DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R1–ES–2014–0002; FXES11130900000C6–156–FF09E42000]

RIN 1018–BA28

Endangered and Threatened Wildlife and Plants; Removing the Oregon Chub From the Federal List of Endangered and Threatened Wildlife

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), are removing the Oregon chub (*Oregonichthys crameri*) from the Federal List of Endangered and Threatened Wildlife. This determination is based on a thorough review of the best available scientific and commercial information, which indicates that the Oregon chub has recovered and no longer meets the definition of an endangered species or a threatened species under the Endangered Species Act of 1973, as amended (Act). Our review of the status of this species shows that the threats to this species have been eliminated or reduced and populations are stable so that the species is not currently, and is not likely to again become, a threatened species within the foreseeable future in all or a significant portion of its range. This rule also removes the currently designated critical habitat for the Oregon chub throughout its range.

DATES: This rule is effective on March 23, 2015.

ADDRESSES: This final rule and the post-delisting monitoring plan are available on the Internet at *http://www.regulations.gov* at Docket Number FWS–R1–ES–2014–0002. Comments and materials received, as well as supporting documentation used in the preparation of this rule, will be available for public inspection, by appointment, during normal business hours, at the Service's Oregon Fish and Wildlife Office, 2600 SE 98th Avenue, Portland, OR 97266.

FOR FURTHER INFORMATION CONTACT: Paul Henson, State Supervisor, Oregon Fish and Wildlife Office (see **ADDRESSES**); telephone 503–231–6179; or facsimile (fax) 503–231–6195. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Information Relay Services (FIRS) at 800–877–8339 for assistance.

SUPPLEMENTARY INFORMATION:

Executive Summary

This document contains: (1) A final rule to remove the Oregon chub from the Federal List of Endangered and Threatened Wildlife, and (2) a notice of availability of a final post-delisting monitoring plan.

Species addressed—The Oregon chub (*Oregonichthys crameri*) is endemic to the Willamette River drainage of western Oregon. Extensive human activities in the Willamette River Basin (*e.g.,* dams, levees, and other human development within the floodplain) have substantially reduced the amount and suitability of habitat for this species. Improved floodplain management and floodplain restoration by multiple conservation partners has reduced and mitigated adverse human-related impacts and resulted in significant improvements to habitat quality and quantity. As a result, threats to the Oregon chub have been largely ameliorated.

The status of the species has improved dramatically due to the discovery of many new populations and successful reintroductions within the species' historical range. At the time of listing in 1993 (58 FR 53800, October 18, 1993), only nine known populations of Oregon chub existed, and few estimates existed of the number of individuals within each population. The locations of these populations represented a small fraction (estimated as 2 percent based on stream miles) of the species' formerly extensive distribution within the Willamette River drainage. In 2013, 77 populations were known to exist throughout the Willamette River drainage. The risk of extinction is substantially reduced as threats have been ameliorated and new populations have been discovered or established.

Purpose of the Regulatory Action—Under the Endangered Species Act of 1973, we may be petitioned to list, delist, or reclassify a species. In 2010, we reclassified the Oregon chub from endangered to threatened (75 FR 21179, April 23, 2010), based on defined criteria in the species recovery plan. In 2014, we proposed to remove the Oregon chub from the Federal List of Endangered and Threatened Wildlife (79 FR 7136, February 6, 2014), based on delisting criteria in the recovery plan and a five factor threats analysis. Threats to this species have been largely ameliorated, with the exception of the effects of climate change, and we do not consider such effects to be a substantial threat to the species at this time. Therefore, we have determined that the Oregon chub no longer meets the definition of an endangered or threatened species under the Act. This final rule removes the Oregon chub from the Federal List of Endangered and Threatened Wildlife. This rule also removes the currently designated critical habitat for the Oregon chub throughout its range.

Basis for the Regulatory Action—Under the Act, a species may be determined to be an endangered species or threatened species because of any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We must consider the same factors in delisting a species. We may delist a species if the best scientific and commercial data indicate the species is neither endangered nor threatened for one or more of the following reasons: (1) The species is extinct; (2) the species has recovered and is no longer threatened or endangered; or (3) the original scientific data used at the time the species was classified were in error.

Threats to the Oregon chub at the time of listing in 1993, included loss of habitat, water quality, and competition with and predation by nonnative fishes. We reviewed all available scientific and commercial information pertaining to the five threat factors in our status review of the Oregon chub, and the results are summarized below.

- We consider the Oregon chub to be ''recovered'' because all substantial threats to this fish have been ameliorated and the species is now abundant and well-distributed throughout much of its presumed historical range.
- All remaining potential threats to the species and its habitat, with the exception of effects related to climate change, have been ameliorated, and many populations exist on public lands managed for fish and wildlife conservation.
- We do not consider effects related to climate change to be a substantial threat to the species at this time, and we do not expect climate change effects to rise to the magnitude or severity such that the species will be likely to become an endangered species within the foreseeable future. While we recognize that climate change effects such as rising air temperatures, reduced snowpack, and increased drought may have potential effects to the Oregon chub and its habitat, the best available information does not indicate that such

effects will significantly impact the Oregon chub or its habitat. We expect that the Oregon chub's susceptibility to climate change effects is low given the wide range of temperature tolerances of Oregon chub, the range and diversity of habitats occupied by the species, and because effects of climate change will be ameliorated by multiple storage dams in the Willamette River Basin.

- We find that delisting the Oregon chub is warranted and thus we are removing this taxon from the Federal List of Endangered and Threatened Wildlife.
- We prepared a final post-delisting monitoring plan to monitor the Oregon chub after delisting to verify that the species remains secure.

Previous Federal Actions

Please refer to the proposed rule to remove the Oregon chub from the Federal List of Endangered and Threatened Wildlife (79 FR 7136, February 6, 2014) for a detailed description of previous Federal actions concerning this species. This document is our final rule to remove the Oregon chub from the Federal List of Endangered and Threatened Wildlife.

Background

This is a final rule to remove the Oregon chub from the Federal List of Endangered and Threatened Wildlife. It is our intent to discuss in this final rule only those topics directly relevant to the removal of the Oregon chub from the Federal List of Endangered and Threatened Wildlife.

Species Information

The following section contains information updated from that presented in the proposed rule to remove Oregon chub from the Federal List of Endangered and Threatened Wildlife, which published in the **Federal Register** on February 6, 2014 (79 FR 7136). A thorough discussion of the species' description, population density, and abundance is also found in the proposed rule.

Species Description and Life History—The Oregon chub is a small minnow in the Cyprinid family. Young of the year range in length from 7 to 32 millimeters (mm) (0.3 to 1.3 inches (in)), and adults grow up to 90 mm (3.5 in) in length (Pearsons 1989, p. 17). The Oregon chub reaches maturity at about 2 years of age (Scheerer and McDonald 2003, p. 78) and in wild populations can live up to 9 years. Oregon chub spawn from May through August and are not known to spawn more than once a year.

The Oregon chub live in slack water off-channel habitats such as beaver (*Castor canadensis*) ponds, oxbows, side channels, backwater sloughs, low-gradient tributaries, and flooded marshes. These habitats usually have little or no water flow, are dominated by silty and organic substrate, and contain considerable aquatic vegetation providing cover for hiding and spawning (Pearsons 1989, p. 27; Markle *et al.* 1991, p. 289; Scheerer and McDonald 2000, p. 1). The average depth of habitat used by the Oregon chub is less than 1.8 meters (m) (6 feet (ft)), and summer water temperatures typically exceed 16 degrees Celsius (61 degrees Fahrenheit). Adult Oregon chub seek dense vegetation for cover and frequently travel in the mid-water column in beaver channels or along the margins of aquatic plant beds. Larval Oregon chub congregate in shallow near-shore areas in the upper layers of the water column, whereas juveniles venture farther from shore into deeper areas of the water column (Pearsons 1989, p. 16). In the winter months, Oregon chub are found buried in the detritus or concealed in aquatic vegetation (Pearsons 1989, p. 16). Fish of similar size school and feed together. In the early spring, Oregon chub are most active in the warmer, shallow areas of aquatic habitats.

The Oregon chub is an obligatory sight feeder (Davis and Miller 1967, p. 32). It feeds throughout the day and stops feeding after dusk (Pearsons 1989, p. 23). The Oregon chub feeds mostly on water column fauna. The diet of Oregon chub adults collected in a May sample consisted primarily of minute crustaceans including copepods, cladocerans, and chironomid larvae (Markle *et al.* 1991, p. 288). The diet of juvenile Oregon chub also consisted of minute organisms such as rotifers and cladocerans (Pearsons 1989, p. 2).

Range—The Oregon chub is endemic to the Willamette River drainage of western Oregon. Historical records show the Oregon chub existed as far downstream as Oregon City and as far upstream as the town of Oakridge. Historically a dynamic, alluvial river, the Willamette and its tributaries created broad floodplains and braided reaches with many side channels, sloughs, and other similar slack-water habitats that support the Oregon chub. The Willamette is typical of river systems on the west side of the Cascade Mountains, with the largest river flows/floods influenced by heavy rain, or rain-on-snow events during the late winter and spring. Snowmelt in the spring typically produces an elongated flow peak in the spring, with decreasing flows throughout summer.

Extensive human activities in the Willamette River Basin have substantially reduced the floodplain habitats and altered water temperatures, as well as the timing, duration, and magnitude of floods in the basin. In the 1950s and 1960s, the U.S. Army Corps of Engineers (USACE) constructed 13 large dams on many of the tributaries of the Willamette River, with the primary purpose of flood risk reduction. Though the Willamette River mainstem and some tributaries remain undammed, miles of levees have also been constructed to further increase agricultural and urban use of these former floodplain areas.

At the time of listing in 1993 (58 FR 53800, October 18, 1993), only nine known populations of Oregon chub existed, and few estimates existed of the number of individuals within each population. The locations of these populations represented a small fraction (estimated as 2 percent based on stream miles) of the species' formerly extensive distribution within the Willamette River drainage.

Abundance and Distribution—Since we listed the Oregon chub as endangered in 1993, the status of the species improved dramatically due to the discovery of many new populations and successful reintroductions within the species' historical range (Scheerer 2007, p. 97). Recently, since we reclassified the Oregon chub to threatened status in 2010 (75 FR 21179, April 23, 2010), a substantial number of new Oregon chub populations were discovered (34 populations) and established through introductions (8 populations). In 2013, the Oregon Department of Fish and Wildlife (ODFW) confirmed the existence of Oregon chub at 77 locations in the Molalla River, Luckiamute River, North and South Santiam River, McKenzie River, Middle Fork and Coast Fork Willamette Rivers, and several tributaries to the mainstem Willamette River downstream of the Coast Fork and Middle Fork Willamette River confluence (Bangs *et al.* 2012, pp. 7–9), including 56 naturally occurring and 21 introduced populations. In 2013, the estimated abundance of 41 Oregon chub populations was greater than 500 fish each, and 23 of these populations exhibited a stable or increasing trend over the last 7 years (Bangs *et al.* 2013, p. 1). The current status of Oregon chub populations meets the goals of the species recovery plan for delisting. The distribution of these sites is shown in Table 1.

TABLE 1—DISTRIBUTION OF OREGON CHUB POPULATIONS MEETING RECOVERY CRITERIA FOR DELISTING

[Bangs *et al.* 2013, pp. 5–8]

Recovery subbasin	Number of populations	Number of large populations (≥500 adult fish)	Number of large populations with stable/increasing abundance trend	Total estimated abundance in subbasin
Santiam	19	13	7	32,714
Mainstem Willamette [1]	26	10	6	71,840
Middle Fork Willamette	28	17	10	54,285
Coast Fork Willamette [2]	4	1	0	824
Total	77	41	23	159,663

[1] Includes McKenzie River subbasin.

[2] The Coast Fork Willamette was identified as a subbasin containing Oregon chub in the recovery plan, but was not identified as a Recovery Area.

Although certain populations of the Oregon chub remain relatively stable from year to year, we observed substantial fluctuations in abundance within populations. For instance, the largest known population at Ankeny National Wildlife Refuge was 21,790 Oregon chub individuals in 2010, and increased to 96,810 in 2011. The population then declined from 82,800 to 47,920 between 2012 and 2013. We observed similar substantial fluctuations in 2013, at the Dunn Wetland and at the Hills Creek Pond populations. While substantial, these fluctuations commonly occur, and appear natural and cyclical. For example, we estimated the population abundance at the Dexter Reservoir Alcove ''PIT1'' site at 140 in 1995. Although annual estimated abundance fluctuated, this population reached 1,440 estimated individuals in 2000. The population then declined to 70 individuals in 2004, and then increased again to reach 1,370 estimated individuals in 2009 (Scheerer *et al.* 2005, p. 2).

A major component of recovery efforts for the Oregon chub was introducing the species into hydrologically isolated habitats that are free from nonnative fish species. Twenty-one new populations were established since 1988 (Table 2). In 2013, 14 introduced populations existed with more than 500 Oregon chub each; 6 of these populations exhibited a stable or increasing 7-year abundance trend (Bangs *et al.* 2013, p. 14).

TABLE 2—INTRODUCED OREGON CHUB POPULATIONS

[Bangs *et al.* 2013, pp. 6–8, 15]

[MS—Mainstem Willamette River, S—Santiam River, CF—Coast Fork Willamette River, and MF—Middle Fork Willamette River]

Site name	Subbasin	Year of first introduction	Number of fish introduced	Estimated abundance (2013)
Dunn Wetland	MS	1997	573	6,439
Finley Display Pond	MS	1998	500	118
Russell Pond	MS	2001	500	133
Finley Cheadle Pond	MS	2002	530	157
Ankeny Willow Marsh	MS	2004	500	47,920
St. Paul Ponds	MS	2008	195	442
Finley-Buford Pond	MS	2011	160	1,009
Murphy Pond	MS	2011	214	1,079
Ellison Pond	MS	2012	110	9
McCrae Reservoir	MS	2013	29	29
Foster Pullout Pond	S	1999	500	3,412
South Stayton Pond	S	2006	439	1,102
North Stayton Pond	S	2010	620	3,724
Budeau South Pond	S	2010	312	2,810
Budeau North Pond	S	2010	310	8,350
Herman Pond	CF	2002	400	184
Sprick Pond	CF	2008	65	608
Wicopee Pond	MF	1992	178	4,375
Fall Creek Spillway Ponds	MF	1996	500	9,107
Haws Enhancement Pond	MF	2009	133	788
Hills Creek Pond	MF	2010	1,127	14,613

Genetic Diversity—The Service's Abernathy Fish Technology Center conducted a genetic analysis on the Oregon chub in 2010 (DeHaan *et al.* 2010, 2012, entire). The analysis examined genetic diversity at 10 microsatellite loci within and among 20 natural and 4 introduced populations. The findings suggest that four genetically distinct groups of the Oregon chub exist, corresponding to the four subbasins of the Willamette River. Levels of genetic diversity were high across the range of the species and equal to, or greater than, other threatened or endangered species of minnows (*i.e.,* cyprinids). In addition, the levels of genetic diversity for Oregon chub were similar to the creek chub *Semotilus atromaculatus,* a widespread and abundant species of minnow (DeHaan 2012, pp. 548–549). Despite fluctuations in population abundance of Oregon chub, genetic diversity remained stable

over a 7- to 8-year interval (three to four Oregon chub generations). Two populations of the 24 evaluated had reduced genetic diversity: A recent bottleneck was observed in the Shetzline population, and the Geren Island population showed evidence of decreasing diversity, possibly due to reductions in the population size from 8,660 to 360 fish between 1997 and 2000 (Bangs *et al.* 2012, p. 109). Currently, both populations are abundant and exhibit an increasing trend in population growth over the last 7 years (Bangs *et al.* 2013, pp. 7–8).

The genetic assessment (DeHaan *et al.* 2010, p. 18; DeHaan *et al.* 2012, p. 545) shows that the current Oregon chub translocation guidelines (ODFW 2006, entire) (which require the donor population from within same subbasin, and a minimum of 500 Oregon chub introduced) are effective in establishing genetically viable populations. Levels of genetic diversity were similar to natural populations in three out of four of the introduced sites studied. Introduced populations from multiple sources had increased diversity and showed evidence of interbreeding. The Dunn wetland population, which had three donor populations, had the highest genetic diversity of all sites (natural and introduced). The Wicopee Pond population had relatively low levels of genetic diversity, which was likely because this population was founded with only 50 Oregon chub originating from 1 source population. These data support introducing greater numbers of individuals and using multiple sources from within a subbasin.

Recovery and Recovery Plan Implementation

Background—Section 4(f) of the Act (16 U.S.C. 1531 *et seq.*) directs us to develop and implement recovery plans for the conservation and survival of endangered and threatened species unless we determine that such a plan will not promote the conservation of the species. Under section 4(f)(1)(B)(ii), recovery plans must, to the maximum extent practicable, include: ''Objective, measurable criteria which, when met, would result in a determination, in accordance with the provisions of [section 4 of the Act], that the species be removed from the list.'' However, revisions to the list (adding, removing, or reclassifying a species) must reflect determinations made in accordance with sections 4(a)(1) and 4(b) of the Act. Section 4(a)(1) requires that the Secretary determine whether a species is endangered or threatened (or not) because of one or more of five threat factors. Section 4(b) of the Act requires that the determination be made ''solely on the basis of the best scientific and commercial data available.'' Therefore, recovery criteria should help indicate when we would anticipate that an analysis of the five threat factors under section 4(a)(1) would result in a determination that the species is no longer an endangered species or threatened species because of any of the five statutory factors (see Summary of Factors Affecting the Species).

While recovery plans provide important guidance to the Service, States, and other partners on methods of minimizing threats to listed species and measurable objectives against which to measure progress towards recovery, they are not regulatory documents and cannot substitute for the determinations and promulgation of regulations required under section 4(a)(1) of the Act. A decision to revise the status of or remove a species from the Federal List of Endangered and Threatened Wildlife (50 CFR 17.11) is ultimately based on an analysis of the best scientific and commercial data then available to determine whether a species is no longer an endangered species or a threatened species, regardless of whether that information differs from the recovery plan.

Recovery plans may be revised to address continuing or new threats to the species, as new, substantive information becomes available. The recovery plan identifies site-specific management actions that will achieve recovery of the species, measurable criteria that set a trigger for review of the species' status, and methods for monitoring recovery progress. Recovery plans are intended to establish goals for long-term conservation of listed species and define criteria that are designed to indicate when the substantial threats facing a species have been removed or reduced to such an extent that the species may no longer need the protections of the Act.

There are many paths to accomplishing recovery of a species, and recovery may be achieved without all criteria being fully met. For example, one or more criteria may be exceeded while other criteria may not yet be accomplished. In that instance, we may determine that the threats are minimized sufficiently and the species is robust enough to delist. In other cases, recovery opportunities may be discovered that were not known when the recovery plan was finalized. These opportunities may be used instead of methods identified in the recovery plan. Likewise, information on the species may be discovered that was not known at the time the recovery plan was finalized. The new information may change the extent to which criteria need to be met for recognizing recovery of the species. Recovery of a species is a dynamic process requiring adaptive management that may, or may not, fully follow the guidance provided in a recovery plan.

Recovery Planning—The Oregon Chub Working Group, which was formed prior to listing the species, is a proactive force in improving the conservation status of the Oregon chub. This group of Federal and State agency biologists, academicians, land managers, and others has met each year since 1991, to share information on the status of the Oregon chub, results of new research, and ongoing threats to the species. Additionally, an interagency conservation agreement was established for the Oregon chub in 1992 (ODFW *et al.* 1992). The objectives of the agreement were to: (1) Establish a task force drawn from participating agencies to oversee and coordinate Oregon chub conservation and management actions; (2) protect existing populations; (3) establish new populations; and (4) foster greater public understanding of the species, its status, and the factors that influence it (ODFW *et al.* 1992, pp. 3–5). These objectives are similar to that of the subsequently developed recovery plan.

The Recovery Plan for the Oregon Chub was approved by the Service on September 3, 1998 (Service 1998). The recovery plan outlines recovery criteria to assist in determining when the Oregon chub has recovered to the point that the protections afforded by the Act are no longer needed. These delisting criteria are: (1) 20 populations of at least 500 individuals each are established and maintained; (2) all of these populations must exhibit a stable or increasing trend for 7 years; (3) at least 4 populations (meeting criteria 1 and 2) must be located in each of the 3 subbasins (Mainstem Willamette, Middle Fork Willamette, and Santiam Rivers); and (4) management of these 20 populations must be guaranteed in perpetuity (Service 1998, pp. 27–28).

Recovery Plan Implementation—The status of the Oregon chub has improved dramatically since it was listed as endangered. The improvement is due largely to the implementation of actions identified in the interagency conservation agreement and the Oregon chub recovery plan. These actions include the establishment of additional populations via successful introductions within the species' historical range and the discovery of many new populations as a result of the ODFW's surveys of the basin (Scheerer 2007, p. 97). Over 20

years have passed since the species was listed, and it is now abundant and well-distributed throughout much of its presumed historical range. Currently, there are 77 Oregon chub populations, of which 41 have more than 500 adults (Bangs *et al.* 2013, pp. 5–11). The risk of extinction is substantially reduced as threats have been ameliorated and new populations have been discovered or established. The following criteria for delisting the Oregon chub are met or exceeded as described in the recovery plan:

Delisting Criterion 1: 20 populations of at least 500 individuals are established and maintained. This criterion was exceeded; in 2013, we identified 41 populations with more than 500 adult Oregon chub (see Table 1, above).

Delisting Criterion 2: All of these populations (20) must exhibit a stable or increasing trend for 7 years. This criterion was met. Currently, 23 populations of at least 500 individuals exhibit a stable or increasing trend for 7 years (see Table 1, above).

Delisting Criterion 3: At least four populations (meeting criteria 1 and 2) must be located in each of the three subbasins (Mainstem Willamette, Middle Fork, and Santiam Rivers). This criterion was exceeded in all three subbasins. Six populations in the Mainstem Willamette River subbasin, 10 populations in the Middle Fork Willamette River subbasin, and 7 populations in the Santiam River subbasin meet the first 3 delisting criteria (see Table 1, above).

Delisting Criterion 4: Management of these 20 populations must be guaranteed in perpetuity. The level of management protection recommended in the Oregon chub recovery plan (*i.e.,* management guaranteed into perpetuity) exceeds the requirements of the Act in evaluating whether a species meets the statutory definition of endangered or threatened, as adequate protection for the species in the long term may be provided otherwise. Although we do not have guarantees that all of the populations will be managed into perpetuity, we have a high level of confidence that management of the Oregon chub sites will continue to provide adequate protection for the species in the long term, as further discussed below. Of the 41 sites with populations of more than 500 Oregon chub, 28 of the sites are in public or Tribal ownership, with either active conservation management programs, or practices where land managers consider the needs of the Oregon chub when implementing site management activities. Additionally, eight of the sites with abundant populations of the Oregon chub are on land that is privately owned, either where landowners have signed conservation agreements or are enrolled in our Safe Harbor Program. Three additional sites are on land that is in a permanent easement or ownership by the McKenzie River Trust, a land trust dedicated to conservation of wetland and riparian habitat.

Based on our review of the Oregon chub recovery plan, we conclude that the status of the species has improved due to implementation of recovery activities and the objectives of the recovery plan have been met. Our analysis of whether the species has achieved recovery and thus no longer requires the protections of the Act because it is no longer an endangered or threatened species is based on the five statutory threat factors identified in section 4 of the Act, and discussed below in the Summary of Factors Affecting the Species.

Summary of Comments and Recommendations

In the proposed rule published February 6, 2014 (79 FR 7136), we requested that all interested parties submit written comments on the proposal by April 7, 2014. We also contacted appropriate Federal and State agencies, scientific experts and organizations, and other interested parties and invited them to comment on the proposal. The Service hosted a media event with local and national news coverage announcing the proposed rule on February 4, 2014. We did not receive any requests for a public hearing.

During the comment period for the proposed rule, we received five comment letters (three from peer reviewers, one from the ODFW, and one from the public) directly addressing the proposed removal of the Oregon chub from the Federal List of Endangered and Threatened Wildlife. All substantive information provided during the comment period is either incorporated directly into this final determination or is addressed below. The following section summarizes issues and information we consider to be substantive from peer review and public comments, and provides our responses.

Peer Review

In accordance with our policy, ''Notice of Interagency Cooperative Policy for Peer Review in Endangered Species Act Activities,'' which was published on July 1, 1994 (59 FR 34270), we solicited expert opinion on the proposed rule and the draft post-delisting monitoring plan from three knowledgeable independent individuals with scientific expertise that included familiarity with Oregon chub and its habitat, biological needs, recovery efforts, and threats. We received responses from all three peer reviewers. Issues and information provided by the peer reviewers are summarized in the *Peer Reviewer Comments* section, and where they overlap with similar issues identified by the public, they are included in the *Public Comments* section.

Peer Reviewer Comments

Comment (1): Two peer reviewers suggested that the lower bounds of the confidence intervals should be used to determine the number of populations meeting Delisting Criterion #1.

Our response: The species' recovery plan does not define the method to determine population size for Delisting Criterion #1. The ODFW uses a single-sample mark-recapture model, also called an adjusted Petersen estimate, to estimate population abundance (Bangs *et al.* 2013, p. 5). This method is supported in the literature (Seber 1973, pp. 59–60, Ricker 1975, pp. 75–79), and demonstrates reliable estimates for sampling conditions similar to what ODFW experiences monitoring Oregon chub. The ODFW also demonstrates the reliability in its population abundance estimates by providing a 95 percent confidence interval (Bangs *et al.* 2013, pp. 9–12). The calculation of the confidence interval is highly influenced by the sample size; a narrower interval requires sampling more individuals (Seber 1973, p. 61). Thus, in small populations, greater sampling effort would be required to demonstrate if a population met Delisting Criterion #1 if the lower bound was used, thus exposing more individuals to the risk of trapping or handling mortality. We do not agree with the reviewer's suggestion to use the lower bound of the 95 percent confidence interval, as this method exposes individuals in small populations to greater risk of mortality than the method used by the ODFW.

Comment (2): One peer reviewer asked why the Coast Fork Willamette Oregon chub populations were not mentioned under Delisting Criterion #3.

Our response: Under the recovery plan for Oregon chub, the Coast Fork Willamette was not included in the Mainstem, Santiam, or Middle Fork Willamette recovery areas. The recovery plan states: ''Although a single small population of Oregon chub currently occurs in a fourth subbasin, the Coast Fork, recovery efforts will not focus on this subbasin because surveys have not

revealed any other suitable habitats, and nonnative fish are very common.'' Although we are encouraged that two additional, small populations of Oregon chub were discovered and two introduced populations were established in the Coast Fork subbasin, recovery criteria were met without the inclusion of the populations in this subbasin.

Comment (3): One peer reviewer asked that the Service provide a more current summary of the 2009–2010 Willamette Floodplain Report (Bangs *et al.* 2011a, entire). This peer reviewer also suggested that the delisting rule incorporate 2013 data.

Our response: The Willamette Floodplain Report, with analysis of data from 2009–2012, is currently in preparation by the ODFW, and is expected to be available late spring 2015 at the earliest. As such, we are using the best available information at this time. We agree with the second part of this comment, and updated the rule to include the 2013 data.

Public Comments

Comment (4): One commenter stated that the Service did not adequately consider effective population size in the decision to delist the Oregon chub. The commenter stated that the general rule for short-term (50) and long-term (500) effective population size is not appropriate, as an effective population size of 500 individuals does not sufficiently reduce extinction risk. The commenter stated that determining a minimum viable population based on effective population size should include additional factors, such as environmental and demographic stochasticity, spatial dispersion, overlapping generations, and synergistic interactions among the risk factors. As an example, the commenter mentioned that the largest population of Oregon chub in the Middle Fork Willamette subbasin is in Hills Creek Pond; the population abundance was estimated at 13,460 individuals in 2012. The commenter noted that this was the total population size and not the effective population size, and was too small to assure viability.

Our response: The minimum viable population is the smallest estimated population size with a high probability of long-term persistence. Minimum viable population factors in risks associated with demographic and environmental stochastic events, and the impacts of inbreeding and limited genetic diversity. The effective population size is the number of breeding individuals in the population that contribute genetic material to the next generation, and can be used to determine the impacts of inbreeding and limited genetic diversity during the analysis of the minimum viable population. The recovery criteria in the recovery plan (Service 1998) do not require measuring effective population sizes for Oregon chub. At the time the recovery plan was written, the Service used the best available science to set the recovery criterion abundance threshold at 500 adult fish per population. This threshold is based on the total adult population size, not effective population size, and takes into account effects of limited genetic diversity and inbreeding associated with small population size and the risk associated with stochastic events.

Jamieson and Allendorf (2012, p. 583) suggested that, at a minimum, an effective population size of 500 individuals is needed for conservation of endangered species, including the potential impacts of stochastic events on conservation genetics. Jamieson and Allendorf (2012, p. 580) suggested an effective population size of 500 individuals is the total for all populations of a species, and not the size of individual populations. The total Oregon chub population size in 2013 was approximately 160,000 adult fish (Bangs *et al.* 2013, pp. 6–9).

DeHaan (2012, p. 543) determined effective population size for three isolated Oregon chub populations as part of a genetic analysis of the species. While these isolated populations represent a worst-case scenario for negative genetic effects, the study suggested: (1) There was no immediate threat from inbreeding or genetic drift, and (2) many Oregon chub populations have some degree of connectivity to other populations. This study also determined that genetic diversity remains high and stable over time, despite fluctuations in individual population size. Further, the ODFW (Bangs *et al.* 2013, p. 17) documented movement of individual Oregon chub between populations, which provides a mechanism for genetic exchange between populations that will maintain genetic variation (DeHaan 2012, p. 543). Despite the recent genetic analysis (DeHaan 2012, p. 543), the best available information is not sufficient to determine a minimum viable population size for Oregon chub.

In our decision to delist the Oregon chub, we are required to analyze the current or foreseeable threats to the species to determine whether a species meets the definition of endangered or of threatened, based on the best available scientific information. Our analysis includes recent genetic data that demonstrate Oregon chub are not threatened by low genetic diversity. We conclude that the recovery criterion abundance threshold of 500 adult fish per population is adequate, and analyzing the effective population size or determining the minimum viable population is not required in order to assess the status of the species.

Comment (5): One commenter stated that the Service was not conservative in the analysis of population size and must err on the side of caution. The reviewer commented that stochastic events and small population sizes decreases the population viability and increases the extinction risk of Oregon chub. The commenter further stated that the extreme annual variability within individual Oregon chub population sizes suggests considerable risk of extinction, even in locally abundant populations. The commenter mentioned that in addition, population growth is impacted by demographic stochasticity.

Our response: We disagree. The Act does not require that we ''err on the side of caution'' in determining the status of a species; it requires that we determine, based on the best available scientific information, whether a species meets the definition of endangered or of threatened. The Willamette River floodplain where Oregon chub evolved has always been highly dynamic. Oregon chub are extremely well adapted to surviving stochastic events. For instance, Oregon chub habitats have been known to freeze each winter, experience high magnitude flood flows in the spring, and reach in excess of 25 degrees Celsius (77 degrees Fahrenheit) in the summer, yet Oregon chub survive. Oregon chub are now well-distributed throughout their historical range in a variety of habitats, which reduces the risk of effects of severe stochastic events to the species throughout its range. Each habitat is impacted by stochastic effects in different ways. For example, while populations in shallow water habitats with high solar exposure may be impacted by severe hot and dry weather that raises temperatures to unsuitable levels for chub, populations in habitats that are deep and well-shaded may benefit by water warmed to the preferred temperature range for the species. Oregon chub have been documented in new, suitable habitat created by floodplain processes in the McKenzie River subbasin, and voluntary movement of Oregon chub was documented between populations in the Middle Fork Willamette River (Bangs *et al.* 2012, p. 19) and McKenzie River subbasins (Bangs *et al.* 2013, p. 17). These findings demonstrate the ability

of Oregon chub to colonize new habitats, resulting in exchange of genetic material between established populations, thus reducing the potential effects of stochastic events on small populations.

Further, for each ''stable'' population (as defined in the recovery plan), we calculate the coefficient of variation for the past 7 years. If the coefficient of variation is greater than one (in other words, if the variation is greater than the mean abundance), we consider the population ''unstable'' and do not consider that population to meet the recovery criteria. The 20 populations in 2012, and 23 populations in 2013, that met delisting criteria had either a ''stable'' or ''increasing'' abundance trend. This leads us to conclude that the variability in population abundance is not a factor that will impact future survival of these populations, provided the abundance criteria (500 adult fish) is met, because genetic diversity remains high and stable over time, despite fluctuations in individual population size (DeHaan 2012, p. 543). Overall, trend analysis conducted since 1996 demonstrates that the Oregon chub populations are stable and that the concerns raised by the commenter are not affecting Oregon chub recovery and are not expected into the foreseeable future.

Comment (6): One commenter and one peer reviewer suggested including a better description of population trends for Oregon chub populations that are coexisting with nonnative predators. One peer reviewer also suggested that the Service discuss specific predators that may impact Oregon chub, instead of combining all nonnatives, specifically western mosquitofish (*Gambusia affinis*) and largemouth bass (*Micropterus salmoides*). One peer reviewer suggested that the Service include western mosquitofish as a potential predator on larval Oregon chub, and that we include this species in the predation discussion. One commenter recommended that efforts to limit largemouth bass colonization should be discussed in the final rule to delist Oregon chub. The peer reviewer asked that the Service explore alternative management of mosquitoes by using native minnows instead of nonnative western mosquitofish. One commenter stated that the inadequacy of existing regulatory mechanisms to prevent spread of western mosquitofish and largemouth bass into connected watersheds was not adequately analyzed, and should be discussed. Additionally, one peer reviewer recommended that the post-delisting monitoring (PDM) plan focus on specific nonnative species of concern (mosquitofish and largemouth bass).

Our response: The best available data show no relationship between the presence of nonnative fish and Oregon chub population abundance trends (Bangs *et al.* 2013, p. 17). Thirteen of the 23 populations that met delisting criteria with either a stable or increasing abundance trend in 2013 occur with nonnative fish; 1 of the 2 populations that had a declining abundance trend occurs with nonnative fish (Bangs *et al.* 2013, p. 17). Nonnative fish that are thought to have the potential to impact Oregon chub populations through predation and competition include largemouth bass, smallmouth bass (*Micropterus dolomieu*), bluegill (*Lepomis macrochirus*), pumpkinseed sunfish (*Lepomis gibbosus*), warmouth (*Lepomis gulosus*), green sunfish (*Lepomis cyanellus*), yellow perch (*Perca flavescens*), walleye (*Sander vitreus*), black crappie (*Pomoxis nigromaculatus*), white crappie (*Pomoxis annularis*), common carp (*Cyprinus carpio*), brown bullhead (*Ameiurus nebulosus*), yellow bullhead (*Ameiurus natalis*), and western mosquitofish (Markle *et al.* 1991, p. 91). We agree that western mosquitofish are potential predators on larval Oregon chub, and we have included an analysis of their impact in this final rule. While we acknowledge that some of these fish species may represent a larger threat to individual Oregon chub populations than others, we maintain that monitoring should include all nonnative species. We determine in the five factor analysis (see Factors A, C, and E) that the threats of nonnative fish to the Oregon chub have been ameliorated; thus, there is no existing or potential future significant threat that is inadequately addressed through existing regulatory mechanisms (see Factor D). Additionally, a regulatory mechanism is in place to prevent the translocation of nonnative fish. Within the State of Oregon, it is unlawful to transport, release, or attempt to release any live fish into the waters of this State (Oregon Administrative Rules (OAR) 635–007–0600). Abiotic factors such as water flow through connected habitats and variability in water temperature and depth keep largemouth bass and nonnative predators from becoming dominant in these habitats. Through the PDM, the ODFW will continue to monitor Oregon chub populations that are thriving, despite the presence of nonnative fish, to better understand the factors that allow this to occur. While we support efforts to limit the proliferation of nonnative fish in the Willamette River Basin, creating a management action for nonnative fish or addressing vector control guidelines is outside the scope of this rule and the PDM plan.

Comment (7): Two peer reviewers and one public commenter discussed the need to consider the effects of climate change, environmental stochasticity, human population growth, and resulting changes in water availability on the viability and vulnerability of Oregon chub populations and suitable habitats. Primary concerns included effects to Oregon chub from: Extreme climatic variation (including drought effects, effects to instream flows, and increased reservoir drawdown); water temperature increases and reduced cool water refugia; the potential reduction in habitat size and quality; habitat fragmentation; and likely increases in populations of predatory and competitor nonnative fish species.

Our response: The Service reviews the best scientific and commercial information available when conducting a threats analysis. In considering what factors might constitute a threat we must look beyond the mere exposure of the species to the factor to determine whether the exposure causes actual impacts to the species. The mere identification of factors that could negatively impact a species is not sufficient to compel a finding that listing (or maintaining a currently listed species on the Federal Lists of Endangered or Threatened Wildlife or Plants) is appropriate. We require evidence that these factors are operative threats currently acting on the species to the point that the species meets the definition of endangered or of threatened under the Act.

The Service acknowledges that environmental changes could occur over the next several decades due to both climate change effects and human population growth. However, it is difficult to: (1) Predict with any certainty how those changes may influence Oregon chub populations and their habitats in the Willamette Valley, and (2) accurately describe and assess the net effects when considering the potential negative consequences together with the potential positive consequences to Oregon chub populations. Additional information and explanation was added to this final rule in the section on ''Effects Related to Climate Change'' (see Factor A).

Comment (8): One commenter stated that if Oregon chub are delisted, the terms and conditions required under the Service's biological opinion issued under section 7 of the Act to the USACE and other Federal agencies on the

continued operation and maintenance of dams in the Willamette River Basin will no longer be required, thereby removing key protections for the Oregon chub. This commenter also expressed a concern that delisting will eliminate consultation and agency review of actions permitted via the USACE permit program.

Our response: Since 2002, the USACE has implemented minimum dam outflow targets that sustain downstream floodplain habitat, which has reduced the threat of habitat loss for the Oregon chub. These minimum flow targets will continue to be required into the future, even after the Oregon chub is delisted, under existing biological opinions from the Service and National Marine Fisheries Service (NMFS) on the USACE's Willamette Valley Project (Service 2008b, pp. 40–51; NMFS 2008, pp. 2–43 to 2–52), because these biological opinions apply to other listed fish species (Upper Willamette spring chinook salmon (*Oncorhynchus tshawytscha*), Upper Willamette winter steelhead (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*)). The USACE also has a memorandum of understanding (MOU) with The Nature Conservancy's (TNC) Sustainable Rivers Project, an ongoing collaboration to promote ecologically sustainable flows below USACE dams in the Willamette River Basin (USACE and TNC 2000, 2011; entire). For these reasons, we anticipate that the USACE will continue to meet these minimum flow targets after delisting of the Oregon chub. Also, the acquisition of floodplain habitat for long-term conservation and restoration, including off-channel locations preferred by the Oregon chub, has gained momentum in the Willamette River Basin by a variety of Federal, State, Tribal, local governmental, and nongovernmental agencies, which provides assurances that Oregon chub habitat will continue to be managed for the species. Given the MOU between the USACE and TNC regarding the Sustainable Rivers Project, and the minimum flows required under two existing biological opinions (NMFS 2008, pp. 2–43 to 2–52; Service 2008b, pp. 40–51) for bull trout, Upper Willamette spring chinook, Upper Willamette winter steelhead, and their designated critical habitats, we anticipate that flow management trending towards natural flow regimes below Willamette Project dams will continue to create and rejuvenate off-channel habitats to the benefit of the Oregon chub into the foreseeable future.

The USACE permits in-water work including construction and dredging in navigable waters under section 404 of the Clean Water Act (CWA; 33 U.S.C. 1251 *et seq.*). While we acknowledge that consultation under section 7 of the Act will no longer be required for Oregon chub, the Service will continue to provide comments to the USACE on individual section 404 permits in the Willamette Valley through our authorities under the Fish and Wildlife Coordination Act (16 U.S.C. 661 *et seq.*). The USACE routinely sends the Service individual permit applications for our review, and we provide specific comments and recommendations to reduce negative effects to fish and wildlife, including unlisted species. For most section 404 projects, any potential negative impacts to habitat and species are generally short-term. While in-water work has the potential to impact individual Oregon chub populations, this impact for the overall population is considered a low risk because the species is widely distributed across multiple subbasins with many abundant populations. In the past 4 years, we have received approximately 13 such requests to review section 404 permits from the USACE. Of those 13 projects, we found that 9 were not likely to adversely affect Oregon chub and 2 projects only required technical assistance; we completed 1 formal consultation for a river restoration study that only anticipated short-term effects and long-term benefits. The last project was an emergency consultation when the USACE had to take action to maintain water levels in Oregon chub habitat on their property, as the habitat was affected by atypical, unexpected operations necessary for dam safety. The USACE worked with the ODFW to introduce Oregon chub into Hills Creek Pond during the drawdown as a back-up to the Dexter RV Park Pond ''DEX3'' and the Dexter Reservoir Alcove ''PIT1'' populations, in case either population failed during the drawdown.

Comment (9): One commenter stated that there are no regulatory mechanisms to protect Oregon chub habitat in the floodplain habitats that have been acquired for long-term conservation and restoration.

Our response: We disagree. One of the factors identified as a threat to Oregon chub at the time of listing was habitat loss. This threat has been ameliorated by the actions of multiple conservation partners over the last 20 years. In 2010, the Bonneville Power Administration (BPA) and the State of Oregon signed the Willamette River Basin Memorandum of Agreement Regarding Wildlife Habitat Protection and Enhancement (BPA and ODFW 2010, entire). The Agreement established goals for mitigating the effects of the construction, inundation, and operation of the Willamette River Basin Flood Control Projects in the Willamette Valley. Under the terms of the Agreement, the State of Oregon and the BPA agreed to acquire at least an additional 16,880 acres (ac) (6,831 hectares (ha)) of wildlife mitigation property to protect 26,537 ac (10,739 ha) (or more) by the end of 2025. Throughout the Willamette River Basin, floodplain properties have been, and will continue to be, acquired. All habitat acquisitions funded by the BPA must include provisions for permanent protections and enforcement of those protections. The acquisition of floodplain habitat for long-term conservation and restoration through these mechanisms provides assurances that Oregon chub habitats will continue to be managed for the species into the foreseeable future.

Summary of Factors Affecting the Species

This section contains updated information and associated analysis from that presented in the proposed rule (79 FR 7136, February 6, 2014). Updated information includes data collected during the 2013 field season (Bangs *et al.* 2013, entire) and additional information requested by peer and public reviewers.

Section 4 of the Act and its implementing regulations (50 CFR part 424) set forth the procedures for listing species, reclassifying species, or removing species from listed status. ''Species'' is defined by the Act as including any species or subspecies of fish or wildlife or plants, and any distinct vertebrate population segment of fish or wildlife that interbreeds when mature (16 U.S.C. 1532(16)). A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1) of the Act: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We must consider these same five factors in delisting a species. We may delist a species according to 50 CFR 424.11(d) if the best available scientific and commercial data indicate that the species is neither endangered nor threatened for the following reasons: (1) The species is extinct; (2) the species has recovered and is no longer endangered or threatened (as is the case with the Oregon chub); and/or (3) the

original scientific data used at the time the species was classified were in error.

A recovered species is one that no longer meets the Act's definition of endangered or of threatened. Determining whether the status of a species has improved to the point that it can be delisted or downlisted requires consideration of whether the species is endangered or threatened because of the same five categories of threats specified in section 4(a)(1) of the Act. For species that are already listed as endangered or threatened, this analysis of threats is an evaluation of both the substantial threats currently facing the species and the threats that are reasonably likely to affect the species in the foreseeable future following the delisting or downlisting and the removal or reduction of the Act's protections.

A species is an ''endangered species'' for purposes of the Act if it is in danger of extinction throughout all or a ''significant portion of its range'' and is a ''threatened species'' if it is likely to become endangered within the foreseeable future throughout all or a ''significant portion of its range.'' The word ''range'' in the significant portion of its range phrase refers to the range in which the species currently exists. For the purposes of this analysis, we will first evaluate whether the currently listed species, the Oregon chub, should be considered endangered or threatened throughout all its range. Then we will consider whether there are any significant portions of the Oregon chub's range where the species is in danger of extinction or likely to become so within the foreseeable future.

The Act does not define the term ''foreseeable future.'' For the purpose of this rule, we define the ''foreseeable future'' to be the extent to which, given the amount and substance of available data, we can anticipate events or effects, or reliably extrapolate threat trends, such that we reasonably believe that reliable predictions can be made concerning the future as it relates to the status of the Oregon chub. In considering the foreseeable future as it relates to the status of the Oregon chub, we considered the factors affecting the Oregon chub, historical abundance trends, and ongoing conservation efforts.

The following analysis examines all five factors currently affecting, or that are likely to affect, the Oregon chub within the foreseeable future.

A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

When the Oregon chub was listed as endangered in 1993, the species was known to exist at nine locations, representing only 2 percent of the species' historical range (Markle 1991, pp. 288–289; Scheerer *et al.* 2007, p. 2; 58 FR 53800, October 18, 1993, p. 53800). The decline in Oregon chub abundance and distribution was attributed to the extensive channelization, dam construction, and chemical contamination that occurred in the Willamette River Basin, particularly from the 1940s through the late 20th century (Pearsons 1989, pp. 29–30).

Since listing, concerted efforts by Federal, State, and local governments and private landowners have greatly reduced the threats to the Oregon chub. For example, the introduction of the Oregon chub into secure habitats has created refugial populations in habitats that are isolated from the threats of habitat loss and invasion by nonnative fishes. Additionally, as explained below, research has expanded our understanding of suitable habitat for the Oregon chub, and increased survey efforts have led to the discovery of many natural populations. Since 2002, the USACE has implemented minimum dam outflow targets that sustain downstream floodplain habitat, which has reduced the threat of habitat loss for the Oregon chub. These minimum flow targets will continue to be required into the future under existing biological opinions from the Service and NMFS on the USACE's Willamette River Basin Project (see description below). The USACE also has a MOU with TNC regarding the Sustainable Rivers Project, an ongoing collaboration to promote ecologically sustainable flows below USACE dams in the Willamette River Basin. For these reasons, we anticipate that the USACE will continue to meet these minimum flow targets after delisting of the Oregon chub. Also, the acquisition of floodplain habitat for long-term conservation and restoration, including off-channel locations preferred by the Oregon chub, has gained momentum in the Willamette River Basin by a variety of Federal, State, Tribal, local governmental and nongovernmental agencies, which provides assurances that Oregon chub habitat will continue to be managed for the species.

Since 1992, the Oregon chub was introduced and established in 21 secure, isolated habitats (Bangs *et al.* 2013, p. 15). These populations contribute to recovery by providing redundancy to the naturally occurring populations, increasing the abundance of the Oregon chub in each recovery area, and providing refugial habitat that is less vulnerable, as compared to connected habitats, to the threats of habitat loss and invasion by nonnative fishes. The majority of Oregon chub individuals occur in populations at these introduction sites. In 2013, we estimated 106,408 Oregon chub in the 21 introduced populations. By contrast, we estimated 53,255 Oregon chub in the 56 naturally occurring populations. Eleven of the introduction sites are in public ownership by Federal and State agencies that manage these sites for conservation of the Oregon chub, and we have no information that suggest these sites would be managed otherwise into the foreseeable future.

The remaining 10 introduction sites are privately owned. Many of these introduction sites were created or restored under the Service's Partners for Fish and Wildlife Program managed by the staff of the Willamette Valley National Wildlife Refuge Complex. Most of these landowners have either signed conservation agreements or are participating in our Safe Harbor Program. In the interest of conserving the Oregon chub, our Safe Harbor Program participants volunteered to allow the introduction of the Oregon chub into ponds on their land, and signed management plans called cooperative agreements, which are designed to protect the species and its habitat. In exchange, the landowners received an incidental take permit that extended an exemption from take prohibitions under section 9 of the Act. If the Oregon chub is delisted, the species will no longer be protected under these take prohibitions and the incidental take permit associated with the safe harbor agreements will no longer be in effect. This means that landowners will no longer be legally bound to protect the species on their property. However, we anticipate, based on their past interest and cooperation in protecting the species, that most or all of these landowners will continue to manage their land for conservation of the Oregon chub into the future as described in their cooperative agreements. We will also seek to extend these agreements beyond their initial 10-year time period and, in the event the property is later sold or transferred, we will work with the future landowners to enroll them in a cooperative agreement.

In 2013, 20 of the 23 populations that met the recovery plan criteria for delisting were located on State, Federal, Tribal, or other property managed for long-term conservation; 3 populations were located on privately owned property. The close knit working relationship with private landowners is extremely important for the recovery of

Oregon chub; 40 percent of all Oregon chub populations exist on privately owned property. We see no reason why the conservation efforts of landowners would cease after delisting, as all efforts have been voluntary. There are an additional 9 recently discovered or introduced populations that exist on public lands with abundances greater than 500 adult Oregon chub, further supporting our determination to delist the species.

In the 2008 5-year review of the status of the Oregon chub (Service 2008a, p. 26), we identified concerns about the ability to achieve recovery due to the focus on managing primarily isolated populations with limited genetic exchange. To reduce threats associated with habitat isolation, we suggested that future recovery efforts should integrate habitat that is connected to the floodplain. Successful efforts to integrate floodplain habitat into Oregon chub recovery were facilitated in part through consultation with several Federal agencies under section 7 of the Act. Specifically, in 2008, the Service and the NMFS completed consultation with the USACE, BPA, and the Bureau of Reclamation under section 7 of the Act on the continued operation and maintenance of 13 large flood-control dams in the Willamette River Basin, collectively known as the Willamette River Basin Project (Willamette Project). The Service's biological opinion considered the Willamette Project's effects to the Oregon chub, the bull trout, and bull trout critical habitat (Service 2008b, entire), while the NMFS' biological opinion considered effects to threatened salmon and steelhead (salmonids) and associated critical habitat (NMFS 2008, entire). The terms and conditions of the Service's biological opinion required the USACE to fund a floodplain study that would increase our understanding of the effects of flow management on connected downstream Oregon chub habitat. The ODFW subsequently pursued opportunities to study these effects and to integrate floodplain habitat in recovery efforts, in part, through funding provided by the USACE under the terms and conditions of the biological opinion.

The floodplain study required by the Willamette Project biological opinion began in 2009 (Bangs *et al.* 2010a, p. 1). Under this study, the ODFW sampled fish assemblages and monitored habitat conditions (*i.e.,* bathymetry, pond volume, percent vegetation, water temperature) in several off-channel habitats in the Middle Fork Willamette River downstream of Dexter Dam in Lowell, Oregon, to Jasper, Oregon (Bangs *et al.* 2010a, pp. 2–4). The ODFW chose the Dexter to Jasper reach of the Middle Fork Willamette River as a study area because several off-channel habitats in this reach were known to be occupied by the Oregon chub, and the majority of the adjacent land is in public ownership and accessible.

The ODFW sampled most of the hydrologically connected, off-channel habitat in this reach and discovered that the Oregon chub also occupied sites previously thought to be unsuitable. These sites contain greater habitat complexity than sites where Oregon chub were previously known to occur. Although these habitats have features such as beaver dams and shallow, inundated benches that were known to provide suitable habitat for Oregon chub, the recently discovered sites also include channels that have frequent connectivity to the adjacent river channel (Bangs 2013, pers. comm.). Frequently connected sites such as these were thought to be unsuitable because these sites were accessible to nonnative fishes that prey upon or compete with the Oregon chub for resources.

The discovery of Oregon chub in these connected sites facilitated a better understanding of the diversity of habitats occupied by Oregon chub, and prompted the ODFW to shift their basin-wide sampling efforts from primarily focusing on isolated habitats or habitats with infrequent river connection to sampling frequently connected, off-channel habitats. They sampled similar habitat in other recovery subbasins and found that Oregon chub also occupied many of these frequently connected habitats. Between 2009 and 2013, the ODFW discovered 34 additional Oregon chub populations throughout the 3 recovery subbasins (Bangs *et al.* 2013, pp. 6–8). In 2013, 14 of the 23 populations that met the delisting criteria were in naturally occurring sloughs, beaver pools, and pond habitats. Fifty-six of the 77 habitats containing Oregon chub were naturally occurring; 21 populations were introduced. In addition, 50 Oregon chub populations are located in habitat that experiences some level of connectivity to the adjacent river channel. The Service has determined that the minimum aquatic area necessary to support a population of at least 500 adult Oregon chub is 500 square meters (m^2) (5,400 square feet (ft^2)) (74 FR 10412, March 10, 2009, p. 10417). Out of the 77 populations, only a single location, Dougren Island Slough, has an aquatic area smaller than 500 m^2 (5,400 ft^2); the site is 400 m^2 (4,300 ft^2) and supported 1,700 adult Oregon chub in 2013.

Several anthropogenic and natural environmental factors, discussed below, may continue to have effects on Oregon chub and its habitat in the foreseeable future. Many of these factors are included in this discussion because the Service previously identified them as threats to the continued existence of the species in the listing and downlisting rules. Additionally, new factors affecting the species are discussed.

Activities Related to the Willamette Project

The Oregon chub occupies 45 connected habitats that are downstream of Willamette Project dams or adjacent to reservoirs; these habitats are influenced by Willamette Project operations. The Willamette Project biological opinions were signed in 2008, and continue until 2023 (NMFS 2008, p. 1–11; Service 2008b, p. 85). In addition to normal operations of the Willamette Project, several actions required under the terms and conditions of the biological opinions may affect Oregon chub populations and habitat in the future.

Temperature and flow augmentation—The USACE is implementing a number of structural and operational changes to alter flows and water temperatures downstream of Willamette Project dams to increase survival of federally listed salmon and steelhead (salmonids). These operational and structural changes have resulted in downstream water temperatures closer to that which existed prior to the construction of the dams (*i.e.,* river temperatures downstream of the reservoirs are now warmer in early summer, and cooler in the late summer and early fall). The USACE also operates to meet mainstem and tributary flow objectives identified in the Willamette Project biological opinion to benefit listed salmonids; these flows also benefit the Oregon chub by sustaining floodplain habitat downstream. In addition, the USACE works with partners in the Willamette River Basin as part of TNC's Sustainable Rivers Project to implement a set of environmental flow objectives designed to improve channel morphology in a manner that will create and sustain new, and improve existing, fish habitat (Gregory *et al.* 2007, p. 11).

The effects of water flow augmentation and temperature normalization on fish communities in off-channel habitat are largely unknown. The ODFW has a monitoring program in place (Bangs *et al.* 2011a, entire) to detect any negative effects on Oregon chub and its habitat. With the delisting of Oregon chub, this monitoring

program, which is detailed in our PDM plan, will continue for several years post-delisting (Service and ODFW 2013, entire). The PDM plan identifies thresholds and responses for detecting and reacting to significant changes in Oregon chub protected habitat, distribution, and persistence. If declines are detected that exceed the thresholds, the Service, in combination with other PDM participants, will investigate causes of these declines and determine if the Oregon chub warrants expanded monitoring, additional research, additional habitat protection, or relisting as an endangered or threatened species under the Act. Additional discussion about temperature and instream flows is presented in the ''Effects of Climate Change'' section (also in Factor A).

Reservoir drawdowns—As required in the NMFS biological opinion for the Willamette Project, the USACE is implementing an annual complete reservoir drawdown of Fall Creek Reservoir on the Middle Fork Willamette River. The biological objectives of the reservoir drawdown are to improve fish passage efficiency and survival of juvenile Chinook salmon migrating out of Fall Creek Reservoir, and to reduce nonnative fish populations inhabiting the Fall Creek Reservoir. This is expected to result in reduced nonnative predation and competition with juvenile Chinook salmon rearing in the reservoir. While reservoir drawdown benefits Chinook salmon, there are potential negative effects to the Oregon chub from sedimentation of Oregon chub habitats.

Willamette River Basin flood control dams inhibit the transport of sediment downstream, causing sedimentation to occur in the reservoirs. During a complete reservoir drawdown, released reservoir water scours the reservoir bed and transports sediment downstream. During the initial Fall Creek Reservoir drawdowns, a massive volume of silt, sand, and debris was flushed, causing sediment deposition to occur in off-channel habitats downstream of the dam. Sampling for Oregon chub populations in the Fall Creek drainage occurred after the first drawdown and three previously undocumented Oregon chub populations were found. The extent to which these populations were affected is unknown because Oregon chub were discovered at these sites after the sedimentation occurred and we cannot determine the area of habitat or number of Oregon chub that existed prior to the sedimentation. Fewer than five Oregon chub were found in each of these three sites after the sedimentation occurred. These sites experienced the accumulation of fine sediments, perhaps beyond typical historical levels, which reduced the amount of habitat available to Oregon chub (Bangs 2013, pers. comm.). However, little sedimentation was observed in the few Oregon chub habitats that occur farther downstream of the confluence of Fall Creek and the Middle Fork Willamette River. Most of the abundant populations of Oregon chub in off-channel habitats of the Middle Fork Willamette River were not affected because they occur upstream of these impacts.

Although partial drawdowns of Willamette Project reservoirs are likely to occur in the near future, they are unlikely to result in large volumes of sediment moving downstream because the water level will remain above the sediment bed and little sediment will be moved. Complete reservoir drawdowns to the extent seen at Fall Creek are not currently planned at other reservoirs. The effects of a complete reservoir drawdown would vary by location; it is difficult to predict what habitat changes may occur downstream. However, any future proposal to implement this scale of drawdown will include extensive coordination and planning among the Service, ODFW, USACE, and other land managers. Additionally, in cooperation with the USACE, we developed monitoring guidance and recommended responses in the event a drawdown is planned (Service and ODFW 2013, pp. 18–19). We do not anticipate that potential negative impacts from reservoir drawdowns will affect the overall status of Oregon chub. Additional discussion about reservoir drawdown is presented in the ''Effects of Climate Change'' section (also in Factor A).

Another concern related to drawdowns is that nonnative predatory fishes are common in reservoir habitats. During a drawdown, these fish are likely transported downstream, where they may invade off-channel habitats. The risks to the Oregon chub associated with nonnative fishes are discussed under Factors C and E, below.

Reservoir water level fluctuations—Fluctuating water levels in Lookout Point Reservoir on the Middle Fork Willamette River may limit the breeding success of the Oregon chub population in Hospital Pond, which provides habitat for the species in a pool connected to the reservoir by a culvert (Service 2008b, p. 160). Between 2001 and 2003, the USACE, which manages Lookout Point Reservoir as part of the Willamette Project, implemented a series of actions to protect the population of Oregon chub in Hospital Pond. The goal was to allow the USACE to manage the water level in Lookout Point Reservoir independently of the water elevation in Hospital Pond. In order to achieve this, they installed a gate on Hospital Pond's outlet culvert and lined the porous berm between the pond and reservoir (Service 2002, pp. 1–11). They also excavated additional areas to create more suitable spawning habitat in the pond (Service 2003, pp. 1–3).

Despite these actions, water elevation in Hospital Pond continues to be influenced by reservoir water levels. Hospital Pond currently supports a large, stable population of the Oregon chub; however, future Willamette Project operations may result in reservoir elevations that are below the levels necessary to inundate the spawning habitat in Hospital Pond (Service 2008b, p. 160). This reduction in spawning habitat may result in limited breeding success for the Oregon chub in Hospital Pond into the foreseeable future. However, the Hospital Pond population is not critical to meeting recovery criteria because additional surveys in the Middle Fork Willamette River subbasin have found that the subbasin has the highest number of Oregon chub populations (29 populations) across the range of the species. Currently, 17 of the Oregon chub sites in this subbasin have abundant (greater than 500 individuals) populations of the Oregon chub. This redundancy of large populations provides additional security to the species in the event that single populations decline.

Inability to meet minimum flow targets—During low water or drought years, the USACE may not be able to meet the seasonal minimum water flow targets established in the Willamette Project biological opinions. Analysis performed by the USACE determined that from 1936 to 1999, low flow and drought conditions occurred 9 percent and 16 percent of the years, respectively (USACE 2007, pp. 2–45). If this occurs in the future, it may have negative effects on Oregon chub habitat downstream through a temporary reduction in pond volume and increased water temperatures. Under the floodplain study, the ODFW mapped the bathymetry (habitat depth) and installed equipment to measure pond elevation, area, volume, and temperature in Oregon chub sites that are influenced by Willamette Project flows. This information was used to determine the effect that low flows may have on the extent of habitat area available to Oregon chub. The USACE has considered these data in managing flows and has a notification process in

place to coordinate with the Service and the ODFW during low water periods before flows are reduced to levels below the minimum flow targets. To date, except for during malfunctions and emergency operations explained below, flows below minimum targets have been of short duration and have not resulted in observable adverse effects to Oregon chub populations (Bangs 2013, pers. comm.). Further, when minimum targets cannot be met, the Service, ODFW, NMFS, and USACE coordinate on a regular basis to discuss reduced flow releases in advance; this coordination allows the Service to weigh in on the magnitude of reductions and mitigate any reductions in flows that may affect Oregon chub populations. This coordination will continue into the future, as required by the two biological opinions, for other listed fish species (Service 2008b, pp. 38–40; NMFS 2008, pp. 2–39 to 2–43).

Willamette Project malfunctions and emergency operations resulting in the USACE not meeting minimum flow targets or necessitating restrictions on reservoir pool elevations have affected Oregon chub habitats. These incidents have been infrequent, but resulted in short-term negative effects on a few Oregon chub populations. For instance, in 2009, two of the three spillway gates at the USACE Big Cliff dam on the North Santiam River failed (Bangs *et al.* 2010b, p. 16). While repairing the gates, the outflow from Big Cliff Dam was reduced to below the minimum summer flow target. Record high air temperatures coincided with the low flow levels. Monitoring during this event detected that three Oregon chub sites downstream were nearly desiccated and fish mortalities were observed. Screened pumps were used to increase the volume of water in the ponds and to reduce water temperatures. The effects of this incident on Oregon chub populations were short-term, and the numbers of Oregon chub in these three populations have either increased or are exhibiting a stable trend (Bangs *et al.* 2013, pp. 6–8).

The minimum flow targets protect not only the Oregon chub, but many other native aquatic species, including listed salmonids. If the Oregon chub is delisted, these minimum flow targets will continue to be required under existing biological opinions from the Service and the NMFS on the Willamette Project for listed bull trout, Chinook salmon, and steelhead. Moreover, the USACE was proactive in implementing recommended flows before the Willamette Project biological opinions were completed (USACE 2007, pp. 3–19). Therefore, we anticipate that the USACE will continue to meet these minimum flow targets after delisting of the Oregon chub, except under infrequent, extreme conditions such as drought.

In 2010, the USACE determined that the condition and reliability of the spillway gates at 13 Willamette Project dams represented an unacceptable risk to public safety (Bangs *et al.* 2011b, p. 16). To mitigate this risk, the USACE proposed implementing pool elevation restrictions at Willamette Project reservoirs to lower than normal levels to support maintenance and repair of the spillway gates. The imposed restrictions affected one population (Dexter Reservoir Alcove ''PIT1'' site) of Oregon chub by reducing the pond below levels critical for Oregon chub survival. The Dexter Reservoir Alcove ''PIT1'' site had filled with sediment over the years and in consultation with the USACE, we determined that removing some of this sediment was the best measure to prevent desiccation of the pond. Prior to removing sediment, the ODFW captured and relocated a total of 1,127 Oregon chub to Hills Creek Pond, a site with perennial flow located on USACE property at Hills Creek Dam. This site is within the historical range of Oregon chub, but at the time was not occupied by the species. The pond site is adjacent to the Middle Fork Willamette River and has historically been managed by USACE staff for wildlife habitat enhancement. The spillway gate repairs were completed, the pool elevation restriction for Dexter Reservoir was lifted in 2011, and the reservoir has returned to normal operations. The Oregon chub population abundance in Dexter Reservoir Alcove ''PIT1'' site and Dexter RV Park Pond ''DEX3'' are both currently stable and contribute towards meeting recovery criteria for delisting (Bangs *et al.* 2013, p. 8). The translocation of Oregon chub into Hills Creek Pond created a large, secure population that is now the largest Oregon chub population within the Middle Fork Willamette River subbasin with an estimated abundance of 14,610 Oregon chub (Bangs *et al.* 2013, p. 8). Additional discussion about minimum flow requirements is presented in the ''Effects of Climate Change'' section (also in Factor A).

Siltation Resulting From Timber Harvest

As previously noted, Oregon chub habitats are generally associated with low gradient floodplain habitats not generally subject to timber harvest activities. However, there are a small number of Oregon chub populations that exist within, or adjacent to, forested landscapes that were, or could be, subject to adverse effects of timber harvest. These adverse effects include siltation (deposition of fine sediment) of stream habitats from ground-disturbing activities involved with standard logging practices. State and private lands in Oregon are subject to water quality as well as fish and wildlife protective measures under the Oregon Forest Practices Act, whereas Federal lands are subject to land and resource management plans that also provide protective guidelines for water quality and fish and wildlife protections. While siltation resulting from timber harvest has not been identified as a significant threat to Oregon chub, there is at least one instance where siltation from timber harvest may have contributed to a decrease in habitat suitability and availability that resulted in a drop in chub abundance.

In the 1990s, timber harvest occurred on private lands upstream of East Fork Minnow Creek. Flood events in the watershed in 1996, 1997, and 1998 caused accelerated siltation into East Fork Minnow Creek Pond, a pond downstream that is occupied by Oregon chub, and over half of the habitat was lost (Scheerer 2009, pers. comm.). The Oregon chub population in East Fork Minnow Creek Pond declined dramatically following these events (Scheerer 2009, pers. comm.). In 2010, the Oregon Department of Transportation excavated accumulated sediment in the pond and created a pool that will provide a buffer from the effects of future siltation. The population subsequently rebounded and it now meets the delisting criterion for a stable or increasing trend over 7 years.

In 2012, timber harvest on private land occurred upstream of an Oregon chub site on the William L. Finley National Wildlife Refuge (Finley NWR) known as Gray Creek Swamp. Due to concerns about potential sedimentation to Oregon chub habitat in Gray Creek Swamp, we negotiated with the landowner who agreed to increase the width of the no-cut riparian buffer along the streams within the harvest area to reduce the risk of siltation in Oregon chub habitat downstream. Siltation of this Oregon chub habitat following harvest has not been observed, but the site will continue to be monitored by the ODFW during the 9-year post-delisting monitoring period.

The potential for adverse effects to Oregon chub habitat from timber harvest was also identified at three other sites: Dexter Reservoir Alcove ''PIT1'' site, Buckhead Creek, and Wicopee Pond (Scheerer 2008, pers. comm.). However, we did not observe levels of siltation at

these sites that resulted in habitat loss, and all of the Oregon chub populations within each of the five sites located downstream of harvest activities met the delisting criteria in 2013. Additionally, the U.S. Forest Service (USFS) manages several Oregon chub sites within the Willamette National Forest. As noted above, forests managed by the USFS operate under land and resource management plans that include management practices protective of fish (USFS 1990, pp. IV–61–64), and we anticipate these resource management plans will continue to guide forest management into the future.

While future siltation of habitats occupied by Oregon chub from timber harvest activities clearly is possible, the frequency is anticipated to be very low, as will be the potential number of affected populations. Given this fact, and the protections afforded by the Oregon Forest Practices Act and Federal land management plans, we do not believe siltation from timber harvest represents a substantial population-level threat to Oregon chub now or in the foreseeable future.

Floods and Seasonal High-Water Events

The Oregon chub is a low-elevation, floodplain-dependent species that evolved under dynamic environmental conditions created by seasonal flooding and droughts. As a result, the species' life history reflects these dynamic conditions. While floods and seasonal high-water events constitute a potential stressor to individuals or specific Oregon chub populations, these events create and maintain off-channel habitats necessary for the long-term persistence of the species, and they function to transport the Oregon chub to colonize these new sites.

For example, in 2007, a flood event in the Santiam River caused channel avulsion (a shift in the stream channel that results in the rapid abandonment of a river channel and formation of a new river channel) at an Oregon chub site, reducing the extent of habitat available at this location and likely negatively affecting this population. Yet in another example, between 2000 and 2003, new off-channel habitat formed in the McKenzie River due to flooding and, after aquatic vegetation became established, the site was subsequently colonized by the Oregon chub (Bangs 2013, pers. comm.). Although we cannot predict the magnitude or the extent to which current Oregon chub habitats may be affected by flooding and seasonal high water events, the number and distribution of large populations, in combination with habitat heterogeneity, increases the species' resilience in recovering from periodic disturbance, as the species would have historically. Additional discussion about increased flood events is presented in the ''Effects of Climate Change'' section (also in Factor A).

Water Quality Issues

The analysis of threats in the final rule to list the Oregon chub as an endangered species and the recovery plan for the species discussed numerous potential threats to water quality in Oregon chub habitats. However, in the 20 years since the Oregon chub was listed, only a few of these concerns, discussed below, have materialized, and even then, these were localized and of short duration.

In the spring of 2011, the ODFW noted the complete die-off of the introduced Oregon chub population in Cheadle Pond on the Finley NWR. They assessed the water quality (temperature, pH, and dissolved oxygen) and discovered that the pH level was abnormally high (mean pH: 9.6, range: 8.4–10.2). The pH level in Oregon chub habitats typically ranges between 7.42 and 8.66. The cause of the increased pH level was unknown and had not been observed previously at this site. The ODFW subsequently conducted an in-situ 7-day bioassay using 30 adult Oregon chub from the Gray Creek Swamp population. All of the Oregon chub survived the trial and were released into Cheadle Pond following the bioassay. We have not observed, and do not anticipate based on this one event, similar incidents in other Oregon chub habitats.

Nutrient enrichment may have caused the extirpation of the Oregon chub population at Oakridge Slough in the Middle Fork Willamette River subbasin. The slough is downstream from the Oakridge Sewage Treatment Plant, and increased nitrogen and phosphorus concentrations were detected in the slough prior to a decline in the population. While the nutrient concentrations are not believed to be directly harmful to the species, the elevated nutrient levels may have contributed to habitat conditions that were unsuitable for Oregon chub (*i.e.,* an increase in growth of algae, which then decomposed and led to low oxygen conditions below what the Oregon chub requires to survive) (Buck 2003, p. 12).

Several Oregon chub sites are located adjacent to agricultural land. Runoff from farm fields may contain pesticides or fertilizers that could adversely affect the water quality in Oregon chub habitats. However, many of these sites have protective vegetated buffers between crops and the aquatic habitat. To date, we have not observed declines in Oregon chub populations that can be attributed to agricultural practices, and several Oregon chub habitats located adjacent to farmland have supported abundant populations of Oregon chub for many years.

Several Oregon chub sites are located adjacent to private forestland (as previously discussed above under ''Siltation Resulting from Timber Harvest''). Additionally, the USFS manages several Oregon chub sites within the Willamette National Forest. Forests managed by the USFS operate under land and resource management plans that include management practices protective of fish (USFS 1990, pp. IV–61–64), and we anticipate these resource management plans will continue to guide forest management into the foreseeable future. On private forestland, the use of chemicals is regulated by the Oregon Department of Forestry, and operators are required to comply with product labels and additional protective measures to protect waters of the State, including leaving untreated vegetated buffers and limiting aerial applications near areas of standing open water larger than one-quarter acre (Oregon Revised Statutes (ORS) 527.765 and OAR 629–620–0000 through 629–620–0800). Although we have no information regarding landowners' compliance with these rules on forestland in the vicinity of Oregon chub habitats, we have not observed harmful effects to Oregon chub populations due to chemical exposure related to forestry operations.

During our analysis of the factors affecting the Oregon chub, we determined that spills via sewage discharge, hazardous cargo from trucks, railways and pipelines, which were identified as threats when the species was first listed, no longer pose a significant threat to the species. At the time of listing, of the nine Oregon chub populations known to exist, seven of these locations were directly adjacent to major transportation corridors where threats to water quality had the potential to impact Oregon chub. Currently, Oregon chub have been documented in 77 populations widely distributed throughout the Willamette River Basin; 20 of these locations are adjacent to transportation corridors. In addition, two populations are adjacent to sewage treatment plants. Despite the proximity to potential threats to water quality, in the 20 years since the Oregon chub was listed, only a few of these concerns have materialized, and even then, these were localized and of short duration. The current distribution of the Oregon chub in many abundant

populations located across multiple subbasins reduces the risk that the above factors will affect a large portion of Oregon chub and its habitat. In summary, we conclude that none of the existing or potential water quality-related threats, either alone or in combination with others, constitutes a substantial threat to the Oregon chub now or in the foreseeable future. Additional discussion about temperature and dissolved oxygen levels is presented in the ''Effects of Climate Change'' section (also in Factor A).

Aggradation

Aggradation is an alluvial process where sediment deposition (deposition of all sizes of sediments, both coarse and fine) is more rapid than the capacity of a river to transport sediment downstream. We observed aggradation at the Geren Island North Channel in the North Santiam River. Natural movement of the river channel changed sediment deposition in the upstream end of this location, which had the potential to block water flow into the site. The City of Salem, which manages the site, excavated a portion of the channel to allow free-flowing water to enter Oregon chub habitat. To date, we have not observed a decline in the Geren Island population. With the exception of this site and habitats in Fall Creek, which we discussed previously, no other Oregon chub habitats are negatively impacted by aggradation. We consider the potential negative impacts to the overall status of Oregon chub from aggradation to be very low now and in the foreseeable future.

Succession

Succession resulting from the manipulation of river flows was identified as a potential threat to Oregon chub habitat in the downlisting rule (75 FR 21179, April 23, 2010). Succession is a natural, long-term ecological process that ponds go through as they mature. As vegetation dies back seasonally, it deposits on the substrate of the pond, causing a reduction in water depth over time. Eventually, plant communities shift from aquatic to amphibious wetland plants, and the open-water ponds are replaced by seasonal wetland and marsh habitat. Historically, seasonal high flows and alluvial floodplain processes created off-channel habitat, and rejuvenated existing habitats by flushing out sediment and diversifying the aquatic plant community. These processes no longer function as they did historically because flows are regulated under the USACE's Willamette Project. The Willamette Project dams were constructed in the 1940s through the 1960s. Oregon chub populations have persisted under managed flow conditions for more than 60 years. In addition, under the Service's Willamette Project biological opinion (Service 2008b, pp. 40–51) and the NMFS Willamette Project biological opinion (NMFS 2008, pp. 2–43 to 2–52), minimum flow levels established for listed salmonids will continue to protect Oregon chub habitat. Other non-regulatory efforts are working to restore floodplain function and sediment transport, such as TNC's Willamette Sustainable Rivers Project. In this project, TNC has developed an MOU with the USACE to release stored water in high-flow pulses to restore natural processes in managed portions of the Middle Fork, McKenzie, and Santiam Rivers. Given the MOU between the USACE and TNC regarding the Sustainable Rivers Project, and the minimum flows required under existing biological opinions from the Service and NMFS, we anticipate flow management trending towards natural flow regimes below Willamette Project dams will continue to create and rejuvenate off-channel habitats and benefit Oregon chub into the future.

We are not aware of any particular sites that are vulnerable to succession in the near future; however, the sites that remain hydrologically isolated during high flows are cut off from these natural processes, and succession may continue resulting in a reduction of open water habitat. For instance, succession occurred at Herman Pond, an isolated Oregon chub site in the Coast Fork Willamette Basin, which led to a reduction in habitat area and a decline in population abundance. In 2005, the site was excavated to remove successional vegetation. This activity was successful in increasing open water habitat and led to an increase in Oregon chub abundance at this location. Given the wide distribution and number of Oregon chub habitats under different land ownership, we are uncertain whether manual modification of chub habitats to reverse the effects of succession will occur in the future following delisting. However, given that we are not aware of any particular sites vulnerable to succession in the foreseeable future, we determined that there is very little potential negative impact, if any, to the overall status of Oregon chub from succession.

Irrigation Withdrawals

A few Oregon chub sites may be influenced by irrigation water withdrawals. In recent years, at Elijah Bristow Berry Slough in the Middle Fork Willamette River subbasin, a drop in summer water level and a significant decline in Oregon chub abundance coincided with increased irrigation use by a farm located upstream. However, this was an isolated event that we have not observed at other sites. Many Oregon chub populations occur on publicly owned lands or on areas managed for conservation, where direct water withdrawals do not occur. In addition, water levels at habitats adjacent to mainstem river channels are highly dependent on river flow, and are less likely to be negatively impacted by irrigation withdrawals due to the amount of hyporheic (subsurface) flow into these habitats from the adjacent river. Based on the wide distribution of Oregon chub, we consider the potential negative impact to the overall status of Oregon chub from irrigation withdrawals to be very low.

Effects Related to Climate Change

Our analyses under the Act include consideration of observed or likely environmental changes resulting from ongoing and projected changes in climate. As defined by the Intergovernmental Panel on Climate Change (IPCC), the term ''climate'' refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2013a, p. 1450). The term ''climate change'' thus refers to a change in the mean or the variability of relevant properties, which persists for an extended period, typically decades or longer, due to natural conditions (*e.g.,* solar cycles) or human-caused changes in the composition of atmosphere or in land use (IPCC 2013a, p. 1,450).

Scientific measurements spanning several decades demonstrate that changes in climate are occurring. In particular, warming of the climate system is unequivocal, and many of the observed changes in the last 60 years are unprecedented over decades to millennia (IPCC 2013b, p. 4). The current rate of climate change may be as fast as any extended warming period over the past 65 million years and is projected to accelerate in the next 30 to 80 years (National Research Council 2013, p. 5). Thus, rapid climate change is adding to other sources of extinction pressures, such as land use and invasive species, which will likely place extinction rates in this era among just a handful of the severe biodiversity crises observed in Earth's geological record (American Association for the Advancement of Sciences (AAAS) 2014, p. 17).

Examples of various other observed and projected changes in climate and associated effects and risks, and the basis for them, are provided for global and regional scales in recent reports issued by the IPCC (2013c, 2014), and similar types of information for the United States and regions within it can be found in the National Climate Assessment (Melillo et al. 2014, entire).

Results of scientific analyses presented by the IPCC show that most of the observed increase in global average temperature since the mid-20th century cannot be explained by natural variability in climate and is ''extremely likely'' (defined by the IPCC as 95 to 100 percent likelihood) due to the observed increase in greenhouse gas (GHG) concentrations in the atmosphere as a result of human activities, particularly carbon dioxide emissions from fossil fuel use (IPCC 2013b, p. 17 and related citations).

Scientists use a variety of climate models, which include consideration of natural processes and variability, as well as various scenarios of potential levels and timing of GHG emissions, to evaluate the causes of changes already observed and to project future changes in temperature and other climate conditions. Model results yield very similar projections of average global warming until about 2030, and thereafter the magnitude and rate of warming vary through the end of the century depending on the assumptions about population levels, emissions of GHGs, and other factors that influence climate change. Thus, absent extremely rapid stabilization of GHGs at a global level, there is strong scientific support for projections that warming will continue through the 21st century, and that the magnitude and rate of change will be influenced substantially by human actions regarding GHG emissions (IPCC 2013b, 2014; entire).

Global climate projections are informative, and, in some cases, the only or the best scientific information available for us to use. However, projected changes in climate and related impacts can vary substantially across and within different regions of the world (*e.g.,* IPCC 2013c, 2014; entire) and within the United States (Melillo et al. 2014, entire). Therefore, we use ''downscaled'' projections when they are available and have been developed through appropriate scientific procedures, because such projections provide higher resolution information that is more relevant to spatial scales used for analyses of a given species (see Glick et al. 2011, pp. 58–61, for a discussion of downscaling).

Various changes in climate may have direct or indirect effects on species. These may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as interactions of climate with other variables such as habitat fragmentation (for examples, see Franco et al. 2006; Forister et al. 2010; Galbraith et al. 2010; Chen et al. 2011). In addition to considering individual species, scientists are evaluating potential climate change-related impacts to, and responses of, ecological systems, habitat conditions, and groups of species (*e.g.,* Deutsch et al. 2008; Berg et al. 2010; Euskirchen et al. 2009; McKechnie and Wolf 2010; Sinervo et al. 2010; Beaumont et al. 2011; McKelvey et al. 2011; Rogers and Schindler 2011).

Climate change effects present substantial uncertainty regarding the future environmental conditions in the Willamette River Basin and may place an added stress on the Oregon chub and its habitats. The IPCC has concluded that recent warming is already strongly affecting aquatic biological systems, as evidenced by increased runoff and earlier spring peak discharge in many glacier- and snow-fed rivers (IPCC 2007, p. 8). Projections for climate change effects in North America include decreased snowpack, more winter flooding, and reduced summer flows (IPCC 2007, p. 14), which may increase periods of drought (Oregon Climate Change Research Institute (OCCRI) 2010a, p. 112).

Observed changes in temperature in the Pacific Northwest (PNW) already show an increase of 1.5 degrees Celsius over the past century due to human activities (OCCRI 2010b, p. 6). Global climate models project temperature increases for the PNW of approximately 2 to 4 degrees Celsius (3 to 10 degrees Fahrenheit) by 2080 (OCCRI 2010b, p. 7). Projections for climate change effects in the Willamette Valley in the next century also include warmer air temperatures that will lead to lower soil moisture and increased evaporation from streams and lakes (Climate Leadership Initiative (CLI) and National Center for Conservation Science and Policy (NCCSP) 2009, p. 9; OCCRI 2010a, p. 71). The frequency of short-term (3- and 6-month) droughts in the Willamette Valley will likely increase due to decreased summer rainfall, which may result in reduced summer baseflows and exacerbate water temperature increases. However, long-term droughts (12 and 24 months) are not projected to substantially change across most of the Willamette Basin (OCCRI 2010a, p. 112).

The 29,700-km^2 (11,467-mi^2) Willamette River Basin is a large complex river basin, influenced by two mountain ranges: the Cascades and the Coast Range (Chang and Jung 2010, pp. 187–190). The rain-dominated Coast Range occupies about 20 percent of the basin; the Cascade Range occupies more than 50 percent, and includes the rain-dominated Western Cascades and the snow-dominated High Cascades. The Willamette Valley region lies between these two ranges. Thus, the basin has complex terrain and geology, and a wide range of elevations that influence the timing and magnitude of runoff. Given this physical variability, the effects of climate change will not uniformly affect all areas or subbasins of the Willamette River (Chang and Jung 2010, pp. 194–204).

The hydrology of the Willamette River Basin is largely influenced by winter rainfall and spring snowmelt, with 77 percent of the flow occurring between November and April (Chang and Jung 2010, p. 190). Overall, the Willamette Basin is considered water abundant in Oregon. In addition to rainfall, the basin is influenced by spring snowmelt and spring-fed tributaries at higher elevations (*e.g.,* High Cascades region), and shallow groundwater aquifers in low-elevation areas in the valley that recharge during the rainy season (OCCRI 2010a, p. 97–104). The Willamette River and its tributaries are highly altered with multiple large reservoirs and other human influences such as dams, levees, and floodplain development. Multiple, large USACE dams, constructed in the 1950s and 1960s for flood reduction, altered seasonal discharge and temperatures, reduced peak flood flows, and augmented summer low flows (OCCRI 2010a, p. 77). Climate change effects that may affect Oregon chub include increased winter flooding, increased temperatures, reduced summer baseflows, and increased negative interactions with nonnative fishes. Each of these is discussed below.

Increased Winter Floods—Effects of climate change predicted for the PNW may include increased winter flood events (OCCRI 2010a, pp. 87–88). These events, which are often associated with an increased proportion of annual precipitation falling as rain instead of snow and reduced snowpack, may better mimic natural riverine processes (such as channel migration, scour, etc.) to create and maintain riverine habitats on which Oregon chub depend. Oregon chub evolved in a dynamic, alluvial river with broad floodplains and braided reaches with many side channels, sloughs, and other similar slack-water habitats. Large floods

commonly rearranged these side-channel habitats, creating new habitats in some locations, and filling in other areas. The construction and operation of the USACE's Willamette Project, a system of 13 flood control dams, has reduced flooding and associated habitat forming processes in the Willamette River Basin, thereby simplifying mid- to low-elevation, aquatic habitats considerably. During previous flood events, the Willamette Project dams have been able to capture and reduce the magnitude of the flow to keep flood waters from impacting downstream communities; the magnitude of these flows were still high enough to alter the stream and floodplain habitat. Increased flows associated with climate change may contribute to the creation and maintenance of off-channel floodplain habitats upon which Oregon chub depend (*e.g.,* side channels, oxbows, etc.), thereby increasing the amount of suitable habitat for the species. For these reasons, it is possible that increases in winter floods associated with climate change may benefit Oregon chub through the creation and maintenance of their habitats.

Temperature and Dissolved Oxygen Effects—The Oregon chub is tolerant of a wide range of temperatures and thus less vulnerable to temperature effects of climate change than other listed fish species in the Willamette River Basin (*e.g.,* bull trout, spring chinook salmon, and winter steelhead). Oregon chub do not require cool temperatures for spawning or other life-history needs and appear tolerant of low dissolved oxygen (DO) levels. DO levels and temperature are related because at higher temperatures, water has a reduced ability to store oxygen. While the upper lethal temperature limit of Oregon chub has not been determined, the best available data based on field observations suggest this limit is approximately 31 to 35 degrees Celsius (88 to 95 degrees Fahrenheit) for adult Oregon chub, and that tolerance may be associated with low DO levels (Scheerer and Apke 1997, p. 25; Bangs et al. 2009, p. 17). Temperature and DO tolerances for juvenile Oregon chub appear to be higher than that of adults (Scheerer and Apke 1997, p. 25; Bangs et al. 2009, p. 17). The observed maximum summer temperature range of occupied Oregon chub habitat is from 23 to 39 degrees Celsius (73 to 102 degrees Fahrenheit) (Bangs 2014, pers. comm.). Despite a proportion of these habitats experience temperatures in excess of 35 degrees Celsius (95 degrees Fahrenheit) (which may result in the loss of some individuals within that population), an entire population has not been lost due to temperature increases and associated low DO levels.

While global climate models project a temperature increase for the PNW of approximately 2 to 4 degrees Celsius (3.6 to 7.2 degrees Fahrenheit) by 2080 (OCCRI 2010b, p. 7), climate models primarily predict air temperature changes, which have led many to believe that water temperatures will also correspondingly rise (Arismendi *et al.* 2012, p. 1). However, water temperatures did not follow expected warming trends or experience the same magnitude of increased temperature as air temperature when analyzing stream temperature data from the Pacific continental United States (Arismendi *et al.* 2012, p. 4). In many cases, water temperatures were found to have more cooling trends than warming trends since 1987, and less variability, especially in highly human-influenced rivers (Arismendi *et al.* 2012, pp. 4–5). Such is the case in the Willamette River; the presence of the 13 USACE flood control dams in the Willamette Valley allows for some amelioration of extreme climate variation, such as temperature extremes and drought. These large dams may be able to adaptively operate in the future to partially offset some of the potential increases in water temperature and flow reductions below the dams, if determined appropriate.

Releases of water below the USACE's Willamette Project dams generally target water temperatures ranging from 12 to 18 degrees Celsius (54 to 64 degrees Fahrenheit), depending on the season. These releases decrease downstream summer river temperatures by 6 to 10 degrees Celsius (10.8 to 18 degrees Fahrenheit) from historic temperatures (Rounds 2010, p. 43) and augment summer low flows (OCCRI 2010a, p. 77). The USACE is working to better mimic historical temperature conditions through water releases at several dams, which primarily target temperature benefits to federally listed salmonids that remain protected under the Act. These salmonid species require much cooler waters than Oregon chub. For example, juvenile salmonids generally prefer temperatures from 11.7 to 14.7 degrees Celsius (53.1 to 58.5 degrees Fahrenheit), and spawning temperatures for these species are typically below 13.0 degrees Celsius (55.4 degrees Fahrenheit) (Richter and Kolmes 2005, pp. 27–28). The needs of these listed salmonids will continue to influence future management decisions. Thus, dam releases targeting these cooler temperature requirements will be protective of Oregon chub habitats downstream of these dams.

Potential reductions in summer baseflows may increase water temperatures (OCCRI 2010a, p. 114). Increased frequency of short-term droughts (3 to 6 months) may reduce the USACE's ability to meet all of the minimum instream flow volumes, especially during late summer and early fall. Many populations (40 out of 77 populations, and 10 of the 23 populations that meet recovery criteria) exist in riverine habitats influenced by releases from the USACE's dams.

While increased frequency of short-term drought may reduce the USACE's ability to meet required instream flows for listed salmonids, we do not anticipate these reductions will result in temperature increases that constitute a substantial threat to Oregon chub now or into the foreseeable future. These dams currently maintain cooler summer temperatures and higher summer baseflows below the dams than existed prior to dam construction, and thereby provide a buffer from increased temperatures. Further, the USACE is required to coordinate with the Service, ODFW, and NMFS when minimum instream flows cannot be met, which allows the Service to weigh in on the magnitude of reductions and mitigate negative effects to Oregon chub populations if necessary. For these reasons, we determine potential instream flow reductions, and any associated temperature increases and reduced DO levels due to increased short-term droughts do not constitute a substantial threat to Oregon chub in habitats below the dams.

Other populations exist outside the influence of the dam releases. Eighteen populations exist in ''up-slope'' habitats that are not directly influenced rivers (6 of these populations met all recovery criteria in 2013); 14 populations occur on or adjacent to undammed rivers (3 met recovery criteria); 5 are adjacent to USACE reservoirs (4 met recovery criteria). The potential effects to each of these habitat categories are discussed below.

The 18 ''upslope'' populations were introductions into isolated ponds, as discussed above. Predicted reductions in summer rainfall and increased evaporation may reduce the volume or depth of these ponds in late summer, increase water temperature, and correspondingly decrease DO levels in these habitats. However, these introduction sites were selected because the habitat is expected to remain stable during extreme climatic events such as droughts or floods. Each of these habitats was chosen for its ability to remain wetted during drought and provide a diversity of habitats

throughout a range of pool elevations. For example, some sites rely on ground water springs or modern water control structures to maintain pond elevations throughout summer.

While it is possible that climate change may impact some aquatic habitats to the extent they no longer can support Oregon chub, the probability of that occurring is low given the wide tolerances of this species to water temperatures and corresponding DO levels. The diversity of isolated Oregon chub habitats spread across multiple watersheds provides further buffers against population level impacts from climate change. For these reasons, we determine that temperature effects due to climate change to these ''up-slope'' habitats do not constitute a substantial threat to Oregon chub now or into the foreseeable future.

Fourteen Oregon chub populations occur on or adjacent to undammed rivers: 13 of these populations are naturally occurring and on or adjacent to rain-dominated, undammed tributaries to the Willamette River (*e.g.,* Marys, Molalla, and Luckiamute Rivers, and Muddy Creek); and 1 population occurs in a spring-fed pond upstream of a USACE dam and thus is unlikely to experience substantial temperature increases or other negative impacts from climate change. For the 13 populations, potential reductions in summer baseflows and associated increases in water temperature are the most likely negative impacts to these populations from climate change effects (including short-term droughts). However, uncertainty in the extent and magnitude of summer baseflow reductions remains high despite modeling efforts (Chang and Jung 2010, pp. 198–202; see following discussion). Given this uncertainty regarding summer baseflow reductions, we cannot predict to what level summer baseflows may drop (and thereby increase water temperatures) and negatively impact these habitats.

We anticipate few of these habitats will be negatively affected to such an extent Oregon chub cannot exist given the high tolerance of Oregon chub to temperature and associated reduced DO levels, the fact that ground water connections to these habitats may remain, and these habitats are distributed across several watersheds with differing influences (Chang and Jung 2010, p. 204). For these reasons, we determine that temperature effects due to climate change in these rain-dominated, undammed tributary habitats do not constitute a substantial threat to Oregon chub now or into the foreseeable future.

The remaining five populations occupy habitats adjacent to USACE reservoirs in the Middle Fork Willamette River: Two populations at Lookout Point Reservoir, two at Dexter Reservoir, and one at Fall Creek Reservoir. Reductions in snow, increases in rain, increased frequency of short-term droughts, instream flow requirements, and related increased water demand for agricultural and municipal uses during droughts may put additional stresses on water supply in the Willamette Basin. These stresses may reduce the USACE's ability to maintain reservoir levels year-round, especially during the late summer and early fall. These reservoir-associated populations are most likely to experience temperature increases, reduced DO levels, and reduction in habitat from loss of connection with the reservoirs, which may occur in the future during predicted short-term droughts. However, we have direct experience with this situation: in 2010, the USACE drew these reservoirs down through the summer of 2011 for dam-safety repairs.

The ODFW monitored these populations closely during and after reservoirs returned to normal levels (Bangs *et al.* 2012, p. 18). No populations were lost due to these reduced reservoir levels, despite reduced habitat and high summer temperatures. While some populations experienced a decline the following year, one population increased. Those populations that experienced a decline due to lowered reservoir levels recovered to previous abundance levels (Bangs *et al.* 2012, p. 10).

In summary, the Oregon chub is tolerant of a wide range of temperatures and not dependent on cool waters to complete its life history. Oregon chub populations are dispersed across a wide range of diverse habitats, each influenced by site specific factors. The predicted increases in water temperature and associated reductions in DO levels from climate change effects are not anticipated to exceed the tolerances for Oregon chub throughout its range. Also, coordination between the Service and the USACE is required when minimum instream flow requirements will not be met. For these reasons, we determine that temperature increases associated with climate change effects are not a threat to Oregon chub across its range.

Oregon chub are tolerant of a wide range of temperatures and associated decreases in DO, and are thus less vulnerable to temperature effects of climate change than other listed fish species in the Willamette Valley. Information specific to Oregon chub regarding its ability to make behavioral or physiological responses to temperature changes is not available. However, given their observed temperature tolerance (up to 31 to 35 degrees Celsius, 88 to 95 degrees Fahrenheit) relative to potential climate increases in water temperature, the coordination of instream flows and reservoir management with the USACE, and the multiple populations across a range of ecological settings and tributaries in the Willamette Basin, we conclude that temperature effects from climate change do not constitute a substantial threat to Oregon chub now, or in the foreseeable future.

Reduction in Summer Baseflows—Climate change effects with the most potential to negatively affect Oregon chub are reduced summer baseflows, which may reduce habitat availability within existing habitats and exacerbate increases in water temperature and declines in DO. Chang and Jung (2010, entire) examined future runoff projections in the Willamette River Basin under eight global climate models and two emissions scenarios. Some consistent trends exist between different models with regards to summer flow conditions: the 7-day low flow minimum decreased in most subbasins of the Willamette River Basin, and the Western Cascade basins (medium elevation) showed greater declines than those in the Willamette Valley (low elevation) and the High Cascades (high elevation) (Chang and Jung 2010, pp. 198–202). However, the range of predicted changes was much more variable in the Willamette Valley and Western Cascades where the majority of Oregon chub populations exist. Further, the predicted changes for both summer runoff and the 7-day low flow minimum were very different depending on the emissions scenario used in the model, and the predicted changes varied by subbasin (Chang and Jung 2010, pp. 201–202).

Given the uncertainty in climate change predictions with differing models and future emission scenarios, we cannot specify the amount of reductions in summer baseflows for each subbasin and extrapolate how those reductions will affect habitat availability, temperatures, and DO (alone or in concert) in individual Oregon chub habitats. Such fine-scale models are not available. Despite modeled projections of changes in temperature, precipitation, and runoff at the global, regional, and basin scale, we cannot: (1) Predict with any certainty how those changes may influence Oregon chub populations and their

individual habitats in the Willamette Valley; and (2) accurately describe and assess the net effects when considering the potential negative consequences together with the potential positive effects to Oregon chub populations.

Oregon chub habitats are often located in side-channel and off-channel areas that are highly influenced by site-specific conditions, including, but not limited to factors such as above- and below-ground water connections between the habitat and the river system or aquifer, and total volume and depth of the habitat. For example, lower baseflows that seasonally disconnect above-ground flow to a side-channel habitat may or may not result in reduced habitat availability and increased temperatures, depending on whether cooler, below-ground water connection to the side channel is maintained.

Oregon chub habitats exist throughout the Willamette River Basin in a variety of subbasins at a variety of elevations, with varying geology and topography, and with differing climatic influences. Modeling conducted by Chang and Jung (2010, pp. 198–204) suggests that the interactions between climate change and land surface hydrology are complex. Because of these varying factors, each subbasin will respond differently to the effects of climate change. Thus, not all Oregon chub populations in the Willamette River Basin will be similarly affected by climate change effects. Because of the variety of habitats within a single subbasin, it is unlikely that all habitats within a single subbasin will experience negative effects to the extent that habitat no longer supports Oregon chub. Further, potential reductions in summer baseflows in portions of the Willamette Basin will likely be moderated by the continuing operations of the USACE's large storage dams that capture a portion of the flood flows from winter and spring precipitation events (including snowmelt) and gradually release these flows over the summer. Thus, for many existing Oregon chub populations, we do not anticipate substantial reductions in summer baseflows. If such reductions are necessary, our coordination with the USACE, as described earlier in this document, will allow the Service to minimize and mitigate impacts to Oregon chub.

For Oregon chub habitats outside of the influence of USACE dam releases, insufficient information exists to determine the magnitude of future reductions in summer baseflows and associated changes in temperature and DO levels. Substantial reductions, if they occur, may result in the reduction of available habitat or in some instances the loss of individual populations. However, we do not anticipate such negative effects across the range of Oregon chub. Based on the existing information collected on Oregon chub since its listing, we anticipate Oregon chub will continue to exist because of its demonstrated resiliency in the past in the face of continual change: Oregon chub have survived despite significant landscape changes across the Willamette River Basin, including the effects of many dams and floodplain development. Studies to date have shown this species is highly adaptable, and able to quickly colonize new habitats. The effects of climate change will continue to progress into the future gradually. We anticipate that not all Oregon chub populations as they exist today will still exist 40 to 50 years from now, but that Oregon chub will exist in abundant and stable populations throughout the Willamette River Basin, colonizing new side channels and habitats as hydrology and floodplains adjust to a changed climate. Thus, we determine that reductions in summer baseflows and any associated increases in temperatures and declines in DO levels do not constitute a substantial threat to Oregon chub now, nor will they be in the foreseeable future.

Competition and Predation by Nonnative Fish Species—Climate change effects may locally alter Oregon chub habitats to the advantage of nonnative species known to compete with and prey on Oregon chub via increasing water temperature and reducing connectivity to river systems during low flow conditions (*e.g.,* summer baseflows). However, the best available data show no relationship between the presence of nonnative fish and Oregon chub population abundance trends (Bangs *et al.* 2013, p. 17). Thirteen of the 23 populations that met delisting criteria with either a stable or increasing abundance trend in 2013 occur with nonnative fish; 1 of the 2 populations that had a declining abundance trend occurs with nonnative fish (Bangs *et al.* 2013, p. 17). The primary driver affecting the abundance and dominance of nonnative fish in suitable Oregon chub habitats appears to be connectivity of these off-channel habitats to the larger river system. To date, these nonnative competitors and predators have not completely overtaken suitable Oregon chub habitats that remain seasonally connected to these river systems because annual flood flows disrupt and flush the nonnative species out of these suitable habitats, whereas Oregon chub have developed behaviors that allow them to remain as they evolved with these high flows. In summary, we do not anticipate climate change effects on the abundance and distribution of nonnative fish in the Willamette Basin will increase competition and predation. We determine that this competition and predation does not constitute a substantial threat to Oregon chub now, nor will they be in the foreseeable future.

Summary for Climate Change Effects—The Willamette River Basin is a geologically complex system, as well as a highly altered and managed system with multiple large reservoirs and other human influences. Although effects of climate change are almost certain to impact aquatic habitats in the Willamette River Basin (CLI and NCCSP 2009, p. 1), researchers have great uncertainty about the specific effects of climate change, including which models and emission scenarios are the best representation of the future. Thus, despite modeled projections of changes in temperature, precipitation, and runoff, we cannot: (1) Predict with any certainty how those changes may influence individual Oregon chub populations and their habitats in the Willamette Basin; and (2) accurately describe and assess the net effects when considering the potential negative consequences together with the potential positive effects to Oregon chub populations.

The effects of climate change have potentially both positive and negative impacts to Oregon chub habitats; there is a wide diversity of habitats occupied by Oregon chub that are individually influenced by the site-specific factors and suitable habitats for Oregon chub are found throughout the Willamette Basin. Oregon chub as a species has proven itself highly adaptable and resilient to change. We cannot project with any certainty whether the effects of climate change will provide more benefits or threats to Oregon chub. However, the best available information suggests that Oregon chub and their habitats are not highly vulnerable to the potential effects of climate change across their range and we do not anticipate that climate change will have population level effects to Oregon chub.

The Service developed a strategic plan to address the threat of climate change to vulnerable species and ecosystems. Goals of this plan include maintaining ecosystem integrity by protecting and restoring key ecological processes such as nutrient cycling, natural disturbance cycles, and predator–prey relationships (Service 2010, p. 23). The Oregon chub recovery

program worked to establish conditions that allow populations of Oregon chub to be resilient to changing environmental conditions and to persist as viable populations into the future. Our recovery program for the species focused on maintaining large populations distributed within the species' entire historical range in a variety of ecological settings (*e.g.,* across a range of elevations). This approach is consistent with the general principles of conservation biology. In their review of minimum population viability literature, Traill *et al.* (2009, p. 3) found that maintenance of large populations across a range of ecological settings increases the likelihood of species persistence under the pressures of environmental variation, and facilitates the retention of important adaptive traits through the maintenance of genetic diversity. Maintaining multiple populations across a range of ecological settings, as described in the recovery plan, increases the likelihood that many abundant populations will persist under the stresses of a changing climate.

Summary of Factor A

Many of the factors discussed above were previously identified as threats to the continued existence of the Oregon chub. These factors include activities associated with the operation of the Willamette Project dams, sedimentation from timber harvest, floods or high-water events, water quality-related impacts, succession, and the effects of climate change. Modifications to the Willamette Project dam operations have provided flows that create and sustain off-channel habitat used by the Oregon chub, and we anticipate these flow targets will continue into the future due to requirements under biological opinions from the Service and NMFS, and the Sustainable Rivers Project collaboration between the USACE and TNC. Sedimentation from timber harvest is not currently indicated in the decline of any Oregon chub populations, and we expect that riparian buffers protected from timber harvest under State and Federal regulations will provide habitat protection in future timber harvest operations. Flooding and high-water events are largely unpredictable. However, Oregon chub evolved within a dynamic environment and the current distribution of Oregon chub in many abundant populations within subbasins and across multiple subbasins reduces the risk that these events will negatively affect a large proportion of Oregon chub and its habitat. Declines in water quality related to factors such as chemical contamination, nutrient enrichment, siltation, and hazardous material spills have the potential to affect individual populations, but few observations of negative effects due to water quality issues have materialized over the past 20 years that we have been monitoring Oregon chub populations. Succession was a factor at one Oregon chub site and may occur in the future, particularly at sites that are isolated from the floodplain. However, succession is a slow process that can be addressed through ongoing monitoring and habitat management, and is not currently a cause for concern at any of the known Oregon chub sites.

Other factors that may affect the Oregon chub and its habitat include actions required under the terms and conditions of the Willamette Project biological opinions, aggradation, and irrigation withdrawals. Actions required under the Willamette Project biological opinions began in 2008, but the effects to Oregon chub habitat from these actions are not well understood as the focus of most of these actions is recovery of listed salmonids. Research into the effects of these actions on off-channel habitats started in 2009 and will continue for the next few years. This research may lead to an improved understanding of the habitat characteristics that support abundant populations of Oregon chub in connected habitats and flow management recommendations specific to maintaining Oregon chub habitat. Aggradation from natural causes has been identified at one Oregon chub site, and aggradation from a complete drawdown of Fall Creek Reservoir resulted in large deposits of sediment in three previously unknown Oregon chub habitats. Other than these events, aggradation has not been observed at Oregon chub sites. Irrigation withdrawal was observed to negatively affect the volume of water available in one Oregon chub habitat in the Middle Fork River subbasin, but is not considered a widespread concern throughout the range of Oregon chub.

In summary, the factors discussed under Factor A continue to occur across the subbasins occupied by Oregon chub, but only a few populations have exhibited declines as a result of any of the factors or combination of factors. The threat of habitat loss has been reduced by changes in flow management and by introducing the species into secure, isolated habitats that are not influenced by floodplain processes. We also better understand the diversity of connected habitats used by Oregon chub and, as a result, discovered many abundant populations in these habitats across multiple subbasins. Therefore, based on the best available information and because we expect that current management practices will continue into the foreseeable future, we conclude that the present or threatened destruction, modification, or curtailment of its habitat or range does not constitute a substantial threat to Oregon chub now and is not expected to in the foreseeable future.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization for commercial, recreational, scientific, or educational purposes was not a factor in listing, nor is it currently known to be a threat to the Oregon chub.

C. Disease or Predation

Predation by Nonnative Fishes and Amphibians

In the final rule to downlist the Oregon chub (75 FR 21179, April 23, 2010), we identified predation by, and competition with, nonnative fishes as primary threats to Oregon chub (competition with nonnative fishes is addressed below under Factor E). The Willamette River Basin contains 31 native fish species and 29 nonnative species (Hulse *et al.* 2002, p. 44). The large-scale alteration of the Willamette River Basin's hydrologic system (*i.e.,* construction of dams and the resultant changes in flood frequency and intensity) created conditions that favor nonnative, predatory fishes, and reservoirs throughout the basin have become sources of continual nonnative fish invasions in the reaches downstream (Li *et al.* 1987, p. 198). Significant declines in Oregon chub abundance due to the presence of nonnative fishes were documented. For instance, after floods in 1996, nonnative fish were first collected from several sites containing Oregon chub in the Santiam River drainage; the two largest populations of Oregon chub (Geren Island North Pond and Santiam Easement) subsequently declined sharply in abundance (Scheerer 2002, p. 1076).

Nonnative fish, which prey upon Oregon chub, were also introduced into Oregon chub habitats. For example, illegal planting of largemouth bass at East Ferrin Pond in the Middle Fork Willamette River drainage coincided with the collapse of an Oregon chub population that had once totaled more than 7,000 fish. A regulatory mechanism is in place to prevent the translocation of nonnative fish. Within the State of Oregon, it is unlawful to transport, release, or attempt to release any live

fish into the waters of this State (OAR 635–007–0600). Although similar illegal introductions may still occur in the future, they have historically been infrequent in habitats known to be occupied by Oregon chub.

Predatory, nonnative centrarchids (bass and sunfish), western mosquitofish (*Gambusia affinis*), and bullhead catfish (*Ameiurus* spp.) are common in the off-channel habitats preferred by Oregon chub (Scheerer 2002, p. 1,075). The Oregon chub is most abundant at sites where nonnative fishes are absent (Scheerer 2007, p. 96). However, ODFW biologists recently found many abundant Oregon chub populations that coexist with nonnative fish in hydrologically connected habitats (Bangs *et al.* 2011a, pp. 21–24). One of the primary objectives of the floodplain study funded under the Willamette Project biological opinion (Service 2008b, pp. 180–182; see previous discussion under Factor A) is to examine the relationship between the environmental conditions at hydrologically connected sites and the fish community, with a focus on Oregon chub and nonnative fish. The results to date indicate that spatial and seasonal differences in temperature within these off-channel habitats may provide areas that are suitable for Oregon chub but not suitable for nonnatives. In other words, Oregon chub may be able to coexist with nonnative fish because the habitat provides a diverse range of temperatures that partitions habitats among the species (Bangs *et al.* 2011a, pp. 9–10 and 16–17). Currently, 41 percent of all known Oregon chub habitats and 50 percent of the habitats supporting abundant populations (more than 500 Oregon chub) contain nonnative fishes. Research conducted under the study will continue to: (1) Improve our understanding of the effects of nonnative fishes on Oregon chub in these connected habitats; and (2) document the habitat conditions that allow these species to coexist. Sampling results to date indicate that Oregon chub coexist with nonnatives more frequently than previously known. Additional discussion about predation by nonnative fish is presented in the ''Effects of Climate Change'' section (discussed under Factor A).

Bullfrogs (*Rana catesbeiana*) were identified as a threat to Oregon chub in the recovery plan (Service 1998, p. 13) because they may compete with Oregon chub for food resources (*e.g.,* invertebrates). However, bullfrogs are prevalent in most of the habitats occupied by Oregon chub and their presence is not correlated with a decline in Oregon chub abundance (Bangs 2013, pers. comm.).

The Oregon chub is not known to be threatened by disease.

Summary of Factor C

Although the habitat conditions that allow Oregon chub to coexist with nonnative fish are not yet well understood, we documented several abundant Oregon chub populations in multiple subbasins that coexist with nonnative, predatory fish. These Oregon chub populations exist in habitat that is connected to the active floodplain. Ongoing research conducted under the floodplain study funded by the USACE will continue to improve our understanding of the interactions between Oregon chub and nonnative fishes.

While the presence of nonnative fishes in isolated sites may be associated with higher rates of predation on Oregon chub, the species has been introduced into 21 isolated habitats that are protected from the risk of invasion by nonnative fishes due to the habitat distance from the floodplain or other fish barriers. As discussed elsewhere in this document, these introductions act as refugial habitats, and the guidelines used to select sites ensure that these locations remain stable during extreme climactic events, such as droughts or floods. During major flooding in the Willamette River Basin in 1996, these sites remained isolated from neighboring water bodies. In addition, the introduction sites are less vulnerable to the threats of habitat loss compared to connected habitats, and the translocation guidelines ensured that the Oregon chub in these isolated populations are genetically diverse. Introduced populations at these sites have been highly successful, and the majority of Oregon chub individuals occur in populations at these sites. Therefore, based on the best available information, we conclude that disease and predation do not constitute substantial threats to Oregon chub now, nor are they expected to in the foreseeable future.

D. The Inadequacy of Existing Regulatory Mechanisms

In evaluating the inadequacy of existing regulatory mechanisms, we first identify threats under one or more of the other four factors that are affecting the species to the extent it meets the definition of an endangered or a threatened species under the Act. We then identify and evaluate the adequacy of existing regulatory mechanisms that may prevent or reduce those threats. The Oregon chub, however, is no longer facing substantial threats to its long-term survival due to the other four factors; thus the inadequacy of existing regulatory mechanisms is also no longer a threat to the species' continued existence. Therefore, our discussion of this factor focuses on regulatory mechanisms not previously discussed that may provide benefits to Oregon chub.

Wetlands and waterways in Oregon are protected by both Federal and State laws. The Environmental Protection Agency (EPA) administrates the Clean Water Act (CWA; 33 U.S.C. 1251 *et seq.*)), which regulates discharges of pollutants into waters of the United States and regulates water quality standards. The EPA sets standards for pollution control programs and water quality standards for all contaminants in surface waters. Many of the water quality criteria are set for human health standards or salmon and steelhead life stage needs, which exceed biological requirements for Oregon chub. For example, the upper temperature tolerance of Oregon chub is significantly higher than the maximum allowable temperatures set by EPA criteria for salmon and steelhead spawning and rearing.

While we acknowledge that there are Oregon chub in reaches in the Willamette River that are on the section 303(d) list of impaired and threatened waters under the CWA, Oregon chub populations have continued to expand throughout the Willamette River Basin in spite of these section 303(d) waters. Further, we do not foresee future water quality declines (*i.e.,* temperature, dissolved oxygen, biological criteria) that are a threat to the continued existence of Oregon chub and require its continued listing under the Act. The Service has consulted with the EPA on existing Oregon water quality standards and the Service's biological opinion concluded that the Oregon water quality standards are not likely to jeopardize the continued existence of Oregon chub (Service 2004, pp. 76–77). While the courts remanded the 2004 biological opinion back to the Service, and we continue to work with the EPA to complete this consultation, the remand was based on thermal requirements for bull trout, not Oregon chub.

Under section 404 of the CWA, the USACE regulates the discharge of dredged material and fill material into waters of the United States, including navigable waters and wetlands that may contain Oregon chub. Oregon's Removal-Fill Law (ORS 196.795–990) requires people who plan to remove or fill material in waters of the State to obtain a permit from the Oregon

Department of State Lands (DSL). Projects impacting waters often require both a State removal-fill permit, issued by the DSL, and a Federal permit issued by the USACE. A permit is required only if 50 cubic yards (1,350 cubic feet) or more of fill or removal will occur. The removal-fill law does not regulate the draining of wetlands. Projects permitted under these programs must avoid and minimize impacts to wetlands or waterways, or propose mitigation to replace the functions and values lost as a result of the project (Oregon Department of State Lands 2013, p. 64). Some actions, however, such as construction and maintenance of irrigation-diversion structures and other activities associated with ongoing farming operations in existing cropped wetlands, are exempt from CWA requirements. Additionally, projects authorized under a nationwide USACE permit program receive minimal public and agency review unless the action may affect a listed species, in which case, consultation under section 7 of the Act is required. Individual permits are subject to a more rigorous review, as well as nationwide permit activities with more than minimal impacts.

Under section 303(c) of the CWA, States are required to adopt water quality standards to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Oregon adopted revised water quality standards for toxic pollutants in 2004. These standards are intended to protect native aquatic species, and are regulated by the Oregon Department of Environmental Quality. The State implements the standards through listing of waters that exceed criteria on the section 303(d) list of the CWA, calculating the Total Maximum Daily Loads (the maximum amount of pollutants that may enter a stream), and issuing or reissuing permits (*i.e.,* National Pollutant Discharge Elimination System). In 2012, we completed consultation under section 7 of the Act on the EPA's proposed approval of the State of Oregon's water quality criteria for toxic pollutants (Service 2012, entire). Although some Oregon chub sites may be affected by point-source discharges (*i.e.,* wastewater treatment facilities and stormwater discharge from a manufacturing plant) and non-point-source discharges (*i.e.,* runoff of agricultural and forestry pesticides and fertilizers) of toxic chemicals, we determined in our consultation with the EPA that the Oregon chub's exposure to these chemicals at the criteria levels and the resulting effects would not jeopardize the species' continued existence, adversely modify or destroy Oregon chub critical habitat, or reach levels preventing Oregon chub from attaining the abundance and distribution criteria for delisting identified in the recovery plan (Service 2012, pp. 351–352).

The Oregon chub is designated as ''Sensitive-Critical'' by the ODFW. Although this designation is a nonregulatory tool, it helps focus wildlife management and research activities, with the goal of preventing species from declining to the point of qualifying as ''threatened'' or ''endangered'' under the Oregon Endangered Species Act (ORS 496.171, 496.172, 496.176, 496.182, and 496.192). ODFW's ''Sensitive-Critical'' designation encourages, but does not require, the implementation of conservation actions for the species; however, other State agencies, such as the DSL and the Oregon Water Resources Department, refer to the Sensitive Species List when making regulatory decisions.

The ODFW's Sensitive Species List is reviewed and updated every 5 years. Each taxonomic group of animals is reviewed by the ODFW biologists and scientific experts from other agencies, universities, and private organizations. The scientists consider new and historic information on species distribution, population trends, and biological needs; changes in threats; gaps in knowledge and data; recent conservation actions; and State and Federal programs or regulations. The scientists may propose to remove, add, or re-classify species based on this information. The draft list is then peer-reviewed by State, Federal, university, and consulting biologists. The ODFW is currently updating the Sensitive Species List and plans to retain the ''Sensitive-Critical'' designation for Oregon chub for the duration of the post-delisting monitoring plan timeframe.

Summary of Factor D

Although existing regulatory mechanisms offer limited protection to Oregon chub, we have no indication that other factors, which these mechanisms are designed to address, are likely to occur at such a magnitude as to negatively impact large numbers of Oregon chub or a substantial area of habitat. Therefore, based on the best available information, we conclude that the inadequacy of existing regulatory mechanisms does not constitute a substantial threat to Oregon chub now, nor is it projected to in the future.

E. Other Natural or Manmade Factors Affecting Its Continued Existence

Interspecific Competition With Nonnative Fishes

Along with the adverse impacts of direct predation described under Factor C (above), nonnative fishes compete with Oregon chub for food resources, such as aquatic invertebrates. Competition with nonnative fishes may contribute to the decline in populations or exclusion of Oregon chub from suitable habitats. Observed feeding strategies and diet of nonnative fishes, particularly juvenile centrarchids and adult western mosquitofish, overlap with those described for Oregon chub (Li *et al.* 1987, pp. 197–198). At South Stayton Pond, a hydrologically isolated site in the Santiam River Basin, we observed a population of 6,200 Oregon chub decline to 2,200 in one season after invasion by western mosquitofish, a nonnative fish that competes with adults and potentially predates on larval Oregon chub. The source of this invasion is unknown, but it is likely that the western mosquitofish were illegally introduced into the pond. The population remained above 1,000 for the past 4 years (Bangs 2014, pers. comm.), demonstrating the ability of nonnative fish to competitively suppress Oregon chub populations. Other populations of the Oregon chub are possibly suppressed by competition with nonnative fishes. However, the current abundance of Oregon chub and its distribution throughout floodplain habitats in the Santiam, McKenzie, and Middle Fork Willamette Rivers indicates that competition by nonnative fish is not affecting Oregon chub populations to the degree that overall status declines are observed. Additional discussion about competition by nonnative fish is presented in the ''Effects of Climate Change'' section (see Factor A).

Isolated Populations

Twenty-eight populations of the Oregon chub are currently isolated; 21 of these sites are introduced sites where isolation was intentional in order to provide refugia from the threat of nonnative fishes. Other sites are isolated due to the reduced frequency and magnitude of flood events and the presence of migration barriers such as beaver dams. Managing species in isolation may have genetic consequences. Burkey (1989, p. 78) concluded that, when species are isolated by fragmented habitats, low rates of population growth are typical in local populations, and their probability of extinction is directly related to the degree of isolation and fragmentation.

Without sufficient immigration, growth of local populations may be low and probability of extinction high (Burkey 1989, p. 78). The genetic analyses performed on Oregon chub (DeHaan *et al.* 2010, pp. 14–19; 2012, pp. 548–549) found high levels of genetic variation at most locations. Also, the genetic analyses found that our guidelines for establishing introduction sites are effective, and introductions stocked from multiple donor sources have higher variability than those from single donor sources. In addition, 50 of the 77 Oregon chub populations are located in habitat that experiences some level of connectivity to the adjacent river channel; 34 of these populations were discovered since we downlisted the Oregon chub to threatened status in 2010. Furthermore, the ODFW documented Oregon chub in new habitat created by floodplain processes in the McKenzie River subbasin, and documented voluntary movement of Oregon chub between populations in the Middle Fork Willamette River (Bangs *et al.* 2012, p. 19) and McKenzie River subbasins (Bangs *et al.* 2013, p. 17). These findings demonstrate the ability of Oregon chub to colonize new habitats and exchange genetic material between established populations. Manual transport of Oregon chub between populations has not been proposed, and we think it unnecessary at this time for the maintenance of populations. Although a recent genetic analysis found that Oregon chub in isolated habitats have levels of genetic diversity equal to or greater than other cyprinids, additional Oregon chub may need to be introduced into these isolated populations in the future to maintain genetic diversity in the event a population shows a significant decline.

In the final rule to reclassify Oregon chub to threatened (75 FR 21179, April 23, 2010), we expressed concern about genetic isolation due to the lack of habitat connectivity between Oregon chub populations. As stated above, we discovered that many of the habitats occupied by the Oregon chub connect to the adjacent river channel more frequently and for longer duration than previously understood, which provides opportunities for genetic dispersal.

Summary of Factor E

Interspecific competition with nonnative fishes and isolation from genetic exchange may affect Oregon chub populations in the future. However, we observed population declines related to competition with nonnative fishes in only one Oregon chub population, South Stayton Pond, a small habitat area with limited resources. Although this decline was substantial (abundance of 6,200 chub declined to 2,200 chub in one season), the population since stabilized and persists with about 1,000 Oregon chub (Bangs *et al.* 2013, p. 6). We documented numerous additional abundant Oregon chub populations in habitats that are connected to the floodplain, which facilitates potential genetic exchange among populations. This has ameliorated the risk of a reduction in genetic diversity. The impacts associated with the effects of climate change will be somewhat ameliorated by the multiple storage dams in the Willamette River Basin, the wide range of temperature tolerances of Oregon chub, and the diversity of habitats occupied by the species. To the extent the effects of climate change manifest on the landscape, these impacts are, and will continue to be, reduced by the distribution of many abundant populations in diverse habitats across multiple subbasins. Therefore, based on the best available information, we conclude that other natural or manmade factors do not constitute a substantial threat to Oregon chub now, nor will they in the foreseeable future.

Cumulative Impacts

Some of the factors discussed in this five-factor analysis could work in concert with one another or synergistically to create cumulative impacts to Oregon chub populations. For example, effects from flow, dam operations, and temperature changes downstream of Willamette Project dams may coincide with an increase in nonnative fish species that prey upon and compete with Oregon chub. Although the types, magnitude, extent, or permutations of cumulative impacts are difficult to assess, the current status of Oregon chub indicates that no such synergies drive population declines now or have the potential to in the future, and the post-delisting monitoring plan is designed to detect such declines if they occur. As discussed below, the agencies and nongovernmental organizations that manage multiple populations agreed to cooperate on the implementation of the post-delisting monitoring plan, which will guide the monitoring and, should population declines occur, necessary research and conservation actions. The best scientific and commercial data available indicate that Oregon chub is genetically diverse, abundant, and well-distributed throughout its historical range and that the factors are not currently, or anticipated to, cumulatively cause declines in Oregon chub populations or its habitat.

Overall Summary of Factors Affecting Oregon Chub

The primary factors that threatened Oregon chub were loss of habitat, predation and competition by nonnative fishes, and the inadequacy of existing regulatory mechanisms. The threats that led to the species' listing under the Act have been removed or ameliorated by the actions of multiple conservation partners over the last 20 years. The introduction of Oregon chub into several secure habitats has provided populations that are isolated from the threats of habitat loss and invasion by nonnative fishes. The discovery of many natural populations, including a number of populations that are connected to the active floodplain and coexist with nonnative fishes, has increased our understanding of population persistence in spite of the presence of predators in the species' environment. The implementation of minimum instream flows and ongoing flushing flows from Willamette Project dams that sustain floodplain habitat downstream reduced the risk of habitat loss due to altered flows. The acquisition of floodplain habitat for long-term conservation and restoration provided assurance that management of floodplain habitat for the species will continue into the foreseeable future.

Many factors still exist that may affect Oregon chub populations; however, most of these factors were isolated incidents, and the magnitude of their effects were not observed on a wide scale across the distribution of Oregon chub populations. The abundance and distribution of known Oregon chub populations has increased each year since the downlisting to threatened, and has exceeded the goals of our recovery criteria for delisting. When the species was listed in 1993, only nine populations of Oregon chub within a small, restricted range were known to occur. Oregon chub populations now exist in 77 diverse habitats across multiple subbasins. Listing the species under the Act resulted in the implementation of focused recovery actions that led to protected, abundant, and well-distributed Oregon chub populations across several Willamette River Basin tributaries. We expect conservation efforts will continue to support persistent recovered Oregon chub populations post-delisting and into the future, as described above. Based on this assessment of factors potentially impacting the species, we consider Oregon chub to face no

substantial threats, now or into the foreseeable future.

Determination

An assessment of the need for a species' protection under the Act is based on whether a species is in danger of extinction or likely to become so because of any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. As required by section 4(a)(1) of the Act, we conducted a review of the status of this species and assessed the five factors to evaluate whether the Oregon chub is endangered or threatened throughout all of its range. We examined the best scientific and commercial information available regarding the past, present, and future threats faced by Oregon chub and its habitat. We reviewed the information available in our files and other available published and unpublished information, and we consulted with recognized experts and other Federal, State, and Tribal agencies.

In considering what factors might constitute threats, we must look beyond the mere exposure of the species to the factor to determine whether the exposure causes actual impacts to the species. If there is exposure to a factor, but no response, or only a positive response, that factor is not a threat. If there is exposure and the species responds negatively, the factor may be a threat and we then attempt to determine how significant the threat is. If the threat is significant, it may drive, or contribute to, the risk of extinction of the species such that the species warrants listing as endangered or threatened as those terms are defined by the Act. This determination does not necessarily require empirical proof of a threat. The combination of exposure and some corroborating evidence of how the species is likely impacted could suffice. The mere identification of factors that could impact a species negatively is not sufficient to compel a finding that listing is appropriate; we require evidence that these factors are operative threats that act on the species to the point that the species meets the definition of an endangered species or threatened species under the Act.

We find that Oregon chub populations are well-distributed among several subbasins and that many large, stable, or increasing populations exist that show no evidence of decline over the last 7 or more years. During our analysis, we did not identify any factors that are likely to reach a magnitude that threatens the continued existence of the species; significant impacts at the time of listing that could have resulted in the extirpation of all or parts of populations have been eliminated or reduced since listing, and we do not expect any of these conditions to substantially change post-delisting and into the foreseeable future. We conclude that the previously recognized impacts to Oregon chub from the present or threatened destruction, modification, or curtailment of its habitat or range (specifically, operation of the USACE's Willamette Project dams, sedimentation from timber harvest and floods, water quality issues, succession, and effects of climate change (Factor A); predation by nonnative species (Factor C); and interspecific competition with nonnative species, and isolation from genetic exchange (Factor E)), do not rise to a level of significance such that the species is in danger of extinction throughout all of its range now or in the foreseeable future.

Significant Portion of the Range Analysis

Having determined that the Oregon chub throughout all its range, is not endangered or threatened throughout all of its range, we next consider whether there are any significant portions of its range in which the Oregon chub is in danger of extinction or likely to become so. Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so throughout all or a significant portion of its range. The Act defines ''endangered species'' as any species which is ''in danger of extinction throughout all or a significant portion of its range,'' and ''threatened species'' as any species which is ''likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' We published a final policy interpreting the phrase ''Significant Portion of its Range'' (SPR) (79 FR 37578; July 1, 2014). The final policy states that (1) if a species is found to be endangered or threatened throughout a significant portion of its range, the entire species is listed as endangered or threatened, respectively, and the Act's protections apply to all individuals of the species wherever found; (2) a portion of the range of a species is ''significant'' if the species is not currently endangered or threatened throughout all of its range, but the portion's contribution to the viability of the species is so important that, without the members in that portion, the species would be in danger of extinction, or likely to become so in the foreseeable future, throughout all of its range; (3) the range of a species is considered to be the general geographical area within which that species can be found at the time the Service or NMFS makes any particular status determination; and (4) if a vertebrate species is endangered or threatened throughout an SPR, and the population in that significant portion is a valid Distinct Population Segment (DPS), we will list the DPS rather than the entire taxonomic species or subspecies.

The procedure for analyzing whether any portion is an SPR is similar, regardless of the type of status determination we are making. The first step in our analysis of the status of a species is to determine its status throughout all of its range. If we determine that the species is in danger of extinction, or likely to become so in the foreseeable future, throughout all of its range, we list the species as an endangered species (or threatened species) and no SPR analysis will be required. If the species is neither in danger of extinction nor likely to become so throughout all of its range, we next determine whether the species is in danger of extinction or likely to become so throughout a significant portion of its range. If it is, we list the species as an endangered species or threatened species, respectively; if it is not, we conclude that listing the species is not warranted.

When we conduct an SPR analysis, we first identify any portions of the species' range that warrant further consideration. The range of a species can theoretically be divided into portions in an infinite number of ways. However, there is no purpose in analyzing portions of the range that have no reasonable potential to be significant or in analyzing portions of the range in which there is no reasonable potential for the species to be endangered or threatened. To identify only those portions that warrant further consideration, we determine whether substantial information indicates that: (1) The portions may be ''significant'' and (2) the species may be in danger of extinction there or likely to become so within the foreseeable future. Depending on the biology of the species, its range, and the threats it faces, it might be more efficient for us to address the significance question first or the status question first. Thus, if we determine that a portion of the range is not ''significant,'' we do not need to determine whether the species is

endangered or threatened there; if we determine that the species is not endangered or threatened in a portion of its range, we do not need to determine if that portion is ''significant.'' In practice, a key part of the determination that a species is in danger of extinction in a significant portion of its range is whether the threats are geographically concentrated in some way. If the threats to the species are affecting it uniformly throughout its range, no portion is likely to have a greater risk of extinction, and thus would not warrant further consideration. Moreover, if any concentration of threats apply only to portions of the range that clearly do not meet the biologically based definition of ''significant'' (*i.e.,* the loss of that portion clearly would not be expected to increase the vulnerability to extinction of the entire species), those portions would not warrant further consideration.

We considered whether any portions of Oregon chub range might be both significant and in danger of extinction, or likely to become so in the foreseeable future. One way to identify portions would be to identify natural divisions within the range that might be of biological or conservation importance. The geographic range of Oregon chub can readily be divided into four subbasins (Santiam, Mainstem Willamette, Middle Fork Willamette, and Coast Fork Willamette Rivers). Although some of the factors we evaluated in the Summary of Factors Affecting the Species section, above, occur in specific habitat types (*i.e.,* hydrologically connected sites versus isolated sites) within these subbasins, the factors affecting Oregon chub generally occur at similarly low levels throughout its range. Because the low level of potential threats to the species is essentially uniform throughout its range and the populations of the species within the subbasins are not in danger of extinction or likely to become so within the foreseeable future due to lack of significant threats, no portion of the range warrants further consideration to determine if it is significant. Based on our review of the best available information concerning the distribution of the species and the potential threats, we have determined that the Oregon chub does not warrant further consideration to determine if there is a significant portion of the range that is endangered or threatened.

Summary

We carefully assessed the best scientific and commercial data available and determined that the Oregon chub is no longer in danger of extinction throughout all or a significant portion of its range, nor is it likely to become so within the foreseeable future. We conclude Oregon chub no longer requires the protection of the Act, and, therefore, we are removing it from the Federal List of Endangered and Threatened Wildlife.

Future Conservation Measures

Section 4(g)(1) of the Act requires us, in cooperation with the States, to implement a monitoring program for not less than 5 years for all species that have been recovered and delisted. The purpose of this post-delisting monitoring (PDM) is to verify that a species remains secure from risk of extinction after the protections of the Act are removed, by developing a program that detects the failure of any delisted species to sustain itself. If, at any time during the monitoring period, data indicate that protective status under the Act should be reinstated, we can initiate listing procedures, including, if appropriate, emergency listing under section 4(b)(7) of the Act.

Post-Delisting Monitoring Plan Overview

The Service developed a final PDM plan in cooperation with the ODFW. In addition, the USACE, USFS, Oregon Parks and Recreation Department, McKenzie River Trust, and Willamette Valley National Wildlife Refuge Complex agreed to cooperate with us in the implementation of the PDM plan. The PDM plan is designed to verify that the Oregon chub remains secure from the risk of extinction after removal from the Federal List of Endangered and Threatened Wildlife by detecting changes in its status and habitat throughout its known range. The final PDM plan consists of: (1) A summary of the species' status at the time of delisting; (2) an outline of the roles of PDM cooperators; (3) a description of monitoring methods; (4) an outline of the frequency and duration of monitoring; (5) an outline of data compilation and reporting procedures; and (6) a definition of thresholds or triggers for potential monitoring outcomes and conclusions of the PDM effort.

The final PDM plan will monitor Oregon chub populations following the same sampling protocol used by the ODFW prior to delisting. Monitoring will consist of three components: Oregon chub distribution and abundance, potential adverse changes to Oregon chub habitat due to environmental or anthropogenic factors, and the distribution of nonnative fishes in Oregon chub habitats. The PDM period consists of three 3-year cycles (9 years total), which will begin in 2015. Both Willamette Project biological opinions continue until 2023, and flow and temperature augmentation will be implemented during this period (Service 2008b, pp. 68–72; NMFS 2008, pp. 2–43 to 2–52, 2–125 to 2–128). Monitoring through this time period will allow us to address any possible negative effects to Oregon chub associated with changes to flow and temperatures. As funding allows, we will collect data on roughly three generations of Oregon chub in each of the three subbasins, which will allow time to observe fluctuations in population abundance that may be attributed to residual stressors. Sites included in the floodplain study will be sampled annually over the next 9 years, enabling the Service and PDM partners to recommend flow and temperature regimes that are beneficial to native fishes in to the future. Sites outside the floodplain study will be sampled only once during each 3-year cycle, thus reducing annual sampling costs from current levels.

The final PDM plan identifies measurable management thresholds and responses for detecting and reacting to significant changes in Oregon chub protected habitat, distribution, and persistence. If monitoring detects declines equaling or exceeding these thresholds, the Service in combination with other PDM participants will investigate causes of these declines, including considerations of habitat changes, substantial human persecution, stochastic events, or any other significant evidence. Such investigation will determine if Oregon chub warrants expanded monitoring, additional research, additional habitat protection, or relisting as an endangered or a threatened species under the Act. If relisting Oregon chub is warranted, emergency procedures to relist the species may be followed, if necessary, in accordance with section 4(b)(7) of the Act.

We will post the final PDM plan and any future revisions on our national Web site (*http://endangered.fws.gov*) and on the Oregon Fish and Wildlife Office's Web site (*http://www.fws.gov/oregonfwo/*).

Effects of the Rule

This final rule revises 50 CFR 17.11(h) by removing Oregon chub from the Federal List of Endangered and Threatened Wildlife. As such, as of the effective date of this rule (see **DATES**), the prohibitions and conservation measures provided by the Act, particularly through sections 7 and 9, no longer apply to this species (including

those contained in the existing conservation agreement, all safe harbor agreements, and all biological opinions for this species). There are no habitat conservation plans related to Oregon chub. Removal of Oregon chub from the Federal List of Endangered and Threatened Wildlife relieves Federal agencies from the need to consult with us under section 7 of the Act to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of this species. This final rule also revises 50 CFR 17.95(e) by removing the designated critical habitat for Oregon chub throughout its range.

Required Determinations

Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.)

This rule does not contain any new collections of information that require approval by the Office of Management and Budget (OMB) under the Paperwork Reduction Act. This rule will not impose recordkeeping or reporting requirements on State or local governments, individuals, businesses, or organizations. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

National Environmental Policy Act

We have determined that environmental assessments and environmental impact statements, as defined under the authority of the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*), need not be prepared in connection with regulations pursuant to section 4(a) of the Act. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244).

References Cited

A complete list of all references cited in this final rule is available at *http://www.regulations.gov* at Docket No. FWS–R1–ES–2014–0002, or upon request from the Oregon Fish and Wildlife Office (see **ADDRESSES**).

Authors

The primary authors of this rule are staff members of the Service's Oregon Fish and Wildlife Office with assistance from ODFW staff (see **ADDRESSES** and **FOR FURTHER INFORMATION CONTACT**).

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Regulation Promulgation

Accordingly, we amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as follows:

PART 17—[AMENDED]

■ 1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

§ 17.11 [Amended]

■ 2. Amend § 17.11(h) by removing the entry for ''Chub, Oregon'' under FISHES in the List of Endangered and Threatened Wildlife.

§ 17.95 [Amended]

■ 3. Amend § 17.95(e) by removing the entry for ''Oregon Chub (*Oregonichthys crameri*)''.

Dated: December 16, 2014.

Stephen Guertin,

Acting Director, U.S. Fish and Wildlife Service.

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