

Post-Delisting Monitoring Plan for the Oregon Chub

(Oregonichthys crameri)



Oregon chub. © Dave Herasimtschuk / Freshwaters Illustrated

Prepared by the U.S. Fish & Wildlife Service
Oregon Fish and Wildlife Office
Portland, Oregon

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Photo Credit: Dave Herasimtschuk/Freshwaters Illustrated

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Anti-Deficiency Act Disclaimer

Post-delisting monitoring is a cooperative effort between the U.S. Fish and Wildlife Service, State and Tribal governments, other Federal agencies, and nongovernmental partners. Funding of post-delisting monitoring presents a challenge for all partners committed to ensuring the continued viability of the Oregon chub following removal of protections afforded under the Endangered Species Act, as amended. To the extent feasible, the Service and our partners intend to provide funding for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this Post-Delisting Monitoring Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation.

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1 Justification and Purpose of the Oregon Chub Post-Delisting Monitoring Plan

The U.S. Fish and Wildlife Service (Service) has determined that the Oregon chub has met recovery criteria as outlined in the species' final Recovery Plan (U.S. Fish and Wildlife Service (USFWS) 1998). As a result, the Service prepared a proposed rule to remove (i.e., delist) the Oregon chub from the Federal List of Endangered and Threatened Wildlife (USFWS 2014). Section 4(g)(1) of the Endangered Species Act (Act) requires the Service to implement a system, in cooperation with the States, to monitor for no fewer than 5 years the status of all species that have recovered and been removed from the List of Threatened and Endangered Wildlife and Plants (50 CFR 17.11 and 17.12). Section 4(g) of the Act explicitly requires cooperation with the States in development and implementation of post-delisting monitoring programs, but the Service remains responsible for compliance with section 4(g) and therefore must remain actively engaged in all phases of the monitoring program.

The Service also seeks active participation of other entities that are expected to assume responsibilities for the species' conservation after delisting or have natural resources management mandates. In keeping with that mandate, the Service developed this monitoring plan in cooperation with the Oregon Department of Fish and Wildlife (ODFW), U.S. Army Corp of Engineers (USACE), U.S. Forest Service (USFS), McKenzie River Trust (MRT), Oregon Parks and Recreation Department (OPRD), and the Service's Willamette Valley National Wildlife Refuge Complex (WVNWRC).

A post delisting monitoring (PDM) plan outlines the monitoring needed to verify that a species delisted due to recovery remains secure from extinction after the protections of the Act no longer apply. The goals of this PDM plan are to: (1) outline the monitoring plan for both species abundance and threats; and (2) identify circumstances that will trigger increased monitoring, or to identify when there are no longer concerns for Oregon chub and the PDM plan requirements have been fulfilled.

Funding of post-delisting monitoring presents a challenge for the partners committed to ensuring the continued viability of the Oregon chub following removal of the Act's protections. To the extent feasible, the Service intends to provide funding for post-delisting monitoring efforts to ODFW through the annual appropriations process (see Appendix 1 for the proposed budget). The USACE intends to continue to request funding for ODFW through the end of the PDM period for monitoring populations that occur on USACE property or are influenced by USACE operations. The USFS intends to continue monitoring Oregon chub populations located on their properties in the Middle Fork and Umpqua Ranger Districts. Nonetheless, nothing in this plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation.

The PDM plan for the Oregon chub is to continue the population monitoring that has been conducted by the ODFW and the Service since 1991. We intend to monitor the status of Oregon chub populations in cooperation with the ODFW, the USACE, and the USFS. The monitoring program will consist of the following three components: (1) population abundance and

distribution monitoring,(2) monitoring the distribution of co-occurring non-native species, and (3) habitat monitoring. If data from this monitoring effort, or from some other source, indicate that the Oregon chub is experiencing significant declines (as defined in section 5 of this document) in abundance or distribution, that substantial habitat has been lost or degraded, or that it requires protective status under the Act for some other reason, the Service can initiate procedures to re-list the species, including, if appropriate, emergency listing. We will consider the post-delisting monitoring period to begin immediately following the effective date of a final rule delisting the Oregon chub.

2 Public Review and Comment

On February 6, 2014, we announced the availability of the Draft Post-delisting Monitoring Plan for public review and comment. In addition, the draft PDM plan was peer reviewed by three experts familiar with Oregon chub ecology. After the comment period closed on April 7, 2014, we reviewed each comment received and prepared responses to substantive comments (see Appendix 6).

3 Roles of Post-Delisting Monitoring Cooperators

The Service's Oregon Fish and Wildlife Office (OFWO) in Portland, Oregon is the Service's lead for this monitoring effort and will be responsible, with the cooperation and assistance of the ODFW, USACE, USFS, MRT, OPRD, and the WVNWRC to ensure that the monitoring requirements outlined in this PDM plan are accomplished, including the final report.

The role of the OFWO is to:

- prepare a draft PDM plan;
- incorporate peer review comments on the draft PDM plan from scientific experts and cooperators into the plan;
- prepare and distribute the draft PDM plan for public comment;
- consider all comments on the draft PDM plan and produce the final PDM plan;
- distribute the final PDM plan to all cooperators;
- request funding for the ODFW's annual sampling and data analysis;
- determine budget requirements to carry out the monitoring;
- coordinate and convene an annual meeting, and other meetings as necessary, to discuss monitoring results and management activities; and
- finalize and implement the PDM plan.

The role of the ODFW is to:

- assist the Service in preparing a draft and final PDM plan;
- continue to conduct annual sampling of Oregon chub populations, except at Oregon chub sites managed by USFS;
- compile all population sampling results annually;
- notify the OFWO of any actions that may significantly affect Oregon chub;
- prepare and distribute an annual progress report to all cooperators, and a final report at the end of the PDM period; and

- participate in the annual coordination meeting and any other meetings or conference calls necessary to discuss monitoring results and management activities.

The role of the USACE:

- continue to implement conservation actions for Oregon chub as described in the Section 11.4 Terms and Conditions of the Service's Biological Opinion (USFWS 2008b) on the continued operation and maintenance of the Willamette River Basin Project:
 - request funding for the ODFW's annual monitoring of Oregon chub populations and habitats that are affected by the operation and maintenance of Willamette Project dams;
- notify the OFWO of any actions that may significantly affect Oregon chub; and
- participate in the annual coordination meeting, and any other meetings or conference calls necessary to discuss monitoring results and management activities.

The role of the USFS:

- continue to implement monitoring of Oregon chub populations located in habitats on National Forests and provide data to ODFW for inclusion in status reports;
- notify the OFWO of any actions that may significantly affect Oregon chub; and
- participate in the annual coordination meeting, and any other meetings or conference calls necessary to discuss monitoring results and management activities.

The role of the MRT:

- continue to incorporate Oregon chub habitat needs into floodplain restoration planning;
- notify the OFWO of any actions that may significantly affect Oregon chub; and
- participate in the annual coordination meeting, and any other meetings or conference calls necessary to discuss monitoring results and management activities.

The role of the OPRD:

- continue to manage public access to Oregon chub habitats;
- continue to incorporate Oregon chub habitat needs into floodplain restoration planning;
- notify the OFWO of any actions that may significantly affect Oregon chub; and
- participate in the annual coordination meeting, and any other meetings or conference calls necessary to discuss monitoring results and management activities.

The role of the WVNWRC:

- continue to manage public access to Oregon chub habitats;
- continue to incorporate Oregon chub habitat needs into floodplain restoration planning;
- notify the OFWO of any actions that may significantly affect Oregon chub; and
- participate in the annual coordination meeting, and any other meetings or conference calls necessary to discuss monitoring results and management activities.

4 Oregon Chub Status

4.1 Background

The Service listed the Oregon chub as an endangered species in 1993 (USFWS 1993) and a final recovery plan for the Oregon chub (Recovery Plan) was published in 1998 (USFWS 1998). At the time of listing, the ODFW documented nine populations of Oregon chub representing only 2 percent of its historical range. The Recovery Plan established the following criteria for downlisting (i.e., reclassifying the species from endangered to threatened status):

- (1) Establish and manage 10 populations of at least 500 adults each; (2) all of these populations must exhibit a stable or increasing trend for 5 years; and (3) at least 3 populations must be located in each of the 3 sub-basins of the Willamette River identified in the plan (mainstem Willamette River, Middle Fork, and Santiam River).

The Recovery Plan established the following criteria for delisting (i.e., removing the species from the List of Endangered and Threatened Wildlife):

- (1) Establish and manage 20 populations of at least 500 adults each; (2) all of these populations must exhibit a stable or increasing trend for 7 years; (3) at least 4 populations must be located in each of the 3 sub-basins (mainstem Willamette River, Middle Fork, and Santiam River); and (4) management of these populations must be guaranteed in perpetuity.

In 2008, the Service completed a 5-year review of the Oregon chub, concluding that downlisting criteria had been met and the species should be downlisted to threatened status (USFWS 2008a). The final rule designating critical habitat (USFWS 2010a, b) and the final rule to downlist Oregon chub were published in 2010 (USFWS 2010c).

As noted above, the fourth recovery criterion for delisting Oregon chub stated that management of the populations which met delisting criteria must be guaranteed in perpetuity. Although we have a high level of confidence that management of Oregon chub sites will continue to provide adequate protection for the species in the long-term, we have not met the high bar proposed by this criterion, to the letter. Recovery Plans are not regulatory documents but instead are intended as guidance documents to recommend actions and criteria that will assist in achieving species recovery (National Marine Fisheries Service (NMFS) and USFWS 2010). 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 threatened or endangered. Our analysis of whether the species has achieved recovery is based on the five factors identified in section 4 of the Act [i.e., (A) the present or threatened destruction, modification, or curtailment of habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence]. Therefore, for the remainder of this document, we will refer to Oregon chub as having met the recovery criteria despite the lack of an explicit guarantee of management actions in perpetuity.

4.2 Demographic Parameters

4.2.1 Species Description and Life History

The Oregon chub is a small minnow in the family Cyprinidae. Young of the year range in length from 7 to 32 millimeters (mm) (0.3 to 1.3 inches (in)), and adults can be up to 90 mm (3.5 in) in length (Pearsons 1989). Oregon chub reach maturity at about 2 years of age (Scheerer and McDonald 2003) 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. Spawning activity has only been observed at water temperatures exceeding 16 °Celsius (C) (61 °Fahrenheit (F)). Males over 35 mm (1.4 in) have been observed exhibiting spawning behavior (Pearsons 1989). Females contain 147 to 671 eggs (Pearsons 1989).

Oregon chub are found 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, Markle et al. 1991, Scheerer and McDonald 2003). The average depth of habitat utilized by Oregon chub is typically less than 1.8 meters (m) (6 feet (ft)), and summer water temperatures typically exceed 16 °C (61 °F).

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). In the winter months, Oregon chub can be found buried in the detritus or concealed in aquatic vegetation (Pearsons 1989). Fish of similar size school and feed together. In the early spring, Oregon chub are most active in the warmer, shallow areas of the ponds.

Oregon chub are obligatory sight feeders (Davis and Miller 1967). They feed throughout the day and stop feeding after dusk (Pearsons 1989). Oregon chub feed 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). The diet of juvenile Oregon chub also consists of minute organisms such as rotifers and cladocerans (Pearsons 1989).

4.2.2 Range

The Oregon chub is endemic to the Willamette River drainage of western Oregon. Historical records show Oregon chub were found as far downstream as Oregon City and as far upstream as Oakridge. At the time of listing in 1993, there were only nine known populations of Oregon chub. These locations represented a small fraction (estimated as 2 percent based on stream miles) of the species' formerly extensive distribution in the Willamette River drainage. The historical and current ranges of Oregon chub are shown in Figure 1.

Oregon chub were documented in mainstem habitats in the Clackamas, Calapooia, and Long Tom Rivers in 1908, 1899, and 1908, respectively (Markle et al. 1991). However, pre-listing

surveys conducted by Oregon State University (Markle et al. 1991) and ODFW at historical locations did not document Oregon chub. Since listing, ODFW has conducted additional surveys in these subbasins but they have not located populations of Oregon chub. Interestingly, the historical records for Oregon chub in these basins were from surveys conducted in main channel habitats. Currently, Oregon chub populations have not been documented in main channel habitats, even in areas where Oregon chub are common. Additionally, only small remnants of off-channel habitat, dominated by non-native fish species, remain in the highly-altered Clackamas, Calapooia, and Long Tom river subbasins (B. Bangs, ODFW, Corvallis, Oregon pers. comm., 2013).

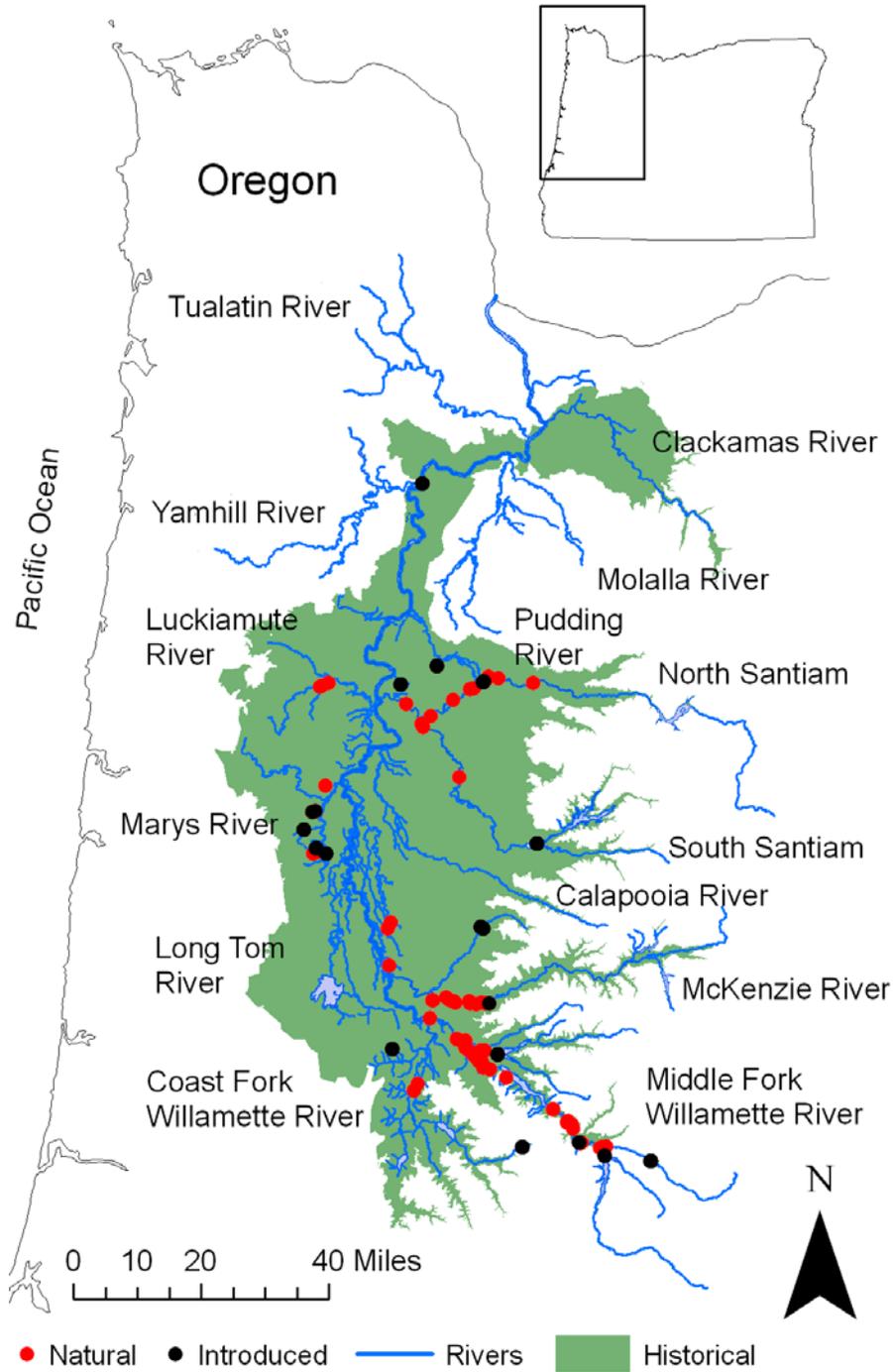


Figure 1. Historical and Current Distribution of Oregon Chub in the Willamette River Basin, Oregon. Green shaded areas represent the historical extent of Oregon chub. Red circles represent natural populations and black circles represent introduced populations (based on 2012 data). Overlapping symbols denote multiple populations near the same location.

4.2.3 Abundance and Distribution

Since Oregon chub were downlisted to threatened status, the number of new Oregon chub populations that have been discovered (n=28) and established through introductions (n=8) is substantial. In 2012, the ODFW confirmed the continued existence of Oregon chub at 79 locations in the Luckiamute River, North and South Santiam River, McKenzie River, Middle Fork and Coast Fork Willamette River, and several tributaries to the mainstem Willamette River downstream of the Coast Fork/Middle Fork Willamette River confluence (Bangs et al. 2012). These include 59 naturally occurring and 20 introduced populations. Currently, 36 Oregon chub populations have an estimated abundance of over 500 fish; and 20 of these populations have also exhibited a stable or increasing trend over the last 7 years (Bangs et al. 2012). The current status of Oregon chub populations meets the goals of the Recovery Plan for delisting. The distribution of these sites is shown in Table 1. Oregon chub population abundance and trend information are provided in Appendix 2. Recovery status, study information, ownership, and habitat area are provided in Appendix 3. A map of all Oregon chub populations is provided in Appendix 4.

Table 1. Distribution of 2012 Oregon Chub Populations Meeting Recovery Criteria for Delisting. (Numbers in parentheses are totals for introduced populations included in the totals for each Recovery Area.)

Recovery Area	# of populations	# of large populations (≥500 adult fish)	# of large populations with stable/increasing abundance trend	Total estimated abundance in subbasin
Santiam	17 (5)	11 (5)	5 (2)	29,070 (18,500)
Mainstem Willamette ^a	25 (9)	9 (4)	6 (3)	146,509 (128,994)
Middle Fork Willamette	33 (4)	15 (4)	9 (2)	44,999 (26,858)
Coast Fork Willamette ^b	4 (2)	1 (1)	0 (0)	962 (700)
Total	79 (20)	36 (14)	20 (7)	221,540 (175,052)

^aincludes McKenzie River subbasin

^bthe 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 Oregon chub have remained relatively stable from year to year, substantial fluctuations in population abundance are normal. For instance, the largest known population at Ankeny National Wildlife Refuge had an estimated abundance of 21,790 Oregon chub in 2010, and increased to 96,810 Oregon chub in 2011. Cyclical fluctuations in Oregon chub population abundance are common. For instance, Dexter Reservoir Alcove “PIT1” had an estimated population abundance of 140 in 1995. Although annual estimated abundance fluctuated, the population reached 1,440 estimated individuals in 2000. A decline in population abundance followed, and the 2004 population estimate was 70 Oregon chub. In 2005 the population again began to increase, and reached 1,370 estimated individuals in 2009.

A major effort for the recovery of Oregon chub has been directed towards introducing Oregon chub into suitable habitats. Oregon chub introductions typically occurred in hydrologically isolated habitats that contained no other fish species. These populations were critical for recovery by providing redundancy to the naturally occurring populations and increasing the abundance of Oregon chub in each Recovery Area. Twenty new populations have been established since 1988. In 2012, there were 13 introduced populations with over 500 fish; 6 of these populations have exhibited a stable or increasing 7-year abundance trend. The majority of all Oregon chub individuals (79 percent) occurs at introduction sites. In 2012, we estimated 174,730 Oregon chub in the 20 introduced populations. By contrast, 46,810 Oregon chub were estimated in the 59 naturally occurring populations. In addition, habitat restoration or improvement projects also occurred at habitats supporting 8 of the 14 naturally occurring populations that currently meet the recovery criteria for delisting.

4.2.4 Genetic Diversity

The Service’s Abernathy Fish Technology Center conducted a genetic analysis on Oregon chub in 2010 (DeHaan et al. 2010; 2012). The analysis examined genetic diversity within and among 20 natural and 4 introduced populations at 10 microsatellite loci. The findings suggest that four genetically distinct groups of Oregon chub exist and these groups corresponded to the subbasins of the Willamette River (Middle Fork Willamette, Coast Fork Willamette, Santiam, and McKenzie Rivers). Levels of genetic diversity were consistent across distribution and equal to or greater than other species of minnows (i.e., cyprinids). Most populations were stable over time at sites where genetic diversity was evaluated at a 7- to 8-year interval (three to four Oregon chub generations). Data suggests that adequate levels of genetic diversity exist in most populations. Two sites were shown to have 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 significant reductions in the population size just prior to when samples were collected the second time.

The report shows that the current translocation guidelines, as described in the Oregon Chub Conservation Agreement (USFWS 1998) are effective in establishing genetically viable populations (donor population from within same subbasin, and a minimum of 500 Oregon chub introduced). Levels of genetic diversity were similar to natural populations in three out of four of the introduced sites studied. The Dunn wetland population, which was introduced from 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; this population was

founded with 50 Oregon chub from 1 source population. Data supports introducing greater numbers of individuals and potentially using multiple sources; introduced populations from multiple sources had increased diversity and showed evidence of interbreeding.

4.3 Residual Threats

Threats to Oregon chub have been greatly reduced since the time of listing. For example, through introduction of Oregon chub into secure habitats, we have created refugial populations in habitat that is isolated from the threats of habitat loss and invasion by non-native fishes. In addition, the USACE has implemented minimum dam outflow targets that sustain floodplain habitat that supports Oregon chub. Also, the acquisition of floodplain habitat for long-term conservation and restoration, including off-channel locations preferred by Oregon chub, has gained momentum in the Willamette basin by a variety of Federal, State, Tribal, local government, and non-governmental agencies. As a result, Oregon chub are now well distributed in several Willamette basin tributaries in habitats with varying degrees of connection to or isolation from the active river channel. In addition, the ODFW recently documented volitional upstream movement of marked Oregon chub between populations in the Middle Fork Willamette (Bangs et al. 2012) and McKenzie River basins (B. Bangs, pers. comm., 2013), which demonstrates the Oregon chub's ability to colonize new habitats and exchange genetic material between established populations.

Although threats have been reduced and Oregon chub abundance and distribution have increased such that the species no longer warrants listing under the Act, the following discussion identifies potential threats that may affect Oregon chub populations following delisting. This PDM plan has been developed to monitor these potential threats throughout the PDM period.

4.3.1 Activities Related to the Willamette Project

In 2008, the Service completed a Biological Opinion on the continued operation and maintenance of the Willamette River Basin Project and Effects to Oregon chub, bull trout, and bull trout critical habitat designated (USFWS 2008b; Biological Opinion), a consultation with the USACE, Bonneville Power Administration, 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). Several projects outlined under the Biological Opinion may impact Oregon chub populations and habitat during the PDM period.

As required in the NMFS Willamette Project Biological Opinion (NMFS 2008; NMFS Opinion), the USACE is implementing structural and operational changes to flows and water temperatures downstream of Willamette Project dams to increase survival of federally listed salmon and steelhead (salmonids). These modifications have resulted in downstream water temperatures closer to natural conditions that existed prior to the construction of the dams, with warmer river temperatures downstream of the reservoirs in early summer, and cooler in the late summer and early fall. The USACE is operating to meet mainstem and tributary flow objectives identified in the NMFS Opinion. In addition, the USACE is working with The Nature Conservancy's Sustainable Rivers Project in the Willamette River Basin to implement a set of environmental

flow objectives designed to improve channel morphology in a manner that would create and sustain new, and improve existing fish habitat. This is being done primarily with short duration bank full releases when conditions allow. Oregon chub occupy 38 known habitats located downstream of Willamette Project dams; these sites could be affected positively or negatively by these changes in flows and water temperatures; these effects are largely unknown. The USACE has provided funding to the ODFW to monitor the effects of flow and temperature augmentation on fish communities and habitat (Bangs et al. 2011b).

As also required in the NMFS Opinion (NMFS 2008), the USACE is implementing an annual complete reservoir drawdown of Fall Creek Reservoir in the Middle Fork Willamette Basin. 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 non-native fish populations inhabiting the Fall Creek Reservoir. This is expected to result in reduced non-native predation and competition with juvenile Chinook salmon rearing in the reservoir. Willamette Project flood control dams inhibit the transport of sediment downstream, causing sediment to accumulate in the reservoirs. During a complete reservoir drawdown, sediment is scoured and transported downstream as the river cuts down through the accumulated sediment. During the Fall Creek drawdowns, a massive volume of silt, sand, and debris was flushed, causing sediment deposition to occur in off-channel habitats located downstream of the dam. Sampling in Fall Creek below the dam occurred after the first drawdown. Three previously undocumented Oregon chub populations (fewer than five Oregon chub were found in each) were negatively affected by sedimentation resulting from the drawdown; the accumulation of fine sediments significantly reduced the amount of wetted habitat available. Little sedimentation was observed in the few Oregon chub habitats that occur downstream of the confluence of Fall Creek on the Middle Fork Willamette River; most of the abundant populations of Oregon chub in the Middle Fork Willamette subbasin occur upstream of the confluence with Fall Creek. An additional concern with drawdowns is that non-native predatory fishes are common in reservoir habitats. During a drawdown, these fish are likely transported downstream, where they may invade off-channel habitats used by Oregon chub.

4.3.2 Siltation Resulting from Timber Harvest

Excessive siltation from ground disturbing activities in the watershed, such as timber harvest upstream of Oregon chub habitat, can degrade or destroy Oregon chub habitat. In the 1990s, timber harvest occurred on lands upstream of East Fork Minnow Creek. Flood events in the watershed in 1996, 1997, and 1998 caused accelerated sedimentation into East Fork Minnow Creek Pond, which is inhabited by Oregon chub, and over half of the habitat was lost (Paul Scheerer, ODFW, Corvallis, Oregon, pers. comm., 2009). The Oregon chub population in East Fork Minnow Creek Pond declined dramatically following these events (P. Scheerer, pers. comm., 2009). The threat of siltation due to logging in the watershed has been identified at four sites: Finley Gray Creek Swamp, East Fork Minnow Creek Pond, Buckhead Creek, and Wicopee Pond (P. Scheerer, pers. comm., 2008).

4.3.3 Floods and Seasonal High-water Events

High magnitude floods and seasonal high-water events are an additional threat to Oregon chub. After the 1996 floods, non-native fish were first collected from several sites containing Oregon chub in the Santiam River drainage; the two largest populations of Oregon chub subsequently declined sharply in abundance (Scheerer 2002). Flood events have also 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 Oregon chub habitats, reducing the extent of habitat available at these locations.

4.3.4 Isolated Populations

Twenty-eight populations of Oregon chub are currently isolated; 20 of these sites are introduction sites where isolation was intentional in order to provide refugia from the threat of non-native 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) 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 for local populations may be low and probability of extinction high (Burkey 1989; 1995). A recent genetic analysis found that Oregon chub in isolated habitats have levels of genetic diversity equal to or greater than other species in the cyprinid family, but additional Oregon chub may need to be introduced into these populations in the future to maintain genetic diversity in the event a population shows a significant decline in abundance.

4.3.5 Predation by and Competition with Non-native Fishes

In the final rule to downlist Oregon chub, the Service identified predation by and competition with non-native fishes as the primary threat to recovery of Oregon chub. The species was once managed primarily in hydrologic isolation because of the threat posed by non-native species and we have documented declines in Oregon chub abundance due to the presence of non-native fishes. However, through recent studies, Bangs *et al.* (2011a, 2012) found many abundant Oregon chub populations that coexist with non-native fish in habitats which frequently have an open-water connection to the adjacent river channel. Currently, 41 percent of all known Oregon chub habitats and 26 percent of the habitats supporting abundant populations (more than 500 Oregon chub) contain non-native fishes.

4.3.6 Monitoring of Residual Threats

Habitat characteristics, including pond bathymetry, pond elevations, pond temperatures, adjacent river flow levels and river temperatures, site connectivity, and fish assemblages will be monitored during the PDM period to evaluate the extent to which the potential threats identified above are occurring in Oregon chub habitats. The ODFW will continue to monitor the distribution and abundance of Oregon chub to maintain consistency with the data collected prior

to delisting. Monitoring the abundance of Oregon chub will allow us to evaluate the effect that any potential threat poses to the long-term survival of the species.

4.4 Management Commitments for Post-delisting Conservation

The Oregon Chub Working Group was formed in 1991 and has been proactive in conserving and restoring habitat for the Oregon chub and raising public awareness of the species since before the Federal listing in 1993 (USFWS 2008a). This group will continue to meet annually throughout the PDM period to discuss Oregon chub status and threats, and to prioritize actions that will be implemented.

In 1992, prior to listing Oregon chub as endangered, an interagency Conservation Agreement for the Oregon chub in the Willamette Valley, Oregon was completed and signed by the Service, USFS, Bureau of Land Management, ODFW, and the OPRD (ODFW *et al.* 1992). The purpose of the coordinated plan was to facilitate Oregon chub protection and recovery and to serve as a guide for all agencies to follow as they conduct their missions. The management objectives, responsibilities, and guidelines defined in the agreement aided in the recovery of the species and are expected to continue post-delisting to support the long-term management of these populations.

Oregon chub habitats are managed by Federal, State, and local governments, Tribes, non-governmental organizations, and private individuals. We have identified, in Section 2 of this plan, the roles of several cooperators that manage multiple populations. These agencies will continue to manage populations to promote continued Oregon chub conservation.

The USACE will continue to address the terms and conditions as described in Section 11.4 of the Biological Opinion related to Oregon chub (USFWS 2008b) during the PDM period, including requesting funding for the ODFW floodplain study and reservoir drawdown study on an annual basis. The ODFW initiated the floodplain study in 2009 to determine the current status of Oregon chub populations, fish assemblages, and habitat conditions in habitats potentially affected by the operation of Willamette Project. The ODFW is assessing relationships between pond bathymetry, pond elevations, pond temperatures, river flow levels, river temperatures, site connectivity, and fish assemblages. Data from this study are used to provide the USACE with flow and temperature management recommendations that will be used to design project operations that restore ecosystem function and encourage habitat use by native fish species, including Oregon chub.

The other cooperators, including the MRT, OPRD, WVNWRC, and USFS, will continue the conservation of Oregon chub while planning and implementing management and restoration on their properties. These cooperators should discourage public access to habitats, and notify the OFWO of any actions that may significantly affect Oregon chub. Physical impacts to habitats, such as fill or removal of substrate, altering water temperatures, or removal of cover will be avoided, unless these activities are likely to have a direct or indirect positive benefit to Oregon chub. For example, the mechanical removal of invasive plant species such as yellow flag iris (*Iris pseudacorus*) or parrot feather (*Myriophyllum aquaticum*) is beneficial to maintaining open water habitat and reducing pond succession, and would be encouraged. The use of chemicals

(such as herbicides and pesticides) over the water or in the adjacent riparian area surrounding Oregon chub habitat will be avoided. In situations where the use of chemical treatment is unavoidable, cooperators should avoid spraying during the Oregon chub spawning period (May through August).

The Service has completed two individual safe harbor agreements (SHA) and a conservation agreement for Oregon chub. To streamline the process for landowners to enter into a SHA, a programmatic SHA was prepared by the Service and ODFW in 2009 (USFWS 2009). Under a SHA, property owners who undertake management activities that attract listed species onto their property or that increase the numbers or distribution of listed species already present on their property will not incur future property-use restrictions. The ODFW enrolls eligible landowners through individual Cooperative Agreements, and issues landowners a Certificate of Inclusion. SHAs provide assurances to the property owner that allow alterations or modifications to the enrolled property, even if such action results in the incidental take of the listed species or, in the future, returns the species back to an originally agreed-upon baseline condition. Five property owners have been issued a Certificate of Inclusion under the programmatic SHA since 2009. Post delisting, managers may choose to conduct introductions of Oregon chub into suitable habitat. In these circumstances, the Certificates of Inclusion are no longer necessary because the take prohibitions of section 9 of the Act will no longer apply, but the ODFW may continue to offer Cooperative Agreements with the willing landowners prior to Oregon chub introductions. We anticipate landowners currently enrolled in the SHA program will continue to manage Oregon chub populations as identified in their Cooperative Agreements.

The improvement in status of Oregon chub is due largely to the implementation of actions identified in the Recovery Plan. This includes habitat restoration, the discovery of new populations as a result of the ODFW's surveys of the basin, and the establishment of additional populations via successful introductions within the species' historical range. Introduced populations have been established in suitable habitats with low connectivity to other aquatic habitats to reduce the risk of invasion by non-native fishes. These actions will continue as part of the ODFW's conservation strategy for Oregon chub.

5 Monitoring Methods

5.1 Definition of Terms

Abundant: A minimum of 500 adult fish.

Occupied habitat: A location where the most recent fish survey documented at least one Oregon chub.

Population: A group of Oregon chub that occupies a single, defined water body. If there is an open hydrologic connection and a high potential for frequent movement of Oregon chub between adjacent sloughs or ponds, adjacent sites are considered to be part of the same population.

Unoccupied habitat: A location where Oregon chub were documented on at least one occasion, but not observed on the most recent fish survey.

5.2 Sampling Locations

A subset of Oregon chub populations across the species range will be monitored for abundance and includes the following:

- a. Populations that have previously met the minimum abundance threshold of 500 fish;
- b. Populations that are located in habitats that have sufficient habitat area, depth, and vegetation as defined in the Primary Constituent Elements of Critical Habitat (Fish and Wildlife Service 2010b, 2010c) to support a minimum of 500 fish; and
- c. Introduced populations.

Note: landowner permission will be obtained prior to monitoring populations located on privately owned land.

5.3 Population Abundance and Distribution Monitoring

Population monitoring will be conducted following the sampling protocol used by the ODFW prior to delisting (Bangs *et al.* 2012). The ODFW and USFS will conduct fish sampling using cylindrical minnow traps (23×46 centimeters (cm), 3.2 or 6.4 mm mesh) baited with wheat bread. Traps will be set for a period of 3 to 18 hours. In addition, pole seines, dip nets, hoop nets, trap nets, or boat electrofishing may be used in certain locations to enable the capture of additional species or a wider size range of fish. All species captured will be identified and enumerated. All amphibian and reptile species and the life stages encountered will be recorded.

Minnow traps will be used to obtain mark-recapture estimates for all fish species present at a location. Total length (TL) of a subsample (n=50) of the captured Oregon chub will be recorded. All fish will be marked with either a partial caudal fin clip or visible implant elastomer tag and returned to the water near the location of capture. When catch rates are low, this procedure will be repeated on a second day. On the second day, all unmarked fish captured will be marked. Population abundance will be estimated using a single-sample mark-recapture model (Ricker 1975). Researchers will calculate 95 percent confidence intervals using a Poisson approximation (Ricker 1975). Age-0 fish smaller than 30 mm (1.2 in) TL (Scheerer and McDonald 2003), are not consistently caught in minnow traps and will not be included in the population abundance estimates.

Population trend analysis will not be required during the PDM period. While Oregon chub were listed, the ODFW discovered that populations have naturally high annual variation in abundance. The trend analysis approach requires that even very large populations of Oregon chub either remain stable or increase; this is contrary to the natural life history of Oregon chub populations. A decline in abundance that occurs as part of the natural cycle of Oregon chub populations may misleadingly suggest a declining trend, especially in large populations that have abundance well above the minimum threshold of 500 fish. The 7-year population trend analysis was a useful tool to document the resiliency of the species while it was listed, but to ensure long term survival of the species we plan to monitor abundance and distribution thresholds, as well as potential threats to the species during the PDM period.

5.4 Habitat Monitoring

In addition to monitoring the population abundance and distribution of Oregon chub, monitoring the status of habitat managed for the Oregon chub is also necessary to tracking the status of the species. Habitat loss was a key factor in the decline of the Oregon chub. Protection and active management of off-channel habitats have allowed the species to recover. For example, the MRT, a non-profit land trust active in western Oregon, has acquired titles and easements of several properties containing Oregon chub to provide long term conservation. This group has actively restored Oregon chub habitats on their properties through removal of non-native species and restoration of floodplain processes (such as annual inundation and allowing channels to meander). Monitoring the status of these off-channel habitats, which are considered important to the populations and were managed for Oregon chub at the time of delisting, will help us evaluate whether the species will again be threatened by habitat loss.

Potential environmental impacts of major Federal projects must be reviewed under the National Environmental Policy Act (NEPA). Environmental Assessments and Environmental Impact Statements for such projects are reviewed by the Service. Impacts of Federal projects on the amount or quality of habitat available to the Oregon chub thus can be tracked by the OFWO through these incoming documents. In addition to NEPA documents, monitoring reports will be prepared by the ODFW under the continuing floodplain study implemented under the terms and conditions of the Service's Biological Opinion (USFWS 2008b).

Non-Federal projects, such as those undertaken by State or local governments, do not require review under NEPA, and their potential impacts may be more difficult to track. In these cases, staff from the OFWO, with assistance from ODFW district biologists, will coordinate with land managers to track changes in habitat across the range of the species.

Physical and biological habitat monitoring will be conducted at each site during the monitoring of population abundance and distribution, and methods will be consistent with the data gathered prior to delisting. The physical and biological habitat parameters that will be monitored at each site include substrate type, type (genus) and amount (percent of wetted surface area) of aquatic vegetation, mean and maximum depth, water temperature, and total wetted surface area. Substrate will be categorized as percent fines, sand, gravel, cobble, boulder, and bedrock as described in Bangs *et al.* 2012. Each habitat will be photographed and assigned a site code consistent with previous data. This information is critical for assessing changes in habitat at Oregon chub locations. Substrate and vegetation monitoring provides information on available cover and spawning habitat available for Oregon chub and non-native species. Documenting temperatures will allow us to determine if minimum temperature requirements for spawning are achieved, and provide some limited information on spawn timing. In addition, monitoring the composition and abundance of aquatic vegetation will enable detection of successional or non-native species, and allow for analysis of trends. Monitoring the water depth and site dimensions will allow us to detect changes in habitat availability, seasonal water levels, and sedimentation rates.

In addition, at the time of delisting, 41 Oregon chub habitats were either located on USACE property or potentially influenced by the Willamette Project (B. Bangs, pers. comm., 2013). The

ODFW has monitored habitat water levels and temperatures, mapped pond bathymetry, and identified critical pond elevations at these sites in relation to USACE operations (Bangs et al. 2011b). Provided funding is available from the USACE, habitat monitoring and methods used in the ODFW floodplain study will be extended through the PDM period, which will provide monitoring of residual or new potential threats to Oregon chub and ensure that USACE operations continue to support existing populations.

5.5 Frequency and Duration of Monitoring

The PDM period will be initiated following the publication of the final rule to delist Oregon chub, and will extend, at a minimum, 9 years after delisting. One Recovery Area will be sampled each year; each Recovery Area will be sampled three times during the PDM period (Table 2). Abundance and population monitoring will occur from April through the end of October. A detailed schedule of annual PDM activities is included in Appendix 5.

Table 2. Frequency of Sampling in each Recovery Area.

Recovery Area	Year								
	Cycle 1			Cycle 2			Cycle 3		
Santiam	Year 1			Year 4			Year 7		
Mainstem Willamette		Year 2			Year 5			Year 8	
Middle Fork Willamette			Year 3			Year 6			Year 9

The 9-year PDM term was selected based on three factors: the duration of the Willamette Project Biological Opinion and associated actions, Oregon chub reproductive biology, and improved sampling efficiency. The Biological Opinion and the NMFS Opinion continue for another 9 years and flow and temperature augmentation is planned during this period. The duration of the PDM will allow for monitoring of Oregon chub populations to address threats associated with changes to flow and temperature.

Oregon chub typically reproduce at age 2 (Scheerer and McDonald 2003). By extending the PDM sampling term to 9 years, we will collect data on three generations of Oregon chub in each of the three subbasins. This will allow time to observe fluctuations in population abundance that may be attributed to residual threats.

The number of known Oregon chub sites has increased significantly over recent years and it is no longer feasible to sample each site annually. However, sites that are included in the floodplain study funded by the USACE will continue to be sampled annually to continue data collection that will be used to recommend flow and temperature regimes beneficial to native fishes. However, sites outside the floodplain study will only be sampled once during each 3-year cycle.

Sampling these sites 1 out of every 3 years versus annually will result in a reduction in annual sampling costs.

6 Definition of Thresholds/Triggers for Potential Monitoring Outcomes and Conclusions

Effective PDM implementation requires timely evaluation of changes in the status of Oregon chub. The following trigger values will enable the Service and its cooperators to initiate a response to population declines or new threats before Oregon chub abundance or distribution falls to critical levels. Conversely, it is also important to identify criteria under which there is no new concern for the status of Oregon chub and to support conclusion of the PDM. The following triggers and responses described below are based on the information to be collected during the PDM and provide a structured process for evaluating the status of the species during PDM.

If any of the conditions described in these triggers occurs, the Service, with input from the ODFW and other cooperators, may initiate a formal status review to assess changes in threats to the species, its abundance, productivity, survival, and distribution to determine whether a proposal for relisting is appropriate. In the event this status review reveals that the Oregon chub is threatened (i.e., likely to become endangered in the foreseeable future throughout all or a significant portion of its range) or endangered, then the Oregon chub may be promptly proposed for relisting under the Act in accordance with procedures in section 4(b)(5) of the Act. Likewise, if the best available information indicates an emergency that poses a significant risk to the well-being of the Oregon chub, then the Service may exercise its emergency listing authority under section 4(b)(7) accordingly.

6.1 Population Abundance and Distribution Triggers

Trigger: The results for the most recent survey effort for each of the subbasins indicates a - change in abundance and distribution resulting in less than 25 abundant (≥ 500) adult Oregon chub populations throughout the species range.

Response: At the time of delisting, there were 36 known, abundant (≥ 500) adult Oregon chub populations throughout the species' range.

A greater than 30 percent reduction in the number of abundant populations would cause concern for the persistence of Oregon chub because it would reduce the margin of safety for the species to withstand significant environmental changes. If this occurs, the cause for the reduction in abundant populations will be investigated. Population monitoring will intensify, and occur the following year in any Recovery Area where such a decline in abundant populations was detected. Oregon chub introductions were successful in increasing the number of abundant populations while the species was listed; managers will consider introducing Oregon chub into suitable, hydrologically isolated ponds that are unoccupied by other fish species.

Trigger: The results for the most recent survey effort for each of the subbasins indicates a change in abundance and distribution resulting in fewer than five abundant Oregon chub populations per Recovery Area (Santiam, Mainstem Willamette, and Middle Fork Willamette).

Response: At the time of delisting, there were 11 abundant populations in the Santiam River Recovery Area, 9 in the Mid-Willamette River Recovery Area, and 15 in the Middle Fork Willamette River Recovery Area (an additional abundant population is in the Coast Fork Willamette River subbasin, which was not identified as a recovery subbasin in the Recovery Plan). A reduction in the number of abundant populations below five in any Recovery Area would reduce the redundancy of populations that provides a margin of safety to withstand significant environmental changes within a Recovery Area. If this occurs, the cause for the decline in the distribution of abundant populations will be investigated. Population monitoring will intensify, and occur the following year in any Recovery Area where a decline to five or less abundant populations was detected. Additional Oregon chub introductions will be considered.

6.2 Non-native Species Triggers

Trigger: Competitive or predatory non-native species invade 80 percent or more of Oregon chub habitats.

Response: In 2012, the ODFW documented non-native fish at 41 percent of the sample locations that contained Oregon chub (Bangs *et al.* 2012). Only 26 percent of the abundant (≥ 500) Oregon chub populations contained non-native fish. However, dominance of non-native fish in Oregon chub habitats was varied. If the percentage of Oregon chub habitats occupied by non-native species doubles to meet or exceed 80 percent, we may have cause for concern about the long-term persistence of the species. Competition and predation by non-native species is a residual threat to Oregon chub that requires monitoring through the PDM period. Increased spread of non-native species may have little or no effect on the abundance or distribution of Oregon chub during the PDM period. A number of Oregon chub populations have demonstrated the ability to persist despite the presence of co-occurring non-native species. However, as changes to individual habitats, management of the Willamette Project, or climate occurs over time, the dominance of non-native fish may change in these habitats. If non-native species inhabit greater than 80 percent of Oregon chub habitats, the PDM period will be extended to determine the threat to the long-term viability of Oregon chub populations. The cause for the widespread invasion of non-native fish into Oregon chub habitats will be investigated prior to the conclusion of the PDM. Research into the cause of non-native invasion would likely be determined through other research, such as the ongoing ODFW floodplain study. Managers will investigate possibilities for excluding non-native species from Oregon chub habitat (or changing flow or temperature regimes to discourage non-natives), and seek methods to remove or reduce the number of non-native fish at each site. A list of currently known competitive or predatory non-native species found in Oregon chub habitats is included in Bangs *et al.* 2011b.

Trigger: New competitive or predatory non-native species become established in the Willamette basin floodplain habitats.

Response: The proliferation of warm water predatory species such as largemouth bass (*Micropterus salmoides*), sunfishes (*Lepomis* sp.), and bullheads (*Ameiurus* sp.) were implicated in the decline of Oregon chub, and the ODFW has documented the extirpation of populations following invasion by these species. New non-native threats (species that have been linked to the decline of natural populations in other basins) will be closely monitored during the PDM. In

the event that new non-native species become established in Oregon chub habitats, those specific habitats will be sampled annually to determine their effect on Oregon chub populations.

6.3 Habitat Status Triggers

Trigger: The USACE implements a complete reservoir drawdown upstream of Oregon chub populations.

Response: High flow events with the capability to alter floodplain channel habitat are uncommon in the managed reaches of the Willamette basin, and sediment transport is arrested at the flood control reservoirs. During a complete reservoir drawdown, sediment is scoured out of the reservoir and transported downstream in large volumes. Rapid sedimentation of off-channel habitats was observed during previous drawdowns at Fall Creek Reservoir, and the Service and ODFW will caution against implementing similar drawdowns to bed elevations at other reservoirs that may negatively affect chub populations. Prior to a reservoir drawdown, the species assemblage will be monitored and habitat mapped following the ODFW floodplain study guidelines (Bangs *et al.* 2011b) at each Oregon chub site potentially affected. Monitoring will continue after the drawdown to document changes at each location. If significant changes to the fish community or habitat occur, we will seek methods to restore floodplain habitats to benefit Oregon chub (e.g., sediment removal to restore floodplain connection).

Trigger: Greater than 50 percent of hydrologically connected Oregon chub habitats in a subbasin experience declines in habitat quality such that their suitability to support Oregon chub is lost.

Response: In 2012, the ODFW documented 38 Oregon chub habitats that were frequently hydrologically connected to the floodplain. Persistence of connected habitats is critical for the viability of Oregon chub, as genetic exchange may occur at these locations and Oregon chub may disperse from these sites to colonize newly created connected floodplain habitats. If trends in flow or temperature reduce the quality of these habitats by limiting the habitat conditions conducive to Oregon chub, or by promoting conditions that favor dominance of non-native species, certain life history characteristics may be lost. These characteristics include, but may not be limited to, the ability to move between populations, colonize new habitats, and genetic exchange between populations. If greater than 50 percent of hydrologically connected Oregon chub habitats in a subbasin experience declines in habitat quality such that their suitability to support Oregon chub is reduced, restoration activities to enhance these habitats or additional introductions of Oregon chub into suitable connected habitats will take place. This trigger is a concern in stream reaches where multiple connected Oregon chub habitats are located, specifically: North Santiam River (Big Cliff dam to confluence with South Santiam River), McKenzie River (Leaburg dam to confluence with Willamette River), and Middle Fork Willamette River (Dexter dam to confluence with Coast Fork Willamette River). These sites may be influenced by flow and temperature changes implemented under the terms and conditions of the Willamette Project biological opinions (USFWS 2008b, NMFS 2008). Specific river flow and temperature conditions that affect Oregon chub habitats are unknown; however, these conditions are researched by the ongoing floodplain study funded by the USACE.

Trigger: Greater than 50-year interval flood event occurs within the Willamette basin.

Response: The ODFW or the USFS will assess the extent to which Oregon chub habitats were affected and, when applicable, whether water control structures, if they exist, remain functional¹. Repairs will be made to water control structures damaged during flood events. Fish surveys will commence the spring after the flood event in the affected subbasin to monitor Oregon chub abundance and effects to Oregon chub habitat, and to determine if non-native species have invaded Oregon chub habitats that hydrologically connected during the flood event.

6.4 Management Concerns

The concerns outlined below, while not critical for the recovery of the species, are recommendations for the management of individual populations of Oregon chub during the PDM period. These management concerns are included as potential guidelines to assist managers in responding to habitat concerns, and during the PDM period and beyond, to guide restoration or responses to changes in habitat conditions.

Concern: A prolonged duration (≥ 48 hours) of managed instream flows below NMFS Opinion defined minimum base flow levels (as defined by Appendix E in NMFS 2008) may reduce habitat quality and quantity for some Oregon chub populations. This situation has occurred in the past due to Willamette Project emergency maintenance and operations.

Response: Our current understanding of off-channel habitats containing Oregon chub in managed systems is that defined minimum base flows are required to sustain the off-channel habitats supporting Oregon chub populations. Previously, when flows dropped below target minimums due to emergency maintenance and operations, we documented severe declines in habitat suitability (depths, areas, volumes) and subsequent declines in Oregon chub abundance. The most current floodplain study report should be consulted to determine which Oregon chub sites are likely to be affected by flows below target minimums (currently Bangs *et al.* 2012). Recommended short-term responses include using screened pumps to transfer water from adjacent rivers and canals into ponds to sustain populations during these periods. Fish salvage may be performed, and fish may be moved into an adjacent Oregon chub habitat or reared off-site and reintroduced after water levels have been restored.

Concern: Sedimentation occurs at an Oregon chub site located downstream of recent timber harvest at Buckhead Creek, East Fork Minnow Creek, Finley Gray Creek Swamp, or Wicopee Pond that results in a loss of aquatic habitat (e.g., reduced depth or wetted surface area) or significant decline of the abundance of Oregon chub at one of these locations.

Response: Restoration activities at East Fork Minnow Creek Pond were successful in restoring the available open water habitat and led to a significant increase in Oregon chub abundance. Restoration of sites where sedimentation occurs, including excavation of fine sediment from the

¹ Most of the created and several of the naturally occurring Oregon chub habitats have water control structures to regulate water levels or provide flow passage under a road, trail, or through a berm or dike.

habitat or construction of a settling pond upstream of the Oregon chub habitat, may mitigate for habitat loss due to sedimentation.

Concern: Successional vegetation such as cattail (*Typha* sp.), yellow flag iris, reed canary grass (*Phalaris arundinacea*), or parrot feather can cause a reduction in the open-water habitat and indirectly cause a significant decline of the abundance of Oregon chub at one or more habitats.

Response: Restoration activities at Herman Pond in the Coast Fork Willamette basin to remove successional vegetation were successful in increasing open water habitat and led to an increase in the population size. Successional vegetation can be mechanically removed, including excavating a portion of a pond, to increase available open water habitat, or vegetation can be treated with an herbicide formulated for use with aquatic plants. Mechanical removal will be favored over herbicide treatment at sites with abundant successional vegetation due to the risk of low oxygen levels associated with decomposing vegetation. Treatments should not take place during the Oregon chub spawning period (May through August).

6.5 Relisting Considerations and Conclusion of Post-Delisting Monitoring

At any time during the PDM period the Service may consider relisting Oregon chub as a response to the conditions identified in the triggers and responses section of this document. At the end of the 9-year PDM period, the Service will conduct a final review of the status of Oregon chub and may conclude the PDM. Any relisting decision by the Service will require evaluating the status of the Oregon chub relative to the Act's five listing factors (section 4(a)(1)). The Service intends to work with all collaborators toward maintaining the recovery of Oregon chub so that the species no longer requires protection under the Act. The following four conclusions are possible at the end of the PDM for Oregon chub:

A. Oregon Chub Remains Secure without the Act's Protections.

The PDM would be concluded under this scenario. Additional monitoring may continue at the discretion of the Service or its collaborators dependent on available funding and resources. This would be true if:

i. Population Abundance and Distribution Triggers

- a. There are at least 25 populations with population abundance ≥ 500 individuals each; and
- b. At least 5 populations with ≥ 500 individuals each exist in each of the 3 Recovery Areas; and

ii. Non-native Species Triggers

- a. Fewer than 80 percent of all habitats occupied by Oregon chub² contain competitive or predatory non-native species; and
- b. New competitive or predatory non-native species are absent or distributed in less than 30 percent of Oregon chub habitat within each individual Recovery Area; and

iii. Habitat Status Triggers

- a. The USACE does not conduct additional complete reservoir drawdowns upstream of Oregon chub populations, or, if complete reservoir drawdowns occur, no significant adverse changes to the fish community or habitat are caused; and
- b. At least 50 percent of the hydrologically connected Oregon chub habitats in a subbasin continue to have sufficient habitat quality to support Oregon chub populations; and
- c. A 50-year interval flood event does not occur in the basins containing Oregon chub or a 50-year interval flood event does occur, but does not cause a decline in Oregon chub populations or habitat, or a significant increase in the distribution of non-native fish.

B. Oregon Chub may be less Secure than Anticipated at the Time of Delisting, but Information does not Indicate that the Species meets the Definition of Threatened or Endangered.

In this case, if the number and distribution of abundant Oregon chub populations remains secure, but new or increasing threats pose a risk to the status of the species, the PDM should be extended for one 3-year cycle with a subsequent reevaluation at the end of that period. If necessary, during the extended PDM, sampling intensity will be increased to provide better monitoring of Oregon chub abundance and increased detection of threats. Studies can be initiated to address threats. New introduced populations of Oregon chub can be established to create isolated refuges and increase the number and distribution of abundant populations. This would be the case if any of the following were true:

i. Non-native Species Triggers

- a. Greater than or equal to 80 percent of all habitats occupied by Oregon chub contain competitive or predatory non-native species; or
- b. New competitive or predatory non-native species are distributed in greater than 30 percent of Oregon chub habitat within a single Recovery Area; or

² Underlining has been added to emphasize the particular habitats to which each percentage applies (e.g., all habitats versus only connected habitats in specific reaches).

ii. Habitat Status Triggers

- a. Additional complete reservoir drawdowns occur upstream of Oregon chub habitat and causes significant adverse changes to the fish community or habitat; or
- b. Greater than 50 percent of hydrologically connected Oregon chub habitats in a subbasin experience declines in habitat quality such that their suitability to support Oregon chub is reduced; and
- c. A 50-year interval flood event occurs in the subbasins containing Oregon chub that causes a decline in the abundance of Oregon chub or its habitat, or if the flood event is implicated in the spread of non-native fish into greater than 30 percent of Oregon chub habitats, which were previously unoccupied by non-native fish, within a single recovery subbasin.

C. PDM Yields Substantial Information Indicating Threats are Causing a Decline in the Status of Oregon Chub, such that Listing the Species as Threatened or Endangered may be Warranted.

In this case, if the number or distribution of abundant Oregon chub populations has declined to the levels identified as triggers, the Service should initiate a formal status review to assess changes in the threats to the species, its abundance, productivity, survival, distribution, or habitat. This review will determine whether a proposal for relisting Oregon chub under section 4(b)(5) of the Act is warranted.

D. PDM Documents a Decline in the Status of Oregon Chub, such that the Species once again Meets the Definition of a Threatened or Endangered Species under the Act.

In this case, if the PDM reveals that the Oregon chub again meets the criteria for listing as threatened (i.e., likely to become endangered in the foreseeable future throughout all or a significant portion of its range) or endangered, the species should be promptly proposed for relisting under section 4(b)(5) of the Act. Likewise, if the best available information indicates an emergency that poses a significant risk to the well-being of Oregon chub, then the Service should exercise its emergency listing authority under section 4(b)(7).

7 Data Compilation and Reporting Procedures and Responsibilities

ODFW and the USFS will prepare annual reports summarizing the activities, data collected, significant findings, and the results of each component of the PDM plan. These reports must be prepared in a timely manner (within 6 months of the end of the field season) to ensure that adequate data are being collected, to allow evaluation of the efficacy of the monitoring programs and their modification, if necessary, and to allow periodic assessment of the status of the Oregon chub. These reports will be distributed to all cooperators. The annual reports will comment on the status of the Oregon chub relative to the need for relisting; the reports will briefly address the

threats to the population with respect to the five factors considered when a species is proposed for addition to the Federal List of Endangered and Threatened Wildlife.

At the end of the 9-year monitoring period, the OFWO will work with ODFW to prepare a final report summarizing the results of the monitoring effort. The report will be made available to the public by fall of the following year; a Notice of Availability of the final report will be published in the *Federal Register*. The final report will include a discussion of whether monitoring should continue beyond the 9-year period for any reason. If there is no indication that the Oregon chub has declined significantly during the 9-year monitoring period and no reason to believe that it will decline in the foreseeable future, then monitoring can be concluded at that time.

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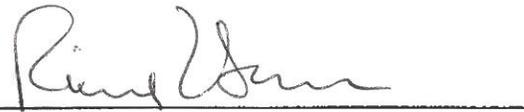
**Post-delisting Monitoring Plan
for the
Oregon Chub
(*Oregonichthys crameri*)**

Approved:

Acting 

State Supervisor
Oregon Fish and Wildlife Office
U.S. Fish and Wildlife Service

18 Nov 14
Date

Acting 

Regional Director
Pacific Region
U.S. Fish and Wildlife Service

Nov 21, 2014
Date

Appendix 1. Proposed Budget for the Oregon Chub Post-delisting Monitoring Plan.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Personnel (Service funding)									
Two field staff (2 months)	\$14,706	\$15,148	\$15,602	\$16,070	\$16,552	\$17,049	\$17,560	\$18,087	\$18,630
Supervisory biologist (2 months)	\$11,744	\$12,097	\$12,460	\$12,833	\$13,218	\$13,615	\$14,023	\$14,444	\$14,877
Indirect	\$7,603	\$7,809	\$8,021	\$8,240	\$8,466	\$8,698	\$8,937	\$9,183	\$9,437
Personnel (USACE funding)									
Two field staff (4 months)	\$29,413	\$30,295	\$31,204	\$32,140	\$33,105	\$34,098	\$35,121	\$36,174	\$37,259
Supervisory biologist (10 months)	\$58,721	\$60,483	\$62,298	\$64,166	\$66,091	\$68,074	\$70,116	\$72,220	\$74,387
Indirect	\$22,915	\$23,602	\$24,310	\$25,040	\$25,791	\$26,565	\$27,362	\$28,182	\$29,028
Supplies									
Crew cell phone (6 months)	\$210	\$210	\$210	\$210	\$210	\$210	\$210	\$210	\$210
Travel (6 months)	\$4,800	\$4,800	\$4,800	\$4,800	\$4,800	\$4,800	\$4,800	\$4,800	\$4,800
Trapping supplies (replacement traps, bait, misc. gear)	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200	\$1,200
Chest waders, wading boots	\$720	\$720	\$720	\$720	\$720	\$720	\$720	\$720	\$720
Indirect	\$1,802	\$1,802	\$1,802	\$1,802	\$1,802	\$1,802	\$1,802	\$1,802	\$1,802
Totals	\$153,843	\$158,166	\$162,627	\$167,222	\$171,955	\$176,830	\$181,851	\$187,023	\$192,350

Appendix 2. Oregon Chub Population Abundance Estimates from 2006 to 2012, Listed by Recovery Area.

Basins: CFW= Coast Fork Willamette, FALL= Fall Creek, LONG = Long Tom, LUCK= Luckiamute, MARY= Mary's, MCK= McKenzie, MFW= Middle Fork Willamette, MS= Mainstem Willamette and tributaries, NS= North Santiam, SS= South Santiam. We also included a summary of data prior to 2006, including the years when we first discovered or introduced each population and the ranges of abundance. Abundance was calculated using a mark-recapture model, except where numbers are shown in bold, which only represent the number of fish captured. Site names in bold italics are locations where Oregon chub were introduced. The numbers of fish stocked at introduction sites are shown in parentheses.

Site Name	Basin	First discovered/ introduced	Range through 2005	2006	2007	2008	2009	2010	2011	2012	7 year trend
Mainstem Willamette											
Ankeny Willow Marsh	MS	2004	500 - 10,110	35,650	26,420	36,460	46,560	21,790	96,810	82,800	increasing
Dunn Wetland	MARY	1997	200 - 28,740	21,530	34,530	46,330	34,300	28,510	47,350	44,160	stable
Shetzline Pond	MCK	2002	120 - 1,050	390	210	130	300	350	5,750	9,270	increasing
McKenzie Oxbow	MCK	2009					2,420	3,000	3,550	2,880	
Finley Gray Creek Swamp	MARY	1993	230 - 730	1,390	1,400	2,140	1,700	2,350	2,150	1,720	stable
Finley Beaver Pond	MARY	2010		0		0		420	310	1,340	stable
Berggren (Hunsaker) Slough	MCK	2009			0		520	520	640	920	
St. Paul Ponds	MS	2008				(25)	(64) 2	(106) 32	4,430	510	
Dry Muddy Creek	MS	1994	1 - 26	0	0				20	500	increasing
Finley-Buford Pond	MARY	2011							(160)	460	
Russell Pond	MCK	2001	350 - 810	1,000	1,400	650	1,290	2,780	340	340	
Big Island	MCK	2002	310 - 940	380	190	200	610	1,240	400	330	
Finley Display Pond	MARY	1998	60 - 1,750	240	(75) 230	830	(85) 320	(119) 500	(67) 420	220	
Finley Cheadle Pond	MARY	2002	50 - 1,300	900	(53) 1,740	3,520	(85) 1,140	(118) 1,130	(30) 0	(184) 20	
Murphy Pond	MARY	2011							(32)	(182) 7	
Cedar Creek	MCK	2012								170	
Ezell Slough	MCK	2005	6						29	140	
Ellison Pond and Slough	MCK	2012								(110) 1	
Jont Creek	LUCK	2012								90	
Hendrick's Bridge Slough	MCK	2011							2	70	
Vickery Park Slough	MCK	2011							22	60	
Grant Farm Channel	MCK	2012								8	
Green Island	MCK	2007			12	12	2	0	10	8	
Dunawi Creek	MARY	2012								5	
Springfield Oxbow	MCK	2012								4	
Muddy Creek	MS	2007			3				33	0	
Jampolsky Wetlands	LONG	2004	500 - 1,230	8,320	4,160	denied access					
Bull Run Creek	MARY	2005	2	0	0	0					
Little Muddy Creek tributary	MS	2004	0 - 5	0	0						
Camous Creek	MS	1993	5	0							

Appendix 2 (continued).

Site Name	Basin	First discovered/ introduced	Range through 2005	2006	2007	2008	2009	2010	2011	2012	7 year trend
Santiam											
Budeau North Pond	MILL	2010						(310)	2,240	5,730	
North Stayton Pond	NS	2010						(620)	300	4,370	
Budeau South Pond	MILL	2010						(312)	890	4,160	
Pioneer Park Pond	NS	1997	0 - 9	110	420	320	830	540	1,470	2,710	increasing
Koenig Slough	NS	2011							443	2,410	
Foster Pullout Pond	SS	1999	85 - 640	470	980	2,640	2,640	2,010	2,360	2,240	increasing
South Stayton Pond	NS	2006		(54)	(67) 560	1,710 (142)	4,970 (232)	6,230	2,210	2,000	stable
Geren Island North Channel	NS	1996	360 - 8,660	1,020	510	210	560	2,230	3,030	1,940	increasing
Stayton Public Works Pond	NS	1998	0 - 530	440	270	70	30	3	110	1,100	unstable
Mehama Slough	NS	2010						15	1,240	1,080	
Chahalpam (Gray) Slough	NS	1995	0 - 340	700	560	660.....denied access.....				520	stable
Santiam Easement	NS	1994	0 - 1,250	3	0	2	22	530	54	260	
Green's Bridge Slough	NS	1993	0 - 7	6	1	8	240	610	370	190	
Buell-Miller Slough	NS	2010						2	710	170	
Santiam I-5 Side Channels	NS	1997	2 - 350	330	22	2	100	160	280	100	
Harris Slough	NS	2011							18	80	
Hospital Slough	SS	2009					2			10	
Cold Creek Slough	NS	2011							59	0	
Logan Slough	NS	1997	0 - 2						1	0	
Menear's Bend	SS	2000	0 - 29.....pond dried up.....								
Coast Fork Willamette											
Sprick Pond	CFW	2008				(12)	(10) 12	(31) 22	(12) 80	700	
Herman Pond	CFW	2002	110 - 420	40	180	3	0	200	130	190	
Coast Fork Side Channels	CFW	2002	16 - 130	150	80	130	100	190	80	70	
Lynx Hollow Side Channels	CFW	2005	2	2	2	0	4	2	2	2	
Camas Swale	CFW	1992	0 - 2	0	0		0			0	

Appendix 2 (continued).

Site Name	Basin	First discovered/ introduced	Range through 2005	2006	2007	2008	2009	2010	2011	2012	7 year trend
Middle Fork Willamette											
Hills Creek Pond	MFW	2010						(1,127)	23,000	13,460	
Fall Creek Spillway Ponds	FALL	1996	480 - 7,770	3,250	2,740	3,050	2,930	4,110	6,690	6,750	increasing
Wicopee Pond	MFW	1992	0 - 4,780	4,860	3,130	5,430	3,040	2,200	3,390	(128) 5,620	stable
East Fork Minnow Creek Pond	MFW	1993	1,850 - 8,770	1,730	1,770	2,160	1,340	2,980	2,170	3,330	increasing
Buckhead Creek	MFW	1992	2 - 7,140	2,500	2,030	1,260	3,600	1,280	1,900	3,180	stable
Hospital Pond	MFW	1993	690 - 5,040	2,040	1,520	3,680	730	1,330	2,860	2,110	stable
Shady Dell Pond	MFW	1993	1,630 - 4,770	5,430	7,250	7,250	2,070	3,110	1,760	1,600	declining
Elijah Bristow Berry Slough	MFW	1993	1,190 - 5,350	5,460	6,580	5,460	8,130	2,360	1,040	1,440	declining
Elijah Bristow Northeast Slough	MFW	1999	610 - 1,340	210	350	230	550	670	670	1,280	increasing
Dougren Slough - RM 198.5	MFW	2008				1	1,640	830	1,730	1,070	
Dexter Dam Slough	MFW	2009					640	510	820	920	
Haws Enhancement Pond	MFW	2009					(47)	(86) 1	3,150	900	
Elijah Bristow Island Pond	MFW	2003	420 - 2,780	2,310	1,620	550	870	2,050	1,400	840	stable
Dexter Reservoir Alcove - PIT1	MFW	1992	40 - 1,440	650	1,130	680	1,370	1,020	350	680	stable
Haws Pond	MFW	2005	120	440	380	280	470	810	350	600	stable
Dougren Island Slough - RM 198.5	MFW	2008						34	280	280	
Elijah Bristow South Slough	MFW	2008				1	880	640	380	230	
Dexter Reservoir RV Alcove - DEX3	MFW	1992	15 - 2,770	3,310	4,020	2,450	2,280	1,800	940	190	
Salt Creek Diversion Canal	MFW	2012								150	
Pengra Island Slough - RM 199.5	MFW	2003					200	60	40	60	
Elijah Bristow North Gravel Pit	MFW	2011				0	0	0	3	60	
Green Grass Gravel Pit	MFW	2012								24	
Pengra Oxbow Slough - RM 199.4	MFW	2008				1	9	60	80	20	
Hospital Impoundment Pond	MFW	1995	0 - 6	0				80	70	20	
Railroad Bridge Slough - RM 197	MFW	2009				0	80	20	30	20	
Lost Creek Slough	MFW	2012								13	
Deep Muddy Slough - RM 198.6	MFW	2009				0	10	40	10	10	
Fall Creek Confluence Slough	FALL	2012								5	
Oakridge Slough	MFW	1994	0 - 480	0	0	0	0		1	4	
TNC Island Slough	MFW	2012								2	
Lookout Point Reservoir	MFW	2012								1	
Baumann Slough	FALL	2012								1	
Simpson Slough	FALL	2012								1	
Pudding Creek	MFW	2011							1	0	
Barnhard Slough	MFW	2000	1 - 7	0	4	0	2	1	0	0	
Rattlesnake Creek	MFW	1992	0 - 2	5	0	0	2			0	
Jasper Park Slough	MFW	1994	0 - 3	0	1	1	0		0		
Springfield Millrace Slough	MFW	2009					8	0			
East Ferrin Pond	MFW	1994	0 - 7,160	0	0	0	0	0			
Dexter East Alcove	MFW	1992	0 - 40	0	0	0	0				
Wallace Slough	MFW	1997	0 - 3	0	0	0					
Elijah Bristow Large Gravel Pit	MFW	1992	0 - 8	0							
Elijah Bristow Small Gravel Pit	MFW	1992	0 - 31	0							
Dexter Reservoir	MFW	2002	1								
West Ferrin Pond	MFW	1992	0 - 525								

Appendix 3. Recovery Status, Study Details, Ownership, and Habitat Area for Oregon Chub Populations, Listed by River Basin.

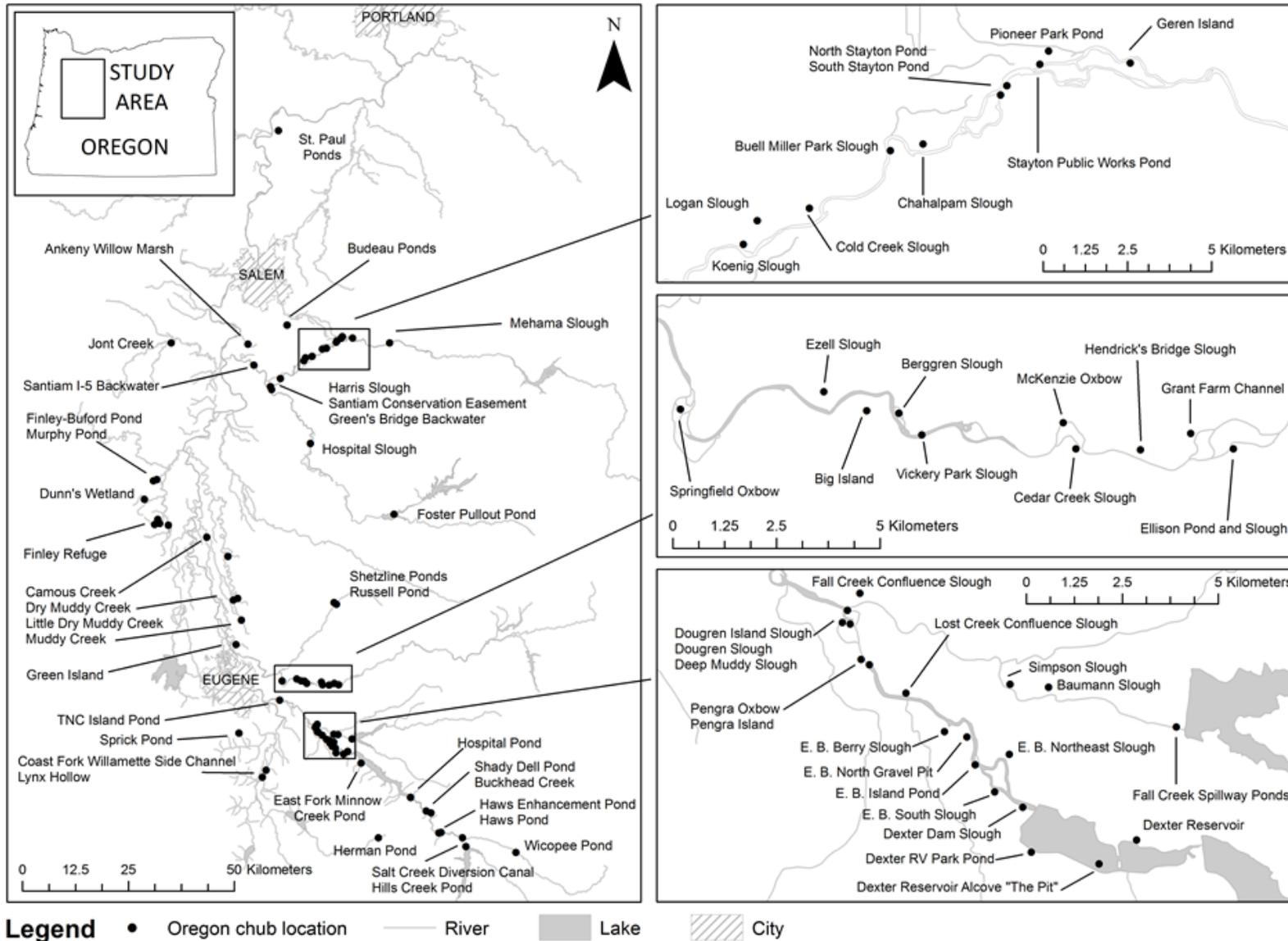
Basins: CFW= Coast Fork Willamette, MCK= McKenzie, MOL= Molalla, LUCK= Luckiamute, MFW= Middle Fork Willamette, MS= Mainstem Willamette and tributaries, SANT= Santiam. Recovery Criteria: year each population met Recovery Plan criteria for delisting. Floodplain study: part of the ODFW floodplain study, and will be monitored annually during the PDM. Movement study: **XX**=Oregon chub were marked at this location, **X**=movement may be documented at this location. Movement possible: location that periodically connects with the floodplain. Non-natives: at least one non-native fish species present. Introduction: Oregon chub were introduced to this location. Safe Harbor: agreement in place with private landowners. Ownership: ACOE=Army Corps of Engineers, MRT=Mckenzie River Trust, ODFW=Oregon Dept. of Fish and Wildlife, ODOT=Oregon Dept. of Transportation, OPRD=Oregon Parks and Rec. Department, TNC=The Nature Conservancy, USFS=United States Forest Service, USFWS=United State Fish and Wildlife Service. Area: wetted habitat area in square meters.

Site Name	Basin	Delisting Criteria		Floodplain study	Movement study	Movement possible	Nonnatives	Introduction	Safe Harbor	Ownership	Area (m ²)
		2012	Past								
Jont Creek	LUCK					X	X			Private	2,450
Budeau North Pond	SANT							X	X	Private	15,730
Budeau South Pond	SANT				X	X	X	X	X	Private	9,264
Buell-Miller Slough	SANT				X	X	X			Private (portion Public)	5,250
Chahalpam (Gray) Slough	SANT	X		X	X	X	X			Confederated Tribes of Grand Ronde	6,600
Cold Creek Slough	SANT				X	X				Private	4,000
Foster Pullout Pond	SANT	X		X				X		ACOE	1,500
Geren Island North Channel	SANT	X		X			X			City of Salem	2,700
Green's Bridge Slough	SANT		X	X	X	X	X			Private (portion Public)	1,200
Harris Slough	SANT				X	X	X			Public	1,500
Hospital Slough	SANT					X	X			Private	720
Koenig Slough	SANT				XX	X	X			Private	2,250
Logan Slough	SANT				X	X				Private	500
Mehama Slough	SANT			X	XX	X				ODOT	2,000
Menear's Bend	SANT							X		ACOE	150
North Stayton Pond	SANT							X		ODFW	1,575
Pioneer Park Pond	SANT	X		X						City of Stayton, Stayton Water Control District	1,300
Santiam Easement	SANT		X	X	X	X	X			USFWS	16,300
Santiam I-5 Side Channels	SANT		X	X		X	X			ODOT	6,000
South Stayton Pond	SANT	X		X		X	X	X		ODFW	1,200
Stayton Public Works Pond	SANT		X	X	X	X	X			City of Stayton	2,100
Ankeny Willow Marsh	MS	X					X			USFWS	25,120
Bull Run Creek	MS					X	X			Private	1,848
Camous Creek	MS					X	X			Private	200
Dry Muddy Creek	MS	X				X	X			Private, City of Coburg	100
Dunawi Creek	MS					X	X			City of Corvallis	900
Dunn Wetland	MS	X						X	X	Private	3,620
Finley Beaver Pond	MS	X					X			USFWS	4,400
Finley Cheadle Pond	MS		X					X		USFWS	5,400
Finley Display Pond	MS		X					X		USFWS	9,900
Finley Gray Creek Swamp	MS	X					X			USFWS	22,872
Finley-Butford Pond	MS							X	X	Private	2,500
Jampolsky Wetlands	MS						X	X		Private	6,000
Little Muddy Creek tributary	MS					X	X			Private	400
Muddy Creek	MS					X	X			Private, City of Coburg	100
St. Paul Ponds	MS							X		ODFW	3,000
Williams (Murphy) Pond	MS							X	X	Private	2,500
Berggren (Hunsaker) Slough	MCK			X	XX	X	X			MRT	2,600
Big Island	MCK		X	X	X	X	X			MRT, private	3,180
Cedar Creek	MCK				X	X	X			Private	6,250
Ellison Pond and Slough	MCK				X	X		X	X	Private	3,598
Ezell Slough	MCK				X	X				Private	1,300
Grant Farm Channel	MCK				X	X	X			Private	13,200
Green Island	MCK			X	X	X	X			MRT	12,000
Hendrick's Bridge Slough	MCK				X	X				Lane County Parks	700
McKenzie Oxbow	MCK			X	XX	X	X			MRT	22,500
Russell Pond	MCK		X					X	X	Private	800
Shetzline Pond	MCK	X								Private	2,925
Springfield Oxbow	MCK				X	X	X			MRT	9,100
Vickery Park Slough	MCK				X	X				Lane County Parks	2,000

Appendix 3 (continued).

Site Name	Basin	Delisting Criteria		Floodplain study	Movement study	Movement possible	Nonnatives	Introduction	Safe Harbor	Ownership	Area (m ²)
		2012	Past								
Barnhard Slough	MFW			X		X				USFS	1,440
Baumann Slough	MFW			X	X	X	X			Private	480
Buckhead Creek	MFW	X				X				USFS	11,290
Deep Muddy Slough - RM 198.6	MFW			X	X	X				OPRD	500
Dexter Dam Slough	MFW			X	XX	X	X			OPRD	1,800
Dexter East Alcove	MFW					X				ACOE	200
Dexter Reservoir	MFW						X			ACOE	10,000
Dexter Reservoir Alcove - PIT1	MFW	X		X		X				ACOE	780
Dexter Reservoir RV Alcove - DEX3	MFW		X	X		X				ACOE	1,650
Dougren Island Slough - RM 198.5	MFW			X	XX	X	X			Public, private	1,200
Dougren Slough - RM 198.5	MFW			X	XX	X	X			OPRD	2,000
East Ferrin Pond	MFW							X		USFS	17,000
East Fork Minnow Creek Pond	MFW	X								ODOT	1,550
Elijah Bristow Berry Slough	MFW		X	X			X			OPRD	9,650
Elijah Bristow Island Pond	MFW	X		X	XX	X	X			OPRD	10,490
Elijah Bristow Large Gravel Pit	MFW					X	X			OPRD	1,250
Elijah Bristow North Gravel Pit	MFW			X	X	X	X			OPRD	140
Elijah Bristow Northeast Slough	MFW	X		X	XX	X	X			OPRD	3,000
Elijah Bristow Small Gravel Pit	MFW					X	X			OPRD	146
Elijah Bristow South Slough	MFW			X	X	X	X			OPRD	2,100
Fall Creek Confluence Slough	MFW			X	X	X	X			Public	500
Fall Creek Spillway Ponds	MFW	X		X				X		ACOE	7,875
Green Grass Gravel Pit	MFW				X	X	X			Private	1,560
Haws Enhancement Pond	MFW			X				X	X	Private	900
Haws Pond	MFW	X		X		X			X	Private	1,000
Hills Creek Pond	MFW			X				X		ACOE	3,000
Hospital Impoundment Pond	MFW						X			ACOE	1,768
Hospital Pond	MFW	X		X						ACOE	5,000
Jasper Park Slough	MFW					X	X			OPRD	500
Lookout Point Reservoir	MFW						X			ACOE	1,849
Lost Creek Slough	MFW				X	X				OPRD	800
Oakridge Slough	MFW					X				City of Oakridge	4,800
Pengra Island Slough - RM 199.5	MFW			X	X	X				ODOT, private	840
Pengra Oxbow Slough - RM 199.4	MFW			X	X	X	X			Public, private	1,000
Pudding Creek	MFW					X	X			TNC	1,551
Railroad Bridge Slough - RM 197	MFW			X		X	X			ODOT	1,560
Rattlesnake Creek	MFW					X	X			Private	160
Salt Creek Diversion Canal	MFW									USFS	1,000
Shady Dell Pond	MFW		X				X			USFS	840
Simpson Slough	MFW			X	X	X	X			Private	1,080
Springfield Millrace Slough	MFW					X	X			City of Springfield	1,320
TNC Island Slough	MFW					X				TNC	1,551
Wallace Slough	MFW					X				Public, Private	2,250
West Ferrin Pond	MFW						X	X		USFS	3,000
Wicopee Pond	MFW	X						X		USFS	3,250
Camas Swale	CFW					X	X			ODOT, City of Eugene	150
Coast Fork Side Channels	CFW			X		X	X			ODOT	1,344
Herman Pond	CFW							X		USFS	3,240
Lynx Hollow Side Channels	CFW			X		X	X			OPRD	4,780
Sprick Pond	CFW							X	X	Private	1,020

Appendix 4. Locations of Oregon Chub Populations in the Willamette River Basin, Oregon.



Appendix 5. Oregon Chub Post-delisting Monitoring Plan Implementation Schedule, including Timing and Responsible Parties.

Task	Recovery Area	Site Name	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Monitoring	Santiam	Budeau North Pond	1			1			1		
		Budeau South Pond	1			1			1		
		Buell-Miller Slough	1			1			1		
		Chahalpam (Gray) Slough	2	2	2	2	2	2	2	2	2
		Foster Pullout Pond	2	2	2	2	2	2	2	2	2
		Geren Island North Channel	2	2	2	2	2	2	2	2	2
		Green's Bridge Slough	2	2	2	2	2	2	2	2	2
		Harris Slough	1			1			1		
		Hospital Slough	1			1			1		
		Koenig Slough	1			1			1		
		Mehama Slough	2	2	2	2	2	2	2	2	2
		North Stayton Pond	1			1			1		
		Pioneer Park Pond	2	2	2	2	2	2	2	2	2
		Santiam Easement	2	2	2	2	2	2	2	2	2
		Santiam I-5 Side Channels	2	2	2	2	2	2	2	2	2
		South Stayton Pond	2	2	2	2	2	2	2	2	2
		Stayton Public Works Pond	2	2	2	2	2	2	2	2	2

Task	Recovery Area	Site Name	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Monitoring	Mainstem	Ankeny Willow Marsh		1			1			1	
		Dunn Wetland		1			1			1	
		Shetzline Pond		1			1			1	
		McKenzie Oxbow	2	2	2	2	2	2	2	2	2
		Finley Gray Creek Swamp		1			1			1	
		Finley Beaver Pond		1			1			1	
		Berggren (Hunsaker) Slough	2	2	2	2	2	2	2	2	2
		St. Paul Ponds		1			1			1	
		Dry Muddy Creek		1			1			1	
		Finley-Buford Pond		1			1			1	
		Russell Pond		1			1			1	
		Big Island	2	2	2	2	2	2	2	2	2
		Finley Display Pond		1			1			1	
		Finley Cheadle Pond		1			1			1	
		Murphy Pond		1			1			1	
		Cedar Creek		1			1			1	
		Ezell Slough		1			1			1	
		Ellison Pond and Slough		1			1			1	

Task	Recovery Area	Site Name	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Monitoring	Mainstem	Jont Creek		1			1			1	
		Hendrick's Bridge Slough		1			1			1	
		Vickery Park Slough		1			1			1	
		Grant Farm Channel		1			1			1	
		Green Island	2	2	2	2	2	2	2	2	2
		Dunawi Creek		1			1			1	
		Springfield Oxbow		1			1			1	
	Middle Fork Willamette	Baumann Slough	2	2	2	2	2	2	2	2	2
		Buckhead Creek			4			4			4
		Deep Muddy Slough	2	2	2	2	2	2	2	2	2
		Dexter Dam Slough	2	2	2	2	2	2	2	2	2
		Dexter Reservoir Alcove - PIT1	2	2	2	2	2	2	2	2	2
		Dexter Reservoir RV Alcove - DEX3	2	2	2	2	2	2	2	2	2
		Dougren Island Slough			1			1			1
		Dougren Slough	2	2	2	2	2	2	2	2	2
		East Fork Minnow Creek Pond			1			1			1
		Elijah Bristow Berry Slough	2	2	2	2	2	2	2	2	2

Task	Recovery Area	Site Name	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Monitoring	Middle Fork Willamette	Elijah Bristow Island Pond	2	2	2	2	2	2	2	2	2
		Elijah Bristow North Gravel Pit	2	2	2	2	2	2	2	2	2
		Elijah Bristow Northeast Slough	2	2	2	2	2	2	2	2	2
		Elijah Bristow South Slough	2	2	2	2	2	2	2	2	2
		Fall Creek Confluence Slough	2	2	2	2	2	2	2	2	2
		Fall Creek Spillway Ponds	2	2	2	2	2	2	2	2	2
		Green Grass Gravel Pit			1			1			1
		Haws Enhancement Pond	2	2	2	2	2	2	2	2	2
		Haws Pond	2	2	2	2	2	2	2	2	2
		Hills Creek Pond	2	2	2	2	2	2	2	2	2
		Hospital Impoundment Pond			1			1			1
		Hospital Pond	2	2	2	2	2	2	2	2	2
		Lost Creek Slough			1			1			1
		Oakridge Slough			4			4			4
		Pengra Island Slough	2	2	2	2	2	2	2	2	2

Task	Recovery Area	Site Name	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Monitoring	Middle Fork Willamette	Pengra Oxbow Slough	2	2	2	2	2	2	2	2	2
		Pudding Creek			1			1			1
		Railroad Bridge Slough	2	2	2	2	2	2	2	2	2
		Salt Creek Diversion Canal			4			4			4
		Shady Dell Pond			4			4			4
		Simpson Slough	2	2	2	2	2	2	2	2	2
		TNC Island Slough			1			1			1
		Wicopee Pond			4			4			4
	Coast Fork Willamette	Coast Fork Side Channels	2	2	2	2	2	2	2	2	2
		Herman Pond			4			4			4
		Lynx Hollow Side Channels	2	2	2	2	2	2	2	2	2
		Sprick Pond	2	2	2	2	2	2	2	2	2
Reporting	Annual report		1	1	1	1	1	1	1	1	1
	Final report										3
Coordination	Annual meeting		3	3	3	3	3	3	3	3	3

1: ODFW

2: ODFW's annual monitoring through the USACE funded floodplain study

3: OFWO

4: USFS

Appendix 6. Response to Peer Review Comments.

Introduction

On February 6, 2014, we published in the Federal Register a proposed rule to remove the Oregon chub from the Federal List of Threatened and Endangered Wildlife (79 FR 7136), and a notice of availability of a Draft Post-Delisting Monitoring Plan. We requested that all interested parties submit written comments on either document 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. Comments and responses on the proposed rule to remove Oregon chub from the Federal List of Endangered and Threatened Wildlife can be viewed in the final rule.

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 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. The following section summarizes the comments we received from peer reviewers.

Comments and Responses

Comment (1): One peer reviewer suggested that the Service be more conservative with the threshold for non-native fish described in the trigger of the post-delisting monitoring plan. The reviewer suggested lowering the threshold for non-native fish presence in Oregon chub habitat from 80 to 60 percent.

Our Response: The ODFW discovered 18 previously undocumented populations of Oregon chub in 2012 and 2013; all of these populations had frequent connection to an adjacent river or waterbody, and therefore all have a high potential for the presence of non-native fish. In 2012, 62 percent of all the Oregon chub populations had frequent open-water connection to an adjacent river or waterbody, and non-native fish were present at over half (55 percent) of these locations. If the threshold for non-native fish were lower, such as 60 percent as the reviewer proposed, the non-native trigger may be reached simply by the discovery of additional previously undocumented populations. In addition, the non-native trigger is synergistic with other triggers;

for example the presence of non-native fish could cause a decline such that the thresholds described in the population abundance and distribution triggers are reached, which would be detected in the PDM and then warrant the Service initiate a formal status review.

Comment (2): One peer reviewer asked that the Service define unoccupied habitat, as it pertains to the PDM plan. In addition, the reviewer asked that we define what a habitat is and how the percentage for this trigger is calculated in Section 5.5 on page 21 of the PDM plan.

Our Response: We agree. We defined an occupied habitat as a waterbody where at least one individual Oregon chub has been documented. Thus, an unoccupied habitat is a waterbody where Oregon chub were documented in the past, but are currently absent. We will calculate percentage for the trigger based on the total of the unoccupied or otherwise impacted habitat divided by the total unoccupied or impacted habitat plus the occupied habitat.

Comment (3): One peer reviewer asked that we discuss and include supporting evidence that habitat restoration improves Oregon chub populations. The reviewer suggested that we describe appropriate habitat restoration actions in the PDM plan.

Our Response: Many habitat improvement projects have enhanced Oregon chub habitats. For instance, at Hospital Pond, the USACE installed a scissor gate over the outflow culvert to control water elevation, and dug an alcove in a high terrace to increase the available spawning habitat. Sedimentation and successional vegetation became limiting at East Fork Minnow Creek and Herman Pond; excavation projects and removal of successional emergent vegetation opened up additional habitat. At the Shetzline Pond, an adjacent habitat contained bluegill and an invasive non-native aquatic plant, parrotfeather. We applied an aquatic piscicide and herbicide to remove both species. The success of each of these projects was documented by a dramatic increase in Oregon chub abundance. Rather than create a long comprehensive list of appropriate habitat restoration actions, we leave restoration decisions to the discretion of the Oregon Chub Working Group and managers, with an overarching guiding principle that, generally, restoration should alter the habitat so that it more closely represents the primary constituent elements (PCEs) described in the Critical Habitat Assessment for Oregon chub, based on site specific needs and parameters.

Comment (4): Several peer reviewers recommended additional monitoring under the PDM plan including: discussions of population status in relation to extinction-colonization processes, examining competing hypotheses and develop the PDM plan to test the predictions and assess "uncertainty" and designing monitoring to relate Oregon chub abundance to key environmental parameters in a modeling framework to provide a more proactive and powerful means of evaluating threats.

Our Response: We appreciate all of the excellent monitoring suggestions we received from the peer reviewers. It is important to note that Service guidance for creation of a PDM plan under Section 4(g) of the Act states that monitoring under the PDM cannot be more intense than the monitoring while the species was listed (USFWS and NMFS 2008, page 2-1). The information necessary to relate environmental factors to Oregon chub abundance would violate our guidance.

For example, one peer reviewer suggested that the Service discuss population status in relation to extinction-colonization processes. The reviewer suggested that rates of extinction in local habitats should not exceed rates of colonization. The reviewer suggested that the extinction-colonization process should influence both the sampling design and response described under the PDM. The reviewer asked that we define "long-term" to include a specific time horizon. We think this is a good suggestion; however extinction and colonization models currently do not exist for the species. The development of this model would be prohibitively expensive during the PDM period, especially since substantial and additional efforts would be required to monitor currently unoccupied habitats to determine colonization rates. For Oregon chub, we define "long-term" as the foreseeable future for the Willamette basin, approximately 50 years.

One peer reviewer asked that the Service clarify the competing hypotheses and develop the PDM to test the predictions and assess "uncertainty", especially those related to the ODFW Floodplain Study. The ODFW will address the competing hypotheses and concerns through the ongoing Floodplain Study. The Floodplain Study, while enhancing our knowledge of the processes that drive diversity and abundance of fish in floodplain habitats, is not necessary for monitoring of the Oregon chub populations during the PDM period.

One peer reviewer recommended that the PDM should design monitoring to relate Oregon chub abundance to key environmental parameters in a modeling framework to provide a more proactive and powerful means of evaluating threats. We agree a model to predict Oregon chub abundance to key environmental parameters would provide a powerful tool for assessing the status of the species and evaluating potential threats. The ODFW Floodplain Study, initiated in 2009, is collecting data that will be used to develop a model of the biological and environmental factors that influence Oregon chub and fish assemblages in floodplain habitats.

Comment (5): One peer reviewer recommended annual monitoring at each Oregon chub population site to monitor presence of Oregon chub, non-native predators and other potential threats. Another peer reviewer suggested that sampling year should not confound sampling sites. Two peer reviewers suggested that the PDM continue and expand upon population trend analysis monitoring.

Our Response: Logistics and budgetary limitations, in combination with the biological rationale to continue monitoring for 3 full life cycles (9 years), are the primary drivers in the decision to sample sites every 3 years instead of annually. We considered continuing the population trend analysis for the PDM plan, but ultimately budgetary and staff limitations prohibit continuing this level of effort. While not necessary for the PDM plan, it is worth noting that the population trend analysis will continue for a subset of Oregon chub populations, as part of the Willamette Floodplain study funded by the USACE on Oregon chub populations affected by the USACE's Willamette Valley Project.

Comment (6): One peer reviewer suggested that the Service leave a provision in the PDM plan to allow flexibility to experiment and adapt new methods that can better address monitoring needs.

Our Response: We agree. The Oregon Chub Working Group, which includes the Service, ODFW, USFS, USACE, and other partners, meets annually to discuss ongoing studies (methods and results), restoration, coordination, and future actions, including implementation of the PDM plan. We believe this is the appropriate forum in which discuss adjustments to the PDM plan and support new methods and flexibility, provided the goals of the PDM plan are still achievable.

Comment (7): One peer reviewer suggested that the Service develop a rapid assessment protocol to analyze aquatic habitat succession and disturbance.

Our Response: Under the protocols described in the PDM plan for Oregon chub, the assessment of many of the aquatic habitat and succession triggers are already rapid. Oregon chub occupy a wide range of habitats, and this type of assessment would not be appropriate for the metrics required by the PDM plan.

Comment (8): One peer reviewer recommended that the Service develop a relational database to track monitoring and evaluate effectiveness and validate hypotheses. The reviewer requested that the database include key assumptions/uncertainties and test. The reviewer commented that this database would also serve as a common source of information that could be updated efficiently and provide some form of institutional continuity. The reviewer suggested linking this database to a decision model.

Our Response: The ODFW already maintains a database that includes location, habitat, temperature, aquatic vegetation, amphibian presence, and population abundance and catch data for all fish species. The ODFW updates this database annually, and includes Oregon chub data collected by other agencies and programs. Currently no decision support model exists, nor are there plans to develop such a model, due to lack of resources.