

2015
Foskett Speckled Dace (*Rhinichthys osculus* ssp.)

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



**U.S. Fish and Wildlife Service
Oregon Fish and Wildlife Office
Portland, Oregon**

2015
5-YEAR REVIEW
Summary and Evaluation
Species reviewed: Foskett Speckled Dace (*Rhinichthys osculus* ssp.)

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5-YEAR REVIEW
Foskett Speckled Dace (*Rhinichthys osculus* ssp.)

1.0 GENERAL INFORMATION

1.1 Reviewers:

Lead Regional Office:

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Lead Field Office:

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Cooperating Field Office(s):

Not applicable

Cooperating Regional Office(s):

Not applicable

1.2 Methodology used to complete the review:

In order to conduct this 5-year review for the Foskett speckled dace, the U.S. Fish and Wildlife Service (Service) gathered available information since the time of listing: including Progress Reports from the Oregon Department of Fish and Wildlife (ODFW) completed in 1997, 2005, 2007, 2009, 2011, 2012, 2013, and 2014; a genetic analysis completed by Ardren (2009); a thesis prepared by Hoekzema (2013); and a published paper submitted by Hoekzema and Sidlauskas (2014); reviewed activities undertaken since the time of listing to determine if recovery actions have progressed; reviewed new information regarding the status of the threats to the species; reviewed the recovery criteria in the recovery plan for the Foskett speckled dace; and made recommendations. This review was conducted by Oregon Fish and Wildlife Office's Bend Field Office. The ODFW Assistant Project Leader for the Native Fish Investigation Project reviewed a draft of this document.

1.3 Background:

1.3.1 FR Notice citation announcing initiation of this review:

The Service announced the initiation of a 5-year status review of five species including the Foskett speckled dace, under section 4(c)(2)(B) of the Endangered Species Act (ESA), in a February 18, 2014, *Federal Register* notice titled "Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Review of Five Species in Oregon, Palau, Guam, and Northern Mariana Islands" (79 FR 9263-9264). This notice requested any information concerning the status

of these species. Two responses were received regarding the Foskett speckled dace.

1.3.2 Listing History:

Original Listing

FR notice: Endangered and threatened wildlife and plants; Determination of threatened status for Hutton tui chub and Foskett speckled dace (50 FR 12302-12305).

Date listed: March 28, 1985

Entity listed: The undescribed sub-species Foskett speckled dace (*Rhinichthys osculus* ssp.)

Classification: Threatened

Revised Listing, if applicable

Not applicable

1.3.3 Associated Rulemakings:

Foskett speckled dace were listed with no critical habitat designated. Foskett speckled dace are included in “Special rules-fishes” in 50 CFR 17.44 (j). The rule has four parts and states:

1. No person shall take these species, except in accordance with applicable State fish and wildlife conservation laws and regulations in the following instances: for educational purposes, scientific purposes, the enhancement of propagation or survival of the species, zoological exhibition, and other conservation purposes consistent with the Endangered Species Act.
2. Any violation of applicable State fish and wildlife conservation laws or regulations with respect to the taking of these species will also be a violation of the Endangered Species Act.
3. No person shall possess, sell, deliver, carry, transport, ship, import, or export, by any means whatsoever, any such species taken in violation of these regulations or in violation of applicable State fish and wildlife conservation laws or regulations.
4. It is unlawful for any person to attempt to commit, solicit another to commit, or cause to be committed, any offense defined in paragraphs (j) (1) through (3) of this section.

1.3.4 Review History:

The first 5-year review for the Foskett speckled dace was completed March 23, 2009 (U.S. Fish and Wildlife Service 2009). This review concluded that Foskett

speckled dace should remain listed as Threatened because only partial implementation of Recovery Plan criteria had occurred and threats remained. Specifically, the 2009 5-year review concluded that Recovery Plan criterion 1, the long-term protection of habitat, had occurred through the acquisition and fencing of both Foskett and Dace springs by the BLM. Recovery plan criterion 2, long-term management guidelines be developed and implemented including monitoring, had not occurred. Recovery plan criterion 3, conduct research into life history, genetics, population trends, habitat use and other important parameters to assist in further developing and/or refining criteria 1 and 2, had only occurred minimally.

This second 5-year review will assess actions that have occurred since the 2009 5-year review including how each recovery criterion has been met or not met, and it includes an updated threats analysis (see section 2.2.3 and section 2.3.2 respectively).

1.3.5 Species' Recovery Priority Number at Start of this 5-Year Review:

The Foskett speckled dace was assigned a recovery priority number of 15. A priority number 15 means the sub-species has a low degree of threat and a high potential for recovery.

1.3.6 Current Recovery Plan or Outline:

Name of plan or outline: "Recovery Plan for the Threatened and Rare Native Fishes of the Warner Basin and Alkali Subbasin" (Recovery Plan).

Date issued: April 27, 1998

Dates of previous revisions, if applicable: Not applicable

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?

Not applicable

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

Yes

X *No*

The Foskett speckled dace was listed as an undescribed sub-species in 1985. The Service did not list the species as a DPS, and therefore there is no new information regarding the Service's application of the DPS policy to this species. However, in 2014 genetic and morphometric analysis of Foskett speckled dace was conducted by Dr. Sidlauskas and Ms. Hoekzema. Although Sidlauskas and Hoekzema provide new information on the uniqueness of Foskett speckled dace, they believe that the Foskett speckled dace would not currently be classified as a separate species or subspecies. However, they suggest that it may fit as a distinct population segment (Sidlauskas and Hoekzema 2014) based on their application of the Service's Distinct Population Segment policy (U.S. Fish and Wildlife Service 1996) (see sections 2.3.1.3 and 2.3.1.4). The Service has not conducted a formal DPS analysis on the Foskett speckled dace.

2.2 Recovery Criteria

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

 X *Yes*
 No

The recovery criteria focus on long-term sustainability rather than delisting (See section 2.2.3 below for the recovery criteria). The Recovery Plan does not describe specific measurable benchmarks to use to demonstrate progress toward recovery instead it provides conservation criteria and step-down recovery actions. We will use these objectives for long-term persistence and preservation of habitat to assess progress toward recovery of the species.

2.2.2 Adequacy of recovery criteria

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

 X *Yes*
 No

The Recovery Plan was finalized in 1998. New biological information on the Foskett speckled dace and its habitat has been developed, including: 1) the completion of population estimates conducted by ODFW in 1997, 2005, 2007, 2009, 2011, 2012, 2013, and 2014; 2) a genetic analysis conducted by the Service's Abernathy Fish Technology Center; and 3) further genetic analysis completed by Oregon State University researchers, Hoekzema (2013) and Hoekzema and Sidlauskas (2014). Additional detail on the genetic and morphological differentiation of dace among the Great Basin portion of Oregon is provided in the thesis by Hoekzema

(2013). Since the recovery plan was completed in 1998, aquatic macrophytes increased throughout the spring habitat which was fenced to exclude cattle grazing. Recent efforts by Bureau of Land Management (BLM) to limit the extent and reverse the trend of vegetation encroachment were implemented in 2012 through 2014. Monitoring indicates a positive population response of Foskett speckled dace to the habitat treatments (Scheerer et al. 2013 and 2014; Leal et al. 2014).

Although new information has been developed, the criteria in the Recovery Plan are still relevant to the recovery of the Foskett speckled dace as further described in Section 2.2.3.

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery plan?

Yes
 No

2.2.3 List the recovery criteria as they appear in the Recovery Plan, and discuss how each criterion has or has not been met, citing information:

The “Recovery Plan for the Threatened and Rare Native Fishes of the Warner Basin and Alkali Subbasin” provides information to guide recovery of the ESA listed Foskett speckled dace (U.S. Fish and Wildlife Service 1998). The Recovery Plan states that the Foskett speckled dace “will probably not be delisted in the near future” because of an extremely isolated range and potential for degradation of the habitat from localized events. The primary objective, therefore, is the long-term persistence through preservation of native ecosystems. The Recovery Plan also provides objectives and criteria for conserving Foskett speckled dace. The Recovery Plan states that the Foskett speckled dace spring habitat is currently stable, but extremely restricted, and any alterations to the spring or surrounding activities that indirectly modify the spring could lead to the extinction of this species. Due to these circumstances, the Recovery Plan focuses on the long-term persistence of Foskett speckled dace through preservation of its native ecosystem. The recovery criteria for Foskett speckled dace are described in the Recovery Plan as:

The conservation and long term sustainability of the Foskett speckled dace will be met when:

1. Long-term protection to habitat, including spring source aquifers, spring pools and outflow channels, and surrounding lands, is assured.
2. Long-term habitat management guidelines are developed and implemented to ensure the continued persistence of important habitat

features and include monitoring of current habitat and investigation for and evaluation of new spring habitats.

3. Research into life-history, genetics, population trends, habitat use and preference, and other important parameters is conducted to assist in further developing and/or refining criteria 1) and 2), above.

Below we discuss how each of these criteria have, or have not, been met:

Recovery Plan Criterion 1: Criterion 1 has been essentially met for Foskett speckled dace. The Foskett speckled dace exists as a single population within Foskett Spring. In 1987, the BLM acquired the 160 acre (65 hectare) parcel of land containing Foskett Spring, and Dace Spring. Dace Spring was the recipient site for an unsuccessful translocation of Foskett speckled dace in 1979 and 1980, and an on-going translocation effort that was initiated in 2009. The BLM and the Service worked together to construct two ponds fed by the outlet flow from Dace Spring within the 160-acre area to provide additional habitat for Foskett speckled dace (see section 2.3.1.2) and additional translocation efforts have been conducted (see section 2.3.1). BLM has fenced 70 acres (28 hectares) of the 160 acre parcel to exclude cattle from both Foskett and Dace springs as well as the two recently constructed ponds. The BLM fence does not include the entire occupied habitat for Foskett speckled dace (see section 2.3.2.1). Little information is available regarding stream flows or the status of the aquifer (see section 2.3.2.1).

Recovery Plan Criterion 1 addresses threat factor one “Present or threatened destruction, modification or curtailment of its habitat or range” (See discussion under 2.3.2.1 five factor analysis” below).

Recovery Plan Criterion 2: Criterion 2 has been essentially met. The BLM, ODFW, and the Service have developed a Cooperative Management Plan for Foskett Speckled Dace (2015) that includes habitat management actions to provide for the continued persistence of habitat features that are important to Foskett speckled dace. The Cooperative Management Plan finalized in August of 2015 was developed to manage and protect the Foskett Spring and Dace Spring areas for the long term conservation of Foskett speckled dace. Actions identified in the Cooperative Management Plan include: 1) protect and manage Foskett speckled dace habitat; 2) enhance the habitat when needed; 3) monitor the Foskett speckled dace population and habitat; and 4) implement an emergency contingency plan as needed to address potential threats from the introduction of non-native species or pollutants.

The BLM manages lands surrounding Foskett and Dace springs consistent with the Lakeview Resource Management Plan (RMP) (BLM 2003). The

RMP provides general management direction for Special Status Species, and states that they will manage the Foskett speckled dace consistent with the current Recovery Plan. Current management by BLM includes livestock exclusion (BLM 2003). Monitoring consists of periodic inspection of the spring habitat, photo point, and vegetation sampling. The BLM plans to consider an action alternative in the next revision of the Lakeview District Resource Management Plan to designate Foskett Spring and Dace Spring as an Area of Critical Environmental Concern as part of a Resource Management Plan amendment tentatively scheduled for completion in 2017. The proposed designation will identify the boundary, including all occupied habitat, and address appropriate management actions to protect the fish and its habitat including such things as management direction for rights-of-way, motorized and non-motorized access, land disposal, hydrology/water rights, visual resources, recreation, grazing, energy and minerals, noxious weeds, wildlife, and prescribed fire (U.S. Fish and Wildlife Service, BLM and ODFW 2015).

The ODFW has conducted an investigation to determine the status of the Foskett speckled dace population and site monitoring included measurements of open-water, vegetated surface area, water depth, water temperature, and photos of habitat conditions. Based on habitat monitoring information and the Foskett speckled dace population survey results, it appears that the Foskett speckled dace population increases quickly in response to vegetation management treatments that increase the amount of open water. In their Progress Reports for the Foskett speckled dace investigation, ODFW recommended monitoring Foskett speckled dace and its habitat to track fluctuations in population abundance and quantity and quality of available habitat as part of a long-term management program (Scheerer and Jacobs 2005, Scheerer and Jacobs 2007). ODFW conducted monitoring in 2005, 2007, 2009, and 2011-2014.

Scott et al. (2006) describes listed species which continually require some level of managed conservation in order to persist as “conservation reliant”. Foskett speckled dace appear to fit the concept of conservation-reliant species as described by Scott (2005) and Goble et al. (2010). Based on observed population response to aquatic vegetation encroachment and to habitat enhancement that increased open-water habitat, the Service believes that with the current state of the existing habitat, the Foskett speckled dace will continually require some level of vegetation management to maintain sufficient area of open water. Therefore, we believe that Foskett speckled dace meets the definition of a “conservation-reliant” species. In the absence of active vegetation management it is expected that aquatic vegetation will continue to reduce open water habitat which is essential to support the Foskett speckled dace population. Therefore, there remains a long term need to manage the Foskett Spring

and Dace Spring habitat to ensure the persistence of the species. The BLM has been proactive in management of the Foskett Spring and Dace Spring habitat to promote the conservation of Foskett speckled dace (see section 2.3.1.2). Additionally, the Cooperative Management Plan identifies creation and maintenance of open water habitat at Foskett and Dace springs as a conservation need and a management action.

Recovery Plan Criterion 3: This criterion has been met through population surveys by ODFW and the Service, and investigation into the genetic relatedness of Foskett speckled dace in comparison with other nearby dace species (see section 2.3.1.3). In 1997, the Service contracted ODFW to conduct an abundance estimate for Foskett speckled dace. No subsequent surveys were conducted from 1998 to 2004. In 2005, 2007, 2009, and 2011 through 2014, the Service again contracted ODFW to conduct abundance surveys for the Foskett speckled dace population. Additionally, a sampling protocol was developed that can be used to study the trend of the population. Survey information can be reviewed in section 2.3.1.2. The ODFW recommended studies of key demographic parameters including population age structure, age and size at maturity, longevity, and spawning timing/duration (Scheerer and Jacobs 2009). In addition, research into life history, habitat use and habitat preference would also be beneficial in the implementation of management activities.

The ODFW recommended these studies to understand the extent of the risk to the population that, at the time, was in decline. Since then, knowledge of age structure, age/size at maturity, and longevity has been acquired through their surveys. The ODFW learned from monitoring the Dace Spring translocation that Foskett speckled dace can and do mature in one year. This was evident in 2014 when the population more than doubled in abundance from 2013 and recruits grew to adult size in one year. The ODFW also learned from monitoring this translocation, that these dace live at least 3 years, as adults stocked in 2011 were still present in 2013 and 2014.

From studies at Foskett Spring, the ODFW documented annual recruitment and a broad size distribution and noted that spawning occurs, as evidenced by presence of larval dace, beginning in early spring (March-April) and extending into July (Scheerer et al. 2014). Regarding habitat use and preference, the ODFW described speckled dace preferring open water habitat and noted that the population increased rapidly in response to habitat restoration/creation of open water habitat (Scheerer et al. 2013). The ODFW also found that young-of-the-year dace are more common in the shallow marsh habitats.

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:

New studies of the species biology or life history since the 2009 5-year review include population estimates by ODFW (Scheerer et al. 2009; Scheerer 2011; Scheerer et al. 2012, 2013, and 2014), a genetic analysis by Ardren (2009); a phylogenetic and morphometric study by Hoekzema (2013); and a molecular phylogenetics and microsatellite analysis by Hoekzema and Sidlauskas (2014).

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

Foskett Spring

Historical data on abundance is limited; Bond (1974) made a visual estimate and reported that there may be 1,500 to 2,000 individual fish at Foskett Spring in 1974. This estimate was not based on sampling of the population. In 1997, the population of Foskett speckled dace was estimated to be 27,787 using a statistically based sampling procedure (Dambacher et al. 1997). Ninety-seven percent of the total population estimate occurred in a shallow ephemeral open-water pool outside of the Foskett Spring enclosure fence. This shallow pool was dry in 1989 (Dambacher et al. 1997).

Additional population estimates were obtained by ODFW from 2005 through 2014 (Table 1.). Population estimates obtained between 2005 and 2012 were done using the Lincoln-Petersen model. In 2011, ODFW added an additional model to adjust the population estimates to be more accurate. The Huggins model was used along with the Lincoln-Petersen model for sample years 2011 through 2012 to compare results of the two methods. The comparison revealed that the Lincoln-Petersen method underestimated the number of individuals. In 2013 and 2014, just the Huggins model for estimating the population was used.

Table 1. Foskett speckled dace population estimates from ODFW reports 1997 through 2014 (Dambacher et al. 1997, Scheerer and Jacobs 2005, 2007, and 2009; Scheerer 2011; Scheerer et al. 2012, 2013; and 2014).

Model	Year	Population	95% Confidence Interval
Lincoln-Petersen	1997	27,787	(14,057 - 41,516)
Lincoln-Petersen	2005	3,147	(2,535 - 3,905)
Lincoln-Petersen	2007	2,984	(2,403 - 3,702)
Lincoln-Petersen	2009	2,830	(2,202-3,633)
Lincoln-Petersen	2011	751	(616 - 915)
Huggins	2011	1,728	(1,269-2,475)
Lincoln-Petersen	2012	988	(898-1,098)
Huggins	2012	1,848	(1,489-2,503)
Huggins	2013	13,142	(10,665-16,616)
Huggins	2014	24,888	(19,250-31,510)

Population estimates conducted since 1997 show substantial population fluctuation with a downward trend from 2005 through 2012 (Scheerer et al. 2013). Scheerer and Jacobs (2007) postulated that the lower population abundance in 2005 and 2007 compared to 1997 was probably due to the reduction of open-water habitat in the cattail marsh. However, with recent habitat restoration efforts, the dace population increased fourteen fold since 2011 (Table 1).

Experimental habitat enhancement work by BLM in 2012, consisted of a controlled burn to reduce vegetation in the tule and cattail marsh, and excavation of eight 2.7 cubic yard pools, resulted in a threefold increase in the open water habitat in 2013. Additional hand excavation of the lower spring brook and marsh sections of the habitat was conducted in 2014. The population at Foskett Spring in 2013 was observed to increase by over 700 percent from the previous population estimate in 2012 and increased another 190% from 2013 to 2014. Large increases in the abundance of the dace population was observed in 2014 in the spring brook and tule marsh areas where BLM excavated open water pools in 2013 and early 2014. This population increase appears to be the result of habitat enhancement by excavating pools to increase open-water habitat. Based on observations of an increase in population from 1,848 to 24,888 in just two years, it is apparent that this type of habitat enhancement is a great benefit to the Foskett speckled dace.

In comparing the estimates from 1997 to 2005, 2007, 2009, 2011, 2012, 2013, and 2014 by habitat type, the ODFW estimated that there was an increase in the number of Foskett speckled dace inhabiting pool habitat and a decrease in the number inhabiting the stream or marsh type habitat. The results of the estimates conducted in 2013 and 2014 show an increase in abundance of Foskett speckled dace in areas where open-water habitat was expanded, but also showed an increase where open-water habitat was

already in existence at the “spring pool” (Scheerer et al. 2013). This supports our assumption that an increase in open-water habitat will result in higher numbers of dace occupying that habitat and also supports the hypothesis that Foskett Spring habitat relies on active vegetation and sediment removal to assure conservation of the habitat, by maintaining and increasing the amount of open-water in the long-term.

Dace Spring

Dace Spring is located within one mile of Foskett Spring. No Foskett speckled dace were found in a 1970 survey of Dace Spring. An attempt was made to establish a refuge population at Dace Spring starting in 1979 and 1980. In each year, 50 fish were removed from Foskett Spring and transplanted into Dace Spring. An estimated 300 fish were present in 1986 (Williams et al. 1990). In 1997, only 19 fish were estimated to remain in Dace Spring (Dambacher et al. 1997). Fish observed in Dace Spring were larger than those in Foskett Spring, probably due to the older age classes present and an indication that reproduction at Dace Spring was no longer occurring. The population persisted for at least 17 years; the last observation of fish from the 1979-80 translocation in Dace Spring was made in 1997.

The loss of Foskett speckled dace from Dace Spring was likely due to the limited area of habitat; the open-water filled in with sediment and vegetation, and habitat conditions for reproduction were not adequate. It is suspected that the Dace Spring habitat was not adequate for fish to persist in the long-term. The outflow of Dace Spring terminated in a metal cattle trough. The fish were probably transported with the water flow to the trough, and were unable to return to the spring. The ODFW recommended in their 2005 Progress Report that restoration of Dace Springs and introduction of Foskett speckled dace could reduce the risk of extinction and aid in recovery.

The BLM and the Service worked together to construct two ponds connected to the outlet channel of Dace Spring to provide additional habitat. Construction was completed in 2009, and 49 Foskett speckled dace were transferred to the constructed ponds in 2010. The population at Dace Spring ponds was estimated to be 34 in 2011 (survival from 2010 was 69 percent). The ODFW transferred an additional 75 Foskett speckled dace into the two ponds in 2011. Only 13 Foskett speckled dace were captured in the ponds in 2012 (survival of individuals from 2010 to 2011 was 11 percent). Large algal blooms and poor dissolved oxygen levels were observed at the ponds and the low survival was attributed to these factors (Scheerer et al. 2012).

In 2013, the BLM reconfigured the inlet and outlet to the two ponds allowing greater water flow which has improved the water quality. Also

in 2013, ODFW estimated there were 34 individuals (95% confidence level: 17 to 62) in the ponds and inlet at Dace Spring (Scheerer et al. 2013). After a few adjustments to the pond inlets to assure adequate water quality (reduction of algal blooms and improvement of dissolved oxygen levels), ODFW transplanted 200 Foskett speckled dace from Foskett Spring into the two ponds (100 fish in each pond) in October 2013.

The 2014 population estimate at Dace Spring was 552 individuals (95% confidence level: 527-694). The presence of smaller fish, and more fish than the number transplanted, indicates recent successful recruitment (Scheerer et al. 2014). The two constructed pools at Dace Spring appear to be successful at providing additional habitat to serve as a refuge population for Foskett speckled dace.

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

In 2003, genetic samples were collected from dace from Foskett Spring, the surrounding Warner Basin, and the adjacent Goose Lake Basin, to analyze the genetic relatedness of Foskett speckled dace in comparison with other nearby dace species. Preliminary genetic information indicates that: “Foskett speckled dace and other populations in the Warner Basin are approximately equally diverged from one another evolutionarily, suggesting similar times of divergence since the late Pleistocene” (Ardren et al. 2009). Based on the genetic analysis, Ardren concluded:

1. The magnitude of genetic distances and phylogenetic structuring observed between speckled dace from the Warner Basin and Goose Lake Basin are consistent with patterns usually observed between congeneric species, indicating a deep biogeographical split between these two basins;
2. Speckled dace within the Warner Basin and Foskett Spring appear to be very closely related with a level of genetic divergence among populations and phylogenetic structuring more typical of conspecific populations than congeneric species or subspecies;
3. The pattern of diversity among the four Warner Basin populations is consistent with all populations being of natural origin; and,
4. No evidence was found that Foskett speckled dace are reciprocally monophyletic in respect to the other Warner Basin populations, and nucleotide variations at two mtDNA genes do not justify subspecies status.

Ardren et al. (2009) went on to say that his results do not preclude the possibility that other independent genetically based traits that are associated with morphological or life history differences could have occurred within the last 10,000 years. A systematic assessment of morphological traits and life history of the speckled dace in Warner Basin (Deep, Honey, and Twelvemile creeks, and Foscett Spring) was needed to determine whether or what subspecies classification is warranted. Ardren et al. (2009) concluded that a comprehensive range wide systematic study of all speckled dace would be needed to identify major evolutionary units of this broadly distributed and morphologically diverse species.

In 2013, additional analysis of the genetic and morphometric variation of several dace in Oregon's Great Basin regions, including Foscett speckled dace, was conducted by Hoekzema (2013). Based on the apparent lack of genetic distance between Foscett speckled dace and the rest of Warner Basin speckled dace, Hoekzema concluded that the Foscett speckled dace have not been isolated long enough to diverge significantly. But Foscett speckled dace exhibit diagnostically different morphology from other dace in Oregon's Great Basin region (Hoekzema 2013). Hoekzema and Sidlauskas (2014) found no genetic evidence that speckled dace from Foscett Spring warrant subspecies or species status.

It is unlikely the differences between spring and stream resident dace in the Warner Basin resulted from randomly accumulated mutations over time, but rather resulted from either ecophenotypic (non-heritable modifications of an organism's physical characteristics, produced in response to factors in the environment or habitat) induction or rapid local adaptation in certain genes to the unusual habitat of Foscett Spring (Hoekzema 2013). The effects of rapid genetic adaptation and phenotypic plasticity are difficult to distinguish without the use of genomic, next-generation sequencing to identify functional genes under selection (Hoekzema 2013).

Although Sidlauskas and Hoekzema (2014) provide new information on the uniqueness of Foscett speckled dace, they state that the Foscett speckled dace would not currently be classified as a separate species or subspecies according to criteria by Zink (2004). However, they suggest that the Foscett speckled dace may fit as a distinct population segment (Sidlauskas and Hoekzema 2014) based on the Service's DPS policy (U.S. Fish and Wildlife Service 1996). Sidlauskas and Hoekzema also present their application of the Service's DPS policy as summarized below.

Their analysis shows that Foscett speckled dace are related to other populations of speckled dace in Oregon. However, both a population genetic analysis (Hoekzema and Sidlauskas 2014) and a morphometric analysis (Hoekzema, 2013) indicate Foscett speckled dace are a discrete

entity relative to dace elsewhere in Oregon's Great Basin. Their analysis shows that Foskett speckled dace are a separate genetic entity, implying reproductive isolation, from surrounding Warner Valley populations of speckled dace for the past 10,000 years (Hoekzema and Sidlauskas 2014). A morphometric study, based on detailed measurements of body proportions and counts of scales and fin elements, conducted by Hoekzema (2013) indicates that Foskett speckled dace differ in mean morphology when compared to other speckled dace in surrounding basins. Foskett speckled dace have significantly fewer scales in the lateral line scale-series, shorter caudal peduncles (the narrow part of the body nearest to where the tail fin is attached), dorsal fins located further back on the body toward the tail, and larger heads compared to other speckled dace in surrounding basins in southeastern Oregon (Hoekzema, 2013).

Sidlauskas and Hoekzema (2014) also state that Foskett Spring itself represents a unique habitat within the Warner Valley. The spring is isolated in the Coleman Subbasin, water temperature is constant at approximately 65 degrees F year round, and has higher mineral concentrations than other springs in Warner Valley (Mauger 2000). Speckled dace occur in several other springs in southeastern Oregon, but none of the springs have the same physical characteristics as Foskett Spring, and the dace residing in other springs do not match Foskett speckled dace morphologically (Sidlauskas and Hoekzema 2014). The differing morphologies could represent either a phenotypic response or genetic adaptation based on the various spring conditions. Current data do not permit a formal test of either hypothesis, but either scenario suggests a substantial role of the unusual habitat of Foskett Spring in shaping the morphology of the Foskett speckled dace living there (Sidlauskas and Hoekzema 2014).

Sidlauskas and Hoekzema also present differences of Foskett speckled dace from other speckled dace populations based on microsatellite analysis. Their analysis indicates that Foskett speckled dace have been reproductively isolated and on an evolutionary trajectory since the end of the Pluvial period, approximately 10,000 years ago representing a significant contribution to the genetic diversity of the speckled dace taxonomic group (Hoekzema and Sidlauskas 2014).

2.3.1.4 Taxonomic classification or changes in nomenclature:

At the time of listing, the Foskett speckled dace was considered to be an undescribed subspecies of *Rhinichthys osculus* (Girard) 1857. *R. osculus* (speckled dace) have a large geographic range throughout major drainages in the western United States, and populations show high degrees of endemism and exhibit large differences in morphological traits (Pfrender et al. 2003). Pfrender et al. (2003) stated that our understanding of the

relationships among populations in this complex is limited, and there is no clear consensus regarding the number of distinct evolutionary lineages within *R. osculus*. Foskett speckled dace can be distinguished from other speckled dace by external characteristics, such as: a much reduced lateral line with about 15 scales with pores; about 5 lateral line scales; a large eye; the dorsal fin is positioned well behind the pelvic fin but before the beginning of the anal fin; and barbells are present on most individuals (Carl Bond, Oregon State University, pers. comm. 1990; cited in U.S. Fish and Wildlife Service 1998). However, Bond did not provide a formal description or a scientific name for this subspecies, nor was his work peer reviewed.

Genetic investigations by Ardren et al. (2009) provided new information regarding the evolutionary relationship of Foskett speckled dace to other Warner Basin and Goose Lake Basin speckled dace (see section 2.3.1.3). Additional analysis of the morphometrics of several dace in Oregon's Great Basin region, including Foskett speckled dace, was conducted by Hoekzema (2013). Hoekzema (2013) and Hoekzema and Sidlauskas (2014) concluded that evidence of genetic isolation, distinct morphology, and the unique habitat at Foskett Spring qualifies Foskett speckled dace for consideration as an evolutionarily significant unit (or DPS) on a unique evolutionary path (see section 2.3.1.3). No changes to the taxonomic classification of Foskett speckled dace as listed under the Endangered Species Act have occurred since it was listed in 1985.

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 historical range, change in distribution of the species' within its historic range, etc.):

The historical known range of the Foskett speckled dace was limited to Foskett Spring in the Coleman Subbasin, in southeastern Oregon. At the time of listing, Foskett speckled dace were restricted to Foskett Spring and a transplanted population at nearby Dace Spring (see section 2.3.1.2). The Recovery Plan describes Foskett Spring as originating in a pool about 5 meters across. The outflow channel is approximately five centimeters deep and it gradually transitions to marshland, drying up before reaching the dry bed of Coleman Lake.

Surveys of Foskett Spring conducted in 2005 and 2007 document Foskett speckled dace in the spring pool, outflow stream, and the tule and cattail marshes of Foskett Spring. The ODFW estimated approximately 722 m² of wetted habitat in the spring pool, spring brook, tule marsh, cattail marsh, and sedge marsh (Scheerer and Jacobs 2005). In 2005 and 2007, approximately half of the population of Foskett speckled dace was located in the 33 m² spring pool. The open water habitat at Foskett Spring has

undergone changes resulting in significantly reduced open water area due to vegetation encroachment between 1997 and 2012. The BLM conducted habitat enhancement projects from 2012 through 2014 that excavated vegetation and increased open-water habitat by approximately 195 m², from 107 to 301 m². The BLM and ODFW conducted monitoring in association with the habitat enhancement projects in 2013 and 2014 (see section 2.3.1.2). Additional results of the habitat enhancement efforts are discussed above in section 2.3.1.2.

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

As discussed in sections 2.3.1.2 and 2.3.1.5 vegetative encroachment has significantly reduced open water habitat in Foscett Spring. Recent habitat enhancement efforts have been implemented at both Foscett and Dace springs that have reversed this trend, at least in the short term. In 2005 and 2007, the ODFW considered the Foscett speckled dace habitat to be in good condition, but limited in extent (Scheerer and Jacobs 2005 and 2007). They noted that encroachment by aquatic macrophytes may be limiting population abundance and that the decline in abundance of Foscett speckled dace since 1997 was probably due to the reduction in open-water habitat (see Figures 1 and 2). Dambacher et al. (1997) noted that past habitat enhancement efforts to increase open-water habitat have been unsuccessful due to sediment infilling and growth of macrophytes.



Figure 1. Foscett Spring 2003

Photo: Chris Allen, U.S. Fish and Wildlife Service



Figure 2. Foskett Spring 2014.

Photo: Alan Mauer, U.S. Fish and Wildlife Service

2.3.1.7 Other:

The State of Oregon enacted an Endangered Species Act (Oregon ESA) in 1987 and amended it in 1995. The Foskett speckled dace was listed as threatened as part of the original enactment of the Oregon ESA in 1987. See section 2.3.2.4 for a description of the Oregon ESA.

In 2002, the Oregon Fish and Wildlife Commission adopted the Native Fish Conservation Policy (ODFW 2002). The purpose of the policy is to ensure the conservation and/or recovery of native fish in Oregon. As part of this policy, interim risk assessments were completed for selected native fish species, including the Foskett speckled dace (ODFW 2005). The ODFW concluded, based on criteria defined in the Native Fish Conservation Policy [OAR 635-007-0507], that the Foskett speckled dace was “at risk”. At the time, the rating was based on low abundance of individuals; lack of information on productivity; and limited distribution. Foskett speckled dace was not considered at risk for reproductive independence and interspecific hybridization. The status review stated that: “Because of its highly restricted distribution, dependence on a single water source, and loss of habitat area from sedimentation and growth of aquatic macrophytes, Foskett speckled dace is vulnerable to catastrophic loss.” Implementation of the policy can occur through the development of a conservation plan that would include current and desired biological status, primary threat factors, short- and long-term management strategies, monitoring and research needs, and reporting. In lieu of a conservation

plan, ODFW manages this species according to administrative rules and statutes requiring that they:

- Protect and enhance Oregon's fish and wildlife and their habitats for use and enjoyment by present and future generations (ORS 496.012 & ORS 506.109).
- Prevent the serious depletion of any native fish species by protecting natural ecological communities, conserving genetic resources, managing consumptive and non-consumptive fisheries, and using hatcheries responsibly so that naturally produced native fish are sustainable (OAR 635-007-0503).
- Maintain and restore naturally produced native fish species, taking full advantage of the productive capacity of natural habitats, in order to provide substantial ecological, economic, and cultural benefits to the citizens of Oregon (OAR 635-007-0503).

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:

The Service listed the Foskett speckled dace as threatened in 1985 due to a very restricted range, it occurred in low numbers, and occupied small springs that were extremely vulnerable to, and were experiencing, destruction or modification. Factors that were identified in the final rule included ground water pumping for irrigation, excessive trampling of the habitat by livestock, channeling of the springs for agricultural purposes, other mechanical modifications of the aquatic ecosystem; and livestock water uses. The vulnerability of the habitat was accentuated by its very small size and a water flow rate less than 0.5 cubic feet per second (50 FR 12303).

Livestock use and Mechanical modification

Since the time of listing, BLM acquired the property containing Foskett and Dace springs by land exchange in 1987. BLM has fenced 70 acres (28 hectares) of the 160 acre parcel to exclude cattle from both Foskett and Dace springs as well as the two recently constructed ponds. Although most of the habitat was excluded from grazing, a portion of the occupied habitat was not included in the fenced area. In 1997, 97 percent of the total estimated population of Foskett speckled dace occurred in a shallow open-water pool outside of the Foskett Spring enclosure fence. This shallow pool was dry in 1989 (Dambacher et al. 1997).

In 2007, 422 out of a population of 2,984 Foskett speckled dace were estimated to occur within outflow habitat outside of the exclusion fence (Scheerer and Jacobs 2007). Trampling of the wetland habitat was evident. Grazing of cattle impacts the form and function of stream and pool habitat by hoof shearing, compaction of soils, and mechanical alteration of the habitat.

In 2011 and 2012, no Foskett speckled dace were detected in the cattail marsh outside of the exclusion fence (Scheerer et al. 2014). BLM conducted a controlled burn in 2013 and in 2013 and 2014 excavated open water habitat in the cattail marsh. Approximately 3,000 Foskett speckled dace were detected both years. Exclusion of grazing cattle improves water quality and habitat stability, but may have played a role in reducing the extent of encroaching aquatic vegetation. The newly created habitat that was created outside the enclosure quickly grew dense with vegetation and the excavated pool filled in. ODFW commented in their 2014 Annual Progress Report, that this illustrates the need for frequent maintenance of open water habitat for the Foskett speckled dace (Scheerer et al. 2014).

Sometime in fall and/or winter of 2014/2015 unauthorized grazing by cattle occurred in the Foskett Spring and Dace Spring enclosures (Leal pers. comm. 2015). Cattle accessed the site after a gate was illegally removed. Based on photos provided by the BLM, it appears the vegetation utilization was sporadic and heavy in some areas, streambank damage appeared light, and impacts to Foskett and Dace springs appeared to be minimal. Although cattle did access the Foskett and Dace spring sites, overall the enclosures have provided sufficient protection to Foskett and Dace springs from damage due to excessive livestock grazing. BLM has replaced the gate and will continue to maintain the fence.

The field surveys conducted in 2005 through 2014 at Foskett Spring did not reveal any sign of artificial channeling of water or mechanized impacts beyond the remnants of the historical activities (two small rock cribs and side-casting of material around the spring). The habitat at Foskett Spring is limited in extent, and encroachment by aquatic vegetation has reduced the area of open-water in the past. The decline in abundance of Foskett speckled dace from 1997 to 2011 was likely due to the reduction in open-water habitat (Scheerer and Jacobs 2005; Scheerer et al. 2012) (see section 2.3.1.2 and 2.3.1.6). Past habitat enhancement efforts to increase open-water habitat have been unsuccessful in the long-term due to sediment infilling, subsequent growth of aquatic plants, and lack of on-going management.

The ODFW recommended that restoration efforts to increase open-water habitat be considered to increase carrying capacity for Foskett speckled dace. Restoration efforts were conducted at both Foskett and Dace springs

with subsequent substantial increases in open-water habitat and dace abundance (see section 2.3.1.2). As discussed in sections 2.2.3, 2.3.1.2, and 2.3.2.5 it is likely that ongoing habitat maintenance at Foskett and Dace springs will be periodically necessary to maintain open water habitat for the Foskett speckled dace. This habitat maintenance has been committed to in the August 2015 Cooperative Management Plan signed by BLM, ODFW and the Service.

The Cooperative Management Plan identifies actions to be taken such as protection of the aquatic habitat and surrounding land; manage and monitor the habitat to ensure continued persistence of important habitat features; and research life history, genetics, population trend, habitat use and preference, and other important parameters as identified by the cooperators. Implementation of the actions described in the Cooperative Management Plan is expected to reduce or eliminate threats related to destruction, modification or curtailment of its habitat or range.

Mechanical modification and livestock watering uses are no longer considered a threat since BLM acquired the property containing both Foskett and Dace springs and constructed an enclosure fence to exclude cattle from most of the habitat.

Pumping of ground water and lowering of the water table

Streams and lakes in and around the Warner Basin have produced a variety of unconsolidated Pliocene to Holocene sediments which have accumulated and contribute to the structure of the aquifer (Gonthier, 1985). Wells in other portions of the Warner Basin utilizing these Pleistocene lake bed aquifers tend to have low to moderate yields. Pleistocene lake bed deposits of clay, sand and diatomaceous earth have a total thickness up to 200 feet (60 meters) (Gonthier 1985). Hydraulic conductivity in the sediments ranges from 25 to 150 feet per day (7.6 to 46 meters per day); while transmissivity (horizontal groundwater flow) in the valley fill aquifer systems ranges from 1,000 to 15,000 square feet per day (Gonthier 1985). This is considered a poor quality aquifer only capable of producing small amounts of water for domestic or stock use (Gonthier 1985). Therefore, few wells are developed in the Warner Valley and are not likely to become an impact to Foskett Spring.

We do not have any evidence of ground water pumping in the area. A query of the Oregon Water Resources Department database for water rights did not reveal any wells within five miles of Foskett Spring. The closest well listed on the Oregon Water Resources Department database is 5.9 miles away and located along Twentymile Creek. No other wells were located closer to Foskett Spring.

There are no Oregon Water Resources Department records of established water rights in the vicinity of the springs. Any development of water resources and filing of water rights on BLM affected lands would require a permit from the BLM (BLM 2003). Therefore, the threat from groundwater pumping and lowering of the water table is no longer considered a reasonably foreseeable threat.

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

The original listing in 1985 stated: “There is no indication that the Foskett speckled dace is over-utilized for any of these purposes.” No additional information is known to change this conclusion.

2.3.2.3 Disease or predation:

The original listing in 1985 stated: “There are no known threats to Foskett speckled dace from disease or predation.” During the 2005 and 2011 population surveys conducted, the ODFW biologist noted that: “[t]he fish appear to be in good condition with no obvious external parasites” (Scheerer and Jacobs 2005 and Scheerer 2011). During the 2007 and 2009 population surveys, the ODFW noted that the Foskett speckled dace appear healthy and near carrying capacity (Scheerer and Jacobs 2007 and 2009). No additional information is known that would change this conclusion.

In addition, the Cooperative Management Plan includes quarterly field visits to Foskett and Dace springs to determine continued presence of Foskett speckled dace, determine general health of the local spring environment (photo points, water quality), and identify threats that necessitate implementation of the emergency contingency plan which could include the detection of disease and introduced predators. The emergency contingency plan describes steps to be taken to temporarily secure Foskett speckled dace in the event their persistence is under immediate threat (e.g., from introduction of non-native fish that may threaten them due to predation or act as a disease vector).

2.3.2.4 Inadequacy of existing regulatory mechanisms:

The 1985 listing rule stated: “The State of Oregon lists Foskett speckled dace as a “fully protected subspecies” under the ODFW regulations. These regulations prohibit taking of the fishes without an Oregon scientific collecting permit. However, no protection of the habitat is included in such a designation and no management or recovery plan exists for these subspecies.”

The Foskett speckled dace was listed as threatened by the State of Oregon as part of the original enactment of the Oregon Endangered Species Act in 1987. The listing designated Foskett speckled dace as a “protected species” and prohibited take or possession unless authorized by a permit. The Oregon ESA prohibits the “take” (kill or obtain possession or control) of listed species without an incidental take permit. The Oregon ESA applies to actions of State agencies on State-owned or leased land, and does not impose any additional restrictions on the use of Federal land. Under the Oregon ESA, State agencies (other than State land owning or managing agencies) determine the role they may serve in contributing toward conservation or take avoidance (OAR 635-100-0150). The Oregon ESA also directs that Survival Guidelines (OAR 635-100-0130 and 0135) or an approved endangered species management plan (OAR 635-100-0140) be prepared. Because the Foskett speckled dace was State listed prior to these 1995 amendments, these requirements do not apply to this species. The Oregon ESA regulates the “take” of Foskett speckled dace, but does not directly regulate or restrict activities that affect Foskett speckled dace habitat, because it is located on Federal land.

The State of Oregon’s Native Fish Conservation Policy (NFCP) calls for conservation and recovery of all native fish in Oregon. The Native Fish Conservation Policy requires that the ODFW prevent the serious depletion of any native fish species by protecting natural ecological communities, conserving genetic resources, managing consumptive and non-consumptive fisheries, and using hatcheries responsibly so that naturally produced native fish are sustainable (OAR 635-007-0503). As described in section 2.3.1.7 above, the policy can be implemented through the development of collaborative conservation plans for individual species management units that are adopted by the Oregon Fish and Wildlife Commission. To date, ODFW has implemented these criteria by following the federally adopted recovery plan.

Additionally, the ODFW, BLM, and the Service have prepared a Cooperative Management Plan to guide future management and protection of Foskett speckled dace (see section 2.2.3). The Cooperative Management Plan will provide a framework for the ODFW, Service, and BLM to work together to protect the Foskett speckled dace habitat in the future. The Cooperative Management Plan identifies actions to be implemented by the cooperating agencies which will provide for the long term persistence of the Foskett speckled dace through the management and protection of Foskett speckled dace habitat at Foskett and Dace springs. The Cooperative Management Plan documents the actions needed for long term conservation of the Foskett speckled dace population and identifies the roles and responsibilities of the Cooperators in carrying out these actions. Actions identified in the Cooperative Management Plan include: 1) protect and manage Foskett speckled dace habitat; 2) monitor the

habitat and the Foskett speckled dace population; 3) enhance the habitat when needed; and 4) implement the emergency contingency plan as needed to address potential threats from the introduction of non-native species, pollutants or other unforeseen threats.

In 1987, BLM acquired the 160 acre (65 hectare) parcel of land containing Foskett and Dace springs by land exchange. BLM has fenced 70 acres (28 hectares) of the 160 acre parcel to exclude cattle from both Foskett and Dace springs as well as the two recently constructed ponds. The BLM manages the site consistent with the Lakeview RMP. The Lakeview RMP provides general management direction for Special Status Species, and states that they will manage the Foskett speckled dace consistent with the Recovery Plan. Therefore, the Service no longer considers inadequacy of existing regulatory mechanisms to be a reasonably foreseeable threat.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Potential introduction of exotic species into Foskett Spring

The original listing rule in 1985 stated: “Additional threats include the possible introduction of exotic fishes into the springs, which could have disastrous effects on the endemic Foskett speckled dace, either through competitive exclusion, predation, or introduced disease. Because these fishes occur in such limited and remote areas, vandalism also poses a potential threat.”

No exotic fish introduction or of vandalism has occurred since the time of listing. The Foskett speckled dace is vulnerable to invasive or nonnative species (aquatic plants, invertebrates, or fish species). However, this vulnerability is reduced in part due to the remoteness of the site and the lack of recreational or other reasons for the public to visit the area. It is also reduced by the potential establishment of a refuge population in Dace Spring. The risk of such invasions occurring through human caused mechanism may be low, but the potential magnitude of the impact is great due to the highly restricted distribution of this species. The Cooperative Management Plan includes quarterly monitoring and an emergency contingency plan to address potential threats from introduction of non-native species or pollutants. Although the introduction of an exotic species represents a potential threat to Foskett speckled dace, we believe the risk is low based on the isolation of the site, the minimal visitor use of the springs, the lack of connectivity to other waterways, and the frequent monitoring agreed to in the Cooperative Management Plan.

Other Risk Factors

A species' habitat requirements, population size, and dispersal abilities among other factors, help to determine its vulnerability to extinction. Key risk factors include small population size, dependence upon a rare habitat

type, inability to move away from sources of stress or habitat degradation, restrictions to a small geographic area, and vulnerability to catastrophic loss resulting from random or localized disturbance (Williams et al. 2005).

The Service listed the Foscett speckled dace in 1985 in part due to these factors. This species had a very restricted range, it occurred in low numbers within a small spring (and a 1982 transplant site) that was extremely vulnerable to destruction or modification due to its small size, and a water flow rate less than 0.5 cubic feet per second. Additionally, the aquatic ecosystem upon which the Foscett speckled dace depended had been affected by livestock grazing and mechanical modification. These factors apply to the Foscett speckled dace and are more specifically discussed below.

Small population size

Surveys by ODFW from 2005 through 2014 indicate a variable population size (see Tables 1 and 2). Available open-water habitat appears to be a key factor in the population size of this species. In 1997, the population was estimated to be 27,787 with ninety-seven percent of the total population in a shallow ephemeral open-water pool outside the fenced enclosure and subject to cattle watering and grazing. This pool was dry in 1989. The 2005 population estimate was 3,147 fish (Scheerer and Jacobs 2005). Over half of the population occurred in the spring pool, and the investigators noted that the site was near carrying capacity, and that encroachment by aquatic macrophytes may be limiting the population abundance (Scheerer and Jacobs 2005). The lowest population estimate was 1,728 fish in 2011 (using the Huggins model). Experimental habitat enhancement work was conducted in 2012 through 2014 (section 2.3.1.2). The 2014 population estimate was 24,888 fish, which is not significantly different from the highest population estimate of 27,787 in 1997.

Table 2. Population estimates by ODFW split by habitat types. Abundance estimates were not calculated by habitat type in 2011 (from Scheerer et al. 2013 and Scheerer et al. 2014). Years 2011 and 2012 utilized both the Lincoln-Petersen model and the Huggins model.

Location	Lincoln-Petersen model						Huggins model			
	1997	2005	2007	2009	2011	2012	2011	2012	2013	2014
Spring Pool	204	1,627	1,418	247	322	404	-	633	2,579	2,843
Spring brook	702	755	719	1,111	262	409	-	589	638	7,571
Tule marsh	no sample	425	273	1,062	301	220	-	625	6,891	11,595
Cattail marsh	26,881	353	422	158	0	0	-	0	3,033	2,936
Entire Site	27,787	3,147	2,984	2,830	751	988	1,728	1,848	13,142	24,888

The population data indicates fluctuations in abundance and population trends. In 2005, the ODFW recommended that restoration efforts to increase open-water habitat be considered to increase carrying capacity. Habitat enhancement work was completed primarily in 2012, with some additional sediment removal in 2013 and 2014 and was concentrated in the tule marsh and cattail marsh habitat locations. The increase in population size in 2013 and 2014 is quite notable in those two habitat locations (see Table 2 above) after the pool excavations were completed (Leal et al. 2014). It is likely that ongoing maintenance at Foskett Spring will be periodically necessary in the future to maintain open water habitat to support healthy population levels of Foskett speckled dace. The Cooperative Management Plan includes measures such as removing encroaching vegetation and sod to enhance open water habitat and excavating open water pools. Habitat maintenance activities will be conducted every five to ten years or as determined necessary to maintain open water habitat to support healthy populations of Foskett speckled dace.

Additionally, the ongoing effort by the BLM and the Service to implement habitat restoration at Dace Spring provides the potential for a refuge population of Foskett speckled dace. Two ponds have been created and connected to the outlet channel of Dace Spring and Foskett speckled dace have been transferred to the ponds. The 2014 abundance estimate was 552 fish, which is a substantial increase from the 2013 estimate of 34 fish (see section 2.3.1.2). The estimate includes an additional 200 Foskett speckled dace that were transplanted from Foskett Spring in 2013 (Scheerer et al. 2014). Reproduction was documented by ODFW in 2014 (Scheerer et al. 2014). The ODFW is currently evaluating the status of the Foskett speckled dace transferred to the new ponds (see section 2.3.1.2) and although results are positive it is premature to conclude whether this effort will be successful over the long term.

Dependence upon a specific rare habitat type and inability to disperse

This species is presently only known to occur within Foskett Spring and a small transplanted population in Dace Spring (see section 2.3.1.2). Due to the small size of Foskett Spring and the lack of connectivity to other aquatic habitat, there is no ability for the Foskett speckled dace to disperse away from stress, habitat degradation, or disturbance factors. There are no streams or drainages or other aquatic connections that provide alternate habitat or allow for emigration. BLM created two new ponds connected to the outlet channel of Dace Spring and ODFW has introduced Foskett speckled dace into these ponds in an attempt to establish a refuge population (see sections 2.3.1.2 and 2.3.1.6). Maintaining the created habitat at Dace Spring and monitoring and management consistent with

the Cooperative Management Plan will minimize threats from stochastic events.

Restriction to a small geographic area and vulnerability to stochastic events

The Foscett speckled dace occurs in one small location in Foscett Spring and has been translocated to two small constructed ponds at Dace Spring. The available open-water habitat at Foscett Spring is limited and suitable habitat had been reduced in area due to encroachment by macrophytic aquatic vegetation. The use of excavation to enhance the amount of open-water habitat has proven to be a good conservation measure resulting in a significant increase in population. Because of its highly restricted distribution and dependence on a single water source, Foscett speckled dace are vulnerable to catastrophic loss. If successful in the long term, the translocation of dace to Dace Spring will help to reduce that risk by establishment of a refuge population.

Additionally, the Cooperative Management Plan will provide management of Foscett Spring and Dace Spring areas for the long term conservation of Foscett speckled dace. Although it is difficult to plan for and address catastrophic disturbances, regular monitoring including quarterly field visits and habitat and population surveys conducted every three to five years as described in the Cooperative Management Plan will help to detect changes to the habitat and identify such disturbances. The Foscett speckled dace is at risk of catastrophic loss, however, establishment of a refuge population in Dace Spring, and implementation of the Cooperative Management Plan would reduce this threat to a low level.

2.4 Synthesis

The Foscett speckled dace was listed as threatened in 1985 because it has an extremely restricted distribution, occurred in low numbers, naturally occurred within a single small spring and its' outflow that was extremely vulnerable to destruction and modification, and was experiencing human disturbance. The 1998 Recovery Plan recognized the vulnerability of the Foscett speckled dace based on its extremely small and isolated range and the potential for degradation of its habitat from localized events. The Recovery Plan stressed the need to address the threats to this species by preservation of its native ecosystem through long-term protection and management of the spring habitats. The Recovery Plan identified three criteria to be met to assure the conservation and long term sustainability of Foscett speckled dace. These criteria have been accomplished as described in this 5-year review and summarized below:

- (1) Long-term protection of habitat has occurred through the acquisition and fencing of both Foscett and Dace springs by the BLM. The aquifer surrounding Foscett Spring and Dace Spring is not currently being threatened. No new wells

have been drilled and the closest known well is approximately six miles away on the west side of Twentymile Creek;

(2) Long-term management actions have been developed and incorporated into a Cooperative Management Plan developed by the BLM, ODFW, and the Service. This plan was finalized in August 2015; and,

(3) Studies have been conducted by the Service, ODFW, BLM, and others, including monitoring genetics (Ardren 2009; Hoekzema 2013, Hoekzema and Sidlauskas 2014), habitat condition, population estimates and trends, and life history from 2005 until the present (Scheerer et al. 2014) that inform Recovery Plan criteria 1 and 2 (see section 2.2.3).

Additionally, BLM and the Service have completed a habitat enhancement effort to increase open water at Foskett Spring. BLM created two new habitat ponds connected to the outlet channel from Dace Spring and ODFW has introduced Foskett speckled dace into these ponds to establish a refuge population (see sections 2.3.1.2 and 2.3.1.6). Maintaining the additional habitat will provide stronger assurance against threats from stochastic events. The new refuge population at Dace Spring will be monitored to assess survival rates and recruitment.

Some of the initial factors that were directly degrading Foskett Spring, such as mechanical modification of the aquatic ecosystem and the use of the springs as livestock watering areas, no longer occur. At the time of listing, livestock grazing and trampling of the spring habitat was identified as a detrimental factor that resulted in a change in water flow, siltation, and accelerated erosion (U.S. Fish and Wildlife Service 1985). However, there was also acknowledgement that livestock grazing at some level may help maintain open water habitat.

Open water habitat in Foskett Spring is limited in extent and has been substantially reduced in area by the encroachment of aquatic vegetation. Maintaining open water is essential to the survival of the Foskett speckled dace. BLM and the Service completed a habitat enhancement project that increased open water habitat by 195m² (see sections 2.3.1.5 and 2.3.1.6). Post project monitoring revealed an increase in the population of Foskett speckled dace (from 1,848 to 13,142 individuals in 2013 (Scheerer et al. 2013; Leal et al. 2014) and 24,888 in 2014 (Scheerer et al. 2014). The observed fluctuations in population abundance and altered species distribution are likely the result of changes in available habitat due to alteration to the amount of open-water (see sections 2.3.1.2 and 2.3.1.5).

Our ability to confidently state that the Foskett speckled dace is not likely to become endangered in the foreseeable future is dependent upon addressing the risks related to a single population with a highly restricted distribution; the quality and quantity of its habitat; and the potential impact of a catastrophic stochastic event. The primary remaining risk factor is the loss of open water habitat due to the encroachment of aquatic

vegetation. This threat is pervasive and recurrent but active management to maintain open water will be sufficient to address this threat.

The Service considers the Foskett speckled dace to be reliant upon active, periodic, long-term habitat management to maintain open water habitat to ensure the persistence of this species. Therefore, there remains a long term need to manage the Foskett Spring habitat. The BLM has been proactive in management of Foskett Spring and Dace Spring to promote the conservation of Foskett speckled dace. Additionally, a Cooperative Management Plan agreement has been signed by BLM, ODFW, and the Service. This plan will provide for joint agency actions to maintain and enhance open-water habitat and allow for monitoring population status and habitat conditions. We believe that the Foskett speckled dace will maintain a self-sustaining wild population under this ongoing management plan to maintain open water habitat within Foskett Spring and Dace Spring.

Research has been conducted on the genetics of Foskett speckled dace. Ardren et al. (2009) provided new information regarding the evolutionary relationship of Foskett speckled dace to other Warner Basin and Goose Lake Basin speckled dace (See section 2.3.1.3) and recommended further investigation comparing Foskett speckled dace with other dace throughout their range. Hoekzema (2013) assessed the genetic relatedness of Foskett speckled dace to other dace in the region, and found them to be quite different, but did not recommend description as a separate species or sub-species.

Although the analysis presented by Sidlauskas and Hoekzema (2014) determines that Foskett speckled dace should no longer be considered a valid subspecies, they also argue, citing genetic and morphometric data, that Foskett speckled dace populations are discrete from speckled dace populations in the rest of the Warner Valley, and have been for about 10,000 years. These authors also articulate a rationale for why the Foskett speckled dace populations might also be considered “significant”, the second prong of a two prong test (the other prong being “discreteness”) to determine if a DPS exists. While we find these arguments compelling, the Service has not made a determination about whether such a DPS exists pursuant to our *Policy Regarding the Recognition of Distinct Vertebrate Population* (U.S. Fish and Wildlife Service 1996). The use of the DPS designation would be similar to the original designation as an “undescribed subspecies”, in that both “subspecies” and DPS are considered listable entities under the Act, as they are both part of the definition of the term “Species” as used in the Act.

Based on the status of the Foskett speckled dace, progress of conservation activities leading to the recovery of the species, and long-term commitments by the Service, BLM and ODFW through the Cooperative Management Plan to manage and monitor open water habitat to support a healthy population, we recommend the Foskett speckled dace be considered for delisting. Given this recommendation, we believe that devoting staff time to the DPS question would be a hypothetical exercise, and hence would not be an efficient use of public resources. We recommend that the Foskett speckled dace be retained as described in the original listing for the time being, and that this entity be proposed for delisting due to progress of conservation activities leading to the recovery of the species (see sections 2.2.3, 2.3.1.5, and 2.4).

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: 15

Brief Rationale:

We recommend maintaining the recovery priority number at 15 which is a low risk with a high potential for recovery. Recovery actions have been accomplished including: acquisition of Foskett Spring and Dace Spring by BLM; improving habitat quality through removal of aquatic vegetation and enhancing the amount of open-water habitat at Foskett Spring; implementing the habitat restoration and fish transplant at Dace Spring; finalizing a joint Cooperative Management Plan between the Service, ODFW, and BLM; and monitoring of Foskett speckled dace, habitat quality, and habitat quantity. All of these actions promote long-term persistence and provide significant recovery benefits for the Foskett speckled dace.

3.3 Listing and Reclassification Priority Number:

- Reclassification (from Threatened to Endangered) Priority Number:** _____
- Reclassification (from Endangered to Threatened) Priority Number:** _____
- Delisting (regardless of current classification) Priority Number:** 6

Brief Rationale:

Based on the criteria in Federal Register 48, No. 184 (U.S. Fish and Wildlife Service 1983), used to determine the priority number, the Foskett speckled dace has a low management impact, and reclassification action has not been petitioned. Therefore, we recommend assigning a Listing and Reclassification Priority Number of six to the Foskett speckled dace.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

1. The Service and BLM should continue to conduct habitat enhancement activities to reduce the encroachment by aquatic and emergent vegetation, and

maintain and enhance the amount of open-water habitat at Foskett Spring and Dace Spring as described in the Cooperative Management Plan.

2. The Service, BLM, and ODFW should continue to monitor the Foskett speckled dace population and spring habitat consistent with the Cooperative Management Plan. Monitoring should be sufficient to track fluctuations in fish abundance, quantity and quality of available habitat, and presence of any non-native or invasive aquatic plant, invertebrate, or fish species. Fish surveys every three to five years are recommended to provide information on multiple age classes of fish, and population trends.
3. The Service, ODFW, and BLM should continue to assess the translocation of Foskett speckled dace to Dace Spring, including habitat maintenance and monitoring requirements.
4. BLM should continue to assess and maintain the fence surrounding Foskett and Dace springs to ensure that livestock do not access the springs.

5.0 REFERENCES

- Ardren, W. R., J. Baumsteiger, C. S. Allen. 2009. Genetic analysis and uncertain taxonomic status of threatened Foskett Spring speckled dace. *Conserv. Genet.* Published online 28 July 2009.
- Bond, C.E. 1974. Endangered plants and animals of Oregon: I. Fishes. *OR Agric. Exp. Sta. Spec. Rept.* 205:1-9.
- Bureau of Land Management (BLM). 2003. Lakeview Resource Management Plan and Record of Decision. Bureau of Land Management, Lakeview, Oregon. 186 pp.
- Dambacher, J.M., A.G. Talabere, D.L. Hill, and D.F. Markle. 1997. Foskett speckled dace investigations. Fish Research Progress Report. Oregon Department of Fish and Wildlife and Oregon State University.
- Gonthier, J.B. 1985. A description of aquifer units in eastern Oregon. U.S. Geological Survey Water Resources Investigation Report 84-4095, 39 pp.
- Hoekzema, K. 2013. Phylogenetic and morphometric analysis of speckled dace (*Rhinichthys osculus*) from Oregon's Great Basin. M.Sci. Thesis, Oregon State University.
- Hoekzema, K., and B.L. Sidlauskas. 2014. Molecular phylogenetics and microsatellite analysis reveal cryptic species of speckled dace (Cyprinidae: *Rhinichthys osculus*) in Oregon's Great Basin. *Molecular Phylogenetics and Evolution*, Volume 77, August 2014, Pages 238-250.
- Leal J.J., P.D. Scheerer, and A.J. Mauer. 2014. Wetland Habitat Restoration and Population Response of Foskett Speckled Dace in Southeast Oregon. Poster presented to the 2014 Oregon Chapter American Fisheries Society Meeting, Eugene, Oregon.
- Mauger, S. 2000. Invertebrate composition and distribution in desert springs of Oregon. Thesis, Oregon State University.
- Oregon Department of Fish and Wildlife (ODFW). 2002. Oregon Native Fish Conservation Policy. Oregon Department of Fish and Wildlife, Salem, Oregon.
- Oregon Department of Fish and Wildlife (ODFW). 2005. Oregon Native fish status report. Oregon Department of Fish and Wildlife, Salem, Oregon.
- Pfrender M.E., J. Hicks, and M. Lynch. 2003. Biogeographic patterns and current distribution of molecular-genetic variation among populations of speckled dace, *Rhinichthys osculus* (Girard). *Molecular Phylogenetics and Evolution*, 30(3), 490-502.

- Scheerer, P.D. and S.E. Jacobs. 2005. Hutton Spring tui chub and Foskett Spring speckled dace investigations. Oregon Department of Fish and Wildlife, Salem, Oregon.
- Scheerer, P.D. and S.E. Jacobs. 2007. Hutton Spring tui chub and Foskett Spring speckled dace investigations. Oregon Department of Fish and Wildlife, Salem, Oregon.
- Scheerer, P.D. and S.E. Jacobs. 2009. 2009 Foskett Spring speckled dace investigations. USFWS cooperative agreement 13420-080J814, Annual Progress Report, Oregon Department of Fish and Wildlife, Salem, Oregon.
- Scheerer, P. D. 2011. 2011 Foskett Spring speckled dace investigations. USFWS cooperative agreement 13420-080J814, Annual Progress Report, Corvallis, Oregon.
- Scheerer, P. D., S. Clements, and J. T. Peterson. 2012. 2012 Foskett Spring speckled dace investigations. USFWS cooperative agreement F11AC00095, Annual Progress Report, Corvallis, Oregon.
- Scheerer, P. D., J. T. Peterson, and S. Clements. 2013. 2013 Foskett speckled dace investigations. USFWS cooperative agreement F12AC01064, Annual Progress Report, Corvallis, Oregon.
- Scheerer, P. D., J. T. Peterson, and S. Clements. 2014. 2014 Foskett speckled dace Investigations. USFWS cooperative agreement F13AC00622 and BLM L12AC20619, Annual Progress Report, Corvallis, Oregon.
- Sidlauskas, B.L. and K. Hoekzema. 2014. Molecular phylogenetics and microsatellite analysis reveal cryptic species of speckled dace (Cyprinidae: *Rhinichthys osculus*) in Oregon's Great Basin. *Molecular Phylogenetics and Evolution* 77 (2014) 238–250
- U.S. Fish and Wildlife Service. 1983. Endangered and threatened species listing and recovery priority guidelines. Federal Register 48:43098-43105.
- U.S. Fish and Wildlife Service. 1985. Endangered and threatened wildlife and plants; Determination of threatened status for Hutton tui chub and Foskett speckled dace. Federal Register 50:12302-12306.
- U.S. Fish and Wildlife Service. 1996. Policy regarding the recognition of distinct vertebrate population segments under the Endangered Species Act. Federal Register 61(26): 4722-4725.
- U.S. Fish and Wildlife Service. 1998. Recovery plan for the native fishes of the Warner Basin and Alkali Subbasin. Portland, Oregon. 86 pp.
http://ecos.fws.gov/docs/recovery_plans/1998/980427.pdf
- U.S. Fish and Wildlife Service. 2009. Foskett speckled dace (*Rhinichthys osculus* ssp.) 5-year review: summary and evaluation, Bend Field Office, Bend, Oregon. 18 pp.

U.S. Fish and Wildlife Service, Bureau of Land Management, and Oregon Department of Fish and Wildlife. 2015. Cooperative Management Plan for Foskett Speckled Dace.

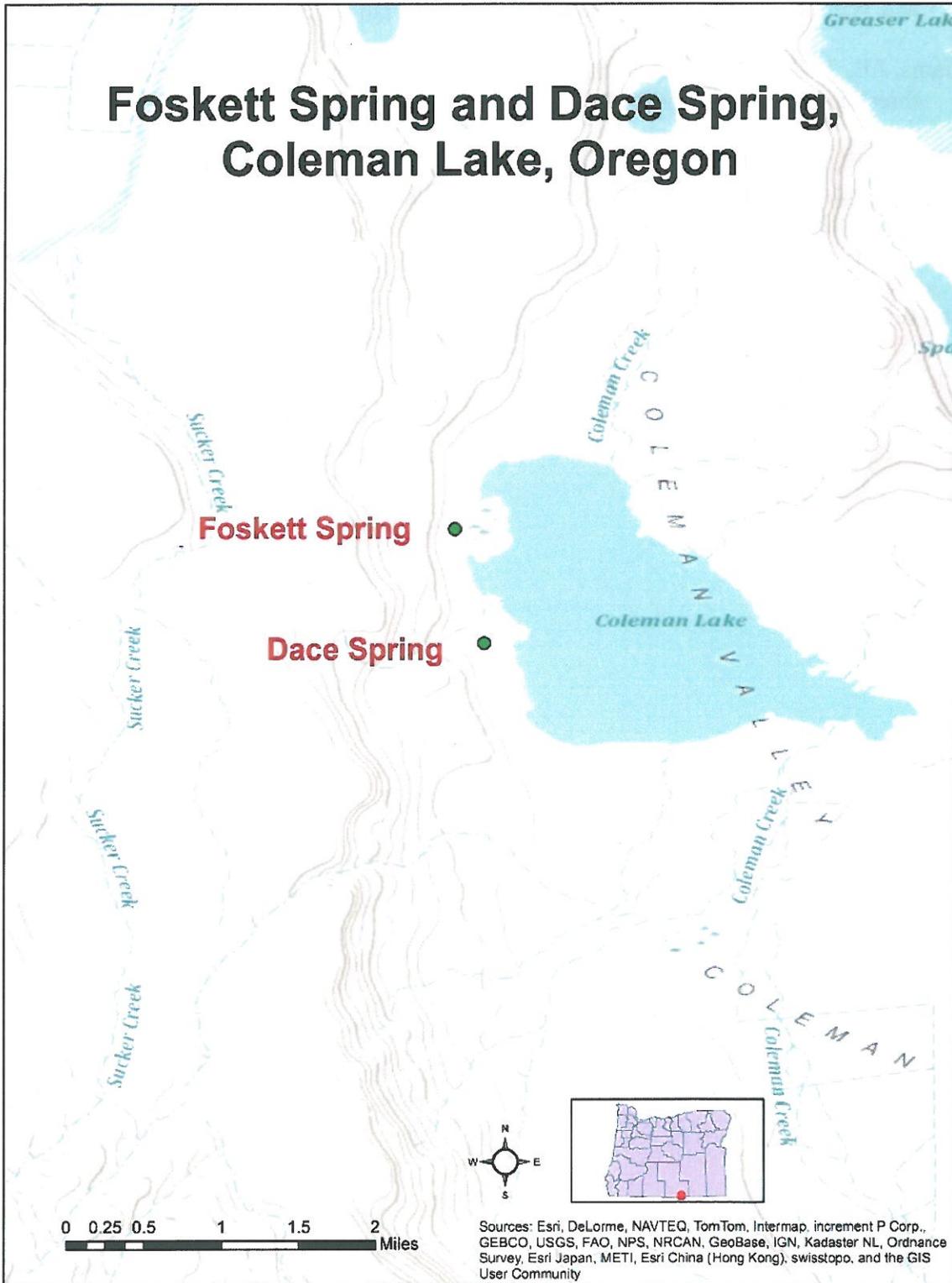
Williams, J.E., M.A. Stern, A.V. Munhall, and G.A. Anderson. 1990. Conservation status of the threatened fishes in Warner Basin, Oregon. *Great Basin Naturalist* 50:243-248.

Williams, J. E., C. A. Macdonald, C. D. Williams, H. Weeks, G. Lampman, and D.W. Sada. 2005. Prospects for Recovering Endemic Fishes Pursuant to the U.S. Endangered Species Act. *Fisheries* 30(6):23-29.

Personal Communications:

Leal J.J. 2015. Pers. Comm. Electronic mail to Alan Mauer on March 17, 2015. Discussion of conditions at Foskett and Dace springs.

6.0 MAP



Signature Page
U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Foskett Speckled Dace (*Rhinichthys osculus* ssp.)

Current Classification: Threatened

Recommendation Resulting from the 5-Year Review:

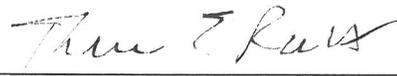
- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: 6

Review Conducted By: Alan Mauer



Lead Field Supervisor, Fish and Wildlife Service Date 10/13/15

Approve 

Lead Regional Director, Fish and Wildlife Service Date 10/26/15
