpopulations of the species within the Columbia Basin through reintroduction and augmentation efforts. With regard to genetic restoration of the Columbia Basin pygmy rabbit, the captive breeding program and intercross strategy have largely succeeded in minimizing genetic drift and inbreeding depression in the captive population. However, considering the available new information (see section 2.3.1.3), it is currently unclear to what extent it may still be possible or prudent to conserve the markedly different genetic characteristics that remain from the founding purebred Columbia Basin pygmy rabbits in a recovered population. Further loss of these markedly different genetic characteristics will necessarily increase the risk of outbreeding depression in the wild. While the extent of this risk is currently unknown, the ultimate success of future reintroduction efforts could depend to a large degree on the potential influence of outbreeding depression following release efforts, and whether any other purebred Columbia Basin pygmy rabbits may eventually be discovered in the wild. Over time, one circumstance that may help mitigate the negative effects of outbreeding depression is the relative influence of epigenetic mechanisms. However, as with outbreeding depression, these potential influences would only be apparent through careful monitoring of wild pygmy rabbits within the Columbia Basin following future release efforts (see #3 under section 4). As a result of the interplay between disease and habituation in captivity and potential outbreeding depression in the wild, significant uncertainty remains regarding our ability to maintain a genetically and demographically viable population of pygmy rabbits within the Columbia Basin without substantial changes to the current recovery strategy.

Considering the available new information and our conclusion that two of the identified threats to the population have increased in their immediacy and magnitude, we recommend that the Columbia Basin pygmy rabbit continue to be classified as ‘endangered’ under the Act (see section 3.1). Furthermore, due to the likelihood that these threats to the population may be more pervasive and less readily alleviated than previously thought, we recommend that the recovery priority for the Columbia Basin pygmy rabbit be reduced from 3 to 6 (see section 3.2).

3.0 RESULTS

3.1 Recommended Classification:

- Downlist to Threatened
- Uplist to Endangered
- Delist
 - Extinction*
 - Recovery*
 - Original data for classification in error*
- No change is needed**

3.2 New Recovery Priority Number: 6

Brief Rationale:

Recovery priority numbers range from 1 (highest) to 18C depending on the level of threat to the listed entity, its estimated potential for recovery, its taxonomic classification, and the anticipated level of controversy for implementing recovery actions. At the time of the 2003 listing

determination, the Columbia Basin pygmy rabbit had a recovery priority of 3. A 3 indicates that the listed entity has a high degree of threat, high potential for recovery, is categorized as a subspecies or DPS, and relatively little controversy over recovery actions is expected. Previously, the recovery potential for the Columbia Basin pygmy rabbit was considered to be relatively high with implementation of a comprehensive captive breeding program. However, in light of the available new information (see section 2.3), the risks from disease and habituation in captivity and potential outbreeding depression in the wild (i.e., loss of locally adaptive genetic variation) have increased since the 2003 listing determination. These threats are currently more pervasive and likely less readily alleviated than previously thought and, as a consequence, the recovery potential for this population segment has declined. Therefore, we recommend that the recovery priority for the Columbia Basin pygmy rabbit be reduced from 3 to 6.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- 1 – Continue efforts to reestablish a viable population of pygmy rabbits within the Columbia Basin through release of the captive, intercrossed pygmy rabbits combined with simultaneous direct translocation of pygmy rabbits captured from outside of the Columbia Basin. This recommendation addresses recovery actions 2 (management of genetic characteristics) and 4 (reestablishment of wild subpopulations) in the current draft recovery plan for the Columbia Basin pygmy rabbit.

The existing captive breeding program cannot support anticipated reintroduction efforts. Furthermore, in the absence of proactive management action, the status of the captive intercrossed population will decline due to demographic stochasticity, genetic stochasticity, and further habituation to captive conditions (see section 2.3.2.3). There is currently a need to maximize the number of individuals in the Columbia Basin population, especially with regard its effective population size, to continue to appropriately manage its genetic and demographic characteristics (Zeoli et al., page 510; WDFW 2010, page 8). Trying to address this management need would require a significant commitment of additional resources to expand the captive breeding program, yet such action is still unlikely to ultimately improve the success of reintroduction efforts (see section 2.3.1.3). Alternatively, maximizing the number of individuals in the Columbia Basin population could be accomplished by reestablishing and attempting to rapidly expand wild subpopulations within this ecological setting (SAG 2008, page n/a), which could be accomplished through release of the captive population combined with simultaneous direct translocation of wild pygmy rabbits captured from outside of the Columbia Basin. Releasing captive-bred progeny that are predominantly of Columbia Basin ancestry (e.g., 75%) is likely no longer possible, and further introgression of the purebred Columbia Basin pygmy rabbit genome will increase the risk of outbreeding depression following release. However, all currently available options for attempting to reestablish a viable population of pygmy rabbits within the Columbia Basin will require some additional wild animals captured from other population segments.

The above represents the primary rationale for concluding that release of the captive animals in conjunction with simultaneous direct translocation of pygmy rabbits from other population segments represents the most feasible approach to pursue the other previously proposed State and Federal recovery objectives for this population (WDFW 1995, page 25; USFWS 2007, pages

57-58).

2 – Carefully monitor all pygmy rabbit subpopulations within the Columbia Basin to determine their collective genetic status, including estimated levels of introgression, and continue to adjust future management actions based on a comprehensive adaptive management approach. This recommendation addresses recovery actions 3 (monitor wild subpopulations) and 10 (revise Federal recovery plan) in the current draft recovery plan for the Columbia Basin pygmy rabbit.

If reintroduced pygmy rabbits are unable to survive or ultimately thrive within the Columbia Basin, this could be an indication of either the effects of significant outbreeding depression or insufficient control of other identified threats to the population (e.g., inadequacy of available habitats). The extent to which we consider the comprehensive objectives of genetic restoration achieved (and, therefore, outbreeding depression minimized), will depend on carefully monitoring the performance of any captive-bred intercrossed and translocated pygmy rabbits following their release to the wild.

3 – Investigate if, and the extent to which, pygmy rabbit populations differentiate with regard to their epigenomes. This recommendation addresses recovery actions 2 (management of genetic characteristics) and 3 (monitor wild subpopulations) in the current draft recovery plan for the Columbia Basin pygmy rabbit.

Even if no markedly different genetic characteristics of the purebred Columbia Basin pygmy rabbits ultimately persist in any reestablished subpopulations, new information addressing the role of epigenetics in lineage diversification indicates that the persistence of the pygmy rabbit within the ecological setting of the Columbia Basin may hold significant adaptive and evolutionary implications for the taxon (see section 2.3.1.3).

4 – Amend the current draft recovery plan for the Columbia Basin pygmy rabbit. This recommendation addresses recovery action 10 (revise Federal recovery plan) in the current draft recovery plan for the Columbia Basin pygmy rabbit.

Currently, there is no final recovery plan for the Columbia Basin pygmy rabbit and, therefore, no final recovery criteria have yet been developed (see section 2.2). As such, we recommend that the current draft recovery plan be amended to account for the available new information and evolving conservation strategies for the Columbia Basin pygmy rabbit discussed above.

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Signature Page

**U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of the Columbia Basin Distinct Population Segment of the Pygmy
Rabbit (*Brachylagus idahoensis*)**

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

Appropriate Listing/Reclassification Priority Number, if applicable: _____

Review Conducted By: Chris Warren, Eastern Washington Field Office, Spokane, Washington

FIELD OFFICE APPROVAL:

Ken S. Berg Date 9/29/2010
Lead Field Supervisor, Fish and Wildlife Service