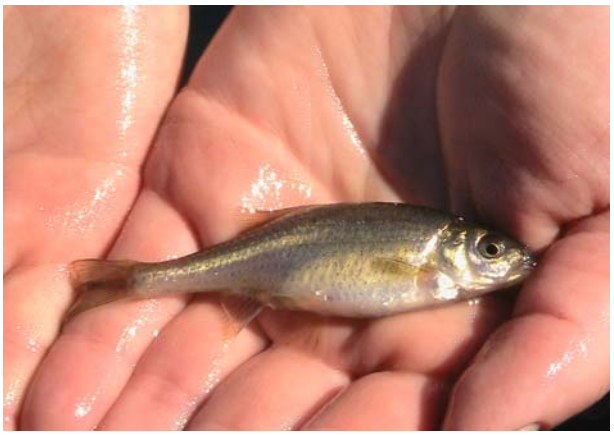
Oregon chub
(Oregonichthys crameri)

5-Year Review
Summary and Evaluation



U.S. Fish and Wildlife Service
Oregon Fish and Wildlife Office
Portland, Oregon
February 8, 2008

Reply To: 8183.0207
File Name: 02.08.08 Oregon chub 5-yr review.doc
TS Number: 08-70

5-YEAR STATUS REVIEW
Oregon chub (*Oregonichthys crameri)*

1.0 GENERAL INFORMATION

1.1 Reviewers:

Doug Baus, Fish and Wildlife Biologist, Oregon Fish and Wildlife Office (OFWO), (Author)
Miel Corbett, Assistant Project Leader, OFWO
Jesse D'Elia, Fish and Wildlife Biologist, Pacific Regional Office
Kemper McMaster, State Supervisor, OFWO
Ron Rhew, Fish Biologist, Vancouver Fisheries Office
Paul Scheerer, Fish Biologist, Corvallis Office, Oregon Department of Fish and Wildlife
Rollie White, Endangered Species Division Manager, OFWO

Lead USFWS Regional Office:

Pacific Regional Office – (Region 1)
Ren Lohoefener, Regional Director
Dave Wesley, Deputy Regional Director
911 NE 11th Ave
Portland, OR 97232

Phone: (503) 231-6828

Lead USFWS Field Office:

Oregon Fish and Wildlife Office
2600 SE 98th AVE
Portland, OR 97266

Phone: (503) 231-6179

1.2 Methodology used to complete the review:

The 5-year review was prepared by the U.S. Fish and Wildlife Service's (USFWS) Oregon Fish and Wildlife Office (OFWO) and was primarily based on Oregon Department of Fish and Wildlife (ODFW) Oregon chub reports (Scheerer 1999, 2002, 2003, 2004) (Scheerer and McDonald 2003) (Scheerer and Terwilliger 2005) (Scheerer *et al.* 2004, 2005, 2006, 2007). These reports constitute the best available information on Oregon chub abundance, distribution, and conservation actions.

1.3 Background:

1.3.1 *Federal Register* Notice citation announcing initiation of this review:

72 FR 10547-10550. Initiation of 5-Year Reviews of 71 Species in Oregon, Hawaii, Commonwealth of the Northern Mariana Islands, and Territory of Guam. March 8, 2007.

1.3.2 Listing history

Original Listing

***Federal Register* notice:**
58 FR 53800-53804

Date listed:
October 18, 1993

Entity listed:
Oregon chub
Common Name: Chub, Oregon
Scientific Name: *Oregonichthys crameri*
Historic Range: U.S.A. (OR)

Classification:
Endangered

1.3.3 Review History

This is the first 5-year status review for the Oregon chub.

1.3.4 Species' Recovery Priority Number at start of this 5-year review

Recovery Priority: 8

1.3.5 Current Recovery Plan or Outline

Name of plan or outline: Recovery Plan for the Oregon Chub (*Oregonichthys crameri*)
Date issued: September 3, 1998
Dates of previous revisions, if applicable: N/A

2.0 REVIEW ANALYSIS

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

This species is not listed as a DPS.

2.2 Recovery Criteria

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

Yes.

2.2.2 Adequacy of recovery criteria.

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

Yes.

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

The 1998 Oregon chub Recovery Plan included the following recovery criteria:

> This species will be considered for downlisting when the following criteria have been met:
>
> Criterion 1: Establish and manage 10 populations of at least 500 adults each.
>
> > **Accomplished.** According to the ODFW's 2007 Oregon chub monitoring report (Scheerer *et al.* 2007), there were at least 19[1] populations totaling 500 or more individuals. These populations are grouped into the three sub-basins (Santiam River, Mainstem Willamette River, and Middle Fork Willamette River) identified in the Oregon chub recovery plan. The populations meeting the recovery criteria and their respective abundance estimates are:
> >
> > Santiam River (4 populations)
> > - Foster Pullout Pond (980)
> > - Gray Slough (560)
> > - South Stayton Pond (560)
> > - Geren Island North Channel (510)
> >
> > Mainstem Willamette River (6 populations)
> > - Dunn Wetland (34,530)
> > - Ankeny Willow Marsh (26,420)
> > - Finley Cheadle Pond (1,740)

[1] The Service is aware the majority of the Jampolsky population was moved at the request of the landowner, which is not reflected in the 2007 Oregon chub Investigations Report (Scheerer *et al.* 2007). The removal of this population does not affect the attainment of the downlisting criteria.

- Finley Gray Creek Swamp (1,400)
- Russell Pond (1,400)

Middle Fork Willamette River (10 populations)

- Shady Dell Pond (7,250)
- Elijah Bristow State Park- Berry Slough (6,580)
- Dexter Reservoir RV Alcove- DEX3 (4,020)
- Wicopee Pond (3,130)
- Fall Creek Spillway Ponds (2,740)
- Buckhead Creek (2,030)
- East Fork Minnow Creek Pond (1,770)
- Elijah Bristow Island Pond (1,620)
- Hospital Pond (1,520)
- Dexter Reservoir Alcove- PIT1 (1,130)

Oregon chub populations are generally managed by a wide variety of local, state, and federal agencies and entities including: The McKenzie River Trust, City of Salem, ODFW, Oregon Parks and Recreation Department (OPRD), Oregon Department of Transportation (ODOT), US Army Corps of Engineers (ACOE), Forest Service (FS), and USFWS. Populations are managed both formally (with a management plan) and informally (without a management plan).

Criterion 2: All of these[2] populations must exhibit a stable or increasing trend for 5 years.

Accomplished. Fifteen of the populations that met criterion #1 also met criterion #2 (Scheerer et al. 2007). The populations meeting the recovery criteria and their respective trend (stable or increasing) are:

Santiam River

- Foster Pullout Pond (stable)
- Gray Slough (stable)
- Geren Island North Channel (stable)

Mainstem Willamette River

- Dunn Wetland (stable)
- Finley Cheadle Pond (increasing)
- Finley Gray Creek Swamp (increasing)
- Russell Pond (increasing)

[2] "These" refers to the 10 populations of at least 500 Oregon chub stated in criterion #1.

Middle Fork Willamette River

- Shady Dell Pond (increasing)
- Elijah Bristow - Berry Slough (increasing)
- Dexter RV Alcove- DEX3 (increasing)
- Wicopee Pond (stable)
- Buckhead Creek (stable)
- Elijah Bristow Island Pond (stable)
- Hospital Pond (stable)
- Dexter Alcove- PIT1 (increasing)

Criterion 3: At least three populations (meeting criteria #1 and #2) must be located in each of the three sub-basins (Mainstem Willamette River, Middle Fork Willamette River and Santiam River).

Accomplished. At least three populations (meeting criteria #1 and #2) are located within each of the three recovery sub-basins (Scheerer et al. 2007). The populations meeting the recovery criteria and their respective abundance estimates and trends are:

Santiam River (3 populations)

- Foster Pullout Pond (980 and stable)
- Gray Slough (560 and stable)
- Geren Island North Channel (510 and stable)

Mainstem Willamette River (4 populations)

- Dunn Wetland (34,530 and stable)
- Finley Cheadle Pond (1,740 and increasing)
- Finley Gray Creek Swamp (1,400 and increasing)
- Russell Pond (1,400 and increasing)

Middle Fork Willamette River (8 populations)

- Shady Dell Pond (7,250 and increasing)
- Elijah Bristow Berry Slough (6,580 and increasing)
- Dexter RV Alcove- DEX3 (4,020 and increasing)
- Wicopee Pond (3,130 and stable)
- Buckhead Creek (2,030 and stable)
- Elijah Bristow Island Pond (1,620 and stable)
- Hospital Pond (1,520 and stable)
- Dexter Alcove- PIT1 (1,130 and increasing)

Table 1 below summarizes Oregon chub populations that have met, and those that have not met, the Oregon chub downlisting criteria outlined in the Oregon chub Recovery Plan (USFWS 1998) (Note: only populations with 500 or more individuals are shown).

Table 1: Summary of Oregon Chub Populations Relative to the Downlisting Criteria Outlined in the Oregon Chub Recovery Plan (USFWS 1998)

Basin	Population Name	Criterion #1	Criterion #2	Criterion #3
Santiam	Foster Pullout Pond	Met	Met	Met
	Gray Slough	Met	Met	Met
	South Stayton Pond	Met	Not Met	Not Met
	Geren Island North Channel	Met	Met	Met
Mainstem Willamette River	Dunn Wetland	Met	Met	Met
	Ankeny Willow Marsh	Met	Not Met	Not Met
	Jampolsky Wetlands*	Not Met	Not Met	Not Met
	Finley Cheadle Pond	Met	Met	Met
	Finley Gray Creek Swamp	Met	Met	Met
	Russell Pond	Met	Met	Met
Middle Fork Willamette River	Shady Dell Pond	Met	Met	Met
	E. Bristow St. Park – Berry Slough	Met	Met	Met
	Dexter Reservoir RV Alcove – DEX 3	Met	Met	Met
	Wicopee Pond	Met	Met	Met
	Fall Creek Spillway Ponds	Met	Not Met	Not Met
	Buckhead Creek	Met	Met	Met
	East Fork Minnow Creek Pond	Met	Not Met	Not Met
	Elijah Bristow Island Pond	Met	Met	Met
	Hospital Pond	Met	Met	Met
	Dexter Reservoir Alcove – PIT 1	Met	Met	Met

* The majority of the Jampolsky Wetland population was moved in 2007 to Ankeny Willow Marsh at the request of the private landowner.

The species can be considered for delisting when:

Criterion 1: 20 populations of at least 500 individuals each are established and maintained.

Not Accomplished at this time. There are currently 19 populations of at least 500 individuals (Scheerer et al. 2007). The populations meeting the recovery criteria by sub-basins are:

Santiam River (4 populations)

- Foster Pullout Pond (980)
- Gray Slough (560)
- South Stayton Pond (560)
- Geren Island North Channel (510)

Mainstem Willamette River (6 populations)

- Dunn Wetland (34,530)
- Ankeny Willow Marsh (26,420)
- Finley Cheadle Pond (1,740)
- Finley Gray Creek Swamp (1,400)
- Russell Pond (1,400)

Middle Fork Willamette River (10 populations)

- Shady Dell Pond (7,250)
- Elijah Bristow State Park- Berry Slough (6,580)
- Dexter Reservoir RV Alcove- DEX3 (4,020)
- Wicopee Pond (3,130)
- Fall Creek Spillway Ponds (2,740)
- Buckhead Creek (2,030)
- East Fork Minnow Creek Pond (1,770)
- Elijah Bristow Island Pond (1,620)
- Hospital Pond (1,520)
- Dexter Reservoir Alcove- PIT1 (1,130)

Criterion 2: All of these populations (20) must exhibit a stable or increasing trend for 7 years.

Not Accomplished at this time. Twelve populations met this criterion (Scheerer et al. 2007). The populations meeting this recovery criterion are:

Santiam River (3 populations)

- Foster Pullout Pond (stable)
- Gray Slough (stable)
- Geren Island North Channel (stable)

Mainstem Willamette River (2 populations)

- Dunn Wetland (stable)
- Finley Gray Creek Swamp (increasing)

Middle Fork Willamette River (7 populations)

- Shady Dell Pond (increasing)
- Elijah Bristow - Berry Slough (increasing)
- Dexter RV Alcove- DEX3 (increasing)

- Wicopee Pond (stable)
- Buckhead Creek (stable)
- Hospital Pond (stable)
- Dexter Alcove- PIT1 (increasing)

Criterion 3: At least four populations (meeting criteria #1 and #2) must be located in each of the three sub-basins (Mainstem Willamette, Middle Fork Willamette and Santiam).

Not accomplished at this time. One out of three sub-basins has achieved this recovery criterion (Scheerer et al. 2007). The populations in the Middle Fork Willamette River meeting the criterion are:

Middle Fork Willamette River (7 populations)

- Shady Dell Pond (7,250 and increasing)
- Elijah Bristow Berry Slough (6,580 and increasing)
- Dexter RV Alcove- DEX3 (4,020 and increasing)
- Wicopee Pond (3,130 and stable)
- Buckhead Creek (2,030 and stable)
- Hospital Pond (15,20 and stable)
- Dexter Alcove- PIT1 (1,130 and increasing)

Criterion 4: Management of these 20 populations must be guaranteed in perpetuity.

Not accomplished at this time. The management of 20 Oregon chub populations meeting the recovery criteria into perpetuity has not been accomplished at this time. Entities that own property with Oregon chub populations or agencies the have actions that may impact Oregon chub have yet to develop management agreements that addresses the management of the populations into perpetuity. The Oregon Chub Working Group (OCWG) could support development of such agreements, especially on lands owned or managed by their respective agencies or entities.

Table 2 below summarizes Oregon chub populations that have met, and those that have not met, the Oregon chub delisting criteria outlined in the Oregon chub Recovery Plan (USFWS 1998).

Table 2: Summary of Oregon Chub Populations Relative to the Delisting Criteria Outlined in the Oregon Chub Recovery Plan (USFWS 1998)

Basin	Population Name	Criterion #1	Criterion #2	Criterion #3	Criterion #4
Santiam	Foster Pullout Pond	Met	Met	Not Met	Not Met
	Gray Slough	Met	Met	Not Met	Not Met
	South Stayton Pond	Met	Not Met	Not Met	Not Met
	Geren Island North Channel	Met	Met	Not Met	Not Met
Mainstem Willamette River	Dunn Wetland	Met	Met	Not Met	Not Met
	Ankeny Willow Marsh	Met	Not Met	Not Met	Not Met
	Jampolsky Wetlands*	Not Met	Not Met	Not Met	Not Met
	Finley Cheadle Pond	Met	Met	Not Met	Not Met
	Finley Gray Creek Swamp	Met	Not Met	Not Met	Not Met
	Russell Pond	Met	Not Met	Not Met	Not Met
Middle Fork Willamette River	Shady Dell Pond	Met	Met	Met	Not Met
	E. Bristow St. Park – Berry Slough	Met	Met	Met	Not Met
	Dexter Reservoir RV Alcove – DEX 3	Met	Met	Met	Not Met
	Wicopee Pond	Met	Met	Met	Not Met
	Fall Creek Spillway Ponds	Met	Not Met	Not Met	Not Met
	Buckhead Creek	Met	Met	Met	Not Met
	East Fork Minnow Creek Pond	Met	Not Met	Not Met	Not Met
	Elijah Bristow Island Pond	Met	Not Met	Not Met	Not Met
	Hospital Pond	Met	Met	Met	Not Met
	Dexter Reservoir Alcove – PIT 1	Met	Met	Met	Not Met

* The majority of the Jampolsky Wetland population was moved in 2007 to Ankeny Willow Marsh at the request of the private landowner.

2.3 Updated Information and Current Species Status

At the time of listing (1993), ODFW documented eight populations of Oregon chub which represented only two percent of its historical range. Known Oregon chub populations were restricted to an 18.6 mile (30 kilometer (km)) stretch of the Middle Fork Willamette River in the vicinity of Dexter and Lookout Point Reservoirs in Lane County, Oregon (58 FR 53800). Since the time of listing ODFW has completed comprehensive investigations for Oregon chub throughout the Willamette Basin. According to the 2007 Oregon chub investigations report, 34 populations are now known to exist within the Willamette Basin. Conservation actions have resulted in a 425 percent increase in the number of Oregon chub populations, from eight to 34 – an addition of 26 populations.

Conservation Efforts

The OCWG was formed in 1991 at the suggestion of the ODFW. The OCWG is composed of Federal and state agency biologists, academics, land managers, and others who seek to improve the status of the species. Participating representatives include the USFWS, FS, ACOE, Bureau of Land Management (BLM), ODFW, Oregon State University, OPRD, ODOT, Oregon Department of Forestry (ODF), and others as appropriate. The OCWG has been proactive in conserving and restoring habitat for the Oregon chub and raising public awareness of the species prior to the Final Federal listing in 1993.

In 1992, an interagency "Conservation Agreement for the Oregon Chub in the Willamette Valley, Oregon" was completed and signed by the USFWS, FS, ACOE, BLM, ODFW, and OPRD. The goal of the plan was to reverse the declining trend of Oregon chub populations, and to increase the abundance of this species in healthy, wild populations through protection of habitat, reintroductions to suitable habitat within its historical range, and public education and involvement. The management objectives and guidelines are to: 1) establish a task force drawn from participating agencies to oversee and coordinate Oregon chub conservation and management actions; 2) protect existing populations; 3) establish new populations; and, 4) foster greater public understanding of the Oregon chub, its status, the factors that influence it, and the conservation agreement.

In October, 1993, a Risk Assessment Analysis for Oregon chub was drafted by the ODFW. The purpose of the document was to provide guidelines for the founding of new populations of Oregon chub. The document sets guidelines for numbers of fish to be used for introductions, genetic considerations in choosing donor populations, timing of introductions, and the monitoring protocol to determine the progress and success of introductions.

In July, 1996, the USFWS, FS, BLM, and the ACOE signed, a programmatic environmental assessment for the establishment of Oregon chub populations within the Willamette River basin. This document has streamlined the process of reintroducing the species into suitable habitats within its historical range. Private landowners are encouraged to participate in reintroduction efforts.

In August, 1996, a no-spray agreement with ODOT was formalized to protect Oregon chub sites located in the Middle Fork Willamette River drainage adjacent to Highway 58 in Lane County. The agreement prohibits spraying of herbicides in the vicinity of Oregon chub sites and limits vegetation control to mechanical methods if necessary.

In January, 1997, a Memorandum of Understanding (MOU) was signed by the USFWS and the City of Salem to protect Oregon chub at the Geren Island Water Treatment Facility in the North Santiam River. The MOU sets interim restrictions on facility operations that might affect Oregon chub on the site until a formal Habitat Conservation Plan is developed.

Since the 1993 listing, the USFWS has conducted Section 7 consultations on actions authorized, funded or carried out by Federal agencies. The types of projects involved in Section 7 consultations have generally been related to transportation, hydropower, and bank stabilization. These consultations have determined minimized or eliminated the effects of various projects on Oregon chub.

A significant recovery effort has focused on the introduction of Oregon chub into suitable habitats within their historical range. Since 1992, 14 populations have been introduced into suitable habitats (Foster Pullout Pond, South Stayton Pond, Menear's Bend, Dunn Wetland, Ankeny Willow Marsh, Jampolsky Wetlands, Finley Cheadle Pond, Finley Display Pond, Russell Pond, Wicopee Pond, Fall Creek Spillway Ponds, East Ferrin Pond, West Ferrin Pond, and Herman Pond). Eleven of these populations still exist in 2007, eight of which totaled 500 or more fish. Four of these populations have exhibited a stable or increasing trend in abundance for the past five years (Scheerer et al. 2007).

Three of the introductions did not succeed due to unforeseen circumstances (East Ferrin Pond, West Ferrin Pond, and Jampolsky Wetlands). Five hundred and seventy-six Oregon chub were introduced into East Ferrin Pond in 1994. In 1997, the chub population was 7,160 fish, which is a significant increase in 3 years. In 1998, largemouth bass were first observed in the pond from an unauthorized introduction, and from then on the chub population declined rapidly. No Oregon chub were collected from 2000 through 2006. The rapid increase in abundance of the Oregon chub population was encouraging; however, the subsequent collapse of the population after largemouth bass were introduced illustrates the continued threat that non-native predators pose to Oregon chub survival and recovery (Scheerer et al. 2006). A similar situation occurred at West Ferrin Pond when a population was introduced but did not succeed due to western mosquitofish presence. Lastly, the majority of the fish were removed from the Jampolsky Wetlands population to the Ankeny Willow Marsh population at the request of the landowner, although a small population likely remains.

In addition to reintroduction efforts, 15 habitat restoration projects (Ferrin Ponds, Dunn Wetlands, Display Pond, Cheadle Pond, Hospital Impoundment Pond, Hospital Pond, Lower Buckhead Enhancement Ponds, Herman Pond, Stayton Ponds, Pioneer Park Backwater, Jampolsky Wetlands, Shetzline Ponds, Wicopee Pond, Haws Restoration Pond, and Willow Marsh) have been completed to increase the quantity of habitat or enhance the suitability of habitat for Oregon chub (Paul Scheerer, Fish Biologist, ODFW, Corvallis Research Office, Corvallis, Oregon, pers. comm., 2008).

ODOT is in the process of developing conservation banks for Oregon chub at two different sites (Santiam River and East Fork Minnow Creek). The conservation banks include the restoration, construction, and enhancement of Oregon chub habitat and other regionally significant native habitats. Although ODOT has been developing these sites, ODOT has not yet utilized these banks due to a lack of agency demand. These banks may be used at a later date when ODOT identifies the need to use a conservation bank site rather than offset impacts at the project site.

2.3.1 Biology and Habitat

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

A significant amount has been learned about Oregon chub since the time of listing. Paul Scheerer, Fish Biologist with ODFW, has been the leading Oregon chub researcher and has been and implementing Oregon chub conservation and recovery efforts in the Willamette Basin. Since the time of listing, agencies have contracted with Paul Scheerer to conduct research on the species. Generally, the research has focused on the biology and life history of the species, but also on documenting the presence or absence of Oregon chub, and how Oregon chub are affected by agency actions. The agencies that typically have effects on Oregon chub are ACOE, ODOT, USFWS, and OPRD.

In 2002, he published an article in the *Transactions of the American Fisheries Society* titled, "Implications of Floodplain Isolation and Connectivity on the Conservation of an Endangered Minnow, Oregon Chub in the Willamette River, Oregon." It described the fish communities in current and historic Oregon chub habitats and documented the need to establish new populations through introductions. Results suggested that increasing the connectivity of floodplain habitats in a system where non-native fishes are widespread may be detrimental to the conservation and recovery of this species (Scheerer 2002).

In 2003, Paul Scheerer and P.J. McDonald's research determined age and growth of Oregon chub at three locations and the timing of spawning at two locations in the Willamette Basin. The results indicated Oregon chub live up to nine years of age, and most of the fish over five years old were females. There are strong relationships between somatic growth and otolith (lapillus) growth within populations and considerable variation among populations. Mature fish were primarily two or more years old, and all fish over 40 mm long had gonads that were developing or mature. Oregon chub spawned from mid-May through August with peak activity in July. Juveniles that hatched prior to mid-June were not found in October, suggesting reduced survival of early hatched fish (Scheerer and McDonald 2003).

Paul Scheerer collected information on the presence/absence of Oregon chub on ODOT properties from 2002-2004. This information was used to assess the conservation needs for Oregon chub for a project involving the replacement and repair of up to 80 bridges within the range of Oregon chub over a seven year period. In 2002-2004, ODFW

surveyed 81 aquatic habitats in the vicinity of proposed ODOT bridge projects (Scheerer *et al.* 2004a).

Continuing his work with ODOT, Paul Scheerer developed management plans for Oregon chub populations at East Fork Minnow Creek (Middle Fork Willamette River), Coast Fork Willamette River Side Channels near Creswell (Coast Fork Willamette River), and Santiam I-5 Backwaters (Santiam River). The management plans included recommendations for habitat protection, habitat improvement, and monitoring of population abundance and habitat condition at these locations. The plans represent continuing collaboration on Oregon chub conservation efforts among the USFWS, ODOT, and ODFW (Scheerer et al. 2004b).

Oregon chub are located on USFWS property at Finley National Wildlife Refuge. In 2004, Paul Scheerer conducted a study to assess Oregon chub population trends and habitat conditions on there. This study improved our understanding of recent declines in chub numbers and assisted in guiding protection, restoration, and enhancement efforts on the refuge (Scheerer et al. 2004c).

The Hospital Pond Oregon chub population is located on ACOE property in the Middle Fork Willamette River. In 2005 and 2006, Paul Scheerer completed monitoring reports with updated information on Oregon chub life history in Hospital pond. These reports focused on the monitoring of air and water temperature profiles, monitoring of reservoir and pond level elevations, and the collection and analysis of Oregon chub aging and hatch date data. These data are useful to the ACOE for planning near-term and flow management and long range water storage and flow management and to protect Oregon chub and their habitat in Hospital pond. These data could also provide valuable life history data for future Oregon chub conservation projects that may need a better understanding of aging to achieve their conservation goals (Scheerer et al. 2005; 2006b).

In 2006, Paul Scheerer documented Oregon chub information on OPRD lands. This monitoring report contains new information on the status of Oregon chub populations and their habitat on OPRD properties in the Willamette Valley, surveys of off-channel habitats, and evaluations of potential reintroduction sites. Information from this report will be used to guide future conservation actions on OPRD properties (Scheerer et al. 2006c).

Beginning in 1991, Paul Scheerer began preparing reports of ODFW's investigations on Oregon chub. From 1991 – 2007, each annual report has incorporated the results of prior years' work. As a result, the 2007 report provides a complete summary of all prior work. The 2007 report shows that Oregon chub have increased their abundance and distribution since the time of listing and their populations are usually stable or increasing as long as no predatory fish species appear in their habitats. This report provides the most up-to-date information on the status of Oregon chub including information on abundance, distribution, conservation actions, and future conservation opportunities (Scheerer et al. 2007). The following annual reports are incorporated by reference in the 2007 Oregon chub Investigations Report (Scheerer 1999), (Scheerer et al. 2003), (Scheerer et al. 2004),

(Scheerer et al. 2005), (Scheerer et al. 2006a), (Scheerer et al. 2006b), (Scheerer et al. 2006c), (Scheerer et al. 2007). In 2007, Paul Scheerer also published two additional reports that documented the improved status of Oregon chub (Scheerer 2007a; 2007b).

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

According to ODFW's 2007 monitoring report (Table 3, below) there are 15 populations with estimates totaling 500 or more individuals that exhibited a stable or increasing trend for the past five years (Scheerer et al. 2007). Eight of these populations are located in the Middle Fork Willamette recovery area, four of these populations are located in the Mid-Willamette recovery area, and three populations are located in the Santiam recovery area. Over the past nine years, ODFW has made significant progress in: increasing the number of known populations, increasing the number of large populations (>500 fish) and expanding the distribution of these populations (Scheerer and McDonald 2003) (Scheerer et al. 2007).

Table 3: Oregon Chub Population Abundance Estimates from 1992-2007 (as reported in Scheerer et al. 2007)

Site Name	Basin	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	5-Year Trend
													(158)	(112)				
Foster Pullout Pond	SANT								(85)	(20) 80	(75) 210	(50) 320	640	570	200	470	980	stable
Gray Slough	SANT				**2**	**3**	**2**	**0**	**13**	**4**	**2**	12	270	340	260	700	560	stable
South Stayton Pond	SANT															(54)	560	
Geren Island North Channel	SANT					8,340	8,660	1,830	860	360	760	740	1,590	2,290	2,630	1,020	510	stable
Pioneer Park Backwater	SANT						**2**	**0**	**0**	**2**	**9**	**4**	**6**	**0**	**4**	110	420	
Stayton Public Works Pond	SANT							**3**	**4**	**1**	**0**	**0**	**0**	**21**	530	440	270	
Santiam I-5 Side Channels	SANT						**5**	**2**	**3**	**13**	**13**	350	220	320	580	330	**22**	
Green's Bridge Slough	SANT		**5**			**2**	**5**	**0**	**2**	**0**	**3**	**2**	**4**	**0**	**7**	**6**	**1**	
Santiam Easement	SANT			1,250		830	300	250	**13**	**4**	**12**	**2**	**0**	**1**	**0**	**3**	**0**	
Menear's Bend	SANT									(15)	**7**	(26) 29	**0**	**0**	.....pond dried up.....			
Logan Slough	SANT						**2**			**0**								
Dunn Wetland	MS						(200)	(373) 460	4,860	14,090	26,240	19,270	28,740	25,810	28,290	21,530	34,530	stable
Ankeny Willow Marsh	MS													(500)	10,110	35,650	26,420	
Jampolsky Wetlands	MS													(500)	1,230	8,320	4,160	
Finley Cheadle Pond	MS											(50)	50	220	1,300	900	1,740	increasing
Finley Gray Creek Swamp	MS		370	600	460	470	520	620	510	730	630	290	230	520	240	1,390	1,400	increasing
Finley Display Pond	MS							(60)	(45) 360	1,750	(49) 670	500	130	70	240	240	230	
Muddy Creek	MS																**3**	
Dry Muddy Creek	MS			**26**			**2**	.....denied access.....					**22**	**1**	**4**	**0**	**0**	
Bull Run Creek	MS														**2**	**0**	**0**	
Little Muddy Creek tributary	MS													**5**	**0**	**0**	**0**	
								.....			.....denied							
Camous Creek	MS		**5**			**5**		access.....								**0**		
Russell Pond	MCK										(350)	(150) 470	450	720	810	1,000	1,400	increasing
Shetzline Pond	MCK											120	650	1,050	730	390	210	
Big Island	MCK											940	620	310	430	380	190	
Green Island	MCK																**12**	
Ezell Slough	MCK														**6**			
Shady Dell Pond	MFW		1,630	4,770	3,770	4,240	3,790	3,650	2,860	3,830	2,280	2,420	2,330	4,210	3,110	5,430	7,250	increasing
E.Bristow St. Park- Berry Slough	MFW		4,010		1,930		2,010	5,350	2,720	1,190	3,970	4,910	2,140	2,950	2,530	5,460	6,580	increasing
Dexter Reservoir RV Alcove-DEX3	MFW	**59**			**15**		1,330	830	50	880	1,950	2,270	870	790	1,850	3,310	4,020	increasing
Wicopee Pond	MFW	**3**			**0**	**1**	**9**	**25**	160	4,580	4,080	2,410	4,100	4,780	6,300	4,860	3,130	stable
Fall Creek Spillway Ponds	MFW					(500)	480	1,420	6,310	5,030	7,770	6,370	5,620	5,850	6,250	3,250	2,740	declining
Buckhead Creek	MFW	**3**	**4**		**2**				3,010	3,570	7,140	4,080	2,830	3,600	3,130	2,500	2,030	stable
East Fork Minnow Creek Pond	MFW		8,770	7,540	7,130	4,540	4,020	4,440	4,780	5,050	3,380	3,270	3,650	3,140	1,850	1,730	1,770	declining
Elijah Bristow Island Pond	MFW												2,780	420	1,700	2,310	1,620	stable
Hospital Pond	MFW		690		780		3,160	3,030	3,020	2,980	2,700	2,130	1,600	4,940	5,040	2,040	1,520	stable
Dexter Reservoir Alcove- PIT1	MFW	780			140	40	920	450	1,130	1,440	800	460	390	70	600	650	1,130	increasing
Haws Pond	MFW														120	440	380	
E.Bristow St. Park- NE Slough	MFW								1,060	1,170	1,090	940	610	1,340	790	210	350	
Barnhard Slough	MFW	**0**								**3**	**7**	**2**	**1**	**2**	**2**	**0**	**4**	
Jasper Park Slough	MFW			**3**			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	
Oakridge Slough	MFW			**4**	**8**		**2**	**21**	480	140	140	**9**	**1**	**1**	**0**	**0**	**0**	
Rattlesnake Creek	MFW	**7**			**6**				**1**	**2**	**2**	**2**	**2**	**0**	**0**	**5**	**0**	
East Ferrin Pond	MFW			(576)	3,520	5,610	7,160	3,490	60	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Wallace Slough	MFW						**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Dexter East Alcove	MFW	**40**				**0**	**0**	**0**		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Elijah Bristow Large Gravel Pit	MFW	**3**			**0**			**7**	**0**	**0**	**0**	**8**	**2**	**0**	**0**	**0**		
Elijah Bristow Small Gravel Pit	MFW	**31**			**0**			**22**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		
Hospital Impoundment Pond	MFW				**6**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		
Dexter Reservoir	MFW											**1**			**1**			
Middle Fk Willamette Backwater	MFW												**13**	**0**				
West Ferrin Pond	MFW	**3**		(525)	**2**	**0**	**0**	**0**	**0**									
Herman Pond	CFW											(400)	420	350	110	40	180	
Coast Fork Side Channels	CFW											**16**	130	190	**12**	150	80	
Lynx Hollow Side Channels	CFW														**2**	**2**	**2**	
Camas Swale	CFW	**1**	**2**	**0**		**0**			**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	

** Abundances are mark-recapture estimates, except those shown in bold, which are the number of fish captured.*

**Site names in bold italics are locations where Oregon chub were introduced.*

**The number of fish stocked at introduction sites is shown in parentheses.*

**Basin codes: SANT- Santiam, MS- Mid-Willamette, MFW- Middle Fork Willamette, MCK- McKenzie, and CFW- Coast Fork Willamette.*

**Five-year trends were not assessed if data were not available for at least five years, if the population abundance was less than 500 fish, or if abundance was not estimated using mark-recapture techniques.*

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

Current Recovery Approach

Oregon chub populations are increasing in abundance and distribution throughout the Willamette Basin in isolated populations. At the time of listing, most of the eight known remaining populations of Oregon chub occurred near rail, highway, power transmission corridors, public parks, and campground facilities. These populations were threatened by (1) direct mortality from chemical spills from overturned truck or rail tankers, runoff or accidental spill of brush control and agricultural chemicals, and the risk of overflow from chemical toilets in campgrounds; (2) competition for resources or predation resulting from intentional or accidental introductions of nonnative fishes and (3) loss of habitat from siltation of shallow habitats from logging and construction activities, unauthorized fill activities, and changes in water level or flow conditions from construction, diversions, or natural desiccation.

Recent increases in the number and distribution of populations have generally resulted from the creation of artificial habitats (ponds) that are disconnected from the floodplain. This results in greater protection from nonnative predatory fish, and increases management capability. Since the time of listing, Oregon chub conservation and recovery efforts have focused on creating these isolated habitats to increase the number of populations. Increasing the abundance and distribution of Oregon chub in isolation has proven to be effective at halting the decline of Oregon chub populations, and bringing Oregon chub to the point of meeting downlisting criteria.

Risks Associated With Isolation

Conservation efforts have successfully increased the abundance and distribution of Oregon chub in the short-term, but according to annual monitoring reports (Scheerer et al. 2006 and 2007) there is still concern about the long-term conservation and recovery of the species. The reports indicate the genetic exchange among Oregon chub populations is believed to be minimal. Nineteen out of 34 Oregon chub populations (56 percent) are isolated and have a low probability of annual floodplain connectivity, and 16 of the 34 populations (47 percent) had less than 500 fish (Scheerer 2007c). Research suggests there may be risks associated with isolating populations that previously interacted with a larger network of interacting populations (Meffe and Vrijenhoek 1988; Burkey 1989).

Isolating populations that would normally experience gene exchange can result in a general decline in local genetic diversity and a corresponding increase in divergence among populations within a drainage system (Meffe and Vrijenhoek 1988). 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). Multiple local populations distributed and interconnected

throughout a watershed provide a mechanism for spreading risk from stochastic events (Hard 1995; Healy & Prince 1995; Rieman & Allendorf 2001; Rieman & McIntyre 1993; Spruell et al. 1999). Migration and occasional spawning between populations increases genetic variability and strengthens population variability (Rieman and McIntyre 1993).

Effective population sizes of 500 to 5000 have been recommended for the retention of evolutionary potential (Franklin & Frankham 1998; Lynch & Lande 1998). According to the annual monitoring report 16 out of 34 populations (47 percent) had less than 500 fish (Scheerer et al. 2007), and therefore do not have sufficiently large effective population sizes to retain optimal evolutionary potential. Increased homozygosity of deleterious recessive alleles is thought to be the main mechanism by which inbreeding depression decreases the fitness of individuals within local populations (Allendorf & Ryman 2002). Hedrick and Kalinowski (2000) provide a review of studies demonstrating inbreeding depression in wild populations with very small effective population sizes.

The USFWS' Abernathy Fish Technology Center conducted a genetic analysis on Oregon chub that will be used to guide future restoration efforts. Though the final report is not expected until May of 2008, the draft report suggests that four genetically distinct groups of Oregon chub exist and these groups corresponded to the sub-basins of the Willamette River. The draft report supports the current approach for chub reintroductions using a donor population for a given reintroduction from within the same sub-basin as the reintroduction site. The draft report authors examined genetic diversity within and among 20 natural and four introduced populations at 10 microsatellite loci and observed moderate levels of diversity with the exception of one population that displayed signs of a genetic bottleneck (Shetzline Pond) (Ardren et al. 2008).

2.3.1.4 Taxonomic classification or changes in nomenclature:

No change in taxonomic classification or changes in nomenclature have been suggested since the time of listing.

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

Historically, Oregon chub were found throughout the Willamette River drainage from Oregon City to Oakridge. Records note collections from the Clackamas River, Molalla River, Mill Creek, Luckiamute River, North Santiam River, South Santiam River, Calapooia River, Long Tom River, Muddy Creek, McKenzie River, Coast Fork Willamette River, Middle Fork Willamette River drainages, and the mainstem Willamette River. Oregon chub were distributed throughout the Willamette River Valley (Snyder 1908) in off-channel habitats such as beaver ponds, oxbows, stable backwater sloughs, and flooded marshes. These habitats usually have little or no water flow, have silty and organic substrate, and have an abundance of aquatic vegetation and cover for hiding and spawning. In the last 100 years, these habitats have largely disappeared because of

changes in seasonal flows resulting from the construction of dams throughout the basin, channelization of the Willamette River and its tributaries, and agricultural practices. This loss of habitat combined with the introduction of non-native species to the Willamette Valley resulted in a sharp decline in Oregon chub abundance, which led to its listing as Endangered.

At the time of listing, the Oregon chub occupied only two percent of its historical range. Recovery efforts since then have focused conservation actions in isolated Oregon chub habitats. These efforts have increased the distribution of Oregon chub throughout the Willamette basin but remain significantly below the historic distribution.

According to the 2007 monitoring report, there are 34 Oregon chub populations distributed throughout the Willamette Basin. Nineteen of 34 (56 percent) of Oregon chub populations have a low probability of annual floodplain connectivity due to isolation (Scheerer 2007c) and they are listed below by recovery area.

Santiam River (4 populations)

- Foster Pullout Pond (980)
- South Stayton Pond (560)
- Geren Island North Channel (510)
- Pioneer Park Backwater (420)

Mainstem Willamette River (7 populations)

- Dunn Wetland (34,530)
- Ankeny Willow Marsh (26,420)
- Jampolsky Wetlands (no current estimate)
- Finley Cheadle Pond (1,740)
- Finley Display Pond (230)
- Russell Pond (1,400)
- Shetzline Pond (210)

Middle Fork Willamette River (7 populations)

- Shady Dell Pond (7,250)
- Elijah Bristow State Park- Berry Slough (6,580)
- Wicopee Pond (3,130)
- Fall Creek Spillway Ponds (2,740)
- East Fork Minnow Creek Pond (1,770)
- Hospital Pond (1,520)
- Haws Pond (380)

Coast Fork Willamette River (1 population)

- Herman Pond (180)

Oregon chub populations have been introduced into habitats throughout the Willamette Basin. Eleven Oregon chub populations have successfully resulted from reintroduction efforts. The donor stock used for the introduction efforts is generally taken from an existing population within the same drainage, when a suitable donor exists in that drainage, as outlined in the reintroduction guidelines outlined in the January 1992 Conservation Agreement for the Oregon Chub. The OCWG has supported the "within drainage" donor population approach for introductions. The goal of this approach is to protect the genetic integrity of Oregon chub in the short-term within each sub-basin in the Willamette Basin. This approach is supported by the draft genetic information developed by Abernathy Fish Technology Center (Ardren et al. 2008). The long-term conservation and recovery efforts will focus on ensuring these secure populations have adequate genetic exchange to ensure genetically stable self-sustaining populations.

The distribution of land ownership of properties with Oregon chub are included below in Table 4. Oregon chub are distributed throughout the Willamette Basin in a mixture of public, private, city, state, and Federal ownership.

Table 4: Ownership of Properties with Oregon Chub Populations

Site Name	Sub-Basin	Ownership
Foster Pullout Pond	SANT	ACOE
Gray Slough	SANT	Private
South Stayton Pond	SANT	ODFW
Geren Island North Channel	SANT	City of Salem
Pioneer Park Backwater	SANT	City of Stayton, Santiam Water Control District
Stayton Public Works Pond	SANT	City of Stayton
Santiam I-5 Side Channels	SANT	ODOT
Green's Bridge Slough	SANT	Private, public boat ramp
** Santiam Easement	SANT	USFWS easement
** Menear's Bend	SANT	ACOE
** Logan Slough	SANT	Public navigable river
Dunn Wetland	MS	Private
Ankeny Willow Marsh	MS	USFWS
Jampolsky Wetlands	MS	Private
Finley Cheadle Pond	MS	USFWS
Finley Gray Creek Swamp	MS	USFWS
Finley Display Pond	MS	USFWS
Muddy Creek	MS	ODOT
** Dry Muddy Creek	MS	Private
** Bull Run Creek	MS	Private
** Little Muddy Creek Trib.	MS	ODOT
** Camous Creek	MS	Private
Russell Pond	MS/MCK	Private
Shetzline Pond	MS/MCK	Private
Big Island	MS/MCK	McKenzie River Trust
Green Island	MS/MCK	McKenzie River Trust,

Site Name	Sub-Basin	Ownership
		private
** Ezell Slough	MS/MCK	Private
Shady Dell Pond	MFW	USFS
E. Bristow St. Park – Berry Slough	MFW	OPRD
Dexter Reservoir RV Alcove – DEX 3	MFW	ACOE
Wicopee Pond	MFW	USFS
Fall Creek Spillway Ponds	MFW	ACOE
Buckhead Creek	MFW	USFS
East Fork Minnow Creek Pond	MFW	ODOT
Elijah Bristow Island Pond	MFW	OPRD
Hospital Pond	MFW	ACOE
Dexter Reservoir Alcove – PIT 1	MFW	ACOE
Haws Pond	MFW	Private
E. Bristow St. Park – NE Slough	MFW	OPRD
Barnhard Slough	MFW	USFS
Jasper Park Slough	MFW	OPRD
** Rattlesnake Creek	MFW	Private
** Oakridge Slough	MFW	USFS
** East Ferrin Pond	MFW	USFS
** Wallace Slough	MFW	Private
**Dexter East Alcove	MFW	ACOE
** Elijah Bristow Large Gravel Pit	MFW	OPRD
** Elijah Bristow Small Gravel Pit	MFW	OPRD
** Hospital Impoundment Pond	MFW	ACOE
** Dexter Reservoir	MFW	ACOE
** Middle Fork Willamette River Backwater	MFW	Public navigable river
** West Ferrin Pond	MFW	USFS
Herman Pond	CFWR	USFS
Coast Fork Side Channels	CFWR	OPRD
Lynx Hollow Side Channels	CFWR	OPRD
** Camas Swale	CFWR	Private
** Survey efforts did not document any Oregon chub at these sites in 2007, but Oregon chub had been collected at these locations at least once between 1991 and 2006.		

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

Factors implicated in the decline of this species include changes in flow regimes and habitat characteristics resulting from the construction of flood control dams, revetments, channelization, diking, and the drainage of wetlands. In the last 100 years, off-channel habitats have disappeared because of changes in seasonal flows resulting from the construction of dams throughout the basin, channelization of the Willamette River and its tributaries, and agricultural practices. This loss of habitat, combined with the

introduction of non-native species to the Willamette Valley, resulted in a restricted distribution and sharp decline in Oregon chub abundance.

Studies to date indicate that Oregon chub conservation and recovery efforts are still inhibited by the lack of suitable habitat and the continued threats posed by the proliferation of non-native fishes, habitat with unnaturally high rates of sedimentation due to land use activities, and the potential for chemical spills or careless pesticide applications. For example, the construction of the ACOE's Willamette Valley Hydrosystem Project has reduced flooding events in the Willamette Basin. Flooding events create and maintain habitat that is utilized by Oregon chub and so the lack of flooding has reduced the amount of suitable habitat. In addition, potential chemical spills may affect Oregon chub. In 1993, a tanker truck of alcohol spilled in the Hazel Dell Arm in the Middle Fork Willamette River shortly after the listing. Hospital Pond, Dry Muddy Creek, Dexter Reservoir Alcoves, East Fork Minnow Creek Pond, and Santiam I-5 Side Channel populations are all located immediately down-slope from roads. In the event of a vehicular accident, these sites could be imminently vulnerable due to their down-slope locations. In addition, USFWS field studies indicate the Muddy Creek population of Oregon chub faces highly elevated levels of pesticides.

A complete list of threats relative to individual Oregon chub populations known in 1998 can be found on page 29 of the Oregon chub Recovery Plan (USFWS 1998).

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

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

The listing of the Oregon chub in 1993 (58 FR 53800) found that the decline of the Oregon chub has been correlated with the construction of dams. Other structural changes along the Willamette River corridor, such as revetment and channelization, diking and drainage, and the removal of floodplain vegetation, have removed or altered the slack water habitats of the Oregon chub. Development of the Willamette River floodplain began in 1872, resulting in the isolation of the Willamette River. The channel was straightened to facilitate development and this resulted in a signification loss of Oregon chub habitat. The reach between Harrisburg and the McKenzie River confluence was reduced from over 155 miles of shoreline habitat in 1854 to less than 40 miles of shoreline habitat in 1984 (58 FR 53800). Development also resulted in the elimination and degradation of seasonal and permanent wetlands that provided habitat.

Since the time of listing, changes have not been made to the Willamette Basin floodplain that would shift habitat back to a historic condition. The lack of available Oregon chub habitat still threatens the long-term conservation of the species. Furthermore, the habitat that remains is frequently occupied by non-

native fishes that have been introduced to the Willamette Basin which prey upon and/or compete with Oregon chub and threaten their recovery.

Oregon chub was formerly distributed throughout the Willamette River Valley in off-channel habitats such as beaver ponds, oxbows, side channels, backwater sloughs, low gradient tributaries, and flooded marshes (Snyder 1908). Historical records show Oregon chub were found as far downstream as Oregon City and as far upstream as Oakridge. Although Oregon chub are still distributed throughout the Willamette basin, a significant proportion of the populations (56 percent) are in isolated habitats (Scheerer 2007c).

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

The 1993 listing indicated this factor was not known to be applicable to Oregon chub. Our review of the 2007 monitoring report and other information indicates this is still the case.

2.3.2.3 Disease or predation:

The 1993 listing of the Oregon chub indicated the establishment and expansion of non-native species in Oregon have likely contributed to the decline of the Oregon chub and limits the species' ability to expand beyond its current restricted range. Non-native fishes and amphibians (bass, crappie, mosquito fish, bullfrogs and others) are now a significant element of the pond and slough habitats of the Willamette River drainage.

According to the 2007 monitoring report (Scheerer et al. 2007), the proliferation of non-native fishes is the largest current threat to Oregon chub populations. Non-native fish have been collected from 43 percent of the 738 sites ODFW sampled in the Willamette Valley since 1991 and 29 of the 35 new sites sampled in 2006. After the 1996 floods, non-native fishes were first collected from several Oregon chub sites in the Santiam River drainage; the two largest populations subsequently declined sharply in abundance (Scheerer 2002). Non-native fishes are well established throughout the Willamette Valley. They threaten to invade sites containing Oregon chub and limit the ability of Oregon chub to migrate from existing sites and colonize suitable habitats elsewhere. Non-native fish are more common in off-channel habitats in the Santiam and Mid-Willamette River drainages than in the Middle Fork Willamette and McKenzie River drainage (Scheerer et al. 2007).

Illegal introduction of non-native species remains a problem as it leads to predation, posing a significant risk to the conservation of Oregon chub populations. For example, an illegal planting of largemouth bass at an Oregon chub introduction site in the Middle Fork Willamette River drainage coincided with the collapse of an Oregon chub population that had once totaled over 7,000

individuals.

Non-native fishes may also serve as sources of parasites and diseases; however, disease and parasite problems have not been studied or defined as a threat to Oregon chub

2.3.2.4 Inadequacy of existing regulatory mechanisms:

The listing of the Oregon chub noted that the Oregon chub was listed as a "sensitive" species by ODFW (ODFW Adm. Rule 635-100-040). The Oregon chub was listed as a sensitive species by Region 6 of the FS, and as a threatened species by the American Fisheries Society (Williams et al. 1990). An interagency Conservation Agreement was established for the Oregon chub in the spring of 1992. The Conservation Agreement was developed in an effort to coordinate management activities among the State and Federal agencies responsible for managing the species and/or its habitat. The goal of the conservation agreement was to conserve and recover the Oregon chub through protection of the species' habitat, introductions into suitable habitat within its historic range, and public education and involvement. Current regulatory mechanisms have not significantly changed since the time of listing. Despite the regulatory mechanisms (ESA listing, FS listing, and the Conservation Agreement), Oregon chub continue to face threats present at the time of listing.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

The 1993 listing of the Oregon chub established that all known extant populations of the Oregon chub occur near rail, highway, and power transmission corridors and within public park and campground facilities. These populations were threatened by chemical spills from overturned truck or rail tankers, runoff or accidental spills of brush control chemicals, overflow from chemical toilets in campgrounds, siltation of shallow habitats from logging and construction activities, loss of habitat from illegal fill activities, and changes in water level or flow conditions from construction, diversions, or natural desiccation. There is public pressure to develop additional sport fisheries in Lookout Point and Dexter Reservoirs. Because all remaining population sites at the time of listing were easily accessible there also continued to be a potential for illegal introductions of non-native species, particularly mosquito fish and game fishes such as bass and walleye.

A higher proportion of Oregon chub populations are secure today than at the time of listing, but many Oregon chub populations still exist near developed infrastructure such as highway, rail, power transmission corridors, etc, and remain susceptible to chemical spills from overturned truck or rail tankers, runoff or accidental spills of brush control chemicals, siltation of shallow habitats from logging and construction activities, etc. Some conservation measures have been implemented to protect Oregon chub from these threats (e.g. the installation of

highway guardrails to protect habitat). Additionally, Oregon chub populations are still susceptible to predation by non-native fishes resulting from illegal introductions.

A threat not considered at the time of listing has arisen. Conservation efforts have successfully increased the abundance and distribution of Oregon chub in the short-term, but according to annual monitoring reports (Scheerer et al. 2006 and 2007) there is still a concern about the genetics and their relation to the long-term conservation of the species. The reports indicate the genetic exchange between Oregon chub populations is believed to be minimal and this could have genetic consequences. A draft report from the USFWS Abernathy Fish Technology Center suggests Oregon chub populations (with the exception of Shetzline Pond) currently have moderate levels of genetic diversity (Ardren et al. 2008), but isolating populations that would normally experience gene exchange can result in a general decline in local genetic diversity and a corresponding increase in divergence among populations within a drainage system (Meffe and Vrijenhoek 1988). 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. Increased homozygosity of deleterious recessive alleles is thought to be the main mechanism by which inbreeding depression decreases the fitness of individuals within local populations (Allendorf & Ryman 2002). Without sufficient immigration, growth for local populations may be low and probability of extinction high (Burkey 1989, 1995). Multiple local populations distributed and interconnected throughout a watershed provide a mechanism for spreading risk from stochastic events (Hard 1995; Healy & Prince 1995; Rieman & Allendorf 2001; Rieman & McIntyre 1993; Spruell et al. 1999).

2.4 Synthesis

At the time of listing (1993) there were only eight populations of Oregon chub. These populations were exposed to various threats (destruction of its habitat, predation by non-native fishes, and the inadequacy of regulatory mechanisms) that could have caused the extinction of the species. Due to the extremely limited number of known populations, agencies active in Oregon chub conservation focused on establishing new populations in habitats without predation from non-native species. This resulted in the creation of isolated populations throughout the Oregon chub's historic range. These efforts have been extremely effective at protecting Oregon chub from their most significant threats (predation by non-native fishes and lack of suitable habitat) that affected the species at the time of listing. According to the 2007 monitoring report, there are now 34 Oregon chub populations throughout the Willamette Basin. Successful conservation efforts have therefore resulted in more than a four-fold increase in the number of Oregon chub populations.

While isolation has worked well to achieve the downlisting criteria, it may not work to accomplish the recovery and ultimate delisting of the species. Oregon chub did not

evolve in isolated habitats and there are potential genetic concerns about the long term viability of Oregon chub if a significant proportion of the populations remain isolated from each other (Meffe and Vrijenhoek 1988) (Burkey 1989, 1995). Integrating floodplain connectivity into Oregon chub conservation actions would allow genetic exchange between populations and the genetic exchange would advance the long term recovery of the species. Unfortunately, non-native fishes are one of the greatest threats to Oregon chub. Non-native fishes that access Oregon chub populations, via floodplain connectivity or unauthorized introductions, generally have significant adverse effects on Oregon chub, and have caused the loss of entire populations. The floodplain connectivity needed ensure the genetic exchange of Oregon chub populations can result in the loss of the Oregon chub populations due to negative interaction of non-native fishes with Oregon chub populations.

Recovery efforts to date have succeeded in increasing the abundance and distribution of Oregon chub in predominantly isolated habitats in the Willamette Basin in the short-term. Oregon chub are no longer at risk of extinction, and meet the downlisting criteria outlined in the Oregon chub recovery plan. Despite the success of short-term recovery efforts, threats still exist to the long-term recovery of the species. Future recovery efforts should continue to build upon the successes of the past, integrate habitat that is connected to the floodplain, researching strategies to ensure the adverse effects associated with non-native fishes are minimized to the greatest extent practicable, and maintain a sufficient level of genetic diversity to ensure the long-term recovery of the species.

Based on the above analysis, we find that the species in not currently in danger of extinction, and warrants downlisting to Threatened; however; without continuing conservation efforts, Oregon chub could once again become endangered throughout all or a significant portion of its range in the foreseeable future.

3.0 RESULTS

3.1 Recommended Classification:

__x__ **Downlist to Threatened**
____ Uplist to Endangered
____ Delist (*Indicate reasons for delisting per 50 CFR 424.11):*
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
____ No change is needed

3.2 New Recovery Priority Number:

No change, recovery priority number remains 8 because Oregon chub have a moderate degree of threat and a high recovery potential.

3.3 Listing and Reclassification Priority Number

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

Brief Rationale:

The management burden associated with Oregon chub is 6 (Low management impact, unpetitioned action). Agencies involved with the management of Oregon chub currently have a mechanism to manage this listed species due to the other Endangered Species Act listed species in the Willamette Basin.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

1. Publish a proposed rule to downlist the Oregon chub from endangered to threatened.

2. Develop and implement a conservation strategy that minimizes the adverse effects of non-native fishes on Oregon chub.

3. Evaluate establishing self-sustaining populations of Oregon chub with access to other Oregon chub populations. The recovery of Oregon chub has focused on securing populations of Oregon chub that are isolated from threats to the species. This strategy has been successful by establishing populations throughout the basin that are isolated from threats. The next step in ensuring the long-term viability of Oregon chub will be facilitating the interaction of an adequate number of sufficiently large Oregon chub populations. Genetic diversity be maintained by interacting populations to ensure the long-term viability of the Oregon chub in the Willamette Basin.

4. If self-sustaining interconnected Oregon chub populations are not possible, develop other means to ensure safe genetic exchange. Moving Oregon chub from populations may be an option to facilitate genetic exchange among populations.

5.0 REFERENCES

The Oregon chub 5-Year Review was primarily based on ODFW monitoring reports from 1991 – 2007 (Scheerer 1999, 2002, 2003, 2004) (Scheerer and McDonald 2003) (Scheerer and Terwilliger 2005) (Scheerer *et al.* 2004, 2005, 2006, 2007). Groups involved in the conservation and recovery of Oregon chub established the OCWG. The OCWG meets annually to discuss conservation and recovery actions for the Oregon chub. The OCWG has representatives from various local, state, and federal agencies. A list of the OCWG members that participated in the 2006 annual OCWG meeting is included below.

City of Salem
T. Sherman

Forest Service
L. Bernstein
Dave Bickford
Doug Larson
Ray Rivera
Nikki Swanson

McKenzie River Trust
Jodi Lemmer

Oregon Department of Fish and Wildlife
Todd Alsbury
Jeff Boechler
Karen Hans
Wayne Hunt
Steven Mamoyac
Steve Marx
Kelly Reis
Paul Scheerer
Jeff Ziller

Oregon Department of Forestry
Russ Anderson

Oregon Department of Transportation
Greg Apke
William Warncke

Oregon State Parks
Kees Ruurs
Jay Schleier

Oregon State University
Douglas Markle

Santiam Water Control District
L. Trosi

US Army Corps of Engineers
Doug Garletts
Greg Taylor
Chuck Willis

US Fish and Wildlife Service
William Ardren
Doug Baus

Jock Beall
Cat Brown
Patrick DeHaan
Jeff Dillon
Vicki Finn
Jim Houk
Ron Rhew
Chris Seal
Steve Smith
Doug Spencer
Rollie White
Paul Wilson

LITERATURE CITED

Allendorf, F.W. and N. Ryman. 2002. The role of genetics in population viability analysis. Pages 50-85 *in* S.R. Beissinger and D.R. McCullough (eds). Population Viability Analysis. The University of Chicago Press, Chicago, IL

Ardren, W.R., P. Scheerer, P. DeHaan, and R. Rhew. 2008. Landscape Genetics and Conservation of Oregon chub (*Oregonichthys crameri*). Abstract from Presentation for the 2008 Western Division American Fisheries Society Meeting. Portland, Oregon. May, 2008.

Burkey, T.V. 1995. Extinction rates in archipelagoes: Implications for populations in fragmented habitats. Conservation Biology 9: 527-541.

Burkey, T.V. 1989. Extinction in nature reserves: the effect of fragmentation and the importance of migration between reserve fragments. Oikos 55:75-81.

Frankham, R. 1995. Effective population size/adult population size ratios in wildlife: a review. Genetical Research 66:95-107.

Franklin, I.A. 1980. Evolutionary changes in small populations. Pages 135-150 *in*: Soulé M. and B.A. Wilcox (eds). Conservation Biology: an evolutionary-ecological perspective. Sinauer Associates, Sunderland, MA.

Franklin, I.R. and R. Frankham. 1998. How large must populations be to retain evolutionary potential? Animal Conservation 1:69-70.

Hard, J. 1995. A quantitative genetic perspective on the conservation of intraspecific diversity. American Fisheries Society Symposium 17: 304-326.

Healy, M. C. and A. Prince. 1995. Scales of variation in life history tactics of Pacific salmon and the conservation of phenotype and genotype. American Fisheries Society Symposium, 17:176-184.

Hedrick, P.W. and S. T. Kalinowski. 2000. Inbreeding depression in conservation biology. Annual Review of Ecology and Systematics 31:139-162.

Lynch, M. and R. Lande. 1998. The critical effective size for a genetically secure population. Animal Conservation 1:70-72.

Meffe and Vrijenhoek 1988. Conservation Genetics in the Management of Desert Fishes. Conservation Biology. Volume 2. Issue 2. Page 157-169, June 1988.

Pearsons, T.N. 1989. Ecology and decline of a rare western minnow: the Oregon chub (*Oregonichthys crameri*). Master of Science Thesis. Oregon State University, Corvallis, Oregon. 86 pp.

Rieman, B.E., and J.D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. U.S. Forest Service, Intermountain Research Station. General Technical Report INT-302.

Rieman, B.E., and F.W. Allendorf. 2001. Effective population size and genetic conservation criteria for bull trout. North American Journal of Fisheries Management 21:756-764. American Fisheries Society, Bethesda, Maryland.

Scheerer, P.D., C. Shafer, and K. Jones. 1992. Oregon Chub Investigations. Oregon Department of Fish and Wildlife, Fish Research Project, EF-91 VII-1. 31 pp.

Scheerer, P.D., S. Loerts, and K. Jones. 1995. Oregon Department of Fish and Wildlife Annual Progress Report on Oregon chub. EF-94 VII-1. 54pp.

Scheerer, P.D. 1999. Oregon Chub Research in the Willamette Valley 1991-99. Fish Research Project Annual Progress Report EF-91 VII-1. Portland.

Scheerer, P.D. and P.J. McDonald. 2000. Oregon chub research: Middle Fork Willamette and Santiam River Drainages. Unpublished. Oregon Department of Fish and Wildlife, Fish Research Project October 1999-September 2000. Annual Progress Report, Portland. 90 pp.

Scheerer, P. D. 2002. Implications of Floodplain Isolation and Connectivity on the Conservation of an Endangered Minnow, Oregon Chub, in the Willamette River, Oregon. Transactions of the American Fisheries Society 131:1070-1080.

Scheerer, P.D., P.S. Kavanagh, and K.K. Jones. 2002. Oregon chub investigations. Oregon Department of Fish and Wildlife, Fish Research Project E-2-32. Annual Progress Report. Oregon Department of Fish and Wildlife, Corvallis, Oregon. 73 pp.

Scheerer, P.D. 2003. Oregon Chub Investigations 2003 Progress Report. Oregon Department of Fish and Wildlife, Fish Research Project E-2-34, Annual Progress Report, Corvallis.

Scheerer, P. D., and P. J. McDonald. 2003. Age and growth and timing of spawning of an endangered minnow, the Oregon chub (*Oregonichthys crameri*), in the Willamette Basin, Oregon. Northwestern Naturalist 84:68-79.

Scheerer, P. D. 2004a. ODOT Oregon chub surveys. Oregon Department of Fish and Wildlife, Fish Research Project 20675, Annual Progress Report, Corvallis.

Scheerer, P. D. 2004b. Management Plan for Oregon Department of Transportation Properties that Support Populations of the Endangered Oregon Chub. Oregon Department of Fish and Wildlife, Fish Research Contract #1448-13420-03-M145, Annual Progress Report, Corvallis.

Scheerer, P. D. 2004c. Population and habitat assessments for Oregon chub on the William L. Finley National Wildlife Refuge (2004). Oregon Department of Fish and Wildlife, Fish Research Project 1448-13420-03-M194, Annual Progress Report, Corvallis.

Scheerer, P. D., P. S. Kavanagh, and S. E. Jacobs. 2004. 2004 Oregon chub investigations. Oregon Department of Fish and Wildlife, Fish Research Project EF-04, Annual Progress Report, Salem.

Scheerer, P. D., P.S. Kavanagh, S. Davis, and S. E. Jacobs. 2005. 2005 Oregon chub investigations. Oregon Department of Fish and Wildlife, Fish Research Project EF-04 VII-1, Annual Progress Report, Salem.

Scheerer, P. D., S. E. Jacobs, and M. Terwilliger. 2005. Monitoring of Hospital Pond (2005): Willamette Basin Oregon Chub Investigations, Monitoring, and Management, Fish Research Project W66QKZ13304328, Annual Progress Report, Corvallis.

Scheerer, P.D., P.S. Kavanagh, B.L. Bangs, and S.E. Jacobs. 2006a. Oregon chub Investigations. Oregon Department of Fish and Wildlife, Fish Research Project E-2-44. Annual Progress Report. Oregon Department of Fish and Wildlife, Corvallis, Oregon 22 pp plus appendix.

Scheerer, P.D., M. Terwilliger, and S. E. Jacobs. 2006b. Willamette Valley Projects - Lookout Point - Oregon Chub (2006), Fish Research Project FW2006-02, Annual Progress Report, Corvallis.

Scheerer, P. D., P. S. Kavanagh, B. L. Bangs, and S. E. Jacobs. 2006c. Oregon Chub Population Monitoring on Oregon State Parks Lands in the Willamette Valley. Oregon Department of Fish and Wildlife, Contract OPRD #06-161, Annual Progress Report, Salem.

Scheerer, P. D. 2007a. Improved Status of the Endangered Oregon Chub in the Willamette River, Oregon. In: Status, distribution and conservation of native freshwater fishes of Western North America: a symposium proceedings. Transactions of the American Fisheries Society Symposium 53:91-102.

Scheerer, P. D. 2007b. Threatened fishes of the world: *Oregonichthys crameri* (Snyder, 1908) (Cyprinidae). Environmental Biology of Fishes 80:493-494.

Scheerer, P.D. 2007c. Unpublished data. Population Abundance Trends for Oregon chub 1997-2007. Oregon Department of Fish and Wildlife, Corvallis, Oregon.

Scheerer, P.D., P.S. Kavanagh, B.L. Bangs, and S.E. Jacobs. 2007. Oregon chub investigations. Oregon Department of Fish and Wildlife, Fish Research Project E-2-45. Annual Progress Report. Oregon Department of Fish and Wildlife, Corvallis, Oregon 18 pp plus appendix.

Snyder, J.O. 1908. Relationships of the fish fauna of the lakes of southeastern Oregon. Bull Bureau Fisheries 27(1907):69-102.

Soulé, M.E. 1987. Viable Populations for Conservation. Cambridge University Press, Cambridge, UK. 206pp.

Spruell, P., B.E. Rieman, K.L. Knudsen, F.M. Utter, and F.W. Allendorf. 1999. Genetic population structure within streams: microsatellite analysis of Bull trout populations. Ecology of Freshwater Fish 8:114-121.

USFWS (U.S. Fish and Wildlife Service). 1998. Recovery Plan for the Oregon Chub (*Oregonichthys crameri)*. U.S. Fish and Wildlife Service, Portland, Oregon. 69+pp.

Waples, R.S. 2002. Definition and estimation of effective population size in the conservation of endangered species. Pages 147-168 *in* S.R. Beissinger and D.R. McCullough (eds). Population Viability Analysis. The University of Chicago Press, Chicago, IL.

Wright, S. 1931. Evolution of Mendelian populations. Genetics 16:97-159.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR STATUS REVIEW
Oregon chub (*Oregonichthys crameri*)

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

__x__ Downlist to Threatened
____ Uplist to Endangered
____ Delist
____ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable:

6

Review Conducted By:

Doug Baus, Fish and Wildlife Biologist, Oregon Fish and Wildlife Office (OFWO), (Author)
Miel Corbett, Assistant Project Leader, OFWO
Jesse D'Elia, Fish and Wildlife Biologist, Pacific Regional Office
Kemper McMaster, State Supervisor, OFWO
Ron Rhew, Fish Biologist, Vancouver Fisheries Office
Paul Scheerer, Fish Biologist, Corvallis Office, Oregon Department of Fish and Wildlife
Rollie White, Endangered Species Division Manager, OFWO

FIELD OFFICE APPROVAL:

_____ Date 02/11/08
Lead Field Supervisor, Fish and Wildlife Service